greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

# Groundwater Quality State of the Environment monitoring programme

## Annual data report, 2013/14

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# Contents

# 1. Introduction

This report summarises the results from Greater Wellington Regional Council's (GWRC) Groundwater Quality State of the Environment (GQSoE) monitoring programme for the period 1 July 2013 to 30 June 2014 inclusive. The GQSoE programme incorporates quarterly monitoring of water quality in 71 bores across the Wellington region.

Reports containing detailed analyses of long-term trends are produced approximately every five years (see Jones & Baker 2005, Tidswell et al 2012).

# 2. Overview of GQSoE monitoring programme

Groundwater quality has been routinely monitored in the western half of the Wellington region (Kapiti Coast and Hutt Valley) since 1994 and in the Wairarapa since 1997. Up until 2003, this monitoring was effectively conducted under two separate programmes, with some differences in the suite of water quality variables and analytical methods. From late 2003, management practices were aligned to provide consistency in sampling methods, sampling frequency (increased from six-monthly to quarterly), analysis and reporting. At this time, a number of changes were also made to the location of monitoring sites, the range of variables monitored and the methods of analysis to improve the representativeness and quality of the information collected (see Jones & Baker 2005 and Tidswell et al 2012) for more details.

## 2.1 Monitoring objectives

The aims of GWRC's GQSoE monitoring programme are to:

1. Provide information on the baseline quality of groundwater;

2. Describe the current state of the region's groundwater resources at a regional scale;

3. Assist in the detection of spatial and temporal changes in groundwater quality;

4. Recommend the suitability of groundwater for designated uses; and

5. Provide a mechanism to determine the effectiveness of regional policies and plans.

## 2.2 Monitoring network

The existing GQSoE monitoring network consists of 71 bores (Figure 2.1, Appendix 1). During the 2013/14 year, only 68 bores were sampled. Three bores could not be used for the reasons shown below:

- Bore S25/5256 was purchased by Transit for the Peka Peka to Otaki Expressway and GWRC have not been able to gain access to the bore to continue sampling.

- Bore R27/1180 has not been able to be sampled due to prolific growth of iron bacteria. However, it is hoped this bore will be online again by early next year.

- Bore R27/1137 has been decommissioned by its owner and pumping equipment removed.

Faecal indicator bacteria[1] are only tested for in 44 of the 71 bores. As sampling could not be conducted at bore R27/1137, only 43 bores were tested for the presence of faecal indicator bacteria during 2013/14.

[1] *Escherichia coli* and faecal coliforms are only tested for in GQSoE bores that are used for potable water supply.

With the exception of a single bore at Riversdale on the eastern Wairarapa Coast, all bores are located in one of the three principal groundwater management areas in the Wellington region; the Kapiti Coast, Lower Hutt Valley or the Wairarapa Valley (see Jones & Baker 2005 and Hughes & Gyopari 2011 for a description of groundwater management areas in the Wellington region).

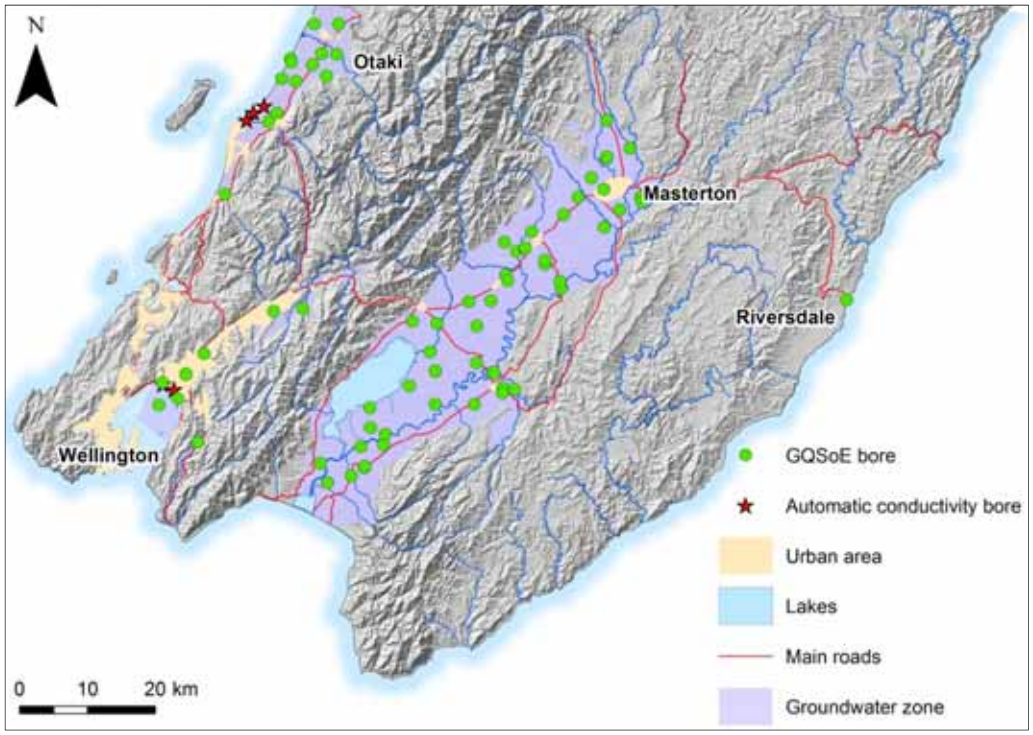


Figure 2.1: Location of groundwater quality monitoring sites in the Wellington region. Automated saline intrusion (conductivity) groundwater monitoring sites are also shown (red stars).

## 2.3 Monitoring variables

The GQSoE network is sampled quarterly for a wide range of physico-chemical and microbiological variables. Groundwater samples are collected by trained GWRC staff using nationally accepted protocols (Ministry for the Environment 2006).

Groundwater quality is assessed by measuring 31 different variables including pH, conductivity, turbidity, faecal indicator bacteria, total organic carbon, dissolved nutrients and major ions. A full list of the variables measured and the analytical methods used are provided in Appendix 2.

# 3. Physico-chemical and microbiological water quality

## 3.1 Approach to analysis

This section provides a brief overview of groundwater quality in the 2013/14 year. As the sampling regime only provides four sets of results per bore per year, a comprehensive evaluation of all the different variables is not undertaken on an annual basis. Instead, the analysis in this report focuses on two key indicators of groundwater contamination arising from landuse intensification and/or on-site wastewater disposal systems; nitrate-nitrogen (nitrate) and *Escherichia coli (E. coli)* bacteria.

Details of the analytical methods used are provided in Appendix 2 (Table A2.2). Summary statistics were calculated using Microsoft Excel (Microsoft Office Professional Plus 2010) and full data summaries are provided in Appendix 3. Data with values less than the laboratory's analytical detection limit were assigned a value of half their respective detection limit.

## 3.2 Results

### 3.2.1 Nitrate

Median nitrate concentrations were low (<3 mg/L) in most of the 68 bores monitored during 2013/14. Ten of 68 (14.7%) bores had elevated (3-7 mg/L)[2] concentrations of nitrate (Figure 3.1). A further two bores in Kapiti and the upper Wairarapa Valley had median nitrate concentrations in the relatively high range (7-11.3 mg/L).

Two bores had median nitrate concentrations above the Ministry of Health Drinking Water Standards (DWSNZ) 2008 maximum acceptable value (MAV) of 11.3 mg/L. Bore T26/0489 (54 metres deep) had a median nitrate concentration of 11.35 mg/L and bore S26/0223 (9.92 metres deep) had a median nitrate concentration of 11.55 mg/L. Both bores are located in the Upper Wairarapa.

[2] While most groundwater in New Zealand rarely has background nitrate-nitrogen concentrations exceeding 1 mg/L (Close et al. 2001), in this report 3 mg/L nitrate nitrogen is used as an indicator of anthropogenic influence in order to increase certainty caused by variability. A threshold concentration of 3 mg/L was also used by Madison & Brunett (1985) and Close et al. (2001). See Tidswell et al. (2012) for further discussion.

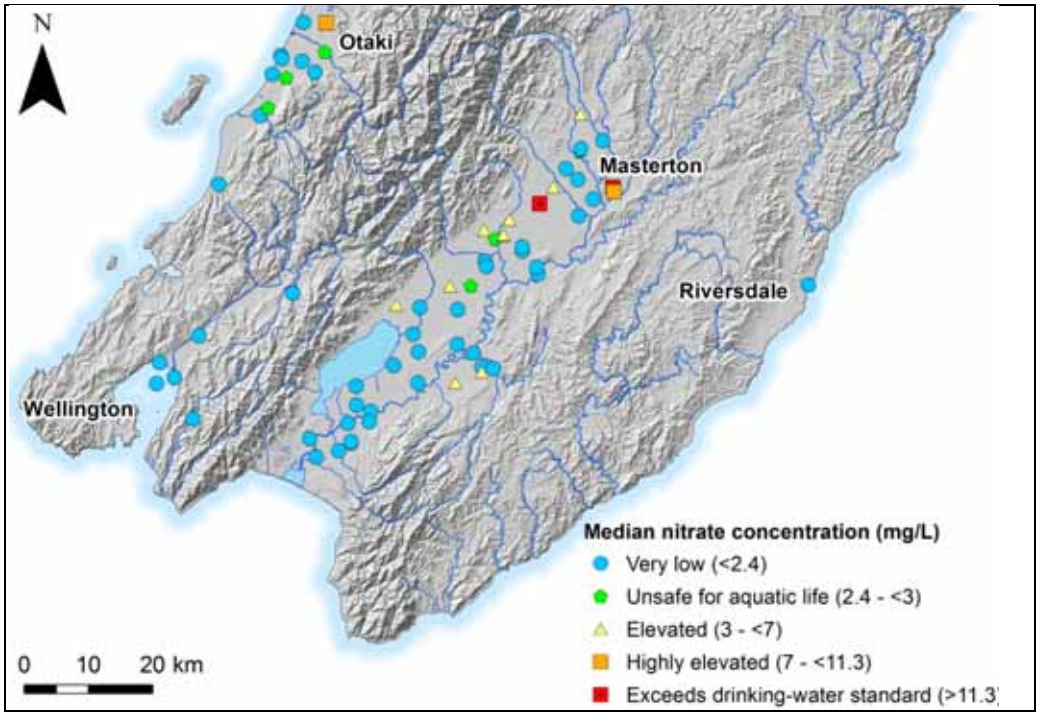


Figure 3.1: 2013/14 median nitrate concentrations in GQSoE monitoring bores

Overall, nitrate contamination was found in bores where previous sampling has detected elevated nitrate concentrations, in areas of intensive agriculture (Wairarapa) and horticulture (Kapiti Coast). The wide-ranging depth of bores with elevated nitrate concentrations (<5 m to 54 m) suggests that nitrate contamination is not limited to shallow unconfined aquifers but is able to migrate into deeper aquifer systems[3].

Groundwater discharges to a number of surface water bodies throughout the region and there is the potential that groundwater discharge high in nitrate could contribute to the decline of surface water quality. The ANZECC (2000) guidelines are commonly used to assess physico-chemical aspects of surface water quality in rivers and streams. Median nitrate concentrations were above the ANZECC (2000) trigger value for lowland ecosystems (0.444 mg/L) in 34 of the 68 (50%) bores. Of these, 20 (29.4%) recorded median concentrations above the Hickey (2013) threshold for aquatic toxicity (2.4 mg/L)[4].

### 3.2.2 *E. coli*

The DWSNZ uses *E. coli* as an indicator[5] of faecal contamination in drinking water. For drinking water supplies, *E. coli* counts should be <1 cfu/100mL.

*E. coli* was not detected (ie, <1 cfu/100mL) in 32 of the 43 (74.4%) bores monitored.

[3] This is particularly evident in recharge areas, with elevated nitrate concentrations not commonly found in deeper confined aquifers.

[4] This (median) value replaces the former threshold of 1.7 mg/L (Hickey & Martin 2009) and is a recommended replacement value for the ANZECC (2000) toxicity threshold value of 7.2 mg/L.

[5] It is impracticable to monitor water supplies for all potential human pathogens, so surrogates are used to indicate possible contamination from such things as human and animal excrement, these being the most frequent causes of health-significant microbial contamination in drinking water supplies.

*E. coli* was detected (ie, ≥1 cfu/100mL) on one or more occasions in 11 of the 43 (25.6%) bores tested (Figure 3.2). The highest *E. coli* count was 160 cfu/100mL in bore R25/5164 at Te Horo Beach. Te Horo Beach is a small settlement reliant on onsite wastewater treatment systems for effluent disposal. Previous studies involving dye tracer tests have confirmed that groundwater at Te Horo Beach is able to move from wastewater treatment systems into nearby bores relatively quickly (Hughes 1998). It is possible that the microbial contamination in bore R25/5164 is due to the bore's proximity to a nearby wastewater treatment system. This bore is not used as a potable drinking water supply.

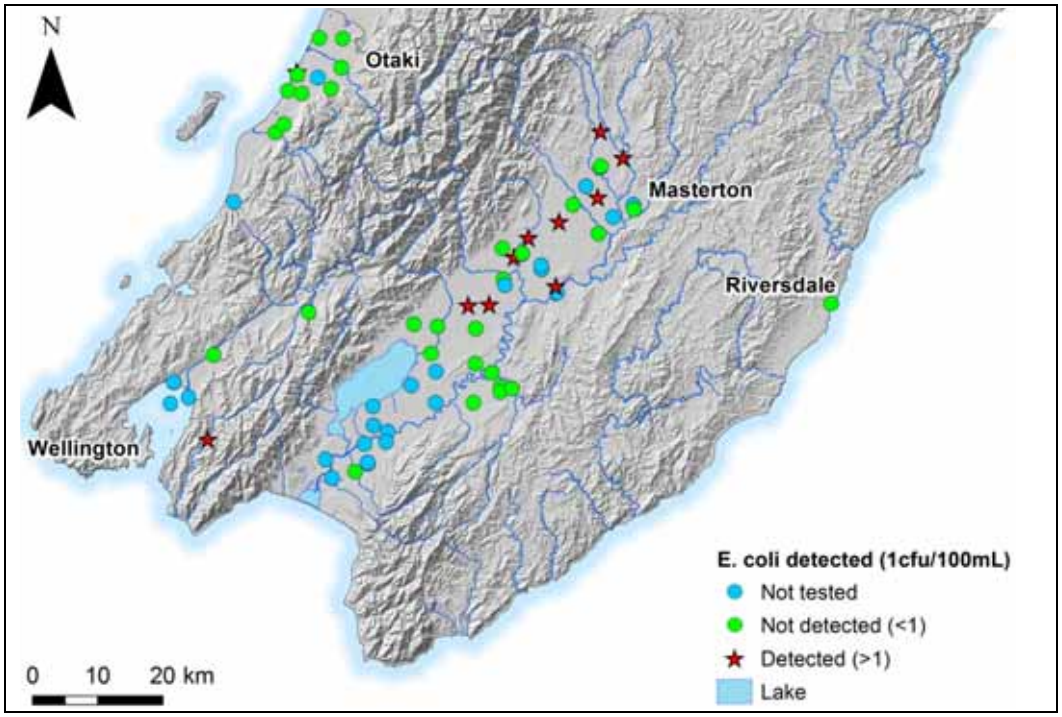


Figure 3.2: Detection of E. coli bacteria in GQSoE monitoring bores in 2013/14

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# Appendix 1: GQSoE monitoring sites

| Site number | Site name | X coordinates | Y coordinates | Groundwater zone | Category |
|---|---|---|---|---|---|
| Kapiti Coast | | | | | |
| R25/5100 | O'Malley | 1774552.15 | 5479451.35 | Te Horo | Category B |
| R25/5135 | Windsor Park | 1779152.45 | 5481483.39 | Te Horo | Category C |
| R25/5164 | Card | 1775873.28 | 5482367.50 | Te Horo | Category B |
| R25/5165 | Salter | 1776019.28 | 5481886.47 | Te Horo | Category B |
| R25/5190 | Williams | 1776678.23 | 5478988.27 | Te Horo | Category B |
| R25/5233 | Otaki Porirua Trust | 1779397.56 | 5487564.84 | Otaki | Category A |
| R26/6503 | Queen Elizabeth Park | 1766253.09 | 5462295.15 | Raumati | Category B |
| R26/6587 | Liddle | 1772633.83 | 5473057.09 | Waikanae | Category A |
| R26/6624 | Boffa | 1773932.93 | 5474297.10 | Waikanae | Category B |
| S25/5125 | Betty Partnership | 1782733.73 | 5483013.44 | Otaki | Category A |
| S25/5200 | Common Property | 1781182.52 | 5479785.21 | Te Horo | Category C |
| S25/5256 | Penray | 1780490.58 | 5483153.49 | Te Horo | Category C |
| S25/5322 | Edhouse | 1782982.85 | 5487485.83 | Otaki | Category C |
| Hutt, Mangaroa and Wainuiomata Valley | | | | | |
| R27/0320 | IBM 1 | 1756996.50 | 5434507.51 | Hutt Valley | Category B |
| R27/1137 | South Pacific Tyres | 1773406.32 | 5444956.34 | Hutt Valley | Category A |
| R27/1171 | Somes Island | 1756493.07 | 5431226.71 | Hutt Valley | Category B |
| R27/1180 | Mahoe/Willoughby St | 1760435.48 | 5435698.05 | Hutt Valley | Category B |
| R27/1182 | Seaview Wools | 1759274.04 | 5432161.32 | Hutt Valley | Category B |
| R27/1183 | Television New Zealand | 1763083.77 | 5438690.64 | Hutt Valley | Category A |
| R27/1265 | IBM 2 | 1756997.50 | 5434515.51 | Hutt Valley | Category B |
| R27/6418 | Wainuiomata Golf Club | 1762217.86 | 5425695.18 | Wainuiomata | Unknown |
| R27/6833 | Mangaroa School | 1777716.35 | 5445323.81 | Mangaroa | Unknown |
| Wairarapa Valley | | | | | |
| S26/0117 | Butcher, G | 1811483.15 | 5456780.11 | Mangatarere | Category A |
| S26/0223 | Nicholson | 1816203.19 | 5459284.79 | Taratahi | Category B |
| S26/0299 | Graham | 1818354.91 | 5461869.91 | Taratahi | Category B |
| S26/0439 | Rogers | 1807492.42 | 5455180.48 | Mangatarere | Category B |
| S26/0457 | Palmer Berry Fruits | 1807656.62 | 5450330.89 | Waiohine | Category A |
| S26/0467 | Fitzgerald | 1809272.40 | 5453850.06 | Mangatarere | Category A |
| S26/0568 | Denbee | 1813486.57 | 5451921.15 | Parkvale | Category B |
| S26/0576 | Mcnamara | 1813461.67 | 5452534.23 | Parkvale | Category B |
| S26/0705 | Carterton District Council South | 1810471.61 | 5454278.93 | Mangatarere | Category B |
| S26/0756 | Stevenson | 1815919.19 | 5448296.24 | Middle Ruamahanga | Category A |
| S26/0762 | Schaef | 1815702.37 | 5449348.42 | Middle Ruamahanga | Category A |
| S26/0824 | Carterton District Council North | 1810546.63 | 5454380.93 | Mangatarere | Category B |
| S26/0846 | Druzianic | 1807902.50 | 5449491.76 | Waiohine | Category A |
| S27/0009 | Dondertman | 1793895.42 | 5443481.45 | Tauherenikau | Category B |
| S27/0070 | South Featherston School | 1797507.54 | 5443110.86 | Tauherenikau | Category B |
| S27/0136 | Sugrue | 1802217.44 | 5446389.36 | Tauherenikau | Category B |
| S27/0156 | O'Neale | 1803402.88 | 5442775.85 | Tauherenikau | Category B |
| S27/0202 | Croad | 1805460.73 | 5446519.85 | Tauherenikau | Category B |
| S27/0268 | Barton | 1793452.70 | 5434055.07 | Lake | Category B |
| S27/0283 | Osborne | 1797276.24 | 5436168.48 | Tauherenikau | Category B |
| S27/0299 | Johnson | 1796503.73 | 5438935.77 | Tauherenikau | Category A |
| S27/0344 | George | 1803347.81 | 5437340.43 | Lower Ruamahanga | Category A |
| S27/0389 | Dimattina | 1807205.35 | 5433792.40 | Martinborough | Category C |
| S27/0396 | SWDC Martinborough | 1805858.70 | 5435961.84 | Lower Ruamahanga | Category A |
| S27/0433 | Mapuna Atea | 1787692.45 | 5427838.97 | Lake | Category B |
| S27/0435 | Wairio | 1787608.01 | 5430805.03 | Lake | Category B |
| S27/0442 | Robinson Transport | 1789891.27 | 5426883.54 | Lake | Category B |
| S27/0495 | Bosch | 1797227.31 | 5431330.26 | Lower Ruamahanga | Category A |
| S27/0522 | Duggan | 1803031.58 | 5431324.10 | Martinborough | Category C |
| S27/0571 | Martinborough Golf Club | 1807158.18 | 5433014.36 | Martinborough | Category C |
| S27/0585 | McCreary | 1780320.53 | 5422598.32 | Onoke | Category C |
| S27/0588 | SWDC Piriona | 1784844.06 | 5420713.48 | Onoke | Category A |
| S27/0594 | Warren | 1781350.93 | 5419721.16 | Onoke | Category C |
| S27/0602 | Weatherstone | 1789625.95 | 5425301.57 | Lake | Category B |

| Site number | Site name | X coordinates | Y coordinates | Groundwater zone | Category |
|---|---|---|---|---|---|
| S27/0607 | Finlayson | 1786288.91 | 5425037.20 | Lake | Category B |
| S27/0614 | Sorenson South | 1786778.28 | 5421924.10 | Unknown | Unknown |
| S27/0615 | Sorenson North | 1786805.33 | 5422158.09 | Unknown | Unknown |
| S27/0681 | Te Kairanga Wines | 1808952.42 | 5433542.02 | Huangarua | Category A |
| T26/0003 | Lenton | 1822559.22 | 5473236.52 | Upper Ruamahanga | Category B |
| T26/0087 | Biss | 1820295.66 | 5464750.15 | Waingawa | Category C |
| T26/0099 | Butcher, M | 1822518.46 | 5467619.40 | Upper Ruamahanga | Category B |
| T26/0206 | Thornton | 1822581.50 | 5467829.43 | Upper Ruamahanga | Category B |
| T26/0259 | Opaki Water Supply Association | 1825997.33 | 5469120.23 | Upper Ruamahanga | Category A |
| T26/0332 | Taratahi Agricultural Training Centre | 1822230.80 | 5457401.54 | Fernhill-Tiffen | Category C |
| T26/0413 | Seymour | 1824485.62 | 5459978.64 | Waingawa | Category B |
| T26/0430 | Trout Hatchery | 1822130.71 | 5463027.57 | Waingawa | Category B |
| T26/0489 | Duffy | 1827571.49 | 5461854.50 | Te Ore Ore | Category B |
| T26/0538 | Percy | 1827738.41 | 5461169.34 | Te Ore Ore | Category B |
| Riversdale | | | | | |
| T27/0063 | Acacia Ave | 1858025.04 | 5446630.37 | Riversdale | Unknown |
| Saline intrusion monitoring | | | | | |
| R26/6378 | Rutherford Drive | 1771994.91 | 5475389.21 | Waikanae | Category B |
| R26/6566 | Waikanae Estuary Shallow | 1769406.76 | 5473310.22 | Waikanae | Category A |
| R26/6673 | Taiata Shallow | 1770438.83 | 5474422.22 | Waikanae | Category B |
| R26/6955 | Taiata Deep | 1770438.83 | 5474422.22 | Waikanae | Category B |
| R26/6956 | Waikanae Estuary Deep | 1769406.76 | 5473310.22 | Waikanae | Category A |
| R27/0122 | McEwan Park Shallow | 1758681.27 | 5433523.34 | Hutt Valley | Category B |
| R27/7153 | McEwan Park Deep | 1758681.27 | 5433523.34 | Hutt Valley | Category B |
| R27/7154 | Tamatoa Deep | 1757019.47 | 5434294.51 | Hutt Valley | Category B |
| R27/7215 | Tamatoa Shallow | 1757021.47 | 5434298.51 | Hutt Valley | Category B |

# Appendix 2: Monitoring variables and analytical methods

Groundwater samples are collected quarterly by trained GWRC staff using nationally accepted protocols (Ministry for the Environment 2006). This involves purging the bore for a predetermined amount of time to remove any standing water and monitoring the pumped water continuously until field measurements (eg conductivity) stabilise. Field measurements (temperature, conductivity, pH and dissolved oxygen) are taken using field meters which are calibrated on the day of sampling.

Water samples are stored on ice upon collection and transported to an external laboratory within 24 hours of sampling. RJ Hill Laboratories in Hamilton analysed the samples for the variables listed in Table A2.1

The rationale for variables monitored is detailed in Table A2.1 and analytical methods are summarised in Table A2.2.

Table A2.1. Rationale for inclusion in GQSoE sampling regime

| Test type | Variable | Rationale for inclusion |
|---|---|---|
| Bacteria | Faecal coliforms<br>*E. coli* | Faecal coliforms *and E. coli* can indicate pollution due to faecal matter and the presence of potentially harmful pathogens in groundwater. Ministry for the Environment uses *E. coli* as an indicator of ground water quality. |
| Major ions | Dissolved sodium<br>Dissolved potassium<br>Dissolved calcium<br>Dissolved magnesium<br>Chloride<br>Sulphate<br>Total alkalinity | Concentrations of major ions can give an indication of the chemical composition of the water, the origins of groundwater, water residence time in the aquifer and extent of rock/water interaction. Concentrations of major ions can also be indicative of groundwater contamination from industrial, agricultural and domestic sources. |
| Nutrients | Total ammoniacal nitrogen<br>Nitrite-nitrate nitrogen (NNN)<br>Nitrate nitrogen<br>Nitrite nitrogen<br>Dissolved reactive phosphorus | Dissolved concentrations of nutrients can indicate impact from anthropogenic activity such as intensive land use.<br>Nitrate nitrogen represents the oxidised form of nitrogen. Elevated concentrations of nitrate nitrogen can have an adverse affect on human health and can be harmful to biota.<br>Total ammoniacal nitrogen usually exists under oxygen-poor conditions and represents the reduced form of nitrogen. Therefore, can be used as an indicator of contamination in the absence of nitrate nitrogen. The ANZECC guidelines (2000) state trigger values for the direct toxicity to biota. |

Table A2.1 cont. Rationale for inclusion in GQSoE sampling regime

| Chemical tests | Variable | Rationale for inclusion in sampling regime |
|---|---|---|
| Metals | Dissolved iron<br>Dissolved manganese<br>Dissolved lead<br>Dissolved zinc | Trace metals are usually present in groundwater at low concentrations. Elevated concentrations of trace metals can suggest contamination of groundwater. Elevated concentrations of dissolved of lead and manganese can have an adverse affect on human health. |
| Trace elements | Bromide<br>Fluoride<br>Dissolved boron | Bromide naturally occurs in water but can suggest contamination from wastewater and agricultural run off. Elevated concentrations of dissolved of boron can have an adverse affect on human health and the DWSNZ (2005) MAV for fluoride is set to protect against potential dental fluorosis. |
| Other | pH | Water with a low pH can have a high plumbosolvency. Measured in the field to identify when the bore is purged and sample can be collected. |
| | Electrical conductivity | Electrical conductivity can provide a measure of total dissolved solids. Measured in the field to identify when the bore is purged and sample can be collected. |
| | Dissolved oxygen | Dissolved oxygen can indicate whether groundwater is under reduced or oxidised conditions. Measured in the field to identify when the bore is purged and sample can be collected. |
| | Dissolved reactive silica | Can help interpret the extent of rock/water interaction |
| | Total organic carbon (TOC) | Can indicate the presence of organic matter (either from wastewater or natural sources) in groundwater. |
| Calculations | Total dissolved solids (TDS) | Can indicate the extent of rock/water interaction. |
| | Free carbon dioxide ($CO_2$) | Can indicate the extent of rock/water interaction. |
| | Bicarbonate ($H_2CO_3$) | Can indicate the extent of rock/water interaction. |
| | Total hardness | Can indicate the extent of rock/water interaction. |
| | Total anions | Sum of all anions |
| | Total cations | Sum of all cations |
| | % Difference in ion balance | Difference between the sum of all anions and the sum of all cations. Can be used as a measure of analytical accuracy of water quality data. Value should be 0% but generally a difference of <5% is considered acceptable. |

NB: Groundwater samples are also tested for arsenic, chromium, cadmium, nickel and copper but on a not routine basis. Conductivity and pH are tested both in the field and by Hills Laboratory. Dissolved oxygen is only tested for in the field.

## Table A2.2. Analytical methods

| Variable | Method Used | Detection Limit |
|---|---|---|
| Temperature | Field meter – Hach HQ40d, YSI 556 , WTW P4 Multiline and WTW350i Meters | 0.01 ˚C |
| Dissolved oxygen | Field meter – Hach HQ40d, YSI 556 , WTW P4 Multiline and WTW350i Meters | 0.01 mg/L |
| Electrical conductivity | Field meter – Hach HQ40d, YSI 556 , WTW P4 Multiline and WTW350i Meters | 0.1 µS/cm |
| pH | Field meter – Hach HQ40d, YSI 556 , WTW P4 Multiline and WTW350i Meters | 0.01 units |
| pH (lab) | pH meter APHA 4500-H+ B 21st ed. 2005. | 0.1 pH units |
| Total alkalinity | Titration to pH 4.5 (M-alkalinity), Radiometer autotitrator. APHA 2320 B (Modified for alk <20) 21st ed. 2005. | 1 mg/L as $CaCO_3$ |
| Bicarbonate | Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO2 D 21st ed. 2005. | 1 mg/L at 25°C |
| Free carbon dioxide | Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-$CO_2$ D 21st ed. 2005. | 1.0 mg/L at 25°C |
| Total hardness | Calculation from calcium and magnesium | 1.0 mg/L $CaCO_3$ |
| Electrical conductivity (lab) | Conductivity meter, 25°C APHA 2510 B 21st ed. 2005. | 0.1 mS/m, 1 µS/cm |
| Total dissolved solids (TDS) | Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 – 105°C used rather than 180 ± 2°C ) 21st ed. 2005. | 10 mg/L |
| Dissolved boron | Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005. | 0.005 mg/L |
| Dissolved calcium | Filtered sample, ICP-MS APHA 3125 B 21st ed. 2005. | 0.05 mg/L |
| Dissolved Iron | Filtered sample. ICP-MS APHA 3125 B 21st ed. 2005. | 0.02 mg/L |
| Dissolved Lead | Filtered sample. ICP-MS APHA 3125 B 21st ed. 2005. | 0.0001 mg/L |
| Dissolved magnesium | Filtered sample, ICP-MS APHA 3125 B 21st ed. 2005. | 0.02 mg/L |
| Dissolved manganese | Filtered sample. ICP-MS APHA 3125 B 21st ed. 2005. | 0.0005 mg/L |
| Dissolved potassium | Filtered sample, ICP-MS APHA 3125 B 21st ed. 2005. | 0.05 mg/L |
| Dissolved sodium | Filtered sample, ICP-MS APHA 3125 B 21st ed. 2005. | 0.02 mg/L |
| Dissolved zinc | Filtered sample. ICP-MS APHA 3125 B 21st ed. 2005. | 0.001 mg/L |
| Bromide | Filtered sample. Ion Chromatography. APHA 4110 B 21st ed. 2005. | 0.05 mg/L |
| Chloride | Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500-Cl- E (modified from continuous-flow analysis) 21st ed. 2005. | 0.5 mg/L |
| Fluoride | Ion selective electrode APHA 4500-F- C 21st ed. 2005. | 0.05 mg/L |
| Total ammoniacal nitrogen | Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. ($NH_4$-N = $NH_4$+-N + $NH_3$-N) APHA 4500-$NH_3$ F (modified from manual analysis) 21st ed. 2005. | 0.01 mg/L |
| Nitrite-N | Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-$NO_3$ - I (modified) 21st ed. 2005. | 0.002 mg/L |
| Nitrate-N* | Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. | 0.001 mg/L |
| Nitrate-N + Nitrite-N (NNN) | Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-$NO_3$ - I (modified) 21st ed. 2005. | 0.002 mg/L |
| Dissolved reactive phosphorus | Filtered sample. Molybdenum blue colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 21st ed. 2005. | 0.004 mg/L |
| Reactive silica | Filtered sample. Heteropoly blue colorimetry. Discrete Analyser. APHA 4500-SiO2 F (modified from flow injection analysis) 21st ed. 2005. | 0.1 mg/L as $SiO_2$ |
| Sulphate | Filtered sample. Ion Chromatography. APHA 4110 B 21st ed. 2005. | 0.5 mg/L |
| Total organic carbon (TOC) | Catalytic oxidation, IR detection, for Total C. Acidification, purging for Total Inorganic C. TOC = TC -TIC. APHA 5310 B (modified) 21st ed. 2005. | 0.05 mg/L |
| Total anions | Calculation: sum of anions as mEquiv/L [Includes Alk, Cl, $NO_x$N & $SO_4$] | 0.07 mEquiv/L |
| Total cations | Calculation: sum of cations as mEquiv/L [Includes Ca, Mg, Na, K, Fe, Mn, Zn & $NH_4$N]. | 0.05 mEquiv/L |
| % Difference in Ion Balance | Calculation from Sum of Anions and Cations. Please note: The result reported for the '% Difference in Ion Balance' is an absolute difference between the 'Sum of Anions' and 'Sum of Cations' based on the formula taken from APHA. This does not indicate whether the 'Sum of Anions' or the 'Sum of Cations' produced a higher value. APHA 1030 E 21st ed. 2005. | 0.1 % |
| Faecal coliforms | APHA 21st Ed. Method 9222 D. | 1 cfu/100 mL |
| *E. coli* | APHA 21st Ed. Method 9222 G. | 1 cfu/100 mL |

*Note the detection limit for Nitrate-N changed from 0.002 mg/L to 0.001 mg/L in November 2013.

# Appendix 3: Tabulated monitoring results

| Site | X | Y | *E. coli* detected | No. of *E. coli* samples | Median nitrate | No. of nitrate samples |
|---|---|---|---|---|---|---|
| R25/5100 | 1774552 | 5479451 | NO | 4 | 0.001 | 4 |
| R25/5135 | 1779152 | 5481483 | NOT TESTED | | 0.001 | 4 |
| R25/5164 | 1775873 | 5482367 | YES | 4 | 0.385 | 4 |
| R25/5165 | 1776019 | 5481886 | NO | 4 | 0.390 | 4 |
| R25/5190 | 1776678 | 5478988 | NO | 4 | 2.45 | 4 |
| R25/5233 | 1779398 | 5487565 | NO | 4 | 1.54 | 4 |
| R26/6503 | 1766253 | 5462295 | NOT TESTED | | 0.016 | 4 |
| R26/6587 | 1772634 | 5473057 | NO | 4 | 0.810 | 4 |
| R26/6624 | 1773933 | 5474297 | NO | 4 | 2.80 | 4 |
| R27/0320 | 1756996 | 5434508 | NOT TESTED | | 0.002 | 4 |
| R27/1137 | 1773406 | 5444956 | NOT TESTED | | | |
| R27/1171 | 1756493 | 5431227 | NOT TESTED | | 0.007 | 4 |
| R27/1180 | 1760435 | 5435698 | NOT TESTED | | | |
| R27/1182 | 1759274 | 5432161 | NOT TESTED | | 0.695 | 4 |
| R27/1183 | 1763084 | 5438691 | NO | 4 | 0.265 | 4 |
| R27/1265 | 1756998 | 5434516 | NOT TESTED | | 0.048 | 4 |
| R27/6418 | 1762218 | 5425695 | YES | 4 | 1.68 | 4 |
| R27/6833 | 1777716 | 5445324 | NO | 4 | 1.87 | 4 |
| S25/5125 | 1782734 | 5483013 | NO | 4 | 2.50 | 4 |
| S25/5200 | 1781183 | 5479785 | NO | 4 | 0.006 | 4 |
| S25/5256 | 1780491 | 5483153 | NOT TESTED | | | |
| S25/5322 | 1782983 | 5487486 | NO | 4 | 9.50 | 4 |
| S26/0117 | 1811483 | 5456780 | YES | 4 | 4.80 | 4 |
| S26/0223 | 1816203 | 5459285 | YES | 4 | 11.55 | 4 |
| S26/0299 | 1818355 | 5461870 | NO | 4 | 3.95 | 4 |
| S26/0439 | 1807492 | 5455180 | NO | 4 | 3.00 | 4 |
| S26/0457 | 1807657 | 5450331 | NO | 4 | 0.875 | 4 |
| S26/0467 | 1809272 | 5453850 | YES | 4 | 2.60 | 4 |
| S26/0568 | 1813487 | 5451921 | NOT TESTED | | 0.010 | 4 |
| S26/0576 | 1813462 | 5452534 | NOT TESTED | | 0.009 | 4 |
| S26/0705 | 1810472 | 5454279 | NO | 4 | 4.40 | 4 |
| S26/0756 | 1815919 | 5448296 | NOT TESTED | | 0.015 | 4 |
| S26/0762 | 1815702 | 5449348 | YES | 4 | 0.010 | 4 |
| S26/0824 | 1810547 | 5454381 | NO | 4 | 4.70 | 4 |
| S26/0846 | 1807902 | 5449492 | NOT TESTED | | 0.825 | 4 |
| S27/0009 | 1793895 | 5443481 | NO | 4 | 3.35 | 4 |
| S27/0070 | 1797508 | 5443111 | NO | 4 | 0.595 | 4 |
| S27/0136 | 1802217 | 5446389 | YES | 4 | 3.20 | 4 |
| S27/0156 | 1803403 | 5442776 | NO | 4 | 0.053 | 4 |
| S27/0202 | 1805461 | 5446520 | YES | 4 | 2.55 | 4 |
| S27/0268 | 1793453 | 5434055 | NOT TESTED | | 0.055 | 4 |
| S27/0283 | 1797276 | 5436168 | NOT TESTED | | 0.010 | 4 |
| S27/0299 | 1796504 | 5438936 | NO | 4 | 0.335 | 4 |

| Site | X | Y | *E. coli* detected | No. of *E. coli* samples | Median nitrate | No. of nitrate samples |
|---|---|---|---|---|---|---|
| S27/0344 | 1803348 | 5437340 | NO | 4 | 0.006 | 4 |
| S27/0389 | 1807205 | 5433792 | NO | 4 | 0.003 | 4 |
| S27/0396 | 1805859 | 5435962 | NO | 4 | 0.345 | 4 |
| S27/0433 | 1787692 | 5427839 | NOT TESTED | | 0.100 | 4 |
| S27/0435 | 1787608 | 5430805 | NOT TESTED | | 0.006 | 4 |
| S27/0442 | 1789891 | 5426884 | NOT TESTED | | 0.008 | 4 |
| S27/0495 | 1797227 | 5431330 | NOT TESTED | | 0.055 | 4 |
| S27/0522 | 1803032 | 5431324 | NO | 4 | 3.50 | 4 |
| S27/0571 | 1807158 | 5433014 | NO | 4 | 6.45 | 4 |
| S27/0585 | 1780321 | 5422598 | NOT TESTED | | 0.050 | 3 |
| S27/0588 | 1784844 | 5420713 | NO | 4 | 0.010 | 4 |
| S27/0594 | 1781351 | 5419721 | NOT TESTED | | 0.026 | 4 |
| S27/0602 | 1789626 | 5425302 | NOT TESTED | | 0.012 | 4 |
| S27/0607 | 1786289 | 5425037 | NOT TESTED | | 0.051 | 4 |
| S27/0614 | 1786778 | 5421924 | NOT TESTED | | 0.055 | 2 |
| S27/0615 | 1786805 | 5422158 | NOT TESTED | | 0.055 | 4 |
| S27/0681 | 1808952 | 5433542 | NO | 4 | 0.340 | 4 |
| T26/0003 | 1822559 | 5473237 | YES | 4 | 4.14 | 4 |
| T26/0087 | 1820296 | 5464750 | NOT TESTED | | 1.96 | 4 |
| T26/0099 | 1822518 | 5467619 | NO | 4 | 2.90 | 4 |
| T26/0206 | 1822582 | 5467829 | NO | 4 | 1.77 | 4 |
| T26/0259 | 1825997 | 5469120 | YES | 4 | 1.18 | 4 |
| T26/0332 | 1822231 | 5457402 | NO | 4 | 0.615 | 4 |
| T26/0413 | 1824486 | 5459979 | NOT TESTED | | 0.002 | 4 |
| T26/0430 | 1822131 | 5463028 | YES | 4 | 2.18 | 4 |
| T26/0489 | 1827571 | 5461855 | NOT TESTED | | 11.35 | 4 |
| T26/0538 | 1827738 | 5461169 | NO | 4 | 8.75 | 4 |
| T27/0063 | 1858025 | 5446630 | NO | 4 | 1.23 | 4 |

*Note summary statistics were calculated using Microsoft Excel Professional Plus 2010. Data with values less than the laboratory's analystical detection limit were assigned a value of one half their original value.

# Appendix 4: Raw data

| Site | X | Y | Date | *E.coli* (cfu/100mlL | Nitrate nitrogen (mg/L) |
|---|---|---|---|---|---|
| R25/5100 | 1774552 | 5479451 | Sep-13 | <1.00 | <0.02 |
| | | | Dec-13 | <1.00 | <0.002 |
| | | | Mar-14 | <1.00 | <0.002 |
| | | | Jun-14 | <1.00 | <0.002 |
| R25/5135 | 1779152 | 5481483 | Sep-13 | Not tested | <0.02 |
| | | | Dec-13 | Not tested | <0.002 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | <0.002 |
| R25/5164 | 1775873 | 5482368 | Sep-13 | <1.00 | 0.29 |
| | | | Dec-13 | <1.00 | 0.58 |
| | | | Mar-14 | 160 | 0.42 |
| | | | Jun-14 | 50 | 0.35 |
| R25/5165 | 1776019 | 5481886 | Sep-13 | <1.00 | 0.43 |
| | | | Dec-13 | <1.00 | 0.35 |
| | | | Mar-14 | <1.00 | 0.054 |
| | | | Jun-14 | <1.00 | 1.2 |
| R25/5190 | 1776678 | 5478988 | Sep-13 | <1.00 | 6.2 |
| | | | Dec-13 | <1.00 | 2.5 |
| | | | Mar-14 | <1.00 | 2.4 |
| | | | Jun-14 | <1.00 | 2.4 |
| R25/5233 | 1779398 | 5487565 | Sep-13 | <1.00 | 1.32 |
| | | | Dec-13 | <1.00 | 1.39 |
| | | | Mar-14 | <1.00 | 1.69 |
| | | | Jun-14 | <1.00 | 1.86 |
| R26/6503 | 1766253 | 5462295 | Sep-13 | Not tested | 0.025 |
| | | | Dec-13 | Not tested | 0.004 |
| | | | Mar-14 | Not tested | 0.0145 |
| | | | Jun-14 | Not tested | 0.018 |
| R26/6587 | 1772634 | 5473057 | Sep-13 | <1.00 | 0.82 |
| | | | Dec-13 | <1.00 | 0.8 |
| | | | Mar-14 | <1.00 | 0.48 |
| | | | Jun-14 | <1.00 | 0.82 |
| R26/6624 | 1773933 | 5474297 | Sep-13 | <1.00 | 2.8 |
| | | | Dec-13 | <1.00 | 2.7 |
| | | | Mar-14 | <1.00 | 2.9 |
| | | | Jun-14 | <1.00 | 2.8 |
| R27/0320 | 1756996 | 5434508 | Sep-13 | Not tested | <0.002 |
| | | | Dec-13 | Not tested | 0.002 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | 0.089 |
| R27/1171 | 1756493 | 5431227 | Sep-13 | Not tested | 0.104 |
| | | | Dec-13 | Not tested | 0.004 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | 0.009 |
| R27/1182 | 1759274 | 5432161 | Sep-13 | Not tested | 0.71 |
| | | | Dec-13 | Not tested | 0.65 |
| | | | Mar-14 | Not tested | 0.68 |
| | | | Jun-14 | Not tested | 0.76 |
| R27/1183 | 1763084 | 5438691 | Sep-13 | <1.00 | 0.35 |
| | | | Dec-13 | <1.00 | 0.26 |
| | | | Mar-14 | <1.00 | 0.26 |
| | | | Jun-14 | <1.00 | 0.27 |
| R27/1265 | 1756998 | 5434516 | Sep-13 | Not tested | 0.093 |
| | | | Dec-13 | Not tested | 0.086 |
| | | | Mar-14 | Not tested | 0.004 |
| | | | Jun-14 | Not tested | <0.02 |
| R27/6418 | 1762218 | 5425695 | Sep-13 | <1.00 | 2.1 |
| | | | Dec-13 | <1.00 | 1.48 |
| | | | Mar-14 | 1 | 1.07 |
| | | | Jun-14 | 3 | 1.88 |

| Site | X | Y | Date | *E.coli* (cfu/100mlL | Nitrate nitrogen (mg/L) |
|---|---|---|---|---|---|
| R27/6833 | 1777716 | 5445324 | Sep-13 | <1.00 | 2.8 |
| | | | Dec-13 | <1.00 | 3.6 |
| | | | Mar-14 | <1.00 | 0.48 |
| | | | Jun-14 | <1.00 | 0.93 |
| S25/5125 | 1782734 | 5483013 | Sep-13 | <1.00 | 2.7 |
| | | | Dec-13 | <1.00 | 2.3 |
| | | | Mar-14 | <1.00 | 0.75 |
| | | | Jun-14 | <1.00 | 3 |
| S25/5200 | 1781182 | 5479785 | Sep-13 | <1.00 | <0.0100 |
| | | | Dec-13 | <1.00 | <0.002 |
| | | | Mar-14 | <1.00 | <0.002 |
| | | | Jun-14 | <1.00 | <0.02 |
| S25/5322 | 1783001 | 5487382 | Sep-13 | <1.00 | 9.8 |
| | | | Dec-13 | <1.00 | 9.6 |
| | | | Mar-14 | <1.00 | 9.4 |
| | | | Jun-14 | <1.00 | 9.4 |
| S26/0117 | 1811483 | 5456780 | Sep-13 | <1.00 | 5.7 |
| | | | Dec-13 | 1 | 5.1 |
| | | | Mar-14 | <1.00 | 3.3 |
| | | | Jun-14 | 1 | 4.5 |
| S26/0223 | 1816203 | 5459285 | Sep-13 | <1.00 | 10.6 |
| | | | Dec-13 | <1.00 | 12.5 |
| | | | Mar-14 | <1.00 | 12.2 |
| | | | Jun-14 | 7 | 10.9 |
| S26/0299 | 1818355 | 5461870 | Sep-13 | <1.00 | 4 |
| | | | Dec-13 | <1.00 | 4.3 |
| | | | Mar-14 | <1.00 | 3.9 |
| | | | Jun-14 | <1.00 | 3.7 |
| S26/0439 | 1807492 | 5455180 | Sep-13 | <1.00 | 3 |
| | | | Dec-13 | <1.00 | 2.7 |
| | | | Mar-14 | <1.00 | 3 |
| | | | Jun-14 | <1.00 | 3.5 |
| S26/0457 | 1807657 | 5450331 | Sep-13 | <1.00 | 1.08 |
| | | | Dec-13 | <1.00 | 0.67 |
| | | | Mar-14 | <1.00 | 0.5 |
| | | | Jun-14 | <1.00 | 1.53 |
| S26/0467 | 1809272 | 5453850 | Sep-13 | <1.00 | 2.5 |
| | | | Dec-13 | 1 | 2.9 |
| | | | Mar-14 | <1.00 | 2.7 |
| | | | Jun-14 | 4 | 2.1 |
| S26/0568 | 1813487 | 5451921 | Sep-13 | Not tested | <0.02 |
| | | | Dec-13 | Not tested | 0.002 |
| | | | Mar-14 | Not tested | <0.02 |
| | | | Jun-14 | Not tested | <0.200 |
| S26/0576 | 1813462 | 5452534 | Sep-13 | Not tested | <0.002 |
| | | | Dec-13 | Not tested | 0.017 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | 0.046 |
| S26/0705 | 1810472 | 5454279 | Sep-13 | <1.00 | 4.7 |
| | | | Dec-13 | <1.00 | 4.4 |
| | | | Mar-14 | <1.00 | 4.3 |
| | | | Jun-14 | <1.00 | 4.4 |
| S26/0756 | 1815919 | 5448296 | Sep-13 | Not tested | 0.02 |
| | | | Dec-13 | Not tested | <0.002 |
| | | | Mar-14 | Not tested | <0.02 |
| | | | Jun-14 | Not tested | <0.200 |
| S26/0762 | 1815702 | 5449348 | Sep-13 | <1.00 | <0.02 |
| | | | Dec-13 | <1.00 | 0.002 |
| | | | Mar-14 | <1.00 | <0.02 |
| | | | Jun-14 | 7 | <0.200 |
| S26/0824 | 1810547 | 5454381 | Sep-13 | <1.00 | 4.7 |
| | | | Dec-13 | <1.00 | 4.5 |

| Site | X | Y | Date | *E.coli* (cfu/100mlL | Nitrate nitrogen (mg/L) |
|---|---|---|---|---|---|
| | | | Mar-14 | <1.00 | 4.7 |
| | | | Jun-14 | <1.00 | 5.1 |
| S26/0846 | 1807902 | 5449492 | Sep-13 | Not tested | 0.79 |
| | | | Dec-13 | Not tested | 0.91 |
| | | | Mar-14 | Not tested | 0.86 |
| | | | Jun-14 | Not tested | 0.71 |
| S27/0009 | 1793895 | 5443482 | Sep-13 | <1.00 | 3.3 |
| | | | Dec-13 | <1.00 | 3.4 |
| | | | Mar-14 | <1.00 | 3.4 |
| | | | Jun-14 | <1.00 | 2.5 |
| S27/0070 | 1797508 | 5443111 | Sep-13 | <1.00 | 0.61 |
| | | | Dec-13 | <1.00 | 0.58 |
| | | | Mar-14 | <1.00 | 0.147 |
| | | | Jun-14 | <1.00 | 0.99 |
| S27/0136 | 1802217 | 5446389 | Sep-13 | <1.00 | 3.7 |
| | | | Dec-13 | <1.00 | 0.57 |
| | | | Mar-14 | <1.00 | 2.7 |
| | | | Jun-14 | 22 | 4.9 |
| S27/0156 | 1803403 | 5442776 | Sep-13 | <1.00 | 0.005 |
| | | | Dec-13 | <1.00 | 3.6 |
| | | | Mar-14 | <1.00 | 0.004 |
| | | | Jun-14 | <1.00 | <0.200 |
| S27/0202 | 1805461 | 5446520 | Sep-13 | <1.00 | 3.6 |
| | | | Dec-13 | <1.00 | 2.2 |
| | | | Mar-14 | 1 | 2.3 |
| | | | Jun-14 | <1.00 | 2.8 |
| S27/0268 | 1793453 | 5434055 | Sep-13 | Not tested | 0.002 |
| | | | Dec-13 | Not tested | <0.200 |
| | | | Mar-14 | Not tested | <0.200 |
| | | | Jun-14 | Not tested | <0.02 |
| S27/0283 | 1797276 | 5436168 | Sep-13 | Not tested | <0.02 |
| | | | Dec-13 | Not tested | <0.02 |
| | | | Mar-14 | Not tested | 0.05 |
| | | | Jun-14 | Not tested | <0.02 |
| S27/0299 | 1796504 | 5438936 | Sep-13 | <1.00 | 0.34 |
| | | | Dec-13 | <1.00 | 0.3 |
| | | | Mar-14 | <1.00 | 0.33 |
| | | | Jun-14 | <1.00 | 0.84 |
| S27/0344 | 1803348 | 5437340 | Sep-13 | <1.00 | 0.26 |
| | | | Dec-13 | <1.00 | <0.002 |
| | | | Mar-14 | <1.00 | <0.002 |
| | | | Jun-14 | <1.00 | <0.02 |
| S27/0389 | 1807205 | 5433792 | Sep-13 | <1.00 | <0.002 |
| | | | Dec-13 | <1.00 | <0.002 |
| | | | Mar-14 | <1.00 | 0.107 |
| | | | Jun-14 | <1.00 | 0.004 |
| S27/0396 | 1805859 | 5435962 | Sep-13 | <1.00 | 0.36 |
| | | | Dec-13 | <1.00 | 0.186 |
| | | | Mar-14 | <1.00 | 0.74 |
| | | | Jun-14 | <1.00 | 0.33 |
| S27/0433 | 1787692 | 5427839 | Sep-13 | Not tested | <0.02 |
| | | | Dec-13 | Not tested | <0.200 |
| | | | Mar-14 | Not tested | <0.200 |
| | | | Jun-14 | Not tested | 0.3 |
| S27/0435 | 1787608 | 5430805 | Sep-13 | Not tested | 0.002 |
| | | | Dec-13 | Not tested | <0.02 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | <0.200 |
| S27/0442 | 1789891 | 5426884 | Sep-13 | Not tested | 0.006 |
| | | | Dec-13 | Not tested | <0.02 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | <0.02 |

| Site | X | Y | Date | *E.coli* (cfu/100mlL | Nitrate nitrogen (mg/L) |
|---|---|---|---|---|---|
| S27/0495 | 1797227 | 5431330 | Sep-13 | Not tested | 0.006 |
| | | | Dec-13 | Not tested | <0.02 |
| | | | Mar-14 | Not tested | 0.2 |
| | | | Jun-14 | Not tested | <0.200 |
| S27/0522 | 1803032 | 5431324 | Sep-13 | <1.00 | 3.3 |
| | | | Dec-13 | <1.00 | 3.5 |
| | | | Mar-14 | <1.00 | 3.5 |
| | | | Jun-14 | <1.00 | 3.8 |
| S27/0571 | 1807158 | 5433014 | Sep-13 | <1.00 | 6.6 |
| | | | Dec-13 | <1.00 | 6.3 |
| | | | Mar-14 | <1.00 | 6 |
| | | | Jun-14 | <1.00 | 6.7 |
| S27/0585 | 1780320 | 5422598 | Sep-13 | Not tested | <0.0100 |
| | | | Dec-13 | Not tested | 0.05 |
| | | | Mar-14 | Could not be sampled | |
| | | | Jun-14 | Not tested | <0.200 |
| S27/0588 | 1784844 | 5420714 | Sep-13 | <1.00 | <0.02 |
| | | | Dec-13 | <1.00 | <0.02 |
| | | | Mar-14 | <1.00 | <0.02 |
| | | | Jun-14 | <1.00 | <0.200 |
| S27/0594 | 1781351 | 5419721 | Sep-13 | Not tested | <0.0100 |
| | | | Dec-13 | Not tested | <0.002 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | 0.107 |
| S27/0602 | 1789626 | 5425302 | Sep-13 | Not tested | <0.002 |
| | | | Dec-13 | Not tested | 0.02 |
| | | | Mar-14 | Not tested | <0.200 |
| | | | Jun-14 | Not tested | 0.003 |
| S27/0607 | 1786289 | 5425037 | Sep-13 | Not tested | 0.9 |
| | | | Dec-13 | Not tested | 0.002 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | <0.200 |
| S27/0614 | 1786778 | 5421924 | Sep-13 | Not tested | <0.200 |
| | | | Dec-13 | Not tested | <0.02 |
| | | | Mar-14 | Could not be sampled | |
| | | | Jun-14 | Could not be sampled | |
| S27/0615 | 1786805 | 5422158 | Sep-13 | Not tested | <0.02 |
| | | | Dec-13 | Not tested | <0.200 |
| | | | Mar-14 | Not tested | <0.02 |
| | | | Jun-14 | Not tested | <0.200 |
| S27/0681 | 1808952 | 5433542 | Sep-13 | <1.00 | 0.38 |
| | | | Dec-13 | <1.00 | 0.39 |
| | | | Mar-14 | <1.00 | 0.3 |
| | | | Jun-14 | <1.00 | 0.24 |
| T26/0003 | 1822559 | 5473236 | Sep-13 | <1.00 | 6.8 |
| | | | Dec-13 | 1 | 7.4 |
| | | | Mar-14 | <1.00 | 0.51 |
| | | | Jun-14 | <1.00 | 1.48 |
| T26/0087 | 1820296 | 5464750 | Sep-13 | Not tested | 2.9 |
| | | | Dec-13 | Not tested | 2.3 |
| | | | Mar-14 | Not tested | 0.92 |
| | | | Jun-14 | Not tested | 1.62 |
| T26/0099 | 1822518 | 5467619 | Sep-13 | <1.00 | 3 |
| | | | Dec-13 | <1.00 | 3.2 |
| | | | Mar-14 | <1.00 | 2.7 |
| | | | Jun-14 | <1.00 | 2.8 |
| T26/0206 | 1822582 | 5467829 | Sep-13 | <1.00 | 1.76 |
| | | | Dec-13 | <1.00 | 1.78 |
| | | | Mar-14 | <1.00 | 1.65 |
| | | | Jun-14 | <1.00 | 1.94 |
| T26/0259 | 1825997 | 5469120 | Sep-13 | <1.00 | 3.6 |
| | | | Dec-13 | 2 | 1.61 |

| Site | X | Y | Date | *E.coli* (cfu/100mlL | Nitrate nitrogen (mg/L) |
|---|---|---|---|---|---|
| | | | Mar-14 | <1.00 | 0.66 |
| | | | Jun-14 | <1.00 | 0.74 |
| T26/0332 | 1822231 | 5457402 | Sep-13 | <1.00 | 1.08 |
| | | | Dec-13 | <1.00 | 0.69 |
| | | | Mar-14 | <1.00 | 0.54 |
| | | | Jun-14 | <1.00 | 0.52 |
| T26/0413 | 1824486 | 5459979 | Sep-13 | Not tested | <0.002 |
| | | | Dec-13 | Not tested | 0.002 |
| | | | Mar-14 | Not tested | <0.002 |
| | | | Jun-14 | Not tested | 0.058 |
| T26/0430 | 1822131 | 5463028 | Sep-13 | 1 | 3.8 |
| | | | Dec-13 | <1.00 | 2.6 |
| | | | Mar-14 | <1.00 | 1.29 |
| | | | Jun-14 | 4 | 1.75 |
| T26/0489 | 1827572 | 5461854 | Sep-13 | Not tested | 12.6 |
| | | | Dec-13 | Not tested | 11.3 |
| | | | Mar-14 | Not tested | 10.5 |
| | | | Jun-14 | Not tested | 11.4 |
| T26/0538 | 1827738 | 5461169 | Sep-13 | <1.00 | 9.8 |
| | | | Dec-13 | <1.00 | 8.7 |
| | | | Mar-14 | <1.00 | 8.8 |
| | | | Jun-14 | <1.00 | 7.8 |
| T27/0063 | 1858025 | 5446630 | Oct-13 | <1.00 | 1.37 |
| | | | Dec-13 | <1.00 | 0.005 |
| | | | Mar-14 | <1.00 | 1.1 |
| | | | Jun-14 | <1.00 | 1.36 |