

# State of the Environment: Groundwater State and Trends in the Auckland Region 2016

Edda Kalbus, Laura Buckthought, Angela Perks, Jamie Boyle

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## Executive summary

The Auckland Council regularly monitors groundwater levels and quality (physical, chemical and microbiological properties) within some of the region's aquifers as part of its state of the environment (SoE) programme. The primary purpose of the SoE groundwater programme is to provide information on the status and long-term trends of groundwater at a regional scale, thus providing evidence for availability and the sustainability of water allocation. The results enable Auckland Council to assess if the groundwater is suitable for potable supply, supporting plant and animal life when discharged as baseflow to rivers, saline intrusion risk and how groundwater quality changes over time.

Groundwater availability in the Auckland region originates primarily from rainfall, which percolates down through porous rock, fractures, or unconsolidated sand, gravel or silt materials. Aquifers in the Auckland region are an important water source for many rural areas and for some industries, and also supply a small proportion of Auckland's drinking water. The primary aquifer types, as used in the Auckland region, include the Waitematā aquifers, Auckland volcanics, south Auckland volcanics, Kaawa formation, greywacke, Quaternary sediments, and geothermal aquifers.

The purpose of this report is to summarise and analyse the groundwater data, assess the current state of groundwater levels and quality across the Auckland region, and identify long-term trends. For the purpose of this report, Auckland's aquifers were grouped into five areas; North-East, North-West, Waiheke Island, Central and South.

Groundwater levels were generally stable with only small fluctuations observed in many bores over time. There were exceptions however, such as the Mt Richmond volcanic aquifer, which had substantial fluctuations over time. Declining trends in water level were observed in Omaha Waitematā, Karaka Waitematā, Waiau Pa Waitematā and Parakai geothermal, aquifers. Increasing trends in water levels were observed in the Manukau Waitematā, Clevedon East Waitematā, Bombay volcanic, Pukekohe central volcanic and Bombay-Drury Kaawa aquifers.

The state of groundwater quality is generally good, with the exception of nitrate which exceeded the maximum allowable value (MAV) for drinking water in four of the thirteen bores situated in Southern aquifers. Two of these sites, BP Bombay and Rifle Range Road Shallow, showed an increasing trend for nitrate for the Bombay volcanic and Pukekohe central volcanic aquifers respectively.

Of the few significant and environmentally meaningful trends, the most common were for total and soluble iron and manganese, with both increasing and decreasing trends.

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## **1.0 Introduction**

### **1.1 Groundwater in the Auckland region**

Auckland's groundwater supply comes predominantly from rainfall, which percolates down through porous rock, rock fractures or unconsolidated sand, gravel or silt materials. This water fills up the pore space between grains or fissures in the rock and forming an aquifer.

The geology of the Auckland region comprises Triassic to Early Cretaceous basement 'greywacke' rocks overlain by a succession of Tertiary (Late Eocene to Early Miocene) marine sediments, covered by a thin sequence of Pliocene to Holocene terrestrial and shallow marine sediments found mainly in coastal and lowland areas. From Early Miocene to Holocene, intermittent volcanic activity formed much of the Waitākere Ranges, Great Barrier Island, Little Barrier Island, South Auckland Volcanic Field and Auckland (Isthmus) Volcanic Field (Edbrooke, 2001).

Aquifers in the Auckland region are low yielding compared with other parts of New Zealand (Crowcroft & Smaill, 2001), yet they are an important water source for many rural areas and for some industries. A small percentage of Auckland's drinking water is sourced from groundwater supplies located in the Onehunga, Muriwai, Hamiltons Road, Waiuku and Bombay areas (WaterCare, 2010).

The primary aquifer types that have been developed and used in the Auckland region are outlined below. Each aquifer type contains many separate aquifer systems, and within each aquifer system are numerous individual aquifers storing and transporting regionally significant quantities of groundwater.

#### **1.1.1 Waitematā Aquifers**

The Waitematā Aquifers are situated within the Waitematā Group sediments and are comprised of alternating sandstones and mudstones. The Waitematā Group rocks form the majority of the Auckland region's local basement, excluding a few locations in the Hunua Ranges, areas of Onerahi rocks in the north, and some Hauraki Gulf Islands (Balance, 1976). Within the Waitematā Group, fracturing, jointing and thickness of the sandstone beds vary throughout the Auckland region. Total thicknesses range from a few meters to over 1000m (Crowcroft & Smaill, 2001). The Waitematā aquifers are mostly confined and hydraulic characteristics vary across the Auckland region. In general, these aquifers are low-yielding.

### **1.1.2 Auckland Volcanics**

The main basaltic aquifers situated within the Auckland Volcanics are located at Mt Albert, Mt Eden, Mt Richmond, Mt Wellington/Onehunga, and Western Springs, with smaller basaltic aquifers located at Epsom and the Auckland Domain (Crowcroft & Smaill, 2001). These aquifers feature multiple basaltic cones, basaltic flow deposits and tuff rings. Basaltic flows from multiple eruptions sites have merged together in the subsurface, allowing for groundwater to be transported through the fractures in these flows (Crowcroft & Smaill, 2001). Due to the nature of volcanic material, aquifer properties vary markedly, both horizontally and vertically over short distances (Crowcroft & Smaill, 2001). Aquifers in the Auckland Volcanic field respond quickly to both rainfall events and abstraction.

### **1.1.3 South Auckland Volcanics**

The South Auckland Volcanic Field extends from Papakura to Pukekawa and westward from the Manukau lowlands to Waiuku. These consist largely of scoria cones, tuff rings and lava flows. Groundwater within these aquifers is mainly utilised for irrigation purposes in areas of the Pukekohe and Bombay Hills. Groundwater is mainly accessed from shallow bores between 30m and 60m depth (Crowcroft & Smaill, 2001).

### **1.1.4 Kaawa Formation**

The Kaawa formation rests unconformably on the Waitematā Group and is comprised of pumiceous/sandy shell beds, sandstone with scattered pebbles and some gravels (ARWB, 1989). Shell beds range from 0.5 to 6.0m in thickness (Crowcroft & Smaill, 2001). The Kaawa Aquifer is an important, relatively deep confined aquifer in the Manukau lowlands, around Waiuku, Glenbrook, Pukekohe and Puni.

### **1.1.5 Geothermal Groundwater**

Parakai and Waiwera are the two most well-known and developed geothermal aquifer resources in the Auckland region. Geothermal water rises through fault systems and is stored within Waitematā Group rocks (Crowcroft & Smaill, 2001). Maximum bore production temperatures have been recorded at 53°C for the Waiwera field and at 65°C at Parakai (Crowcroft & Smaill, 2001). Other smaller geothermal waters also occur as springs on Great Barrier Island and at Whitford and East Tamaki.

### **1.1.6 Greywacke**

Greywacke is the main base rock of the Auckland region and is comprised of hardened sandstone, siltstone and mudstone. The low porosity of greywacke means that this substrate is unsuitable as a good aquifer host rock. Groundwater movement within greywacke is primarily through fractures or along contacts with overlying material (Crowcroft & Smaill, 2001). Within the Auckland region, greywacke rocks are not generally used as a source for groundwater, with the exception of locations where water supplies are limited and alternative water supplies are scarce, such as Waiheke Island.

### **1.1.7 Quaternary Sediments**

Quaternary Sediments are geologically young sediments that form in the low-lying parts of the Auckland region. In areas such as the Manukau lowlands, groundwater within the quaternary sediments has been an important source of minor water supplies for rural domestic use and farm holdings. However, yields are low and water quality is generally quite poor (Crowcroft & Smaill, 2001).

## **1.2 Groundwater management**

For management purposes, the Auckland region is divided into five aquifer management areas, and high-use aquifer management areas have been defined for the areas in which most of the groundwater abstraction occurs. The Auckland Unitary Plan (AUP (OP)) sets a guideline availability for annual abstraction from specific aquifer management areas (Appendix 3 AUP (OP)). For one of these aquifers (Omaha Waitematā), and additionally, for the two geothermal aquifers (Parakai & Waiwera), the AUP (OP) also sets an interim minimum groundwater level (metres above sea level). For all aquifers not separately listed in the AUP, availability is estimated as a percentage of average annual recharge depending on aquifer type:

- 15 per cent of average annual recharge for shallow, coastal aquifers;
- 35 per cent for aquifers with connection to a surface water body;
- 65 per cent for all other aquifers not separately listed without connection to a surface water body.

The AUP (OP) also defines a number of quality-sensitive aquifer management areas for aquifers that are shallow and unconfined and, therefore, susceptible to pollution from surface sources:

- rural aquifers - Kaipara Sand, Franklin Volcanic, Drury Sand and Āwhitu Sand; and
- urban aquifers - Auckland isthmus volcanics (including the Ōnehunga, Western Springs Volcanic, Mt Richmond Volcanic, Wiri Volcanic and Mt Wellington aquifers).

### **1.3 Auckland Council monitoring programme**

The Auckland Council state of the environment (SoE) groundwater monitoring programme includes groundwater level and groundwater quality work streams. The primary purpose of the SoE groundwater programme is to provide information on the state and trends of groundwater levels and groundwater quality at a *regional* scale.

Groundwater levels are monitored across the region to determine long-term trends in groundwater levels, which provides evidence for groundwater availability and of the sustainability of water allocation limits. The majority of groundwater level records commenced between 1977 and 1997, providing a long-term record of groundwater level for the region.

The groundwater quality programme monitors the physical, chemical and microbiological properties of groundwater within the region's aquifers. The results enable Auckland Council to assess how suitable the groundwater is for potable supply, supporting plant and animal life when discharged as baseflow to rivers, and how groundwater quality changes over time. Records of groundwater quality data commenced in 1998.

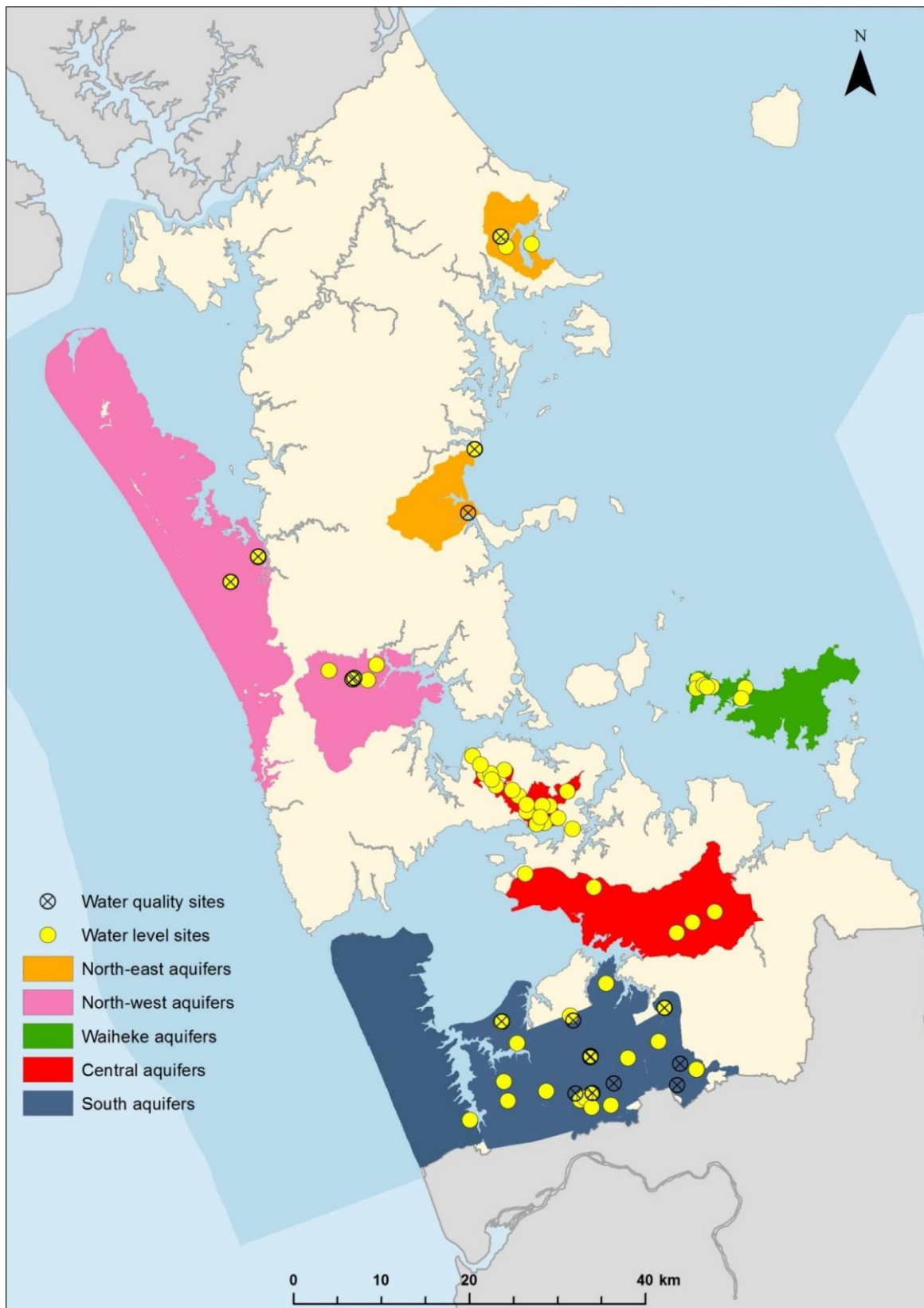
### **1.4 Purpose, scope and structure of this report**

As required under the Resource Management Act (RMA), (1991), the current state of groundwater levels and quality across the Auckland region are monitored to determine long term-trends and region-scale information to report to Aucklanders on the state of the region's groundwater resources.

This report summarises the state of the environment for Auckland's groundwater across all sites included in the analysis and compares, where appropriate, to relevant guidelines and standards. Trend analysis for each water quality parameter and water level at each monitoring site are also presented.

This is the first technical report on the Auckland region's groundwater quality (state and trends) since Daughney (2007), which covered 24 sites sampled between 1998 and 2004. Auckland's groundwater levels (state and trends) have not been reported previously.

For the purpose of this report, Auckland's monitored aquifers were grouped into five areas: North-East, North-West, Waiheke Island, Central and South (Figure 1). Groundwater level and quality results are presented for each aquifer and grouped into these five areas.



**Figure 1: Overview of aquifer groups and sites monitored as part of state of the environment monitoring in the Auckland region.**

## **2.0 Methods**

### **2.1 Groundwater level methods**

#### **2.1.1 Data collection**

The groundwater level network consisted of 75 sites in 2015. Of these sites, eight were fully automated and 67 were manual, with measurements taken monthly or fortnightly (Tables 2, 5, 8, 10 and 12).

Data collection is carried out by the RIMU team of Auckland Council. Water levels in manual bores are measured with a water level meter (Heron T-Dipper). Automated bores are equipped with pressure transducers or shaft encoders, which record water levels at 15-minute intervals.

#### **2.1.2 Data analysis**

Groundwater level data were analysed for the 10-year period 2006-2015 using the R software environment for statistical computing and graphics version 3.2.4 (R Core Team, 2016) with the wq-package version 0.4.8 (Jassby and Cloern, 2016).

Based on monthly averages of groundwater level, summary statistics (minimum, median, mean, maximum and standard deviation) were calculated for each site.

Trends over the 10-year period were estimated using the Seasonal Sen Slope Estimator method ( $p < 0.05$ ). A statistically significant trend does not necessarily indicate a 'meaningful' trend that is likely to be relevant in a management sense. Using the approach taken by Environment Southland (Wilson, 2011), a trend was considered meaningful when it was both statistically significant and the annual rate of change (i.e. the slope in m/yr) exceeded five per cent of the inter-quartile range of the groundwater levels. This means, for instance, if a decreasing trend at a site were to continue for 20 years, the minimum groundwater level as it is currently would become the maximum water level.

For each aquifer, a set of graphs was produced (Appendices A-E):

- A time series graph showing the complete data record for each site in the aquifer.
- Box plots of monthly variations for the 10-year period 2006-2015 for each site. Boxplots show minimum (lower whiskers), 25<sup>th</sup> percentile (bottom of box), median (horizontal line within box), 75<sup>th</sup> percentile (top of box) and maximum (upper whiskers).

- Time series graphs for the 10-year period 2006-2015 including a trend line obtained from Sen Slope estimation for each site (solid line indicates a meaningful trend, dashed line indicates a non-meaningful trend).

## **2.2 Groundwater quality methods**

### **2.2.1 Data collection**

From 1998 to 2013, the groundwater quality network consisted of 27 sites (24 bores and three springs). Since the network has been reduced to nine sites (six bores and three springs). There is high variability in data collection as the frequency of monitoring has changed over time, but since 2013 monitoring has occurred four times per year.

Sample collection is carried out by Auckland Council staff. Bores are purged to remove the equivalent of three times the bore volume before samples are collected. This is to remove stagnant water from the bore and ensure the sample collected is representative of fresh recharge from the groundwater table. A variety of water quality parameters (Table 1) are routinely monitored, some in the field using a portable handheld multiparameter meter (YSI 556 MPS), and the remainder determined by laboratory analysis.

Quality control measures are undertaken in accordance with Auckland Council's internal standards (ISO 9001:2008). This covers procedures for the collection, transport and storage of samples, methods for data verification and quality assurance to ensure consistency and accuracy across the monitoring programmes.

Laboratory samples are analysed under contract by Watercare Laboratory Services Ltd. Analytical methods for all analytes (except metals) follow the "Standard Methods for the Examination of Water and Wastewater" 22nd Edition (APHA, 2005). Metal analytes are tested according to US EPA Method 200.8 for the "Determination of Trace Metals in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry" Revision 5.4 (USEPA, 1994).

All field and laboratory data generated by Council are stored in the council's water quality archiving database (HYDSTRA).

**Table 1: Parameters tested in the groundwater quality programme and analysed for state and trends in this report (laboratory test methods refer to those tests carried out by Watercare Services Ltd under contract).**

| Parameters              | Units                     | Field/Laboratory |
|-------------------------|---------------------------|------------------|
| Temperature             | °C                        | Field            |
| Electrical conductivity | µS/cm                     | Field            |
| pH                      |                           | Field            |
| DO mg/L                 | mg/L                      | Field            |
| DO % sat                | %                         | Field            |
| Turbidity               | NTU                       | Laboratory       |
| Dissolved solids        | mg/L                      | Laboratory       |
| Ammonium-N              | mg/L                      | Laboratory       |
| Nitrite-N               | mg/L                      | Laboratory       |
| Nitrate-N               | mg/L                      | Laboratory       |
| Soluble P               | mg/L                      | Laboratory       |
| Total P                 | mg/L                      | Laboratory       |
| Total alkalinity        | mg/L (CaCO <sub>3</sub> ) | Laboratory       |
| Hydroxide alkalinity    | mg/L                      | Laboratory       |
| Carbonate alkalinity    | mg/L                      | Laboratory       |
| Total hardness          | mg/L (CaCO <sub>3</sub> ) | Laboratory       |
| Magnesium hardness      | mg/L (CaCO <sub>3</sub> ) | Laboratory       |
| Calcium hardness        | mg/L (CaCO <sub>3</sub> ) | Laboratory       |
| Bicarbonate             | mg/L                      | Laboratory       |
| Soluble potassium       | mg/L                      | Laboratory       |
| Chloride                | mg/L                      | Laboratory       |
| Soluble iron            | mg/L                      | Laboratory       |
| Total iron              | mg/L                      | Laboratory       |
| Soluble manganese       | mg/L                      | Laboratory       |
| Total manganese         | mg/L                      | Laboratory       |
| Soluble calcium         | mg/L                      | Laboratory       |
| Soluble magnesium       | mg/L                      | Laboratory       |
| Soluble sodium          | mg/L                      | Laboratory       |
| Soluble silica          | mg/L                      | Laboratory       |
| Sulphate                | mg/L                      | Laboratory       |
| Total fluoride          | mg/L                      | Laboratory       |

### 2.2.2 Data analysis

Summary statistics for selected parameters, based on those reported by GNS for the national groundwater quality state and trends analyses (Moreau and Daughney, 2015) are provided in the main body of this report, while summary statistics for all analysed parameters are included in Appendix F. The selected groundwater parameters this report focuses on include:

- Nitrogen species
- Phosphorus species
- E.coli
- Iron
- Manganese
- Salinity
- Electrical conductivity
- Dissolved oxygen

Where applicable, median values of the parameters were compared to the Australia and New Zealand Environment and Conservation Council (ANZECC) Guidelines for Marine and Fresh Waters (ANZECC, 2000), using trigger values (TV) for the 95 per cent species protection level for freshwater systems. Median values were also compared to maximum allowable values (MAV) or aesthetic guideline values (GV) based on the Drinking Water Standards for New Zealand (MoH, 2000).

The mean absolute deviation (MAD) was calculated for each parameter as a means of assessing variability. The MAD can be compared to the median to provide an estimation of the groundwater security. A large MAD can indicate the site is likely non-secure meaning it may be affected by significant seasonal variation, groundwater abstraction, land use change, or other factors such as changes in laboratory methods.

Groundwater quality data was also analysed for trends for the 15 year period from 1998-2013 using a GNS spreadsheet for automated processing of water quality data (Daughney 2010). A Mann Kendall test was used to determine the direction and magnitude of any monotonic trends in the data.

Historically, the groundwater quality data was highly varied in terms of the sites that were routinely monitored; the frequency that monitoring was undertaken; and the parameters analysed. For this reason, it was not possible to perform the trend analysis for identical time periods for each site. The majority of sites had good data

records from 1998 to 2013; therefore the trend analysis was carried out on the available data for each site for this period (Table 3, Table 7, Table 13 and Table 17). The difference in length and frequency of the datasets creates limitations in the ability to accurately compare trends from different sites that have different historic datasets.

A statistically significant trend does not necessarily indicate an environmentally meaningful trend (that is likely to be relevant in a management sense), therefore the trends in this report are categorised as recommended by Scarsbrook (2006) and Ballantine (2012) for surface water. As standard practice, a trend is considered environmentally meaningful if it is both statistically significant and the per cent annual change is greater than 1 per cent per year.

#### **2.2.2.1 Groundwater quality trend graphs**

Groundwater quality trends are shown for the selected parameters for each site in a graph. The trend information is displayed graphically with the parameters on the y axis and the per cent annual change on the x axis. The significance of the trends are illustrated as a square symbol for non-significant trends and a circle for statistically significant trends at the 95% level ( $P < 0.05$ ); the colour of the circle indicates the strength of the significance (yellow:  $P < 0.05$ , orange:  $P < 0.01$  and red:  $P < 0.001$ , the lower the P value the higher the level of significance of the trend). The 1% annual change threshold for an environmentally meaningful trend is also shown as two vertical dashed lines on each graph.

## 3.0 Results and Discussion

### 3.1 North-East aquifers

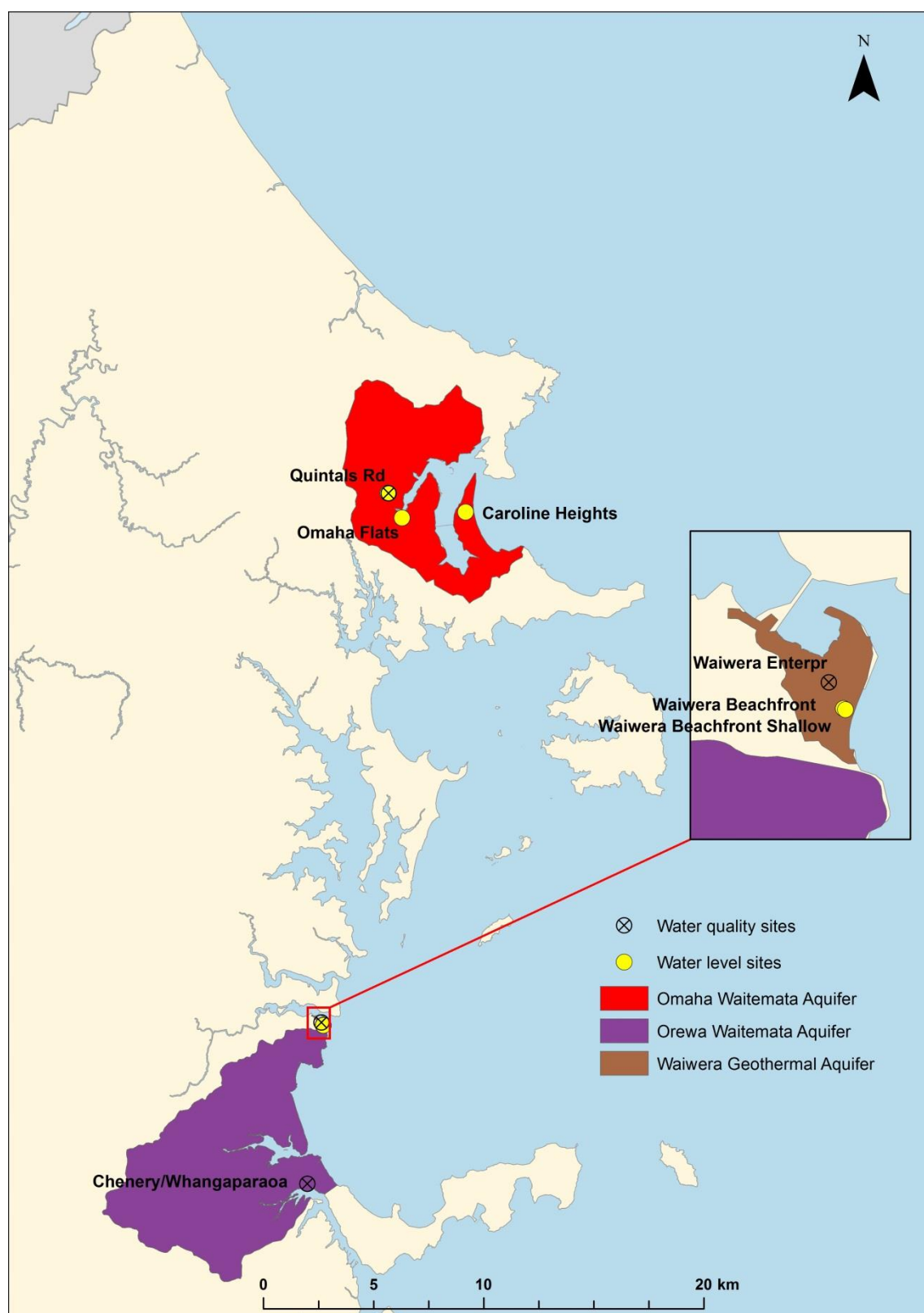


Figure 2: Aquifers and monitoring sites in the North-East.

**Table 2: Groundwater level monitoring sites in the North-East.**

(**bold** = automatic bore, 15 min frequency; *italics* = manual bore, monthly frequency)

Note: some bores do not have I.D.s and screen information and this is indicated by a dash.

| Aquifer            | Site name                         | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth | Screen top | Screen bottom |
|--------------------|-----------------------------------|-------------|---------|---------|----------|---------------|----------------|------------|------------|---------------|
|                    |                                   |             |         |         |          |               |                | (mbgl)     | (mbgl)     | (mbgl)        |
| Omaha Waitematā    | <i>Quintals Rd</i>                | 6437005     | 2046    | 1755808 | 5978258  | 12.9          | 3/02/1977      | 130        | 94         | 130           |
|                    | <b>Omaha Flats</b>                | 6437021     | -       | 1756458 | 5977136  | 7.0           | 7/12/1977      | 50         | -          | -             |
|                    | <i>Caroline Heights</i>           | 6437087     | 752     | 1759336 | 5977399  | 13.0          | 31/05/1993     | 188        | -          | -             |
| Waiwera Geothermal | <b>Waiwera Beachfront</b>         | 6457041     | 2424    | 1752864 | 5954099  | 3.2           | 30/11/1976     | 405        | 150        | 405           |
|                    | <b>Waiwera Beachfront Shallow</b> | 6457097     | 5679    | 1752874 | 5954094  | 3.2           | 10/12/1997     | 52         | 30         | 52            |

**Table 3: Groundwater quality monitoring sites in the North-East.**

| Aquifer            | Site name             | Site number | Bore ID | Easting | Northing | Date sampling commenced | Trend analysis period | Bore depth (mbgl) | Pumping depth (mbgl) |
|--------------------|-----------------------|-------------|---------|---------|----------|-------------------------|-----------------------|-------------------|----------------------|
| Omaha Waitematā    | Quintals Rd           | 6437005     | 2046    | 1755808 | 5978258  | 8/11/1994               | 1998-2013             | 130               | 40                   |
| Waiwera Geothermal | Waiwera Enterpr       | 6457053     | -       | 1752798 | 5954217  | 19/01/1999              | 1999-2012             | 400               | N/A                  |
| Orewa Waitematā    | Chenery/ Whangaparaoa | 6467025     | -       | 1752155 | 5946891  | 22/01/1998              | 1998-2013             | 500               | 40                   |

The dominant land uses in this area are pastoral farming, horticulture and forestry. Groundwater demand is mainly for horticulture and municipal water supply. Waiwera geothermal water is used for recreational purposes.

The monitored aquifers in this area are all from the Waitematā Group (Figure 2). The Omaha Waitematā aquifer has three monitoring bores, one of which is also sampled for groundwater quality. The Waiwera Geothermal Aquifer has two groundwater level monitoring bores, and a water quality bore (Waiwera Enterpr). Details of the groundwater level monitoring bores are shown in Table 2, and details of the groundwater quality monitoring bores are shown in Table 3.

### 3.1.1 Groundwater levels

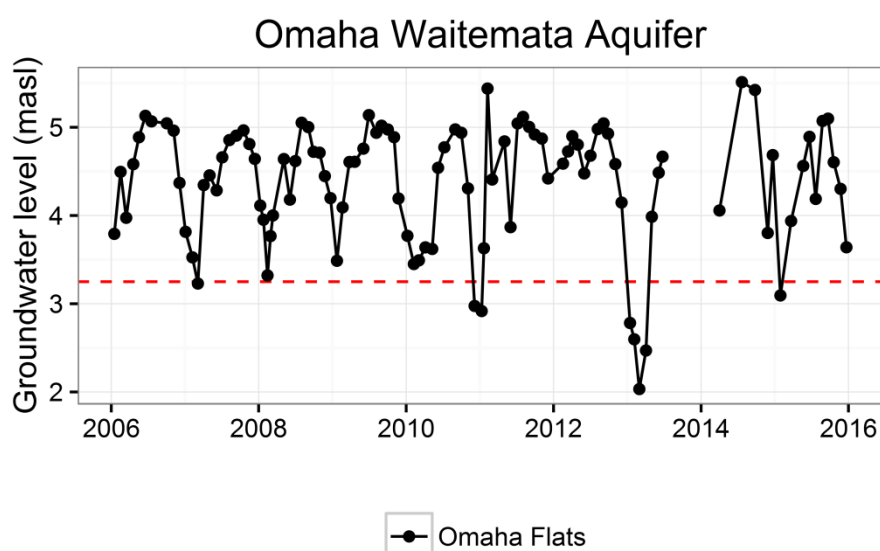
An environmentally meaningful decline in groundwater level has been measured at the Quintals Rd bore and the Caroline Heights bore within the Omaha Waitematā Aquifer during the last ten years (Table 4 and Appendix A).

**Table 4: Groundwater level summary statistics of the aquifers in the North-East**

(Min = minimum, Max = maximum, SD = standard deviation, masl = meters above sea level, \* = statistically significant, \*\* = meaningful)

| Aquifer            | Site name                  | Min (masl) | Max (masl) | Median (masl) | Mean (masl) | SD (m) | Sen slope (m/yr) |
|--------------------|----------------------------|------------|------------|---------------|-------------|--------|------------------|
| Omaha Waitematā    | Quintals Rd                | 7.24       | 9.50       | 8.58          | 8.50        | 0.58   | -0.045**         |
|                    | Omaha Flats                | 2.23       | 5.48       | 4.55          | 4.42        | 0.62   | -0.016           |
|                    | Caroline Heights           | -0.53      | 1.64       | 0.80          | 0.78        | 0.49   | -0.048**         |
| Waiwera Geothermal | Waiwera Beachfront         | -0.03      | 1.68       | 1.38          | 1.21        | 0.43   | 0.110**          |
|                    | Waiwera Beachfront Shallow | -0.10      | 1.71       | 1.41          | 1.21        | 0.43   | 0.110**          |

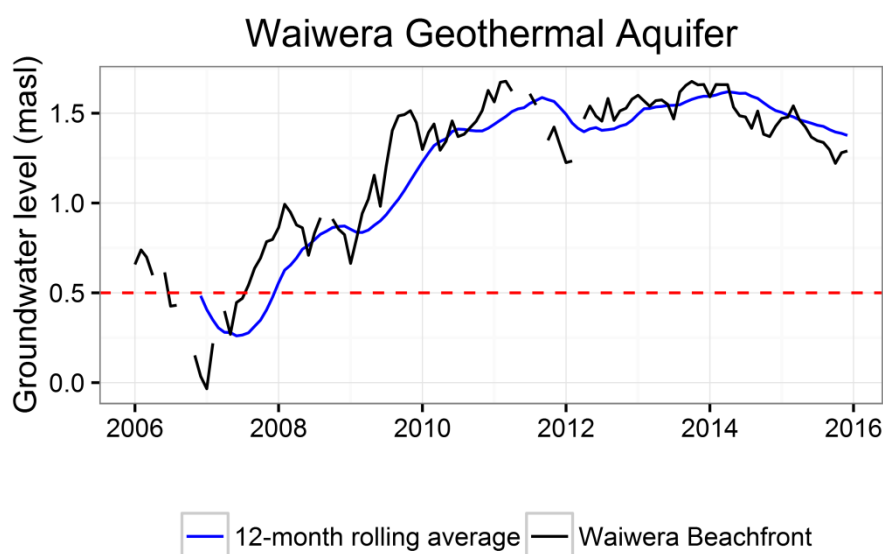
The Omaha Waitematā aquifer has an interim minimum level set in the AUP (OP), at 3.25 masl for any 11 months of the year at the Omaha Flats bore (“Bore 25, Point Wells Rd” in the AUP (OP) Appendix 3). At this bore, the water level fell below the minimum level set in the AUP during one month in 2015, two months in 2013 and one month in 2011 (Figure 3). With the exception of the summer of 2013, the limit set in the AUP was met.



**Figure 3: Water levels at the Omaha Flats bore. Red dashed line indicates the interim management level set in the AUP (OP). Dots indicate individual manual measurements.**

In the Waiwera Geothermal Aquifer, water levels have increased since the 1980s and also show an environmentally meaningful increase over the last ten years, although they have declined the last two years (Figure 4).

An interim minimum water level is set in the AUP (OP) at 0.5 masl averaged over any consecutive 12 months at the Waiwera Beachfront bore (“AC Beachfront Deep Bore No. 74” AUP (OP) Appendix 3), which is interpreted as a 12-month rolling average. The 12-month rolling average has been consistently above the minimum level set in the AUP since 2008 (Figure 4).



**Figure 4: Water levels and 12-month rolling average at the Waiwera Beachfront bore. Red dashed line indicates the management level set in the AUP.**

### 3.1.2 Groundwater quality

The summary statistics showed that most sites, across all aquifers exceeded the mean absolute deviation (MAD) for ammoniacal N, soluble P, soluble iron, soluble manganese and dissolved oxygen, suggesting there was a high level of variation in the data for these parameters (Table 5). This variation is unexplained, but could be natural variation or related to temperature in the case of the Waiwera geothermal aquifer. There were very few meaningful trends observed in the North-East aquifers (Figure 5).

#### *Omaha Waitematā Aquifer*

Soluble iron and manganese at the Quintels road site exceeded the aesthetic guideline values (GV); however, there were no exceedances of the maximum allowable values (MAV) in any parameters at this or any other site (Table 5).

There was an increase in soluble iron of approximately 6% per year at the Quintels Road site. The solubility of iron (and manganese) depends largely on the dissolved oxygen (DO) content of the water. When DO concentrations are greater than 1-2 mg/L (~10% saturation), iron occurs in the largely insoluble  $\text{Fe}^{3+}$  form, while at lower concentrations, it occurs as soluble  $\text{Fe}^{2+}$ . The increasing trend in soluble iron could be due to the decreasing (but not-significant) trend in the oxygen content of the groundwater. This may or may not be linked to the observed decline in groundwater levels in this bore (Table 4).

#### *Waiwera Geothermal Aquifer*

Ammoniacal N at the Waiwera Enterpr. site exceeded the ANZECC trigger value. There were no significant trends in any water quality parameters at this site, suggesting background concentrations of ammoniacal N may be naturally high. This may be due to the geothermal conditions in this aquifer.

#### *Orewa Waitematā Aquifer*

At the Chenery/Whangaparaoa site there were decreases in total iron (11%) and soluble manganese (4%). There was a small but non-significant increasing trend in DO, which may have influenced the soluble manganese trend, but not total iron. Also, the nature of the DO data was very changeable, making it difficult to identify links with the water chemistry trends. The high pH in this bore (median = 9.86) could be playing a role in the observed trends.

This high pH could also explain the decreasing ammoniacal N trend. Where ammoniacal N is present in water, there is an equilibrium reaction between ammonium ( $\text{NH}_4^+$ ) and ammonia ( $\text{NH}_3$ ). High pH conditions favour the formation of

ammonia gas ( $\text{NH}_3$ ), which could slowly escape the system, reducing the amount of detectable ammoniacal N in the water.

**Table 5: Summary of medians, median absolute deviations (MAD) and trends for selected parameters in the North-East bores.**

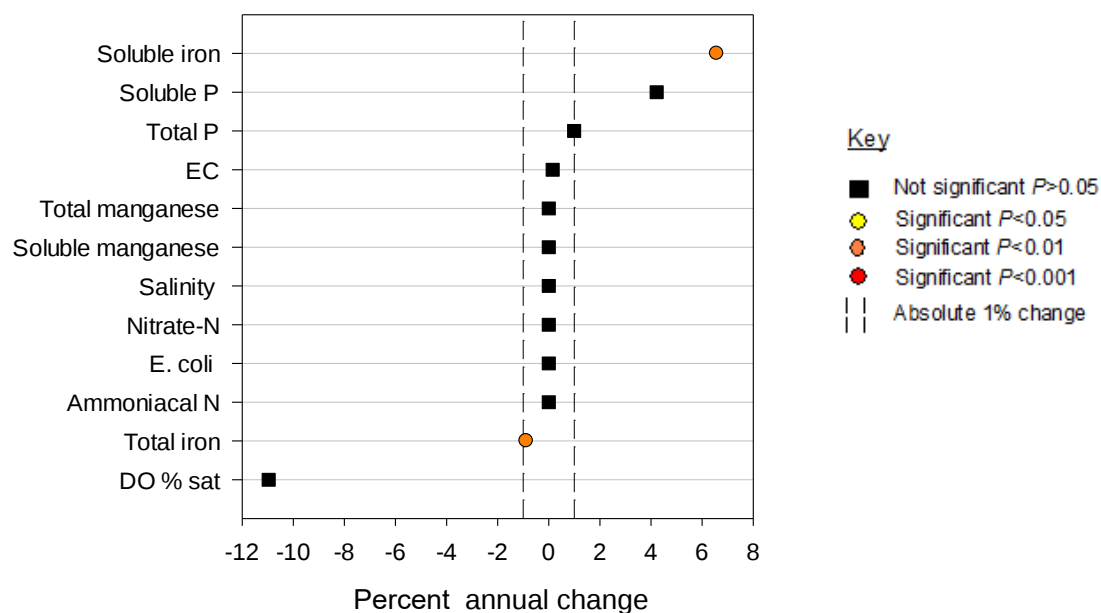
Medians in **orange** exceed trigger values (TV) for the 95% species protection level for freshwaters (ANZECC, 2000), **red** exceed health-related maximum allowable values (MAV) and **purple** exceed aesthetic guideline values (GV). MAV and GV are based on the NZ Drinking Water Standards (MoH, 2000). MAD in **blue** are deviations >10% of the median. Trends in **green** are statistically significant (p<0.05).

|                    |                       | Nitrate (mg/L)<br>TV=7.2, MAV=11.3            |       |                | Ammoniacal N (mg/L)<br>TV=0.9, GV=1.24 |       |                | Soluble P (mg/L) |       |                | Soluble Fe (mg/L)<br>GV=0.2 |       |                |
|--------------------|-----------------------|-----------------------------------------------|-------|----------------|----------------------------------------|-------|----------------|------------------|-------|----------------|-----------------------------|-------|----------------|
| Aquifer            | Site                  | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD   | Trend (unit/y) |
| Omaha Waitematā    | Quintals Rd           | 0.002                                         | 0.000 | 0.000          | 0.031                                  | 0.006 | 0.000          | 0.012            | 0.008 | 0.000          | 1.800                       | 0.500 | 0.118          |
| Waiwera geothermal | Waiwera Enterpr.      | 0.002                                         | 0.000 | 0.000          | 1.275                                  | 0.025 | -0.009         | 0.005            | 0.001 | 0.000          | 0.005                       | 0.003 | 0.000          |
| Orewa Waitematā    | Chenery/ Whangaparaoa | 0.002                                         | 0.000 | 0.000          | 0.288                                  | 0.048 | -0.006         | 0.044            | 0.007 | -0.001         | 0.007                       | 0.002 | 0.000          |
|                    |                       | Soluble Mn (mg/L)<br>TV=1.9, MAV=0.5, GV=0.05 |       |                | TDS (mg/L)<br>GV=1000                  |       |                | EC (mS/cm)       |       |                | DO (%sat)                   |       |                |
| Aquifer            | Site                  | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD   | Trend (unit/y) |
| Omaha Waitematā    | Quintals Rd           | 0.229                                         | 0.009 | 0.000          | 326                                    | 8.0   | 1.641          | 0.460            | 0.006 | 0.001          | 1.800                       | 0.950 | -0.197         |
| Waiwera geothermal | Waiwera Enterpr.      | 0.002                                         | 0.001 | 0.000          | 2059                                   | 41.5  | 0.000          | ND               | ND    | ND             | ND                          | ND    | ND             |
| Orewa Waitematā    | Chenery/ Whangaparaoa | 0.001                                         | 0.000 | 0.000          | 236                                    | 4.5   | 0.545          | 0.385            | 0.027 | 0.007          | 23.850                      | 3.550 | 0.528          |

### 3.1.2.1 Trends Graphs North-East Aquifers

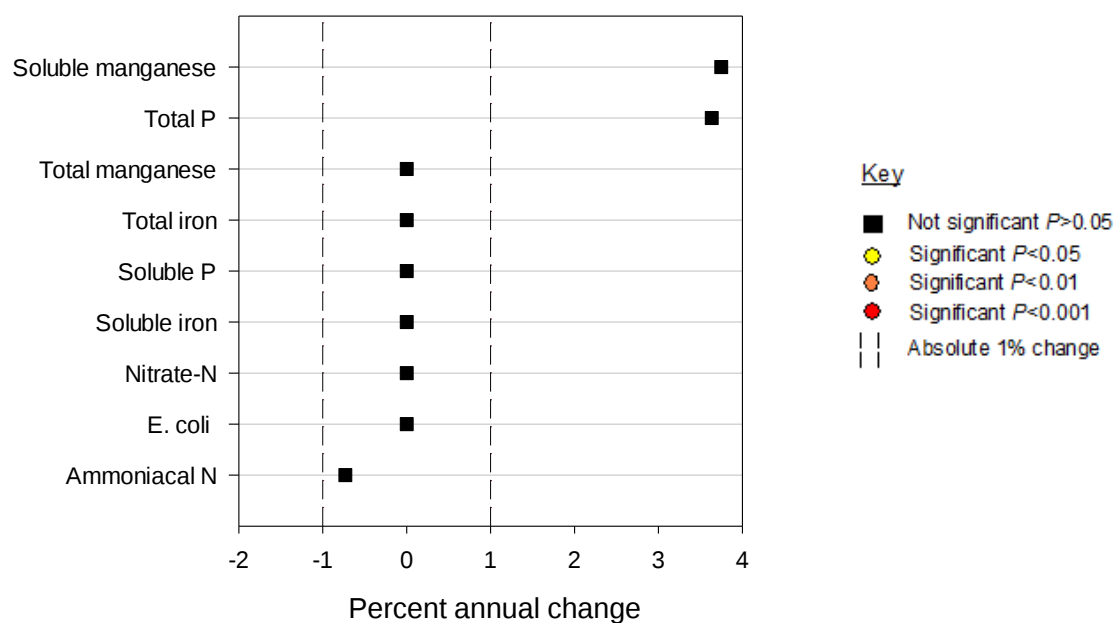
#### *Omaha Waitematā Aquifer:*

##### a) Quintels Rd



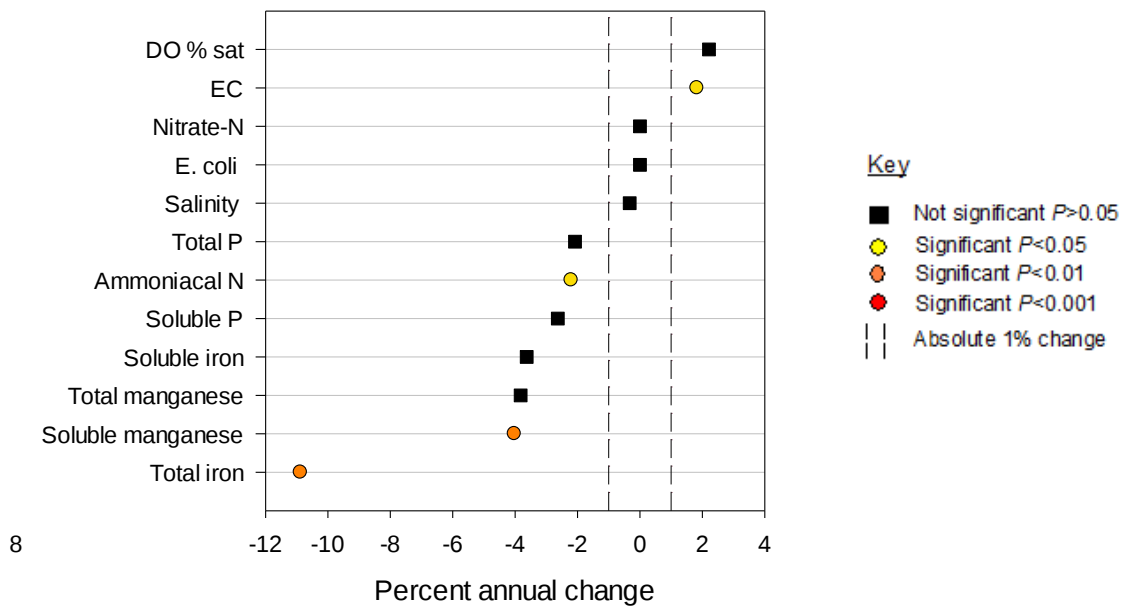
#### *Waiwera Geothermal Aquifer:*

##### b) Waiwera Enterpr.



## Orewa Waitematā Aquifer

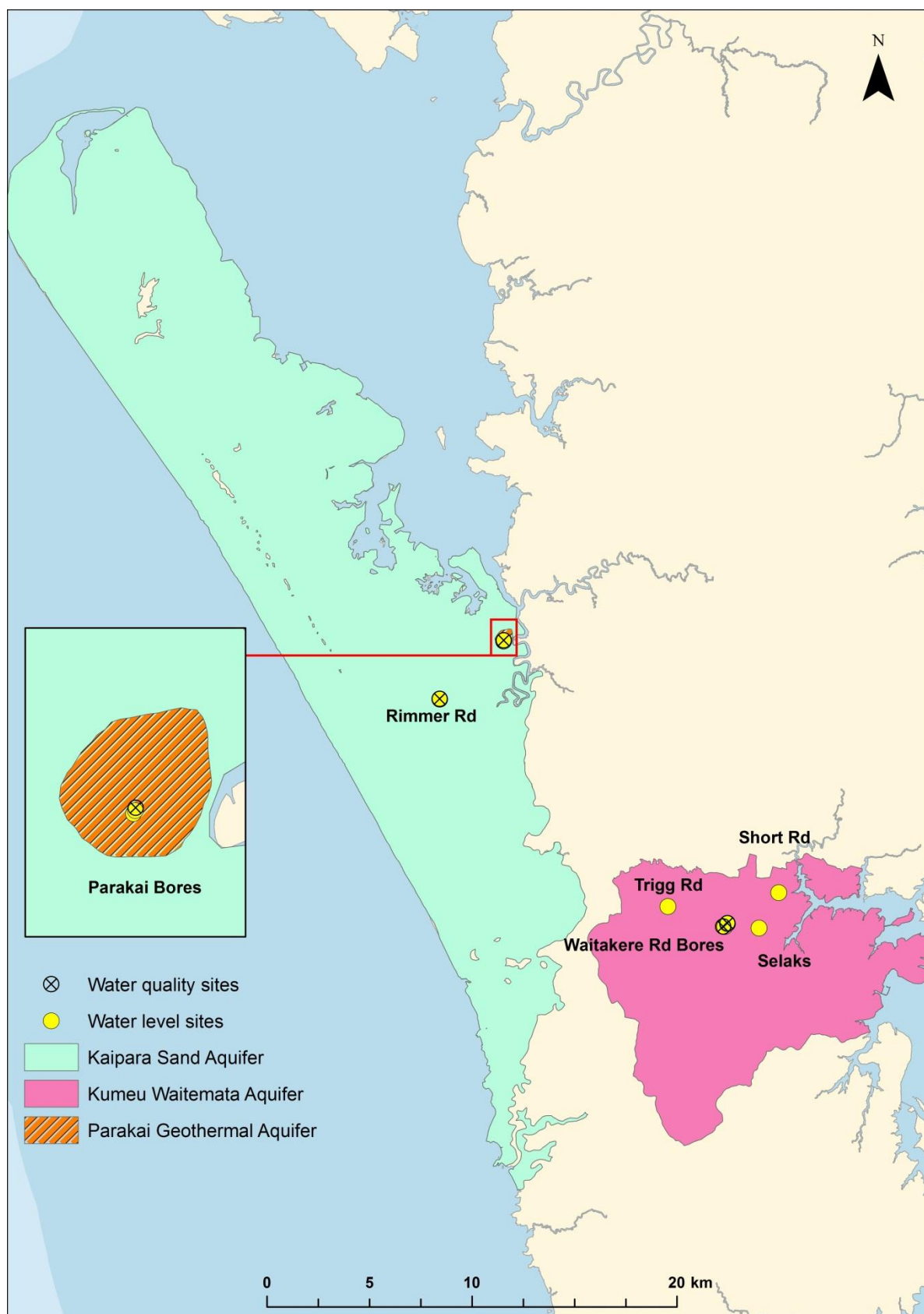
### c) Chenery/Whangaparaoa



**Figure 5: Groundwater quality trends in the North-East aquifers for (a) Quintels Rd, (b) Waiwera Enterpr and (c) Chenery/Whangaparaoa sites.**

The 1% annual change threshold for an environmentally meaningful trend is shown as two vertical dashed lines.

### 3.2 North-West aquifers



**Figure 6: Aquifers and monitoring sites in the North-West.**

**Table 6: Groundwater level monitoring sites in the North-West.**

(**bold** = automatic bore, 15 min frequency; *italics* = manual bore, monthly frequency)

Note: some bores do not have I.Ds and screen information and this is indicated by a dash.

| Aquifer            | Site name               | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth (mbgl) | Screen top (mbgl) | Screen bottom (mbgl) |
|--------------------|-------------------------|-------------|---------|---------|----------|---------------|----------------|-------------------|-------------------|----------------------|
| Kaipara Sand       | <i>Rimmer Rd</i>        | 6464089     | 5680    | 1725180 | 5939063  | 33.7          | 15/04/1997     | 64                | 50                | 62                   |
| Parakai Geothermal | <b>Parakai 86</b>       | 6464007     | 22225   | 1728295 | 5941889  | 4.3           | 13/06/1984     | 249               | -                 | -                    |
|                    | <i>Parakai 87</i>       | 6464009     | 22226   | 1728305 | 5941906  | 3.7           | 3/07/1984      | 58                | -                 | -                    |
| Kumeu Waitematā    | <i>Selaks</i>           | 6475003     | 2552    | 1740751 | 5927908  | 36.4          | 12/02/1986     | 299               | -                 | -                    |
|                    | <i>Waitākere Rd No2</i> | 6474003     | 1202    | 1739082 | 5927989  | 33.2          | 5/08/1998      | 150               | 78                | 150                  |
|                    | <i>Trigg Rd</i>         | 6475005     | 140     | 1736310 | 5928959  | 27.9          | 11/01/1989     | 248               | -                 | -                    |
|                    | <i>Short Rd</i>         | 6475157     | 5262    | 1741720 | 5929635  | 31.1          | 10/09/1996     | 242               | -                 | -                    |
|                    | <i>Waitākere Rd</i>     | 6475015     | 1203    | 1739216 | 5928122  | 25.4          | 11/01/1989     | 37                | 20                | 36                   |

**Table 7: Groundwater quality monitoring sites in the North-West**

| Aquifer            | Site name                   | Site number | Bore ID | Easting | Northing | Date sampling commenced | Trend analysis period | Bore depth (mbgl) | Pumping depth (mbgl) |
|--------------------|-----------------------------|-------------|---------|---------|----------|-------------------------|-----------------------|-------------------|----------------------|
| Parakai Geothermal | <b>Parakai Aquatic Park</b> | 6464015     | -       | 1728172 | 5942018  | 21/04/1998              | 1998-2013             | -                 | N/A                  |
| Kaipara sand       | <b>Rimmer Rd</b>            | 6464089     | 5680    | 1725180 | 5939063  | 7/01/1998               | 1998-2013             | 64                | 40                   |
| Kumeu Waitematā    | <b>Waitākere Rd</b>         | 6475015     | 1203    | 1739216 | 5928122  | 4/12/1996               | 1998-2013             | 37                | 15                   |
|                    | <b>Waitākere Rd No2</b>     | 6474003     | 1202    | 1739082 | 5927989  | 4/12/1996               | 1998-2013             | 150               | 40                   |

Most of the North-Western area is pastoral farmland used for dairying and drystock. Forestry is also a key land use in the area, with large pine forests in the eastern elevated areas and along the western South Kaipara Peninsula. Horticultural activities are scattered across the area, such as in Kumeu, Kaukapakapa and Kaipara South Head, where groundwater is used for irrigation. Several quarries are operated within this area, using water for dust suppression and/or quarry dewatering. In Parakai, geothermal water is used to supply thermal pools complexes, accommodation complexes and private spa pools.

There are two main aquifer types in the North-West: the Waitematā Group and the Pliocene/Pleistocene sands. The Kumeu Waitematā Aquifer has five water level monitoring bores and two water quality sites. The Kaipara Sand Aquifer has one monitoring bore at which water levels and water quality are measured. The Parakai Geothermal Aquifer has two water level bores at different depths, and a water quality bore (Parakai Aquatic Park). The aquifers and associated monitoring sites in the North-West are shown in Figure 6. Details of the groundwater level monitoring bores, and groundwater quality monitoring sites are shown in Table 6 and Table 7, respectively.

### **3.2.1 Groundwater levels**

In the Kaipara Sand Aquifer, a statistically significant increasing trend (but not meaningful) can be observed in the Rimmer Rd bore over the last ten years (Table 8).

The Parakai Geothermal Aquifer shows a seasonal trend which is the reverse of most other aquifers because most water use in the geothermal field is in winter while freshwater demand is generally higher in summer (Figure 7). Water levels have increased since the 1980s and were highest in the 2000s. Over the last ten years there is a meaningful decreasing trend in water levels in both bores in the Parakai Geothermal Aquifer.

The AUP (OP) sets an interim minimum level at 2.5 masl averaged over any consecutive 12 months at the Parakai 86 bore, which is interpreted as a 12-month rolling average. The 12-month rolling average has been below the minimum level since mid-2014 (Figure 7).

#### **Water level results are presented in**

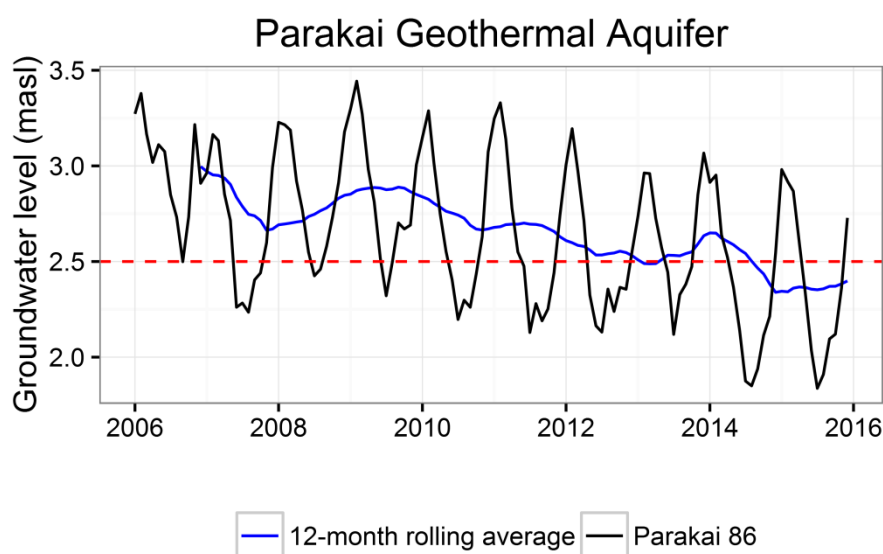
Table 8 and Appendix B. In the Kumeu Waitematā Aquifer, the five monitoring bores all show a different behaviour. The Waitākere Rd bore shows only small seasonal fluctuations, whereas the Waitākere Rd No2 bore shows substantial seasonal fluctuations. Water levels are lowest at the Short Rd bore, where they often fall below

sea level during the summer months. Trends over the last ten years are insignificant or increasing, with meaningful increasing trends at Trigg Rd and Short Rd.

**Table 8: Groundwater level summary statistics of the aquifers in the North-West**

(Min = minimum, Max = maximum, SD = standard deviation, masl = meters above sea level, \* = statistically significant, \*\* = meaningful)

| Aquifer            | Site name        | Min (masl) | Max (masl) | Median (masl) | Mean (masl) | SD (m) | Sen slope (m/yr) |
|--------------------|------------------|------------|------------|---------------|-------------|--------|------------------|
| Kaipara Sand       | Rimmer Rd        | 4.11       | 5.09       | 4.61          | 4.60        | 0.23   | 0.013*           |
| Parakai Geothermal | Parakai 86       | 1.84       | 3.44       | 2.66          | 2.66        | 0.39   | -0.055**         |
|                    | Parakai 87       | 1.74       | 3.20       | 2.54          | 2.55        | 0.25   | -0.019**         |
| Kumeu Waitematā    | Selaks           | 18.05      | 26.17      | 23.29         | 23.00       | 1.89   | -0.052           |
|                    | Waitākere Rd No2 | 3.98       | 28.98      | 19.24         | 18.27       | 5.53   | 0.249*           |
|                    | Trigg Rd         | 19.80      | 21.54      | 20.69         | 20.72       | 0.40   | 0.051**          |
|                    | Short Rd         | -3.96      | 16.39      | 6.08          | 6.23        | 5.18   | 0.984**          |
|                    | Waitākere Rd     | 23.17      | 24.51      | 24.22         | 24.16       | 0.28   | 0.004            |



**Figure 7: Water levels and 12-month rolling average at the Parakai 86 bore.**  
Red dashed line indicates the management level set in the AUP.

### 3.2.2 Groundwater quality

The summary statistics show there were no exceedances of any drinking water standards nor ANZECC trigger values in any of the North-West aquifers (Table 9).

#### *Parakai Geothermal Aquifer:*

Aesthetic guideline values were exceeded for ammoniacal N and total dissolved solids at the Parakai aquatic park (a geothermal site); for soluble iron at three out of four sites and for soluble manganese at two of the four sites (Table 9). There was large variability in the data, as shown by higher MAD values for nitrate, dissolved oxygen, and soluble P, iron and manganese (Table 9).

There was one meaningful declining trend in total iron in the Parakai Aquatic Park bore. There is no DO data for this site to determine whether the oxygen conditions in the aquifer are influencing this trend. Other geothermal properties in this aquifer, including the water temperature, are also likely influencing this trend.

#### *Kaipara Sand Aquifer:*

There were no significant and/or meaningful trends in the Rimmer Rd bore.

#### *Kumeu Waitematā Aquifer:*

There were meaningful and highly significant decreasing trends in total and soluble manganese in the Waitākere Rd 1 bore. There was also an increasing but non-significant trend in DO. If there are increased oxygenated conditions in the aquifer, this could result in precipitation of manganese out of solution, explaining the decreasing trends.

In the Waitākere Rd 2 bore, there was only one significant meaningful trend, a small increase in soluble iron. Again, this could be due to the oxygen available in the aquifer, where under low oxygen levels; the iron exists in the soluble  $\text{Fe}^{2+}$  form. There is a decreasing but non-significant trend in DO in this aquifer, which may explain some of the trends in iron solubility; however the lack of significance in this trend makes this potential link a tenuous one.

**Table 9: Summary of medians, median absolute deviations (MAD) and trends for selected parameters in the North-West bores.**

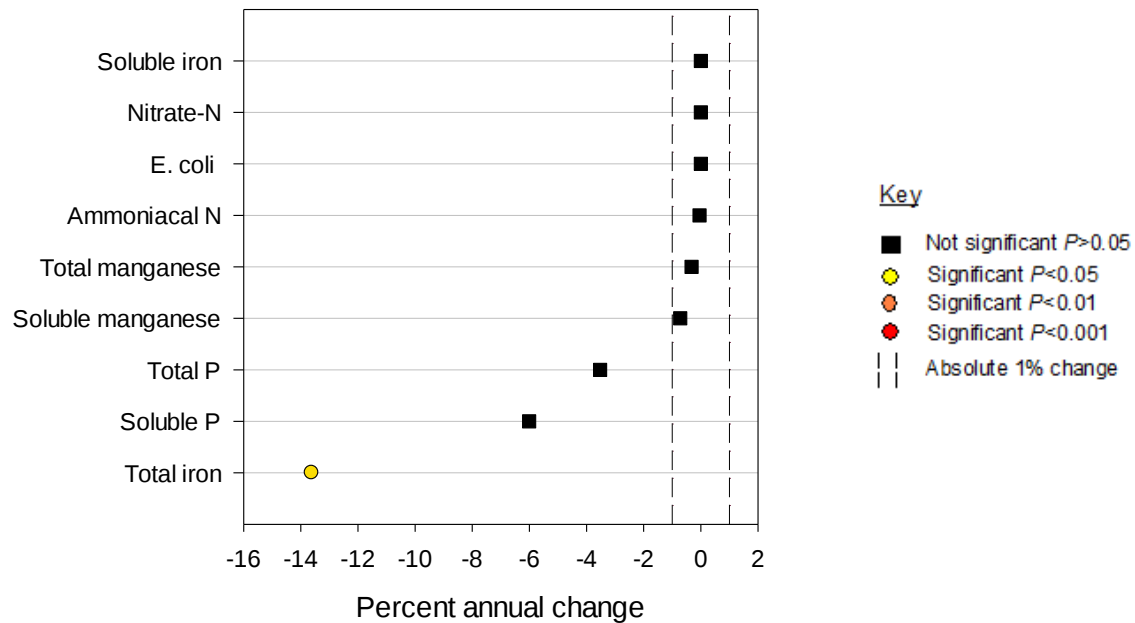
Medians in **orange** exceed trigger values (TV) for the 95% species protection level for freshwaters (ANZECC, 2000), **red** exceed health-related maximum allowable values (MAV) and **purple** exceed aesthetic guideline values (GV). MAV and GV are based on the NZ Drinking Water Standards (MoH, 2000). MAD in **blue** are deviations >10% of the median. Trends in **green** are statistically significant (p<0.05).

|                    |                      | Nitrate (mg/L)<br>TV=7.2, MAV=11.3            |       |                | Ammoniacal N (mg/L)<br>TV=0.9, GV=1.24 |       |                | Soluble P (mg/L) |       |                | Soluble Fe (mg/L)<br>GV=0.2 |       |                |
|--------------------|----------------------|-----------------------------------------------|-------|----------------|----------------------------------------|-------|----------------|------------------|-------|----------------|-----------------------------|-------|----------------|
| Aquifer            | Site                 | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD   | Trend (unit/y) |
| Parakai Geothermal | Parakai Aquatic Park | 0.002                                         | 0.000 | 0.000          | 1.400                                  | 0.100 | -0.001         | 0.006            | 0.002 | 0.000          | 0.005                       | 0.001 | 0.000          |
| Kaipara Sand       | Rimmer Rd            | 0.002                                         | 0.000 | 0.000          | 0.040                                  | 0.002 | 0.000          | 0.067            | 0.017 | 0.002          | 5.170                       | 0.340 | 0.048          |
| Kumeu Waitematā    | Waitākere Rd1        | 0.006                                         | 0.004 | 0.000          | 0.120                                  | 0.010 | 0.000          | 0.013            | 0.009 | 0.000          | 6.200                       | 0.700 | 0.000          |
|                    | Waitākere Rd2        | 0.003                                         | 0.001 | 0.000          | 0.270                                  | 0.010 | 0.000          | 0.007            | 0.003 | 0.000          | 1.100                       | 0.100 | 0.018          |
|                    |                      | Soluble Mn (mg/L)<br>TV=1.9, MAV=0.5, GV=0.05 |       |                | TDS (mg/L)<br>GV=1000                  |       |                | EC (mS/cm)       |       |                | DO (%sat)                   |       |                |
|                    | Site                 | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD   | Trend (unit/y) |
| Parakai Geothermal | Parakai Aquatic Park | 0.013                                         | 0.002 | 0.000          | 1942                                   | 42.0  | 3.323          | ND               | ND    | ND             | ND                          | ND    | ND             |
| Kaipara Sand       | Rimmer Rd            | 0.116                                         | 0.006 | 0.000          | 298                                    | 7.0   | 0.492          | 0.487            | 0.013 | 0.004          | 0.850                       | 0.250 | 0.044          |
| Kumeu Waitematā    | Waitākere Rd1        | 0.160                                         | 0.030 | -0.006         | 211                                    | 11.0  | 0.503          | 0.299            | 0.005 | 0.000          | 2.500                       | 1.350 | 0.063          |
|                    | Waitākere Rd2        | 0.050                                         | 0.004 | 0.000          | 435                                    | 9.0   | 1.074          | 0.742            | 0.020 | 0.005          | 1.300                       | 0.800 | -0.051         |

### 3.2.2.1 Trends Graphs North-West Aquifers

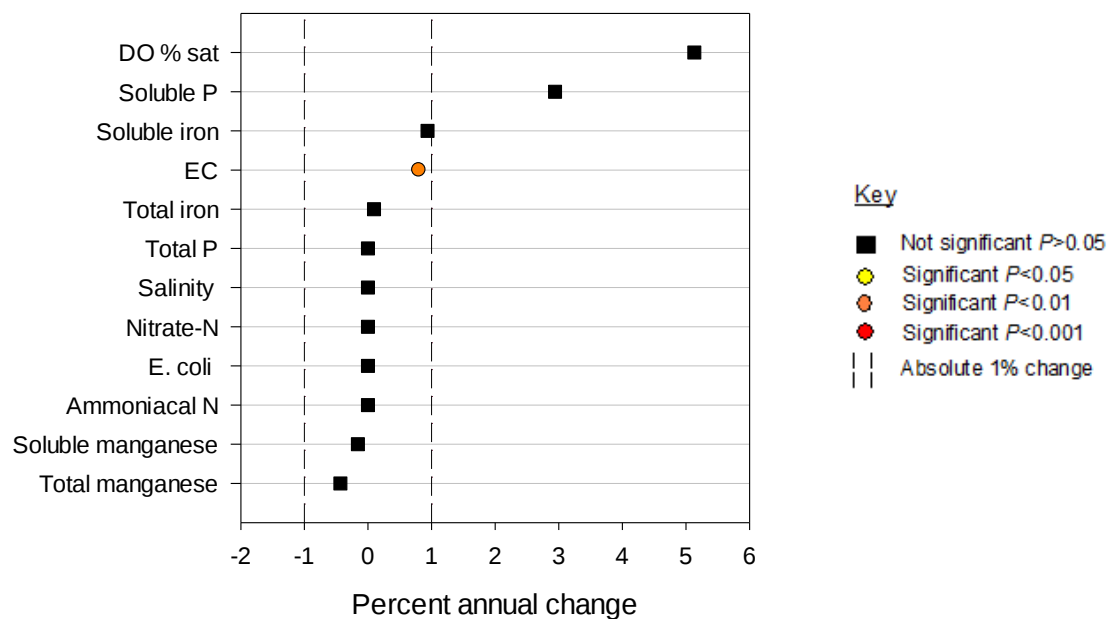
#### *Parakai Geothermal Aquifer:*

##### a) Parakai Aquatic Park



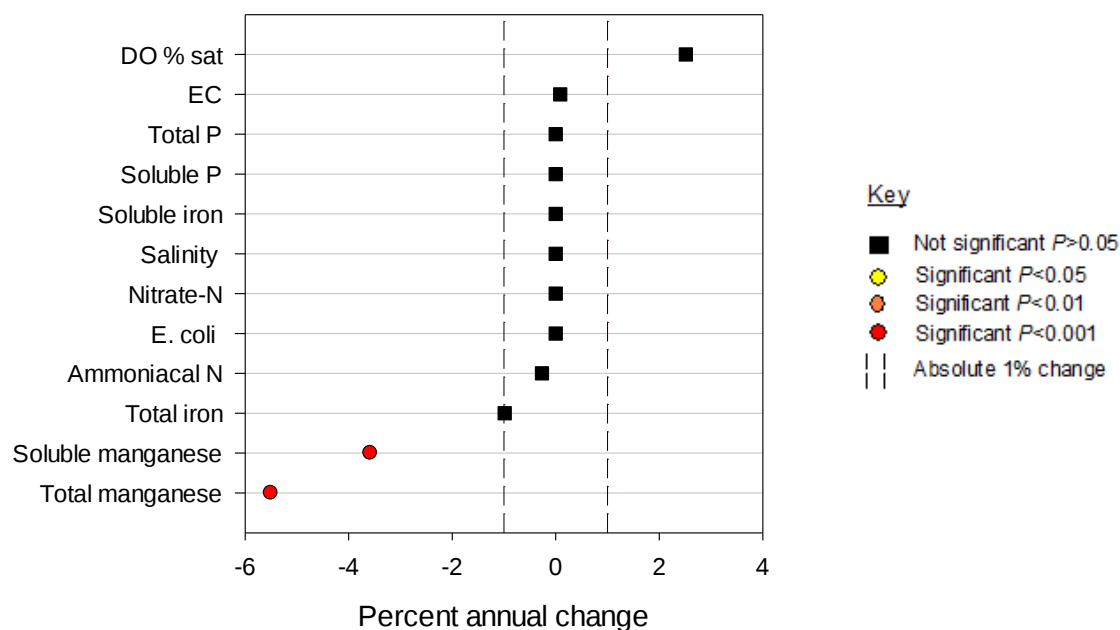
#### *Kaipara Sand Aquifer:*

##### b) Rimmer Rd

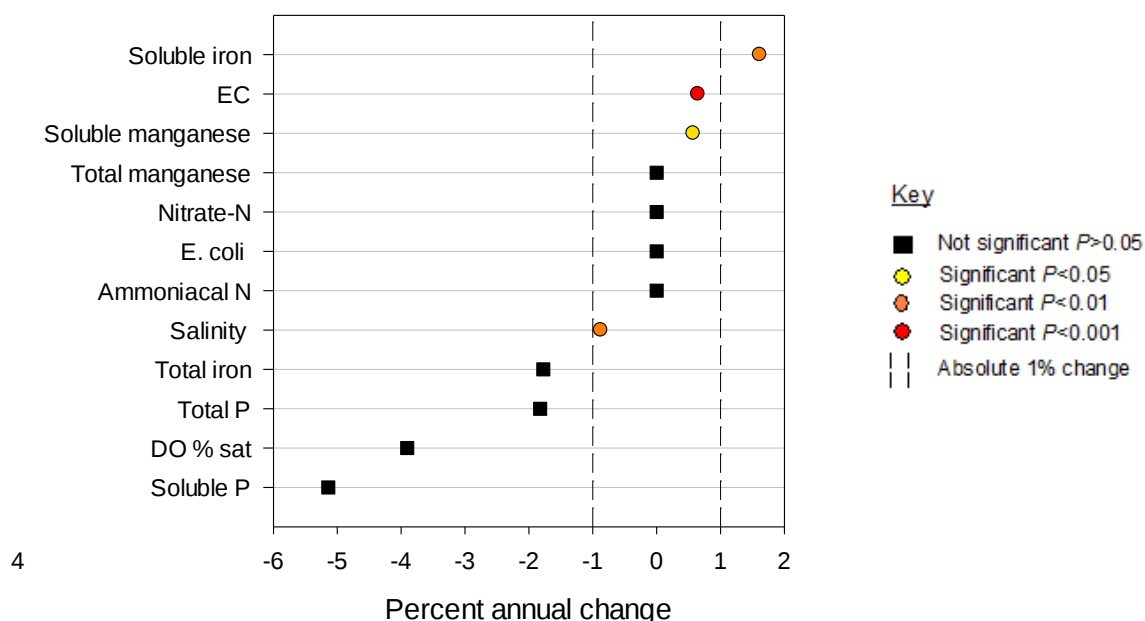


*Kumeu Waitematā Aquifer:*

c) Waitākere Rd 1



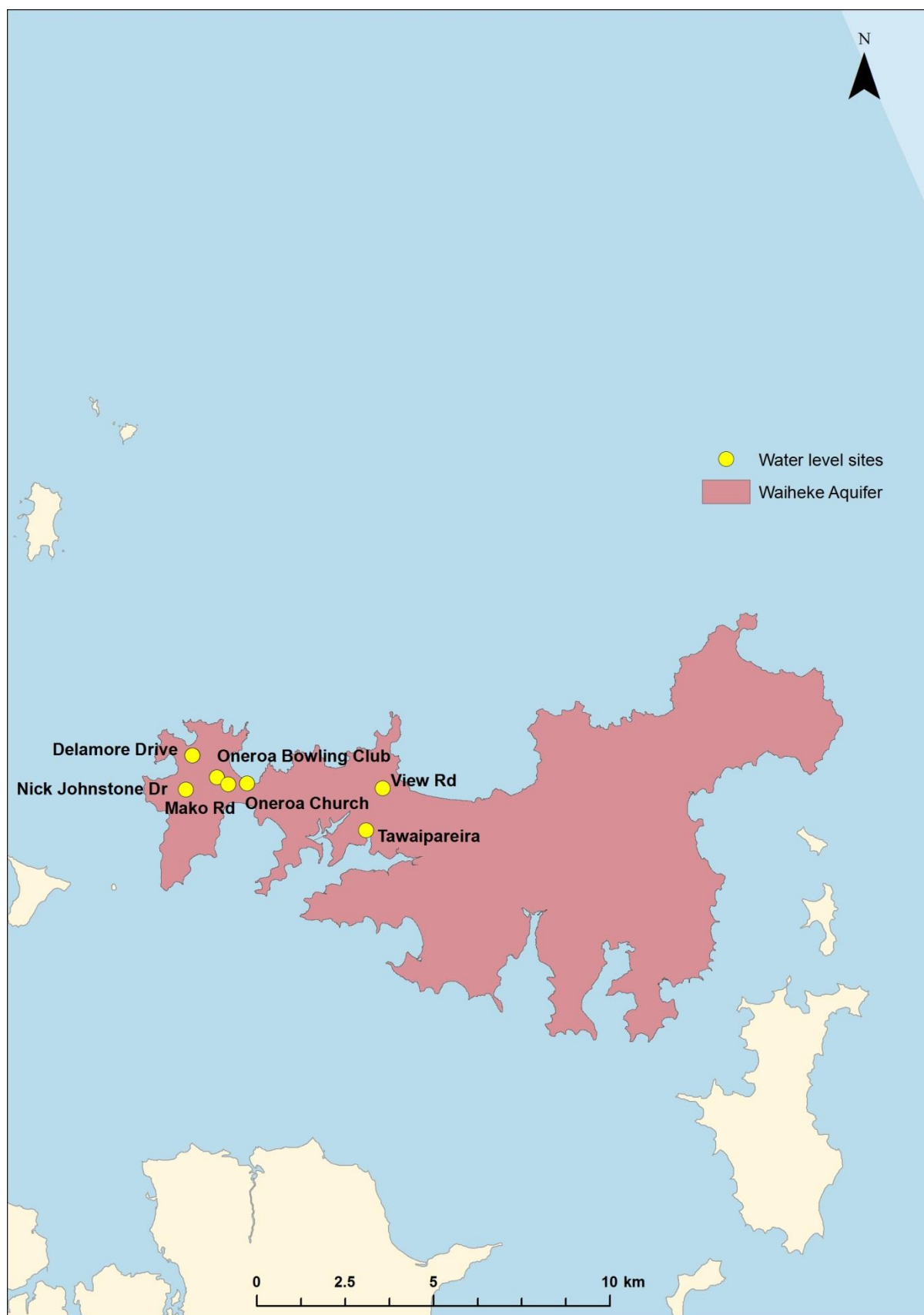
d) Waitākere Rd 2



**Figure 8: Groundwater quality trends in the North-East aquifers for (a) Parakai Aquatic Park, (b) Rimmer Rd, (c) Waitākere Rd 1 and (d) Waitākere Rd 2 sites.**

The 1% annual change threshold for an environmentally meaningful trend is shown as two vertical dashed lines.

### 3.3 Waiheke Island



**Figure 9: Aquifers and monitoring sites on Waiheke Island.**

**Table 10: Groundwater level monitoring sites on Waiheke Island.**

(**bold** = automatic bore, 15 min frequency; *italics* = manual bore, monthly frequency)

| Aquifer           | Site name                      | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth (mbgl) |
|-------------------|--------------------------------|-------------|---------|---------|----------|---------------|----------------|-------------------|
| Waiheke Greywacke | <i>Delamore Drive @29</i>      | 6479001     | 22349   | 1778232 | 5927911  | 81.7          | 27/07/2005     | 29                |
|                   | <i>Delamore Drive @55</i>      | 6479003     | 22349   | 1778232 | 5927911  | 82.6          | 12/12/2005     | 55                |
|                   | <i>Delamore Drive @105</i>     | 6479005     | 22349   | 1778232 | 5927911  | 81.7          | 27/07/2005     | 105               |
|                   | <i>Nick Johnstone Dr</i>       | 6479007     | 22549   | 1778056 | 5926955  | 60.3          | 11/03/2006     | 42                |
|                   | <i>Oneroa Bowling Club @29</i> | 6570003     | 22347   | 1778932 | 5927297  | 35.9          | 27/07/2005     | 29                |
|                   | <i>Oneroa Bowling Club @54</i> | 6570005     | 22347   | 1778932 | 5927296  | 35.8          | 27/07/2005     | 54                |
|                   | <i>Oneroa Church @15</i>       | 6570007     | 22351   | 1779791 | 5927123  | 24.8          | 12/11/2007     | 15                |
|                   | <i>Oneroa Church @39.5</i>     | 6570009     | 22351   | 1779790 | 5927122  | 24.8          | 27/07/2005     | 40                |
|                   | <i>View Rd</i>                 | 6570011     | 22542   | 1783628 | 5926989  | 107.5         | 22/03/2006     | 70                |
|                   | <i>Mako Rd</i>                 | 6570013     | 22541   | 1779250 | 5927094  | 19.6          | 16/03/2006     | 117               |
|                   | <b>Tawaipareira</b>            | 6570015     | 22550   | 1783164 | 5925798  | 3.5           | 12/02/2007     | 60                |

Waiheke Island consists of greywacke rocks which form comparatively poor aquifers with low permeability. Groundwater demand is mainly for community water supply, irrigation and hotels. There are seven groundwater level monitoring sites on Waiheke Island, with some sites consisting of two or three bores at different depths. All sites are in the western part of the island. There are no groundwater quality sites on Waiheke Island. The monitoring sites on Waiheke Island are shown in Figure 9 and details of the monitoring bores are shown in Table 10.

### 3.3.1 Groundwater levels

Seven of the 11 bores show meaningful increasing trends, with the exception of the deepest bore at Delamore Drive, which shows a meaningful decreasing trend, and the Tawaipareira bore, which does not show any significant trend. Two bores (Delamore Drive @29 and Oneroa Church @15) often fall dry and no meaningful results could be obtained. Water level results for Waiheke Island are presented in

Table 11 and Appendix C.

**Table 11: Groundwater level statistics of the Waiheke Aquifer**

(Min = minimum, Max = maximum, SD = standard deviation, masl = meters above sea level, \* = statistically significant, \*\* = meaningful)

| Site name and depth     | Min (masl) | Max (masl) | Median (masl) | Mean (masl) | SD (m) | Sen slope (m/yr) |
|-------------------------|------------|------------|---------------|-------------|--------|------------------|
| Delamore Drive @29      | n/a        | 53.05      | n/a           | n/a         | n/a    | n/a              |
| Delamore Drive @55      | 30.43      | 41.92      | 35.01         | 35.86       | 2.93   | 0.660**          |
| Delamore Drive @105     | 16.77      | 20.49      | 18.39         | 18.37       | 0.89   | -0.051**         |
| Nick Johnstone Dr       | 28.90      | 31.48      | 30.11         | 30.18       | 0.75   | 0.211**          |
| Oneroa Bowling Club @29 | 23.74      | 30.47      | 27.96         | 27.58       | 1.51   | 0.104**          |
| Oneroa Bowling Club @54 | 2.21       | 26.39      | 25.51         | 23.16       | 5.90   | 0.228**          |
| Oneroa Church @15       | n/a        | 21.98      | n/a           | n/a         | n/a    | n/a              |
| Oneroa Church @39.5     | 3.63       | 11.54      | 4.36          | 4.56        | 1.18   | 0.080**          |
| View Rd                 | 75.29      | 78.14      | 76.34         | 76.35       | 0.69   | 0.129**          |
| Mako Rd                 | 5.43       | 6.38       | 6.01          | 5.98        | 0.22   | 0.042**          |
| Tawaipareira            | 1.22       | 3.41       | 2.82          | 2.72        | 0.41   | 0.003            |

### 3.4 Central aquifers



**Figure 10: Aquifers and monitoring sites in Central Auckland**

**Table 12: Groundwater level monitoring sites in Central Auckland.**

(**bold** = automatic bore, 15 min frequency; *italics* = manual bore, monthly frequency, underlined = manual bore, fortnightly frequency)

Note: some bores do not have I.Ds and screen information and this is indicated by a dash.

| Aquifer                 | Site name                 | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth | Screen top | Screen bottom |
|-------------------------|---------------------------|-------------|---------|---------|----------|---------------|----------------|------------|------------|---------------|
|                         |                           |             |         |         |          |               |                | (mbgl)     | (mbgl)     | (mbgl)        |
| Clevedon East Waitematā | <i>Burnside Rd</i>        | 7409001     | 20843   | 1777648 | 5900355  | 30.5          | 10/07/1985     | 169        | 154        | 169           |
|                         | <i>Clevedon Rd</i>        | 7500001     | 1315    | 1780166 | 5901580  | 12.1          | 10/05/1994     | 178        | -          | -             |
| Clevedon West Waitematā | <i>Bullens Rd</i>         | 7409011     | 960     | 1775844 | 5899172  | 34.1          | 21/06/1993     | 75         | 39         | 75            |
| Manukau Kaawa           | <u>Amelia Earhart Ave</u> | 6497017     | 5682    | 1758649 | 5905851  | 11.9          | 25/03/1997     | 51         | 43         | 49            |
| Manukau Waitematā       | <i>Puhinui</i>            | 6498035     | 964     | 1766421 | 5904323  | 18.7          | 30/06/1993     | 201        | 60         | 201           |
| Mt Wellington Volcanic  | <b>Angle St</b>           | 6498003     | 349     | 1760812 | 5911670  | 4.8           | 6/06/1989      | 25         | -          | -             |
|                         | <u>PD13-B</u>             | 6488049     | 471     | 1763377 | 5915228  | 41.4          | 11/12/1991     | 40         | -          | -             |
|                         | <u>PD13-S</u>             | 6488045     | 471     | 1763377 | 5915228  | 41.3          | 11/12/1991     | 24         | -          | -             |
|                         | <u>PD13-T</u>             | 6488047     | 471     | 1763378 | 5915229  | 41.3          | 11/12/1991     | 33         | -          | -             |
|                         | <u>Simson Reserve</u>     | 6498005     | 350     | 1762343 | 5912244  | 6.9           | 17/07/1989     | 21         | -          | -             |
|                         | <u>Tanner Reserve</u>     | 6498011     | 691     | 1761378 | 5913611  | 23.7          | 5/06/1991      | 33         | -          | -             |
| Onehunga Volcanic       | <u>Alfred St</u>          | 6497007     | 234     | 1759794 | 5912794  | 28.9          | 6/06/1989      | 40         | -          | -             |
|                         | <u>Waikaraka Cemetery</u> | 6497013     | 959     | 1759920 | 5911507  | 4.6           | 21/06/1993     | 16         | -          | -             |
|                         | <u>Wallath St</u>         | 6498019     | 20362   | 1760580 | 5913671  | 28.5          | 27/11/1972     | 25         | -          | -             |
|                         | <u>Selwyn St</u>          | 6497011     | 20369   | 1758762 | 5912965  | 45.5          | 27/11/1972     | 40         | -          | -             |
|                         | <u>Orakau Ave</u>         | 6497015     | 5343    | 1757832 | 5914770  | 84.6          | 14/11/1996     | 48         | -          | -             |
|                         | <u>Te Papapa</u>          | 6498033     | 958     | 1760335 | 5912339  | 11.0          | 21/10/1993     | 20         | -          | -             |
|                         | <u>Tiwai Rd</u>           | 6497019     | 5683    | 1758791 | 5913752  | 70.2          | 8/04/1997      | 59         | 47         | 59            |

| Aquifer                  | Site name          | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth | Screen top | Screen bottom |
|--------------------------|--------------------|-------------|---------|---------|----------|---------------|----------------|------------|------------|---------------|
|                          |                    |             |         |         |          |               |                | (mbgl)     | (mbgl)     | (mbgl)        |
| Mt Richmond Volcanic     | <u>Mt Richmond</u> | 6594001     | 1379    | 1763997 | 5910991  | 11.2          | 9/08/2001      | 43         | 29         | 37            |
| Western Springs Volcanic | Alderley Rd        | 6487003     | 4865    | 1756256 | 5917682  | 67.7          | 14/11/1996     | 36         | -          | -             |
|                          | Chamberlain Park   | 6487021     | 4743    | 1753511 | 5918278  | 17.8          | 15/06/1998     | -          | -          | -             |
|                          | <b>Leslie Rd</b>   | 6487009     | 5337    | 1754681 | 5917287  | 39.6          | 13/11/1996     | 24         | -          | -             |
|                          | Morven Rd          | 6487011     | 5342    | 1757161 | 5915388  | 84.2          | 14/11/1996     | 11         | -          | -             |
|                          | Meola Rd           | 6487017     | 44      | 1752648 | 5919238  | 5.0           | 14/11/1996     | 7          | -          | -             |
|                          | <b>Selkirk Rd</b>  | 6487007     | 5267    | 1754021 | 5917236  | 34.2          | 13/11/1996     | 26         | -          | -             |
|                          | Volcanic St        | 6487001     | 4864    | 1755313 | 5915915  | 47.4          | 14/11/1996     | 11         | -          | -             |
|                          | Watson Ave         | 6487015     | 5339    | 1754832 | 5916586  | 42.2          | 14/11/1996     | 38         | 33         | 39            |

**Table 13: Groundwater quality monitoring sites in Central Auckland**

| Aquifer                  | Site Name          | Site number | Bore ID | Easting | Northing | Date Commenced | Trend analysis period | Bore depth (mbgl) | Pumping depth (mbgl) |
|--------------------------|--------------------|-------------|---------|---------|----------|----------------|-----------------------|-------------------|----------------------|
| Manukau Southeast Kaawa  | Amelia Earhart Ave | 6497017     | 5682    | 1758649 | 5905851  | 15/01/1998     | 1998-2013             | 51                | 40                   |
| Clevedon West Waitematā  | Bullens Rd         | 7409011     | 960     | 1775844 | 5899172  | 9/11/1994      | 1998-2013             | 75                | 35                   |
| Clevedon East Waitematā  | Burnside Rd        | 7409001     | 20843   | 1777648 | 5900355  | 19/01/1998     | 1998-2013             | 169               | 40                   |
| Onehunga Volcanic        | Central Park       | 6498007     | -       | 1761070 | 5914597  | 8/01/1998      | 1998-2012             | 22                | 15                   |
|                          | Central Park New   | 6498043     | -       | 1761070 | 5914597  | 3/07/2009      | 2009-2013             | 20                | 15                   |
|                          | Tiwai Rd           | 6497019     | 5683    | 1758791 | 5913752  | 5/01/1998      | 1998-2013             | 59                | 40                   |
| Mt Richmond Volcanic     | Mt Richmond        | 6494001     | 1379    | 1763997 | 5910991  | 22/04/1999     | 1999-2013             | 43                | 35                   |
| Western Springs Volcanic | Watson Ave         | 6487015     | 5339    | 1754832 | 5916586  | 23/06/1997     | 1998-2013             | 38                | 35                   |

Land use in the Central Auckland area is mainly urban and peri-urban. The Western Springs Volcanic Aquifer is the main source of water to the Western Springs Lake. The Onehunga Volcanic Aquifer is a source of municipal water supply. Other groundwater uses in Central Auckland include industrial processing and irrigation of sports fields.

Volcanic basalt aquifers are the dominant hydrogeological unit in the northern part of the area and they are considered quality-sensitive aquifers because of their high permeability, which leads to direct impacts of any discharges such as stormwater or sewage. There are several monitoring bores in each of the volcanic aquifers: Western Springs Volcanic Aquifer (eight water level and one water quality bore), Mt Richmond Volcanic Aquifer (one combined water level and quality bore), Mt Wellington Volcanic Aquifer (six water level bores), and Onehunga Volcanic Aquifer (seven water level and three water quality bores).

In the Southern part of the Central area Waitematā aquifers dominate. A groundwater divide separates the Clevedon Waitematā Aquifer into East (two water level and one water quality bore) and West (one combined water level and quality bore). Another important local source of groundwater is the Manukau Kaawa Aquifer (one combined water level and quality bore).

The aquifers and monitoring sites in Central Auckland are shown in Figure 10. Details of the groundwater level monitoring bores groundwater quality monitoring sites are shown in Table 12 and Table 13, respectively.

### **3.4.1 Groundwater levels**

The Manukau Waitematā Aquifer bore (Puhinui) shows increasing water levels since the 1990s. In the Clevedon East and Manukau Waitematā aquifers, meaningful increasing trends in water level were observed. Water levels are also increasing at the Angle St bore in the Mt Wellington Volcanic aquifer.

The Mt Richmond Volcanic Aquifer bore had decreasing water levels from the early 2000s to 2008, followed by a sharp increase then decrease from 2013. However, there is an overall increasing trend in this aquifer when all the data from 2006-2015 were assessed. Given the strong fluctuations, a straight trend line does not appropriately reflect the changing water levels. Decreasing water levels were also observed in the Tanner Reserve bore in the Mt Wellington Volcanic aquifer.

There were no meaningful trends in water level observed at any other bores (Table 14 and Appendix D).

**Table 14: Groundwater level statistics of the Central aquifers**

(Min = minimum, Max = maximum, SD = standard deviation, masl = meters above sea level,  
 \* = statistically significant, \*\* = meaningful)

| Aquifer                  | Site name          | Min (masl) | Max (masl) | Median (masl) | Mean (masl) | SD (m) | Sen slope (m/yr) |
|--------------------------|--------------------|------------|------------|---------------|-------------|--------|------------------|
| Clevedon East Waitematā  | Burnside Rd        | 25.68      | 30.49      | 28.61         | 28.47       | 1.03   | -0.008           |
|                          | Clevedon Rd        | 12.74      | 14.48      | 13.57         | 13.63       | 0.40   | 0.074**          |
| Clevedon West Waitematā  | Bullens Rd         | 18.79      | 24.27      | 23.14         | 22.93       | 0.93   | 0.029            |
| Manukau Kaawa            | Amelia Earhart Ave | 2.57       | 3.78       | 3.31          | 3.27        | 0.29   | 0.006            |
| Manukau Waitematā        | Puhinui            | 19.94      | 24.96      | 24.51         | 24.44       | 0.57   | 0.079**          |
| Mt Richmond Volcanic     | Mt Richmond        | -8.70      | -3.74      | -5.32         | -5.62       | 1.35   | 0.123**          |
| Mt Wellington Volcanic   | Angle St           | 2.36       | 2.93       | 2.61          | 2.62        | 0.12   | 0.017**          |
|                          | PD13-B             | 19.20      | 25.13      | 21.43         | 21.53       | 1.13   | -0.045           |
|                          | PD13-S             | 19.04      | 25.17      | 21.39         | 21.49       | 1.20   | -0.079*          |
|                          | PD13-T             | 18.99      | 25.13      | 21.41         | 21.49       | 1.20   | -0.066           |
|                          | Simson Reserve     | 3.66       | 5.02       | 4.31          | 4.26        | 0.17   | 0.002            |
|                          | Tanner Reserve     | 7.60       | 13.29      | 11.21         | 10.99       | 1.14   | -0.081**         |
| Onehunga Volcanic        | Alfred St          | 3.64       | 5.66       | 4.55          | 4.52        | 0.40   | -0.011           |
|                          | Waikaraka Cemetery | 2.01       | 3.09       | 2.60          | 2.60        | 0.19   | -0.017*          |
|                          | Wallath St         | 6.49       | 10.78      | 9.54          | 9.34        | 0.89   | -0.019           |
|                          | Selwyn St          | 17.53      | 17.87      | 17.59         | 17.60       | 0.05   | 0.003**          |
|                          | Orakau Ave         | 38.28      | 43.39      | 39.98         | 40.15       | 1.32   | -0.019           |
|                          | Te Papapa          | 4.52       | 6.40       | 5.23          | 5.22        | 0.34   | 0.003            |
|                          | Tiwai Rd           | 11.53      | 17.16      | 15.99         | 15.85       | 0.68   | 0.014            |
| Western Springs Volcanic | Alderley Rd        | 31.43      | 34.62      | 32.91         | 32.90       | 0.67   | 0.006            |
|                          | Chamberlain Park   | 10.09      | 12.54      | 11.37         | 11.31       | 0.37   | 0.014            |
|                          | Leslie Rd          | 26.78      | 31.38      | 29.67         | 29.45       | 1.07   | 0.019            |
|                          | Morven Rd          | 76.01      | 78.50      | 77.35         | 77.41       | 0.38   | -0.011           |
|                          | Meola Rd           | 3.17       | 4.24       | 3.59          | 3.64        | 0.23   | 0.012            |
|                          | Selkirk Rd         | 17.68      | 20.01      | 19.34         | 19.18       | 0.49   | -0.006           |
|                          | Volcanic St        | 37.88      | 40.50      | 38.54         | 38.67       | 0.60   | -0.016*          |
|                          | Watson Ave         | 26.85      | 31.86      | 29.80         | 29.69       | 1.03   | -0.015           |

### 3.4.2 Groundwater quality

The Central aquifer monitoring bores showed no exceedances of any drinking water standards, nor any ANZECC trigger values (Table 15). There was greater than 10% variability from the median (MAD) in at least one site for every parameter. Large MAD values were observed at various sites for nitrate, ammoniacal N, soluble P, total dissolved solids and electrical conductivity, as well as at most sites for dissolved oxygen and dissolved iron and manganese (Table 15). This could be due to changing land use, particularly in rural areas that have become increasingly urbanised over the last few decades. It is also possible that this variation is entirely natural. Groundwater quality trends for the Central aquifers are shown in Figure 11.

#### *Manukau South East Kaawa Aquifer:*

Aesthetic guideline values were exceeded for soluble iron and manganese at the Amelia Earhart Ave site. Small declining trends in total and soluble manganese and ammoniacal N were also observed in this aquifer. The declining trend in ammoniacal N may be a long-term result of more urbanised land use.

#### *Clevedon West Waitematā Aquifer:*

Aesthetic guideline values were exceeded for soluble iron and manganese at the Bullens Rd site. A single decreasing trend in ammoniacal N was also observed. This could potentially be the result of increasing urbanisation and historic cessation of rural land use in this area.

#### *Clevedon West Waitematā Aquifer:*

Aesthetic guideline values were exceeded for soluble iron only at the Burnside Rd site. This site also exhibited an increasing trend in DO. Interestingly, there were no observed trends in iron, manganese or nutrients alongside this trend.

#### *Onehunga Volcanic Aquifer:*

Central Park bore had considerable increasing trends in total and soluble manganese and soluble iron. The oxygen conditions in this aquifer are relatively high (greater than 2 mg/L), meaning the iron and manganese are relatively insoluble. One possible explanation is that small short term reductions in the oxygen content could dissolve some of the previously insoluble iron and manganese minerals. There is a small, non-significant decreasing trend in DO in this bore. Although this is regarded as a tenuous link due to the lack of statistical significance, the significant decreasing trend observed in the Central Park New bore provides some support for this.

In the Central Park New bore of the same aquifer, an increasing trend in total P and a large decreasing trend in DO was observed. It should be noted that there are

relatively few data for the Central Park New bore (2009-2013), so these trends may not be as reliable as some of the longer datasets.

The Tiwai Road bore showed a significant increasing trend in total manganese and DO. This is the opposite of what we would expect to observe, as (a) decreasing DO was observed in the other two bores in this aquifer and (b) increasing oxygen conditions would decrease the solubility of manganese, precipitating it out of solution. Another possibility is that there may be a source of manganese to this aquifer in addition to the natural mineralogy of the bedrock.

#### *Western Springs Volcanic Aquifer:*

Watson Ave bore presented a significant increasing trend in soluble manganese and soluble iron, yet a significant decreasing trend in total iron. This aquifer is well oxygenated (greater than 5 mg/L) and the pH is close to neutral. One possible explanation is that there are anaerobic pockets or microsites where iron and manganese is readily dissolved. This would need to be an increasingly common occurrence or the number of these postulated anaerobic microsites would need to be increasing to account for the strong increasing trends. The decrease in total iron could be an indication that overall iron is being lost from the system and that the proportion of this iron being solubilised is increasing. There are also small decreasing trends in total and soluble phosphorus. This could be attributable to changes in land use with less inputs of phosphorus in a now completely urban environment.

#### *Mt Richmond Volcanic Aquifer*

There were no significant trends observed in the Mt Richmond Volcanic aquifer.

**Table 15: Summary of medians, median absolute deviations (MAD) and trends for selected parameters in the Central bores.**

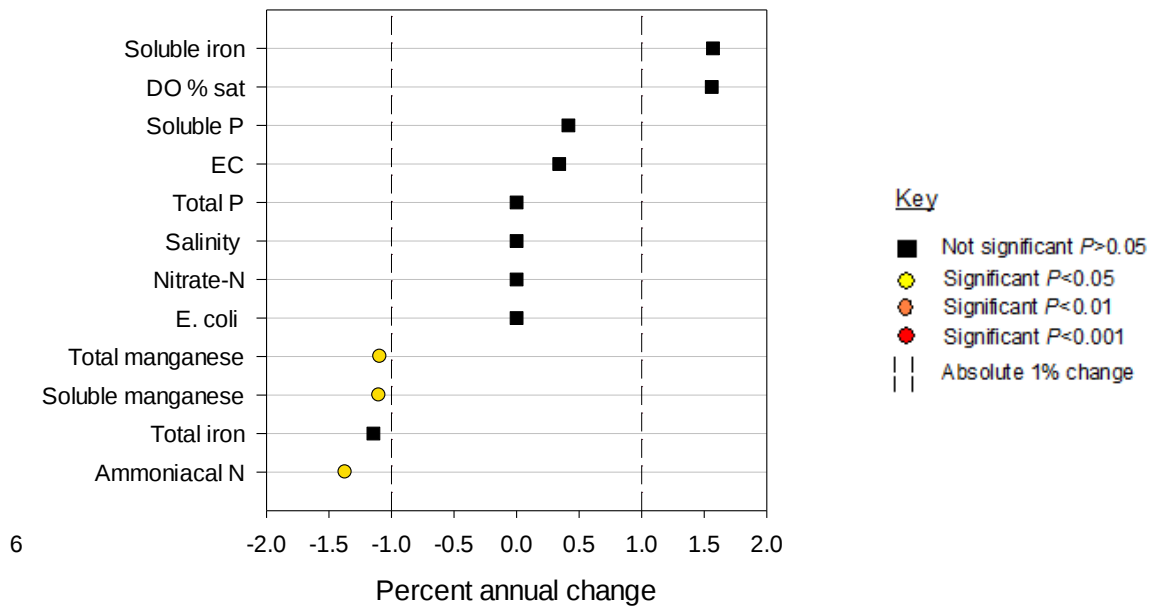
Medians in **orange** exceed trigger values (TV) for the 95% species protection level for freshwaters (ANZECC, 2000), **red** exceed health-related maximum allowable values (MAV) and **purple** exceed aesthetic guideline values (GV). MAV and GV are based on the NZ Drinking Water Standards (MoH, 2000). MAD in **blue** are deviations >10% of the median. Trends in **green** are statistically significant (p<0.05).

| Aquifer                 | Site               | Nitrate (mg/L)<br>TV=7.2, MAV=11.3            |       |                | Ammoniacal N (mg/L)<br>TV=0.9, GV=1.24 |       |                | Soluble P (mg/L) |       |                | Soluble Fe (mg/L)<br>GV=0.2 |        |                |
|-------------------------|--------------------|-----------------------------------------------|-------|----------------|----------------------------------------|-------|----------------|------------------|-------|----------------|-----------------------------|--------|----------------|
|                         |                    | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD    | Trend (unit/y) |
| Manukau Sth East Kaawa  | Amelia Earhart Ave | 0.002                                         | 0.000 | 0.000          | 0.735                                  | 0.055 | -0.010         | 0.044            | 0.004 | 0.000          | 1.070                       | 0.120  | 0.017          |
| Clevedon West Waitematā | Bullens Rd         | 0.002                                         | 0.000 | 0.000          | 0.500                                  | 0.070 | -0.013         | 0.090            | 0.003 | 0.000          | 0.260                       | 0.190  | 0.009          |
| Clevedon East Waitematā | Burnside Rd        | 0.071                                         | 0.012 | 0.000          | 0.010                                  | 0.000 | 0.000          | 0.004            | 0.000 | 0.000          | 0.990                       | 0.055  | -0.002         |
| Onehunga Volcanic       | Central Park       | 3.599                                         | 0.345 | -0.038         | 0.010                                  | 0.000 | 0.000          | 0.070            | 0.007 | 0.001          | 0.017                       | 0.009  | 0.001          |
|                         | Central Park New   | 3.435                                         | 0.295 | -0.162         | 0.005                                  | 0.000 | 0.000          | 0.080            | 0.008 | 0.007          | 0.035                       | 0.020  | 0.012          |
|                         | Tiwai Rd           | 0.889                                         | 0.300 | 0.002          | 0.010                                  | 0.000 | 0.000          | 0.075            | 0.017 | -0.001         | 0.006                       | 0.001  | 0.000          |
| Mt Richmond             | Mt Richmond        | 0.102                                         | 0.022 | 0.000          | 0.010                                  | 0.000 | 0.000          | 0.007            | 0.003 | 0.000          | 0.005                       | 0.000  | 0.000          |
| Western Springs         | Watson Ave         | 3.995                                         | 0.295 | -0.014         | 0.010                                  | 0.000 | 0.000          | 0.070            | 0.010 | -0.002         | 0.007                       | 0.002  | 0.001          |
|                         | Site               | Soluble Mn (mg/L)<br>TV=1.9, MAV=0.5, GV=0.05 |       |                | TDS (mg/L)<br>GV=1000                  |       |                | EC (mS/cm)       |       |                | DO (%sat)                   |        |                |
|                         |                    | Median                                        | MAD   | Trend (unit/y) | Median                                 | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median                      | MAD    | Trend (unit/y) |
| Manukau Sth East Kaawa  | Amelia Earhart Ave | 0.090                                         | 0.004 | -0.001         | 420                                    | 5.5   | 0.000          | 0.614            | 0.008 | 0.002          | 1.300                       | 0.450  | 0.020          |
| Clevedon West Waitematā | Bullens Rd         | 0.083                                         | 0.020 | 0.001          | 314                                    | 12.0  | 0.324          | 0.450            | 0.014 | 0.000          | 1.200                       | 0.400  | 0.112          |
| Clevedon East Waitematā | Burnside Rd        | 0.010                                         | 0.001 | 0.000          | 340                                    | 10.0  | 1.073          | 0.538            | 0.033 | 0.005          | 3.650                       | 0.750  | 0.227          |
| Onehunga Volcanic       | Central Park       | 0.004                                         | 0.002 | 0.000          | 150                                    | 17.5  | 0.995          | 0.218            | 0.027 | 0.003          | 48.300                      | 12.100 | -1.306         |
|                         | Central Park New   | 0.004                                         | 0.002 | -0.001         | 160                                    | 10.0  | -4.614         | 0.246            | 0.012 | -0.011         | 40.600                      | 14.850 | -7.225         |
|                         | Tiwai Rd           | 0.006                                         | 0.004 | 0.000          | 154                                    | 20.0  | 1.400          | 0.196            | 0.045 | -0.001         | 55.350                      | 16.350 | 2.278          |
| Mt Richmond             | Mt Richmond        | 0.001                                         | 0.000 | 0.000          | 81                                     | 10.0  | 2.403          | 0.126            | 0.013 | 0.002          | 92.900                      | 4.600  | 0.547          |
| Western Springs         | Watson Ave         | 0.004                                         | 0.003 | 0.000          | 145                                    | 8.0   | 0.726          | 0.216            | 0.009 | 0.001          | 63.900                      | 5.500  | 0.759          |

### 3.4.2.1 Trends Graphs Central Aquifers

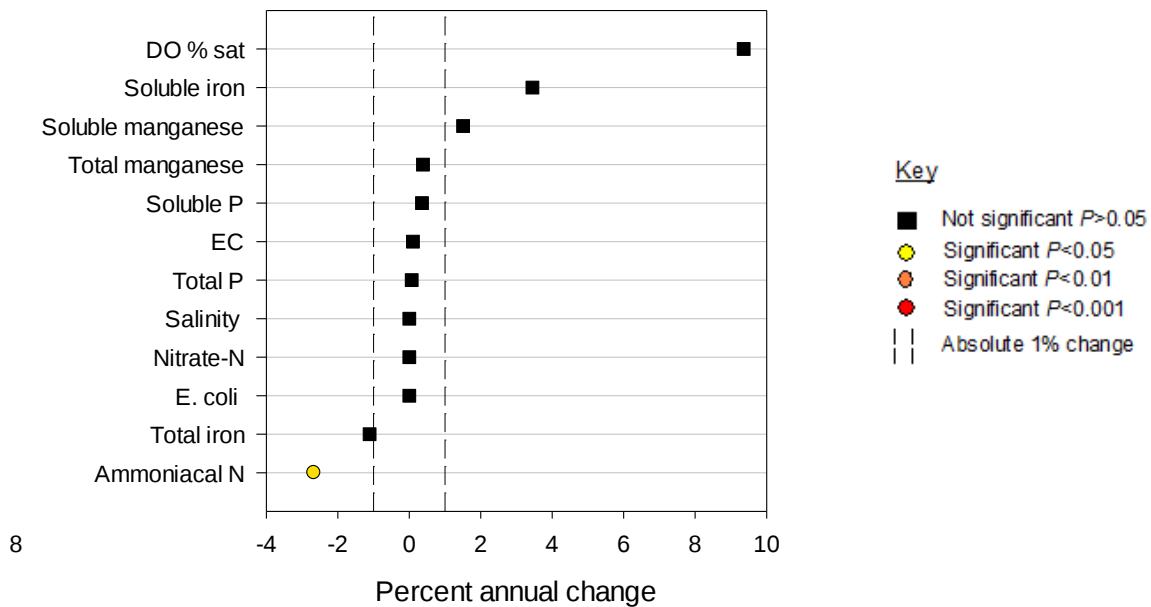
#### Manukau South East Kaawa

##### a) Amelia Earhart Ave



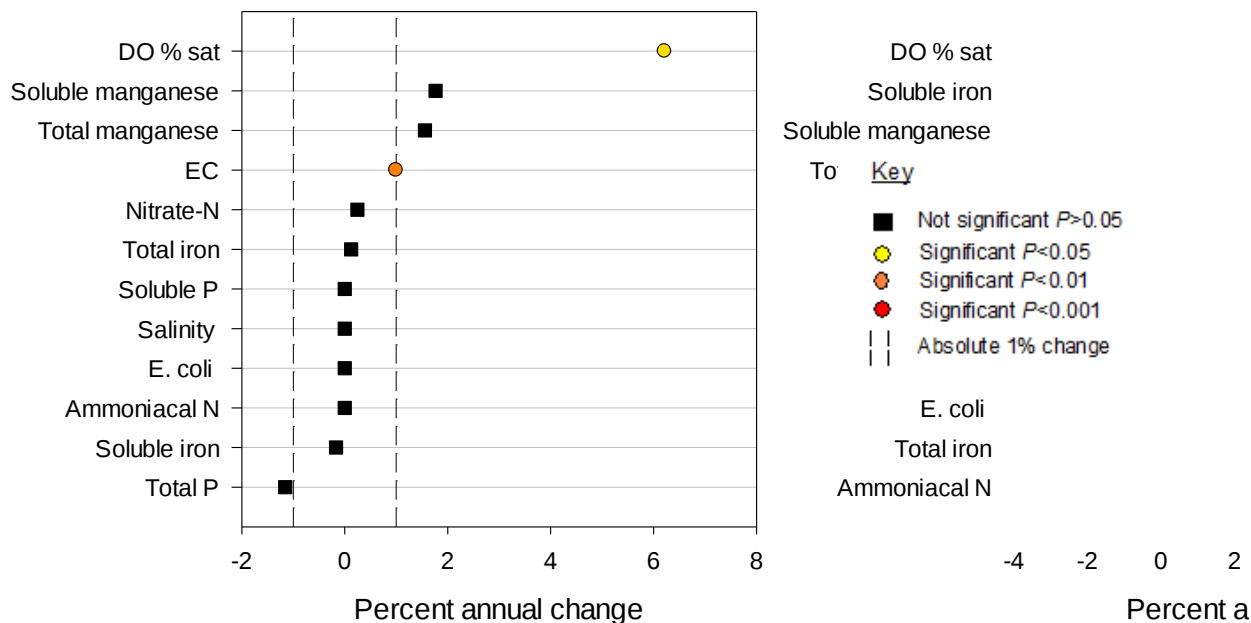
#### Clevedon West Waitematā Aquifer

##### b) Bullens Rd



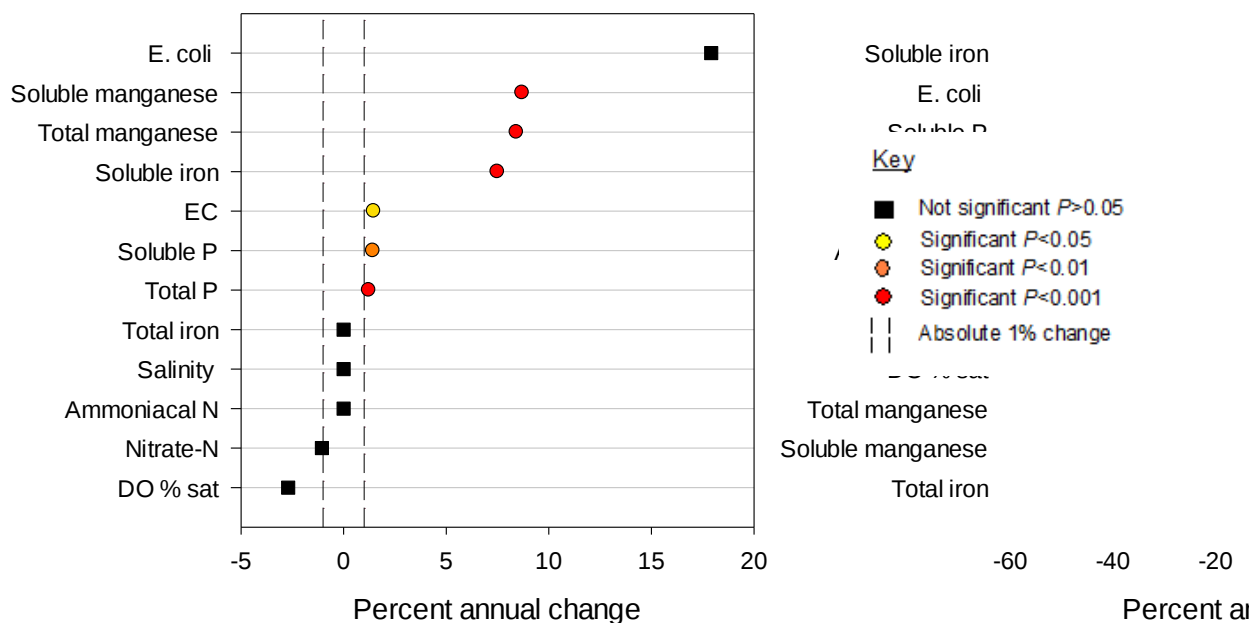
## Clevedon East Waitematā Aquifer

### c) Burnside Rd

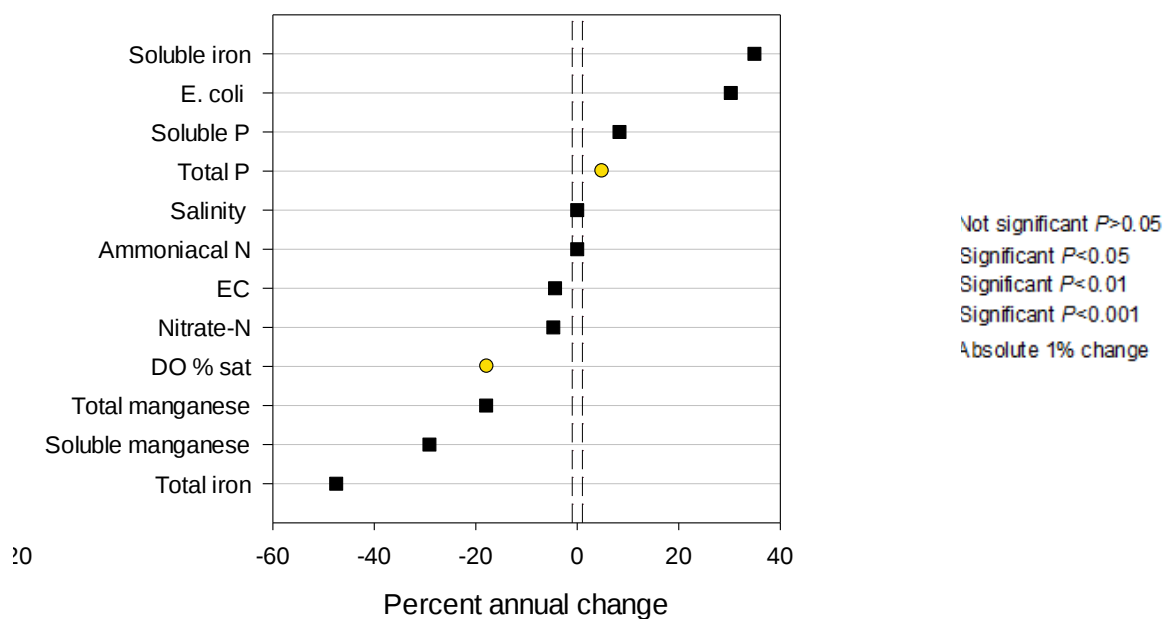


## Onehunga Volcanic Aquifer

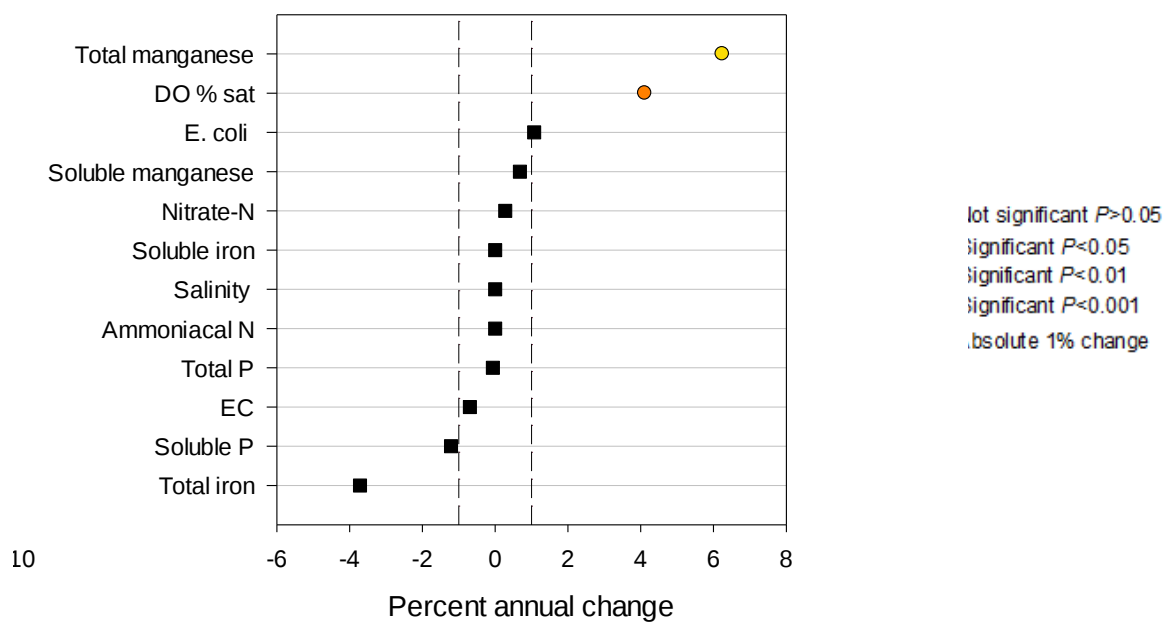
### d) Central Park



### e) Central Park New

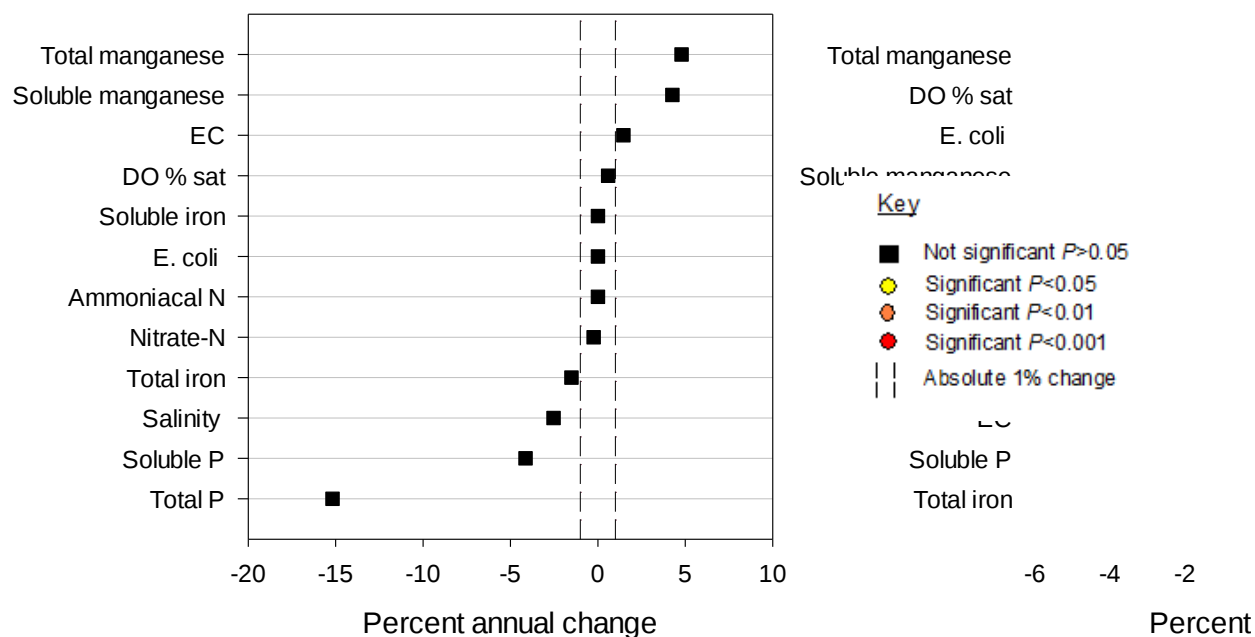


### f) Tiwai Rd



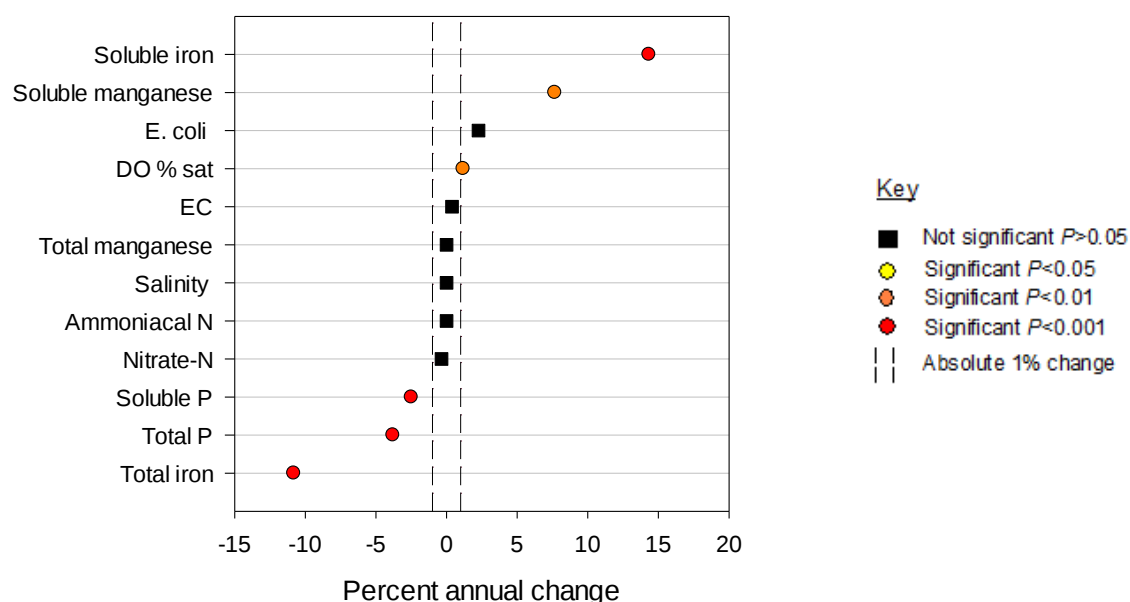
## Mt Richmond Volcanic Aquifer

### g) Mt Richmond



## Western Springs Volcanic Aquifer

### h) Watson Ave



**Figure 11: Groundwater quality trends in the Central aquifers for (a) Amelia Earhart Ave, (b) Bullens Rd, (c) Burnside Rd, (d) Central Park, (e) Central Park New, (f) Tiwai Rd, (g) Mt Richmond and (h) Watson Ave sites.**

The 1% annual change threshold for an environmentally meaningful trend is shown as two vertical dashed lines.

### 3.5 South aquifers



**Figure 12: Aquifers and monitoring sites in the South.**

**Table 16: Groundwater level monitoring sites in South Auckland.**

(**bold** = automatic bore, 15 min frequency; *italics* = manual bore, monthly frequency, underlined = manual bore, fortnightly frequency)

Note: some bores do not have I.Ds and screen information and this is indicated by a dash.

| Aquifer                   | Site name                     | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth | Screen top | Screen bottom |
|---------------------------|-------------------------------|-------------|---------|---------|----------|---------------|----------------|------------|------------|---------------|
|                           |                               |             |         |         |          |               |                | (mbgl)     | (mbgl)     | (mbgl)        |
| Awhitu Kaawa              | <b>Maraeorahia</b>            | 7427005     | 20807   | 1752324 | 5877924  | 5.0           | 5/01/1987      | 62         | -          | -             |
| Bombay Volcanic           | <u>Wooten Rd</u>              | 7510005     | 791     | 1778056 | 5883668  | 217.4         | 15/12/1991     | 77         | -          | -             |
| Bombay-Drury Kaawa        | <i>Cooper Rd</i>              | 7419011     | 479     | 1773768 | 5886832  | 48.6          | 16/01/1990     | 121        | -          | -             |
| Drury Sand                | <i>Fielding Rd Sand</i>       | 7419007     | 343     | 1774440 | 5890658  | 19.7          | 4/04/1989      | 64         | 57         | 64            |
| Drury Waitematā           | <i>Fielding Rd Waitematā</i>  | 7419013     | 640     | 1774436 | 5890639  | 19.3          | 24/04/1991     | 273        | -          | -             |
| Drury Volcanic            | <i>Fielding Rd Volcanic</i>   | 7419009     | 344     | 1774443 | 5890669  | 20.0          | 4/04/1989      | 47         | 13         | 47            |
| Karaka Waitematā          | <i>Karaka North</i>           | 7419119     | 832     | 1767788 | 5893431  | 35.6          | 12/03/1992     | 207        | -          | -             |
| Pukekohe Central Volcanic | <u>Pukekohe DSIR</u>          | 7428043     | 3553    | 1764896 | 5880205  | 84.1          | 26/04/1979     | 96         | -          | -             |
|                           | <u>Rifle Range Rd Deep</u>    | 7428103     | 5681    | 1766081 | 5880866  | 72.7          | 24/04/1997     | 90         | 78         | 90            |
|                           | <u>Rifle Range Rd Shallow</u> | 7428105     | 5681    | 1766074 | 5880860  | 72.7          | 24/04/1997     | 42         | 30         | 42            |
|                           | <i>Jenkin Rd</i>              | 7428109     | 20061   | 1765371 | 5880436  | 87.0          | 31/08/2001     | 87         | -          | -             |
|                           | <i>Revell Court</i>           | 7429011     | 20816   | 1768380 | 5879579  | 86.8          | 14/08/1979     | 55         | -          | -             |
|                           | <u>Douglas Rd</u>             | 7429013     | 3614    | 1766191 | 5879344  | 109.0         | 6/06/1980      | 268        | 254        | 268           |

| Aquifer            | Site name                      | Site number | Bore ID | Easting | Northing | Elevation (m) | Date commenced | Bore depth | Screen top | Screen bottom |
|--------------------|--------------------------------|-------------|---------|---------|----------|---------------|----------------|------------|------------|---------------|
|                    |                                |             |         |         |          |               |                | (mbgl)     | (mbgl)     | (mbgl)        |
| Pukekohe Kaawa     | <i>Ostrich Farm Production</i> | 7418021     | 20815   | 1766025 | 5885180  | 24.3          | 20/12/1985     | 84         | -          | -             |
|                    | <i>Ostrich Farm No2</i>        | 7418023     | 20814   | 1766029 | 5885168  | 24.3          | 20/12/1985     | 48         | 46         | 47            |
|                    | <i>Ostrich Farm No1</i>        | 7418027     | 20817   | 1766023 | 5885106  | 23.0          | 11/12/1985     | 85         | 68         | 84            |
|                    | <i>Tuhimata Rd</i>             | 7419003     | 3770    | 1770312 | 5884972  | 28.9          | 3/12/1986      | 114        | -          | -             |
| Glenbrook Kaawa    | <i>Glenbrook Hall</i>          | 7417001     | 3199    | 1756228 | 5882283  | 57.7          | 16/03/1970     | 104        | -          | -             |
|                    | <i>Waiau Pa</i>                | 7418003     | 20810   | 1757683 | 5886638  | -             | 18/04/1980     | 44         | -          | -             |
|                    | <i>Batty Rd</i>                | 7418013     | 20813   | 1763734 | 5889746  | 35.5          | 20/12/1985     | 50         | -          | -             |
|                    | <i>Mauku Main</i>              | 7428047     | 20812   | 1760995 | 5881192  | -             | 17/04/1985     | 195        | -          | -             |
| Waiau Pa Waitematā | <i>Seagrove Rd Main</i>        | 7417021     | 724     | 1755889 | 5889018  | 27.9          | 8/08/1991      | 201        | -          | -             |
|                    | <i>Seagrove Road Obs</i>       | 7417023     | 725     | 1755995 | 5889108  | 28.2          | 8/08/1991      | 201        | 98         | 201           |
| Waiuku Kaawa       | <i>Divers Rd</i>               | 7427003     | 3215    | 1756678 | 5880097  | 52.3          | 27/08/1985     | 218        | -          | -             |

**Table 17: Groundwater quality monitoring sites in South Auckland.**

| <b>Aquifer</b>            | <b>Site Name</b>       | <b>Site number</b> | <b>Bore ID</b> | <b>Easting</b> | <b>Northing</b> | <b>Date sampling commenced</b> | <b>Trend analysis period</b> | <b>Bore depth (mbgl)</b> | <b>Pumping depth (mbgl)</b> |
|---------------------------|------------------------|--------------------|----------------|----------------|-----------------|--------------------------------|------------------------------|--------------------------|-----------------------------|
| Bombay Volcanic           | BP Bombay              | 7419121            | -              | 1775891        | 5881877         | 15/11/1994                     | 1998-2013                    | 80                       | N/A                         |
| Drury Sand                | Fielding Rd Sand       | 7419007            | 343            | 1774440        | 5890658         | 21/01/1998                     | 1998-2013                    | 64                       | 25                          |
| Drury Volcanic            | Fielding Rd Volcanic   | 7419009            | 344            | 1774443        | 5890669         | 21/01/1998                     | 1998-2013                    | 47                       | 45                          |
|                           | Hillview spring        | 7419126            | Spring         | 1776245        | 5884311         | 19/04/2011                     | 2011-2013                    | 4                        | N/A                         |
| Glenbrook Volcanic        | Gun Club Rd            | 7428031            | -              | 1764324        | 5880929         | 21/08/1990                     | 2006-2013                    | -                        | N/A                         |
|                           | Patumahoe spring       | 43915              | Spring         | 1764114        | 5889239         | 3/04/1998                      | 1999-2013                    | Spring                   | N/A                         |
| Pukekohe Central volcanic | Hickey spring          | 7419127            | Spring         | 1768720        | 5882057         | 3/04/1998                      | 1998-2013                    | Spring                   | N/A                         |
|                           | Rifle Range Rd Shallow | 7428105            | 5681           | 1766074        | 5880860         | 9/01/1998                      | 1998-2013                    | 42                       | 25                          |
| Pukekohe Kaawa            | Ostrich Farm No1       | 7418027            | 20817          | 1766023        | 5885106         | 15/01/1998                     | 1998-2013                    | 85                       | 40                          |
|                           | Ostrich Farm No2       | 7418023            | 20814          | 1766029        | 5885168         | 15/01/1998                     | 1998-2013                    | 48                       | 40                          |
|                           | Rifle Range Rd Deep    | 7428103            | 5681           | 1766081        | 5880866         | 9/01/1998                      | 1998-2013                    | 90                       | 40                          |
| Waiau Pa Waitematā        | Seagrove Rd            | 7417021            | 724            | 1755889        | 5889018         | 14/01/1998                     | 1998-2013                    | 201                      | 40                          |

The main land use in south Auckland is rural including pastoral farming, horticulture and orchards and increasing areas of lifestyle blocks and hobby farms. Groundwater is mainly used for horticulture irrigation, municipal supply, and stock water supply.

Aquifers in this area include Waitematā aquifers, Kaawa aquifers, South Auckland Volcanics and Plio-Pleistocene deposits. These Plio-Pleistocene deposits form a layered system with shallow volcanic and sand aquifers overlying the deeper Kaawa aquifers, and are considered as part of these. The aquifers and monitoring sites in south Auckland (Figure 12, Table 16 and Table 17) are described below.

The South Auckland Volcanic Field is subdivided into several aquifer management areas with monitoring sites present in the Pukekohe Central Volcanic aquifer (six water level bores and two water quality bores). The Bombay Volcanic Aquifer has one water level bore and one water quality bore. The Drury Volcanic Aquifer has one water level and water quality bore. The Drury Sands Aquifer has one water level and water quality bore.

In the Kaawa aquifers, monitoring bores exist in the Pukekohe Kaawa (four water level bores and three water quality bores), Glenbrook Kaawa (four water level bores), Waiuku Kaawa (one water level bore), Bombay-Drury Kaawa (one water level bore and one spring sampled for water quality), and the Awhitu Kaawa (one water level bore).

In the Waitematā aquifers, there is one water level bore in the Drury Waitematā Aquifer, one in the Karaka Waitematā Aquifer and two in the Waiau Pa Waitematā Aquifer of which one is also sampled for water quality.

Several springs emerge from the aquifers in the wider area and are sampled for water quality: Hickey Spring (Pukekohe Central Volcanic Aquifer), Hillview Spring (Bombay Drury Kaawa Aquifer), and Patumahoe Spring (Glenbrook Volcanic Aquifer).

### **3.5.1 Groundwater levels**

Water levels in the Bombay Volcanic and Bombay-Drury Kaawa Aquifer bores show environmentally meaningful increasing trends. In addition, five of the six bores in the Pukekohe Central Volcanic Aquifer show meaningful increasing trends in water level. In contrast, meaningful decreasing trends in water level are observed in the Karaka and Waiau Pa Waitematā aquifers. Water level results are presented in Table 18 and Appendix E.

**Table 18: Groundwater level statistics of the aquifers in the South Auckland**

(Min = minimum, Max = maximum, SD = standard deviation, masl = meters above sea level,  
 \* = statistically significant, \*\* = meaningful)

| Aquifer                   | Site name               | Min (masl) | Max (masl) | Median (masl) | Mean (masl) | SD (m) | Sen slope (m/yr) |
|---------------------------|-------------------------|------------|------------|---------------|-------------|--------|------------------|
| Awhitu Kaawa              | Maraeoriahia            | 1.50       | 3.12       | 2.81          | 2.66        | 0.41   | -0.014*          |
| Bombay Volcanic           | Wooten Rd               | 160.72     | 165.06     | 162.91        | 162.92      | 1.07   | 0.096**          |
| Bombay-Drury Kaawa        | Cooper Rd               | 15.29      | 25.60      | 17.37         | 17.69       | 1.85   | 0.196**          |
| Drury Sand                | Fielding Rd Sand        | 3.83       | 11.71      | 8.81          | 8.34        | 2.06   | 0.164*           |
| Drury Volcanic            | Fielding Rd Volcanic    | 13.35      | 16.07      | 14.63         | 14.69       | 0.73   | -0.018           |
| Drury Waitematā           | Fielding Rd Waitematā   | 9.98       | 12.24      | 11.54         | 11.52       | 0.38   | -0.001           |
| Glenbrook Kaawa           | Batty Rd                | 22.14      | 27.16      | 23.00         | 22.93       | 0.40   | 0.020*           |
|                           | Glenbrook Hall          | 7.92       | 9.01       | 8.60          | 8.56        | 0.25   | -0.004           |
|                           | Mauku Main              | 15.84      | 27.16      | 26.33         | 26.17       | 1.12   | 0.030*           |
|                           | Waiau Pa                | 7.95       | 14.45      | 12.08         | 12.14       | 1.22   | 0.018            |
| Karaka Waitematā          | Karaka North            | 3.60       | 5.52       | 4.71          | 4.66        | 0.47   | -0.055**         |
| Pukekohe Central Volcanic | Revell Court            | 62.03      | 65.18      | 63.37         | 63.35       | 0.74   | 0.009            |
|                           | Rifle Range Rd Shallow  | 54.34      | 59.31      | 56.98         | 56.82       | 1.22   | 0.173**          |
|                           | Rifle Range Rd Deep     | 41.56      | 50.13      | 45.98         | 46.10       | 1.71   | 0.260**          |
|                           | Douglas Rd              | 48.68      | 52.59      | 49.79         | 49.82       | 0.63   | 0.058**          |
|                           | Jenkin Rd               | 38.24      | 42.49      | 39.72         | 39.82       | 1.01   | 0.193**          |
|                           | Pukekohe DSIR           | 46.60      | 49.99      | 48.43         | 48.39       | 0.65   | 0.069**          |
| Pukekohe Kaawa            | Ostrich Farm No1        | 19.49      | 21.32      | 20.56         | 20.58       | 0.35   | -0.006           |
|                           | Ostrich Farm No2        | 20.04      | 21.71      | 20.66         | 20.65       | 0.32   | -0.005           |
|                           | Ostrich Farm Production | 20.13      | 21.96      | 21.00         | 21.04       | 0.33   | 0.003            |
|                           | Tuhimata Rd             | 23.04      | 24.65      | 23.94         | 23.87       | 0.45   | 0.043**          |
| Waiau Pa Waitematā        | Seagrove Rd Main        | 2.94       | 6.51       | 4.81          | 4.71        | 0.73   | -0.154**         |
|                           | Seagrove Rd Obs         | 3.32       | 6.47       | 5.30          | 5.16        | 0.75   | -0.163**         |
| Waiuku Kaawa              | Divers Rd               | 11.11      | 13.80      | 12.68         | 12.55       | 0.64   | 0.049*           |

### 3.5.2 Groundwater quality

There are high nitrate concentrations in some southern aquifers. There were some considerable exceedances of the maximum allowable value (MAV) for drinking water for nitrate in the Glenbrook Volcanic aquifer (Patumahoe Spring and Gun Club Rd sites), Pukekohe Central Volcanic aquifer (Hickey Spring) and the Drury Volcanic aquifer (Hillview Spring site). The Bombay Volcanic and Pukekohe Central Volcanic aquifers (BP Bombay and Rifle Range Shallow sites) also exceeded the ANZECC trigger value for nitrate (Table 19).

High nitrate concentrations in the shallow aquifers in Franklin are a well-known issue (Meijer et al., 2016). The Franklin area has a long history of outdoor vegetable production, resulting in continuous cultivation and requiring high levels of regular nitrogen fertiliser inputs. When nitrogen inputs exceed the assimilative capacity of the plants, the excess nitrate becomes vulnerable to leaching through the soil profile when soil drainage occurs. The susceptibility for leaching can be enhanced when there is a lack of carbon in the soil system. The high nitrate concentrations in the shallow volcanic aquifers are a result of nitrate leaching over many decades.

There are also increasing trends observed in some aquifers, including the Bombay Volcanic aquifer (BP Bombay site), and Pukekohe Central Volcanic aquifer (Rifle Range Rd Shallow site). Although high nitrate concentrations in groundwater are widespread in Franklin, only few sites exhibit increasing trends, suggesting there may be specific areas where land-use management and/or activities are resulting in continued and increasing nitrogen leaching from the soil.

#### *Bombay Volcanic Aquifer:*

In addition to the increasing trend in nitrate (discussed above) there was also a small increasing trend in DO at the BP Bombay site, which could possibly be attributed to increased recharge of oxygenated water.

#### *Drury Sand Aquifer:*

The aesthetic guideline value for soluble iron was exceeded at the Fielding Rd Sand site. The oxygen conditions in this aquifer are very low, so this could be due to iron rich water moving into the aquifer and/or antecedent mineral iron being dissolved over time. There was a decreasing trend in ammoniacal N, which could be due to small amounts of ammonium-N ( $\text{NH}_4^+$ ) being converted to ammonia gas ( $\text{NH}_3$ ). A decreasing trend in soluble P was also observed which could be due to changes in land use, with decreasing P fertiliser application.

#### *Drury Volcanic Aquifer:*

At the Fielding Road Volcanic site there was an increasing trend in soluble iron, however a decreasing trend in total and soluble manganese. The oxygen conditions in this aquifer are relatively low (less than 1 mg/L) which supports the presence of iron in its dissolved form ( $\text{Fe}^{2+}$ ) but doesn't explain the trend. Perhaps there is an increase in the overall supply of iron in the aquifer. The declining trend in total and soluble manganese could be due to the opposite where there may be decreasing availability of this mineral overall, or could be due to reduced manganese inputs via fertiliser over time. There are also decreasing trends in ammoniacal N, total P and soluble P, which may all be due to changes in land use and management over time resulting in less nutrient losses to groundwater.

There were no trends observed at the Hillview Spring site.

#### *Pukekohe Central Volcanic Aquifer:*

In addition to the increasing trend in nitrate at the Rifle Range Road Shallow site, there were small increasing trends in DO and electrical conductivity (EC). The increase in EC could be occurring as a result of the increasing nitrate-N concentrations. There was a large decrease in total iron, which could be related to the increasing DO trend, where greater oxygenation results in precipitation of iron out of solution. There was also a small decreasing trend in soluble manganese, which is supported by the increasing trend in DO.

There were no trends observed at the Hickey Spring site.

#### *Pukekohe Kaawa Aquifer:*

Aesthetic guideline values were exceeded for soluble manganese at the Ostrich Farm No. 1 site and for soluble iron and manganese at the Ostrich Farm No. 2 site. Decreasing trends were observed in total and soluble manganese at the Ostrich Farm Road No. 2 site, which could possibly be a result of either decreasing availability of this mineral or reduced manganese inputs via fertiliser over time.

At the Rifle Range Road Deep site, there was an increasing trend in soluble iron. The oxygen conditions are very low in this site (less than 0.5 mg/L), which will readily dissolve iron in the  $\text{Fe}^{3+}$  form to the  $\text{Fe}^{2+}$  form, however, there may have been an increased supply of iron through groundwater movement or from the antecedent bedrock to result in the increasing trend observed.

There was also a small decreasing trend in total P at the Rifle Range Rd Deep site which may be due to changes in fertiliser and soil management over time resulting in less nutrient losses to groundwater.

There were no significant and meaningful trends observed in the Glenbrook Volcanic (Gun Club Road and Patumahow Spring sites) or Waiau Pa Waitematā aquifers (Seagrove Rd site).

**Table 19: Summary of medians, median absolute deviations (MAD) and trends for selected parameters in the Southern bores.**

Medians in **orange** exceed trigger values (TV) for the 95% species protection level for freshwaters (ANZECC, 2000), **red** exceed health-related maximum allowable values (MAV) and **purple** exceed aesthetic guideline values (GV). MAV and GV are based on the NZ Drinking Water Standards (MoH, 2000). MAD in **blue** are deviations >10% of the median. Trends in **green** are statistically significant (p<0.05).

| Aquifer                   | Site                   | Nitrate (mg/L)   |       |                | Ammoniacal N (mg/L) |       |                | Soluble P (mg/L) |       |                | Soluble Fe (mg/L) |       |                |
|---------------------------|------------------------|------------------|-------|----------------|---------------------|-------|----------------|------------------|-------|----------------|-------------------|-------|----------------|
|                           |                        | TV=7.2, MAV=11.3 |       |                | TV=0.9, GV=1.24     |       |                |                  |       |                | GV=0.2            |       |                |
|                           |                        | Median           | MAD   | Trend (unit/y) | Median              | MAD   | Trend (unit/y) | Median           | MAD   | Trend (unit/y) | Median            | MAD   | Trend (unit/y) |
| Bombay Volcanic           | BP Bombay              | 9.200            | 0.884 | 0.210          | 0.010               | 0.000 | 0.000          | 0.100            | 0.005 | 0.000          | 0.005             | 0.000 | 0.000          |
| Drury Sand                | Fielding Rd Sand       | 0.002            | 0.000 | 0.000          | 0.650               | 0.040 | -0.013         | 0.182            | 0.020 | -0.005         | 0.303             | 0.072 | 0.015          |
| Drury Volcanic            | Fielding Rd Volcanic   | 0.005            | 0.003 | 0.000          | 0.050               | 0.010 | -0.002         | 0.039            | 0.004 | -0.001         | 0.056             | 0.018 | 0.003          |
|                           | Hillview spring        | 14.300           | 1.250 | -0.270         | 0.005               | 0.000 | 0.000          | 0.050            | 0.001 | 0.001          | 0.014             | 0.008 | 0.003          |
| Glenbrook Volcanic        | Gun Club Rd            | 26.600           | 0.550 | -0.452         | 0.005               | 0.000 | 0.000          | 0.017            | 0.001 | -0.002         | 0.037             | 0.014 | ND             |
|                           | Patumahoe spring       | 24.750           | 0.750 | 0.105          | 0.005               | 0.000 | 0.000          | 0.014            | 0.001 | 0.000          | 0.002             | 0.000 | 0.001          |
| Pukekohe Central Volcanic | Hickey spring          | 18.300           | 0.900 | -0.193         | 0.005               | 0.000 | 0.000          | 0.016            | 0.002 | -0.003         | 0.004             | 0.001 | -0.002         |
|                           | Rifle Range Rd Shallow | 7.500            | 2.000 | 0.570          | 0.010               | 0.000 | 0.000          | 0.060            | 0.002 | 0.000          | 0.005             | 0.000 | 0.000          |
| Pukekohe Kaawa            | Ostrich Farm No1       | 0.005            | 0.003 | 0.000          | 0.180               | 0.010 | 0.001          | 0.123            | 0.006 | 0.000          | 0.120             | 0.010 | 0.000          |
|                           | Ostrich Farm No2       | 0.003            | 0.001 | 0.000          | 0.200               | 0.020 | -0.007         | 0.010            | 0.006 | 0.000          | 2.900             | 0.300 | 0.056          |
|                           | Rifle Range Rd Deep    | 0.002            | 0.000 | 0.000          | 0.170               | 0.010 | 0.000          | 0.230            | 0.010 | -0.002         | 0.026             | 0.007 | 0.001          |
| Waiau Pa Waitematā        | Seagrove Rd Main       | 0.002            | 0.001 | 0.000          | 0.230               | 0.020 | -0.001         | 0.040            | 0.003 | 0.000          | 0.020             | 0.000 | 0.000          |

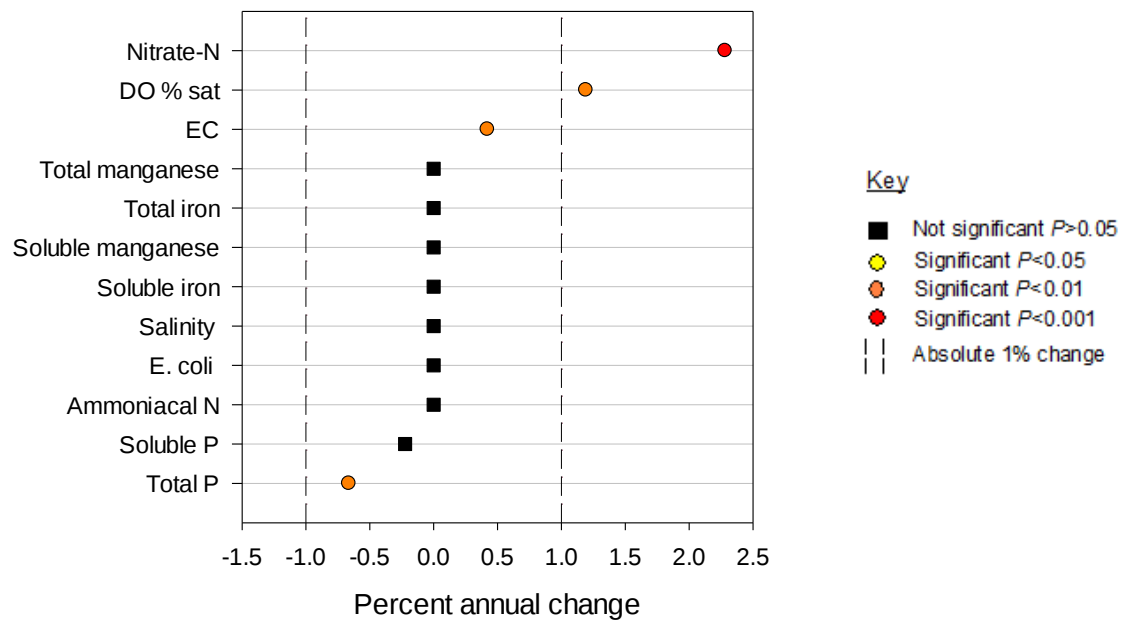
Table 19 cont.

| Aquifer                   | Site                   | Soluble Mn (mg/L)        |       |                | TDS (mg/L) |      |                | EC (mS/cm) |       |                | DO (%sat) |       |                |
|---------------------------|------------------------|--------------------------|-------|----------------|------------|------|----------------|------------|-------|----------------|-----------|-------|----------------|
|                           |                        | TV=1.9, MAV=0.5, GV=0.05 |       |                | GV=1000    |      |                |            |       |                |           |       |                |
|                           |                        | Median                   | MAD   | Trend (unit/y) | Median     | MAD  | Trend (unit/y) | Median     | MAD   | Trend (unit/y) | Median    | MAD   | Trend (unit/y) |
| Bombay Volcanic           | BP Bombay              | 0.001                    | 0.000 | 0.000          | 207        | 10.0 | 1.414          | 0.272      | 0.006 | 0.001          | 76.600    | 4.800 | 0.914          |
| Drury Sand                | Fielding Rd Sand       | 0.037                    | 0.005 | 0.000          | 251        | 6.0  | 0.000          | 0.351      | 0.013 | 0.002          | 0.800     | 0.300 | 0.000          |
| Drury Volcanic            | Fielding Rd Volcanic   | 0.020                    | 0.003 | -0.001         | 204        | 6.0  | 0.000          | 0.322      | 0.006 | 0.001          | 1.350     | 0.350 | -0.027         |
|                           | Hillview spring        | 0.001                    | 0.000 | 0.000          | 244        | 15.0 | 0.000          | 0.276      | 0.006 | -0.005         | 90.250    | 2.700 | -0.019         |
| Glenbrook Volcanic        | Gun Club Rd            | 0.001                    | 0.000 | ND             | 300        | 20.0 | 31.307         | 0.380      | 0.002 | 0.001          | 82.900    | 2.300 | 0.764          |
|                           | Patumahoe spring       | 0.001                    | 0.000 | 0.000          | 310        | 40.0 | -62.614        | 0.367      | 0.003 | 0.000          | 77.000    | 4.400 | 1.464          |
| Pukekohe Central Volcanic | Hickey spring          | 0.001                    | 0.000 | 0.000          | 250        | 30.0 | -41.155        | 0.304      | 0.002 | 0.004          | 80.700    | 6.600 | 1.056          |
|                           | Rifle Range Rd Shallow | 0.001                    | 0.000 | 0.000          | 173        | 12.0 | 3.345          | 0.213      | 0.013 | 0.004          | 69.000    | 6.900 | 1.973          |
| Pukekohe Kaawa            | Ostrich Farm No1       | 0.060                    | 0.000 | 0.000          | 207        | 5.0  | 0.167          | 0.310      | 0.005 | 0.001          | 1.100     | 0.300 | 0.000          |
|                           | Ostrich Farm No2       | 0.145                    | 0.022 | -0.007         | 220        | 9.0  | 2.102          | 0.295      | 0.007 | 0.002          | 1.750     | 0.750 | -0.076         |
|                           | Rifle Range Rd Deep    | 0.024                    | 0.002 | 0.000          | 174        | 6.0  | -0.023         | 0.273      | 0.004 | -0.001         | 1.150     | 0.550 | 0.050          |
| Waiau Pa Waitematā        | Seagrove Rd Main       | 0.005                    | 0.000 | 0.000          | 250        | 8.5  | 0.775          | 0.418      | 0.012 | 0.002          | 0.900     | 0.300 | -0.051         |

### 3.5.2.1 Trends Graphs Southern Aquifers

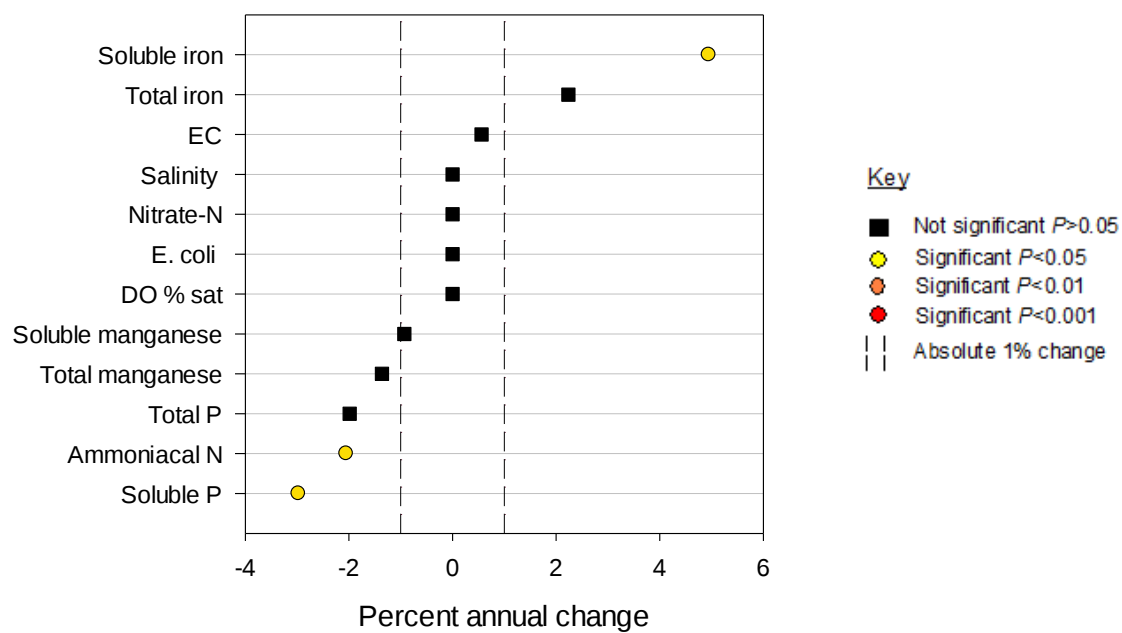
#### Bombay Volcanic Aquifer

##### a) BP Bombay



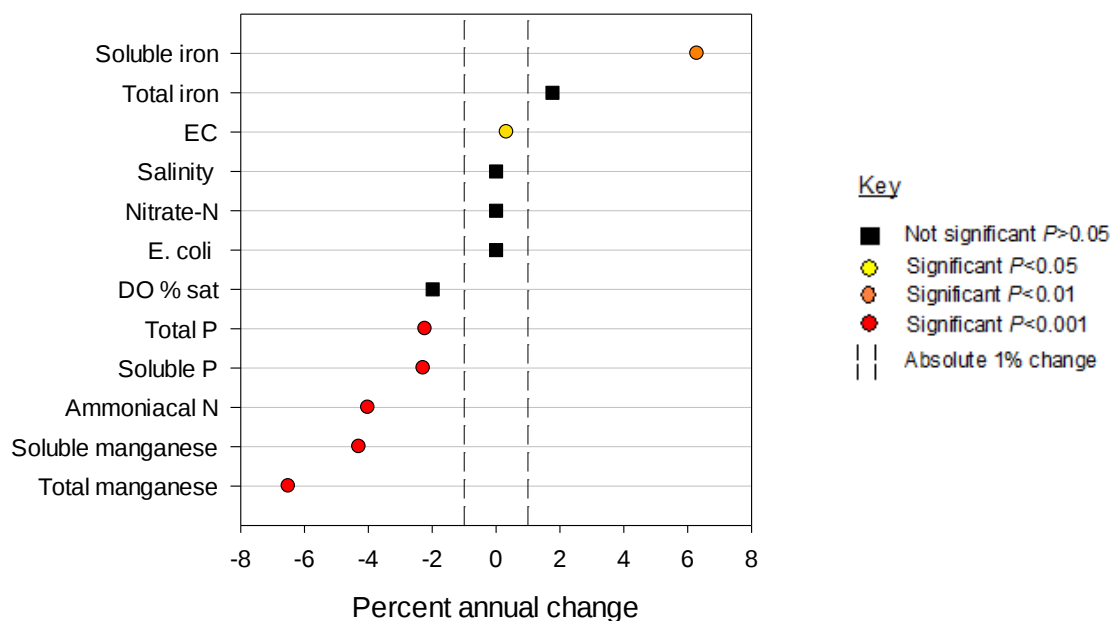
#### Drury Sand Aquifer

##### b) Fielding Rd Sand

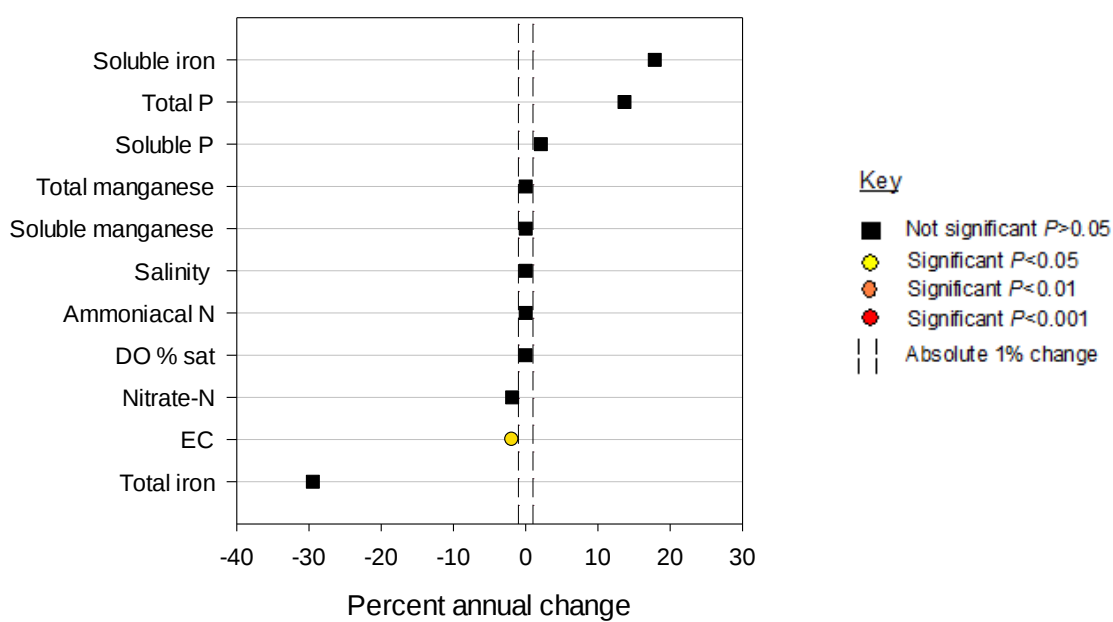


## Drury Volcanic Aquifer

### c) Fielding Rd Volcanic

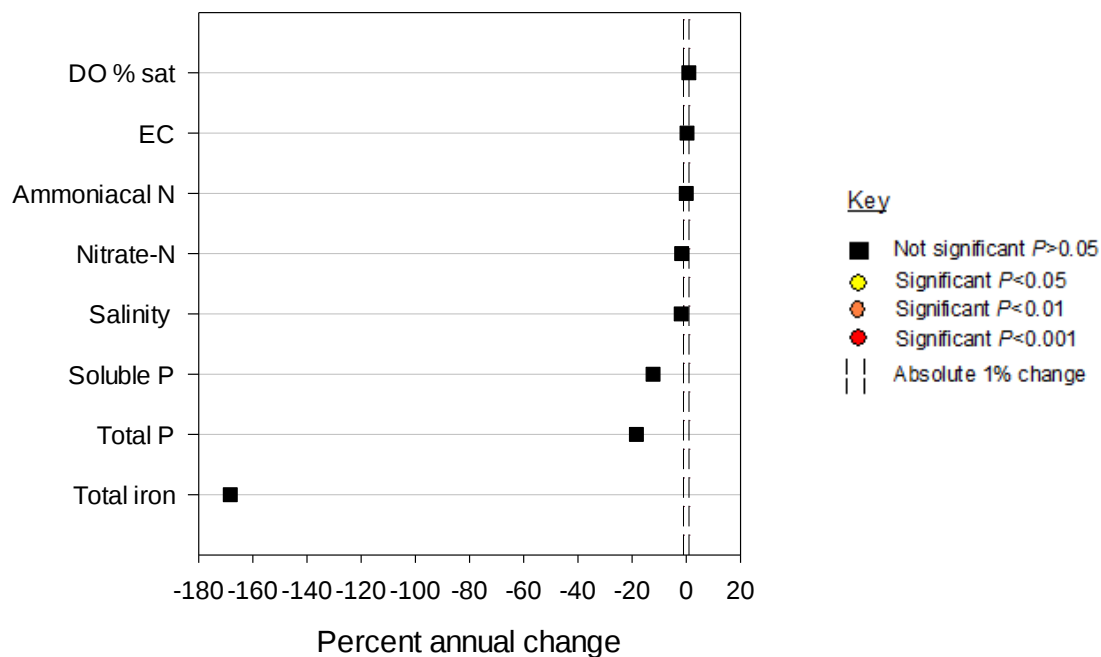


### d) Hillview Spring

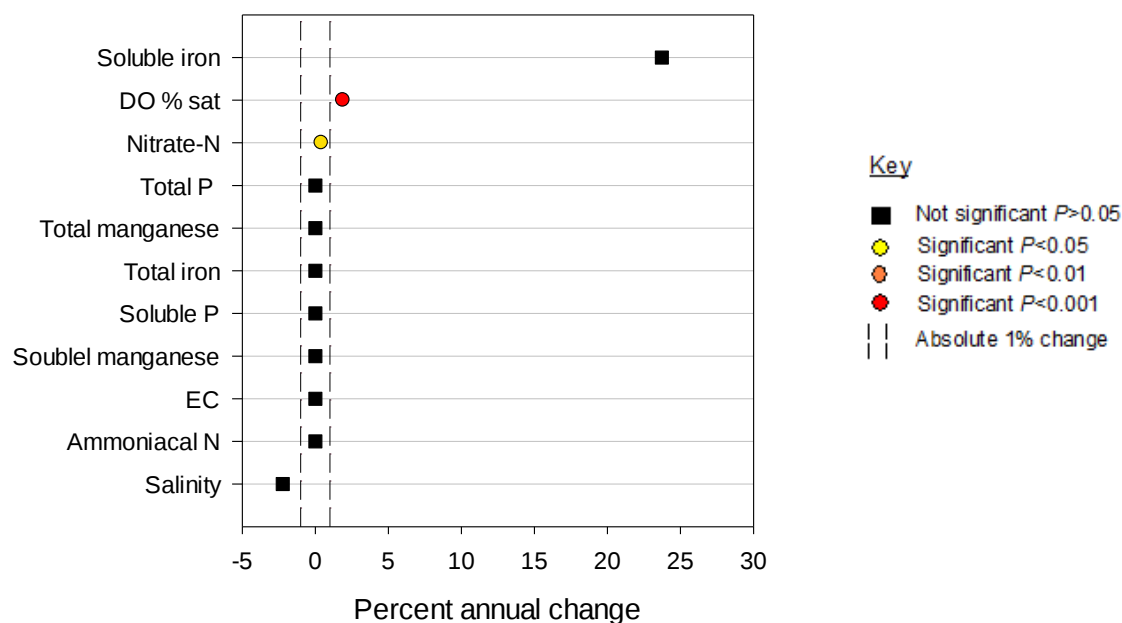


## Glenbrook Volcanic Aquifer

### e) Gun Club Rd

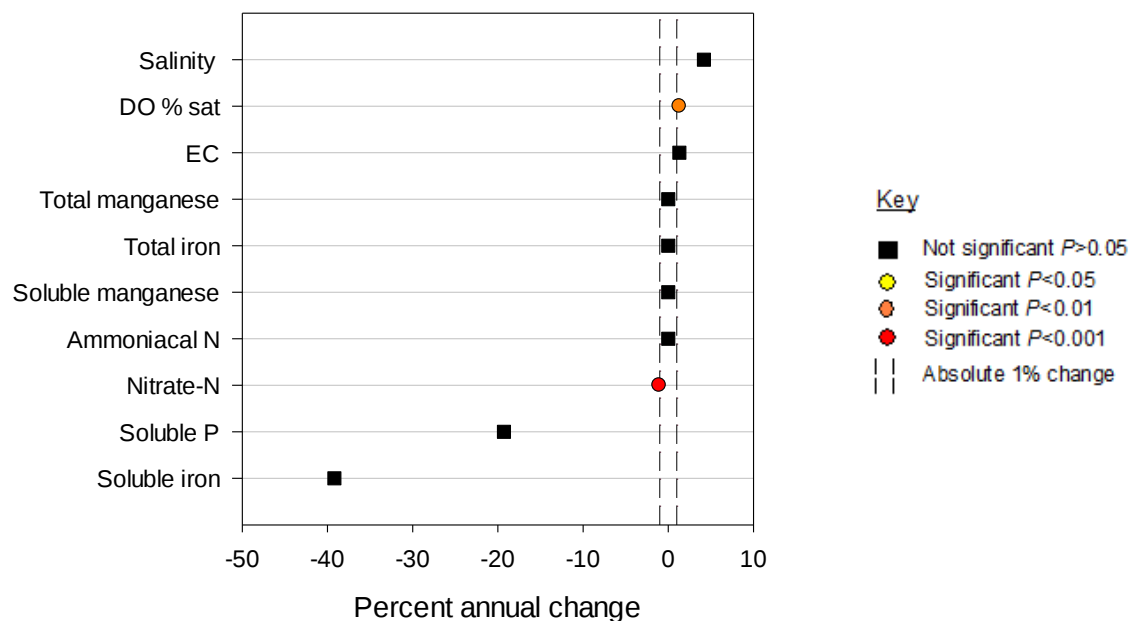


### f) Patumahoe Spring

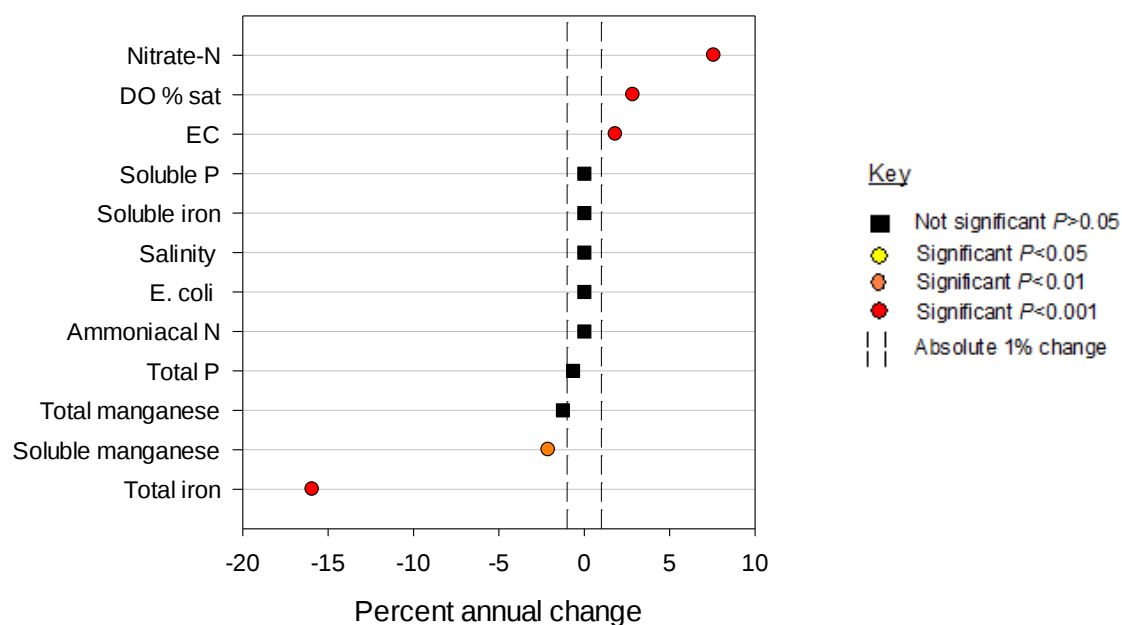


## Pukekohe Central Volcanic Aquifer

### g) Hickey Spring

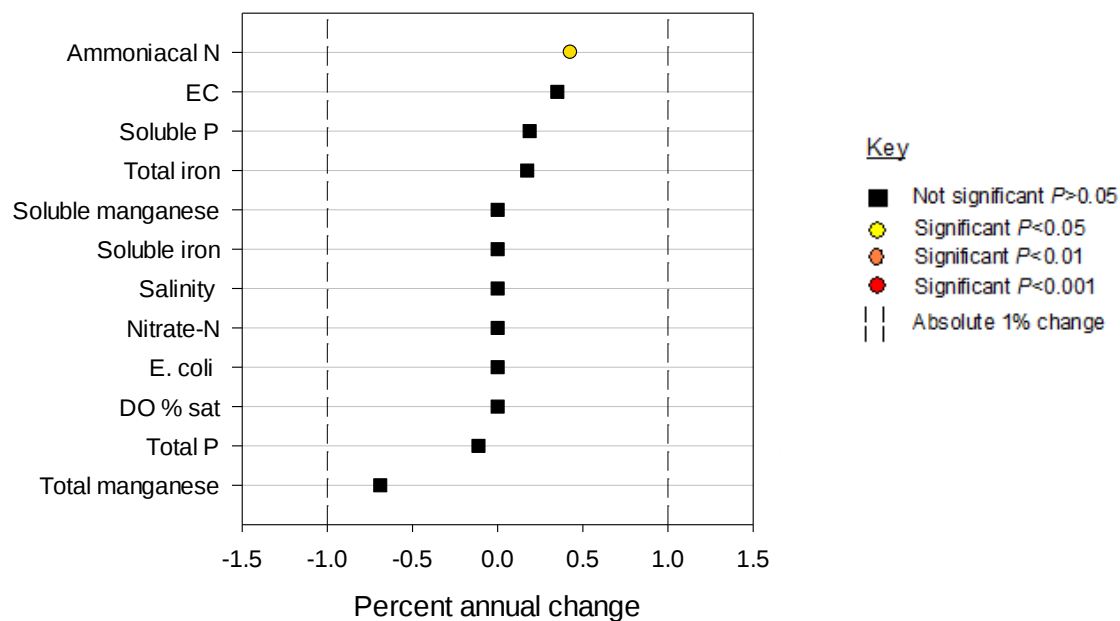


### h) Rifle Range Rd Shallow

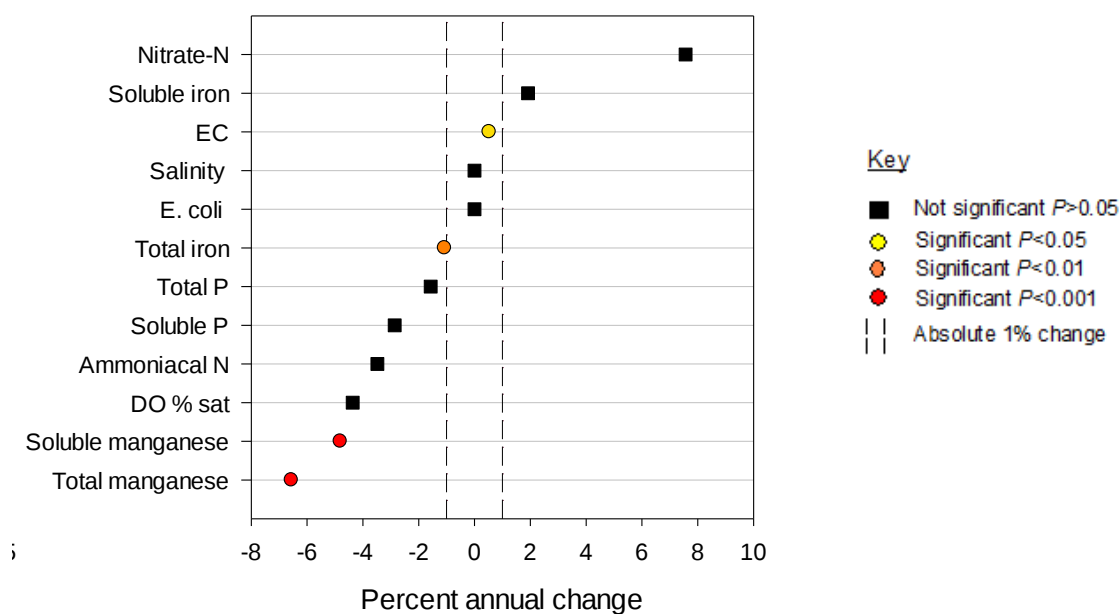


## Pukekohe Kaawa Aquifer

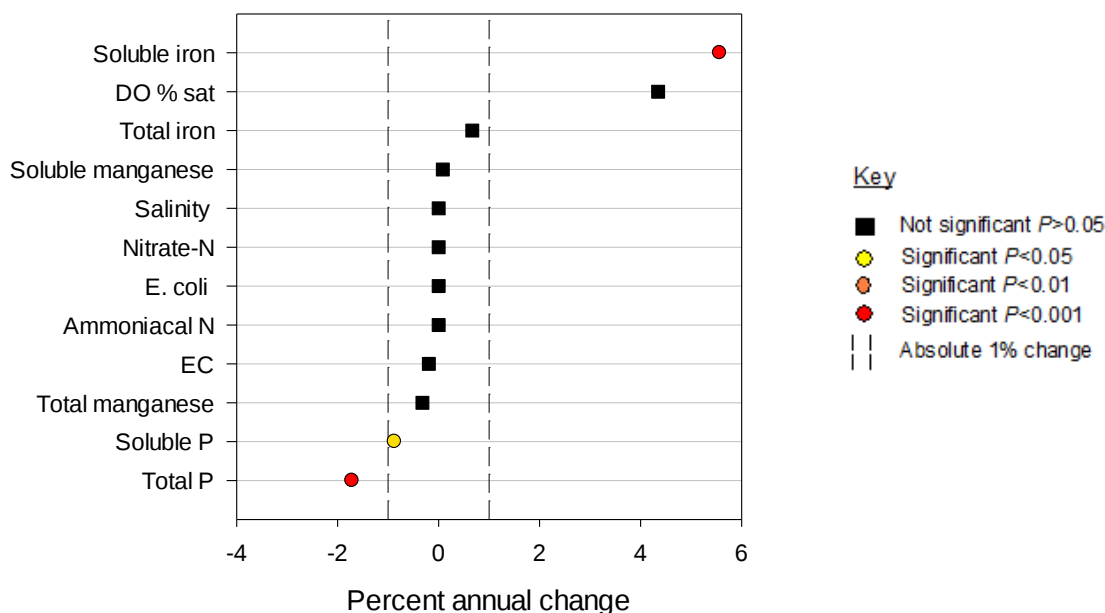
### i) Ostrich Farm Rd No.1



### j) Ostrich Farm Rd No. 2

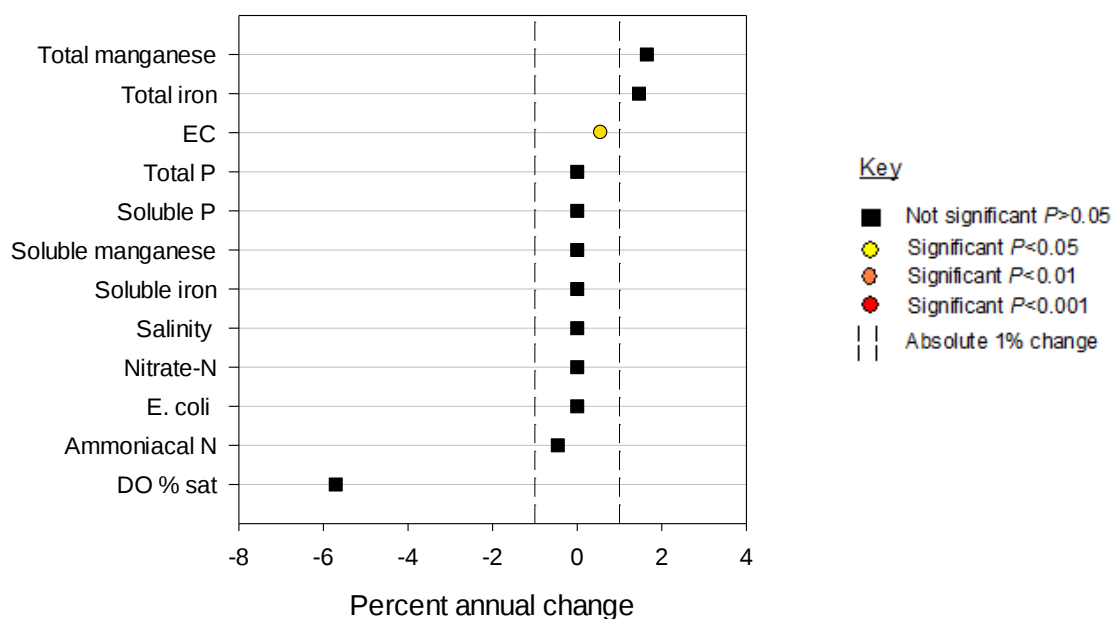


### k) Rifle Range Rd Deep



### Waiau Pa Waitematā Aquifer

#### l) Seagrove Rd



**Figure 13: Groundwater quality trends in the Central aquifers for (a) BP Bombay, (b) Fielding Rd Sand, (c) Fielding Rd Volcanic, (d) Hillview Spring, (e) Gun Club Rd, (f) Patumahoe Spring, (g) Hickey Spring, (h) Rifle Range Rd Shallow, (i) Ostrich Farm Rd No. 1, (j) Ostrich Farm Rd No. 2, (k) Rifle Range Rd Deep and (l) Seagrove Rd sites. The 1% annual change threshold for an environmentally meaningful trend is shown as two vertical dashed lines.**

## 4.0 Summary and conclusions

The Auckland Council state of the environment groundwater monitoring network allows for the formation of a long-term data set for both groundwater level and groundwater quality. Such long-term data sets are essential for the establishment of baselines, and allow for the detection of potentially small trends over a long period.

This report provides a summary of the data (the state) across all sites included in the analysis and, where appropriate, compares it to relevant guidelines and standards. It also presents results of trend analysis of data from the groundwater level programme (2006-2016) and the groundwater quality programme (1998-2013).

### *Groundwater levels*

Significant and environmentally meaningful declining trends in water level were observed in the Omaha Waitematā, Parakai geothermal, Karaka Waitematā and Waiau Pa Waitematā aquifers. Increasing trends in water levels were observed in the Manukau Waitematā, Clevedon East Waitematā, Bombay volcanic, Pukekohe central volcanic and Bombay-Drury Kaawa aquifers. Groundwater levels in other aquifers were generally stable with only small fluctuations in water levels in many bores over time. However, there were some exceptions, such as the Mt Richmond volcanic aquifer, which showed substantial increases and decreases over time.

### *Groundwater quality*

With the exception of nitrate in four of the bores in the South aquifers (Gun Club Rd, and the Patumahoe, Hickey and Hillview springs), the state of groundwater quality is generally good. There were no exceedances of the Maximum Allowable Value (MAV) for drinking water. There were also exceedances of the ANZECC trigger value for nitrate (for 95% species protection) at 2 of the Southern sites (BP Bombay and Rifle Range Rd Shallow). This is due to the high nitrate concentrations in the shallow volcanic aquifers of the Franklin region, caused by land use and management associated with horticultural vegetable production in this area.

Increasing trends in nitrate-N were observed in two of the Southern sites (BP Bombay and Rifle Range Road Shallow), where high nitrate concentrations in shallow groundwater is a well-known issue.

There were a low number of exceedances of the Aesthetic Guideline Values across a range of parameters (three in the North-East, 7 in the North-East, 5 in the Central and 4 in the South aquifers).

Overall, the most common trends observed across all the monitoring sites were changes (both increasing and decreasing trends) in total and soluble iron and

manganese. One of the main drivers of the solubility of these minerals is the oxygen status of the aquifer; however, corresponding long term trends in dissolved oxygen were not observed in most cases and therefore cannot be linked to the causation of these fluctuations. Perhaps short term fluctuations in oxygen are influencing the observed long term changes in the state and solubility of these minerals.

## 5.0 References

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## Appendices A-E

Appendices A through E provide time series data and trend information for each set of aquifers. For each appendix:

### Monthly variations

Box plots of monthly variations for the 10-year period 2006-2015 are shown for each site. Boxplots show minimum (lower whiskers), 25<sup>th</sup> percentile (bottom of box), median (horizontal line within box), 75<sup>th</sup> percentile (top of box) and maximum (upper whiskers).

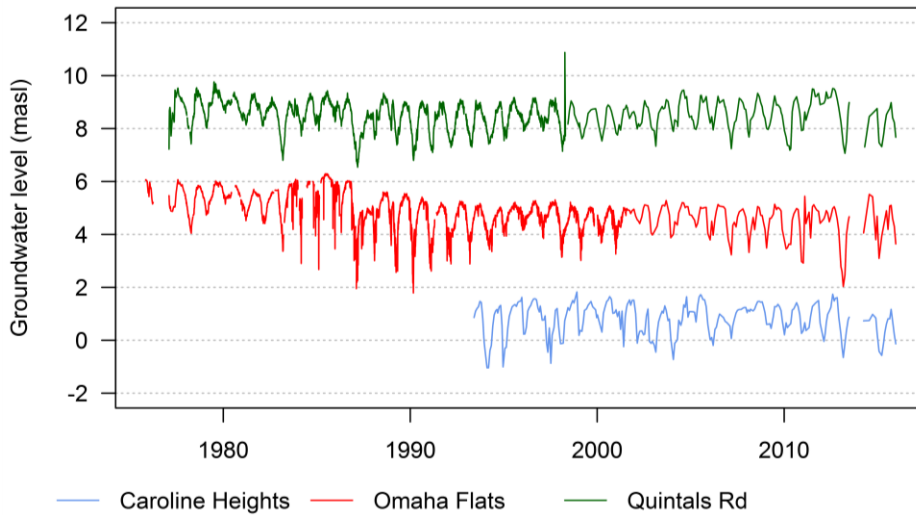
### Trends

Time series graphs are displayed for the 10-year period 2006-2015 including a trend line obtained from Sen Slope estimation for each site (solid line indicates a meaningful trend, dashed line indicates a non-meaningful trend).

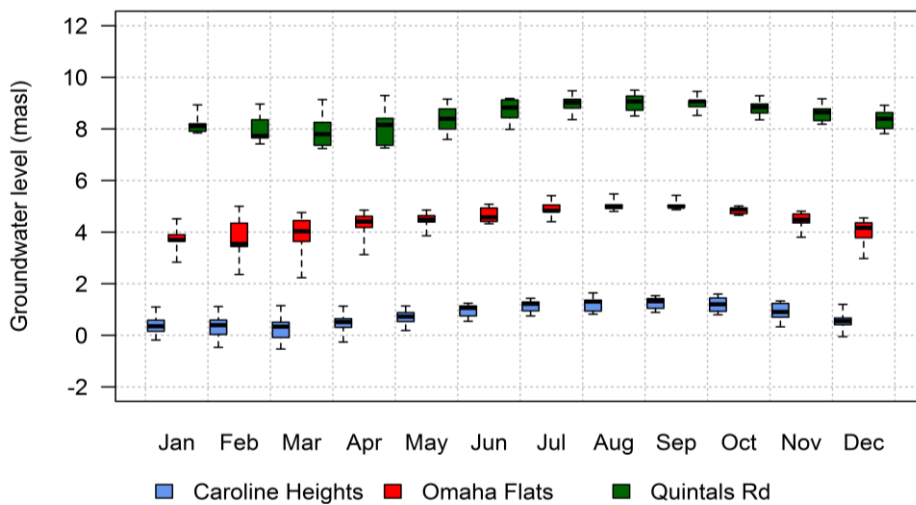
## Appendix A Water Level North East Aquifers

### 1. Omaha Waitematā Aquifer

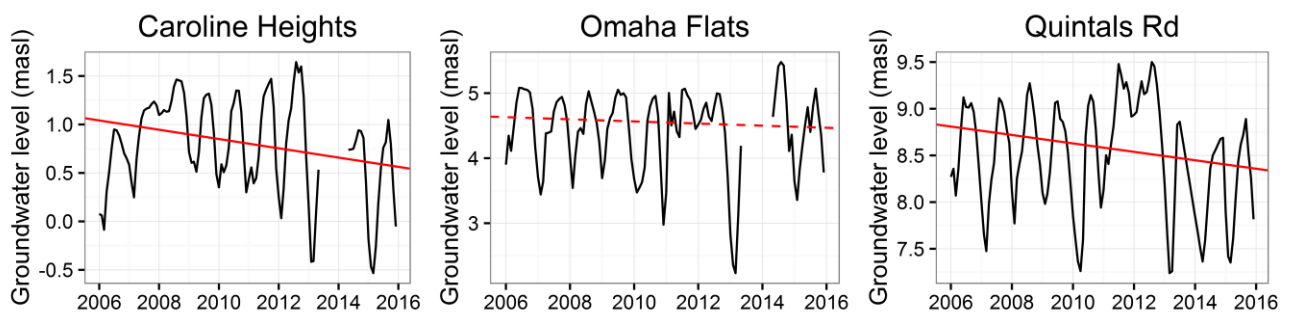
Time series of full data set:



Monthly variations 2006-2015:

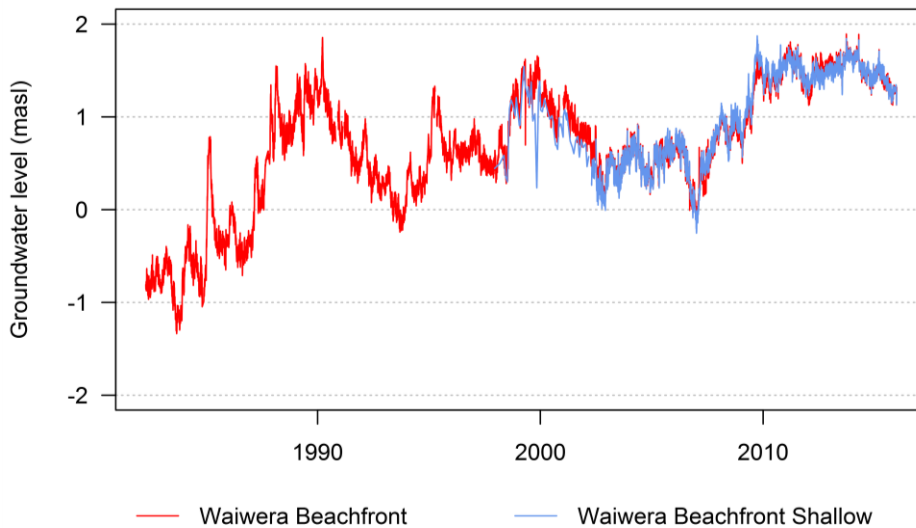


Trends 2006-2015:

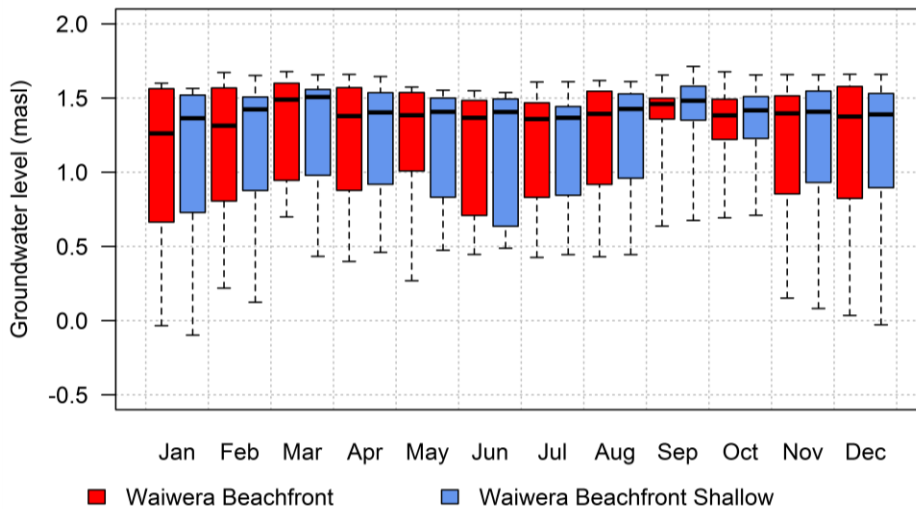


## 2. Waiwera Geothermal Aquifer

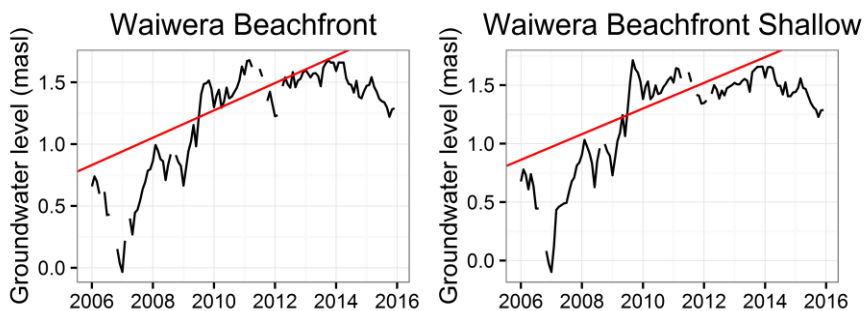
### Time series of full data set:



### Monthly variations 2006-2015:



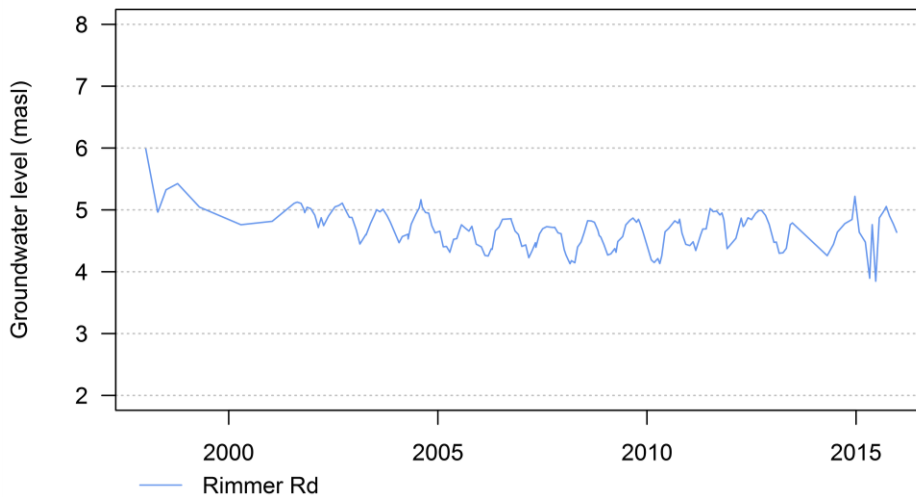
### Trends 2006-2015:



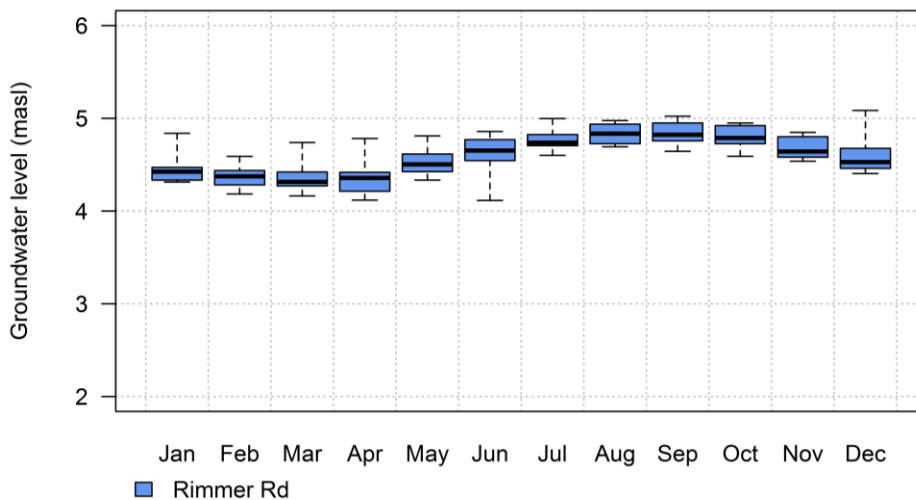
## Appendix B Water Level North West Aquifers

### 1. Kaipara Sand Aquifer

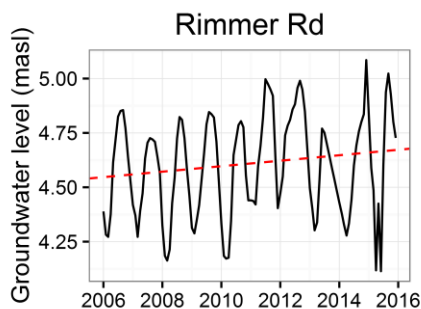
Time series of full data set:



Monthly variations 2006-2015:

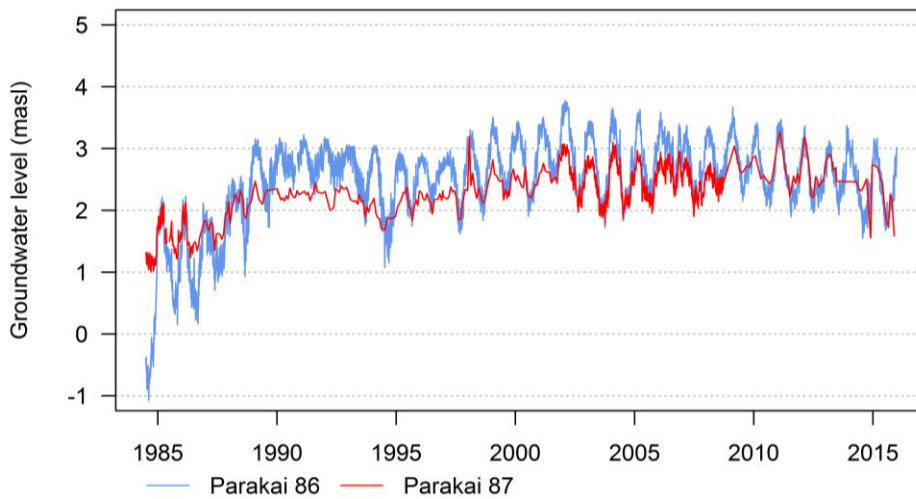


Trends 2006-2015:

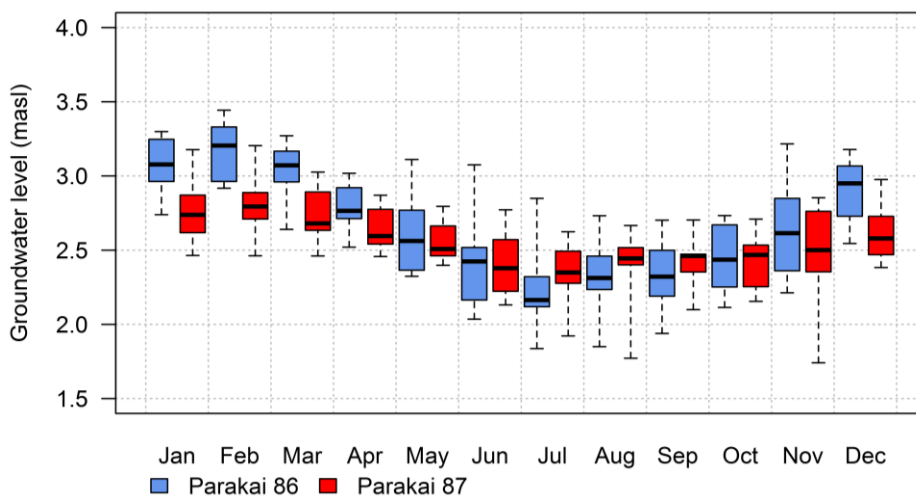


## 2. Parakai Geothermal Aquifer

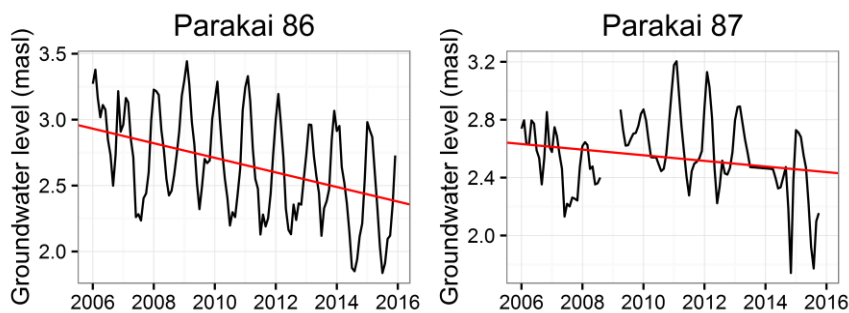
Time series of full data set:



Monthly variations 2006-2015:

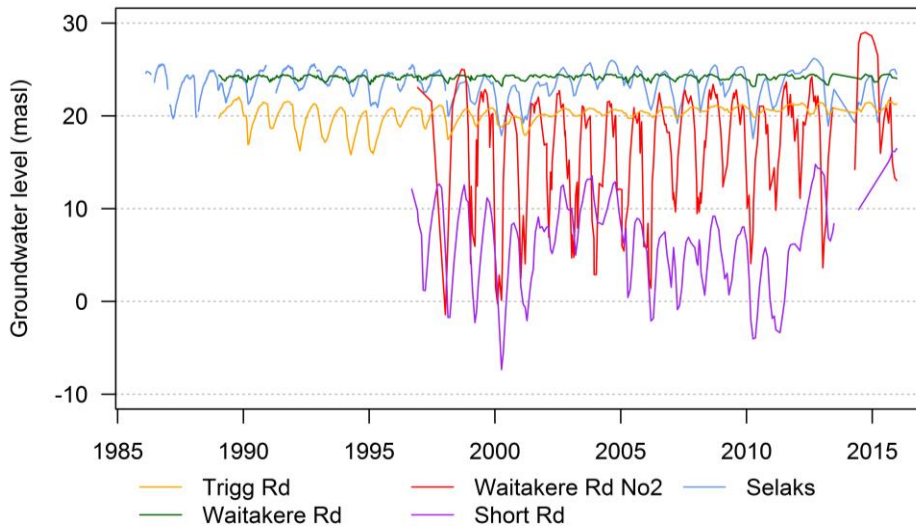


Trends 2006-2015:

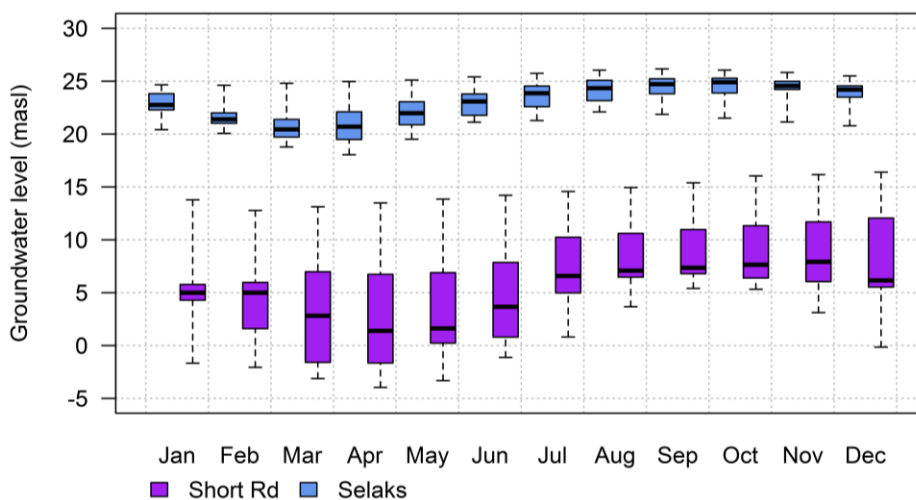
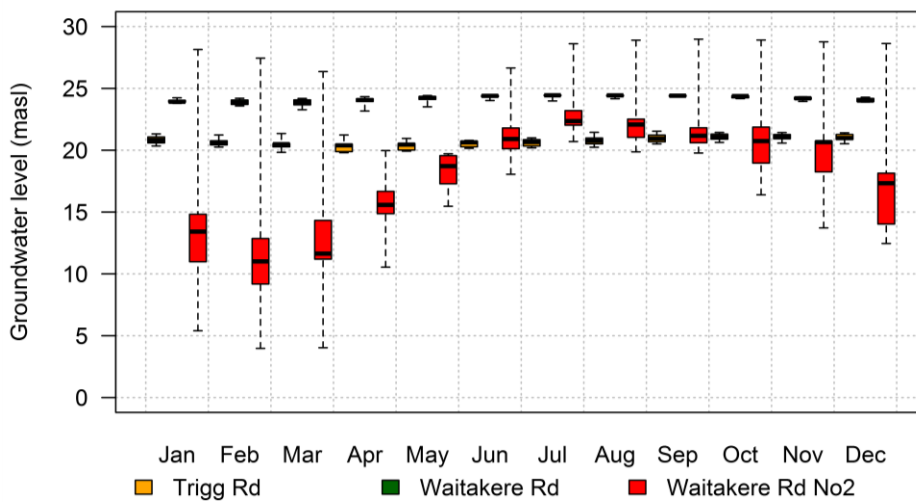


### 3. Kumeu Waitematā Aquifer

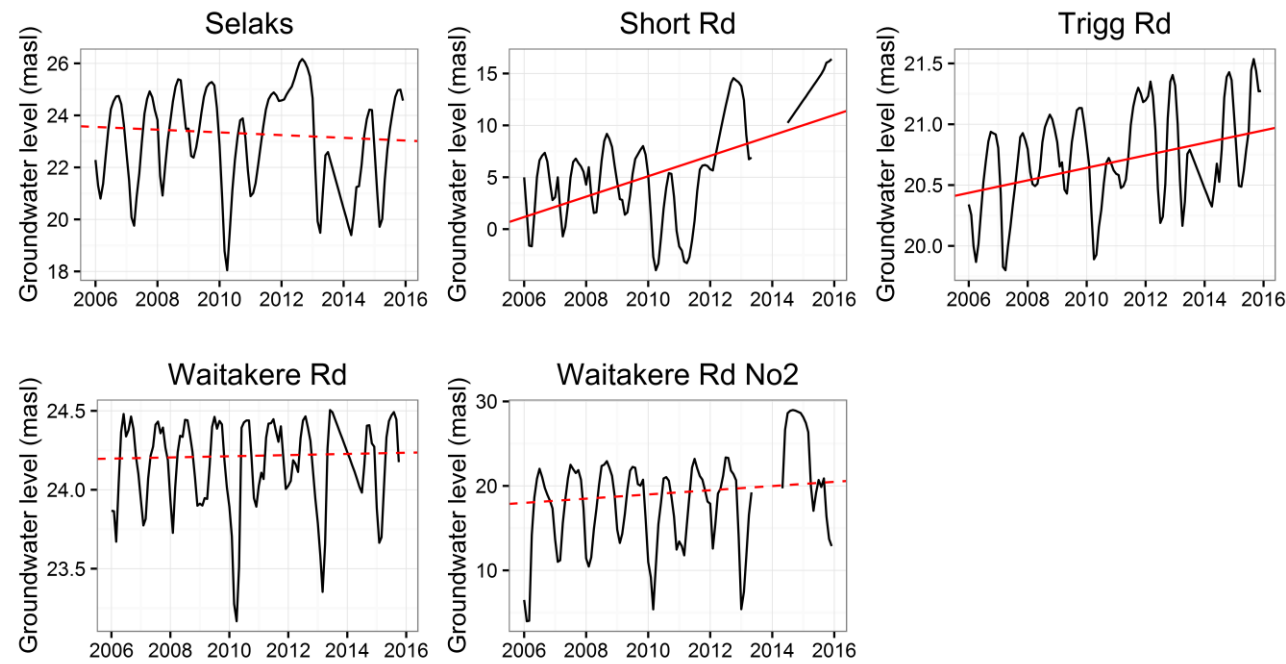
Time series of full data set:



Monthly variations 2006-2015:



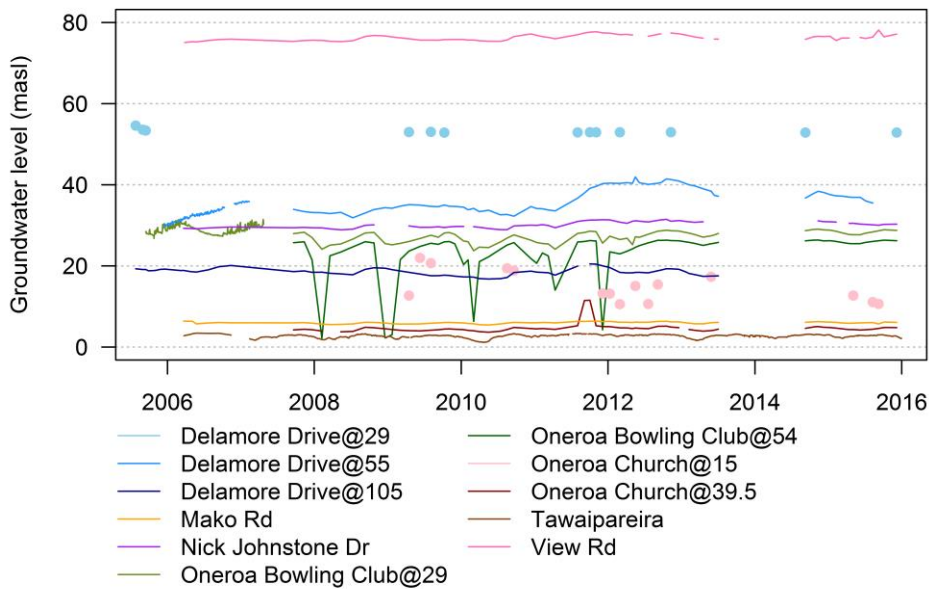
**Trends 2006-2015:**



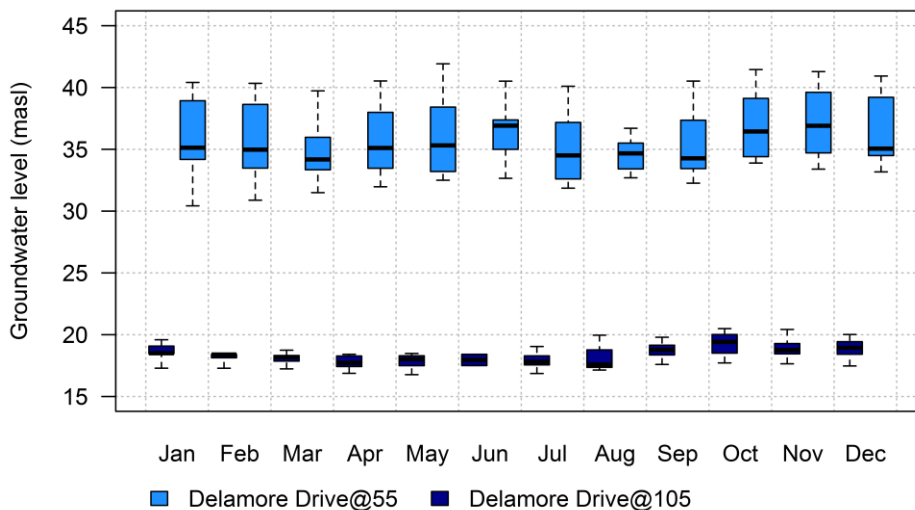
## Appendix C Water Level Waiheke Aquifers

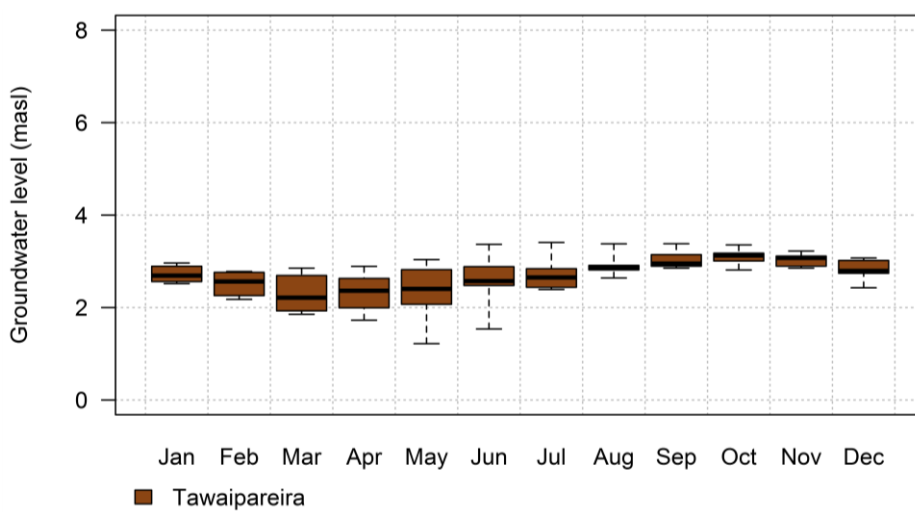
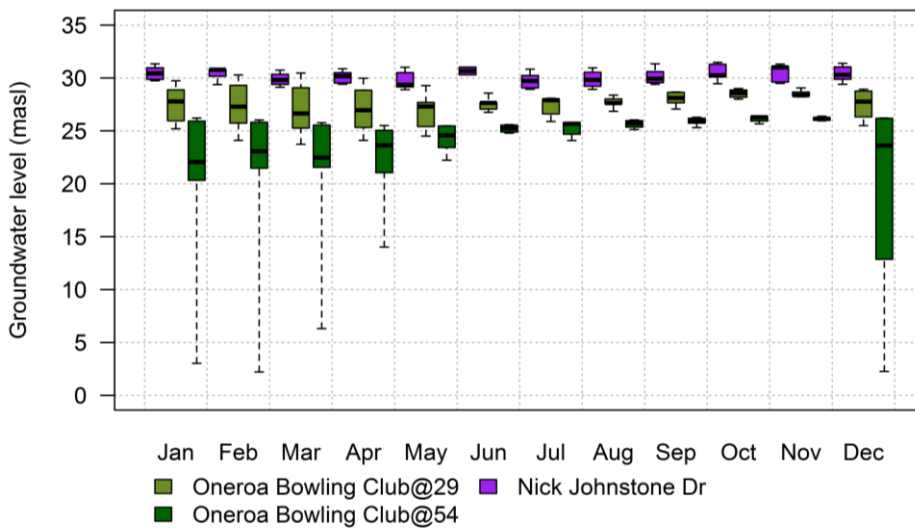
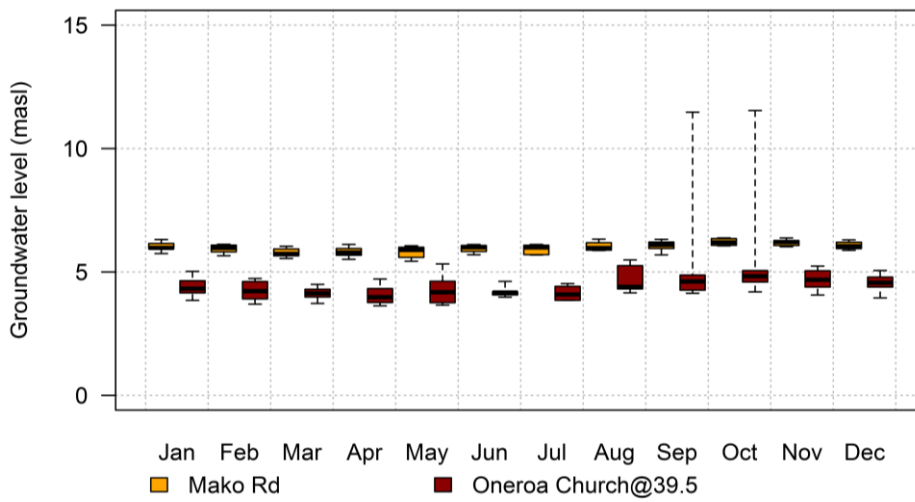
### 1. Waiheke Aquifers

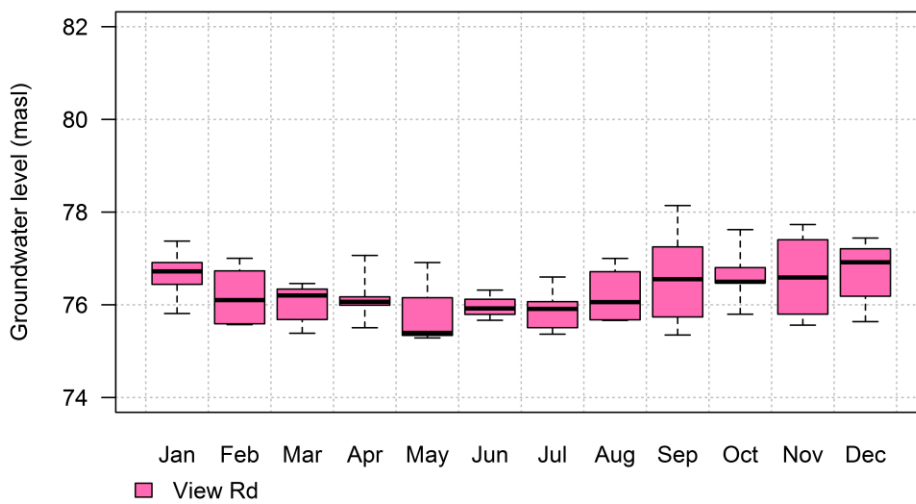
Time series of full data set:



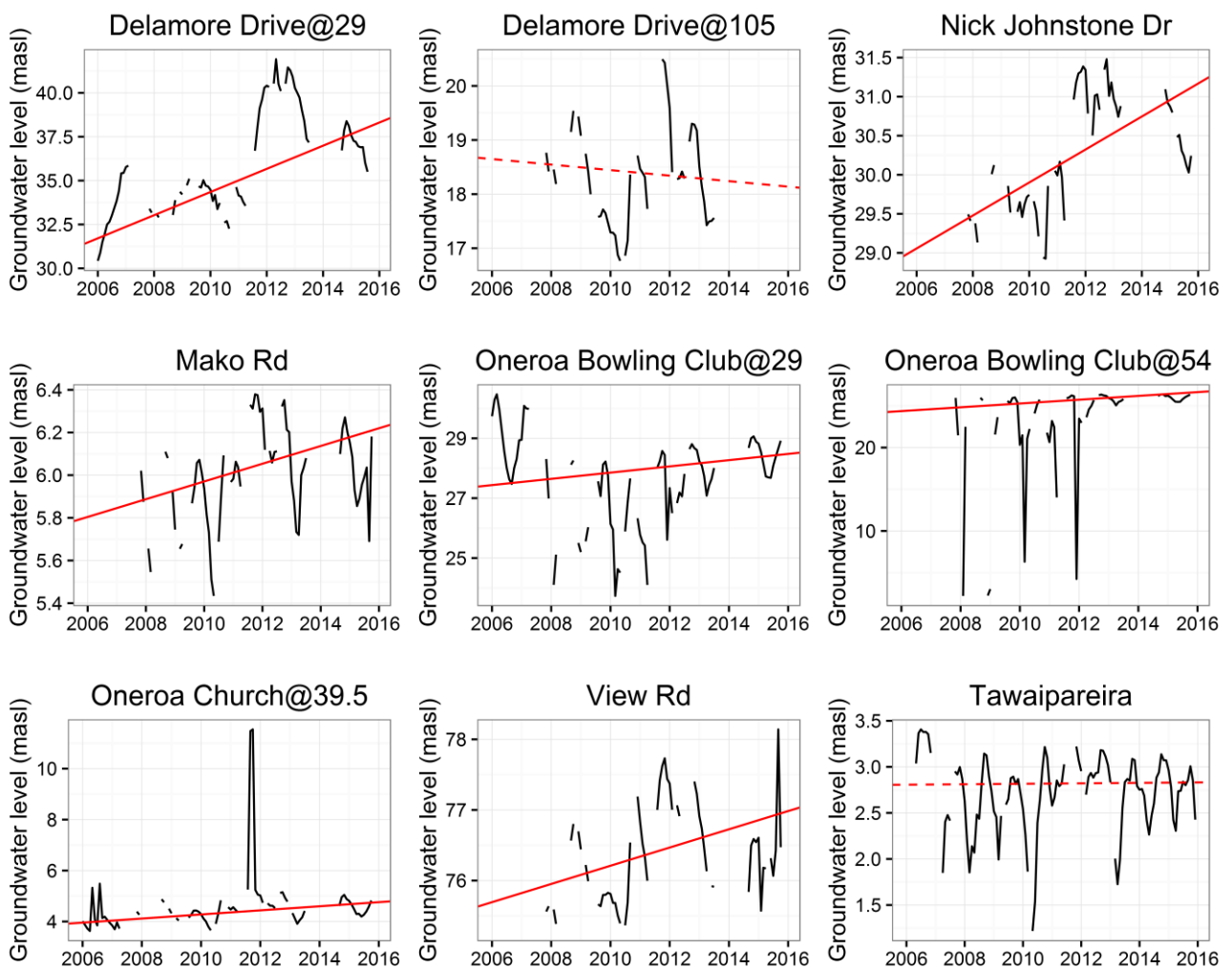
Monthly variations 2006-2015:







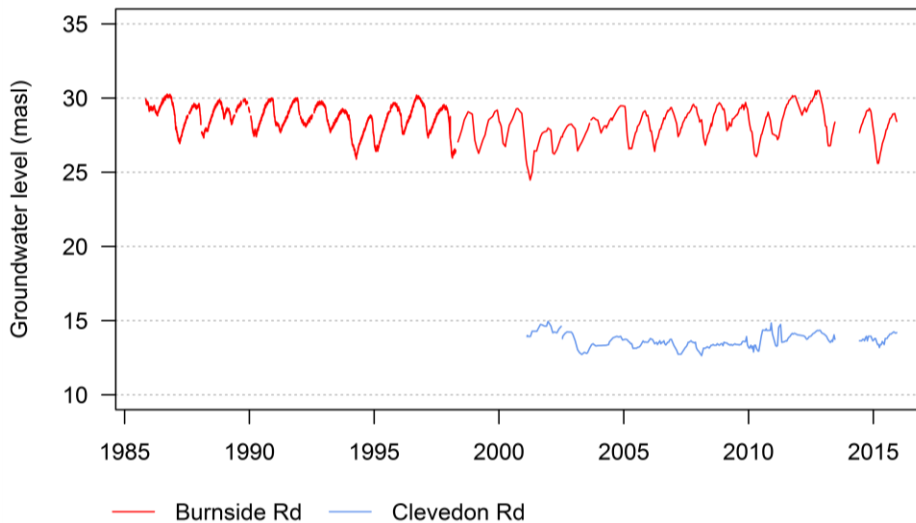
### Trends 2006-2015:



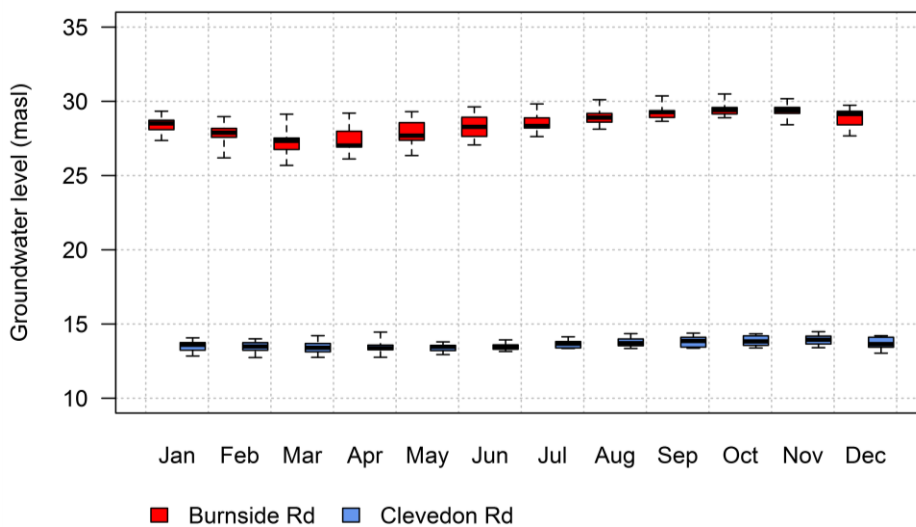
## Appendix D Water Level Central Aquifers

### 1. Clevedon East Waitematā Aquifer

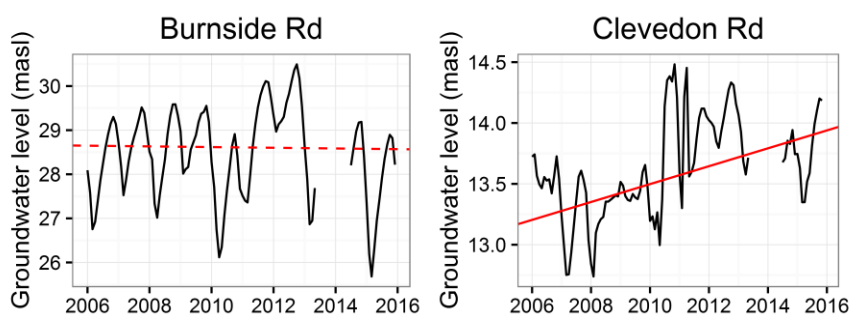
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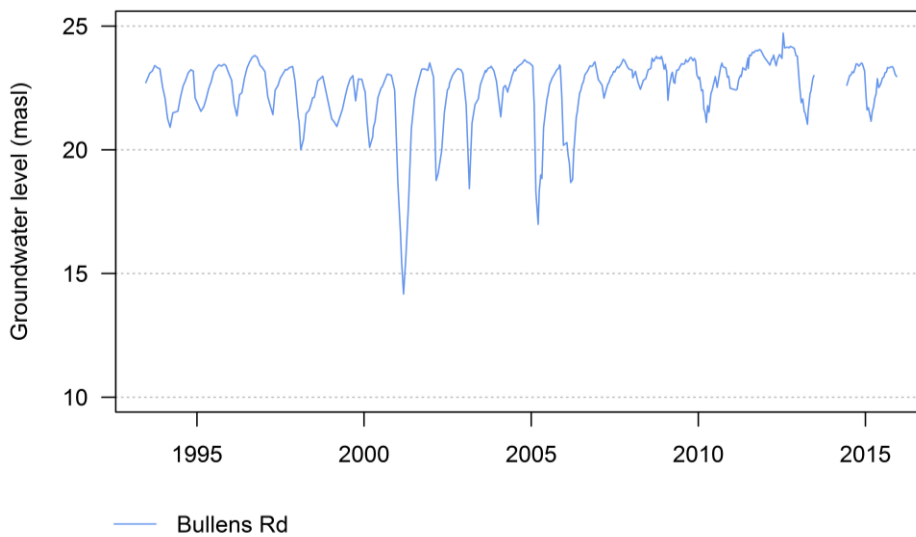


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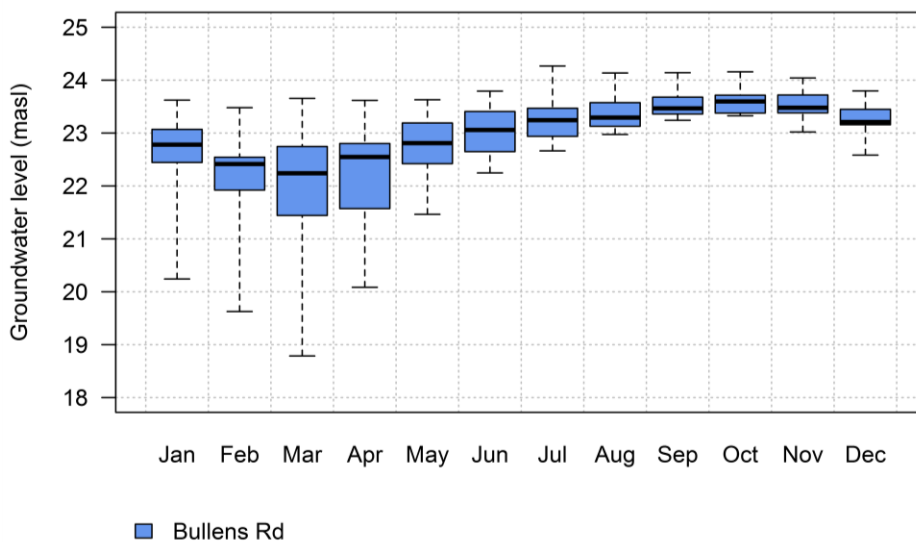


## 2. Clevedon West Waitematā Aquifer

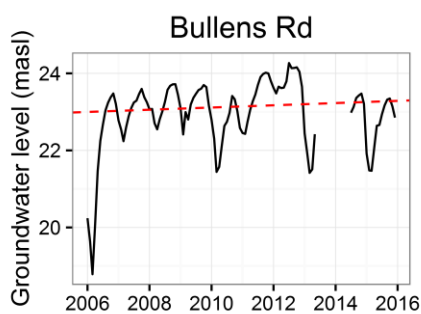
### Time series of full data set:



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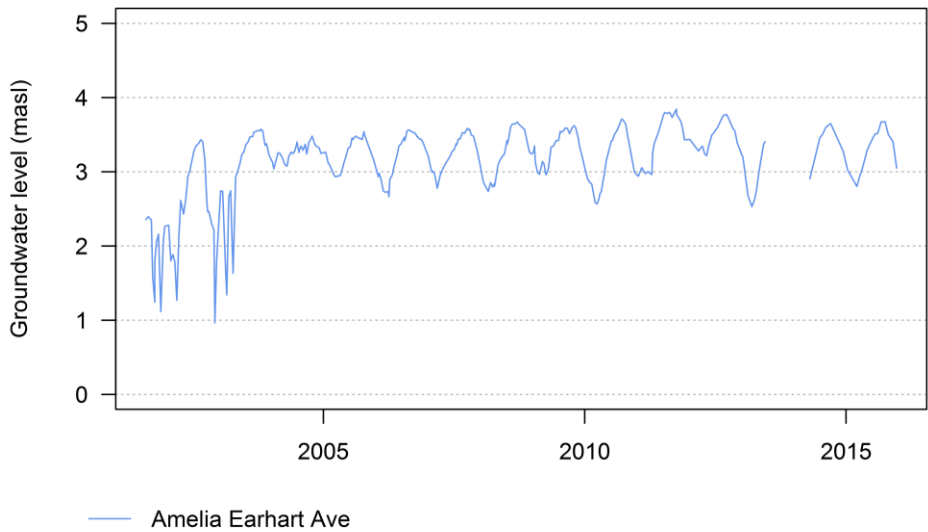


### Trends 2006-2015:

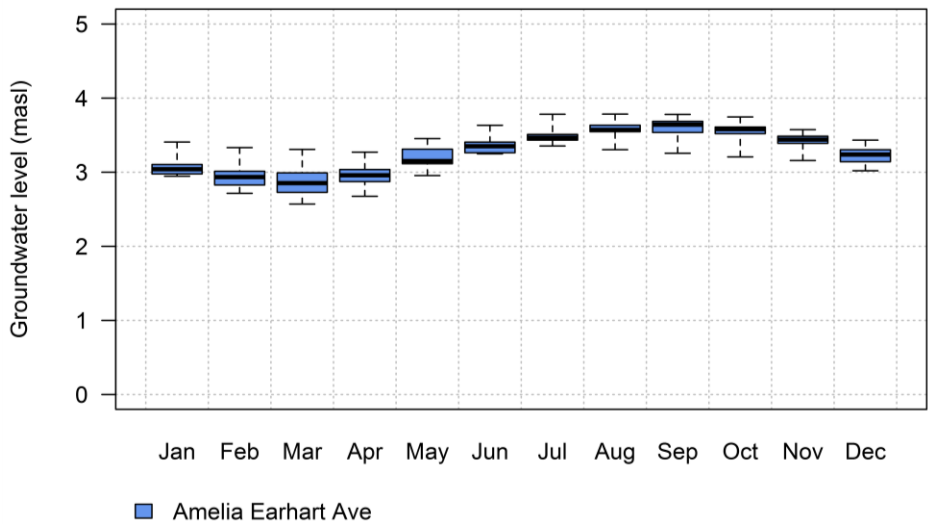


### 3. Manukau Kaawa Aquifer

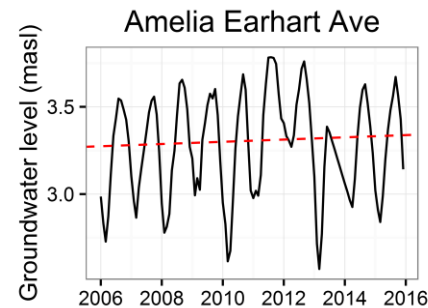
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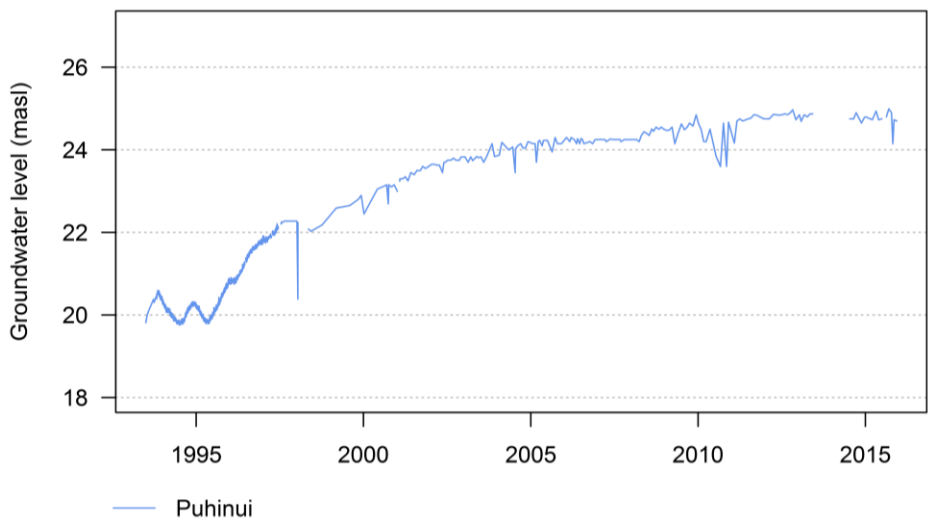


Trends 2006-2015:

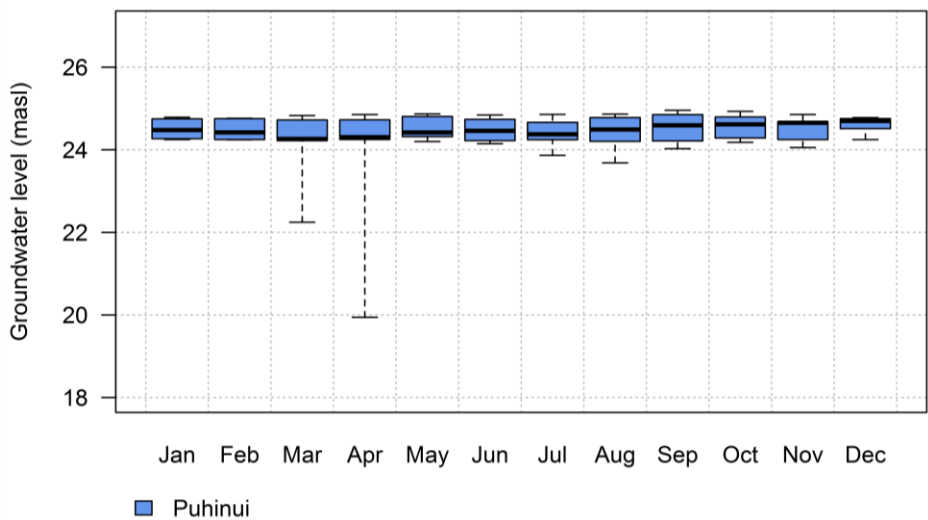


# 4. Manukau Waitematā Aquifer

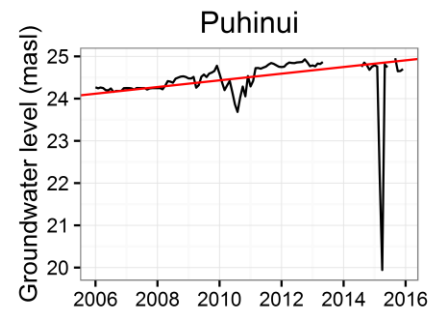
Time series of full data set:



Monthly variations 2006-2015:

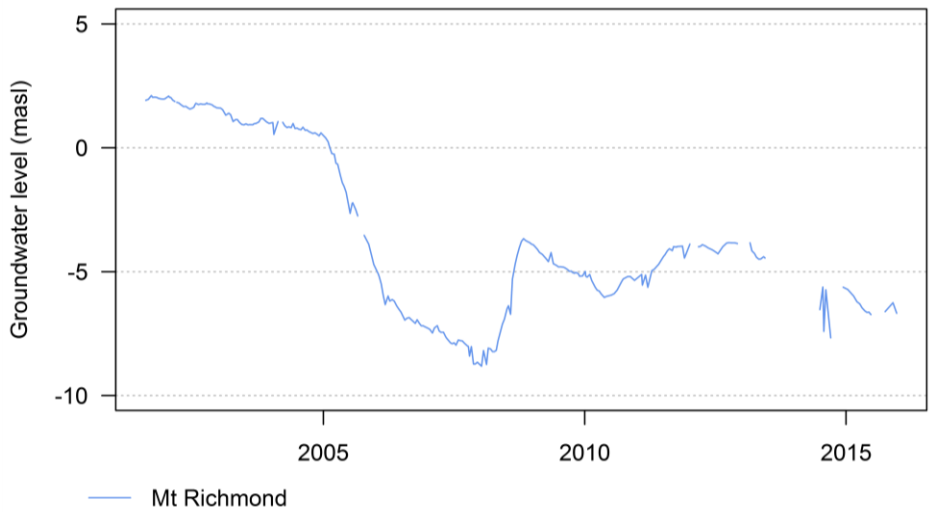


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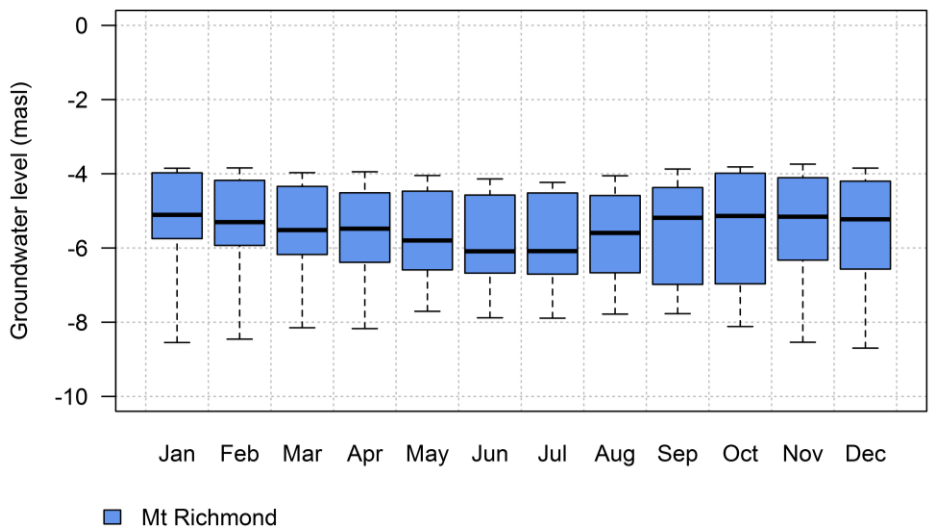


# 5. Mt Richmond Volcanic Aquifer

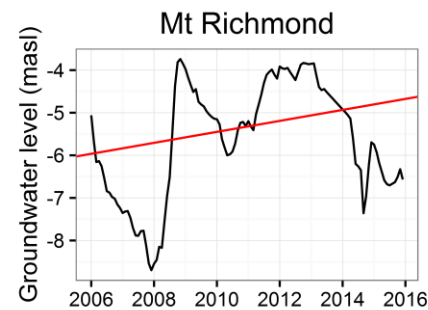
## Time series of full data set:



## Monthly variations 2006-2015:

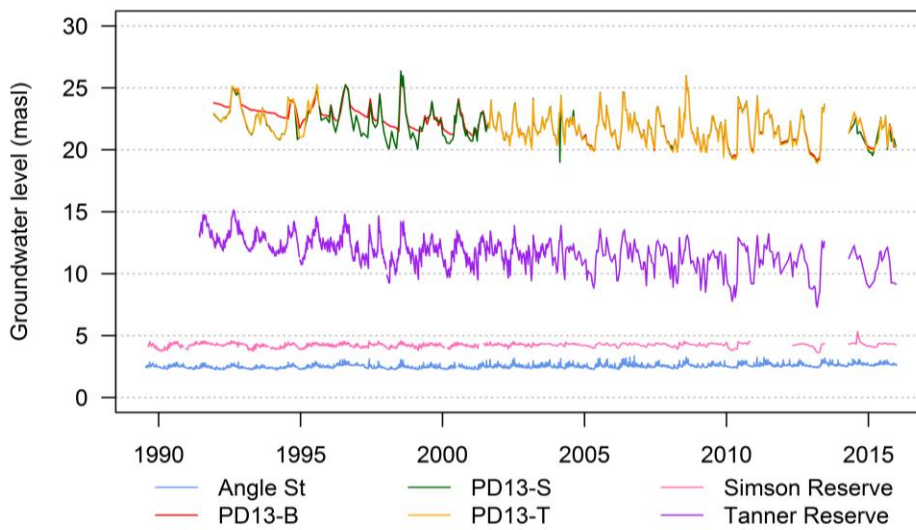


## Trends 2006-2015:

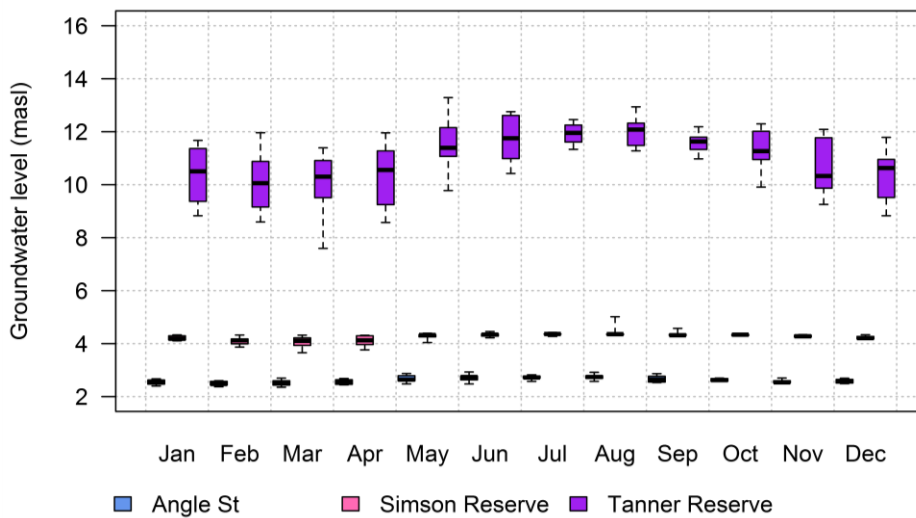
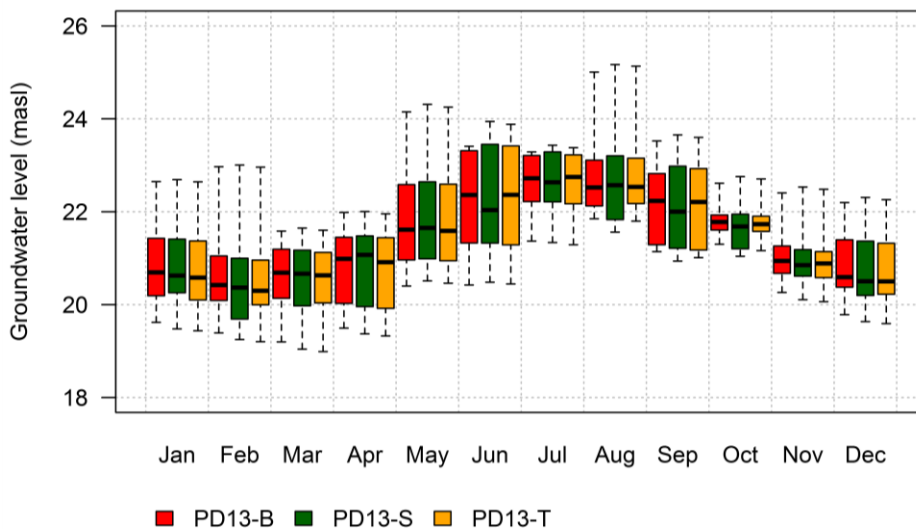


## 6. Mt Wellington Volcanic Aquifer

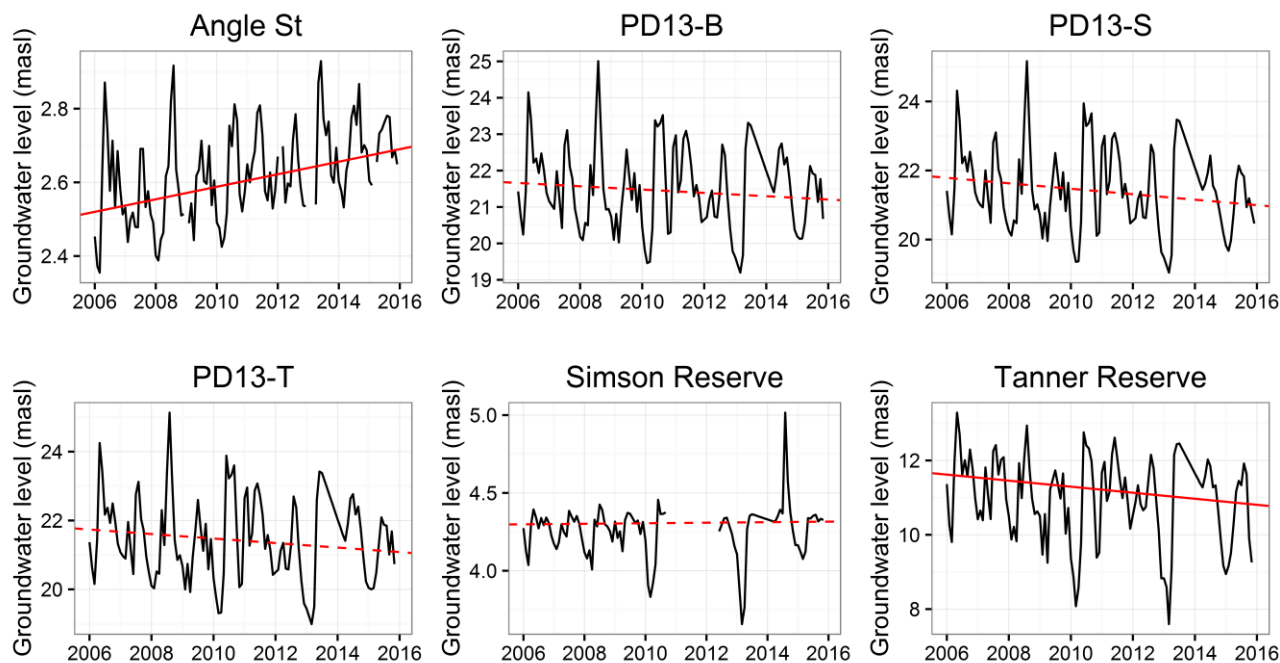
Time series of full data set:



Monthly variations 2006-2015:

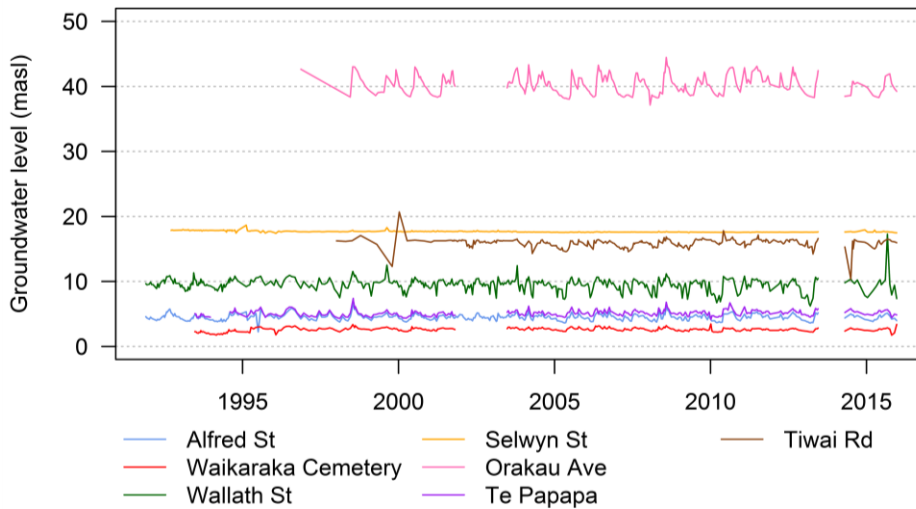


**Trends 2006-2015:**

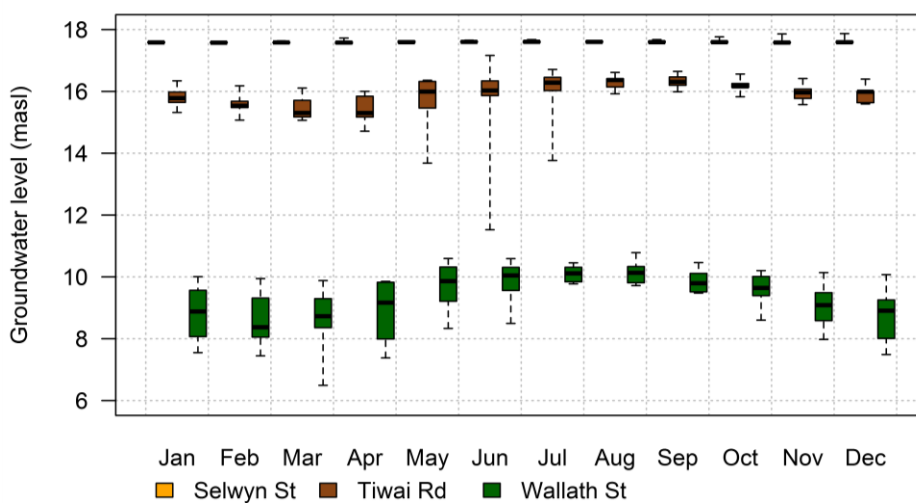
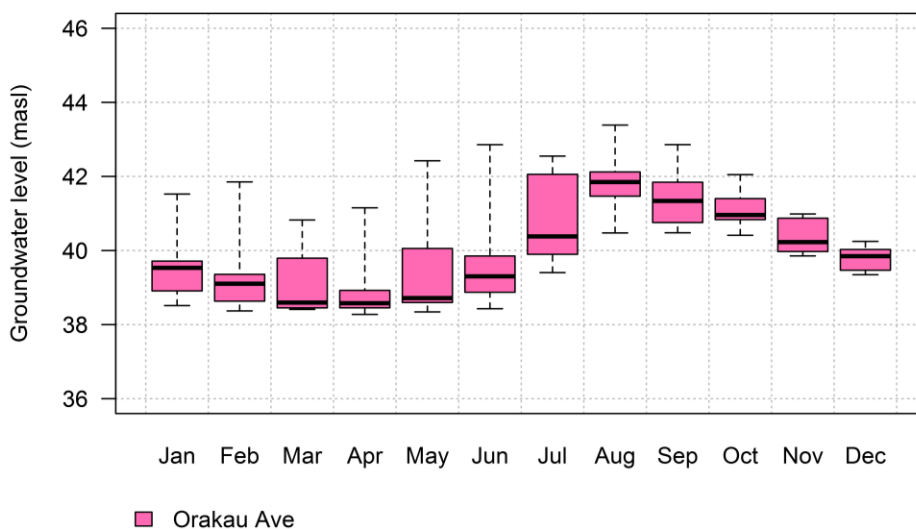


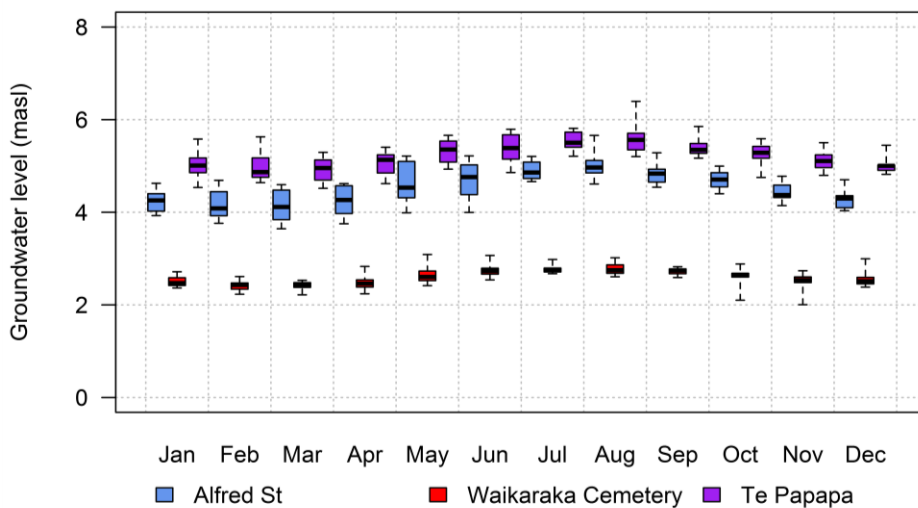
## 7. Onehunga Volcanic Aquifer

### Time series of full data set:

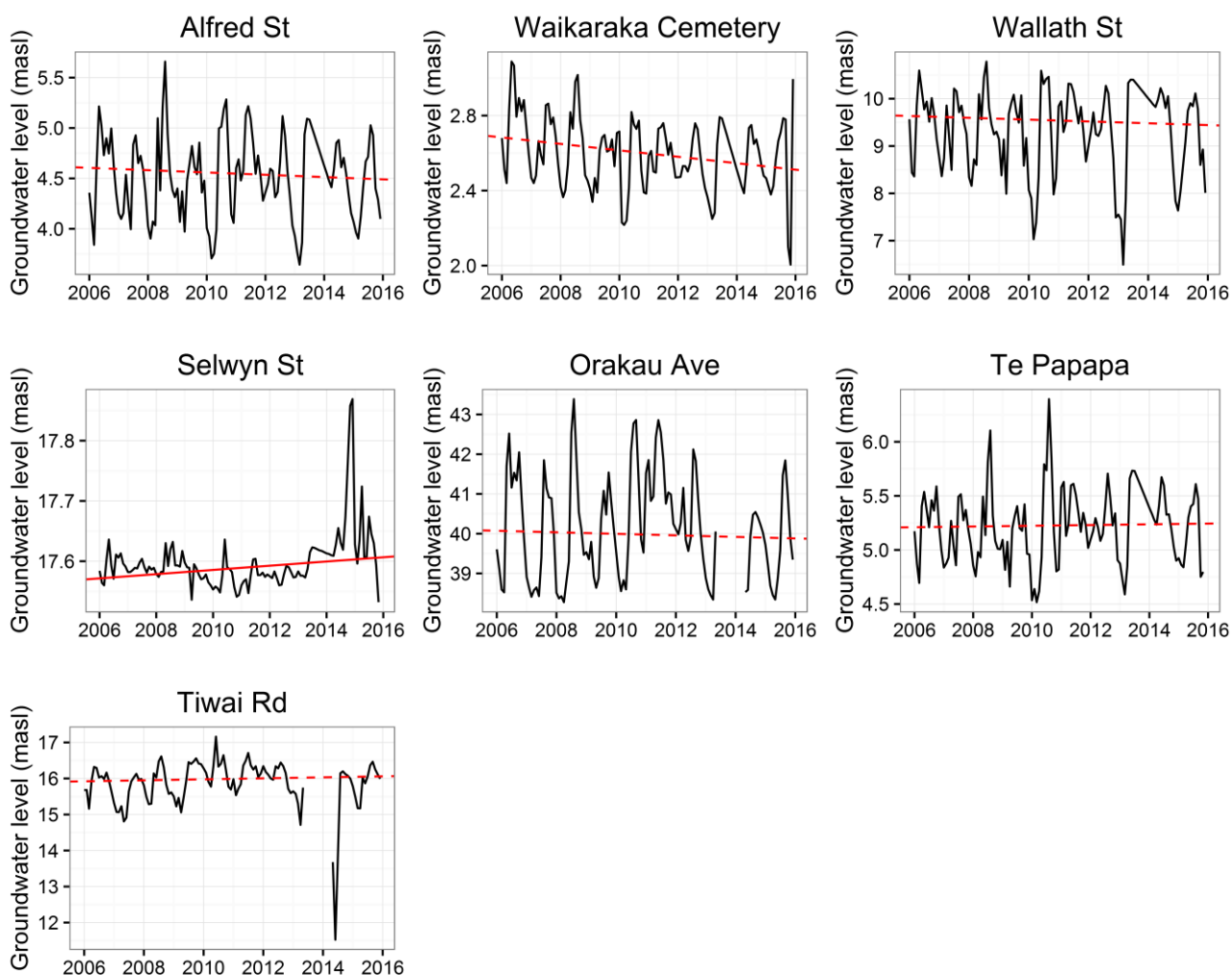


### Monthly variations 2006-2015:



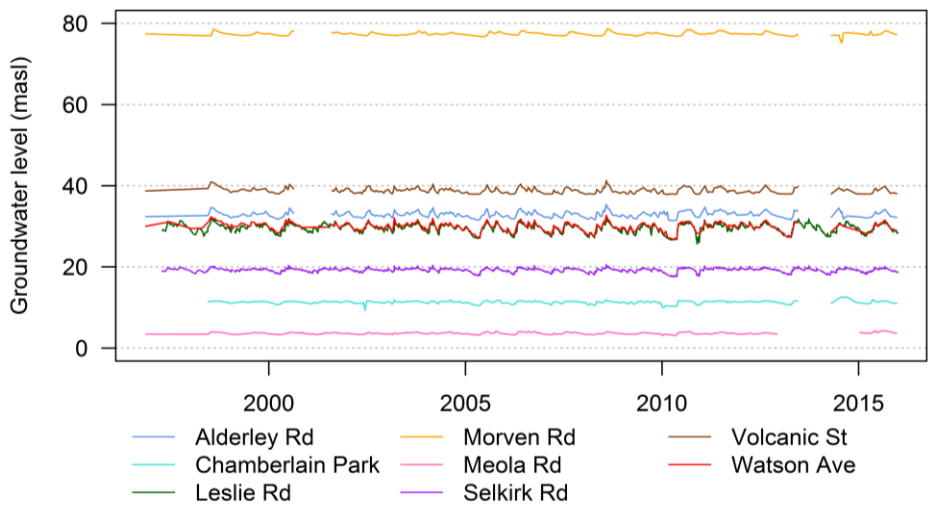


### Trends 2006-2015:

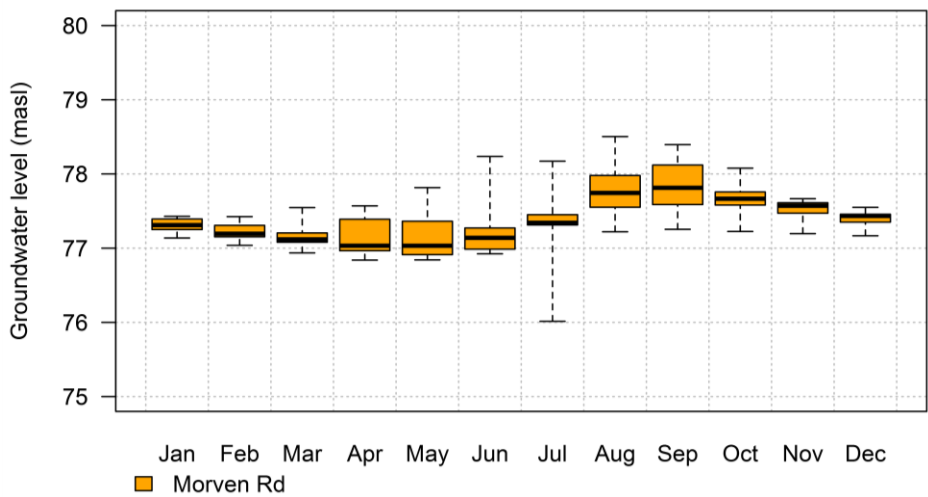


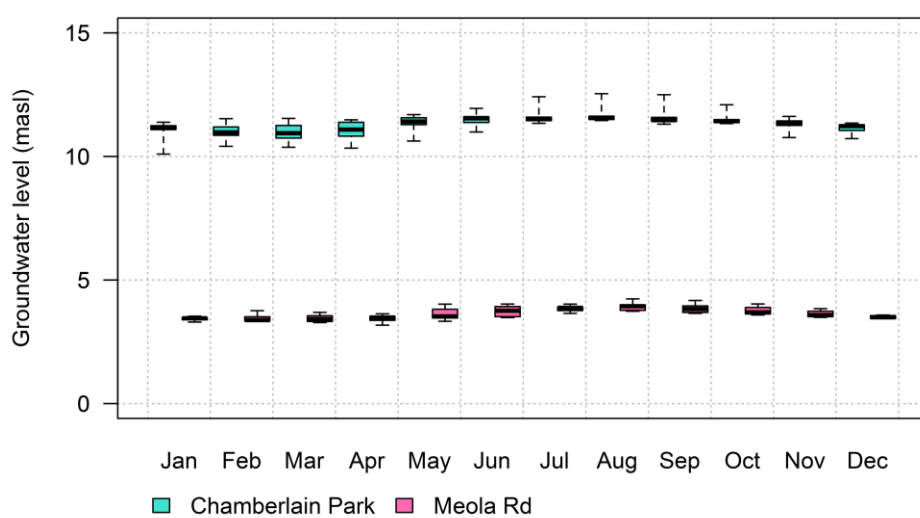
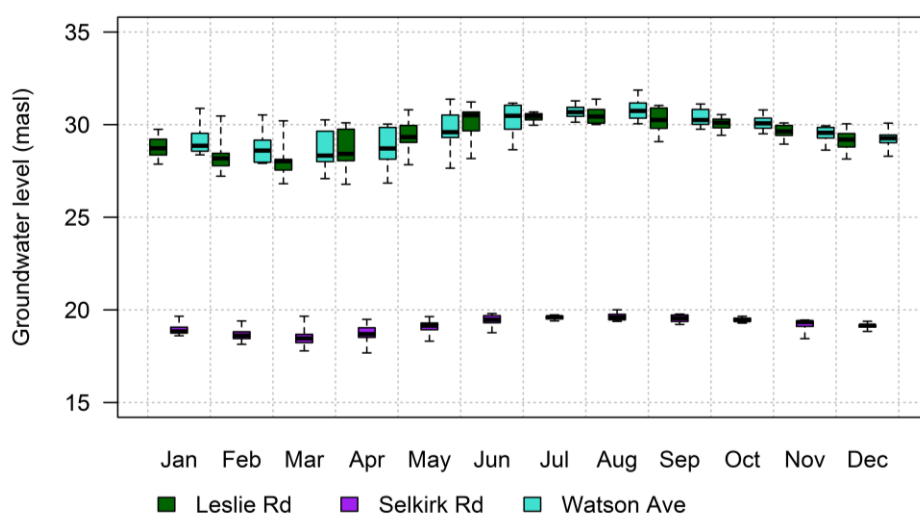
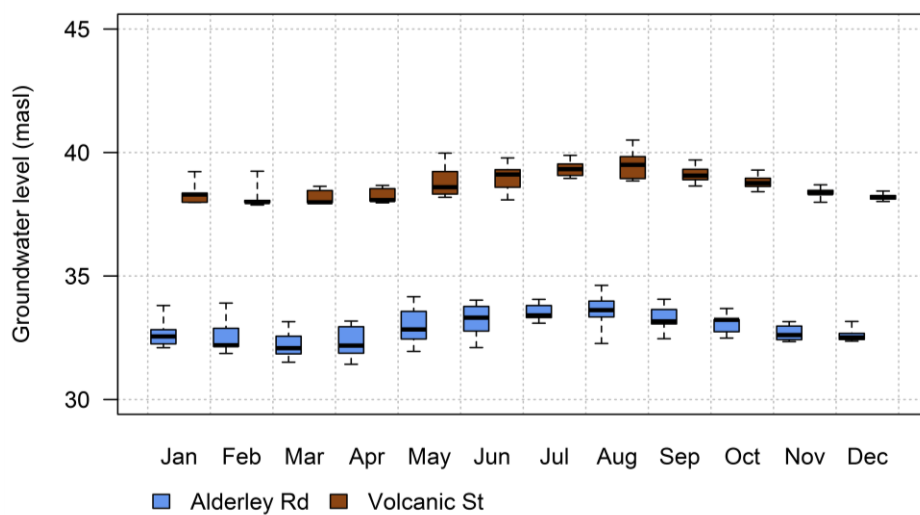
## 8. Western Springs Volcanic Aquifer

### Time series of full data set:

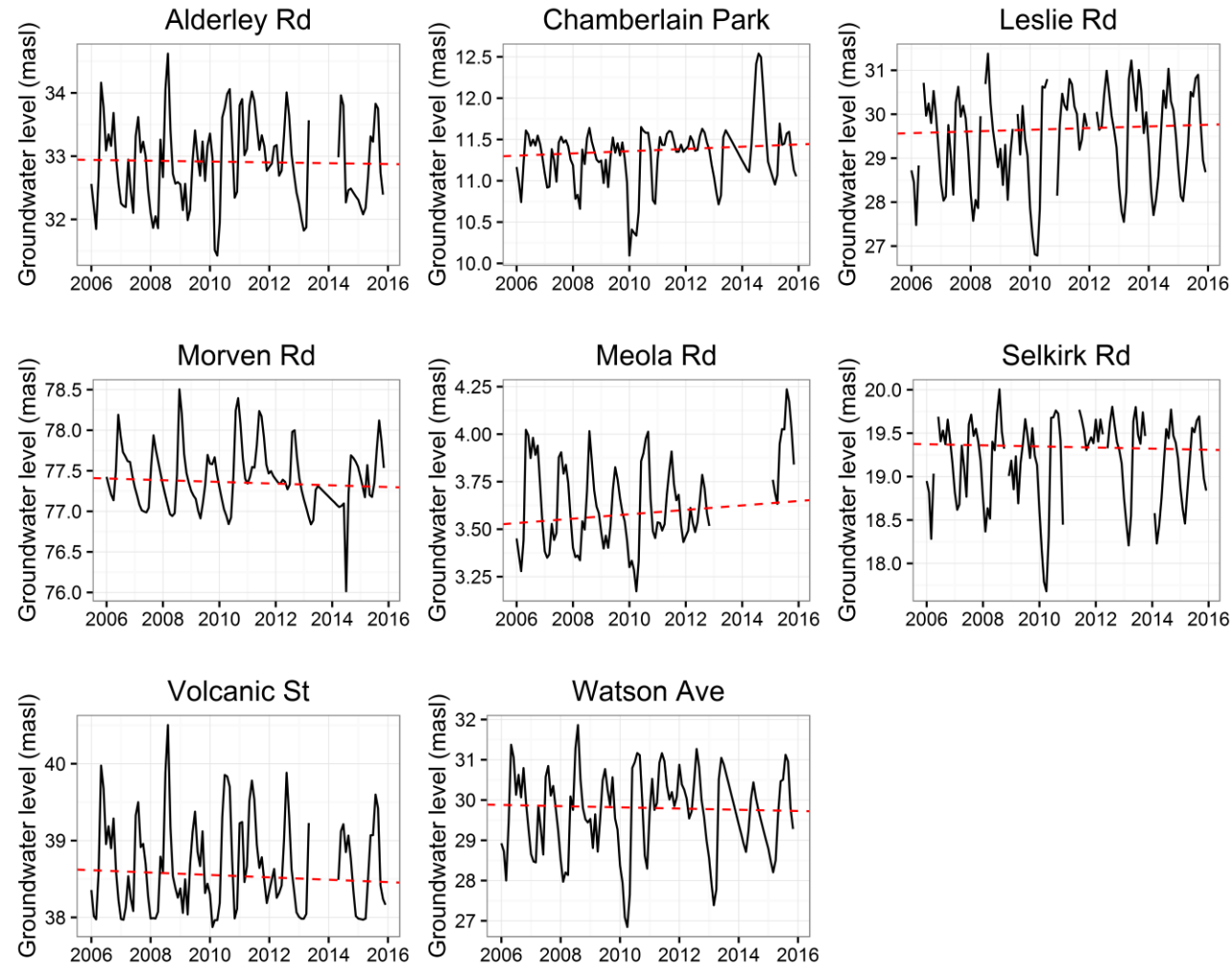


### Monthly variations 2006-2015:





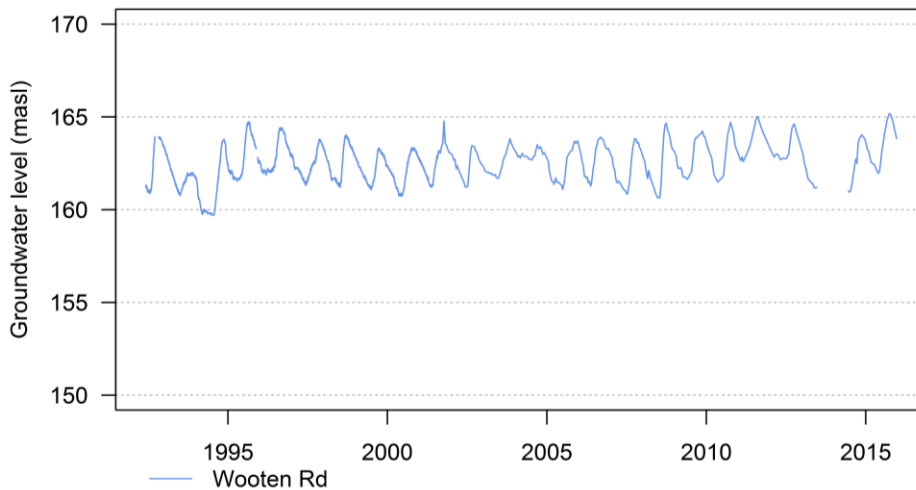
**Trends 2006-2015:**



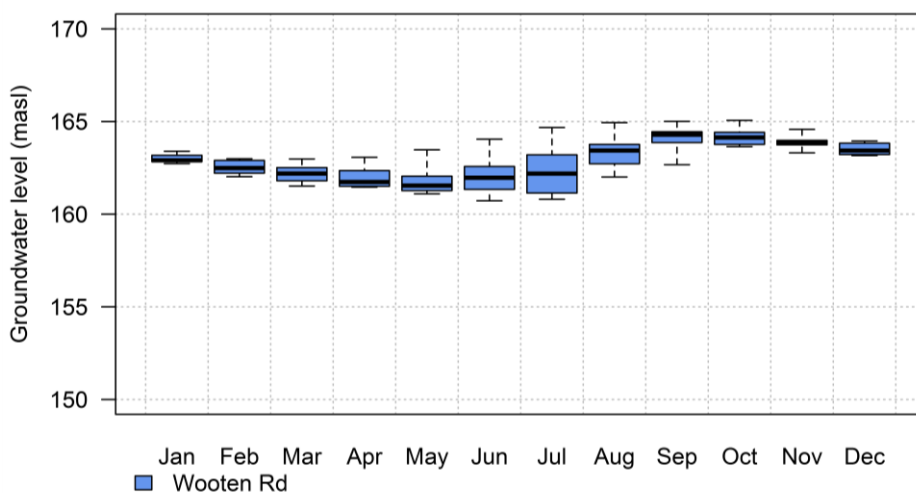
## Appendix E Water Level South Aquifers

### 1. Bombay Volcanic Aquifer

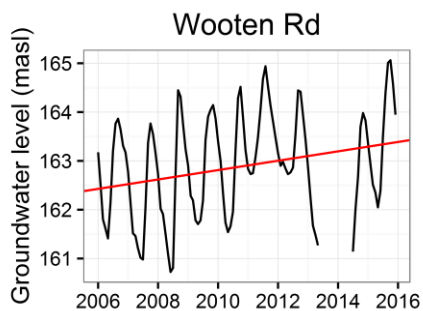
Time series of full data set:



Monthly variations 2006-2015:

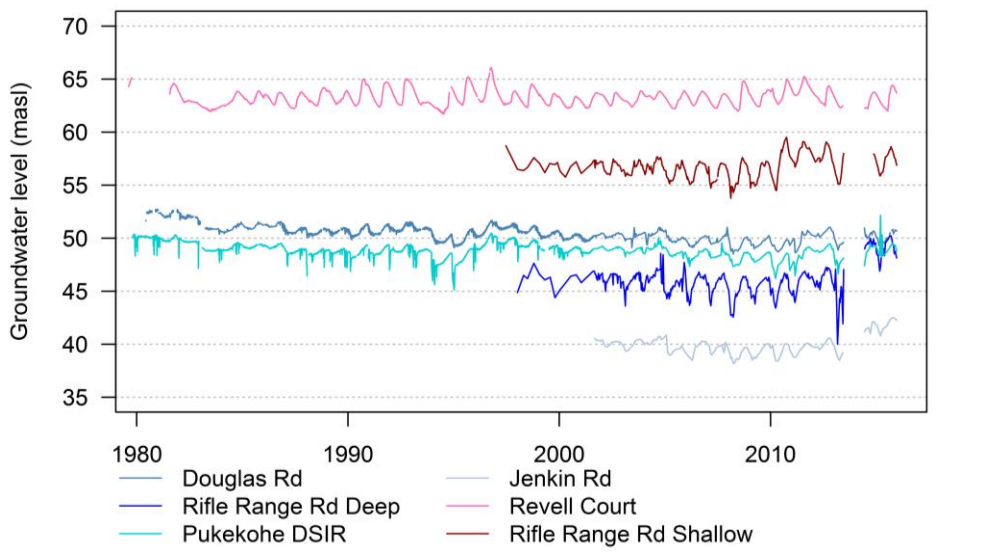


Trends 2006-2015:



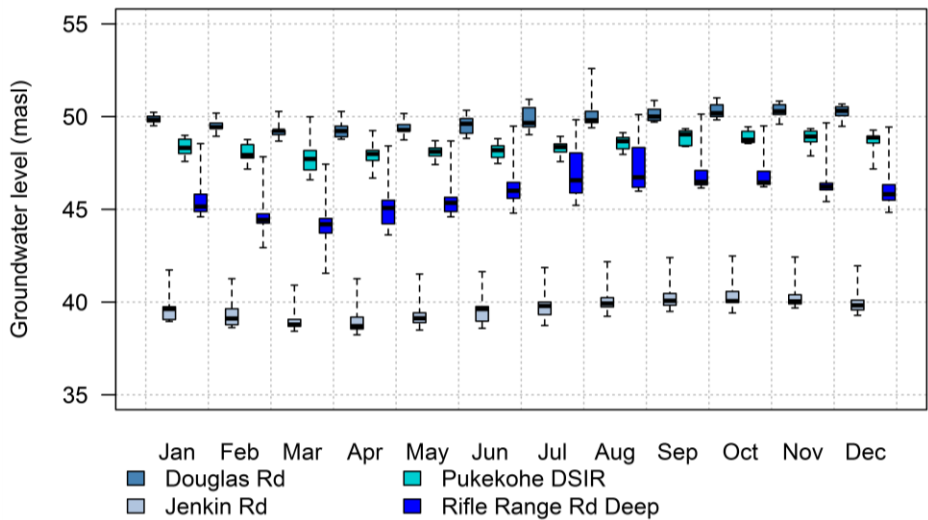
# 2. Pukekohe Central Volcanic Aquifer

Time series of full data set:

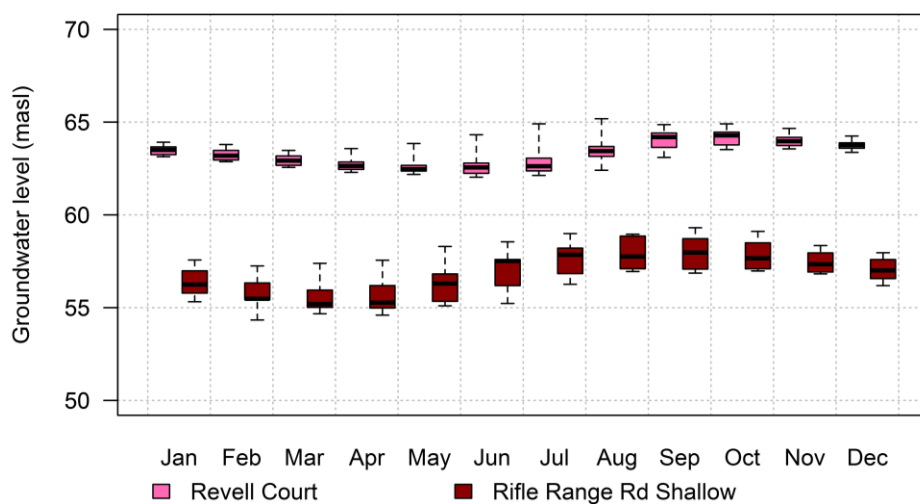


Monthly variations 2006-2015:

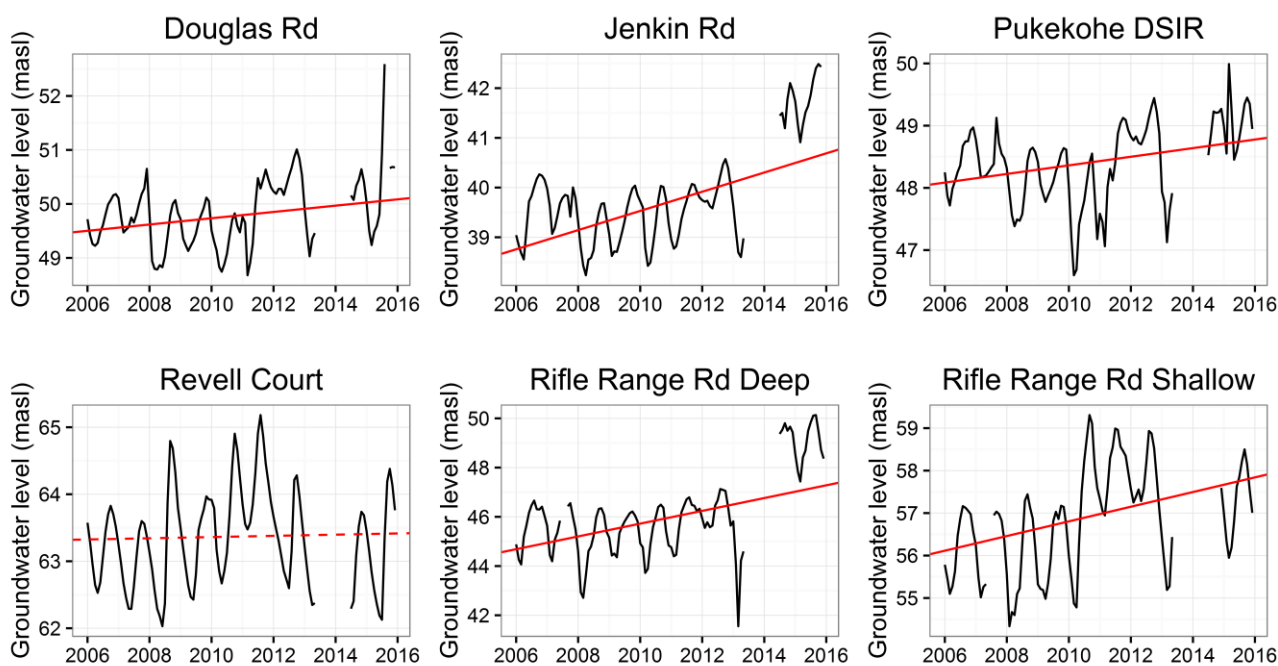
Deep Volcanic Aquifer



## Shallow Volcanic Aquifer

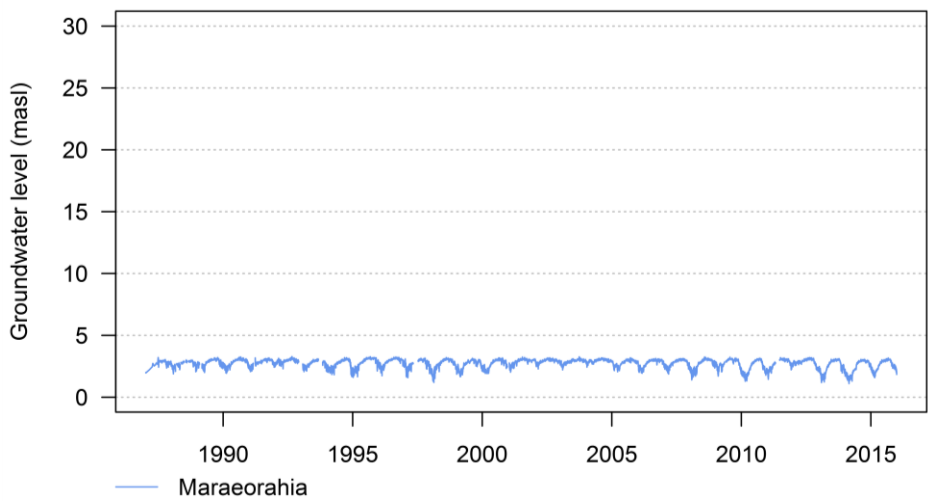


## Trends 2006-2015:

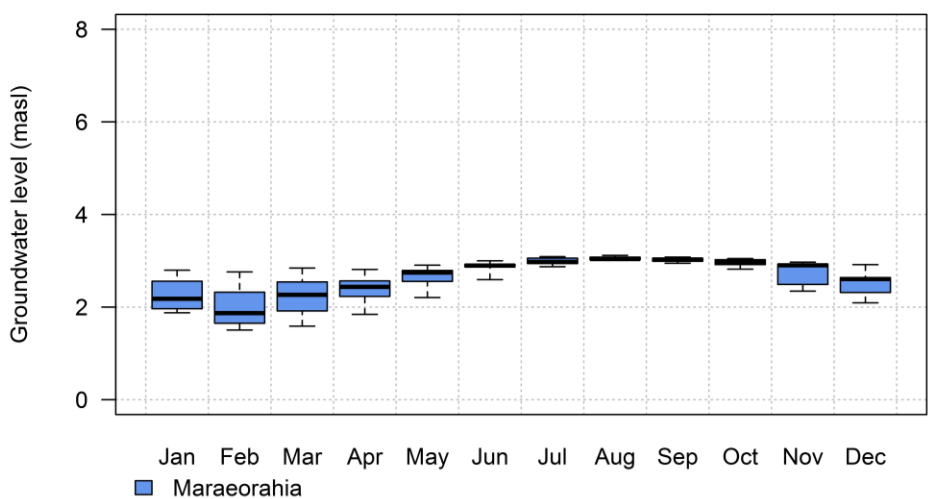


### 3. Awhitu Kaawa Aquifer

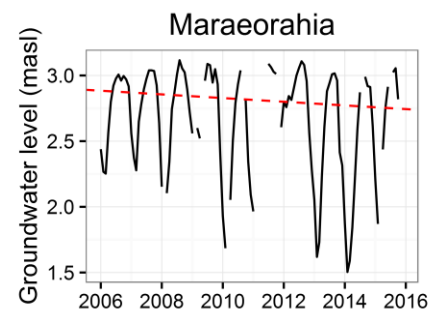
#### Time series of full data set:



#### Monthly variations 2006-2015:

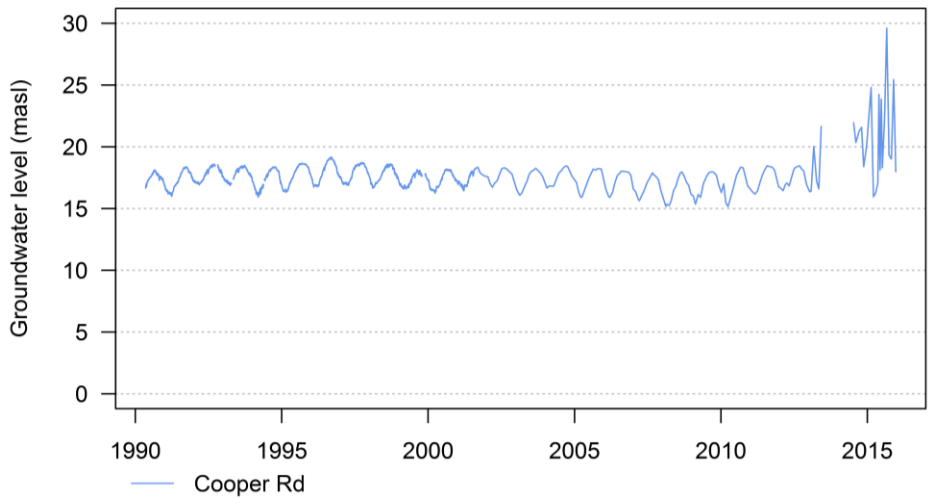


#### Trends 2006-2015:

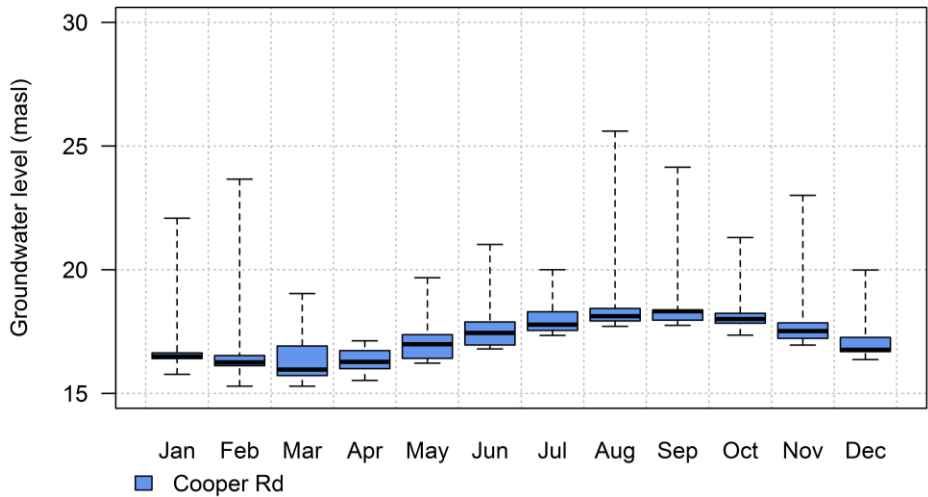


# 4. Bombay-Drury Kaawa Aquifer

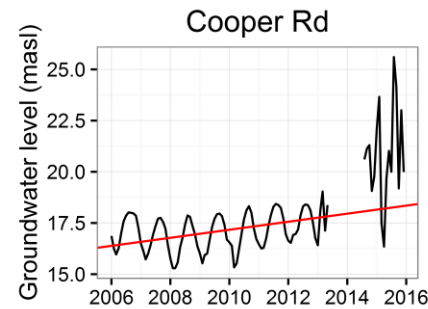
## Time series of full data set:



## Monthly variations 2006-2015:

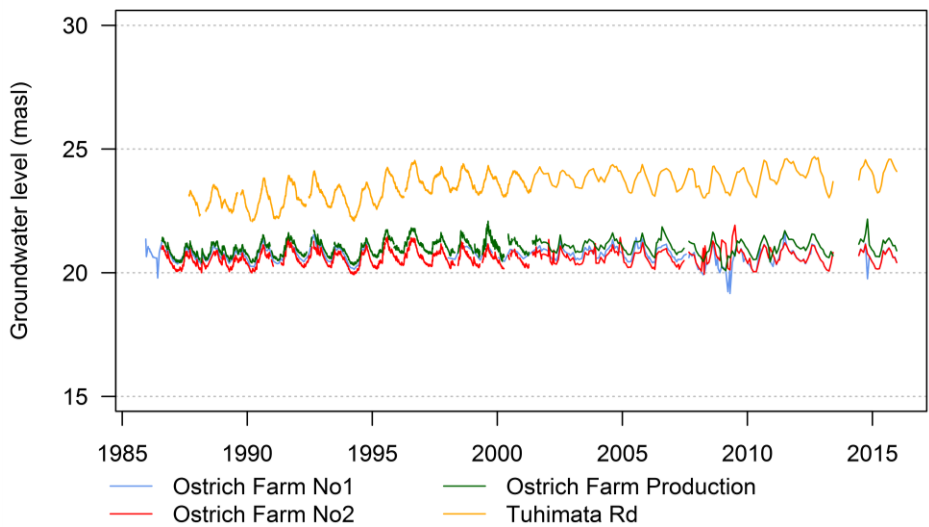


## Trends 2006-2015:

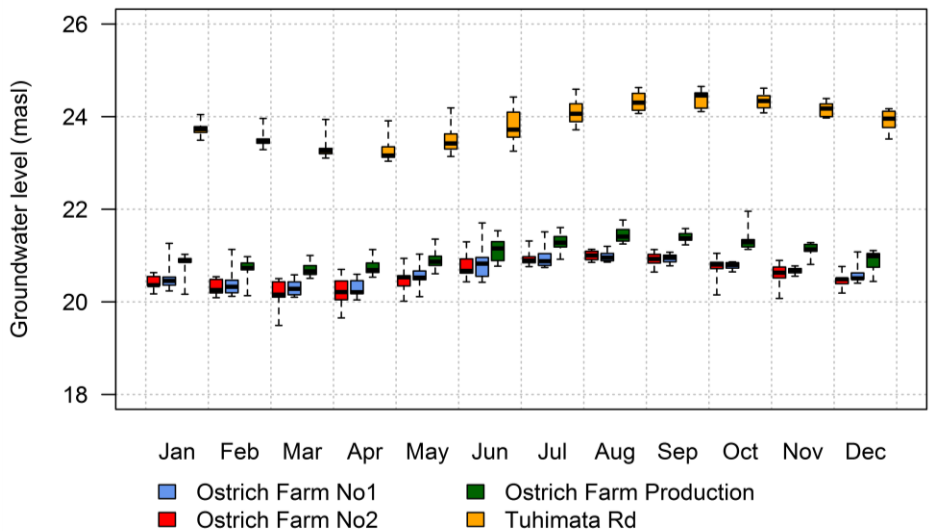


# 5. Pukekohe Kaawa Aquifer

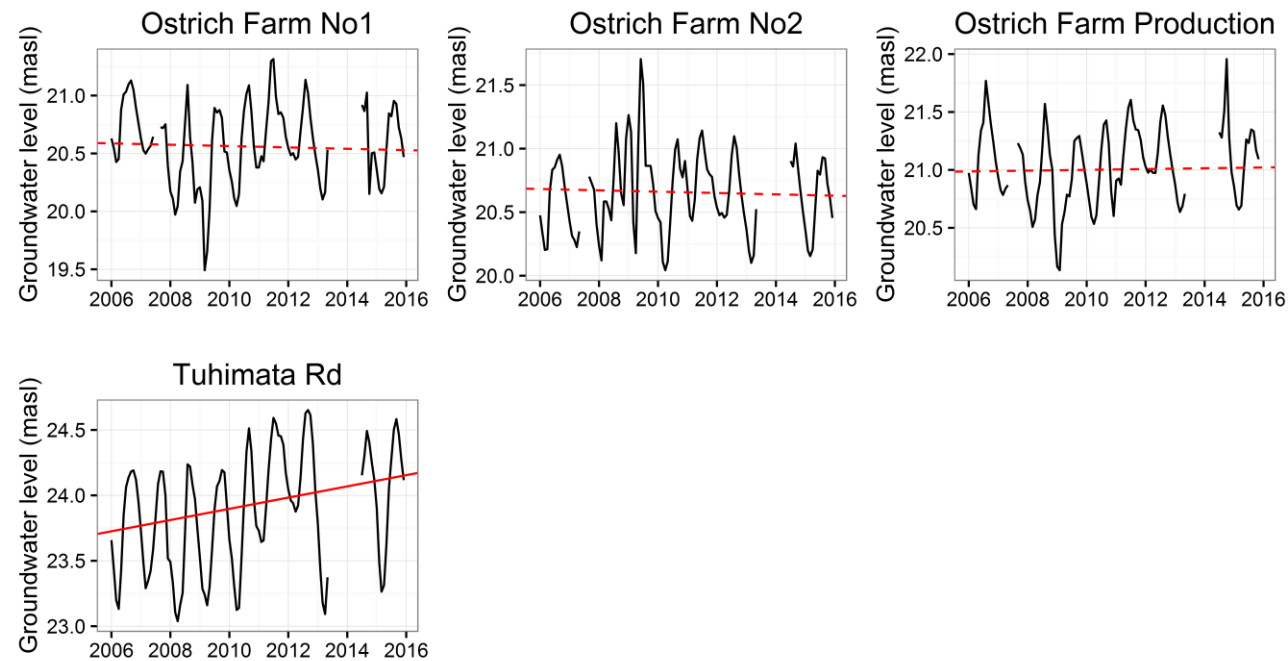
Time series of full data set:



Monthly variations 2006-2015:

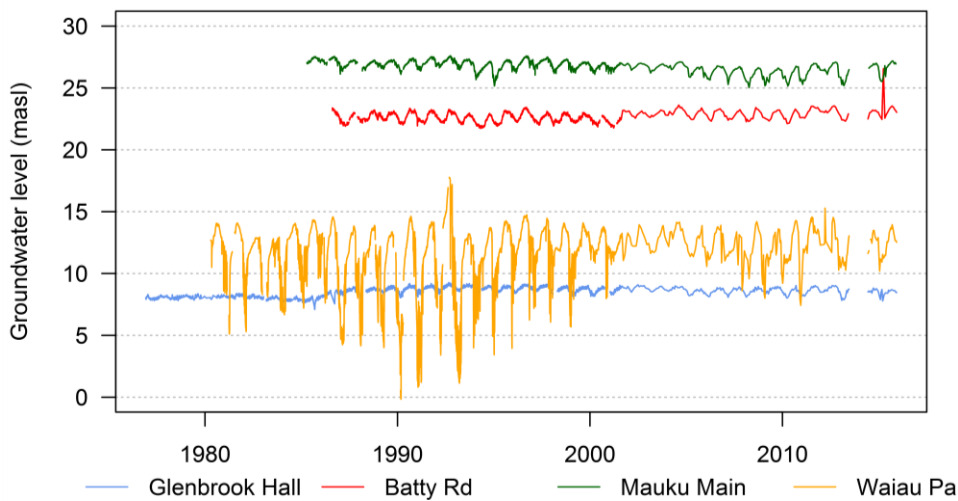


**Trends 2006-2015:**

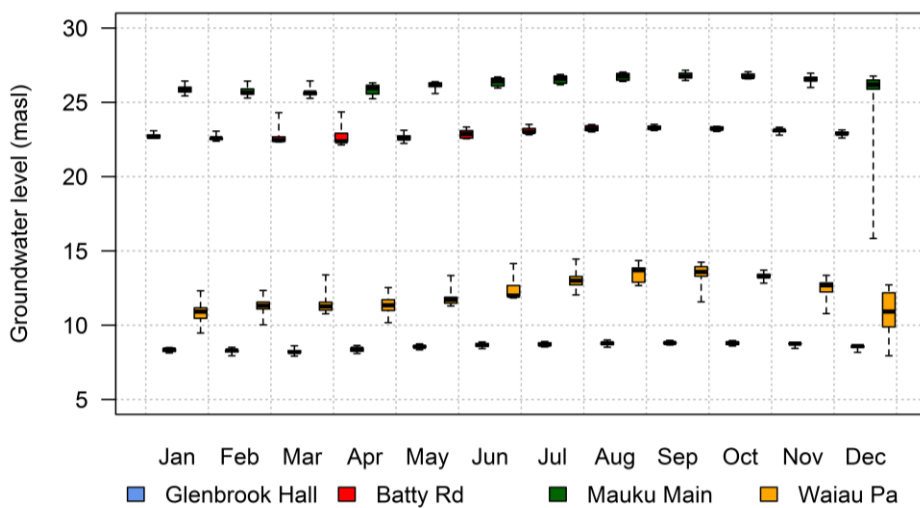


# 6. Glenbrook Kaawa Aquifer

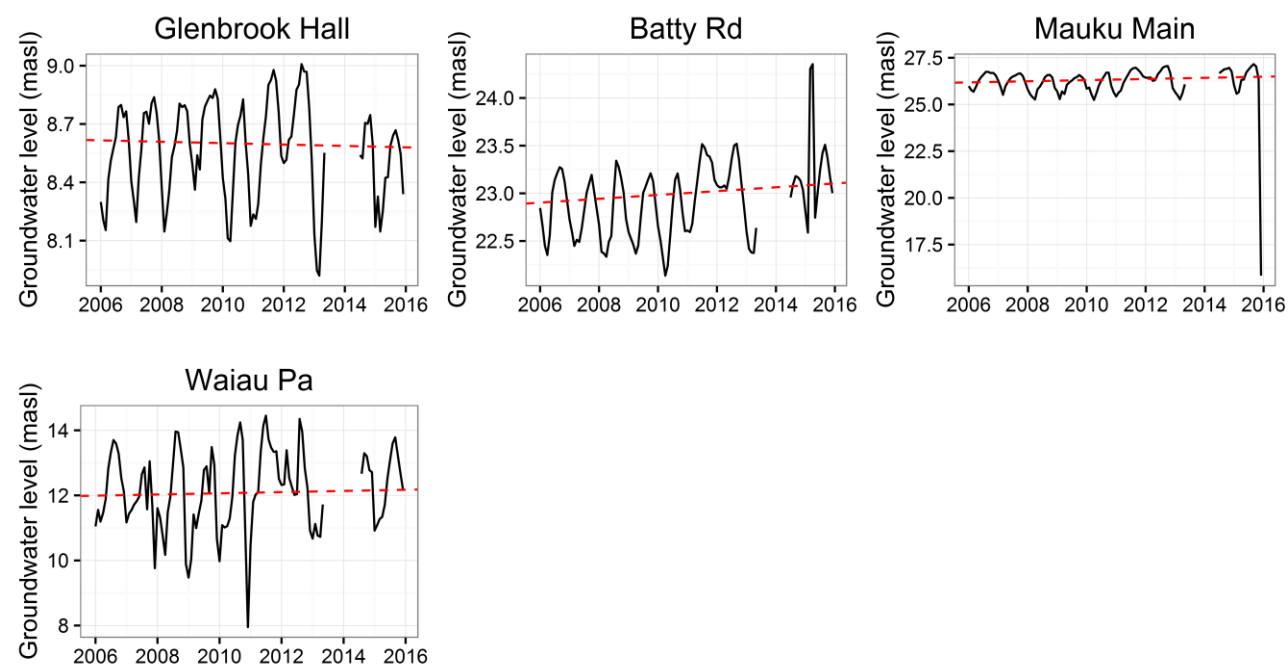
Time series of full data set:



Monthly variations 2006-2015:

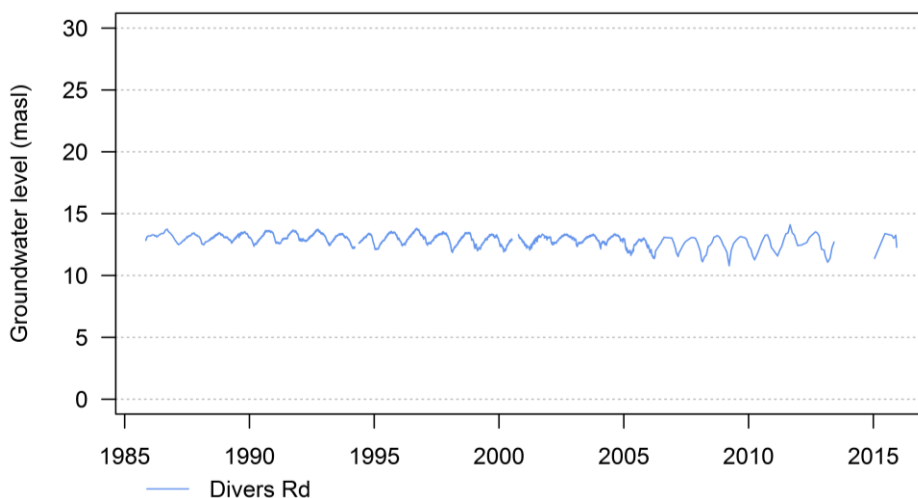


**Trends 2006-2015:**

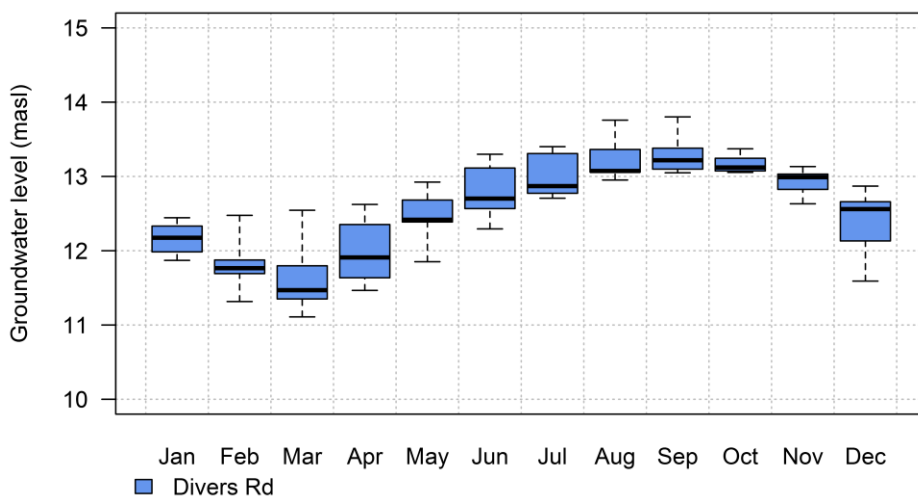


## 7. Waiuku Kaawa Aquifer

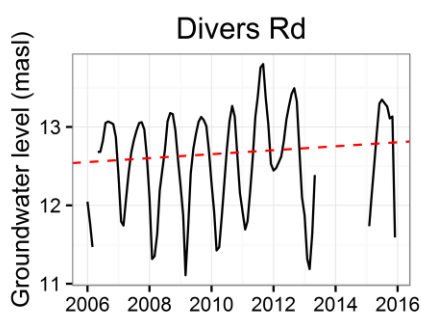
### Time series of full data set:



### Monthly variations 2006-2015:

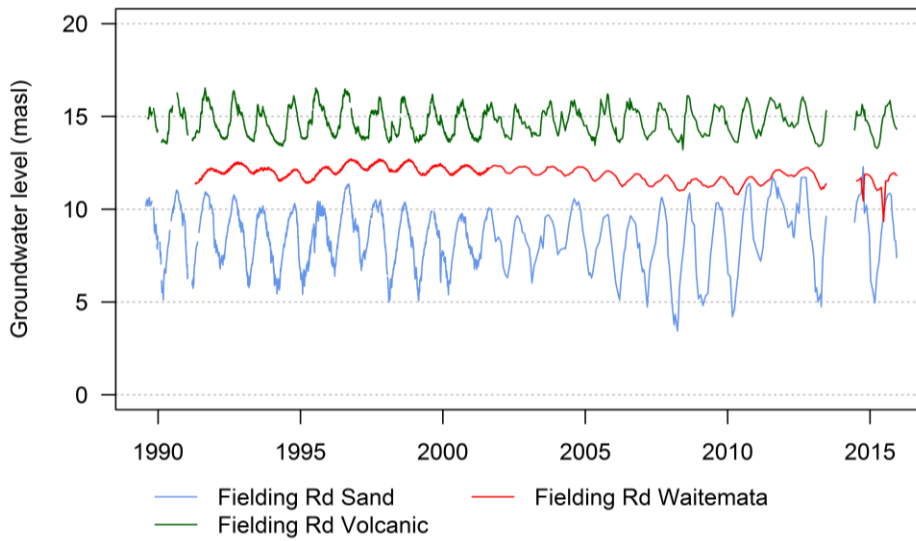


### Trends 2006-2015:

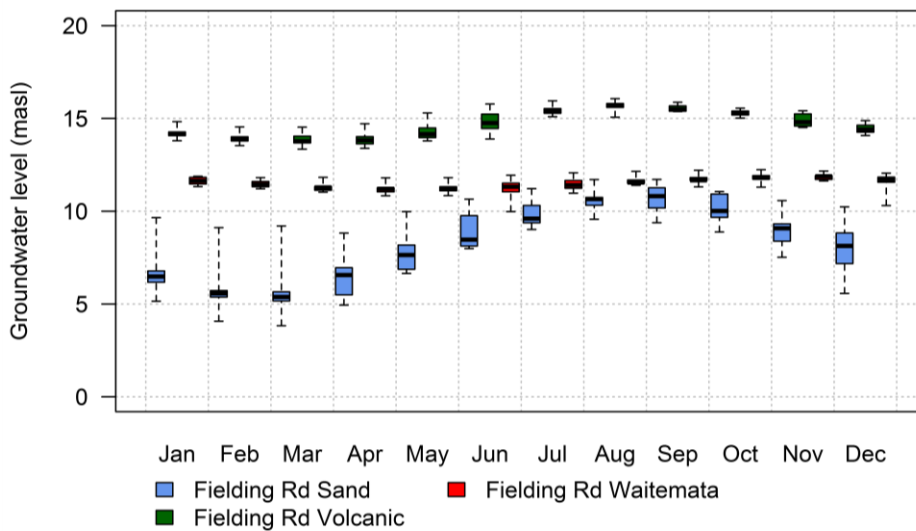


## 8. Drury Sand, Volcanic and Waitematā Aquifers

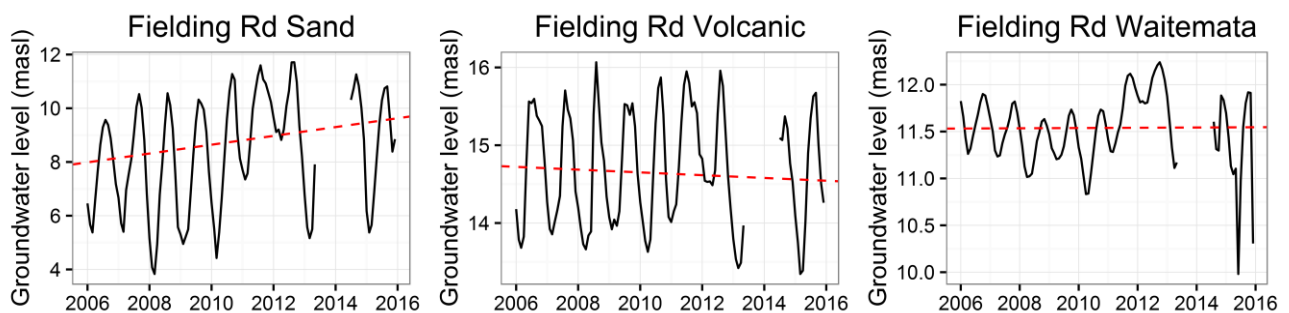
Time series of full data set:



Monthly variations 2006-2015:

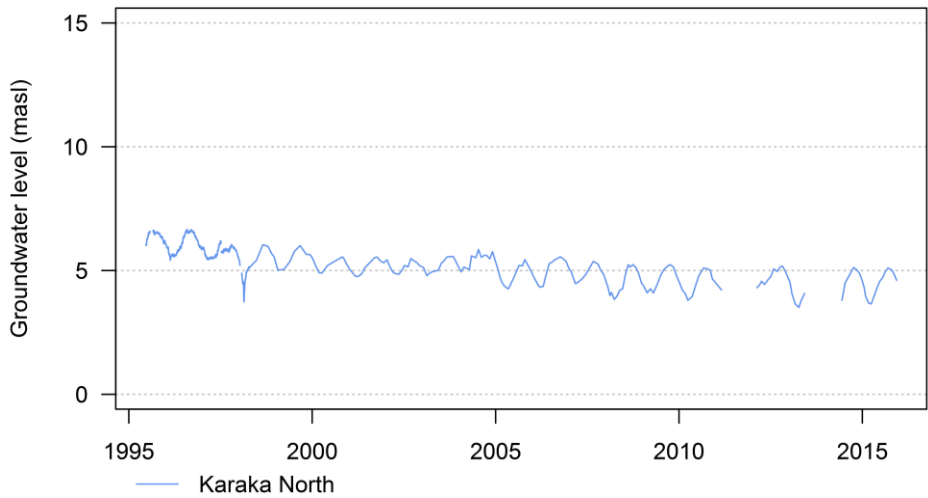


Trends 2006-2015:

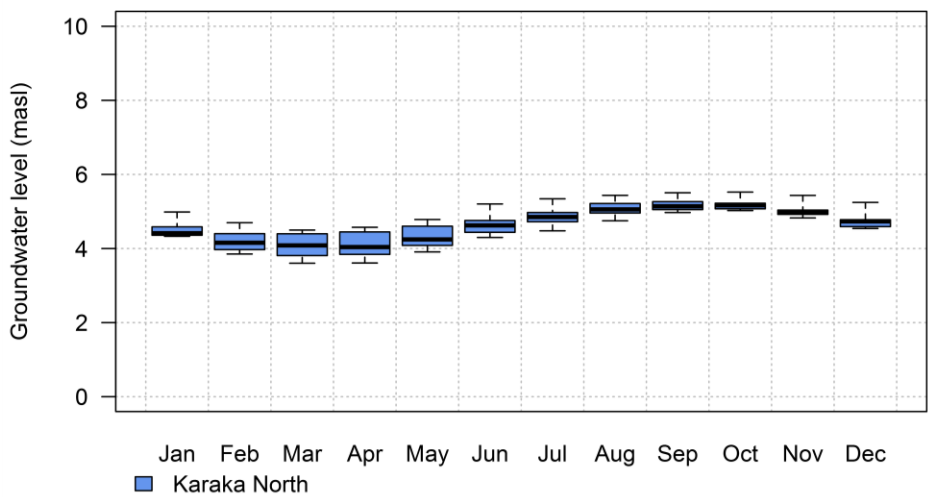


# 9. Karaka Waitematā Aquifer

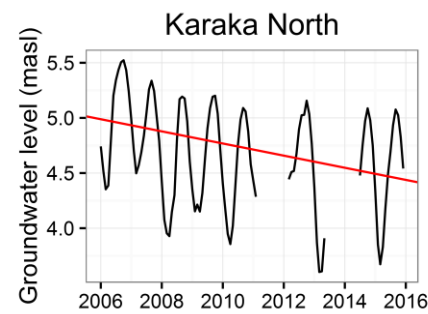
Time series of full data set:



Monthly variations 2006-2015:

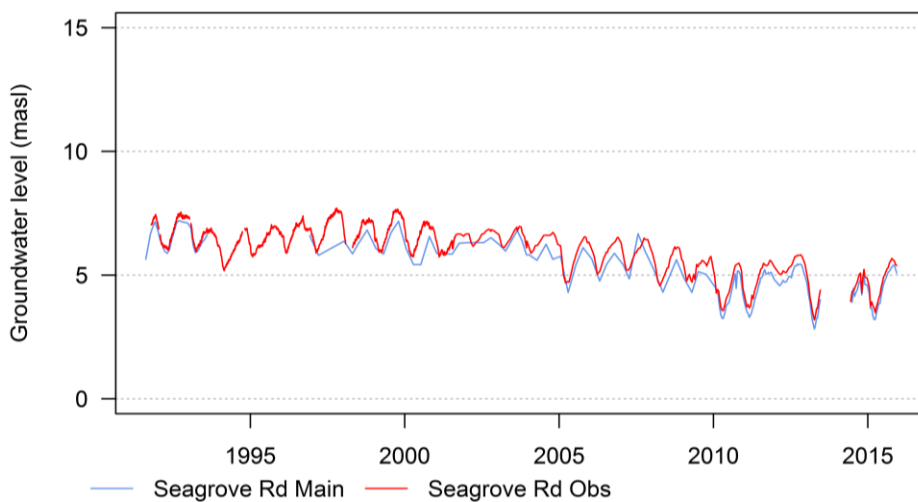


Trends 2006-2015:

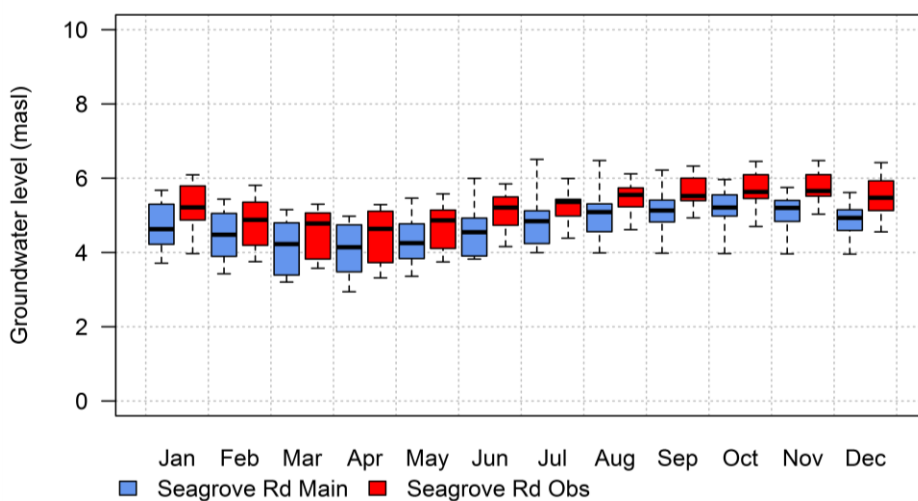


## 10. Waiau Pa Waitematā Aquifer

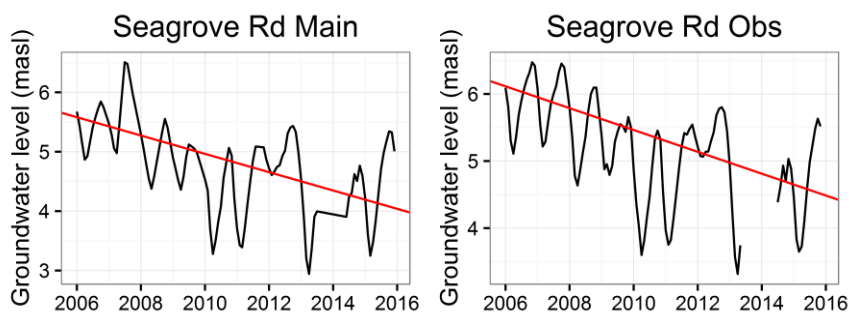
Time series of full data set:



Monthly variations 2006-2015:



Trends 2006-2015:



# Appendix F    Water quality summary tables

Table F-1: Summary table showing minimum (Min), 5<sup>th</sup> percentile, 25<sup>th</sup> percentile, median, 75<sup>th</sup> percentile, 95<sup>th</sup> percentile, maximum (Max), median absolute deviation (MAD), and trend magnitude by Sen’s estimator (units/year). Trends in **bold** are statistically significant (p<0.05). Tables are sorted by analyte, area and site name.

|                                    |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend (units/y) |
|------------------------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|--------|--------|-----------------|
| Ammoniacal N (mg/L)                | NE      | Chenery/Whangaparaoa   | 0.098 | 0.203  | 0.255  | 0.288  | 0.35   | 0.39   | 0.41   | 0.048  | -0.0063         |
|                                    |         | Quintals Rd            | 0.005 | 0.0232 | 0.03   | 0.0305 | 0.04   | 0.0433 | 0.05   | 0.0055 | 0               |
|                                    |         | Waiwera Enterpr.       | 1.1   | 1.145  | 1.2263 | 1.275  | 1.3    | 1.3075 | 1.33   | 0.025  | -0.0093         |
|                                    | NW      | Parakai Aquatic Park   | 1.2   | 1.29   | 1.385  | 1.4    | 1.505  | 1.6    | 1.6    | 0.1    | -0.0006         |
|                                    |         | Rimmer Rd              | 0.03  | 0.03   | 0.038  | 0.04   | 0.0435 | 0.057  | 0.06   | 0.002  | 0               |
|                                    |         | Waitakere Rd           | 0.09  | 0.1    | 0.11   | 0.12   | 0.13   | 0.15   | 0.16   | 0.01   | -0.0003         |
|                                    |         | Waitakere Rd No2       | 0.239 | 0.2435 | 0.26   | 0.27   | 0.28   | 0.3065 | 0.31   | 0.01   | 0               |
|                                    | Central | Amelia Earhart Ave     | 0.57  | 0.6153 | 0.6825 | 0.735  | 0.7875 | 0.83   | 0.91   | 0.055  | -0.0101         |
|                                    |         | Bullens Rd             | 0.29  | 0.318  | 0.44   | 0.5    | 0.565  | 0.647  | 0.72   | 0.07   | -0.0133         |
|                                    |         | Burnside Rd            | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Central Park           | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Central Park New       | 0.005 | 0.005  | 0.005  | 0.005  | 0.005  | 0.0053 | 0.0055 | 0      | 0               |
|                                    |         | Mt Richmond            | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Puhinui                | 0.17  | 0.17   | 0.19   | 0.196  | 0.21   | 0.22   | 0.24   | 0.014  | 0               |
|                                    |         | Tiwai Rd               | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Watson Ave             | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    | South   | BP Bombay              | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Fielding Rd Sand       | 0.5   | 0.5124 | 0.605  | 0.65   | 0.69   | 0.719  | 0.77   | 0.04   | -0.0133         |
|                                    |         | Fielding Rd Volcanic   | 0.01  | 0.03   | 0.04   | 0.05   | 0.06   | 0.08   | 0.09   | 0.01   | -0.002          |
|                                    |         | Gun Club Rd            | 0.005 | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                                    |         | Hickey spring          | 0.005 | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                                    |         | Hillview spring        | 0.005 | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                                    |         | Ostrich Farm No1       | 0.14  | 0.15   | 0.17   | 0.18   | 0.19   | 0.2015 | 0.21   | 0.01   | 0.00077         |
|                                    |         | Ostrich Farm No2       | 0.15  | 0.153  | 0.18   | 0.2    | 0.238  | 0.32   | 0.33   | 0.02   | -0.007          |
|                                    |         | Patumahoe spring       | 0.005 | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                                    |         | Rifle Range Rd Deep    | 0.13  | 0.15   | 0.1685 | 0.17   | 0.18   | 0.193  | 0.21   | 0.01   | 0               |
|                                    |         | Rifle Range Rd Shallow | 0.01  | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0      | 0               |
|                                    |         | Seagrove Rd Main       | 0.167 | 0.195  | 0.22   | 0.23   | 0.25   | 0.27   | 0.3    | 0.02   | -0.0011         |
| Bicarbonate HCO3 (mg/L) calculated | NE      | Chenery/Whangaparaoa   | 11    | 25.2   | 52     | 73     | 100    | 152    | 170    | 27     | 1.00108         |
|                                    |         | Quintals Rd            | 220   | 223.6  | 230    | 232    | 235    | 240.6  | 244    | 2      | 0               |
|                                    |         | Waiwera Enterpr.       | 37    | 37     | 37     | 38.5   | 44.25  | 46     | 46     | 1.5    | 0               |
|                                    | NW      | Parakai Aquatic Park   | 55    | 60.1   | 62     | 64.5   | 67     | 71.9   | 77     | 2.5    | 0.2215          |
|                                    |         | Rimmer Rd              | 97    | 98.2   | 103    | 107    | 110    | 117.2  | 120    | 4      | -0.1434         |
|                                    |         | Waitakere Rd           | 123   | 128.7  | 132    | 134    | 137.75 | 141.15 | 146    | 3      | 0.20049         |
|                                    |         | Waitakere Rd No2       | 330   | 340.85 | 350.25 | 354.5  | 363    | 370.3  | 375    | 6.5    | 1.6199          |
|                                    | Central | Amelia Earhart Ave     | 298   | 313.55 | 320    | 324.5  | 331    | 342    | 349    | 6.5    | 0.16669         |
|                                    |         | Bullens Rd             | 238   | 245    | 255.25 | 267.5  | 273.75 | 280    | 281    | 8      | 0.14091         |
|                                    |         | Burnside Rd            | 271   | 276.6  | 288    | 300    | 302.5  | 316.4  | 320    | 7      | -0.1245         |
|                                    |         | Central Park           | 40    | 42.4   | 51     | 57     | 61.5   | 67     | 73     | 6      | 0.15389         |
|                                    |         | Central Park New       | 44    | 46.1   | 55.5   | 58     | 61     | 65.8   | 70     | 3      | 1.66174         |
|                                    |         | Mt Richmond            | 20    | 20.4   | 27     | 29     | 32     | 38.2   | 40     | 3      | 0.82803         |
|                                    |         | Puhinui                | 71    | 84.45  | 97.75  | 117    | 130    | 149.65 | 152    | 19     | -2.6588         |
|                                    |         | Tiwai Rd               | 28    | 42     | 66     | 88     | 102    | 117    | 123    | 20     | -0.6014         |
|                                    |         | Watson Ave             | 49    | 52.8   | 56     | 57     | 61     | 65     | 67     | 2      | -0.3339         |
|                                    | South   | BP Bombay              | 72    | 73.65  | 77     | 78     | 80     | 82.35  | 85     | 2      | -0.1115         |
|                                    |         | Fielding Rd Sand       | 187   | 188.15 | 193.75 | 199    | 205.25 | 211.85 | 220    | 6      | -1.1017         |
|                                    |         | Fielding Rd Volcanic   | 150   | 154    | 161    | 165    | 171    | 177    | 182    | 5      | -0.5984         |
|                                    |         | Gun Club Rd            | 36    | 36     | 36     | 37     | 37     | 40.2   | 41     | 1      | 1.04357         |
|                                    |         | Hickey spring          | 40    | 40     | 40     | 41     | 41     | 41.8   | 42     | 1      | -1.0289         |
|                                    |         | Hillview spring        | 46    | 47.05  | 54.25  | 57.5   | 58.5   | 63.25  | 65     | 2      | 1.00343         |
|                                    |         | Ostrich Farm No1       | 155   | 155    | 158.25 | 159.1  | 160    | 161    | 163    | 0.9    | 0               |
|                                    |         | Ostrich Farm No2       | 137   | 138.35 | 140    | 144    | 150    | 155.25 | 158    | 4      | 0               |
|                                    |         | Patumahoe spring       | 35    | 35.2   | 36     | 36     | 37     | 37     | 37     | 1      | 1.04357         |
|                                    |         | Rifle Range Rd Deep    | 108   | 111.9  | 120    | 124    | 127.5  | 131    | 134    | 4      | 0.3354          |
|                                    |         | Rifle Range Rd Shallow | 50    | 52     | 53     | 55     | 56     | 57     | 59     | 1      | 0               |
|                                    |         | Seagrove Rd Main       | 179   | 185.8  | 192    | 197.5  | 201.25 | 208.1  | 211    | 5.5    | -0.998          |

|                                          |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|------------------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Calcium hardness CaCO3 (mg/L) calculated | NE      | Chenery/Whangaparaoa   | 1.5    | 2      | 3.0731 | 7.5    | 11.25  | 21.39  | 21.425 | 4.6    | -0.5461            |
|                                          |         | Quintals Rd            | 114.86 | 120    | 125    | 130    | 134    | 139.95 | 148.3  | 5      | 0.0207             |
|                                          |         | Waiwera Enterpr.       | 97.5   | 97.5   | 102.94 | 107.5  | 110    | 112.68 | 114.86 | 4.25   | 1.55788            |
|                                          | NW      | Parakai Aquatic Park   | 100.9  | 103.98 | 112.06 | 120    | 125.76 | 147.83 | 151.8  | 8.025  | -0.3161            |
|                                          |         | Rimmer Rd              | 19.477 | 19.8   | 20.5   | 21     | 22     | 22.86  | 24     | 0.9    | 0                  |
|                                          |         | Waitakere Rd           | 44.946 | 45.488 | 47.457 | 49.47  | 51     | 53.35  | 56     | 1.97   | 0                  |
|                                          |         | Waitakere Rd No2       | 170    | 177.34 | 186.44 | 190    | 195.31 | 200.69 | 202.75 | 5.111  | <b>-1.3401</b>     |
|                                          | Central | Amelia Earhart Ave     | 180    | 180.9  | 188.5  | 193.5  | 199.5  | 209.3  | 215    | 5.5    | <b>-0.8133</b>     |
|                                          |         | Bullens Rd             | 71     | 79.775 | 101.94 | 117.75 | 133.88 | 142.7  | 152.8  | 17.25  | -0.4923            |
|                                          |         | Burnside Rd            | 190    | 190    | 198.13 | 201    | 206    | 216.2  | 220    | 5      | -0.5057            |
|                                          |         | Central Park           | 19     | 20.55  | 26.188 | 29     | 32     | 34.958 | 37     | 3      | 0.09391            |
|                                          |         | Central Park New       | 23.971 | 24.383 | 27.467 | 29.964 | 34.958 | 34.958 | 34.958 | 4.964  | 2.48101            |
|                                          |         | Mt Richmond            | 17     | 18.553 | 20.6   | 23     | 25.5   | 27.7   | 28     | 2.8    | <b>0.59879</b>     |
|                                          |         | Puhinui                | 2      | 2      | 2.5    | 2.75   | 3      | 3      | 3      | 0.25   | -0.0152            |
|                                          |         | Tiwai Rd               | 13     | 14.651 | 25     | 34     | 40     | 46.675 | 51.5   | 7.75   | -0.1289            |
|                                          |         | Watson Ave             | 19.9   | 20.7   | 21.55  | 23     | 24.878 | 27.257 | 29     | 1.6    | -0.0347            |
|                                          | South   | BP Bombay              | 33     | 34.885 | 36.063 | 37.455 | 38.375 | 41     | 42     | 1.33   | <b>0.19105</b>     |
|                                          |         | Fielding Rd Sand       | 43.75  | 44.3   | 45.15  | 47     | 47.722 | 50     | 50     | 1      | -0.2197            |
|                                          |         | Fielding Rd Volcanic   | 39     | 39.952 | 41.813 | 43.25  | 44.75  | 46     | 47     | 1.5    | -0.0425            |
|                                          |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                          |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                          |         | Hillview spring        | 29.964 | 30.214 | 31.213 | 32.461 | 33.71  | 34.708 | 34.958 | 2.497  | ND                 |
|                                          |         | Ostrich Farm No1       | 69.916 | 70.1   | 74     | 76.5   | 78.6   | 82.94  | 85     | 2.5    | -0.0557            |
|                                          |         | Ostrich Farm No2       | 63     | 64.046 | 67     | 67.46  | 69.225 | 71.965 | 72.25  | 1.5405 | -0.3975            |
|                                          |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                          |         | Rifle Range Rd Deep    | 37.455 | 37.455 | 40.125 | 42     | 43.5   | 47     | 49     | 1.75   | <b>-0.3972</b>     |
|                                          |         | Rifle Range Rd Shallow | 20.725 | 22.1   | 24     | 25.75  | 28     | 29.18  | 30     | 2.25   | <b>0.44957</b>     |
|                                          |         | Seagrove Rd Main       | 5      | 5.09   | 5.4967 | 5.8    | 6      | 6.025  | 6.25   | 0.2    | -0.0463            |
| Carbonate alkalinity (mg/L) calculated   | NE      | Chenery/Whangaparaoa   | 30     | 33.15  | 43.125 | 47     | 50.5   | 56.91  | 61.6   | 4.25   | -0.5545            |
|                                          |         | Quintals Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Waiwera Enterpr.       | 1      | 1      | 1      | 1      | 2.5    | 4.35   | 5      | 0      | 0                  |
|                                          | NW      | Parakai Aquatic Park   | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Rimmer Rd              | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Waitakere Rd           | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Waitakere Rd No2       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          | Central | Amelia Earhart Ave     | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Bullens Rd             | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Burnside Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Central Park           | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Central Park New       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Mt Richmond            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Puhinui                | 20     | 23.66  | 30.25  | 34.3   | 39.15  | 43.91  | 53.5   | 5.1    | 0.57204            |
|                                          |         | Tiwai Rd               | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Watson Ave             | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          | South   | BP Bombay              | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Fielding Rd Sand       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Fielding Rd Volcanic   | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Gun Club Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Hickey spring          | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Hillview spring        | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Ostrich Farm No1       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Ostrich Farm No2       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Patumahoe spring       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Rifle Range Rd Deep    | 1      | 1      | 1      | 1.4    | 5      | 5      | 5.7    | 0.4    | 0                  |
|                                          |         | Rifle Range Rd Shallow | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                          |         | Seagrove Rd Main       | 4      | 5.785  | 8.325  | 9.25   | 10.95  | 13.575 | 15     | 1.25   | <b>0.23201</b>     |

|                          |         | Site name              | Min  | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD   | Trend (units/y) |
|--------------------------|---------|------------------------|------|--------|--------|--------|--------|--------|-------|-------|-----------------|
| Chloride low (AT) and IC | NE      | Chenery/Whangaparaoa   | 30.2 | 30.93  | 31.25  | 32     | 33     | 34.14  | 35.5  | 1     | -0.0456         |
|                          |         | Quintals Rd            | 27   | 27.94  | 28.6   | 29     | 29.9   | 30.76  | 31.7  | 0.8   | <b>-0.1438</b>  |
|                          |         | Waiwera Enterpr.       | 1010 | 1083.2 | 1109   | 1170   | 1200   | 1240   | 1240  | 45    | 5.00342         |
|                          | NW      | Parakai Aquatic Park   | 953  | 977.3  | 1002   | 1040   | 1065   | 1100   | 1100  | 36    | -4.309          |
|                          |         | Rimmer Rd              | 85.9 | 88.95  | 91.525 | 93.75  | 95     | 97.46  | 100   | 1.95  | 0.27871         |
|                          |         | Waitakere Rd           | 21   | 22     | 23     | 24     | 24.6   | 25.8   | 27.7  | 0.9   | <b>0.09519</b>  |
|                          |         | Waitakere Rd No2       | 68   | 69     | 72     | 73.75  | 75     | 76.015 | 77    | 1.3   | <b>-0.2256</b>  |
|                          | Central | Amelia Earhart Ave     | 39.3 | 39.7   | 41     | 42     | 42.8   | 44     | 45.2  | 0.8   | -0.1            |
|                          |         | Bullens Rd             | 19.8 | 20     | 20.875 | 21     | 21.275 | 21.885 | 22    | 0.2   | -0.0293         |
|                          |         | Burnside Rd            | 22.2 | 22.6   | 23.4   | 24     | 25     | 26     | 27    | 0.8   | 0.0998          |
|                          |         | Central Park           | 10.5 | 13.295 | 15.225 | 17     | 19.3   | 21.74  | 24.6  | 2     | 0.09963         |
|                          |         | Central Park New       | 14   | 14.075 | 15.75  | 18.15  | 19.925 | 21.35  | 22.4  | 2     | -0.3346         |
|                          |         | Mt Richmond            | 11.7 | 12.86  | 13.925 | 15.05  | 16.8   | 19.175 | 19.9  | 1.35  | <b>0.43363</b>  |
|                          |         | Puhinui                | 24.8 | 25.045 | 26.15  | 27.1   | 27.55  | 28     | 28.4  | 0.7   | -0.02           |
|                          |         | Tiwai Rd               | 4.9  | 5.74   | 11     | 17.5   | 20     | 23.7   | 23.9  | 3.8   | 0.20003         |
|                          |         | Watson Ave             | 14.5 | 15.525 | 16.7   | 17.4   | 18.55  | 19.7   | 20.1  | 0.75  | <b>0.12957</b>  |
|                          | South   | BP Bombay              | 18.8 | 19     | 19.8   | 20     | 20.5   | 21     | 22    | 0.3   | 0.01248         |
|                          |         | Fielding Rd Sand       | 17.8 | 17.9   | 18.8   | 19     | 19.5   | 20     | 20.1  | 0.2   | -0.0367         |
|                          |         | Fielding Rd Volcanic   | 19.3 | 19.52  | 20.4   | 20.8   | 21     | 21.5   | 22.2  | 0.4   | 0.01424         |
|                          |         | Gun Club Rd            | 28   | 28     | 28     | 28.5   | 29     | 29     | 29    | 0.5   | 1.04357         |
|                          |         | Hickey spring          | 22   | 22     | 22     | 22.5   | 23.25  | 23.85  | 24    | 0.5   | 1.02887         |
|                          |         | Hillview spring        | 19   | 19     | 20     | 20.9   | 21     | 22.08  | 22.8  | 0.9   | -0.9783         |
|                          |         | Ostrich Farm No1       | 22   | 22     | 22     | 22     | 22     | 22     | 22    | 0     | 0               |
|                          |         | Ostrich Farm No2       | 18.2 | 18.85  | 19.5   | 20     | 20.275 | 20.95  | 21    | 0.5   | -0.0118         |
|                          |         | Patumahoe spring       | 27   | 27     | 27     | 27     | 27     | 27     | 27    | 0     | ND              |
|                          |         | Rifle Range Rd Deep    | 21.4 | 22.91  | 23.2   | 24     | 24.3   | 25.23  | 25.5  | 0.6   | 0.02497         |
|                          |         | Rifle Range Rd Shallow | 15.2 | 15.97  | 16.65  | 17     | 17.575 | 18     | 19.1  | 0.5   | <b>-0.0499</b>  |
|                          |         | Seagrove Rd Main       | 30   | 31.5   | 33     | 33.7   | 34     | 35.8   | 36    | 0.7   | 0.01341         |
| DO % sat                 | NE      | Chenery/Whangaparaoa   | 8.4  | 12.04  | 20.475 | 23.85  | 27.4   | 37.595 | 43.9  | 3.55  | 0.52844         |
|                          |         | Quintals Rd            | 0.5  | 0.5    | 0.775  | 1.8    | 2.7    | 4.635  | 5.3   | 0.95  | -0.1974         |
|                          |         | Waiwera Enterpr.       | ND   | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND              |
|                          | NW      | Parakai Aquatic Park   | ND   | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND              |
|                          |         | Rimmer Rd              | 0.3  | 0.355  | 0.75   | 0.85   | 1.125  | 1.335  | 1.5   | 0.25  | 0.04362         |
|                          |         | Waitakere Rd           | 0.3  | 0.57   | 1.325  | 2.5    | 4.7    | 6.315  | 8.5   | 1.35  | 0.06287         |
|                          |         | Waitakere Rd No2       | 0.2  | 0.4    | 0.6    | 1.3    | 2.25   | 3.03   | 4     | 0.8   | -0.0508         |
|                          | Central | Amelia Earhart Ave     | 0.3  | 0.435  | 0.875  | 1.3    | 1.775  | 3.46   | 3.7   | 0.45  | 0.02028         |
|                          |         | Bullens Rd             | 0.4  | 0.47   | 0.8    | 1.2    | 1.6    | 2.64   | 3.2   | 0.4   | 0.1123          |
|                          |         | Burnside Rd            | 1.6  | 1.79   | 2.85   | 3.65   | 4.275  | 6.055  | 6.7   | 0.75  | <b>0.22686</b>  |
|                          |         | Central Park           | 4.7  | 21.2   | 36.2   | 48.3   | 60.2   | 69.8   | 70.8  | 12.1  | -1.3057         |
|                          |         | Central Park New       | 2    | 17.225 | 26.55  | 40.6   | 56.15  | 61.7   | 67.7  | 14.85 | <b>-7.2247</b>  |
|                          |         | Mt Richmond            | 82.9 | 84.46  | 89.4   | 92.9   | 98.3   | 100.88 | 105.5 | 4.6   | 0.547           |
|                          |         | Puhinui                | 0.5  | 0.695  | 1.45   | 2.15   | 2.8    | 4.365  | 6.9   | 0.7   | 0.11923         |
|                          |         | Tiwai Rd               | 17.1 | 21.075 | 37.675 | 55.35  | 67.55  | 91.55  | 95    | 16.35 | <b>2.27782</b>  |
|                          |         | Watson Ave             | 46.3 | 51.18  | 58.8   | 63.9   | 69.5   | 76.1   | 78.4  | 5.5   | <b>0.75883</b>  |
|                          | South   | BP Bombay              | 64.8 | 65.57  | 71.25  | 76.6   | 80.95  | 87.38  | 91.8  | 4.8   | <b>0.91402</b>  |
|                          |         | Fielding Rd Sand       | 0.1  | 0.24   | 0.6    | 0.8    | 1.1    | 1.59   | 1.8   | 0.3   | 0               |
|                          |         | Fielding Rd Volcanic   | 0.4  | 0.565  | 0.9    | 1.35   | 1.625  | 2.445  | 3.2   | 0.35  | -0.0268         |
|                          |         | Gun Club Rd            | 77.2 | 78.56  | 81.1   | 82.9   | 85.2   | 93.62  | 93.7  | 2.3   | 0.76404         |
|                          |         | Hickey spring          | 59   | 64.9   | 74     | 80.7   | 86.5   | 92.6   | 96.1  | 6.6   | <b>1.05555</b>  |
|                          |         | Hillview spring        | 86.5 | 86.5   | 87.75  | 90.25  | 92.55  | 96.585 | 97.8  | 2.7   | -0.0186         |
|                          |         | Ostrich Farm No1       | 0.06 | 0.53   | 0.9    | 1.1    | 1.575  | 2.8    | 3.2   | 0.3   | 0               |
|                          |         | Ostrich Farm No2       | 0.6  | 0.6    | 1      | 1.75   | 2.45   | 4.13   | 4.3   | 0.75  | -0.0764         |
|                          |         | Patumahoe spring       | 60.8 | 61.86  | 72     | 77     | 81.3   | 88.16  | 88.8  | 4.4   | <b>1.46446</b>  |
|                          |         | Rifle Range Rd Deep    | 0.2  | 0.4    | 0.775  | 1.15   | 1.9    | 2.83   | 3.6   | 0.55  | 0.05            |
|                          |         | Rifle Range Rd Shallow | 51   | 54.98  | 63.2   | 69     | 78.6   | 85.18  | 88.9  | 6.9   | <b>1.97313</b>  |
|                          |         | Seagrove Rd Main       | 0.3  | 0.44   | 0.7    | 0.9    | 1.5    | 2.3    | 3     | 0.3   | -0.0514         |

|                      |         | Site name              | Min  | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD   | Trend<br>(units/y) |
|----------------------|---------|------------------------|------|--------|--------|--------|--------|--------|-------|-------|--------------------|
| DO ppm               | NE      | Chenery/Whangaparaoa   | 0.77 | 1.069  | 1.8125 | 2.195  | 2.5075 | 3.387  | 3.92  | 0.36  | 0.05663            |
|                      |         | Quintals Rd            | 0.04 | 0.0495 | 0.075  | 0.17   | 0.26   | 0.4435 | 0.51  | 0.09  | -0.0185            |
|                      |         | Waiwera Enterpr.       | ND   | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                 |
|                      | NW      | Parakai Aquatic Park   | ND   | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                 |
|                      |         | Rimmer Rd              | 0.03 | 0.036  | 0.08   | 0.08   | 0.12   | 0.134  | 0.14  | 0.02  | 0                  |
|                      |         | Waitakere Rd           | 0.03 | 0.049  | 0.135  | 0.25   | 0.485  | 0.618  | 0.81  | 0.15  | -0.0007            |
|                      |         | Waitakere Rd No2       | 0.02 | 0.04   | 0.06   | 0.12   | 0.2    | 0.28   | 0.37  | 0.07  | -0.0033            |
|                      | Central | Amelia Earhart Ave     | 0.03 | 0.0435 | 0.0875 | 0.125  | 0.175  | 0.326  | 0.36  | 0.045 | 0.00223            |
|                      |         | Bullens Rd             | 0.04 | 0.047  | 0.075  | 0.11   | 0.155  | 0.251  | 0.3   | 0.04  | 0.01129            |
|                      |         | Burnside Rd            | 0.16 | 0.169  | 0.285  | 0.36   | 0.4175 | 0.591  | 0.65  | 0.07  | <b>0.02273</b>     |
|                      |         | Central Park           | 0.45 | 2.02   | 3.44   | 4.61   | 5.74   | 6.6    | 6.77  | 1.17  | -0.1239            |
|                      |         | Central Park New       | 0.19 | 1.645  | 2.5125 | 3.86   | 5.3525 | 5.8675 | 6.37  | 1.42  | <b>-0.6474</b>     |
|                      |         | Mt Richmond            | 7.35 | 7.816  | 8.1    | 8.87   | 9.31   | 10.42  | 10.47 | 0.75  | 0.03167            |
|                      |         | Puhinui                | 0.05 | 0.0695 | 0.145  | 0.19   | 0.2625 | 0.2835 | 0.29  | 0.065 | -0.0033            |
|                      |         | Tiwai Rd               | 1.66 | 2.045  | 3.4975 | 5.325  | 6.545  | 8.9525 | 9.21  | 1.53  | <b>0.21694</b>     |
|                      |         | Watson Ave             | 4.43 | 4.87   | 5.59   | 6.12   | 6.64   | 7.29   | 7.46  | 0.53  | <b>0.07434</b>     |
|                      |         | BP Bombay              | 6.62 | 6.6885 | 7.205  | 7.735  | 8.1625 | 8.6895 | 9.05  | 0.5   | <b>0.09175</b>     |
|                      | South   | Fielding Rd Sand       | 0.01 | 0.024  | 0.06   | 0.07   | 0.1    | 0.156  | 0.17  | 0.02  | 0                  |
|                      |         | Fielding Rd Volcanic   | 0.04 | 0.052  | 0.09   | 0.13   | 0.17   | 0.322  | 0.37  | 0.04  | -0.0014            |
|                      |         | Gun Club Rd            | 7.73 | 7.802  | 7.98   | 8.23   | 8.53   | 9.38   | 9.38  | 0.3   | 0.06864            |
|                      |         | Hickey spring          | 5.91 | 6.5405 | 7.3425 | 8.04   | 8.605  | 9.1645 | 9.48  | 0.67  | <b>0.09879</b>     |
|                      |         | Hillview spring        | 8.68 | 8.689  | 8.77   | 9.095  | 9.3625 | 9.667  | 9.82  | 0.34  | -0.0924            |
|                      |         | Ostrich Farm No1       | 0.04 | 0.06   | 0.09   | 0.11   | 0.155  | 0.279  | 0.32  | 0.03  | 0                  |
|                      |         | Ostrich Farm No2       | 0.01 | 0.055  | 0.09   | 0.16   | 0.23   | 0.391  | 0.4   | 0.07  | -0.0075            |
|                      |         | Patumahoe spring       | 6.12 | 6.24   | 7.2725 | 7.745  | 8.17   | 8.8475 | 8.94  | 0.43  | <b>0.13819</b>     |
|                      |         | Rifle Range Rd Deep    | 0.02 | 0.0415 | 0.07   | 0.115  | 0.2    | 0.3395 | 0.41  | 0.06  | 0.005              |
|                      |         | Rifle Range Rd Shallow | 5.13 | 5.532  | 6.315  | 6.79   | 7.74   | 8.41   | 8.82  | 0.66  | <b>0.1674</b>      |
|                      |         | Seagrove Rd Main       | 0.03 | 0.04   | 0.06   | 0.1    | 0.15   | 0.33   | 0.35  | 0.04  | -0.0022            |
| E. coli (cfu/100 mL) | NE      | Chenery/Whangaparaoa   | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Quintals Rd            | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Waiwera Enterpr.       | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      | NW      | Parakai Aquatic Park   | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Rimmer Rd              | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Waitakere Rd           | 1    | 1      | 1.6    | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Waitakere Rd No2       | 1    | 1      | 1.6    | 1.8    | 2      | 2      | 2     | 0.2   | 0                  |
|                      | Central | Amelia Earhart Ave     | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Bullens Rd             | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Burnside Rd            | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Central Park           | 86   | 99.6   | 197.5  | 285    | 482.5  | 745    | 830   | 111   | 51.0558            |
|                      |         | Central Park New       | 114  | 126.6  | 187.5  | 345    | 615    | 902.5  | 920   | 190   | 104.357            |
|                      |         | Mt Richmond            | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Puhinui                | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Tiwai Rd               | 1    | 1.06   | 2      | 3      | 12     | 27.6   | 30    | 1.9   | 0.03211            |
|                      |         | Watson Ave             | 16   | 18     | 36     | 60     | 80     | 120    | 150   | 20    | 1.35889            |
|                      | South   | BP Bombay              | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Fielding Rd Sand       | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Fielding Rd Volcanic   | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Gun Club Rd            | 1.6  | 1.6    | 1.6    | 1.6    | 1.6    | 1.6    | 1.6   | 0     | ND                 |
|                      |         | Hickey spring          | 1.6  | 1.6    | 1.6    | 1.6    | 1.6    | 1.6    | 1.6   | 0     | ND                 |
|                      |         | Hillview spring        | 1.6  | 1.6    | 1.6    | 1.6    | 1.6    | 1.6    | 1.6   | 0     | ND                 |
|                      |         | Ostrich Farm No1       | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Ostrich Farm No2       | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Patumahoe spring       | 1.6  | 1.6    | 1.6    | 1.6    | 1.6    | 1.6    | 1.6   | 0     | ND                 |
|                      |         | Rifle Range Rd Deep    | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Rifle Range Rd Shallow | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |
|                      |         | Seagrove Rd Main       | 2    | 2      | 2      | 2      | 2      | 2      | 2     | 0     | 0                  |

|                                 |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|---------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Electrical conductivity (mS/cm) | NE      | Chenerv/Whangaparaoa   | 0.3026 | 0.3131 | 0.3415 | 0.3847 | 0.39   | 0.4097 | 0.46   | 0.0272 | <b>0.00703</b>     |
|                                 |         | Quintals Rd            | 0.425  | 0.4256 | 0.453  | 0.46   | 0.4659 | 0.4714 | 0.478  | 0.0059 | 0.00069            |
|                                 |         | Waiwera Enterpr.       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                 | NW      | Parakai Aquatic Park   | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                 |         | Rimmer Rd              | 0.4216 | 0.4357 | 0.4695 | 0.487  | 0.497  | 0.502  | 0.513  | 0.0126 | <b>0.00391</b>     |
|                                 |         | Waitakere Rd           | 0.2871 | 0.2885 | 0.2927 | 0.2994 | 0.302  | 0.3078 | 0.309  | 0.0045 | 0.00026            |
|                                 |         | Waitakere Rd No2       | 0.647  | 0.6546 | 0.718  | 0.742  | 0.762  | 0.775  | 0.822  | 0.02   | <b>0.00481</b>     |
|                                 | Central | Amelia Earhart Ave     | 0.552  | 0.5692 | 0.606  | 0.614  | 0.622  | 0.6352 | 0.65   | 0.008  | 0.00209            |
|                                 |         | Bullens Rd             | 0.4    | 0.4016 | 0.4383 | 0.4503 | 0.4623 | 0.4737 | 0.488  | 0.0139 | 0.00047            |
|                                 |         | Burnside Rd            | 0.4386 | 0.467  | 0.5205 | 0.5375 | 0.571  | 0.5792 | 0.595  | 0.0335 | <b>0.00536</b>     |
|                                 |         | Central Park           | 0.108  | 0.1708 | 0.194  | 0.218  | 0.249  | 0.2788 | 0.3027 | 0.027  | <b>0.00319</b>     |
|                                 |         | Central Park New       | 0.2    | 0.209  | 0.224  | 0.246  | 0.253  | 0.2624 | 0.269  | 0.012  | -0.0108            |
|                                 |         | Mt Richmond            | 0.0856 | 0.09   | 0.1074 | 0.126  | 0.1379 | 0.1477 | 0.1539 | 0.013  | 0.00184            |
|                                 |         | Puhinui                | 0.3435 | 0.3709 | 0.3809 | 0.385  | 0.3952 | 0.4033 | 0.407  | 0.005  | <b>-0.0014</b>     |
|                                 |         | Tiwai Rd               | 0.0247 | 0.1038 | 0.1503 | 0.196  | 0.2403 | 0.288  | 0.337  | 0.045  | -0.0014            |
|                                 |         | Watson Ave             | 0.1766 | 0.1807 | 0.2031 | 0.2155 | 0.2231 | 0.2298 | 0.251  | 0.0085 | 0.00083            |
|                                 | South   | BP Bombay              | 0.236  | 0.2536 | 0.2665 | 0.2721 | 0.278  | 0.2818 | 0.2904 | 0.0059 | <b>0.00115</b>     |
|                                 |         | Fielding Rd Sand       | 0.3    | 0.3036 | 0.3265 | 0.351  | 0.3622 | 0.3727 | 0.386  | 0.013  | 0.00197            |
|                                 |         | Fielding Rd Volcanic   | 0.289  | 0.2942 | 0.3132 | 0.3217 | 0.3255 | 0.3323 | 0.3437 | 0.0059 | <b>0.00107</b>     |
|                                 |         | Gun Club Rd            | 0.376  | 0.3767 | 0.3788 | 0.38   | 0.3808 | 0.3843 | 0.385  | 0.0015 | 0.001              |
|                                 |         | Hickey spring          | 0.301  | 0.3013 | 0.3025 | 0.304  | 0.305  | 0.3088 | 0.31   | 0.002  | 0.00397            |
|                                 |         | Hillview spring        | 0.26   | 0.264  | 0.275  | 0.276  | 0.294  | 0.2976 | 0.298  | 0.006  | <b>-0.0052</b>     |
|                                 |         | Ostrich Farm No1       | 0.277  | 0.279  | 0.3015 | 0.3102 | 0.314  | 0.3188 | 0.326  | 0.005  | 0.00109            |
|                                 |         | Ostrich Farm No2       | 0.26   | 0.2606 | 0.284  | 0.2952 | 0.3008 | 0.3059 | 0.312  | 0.0065 | <b>0.00158</b>     |
|                                 |         | Patumahoe spring       | 0.361  | 0.3614 | 0.3643 | 0.3665 | 0.3693 | 0.37   | 0.37   | 0.003  | 0                  |
|                                 |         | Rifle Range Rd Deep    | 0.257  | 0.2677 | 0.2697 | 0.2728 | 0.2779 | 0.2853 | 0.293  | 0.0036 | -0.0005            |
|                                 |         | Rifle Range Rd Shallow | 0.16   | 0.1625 | 0.2    | 0.2134 | 0.225  | 0.2298 | 0.2378 | 0.0128 | <b>0.00391</b>     |
|                                 |         | Seagrove Rd Main       | 0.3689 | 0.3735 | 0.3946 | 0.418  | 0.426  | 0.4352 | 0.44   | 0.012  | <b>0.00235</b>     |
| Faecal coliform (cfu/100mL)     | NE      | Chenerv/Whangaparaoa   | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Quintals Rd            | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Waiwera Enterpr.       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 | NW      | Parakai Aquatic Park   | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Rimmer Rd              | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Waitakere Rd           | 1      | 1      | 1      | 2      | 2      | 2      | 2      | 0      | 0.19975            |
|                                 |         | Waitakere Rd No2       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 | Central | Amelia Earhart Ave     | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Bullens Rd             | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Burnside Rd            | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Central Park           | 100    | 115.3  | 205    | 345    | 575    | 874.5  | 900    | 171    | 20.2019            |
|                                 |         | Central Park New       | 150    | 169.5  | 247.5  | 310    | 422.5  | 620.5  | 670    | 95     | -182.63            |
|                                 |         | Mt Richmond            | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Puhinui                | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Tiwai Rd               | 1      | 1.4    | 2      | 3      | 8      | 16     | 18     | 1      | 0.71087            |
|                                 |         | Watson Ave             | 25     | 25.85  | 39.5   | 58     | 78.25  | 106.3  | 108    | 20.5   | 0.75221            |
|                                 | South   | BP Bombay              | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Fielding Rd Sand       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Fielding Rd Volcanic   | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                 |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                 |         | Hillview spring        | 8      | 8      | 8      | 8      | 8      | 8      | 8      | ND     | ND                 |
|                                 |         | Ostrich Farm No1       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Ostrich Farm No2       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                 |         | Rifle Range Rd Deep    | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Rifle Range Rd Shallow | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |
|                                 |         | Seagrove Rd Main       | 2      | 2      | 2      | 2      | 2      | 2      | 2      | 0      | 0                  |

|                                             |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|---------------------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Hydroxide alkalinity (mg/L) calculated      | NE      | Chenery/Whangaparaoa   | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Quintals Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Waiwera Enterpr.       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             | NW      | Parakai Aquatic Park   | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Rimmer Rd              | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Waitakere Rd           | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Waitakere Rd No2       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             | Central | Amelia Earhart Ave     | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Bullens Rd             | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Burnside Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Central Park           | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Central Park New       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Mt Richmond            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Puhinui                | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Tiwai Rd               | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Watson Ave             | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             | South   | BP Bombay              | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Fielding Rd Sand       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Fielding Rd Volcanic   | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Gun Club Rd            | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Hickey spring          | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Hillview spring        | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Ostrich Farm No1       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Ostrich Farm No2       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Patumahoe spring       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Rifle Range Rd Deep    | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Rifle Range Rd Shallow | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             |         | Seagrove Rd Main       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
| Magnesium hardness CaCO3 (mg/L) calculation | NE      | Chenery/Whangaparaoa   | 0.2059 | 0.428  | 0.751  | 1      | 1      | 1.0459 | 1.2    | 0.0947 | 0                  |
|                                             |         | Quintals Rd            | 39.095 | 42.601 | 45.201 | 47.163 | 49.562 | 52.3   | 54     | 2.208  | 0.18498            |
|                                             |         | Waiwera Enterpr.       | 1      | 1      | 1      | 1      | 1      | 1      | 1      | 0      | 0                  |
|                                             | NW      | Parakai Aquatic Park   | 1.06   | 1.465  | 2.075  | 2.4259 | 3      | 3.1957 | 3.4    | 0.4259 | 0.10238            |
|                                             |         | Rimmer Rd              | 12     | 12.43  | 13.2   | 14     | 14.403 | 15.8   | 16     | 0.8    | -0.0596            |
|                                             |         | Waitakere Rd           | 35.003 | 35.737 | 38     | 39.259 | 41.18  | 43.45  | 45     | 1.7407 | -0.2348            |
|                                             |         | Waitakere Rd No2       | 94.65  | 104.58 | 115.23 | 119.42 | 130    | 135.6  | 138    | 9.957  | -1.2397            |
|                                             | Central | Amelia Earhart Ave     | 23     | 23     | 24     | 24.708 | 25.102 | 26.499 | 27     | 0.708  | 0                  |
|                                             |         | Bullens Rd             | 25.514 | 28.185 | 38     | 42     | 47.737 | 52.8   | 54     | 5.1687 | 0.26803            |
|                                             |         | Burnside Rd            | 30.165 | 32.6   | 34     | 35     | 36.238 | 38     | 38     | 1.214  | 0.10413            |
|                                             |         | Central Park           | 22.634 | 26     | 31.963 | 35.002 | 38.35  | 41.984 | 46     | 3.2843 | -0.0235            |
|                                             |         | Central Park New       | 29.65  | 30.144 | 32     | 34.591 | 37.062 | 38.215 | 38.709 | 2.5912 | 0.72825            |
|                                             |         | Mt Richmond            | 5      | 5.1904 | 5.925  | 6.95   | 7.4124 | 8      | 9      | 0.9    | <b>0.22608</b>     |
|                                             |         | Puhinui                | 1      | 1      | 1      | 1      | 1      | 1.087  | 1.1934 | 0      | 0                  |
|                                             |         | Tiwai Rd               | 16     | 17.284 | 21.501 | 24     | 26.669 | 33.133 | 35.391 | 2.9982 | -0.1683            |
|                                             |         | Watson Ave             | 19.766 | 20.165 | 22     | 23.457 | 25     | 26     | 28.002 | 1.5    | 0.07152            |
|                                             | South   | BP Bombay              | 42.387 | 44.28  | 46.914 | 49.383 | 51     | 54.28  | 56     | 1.6461 | 0.20561            |
|                                             |         | Fielding Rd Sand       | 37.037 | 37.998 | 40.307 | 42.2   | 44.75  | 45.298 | 45.298 | 2.05   | <b>0.45876</b>     |
|                                             |         | Fielding Rd Volcanic   | 54.733 | 58.32  | 61     | 63.786 | 65.888 | 70     | 73     | 2.214  | 0                  |
|                                             |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                             |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                             |         | Hillview spring        | 53.534 | 53.534 | 53.534 | 53.534 | 53.534 | 53.534 | 53.534 | 0      | ND                 |
|                                             |         | Ostrich Farm No1       | 26.337 | 26.502 | 29     | 30.453 | 32     | 35     | 35     | 1.5473 | -0.0425            |
|                                             |         | Ostrich Farm No2       | 24.403 | 25.094 | 27.08  | 28     | 29.25  | 30.818 | 32     | 1      | -0.0747            |
|                                             |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                             |         | Rifle Range Rd Deep    | 27.572 | 28.28  | 30.885 | 32     | 33.909 | 36.395 | 39     | 1.5473 | 0.04107            |
|                                             |         | Rifle Range Rd Shallow | 27.572 | 29.391 | 31.4   | 34     | 36.65  | 39     | 44     | 2.6502 | <b>0.55557</b>     |
|                                             |         | Seagrove Rd Main       | 2.8724 | 2.9936 | 3      | 3.4797 | 3.8762 | 4      | 4      | 0.425  | -0.0375            |

|                  |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/ly) |
|------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------------------|
| Nitrate N (mg/L) | NE      | Chenery/Whangaparaoa   | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.0021 | 0.0023 | 0      | 0                   |
|                  |         | Quintals Rd            | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Waiwera Enterpr.       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  | NW      | Parakai Aquatic Park   | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Rimmer Rd              | 0.001  | 0.002  | 0.002  | 0.002  | 0.0043 | 0.0061 | 0.007  | 0      | 0                   |
|                  |         | Waitakere Rd           | 0.002  | 0.002  | 0.0026 | 0.0061 | 0.019  | 0.03   | 0.03   | 0.0041 | 0                   |
|                  |         | Waitakere Rd No2       | 0.002  | 0.002  | 0.002  | 0.003  | 0.03   | 0.03   | 0.03   | 0.001  | 0                   |
|                  | Central | Amelia Earhart Ave     | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Bullens Rd             | 0.001  | 0.001  | 0.002  | 0.002  | 0.0028 | 0.004  | 0.004  | 0      | 0                   |
|                  |         | Burnside Rd            | 0.031  | 0.0363 | 0.051  | 0.0705 | 0.079  | 0.087  | 0.115  | 0.012  | 0.00017             |
|                  |         | Central Park           | 2.248  | 2.993  | 3.2775 | 3.599  | 3.9975 | 4.3934 | 4.49   | 0.345  | -0.0381             |
|                  |         | Central Park New       | 3      | 3.0325 | 3.1775 | 3.435  | 3.745  | 4.207  | 4.22   | 0.295  | -0.1625             |
|                  |         | Mt Richmond            | 0.008  | 0.0412 | 0.0745 | 0.102  | 0.123  | 0.2045 | 0.251  | 0.022  | -0.0002             |
|                  |         | Puhinui                | 0.002  | 0.002  | 0.002  | 0.002  | 0.0038 | 0.0058 | 0.007  | 0      | 0                   |
|                  |         | Tiwai Rd               | 0.031  | 0.18   | 0.5805 | 0.889  | 1.1525 | 1.697  | 2.13   | 0.3    | 0.00246             |
|                  |         | Watson Ave             | 3.2    | 3.3105 | 3.7075 | 3.995  | 4.2925 | 4.663  | 4.9    | 0.295  | -0.0143             |
|                  |         | BP Bombay              | 6.848  | 7.5065 | 8.1775 | 9.2    | 10     | 10.71  | 11     | 0.884  | <b>0.21</b>         |
|                  | South   | Fielding Rd Sand       | 0.001  | 0.0017 | 0.002  | 0.002  | 0.0024 | 0.0034 | 0.004  | 0      | 0                   |
|                  |         | Fielding Rd Volcanic   | 0.002  | 0.002  | 0.003  | 0.005  | 0.0081 | 0.0136 | 0.016  | 0.003  | 0                   |
|                  |         | Gun Club Rd            | 24     | 24.72  | 26.025 | 26.6   | 27     | 29     | 29     | 0.55   | -0.4515             |
|                  |         | Hickey spring          | 14.8   | 16.16  | 17.5   | 18.3   | 19.2   | 20.22  | 21.4   | 0.9    | <b>-0.1927</b>      |
|                  |         | Hillview spring        | 12     | 12     | 12.75  | 14.3   | 15.125 | 15.825 | 16     | 1.25   | -0.2695             |
|                  |         | Ostrich Farm No1       | 0.002  | 0.002  | 0.002  | 0.005  | 0.02   | 0.03   | 0.036  | 0.003  | 0                   |
|                  |         | Ostrich Farm No2       | 0.0016 | 0.0019 | 0.002  | 0.003  | 0.004  | 0.006  | 0.006  | 0.001  | 0.00023             |
|                  |         | Patumahoe spring       | 22.1   | 22.555 | 23.7   | 24.75  | 25.3   | 26.8   | 27.3   | 0.75   | <b>0.10454</b>      |
|                  |         | Rifle Range Rd Deep    | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Rifle Range Rd Shallow | 3.538  | 4.546  | 5.22   | 7.5    | 9.4    | 11.9   | 16     | 2      | <b>0.56996</b>      |
|                  |         | Seagrove Rd Main       | 0.001  | 0.002  | 0.002  | 0.002  | 0.01   | 0.02   | 0.02   | 0.0005 | 0                   |
| Nitrite N (mg/L) | NE      | Chenery/Whangaparaoa   | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Quintals Rd            | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Waiwera Enterpr.       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  | NW      | Parakai Aquatic Park   | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Rimmer Rd              | 0.002  | 0.002  | 0.002  | 0.0035 | 0.005  | 0.006  | 0.007  | 0.0015 | -8E-05              |
|                  |         | Waitakere Rd           | 0.002  | 0.002  | 0.002  | 0.002  | 0.003  | 0.005  | 0.0051 | 0      | 0                   |
|                  |         | Waitakere Rd No2       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  | Central | Amelia Earhart Ave     | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Bullens Rd             | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Burnside Rd            | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Central Park           | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Central Park New       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Mt Richmond            | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Puhinui                | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Tiwai Rd               | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Watson Ave             | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  | South   | BP Bombay              | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Fielding Rd Sand       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Fielding Rd Volcanic   | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Gun Club Rd            | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Hickey spring          | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Hillview spring        | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Ostrich Farm No1       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Ostrich Farm No2       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Patumahoe spring       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Rifle Range Rd Deep    | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Rifle Range Rd Shallow | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |
|                  |         | Seagrove Rd Main       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                   |

|                                        |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD   | Trend<br>(units/ly) |
|----------------------------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|-------|-------|---------------------|
| Oxygen Reduction potential (mV)        | NE      | Chenerv/Whangaparaoa   | -294  | -277.8 | -243.6 | -172.5 | -94.65 | 74.9   | 101   | 80.55 | 0                   |
|                                        |         | Quintals Rd            | -208  | -206   | -160.5 | -141.9 | -95    | -83.5  | -79   | 44.9  | 0                   |
|                                        |         | Waiwera Enterpr.       | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                  |
|                                        | NW      | Parakai Aquatic Park   | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                  |
|                                        |         | Rimmer Rd              | -227  | -213   | -181   | -161   | -84.5  | -28    | -27   | 38    | 0                   |
|                                        |         | Waitakere Rd           | -221  | -187   | -125.8 | -94.5  | -52.5  | -13.27 | 17    | 41    | 0                   |
|                                        |         | Waitakere Rd No2       | -171  | -166.2 | -134   | -117   | -101   | -84.2  | -76   | 16    | 0                   |
|                                        | Central | Amelia Earhart Ave     | -220  | -196.3 | -171.3 | -128.6 | -102.5 | -81.3  | -68   | 30.55 | 0                   |
|                                        |         | Bullens Rd             | -263  | -257.6 | -225   | -206   | -133.8 | -88.6  | -85   | 33.3  | 0                   |
|                                        |         | Burnside Rd            | -118  | -115.3 | -99    | -85    | -80.85 | -60.5  | -56   | 9     | 0                   |
|                                        |         | Central Park           | 32    | 42.4   | 65     | 87     | 108    | 132.34 | 133.7 | 22    | -6.8484             |
|                                        |         | Central Park New       | 32    | 44.35  | 89.5   | 107.5  | 131.75 | 187.25 | 197   | 24    | 24.3162             |
|                                        |         | Mt Richmond            | 429.6 | 434.8  | 564.2  | 586    | 608    | 647    | 662   | 25    | -3.749              |
|                                        |         | Puhinui                | -369  | -357.3 | -319   | -274.5 | -146   | -102.3 | -98   | 71    | 0                   |
|                                        |         | Tiwai Rd               | -29.5 | 16.1   | 64     | 99     | 193    | 242.1  | 303   | 51    | 22.7652             |
|                                        |         | Watson Ave             | 25    | 31     | 51     | 79     | 115    | 134    | 145   | 34    | 9.0254              |
|                                        |         | BP Bombay              | 4.8   | 43.25  | 85.75  | 112    | 183    | 274.55 | 286   | 44    | -3.3602             |
|                                        | South   | Fielding Rd Sand       | -253  | -230   | -201.5 | -185   | -169   | -135.8 | -129  | 17    | 0                   |
|                                        |         | Fielding Rd Volcanic   | -223  | -219   | -198   | -178   | -141   | -116   | -112  | 26    | 0                   |
|                                        |         | Gun Club Rd            | 76    | 85.1   | 128.8  | 153    | 235    | 282.3  | 307   | 59.5  | 2.91161             |
|                                        |         | Hickey spring          | 86    | 105.8  | 135    | 214    | 249    | 299.4  | 306   | 58    | -2.5778             |
|                                        |         | Hillview spring        | 79    | 87.4   | 102    | 110    | 201    | 263.2  | 280   | 31    | 76.2164             |
|                                        |         | Ostrich Farm No1       | -255  | -244.5 | -201.5 | -163   | -140   | -118.5 | -75   | 26    | 0                   |
|                                        |         | Ostrich Farm No2       | -174  | -170   | -156   | -132   | -111   | -88.5  | -81   | 28    | 0                   |
|                                        |         | Patumahoe spring       | 84    | 100.17 | 118    | 181    | 269    | 353.1  | 477   | 74    | -3.813              |
|                                        |         | Rifle Range Rd Deep    | -306  | -281   | -238.8 | -195.5 | -161.3 | -93.75 | -73   | 39.5  | 0                   |
|                                        |         | Rifle Range Rd Shallow | 28    | 56.245 | 84.75  | 144.5  | 179.75 | 254    | 293   | 51.5  | <b>22.5791</b>      |
|                                        |         | Seagrove Rd Main       | -324  | -318   | -277.3 | -251.5 | -219.1 | -163.3 | -129  | 28.5  | 0                   |
| Oxygen Reduction potential as SHE (mV) | NE      | Chenerv/Whangaparaoa   | -89   | -72.8  | -38.58 | 32.5   | 110.35 | 279.9  | 306   | 80.55 | 56.5125             |
|                                        |         | Quintals Rd            | -3    | -1     | 44.5   | 63.1   | 109.5  | 121.5  | 126   | 44.9  | 16.1931             |
|                                        |         | Waiwera Enterpr.       | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                  |
|                                        | NW      | Parakai Aquatic Park   | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND    | ND                  |
|                                        |         | Rimmer Rd              | -22   | -8     | 24     | 44     | 120.5  | 176.5  | 177   | 38    | <b>29.7512</b>      |
|                                        |         | Waitakere Rd           | -16   | 18.05  | 79.25  | 110.5  | 152.5  | 191.73 | 222   | 40.5  | 11.8801             |
|                                        |         | Waitakere Rd No2       | 34    | 38.8   | 70     | 88     | 104    | 120.8  | 129   | 16    | 3.97138             |
|                                        | Central | Amelia Earhart Ave     | -15   | 8.75   | 33.75  | 76.45  | 102.5  | 123.7  | 137   | 30.55 | <b>9.13125</b>      |
|                                        |         | Bullens Rd             | -58   | -52.6  | -19.95 | -1     | 70.5   | 116.4  | 120   | 33.3  | 15.3028             |
|                                        |         | Burnside Rd            | 86    | 89.6   | 106    | 120    | 124.15 | 144.5  | 149   | 9     | 2.35248             |
|                                        |         | Central Park           | 237   | 247.4  | 270    | 292    | 313    | 337.34 | 338.7 | 22    | -6.8484             |
|                                        |         | Central Park New       | 237   | 249.35 | 294.5  | 312    | 336.75 | 392.25 | 402   | 24.5  | 24.3162             |
|                                        |         | Mt Richmond            | 634.6 | 639.8  | 769.2  | 791    | 813    | 852    | 867   | 25    | -3.749              |
|                                        |         | Puhinui                | -164  | -152.3 | -114   | -69.5  | 58.25  | 102.5  | 107   | 71    | 14.8571             |
|                                        |         | Tiwai Rd               | 175.5 | 221.1  | 268.5  | 304    | 398    | 447.1  | 508   | 51    | 22.7652             |
|                                        |         | Watson Ave             | 230   | 236    | 256    | 284    | 320    | 339    | 350   | 34    | 8.77489             |
|                                        |         | BP Bombay              | 209.8 | 248.25 | 290.75 | 317    | 388    | 479.55 | 491   | 44    | -3.3602             |
|                                        | South   | Fielding Rd Sand       | -48   | -25    | 3.5    | 20     | 35.5   | 69.2   | 76    | 17    | <b>6.71415</b>      |
|                                        |         | Fielding Rd Volcanic   | -18   | -14    | 7      | 27     | 64     | 89     | 93    | 26    | 6.24559             |
|                                        |         | Gun Club Rd            | 295   | 297.45 | 324.5  | 354.5  | 379.5  | 463.5  | 474   | 37.5  | 24.5841             |
|                                        |         | Hickey spring          | 291   | 302.55 | 335.25 | 436.5  | 465.5  | 507.15 | 511   | 69    | 74.7115             |
|                                        |         | Hillview spring        | 284   | 292    | 307    | 315    | 406    | 468.2  | 485   | 31    | 76.2164             |
|                                        |         | Ostrich Farm No1       | -50   | -39.5  | 3.5    | 42     | 65     | 86.5   | 130   | 26    | <b>10.3764</b>      |
|                                        |         | Ostrich Farm No2       | 31    | 35     | 49     | 73     | 93.5   | 116.5  | 124   | 28    | -2.4869             |
|                                        |         | Patumahoe spring       | 289   | 298.45 | 323.5  | 351.5  | 470.75 | 501.15 | 505   | 49    | 27.6781             |
|                                        |         | Rifle Range Rd Deep    | -101  | -76    | -33.75 | 9.5    | 43.75  | 111.25 | 132   | 39.5  | 3.13015             |
|                                        |         | Rifle Range Rd Shallow | 233   | 261.25 | 289.75 | 349.5  | 384.75 | 459    | 498   | 51.5  | <b>22.5791</b>      |
|                                        |         | Seagrove Rd Main       | -119  | -113   | -72.25 | -46.5  | -14.1  | 41.75  | 76    | 28.5  | 0                   |

|                |         | Site name              | Min  | 5th    | 25th   | Median | 75th   | 95th   | Max  | MAD   | Trend<br>(units/y) |
|----------------|---------|------------------------|------|--------|--------|--------|--------|--------|------|-------|--------------------|
| pH (lab)       | NE      | Chenery/Whangaparaoa   | 9.7  | 9.7925 | 9.8    | 9.85   | 9.9    | 10.1   | 10.1 | 0.05  | 0                  |
|                |         | Quintals Rd            | 6.9  | 6.9    | 7.08   | 7.2    | 7.3    | 7.4    | 7.41 | 0.1   | 0                  |
|                |         | Waiwera Enterpr.       | 8.4  | 8.4    | 8.5    | 8.6    | 8.655  | 8.7    | 8.7  | 0.1   | 0                  |
|                | NW      | Parakai Aquatic Park   | 7.9  | 7.9    | 7.9    | 7.9    | 7.9    | 7.94   | 7.94 | 0     | 0                  |
|                |         | Rimmer Rd              | 6.3  | 6.424  | 6.565  | 6.7    | 6.755  | 6.879  | 6.9  | 0.1   | 0.00167            |
|                |         | Waitakere Rd           | 6.21 | 6.434  | 6.66   | 6.8    | 6.9425 | 7.236  | 7.31 | 0.145 | 0.01029            |
|                |         | Waitakere Rd No2       | 7.35 | 7.418  | 7.6    | 7.7    | 7.83   | 7.994  | 8.1  | 0.12  | 0.00537            |
|                | Central | Amelia Earhart Ave     | 7.4  | 7.4    | 7.485  | 7.5    | 7.6    | 7.815  | 7.9  | 0.1   | 0                  |
|                |         | Bullens Rd             | 7.4  | 7.4    | 7.5025 | 7.6    | 7.7375 | 7.8    | 8    | 0.1   | 0.0152             |
|                |         | Burnside Rd            | 7.1  | 7.2985 | 7.4    | 7.405  | 7.5    | 7.7    | 7.7  | 0.09  | 0                  |
|                |         | Central Park           | 6.53 | 6.6    | 6.885  | 7      | 7.1225 | 7.4    | 7.4  | 0.125 | 0.01233            |
|                |         | Central Park New       | 6.8  | 6.8    | 6.9    | 6.975  | 7.0475 | 7.1625 | 7.2  | 0.075 | -0.0374            |
|                |         | Mt Richmond            | 7.3  | 7.321  | 7.5    | 7.7    | 7.895  | 8.5    | 8.5  | 0.2   | -0.0468            |
|                |         | Puhinui                | 9.3  | 9.404  | 9.6    | 9.7    | 9.755  | 9.8    | 9.88 | 0.08  | 0                  |
|                |         | Tiwai Rd               | 6.87 | 6.9335 | 7.3325 | 7.59   | 7.9    | 8.1    | 8.43 | 0.3   | 0                  |
|                |         | Watson Ave             | 6.6  | 6.699  | 6.97   | 7.2    | 7.3    | 7.51   | 7.8  | 0.2   | 0.0113             |
|                |         | BP Bombay              | 6.9  | 6.9    | 7.1775 | 7.3    | 7.4    | 7.6    | 7.7  | 0.1   | 0                  |
|                | South   | Fielding Rd Sand       | 7.6  | 7.72   | 7.805  | 7.9    | 7.9825 | 8.075  | 8.2  | 0.1   | 0                  |
|                |         | Fielding Rd Volcanic   | 8    | 8.0565 | 8.1    | 8.17   | 8.2    | 8.248  | 8.3  | 0.03  | 0                  |
|                |         | Gun Club Rd            | 6.5  | 6.5    | 6.525  | 6.65   | 6.7    | 6.775  | 6.8  | 0.1   | 0.05045            |
|                |         | Hickey spring          | 6.2  | 6.3    | 6.5    | 6.6    | 6.825  | 7      | 7.4  | 0.15  | -0.0084            |
|                |         | Hillview spring        | 6.8  | 6.828  | 6.9    | 6.9    | 7      | 7      | 7    | 0.09  | 0.00734            |
|                |         | Ostrich Farm No1       | 7.68 | 7.718  | 7.9    | 8      | 8.11   | 8.291  | 8.3  | 0.1   | 0.02069            |
|                |         | Ostrich Farm No2       | 6.9  | 7.012  | 7.2    | 7.29   | 7.37   | 7.516  | 7.6  | 0.09  | -0.0143            |
|                |         | Patumahoe spring       | 6.2  | 6.3    | 6.4    | 6.5    | 6.7    | 6.8    | 6.9  | 0.1   | 0                  |
|                |         | Rifle Range Rd Deep    | 8.3  | 8.3    | 8.4    | 8.465  | 8.5    | 8.6    | 8.64 | 0.065 | -0.0073            |
|                |         | Rifle Range Rd Shallow | 6.2  | 6.212  | 6.8    | 7.06   | 7.21   | 7.616  | 7.8  | 0.2   | -0.0388            |
|                |         | Seagrove Rd Main       | 8.53 | 8.686  | 8.8    | 8.9    | 8.96   | 9.057  | 9.12 | 0.1   | 0.01248            |
| Salinity (ppt) | NE      | Chenery/Whangaparaoa   | 0.17 | 0.1745 | 0.1825 | 0.19   | 0.2    | 0.211  | 0.22 | 0.01  | -0.0006            |
|                |         | Quintals Rd            | 0.2  | 0.207  | 0.22   | 0.22   | 0.23   | 0.23   | 0.23 | 0.005 | 0                  |
|                |         | Waiwera Enterpr.       | ND   | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                | NW      | Parakai Aquatic Park   | ND   | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                |         | Rimmer Rd              | 0.24 | 0.24   | 0.24   | 0.24   | 0.24   | 0.24   | 0.24 | 0     | 0                  |
|                |         | Waitakere Rd           | 0.14 | 0.14   | 0.14   | 0.14   | 0.14   | 0.14   | 0.14 | 0     | 0                  |
|                |         | Waitakere Rd No2       | 0.3  | 0.355  | 0.37   | 0.38   | 0.4    | 0.4    | 0.4  | 0.02  | -0.0033            |
|                | Central | Amelia Earhart Ave     | 0.28 | 0.286  | 0.3    | 0.3    | 0.31   | 0.314  | 0.32 | 0.01  | 0                  |
|                |         | Bullens Rd             | 0.22 | 0.22   | 0.22   | 0.22   | 0.22   | 0.22   | 0.22 | 0     | 0                  |
|                |         | Burnside Rd            | 0.28 | 0.28   | 0.28   | 0.28   | 0.28   | 0.28   | 0.28 | 0     | 0                  |
|                |         | Central Park           | 0.08 | 0.085  | 0.1    | 0.12   | 0.12   | 0.125  | 0.13 | 0.01  | 0                  |
|                |         | Central Park New       | 0.08 | 0.087  | 0.1    | 0.12   | 0.12   | 0.123  | 0.13 | 0.01  | 0                  |
|                |         | Mt Richmond            | 0.36 | 0.3675 | 0.3925 | 0.4    | 0.4    | 0.4    | 0.4  | 0     | -0.0102            |
|                |         | Puhinui                | 0.18 | 0.18   | 0.185  | 0.19   | 0.2    | 0.2    | 0.2  | 0.01  | 0                  |
|                |         | Tiwai Rd               | 0.06 | 0.0675 | 0.07   | 0.09   | 0.1    | 0.1375 | 0.16 | 0.015 | 0                  |
|                |         | Watson Ave             | 0.1  | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | 0                  |
|                |         | BP Bombay              | 0.13 | 0.13   | 0.13   | 0.13   | 0.13   | 0.13   | 0.13 | 0     | 0                  |
|                | South   | Fielding Rd Sand       | 0.17 | 0.17   | 0.17   | 0.17   | 0.17   | 0.17   | 0.17 | 0     | 0                  |
|                |         | Fielding Rd Volcanic   | 0.16 | 0.16   | 0.16   | 0.16   | 0.16   | 0.16   | 0.16 | 0     | 0                  |
|                |         | Gun Club Rd            | 0.18 | 0.18   | 0.18   | 0.18   | 0.1925 | 0.2    | 0.2  | 0     | -0.0033            |
|                |         | Hickey spring          | 0.1  | 0.1    | 0.1    | 0.14   | 0.15   | 0.165  | 0.2  | 0.01  | 0.00585            |
|                |         | Hillview spring        | 0.12 | 0.124  | 0.13   | 0.13   | 0.14   | 0.14   | 0.14 | 0     | 0                  |
|                |         | Ostrich Farm No1       | 0.15 | 0.15   | 0.15   | 0.15   | 0.15   | 0.15   | 0.15 | 0     | 0                  |
|                |         | Ostrich Farm No2       | 0.14 | 0.14   | 0.14   | 0.14   | 0.14   | 0.14   | 0.14 | 0     | 0                  |
|                |         | Patumahoe spring       | 0.17 | 0.17   | 0.18   | 0.18   | 0.2    | 0.2    | 0.2  | 0.01  | -0.004             |
|                |         | Rifle Range Rd Deep    | 0.13 | 0.13   | 0.13   | 0.13   | 0.13   | 0.13   | 0.13 | 0     | 0                  |
|                |         | Rifle Range Rd Shallow | 0.11 | 0.11   | 0.11   | 0.11   | 0.11   | 0.11   | 0.11 | 0     | 0                  |
|                |         | Seagrove Rd Main       | 0.2  | 0.2    | 0.2    | 0.2    | 0.2    | 0.2    | 0.2  | 0     | 0                  |

|                          |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|--------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble aluminium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.016  | 0.0166 | 0.021  | 0.024  | 0.03   | 0.0374 | 0.039  | 0.006  | -0.0009            |
|                          |         | Quintals Rd            | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Waiwera Enterpr.       | 0.01   | 0.01   | 0.011  | 0.011  | 0.0118 | 0.0141 | 0.015  | 0.0005 | 8.3E-05            |
|                          | NW      | Parakai Aquatic Park   | 0.005  | 0.005  | 0.0056 | 0.006  | 0.0061 | 0.0069 | 0.0073 | 0.0002 | 2.9E-05            |
|                          |         | Rimmer Rd              | 0.003  | 0.003  | 0.003  | 0.003  | 0.005  | 0.005  | 0.005  | 0      | <b>0.00021</b>     |
|                          |         | Waitakere Rd           | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                          |         | Waitakere Rd No2       | 0.003  | 0.003  | 0.003  | 0.003  | 0.005  | 0.005  | 0.005  | 0      | <b>0.00027</b>     |
|                          | Central | Amelia Earhart Ave     | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Bullens Rd             | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Burnside Rd            | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Central Park           | 0.003  | 0.003  | 0.0043 | 0.006  | 0.009  | 0.0161 | 0.02   | 0.003  | -0.0012            |
|                          |         | Central Park New       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                          |         | Mt Richmond            | 0.003  | 0.004  | 0.0075 | 0.015  | 0.0185 | 0.022  | 0.022  | 0.005  | -0.0003            |
|                          |         | Puhinui                | 0.011  | 0.0124 | 0.015  | 0.017  | 0.019  | 0.02   | 0.02   | 0.002  | <b>-0.0009</b>     |
|                          |         | Tiwai Rd               | 0.003  | 0.0047 | 0.0087 | 0.013  | 0.0193 | 0.027  | 0.027  | 0.0048 | -0.0009            |
|                          |         | Watson Ave             | 0.003  | 0.003  | 0.003  | 0.005  | 0.008  | 0.0132 | 0.018  | 0.002  | 0.00027            |
|                          |         | BP Bombay              | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          | South   | Fielding Rd Sand       | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Fielding Rd Volcanic   | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Gun Club Rd            | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                          |         | Hickey spring          | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | ND                 |
|                          |         | Hillview spring        | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                          |         | Ostrich Farm No1       | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Ostrich Farm No2       | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Patumahoe spring       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                          |         | Rifle Range Rd Deep    | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.0054 | 0.0056 | 0      | 0                  |
|                          |         | Rifle Range Rd Shallow | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0.003  | 0      | 0                  |
|                          |         | Seagrove Rd Main       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
| Soluble arsenic (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Quintals Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                          | NW      | Parakai Aquatic Park   | 0.0001 | 0.0003 | 0.0005 | 0.001  | 0.001  | 0.0016 | 0.002  | 0.0005 | 0                  |
|                          |         | Rimmer Rd              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Waitakere Rd           | 0.0005 | 0.0022 | 0.0052 | 0.0079 | 0.0085 | 0.0123 | 0.015  | 0.0022 | -0.0006            |
|                          |         | Waitakere Rd No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          | Central | Amelia Earhart Ave     | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Bullens Rd             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Burnside Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Central Park           | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Central Park New       | 0.0003 | 0.0003 | 0.0003 | 0.0004 | 0.0005 | 0.0005 | 0.0005 | 0.0001 | -0.0003            |
|                          |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Tiwai Rd               | 0.0006 | 0.0006 | 0.0011 | 0.0018 | 0.002  | 0.0021 | 0.0022 | 0.0004 | -0.0002            |
|                          |         | Watson Ave             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Fielding Rd Sand       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Fielding Rd Volcanic   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                          |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                          |         | Hillview spring        | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | ND     | ND                 |
|                          |         | Ostrich Farm No1       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Ostrich Farm No2       | 0.0012 | 0.0012 | 0.0014 | 0.0017 | 0.002  | 0.0022 | 0.0024 | 0.0003 | <b>-0.0001</b>     |
|                          |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                          |         | Rifle Range Rd Deep    | 0.0001 | 0.0001 | 0.0005 | 0.0005 | 0.001  | 0.001  | 0.001  | 0      | <b>-7E-05</b>      |
|                          |         | Rifle Range Rd Shallow | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Seagrove Rd Main       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |

|                        |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD    | Trend<br>(units/y) |
|------------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|-------|--------|--------------------|
| Soluble boron (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.89  | 0.899  | 0.925  | 0.99   | 1.03   | 1.21   | 1.3   | 0.06   | -0.015             |
|                        |         | Quintals Rd            | 0.02  | 0.0204 | 0.0218 | 0.0225 | 0.024  | 0.0247 | 0.025 | 0.0015 | -0.0002            |
|                        |         | Waiwera Enterpr.       | 7.7   | 7.98   | 8.6    | 8.9    | 9.58   | 9.828  | 9.98  | 0.5    | -0.1764            |
|                        | NW      | Parakai Aquatic Park   | 11    | 11     | 11.5   | 12.9   | 13     | 13.7   | 13.9  | 0.9    | -0.1278            |
|                        |         | Rimmer Rd              | 0.037 | 0.0384 | 0.0413 | 0.043  | 0.0448 | 0.0467 | 0.048 | 0.002  | 0.00068            |
|                        |         | Waitakere Rd           | 0.017 | 0.0181 | 0.02   | 0.0215 | 0.0245 | 0.0274 | 0.029 | 0.002  | 0                  |
|                        | Central | Waitakere Rd No2       | 0.014 | 0.0149 | 0.017  | 0.018  | 0.018  | 0.0201 | 0.021 | 0.001  | 0.0005             |
|                        |         | Amelia Earhart Ave     | 0.053 | 0.0536 | 0.0568 | 0.06   | 0.0643 | 0.0669 | 0.068 | 0.004  | -0.0013            |
|                        |         | Bullens Rd             | 0.11  | 0.1575 | 0.2025 | 0.2215 | 0.355  | 0.4601 | 0.49  | 0.0735 | 0.00011            |
|                        | South   | Burnside Rd            | 0.054 | 0.0562 | 0.0623 | 0.063  | 0.068  | 0.0709 | 0.072 | 0.0045 | -0.0012            |
|                        |         | Central Park           | 0.064 | 0.0679 | 0.074  | 0.0845 | 0.095  | 0.1073 | 0.11  | 0.0105 | -0.003             |
|                        |         | Central Park New       | 0.069 | 0.0693 | 0.0703 | 0.0715 | 0.0728 | 0.0738 | 0.074 | 0.0025 | -0.005             |
|                        | Central | Mt Richmond            | 0.009 | 0.0168 | 0.042  | 0.0505 | 0.0598 | 0.068  | 0.07  | 0.011  | 0.00492            |
|                        |         | Puhinui                | 0.3   | 0.313  | 0.3675 | 0.3735 | 0.3993 | 0.4118 | 0.415 | 0.025  | -0.0084            |
|                        |         | Tiwai Rd               | 0.018 | 0.018  | 0.0198 | 0.026  | 0.0273 | 0.03   | 0.03  | 0.003  | -0.0015            |
|                        | South   | Watson Ave             | 0.058 | 0.0606 | 0.065  | 0.0695 | 0.0728 | 0.0747 | 0.076 | 0.004  | -0.002             |
|                        |         | BP Bombay              | 0.013 | 0.013  | 0.014  | 0.015  | 0.015  | 0.0174 | 0.018 | 0.001  | 0.00029            |
|                        |         | Fielding Rd Sand       | 0.044 | 0.0445 | 0.0465 | 0.05   | 0.0508 | 0.0548 | 0.057 | 0.002  | -0.0003            |
|                        | South   | Fielding Rd Volcanic   | 0.016 | 0.016  | 0.017  | 0.018  | 0.019  | 0.0203 | 0.021 | 0.001  | 0                  |
|                        |         | Gun Club Rd            | 0.014 | 0.014  | 0.014  | 0.014  | 0.014  | 0.014  | 0.014 | ND     | ND                 |
|                        |         | Hickey spring          | 0.021 | 0.021  | 0.021  | 0.021  | 0.021  | 0.021  | 0.021 | ND     | ND                 |
|                        | South   | Hillview spring        | 0.01  | 0.0103 | 0.0115 | 0.013  | 0.0135 | 0.0139 | 0.014 | 0.001  | 0.00303            |
|                        |         | Ostrich Farm No1       | 0.017 | 0.017  | 0.018  | 0.018  | 0.019  | 0.0205 | 0.021 | 0.001  | -0.0004            |
|                        |         | Ostrich Farm No2       | 0.016 | 0.0165 | 0.018  | 0.018  | 0.019  | 0.0196 | 0.02  | 0.001  | 7.1E-05            |
|                        | South   | Patumahoe spring       | 0.015 | 0.015  | 0.015  | 0.015  | 0.015  | 0.015  | 0.015 | ND     | ND                 |
|                        |         | Rifle Range Rd Deep    | 0.015 | 0.015  | 0.0165 | 0.018  | 0.018  | 0.0199 | 0.022 | 0.001  | 0                  |
|                        |         | Rifle Range Rd Shallow | 0.014 | 0.0147 | 0.015  | 0.017  | 0.0175 | 0.0186 | 0.02  | 0.001  | 0.00075            |
|                        | South   | Seagrove Rd Main       | 0.087 | 0.0942 | 0.1045 | 0.11   | 0.12   | 0.1266 | 0.131 | 0.0085 | -0.0039            |
| Soluble cadmium (mg/L) | NE      | Chenery/Whangaparaoa   | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        |         | Quintals Rd            | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Waiwera Enterpr.       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        | NW      | Parakai Aquatic Park   | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Rimmer Rd              | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Waitakere Rd           | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        | Central | Waitakere Rd No2       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Amelia Earhart Ave     | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |
|                        |         | Bullens Rd             | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        | South   | Burnside Rd            | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |
|                        |         | Central Park           | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                        |         | Central Park New       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        | Central | Mt Richmond            | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |
|                        |         | Puhinui                | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Tiwai Rd               | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        | South   | Watson Ave             | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        |         | BP Bombay              | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                        |         | Fielding Rd Sand       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        | South   | Fielding Rd Volcanic   | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |
|                        |         | Gun Club Rd            | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Hickey spring          | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        | South   | Hillview spring        | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Ostrich Farm No1       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |
|                        |         | Ostrich Farm No2       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        | South   | Patumahoe spring       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | 0                  |
|                        |         | Rifle Range Rd Deep    | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        |         | Rifle Range Rd Shallow | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | 0      | ND                 |
|                        | South   | Seagrove Rd Main       | 5E-05 | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05 | ND     | ND                 |

|                         |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/ly) |
|-------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------------------|
| Soluble calcium (mg/L)  | NE      | Chenery/Whangaparaoa   | 0.59   | 0.604  | 0.72   | 0.79   | 1.03   | 1.13   | 1.2    | 0.18   | -0.0391             |
|                         |         | Quintals Rd            | 46     | 46     | 49     | 51.5   | 53.475 | 54.935 | 55.7   | 2.35   | -0.7297             |
|                         |         | Waiwera Enterpr.       | 41     | 41.4   | 43     | 43.2   | 44     | 44.6   | 45     | 0.8    | 0.1524              |
|                         | NW      | Parakai Aquatic Park   | 39     | 41.5   | 44.5   | 46     | 48.2   | 51.25  | 52.4   | 2      | -1.1682             |
|                         |         | Rimmer Rd              | 7.5    | 7.585  | 8.225  | 8.42   | 8.61   | 9      | 9      | 0.21   | <b>-0.1208</b>      |
|                         |         | Waitakere Rd           | 18     | 18     | 19.075 | 20     | 20.275 | 21.16  | 22.3   | 0.7    | 0                   |
|                         |         | Waitakere Rd No2       | 66     | 70     | 72     | 75     | 78     | 83.9   | 87     | 3      | <b>0.44635</b>      |
|                         | Central | Amelia Earhart Ave     | 71     | 72.27  | 74     | 76     | 78.95  | 82.575 | 83.6   | 2.45   | <b>-0.8715</b>      |
|                         |         | Bullens Rd             | 29     | 32.655 | 40.525 | 45     | 52.575 | 55.94  | 57.3   | 5.65   | -0.6929             |
|                         |         | Burnside Rd            | 74     | 75     | 78.15  | 80.4   | 82     | 84.85  | 87     | 1.9    | -0.2287             |
|                         |         | Central Park           | 7.78   | 8.318  | 10     | 11.6   | 13     | 14.32  | 15     | 1.4    | 0                   |
|                         |         | Central Park New       | 8.8    | 9.325  | 10.75  | 12     | 13     | 14     | 14     | 1      | -0.1662             |
|                         |         | Mt Richmond            | 8.2    | 8.302  | 9.245  | 9.95   | 10.875 | 11.03  | 11.2   | 0.9    | -0.017              |
|                         |         | Puhinui                | 0.96   | 0.968  | 0.99   | 1      | 1.03   | 1.106  | 1.15   | 0.02   | -0.0101             |
|                         |         | Tiwai Rd               | 5.79   | 6.1    | 10.475 | 12.85  | 16.05  | 18.135 | 19.3   | 2.85   | -0.5136             |
|                         |         | Watson Ave             | 7.6    | 7.94   | 8.57   | 8.9    | 9.24   | 10.06  | 10.4   | 0.34   | -0.0678             |
|                         | South   | BP Bombay              | 14     | 14.07  | 15     | 15.6   | 16     | 16.59  | 17     | 0.6    | 0                   |
|                         |         | Fielding Rd Sand       | 18     | 18     | 18.1   | 19     | 19     | 19.94  | 20.1   | 0.3    | 0                   |
|                         |         | Fielding Rd Volcanic   | 15.5   | 16     | 16.6   | 17     | 17.8   | 18.32  | 18.9   | 0.8    | -0.1253             |
|                         |         | Gun Club Rd            | 16     | 16     | 16     | 17     | 17     | 18.6   | 19     | 1      | 3.13071             |
|                         |         | Hickey spring          | 13     | 13.2   | 14     | 14     | 15     | 17.4   | 18     | 1      | 2.05775             |
|                         |         | Hillview spring        | 11     | 11.4   | 12     | 12     | 13     | 13     | 13     | 1      | 0                   |
|                         |         | Ostrich Farm No1       | 27     | 28.75  | 30     | 31     | 32     | 33.475 | 34.2   | 1      | 0.00714             |
|                         |         | Ostrich Farm No2       | 25     | 25     | 26     | 26.85  | 27.375 | 28.305 | 28.9   | 0.85   | <b>-0.2453</b>      |
|                         |         | Patumahoe spring       | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 0      | 0                   |
|                         |         | Rifle Range Rd Deep    | 15     | 15     | 16     | 16.9   | 17.575 | 18.785 | 19.5   | 0.85   | <b>-0.1657</b>      |
|                         |         | Rifle Range Rd Shallow | 7      | 8.273  | 9.8    | 10.4   | 11.05  | 11.97  | 13     | 0.6    | <b>0.16709</b>      |
|                         |         | Seagrove Rd Main       | 2      | 2      | 2.2    | 2.215  | 2.3    | 2.4    | 2.4    | 0.085  | 0                   |
| Soluble chromium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Quintals Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                   |
|                         | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                   |
|                         |         | Rimmer Rd              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Waitakere Rd           | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Waitakere Rd No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         | Central | Amelia Earhart Ave     | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Bullens Rd             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Burnside Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Central Park           | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.0009 | 0.001  | 0.0011 | 1E-04  | 0                   |
|                         |         | Central Park New       | 0.0006 | 0.0006 | 0.0007 | 0.0008 | 0.0008 | 0.0009 | 0.0009 | 0.0002 | 0.00031             |
|                         |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Tiwai Rd               | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Watson Ave             | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.0008 | 0.001  | 0.001  | 1E-04  | -2E-06              |
|                         | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Fielding Rd Sand       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Fielding Rd Volcanic   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                  |
|                         |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                  |
|                         |         | Hillview spring        | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | ND     | ND                  |
|                         |         | Ostrich Farm No1       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Ostrich Farm No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                  |
|                         |         | Rifle Range Rd Deep    | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Rifle Range Rd Shallow | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |
|                         |         | Seagrove Rd Main       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                   |

|                         |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|-------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble copper (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Quintals Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                         | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                         |         | Rimmer Rd              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Waitakere Rd           | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Waitakere Rd No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         | Central | Amelia Earhart Ave     | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Bullens Rd             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Burnside Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Central Park           | 0.0009 | 0.001  | 0.0012 | 0.0017 | 0.0023 | 0.0032 | 0.0037 | 0.0005 | -0.0002            |
|                         |         | Central Park New       | 0.0012 | 0.0012 | 0.0013 | 0.0015 | 0.0022 | 0.0026 | 0.0026 | 0.0003 | 3.2E-05            |
|                         |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0006 | 0.0007 | 0.0007 | 0.0013 | 0.0015 | 7E-05  | 4.5E-05            |
|                         |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Tiwai Rd               | 0.0004 | 0.0005 | 0.0008 | 0.0014 | 0.0021 | 0.0025 | 0.0028 | 0.0007 | 0.00024            |
|                         |         | Watson Ave             | 0.0006 | 0.0007 | 0.0007 | 0.0008 | 0.001  | 0.0011 | 0.0012 | 0.0001 | -2E-06             |
|                         | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Fielding Rd Sand       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Fielding Rd Volcanic   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Gun Club Rd            | 0.0002 | 0.0003 | 0.0007 | 0.0011 | 0.0016 | 0.0019 | 0.002  | 0.0009 | ND                 |
|                         |         | Hickey spring          | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | ND                 |
|                         |         | Hillview spring        | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 0                  |
|                         |         | Ostrich Farm No1       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Ostrich Farm No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Patumahoe spring       | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | ND                 |
|                         |         | Rifle Range Rd Deep    | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                         |         | Rifle Range Rd Shallow | 0.0002 | 0.0002 | 0.0002 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0      | -4E-05             |
|                         |         | Seagrove Rd Main       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
| Soluble fluoride (mg/L) | NE      | Chenery/Whangaparaoa   | 1.52   | 1.52   | 1.52   | 1.52   | 1.52   | 1.52   | 1.52   | ND     | ND                 |
|                         |         | Quintals Rd            | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | ND     | ND                 |
|                         |         | Waiwera Enterpr.       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | ND     | ND                 |
|                         | NW      | Parakai Aquatic Park   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | ND     | ND                 |
|                         |         | Rimmer Rd              | 0.029  | 0.029  | 0.029  | 0.029  | 0.029  | 0.029  | 0.029  | ND     | ND                 |
|                         |         | Waitakere Rd           | 0.02   | 0.025  | 0.045  | 0.07   | 0.08   | 0.088  | 0.09   | 0.02   | 0.05116            |
|                         |         | Waitakere Rd No2       | 0.02   | 0.0205 | 0.0225 | 0.025  | 0.0275 | 0.0295 | 0.03   | 0.005  | 0.01023            |
|                         | Central | Amelia Earhart Ave     | 0.13   | 0.133  | 0.145  | 0.16   | 0.175  | 0.187  | 0.19   | 0.03   | ND                 |
|                         |         | Bullens Rd             | 0.086  | 0.0937 | 0.1245 | 0.163  | 0.2015 | 0.2323 | 0.24   | 0.077  | 0.15411            |
|                         |         | Burnside Rd            | 0.12   | 0.1205 | 0.1225 | 0.125  | 0.1275 | 0.1295 | 0.13   | 0.005  | ND                 |
|                         |         | Central Park           | 0.02   | 0.023  | 0.035  | 0.05   | 0.065  | 0.077  | 0.08   | 0.03   | ND                 |
|                         |         | Central Park New       | 0.032  | 0.0344 | 0.044  | 0.056  | 0.068  | 0.0776 | 0.08   | 0.024  | ND                 |
|                         |         | Mt Richmond            | 0.36   | 0.3905 | 0.5125 | 0.665  | 0.8175 | 0.9395 | 0.97   | 0.305  | ND                 |
|                         |         | Puhinui                | 0.29   | 0.29   | 0.29   | 0.29   | 0.29   | 0.29   | 0.29   | ND     | ND                 |
|                         |         | Tiwai Rd               | 0.02   | 0.0255 | 0.0475 | 0.075  | 0.1025 | 0.1245 | 0.13   | 0.055  | ND                 |
|                         |         | Watson Ave             | 0.025  | 0.0313 | 0.0563 | 0.0875 | 0.1188 | 0.1438 | 0.15   | 0.0625 | ND                 |
|                         | South   | BP Bombay              | 0.02   | 0.023  | 0.035  | 0.05   | 0.055  | 0.059  | 0.06   | 0.01   | 0.04036            |
|                         |         | Fielding Rd Sand       | 0.02   | 0.0231 | 0.0353 | 0.0505 | 0.0658 | 0.078  | 0.081  | 0.0305 | 0.06224            |
|                         |         | Fielding Rd Volcanic   | 0.02   | 0.021  | 0.025  | 0.03   | 0.0365 | 0.0417 | 0.043  | 0.01   | 0.02347            |
|                         |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                         |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                         |         | Hillview spring        | 0.04   | 0.04   | 0.04   | 0.04   | 0.04   | 0.04   | 0.04   | ND     | ND                 |
|                         |         | Ostrich Farm No1       | 0.02   | 0.0225 | 0.0325 | 0.045  | 0.0575 | 0.0675 | 0.07   | 0.025  | 0.05116            |
|                         |         | Ostrich Farm No2       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | ND     | ND                 |
|                         |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                         |         | Rifle Range Rd Deep    | 0.09   | 0.0905 | 0.0925 | 0.095  | 0.0975 | 0.0995 | 0.1    | 0.005  | ND                 |
|                         |         | Rifle Range Rd Shallow | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0                  |
|                         |         | Seagrove Rd Main       | 0.02   | 0.0245 | 0.0425 | 0.065  | 0.0875 | 0.1055 | 0.11   | 0.045  | 0.09182            |

|                     |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|---------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble iron (mg/L) | NE      | Chenery/Whangaparaoa   | 0.005  | 0.005  | 0.006  | 0.007  | 0.01   | 0.015  | 0.019  | 0.002  | -0.0003            |
|                     |         | Quintals Rd            | 0.005  | 0.02   | 0.2285 | 1.8    | 2      | 2.16   | 2.3    | 0.5    | <b>0.11835</b>     |
|                     |         | Waiwera Enterpr.       | 0.002  | 0.002  | 0.005  | 0.005  | 0.01   | 0.0104 | 0.012  | 0.003  | 0                  |
|                     | NW      | Parakai Aquatic Park   | 0.002  | 0.0043 | 0.005  | 0.0052 | 0.01   | 0.01   | 0.01   | 0.0006 | 0                  |
|                     |         | Rimmer Rd              | 4.09   | 4.4395 | 4.825  | 5.17   | 5.475  | 5.9165 | 6.31   | 0.34   | 0.04844            |
|                     |         | Waitakere Rd           | 3.32   | 3.962  | 5.45   | 6.2    | 6.88   | 7.36   | 7.7    | 0.7    | 0                  |
|                     |         | Waitakere Rd No2       | 0.6    | 0.8265 | 1      | 1.1    | 1.2    | 1.5    | 1.7    | 0.1    | <b>0.01777</b>     |
|                     | Central | Amelia Earhart Ave     | 0.355  | 0.6142 | 0.95   | 1.07   | 1.1075 | 1.455  | 1.6    | 0.12   | 0.0168             |
|                     |         | Bullens Rd             | 0.005  | 0.0083 | 0.0665 | 0.26   | 0.44   | 0.6997 | 0.83   | 0.19   | 0.00896            |
|                     |         | Burnside Rd            | 0.802  | 0.8305 | 0.9425 | 0.99   | 1.07   | 1.425  | 1.53   | 0.0545 | -0.0017            |
|                     |         | Central Park           | 0.005  | 0.005  | 0.008  | 0.017  | 0.0238 | 0.0476 | 0.058  | 0.009  | <b>0.00128</b>     |
|                     |         | Central Park New       | 0.0072 | 0.0127 | 0.019  | 0.035  | 0.0625 | 0.1048 | 0.13   | 0.02   | 0.01222            |
|                     |         | Mt Richmond            | 0.0028 | 0.005  | 0.005  | 0.005  | 0.009  | 0.0136 | 0.015  | 0      | 0                  |
|                     |         | Puhinui                | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                     |         | Tiwai Rd               | 0.001  | 0.0043 | 0.005  | 0.0056 | 0.01   | 0.02   | 0.02   | 0.0014 | 0                  |
|                     |         | Watson Ave             | 0.005  | 0.005  | 0.005  | 0.007  | 0.0195 | 0.0331 | 0.037  | 0.002  | <b>0.001</b>       |
|                     | South   | BP Bombay              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                     |         | Fielding Rd Sand       | 0.107  | 0.1748 | 0.222  | 0.303  | 0.36   | 0.478  | 0.53   | 0.072  | <b>0.015</b>       |
|                     |         | Fielding Rd Volcanic   | 0.016  | 0.0267 | 0.0415 | 0.0555 | 0.0733 | 0.1048 | 0.15   | 0.0175 | <b>0.0035</b>      |
|                     |         | Gun Club Rd            | 0.014  | 0.0167 | 0.0275 | 0.0365 | 0.0528 | 0.081  | 0.088  | 0.0135 | ND                 |
|                     |         | Hickey spring          | 0.0026 | 0.0028 | 0.0036 | 0.0042 | 0.0052 | 0.0057 | 0.0058 | 0.001  | -0.0016            |
|                     |         | Hillview spring        | 0.0023 | 0.0035 | 0.0104 | 0.014  | 0.0213 | 0.0285 | 0.032  | 0.0075 | 0.0025             |
|                     |         | Ostrich Farm No1       | 0.08   | 0.097  | 0.11   | 0.12   | 0.13   | 0.14   | 0.16   | 0.01   | 0                  |
|                     |         | Ostrich Farm No2       | 0.871  | 1.18   | 1.64   | 2.9    | 3.15   | 3.4    | 3.4    | 0.3    | 0.0556             |
|                     |         | Patumahoe spring       | 0.002  | 0.002  | 0.0021 | 0.0022 | 0.0024 | 0.0025 | 0.0025 | 0.0002 | 0.00052            |
|                     |         | Rifle Range Rd Deep    | 0.005  | 0.0121 | 0.02   | 0.026  | 0.035  | 0.04   | 0.045  | 0.007  | <b>0.00145</b>     |
|                     |         | Rifle Range Rd Shallow | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                     |         | Seagrove Rd Main       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0                  |
| Soluble lead (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Quintals Rd            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Waiwera Enterpr.       | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 0                  |
|                     | NW      | Parakai Aquatic Park   | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 0                  |
|                     |         | Rimmer Rd              | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Waitakere Rd           | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Waitakere Rd No2       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     | Central | Amelia Earhart Ave     | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Bullens Rd             | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Burnside Rd            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Central Park           | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Central Park New       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Mt Richmond            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Puhinui                | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Tiwai Rd               | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0004 | 0.0009 | 0.0009 | 0.0001 | -8E-06             |
|                     |         | Watson Ave             | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     | South   | BP Bombay              | 0.0001 | 0.0001 | 0.001  | 0.0012 | 0.0016 | 0.0023 | 0.0027 | 0.0004 | <b>-0.0002</b>     |
|                     |         | Fielding Rd Sand       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Fielding Rd Volcanic   | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Gun Club Rd            | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | ND     | ND                 |
|                     |         | Hickey spring          | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | ND     | ND                 |
|                     |         | Hillview spring        | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 3E-05  | -5E-05             |
|                     |         | Ostrich Farm No1       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Ostrich Farm No2       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Patumahoe spring       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | ND     | ND                 |
|                     |         | Rifle Range Rd Deep    | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Rifle Range Rd Shallow | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                     |         | Seagrove Rd Main       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |

|                          |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|--------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble lithium (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.0045 | 0.0046 | 0.0078 | 0.0089 | 0.0096 | 0.0105 | 0.011  | 0.0011 | -4E-05             |
|                          |         | Quintals Rd            | 0.01   | 0.0105 | 0.0111 | 0.0116 | 0.0128 | 0.0131 | 0.0131 | 0.0006 | -0.0001            |
|                          |         | Waiwera Enterpr.       | 0.59   | 0.594  | 0.6    | 0.62   | 0.647  | 0.6626 | 0.663  | 0.02   | -0.0095            |
|                          | NW      | Parakai Aquatic Park   | 0.667  | 0.6785 | 0.73   | 0.76   | 0.775  | 0.8125 | 0.835  | 0.03   | -0.0056            |
|                          |         | Rimmer Rd              | 0.002  | 0.0021 | 0.0023 | 0.0025 | 0.0026 | 0.0027 | 0.0027 | 0.0002 | -4E-05             |
|                          |         | Waitakere Rd           | 0.013  | 0.0135 | 0.014  | 0.0147 | 0.0156 | 0.0161 | 0.0162 | 0.0007 | -0.0002            |
|                          |         | Waitakere Rd No2       | 0.026  | 0.026  | 0.027  | 0.029  | 0.0296 | 0.0304 | 0.0308 | 0.001  | <b>-0.0004</b>     |
|                          | Central | Amelia Earhart Ave     | 0.017  | 0.017  | 0.0173 | 0.0176 | 0.0177 | 0.0179 | 0.018  | 0.0002 | -0.0001            |
|                          |         | Bullens Rd             | 0.067  | 0.0683 | 0.0712 | 0.076  | 0.091  | 0.1152 | 0.123  | 0.009  | 0.00386            |
|                          |         | Burnside Rd            | 0.029  | 0.0308 | 0.034  | 0.035  | 0.0371 | 0.0392 | 0.0408 | 0.0015 | -0.0004            |
|                          |         | Central Park           | 0.0003 | 0.0004 | 0.0005 | 0.0005 | 0.0006 | 0.0008 | 0.0008 | 1E-04  | -2E-05             |
|                          |         | Central Park New       | 0.0003 | 0.0003 | 0.0005 | 0.0006 | 0.0006 | 0.0007 | 0.0007 | 0.0001 | -4E-05             |
|                          |         | Mt Richmond            | 0.0028 | 0.0032 | 0.0045 | 0.0089 | 0.015  | 0.0198 | 0.021  | 0.0047 | -0.0005            |
|                          |         | Puhinui                | 0.0045 | 0.0046 | 0.005  | 0.0054 | 0.0055 | 0.0056 | 0.0057 | 0.0002 | <b>-0.0001</b>     |
|                          |         | Tiwai Rd               | 0.0002 | 0.0002 | 0.0013 | 0.0019 | 0.0034 | 0.0037 | 0.0038 | 0.0011 | -0.0003            |
|                          |         | Watson Ave             | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0004 | 0.0005 | 0.0005 | 8E-05  | <b>-1E-05</b>      |
|                          |         | BP Bombay              | 0.0009 | 0.0009 | 0.001  | 0.001  | 0.0011 | 0.0012 | 0.0012 | 0      | -1E-05             |
|                          | South   | Fielding Rd Sand       | 0.0127 | 0.0129 | 0.0138 | 0.014  | 0.015  | 0.0151 | 0.0152 | 0.001  | -0.0002            |
|                          |         | Fielding Rd Volcanic   | 0.0039 | 0.0041 | 0.0042 | 0.0043 | 0.0043 | 0.0044 | 0.0045 | 5E-05  | 0                  |
|                          |         | Gun Club Rd            | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0004 | 0.0004 | 0.0004 | 6E-05  | 0.00015            |
|                          |         | Hickey spring          | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 1E-05  | ND                 |
|                          |         | Hillview spring        | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0003 | 0.0004 | 0.0004 | 3E-05  | 9.3E-05            |
|                          |         | Ostrich Farm No1       | 0.0082 | 0.0085 | 0.0088 | 0.0091 | 0.0093 | 0.0098 | 0.0102 | 0.0003 | -6E-05             |
|                          |         | Ostrich Farm No2       | 0.011  | 0.011  | 0.0118 | 0.0126 | 0.013  | 0.013  | 0.013  | 0.0004 | -6E-05             |
|                          |         | Patumahoe spring       | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 1E-05  | ND                 |
|                          |         | Rifle Range Rd Deep    | 0.0034 | 0.0035 | 0.0037 | 0.004  | 0.0041 | 0.0044 | 0.0047 | 0.0002 | -1E-04             |
|                          |         | Rifle Range Rd Shallow | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0006 | 0.0007 | 0.0001 | 3.3E-05            |
|                          |         | Seagrove Rd Main       | 0.0061 | 0.0061 | 0.0064 | 0.0068 | 0.0068 | 0.0072 | 0.0072 | 0.0003 | -7E-05             |
| Soluble magnesium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0055 | 0.0077 | 0.012  | 0.0175 | 0.02   | 0.0207 | 0.022  | 0.0035 | -0.0013            |
|                          |         | Quintals Rd            | 10     | 10     | 11     | 12     | 12.3   | 12.52  | 13     | 0.8    | <b>-0.2746</b>     |
|                          |         | Waiwera Enterpr.       | 0.1    | 0.1    | 0.1075 | 0.11   | 0.11   | 0.123  | 0.13   | 0      | -0.0013            |
|                          | NW      | Parakai Aquatic Park   | 0.48   | 0.498  | 0.56   | 0.595  | 0.625  | 0.6775 | 0.7    | 0.035  | -0.0114            |
|                          |         | Rimmer Rd              | 3      | 3      | 3.2    | 3.3    | 3.38   | 3.504  | 3.6    | 0.1    | <b>-0.04</b>       |
|                          |         | Waitakere Rd           | 8.8    | 8.875  | 9.295  | 9.655  | 10     | 10.15  | 10.9   | 0.345  | -0.0333            |
|                          |         | Waitakere Rd No2       | 26     | 27     | 29     | 30     | 31     | 32     | 32.7   | 1      | 0                  |
|                          | Central | Amelia Earhart Ave     | 5.3    | 5.5    | 5.7    | 5.92   | 6.22   | 6.38   | 6.62   | 0.3    | <b>-0.102</b>      |
|                          |         | Bullens Rd             | 7.4    | 7.6295 | 9.22   | 10.5   | 11.875 | 12.83  | 13     | 1.35   | -0.2688            |
|                          |         | Burnside Rd            | 7.7    | 7.817  | 8.27   | 8.6    | 8.885  | 9.155  | 9.9    | 0.325  | 0.01143            |
|                          |         | Central Park           | 5.7    | 6.2885 | 7.7775 | 8.565  | 9.49   | 10.59  | 11     | 0.89   | -0.1003            |
|                          |         | Central Park New       | 6.4    | 6.61   | 7.9    | 8.2    | 8.8    | 9.43   | 9.5    | 0.6    | -0.2986            |
|                          |         | Mt Richmond            | 1.33   | 1.393  | 1.635  | 1.7    | 1.825  | 1.93   | 2.02   | 0.1    | -0.0277            |
|                          |         | Puhinui                | 0.066  | 0.0741 | 0.09   | 0.093  | 0.1    | 0.111  | 0.12   | 0.007  | -0.0041            |
|                          |         | Tiwai Rd               | 4.1    | 4.3    | 5.09   | 5.9    | 6.235  | 6.445  | 7.22   | 0.49   | -0.0691            |
|                          |         | Watson Ave             | 4.9    | 5      | 5.325  | 5.725  | 6      | 6.2575 | 6.58   | 0.33   | <b>-0.0725</b>     |
|                          |         | BP Bombay              | 11     | 11     | 12     | 12     | 13     | 14     | 14     | 0.6    | 0                  |
|                          | South   | Fielding Rd Sand       | 9.68   | 9.77   | 10     | 10.5   | 10.925 | 11.25  | 12     | 0.5    | 0.03404            |
|                          |         | Fielding Rd Volcanic   | 13     | 13.5   | 15     | 15.7   | 16     | 17.8   | 18.1   | 0.7    | -0.1499            |
|                          |         | Gun Club Rd            | 15     | 15     | 15     | 15     | 15     | 15     | 15     | 0      | ND                 |
|                          |         | Hickey spring          | 11     | 11     | 11     | 12     | 12     | 14.4   | 15     | 1      | 1.02887            |
|                          |         | Hillview spring        | 13     | 13     | 13     | 13     | 13     | 13     | 13     | 0      | 0                  |
|                          |         | Ostrich Farm No1       | 6.3    | 6.905  | 7.2    | 7.5    | 7.7    | 8.2045 | 8.58   | 0.3    | 0.01439            |
|                          |         | Ostrich Farm No2       | 5.98   | 6.156  | 6.5    | 6.83   | 7      | 7.328  | 7.72   | 0.29   | -0.0743            |
|                          |         | Patumahoe spring       | 14     | 14     | 14     | 14     | 14     | 14     | 14     | 0      | ND                 |
|                          |         | Rifle Range Rd Deep    | 6.7    | 6.8    | 7.6    | 7.9    | 8.2    | 8.6    | 8.96   | 0.3    | -0.0075            |
|                          |         | Rifle Range Rd Shallow | 6.6    | 7.36   | 8      | 8.4    | 8.8    | 9.3    | 9.5    | 0.4    | <b>0.10018</b>     |
|                          |         | Seagrove Rd Main       | 0.76   | 0.779  | 0.82   | 0.87   | 0.91   | 0.951  | 0.98   | 0.04   | -0.0029            |

|                          |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|--------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble manganese (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0009 | 0.001  | 0.001  | 0.0017 | 0.0001 | -3E-05             |
|                          |         | Quintals Rd            | 0.196  | 0.1988 | 0.216  | 0.229  | 0.234  | 0.2476 | 0.251  | 0.009  | 0                  |
|                          |         | Waiwera Enterpr.       | 0.0009 | 0.001  | 0.002  | 0.002  | 0.0027 | 0.003  | 0.003  | 0.0007 | 7.5E-05            |
|                          | NW      | Parakai Aquatic Park   | 0.01   | 0.0107 | 0.0115 | 0.013  | 0.0145 | 0.016  | 0.016  | 0.002  | -9E-05             |
|                          |         | Rimmer Rd              | 0.095  | 0.099  | 0.11   | 0.116  | 0.1208 | 0.1258 | 0.15   | 0.006  | -0.0002            |
|                          |         | Waitakere Rd           | 0.1    | 0.11   | 0.13   | 0.16   | 0.187  | 0.218  | 0.26   | 0.03   | -0.0057            |
|                          |         | Waitakere Rd No2       | 0.038  | 0.0408 | 0.05   | 0.05   | 0.0565 | 0.062  | 0.068  | 0.0035 | 0.00029            |
|                          | Central | Amelia Earhart Ave     | 0.073  | 0.0799 | 0.086  | 0.0902 | 0.0955 | 0.103  | 0.104  | 0.0043 | -0.001             |
|                          |         | Bullens Rd             | 0.037  | 0.0487 | 0.071  | 0.083  | 0.1093 | 0.1195 | 0.123  | 0.02   | 0.00125            |
|                          |         | Burnside Rd            | 0.006  | 0.0065 | 0.0083 | 0.0097 | 0.011  | 0.013  | 0.016  | 0.0013 | 0.00017            |
|                          |         | Central Park           | 0.001  | 0.001  | 0.002  | 0.0037 | 0.0047 | 0.0074 | 0.0088 | 0.0017 | 0.00032            |
|                          |         | Central Park New       | 0.0013 | 0.0015 | 0.0023 | 0.004  | 0.0065 | 0.01   | 0.011  | 0.0021 | -0.0012            |
|                          |         | Mt Richmond            | 0.0005 | 0.0006 | 0.001  | 0.0011 | 0.002  | 0.0029 | 0.0033 | 0.0004 | 4.7E-05            |
|                          |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Tiwai Rd               | 0.0006 | 0.0009 | 0.002  | 0.0055 | 0.0102 | 0.0152 | 0.0224 | 0.0037 | 3.7E-05            |
|                          |         | Watson Ave             | 0.001  | 0.001  | 0.0019 | 0.0042 | 0.0081 | 0.0131 | 0.015  | 0.003  | 0.00032            |
|                          |         | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          | South   | Fielding Rd Sand       | 0.025  | 0.0292 | 0.032  | 0.0372 | 0.0417 | 0.0449 | 0.049  | 0.0048 | -0.0003            |
|                          |         | Fielding Rd Volcanic   | 0.0119 | 0.014  | 0.017  | 0.02   | 0.0227 | 0.028  | 0.029  | 0.003  | -0.0009            |
|                          |         | Gun Club Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | ND                 |
|                          |         | Hickey spring          | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Hillview spring        | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Ostrich Farm No1       | 0.0563 | 0.058  | 0.06   | 0.06   | 0.06   | 0.061  | 0.064  | 0      | 0                  |
|                          |         | Ostrich Farm No2       | 0.11   | 0.11   | 0.12   | 0.1445 | 0.158  | 0.1892 | 0.216  | 0.0215 | -0.0069            |
|                          |         | Patumahoe spring       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                          |         | Rifle Range Rd Deep    | 0.015  | 0.019  | 0.022  | 0.024  | 0.0259 | 0.03   | 0.03   | 0.002  | 2E-05              |
|                          |         | Rifle Range Rd Shallow | 0.0005 | 0.0006 | 0.0008 | 0.001  | 0.001  | 0.0016 | 0.0017 | 0.0001 | -2E-05             |
|                          |         | Seagrove Rd Main       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
| Soluble mercury (mg/L)   | NE      | Chenery/Whangaparaoa   | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Quintals Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Waiwera Enterpr.       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          | NW      | Parakai Aquatic Park   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | ND                 |
|                          |         | Rimmer Rd              | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Waitakere Rd           | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Waitakere Rd No2       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          | Central | Amelia Earhart Ave     | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND                 |
|                          |         | Bullens Rd             | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Burnside Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND                 |
|                          |         | Central Park           | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                          |         | Central Park New       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Mt Richmond            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND                 |
|                          |         | Puhinui                | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Tiwai Rd               | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Watson Ave             | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | BP Bombay              | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          | South   | Fielding Rd Sand       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Fielding Rd Volcanic   | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Gun Club Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Hickey spring          | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Hillview spring        | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Ostrich Farm No1       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND                 |
|                          |         | Ostrich Farm No2       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Patumahoe spring       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0                  |
|                          |         | Rifle Range Rd Deep    | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Rifle Range Rd Shallow | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND                 |
|                          |         | Seagrove Rd Main       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND                 |

|                           |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|---------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble nickel (mg/L)     | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Quintals Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                           | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                           |         | Rimmer Rd              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Waitakere Rd           | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0      | 0                  |
|                           |         | Waitakere Rd No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           | Central | Amelia Earhart Ave     | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Bullens Rd             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Burnside Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Central Park           | 0.0005 | 0.0006 | 0.0007 | 0.0009 | 0.001  | 0.0013 | 0.0013 | 0.0002 | -9E-05             |
|                           |         | Central Park New       | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0008 | 0.0008 | 0.0008 | 2E-05  | 3E-05              |
|                           |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Tiwai Rd               | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Watson Ave             | 0.0003 | 0.0004 | 0.0006 | 0.0007 | 0.0009 | 0.0012 | 0.0013 | 0.0002 | -3E-05             |
|                           | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Fielding Rd Sand       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Fielding Rd Volcanic   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                           |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                           |         | Hillview spring        | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | ND     | ND                 |
|                           |         | Ostrich Farm No1       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Ostrich Farm No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                           |         | Rifle Range Rd Deep    | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Rifle Range Rd Shallow | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                           |         | Seagrove Rd Main       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
| Soluble phosphorus (mg/L) | NE      | Chenery/Whangaparaoa   | 0.016  | 0.02   | 0.03   | 0.0435 | 0.05   | 0.0643 | 0.07   | 0.007  | -0.0011            |
|                           |         | Quintals Rd            | 0.004  | 0.004  | 0.0093 | 0.0115 | 0.0235 | 0.0388 | 0.057  | 0.0075 | 0.00049            |
|                           |         | Waiwera Enterpr.       | 0.004  | 0.004  | 0.004  | 0.005  | 0.008  | 0.01   | 0.01   | 0.001  | 0                  |
|                           | NW      | Parakai Aquatic Park   | 0.004  | 0.004  | 0.005  | 0.006  | 0.01   | 0.01   | 0.01   | 0.002  | -0.0004            |
|                           |         | Rimmer Rd              | 0.004  | 0.0116 | 0.03   | 0.067  | 0.074  | 0.0868 | 0.1    | 0.017  | 0.00197            |
|                           |         | Waitakere Rd           | 0.004  | 0.004  | 0.005  | 0.013  | 0.04   | 0.05   | 0.054  | 0.009  | 0                  |
|                           |         | Waitakere Rd No2       | 0.002  | 0.004  | 0.005  | 0.0065 | 0.01   | 0.0199 | 0.03   | 0.0025 | -0.0003            |
|                           | Central | Amelia Earhart Ave     | 0.027  | 0.0354 | 0.04   | 0.044  | 0.052  | 0.0603 | 0.07   | 0.004  | 0.00018            |
|                           |         | Bullens Rd             | 0.076  | 0.077  | 0.085  | 0.09   | 0.091  | 0.1    | 0.1    | 0.003  | 0.00032            |
|                           |         | Burnside Rd            | 0.004  | 0.004  | 0.004  | 0.004  | 0.005  | 0.0077 | 0.009  | 0      | 0                  |
|                           |         | Central Park           | 0.05   | 0.0582 | 0.065  | 0.07   | 0.077  | 0.095  | 0.1    | 0.007  | 0.001              |
|                           |         | Central Park New       | 0.053  | 0.0607 | 0.0725 | 0.08   | 0.087  | 0.096  | 0.11   | 0.008  | 0.00665            |
|                           |         | Mt Richmond            | 0.004  | 0.004  | 0.004  | 0.0065 | 0.01   | 0.0152 | 0.024  | 0.0025 | -0.0003            |
|                           |         | Puhinui                | 0.056  | 0.057  | 0.061  | 0.068  | 0.07   | 0.075  | 0.08   | 0.004  | -0.0014            |
|                           |         | Tiwai Rd               | 0.01   | 0.038  | 0.058  | 0.075  | 0.096  | 0.1138 | 0.15   | 0.017  | -0.0009            |
|                           |         | Watson Ave             | 0.035  | 0.046  | 0.06   | 0.07   | 0.08   | 0.0918 | 0.1    | 0.01   | -0.0017            |
|                           | South   | BP Bombay              | 0.079  | 0.09   | 0.095  | 0.1    | 0.1058 | 0.113  | 0.118  | 0.005  | -0.0002            |
|                           |         | Fielding Rd Sand       | 0.141  | 0.1505 | 0.1645 | 0.1815 | 0.2053 | 0.2248 | 0.233  | 0.0195 | -0.0054            |
|                           |         | Fielding Rd Volcanic   | 0.024  | 0.0267 | 0.0313 | 0.039  | 0.0408 | 0.0461 | 0.05   | 0.0035 | -0.0009            |
|                           |         | Gun Club Rd            | 0.015  | 0.0152 | 0.016  | 0.017  | 0.018  | 0.018  | 0.018  | 0.001  | -0.0021            |
|                           |         | Hickey spring          | 0.01   | 0.011  | 0.015  | 0.016  | 0.018  | 0.0188 | 0.019  | 0.002  | -0.0031            |
|                           |         | Hillview spring        | 0.043  | 0.0448 | 0.0495 | 0.05   | 0.052  | 0.0544 | 0.055  | 0.001  | 0.00104            |
|                           |         | Ostrich Farm No1       | 0.1    | 0.104  | 0.12   | 0.123  | 0.13   | 0.1362 | 0.138  | 0.006  | 0.00023            |
|                           |         | Ostrich Farm No2       | 0.004  | 0.004  | 0.0083 | 0.01   | 0.0175 | 0.02   | 0.037  | 0.0055 | -0.0003            |
|                           |         | Patumahoe spring       | 0.013  | 0.013  | 0.013  | 0.014  | 0.016  | 0.016  | 0.016  | 0.001  | 0                  |
|                           |         | Rifle Range Rd Deep    | 0.179  | 0.1863 | 0.214  | 0.23   | 0.24   | 0.254  | 0.263  | 0.01   | -0.002             |
|                           |         | Rifle Range Rd Shallow | 0.05   | 0.0524 | 0.0595 | 0.06   | 0.064  | 0.0693 | 0.07   | 0.002  | 0                  |
|                           |         | Seagrove Rd Main       | 0.032  | 0.0337 | 0.0398 | 0.04   | 0.043  | 0.05   | 0.05   | 0.0025 | 0                  |

|                              |         | Site name              | Min  | 5th    | 25th   | Median | 75th   | 95th   | Max  | MAD   | Trend<br>(units/y) |
|------------------------------|---------|------------------------|------|--------|--------|--------|--------|--------|------|-------|--------------------|
| Soluble potassium (mg/L)     | NE      | Chenery/Whangaparaoa   | 0.16 | 0.167  | 0.18   | 0.2    | 0.22   | 0.252  | 0.28 | 0.02  | -0.0017            |
|                              |         | Quintals Rd            | 0.4  | 0.417  | 0.465  | 0.49   | 0.5175 | 0.563  | 0.58 | 0.03  | -0.005             |
|                              |         | Waiwera Enterpr.       | 6.8  | 7.04   | 7.4    | 7.6    | 8      | 8.2    | 8.2  | 0.2   | -0.0083            |
|                              | NW      | Parakai Aquatic Park   | 16.6 | 16.8   | 17     | 18     | 18.05  | 19.8   | 20.4 | 1     | -0.2807            |
|                              |         | Rimmer Rd              | 1.9  | 1.9    | 2      | 2.035  | 2.16   | 2.2205 | 2.28 | 0.065 | <b>-0.027</b>      |
|                              |         | Waitakere Rd           | 2    | 2      | 2.1    | 2.2    | 2.25   | 2.4    | 2.5  | 0.1   | -0.0081            |
|                              |         | Waitakere Rd No2       | 1.3  | 1.4    | 1.6    | 1.7    | 1.815  | 1.994  | 2.1  | 0.1   | <b>-0.0143</b>     |
|                              | Central | Amelia Earhart Ave     | 7    | 7.1    | 7.465  | 7.88   | 8.19   | 8.36   | 8.44 | 0.38  | <b>-0.1156</b>     |
|                              |         | Bullens Rd             | 2.8  | 2.88   | 3.1    | 3.22   | 3.53   | 3.874  | 3.89 | 0.18  | -0.0528            |
|                              |         | Burnside Rd            | 1.4  | 1.445  | 1.54   | 1.62   | 1.675  | 1.74   | 1.88 | 0.06  | <b>-0.0187</b>     |
|                              |         | Central Park           | 2.13 | 2.165  | 2.4    | 2.52   | 2.8    | 3.14   | 3.48 | 0.22  | 0.02813            |
|                              |         | Central Park New       | 2.1  | 2.175  | 2.525  | 2.8    | 3.225  | 4.025  | 4.1  | 0.4   | 0.07571            |
|                              |         | Mt Richmond            | 1.3  | 1.3    | 1.4    | 1.61   | 1.695  | 1.86   | 2.4  | 0.18  | -0.0533            |
|                              |         | Puhinui                | 0.33 | 0.4015 | 0.46   | 0.5    | 0.5425 | 0.595  | 0.66 | 0.045 | -0.019             |
|                              |         | Tiwai Rd               | 2.2  | 2.594  | 3.94   | 4.4    | 5.26   | 6.864  | 7.01 | 0.72  | <b>-0.1861</b>     |
|                              |         | Watson Ave             | 4.8  | 4.9    | 5.2    | 5.5    | 5.93   | 6.608  | 7.2  | 0.4   | <b>-0.1129</b>     |
|                              | South   | BP Bombay              | 1.9  | 2      | 2.095  | 2.18   | 2.25   | 2.318  | 2.37 | 0.08  | -0.0024            |
|                              |         | Fielding Rd Sand       | 5.5  | 5.585  | 5.7175 | 5.92   | 6.145  | 6.429  | 6.65 | 0.22  | <b>-0.0995</b>     |
|                              |         | Fielding Rd Volcanic   | 3.3  | 3.3    | 3.5    | 3.665  | 3.855  | 3.9545 | 4.22 | 0.175 | -0.0149            |
|                              |         | Gun Club Rd            | 1.6  | 1.62   | 1.7    | 1.8    | 1.8    | 1.88   | 1.9  | 0.1   | -0.2087            |
|                              |         | Hickey spring          | 1.6  | 1.6    | 1.6    | 1.6    | 1.6    | 1.6    | 1.6  | 0     | ND                 |
|                              |         | Hillview spring        | 1.5  | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5  | 0     | 0                  |
|                              |         | Ostrich Farm No1       | 2.8  | 2.9    | 3.2    | 3.3    | 3.445  | 3.6    | 3.6  | 0.115 | <b>-0.0223</b>     |
|                              |         | Ostrich Farm No2       | 3.3  | 3.385  | 3.675  | 3.8    | 3.9375 | 4.0665 | 4.33 | 0.145 | <b>-0.0317</b>     |
|                              |         | Patumahoe spring       | 1.8  | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8  | 0     | ND                 |
|                              |         | Rifle Range Rd Deep    | 3.8  | 3.995  | 4.3    | 4.5    | 4.705  | 4.9015 | 5.3  | 0.2   | <b>-0.0401</b>     |
|                              |         | Rifle Range Rd Shallow | 0.83 | 0.8555 | 0.9175 | 0.965  | 1      | 1.019  | 1.1  | 0.035 | <b>-0.0045</b>     |
|                              |         | Seagrove Rd Main       | 3.6  | 3.69   | 4      | 4.2    | 4.5    | 4.719  | 5    | 0.2   | -0.0222            |
| Soluble silica (SiO2) (mg/L) | NE      | Chenery/Whangaparaoa   | 21   | 21     | 22.5   | 23     | 24     | 24.95  | 25   | 1     | -0.3951            |
|                              |         | Quintals Rd            | 78.6 | 78.88  | 80.1   | 81     | 82.55  | 83.74  | 84.3 | 1.4   | 0.17994            |
|                              |         | Waiwera Enterpr.       | 30   | 30.2   | 31.95  | 32.8   | 33.2   | 33.8   | 33.9 | 0.8   | -0.0803            |
|                              | NW      | Parakai Aquatic Park   | 68   | 68.42  | 69.7   | 70.3   | 71.25  | 72.52  | 73   | 0.9   | 0.32181            |
|                              |         | Rimmer Rd              | 46   | 46     | 47     | 47.8   | 48.825 | 49.45  | 50   | 0.9   | 0.33387            |
|                              |         | Waitakere Rd           | 58.6 | 58.9   | 60     | 61     | 62     | 64     | 65   | 1     | 0.35809            |
|                              |         | Waitakere Rd No2       | 22.9 | 23.04  | 23.45  | 23.75  | 24.075 | 24.56  | 24.7 | 0.35  | -0.0597            |
|                              | Central | Amelia Earhart Ave     | 76.4 | 77     | 79     | 80     | 81     | 82     | 83   | 1     | -0.1683            |
|                              |         | Bullens Rd             | 54.7 | 56.195 | 59.8   | 65.5   | 66.825 | 69.315 | 69.9 | 1.6   | 1.00214            |
|                              |         | Burnside Rd            | 31   | 31     | 31.2   | 32     | 32.4   | 33     | 34   | 0.4   | -0.0345            |
|                              |         | Central Park           | 16   | 16.175 | 17.025 | 18.5   | 19.825 | 21     | 21.3 | 1.5   | -0.1989            |
|                              |         | Central Park New       | 16   | 16.2   | 17     | 17     | 17     | 17     | 17   | 0     | 0.16587            |
|                              |         | Mt Richmond            | 15   | 15.85  | 16.325 | 17.3   | 18.175 | 19     | 19   | 0.95  | 0.05005            |
|                              |         | Puhinui                | 16   | 16.54  | 17     | 17.4   | 17.9   | 18.04  | 18.1 | 0.5   | -0.1749            |
|                              |         | Tiwai Rd               | 20.9 | 21.675 | 24.75  | 26.9   | 28.775 | 30.195 | 32.2 | 2     | -0.1003            |
|                              |         | Watson Ave             | 20   | 22     | 23     | 23.85  | 25     | 26.27  | 27.7 | 1.05  | <b>-0.2989</b>     |
|                              | South   | BP Bombay              | 40.4 | 41.35  | 43.975 | 45.6   | 47     | 47.825 | 49.5 | 1.4   | -0.0954            |
|                              |         | Fielding Rd Sand       | 61.8 | 61.91  | 63     | 64     | 65.05  | 67.01  | 69.1 | 1.1   | 0.21549            |
|                              |         | Fielding Rd Volcanic   | 38.3 | 38.425 | 39.9   | 41     | 42     | 43.525 | 44   | 1.1   | 0.33085            |
|                              |         | Gun Club Rd            | 32   | 32.2   | 33     | 33     | 36     | 36.8   | 37   | 1     | -4.1743            |
|                              |         | Hickey spring          | 31   | 31     | 31     | 33     | 34     | 34     | 34   | 1     | 3.08662            |
|                              |         | Hillview spring        | 35   | 35.4   | 37     | 39     | 41     | 45     | 46   | 2     | -5.2179            |
|                              |         | Ostrich Farm No1       | 47   | 47.135 | 47.6   | 47.8   | 48.125 | 48.685 | 49   | 0.3   | -0.102             |
|                              |         | Ostrich Farm No2       | 66   | 66.55  | 67.675 | 67.9   | 68.3   | 69.18  | 69.4 | 0.3   | -0.139             |
|                              |         | Patumahoe spring       | 32   | 32     | 32     | 32     | 32     | 32     | 32   | 0     | ND                 |
|                              |         | Rifle Range Rd Deep    | 33   | 33.7   | 34.25  | 34.7   | 35.875 | 36.475 | 37   | 0.8   | 0.1368             |
|                              |         | Rifle Range Rd Shallow | 48.5 | 48.6   | 49.4   | 50.2   | 51     | 52.55  | 53   | 0.8   | <b>0.3044</b>      |
|                              |         | Seagrove Rd Main       | 10.8 | 10.88  | 11     | 11.1   | 11.3   | 11.36  | 11.4 | 0.1   | -0.0981            |

|                       |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|-----------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Soluble sodium (mg/L) | NE      | Chenery/Whangaparaoa   | 73     | 74.75  | 78     | 81     | 86.75  | 90.2   | 93     | 5      | -0.3866            |
|                       |         | Quintals Rd            | 23     | 23.8   | 26     | 27     | 28.5   | 29.16  | 31     | 1.5    | -0.3823            |
|                       |         | Waiwera Enterpr.       | 660    | 669    | 682.5  | 694.5  | 700    | 711.1  | 712    | 10     | 0.13377            |
|                       | NW      | Parakai Aquatic Park   | 570    | 575.5  | 596    | 615    | 637.75 | 643.6  | 648    | 23.5   | -4.9807            |
|                       |         | Rimmer Rd              | 74     | 75.6   | 80     | 81.7   | 84.8   | 87.02  | 87.1   | 1.8    | -0.3561            |
|                       |         | Waitakere Rd           | 20     | 20     | 21     | 22     | 22.45  | 24     | 25.6   | 1      | <b>-0.1679</b>     |
|                       |         | Waitakere Rd No2       | 32     | 33.05  | 35     | 36     | 37     | 39     | 40     | 1      | -0.0409            |
|                       | Central | Amelia Earhart Ave     | 38     | 38.945 | 40     | 40.85  | 43     | 45.5   | 46.3   | 1.8    | <b>-0.58</b>       |
|                       |         | Bullens Rd             | 28.7   | 28.78  | 30.6   | 37     | 45     | 53.5   | 56.7   | 6.8    | 1.38719            |
|                       |         | Burnside Rd            | 23     | 23.2   | 24     | 25     | 25.95  | 26.65  | 27.6   | 1      | -0.0753            |
|                       |         | Central Park           | 14     | 14.1   | 16.35  | 18     | 19.95  | 22.9   | 24     | 1.9    | 0.01726            |
|                       |         | Central Park New       | 14     | 14.7   | 17.5   | 19     | 21     | 23     | 23     | 2      | 0                  |
|                       |         | Mt Richmond            | 8.42   | 9.212  | 11     | 12     | 12.9   | 13.94  | 14.3   | 1      | 0                  |
|                       |         | Puhinui                | 77.8   | 79.12  | 83.8   | 88.2   | 89.1   | 90.1   | 90.4   | 1.7    | -0.7437            |
|                       |         | Tiwai Rd               | 8.9    | 9.7425 | 16     | 19.75  | 23.25  | 26.975 | 29     | 3.75   | -0.7832            |
|                       |         | Watson Ave             | 19     | 19     | 21     | 22     | 23.2   | 24.49  | 25     | 1.15   | -0.1665            |
|                       | South   | BP Bombay              | 15.7   | 16     | 16.15  | 17     | 17.3   | 18.18  | 18.6   | 0.4    | 0                  |
|                       |         | Fielding Rd Sand       | 35.7   | 35.94  | 39     | 40     | 41.3   | 42.2   | 44.2   | 1.3    | -0.3345            |
|                       |         | Fielding Rd Volcanic   | 22.1   | 23.73  | 24.9   | 25.95  | 26.9   | 27.615 | 29     | 0.95   | -0.2009            |
|                       |         | Gun Club Rd            | 23     | 23     | 23     | 24     | 24     | 26.4   | 27     | 1      | 3.13071            |
|                       |         | Hickey spring          | 18     | 18.2   | 19     | 20     | 20     | 22.4   | 23     | 1      | 0                  |
|                       |         | Hillview spring        | 16     | 16     | 16     | 17     | 17     | 17.7   | 18     | 1      | -1.0034            |
|                       |         | Ostrich Farm No1       | 18.8   | 20.05  | 21     | 21     | 22     | 23     | 24     | 1      | 0                  |
|                       |         | Ostrich Farm No2       | 18     | 18     | 19     | 19.6   | 20     | 20.6   | 21     | 0.6    | -0.1591            |
|                       |         | Patumahoe spring       | 22     | 22     | 22     | 23     | 23     | 23.8   | 24     | 1      | -1.0436            |
|                       |         | Rifle Range Rd Deep    | 23     | 24.035 | 25.725 | 26     | 27     | 28.29  | 30     | 1      | -0.0733            |
|                       |         | Rifle Range Rd Shallow | 14.4   | 15     | 15.7   | 16.2   | 17     | 18     | 19     | 0.7    | <b>0.17452</b>     |
|                       |         | Seagrove Rd Main       | 83     | 86.95  | 90     | 92.5   | 96     | 101    | 102    | 2.5    | <b>-0.4358</b>     |
| Soluble zinc (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.001  | 0.001  | 0.002  | 0.0024 | 0.0039 | 0.0052 | 0.006  | 0.0013 | -0.0002            |
|                       |         | Quintals Rd            | 0.001  | 0.001  | 0.0011 | 0.0022 | 0.003  | 0.0052 | 0.006  | 0.0011 | -0.0001            |
|                       |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.002  | 0.002  | 0.0027 | 0.003  | 0.0005 | -0.0003            |
|                       | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.001  | 0.0018 | 0.0021 | 0.0034 | 0.004  | 0.0006 | <b>-0.0003</b>     |
|                       |         | Rimmer Rd              | 0.001  | 0.001  | 0.0017 | 0.0026 | 0.0032 | 0.0052 | 0.006  | 0.001  | -0.0003            |
|                       |         | Waitakere Rd           | 0.001  | 0.0011 | 0.0029 | 0.0034 | 0.005  | 0.0057 | 0.006  | 0.0016 | <b>-0.0004</b>     |
|                       |         | Waitakere Rd No2       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       | Central | Amelia Earhart Ave     | 0.001  | 0.001  | 0.001  | 0.0015 | 0.002  | 0.002  | 0.002  | 0.0005 | -5E-05             |
|                       |         | Bullens Rd             | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Burnside Rd            | 0.001  | 0.001  | 0.0014 | 0.0044 | 0.0098 | 0.011  | 0.011  | 0.0034 | 0.00013            |
|                       |         | Central Park           | 0.008  | 0.0085 | 0.01   | 0.015  | 0.02   | 0.0266 | 0.032  | 0.005  | -0.0018            |
|                       |         | Central Park New       | 0.0092 | 0.0097 | 0.012  | 0.014  | 0.016  | 0.0188 | 0.02   | 0.002  | -9E-05             |
|                       |         | Mt Richmond            | 0.011  | 0.011  | 0.0115 | 0.031  | 0.036  | 0.0569 | 0.065  | 0.019  | 0.00223            |
|                       |         | Puhinui                | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Tiwai Rd               | 0.001  | 0.001  | 0.0015 | 0.0045 | 0.0055 | 0.0109 | 0.013  | 0.0025 | -3E-05             |
|                       |         | Watson Ave             | 0.001  | 0.001  | 0.002  | 0.004  | 0.0073 | 0.0112 | 0.016  | 0.002  | <b>0.00075</b>     |
|                       | South   | BP Bombay              | 0.0018 | 0.0023 | 0.0059 | 0.0105 | 0.0223 | 0.0273 | 0.034  | 0.0084 | <b>-0.0033</b>     |
|                       |         | Fielding Rd Sand       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Fielding Rd Volcanic   | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Gun Club Rd            | 0.01   | 0.0134 | 0.027  | 0.031  | 0.043  | 0.059  | 0.063  | 0.012  | -0.0344            |
|                       |         | Hickey spring          | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Hillview spring        | 0.0046 | 0.0047 | 0.0049 | 0.0069 | 0.0142 | 0.0175 | 0.018  | 0.0022 | -0.0077            |
|                       |         | Ostrich Farm No1       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                       |         | Ostrich Farm No2       | 0.001  | 0.001  | 0.0011 | 0.002  | 0.0026 | 0.0037 | 0.004  | 0.001  | <b>-0.0004</b>     |
|                       |         | Patumahoe spring       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | ND                 |
|                       |         | Rifle Range Rd Deep    | 0.001  | 0.001  | 0.0013 | 0.002  | 0.003  | 0.0052 | 0.006  | 0.001  | -0.0002            |
|                       |         | Rifle Range Rd Shallow | 0.001  | 0.001  | 0.001  | 0.002  | 0.0026 | 0.0052 | 0.0057 | 0.001  | -1E-04             |
|                       |         | Seagrove Rd Main       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |

|                 |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max  | MAD   | Trend<br>(units/y) |
|-----------------|---------|------------------------|-------|--------|--------|--------|--------|--------|------|-------|--------------------|
| Sulphate (mg/L) | NE      | Chenery/Whangaparaoa   | 0.12  | 0.155  | 0.4225 | 0.5    | 0.6875 | 0.87   | 0.94 | 0.175 | 0.00478            |
|                 |         | Quintals Rd            | 5.51  | 5.633  | 6.525  | 6.9    | 7.215  | 7.665  | 8    | 0.335 | <b>0.06844</b>     |
|                 |         | Waiwera Enterpr.       | 1.2   | 1.675  | 2.1375 | 2.845  | 3.725  | 4.85   | 5.8  | 0.75  | 0.04411            |
|                 | NW      | Parakai Aquatic Park   | 2.6   | 2.771  | 3      | 3.33   | 3.9    | 4.71   | 4.8  | 0.53  | 0                  |
|                 |         | Rimmer Rd              | 0.37  | 0.5945 | 0.97   | 1.175  | 1.575  | 1.965  | 2.26 | 0.325 | <b>0.09125</b>     |
|                 |         | Waitakere Rd           | 0.02  | 0.02   | 0.05   | 0.055  | 0.1    | 0.1305 | 0.42 | 0.035 | 0.00178            |
|                 |         | Waitakere Rd No2       | 0.01  | 0.02   | 0.03   | 0.05   | 0.1    | 0.1    | 0.1  | 0.03  | 0                  |
|                 | Central | Amelia Earhart Ave     | 0.5   | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.6  | 0     | 0                  |
|                 |         | Bullens Rd             | 0.06  | 0.064  | 0.34   | 0.5    | 0.68   | 1.1    | 1.3  | 0.18  | <b>0.02622</b>     |
|                 |         | Burnside Rd            | 15.3  | 16.6   | 18.3   | 20     | 21.9   | 22.4   | 23   | 1.9   | 0.22703            |
|                 |         | Central Park           | 14.3  | 16     | 20.85  | 23.5   | 28.1   | 31.72  | 34.7 | 3.7   | -0.1251            |
|                 |         | Central Park New       | 15    | 17.8   | 20.45  | 22     | 24.05  | 26.15  | 26.5 | 1.8   | -0.4896            |
|                 |         | Mt Richmond            | 7.1   | 7.34   | 8.77   | 10.4   | 12     | 14.6   | 16   | 1.63  | <b>0.48604</b>     |
|                 |         | Puhinui                | 2.16  | 2.606  | 2.9    | 2.91   | 3.2    | 3.39   | 3.5  | 0.21  | <b>0.04379</b>     |
|                 |         | Tiwai Rd               | 3.2   | 3.9965 | 6.1675 | 9.44   | 11.85  | 14.195 | 18   | 2.6   | -0.005             |
|                 |         | Watson Ave             | 11.5  | 12.19  | 13.85  | 14.9   | 15.6   | 16.81  | 18.4 | 1     | -0.0698            |
|                 |         | BP Bombay              | 1.51  | 1.619  | 2.1    | 2.3    | 2.4    | 2.71   | 2.9  | 0.2   | <b>0.02502</b>     |
|                 | South   | Fielding Rd Sand       | 0.02  | 0.02   | 0.02   | 0.18   | 0.5    | 0.5    | 0.5  | 0.16  | 0                  |
|                 |         | Fielding Rd Volcanic   | 2.5   | 2.574  | 3.1    | 3.3    | 3.4    | 3.7    | 3.8  | 0.2   | 0.01981            |
|                 |         | Gun Club Rd            | 3.1   | 3.1    | 3.1    | 3.1    | 3.1    | 3.1    | 3.1  | 0     | ND                 |
|                 |         | Hickey spring          | 3.6   | 3.6    | 3.6    | 3.6    | 3.6    | 3.6    | 3.6  | 0     | 0                  |
|                 |         | Hillview spring        | 2.34  | 2.396  | 2.5    | 2.65   | 2.945  | 3.265  | 3.3  | 0.18  | -0.1806            |
|                 |         | Ostrich Farm No1       | 0.072 | 0.0894 | 0.1    | 0.11   | 0.14   | 0.1765 | 0.19 | 0.018 | 0.0005             |
|                 |         | Ostrich Farm No2       | 0.02  | 0.047  | 0.2125 | 0.5    | 0.6775 | 0.986  | 1.07 | 0.275 | <b>-0.0586</b>     |
|                 |         | Patumahoe spring       | 3.1   | 3.1    | 3.1    | 3.1    | 3.1    | 3.1    | 3.1  | 0     | ND                 |
|                 |         | Rifle Range Rd Deep    | 0.02  | 0.3075 | 0.5425 | 0.69   | 0.8    | 1.1325 | 1.3  | 0.125 | 0.01831            |
|                 |         | Rifle Range Rd Shallow | 1.7   | 1.776  | 1.96   | 2.4    | 2.62   | 2.8    | 3.3  | 0.3   | <b>-0.0562</b>     |
|                 |         | Seagrove Rd Main       | 0.8   | 1      | 1.3    | 1.6    | 2.2    | 2.6    | 3.1  | 0.43  | <b>0.06644</b>     |
| Sulphide (mg/L) | NE      | Chenery/Whangaparaoa   | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Quintals Rd            | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Waiwera Enterpr.       | 1.4   | 1.4    | 1.4    | 1.4    | 1.4    | 1.4    | 1.4  | ND    | ND                 |
|                 | NW      | Parakai Aquatic Park   | 1.5   | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5  | ND    | ND                 |
|                 |         | Rimmer Rd              | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Waitakere Rd           | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Waitakere Rd No2       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 | Central | Amelia Earhart Ave     | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Bullens Rd             | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Burnside Rd            | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Central Park           | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Central Park New       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Mt Richmond            | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Puhinui                | 0.5   | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5  | ND    | ND                 |
|                 |         | Tiwai Rd               | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Watson Ave             | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 | South   | BP Bombay              | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Fielding Rd Sand       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Fielding Rd Volcanic   | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Gun Club Rd            | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Hickey spring          | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Hillview spring        | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Ostrich Farm No1       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Ostrich Farm No2       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |
|                 |         | Patumahoe spring       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | 0     | ND                 |
|                 |         | Rifle Range Rd Deep    | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Rifle Range Rd Shallow | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                 |         | Seagrove Rd Main       | 0.1   | 0.1    | 0.1    | 0.1    | 0.1    | 0.1    | 0.1  | ND    | ND                 |

|                               |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD   | Trend<br>(units/y) |
|-------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|-------|--------------------|
| Temperature                   | NE      | Chenery/Whangaparaoa   | 17.6   | 17.764 | 19     | 20.1   | 21.43  | 22.432 | 22.6   | 1.3   | -0.1306            |
|                               |         | Quintals Rd            | 17.6   | 17.646 | 17.71  | 17.8   | 17.935 | 18.17  | 18.2   | 0.1   | 0                  |
|                               |         | Waiwera Enterpr.       | 48.27  | 49.568 | 51.375 | 52     | 53.25  | 53.75  | 54.5   | 1.1   | 0.06241            |
|                               | NW      | Parakai Aquatic Park   | 58.4   | 59.44  | 62.425 | 63.25  | 64.375 | 64.87  | 65     | 1.05  | 0.07691            |
|                               |         | Rimmer Rd              | 17.1   | 17.128 | 17.208 | 17.3   | 17.4   | 17.5   | 17.6   | 0.1   | -0.0013            |
|                               |         | Waitakere Rd           | 16.31  | 16.697 | 16.9   | 17.17  | 17.575 | 18.034 | 18.4   | 0.325 | <b>-0.0415</b>     |
|                               |         | Waitakere Rd No2       | 18.4   | 18.5   | 18.7   | 18.8   | 18.9   | 19.106 | 19.2   | 0.1   | -0.0122            |
|                               | Central | Amelia Earhart Ave     | 17.1   | 17.2   | 17.36  | 17.5   | 17.8   | 18.1   | 18.25  | 0.2   | <b>-0.0226</b>     |
|                               |         | Bullens Rd             | 17.3   | 17.6   | 17.8   | 18.065 | 18.278 | 18.491 | 18.6   | 0.235 | -0.005             |
|                               |         | Burnside Rd            | 15.8   | 15.996 | 16.163 | 16.3   | 16.4   | 16.615 | 16.7   | 0.12  | 0.01339            |
|                               |         | Central Park           | 17.3   | 17.371 | 17.493 | 17.59  | 17.7   | 17.795 | 17.9   | 0.11  | -0.0016            |
|                               |         | Central Park New       | 17.38  | 17.408 | 17.51  | 17.7   | 17.82  | 18.056 | 18.14  | 0.19  | <b>0.14038</b>     |
|                               |         | Mt Richmond            | 12.34  | 12.5   | 15.35  | 17.5   | 20.328 | 21.525 | 23.3   | 2.855 | -0.0258            |
|                               |         | Puhinui                | 15.5   | 16.01  | 16.35  | 16.7   | 16.9   | 17.75  | 17.9   | 0.3   | -0.0449            |
|                               |         | Tiwai Rd               | 15     | 15.554 | 16.2   | 16.6   | 17.1   | 17.775 | 18.2   | 0.5   | <b>-0.0559</b>     |
|                               |         | Watson Ave             | 17.1   | 17.2   | 17.4   | 17.5   | 17.6   | 17.8   | 17.9   | 0.1   | 0.00787            |
|                               | South   | BP Bombay              | 14.1   | 14.3   | 14.4   | 14.51  | 14.7   | 15     | 15.03  | 0.11  | -0.01              |
|                               |         | Fielding Rd Sand       | 17.3   | 17.3   | 17.4   | 17.5   | 17.6   | 17.78  | 17.8   | 0.1   | -0.005             |
|                               |         | Fielding Rd Volcanic   | 16.5   | 16.64  | 16.9   | 17     | 17.18  | 17.452 | 17.5   | 0.1   | 0                  |
|                               |         | Gun Club Rd            | 15.2   | 15.238 | 15.3   | 15.385 | 15.505 | 15.71  | 15.8   | 0.115 | 0                  |
|                               |         | Hickey spring          | 15     | 15     | 15.5   | 15.6   | 15.9   | 16.3   | 16.4   | 0.2   | 0                  |
|                               |         | Hillview spring        | 15.12  | 15.134 | 15.205 | 15.245 | 15.325 | 15.433 | 15.45  | 0.07  | -0.0052            |
|                               |         | Ostrich Farm No1       | 17.4   | 17.425 | 17.5   | 17.55  | 17.6   | 17.7   | 17.7   | 0.05  | 0                  |
|                               |         | Ostrich Farm No2       | 16.94  | 17     | 17.06  | 17.2   | 17.39  | 17.675 | 17.86  | 0.18  | <b>-0.032</b>      |
|                               |         | Patumahoe spring       | 14.9   | 15     | 15     | 15.1   | 15.2   | 15.5   | 15.5   | 0.1   | 0                  |
|                               |         | Rifle Range Rd Deep    | 14.3   | 14.4   | 14.5   | 14.57  | 14.66  | 14.8   | 15     | 0.07  | 0                  |
|                               |         | Rifle Range Rd Shallow | 15     | 15.085 | 15.178 | 15.315 | 15.683 | 16.062 | 16.46  | 0.215 | <b>0.0301</b>      |
|                               |         | Seagrove Rd Main       | 17.6   | 17.897 | 18.015 | 18.1   | 18.3   | 18.5   | 18.6   | 0.1   | <b>-0.0199</b>     |
| Total Alkalinity CaCO3 (mg/L) | NE      | Chenery/Whangaparaoa   | 107    | 111.46 | 114.8  | 136.22 | 140    | 148.7  | 150    | 9.78  | -0.0686            |
|                               |         | Quintals Rd            | 185.1  | 188.05 | 189    | 190    | 191.25 | 193.31 | 194.98 | 1     | 0                  |
|                               |         | Waiwera Enterpr.       | 29.25  | 29.925 | 31     | 32     | 35     | 39     | 39     | 1.7   | 0                  |
|                               | NW      | Parakai Aquatic Park   | 49.6   | 49.6   | 51.325 | 53.25  | 54.6   | 57.15  | 58     | 1.65  | -0.0208            |
|                               |         | Rimmer Rd              | 79     | 80.41  | 84.45  | 88.5   | 90.83  | 95.65  | 97     | 3     | 0                  |
|                               |         | Waitakere Rd           | 98.36  | 99.818 | 107    | 109.5  | 112.25 | 120    | 120    | 2.5   | 0.05856            |
|                               |         | Waitakere Rd No2       | 270    | 276.89 | 280.25 | 285.05 | 290    | 300    | 300    | 4.95  | 0.16523            |
|                               | Central | Amelia Earhart Ave     | 253    | 255.29 | 260.3  | 269    | 272.15 | 281    | 286.38 | 7     | -0.1021            |
|                               |         | Bullens Rd             | 195    | 200    | 210    | 220    | 225    | 230    | 231    | 7.5   | 0                  |
|                               |         | Burnside Rd            | 217.24 | 223.48 | 237    | 242.1  | 250    | 258.81 | 260    | 7.1   | -0.4883            |
|                               |         | Central Park           | 33     | 35.25  | 41.15  | 46.4   | 50.1   | 54.21  | 60     | 5     | 0.02521            |
|                               |         | Central Park New       | 36     | 38.1   | 45.54  | 47.25  | 50.125 | 54.2   | 57     | 2     | 1.36927            |
|                               |         | Mt Richmond            | 16.1   | 16.78  | 22     | 24     | 26.7   | 31.2   | 33     | 2.7   | <b>0.68206</b>     |
|                               |         | Puhinui                | 140.03 | 140.76 | 144.5  | 148    | 149.4  | 151.1  | 153    | 2     | -0.1618            |
|                               |         | Tiwai Rd               | 22.8   | 35.055 | 54.375 | 70.355 | 85.175 | 96.95  | 101    | 15.85 | -0.3017            |
|                               |         | Watson Ave             | 43     | 43.848 | 46     | 47     | 49     | 52     | 53.3   | 1.3   | <b>-0.2239</b>     |
|                               | South   | BP Bombay              | 58.6   | 59.848 | 63     | 64     | 66     | 68     | 69     | 1.7   | -0.1001            |
|                               |         | Fielding Rd Sand       | 142    | 150.75 | 156.75 | 163    | 170    | 173    | 180    | 7     | <b>-1.3705</b>     |
|                               |         | Fielding Rd Volcanic   | 125.67 | 127.22 | 134    | 137    | 141    | 146.9  | 149    | 3.5   | <b>-0.74</b>       |
|                               |         | Gun Club Rd            | 29     | 29.2   | 30     | 30     | 31     | 33.4   | 34     | 1     | 2.08714            |
|                               |         | Hickey spring          | 32     | 32.2   | 33     | 34     | 34     | 34     | 34     | 0     | -1.0289            |
|                               |         | Hillview spring        | 40     | 41.8   | 46.5   | 47.77  | 48.5   | 51.8   | 53     | 1.23  | 0.61711            |
|                               |         | Ostrich Farm No1       | 117    | 121.75 | 126.75 | 128    | 130.78 | 132.15 | 135    | 2.65  | -0.4683            |
|                               |         | Ostrich Farm No2       | 112    | 113.33 | 115.25 | 118    | 120.75 | 127.25 | 130    | 3     | -0.0516            |
|                               |         | Patumahoe spring       | 29     | 29     | 29     | 30     | 30     | 30.8   | 31     | 1     | 1.04357            |
|                               |         | Rifle Range Rd Deep    | 91.2   | 97.15  | 100.73 | 104.5  | 108    | 110    | 113    | 3.515 | -0.3092            |
|                               |         | Rifle Range Rd Shallow | 42     | 43     | 44     | 45     | 46     | 47     | 48.1   | 1     | -0.0337            |
|                               |         | Seagrove Rd Main       | 154.66 | 158.09 | 162.5  | 168    | 171.9  | 172.95 | 178    | 4     | <b>-0.8723</b>     |

|                        |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Total aluminium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.047  | 0.0653 | 0.14   | 0.225  | 0.25   | 0.385  | 0.43   | 0.065  | 0.06451            |
|                        |         | Quintals Rd            | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Waiwera Enterpr.       | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0      | 0                  |
|                        | NW      | Parakai Aquatic Park   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0      | 0                  |
|                        |         | Rimmer Rd              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Waitakere Rd           | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Waitakere Rd No2       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        | Central | Amelia Earhart Ave     | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Bullens Rd             | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Burnside Rd            | 0.005  | 0.005  | 0.005  | 0.0275 | 0.05   | 0.05   | 0.05   | 0.0225 | 0                  |
|                        |         | Central Park           | 0.032  | 0.0389 | 0.0665 | 0.101  | 0.1355 | 0.1631 | 0.17   | 0.069  | 0.13809            |
|                        |         | Central Park New       | 0.039  | 0.0394 | 0.041  | 0.043  | 0.046  | 0.0564 | 0.059  | 0.003  | 0.00406            |
|                        |         | Mt Richmond            | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Puhinui                | 0.018  | 0.0182 | 0.0188 | 0.0215 | 0.0245 | 0.0257 | 0.026  | 0.003  | 0.00233            |
|                        |         | Tiwai Rd               | 1.8    | 1.85   | 2.2    | 3.2    | 4.05   | 7.5    | 8.6    | 1.1    | 0.78654            |
|                        |         | Watson Ave             | 0.03   | 0.0366 | 0.0565 | 0.067  | 0.0735 | 0.0833 | 0.086  | 0.01   | 0.00817            |
|                        | South   | BP Bombay              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Fielding Rd Sand       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Fielding Rd Volcanic   | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Gun Club Rd            | 0.005  | 0.005  | 0.005  | 0.005  | 0.0052 | 0.0054 | 0.0054 | 0      | ND                 |
|                        |         | Hickey spring          | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Hillview spring        | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Ostrich Farm No1       | 0.0068 | 0.0068 | 0.007  | 0.0072 | 0.0073 | 0.0075 | 0.0075 | 0.0004 | -0.0003            |
|                        |         | Ostrich Farm No2       | 0.005  | 0.005  | 0.005  | 0.005  | 0.0057 | 0.0063 | 0.0064 | 0      | -0.0005            |
|                        |         | Patumahoe spring       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                        |         | Rifle Range Rd Deep    | 0.0071 | 0.0072 | 0.0078 | 0.0084 | 0.0086 | 0.0088 | 0.0088 | 0.0004 | 0.00133            |
| Total arsenic (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Quintals Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Waiwera Enterpr.       | 0.0002 | 0.0003 | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0      | 0                  |
|                        | NW      | Parakai Aquatic Park   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0007 | 0.0007 | 0      | -3E-05             |
|                        |         | Rimmer Rd              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Waitakere Rd           | 0.003  | 0.0031 | 0.004  | 0.0056 | 0.006  | 0.0092 | 0.0124 | 0.001  | -0.0003            |
|                        |         | Waitakere Rd No2       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        | Central | Amelia Earhart Ave     | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Bullens Rd             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Burnside Rd            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Central Park           | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Central Park New       | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 9E-05  | -0.0002            |
|                        |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Tiwai Rd               | 0.0005 | 0.0006 | 0.0012 | 0.0029 | 0.0055 | 0.009  | 0.011  | 0.002  | -7E-05             |
|                        |         | Watson Ave             | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Fielding Rd Sand       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Fielding Rd Volcanic   | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Gun Club Rd            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                        |         | Hickey spring          | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                        |         | Hillview spring        | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                        |         | Ostrich Farm No1       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Ostrich Farm No2       | 0.0006 | 0.0006 | 0.0013 | 0.0024 | 0.0032 | 0.0046 | 0.0062 | 0.0011 | -1E-04             |
|                        |         | Patumahoe spring       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0                  |
|                        |         | Rifle Range Rd Deep    | 0.0002 | 0.0002 | 0.0005 | 0.0007 | 0.0009 | 0.0014 | 0.0014 | 0.0002 | -9E-05             |
|                        |         | Rifle Range Rd Shallow | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Seagrove Rd Main       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |

|                      |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD    | Trend<br>(units/y) |
|----------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|-------|--------|--------------------|
| Total boron (mg/L)   | NE      | Chenery/Whangaparaoa   | 0.78   | 0.852  | 0.972  | 1.11   | 1.35   | 1.516  | 1.57  | 0.18   | -0.0154            |
|                      |         | Quintals Rd            | 0.016  | 0.0178 | 0.02   | 0.02   | 0.021  | 0.023  | 0.023 | 0.001  | 0                  |
|                      |         | Waiwera Enterpr.       | 8.5    | 8.633  | 9.095  | 9.51   | 9.775  | 10.39  | 10.6  | 0.41   | 0.01614            |
|                      | NW      | Parakai Aquatic Park   | 12.4   | 12.478 | 13.1   | 13.7   | 14     | 14.6   | 15.5  | 0.3    | 0.04348            |
|                      |         | Rimmer Rd              | 0.038  | 0.038  | 0.04   | 0.04   | 0.049  | 0.05   | 0.05  | 0.002  | -0.0002            |
|                      |         | Waitakere Rd           | 0.012  | 0.0143 | 0.0183 | 0.0195 | 0.02   | 0.0211 | 0.022 | 0.0005 | -0.0008            |
|                      |         | Waitakere Rd No2       | 0.01   | 0.01   | 0.015  | 0.016  | 0.0195 | 0.02   | 0.02  | 0.003  | 0                  |
|                      | Central | Amelia Earhart Ave     | 0.057  | 0.0575 | 0.059  | 0.06   | 0.0608 | 0.0627 | 0.064 | 0.001  | -0.0002            |
|                      |         | Bullens Rd             | 0.11   | 0.1325 | 0.2123 | 0.285  | 0.4125 | 0.5275 | 0.64  | 0.095  | -0.0115            |
|                      |         | Burnside Rd            | 0.04   | 0.0459 | 0.05   | 0.057  | 0.0608 | 0.0657 | 0.067 | 0.007  | 0.00017            |
|                      |         | Central Park           | 0.05   | 0.0543 | 0.0723 | 0.08   | 0.09   | 0.0915 | 0.1   | 0.01   | -0.0001            |
|                      |         | Central Park New       | 0.054  | 0.0573 | 0.0655 | 0.067  | 0.073  | 0.0786 | 0.081 | 0.006  | -0.0005            |
|                      |         | Mt Richmond            | 0.01   | 0.01   | 0.01   | 0.03   | 0.0465 | 0.0553 | 0.056 | 0.02   | 0.00071            |
|                      |         | Puhinui                | 0.34   | 0.34   | 0.36   | 0.38   | 0.3908 | 0.4    | 0.4   | 0.02   | -0.0016            |
|                      |         | Tiwai Rd               | 0.01   | 0.01   | 0.02   | 0.02   | 0.0275 | 0.035  | 0.04  | 0.006  | 0                  |
|                      |         | Watson Ave             | 0.045  | 0.0547 | 0.06   | 0.0645 | 0.07   | 0.07   | 0.076 | 0.0045 | -0.0004            |
|                      |         | BP Bombay              | 0.0097 | 0.0099 | 0.01   | 0.01   | 0.01   | 0.01   | 0.01  | 0      | 0                  |
|                      | South   | Fielding Rd Sand       | 0.04   | 0.04   | 0.044  | 0.046  | 0.048  | 0.05   | 0.05  | 0.002  | -0.0002            |
|                      |         | Fielding Rd Volcanic   | 0.01   | 0.01   | 0.011  | 0.018  | 0.02   | 0.03   | 0.04  | 0.003  | -0.0003            |
|                      |         | Gun Club Rd            | 0.013  | 0.0132 | 0.0138 | 0.0145 | 0.0155 | 0.0167 | 0.017 | 0.001  | -0.0042            |
|                      |         | Hickey spring          | 0.02   | 0.0202 | 0.0208 | 0.022  | 0.0238 | 0.0256 | 0.026 | 0.0015 | -0.0021            |
|                      |         | Hillview spring        | 0.0084 | 0.0091 | 0.0113 | 0.0125 | 0.0138 | 0.014  | 0.014 | 0.0015 | -0.0018            |
|                      |         | Ostrich Farm No1       | 0.01   | 0.01   | 0.0115 | 0.0175 | 0.0195 | 0.02   | 0.02  | 0.0025 | 0                  |
|                      |         | Ostrich Farm No2       | 0.01   | 0.01   | 0.011  | 0.017  | 0.019  | 0.02   | 0.02  | 0.003  | 0                  |
|                      |         | Patumahoe spring       | 0.013  | 0.0133 | 0.0145 | 0.015  | 0.0158 | 0.0176 | 0.018 | 0.001  | 0                  |
|                      |         | Rifle Range Rd Deep    | 0.01   | 0.01   | 0.01   | 0.012  | 0.0195 | 0.02   | 0.021 | 0.002  | 0                  |
|                      |         | Rifle Range Rd Shallow | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01   | 0.01  | 0      | 0                  |
|                      |         | Seagrove Rd Main       | 0.098  | 0.0987 | 0.1035 | 0.11   | 0.113  | 0.123  | 0.13  | 0.006  | -0.0009            |
| Total bromide (mg/L) | NE      | Chenery/Whangaparaoa   | 0.11   | 0.11   | 0.11   | 0.11   | 0.115  | 0.119  | 0.12  | 0      | ND                 |
|                      |         | Quintals Rd            | 0.1    | 0.102  | 0.11   | 0.12   | 0.13   | 0.138  | 0.14  | 0.02   | -0.0414            |
|                      |         | Waiwera Enterpr.       | 4.2    | 4.49   | 5.65   | 7.1    | 8.55   | 9.71   | 10    | 2.9    | ND                 |
|                      | NW      | Parakai Aquatic Park   | 1.2    | 1.225  | 1.325  | 1.45   | 1.575  | 1.675  | 1.7   | 0.25   | ND                 |
|                      |         | Rimmer Rd              | 0.31   | 0.314  | 0.33   | 0.35   | 0.37   | 0.386  | 0.39  | 0.04   | 0.00267            |
|                      |         | Waitakere Rd           | 0.061  | 0.0656 | 0.088  | 0.1    | 0.1    | 0.12   | 0.14  | 0.01   | 0                  |
|                      |         | Waitakere Rd No2       | 0.16   | 0.16   | 0.19   | 0.215  | 0.23   | 0.2645 | 0.29  | 0.025  | -0.0014            |
|                      | Central | Amelia Earhart Ave     | 0.12   | 0.12   | 0.12   | 0.12   | 0.12   | 0.12   | 0.12  | ND     | ND                 |
|                      |         | Bullens Rd             | 0.087  | 0.0872 | 0.0878 | 0.0885 | 0.0893 | 0.0899 | 0.09  | 0.0015 | ND                 |
|                      |         | Burnside Rd            | 0.08   | 0.08   | 0.08   | 0.08   | 0.08   | 0.08   | 0.08  | ND     | ND                 |
|                      |         | Central Park           | ND     | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                      |         | Central Park New       | 0.077  | 0.0836 | 0.11   | 0.11   | 0.12   | 0.12   | 0.12  | 0.01   | -0.0335            |
|                      |         | Mt Richmond            | 0.15   | 0.15   | 0.15   | 0.15   | 0.15   | 0.15   | 0.15  | ND     | ND                 |
|                      |         | Puhinui                | 0.089  | 0.0895 | 0.0915 | 0.094  | 0.0965 | 0.0985 | 0.099 | 0.005  | -0.0104            |
|                      |         | Tiwai Rd               | 0.05   | 0.0504 | 0.052  | 0.059  | 0.065  | 0.0706 | 0.072 | 0.007  | 0.00207            |
|                      |         | Watson Ave             | 0.076  | 0.0768 | 0.08   | 0.083  | 0.083  | 0.0918 | 0.094 | 0.003  | 0.00304            |
|                      | South   | BP Bombay              | 0.12   | 0.121  | 0.125  | 0.13   | 0.135  | 0.139  | 0.14  | 0.01   | ND                 |
|                      |         | Fielding Rd Sand       | 0.067  | 0.0674 | 0.069  | 0.071  | 0.073  | 0.0746 | 0.075 | 0.004  | -0.0082            |
|                      |         | Fielding Rd Volcanic   | 0.06   | 0.0605 | 0.0623 | 0.0645 | 0.0668 | 0.0686 | 0.069 | 0.0045 | ND                 |
|                      |         | Gun Club Rd            | 0.16   | 0.1675 | 0.1975 | 0.215  | 0.2225 | 0.2285 | 0.23  | 0.01   | 0.01044            |
|                      |         | Hickey spring          | 0.15   | 0.152  | 0.16   | 0.17   | 0.17   | 0.202  | 0.21  | 0.01   | 0.01029            |
|                      |         | Hillview spring        | 0.13   | 0.13   | 0.13   | 0.13   | 0.13   | 0.13   | 0.13  | 0      | 0                  |
|                      |         | Ostrich Farm No1       | 0.03   | 0.039  | 0.06   | 0.08   | 0.1    | 0.12   | 0.02  | 0      | 0                  |
|                      |         | Ostrich Farm No2       | 0.086  | 0.0866 | 0.0888 | 0.0915 | 0.0943 | 0.0965 | 0.097 | 0.0055 | -0.011             |
|                      |         | Patumahoe spring       | 0.19   | 0.192  | 0.2    | 0.21   | 0.22   | 0.228  | 0.23  | 0.01   | 0.02087            |
|                      |         | Rifle Range Rd Deep    | 0.03   | 0.04   | 0.069  | 0.08   | 0.1    | 0.101  | 0.15  | 0.02   | 0                  |
|                      |         | Rifle Range Rd Shallow | 0.051  | 0.063  | 0.0805 | 0.09   | 0.1    | 0.11   | 0.12  | 0.01   | 0                  |
|                      |         | Seagrove Rd Main       | 0.06   | 0.06   | 0.1    | 0.1    | 0.11   | 0.12   | 0.13  | 0.01   | 0                  |

|                       |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|-----------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Total calcium (mg/L)  | NE      | Chenery/Whangaparaoa   | 1.3    | 1.54   | 2.71   | 4.02   | 6.2    | 8.562  | 8.57   | 1.32   | -0.05              |
|                       |         | Quintals Rd            | 46     | 48.55  | 50     | 51.8   | 53.25  | 56.495 | 59.3   | 1.75   | 0                  |
|                       |         | Waiwera Enterpr.       | 39     | 39     | 41.1   | 42     | 43.9   | 45.34  | 46     | 1.9    | 0.79332            |
|                       | NW      | Parakai Aquatic Park   | 40.37  | 41.267 | 44.825 | 48.3   | 50.3   | 59.545 | 60.7   | 3.2    | 0.02371            |
|                       |         | Rimmer Rd              | 7.8    | 7.88   | 8.2    | 8.2    | 8.71   | 9.036  | 9.18   | 0.3    | 0                  |
|                       |         | Waitakere Rd           | 18     | 18.21  | 19     | 19     | 19.4   | 20.13  | 20.2   | 0.4    | -0.0154            |
|                       |         | Waitakere Rd No2       | 72     | 72.05  | 74.5   | 76     | 77.2   | 79.8   | 81.1   | 2      | <b>-0.5418</b>     |
|                       | Central | Amelia Earhart Ave     | 74     | 74.54  | 75.75  | 77     | 78.8   | 80.02  | 80.2   | 1.6    | -0.1498            |
|                       |         | Bullens Rd             | 31.9   | 31.96  | 38     | 49.6   | 53.1   | 58.04  | 61.1   | 6.4    | 0.81696            |
|                       |         | Burnside Rd            | 77     | 77.85  | 79.475 | 80     | 81.875 | 85.49  | 86     | 1.15   | -0.0882            |
|                       |         | Central Park           | 7.6    | 9.232  | 10.6   | 12     | 13     | 13.76  | 14     | 1.3    | 0.08623            |
|                       |         | Central Park New       | 9.6    | 10.09  | 11.75  | 12     | 14     | 14     | 14     | 1.5    | -0.5003            |
|                       |         | Mt Richmond            | 6.8    | 7.199  | 7.775  | 8.57   | 9.605  | 9.937  | 10     | 0.93   | 0.19276            |
|                       |         | Puhinui                | 0.99   | 0.996  | 1.02   | 1.07   | 1.1    | 1.2    | 1.2    | 0.05   | -0.0122            |
|                       |         | Tiwai Rd               | 5.2    | 5.8915 | 9.175  | 13.85  | 17.575 | 19.755 | 25.6   | 4.15   | 0.19236            |
|                       |         | Watson Ave             | 7.94   | 8.165  | 8.505  | 9      | 9.825  | 10.9   | 11.2   | 0.6    | -0.0797            |
|                       |         | BP Bombay              | 13.9   | 14     | 14.5   | 14.9   | 15     | 15.4   | 15.9   | 0.3    | 0.03173            |
|                       | South   | Fielding Rd Sand       | 17.5   | 17.63  | 18     | 18.55  | 18.95  | 19.74  | 20     | 0.5    | 0.02919            |
|                       |         | Fielding Rd Volcanic   | 15.8   | 16     | 16.8   | 17.3   | 17.7   | 18.135 | 18.6   | 0.4    | -0.0501            |
|                       |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Hillview spring        | 12     | 12.1   | 12.5   | 13     | 13.5   | 13.9   | 14     | 1      | ND                 |
|                       |         | Ostrich Farm No1       | 28     | 28     | 29.4   | 30.8   | 31.1   | 32     | 32.7   | 0.7    | 0                  |
|                       |         | Ostrich Farm No2       | 26     | 26.42  | 26.9   | 27     | 27.7   | 28.66  | 28.9   | 0.1    | -0.0749            |
|                       |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Rifle Range Rd Deep    | 15     | 15     | 16     | 17     | 17.7   | 19.3   | 20.3   | 0.9    | <b>-0.1501</b>     |
|                       |         | Rifle Range Rd Shallow | 8.3    | 8.62   | 9.21   | 9.69   | 10     | 10.82  | 11     | 0.41   | 0.10762            |
|                       |         | Seagrove Rd Main       | 2.03   | 2.0755 | 2.2    | 2.3    | 2.32   | 2.435  | 2.5    | 0.095  | -0.0218            |
| Total chromium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0016 | 0.0031 | 0.005  | 0.005  | 0.005  | 0.006  | 0.006  | 0      | 0                  |
|                       |         | Quintals Rd            | 0.0001 | 0.0002 | 0.0005 | 0.0031 | 0.005  | 0.006  | 0.006  | 0.0026 | <b>-0.0003</b>     |
|                       |         | Waiwera Enterpr.       | 0.0001 | 0.0003 | 0.0005 | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0.00028            |
|                       | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.002  | 0.005  | 0.005  | 0.006  | 0.006  | 0.0005 | -0.0004            |
|                       |         | Rimmer Rd              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                       |         | Waitakere Rd           | 0.0004 | 0.0004 | 0.0005 | 0.0028 | 0.005  | 0.006  | 0.006  | 0.0023 | -0.0002            |
|                       |         | Waitakere Rd No2       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.0057 | 0.006  | 0      | 0.00012            |
|                       | Central | Amelia Earhart Ave     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Bullens Rd             | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Burnside Rd            | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | ND     | ND                 |
|                       |         | Central Park           | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Central Park New       | 0.0015 | 0.0015 | 0.0017 | 0.0019 | 0.0019 | 0.0019 | 0.0019 | 5E-05  | 0                  |
|                       |         | Mt Richmond            | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | ND     | ND                 |
|                       |         | Puhinui                | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Tiwai Rd               | 0.0052 | 0.0053 | 0.0055 | 0.0058 | 0.006  | 0.0062 | 0.0062 | 0.0004 | ND                 |
|                       |         | Watson Ave             | 0.0005 | 0.0006 | 0.0012 | 0.0016 | 0.0016 | 0.002  | 0.0021 | 0.0004 | 0.00164            |
|                       | South   | BP Bombay              | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Fielding Rd Sand       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Fielding Rd Volcanic   | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Gun Club Rd            | 0.0005 | 0.0005 | 0.0006 | 0.0011 | 0.0011 | 0.0016 | 0.0017 | 0.0005 | 0.00129            |
|                       |         | Hickey spring          | 0.0006 | 0.0006 | 0.0008 | 0.0008 | 0.001  | 0.0012 | 0.0013 | 0.0002 | 0.00023            |
|                       |         | Hillview spring        | 0.0009 | 0.0009 | 0.001  | 0.0012 | 0.0015 | 0.0016 | 0.0016 | 0.0003 | 0.00042            |
|                       |         | Ostrich Farm No1       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Ostrich Farm No2       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                       |         | Patumahoe spring       | 0.0004 | 0.0004 | 0.0006 | 0.0007 | 0.001  | 0.0012 | 0.0012 | 0.0003 | 0.00089            |
|                       |         | Rifle Range Rd Deep    | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                       |         | Rifle Range Rd Shallow | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                       |         | Seagrove Rd Main       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |

|                               |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend (units/y) |
|-------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------|
| Total copper (mg/L)           | NE      | Chenery/Whangaparaoa   | 0.0011 | 0.0019 | 0.005  | 0.005  | 0.006  | 0.0065 | 0.007  | 0.0007 | -0.0002         |
|                               |         | Quintals Rd            | 0.0002 | 0.0002 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | -2E-05          |
|                               |         | Waiwera Enterpr.       | 0.0004 | 0.0004 | 0.0005 | 0.001  | 0.001  | 0.0016 | 0.002  | 0.0005 | 0.00034         |
|                               | NW      | Parakai Aquatic Park   | 0.001  | 0.001  | 0.0028 | 0.005  | 0.0058 | 0.006  | 0.006  | 0.001  | -0.0004         |
|                               |         | Rimmer Rd              | 0.0002 | 0.0002 | 0.0005 | 0.005  | 0.0065 | 0.0096 | 0.011  | 0.002  | <b>-0.0006</b>  |
|                               |         | Waitakere Rd           | 0.0002 | 0.0002 | 0.0004 | 0.0005 | 0.005  | 0.006  | 0.006  | 0.0003 | -0.0002         |
|                               |         | Waitakere Rd No2       | 0.0002 | 0.0002 | 0.0005 | 0.005  | 0.006  | 0.008  | 0.011  | 0.0045 | <b>-0.0004</b>  |
|                               | Central | Amelia Earhart Ave     | 0.0002 | 0.0004 | 0.0005 | 0.005  | 0.005  | 0.0066 | 0.008  | 0.0027 | -0.0007         |
|                               |         | Bullens Rd             | 0.005  | 0.005  | 0.005  | 0.005  | 0.0053 | 0.006  | 0.006  | 0      | 0               |
|                               |         | Burnside Rd            | 0.0002 | 0.0004 | 0.0005 | 0.005  | 0.005  | 0.0076 | 0.009  | 0.003  | -0.0005         |
|                               |         | Central Park           | 0.0015 | 0.0017 | 0.0029 | 0.005  | 0.005  | 0.006  | 0.006  | 0.001  | <b>-0.0004</b>  |
|                               |         | Central Park New       | 0.0013 | 0.0014 | 0.0016 | 0.0017 | 0.0019 | 0.002  | 0.002  | 0.0002 | 0.00035         |
|                               |         | Mt Richmond            | 0.0005 | 0.0005 | 0.0006 | 0.0016 | 0.0049 | 0.0057 | 0.007  | 0.0011 | 5.8E-05         |
|                               |         | Puhinui                | 0.0002 | 0.0002 | 0.0005 | 0.005  | 0.0058 | 0.0091 | 0.013  | 0.0032 | -0.0005         |
|                               |         | Tiwai Rd               | 0.0005 | 0.0012 | 0.0072 | 0.013  | 0.0265 | 0.0557 | 0.072  | 0.008  | -0.0002         |
|                               |         | Watson Ave             | 0.0006 | 0.001  | 0.0014 | 0.005  | 0.005  | 0.0071 | 0.012  | 0.0024 | <b>-0.0003</b>  |
|                               |         | BP Bombay              | 0.001  | 0.0044 | 0.005  | 0.005  | 0.005  | 0.0063 | 0.008  | 0      | 0               |
|                               | South   | Fielding Rd Sand       | 0.0002 | 0.0004 | 0.0005 | 0.0041 | 0.005  | 0.0069 | 0.008  | 0.0028 | -0.0009         |
|                               |         | Fielding Rd Volcanic   | 0.0002 | 0.0005 | 0.0005 | 0.005  | 0.006  | 0.0087 | 0.012  | 0.002  | <b>-0.0009</b>  |
|                               |         | Gun Club Rd            | 0.0055 | 0.0098 | 0.0269 | 0.062  | 0.1025 | 0.1325 | 0.14   | 0.0423 | -0.0522         |
|                               |         | Hickey spring          | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 0               |
|                               |         | Hillview spring        | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 2.1E-05         |
|                               |         | Ostrich Farm No1       | 0.0002 | 0.0002 | 0.0005 | 0.0028 | 0.005  | 0.006  | 0.006  | 0.0023 | <b>-0.0005</b>  |
|                               |         | Ostrich Farm No2       | 0.0002 | 0.0003 | 0.0005 | 0.005  | 0.006  | 0.007  | 0.007  | 0.002  | <b>-0.001</b>   |
|                               |         | Patumahoe spring       | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0      | 0               |
|                               |         | Rifle Range Rd Deep    | 0.005  | 0.005  | 0.005  | 0.005  | 0.0055 | 0.0063 | 0.007  | 0      | 0               |
|                               |         | Rifle Range Rd Shallow | 0.0002 | 0.0004 | 0.0007 | 0.005  | 0.005  | 0.0066 | 0.007  | 0.001  | <b>-0.0004</b>  |
|                               |         | Seagrove Rd Main       | 0.0002 | 0.0002 | 0.0005 | 0.0028 | 0.005  | 0.0064 | 0.007  | 0.0023 | <b>-0.0008</b>  |
| Total Dissolved Solids (mg/L) | NE      | Chenery/Whangaparaoa   | 220    | 220.2  | 230    | 236    | 240    | 247.65 | 251    | 4.5    | 0.54522         |
|                               |         | Quintals Rd            | 288    | 291.5  | 318    | 326    | 333.5  | 354.3  | 363    | 8      | 1.6413          |
|                               |         | Waiwera Enterpr.       | 1930   | 1989.5 | 2020   | 2058.5 | 2100   | 2149.4 | 2214   | 41.5   | 0               |
|                               | NW      | Parakai Aquatic Park   | 1815   | 1867.3 | 1900   | 1942   | 1992.5 | 2064.4 | 2110   | 42     | 3.32348         |
|                               |         | Rimmer Rd              | 275    | 276.7  | 289.75 | 298    | 304    | 310    | 323    | 7      | 0.49225         |
|                               |         | Waitakere Rd           | 170    | 197    | 202    | 211    | 222    | 230.8  | 245    | 11     | 0.50345         |
|                               |         | Waitakere Rd No2       | 410    | 410    | 426.5  | 435    | 444.5  | 457.3  | 460    | 9      | 1.07445         |
|                               | Central | Amelia Earhart Ave     | 399    | 403.98 | 415.25 | 419.5  | 425.5  | 440    | 440    | 5.5    | 0               |
|                               |         | Bullens Rd             | 298    | 298.6  | 305.5  | 314    | 330    | 335    | 350    | 12     | 0.32403         |
|                               |         | Burnside Rd            | 310    | 323.95 | 331.5  | 340    | 350    | 362.1  | 370    | 10     | 1.07321         |
|                               |         | Central Park           | 98     | 113.25 | 134    | 150    | 167.75 | 184.45 | 191    | 17.5   | 0.99483         |
|                               |         | Central Park New       | 130    | 134.5  | 150    | 160    | 170    | 190.75 | 199    | 10     | -4.6141         |
|                               |         | Mt Richmond            | 52.5   | 62.8   | 71     | 81     | 90     | 104.6  | 110    | 10     | <b>2.4029</b>   |
|                               |         | Puhinui                | 205    | 206.2  | 219    | 230    | 235.5  | 244    | 268    | 10     | -0.9612         |
|                               |         | Tiwai Rd               | 62     | 81     | 124.5  | 153.5  | 170.5  | 180.25 | 209    | 20     | 1.40045         |
|                               |         | Watson Ave             | 115    | 126.2  | 135    | 145    | 151    | 159.4  | 171    | 8      | <b>0.72557</b>  |
|                               |         | BP Bombay              | 167    | 181.6  | 196    | 207    | 214    | 237.6  | 253    | 10     | <b>1.41384</b>  |
|                               | South   | Fielding Rd Sand       | 241    | 241.8  | 246    | 251    | 260    | 269    | 274    | 6      | 0               |
|                               |         | Fielding Rd Volcanic   | 181    | 190    | 200    | 204    | 210.25 | 219.13 | 226    | 6      | 0               |
|                               |         | Gun Club Rd            | 250    | 258    | 290    | 300    | 320    | 328    | 330    | 20     | 31.3071         |
|                               |         | Hickey spring          | 210    | 214    | 230    | 250    | 280    | 312    | 320    | 30     | -41.155         |
|                               |         | Hillview spring        | 207    | 215.05 | 230    | 243.5  | 260    | 260    | 260    | 15     | 0               |
|                               |         | Ostrich Farm No1       | 190    | 200    | 206    | 207    | 213    | 219    | 220    | 5      | 0.1667          |
|                               |         | Ostrich Farm No2       | 193    | 200.13 | 211.75 | 220    | 229.5  | 253.25 | 257    | 9      | <b>2.10186</b>  |
|                               |         | Patumahoe spring       | 250    | 254    | 270    | 310    | 310    | 342    | 350    | 40     | -62.614         |
|                               |         | Rifle Range Rd Deep    | 160    | 160    | 170    | 174    | 182    | 190.7  | 192    | 6      | -0.0228         |
|                               |         | Rifle Range Rd Shallow | 135    | 142    | 160.75 | 173    | 184    | 207    | 225.5  | 12     | <b>3.34479</b>  |
|                               |         | Seagrove Rd Main       | 230    | 235.05 | 240    | 249.5  | 255    | 269.8  | 280    | 8.5    | 0.7747          |

|                                        |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|----------------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Total fluoride (mg/L)                  | NE      | Chenery/Whangaparaoa   | 0.71   | 0.721  | 0.87   | 0.97   | 1.315  | 1.496  | 1.55   | 0.19   | 0.00168            |
|                                        |         | Quintals Rd            | 0.005  | 0.02   | 0.05   | 0.08   | 0.1    | 0.127  | 0.13   | 0.026  | -0.0025            |
|                                        |         | Waiwera Enterpr.       | 1.21   | 1.354  | 1.55   | 1.67   | 1.7    | 1.752  | 1.8    | 0.06   | 0.01002            |
|                                        | NW      | Parakai Aquatic Park   | 1.43   | 1.715  | 1.9975 | 2.11   | 2.185  | 2.3825 | 2.51   | 0.11   | -0.0123            |
|                                        |         | Rimmer Rd              | 0.031  | 0.0704 | 0.09   | 0.13   | 0.14   | 0.19   | 0.25   | 0.03   | 0                  |
|                                        |         | Waitakere Rd           | 0.02   | 0.0493 | 0.06   | 0.075  | 0.09   | 0.14   | 0.15   | 0.015  | 0.0005             |
|                                        |         | Waitakere Rd No2       | 0.012  | 0.02   | 0.03   | 0.04   | 0.05   | 0.08   | 0.08   | 0.01   | 0                  |
|                                        | Central | Amelia Earhart Ave     | 0.13   | 0.132  | 0.15   | 0.19   | 0.2    | 0.248  | 0.26   | 0.02   | -0.0029            |
|                                        |         | Bullens Rd             | 0.08   | 0.0913 | 0.13   | 0.16   | 0.19   | 0.2385 | 0.28   | 0.03   | 0.0038             |
|                                        |         | Burnside Rd            | 0.02   | 0.0538 | 0.08   | 0.11   | 0.12   | 0.148  | 0.16   | 0.02   | 0                  |
|                                        |         | Central Park           | 0.032  | 0.049  | 0.065  | 0.09   | 0.1    | 0.111  | 0.13   | 0.02   | -0.0013            |
|                                        |         | Central Park New       | 0.032  | 0.0379 | 0.0563 | 0.0675 | 0.08   | 0.0973 | 0.1    | 0.0125 | 0.01269            |
|                                        |         | Mt Richmond            | 0.77   | 0.7775 | 0.79   | 0.85   | 0.8825 | 0.9375 | 0.96   | 0.055  | 0                  |
|                                        |         | Puhinui                | 0.24   | 0.2515 | 0.28   | 0.3    | 0.34   | 0.3755 | 0.38   | 0.03   | 0.003              |
|                                        |         | Tiwai Rd               | 0.02   | 0.02   | 0.0885 | 0.135  | 0.163  | 0.19   | 0.26   | 0.045  | 0                  |
|                                        |         | Watson Ave             | 0.05   | 0.0805 | 0.11   | 0.13   | 0.14   | 0.1685 | 0.18   | 0.02   | 0                  |
|                                        | South   | BP Bombay              | 0.02   | 0.03   | 0.0373 | 0.05   | 0.07   | 0.0885 | 0.11   | 0.02   | 0                  |
|                                        |         | Fielding Rd Sand       | 0.02   | 0.03   | 0.049  | 0.06   | 0.09   | 0.11   | 0.13   | 0.02   | -0.0066            |
|                                        |         | Fielding Rd Volcanic   | 0.02   | 0.02   | 0.03   | 0.05   | 0.06   | 0.09   | 0.1    | 0.02   | 0                  |
|                                        |         | Gun Club Rd            | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0                  |
|                                        |         | Hickey spring          | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0                  |
|                                        |         | Hillview spring        | 0.02   | 0.02   | 0.02   | 0.027  | 0.033  | 0.04   | 0.04   | 0.007  | -0.0113            |
|                                        |         | Ostrich Farm No1       | 0.014  | 0.0287 | 0.05   | 0.053  | 0.07   | 0.08   | 0.1    | 0.0125 | 0.00044            |
|                                        |         | Ostrich Farm No2       | 0.02   | 0.0309 | 0.05   | 0.07   | 0.08   | 0.109  | 0.13   | 0.02   | -0.0014            |
|                                        |         | Patumahoe spring       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0                  |
|                                        |         | Rifle Range Rd Deep    | 0.05   | 0.0585 | 0.08   | 0.09   | 0.1    | 0.12   | 0.13   | 0.01   | 0                  |
|                                        |         | Rifle Range Rd Shallow | 0.01   | 0.02   | 0.02   | 0.035  | 0.05   | 0.067  | 0.09   | 0.015  | -0.0014            |
|                                        |         | Seagrove Rd Main       | 0.061  | 0.08   | 0.09   | 0.1    | 0.11   | 0.12   | 0.13   | 0.01   | 0                  |
| Total hardness CaCO3 (mg/L) calculated | NE      | Chenery/Whangaparaoa   | 1.5    | 2.03   | 3.1869 | 8.3231 | 12.217 | 23.365 | 24.5   | 4.9557 | -0.5699            |
|                                        |         | Quintals Rd            | 160    | 160.06 | 171.39 | 178.28 | 184.28 | 193.38 | 195.9  | 6.6805 | 0.16267            |
|                                        |         | Waiwera Enterpr.       | 97.9   | 97.91  | 103.48 | 107.5  | 110    | 113.35 | 115.36 | 3.8997 | 1.54456            |
|                                        | NW      | Parakai Aquatic Park   | 102.9  | 106.43 | 114.46 | 121    | 129.18 | 149.6  | 154.1  | 7.8518 | -0.5167            |
|                                        |         | Rimmer Rd              | 32.242 | 32.884 | 34.087 | 35     | 36.409 | 37.982 | 40     | 1.2421 | -0.1196            |
|                                        |         | Waitakere Rd           | 79.187 | 81.426 | 86     | 88.915 | 91.75  | 94     | 95     | 2.9846 | 0                  |
|                                        |         | Waitakere Rd No2       | 280.23 | 285.86 | 299.42 | 309.47 | 321.49 | 330.3  | 332    | 11.065 | -1.8437            |
|                                        | Central | Amelia Earhart Ave     | 206    | 209.07 | 211.99 | 220    | 222.5  | 235.14 | 239.28 | 6.3436 | -0.79              |
|                                        |         | Bullens Rd             | 100    | 105.85 | 139.25 | 163.5  | 178.86 | 193.1  | 195.1  | 21.5   | 1.13658            |
|                                        |         | Burnside Rd            | 220    | 225.76 | 233.45 | 237.29 | 242    | 251.41 | 255.21 | 4.3853 | -0.7809            |
|                                        |         | Central Park           | 41.634 | 46.6   | 58     | 65.479 | 69     | 75.191 | 82     | 6.4794 | 0.14095            |
|                                        |         | Central Park New       | 53.621 | 55.372 | 58.352 | 64.555 | 71.196 | 73.173 | 73.667 | 6.5552 | 2.96011            |
|                                        |         | Mt Richmond            | 23.173 | 23.839 | 26.75  | 30     | 32.537 | 35     | 36     | 3      | 0.80666            |
|                                        |         | Puhinui                | 2.8    | 2.8012 | 2.925  | 3      | 3      | 3.1615 | 3.1615 | 0      | -0.0219            |
|                                        |         | Tiwai Rd               | 22.465 | 30.981 | 48     | 59.615 | 69.828 | 78.24  | 98.48  | 10.945 | -0.3               |
|                                        |         | Watson Ave             | 40.242 | 42.447 | 45     | 46     | 48.35  | 52.206 | 52.999 | 2      | 0                  |
|                                        | South   | BP Bombay              | 75.387 | 79.972 | 83.122 | 86.871 | 89.408 | 94.35  | 97     | 3.129  | 0.38192            |
|                                        |         | Fielding Rd Sand       | 80.787 | 82.532 | 86.85  | 89.35  | 91.75  | 94.9   | 95     | 2.6    | 0.37443            |
|                                        |         | Fielding Rd Volcanic   | 95.4   | 99.5   | 102.51 | 106.3  | 110.42 | 116.65 | 122    | 4.2    | -0.0999            |
|                                        |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                        |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                        |         | Hillview spring        | 83.498 | 83.748 | 84.747 | 85.995 | 87.244 | 88.242 | 88.492 | 2.497  | ND                 |
|                                        |         | Ostrich Farm No1       | 97.507 | 100    | 103.21 | 107.09 | 110    | 119.85 | 121    | 3.5313 | 0                  |
|                                        |         | Ostrich Farm No2       | 87     | 87.728 | 94     | 96.653 | 98.7   | 105.04 | 106.2  | 2.6533 | -0.3374            |
|                                        |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                                        |         | Rifle Range Rd Deep    | 66.693 | 68.081 | 72.148 | 74.791 | 78     | 81.9   | 86     | 3.2088 | -0.4524            |
|                                        |         | Rifle Range Rd Shallow | 45.692 | 48.653 | 54.826 | 58.95  | 64.088 | 68     | 70     | 4.5899 | 0.983              |
|                                        |         | Seagrove Rd Main       | 7.7    | 8      | 8.7922 | 9      | 9.536  | 10     | 10.201 | 0.4493 | -0.0937            |

|                                  |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|----------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Total hexavalent chromium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Quintals Rd            | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  | NW      | Parakai Aquatic Park   | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Rimmer Rd              | 0.005  | 0.0051 | 0.0053 | 0.0055 | 0.0058 | 0.006  | 0.006  | 0.0005 | -0.001             |
|                                  |         | Waitakere Rd           | 0.005  | 0.005  | 0.005  | 0.005  | 0.006  | 0.0068 | 0.007  | 0      | 0.00101            |
|                                  |         | Waitakere Rd No2       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  | Central | Amelia Earhart Ave     | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Bullens Rd             | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Burnside Rd            | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Central Park           | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Central Park New       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Mt Richmond            | 0.001  | 0.001  | 0.001  | 0.003  | 0.005  | 0.005  | 0.005  | 0.002  | 0                  |
|                                  |         | Puhinui                | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Tiwai Rd               | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Watson Ave             | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  | South   | BP Bombay              | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Fielding Rd Sand       | 0.001  | 0.001  | 0.001  | 0.003  | 0.005  | 0.005  | 0.005  | 0.002  | 0                  |
|                                  |         | Fielding Rd Volcanic   | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Gun Club Rd            | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Hickey spring          | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Hillview spring        | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Ostrich Farm No1       | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Ostrich Farm No2       | 0.001  | 0.001  | 0.001  | 0.003  | 0.005  | 0.005  | 0.005  | 0.002  | 0                  |
|                                  |         | Patumahoe spring       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0                  |
|                                  |         | Rifle Range Rd Deep    | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Rifle Range Rd Shallow | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0                  |
|                                  |         | Seagrove Rd Main       | 0.001  | 0.001  | 0.001  | 0.003  | 0.005  | 0.005  | 0.005  | 0.002  | 0                  |
| Total iron (mg/L)                | NE      | Chenery/Whangaparaoa   | 0.0068 | 0.011  | 0.0828 | 0.24   | 0.4478 | 0.6346 | 0.648  | 0.19   | -0.0261            |
|                                  |         | Quintals Rd            | 1.8    | 1.8    | 2.12   | 2.2    | 2.32   | 2.432  | 2.44   | 0.09   | -0.0193            |
|                                  |         | Waiwera Enterpr.       | 0.002  | 0.0047 | 0.0105 | 0.03   | 0.04   | 0.0428 | 0.05   | 0.01   | 0                  |
|                                  | NW      | Parakai Aquatic Park   | 0.0021 | 0.0033 | 0.008  | 0.021  | 0.04   | 0.052  | 0.063  | 0.0168 | -0.0029            |
|                                  |         | Rimmer Rd              | 4.5    | 4.728  | 5.015  | 5.32   | 5.5075 | 5.997  | 6.07   | 0.245  | 0.00501            |
|                                  |         | Waitakere Rd           | 4.2    | 5.15   | 5.68   | 6.09   | 6.63   | 7.474  | 7.8    | 0.48   | -0.06              |
|                                  |         | Waitakere Rd No2       | 0.773  | 0.93   | 1.01   | 1.11   | 1.3    | 1.6    | 1.78   | 0.17   | -0.0197            |
|                                  | Central | Amelia Earhart Ave     | 0.93   | 0.9955 | 1.0825 | 1.16   | 1.255  | 1.362  | 1.5    | 0.08   | -0.0133            |
|                                  |         | Bullens Rd             | 0.12   | 0.29   | 0.385  | 0.55   | 0.71   | 0.852  | 0.875  | 0.16   | -0.0061            |
|                                  |         | Burnside Rd            | 0.933  | 0.959  | 1.17   | 1.32   | 1.6    | 1.764  | 1.92   | 0.18   | 0.00165            |
|                                  |         | Central Park           | 0.018  | 0.08   | 0.13   | 0.16   | 0.22   | 0.3261 | 0.361  | 0.046  | 0                  |
|                                  |         | Central Park New       | 0.0073 | 0.0101 | 0.016  | 0.058  | 0.0808 | 0.1575 | 0.18   | 0.0395 | -0.0276            |
|                                  |         | Mt Richmond            | 0.011  | 0.0132 | 0.02   | 0.022  | 0.0345 | 0.0678 | 0.08   | 0.007  | -0.0003            |
|                                  |         | Puhinui                | 0.0033 | 0.0034 | 0.005  | 0.0155 | 0.02   | 0.022  | 0.03   | 0.006  | 0                  |
|                                  |         | Tiwai Rd               | 0.002  | 0.002  | 0.6    | 1.68   | 3.415  | 8.066  | 8.47   | 1.22   | -0.0624            |
|                                  |         | Watson Ave             | 0.018  | 0.0279 | 0.0645 | 0.11   | 0.238  | 0.3481 | 0.45   | 0.063  | -0.0119            |
|                                  | South   | BP Bombay              | 0.002  | 0.002  | 0.005  | 0.011  | 0.02   | 0.021  | 0.03   | 0.009  | 0                  |
|                                  |         | Fielding Rd Sand       | 0.24   | 0.2785 | 0.362  | 0.423  | 0.4825 | 0.5805 | 0.66   | 0.063  | 0.00946            |
|                                  |         | Fielding Rd Volcanic   | 0.023  | 0.0748 | 0.49   | 0.809  | 1.1    | 1.458  | 1.67   | 0.291  | 0.01429            |
|                                  |         | Gun Club Rd            | 0.002  | 0.002  | 0.0021 | 0.0031 | 0.0036 | 0.0063 | 0.007  | 0.001  | -0.0052            |
|                                  |         | Hickey spring          | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                  |
|                                  |         | Hillview spring        | 0.002  | 0.0021 | 0.0027 | 0.003  | 0.0041 | 0.0054 | 0.0059 | 0.0009 | -0.0009            |
|                                  |         | Ostrich Farm No1       | 0.11   | 0.11   | 0.12   | 0.123  | 0.13   | 0.141  | 0.145  | 0.005  | 0.00021            |
|                                  |         | Ostrich Farm No2       | 3      | 3.116  | 3.2    | 3.3    | 3.49   | 3.68   | 3.68   | 0.1    | -0.0353            |
|                                  |         | Patumahoe spring       | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0.002  | 0      | 0                  |
|                                  |         | Rifle Range Rd Deep    | 0.02   | 0.0225 | 0.031  | 0.038  | 0.044  | 0.06   | 0.07   | 0.007  | 0.00025            |
|                                  |         | Rifle Range Rd Shallow | 0.002  | 0.002  | 0.02   | 0.052  | 0.12   | 0.189  | 0.2    | 0.032  | -0.0083            |
|                                  |         | Seagrove Rd Main       | 0.0059 | 0.0113 | 0.0203 | 0.0265 | 0.03   | 0.04   | 0.05   | 0.005  | 0.00039            |

|                      |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend (units/y) |
|----------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------|
| Total lead (mg/L)    | NE      | Chenerv/Whangaparaoa   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Quintals Rd            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0004 | 0.0006 | 0      | 0               |
|                      |         | Waiwera Enterpr.       | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0005 | 0.0007 | 8E-05  | 9.8E-05         |
|                      | NW      | Parakai Aquatic Park   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Rimmer Rd              | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Waitakere Rd           | 0.0001 | 0.0001 | 0.0001 | 0.0102 | 0.02   | 0.02   | 0.02   | 0.0099 | -0.0007         |
|                      |         | Waitakere Rd No2       | 0.0001 | 0.0001 | 0.0001 | 0.0026 | 0.0093 | 0.02   | 0.02   | 0.0025 | -0.0003         |
|                      | Central | Amelia Earhart Ave     | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Bullens Rd             | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Burnside Rd            | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Central Park           | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Central Park New       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0               |
|                      |         | Mt Richmond            | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0004 | 0.0013 | 0.0013 | 2E-05  | 2.1E-06         |
|                      |         | Puhinui                | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Tiwai Rd               | 0.0001 | 0.0052 | 0.0442 | 0.057  | 0.14   | 0.218  | 0.24   | 0.037  | -4E-05          |
|                      |         | Watson Ave             | 0.0001 | 0.0001 | 0.0005 | 0.0109 | 0.02   | 0.02   | 0.02   | 0.0091 | -0.0014         |
|                      | South   | BP Bombay              | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Fielding Rd Sand       | 0.0001 | 0.0001 | 0.0001 | 0.0101 | 0.02   | 0.02   | 0.02   | 0.01   | 0               |
|                      |         | Fielding Rd Volcanic   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Gun Club Rd            | 0.0006 | 0.0009 | 0.002  | 0.005  | 0.0081 | 0.0096 | 0.01   | 0.0034 | -0.0026         |
|                      |         | Hickey spring          | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0               |
|                      |         | Hillview spring        | 0.0001 | 0.0002 | 0.0003 | 0.0006 | 0.0008 | 0.0013 | 0.0014 | 0.0003 | -0.0006         |
|                      |         | Ostrich Farm No1       | 0.0001 | 0.0001 | 0.0001 | 0.0123 | 0.02   | 0.02   | 0.02   | 0.0077 | -0.0019         |
|                      |         | Ostrich Farm No2       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Patumahoe spring       | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0               |
|                      |         | Rifle Range Rd Deep    | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Rifle Range Rd Shallow | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0      | 0               |
|                      |         | Seagrove Rd Main       | 0.0001 | 0.0001 | 0.0001 | 0.0103 | 0.02   | 0.02   | 0.02   | 0.0097 | -0.0016         |
| Total lithium (mg/L) | NE      | Chenerv/Whangaparaoa   | 0.0042 | 0.0048 | 0.0055 | 0.008  | 0.0098 | 0.0113 | 0.012  | 0.002  | -0.0002         |
|                      |         | Quintals Rd            | 0.011  | 0.0113 | 0.0117 | 0.0128 | 0.013  | 0.0138 | 0.015  | 0.0006 | -0.0001         |
|                      |         | Waiwera Enterpr.       | 0.61   | 0.6265 | 0.6458 | 0.6525 | 0.679  | 0.71   | 0.71   | 0.01   | -0.0049         |
|                      | NW      | Parakai Aquatic Park   | 0.73   | 0.75   | 0.8    | 0.82   | 0.8485 | 0.88   | 0.9    | 0.02   | -0.006          |
|                      |         | Rimmer Rd              | 0.001  | 0.0016 | 0.002  | 0.0023 | 0.0029 | 0.003  | 0.003  | 0.0003 | -3E-05          |
|                      |         | Waitakere Rd           | 0.0136 | 0.0138 | 0.014  | 0.0147 | 0.016  | 0.017  | 0.017  | 0.0007 | -0.0001         |
|                      |         | Waitakere Rd No2       | 0.0267 | 0.0274 | 0.0285 | 0.0295 | 0.0313 | 0.0325 | 0.033  | 0.0015 | -0.0005         |
|                      | Central | Amelia Earhart Ave     | 0.016  | 0.016  | 0.017  | 0.018  | 0.019  | 0.0194 | 0.02   | 0.001  | 6E-05           |
|                      |         | Bullens Rd             | 0.064  | 0.0682 | 0.0758 | 0.085  | 0.0958 | 0.1115 | 0.128  | 0.0115 | -0.0025         |
|                      |         | Burnside Rd            | 0.032  | 0.032  | 0.0348 | 0.037  | 0.0378 | 0.0414 | 0.042  | 0.0016 | -0.0004         |
|                      |         | Central Park           | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0               |
|                      |         | Central Park New       | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0.0007 | 0.0007 | 0.0007 | 1E-04  | -0.0002         |
|                      |         | Mt Richmond            | 0.001  | 0.001  | 0.001  | 0.0056 | 0.0101 | 0.0138 | 0.017  | 0.0046 | 0.00107         |
|                      |         | Puhinui                | 0.0042 | 0.0045 | 0.005  | 0.005  | 0.0051 | 0.0053 | 0.0054 | 5E-05  | -1E-05          |
|                      |         | Tiwai Rd               | 0.001  | 0.001  | 0.0012 | 0.0044 | 0.007  | 0.0087 | 0.0137 | 0.0027 | 0               |
|                      |         | Watson Ave             | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0               |
|                      | South   | BP Bombay              | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0               |
|                      |         | Fielding Rd Sand       | 0.0136 | 0.0138 | 0.014  | 0.0148 | 0.015  | 0.016  | 0.016  | 0.0007 | 0               |
|                      |         | Fielding Rd Volcanic   | 0.002  | 0.002  | 0.004  | 0.0042 | 0.005  | 0.005  | 0.005  | 0.0007 | 0               |
|                      |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND              |
|                      |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND              |
|                      |         | Hillview spring        | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0.0006 | 9E-05  | ND              |
|                      |         | Ostrich Farm No1       | 0.0086 | 0.0087 | 0.0092 | 0.01   | 0.01   | 0.0105 | 0.011  | 0.0003 | 0               |
|                      |         | Ostrich Farm No2       | 0.012  | 0.0121 | 0.0127 | 0.013  | 0.0132 | 0.014  | 0.014  | 0.0004 | -0.0002         |
|                      |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND              |
|                      |         | Rifle Range Rd Deep    | 0.003  | 0.0031 | 0.004  | 0.004  | 0.005  | 0.005  | 0.005  | 0.0003 | 0               |
|                      |         | Rifle Range Rd Shallow | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0.001  | 0      | 0               |
|                      |         | Seagrove Rd Main       | 0.0062 | 0.0063 | 0.0066 | 0.007  | 0.007  | 0.0076 | 0.008  | 0.0002 | -5E-05          |

|                        |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend<br>(units/y) |
|------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| Total magnesium (mg/L) | NE      | Chenery/Whangaparaoa   | 0.03   | 0.044  | 0.11   | 0.18   | 0.21   | 0.348  | 0.46   | 0.07   | -0.01              |
|                        |         | Quintals Rd            | 10.3   | 10.64  | 11     | 11.4   | 11.7   | 12.06  | 12.4   | 0.4    | 0.03716            |
|                        |         | Waiwera Enterpr.       | 0.08   | 0.08   | 0.09   | 0.1    | 0.11   | 0.115  | 0.12   | 0.01   | 0.00143            |
|                        | NW      | Parakai Aquatic Park   | 0.49   | 0.5215 | 0.5725 | 0.61   | 0.64   | 0.7105 | 0.76   | 0.035  | 0.00198            |
|                        |         | Rimmer Rd              | 3      | 3.08   | 3.2    | 3.4    | 3.5    | 3.692  | 3.9    | 0.2    | -0.0157            |
|                        |         | Waitakere Rd           | 7.7    | 8.46   | 9.025  | 9.285  | 9.825  | 10.015 | 10.3   | 0.485  | -0.0792            |
|                        |         | Waitakere Rd No2       | 26     | 26.2   | 27.3   | 28     | 28.95  | 30.1   | 31.1   | 1      | -0.091             |
|                        | Central | Amelia Earhart Ave     | 5.51   | 5.7565 | 5.9    | 6      | 6.1075 | 6.415  | 6.5    | 0.1    | 0.00998            |
|                        |         | Bullens Rd             | 6.2    | 6.56   | 8.95   | 10.1   | 11     | 11.74  | 11.8   | 1.15   | -0.0273            |
|                        |         | Burnside Rd            | 7.33   | 7.978  | 8.19   | 8.42   | 8.65   | 8.84   | 9.2    | 0.24   | 0.01911            |
|                        |         | Central Park           | 5.5    | 7.1    | 7.72   | 8.5    | 9.26   | 9.902  | 10.5   | 0.8    | -0.0077            |
|                        |         | Central Park New       | 7.2    | 7.2    | 7.35   | 8.15   | 8.95   | 9.265  | 9.4    | 0.85   | -0.4008            |
|                        |         | Mt Richmond            | 1.26   | 1.26   | 1.33   | 1.5    | 1.725  | 1.884  | 2.08   | 0.2    | 0.064              |
|                        |         | Puhinui                | 0.07   | 0.07   | 0.08   | 0.095  | 0.11   | 0.12   | 0.12   | 0.015  | -0.0012            |
|                        |         | Tiwai Rd               | 2.3    | 3.64   | 5.1    | 6.09   | 6.9    | 8.54   | 10.4   | 0.99   | 0.0089             |
|                        |         | Watson Ave             | 4.7    | 4.8    | 5.3    | 5.68   | 5.915  | 6.2    | 6.8    | 0.36   | -0.008             |
|                        | South   | BP Bombay              | 10.3   | 10.7   | 11.2   | 11.9   | 12.1   | 13.02  | 13.3   | 0.4    | 0.0287             |
|                        |         | Fielding Rd Sand       | 9      | 9.1495 | 9.8    | 10.05  | 10.925 | 11     | 11     | 0.7    | 0.10118            |
|                        |         | Fielding Rd Volcanic   | 13.3   | 13.94  | 15     | 15.3   | 16     | 16.58  | 17.3   | 0.5    | 0                  |
|                        |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                        |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                        |         | Hillview spring        | 12     | 12.15  | 12.75  | 13     | 13.5   | 14.7   | 15     | 0.5    | ND                 |
|                        |         | Ostrich Farm No1       | 6.4    | 6.428  | 6.9    | 7.4    | 7.65   | 8.056  | 8.07   | 0.4    | -0.0231            |
|                        |         | Ostrich Farm No2       | 5.8    | 5.8975 | 6.525  | 6.78   | 7.045  | 7.41   | 7.5    | 0.31   | -0.0087            |
|                        |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND                 |
|                        |         | Rifle Range Rd Deep    | 6.7    | 6.782  | 7.3    | 7.71   | 8.1625 | 8.694  | 8.9    | 0.425  | 0.0417             |
|                        |         | Rifle Range Rd Shallow | 6.7    | 7.065  | 7.5    | 7.8    | 8.4    | 8.935  | 9.3    | 0.355  | 0.09525            |
|                        |         | Seagrove Rd Main       | 0.7    | 0.765  | 0.8325 | 0.885  | 0.9475 | 0.995  | 1.06   | 0.06   | -0.0116            |
| Total manganese (mg/L) | NE      | Chenery/Whangaparaoa   | 0.0026 | 0.0028 | 0.0068 | 0.016  | 0.025  | 0.0534 | 0.059  | 0.0092 | -0.0006            |
|                        |         | Quintals Rd            | 0.206  | 0.2185 | 0.2225 | 0.23   | 0.2395 | 0.249  | 0.254  | 0.009  | 0                  |
|                        |         | Waiwera Enterpr.       | 0.002  | 0.002  | 0.0023 | 0.0028 | 0.003  | 0.003  | 0.003  | 0.0003 | 0                  |
|                        | NW      | Parakai Aquatic Park   | 0.011  | 0.0119 | 0.013  | 0.014  | 0.015  | 0.0153 | 0.018  | 0.001  | -5E-05             |
|                        |         | Rimmer Rd              | 0.105  | 0.1083 | 0.1168 | 0.12   | 0.1233 | 0.1319 | 0.133  | 0.0035 | -0.0005            |
|                        |         | Waitakere Rd           | 0.094  | 0.11   | 0.12   | 0.15   | 0.177  | 0.2229 | 0.25   | 0.03   | -0.0083            |
|                        |         | Waitakere Rd No2       | 0.043  | 0.0466 | 0.049  | 0.053  | 0.0566 | 0.0631 | 0.064  | 0.004  | 0                  |
|                        | Central | Amelia Earhart Ave     | 0.081  | 0.0848 | 0.088  | 0.092  | 0.097  | 0.1042 | 0.113  | 0.005  | -0.001             |
|                        |         | Bullens Rd             | 0.033  | 0.0486 | 0.0715 | 0.097  | 0.111  | 0.1227 | 0.123  | 0.018  | 0.00037            |
|                        |         | Burnside Rd            | 0.007  | 0.0072 | 0.0095 | 0.0103 | 0.0111 | 0.015  | 0.016  | 0.0009 | 0.00016            |
|                        |         | Central Park           | 0.001  | 0.0014 | 0.003  | 0.0048 | 0.007  | 0.0099 | 0.014  | 0.002  | 0.0004             |
|                        |         | Central Park New       | 0.0015 | 0.0025 | 0.0037 | 0.0048 | 0.0071 | 0.0095 | 0.011  | 0.0013 | -0.0009            |
|                        |         | Mt Richmond            | 0.001  | 0.001  | 0.0035 | 0.0049 | 0.0069 | 0.0162 | 0.0194 | 0.0019 | 0.00023            |
|                        |         | Puhinui                | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.001  | 0.001  | 0.0012 | 1E-04  | -2E-05             |
|                        |         | Tiwai Rd               | 0.003  | 0.007  | 0.0379 | 0.0574 | 0.0957 | 0.1718 | 0.208  | 0.0294 | 0.00358            |
|                        |         | Watson Ave             | 0.001  | 0.0023 | 0.0049 | 0.0099 | 0.0122 | 0.0183 | 0.024  | 0.0036 | 0                  |
|                        | South   | BP Bombay              | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Fielding Rd Sand       | 0.029  | 0.0321 | 0.0361 | 0.0379 | 0.0404 | 0.044  | 0.045  | 0.0021 | -0.0005            |
|                        |         | Fielding Rd Volcanic   | 0.013  | 0.0147 | 0.0193 | 0.0246 | 0.03   | 0.0414 | 0.044  | 0.0055 | -0.0016            |
|                        |         | Gun Club Rd            | 0.0005 | 0.0005 | 0.0007 | 0.0008 | 0.0009 | 0.0011 | 0.0012 | 0.0002 | ND                 |
|                        |         | Hickey spring          | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Hillview spring        | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Ostrich Farm No1       | 0.0501 | 0.0511 | 0.053  | 0.056  | 0.0582 | 0.0618 | 0.066  | 0.003  | -0.0004            |
|                        |         | Ostrich Farm No2       | 0.06   | 0.0828 | 0.1125 | 0.1365 | 0.1683 | 0.203  | 0.249  | 0.0265 | -0.009             |
|                        |         | Patumahoe spring       | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0      | 0                  |
|                        |         | Rifle Range Rd Deep    | 0.019  | 0.02   | 0.022  | 0.024  | 0.0253 | 0.029  | 0.03   | 0.002  | -8E-05             |
|                        |         | Rifle Range Rd Shallow | 0.0006 | 0.001  | 0.0019 | 0.002  | 0.0026 | 0.0037 | 0.004  | 0.0003 | -2E-05             |
|                        |         | Seagrove Rd Main       | 0.002  | 0.002  | 0.0026 | 0.0029 | 0.0031 | 0.0036 | 0.0037 | 0.0003 | 4.7E-05            |

|                      |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max    | MAD    | Trend (units/y) |
|----------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------|
| Total mercury (mg/L) | NE      | Chenery/Whangaparaoa   | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Quintals Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Waiwera Enterpr.       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      | NW      | Parakai Aquatic Park   | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 4E-05  | ND              |
|                      |         | Rimmer Rd              | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Waitakere Rd           | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Waitakere Rd No2       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      | Central | Amelia Earhart Ave     | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND              |
|                      |         | Bullens Rd             | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Burnside Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND              |
|                      |         | Central Park           | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND     | ND              |
|                      |         | Central Park New       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Mt Richmond            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND              |
|                      |         | Puhinui                | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Tiwai Rd               | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Watson Ave             | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      | South   | BP Bombay              | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Fielding Rd Sand       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Fielding Rd Volcanic   | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Gun Club Rd            | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Hickey spring          | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Hillview spring        | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Ostrich Farm No1       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | ND     | ND              |
|                      |         | Ostrich Farm No2       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Patumahoe spring       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
|                      |         | Rifle Range Rd Deep    | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Rifle Range Rd Shallow | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | ND              |
|                      |         | Seagrove Rd Main       | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 5E-05  | 0      | 0               |
| Total nickel (mg/L)  | NE      | Chenery/Whangaparaoa   | 0.0011 | 0.0031 | 0.005  | 0.005  | 0.005  | 0.0065 | 0.007  | 0      | 0               |
|                      |         | Quintals Rd            | 0.0001 | 0.0001 | 0.0005 | 0.005  | 0.005  | 0.0086 | 0.009  | 0.0023 | -0.0003         |
|                      |         | Waiwera Enterpr.       | 0.0001 | 0.0001 | 0.0001 | 0.001  | 0.001  | 0.001  | 0.001  | 0      | -4E-05          |
|                      | NW      | Parakai Aquatic Park   | 0.0001 | 0.0001 | 0.001  | 0.0055 | 0.0098 | 0.0188 | 0.022  | 0.0045 | -0.0007         |
|                      |         | Rimmer Rd              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Waitakere Rd           | 0.0002 | 0.0002 | 0.0003 | 0.0006 | 0.005  | 0.005  | 0.005  | 0.0005 | -6E-05          |
|                      |         | Waitakere Rd No2       | 0.0001 | 0.0001 | 0.0003 | 0.005  | 0.005  | 0.005  | 0.005  | 0      | -6E-05          |
|                      | Central | Amelia Earhart Ave     | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.006  | 0.006  | 0      | 0               |
|                      |         | Bullens Rd             | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Burnside Rd            | 0.0001 | 0.0001 | 0.0015 | 0.005  | 0.0056 | 0.0076 | 0.0087 | 0.0015 | 0               |
|                      |         | Central Park           | 0.0044 | 0.0049 | 0.005  | 0.005  | 0.005  | 0.006  | 0.006  | 0      | 0               |
|                      |         | Central Park New       | 0.0005 | 0.0006 | 0.001  | 0.001  | 0.0014 | 0.0016 | 0.0017 | 0.0002 | 0.00012         |
|                      |         | Mt Richmond            | 0.0011 | 0.0012 | 0.005  | 0.005  | 0.0058 | 0.006  | 0.006  | 0.0005 | 0               |
|                      |         | Puhinui                | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Tiwai Rd               | 0.0005 | 0.0018 | 0.0048 | 0.0056 | 0.0083 | 0.017  | 0.017  | 0.0019 | -0.0002         |
|                      |         | Watson Ave             | 0.0011 | 0.0015 | 0.005  | 0.005  | 0.005  | 0.006  | 0.007  | 0      | 0               |
|                      | South   | BP Bombay              | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Fielding Rd Sand       | 0.0001 | 0.0002 | 0.0005 | 0.005  | 0.005  | 0.0064 | 0.0068 | 0.001  | 0               |
|                      |         | Fielding Rd Volcanic   | 0.0013 | 0.0048 | 0.005  | 0.005  | 0.006  | 0.008  | 0.008  | 0      | 0               |
|                      |         | Gun Club Rd            | 0.0004 | 0.0004 | 0.0005 | 0.0006 | 0.0007 | 0.0009 | 0.001  | 0.0001 | -0.0003         |
|                      |         | Hickey spring          | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0      | 0               |
|                      |         | Hillview spring        | 0.0001 | 0.0001 | 0.0002 | 0.0005 | 0.0007 | 0.001  | 0.0011 | 0.0003 | 3.7E-05         |
|                      |         | Ostrich Farm No1       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Ostrich Farm No2       | 0.0002 | 0.0002 | 0.0005 | 0.005  | 0.005  | 0.0076 | 0.0095 | 0.0005 | -4E-05          |
|                      |         | Patumahoe spring       | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0003 | 5E-05  | -0.0001         |
|                      |         | Rifle Range Rd Deep    | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Rifle Range Rd Shallow | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |
|                      |         | Seagrove Rd Main       | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0      | 0               |

|                         |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD    | Trend<br>(units/y) |
|-------------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|-------|--------|--------------------|
| Total phosphorus (mg/L) | NE      | Chenery/Whangaparaoa   | 0.022 | 0.0304 | 0.043  | 0.057  | 0.07   | 0.0784 | 0.1   | 0.013  | -0.0012            |
|                         |         | Quintals Rd            | 0.13  | 0.13   | 0.14   | 0.1555 | 0.1685 | 0.1822 | 0.188 | 0.0145 | 0.00154            |
|                         |         | Waiwera Enterpr.       | 0.004 | 0.004  | 0.004  | 0.004  | 0.005  | 0.0104 | 0.011 | 0      | 0.00015            |
|                         | NW      | Parakai Aquatic Park   | 0.004 | 0.004  | 0.005  | 0.01   | 0.016  | 0.021  | 0.03  | 0.005  | -0.0004            |
|                         |         | Rimmer Rd              | 0.069 | 0.07   | 0.071  | 0.079  | 0.08   | 0.085  | 0.086 | 0.003  | 0                  |
|                         |         | Waitakere Rd           | 0.15  | 0.1581 | 0.17   | 0.188  | 0.2    | 0.22   | 0.23  | 0.016  | 0                  |
|                         | Central | Waitakere Rd No2       | 0.015 | 0.0151 | 0.02   | 0.02   | 0.0268 | 0.03   | 0.031 | 0.0025 | -0.0004            |
|                         |         | Amelia Earhart Ave     | 0.11  | 0.113  | 0.122  | 0.13   | 0.14   | 0.15   | 0.157 | 0.01   | 0                  |
|                         |         | Bullens Rd             | 0.066 | 0.081  | 0.1125 | 0.145  | 0.17   | 0.1808 | 0.183 | 0.0255 | 0.0001             |
|                         |         | Burnside Rd            | 0.039 | 0.0438 | 0.05   | 0.059  | 0.0635 | 0.09   | 0.097 | 0.009  | -0.0007            |
|                         |         | Central Park           | 0.06  | 0.0695 | 0.0705 | 0.08   | 0.09   | 0.11   | 0.12  | 0.01   | <b>0.00098</b>     |
|                         |         | Central Park New       | 0.066 | 0.0684 | 0.076  | 0.084  | 0.091  | 0.11   | 0.11  | 0.008  | <b>0.00415</b>     |
|                         |         | Mt Richmond            | 0.004 | 0.004  | 0.005  | 0.008  | 0.0185 | 0.027  | 0.03  | 0.004  | -0.0012            |
|                         |         | Puhinui                | 0.06  | 0.06   | 0.062  | 0.067  | 0.07   | 0.0769 | 0.08  | 0.0045 | 0                  |
|                         |         | Tiwai Rd               | 0.06  | 0.0955 | 0.1945 | 0.2575 | 0.3588 | 0.5141 | 0.66  | 0.082  | -0.0002            |
|                         |         | Watson Ave             | 0.051 | 0.0548 | 0.0688 | 0.085  | 0.0963 | 0.1178 | 0.13  | 0.015  | <b>-0.0032</b>     |
|                         | South   | BP Bombay              | 0.086 | 0.09   | 0.0993 | 0.1    | 0.106  | 0.11   | 0.113 | 0.003  | <b>-0.0007</b>     |
|                         |         | Fielding Rd Sand       | 0.161 | 0.1636 | 0.18   | 0.2005 | 0.2303 | 0.2685 | 0.3   | 0.0245 | -0.004             |
|                         |         | Fielding Rd Volcanic   | 0.026 | 0.0295 | 0.037  | 0.04   | 0.043  | 0.0522 | 0.055 | 0.003  | <b>-0.0009</b>     |
|                         |         | Gun Club Rd            | 0.015 | 0.0154 | 0.017  | 0.017  | 0.019  | 0.0214 | 0.022 | 0.002  | -0.0031            |
|                         |         | Hickey spring          | 0.018 | 0.018  | 0.018  | 0.018  | 0.018  | 0.018  | 0.018 | 0      | ND                 |
|                         |         | Hillview spring        | 0.037 | 0.0386 | 0.05   | 0.053  | 0.057  | 0.0626 | 0.063 | 0.004  | 0.00724            |
|                         |         | Ostrich Farm No1       | 0.113 | 0.12   | 0.12   | 0.13   | 0.13   | 0.144  | 0.15  | 0.004  | -0.0001            |
|                         |         | Ostrich Farm No2       | 0.17  | 0.1733 | 0.1893 | 0.21   | 0.2288 | 0.25   | 0.25  | 0.02   | -0.0033            |
|                         |         | Patumahoe spring       | 0.014 | 0.014  | 0.014  | 0.015  | 0.015  | 0.0158 | 0.016 | 0.001  | 0                  |
|                         |         | Rifle Range Rd Deep    | 0.17  | 0.1873 | 0.21   | 0.23   | 0.24   | 0.263  | 0.29  | 0.016  | <b>-0.0039</b>     |
|                         |         | Rifle Range Rd Shallow | 0.05  | 0.0527 | 0.06   | 0.0605 | 0.065  | 0.08   | 0.08  | 0.0025 | -0.0004            |
|                         |         | Seagrove Rd Main       | 0.037 | 0.038  | 0.039  | 0.04   | 0.0413 | 0.0461 | 0.047 | 0.001  | 0                  |
| Total potassium (mg/L)  | NE      | Chenery/Whangaparaoa   | 0.14  | 0.1455 | 0.195  | 0.22   | 0.26   | 0.2825 | 0.31  | 0.04   | 0                  |
|                         |         | Quintals Rd            | 0.45  | 0.4555 | 0.4775 | 0.48   | 0.4975 | 0.5245 | 0.53  | 0.01   | 0.00083            |
|                         |         | Waiwera Enterpr.       | 7.3   | 7.44   | 7.8    | 8.1    | 8.2    | 8.3    | 8.3   | 0.2    | 0.14419            |
|                         | NW      | Parakai Aquatic Park   | 16.7  | 16.82  | 17.4   | 17.8   | 18.2   | 19.28  | 19.4  | 0.4    | 0.40027            |
|                         |         | Rimmer Rd              | 2.08  | 2.1025 | 2.15   | 2.155  | 2.1975 | 2.3355 | 2.34  | 0.03   | 0.00576            |
|                         |         | Waitakere Rd           | 2.16  | 2.172  | 2.22   | 2.26   | 2.4    | 2.44   | 2.5   | 0.06   | 0.0058             |
|                         | Central | Waitakere Rd No2       | 1.59  | 1.5965 | 1.645  | 1.73   | 1.875  | 1.935  | 2     | 0.1    | -0.0033            |
|                         |         | Amelia Earhart Ave     | 7.44  | 7.5005 | 7.6    | 7.725  | 7.9075 | 8.2625 | 8.29  | 0.135  | 0.02497            |
|                         |         | Bullens Rd             | 2.98  | 3.1795 | 3.5875 | 3.69   | 3.7525 | 3.825  | 3.86  | 0.08   | 0.00093            |
|                         |         | Burnside Rd            | 1.63  | 1.638  | 1.66   | 1.66   | 1.66   | 1.688  | 1.7   | 0      | -0.0101            |
|                         |         | Central Park           | 1.39  | 1.546  | 2.33   | 2.66   | 3.24   | 3.864  | 3.9   | 0.45   | -0.0132            |
|                         |         | Central Park New       | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                         |         | Mt Richmond            | 0.65  | 0.7215 | 1.055  | 1.23   | 1.29   | 1.5945 | 1.6   | 0.155  | <b>0.12341</b>     |
|                         |         | Puhinui                | 0.34  | 0.385  | 0.45   | 0.51   | 0.525  | 0.58   | 0.6   | 0.04   | 0                  |
|                         |         | Tiwai Rd               | 1.43  | 1.8355 | 2.83   | 4.605  | 6.55   | 7.7785 | 10.7  | 1.905  | 0.32126            |
|                         |         | Watson Ave             | 4.9   | 4.9    | 5.02   | 5.4    | 5.72   | 6.1    | 6.3   | 0.38   | <b>0.13975</b>     |
|                         | South   | BP Bombay              | 1.97  | 2.014  | 2.06   | 2.09   | 2.11   | 2.178  | 2.2   | 0.03   | 0                  |
|                         |         | Fielding Rd Sand       | 5.5   | 5.64   | 5.9    | 6.04   | 6.17   | 6.248  | 6.28  | 0.14   | -0.0936            |
|                         |         | Fielding Rd Volcanic   | 3.52  | 3.5675 | 3.65   | 3.705  | 3.78   | 3.8385 | 4     | 0.065  | -0.0124            |
|                         |         | Gun Club Rd            | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                         |         | Hickey spring          | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                         |         | Hillview spring        | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                         |         | Ostrich Farm No1       | 3.16  | 3.241  | 3.3    | 3.34   | 3.43   | 3.51   | 3.6   | 0.06   | 0.0075             |
|                         |         | Ostrich Farm No2       | 3.69  | 3.6945 | 3.7525 | 3.855  | 3.9375 | 4.024  | 4.06  | 0.1    | -0.0053            |
|                         |         | Patumahoe spring       | ND    | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND                 |
|                         |         | Rifle Range Rd Deep    | 4.08  | 4.2335 | 4.525  | 4.63   | 4.76   | 4.8495 | 5.04  | 0.13   | -0.0163            |
|                         |         | Rifle Range Rd Shallow | 0.71  | 0.786  | 0.8775 | 0.895  | 0.9425 | 0.9705 | 0.98  | 0.025  | -0.0004            |
|                         |         | Seagrove Rd Main       | 3.8   | 3.88   | 4.04   | 4.1    | 4.19   | 4.416  | 4.48  | 0.09   | 0.01734            |

|                                         |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max  | MAD   | Trend<br>(units/y) |
|-----------------------------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|------|-------|--------------------|
| Total silica (SiO <sub>2</sub> ) (mg/L) | NE      | Chenery/Whangaparaoa   | 22.9  | 23.67  | 25.35  | 27.1   | 30.75  | 34.8   | 35.5 | 2.3   | 0.06               |
|                                         |         | Quintals Rd            | 70.1  | 71.66  | 75     | 79     | 80     | 82.78  | 84.7 | 2     | 1.5592             |
|                                         |         | Waiwera Enterpr.       | 26.6  | 26.84  | 27.45  | 28     | 28.45  | 28.85  | 29   | 0.5   | 0.19664            |
|                                         | NW      | Parakai Aquatic Park   | 59.51 | 60.906 | 63.1   | 66.3   | 70.9   | 75.26  | 78.1 | 4.4   | 0.42757            |
|                                         |         | Rimmer Rd              | 41.5  | 41.95  | 43.99  | 45.2   | 49.4   | 51.7   | 52   | 2.5   | 0.00569            |
|                                         |         | Waitakere Rd           | 54    | 55.255 | 58.625 | 61     | 62     | 65.15  | 66   | 2     | <b>0.37182</b>     |
|                                         |         | Waitakere Rd No2       | 20    | 21.4   | 23     | 23     | 24     | 25.2   | 27   | 1     | <b>0.14569</b>     |
|                                         | Central | Amelia Earhart Ave     | 68.6  | 68.94  | 73.25  | 77.5   | 80.125 | 86.57  | 89.8 | 4     | 0.54706            |
|                                         |         | Bullens Rd             | 49.9  | 50.8   | 53.9   | 58.2   | 62.35  | 68.65  | 73.3 | 4.9   | 0.37283            |
|                                         |         | Burnside Rd            | 28.4  | 29.6   | 31     | 31     | 31.625 | 32.35  | 33.4 | 0.45  | 0                  |
|                                         |         | Central Park           | 16    | 16.225 | 17.325 | 18     | 18.275 | 19.6   | 20   | 0.55  | 0                  |
|                                         |         | Central Park New       | 17    | 17.4   | 18     | 18     | 19     | 20     | 20   | 1     | 0.48059            |
|                                         |         | Mt Richmond            | 12    | 12.5   | 13.57  | 14     | 14.85  | 18     | 18   | 0.66  | 0.60372            |
|                                         |         | Puhinui                | 15.2  | 15.245 | 15.6   | 16.05  | 16.45  | 17.37  | 18   | 0.45  | -0.0251            |
|                                         |         | Tiwai Rd               | 4.09  | 13.175 | 25.503 | 28.9   | 38.65  | 49.65  | 51   | 6.3   | 0.40546            |
|                                         |         | Watson Ave             | 21.8  | 21.835 | 22.788 | 24     | 25     | 26     | 26.9 | 1     | 0.06855            |
|                                         | South   | BP Bombay              | 38.2  | 39.62  | 41.3   | 42.95  | 44.25  | 46.955 | 48   | 1.5   | 0.17355            |
|                                         |         | Fielding Rd Sand       | 55    | 55.605 | 57.125 | 60.2   | 62.2   | 64.45  | 65   | 2.75  | 0.37839            |
|                                         |         | Fielding Rd Volcanic   | 35.8  | 36.845 | 37.425 | 39.6   | 41.75  | 45.235 | 48   | 2.3   | <b>0.30534</b>     |
|                                         |         | Gun Club Rd            | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Hickey spring          | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Hillview spring        | 42    | 42     | 42     | 43.5   | 45.75  | 47.55  | 48   | 1.5   | ND                 |
|                                         |         | Ostrich Farm No1       | 42    | 43     | 45     | 46     | 47     | 49.25  | 50   | 1     | <b>0.125</b>       |
|                                         |         | Ostrich Farm No2       | 60.3  | 60.465 | 63.95  | 65     | 66.4   | 70.36  | 73   | 1.6   | <b>0.68537</b>     |
|                                         |         | Patumahoe spring       | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Rifle Range Rd Deep    | 26.4  | 28.15  | 31.225 | 33     | 34.8   | 37.75  | 39   | 2     | <b>0.50345</b>     |
|                                         |         | Rifle Range Rd Shallow | 39.5  | 43.35  | 46     | 48     | 49.025 | 52     | 54.2 | 1.85  | 0.1272             |
|                                         |         | Seagrove Rd Main       | 9.1   | 9.39   | 10.4   | 10.8   | 11.1   | 11.61  | 12.2 | 0.3   | <b>0.05009</b>     |
| Total sodium (mg/L)                     | NE      | Chenery/Whangaparaoa   | 69.1  | 69.685 | 71.15  | 78     | 81.925 | 85.045 | 86.8 | 6.05  | -0.802             |
|                                         |         | Quintals Rd            | 24.5  | 25.325 | 26.45  | 26.8   | 27.075 | 27.535 | 27.7 | 0.35  | 0.06991            |
|                                         |         | Waiwera Enterpr.       | 644   | 655.2  | 673    | 684    | 689    | 706.6  | 717  | 7     | -0.7314            |
|                                         | NW      | Parakai Aquatic Park   | 610   | 610.6  | 612    | 613    | 620.5  | 632.9  | 638  | 3     | 3.00617            |
|                                         |         | Rimmer Rd              | 68.3  | 70.863 | 76.125 | 79.5   | 81.9   | 83.38  | 83.6 | 3.3   | -1.5136            |
|                                         |         | Waitakere Rd           | 21.4  | 21.4   | 21.65  | 23     | 23.475 | 24     | 24   | 1     | 0.07835            |
|                                         |         | Waitakere Rd No2       | 34.1  | 34.36  | 35.325 | 37.65  | 39     | 39.35  | 40   | 1.65  | 0.04931            |
|                                         | Central | Amelia Earhart Ave     | 40.1  | 40.4   | 41.6   | 42     | 43.2   | 43.8   | 44.4 | 1     | -0.0499            |
|                                         |         | Bullens Rd             | 23.12 | 24.793 | 29.025 | 29.9   | 30.625 | 34.25  | 36   | 0.85  | -0.5569            |
|                                         |         | Burnside Rd            | 21.7  | 22.05  | 23.15  | 23.5   | 24.5   | 25.15  | 25.4 | 0.7   | 0.23286            |
|                                         |         | Central Park           | 12.9  | 13.58  | 16     | 18.1   | 20.5   | 23.72  | 23.9 | 2.4   | 0.04928            |
|                                         |         | Central Park New       | 14    | 14     | 14     | 14     | 14     | 14     | 14   | ND    | ND                 |
|                                         |         | Mt Richmond            | 7.3   | 7.63   | 9.0275 | 10.725 | 11.725 | 12.6   | 12.6 | 1.655 | <b>1.04739</b>     |
|                                         |         | Puhinui                | 80.2  | 80.475 | 81.75  | 83.7   | 85.4   | 86.775 | 87.6 | 1.85  | <b>1.01307</b>     |
|                                         |         | Tiwai Rd               | 6.2   | 6.931  | 9.6    | 20.5   | 26.135 | 28.04  | 29.4 | 7.1   | <b>1.65491</b>     |
|                                         |         | Watson Ave             | 18.91 | 20.2   | 21     | 21.7   | 22.5   | 23.2   | 23.3 | 0.7   | 0.11675            |
|                                         | South   | BP Bombay              | 15.3  | 15.8   | 16     | 16.28  | 16.45  | 16.7   | 17.1 | 0.28  | <b>0.10885</b>     |
|                                         |         | Fielding Rd Sand       | 40.4  | 40.56  | 40.9   | 41.2   | 42     | 43.12  | 43.2 | 0.4   | -0.4016            |
|                                         |         | Fielding Rd Volcanic   | 23.7  | 24.2   | 25.2   | 25.6   | 26.4   | 27.1   | 27.6 | 0.6   | 0.10769            |
|                                         |         | Gun Club Rd            | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Hickey spring          | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Hillview spring        | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Ostrich Farm No1       | 19.8  | 20.845 | 21.175 | 21.7   | 22.55  | 23     | 23   | 0.65  | 0.09923            |
|                                         |         | Ostrich Farm No2       | 19.2  | 19.35  | 19.55  | 19.8   | 19.95  | 20.3   | 20.4 | 0.2   | 0.04997            |
|                                         |         | Patumahoe spring       | ND    | ND     | ND     | ND     | ND     | ND     | ND   | ND    | ND                 |
|                                         |         | Rifle Range Rd Deep    | 24.7  | 24.8   | 25.5   | 26.82  | 27.6   | 28.5   | 28.6 | 0.82  | -0.2341            |
|                                         |         | Rifle Range Rd Shallow | 14.8  | 14.8   | 15.173 | 15.3   | 15.525 | 16.315 | 16.6 | 0.2   | 0.14904            |
|                                         |         | Seagrove Rd Main       | 86.5  | 86.925 | 89.9   | 95     | 98.75  | 101.15 | 102  | 4.9   | 1.01754            |

|                               |         | Site name              | Min    | 5th    | 25th   | Median | 75th   | 95th   | Max   | MAD    | Trend (units/y) |
|-------------------------------|---------|------------------------|--------|--------|--------|--------|--------|--------|-------|--------|-----------------|
| Total Suspended Solids (mg/L) | NE      | Chenery/Whangaparaoa   | 2      | 2.05   | 5.55   | 12     | 24     | 27.8   | 51    | 7.6    | -0.5298         |
|                               |         | Quintals Rd            | 1.6    | 1.95   | 2.8    | 4.1    | 5.5    | 6.75   | 8.8   | 1.4    | -0.0757         |
|                               |         | Waiwera Enterpr.       | 0.1    | 0.1    | 0.4    | 0.5    | 0.57   | 1.28   | 1.6   | 0.1    | 0.02969         |
|                               | NW      | Parakai Aquatic Park   | 0.1    | 0.1    | 0.425  | 0.5    | 0.6    | 0.703  | 0.72  | 0.1    | -0.0108         |
|                               |         | Rimmer Rd              | 0.1    | 0.1    | 0.5    | 0.5    | 0.8    | 1.195  | 1.5   | 0.2    | <b>0.04457</b>  |
|                               |         | Waitakere Rd           | 0.6    | 1.49   | 2.6    | 5.6    | 8.75   | 15     | 16.1  | 3.1    | <b>-0.7515</b>  |
|                               |         | Waitakere Rd No2       | 1.5    | 1.5    | 1.7    | 2.5    | 2.9    | 3.86   | 5.3   | 0.6    | -0.0716         |
|                               | Central | Amelia Earhart Ave     | 0.38   | 0.4    | 0.5    | 0.55   | 0.985  | 1.915  | 2     | 0.15   | 0.01423         |
|                               |         | Bullens Rd             | 0.4    | 0.5    | 0.5    | 0.7    | 1.125  | 2      | 2     | 0.2    | 0               |
|                               |         | Burnside Rd            | 0.1    | 0.98   | 2.3    | 3      | 3.4    | 4.04   | 4.5   | 0.7    | 0.07518         |
|                               |         | Central Park           | 0.1    | 0.201  | 0.5    | 0.5    | 0.805  | 1.19   | 1.4   | 0.2    | <b>0.02728</b>  |
|                               |         | Central Park New       | 0.4    | 0.4    | 0.7375 | 1.05   | 1.575  | 2.075  | 2.3   | 0.4    | 0.18208         |
|                               |         | Mt Richmond            | 0.1    | 0.1    | 0.4    | 0.5    | 0.5    | 0.8    | 0.9   | 0.08   | <b>0.04978</b>  |
|                               |         | Puhinui                | 0.3    | 0.385  | 0.5    | 0.5    | 0.5    | 0.615  | 0.7   | 0      | -0.0101         |
|                               |         | Tiwai Rd               | 0.004  | 29.515 | 65.425 | 91     | 136.25 | 245.65 | 270   | 37     | -3.0549         |
|                               |         | Watson Ave             | 0.4    | 0.5    | 0.875  | 1.4    | 2.825  | 5      | 5.4   | 0.6    | <b>-0.1538</b>  |
|                               |         | BP Bombay              | 0.1    | 0.1    | 0.2    | 0.5    | 0.5    | 0.6    | 0.8   | 0.1    | <b>0.02718</b>  |
|                               | South   | Fielding Rd Sand       | 0.4    | 0.4    | 0.5    | 0.5    | 0.5    | 0.55   | 0.7   | 0      | 0               |
|                               |         | Fielding Rd Volcanic   | 0.3    | 0.485  | 1.2    | 2      | 2.85   | 5.03   | 5.5   | 0.8    | 0.06368         |
|                               |         | Gun Club Rd            | 0.53   | 0.53   | 0.53   | 0.8    | 0.8    | 0.96   | 1     | 0.2    | 0               |
|                               |         | Hickey spring          | 0.53   | 0.53   | 0.53   | 0.53   | 0.53   | 0.53   | 0.53  | 0      | ND              |
|                               |         | Hillview spring        | 0.4    | 0.4    | 0.53   | 0.6    | 0.8    | 0.848  | 0.88  | 0.2    | -0.2366         |
|                               |         | Ostrich Farm No1       | 0.1    | 0.1    | 0.265  | 0.5    | 0.5    | 0.8    | 0.8   | 0.1    | <b>0.03458</b>  |
|                               |         | Ostrich Farm No2       | 4      | 4.175  | 5.375  | 6.15   | 7.125  | 7.555  | 8     | 0.9    | -0.0775         |
|                               |         | Patumahoe spring       | 0.4    | 0.4    | 0.4    | 0.53   | 0.53   | 0.746  | 0.8   | 0.13   | 0               |
|                               |         | Rifle Range Rd Deep    | 0.1    | 0.1    | 0.4    | 0.5    | 0.5    | 0.8    | 0.8   | 0.03   | <b>0.0099</b>   |
|                               |         | Rifle Range Rd Shallow | 0.1    | 0.5    | 0.5    | 0.6    | 1      | 2.9    | 3     | 0.15   | -0.012          |
|                               |         | Seagrove Rd Main       | 0.05   | 0.1    | 0.12   | 0.5    | 0.53   | 1.2    | 1.8   | 0.31   | 0.02673         |
| Total zinc (mg/L)             | NE      | Chenery/Whangaparaoa   | 0.005  | 0.0076 | 0.0108 | 0.02   | 0.0278 | 0.0348 | 0.038 | 0.0095 | 0.00178         |
|                               |         | Quintals Rd            | 0.001  | 0.001  | 0.0017 | 0.005  | 0.008  | 0.0135 | 0.017 | 0.0037 | 0               |
|                               |         | Waiwera Enterpr.       | 0.001  | 0.001  | 0.002  | 0.005  | 0.0065 | 0.0095 | 0.01  | 0.003  | -0.0005         |
|                               | NW      | Parakai Aquatic Park   | 0.001  | 0.0018 | 0.005  | 0.005  | 0.006  | 0.0142 | 0.017 | 0.001  | 0.00035         |
|                               |         | Rimmer Rd              | 0.001  | 0.0012 | 0.0028 | 0.005  | 0.005  | 0.0072 | 0.009 | 0.001  | -5E-05          |
|                               |         | Waitakere Rd           | 0.002  | 0.0022 | 0.0032 | 0.005  | 0.0055 | 0.008  | 0.01  | 0.001  | -0.0001         |
|                               |         | Waitakere Rd No2       | 0.001  | 0.001  | 0.0035 | 0.008  | 0.0105 | 0.019  | 0.025 | 0.003  | 0               |
|                               | Central | Amelia Earhart Ave     | 0.001  | 0.001  | 0.0011 | 0.0045 | 0.005  | 0.0099 | 0.017 | 0.0021 | 0               |
|                               |         | Bullens Rd             | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.005 | 0      | 0               |
|                               |         | Burnside Rd            | 0.001  | 0.001  | 0.0015 | 0.005  | 0.0055 | 0.0109 | 0.013 | 0.002  | 0               |
|                               |         | Central Park           | 0.009  | 0.0101 | 0.0125 | 0.015  | 0.016  | 0.0198 | 0.02  | 0.002  | -0.0002         |
|                               |         | Central Park New       | 0.01   | 0.0101 | 0.0105 | 0.011  | 0.0115 | 0.0119 | 0.012 | 0.001  | -0.002          |
|                               |         | Mt Richmond            | 0.005  | 0.0055 | 0.006  | 0.007  | 0.0225 | 0.031  | 0.032 | 0.002  | -0.0001         |
|                               |         | Puhinui                | 0.005  | 0.005  | 0.005  | 0.005  | 0.005  | 0.0057 | 0.006 | 0      | 0               |
|                               |         | Tiwai Rd               | 0.005  | 0.0052 | 0.011  | 0.019  | 0.032  | 0.0708 | 0.078 | 0.01   | -3E-05          |
|                               |         | Watson Ave             | 0.001  | 0.0031 | 0.004  | 0.005  | 0.005  | 0.006  | 0.007 | 0.0006 | 0               |
|                               |         | BP Bombay              | 0.0023 | 0.0051 | 0.026  | 0.059  | 0.109  | 0.1402 | 0.157 | 0.034  | <b>-0.0158</b>  |
|                               | South   | Fielding Rd Sand       | 0.001  | 0.001  | 0.0012 | 0.005  | 0.005  | 0.0065 | 0.008 | 0.002  | 0               |
|                               |         | Fielding Rd Volcanic   | 0.001  | 0.001  | 0.0028 | 0.005  | 0.005  | 0.006  | 0.009 | 0      | 0               |
|                               |         | Gun Club Rd            | ND     | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND              |
|                               |         | Hickey spring          | ND     | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND              |
|                               |         | Hillview spring        | 0.0017 | 0.0025 | 0.0055 | 0.0094 | 0.0132 | 0.0162 | 0.017 | 0.0077 | ND              |
|                               |         | Ostrich Farm No1       | 0.001  | 0.001  | 0.0018 | 0.003  | 0.005  | 0.005  | 0.005 | 0.002  | -8E-05          |
|                               |         | Ostrich Farm No2       | 0.0017 | 0.0017 | 0.003  | 0.005  | 0.005  | 0.0132 | 0.016 | 0.002  | -0.0002         |
|                               |         | Patumahoe spring       | ND     | ND     | ND     | ND     | ND     | ND     | ND    | ND     | ND              |
|                               |         | Rifle Range Rd Deep    | 0.001  | 0.001  | 0.002  | 0.005  | 0.005  | 0.0069 | 0.011 | 0.001  | -8E-05          |
|                               |         | Rifle Range Rd Shallow | 0.001  | 0.0011 | 0.0035 | 0.005  | 0.005  | 0.007  | 0.007 | 0.001  | 0               |
|                               |         | Seagrove Rd Main       | 0.001  | 0.001  | 0.0018 | 0.0035 | 0.0055 | 0.0089 | 0.01  | 0.002  | -0.0001         |

|                       |         | Site name              | Min   | 5th    | 25th   | Median | 75th   | 95th   | Max  | MAD   | Trend<br>(units/y) |
|-----------------------|---------|------------------------|-------|--------|--------|--------|--------|--------|------|-------|--------------------|
| Turbidity (NTU) - lab | NE      | Chenery/Whangaparaoa   | 1.4   | 1.62   | 2.15   | 3.5    | 7.45   | 9.75   | 12   | 1.7   | 0.15416            |
|                       |         | Quintals Rd            | 5.03  | 7.493  | 12.925 | 16.7   | 23.45  | 28.855 | 31   | 5.55  | <b>-1.4433</b>     |
|                       |         | Waiwera Enterpr.       | 0.07  | 0.078  | 0.1    | 0.1    | 0.12   | 0.1528 | 0.16 | 0.02  | -0.0031            |
|                       | NW      | Parakai Aquatic Park   | 0.07  | 0.084  | 0.1    | 0.1    | 0.14   | 0.206  | 0.22 | 0.019 | -0.0018            |
|                       |         | Rimmer Rd              | 0.33  | 0.4041 | 1.89   | 2.645  | 3.55   | 8.81   | 9    | 0.785 | -0.1819            |
|                       |         | Waitakere Rd           | 0.87  | 3.64   | 12.35  | 29.6   | 49.3   | 60.1   | 61.3 | 17.7  | -1.6014            |
|                       |         | Waitakere Rd No2       | 8.42  | 9.05   | 10.1   | 12.2   | 14     | 16     | 17   | 1.8   | 0.09095            |
|                       | Central | Amelia Earhart Ave     | 1.66  | 1.7425 | 2.07   | 2.375  | 2.5875 | 3.215  | 3.4  | 0.295 | <b>-0.0424</b>     |
|                       |         | Bullens Rd             | 0.1   | 0.5725 | 0.675  | 1.16   | 1.775  | 2.71   | 2.97 | 0.535 | -0.0114            |
|                       |         | Burnside Rd            | 3.71  | 6.95   | 12.05  | 14.8   | 18.35  | 24.38  | 26.2 | 2.8   | 0.21773            |
|                       |         | Central Park           | 0.5   | 0.6    | 1.1325 | 1.53   | 2.3    | 3.268  | 3.66 | 0.44  | 0.06982            |
|                       |         | Central Park New       | 0.65  | 0.6998 | 0.842  | 0.96   | 1.2    | 1.44   | 1.65 | 0.141 | -0.1116            |
|                       |         | Mt Richmond            | 0.1   | 0.1125 | 0.2023 | 0.295  | 0.5075 | 0.7925 | 1.03 | 0.15  | 0.02008            |
|                       |         | Puhinui                | 0.21  | 0.21   | 0.24   | 0.31   | 0.33   | 0.436  | 0.46 | 0.05  | -0.0099            |
|                       |         | Tiwai Rd               | 3.1   | 16.8   | 38.275 | 60.5   | 92.95  | 153    | 170  | 25.7  | -2.5577            |
|                       |         | Watson Ave             | 0.3   | 0.5395 | 0.8    | 1.16   | 1.8675 | 3.1035 | 3.69 | 0.455 | <b>-0.0641</b>     |
|                       |         | BP Bombay              | 0.043 | 0.06   | 0.1    | 0.1    | 0.12   | 0.18   | 0.19 | 0.016 | 0                  |
|                       | South   | Fielding Rd Sand       | 0.31  | 0.3145 | 0.39   | 0.5    | 0.67   | 0.9226 | 1    | 0.137 | 0.02008            |
|                       |         | Fielding Rd Volcanic   | 0.38  | 0.704  | 2.4    | 4.6    | 7.5    | 11.5   | 14.2 | 2.55  | <b>0.35062</b>     |
|                       |         | Gun Club Rd            | 0.1   | 0.1075 | 0.1375 | 0.2    | 0.3125 | 0.4625 | 0.5  | 0.075 | ND                 |
|                       |         | Hickey spring          | 0.1   | 0.1    | 0.1    | 0.11   | 0.15   | 0.15   | 0.15 | 0.01  | -0.0103            |
|                       |         | Hillview spring        | 0.1   | 0.1175 | 0.1725 | 0.1965 | 0.2975 | 0.3825 | 0.4  | 0.065 | -0.0467            |
|                       |         | Ostrich Farm No1       | 0.14  | 0.18   | 0.205  | 0.252  | 0.3075 | 0.4698 | 0.5  | 0.052 | -0.0034            |
|                       |         | Ostrich Farm No2       | 5.25  | 9.44   | 20.5   | 26     | 31.45  | 35.73  | 37   | 5.9   | <b>-1.0256</b>     |
|                       |         | Patumahoe spring       | 0.1   | 0.1045 | 0.1225 | 0.14   | 0.15   | 0.15   | 0.15 | 0.01  | -0.0313            |
|                       |         | Rifle Range Rd Deep    | 0.1   | 0.1035 | 0.13   | 0.155  | 0.24   | 0.38   | 0.42 | 0.045 | -0.0022            |
|                       |         | Rifle Range Rd Shallow | 0.16  | 0.1906 | 0.34   | 0.6    | 1      | 2.28   | 2.5  | 0.28  | <b>-0.0638</b>     |
|                       |         | Seagrove Rd Main       | 0.1   | 0.13   | 0.15   | 0.22   | 0.31   | 0.406  | 0.49 | 0.07  | 0.00483            |



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