18 August 2020 Reference No. 1898725_7403-012-LR-Rev1

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GISBORNE MAR STAGE 3 INJECTION TRIAL – INTERIM MONITORING REPORT – AUGUST 2020

Dear Graeme,

In this letter report[1] Golder Associates NZ Ltd (Golder) in association with KWR Water Research Institute (KWR) provides the first interim monitoring report for 2020, regarding the Gisborne Managed Aquifer Recharge (MAR) Stage 2 trial. The data analysed was generated from monitoring rounds completed on 14 October 2019, 11 November 2019, 6 May 2020 and flow/level data collected in July 2020. Injection of MAR water recommenced on 13 May 2020.

Previous monitoring results covering the period of September 2018 and August 2019 are reported by Golder[2].

Gisborne MAR Project

Gisborne District Council (GDC) has initiated the Gisborne Managed Aquifer Recharge (MAR) project, which encompasses investigations and aquifer injection pilot trials to assess the technical and environmental feasibility of MAR solutions to counter the long-term groundwater level decline and degradation of the water quality of the Makauri aquifer beneath the Poverty Bay Flats, Gisborne.

A total of 73,180 m^3 of Waipaoa River water was injected into the Makauri Aquifer with a single injection well during three months in the winter 2017 trial. No injection was undertaken in 2018.

Following MAR infrastructure upgrading in 2019, the Stage 2 injection trial has commenced on August 2019. In 2019 a total of 39,881 m^3 was injected into the Makauri Aquifer over a period of 69 days. Another injection trial as part of Stage 2 has commenced on 12 May 2020.

Interim Monitoring Reporting

The Gisborne MAR Stage 2 Injection trial includes a programme to monitor the MAR infrastructure performance, injection flows and quality, and the hydraulic and hydrogeochemical response of the aquifer injection trials (monitoring schedule followed up to June 2020 and lab testing parameter suites included in Attachment 2). Reporting during the injection trial period addresses the following matters:

[1] Subject to Golder's limitations attached (Attachment 1).

[2] Golder Letter Report No.s: 1898725-7403-007-LR-Rev0 (25/9/2019), 1898725-7403-006-LR-Rev0 (8/2/2019), and 1898725-7403-005-LR-Rev1 21/12/2018)

- General comments on system performance, environmental effects and any required mitigation
- Abstraction and injection
- Hydraulic responses
- Injection plume tracking
- Hydrogeochemical responses
- Compliance with conditions of resource consent
- Emerging contaminants testing
- Recommendations for any changes to the current management, mitigation and monitoring schedule.

Monitoring rounds and subsequent reporting is planned to be undertaken four times during 2020. The findings are listed in Table 1. Water quality test results are included in Attachment 3.

Table 1: Gisborne MAR stage 2 injection trial report.

General	
Report number	04
Reporting period	August 2020
Monitoring period	14 October 2019 – 27 July 2020

Findings

Stage 2 injection started in August 2019. In addition, the injection plume from the 2017 and 2019 injection trials is still present around the injection well and can be tracked with monitoring wells GPE065, GPE067, GPE068 and GPE069 (see map below).

General conclusions that can be drawn so far are as follows:

- There are signs of progressive clogging caused by fines within the source water (Waipaoa River water) used for injection. Specific capacity, a measure for well performance, declined from 4.0 L/s/m at the start of the 2020 injection trial to 1.8 L/s/m in mid-June 2020, which is lower than values recorded in the 2019. However, well backwashing cycles were undertaken in July 2020 and the injection specific capacity appear to have improved to approximately 2.5 L/s/m. The continuation of frequent well backwashing during injection is recommended, which should occur at least once per week (with each backwashing cycle the injection well is pumped at 10 to 15 L/s for approximately 1 hour until pumped water runs visually clean).
- Results from all monitoring rounds between October 2018 to June 2020 indicate the injection plume resulting from the 2017, 2019 and 2020 trials is still present at GPE066 (injection well), GPE065, GPE067 and GPE068 (within 330 m distant downgradient from injection well). Ambient groundwater appears to be only present at GPE069 (194 m distant upgradient from injection well) currently, which is reflected in the recorded water quality signature.

Findings

- The water quality signature of GPE065, GPE067 and GPE068 are all gradually becoming more similar as the centre of the injection plume encompasses the entire area between these monitoring wells. As injection continues, it is expected that all three of these monitoring wells will eventually have the same water quality signature as Waipaoa River water.
- Breakthrough of the MAR injection plume would appear to have occurred in downgradient irrigation well GDP189 at about 1 km southeast from the injection well. However, this well is 83.3 m deep and possibly not screened in the Makauri Aquifer. Water quality of irrigation well GPD115 at 1.5 km southwest of the injection well represents ambient groundwater. Golder recommends more frequent sampling and testing of both wells. This will help confirm whether breakthrough has reached these wells.
- There are no indications of adverse water quality effects within the current injection plume (present since July 2017) based on the results of water quality monitoring rounds between October 2018 and June 2020. Total and dissolved arsenic concentrations in the injection plume remain below levels measured in native groundwater. The injection plume water is less mineralised and likely to be less corrosive and more suitable for irrigation purposes than native groundwater.
- Where pathogens are clearly present at high levels in Waipaoa River water on occasion, this is generally not the case in the groundwater monitoring wells located within the 2017, 2019 and 2020 injection plume. Although some pathogens tested positive in groundwater at low levels, as previously reported[3]. Rapid die-off limits the spread of pathogens within groundwater.
- No mitigation for protection against any adverse effects on the aquifer's water quality is deemed necessary based on the monitoring results to date.
- The test results suggest emerging contaminant are present in the Waipaoa River. The monitoring also shows a progressive rise in total emerging contaminant load in the injection plume although concentrations remain very low (i.e., in order of ng/L). If emerging contaminants are present in the MAR source water (Waipaoa River) they will enter the groundwater system. If no natural decay occurs, these emerging contaminants will remain present within the injection plume, which will grow in size, as the MAR injection progresses. It is noted that natural recharge processes will inevitably cause emerging contaminants to enter the groundwater system and that ambient groundwater may already contain emerging contaminants. Therefore, we recommend a further review, as well as sampling and testing for emerging contaminants and Suite 2 parameters (Attachment 2) of up to 3 existing upgradient wells that are at sufficient distance away from the injection well (to not be influenced by the injection plume) and screened in the Makauri Aquifer. Potential wells to sample and test could be GPE058, GPE023, GPE038 west of SH2 / Matawai Rd; or GPF147 and GPF111 along Tucker Rd. This would help to better understand existing levels of emerging contaminants within the ambient groundwater.
- The injection of MAR water in 2020 has not fully comply with river abstraction condition 16 to 19 of the resource consent which enables the trial. River water was abstracted for two days when the flows in the Waipaoa River were below minimum flows of 4,000 L/s. However, all other conditions related to injection water quality and injection flows are currently being met.

[3] Golder Letter Report No.: 1898725-7403-007-LR-Rev0 (25/9/2019)

Findings

- Golder identified quality control issues

Abstraction and Injection

Injection Period: Winter 2019 to early spring 2019

Volume taken from river	Average river take rate	Maximum river take rate
40,658 m^3	13.9 L/s	21.6 L/s
Volume injected	Average injection rate	Maximum injection rate
39,881 m^3	13.8 L/s	19.8 L/s
Backwash volume	N/A (Filter backwashing and line flushing: 777 m^3; injection well backwashing: N/A)	
Injection period	5 August 2019 to 13 October 2019	
Total injection period duration	69 days	
Number of days of injection	33 days	
Average injection turbidity	3.67 NTU	

Injection Period: Winter 2020 onwards

Volume taken from river	Average river take rate	Maximum river take rate
25,838 m^3	14.3 L/s	20.6 L/s
Total volume injected	Average injection rate	Maximum injection rate
25,406 m^3 (net volume injected*: 24,703 m^3)	14.2 L/s	19.9 L/s
Backwash volume	1,135 m^3 (Filter backwashing and line flushing: 432 m^3; injection well backwashing and performance testing: 703 m^3)	
Injection period	12 May 2020 to 16 July 2020 and ongoing (as per 27 July 2020)	

Total injection period duration	76 days
Number of days of injection	21 days
Average injection turbidity	3.75 NTU
** Water is occasionally abstracted from the well for backwashing and performance testing. The net volume injected is the difference between the total volume injected and the injection well backwashing and performance testing volume.*	

Overview Map

Injection Well Performance

The injection and abstraction performance of the MAR injection well GPE066 can change over time. Clogging can cause the performance to gradually deteriorate and periodic well remediation will be required. Potential clogging occurs from the injection of sediment-laden water, but could also be caused by the deposition of iron sulphides on the well screen, as was confirmed to have occurred during the idle phase (i.e., October 2017 and August 2019), and was remediated by air-lifting in May 2019.

The specific capacity provides an indication of well performance. The specific capacity for abstraction (i.e., the flow rate per metre drawdown) differs from the specific capacity for injection (i.e., the flow rate per metre per metre rise) for most wells. In general, abstraction specific capacities are higher. Both can be tracked over time to review changes in well performance. To compare results, the specific capacity test has to be undertaken at similar flow rates and length of time. Comparable test results for abstraction specific capacity are available from August 2019 onwards and results are shown in the table below.

Abstraction well performance

Well performance appear to have deteriorated after the 2019 injection trial, with specific capacities being lower between October 2019 and March 2020, than they were before the injection trial in August 2019. However, there is no indication that the idle phase between October 2019 and March 2020 has resulted in a significant further deterioration of well performance due to clogging during that period. As such, the injection of sediment-laden river water appears to be the main driver for clogging and reduction in well performance.

Date	Duration (mins)	Average Rate (L/s)	Average Specific Capacity (L/s/m)
02/08/2019	120	15.2	5.41
18/10/2019	130	14.6	4.46
13/11/2019	130	15.6	4.58
03/03/2020*	120	15	4.10

**The March 2020 specific capacity was derived from an 8 hour long stepped rate drawdown test with 4 steps of 120 minute each; the last step was undertaken at a flow rate of 15 L/s.*

A more comprehensive well performance test is a stepped rate pumping test. Stepped rate pumping (abstraction) testing was undertaken in May 2017 when the injection well was installed, and again in March 2020. A comparison of the results of these two stepped rate tests suggest well performance of the injection well has improved since the previous testing in 2017. However, gas clogging affected the 2017 stepped rate test and this has not occurred in the 2020 test and therefore the results may not be fully comparable. A further stepped rate pumping test is recommended during or after completion of the 2020 injection trial.

Injection well performance

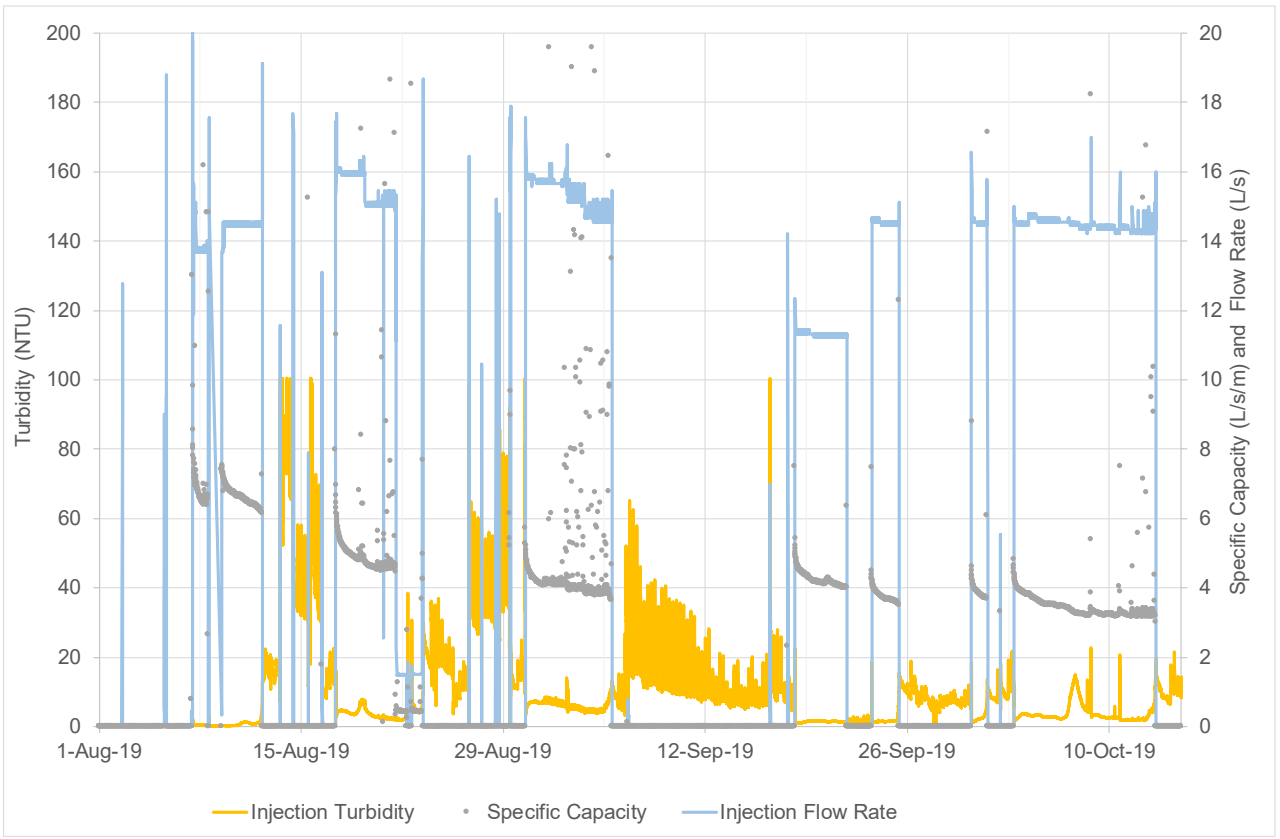
The Scott Tech telemetered monitoring system for the Gisborne MAR injection well provides continuous data on injection flows, injection turbidity levels and injection well water level responses. Reductions in well performance from clogging can be analysed by reviewing the specific capacity (SC in L/s/m) of the well, which equals the flow rate (Q in L/s) divided by the associated drawdown (dH in m):

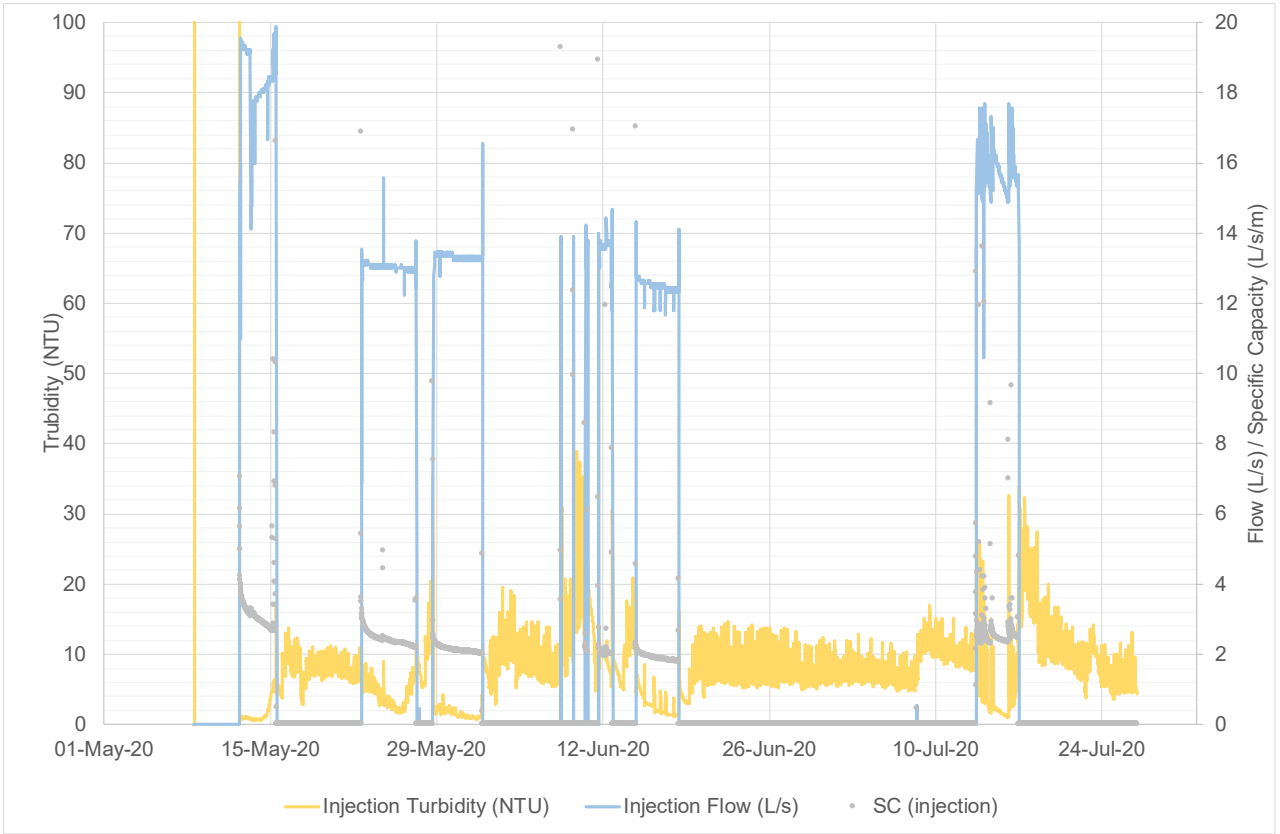
$$SC = \frac{Q}{dH}$$

In case of injection, the injection flow rate and the subsequent rise in well water level are used to derive the injection specific capacity. The injection specific capacity can be tracked throughout the Stage 2 injection trial. The first graph below shows the progression of the specific capacity in the 2019 injection period, together with injection flow rate and injection turbidity level (turbidity is shown as this represents the most dominant type of well clogging). There is a general decline in injection specific capacity from approximately 6 L/s/m at the beginning of the injection period to approximately 3 L/s/m at the end. Injection flow rates varied from approximately 15.5 L/s in the first half of the trial to 14.5 L/s in the second half.

It should be considered that specific capacity is generally lower at higher injection rates, so a decline in the specific capacity at reduced injection rates is a sign of ongoing well performance loss due to clogging.

The second graph below shows the progression of the specific capacity in the 2020 injection trial. Specific capacity declined from 4.0 L/s/m at the start to 1.8 L/s/m in mid-June 2020, which is lower than recorded in the 2019 injection period. Injection rates reduced from approximately 19 L/s at the beginning on injection in May 2020 to 12 L/s in mid-June 2020. However, well backwashing cycles were undertaken in July 2020 and the injection specific capacity appear to have improved to approximately 2.5 L/s/m, with injection rates around 16 L/s.


Turbidity (NTU)
Specific Capacity (L/s/m) and Flow Rate (L/s)
1-Aug-19
15-Aug-19
29-Aug-19
12-Sep-19
26-Sep-19
10-Oct-19
Injection Turbidity
Specific Capacity
Injection Flow Rate


Trubidity (NTU)
Flow (L/s) / Specific Capacity (L/s/m)
01-May-20
15-May-20
29-May-20
12-Jun-20
26-Jun-20
10-Jul-20
24-Jul-20
Injection Turbidity (NTU)
Injection Flow (L/s)
SC (injection)

Recommendation

The continuation of well backwashing during the remainder of the injection trial is recommended to be undertaken at least once per week. Backwashing should be for approximately 1 hour (but at least 30 minutes) at 10 to 15 L/s until the pumped water runs visually clean. Continuation of periodic well backwashing should be considered during times that no injection can occur (e.g., when river turbidity levels are high). Specific capacity testing and stepped rate pumping testing are in effect backwashing events, and as such performance testing and backwashing events can be combined.

Hydraulic responses

Groundwater level responses

Makauri Aquifer water levels[4] in m RL in injection well GPE066 and monitoring wells GPE065, GPE067, GPE068 and GPE069 are shown in the graph below for the October 2019 – July 2020 period. GPE067 groundwater data can be retrieved from the logger in the field, and this data has been uploaded to the HillTop database by GDC. Whilst a complete data set is available for electrical conductivity (EC), the water level data set has a gap between 21 September and 20 December 2019 for GPE067. All other groundwater levels presented have been downloaded from the Gisborne MAR telemetry website. Note that GPE066 and GPE065 groundwater levels are almost identical and cannot be distinguished. GPE068 and GPE069 groundwater levels are also very similar although a slight difference is visible.

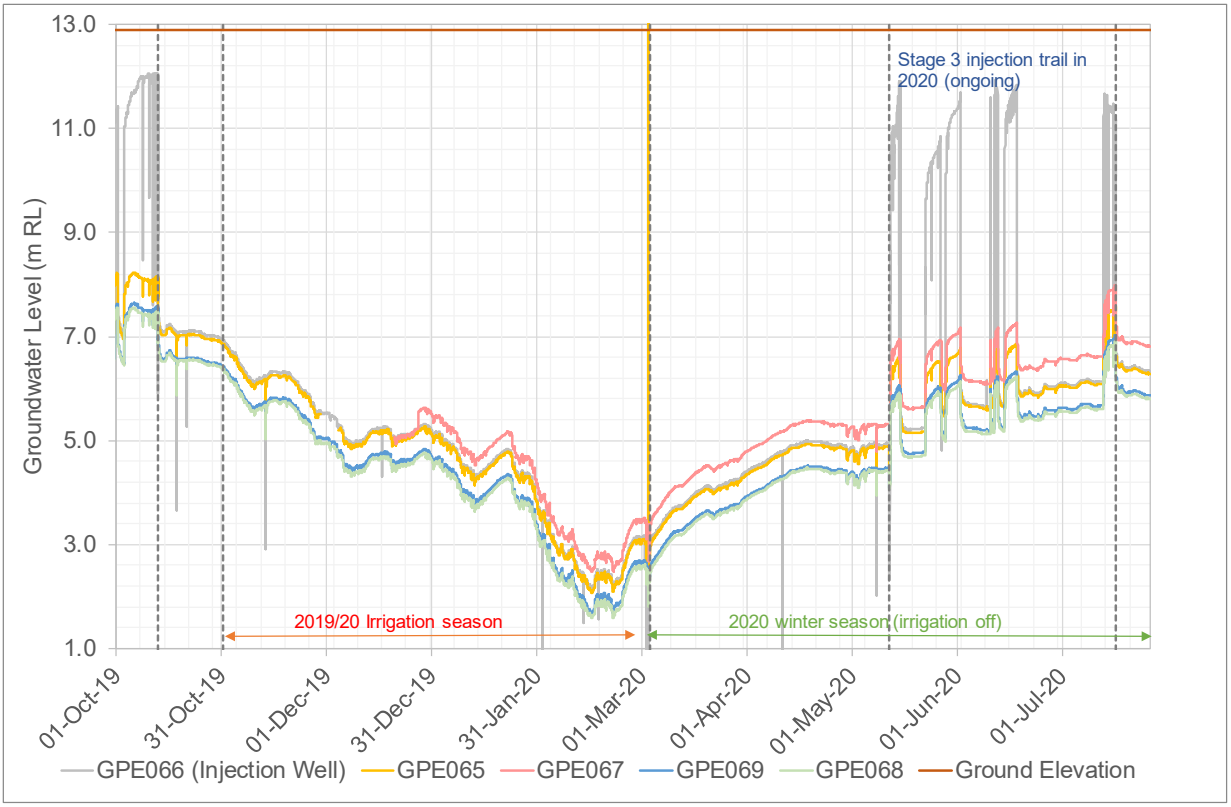
Groundwater levels decreased notably during the 2019/2020 irrigation season between November 2019 and March 2020. The recorded groundwater levels were the lowest since monitoring commenced in 2017, which suggest the irrigation season was relatively dry and more abstraction for irrigation may have been needed. In autumn and winter (i.e., irrigation off season) the groundwater levels rise again as shown in the graph since March 2020. The response to the MAR injection trial since May 2020 is clearly visible in all monitoring wells. Injection well (GPE066) water levels reach to approximately 0.5 m below the ground surface during injection, but injection water levels appear to have declined somewhat following well backwashing in July 2020, which suggest better well performance.

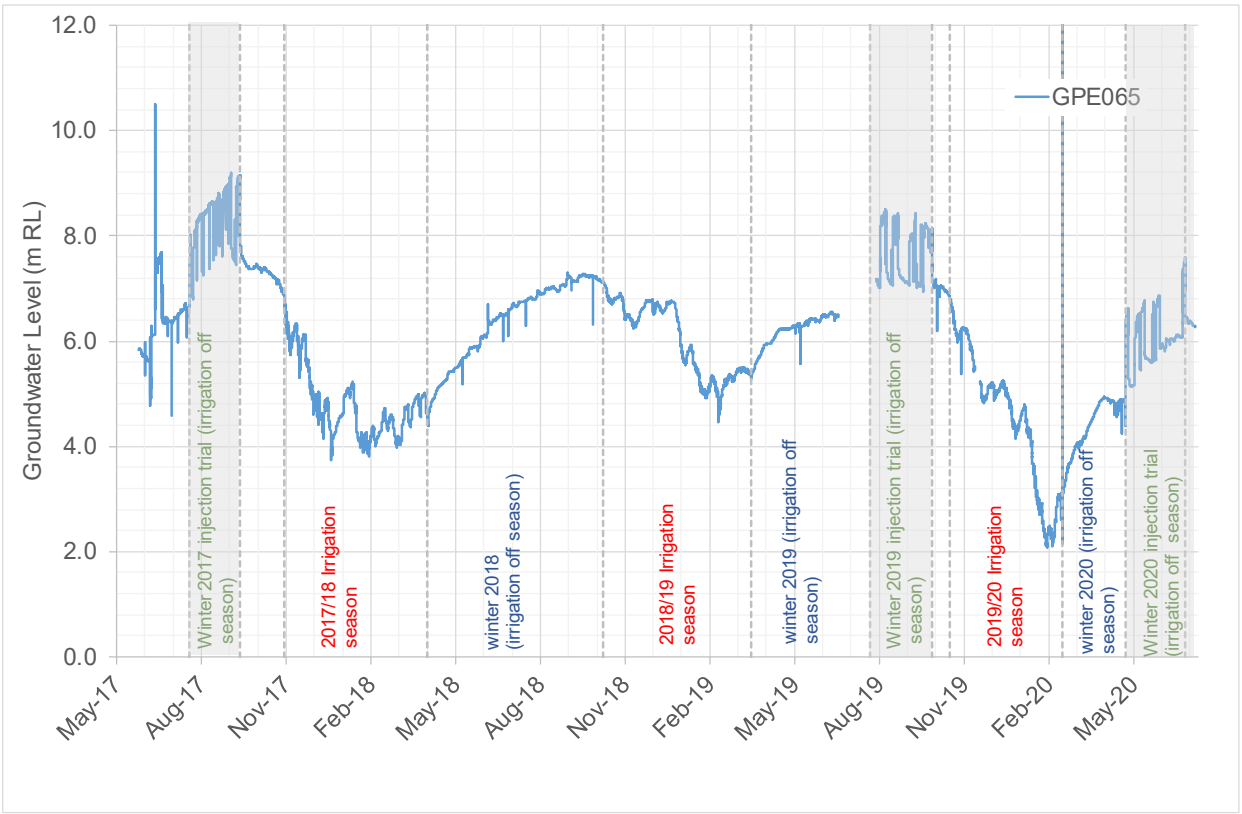
Groundwater elevation obtained from telemetry shown in the graph above indicates the direction of groundwater flow is to the south west. This is inconstant with previous groundwater level assessments. As mentioned in earlier reports, we recommend reviewing and re-surveying the top of casing elevation of all monitoring wells in due course. In addition, GPE067 which is at greater distance from the injection well than GPE065, would unlikely reach a higher groundwater level in m RL than GPE065 in response to injection, which the graph suggests.

Longer term overview of the Gisborne MAR injection pilot project and groundwater level responses in monitoring well GPE065 from seasonal changes (summer irrigation abstraction and winter recharge) and injection trials is shown in the second graphs below.

[4] The ~70 m deep Makauri Aquifer is a semi-confined naturally pressurised aquifer with aquifer water levels rising well above the top of the aquifer at the site.

Hydraulic responses





Injection Plume Tracking

Quality Control Issues

Golder identified several issues with the water level and water quality data provided and these are listed below.

Golder recommends the following are corrected:

- The reference levels used to derive groundwater levels in m RL for the 4 monitoring wells (GPE065, GPE067, GPE068 and GPE069) and the injection well (GPE066) appear to be incorrect. Golder recommends these are reviewed by confirming depth of logger below reference point, and confirming reference point elevation in m RL.
- No sampling of GPD189 and GPD115 has been undertaken, although injection plume breakthrough to wells further afield can now be expected. Golder recommends these two wells are included in future sampling rounds. It is noted that GPD189 may not be screened in the Makauri Aquifer, but in the Matokitoki Aquifer.
- The 26 May 2020 chloride concentration for GPE069 (i.e., 249 mg/L shown in both the HillTop database and in lab report) is likely to be incorrect, as this has both previously and subsequently been below 150 mg/L consistently. Furthermore, no other parameter shows a sudden rise for this well for the 26 May 2020 monitoring round. Golder understands GDC sought clarification from the lab and the lab confirmed the initially reported chloride concentration was an error. A revised lab report will be issued.
- Waipaoa River water was sampled from the infiltration chamber on 6 May 2020, but not tested for metals. Golder recommends sampling and Suite 2 testing of Waipaoa River water for the next sampling round.
- The EC level of 26 May 2020 for GPE067 (i.e., 68 µS/cm) is likely to be incorrect, as no EC level in either the river water or the ambient groundwater within any of the wells has been recorded this low at the MAR site. The salinity level of 0.33 ppt recorded in GPE067 suggest the EC level is likely to have been 680 µS/cm, which has been assumed. We recommend that this is corrected in the HillTop database.

Further issues are listed below, but no corrections are recommended at this stage, as these would not change the general conclusions in this report:

- There is a gap in the water level data set retrieved from the logger in GPE067 between 21 September and 20 December 2019. Replacement of the water level logger in that monitoring well may be necessary.
- Negative DO levels are recorded during the 26 May 2020 monitoring round in the field. An error with the measuring instrument has been assumed.
- No suite 1 or 2 sampling (specified in Attachment 2) was undertaken of the source water (i.e., Waipaoa River water) in the June 2020 sampling round.

Injection Plume Tracking

Injection Plume Tracking

As with field testing results from between September 2018 and September 2019, the recent results from October 2019 to June 2020, listed in the table below, show a clear difference in water quality in all four monitoring wells, with GPE065 still most akin to the injected Waipaoa River water and GPE069, representing native groundwater in the Makauri Aquifer at this site.

Monitoring well	Sample date	Temperature (°C)	DO (%)	DO (mg/L)	EC (uS/cm)	pH (-)	Turbidity* (NTU)
October 2019							
Waipaoa River at Infiltration Chamber	14-10-19	14.8	98	9.92	373	7.88	260
GPE065	14-10-19	15.1	0.1	0.01	494	7.33	0.25
GPE067	14-10-19	15.0	0.3	0.03	824	6.97	22
GPE069	14-10-19	15.3	0.1	0.01	1,455	6.59	55
GPE068	14-10-19	14.9	0.3	0.03	941	6.8	40
November 2019							
GPE065	11-11-19	15.4	0	0	517	7.59	8.6
GPE067	11-11-19	15.3	0.2	0.02	761	7.26	24
GPE069	11-11-19	16.5	0.1	0.01	1,455	6.98	50
GPE068	11-11-19	17.1	0.3	0.03	949	7.18	4.3
May 2020							
Waipaoa River at Infiltration Chamber	06-05-20	11.6	97.2	10.56	453	8.42	700
GPE065	06-05-20	14.6	0.5	0.05	557	7.54	39
GPE067	06-05-20	14.4	0.8	0.08	705	7.39	12
GPE069	06-05-20	14.7	1	0.1	1,385	7.25	60
GPE068	06-05-20	14.9	1	0.1	728	7.4	14

Injection Plume Tracking

Monitoring well	Sample date	Temperature (°C)	DO (%)	DO (mg/L)	EC (uS/cm)	pH (-)	Turbidity* (NTU)
(commence injection on 13 May 2020)							
MAR headworks (Waipaoa River water)	26-05-20	13.9	70.5	7.26	490	7.56	4.1
GPE065	26-05-20	14.9	0.8	0.08	503	7.51	0.2
GPE067	26-05-20	15.0	-	-	680**	7.25	9.1
GPE069	26-05-20	15.0	-	-	1,401	6.89	60
GPE068	26-05-20	15.3	-	-	764	7.11	25
June 2020							
GPE065	24-06-20	14.4	0.6	0.06	490	7.52	0.60
GPE067	24-06-20	14.5	1.6	0.16	650	7.3	12
GPE069	24-06-20	14.7	1.2	0.12	1,324	6.98	60
GPE068	24-06-20	14.7	1.1	0.11	762	7.22	26
Monitoring well	**Sample date**	**Temperature (°C)**	**DO (%)**	**DO (mg/L)**	**EC (uS/cm)**	**pH (-)**	**Turbidity* (NTU)**
Pre-injection trial (May 2017)							
GPE065	17-05-17	-	-	-	1,347	-	-
GPE066 (injection well)	08-05-17	-	-	-	1,302	-	-

**Lab test results*
***Likely value listed in table; value recorded was 68 µS/cm which is inconsistent with previous and subsequent recordings*

EC levels prior to the winter 2017 MAR injection trial in GPE065 and GPE066 (injection well) are similar to those recorded in GPE069 in all sampling rounds between September 2018 and September 2019, suggesting the 2017 injection plume has so far not reached GPE069. The other two wells (GPE067 and GPE068) show various degrees of dispersive mixing between injected river water and native groundwater. Nonetheless, GPE065, GPE067 and GPE068 appear to gradually become more similar and will at some

Injection Plume Tracking

stage be akin to Waipaoa River water as the centre of the plume fully covers the area in which these monitoring wells are installed.

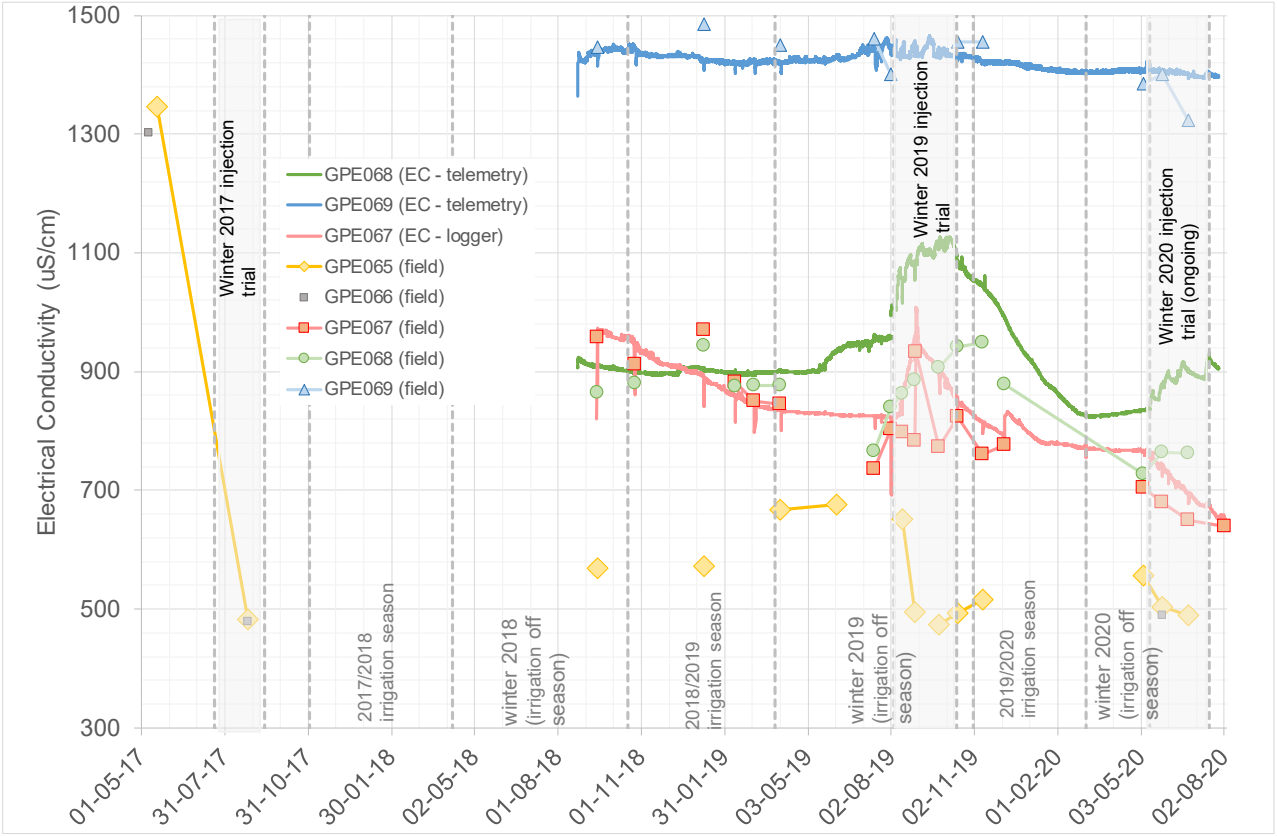
Oxygen (O_2) concentrations in all four monitoring wells (GPE065, GPE067, GPE068 and GPE069) are low (i.e., EC less than 1 mg/L) in the October 2019 to June 2020 sampling rounds and this reflects the reactiveness of organic matter present in the native groundwater causing oxygen within the injected water to be quickly consumed. This is as expected.

Field recorded EC levels between October 2019 and July 2020 appear to show similar trends as the conductivity logger recordings in GPE065, GPE067 and GPE068, as shown in the graph below. The following trends can be observed:

- EC levels are more or less stable in GPE069, which is the upgradient monitoring well generally unaffected by water quality change from injection.
- With each injection cycle the EC levels in GPE065, which is nearest to the injection well, will decline as river water is pushed towards this well. This is followed by a gradual increase after injection ceases.
- Summer irrigation abstraction will cause an eastward flow direction and injection plume water with lower EC levels will be drawn to GPE067 and GPE068, thus lowering EC levels in those wells.
- EC levels in GPE067 and GPE068 will rise suddenly when injection recommences in the winter as more mineralised ambient groundwater with higher EC levels is pushed towards these wells from upstream, thus increasing EC levels in those wells.
- EC levels of GPE065, GPE067 and GPE068 are all gradually decreasing and the water quality in these wells is becoming more akin to river water as the plume gradually expands.

As noted previously, field testing EC values are notably lower for GPE067 and GPE068 than the conductivity logger recordings since August 2019. It is unclear what the cause is, and recalibration of both the field monitoring equipment and EC loggers is recommended.

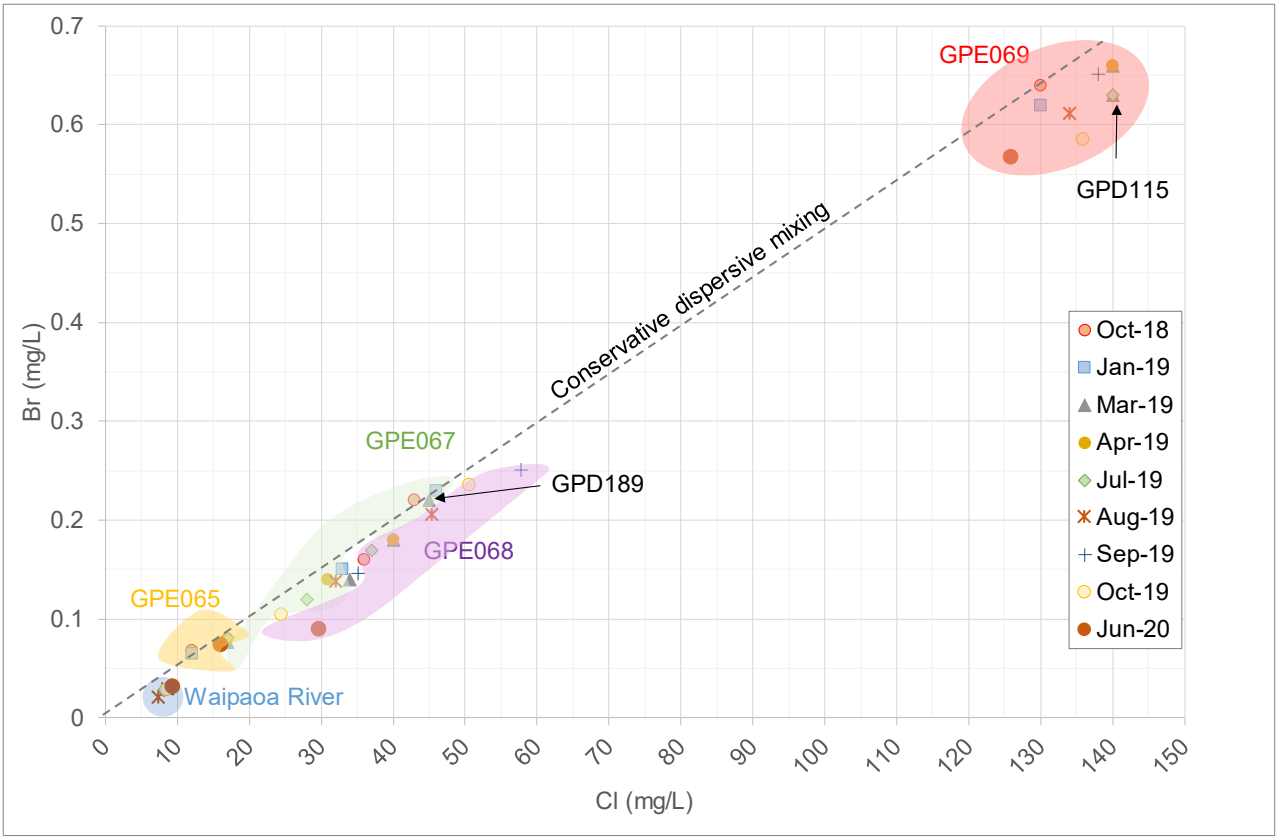
Injection Plume Tracking



When plotting the Bromide (Br) against the Chloride (Cl) concentrations (see top graph below), the progressive dispersive mixing is also apparent. The dotted line in the graph represents mixing between river water and native groundwater, which have very different compositions of Cl and Br. For components that are not subject to chemical reactions (which is the case for Br and Cl), any degree of mixing between these two water types will result in a mixture with a Br and Cl levels that plots on this line. Any deviation from this line may point to ongoing biological or chemical reactions causing depletion or enrichment of either component. No such deviation is indicated from the results for Br and Cl in any of the monitoring rounds between October 2018 to July 2020. In addition, the recent monitoring data from 2019 and 2020 sampling rounds clearly fit on the progressive dispersive mixing line (graph below).

A shift in water quality signature is observed in GPE067 in comparison to GPE068 was noted following the March 2019 sampling round as reported previously. A higher degree of dispersive mixing was observed in GPE067 than in GPE068 prior to March 2019, although GPE068 is at greater distance from injection well then GPE067. This has changed since March 2019, with GPE067 becoming more akin to the injection water.

Injection Plume Tracking

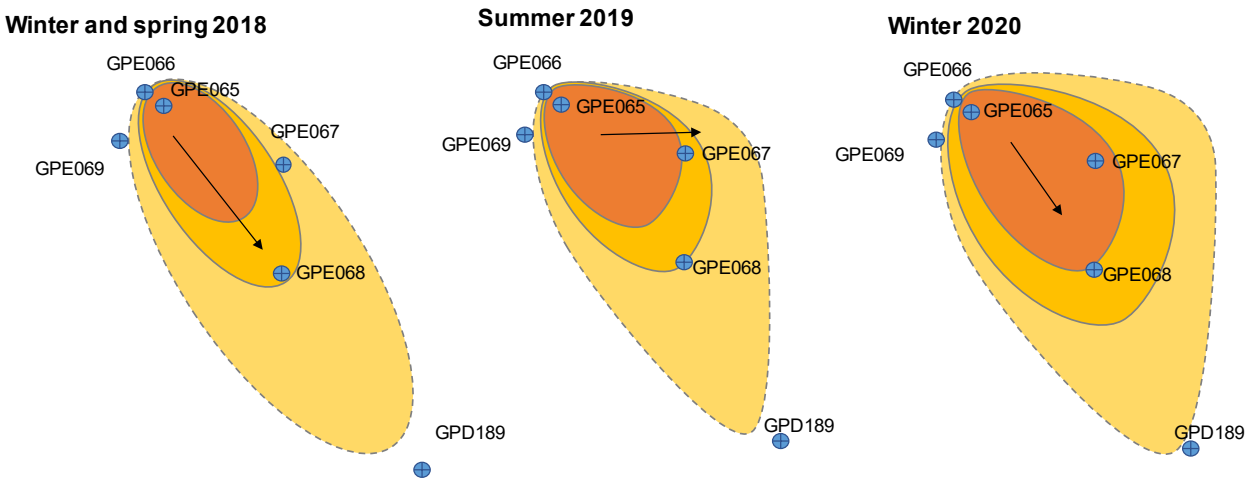


The shift in water quality signature of GPE067 is caused by a change in direction of the 2017 injection plume due to summer abstraction for irrigation to the east of the MAR site. GPE067 was at the fringe of the injection plume in winter and spring 2018, but this shifted as the injection plume was drawn eastwards. This process has progressed further in the course of 2019 and 2020, and the water quality signature of GPE065, GPE067 and GPE068 are all gradually become more akin as the centre of the injection plume covers the entire area between these monitoring wells. If injection trials continue all three of these monitoring wells will have the same water quality signature as Waipaoa River water.

Whilst GPD189 has a similar Br/Cl ratio as GPE067 and GPE068, it is not clear if the injection plume as reached this well. Given its depth of 83.3 m, this well may not be screened in the Makauri Aquifer.

Concentration contour changes with time are conceptually depicted in the figure below.

Injection Plume Tracking



Hydrogeochemical responses

General

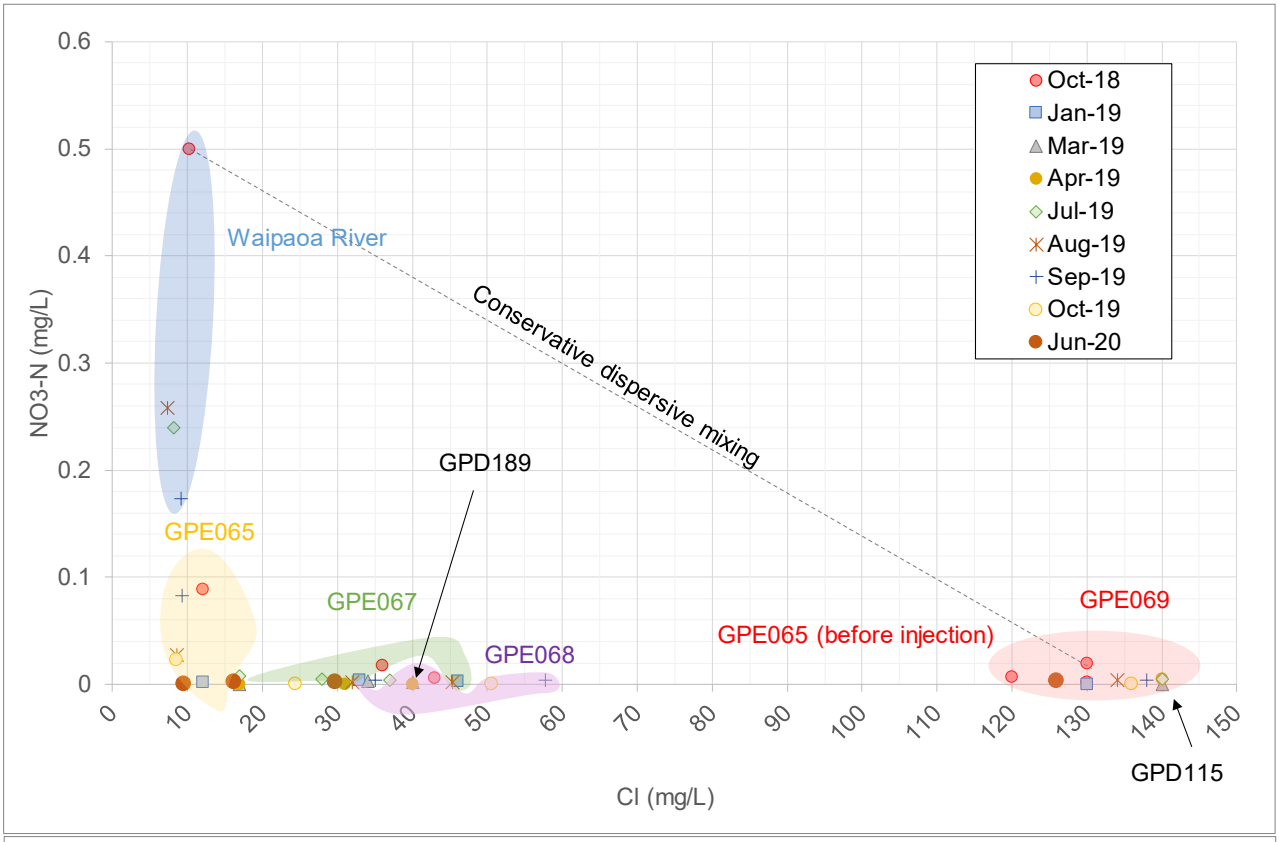
Processes described in previous monitoring reports have progressed as expected. For reporting purposes, the relevant processes and trends are described again below and graphs updated.

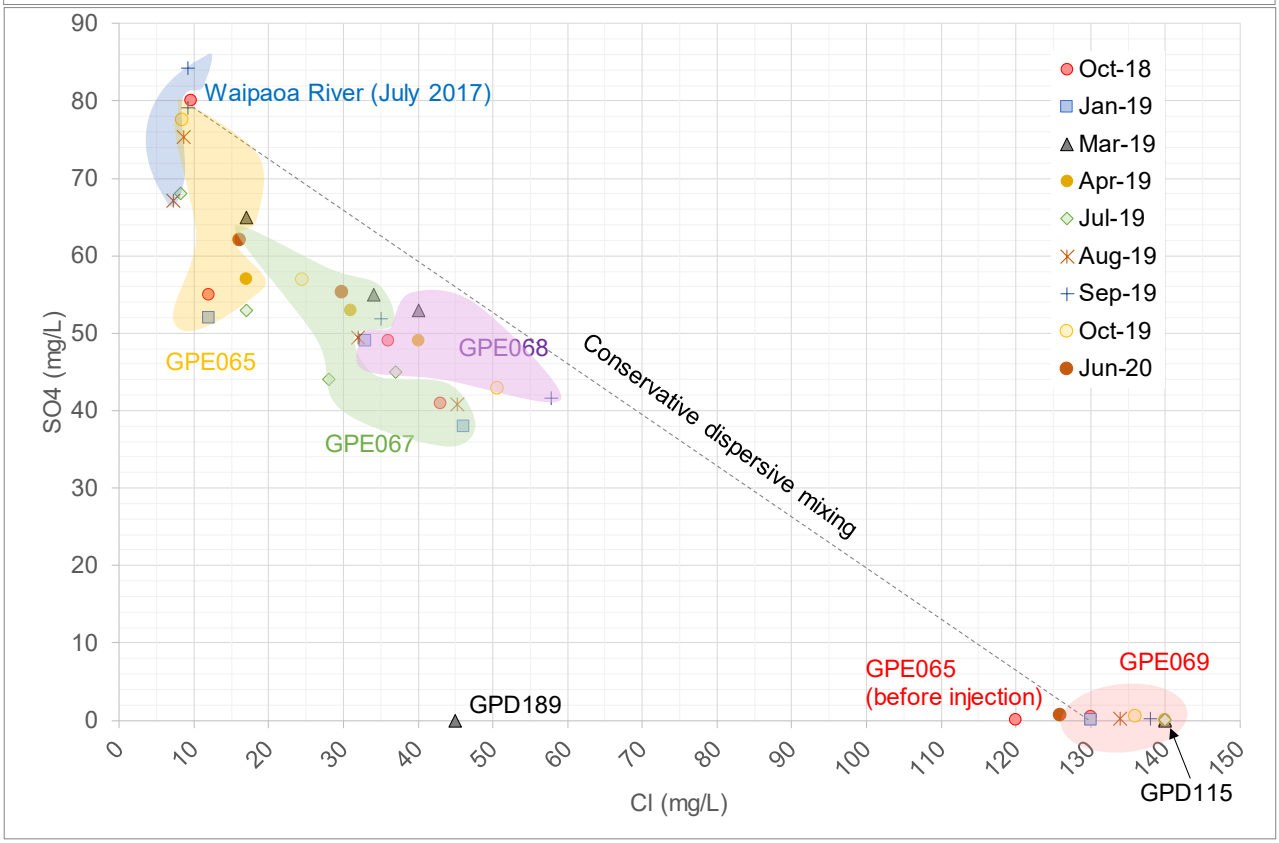
Redox state

The dissolved oxygen (DO) concentration in the aquifer is less than 1 mg/L, which suggests most oxygen has been consumed in the generally anoxic Makauri Aquifer.

In the graphs below, the nitrate-N (NO_3) and sulphate (SO_4) have been plotted against the chloride (Cl) concentration. Median values for Waipaoa River water and GPE065 water prior to the 2017 injection, have been included in the graph as well. Both the concentration of NO_3 and SO_4 fall more strongly than what would be expected from conservative dispersive mixing. Furthermore, NO_3 shows a sharper fall than SO_4 and appears to be entirely depleted in all monitoring wells since the January 2019 sampling round. These trends are consistent with reduction processes in which NO_3 is typically targeted first as a source oxygen (i.e., denitrification) followed by iron and manganese oxides (i.e., iron reduction) and then SO_4 (i.e., sulphate reduction). Pyrite oxidation would have resulted in a sulphate increase, as noted in previous monitoring reports, and this does not seem to occur in any of the three monitoring rounds between March and July 2019. The same shift in GPE067 and GPE068 water quality signature towards injection water, as explained above can be observed in these graphs.

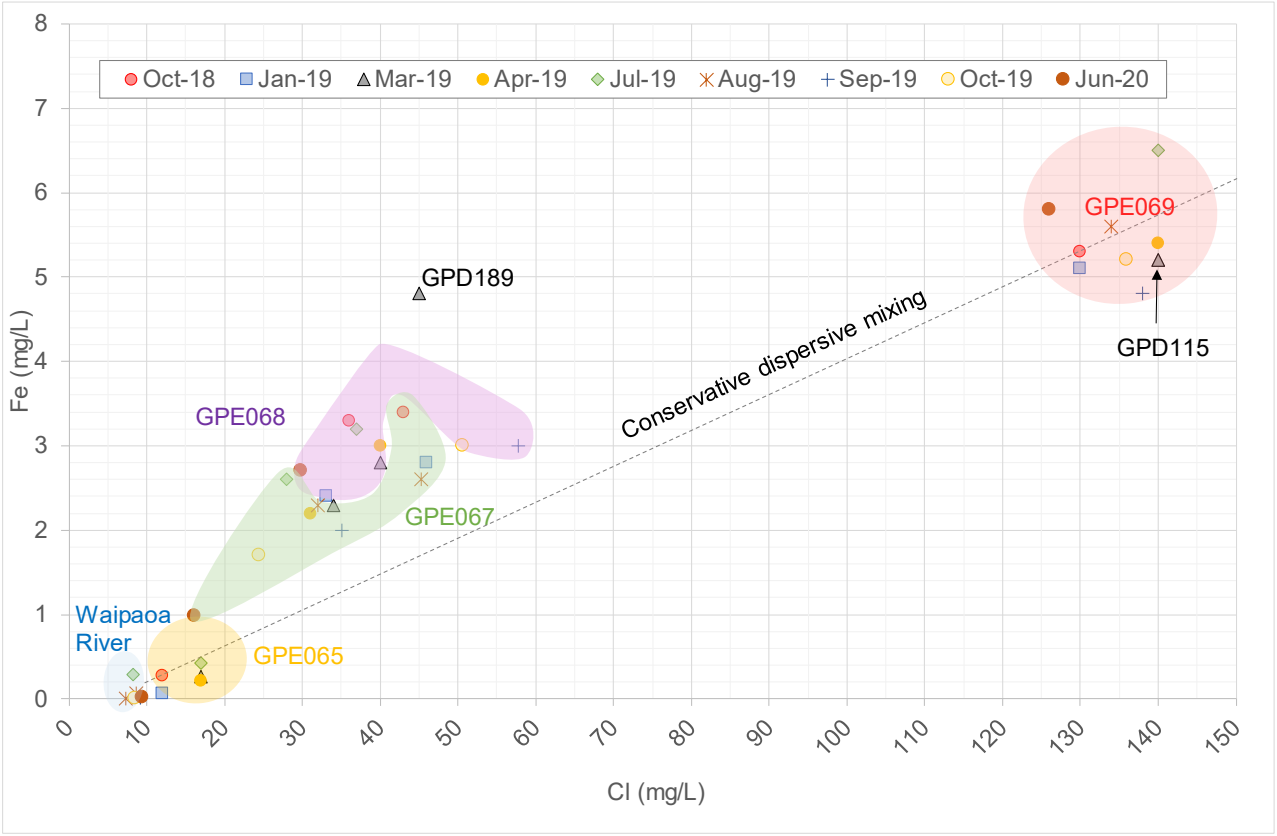
Hydrogeochemical responses





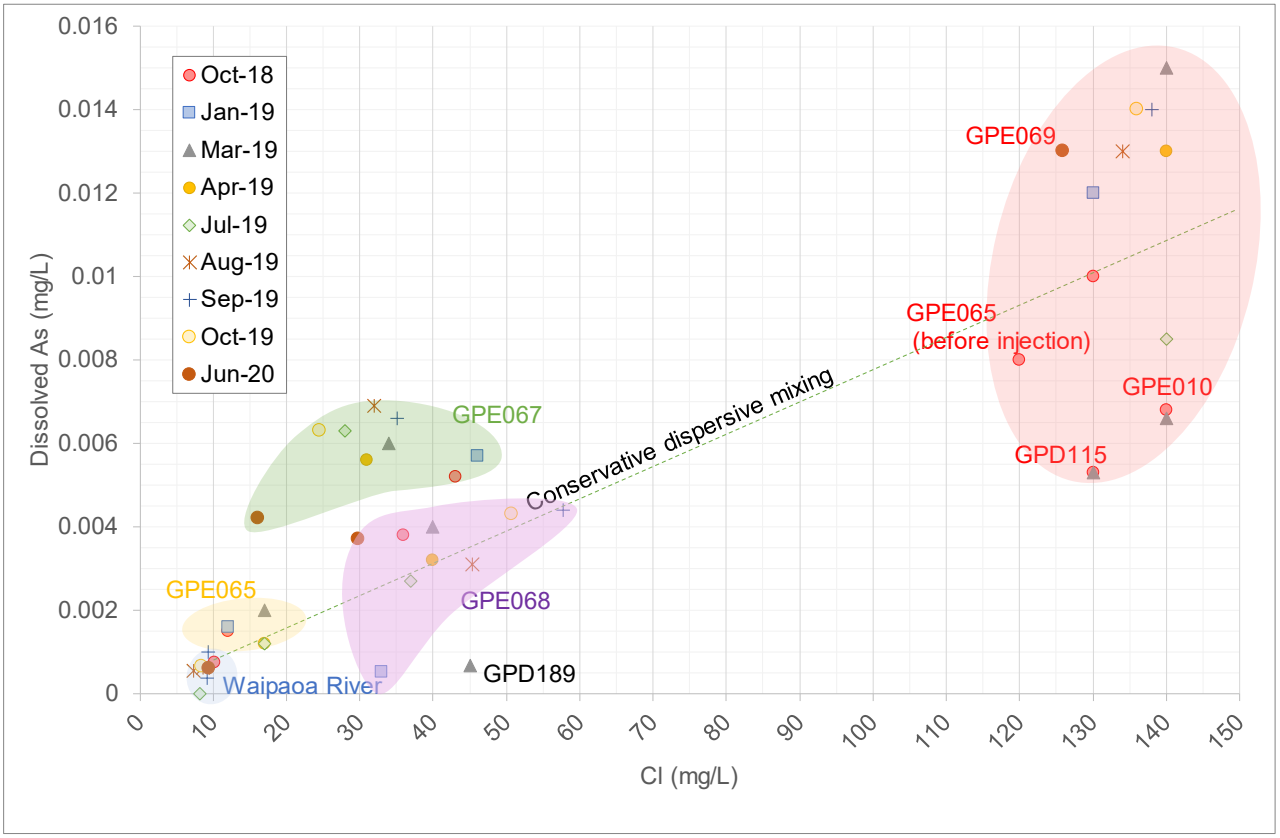
Hydrogeochemical responses

Where iron concentrations appeared to decrease in GPE067 and GPE068 in the March 2019 monitoring round relative to the October 2018 and January 2019 rounds. This trend seems to have reversed in the April and July 2019 sampling rounds. More recent sampling results from the August 2019 to June 2020 show further fluctuations and a gradual shift of both the GPE067 and GPE068 water quality signature towards that of GPE065 and river water. The changes in iron concentrations appear to be associated with changes in groundwater flow direction as described above, and not due to hydrogeochemical reactions.



As observed in the previous monitoring rounds in October 2018 and January 2019, significant arsenic mobilisation (a concern with pyrite oxidation) does not seem to occur, as suggested by the graph below. Concentrations are highest in GPE069 with a composition similar to native groundwater for the other parameters. The low arsenic concentration in GPE068 in the January 2019 round appears to be inconsistent with previous and subsequent arsenic concentrations recorded in this well. It is considered that the variability in arsenic concentrations recorded in GPE065, GPE067 and GPE068 are a result of the variability in arsenic concentrations of the native groundwater, reflected by the results for GPE069. There is no indication of arsenic release by hydrogeochemical processes associated with the injection trial.

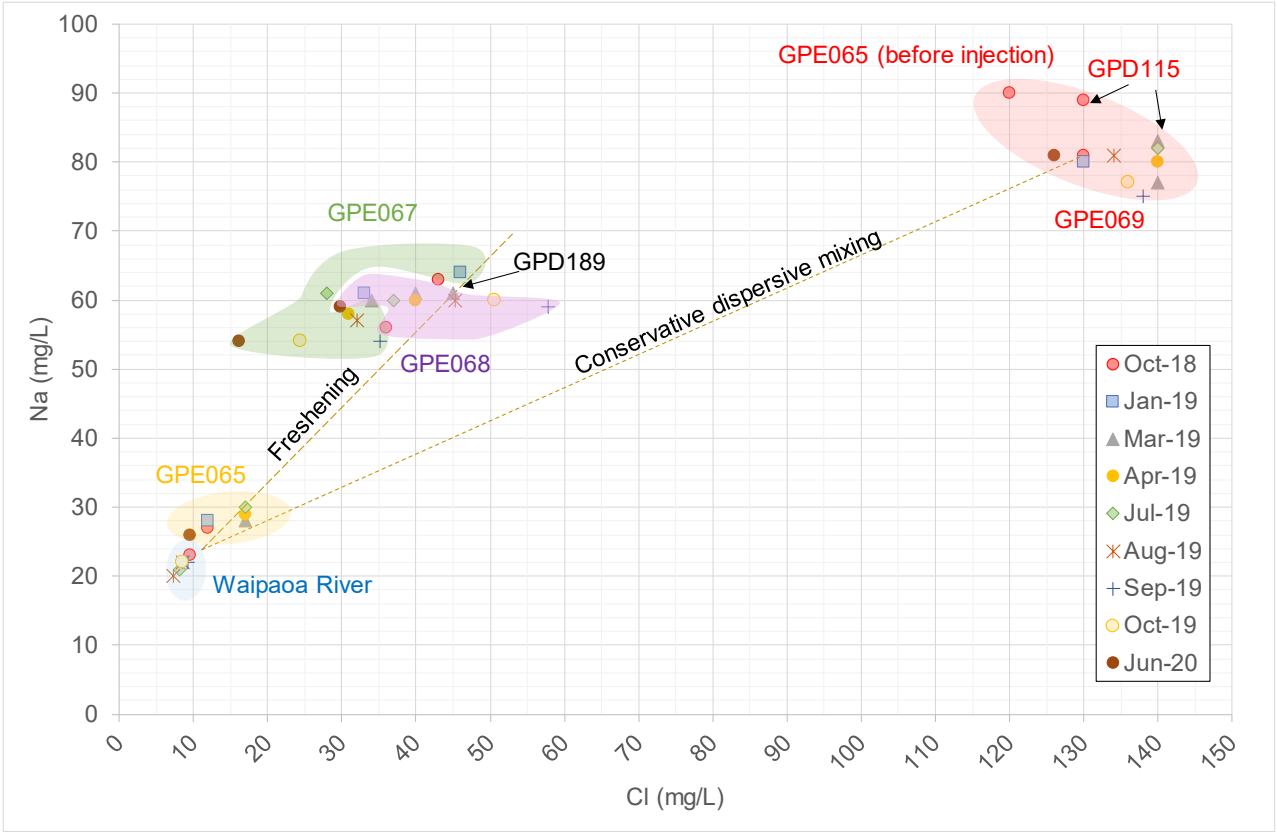
Hydrogeochemical responses



Cation Exchange

In the graph below, sodium (Na) concentration is plotted against the chloride (Cl) concentration. The sodium appears to increase more readily than would be expected from 'conservative' dispersive mixing (e.g., Br/Cl relationship). This is due to the high calcium concentration in injected river water compared to the concentration in native groundwater. Cation exchange will result in calcium ions replacing sodium ions within exchange complexes in the sediments, which are subsequently released to the groundwater. This process is referred to as 'freshening' and the data from all monitoring rounds between October 2018 and June 2020 indicate that this process is ongoing.

Hydrogeochemical responses

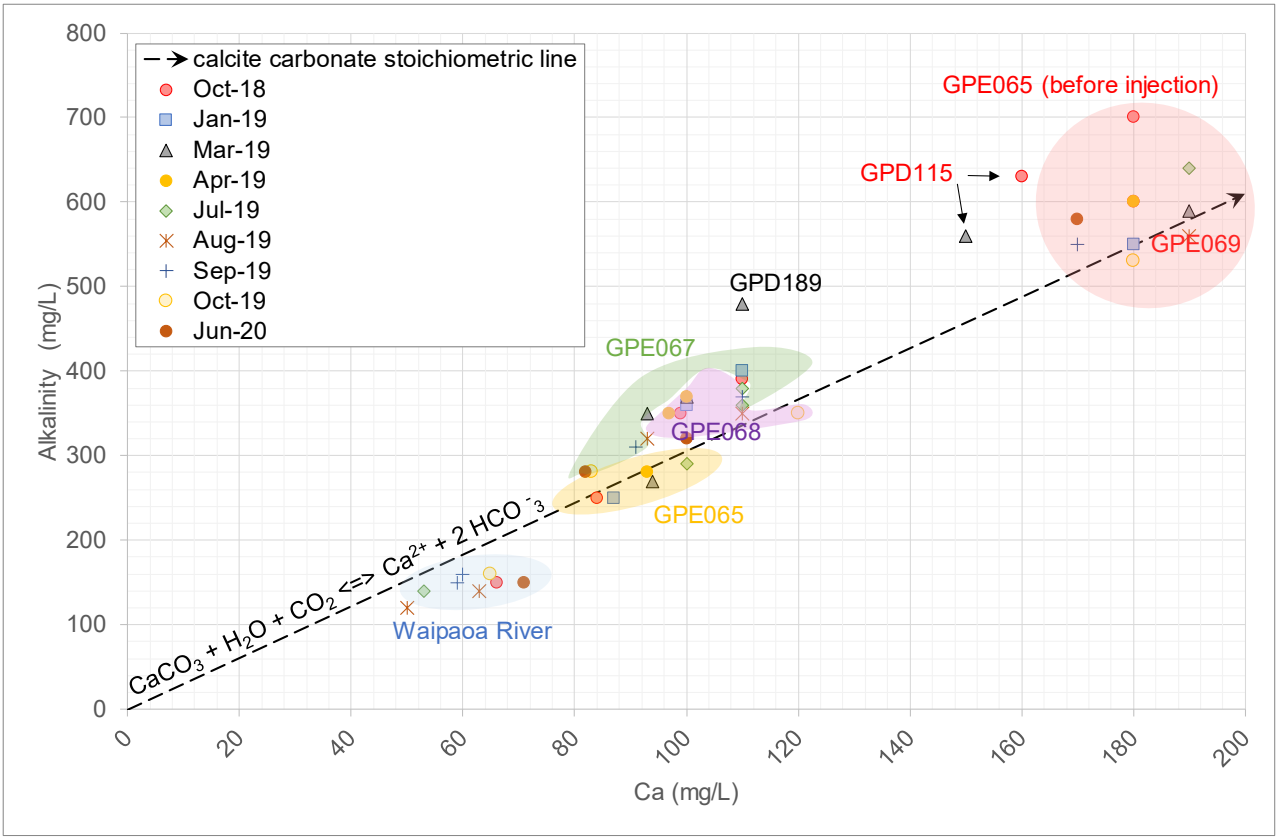


Carbonates and Carbon Dioxide

In the graph below the calcium (Ca) concentration is plotted against the total alkalinity. The injection of river water results in an increase of both parameters, as particularly highlighted by the October 2018 to June 2020 monitoring data for GPE067 and GPE068. It is considered that this is not the result of dispersive mixing, but is a result of calcite carbonate reactions. Carbon dioxide (CO_2) is produced from the oxidation of organic matter by oxygen in the infiltrated river water. This shifts the calcite dissolution reaction indicated in the graph to the right (calcium carbonate stoichiometric relationship represented by the straight line), and both calcium and alkalinity (expressed as HCO_3^-) will increase. However, CO_2 pressures within the injection plume appear to remain well below those present in the ambient groundwater, as shown by the distinctively higher Ca/Alkalinity concentrations in GPE069.

The October 2018 to June 2020 monitoring data shows some change in Ca/alkalinity ratio in all wells but most notably in GPE069 (i.e., native groundwater), suggesting variability in the native groundwater composition.

Hydrogeochemical responses



Compliance with Conditions of Resource Consent

Compliance

Compliance with conditions in relation to the Stage 2 Injection Trial include the following matters:

- Surface water take and use
- Water use monitoring
- Discharge of water to the Makauri Aquifer

The Gisborne MAR resource consent for the current Stage 2 injection pilot project is included in Attachment 4. Compliance has been reviewed for the key conditions listed below.

Condition 16 to 19 of the resource consent require the following:

- *The daily quantity of water taken from Waipaoa River for the purposes of the pilot trial shall not exceed 1901 cubic metres.*
- *The instantaneous rate of take from the Waipaoa River shall not exceed 22 litres per second at any time.*

Compliance with Conditions of Resource Consent

- *Abstraction from the Waipaoa River shall only occur when the flow at Kanakanaia and Matawhero, as measured by Gisborne District Council is greater than 4000 litres per second.*
- *Abstraction from the Waipaoa River:*

  (a) shall only occur during periods when the flow of the Waipaoa River at Kanakania is greater than 4,000 litres per second; and
  (b) shall not occur when the flow of the Waipaoa River at Kanakania has been at or below 4,100 litres per second for a consecutive period of 5 or more days;
  for the duration of this resource consent.

River abstraction rates have been below 22 L/s and below 1901 m^3/day at all times during this monitoring period. River abstraction has taken place during river flows generally above 4,000 L/s during this monitoring period. However, between 12 and 14 May 2020 flows were below 4,000 L/s in the Waipaoa River at both the Kanakanaia and Matawhero flow monitoring sites. Approximately 4,000 m^3 was abstracted from the river during those 2 days. As such, this injection trial did not fully comply with condition 16 to 19 of the resource consent.

Condition 20 of the resource consent requires the following:

- *Water shall only be used for the purpose of completing Phase 2 pilot trial of injecting water into the Makauri Aquifer, or in the case of discharging water to land in accordance with the resource consent application document.*

All water abstracted from the river for the Gisborne MAR injection trial has been used for that purpose at all times during this monitoring period.

Condition 27 of the resource consent requires the following:

- *The rate of water injected into the Makauri Aquifer shall not exceed 22 litres per second and the total volume of water injected under this consent shall not exceed 365,000 cubic metres per year for two years.*

Injection rate has been below 22 L/s and total injected volume below 365,000 m^3 at all times during this monitoring period.

Condition 31 of the resource consent requires the following:

- *No water shall be discharged into the Makauri Aquifer if the following discharge limits have been exceeded:*

  (a) A concentration of E.coli of 100 cfu/100ml; and
  (b) Turbidity of 50 NTU; or
  (c) Any amended limit(s) adjusted with the approval of an independent and suitably qualified and experienced professional and certified by the GDC Manager.

There have been no instances in which E.coli levels of above 100 cfu/100 ml or turbidity above 50 NTU have been injected into the Makauri Aquifer during this monitoring period.

Compliance with Conditions of Resource Consent

Pathogen Testing

Several indicator pathogen parameters have been tested as part of Suite 4 of the Gisborne MAR monitoring programme, prior to and during the 2020 injection trial. The results are included in the table below.

The results indicate the pathogens can be present at significant levels in Waipaoa River water abstracted by the Kaiaponi irrigation infrastructure. Elevated pathogen levels for Enterococci, E.coli and Faecal Coliforms were recorded on 26 May 2020 in the headworks (Waipaoa River water) which was subsequently injected into injection well GPE066. Both the flow recordings and groundwater level responses show continuous injection on that date. However, E.coli levels were below 100 cfu/100ml and as such the injection did not exceed compliance limits included in the resource consent.

Component	Date	Adenovirus (presumptive)	Enterococci	Escherichia coli	Faecal coliforms	Somatic coliphage
		MPN/ 100 mL	cfu/ 100 mL	cfu/ 100 mL	cfu/ 100 mL	PFU/ 100 mL
Prior to 2020 MAR injection trial						
Waipaoa River Intake	14-10-19	-	-	-	-	890
GPE066 (headworks)	14-10-19	-	-	-	-	-
GPE065	14-10-19	<5.0	<1.6	<1.6	<1.6	<1
GPE067	14-10-19	<5.0	<1.6	<1.6	<1.6	<1
GPE068	14-10-19	<5.0	<1.6	<1.6	<1.6	-
GPE069	14-10-19	<5.0	<1.6	<1.6	<1.6	-
Waipaoa River Intake	06-05-20	-	2000	1400	1400	-
GPE065	06-05-20	-	<1.6	<1.6	<1.6	-
GPE067	06-05-20	-	<1.6	<1.6	<1.6	-
GPE068	06-05-20	-	<1.6	<1.6	<1.6	-
GPE069	06-05-20	-	<1.6	<1.6	<1.6	-
Waipaoa River Intake	12-05-20	-	-	-	-	66
GPE066 (headworks)	12-05-20	-	-	-	-	9
GPE065	12-05-20	-	-	-	-	<1
GPE067	12-05-20	-	-	-	-	<1
GPE068	12-05-20	-	-	-	-	<1
GPE069	12-05-20	-	-	-	-	<1

Compliance with Conditions of Resource Consent

Component	Date	Adenovirus (presumptive) MPN/ 100 mL	Enterococci cfu/ 100 mL	Escherichia coli cfu/ 100 mL	Faecal coliforms cfu/ 100 mL	Somatic coliphage PFU/ 100 mL
During 2020 MAR injection trial						
Waipaoa River Intake	26-05-20	-	-	-	-	-
GPE066 (headworks)	26-05-20	-	20	33	34	-
GPE065	26-05-20	-	<1.6	<1.6	<1.6	-
GPE067	26-05-20	-	*	<1.6	<1.6	-
GPE068	26-05-20	-	<1.6	<1.6	<1.6	-
GPE069	26-05-20	-	<1.6	<1.6	<1.6	-
Waipaoa River Intake	02-06-20	-	-	-	-	-
GPE066 (headworks)	02-06-20	-	-	-	-	-
GPE065	02-06-20	-	-	-	-	<1
GPE067	02-06-20	-	-	-	-	<1
GPE068	02-06-20	-	-	-	-	<1
GPE069	02-06-20	-	-	-	-	<1
Waipaoa River Intake	24-06-20	-	-	-	-	95
GPE066 (headworks)	24-06-20	-	-	-	-	-
GPE065	24-06-20	-	<1.6	<1.6	<1.6	<1
GPE067	24-06-20	-	<1.6	<1.6	<1.6	<1
GPE068	24-06-20	-	<1.6	<1.6	<1.6	<1
GPE069	24-06-20	-	<1.6	<1.6	<1.6	<1

**Suspect result of 210 cfu/100mL reported by lab; not adopted as it appears to be an anomaly inconsistent with any other pathogen test results for groundwater in the 2018 – 2020 period.*

No bacterial contamination has been recorded in GPE065, GPE067 and GPE068 before the start of the 2020 injection trial although injection plume water from the 2019 injection trial would have been still present there. No bacterial contamination has been recorded in any of the monitoring wells GPE065, GPE067 and GPE068 during the 2020 injection trial, despite GPE066 (headworks, i.e., source water) was tested positive for Enterococci, E.coli and Faecal Coliforms in the 26 May 2020 monitoring round, and Waipaoa River intake water for somatic coliphages in the 24 June 2020 monitoring round.

Where pathogens are clearly present at high levels in Waipaoa River water on occasion, this is generally not the case in the groundwater monitoring wells located within the 2017, 2019 and 2020 injection plume,

Compliance with Conditions of Resource Consent

although some pathogens test positive in groundwater at low levels as previously reported. From previous reports, a rapid die-off is expected, and this limits the spread of pathogens within groundwater.

Emerging Contaminants Testing

GDC has tested Waipaoa River and groundwater for several groups of 'emerging contaminants', including dioxins, personal care products & pharmaceuticals (PCP&P's), pesticides and some other chemicals. Results for the October 2019 to June 2020 period are listed in the table below.

	Sample Date/Time	Caffeine (ng/L)	Cotinine (ng/L)	Paracetamol (ng/L)	Triclosan (ng/L)	Carbamazepine (ng/L)	Lamotrigine (ng/L)	Metaprolol (ng/L)	Norcotinine (ng/L)	Sulfamethoxazole (ng/L)	Trimethoprim (ng/L)
Prior to 2020 MAR injection trial											
Waipaoa River at infiltration chamber	14-10-19	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE065	14-10-19	149	6.8	58	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE067	14-10-19	19	9.4	1.7	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE068	14-10-19	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE069	14-10-19	25	8.3	3.4	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
Waipaoa River at infiltration chamber	06-05-20	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE065	06-05-20	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE067	06-05-20	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE068	06-05-20	10	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE069	06-05-20	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5

Emerging Contaminants Testing

	Sample Date/Time	Caffeine (ng/L)	Cotinine (ng/L)	Paracetamol (ng/L)	Triclosan (ng/L)	Carbamazepine (ng/L)	Lamotrigine (ng/L)	Metaprolol (ng/L)	Norcotinine (ng/L)	Sulfamethoxazole (ng/L)	Trimethoprim (ng/L)
During 2020 MAR injection trial											
MAR headworks	26-05-20	3	10	<2	<0.5	<0.5	<0.5	<0.5	8	<0.5	<0.5
GPE065	26-05-20	30	20	20	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
GPE067	26-05-20	5	20	3	<0.5	<0.5	<0.5	<0.5	<1	<0.5	0.7
GPE068	26-05-20	60	20	40	<0.5	<0.5	<0.5	<0.5	<1	0.9	<0.5
GPE069	26-05-20	20	20	10	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
MAR headworks	24-06-20	-	-	-	-	-	-	-	-	-	-
GPE065	24-06-20	5	3	10	<0.5	1	40	0.9	5	2	<0.5
GPE067	24-06-20	3	5	6	<0.5	<0.5	3	<0.5	2	<0.5	<0.5
GPE068	24-06-20	9	9	<2	<0.5	<0.5	0.9	<0.5	6	<0.5	<0.5
GPE069	24-06-20	2	2	<2	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5

Parameters tested positive in the October 2019 to June 2020 period were cotinine, caffeine, paracetamol, carbamazepine, lamotrigine, metaprolol, norcotinine, sulfamethoxazole and trimethoprim. Previously triclosan tested positive in GPE069 on 16 July 2019 (5 ng/l). Cotinine and norcotinine are found in tobacco, caffeine is present in various beverages (such as coffee), and all other parameters listed are pharmaceuticals.

The emerging contaminants are encountered in the source water, in the injection plume (GPE065, GPE067 and GPE068), and in the upgradient monitoring well GPE069 which is likely to represent ambient groundwater (although a small fraction of source water could have reached this well through dispersive mixing). The test results suggest a progressive rise in total emerging contaminant load in the injection plume although concentrations remain very low in both the Waipaoa River water and within the injection plume (i.e., in order of ng/L).

If emerging contaminants are present in the MAR source water (Waipaoa River) they will enter groundwater. If no natural decay occurs, these emerging contaminants will remain present within the injection plume which will grow ever large as the MAR progresses. With the Waipaoa River being a major natural source of recharge for the Makauri Aquifer it is inevitable that emerging contaminants will eventually enter the groundwater system via natural processes as well, and may already be present in ambient groundwater.

Emerging Contaminants Testing

No further conclusions can be drawn from these initial test results. We recommend a further review when more data is available. We also recommend sampling and testing for emerging contaminants and Suite 2 parameters (Attachment 2) of up to 3 existing upgradient Makauri Aquifer wells that are at sufficient distance away from the injection well (to not be influenced by the injection plume) to better understand what levels are currently already present in ambient groundwater. Potential wells to sample and test could be GPE058, GPE023, GPE038 west of SH2 / Matawai Rd; or GPF147 and GPF111 along Tucker Rd.

Recommendations

1) The continuation of frequent well backwashing during injection is recommended, which should occur at least once per week. Well backwashing could also be considered during times that no injection can occur because of high river turbidity levels. Specific capacity testing and stepped rate pumping testing are in effect backwashing events, and as such performance testing and backwashing could be combined.
2) Golder identified several issues with the water level and water quality data provided and recommend the most critical issues are addressed as listed above.
3) Golder recommends more frequent sampling and testing of nearby irrigation wells GPD189 and GPD115 as plume water breakthrough may have already occurred.
4) We also recommend a further review of emerging contaminants as well as sampling and testing for emerging contaminants of existing wells that are some distance away from the injection well to better understand what levels are currently already present in ambient groundwater.

Closure

We trust this report provides the information required by GDC to further progress the Gisborne MAR Stage 3 Injection Trial project. For further questions please contact Roger Cudmore (Golder Project Manager, T: 021 22 33 873 / E: rcudmore@golder.com), or else Eric van Nieuwkerk (T: 021 284 7133 / E: evannieuwkerk@golder.com).

Yours sincerely,

Golder Associates (NZ) Limited

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EVN/JVA/RSC/mt

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Attachments:
1) Report Limitations
2) Monitoring Programme Schedule and Parameter Suites
3) Water Quality and Aquifer Material Test Reports
4) Current Gisborne MAR Injection Trial Resource Consent

https://golderassociates.sharepoint.com/sites/20273g/deliverables/012 - aug 2020 monitoring/rev1/1898725-7403-012-lr-rev0 monitoring report - august 2020.docx

ATTACHMENT 1

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ATTACHMENT 2

Monitoring Programme Schedule and Parameter Suites

Suite 1 Parameters: Plume Tracking.

Type	Full Name	Abbreviation
General	Conductivity	EC (field)
	Temperature	Temp (field)
	Dissolved Oxygen	DO (field)
	pH	pH (field)
	Sum cations & anions	Sum Cat & An
	Alkalinity	ALK
Cations	Total Potassium	K
	Total Calcium	Ca
	Total Magnesium	Mg
	Total Sodium	Na
	Total Arsenic	As
	Total Iron	Fe
	Total Manganese	Mn
	Dissolved Arsenic	diss As
	Dissolved Iron	diss Fe
	Dissolved Manganese	diss Mn
Anions	Total Chloride	Cl
	Total Sulphate	SO4
	Total Nitrate	NO3
	Total Bromide	Br
	Bicarbonate	HCO3

Suite 2 Parameters: Hydrogeochemistry and Plume Tracking.

Type	Full Name	Abbreviation
General	Conductivity	EC (field)
	Temperature	Temp (field)
	Dissolved Oxygen	DO (field)
	pH	pH (field)
	Sum cations & anions	Sum Cat & An
	Alkalinity	ALK
Cations	Total Potassium	K
	Total Calcium	Ca
	Total Magnesium	Mg
	Total Sodium	Na
	Total Aluminium	Al
	Total Barium	Ba
	Total Boron	B
	Total Nickel	Ni
	Total Zinc	Zn
	Total Arsenic	As
	Total Iron	Fe
	Total Manganese	Mn
	Dissolved Arsenic	diss As
	Dissolved Iron	diss Fe
	Dissolved Manganese	diss Mn
Anions	Total Chloride	Cl
	Total Sulphate	SO4
	Total Bromide	Br
	Dissolved Reactive Phosphorus	DRP

Type	Full Name	Abbreviation
	Total Nitrate	NO3
	Dissolved Ammoniacal Nitrogen	diss NH4
	Nitrite	NO2
	Total Silicon	Si
	Dissolved Sulphur	diss S
	Bicarbonate	HCO3
Other	Total Organic Carbon	TOC

Suite 3: Emerging Contaminants.

Analyte	Detection Limit	Unit
Estrogen		
17 alpha-ethynylestradiol	0.02	µg/L
beta-Estradiol	0.02	µg/L
Estriol	0.004	µg/L
Estrone	0.004	µg/L
Ethinylestradiol	0.04	µg/L
Total Estrogen	0.004	µg/L

Analyte	Detection Limit	Unit
Glyphosate & AMPA		
AMPA	0.04	µg/L
Glyphosate	0.04	µg/L

Analyte	Detection Limit	Unit
Organonitrogen & Organophosphorus Pesticides		
Acetochlor	0.1	µg/L
Alachlor	0.1	µg/L
Atrazine desethyl	0.1	µg/L
Atrazine desisopropyl	0.1	µg/L
Atrazine	0.1	µg/L
Azaconazole	0.1	µg/L
Azinphos methyl	0.1	µg/L
Benalaxyl	0.1	µg/L
Bitertanol	0.1	µg/L
Bromacil	0.1	µg/L

Analyte	Detection Limit	Unit
Butachlor	0.1	µg/L
Carbaryl	0.1	µg/L
Carbofuran	0.1	µg/L
Chlorfluazuron	0.4	µg/L
Chlorpyrifos methyl	0.4	µg/L
Chlorpyrifos	0.1	µg/L
Chlortoluron	0.1	µg/L
Cyanazine	0.1	µg/L
Diazinon	0.1	µg/L
Dichlofluanid	40	µg/L
Dichlorvos	0.1	µg/L
Difenoconazole	0.1	µg/L
Dimethoate	0.1	µg/L
Diphenylamine	2	µg/L
Diuron	0.1	µg/L
Fenpropimorph	0.1	µg/L
Fluazifop butyl	0.1	µg/L
Fluometuron	0.1	µg/L
Flusilazole	0.1	µg/L
Fluvalinate tau	2	µg/L
Furalaxyl	0.1	µg/L
Haloxyfop methyl	0.1	µg/L
Hexaconazole	0.1	µg/L
Hexazinone	0.1	µg/L
Imazapyr	0.1	µg/L
IPBC	0.1	µg/L

Analyte	Detection Limit	Unit
Kresoxim methyl	0.1	µg/L
Linuron	0.1	µg/L
Malathion	0.1	µg/L
Metalaxyl	0.1	µg/L
Metolachlor	0.1	µg/L
Metribuzin	0.1	µg/L
Metsulfuron	0.05	µg/L
Molinate	0.1	µg/L
Myclobutanil	0.1	µg/L
Naled	1	µg/L
Norflurazon	0.1	µg/L
Oryzalin	4	µg/L
Oxadiazon	0.1	µg/L
Paclobutrazol	0.1	µg/L
Parathion Ethyl	1	µg/L
Pendimethalin	0.1	µg/L
Pirimicarb	0.1	µg/L
Pirimiphos methyl	0.1	µg/L
Prochloraz	0.1	µg/L
Prometryne	0.1	µg/L
Propachlor	0.1	µg/L
Propanil	0.1	µg/L
Propazine	0.1	µg/L
Propiconazole	0.1	µg/L
Pyriproxifen	0.1	µg/L
Quizalofop ethyl	0.1	µg/L

Analyte	Detection Limit	Unit
Simazine	0.1	µg/L
Simetryn	0.1	µg/L
Sulfentrazone	2	µg/L
TCMTB	0.1	µg/L
Tebuconazol	0.1	µg/L
Terbacil	0.1	µg/L
Terbufos	1	µg/L
Terbumeton	0.1	µg/L
Terbuthylazine desethyl	0.1	µg/L
Terbuthylazine	0.1	µg/L
Terbutryn	0.1	µg/L
Thiabendazole	0.1	µg/L
Thiobencarb	0.1	µg/L
Tolylfluanide	40	µg/L
Triazophos	0.1	µg/L

Analyte	Detection Limit	Unit
Pharmaceutical and Personal Care Products		
Acesulfame	20	ng/L
Atenolol	0.5	ng/L
Benzophenone	20	ng/L
Bupropion	0.5	ng/L
Caffeine	0.5	ng/L
Carbamazepine	0.5	ng/L
Ciprofloxacin	20	ng/L
Cotinine	0.5	ng/L

Analyte	Detection Limit	Unit
DEET	20	ng/L
Diclofenac	2	ng/L
Diltiazem	0.5	ng/L
Diphenhydramine	20	ng/L
Doxycycline	20	ng/L
Fluoxetine	0.5	ng/L
Gabapentin	0.5	ng/L
Gemfibrozil	0.5	ng/L
Ibuprofen	100	ng/L
Lamotrigine	0.5	ng/L
Metoprolol	0.5	ng/L
Naproxen	20	ng/L
Norcotinine	1	ng/L
Paracetamol	2	ng/L
Sucralose	0.5	ng/L
Sulfamethoxazole	0.5	ng/L
Triclocarban	20	ng/L
Triclosan	0.5	ng/L
Trimethoprim	0.5	ng/L
Varenicline	0.5	ng/L
Venlafaxine	0.5	ng/L

Suite 4: Pathogens.

Type	Full Name	Abbreviation	Detection Limit	Unit
Indicator bacteria	E. *coli*	E. coli	1.6	CFU/100 mL
	Enterococcus	Ent.	1.6	CFU/100 mL
	Faecal Coliforms	FC	1.6	CFU/100 mL
Indicator viruses	Somatic Coliphages	SC	1	PFU/100 mL
	Adenovirus	AV	5	MPN/100 mL

Monitoring Schedule.

Round	Date	Parameter Suite	Gisborne MAR trial phase
1	13 September 2018	Field testing only	Idle period between 2017 and 2019 injection trials (2018-2019 irrigation season)
2	24 and 26 October 2018	Field testing and suite 2	
3	8 January 2019	Field testing and suite 2	
4	5 and 6 March 2019	Field testing and suite 2	
5	3 April 2019	Field testing and suite 1	
6	15 and 16 July 2019	Field testing and suite 2, 3 and 4	
7	22 July 2019	Suite 3 and 4 testing only	
8	18 July 2019	Field testing and suite 1	
9	22 July 2019	Field testing and suite 2	
11	14, 15 and 16 August 2019	Field testing and suite 1 and 4	2019 injection trial
12	28 August 2019	Field testing and suite 1	
13	24 and 25 September 2019	Field testing and suite 2, 3 and 4	
14	14 October 2019	Field testing and suite 2, 3 and 4	Idle period between 2019 and 2020 injection trials (2019-2020 irrigation season)
15	11 November 2019	Field testing and suite 1	
16	6 May 2020	Field testing and suite 2, 3 and 4	
17	12 May 2020	Somatic coliphage testing only	2020 injection trial
18	26 May 2020	Field testing and suite 1, 3 and 4	
19	2 June 2020	Somatic coliphage testing only	
20	24 June 2020	Field testing and suite 1, 3 and 4	

Note:
Suite 1: Plume tracking
Suite 2: Hydrogeochemistry and plume tracking
Suite 3: Emerging contaminants
Suite 4: Pathogens

ATTACHMENT 3

Water Quality Test Results and Reports

October 2019 (Suite 1 and 2).

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Date and time sample taken	-	-	14-10-19	14-10-19	14-10-19	14-10-19
Anion Total	meq/L	-	4.9	7.5	9.4	14
Cation Total	meq/L	-	4.8	7.4	9.9	15
Sum of Anions + Cations by Calculation	meq/L	-	9.7	15	19	29
meq/L Difference by Calculation	meq/L	-	0.12	0.088	0.56	0.38
Total Alkalinity (as CaCO3)	g/m^3	-	160	280	350	530
Bicarbonate Alkalinity (as HCO3)	g/m^3	-	190	350	430	640
Carbonate Alkalinity (as CO3)	g/m^3	-	<2.00	<4.00	<4.00	<4.0
Hydroxide Alkalinity (as CaCO3)	g/m^3	-	<2.00	<4.00	<4.00	<4.0
Bromide	g/m^3	-	0.028	0.104	0.235	0.585
Chloride	g/m^3	-	8.53	24.5	50.7	136
Fluoride	g/m^3	-	-	-	-	-
Nitrate (as N)	g/m^3	-	0.022	<0.00200	<0.00200	<0.004
Nitrite (as N)	g/m^3	-	0.0051	<0.00200	<0.00200	<0.002
Sulphate	g/m^3	-	77.5	56.9	42.8	0.47
Total Aluminium	g/m^3	-	-	-	-	-
Total Arsenic	g/m^3	-	0.00062	0.0061	0.004	0.013
Total Barium	g/m^3	-	1.1	1.3	2.2	3.3
Total Boron	g/m^3	-	0.084	0.14	0.15	0.2

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Total Cadmium	g/m^3	-	-	-	-	-
Total Calcium	g/m^3	-	67	86	110	210
Total Chromium	g/m^3	-	-	-	-	-
Total Cobalt	g/m^3	-	-	-	-	-
Total Copper	g/m^3	-	-	-	-	-
Total Iron	g/m^3	-	0.05	2	3.2	5.1
Total Lead	g/m^3	-	-	-	-	-
Total Magnesium	g/m^3	-	6.5	9.9	13	24
Total Manganese	g/m^3	-	0.012	0.49	0.46	1.2
Total Molybdenum	g/m^3	-	-	-	-	-
Total Nickel	g/m^3	-	0.00088	0.0016	0.0031	0.00078
Total Nitrogen (as N)	g/m^3	-	0.057	1.6	1.1	3.1
Total Organic Carbon	g/m^3	-	-	-	-	-
Total Oxidised Nitrogen (as N)	g/m^3	-	-	-	-	-
Total Potassium	g/m^3	-	3.1	6.1	6.8	8.2
Total Silicon (as Silica)	g/m^3	-	11	33	34	32
Total Sodium	g/m^3	-	22	54	60	77
Total Strontium	g/m^3	-	-	-	-	-
Total Sulphur	g/m^3	-	-	-	-	-
Total Vanadium	g/m^3	-	-	-	-	-
Total Zinc	g/m^3	-	0.0014	0.0059	0.0052	0.0038
Dissolved Aluminium	g/m^3	-	-	-	-	-

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Dissolved Ammoniacal Nitrogen (as N)	g/m^3	-	0.02	1.6	1.1	2.8
Dissolved Arsenic	g/m^3	-	0.00065	0.0063	0.0043	0.014
Dissolved Barium	g/m^3	-	-	-	-	-
Dissolved Boron	g/m^3	-	-	-	-	-
Dissolved Cadmium	g/m^3	-	-	-	-	-
Dissolved Calcium	g/m^3	-	65	83	120	180
Dissolved Chromium	g/m^3	-	-	-	-	-
Dissolved Cobalt	g/m^3	-	-	-	-	-
Dissolved Copper	g/m^3	-	-	-	-	-
Dissolved Inorganic Nitrogen (as N)	g/m^3	-	-	-	-	-
Dissolved Iron	g/m^3	-	0.0095	1.7	3	5.2
Dissolved Lead	g/m^3	-	-	-	-	-
Dissolved Magnesium	g/m^3	-	5.8	9	12	20
Dissolved Manganese	g/m^3	-	0.0087	0.5	0.46	1.2
Dissolved Molybdenum	g/m^3	-	-	-	-	-
Dissolved Nickel	g/m^3	-	-	-	-	-
Dissolved Potassium	g/m^3	-	3	6.1	6.9	8.3
Dissolved Reactive Phosphorus (as P)	g/m^3	-	-	-	-	-
Dissolved Sodium	g/m^3	-	23	51	62	77
Dissolved Strontium	g/m^3	-	-	-	-	-
Dissolved Sulphur	g/m^3	-	-	-	-	-

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Dissolved Vanadium	g/m^3	-	-	-	-	-
Dissolved Zinc	g/m^3	-	-	-	-	-

November 2019

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Date and time sample taken	-	-	11-11-19	11-11-19	11-11-19	11-11-19
Anion Total	meq/L	-	5.1	8.5	10	16
Cation Total	meq/L	-	5.3	7.8	9.8	15
Sum of Anions + Cations by Calculation	meq/L	-	10	16	20	31
meq/L Difference by Calculation	meq/L	-	0.22	0.69	0.62	0.32
Total Alkalinity (as CaCO3)	g/m^3	-	170	330	410	600
Bicarbonate Alkalinity (as HCO3)	g/m^3	-	170	400	500	740
Carbonate Alkalinity (as CO3)	g/m^3	-	16	<4.00	<4.00	<4.0
Hydroxide Alkalinity (as CaCO3)	g/m^3	-	<2.00	<4.00	<4.00	<4.0
Bromide	g/m^3	-	0.027	0.114	0.214	0.582
Chloride	g/m^3	-	8.2	27.4	49.2	129
Fluoride	g/m^3	-	-	-	-	-
Nitrate (as N)	g/m^3	-	<0.00200	<0.00200	<0.00400	<0.004
Nitrite (as N)	g/m^3	-	0.0022	<0.00200	0.0047	0.013

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Sulphate	g/m^3	-	76.3	51.8	41.6	0.28
Total Aluminium	g/m^3	-	-	-	-	-
Total Arsenic	g/m^3	-	0.00087	0.0061	0.0016	0.014
Total Barium	g/m^3	-	-	-	-	-
Total Boron	g/m^3	-	-	-	-	-
Total Cadmium	g/m^3	-	-	-	-	-
Total Calcium	g/m^3	-	66	85	110	180
Total Chromium	g/m^3	-	-	-	-	-
Total Cobalt	g/m^3	-	-	-	-	-
Total Copper	g/m^3	-	-	-	-	-
Total Iron	g/m^3	-	0.34	1.8	1.4	5.4
Total Lead	g/m^3	-	-	-	-	-
Total Magnesium	g/m^3	-	6.5	10	12	27
Total Manganese	g/m^3	-	0.065	0.46	0.47	1.3
Total Molybdenum	g/m^3	-	-	-	-	-
Total Nickel	g/m^3	-	-	-	-	-
Total Nitrogen (as N)	g/m^3	-	0.12	1.9	1.2	3.1
Total Organic Carbon	g/m^3	-	-	-	-	-
Total Oxidised Nitrogen (as N)	g/m^3	-	-	-	-	-
Total Potassium	g/m^3	-	2.9	6.4	6.8	8.8
Total Silicon (as Silica)	g/m^3	-	-	-	-	-
Total Sodium	g/m^3	-	22	53	57	77

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Total Strontium	g/m^3	-	-	-	-	-
Total Sulphur	g/m^3	-	-	-	-	-
Total Vanadium	g/m^3	-	-	-	-	-
Total Zinc	g/m^3	-	-	-	-	-
Dissolved Aluminium	g/m^3	-	-	-	-	-
Dissolved Ammoniacal Nitrogen (as N)	g/m^3	-	0.012	1.5	1	2.6
Dissolved Arsenic	g/m^3	-	0.00085	0.0059	0.0017	0.012
Dissolved Barium	g/m^3	-	-	-	-	-
Dissolved Boron	g/m^3	-	-	-	-	-
Dissolved Cadmium	g/m^3	-	-	-	-	-
Dissolved Calcium	g/m^3	-	73	86	120	190
Dissolved Chromium	g/m^3	-	-	-	-	-
Dissolved Cobalt	g/m^3	-	-	-	-	-
Dissolved Copper	g/m^3	-	-	-	-	-
Dissolved Inorganic Nitrogen (as N)	g/m^3	-	-	-	-	-
Dissolved Iron	g/m^3	-	0.038	0.78	0.94	5.3
Dissolved Lead	g/m^3	-	-	-	-	-
Dissolved Magnesium	g/m^3	-	7.2	11	13	21
Dissolved Manganese	g/m^3	-	0.099	0.48	0.49	1.2
Dissolved Molybdenum	g/m^3	-	-	-	-	-
Dissolved Nickel	g/m^3	-	-	-	-	-

Parameter	Unit	GPE066 (injection well)	GPE065	GPE067	GPE068	GPE069
Dissolved Potassium	g/m^3	-	3	6.5	6.8	8.8
Dissolved Reactive Phosphorus (as P)	g/m^3	-	-	-	-	-
Dissolved Sodium	g/m^3	-	24	53	60	80
Dissolved Strontium	g/m^3	-	-	-	-	-
Dissolved Sulphur	g/m^3	-	-	-	-	-
Dissolved Vanadium	g/m^3	-	-	-	-	-
Dissolved Zinc	g/m^3	-	-	-	-	-

May 2020 (Suite 1 and 2)

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Date and time sample taken	-	26-05-20	26-05-20	26-05-20	26-05-20	26-05-20
Anion Total	meq/L	5	5.3	7.4	7.7	17
Cation Total	meq/L	4.9	5.1	7.1	8.3	16
Sum of Anions + Cations by Calculation	meq/L	10	10	14	16	33
meq/L Difference by Calculation	meq/L	0.097	0.17	0.26	0.57	0.83
Total Alkalinity (as CaCO3)	g/m^3	140	150	280	290	490
Bicarbonate Alkalinity (as HCO3)	g/m^3	180	190	340	360	600
Carbonate Alkalinity (as CO3)	g/m^3	<1.00	<1.00	<2.00	<2.00	<4.00

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Hydroxide Alkalinity (as CaCO3)	g/m^3	<1.00	<1.00	<2.00	<2.00	<4.00
Bromide	g/m^3	0.027	0.031	0.0731	0.0891	0.567
Chloride	g/m^3	9.33	10.1	17.7	20.9	249
Fluoride	g/m^3	-	-	-	-	-
Nitrate (as N)	g/m^3	0.0656	0.1	<0.00200	0.0029	0.0025
Nitrite (as N)	g/m^3	<0.00200	<0.00200	<0.00200	<0.00200	0.002
Sulphate	g/m^3	90.9	93.5	63.4	61.1	0.47
Total Aluminium	g/m^3	-	-	-	-	-
Total Arsenic	g/m^3	0.00051	0.0005	0.0046	0.0036	0.013
Total Barium	g/m^3	-	-	-	-	-
Total Boron	g/m^3	-	-	-	-	-
Total Cadmium	g/m^3	-	-	-	-	-
Total Calcium	g/m^3	61	64	77	92	200
Total Chromium	g/m^3	-	-	-	-	-
Total Cobalt	g/m^3	-	-	-	-	-
Total Copper	g/m^3	-	-	-	-	-
Total Iron	g/m^3	0.11	0.024	1.7	2.6	5.6
Total Lead	g/m^3	-	-	-	-	-
Total Magnesium	g/m^3	6.7	6.7	9	11	23
Total Manganese	g/m^3	0.015	0.054	0.45	0.37	1.2
Total Molybdenum	g/m^3	-	-	-	-	-

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Total Nickel	g/m^3	-	-	-	-	-
Total Nitrogen (as N)	g/m^3	0.2	0.22	1.8	1.2	3.5
Total Organic Carbon	g/m^3	-	-	-	-	-
Total Oxidised Nitrogen (as N)	g/m^3	-	-	-	-	-
Total Potassium	g/m^3	2.5	2.6	5.7	6	8.6
Total Silicon (as Silica)	g/m^3	-	-	-	-	-
Total Sodium	g/m^3	25	25	48	52	83
Total Strontium	g/m^3	-	-	-	-	-
Total Sulphur	g/m^3	-	-	-	-	-
Total Vanadium	g/m^3	-	-	-	-	-
Total Zinc	g/m^3	-	-	-	-	-
Dissolved Aluminium	g/m^3	-	-	-	-	-
Dissolved Ammoniacal Nitrogen (as N)	g/m^3	0.013	0.013	1.5	1.1	3
Dissolved Arsenic	g/m^3	0.00047	0.00047	0.0028	0.0011	0.0048
Dissolved Barium	g/m^3	-	-	-	-	-
Dissolved Boron	g/m^3	-	-	-	-	-
Dissolved Cadmium	g/m^3	<0.00005	<0.00005	<0.00005	<0.00005	<0.0005
Dissolved Calcium	g/m^3	63	67	79	94	200
Dissolved Chromium	g/m^3	-	-	-	-	-
Dissolved Cobalt	g/m^3	-	-	-	-	-

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Dissolved Copper	g/m^3	-	-	-	-	-
Dissolved Inorganic Nitrogen (as N)	g/m^3	-	-	-	-	-
Dissolved Iron	g/m^3	<0.00200	0.0068	0.0059	0.057	0.58
Dissolved Lead	g/m^3	-	-	-	-	-
Dissolved Magnesium	g/m^3	6.8	6.9	8.8	11	24
Dissolved Manganese	g/m^3	0.00083	0.055	0.44	0.37	1.2
Dissolved Molybdenum	g/m^3	-	-	-	-	-
Dissolved Nickel	g/m^3	-	-	-	-	-
Dissolved Potassium	g/m^3	2.6	2.8	5.9	6.4	9.1
Dissolved Reactive Phosphorus (as P)	g/m^3	-	-	-	-	-
Dissolved Sodium	g/m^3	26	26	50	57	87
Dissolved Strontium	g/m^3	-	-	-	-	-
Dissolved Sulphur	g/m^3	-	-	-	-	-
Dissolved Vanadium	g/m^3	-	-	-	-	-
Dissolved Zinc	g/m^3	-	-	-	-	-

June 2020 (suite 1 and 2)

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Date and time sample taken	-	24-06-20	24-06-20	24-06-20	24-06-20	24-06-20
Anion Total	meq/L	-	5.3	7.3	8.4	15
Cation Total	meq/L	-	5.3	7.4	8.7	14
Sum of Anions + Cations by Calculation	meq/L	-	11	15	17	29
meq/L Difference by Calculation	meq/L	-	0.02	0.09	0.34	0.75
Total Alkalinity (as CaCO3)	g/m^3	-	150	280	320	580
Bicarbonate Alkalinity (as HCO3)	g/m^3	-	190	340	390	700
Carbonate Alkalinity (as CO3)	g/m^3	-	<2.00	<4.00	<4.00	<4.00
Hydroxide Alkalinity (as CaCO3)	g/m^3	-	<2.00	<4.00	<4.00	<4.00
Bromide	g/m^3	-	0.029	0.0667	0.132	0.52
Chloride	g/m^3	-	9.51	16.2	29.8	126
Fluoride	g/m^3	-	-	-	-	-
Nitrate (as N)	g/m^3	-	<0.00200	0.0021	0.002	0.0027
Nitrite (as N)	g/m^3	-	<0.00200	0.0027	0.0035	0.0044
Sulphate	g/m^3	-	94.5	62	55.3	0.61
Total Aluminium	g/m^3	-	-	-	-	-
Total Arsenic	g/m^3	-	0.00057	0.0043	0.0038	0.013
Total Barium	g/m^3	-	-	-	-	-

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Total Boron	g/m^3	-	-	-	-	-
Total Cadmium	g/m^3	-	-	-	-	-
Total Calcium	g/m^3	-	67	78	94	180
Total Chromium	g/m^3	-	-	-	-	-
Total Cobalt	g/m^3	-	-	-	-	-
Total Copper	g/m^3	-	-	-	-	-
Total Iron	g/m^3	-	0.023	1.1	2.7	5.8
Total Lead	g/m^3	-	-	-	-	-
Total Magnesium	g/m^3	-	7.3	9	11	21
Total Manganese	g/m^3	-	0.026	0.45	0.4	1.2
Total Molybdenum	g/m^3	-	-	-	-	-
Total Nickel	g/m^3	-	-	-	-	-
Total Nitrogen (as N)	g/m^3	-	0.088	1.6	1.1	3
Total Organic Carbon	g/m^3	-	-	-	-	-
Total Oxidised Nitrogen (as N)	g/m^3	-	-	-	-	-
Total Potassium	g/m^3	-	2.7	5.9	6.4	9.2
Total Silicon (as Silica)	g/m^3	-	-	-	-	-
Total Sodium	g/m^3	-	27	52	56	76
Total Strontium	g/m^3	-	-	-	-	-
Total Sulphur	g/m^3	-	-	-	-	-
Total Vanadium	g/m^3	-	-	-	-	-

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Total Zinc	g/m^3	-	-	-	-	-
Dissolved Aluminium	g/m^3	-	-	-	-	-
Dissolved Ammoniacal Nitrogen (as N)	g/m^3	-	0.017	1.4	0.98	2.8
Dissolved Arsenic	g/m^3	-	0.00059	0.0042	0.0037	0.013
Dissolved Barium	g/m^3	-	-	-	-	-
Dissolved Boron	g/m^3	-	-	-	-	-
Dissolved Cadmium	g/m^3	-	<0.00005	<0.00005	<0.00005	<0.00005
Dissolved Calcium	g/m^3	-	71	82	100	170
Dissolved Chromium	g/m^3	-	-	-	-	-
Dissolved Cobalt	g/m^3	-	-	-	-	-
Dissolved Copper	g/m^3	-	-	-	-	-
Dissolved Inorganic Nitrogen (as N)	g/m^3	-	-	-	-	-
Dissolved Iron	g/m^3	-	0.012	0.98	2.7	5.8
Dissolved Lead	g/m^3	-	-	-	-	-
Dissolved Magnesium	g/m^3	-	6.7	8.5	10	19
Dissolved Manganese	g/m^3	-	0.022	0.43	0.37	1.2
Dissolved Molybdenum	g/m^3	-	-	-	-	-
Dissolved Nickel	g/m^3	-	-	-	-	-
Dissolved Potassium	g/m^3	-	2.5	5.6	6.1	8.1
Dissolved Reactive Phosphorus (as P)	g/m^3	-	-	-	-	-

Parameter	Unit	MAR Headworks (Waipaoa River water)	GPE065	GPE067	GPE068	GPE069
Dissolved Sodium	g/m^3	-	26	54	59	81
Dissolved Strontium	g/m^3	-	-	-	-	-
Dissolved Sulphur	g/m^3	-	-	-	-	-
Dissolved Vanadium	g/m^3	-	-	-	-	-
Dissolved Zinc	g/m^3	-	-	-	-	-

Watercare Services Limited
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PO Box 107028, Auckland, 2150
T: (09) 539 7600
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www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference:191015-136

Attention:	Paul Murphy	*Final Report:*	**341450-0**
Client:	**GISBORNE DISTRICT COUNCIL**	*Report Issue Date:*	**14-Nov-2019**
Address:	**PO Box 747, Gisborne, 4040**	*Received Date:*	**15-Oct-2019**
Client Reference:	**Managed Aquifer Recharge**	*Sampled By:*	**Kathryn Sharman**
Purchase Order:	**3700110012201**	*Quote Reference :*	**5880**

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191015-136-1**	**191015-136-2**	**191015-136-3**	**191015-136-4**
Client Sample ID:		20193541	20193542	20193543	20193544
Sample Date/Time		14/10/2019 12:22	14/10/2019 11:30	14/10/2019 10:25	14/10/2019 09:36
Description:		599 Bushmere Rd-GPE069	598 Bushmere Rd-MAR pilot bore GPE 065	598 Bushmere Rd-MAR injection Bore 75 m GPE067	598 Bushmere Rd-MAR injection Bore 350m GPE068
Chemistry Detailed					
Anions					
Bromide	mg/L	0.585	0.028	0.104	0.235
Chloride	mg/L	136	8.53	24.5	50.7
Nitrate (as N)	mg/L	<0.004	0.022	<0.002	<0.002
Nitrite (as N)	mg/L	<0.002	0.0051	<0.002	<0.002
Sulphate	mg/L	0.47	77.5	56.9	42.8
Ion Balance (Anions/Cations) by Calculation					
Anion Total	meq/L	14 *	4.9 *	7.5 *	9.4 *
Cation Total	meq/L	15 *	4.8 *	7.4 *	9.9 *
meq/L Difference	meq/L	0.38 *	0.12 *	0.88e-1 *	0.56 *
Percent Difference	%	1.3 *	1.2 *	0.59 *	2.9 *
Sum of Anions + Cations	meq/L	29 *	9.7 *	15 *	19 *
General Testing					
Bicarbonate Alkalinity (as HCO3)	mg/L	640	190	350	430
Carbonate Alkalinity (as CO3)	mg/L	<4.0	<2.0	<4.0	<4.0
Dissolved Ammoniacal Nitrogen (as N)	mg/L	2.8	0.02	1.6	1.1
Hydroxide Alkalinity (as CaCO3)	mg/L	<4.0	<2.0	<4.0	<4.0
Total Alkalinity (as CaCO3)	mg/L	530	160	280	350
Total Nitrogen (as N)	mg/L	3.1	0.057	1.6	1.1
Turbidity (Infrared Light Source)	FNU	74.4 *	0.69 *	22.2 *	44.4 *
Turbidity	NTU	55	0.25	22	40
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Arsenic (Dissolved)	mg/L	0.014	0.00065	0.0063	0.0043
Calcium (Dissolved)	mg/L	180	65	83	120
Iron (Dissolved)	mg/L	5.2	0.0095	1.7	3.0
Magnesium (Dissolved)	mg/L	20	5.8	9.0	12
Manganese (Dissolved)	mg/L	1.2	0.0087	0.5	0.46
Potassium (Dissolved)	mg/L	8.3	3.0	6.1	6.9
Sodium (Dissolved)	mg/L	77	23	51	62
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	0.013	0.00062	0.0061	0.004
Barium (Total)	mg/L	3.3	1.1	1.3	2.2
Boron (Total)	mg/L	0.2	0.084	0.14	0.15
Calcium (Total)	mg/L	210	67	86	110
Calcium Hardness (as CaCO3) (Total)	mg/L	450	160	220	280

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191015-136-1**	**191015-136-2**	**191015-136-3**	**191015-136-4**
Client Sample ID:		20193541	20193542	20193543	20193544
Sample Date/Time:		14/10/2019 12:22	14/10/2019 11:30	14/10/2019 10:25	14/10/2019 09:36
Description:		599 Bushmere Rd-GPE069	598 Bushmere Rd-MAR pilot bore GPE 065	598 Bushmere Rd-MAR injection Bore 75 m GPE067	598 Bushmere Rd-MAR injection Bore 350m GPE068
Metals					
Total Metals by ICP-MS—Trace (Default Digest)					
Iron (Total)	mg/L	5.1	0.05	2.0	3.2
Magnesium (Total)	mg/L	24	6.5	9.9	13
Magnesium Hardness (as CaCO3) (Total)	mg/L	85	27	41	52
Manganese (Total)	mg/L	1.2	0.012	0.49	0.46
Nickel (Total)	mg/L	0.00078	0.00088	0.0016	0.0031
Potassium (Total)	mg/L	8.2	3.1	6.1	6.8
Silicon (as Silica) (Total)	mg/L	32	11	33	34
Sodium (Total)	mg/L	77	22	54	60
Total Hardness (as CaCO3)	mg/L	530	180	260	340
Zinc (Total)	mg/L	0.0038	0.0014	0.0059	0.0052
Organics					
Adhoc investigation					
Acesulfame	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Atenolol	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Benzophenone	ng/L	<20 *	<20 *	<20 *	<20 *
Bisphenol A	µg/L	<20 *	<20 *	<20 *	<20 *
Bupropion	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Caffeine	ng/L	25 *	149 *	19 *	<0.5 *
Carbamazepine	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Ciprofloxacin	ng/L	<20 *	<20 *	<20 *	<20 *
Comments		Analysed by LCMS and GCMS *	Analysed by LCMS and GCMS *	Analysed by LCMS and GCMS *	Analysed by LCMS and GCMS *
Cotinine	ng/L	8.3 *	6.8 *	9.4 *	<0.5 *
DEET	ng/L	<20 *	<20 *	<20 *	<20 *
Diclofenac	ng/L	<2 *	<2 *	<2 *	<2 *
Diltiazem	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Diphenhydramine	ng/L	<20 *	<20 *	<20 *	<20 *
Doxycycline	ng/L	<20 *	<20 *	<20 *	<20 *
Fluoxetine	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Gabapentin	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Galaxolide	µg/L	<0.1 *	<0.1 *	<0.1 *	<0.1 *
Gemfibrozil	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Ibuprofen	ng/L	<100 *	<100 *	<100 *	<100 *
Lamotrigine	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Metoprolol	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Naproxen	ng/L	<20 *	<20 *	<20 *	<20 *
Norcotinine	ng/L	<1 *	<1 *	<1 *	<1 *
Paracetamol	ng/L	3.4 *	58 *	1.7 *	<2 *
Sucralose	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Sulfamethoxazole	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Tonalid	µg/L	<0.1 *	<0.1 *	<0.1 *	<0.1 *
Triclocarban	ng/L	<15 *	<15 *	<15 *	<15 *
Triclosan	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Trimethoprim	ng/L	<0.5 *	1.5 *	<0.5 *	<0.5 *
Varenicline	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Venlafaxine	ng/L	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry					
17 alpha-ethynylestradiol	µg/L	<0.02	<0.02	<0.02	<0.02
beta-Estradiol	µg/L	<0.02	<0.02	<0.02	<0.02
Estriol	µg/L	<0.004	<0.004	<0.004	<0.004
Estrone	µg/L	<0.004	<0.004	<0.004	<0.004
Ethinylestradiol	µg/L	<0.04	<0.04	<0.04	<0.04
Total Estrogen	µg/L	<0.04	<0.04	<0.04	<0.04

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191015-136-1**	**191015-136-2**	**191015-136-3**	**191015-136-4**
Client Sample ID:		20193541	20193542	20193543	20193544
Sample Date/Time:		14/10/2019 12:22	14/10/2019 11:30	14/10/2019 10:25	14/10/2019 09:36
Description:		599 Bushmere Rd-GPE069	598 Bushmere Rd-MAR pilot bore GPE 065	598 Bushmere Rd-MAR injection Bore 75 m GPE067	598 Bushmere Rd-MAR injection Bore 350m GPE068
Organics					
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry					
AMPA	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate	µg/L	<0.04	<0.04	<0.04	<0.04
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Acetochlor	µg/L	<0.1	<0.1	<0.1	<0.1
Alachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desisopropyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine	µg/L	<0.1	<0.1	<0.1	<0.1
Azaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Azinphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Benalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Bitertanol	µg/L	<0.1	<0.1	<0.1	<0.1
Bromacil	µg/L	<0.1	<0.1	<0.1	<0.1
Butachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Carbaryl	µg/L	<0.1	<0.1	<0.1	<0.1
Carbofuran	µg/L	<0.1	<0.1	<0.1	<0.1
Chlorfluazuron	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos methyl	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos	µg/L	<0.1	<0.1	<0.1	<0.1
Chlortoluron	µg/L	<0.1	<0.1	<0.1	<0.1
Cyanazine	µg/L	<0.1	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.1	<0.1	<0.1	<0.1
Dichlofluanid	µg/L	<40	<40	<40	<40
Dichlorvos	µg/L	<0.1	<0.1	<0.1	<0.1
Difenoconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Dimethoate	µg/L	<0.1	<0.1	<0.1	<0.1
Diphenylamine	µg/L	<2.0	<2.0	<2.0	<2.0
Diuron	µg/L	<0.1	<0.1	<0.1	<0.1
Fenpropimorph	µg/L	<0.1	<0.1	<0.1	<0.1
Fluazifop butyl	µg/L	<0.1	<0.1	<0.1	<0.1
Fluometuron	µg/L	<0.1	<0.1	<0.1	<0.1
Flusilazole	µg/L	<0.1	<0.1	<0.1	<0.1
Fluvalinate tau	µg/L	<2.0	<2.0	<2.0	<2.0
Furalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Haloxyfop methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Hexaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Hexazinone	µg/L	<0.1	<0.1	<0.1	<0.1
Imazapyr	µg/L	<0.1	<0.1	<0.1	<0.1
IPBC	µg/L	<0.1	<0.1	<0.1	<0.1
Kresoxim methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Linuron	µg/L	<0.1	<0.1	<0.1	<0.1
Malathion	µg/L	<0.1	<0.1	<0.1	<0.1
Metalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Metolachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Metribuzin	µg/L	<0.1	<0.1	<0.1	<0.1
Metsulfuron	µg/L	<0.05	<0.05	<0.05	<0.05
Molinate	µg/L	<0.1	<0.1	<0.1	<0.1
Myclobutanil	µg/L	<0.1	<0.1	<0.1	<0.1
Naled	µg/L	<1.0	<1.0	<1.0	<1.0
Norflurazon	µg/L	<0.1	<0.1	<0.1	<0.1
Oryzalin	µg/L	<4.0	<4.0	<4.0	<4.0
Oxadiazon	µg/L	<0.1	<0.1	<0.1	<0.1
Paclobutrazol	µg/L	<0.1	<0.1	<0.1	<0.1
Parathion Ethyl	µg/L	<1.0	<1.0	<1.0	<1.0
Pendimethalin	µg/L	<0.1	<0.1	<0.1	<0.1

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191015-136-1**	**191015-136-2**	**191015-136-3**	**191015-136-4**
Client Sample ID:		20193541	20193542	20193543	20193544
Sample Date/Time:		14/10/2019 12:22	14/10/2019 11:30	14/10/2019 10:25	14/10/2019 09:36
Description:		599 Bushmere Rd-GPE069	598 Bushmere Rd-MAR pilot bore GPE 065	598 Bushmere Rd-MAR injection Bore 75 m GPE067	598 Bushmere Rd-MAR injection Bore 350m GPE068
Organics					
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Pirimicarb	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimiphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Prochloraz	µg/L	<0.1	<0.1	<0.1	<0.1
Prometryne	µg/L	<0.1	<0.1	<0.1	<0.1
Propachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Propanil	µg/L	<0.1	<0.1	<0.1	<0.1
Propazine	µg/L	<0.1	<0.1	<0.1	<0.1
Propiconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Pyriproxifen	µg/L	<0.1	<0.1	<0.1	<0.1
Quizalofop ethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Simazine	µg/L	<0.1	<0.1	<0.1	<0.1
Simetryn	µg/L	<0.1	<0.1	<0.1	<0.1
Sulfentrazone	µg/L	<2.0	<2.0	<2.0	<2.0
TCMTB	µg/L	<0.1	<0.1	<0.1	<0.1
Tebuconazol	µg/L	<0.1	<0.1	<0.1	<0.1
Terbacil	µg/L	<0.1	<0.1	<0.1	<0.1
Terbufos	µg/L	<1.0	<1.0	<1.0	<1.0
Terbumeton	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine	µg/L	<0.1	<0.1	<0.1	<0.1
Terbutryn	µg/L	<0.1	<0.1	<0.1	<0.1
Thiabendazole	µg/L	<0.1	<0.1	<0.1	<0.1
Thiobencarb	µg/L	<0.1	<0.1	<0.1	<0.1
Tolylfluanide	µg/L	<40	<40	<40	<40
Triazophos	µg/L	<0.1	<0.1	<0.1	<0.1
Microbiology					
Culturable Adenoviruses by MPN					
Adenovirus (presumptive)	MPN/100 L	<5.0	<5.0	<5.0	<5.0
Enterococci by Membrane Filtration					
Enterococci	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Escherichia coli by Membrane Filtration					
Escherichia coli	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Faecal coliforms by Membrane Filtration					
Faecal coliforms	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Subcontracting					
		0000018106.pdf *	0000018107.pdf *	0000018108.pdf *	0000018109.pdf *

Sample Details		WATERS
Lab Sample ID:		**191015-136-6**
Client Sample ID:		20193546
Sample Date/Time		14/10/2019 12:28
Description:		Waipaoa River at Infiltration Chamber
General Testing		
Total Suspended Solids	mg/L	390
Turbidity (Infrared Light Source)	FNU	351 *
Turbidity	NTU	260

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location

Chemistry Detailed				
Anions				
Bromide	APHA (online edition) 4110 B	0.005 mg/L	1, 2, 3, 4	Auckland
Chloride	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 4	Auckland
Nitrate (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 4	Auckland
Nitrite (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 4	Auckland
Sulphate	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 4	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 4	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 4	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	1, 2, 3, 4	Auckland
Percent Difference	APHA (online edition) 1030 E		1, 2, 3, 4	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		1, 2, 3, 4	Auckland
General Testing				
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 4	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 4	Auckland
Dissolved Ammoniacal Nitrogen (as N) by Colorimetry/ Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	1, 2, 3, 4	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 4	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 4	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	1, 2, 3, 4	Auckland
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D / 2540 E	0.2 mg/L	6	Auckland
Turbidity (Infrared Light Source) by Nephelometry	ISO 7027-1:2016	0.05 FNU	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtered)				
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 4	Auckland
Calcium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 4	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 4	Auckland
Magnesium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 4	Auckland
Manganese (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 4	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.02 mg/L	1, 2, 3, 4	Auckland
Sodium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 4	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 4	Auckland
Barium (Total)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	1, 2, 3, 4	Auckland
Boron (Total)	APHA (online edition) 3125 B by ICPMS	0.005 mg/L	1, 2, 3, 4	Auckland
Calcium (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 4	Auckland
Calcium Hardness (as CaCO3) (Total)	APHA (online edition) 3125 B by ICPMS	0.03 mg/L	1, 2, 3, 4	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 4	Auckland
Magnesium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 4	Auckland
Magnesium Hardness (as CaCO3) (Total)	APHA (online edition) 3125 B by ICPMS	0.004 mg/L	1, 2, 3, 4	Auckland
Manganese (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 4	Auckland
Nickel (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 4	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	1, 2, 3, 4	Auckland
Silicon (as Silica) (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 4	Auckland
Sodium (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 4	Auckland
Total Hardness (as CaCO3)	APHA (online edition) 3125 B by ICPMS	0.03 mg/L	1, 2, 3, 4	Auckland
Zinc (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 4	Auckland
Organics				
Adhoc investigation				
Comments	In House		1, 2, 3, 4	Auckland
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry				
17 alpha-ethynylestradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 4	Auckland
beta-Estradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 4	Auckland
Estriol	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 4	Auckland
Estrone	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 4	Auckland
Ethinylestradiol	SPE cleanup, LC MS/MS	0.04 µg/L	1, 2, 3, 4	Auckland
Total Estrogen	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 4	Auckland

Organics				
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry				
AMPA	In-house by LC-MS	0.04 µg/L	1, 2, 3, 4	Auckland
Glyphosate	In-house by LC-MS	0.04 µg/L	1, 2, 3, 4	Auckland
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Acetochlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Alachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Atrazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Atrazine desisopropyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Atrazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Azaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Azinphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Benalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Bitertanol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Bromacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Butachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Carbaryl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Carbofuran	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Chlorfluazuron	In-house by LC-MS	0.4 µg/L	1, 2, 3, 4	Auckland
Chlorpyrifos methyl	In-house by LC-MS	0.4 µg/L	1, 2, 3, 4	Auckland
Chlorpyrifos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Chlortoluron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Cyanazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Diazinon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Dichlofluanid	In-house by LC-MS	40 µg/L	1, 2, 3, 4	Auckland
Dichlorvos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Difenoconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Dimethoate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Diphenylamine	In-house by LC-MS	2 µg/L	1, 2, 3, 4	Auckland
Diuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Fenpropimorph	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Fluazifop butyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Fluometuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Flusilazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Fluvalinate tau	In-house by LC-MS	2 µg/L	1, 2, 3, 4	Auckland
Furalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Haloxyfop methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Hexaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Hexazinone	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Imazapyr	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
IPBC	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Kresoxim methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Linuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Malathion	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Metalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Metolachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Metribuzin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Metsulfuron	In-house by LC-MS	0.05 µg/L	1, 2, 3, 4	Auckland
Molinate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Myclobutanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Naled	In-house by LC-MS	1 µg/L	1, 2, 3, 4	Auckland
Norflurazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Oryzalin	In-house by LC-MS	4 µg/L	1, 2, 3, 4	Auckland
Oxadiazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Paclobutrazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Parathion Ethyl	In-house by LC-MS	1 µg/L	1, 2, 3, 4	Auckland
Pendimethalin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Pirimicarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Pirimiphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Prochloraz	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Prometryne	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland

Organics				
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Propachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Propanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Propazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Propiconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Pyriproxifen	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Quizalofop ethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Simazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Simetryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Sulfentrazone	In-house by LC-MS	2 µg/L	1, 2, 3, 4	Auckland
TCMTB	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Tebuconazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Terbacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Terbufos	In-house by LC-MS	1 µg/L	1, 2, 3, 4	Auckland
Terbumeton	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Terbuthylazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Terbuthylazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Terbutryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Thiabendazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Thiobencarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Tolylfluanide	In-house by LC-MS	40 µg/L	1, 2, 3, 4	Auckland
Triazophos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 4	Auckland
Microbiology				
Culturable Adenoviruses by MPN				
Adenovirus (presumptive)	In-house based on APHA 9510 & Manual of Environmental Biology	5 MPN/100 L	1, 2, 3, 4	Auckland
Enterococci by Membrane Filtration				
Enterococci	APHA (online edition) 9230 C	2 cfu/100 mL	1, 2, 3, 4	Auckland
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	1, 2, 3, 4	Auckland
Faecal coliforms by Membrane Filtration				
Faecal coliforms	APHA (online edition) 9222 D	2 cfu/100 mL	1, 2, 3, 4	Auckland
Subcontracting				
COA	As per Subcontractor Method		1, 2, 3, 4	Auckland
Preparations				
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		1, 2, 3, 4	Auckland
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		1, 2, 3, 4	Auckland
Nonpotable waters preparation (virus)	In-house method (based on different sources)		1, 2, 3, 4	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Appendix 1 - Result Images

Lab Sample ID 191015-136-4

Client Sample ID 5084709

Sampling Point

598 Bushmere Rd- MAR injection Bore 350m GPE068

Dioxins

Lab Sample ID 191015-136-3

Client Sample ID 5084708

Sampling Point

598 Bushmere Rd- MAR injection Bore 75m GPE067

Dioxins

Lab Sample ID	191015-136-2
Client Sample ID	5084707
Sampling Point	

598 Bushmere Rd- MAR pilot bore GPE 065

Dioxins

Lab Sample ID	191015-136-1
Client Sample ID	5084706
Sampling Point	

599 Bushmere Rd- GPE069

Dioxins

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Peter Boniface
KTP Signatory

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Certificate of Analysis
Laboratory Reference:191112-090

Attention:	Paul Murphy	*Final Report:*	**343037-0**
Client:	**GISBORNE DISTRICT COUNCIL**	*Report Issue Date:*	**26-Nov-2019**
Address:	**PO Box 747, Gisborne, 4040**	*Received Date:*	**12-Nov-2019**
Client Reference:	**Managed Aquifer Recharge**	*Sampled By:*	**Kathryn Sharman**
Purchase Order:	**3700110012201**	*Quote Reference :*	**5880**

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191112-090-1**	**191112-090-2**	**191112-090-3**	**191112-090-6**
Client Sample ID:		20193899	20193900	20193901	20193898
Sample Date/Time		11/11/2019 10:32	11/11/2019 10:04	11/11/2019 09:36	11/11/2019 11:00
Description:		598 Bushmere Road MAR Pilot Bore GPE 065	598 Bushmere Road MAR injection bore 75 m GPE067	598 Bushmere Road MAR injection bore 350m GPE068	599 Bushmere Road GPE069
Chemistry Detailed					
Anions					
Bromide	mg/L	0.027	0.114	0.214	0.582
Chloride	mg/L	8.2	27.4	49.2	129
Nitrate (as N)	mg/L	0.0022	<0.002	0.0047	0.013
Nitrite (as N)	mg/L	<0.002	<0.002	<0.004	<0.004
Sulphate	mg/L	76.3	51.8	41.6	0.28
Ion Balance (Anions/Cations) by Calculation					
Anion Total	meq/L	5.1 *	8.5 *	10 *	16 *
Cation Total	meq/L	5.3 *	7.8 *	9.8 *	15 *
meq/L Difference	meq/L	0.22 *	0.69 *	0.62 *	0.32 *
Percent Difference	%	2.1 *	4.3 *	3.1 *	1.0 *
Sum of Anions + Cations	meq/L	10 *	16 *	20 *	31 *
General Testing					
Bicarbonate Alkalinity (as HCO3)	mg/L	170	400	500	740
Carbonate Alkalinity (as CO3)	mg/L	16	<4.0	<4.0	<4.0
Dissolved Ammoniacal Nitrogen (as N)	mg/L	0.012	1.5	1.0	2.6
Hydroxide Alkalinity (as CaCO3)	mg/L	<2.0	<4.0	<4.0	<4.0
Total Alkalinity (as CaCO3)	mg/L	170	330	410	600
Total Nitrogen (as N)	mg/L	0.12	1.9	1.2	3.1
Turbidity (Infrared Light Source)	FNU	11.6 *	26.0 *	4.64 *	52.4 *
Turbidity	NTU	8.6	24	4.3	50
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Arsenic (Dissolved)	mg/L	0.00085	0.0059	0.0017	0.012
Calcium (Dissolved)	mg/L	73	86	120	190
Iron (Dissolved)	mg/L	0.038	0.78	0.94	5.3
Magnesium (Dissolved)	mg/L	7.2	11	13	21
Manganese (Dissolved)	mg/L	0.099	0.48	0.49	1.2
Potassium (Dissolved)	mg/L	3.0	6.5	6.8	8.8
Sodium (Dissolved)	mg/L	24	53	60	80
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	0.00087	0.0061	0.0016	0.014
Calcium (Total)	mg/L	66	85	110	180
Iron (Total)	mg/L	0.34	1.8	1.4	5.4
Magnesium (Total)	mg/L	6.5	10	12	27
Manganese (Total)	mg/L	0.065	0.46	0.47	1.3
Potassium (Total)	mg/L	2.9	6.4	6.8	8.8

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**191112-090-1**	**191112-090-2**	**191112-090-3**	**191112-090-6**
Client Sample ID:		20193899	20193900	20193901	20193898
Sample Date/Time:		11/11/2019 10:32	11/11/2019 10:04	11/11/2019 09:36	11/11/2019 11:00
Description:		598 Bushmere Road MAR Pilot Bore GPE 065	598 Bushmere Road MAR injection bore 75 m GPE067	598 Bushmere Road MAR injection bore 350m GPE068	599 Bushmere Road GPE069
Metals					
Total Metals by ICP-MS—Trace (Default Digest)					
Sodium (Total)	mg/L	22	53	57	77

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Detailed				
Anions				
Bromide	APHA (online edition) 4110 B	0.005 mg/L	All	Auckland
Chloride	APHA (online edition) 4110 B	0.02 mg/L	All	Auckland
Nitrate (as N)	APHA (online edition) 4110 B	0.002 mg/L	All	Auckland
Nitrite (as N)	APHA (online edition) 4110 B	0.002 mg/L	All	Auckland
Sulphate	APHA (online edition) 4110 B	0.02 mg/L	All	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	All	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	All	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	All	Auckland
Percent Difference	APHA (online edition) 1030 E		All	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		All	Auckland
General Testing				
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Dissolved Ammoniacal Nitrogen (as N) by Colorimetry/ Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	All	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	All	Auckland
Turbidity (Infrared Light Source) by Nephelometry	ISO 7027-1:2016	0.05 FNU	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtered)				
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Calcium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	All	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Magnesium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Manganese (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.02 mg/L	All	Auckland
Sodium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	All	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Calcium (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	All	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Magnesium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Manganese (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Sodium (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	All	Auckland
Preparations				
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		All	Auckland

Preparations			
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)	All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

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Certificate of Analysis
Laboratory Reference:200506-138

Attention:	Paul Murphy	*Final Report:*	**365385-0**	*Replaces Report*	**364578-0**
Client:	**GISBORNE DISTRICT COUNCIL**	*Report Issue Date:*	**16-Jul-2020**		
Address:	**PO Box 747, Gisborne, 4040**	*Received Date:*	**07-May-2020**		
Client Reference:	**Managed Aquifer Recharge**	*Sampled By:*	**Kathryn Sharman**		
Purchase Order:	**3700110012201**	*Quote Reference :*	**5880**		

Amended Certificate of Analysis: dissolved Mn results added to samples 2,3,6, Total and dissolved sulfur added to samples 1,2, 3 and 6..

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200506-138-1**	**200506-138-2**	**200506-138-3**	**200506-138-6**
Client Sample ID:		20202242	20202243	20202244	20202245
Sample Date/Time		06/05/2020 10:57	06/05/2020 11:31	06/05/2020 12:15	06/05/2020 09:41
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Chemistry Detailed					
Anions					
Bromide	mg/L	0.0866	0.0799	0.042	0.618
Chloride	mg/L	20.2	19.1	9.44	135
Nitrate (as N)	mg/L	<0.002	<0.002	<0.002	0.012
Nitrite (as N)	mg/L	<0.002	<0.002	<0.002	<0.004
Sulphate	mg/L	65.5	62.7	74.5	0.059
Ion Balance (Anions/Cations) by Calculation					
Anion Total	meq/L	8.0 *	7.7 *	5.6 *	16 *
Cation Total	meq/L	7.7 *	7.4 *	5.8 *	14 *
meq/L Difference	meq/L	0.26 *	0.35 *	0.18 *	1.4 *
Percent Difference	%	1.7 *	2.3 *	1.6 *	4.5 *
Sum of Anions + Cations	meq/L	16 *	15 *	11 *	30 *
Sample Parameters and Field Testing					
Laboratory Arrival Temperature	°C	2.3	2.3	2.3	2.3
Laboratory Arrival Time		08:30:00 AM	08:30:00 AM	08:30:00 AM	08:30:00 AM
General Testing					
Bicarbonate Alkalinity (as HCO3)	mg/L	370	360	230	730
Carbonate Alkalinity (as CO3)	mg/L	<4.0	<4.0	<2.0	<4.0
Conductivity (at 25 °C)	mS/m	77.7	72.7	54.1	149
Dissolved Ammoniacal Nitrogen (as N)	mg/L	0.99	1.5	0.17	3.0
Dissolved Reactive Phosphorus (as P)	mg/L	0.027	0.19	0.025	0.005
Hydroxide Alkalinity (as CaCO3)	mg/L	<4.0	<4.0	<2.0	<4.0
pH (at room temp c. 20 °C)	pH unit	7.6	7.5	8.1	7.2
Total Alkalinity (as CaCO3)	mg/L	300	290	190	600
Total Nitrogen (as N)	mg/L	1.1	1.7	0.25	3.3
Turbidity (Infrared Light Source)	FNU	17.2 *	12.2 *	47.5 *	61.8 *
Turbidity	NTU	14	12	39	60
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Arsenic (Dissolved)	mg/L	0.002	0.0051	0.00094	0.0075
Calcium (Dissolved)	mg/L	87	77	79	180
Iron (Dissolved)	mg/L	0.22	0.18	0.037	0.089
Magnesium (Dissolved)	mg/L	9.8	9.7	7.9	20
Manganese (Dissolved)	mg/L	0.36	0.48	0.22	1.2

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Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200506-138-1**	**200506-138-2**	**200506-138-3**	**200506-138-6**
Client Sample ID:		20202242	20202243	20202244	20202245
Sample Date/Time:		06/05/2020 10:57	06/05/2020 11:31	06/05/2020 12:15	06/05/2020 09:41
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Nickel (Dissolved)	mg/L	<0.0001	<0.0001	0.00028	0.00014
Potassium (Dissolved)	mg/L	6.4	6.5	3.4	9.0
Sodium (Dissolved)	mg/L	52	56	25	76
Sulfur (Dissolved)	mg/L	26	29	28	0.45
Zinc (Dissolved)	mg/L	0.0014	<0.001	0.0011	0.0024
Total Metals by ICP-MS—Trace (Default Digest)					
Aluminium (Total)	mg/L	0.21	0.15	0.0052	0.71
Arsenic (Total)	mg/L	0.00061	0.0065	0.0011	0.015
Barium (Total)	mg/L	1.8	1.5	1.4	3.9
Boron (Total)	mg/L	0.15	0.15	0.11	0.22
Calcium (Total)	mg/L	85	86	90	200
Iron (Total)	mg/L	2.1	1.8	0.16	6.4
Magnesium (Total)	mg/L	9.8	8.9	7.8	23
Manganese (Total)	mg/L	0.35	0.47	0.21	1.2
Nickel (Total)	mg/L	0.0031	0.0011	0.00042	0.0038
Potassium (Total)	mg/L	6.6	5.7	3.5	8.7
Silicon (as Silica) (Total)	mg/L	32	30	14	35
Sodium (Total)	mg/L	53	54	24	78
Sulfur (Total)	mg/L	25 *	25 *	27 *	0.33 *
Zinc (Total)	mg/L	0.0052	0.0053	0.0014	0.0095
Organics					
Adhoc investigation					
Comments		Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Galaxolide	µg/L	<0.1 *	<0.1 *	<0.1 *	<0.1 *
Tonalid	µg/L	<0.1 *	<0.1 *	<0.1 *	<0.1 *
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry					
17 alpha-ethynylestradiol	µg/L	<0.02	<0.02	<0.02	<0.02
beta-Estradiol	µg/L	<0.02	<0.02	<0.02	<0.02
Estriol	µg/L	<0.004	<0.004	<0.004	<0.004
Estrone	µg/L	<0.004	<0.004	<0.004	<0.004
Ethinylestradiol	µg/L	<0.04	<0.04	<0.04	<0.04
Total Estrogen	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry					
AMPA	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate	µg/L	<0.04	<0.04	<0.04	<0.04
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Acetochlor	µg/L	<0.1	<0.1	<0.1	<0.1
Alachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desisopropyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine	µg/L	<0.1	<0.1	<0.1	<0.1
Azaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Azinphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Benalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Bitertanol	µg/L	<0.1	<0.1	<0.1	<0.1
Bromacil	µg/L	<0.1	<0.1	<0.1	<0.1
Butachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Carbaryl	µg/L	<0.1	<0.1	<0.1	<0.1
Carbofuran	µg/L	<0.1	<0.1	<0.1	<0.1
Chlorfluazuron	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos methyl	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos	µg/L	<0.1	<0.1	<0.1	<0.1

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200506-138-1**	**200506-138-2**	**200506-138-3**	**200506-138-6**
Client Sample ID:		20202242	20202243	20202244	20202245
Sample Date/Time:		06/05/2020 10:57	06/05/2020 11:31	06/05/2020 12:15	06/05/2020 09:41
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Organics					
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Chlortoluron	µg/L	<0.1	<0.1	<0.1	<0.1
Cyanazine	µg/L	<0.1	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.1	<0.1	<0.1	<0.1
Dichlofluanid	µg/L	<40	<40	<40	<40
Dichlorvos	µg/L	<0.1	<0.1	<0.1	<0.1
Difenoconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Dimethoate	µg/L	<0.1	<0.1	<0.1	<0.1
Diphenylamine	µg/L	<2.0	<2.0	<2.0	<2.0
Diuron	µg/L	<0.1	<0.1	<0.1	<0.1
Fenpropimorph	µg/L	<0.1	<0.1	<0.1	<0.1
Fluazifop butyl	µg/L	<0.1	<0.1	<0.1	<0.1
Fluometuron	µg/L	<0.1	<0.1	<0.1	<0.1
Flusilazole	µg/L	<0.1	<0.1	<0.1	<0.1
Fluvalinate tau	µg/L	<2.0	<2.0	<2.0	<2.0
Furalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Haloxyfop methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Hexaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Hexazinone	µg/L	<0.1	<0.1	<0.1	<0.1
Imazapyr	µg/L	<0.1	<0.1	<0.1	<0.1
IPBC	µg/L	<0.1	<0.1	<0.1	<0.1
Kresoxim methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Linuron	µg/L	<0.1	<0.1	<0.1	<0.1
Malathion	µg/L	<0.1	<0.1	<0.1	<0.1
Metalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Metolachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Metribuzin	µg/L	<0.1	<0.1	<0.1	<0.1
Metsulfuron	µg/L	<0.05	<0.05	<0.05	<0.05
Molinate	µg/L	<0.1	<0.1	<0.1	<0.1
Myclobutanil	µg/L	<0.1	<0.1	<0.1	<0.1
Naled	µg/L	<1.0	<1.0	<1.0	<1.0
Norflurazon	µg/L	<0.1	<0.1	<0.1	<0.1
Oryzalin	µg/L	<4.0	<4.0	<4.0	<4.0
Oxadiazon	µg/L	<0.1	<0.1	<0.1	<0.1
Paclobutrazol	µg/L	<0.1	<0.1	<0.1	<0.1
Parathion Ethyl	µg/L	<1.0	<1.0	<1.0	<1.0
Pendimethalin	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimicarb	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimiphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Prochloraz	µg/L	<0.1	<0.1	<0.1	<0.1
Prometryne	µg/L	<0.1	<0.1	<0.1	<0.1
Propachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Propanil	µg/L	<0.1	<0.1	<0.1	<0.1
Propazine	µg/L	<0.1	<0.1	<0.1	<0.1
Propiconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Pyriproxifen	µg/L	<0.1	<0.1	<0.1	<0.1
Quizalofop ethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Simazine	µg/L	<0.1	<0.1	<0.1	<0.1
Simetryn	µg/L	<0.1	<0.1	<0.1	<0.1
Sulfentrazone	µg/L	<2.0	<2.0	<2.0	<2.0
TCMTB	µg/L	<0.1	<0.1	<0.1	<0.1
Tebuconazol	µg/L	<0.1	<0.1	<0.1	<0.1
Terbacil	µg/L	<0.1	<0.1	<0.1	<0.1
Terbufos	µg/L	<1.0	<1.0	<1.0	<1.0
Terbumeton	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200506-138-1**	**200506-138-2**	**200506-138-3**	**200506-138-6**
Client Sample ID:		20202242	20202243	20202244	20202245
Sample Date/Time:		06/05/2020 10:57	06/05/2020 11:31	06/05/2020 12:15	06/05/2020 09:41
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Organics					
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Terbuthylazine	µg/L	<0.1	<0.1	<0.1	<0.1
Terbutryn	µg/L	<0.1	<0.1	<0.1	<0.1
Thiabendazole	µg/L	<0.1	<0.1	<0.1	<0.1
Thiobencarb	µg/L	<0.1	<0.1	<0.1	<0.1
Tolylfluanide	µg/L	<40	<40	<40	<40
Triazophos	µg/L	<0.1	<0.1	<0.1	<0.1
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry					
Acesulfame	ng/L	<20	<20	<20	<20
Atenolol	ng/L	<0.5	<0.5	<0.5	<0.5
Benzophenone	ng/L	<20	<20	<20	<20
Bupropion	ng/L	<0.5	<0.5	<0.5	<0.5
Caffeine	ng/L	10	<0.5	<0.5	<0.5
Carbamazepine	ng/L	<0.5	<0.5	<0.5	<0.5
Ciprofloxacin	ng/L	<20	<20	<20	<20
Cotinine	ng/L	<0.5	<0.5	<0.5	<0.5
DEET	ng/L	<20	<20	<20	<20
Diclofenac	ng/L	<2	<2	<2	<2
Diltiazem	ng/L	<0.5	<0.5	<0.5	<0.5
Diphenhydramine	ng/L	<20	<20	<20	<20
Doxycycline	ng/L	<20	<20	<20	<20
Fluoxetine	ng/L	<0.5	<0.5	<0.5	<0.5
Gabapentin	ng/L	<0.5	<0.5	<0.5	<0.5
Gemfibrozil	ng/L	<0.5	<0.5	<0.5	<0.5
Ibuprofen	ng/L	<100	<100	<100	<100
Lamotrigine	ng/L	<0.5	<0.5	<0.5	<0.5
Metoprolol	ng/L	<0.5	<0.5	<0.5	<0.5
Naproxen	ng/L	<20	<20	<20	<20
Norcotinine	ng/L	<1	<1	<1	<1
Paracetamol	ng/L	<2	<2	<2	<2
Sucralose	ng/L	<0.5	<0.5	<0.5	<0.5
Sulfamethoxazole	ng/L	<0.5	<0.5	<0.5	<0.5
Triclocarban	ng/L	<20	<20	<20	<20
Triclosan	ng/L	<0.5	<0.5	<0.5	<0.5
Trimethoprim	ng/L	<0.5	<0.5	<0.5	<0.5
Varenicline	ng/L	<0.5	<0.5	<0.5	<0.5
Venlafaxine	ng/L	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon by Non-dispersive infrared detection					
Total Organic Carbon	mg/L	2.5	2.8	2.0	3.5
Microbiology					
Enterococci by Membrane Filtration					
Enterococci	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Escherichia coli by Membrane Filtration					
Escherichia coli	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Faecal coliforms by Membrane Filtration					
Faecal coliforms	cfu/100 mL	<1.6	<1.6	<1.6	<1.6

Sample Details	WATERS
Lab Sample ID:	**200506-138-7**
Client Sample ID:	20202246
Sample Date/Time	06/05/2020 10:06
Description:	Waipaoa River at Infiltration Chamber
Chemistry Detailed	

Sample Details (continued)	WATERS
Lab Sample ID:	**200506-138-7**
Client Sample ID:	20202246
Sample Date/Time:	06/05/2020 10:06
Description:	Waipaoa River at Infiltration Chamber

Chemistry Detailed

Anions

Bromide	mg/L	0.026
Chloride	mg/L	11.3
Nitrate (as N)	mg/L	0.0666
Nitrite (as N)	mg/L	<0.002
Sulphate	mg/L	76.3

Sample Parameters and Field Testing

Laboratory Arrival Temperature	°C	2.3
Laboratory Arrival Time		08:30:00 AM

General Testing

Bicarbonate Alkalinity (as HCO3)	mg/L	180
Carbonate Alkalinity (as CO3)	mg/L	<4.0
Dissolved Ammoniacal Nitrogen (as N)	mg/L	0.01
Dissolved Reactive Phosphorus (as P)	mg/L	0.006
Hydroxide Alkalinity (as CaCO3)	mg/L	<4.0
Total Alkalinity (as CaCO3)	mg/L	140
Turbidity (Infrared Light Source)	FNU	712 *
Turbidity	NTU	700

Organics

Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry

Acetochlor	µg/L	<0.1
Alachlor	µg/L	<0.1
Atrazine desethyl	µg/L	<0.1
Atrazine desisopropyl	µg/L	<0.1
Atrazine	µg/L	<0.1
Azaconazole	µg/L	<0.1
Azinphos methyl	µg/L	<0.1
Benalaxyl	µg/L	<0.1
Bitertanol	µg/L	<0.1
Bromacil	µg/L	<0.1
Butachlor	µg/L	<0.1
Carbaryl	µg/L	<0.1
Carbofuran	µg/L	<0.1
Chlorfluazuron	µg/L	<0.4
Chlorpyrifos methyl	µg/L	<0.4
Chlorpyrifos	µg/L	<0.1
Chlortoluron	µg/L	<0.1
Cyanazine	µg/L	<0.1
Diazinon	µg/L	<0.1
Dichlofluanid	µg/L	<40
Dichlorvos	µg/L	<0.1
Difenoconazole	µg/L	<0.1
Dimethoate	µg/L	<0.1
Diphenylamine	µg/L	<2.0
Diuron	µg/L	<0.1
Fenpropimorph	µg/L	<0.1
Fluazifop butyl	µg/L	<0.1
Fluometuron	µg/L	<0.1
Flusilazole	µg/L	<0.1
Fluvalinate tau	µg/L	<2.0
Furalaxyl	µg/L	<0.1
Haloxyfop methyl	µg/L	<0.1
Hexaconazole	µg/L	<0.1
Hexazinone	µg/L	<0.1
Imazapyr	µg/L	<0.1

Sample Details (continued)

WATERS

Lab Sample ID:	**200506-138-7**
Client Sample ID:	20202246
Sample Date/Time:	06/05/2020 10:06
Description:	Waipaoa River at Infiltration Chamber

Organics

Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry

IPBC	µg/L	<0.1
Kresoxim methyl	µg/L	<0.1
Linuron	µg/L	<0.1
Malathion	µg/L	<0.1
Metalaxyl	µg/L	<0.1
Metolachlor	µg/L	<0.1
Metribuzin	µg/L	<0.1
Metsulfuron	µg/L	<0.05
Molinate	µg/L	<0.1
Myclobutanil	µg/L	<0.1
Naled	µg/L	<1.0
Norflurazon	µg/L	<0.1
Oryzalin	µg/L	<4.0
Oxadiazon	µg/L	<0.1
Paclobutrazol	µg/L	<0.1
Parathion Ethyl	µg/L	<1.0
Pendimethalin	µg/L	<0.1
Pirimicarb	µg/L	<0.1
Pirimiphos methyl	µg/L	<0.1
Prochloraz	µg/L	<0.1
Prometryne	µg/L	<0.1
Propachlor	µg/L	<0.1
Propanil	µg/L	<0.1
Propazine	µg/L	<0.1
Propiconazole	µg/L	<0.1
Pyriproxifen	µg/L	<0.1
Quizalofop ethyl	µg/L	<0.1
Simazine	µg/L	<0.1
Simetryn	µg/L	<0.1
Sulfentrazone	µg/L	<2.0
TCMTB	µg/L	<0.1
Tebuconazol	µg/L	<0.1
Terbacil	µg/L	<0.1
Terbufos	µg/L	<1.0
Terbumeton	µg/L	<0.1
Terbuthylazine desethyl	µg/L	<0.1
Terbuthylazine	µg/L	<0.1
Terbutryn	µg/L	<0.1
Thiabendazole	µg/L	<0.1
Thiobencarb	µg/L	<0.1
Tolylfluanide	µg/L	<40
Triazophos	µg/L	<0.1

Microbiology

Enterococci by Membrane Filtration

Enterococci	cfu/100 mL	2000

Escherichia coli by Membrane Filtration

Escherichia coli	cfu/100 mL	1400

Faecal coliforms by Membrane Filtration

Faecal coliforms	cfu/100 mL	1400

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location

Chemistry Detailed				
Anions				
Bromide	APHA (online edition) 4110 B	0.005 mg/L	All	Auckland
Chloride	APHA (online edition) 4110 B	0.02 mg/L	All	Auckland
Nitrate (as N)	APHA (online edition) 4110 B	0.002 mg/L	All	Auckland
Nitrite (as N)	APHA (online edition) 4110 B	0.002 mg/L	All	Auckland
Sulphate	APHA (online edition) 4110 B	0.02 mg/L	All	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
Percent Difference	APHA (online edition) 1030 E		1, 2, 3, 6	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		1, 2, 3, 6	Auckland
Sample Parameters and Field Testing				
Laboratory Arrival Temperature	APHA (online edition) 2550 B		All	Auckland
Laboratory Arrival Time	APHA (online edition) 2550 B		All	Auckland
General Testing				
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Conductivity (at 25 °C) by Electrode	APHA (online edition) 2510 B	0.5 mS/m	1, 2, 3, 6	Auckland
Dissolved Ammoniacal Nitrogen (as N) by Colorimetry/ Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	All	Auckland
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P F	0.002 mg/L	All	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	1, 2, 3, 6	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	1, 2, 3, 6	Auckland
Turbidity (Infrared Light Source) by Nephelometry	ISO 7027-1:2016	0.05 FNU	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtered)				
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Calcium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 6	Auckland
Magnesium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Manganese (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 6	Auckland
Nickel (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.02 mg/L	1, 2, 3, 6	Auckland
Sodium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 6	Auckland
Sulfur (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Zinc (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Aluminium (Total)	APHA (online edition) 3125 B by ICPMS	0.005 mg/L	1, 2, 3, 6	Auckland
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Barium (Total)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	1, 2, 3, 6	Auckland
Boron (Total)	APHA (online edition) 3125 B by ICPMS	0.005 mg/L	1, 2, 3, 6	Auckland
Calcium (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 6	Auckland
Magnesium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Manganese (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 6	Auckland
Nickel (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	1, 2, 3, 6	Auckland
Silicon (as Silica) (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 6	Auckland
Sodium (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 6	Auckland
Sulfur (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Zinc (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Organics				
Adhoc investigation				

Organics				
Adhoc investigation				
Comments	As specified above		1, 2, 3, 6	Auckland
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry				
17 alpha-ethynylestradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 6	Auckland
beta-Estradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 6	Auckland
Estriol	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Estrone	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Ethinylestradiol	SPE cleanup, LC MS/MS	0.04 µg/L	1, 2, 3, 6	Auckland
Total Estrogen	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry				
AMPA	In-house by LC-MS	0.04 µg/L	1, 2, 3, 6	Auckland
Glyphosate	In-house by LC-MS	0.04 µg/L	1, 2, 3, 6	Auckland
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Acetochlor	In-house by LC-MS	0.1 µg/L	All	Auckland
Alachlor	In-house by LC-MS	0.1 µg/L	All	Auckland
Atrazine desethyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Atrazine desisopropyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Atrazine	In-house by LC-MS	0.1 µg/L	All	Auckland
Azaconazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Azinphos methyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Benalaxyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Bitertanol	In-house by LC-MS	0.1 µg/L	All	Auckland
Bromacil	In-house by LC-MS	0.1 µg/L	All	Auckland
Butachlor	In-house by LC-MS	0.1 µg/L	All	Auckland
Carbaryl	In-house by LC-MS	0.1 µg/L	All	Auckland
Carbofuran	In-house by LC-MS	0.1 µg/L	All	Auckland
Chlorfluazuron	In-house by LC-MS	0.4 µg/L	All	Auckland
Chlorpyrifos methyl	In-house by LC-MS	0.4 µg/L	All	Auckland
Chlorpyrifos	In-house by LC-MS	0.1 µg/L	All	Auckland
Chlortoluron	In-house by LC-MS	0.1 µg/L	All	Auckland
Cyanazine	In-house by LC-MS	0.1 µg/L	All	Auckland
Diazinon	In-house by LC-MS	0.1 µg/L	All	Auckland
Dichlofluanid	In-house by LC-MS	40 µg/L	All	Auckland
Dichlorvos	In-house by LC-MS	0.1 µg/L	All	Auckland
Difenoconazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Dimethoate	In-house by LC-MS	0.1 µg/L	All	Auckland
Diphenylamine	In-house by LC-MS	2 µg/L	All	Auckland
Diuron	In-house by LC-MS	0.1 µg/L	All	Auckland
Fenpropimorph	In-house by LC-MS	0.1 µg/L	All	Auckland
Fluazifop butyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Fluometuron	In-house by LC-MS	0.1 µg/L	All	Auckland
Flusilazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Fluvalinate tau	In-house by LC-MS	2 µg/L	All	Auckland
Furalaxyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Haloxyfop methyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Hexaconazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Hexazinone	In-house by LC-MS	0.1 µg/L	All	Auckland
Imazapyr	In-house by LC-MS	0.1 µg/L	All	Auckland
IPBC	In-house by LC-MS	0.1 µg/L	All	Auckland
Kresoxim methyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Linuron	In-house by LC-MS	0.1 µg/L	All	Auckland
Malathion	In-house by LC-MS	0.1 µg/L	All	Auckland
Metalaxyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Metolachlor	In-house by LC-MS	0.1 µg/L	All	Auckland
Metribuzin	In-house by LC-MS	0.1 µg/L	All	Auckland
Metsulfuron	In-house by LC-MS	0.05 µg/L	All	Auckland
Molinate	In-house by LC-MS	0.1 µg/L	All	Auckland
Myclobutanil	In-house by LC-MS	0.1 µg/L	All	Auckland
Naled	In-house by LC-MS	1 µg/L	All	Auckland
Norflurazon	In-house by LC-MS	0.1 µg/L	All	Auckland

Organics

Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry

Oryzalin	In-house by LC-MS	4 µg/L	All	Auckland
Oxadiazon	In-house by LC-MS	0.1 µg/L	All	Auckland
Paclobutrazol	In-house by LC-MS	0.1 µg/L	All	Auckland
Parathion Ethyl	In-house by LC-MS	1 µg/L	All	Auckland
Pendimethalin	In-house by LC-MS	0.1 µg/L	All	Auckland
Pirimicarb	In-house by LC-MS	0.1 µg/L	All	Auckland
Pirimiphos methyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Prochloraz	In-house by LC-MS	0.1 µg/L	All	Auckland
Prometryne	In-house by LC-MS	0.1 µg/L	All	Auckland
Propachlor	In-house by LC-MS	0.1 µg/L	All	Auckland
Propanil	In-house by LC-MS	0.1 µg/L	All	Auckland
Propazine	In-house by LC-MS	0.1 µg/L	All	Auckland
Propiconazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Pyriproxifen	In-house by LC-MS	0.1 µg/L	All	Auckland
Quizalofop ethyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Simazine	In-house by LC-MS	0.1 µg/L	All	Auckland
Simetryn	In-house by LC-MS	0.1 µg/L	All	Auckland
Sulfentrazone	In-house by LC-MS	2 µg/L	All	Auckland
TCMTB	In-house by LC-MS	0.1 µg/L	All	Auckland
Tebuconazol	In-house by LC-MS	0.1 µg/L	All	Auckland
Terbacil	In-house by LC-MS	0.1 µg/L	All	Auckland
Terbufos	In-house by LC-MS	1 µg/L	All	Auckland
Terbumeton	In-house by LC-MS	0.1 µg/L	All	Auckland
Terbuthylazine desethyl	In-house by LC-MS	0.1 µg/L	All	Auckland
Terbuthylazine	In-house by LC-MS	0.1 µg/L	All	Auckland
Terbutryn	In-house by LC-MS	0.1 µg/L	All	Auckland
Thiabendazole	In-house by LC-MS	0.1 µg/L	All	Auckland
Thiobencarb	In-house by LC-MS	0.1 µg/L	All	Auckland
Tolylfluanide	In-house by LC-MS	40 µg/L	All	Auckland
Triazophos	In-house by LC-MS	0.1 µg/L	All	Auckland

Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry

Acesulfame	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Atenolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Benzophenone	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Bupropion	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Caffeine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Carbamazepine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Ciprofloxacin	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Cotinine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
DEET	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Diclofenac	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 6	Auckland
Diltiazem	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Diphenhydramine	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Doxycycline	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Fluoxetine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Gabapentin	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Gemfibrozil	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Ibuprofen	Instrumental Techniques by LC/MS 2.70	100 ng/L	1, 2, 3, 6	Auckland
Lamotrigine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Metoprolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Naproxen	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Norcotinine	Instrumental Techniques by LC/MS 2.70	1 ng/L	1, 2, 3, 6	Auckland
Paracetamol	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 6	Auckland
Sucralose	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Sulfamethoxazole	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Triclocarban	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Triclosan	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Trimethoprim	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Varenicline	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland

Organics				
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry				
Venlafaxine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Total Organic Carbon by Non-dispersive infrared detection				
Total Organic Carbon	APHA (online edition) 5310 B	0.1 mg/L	1, 2, 3, 6	Auckland
Microbiology				
Enterococci by Membrane Filtration				
Enterococci	APHA (online edition) 9230 C	2 cfu/100 mL	All	Auckland
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	All	Auckland
Faecal coliforms by Membrane Filtration				
Faecal coliforms	APHA (online edition) 9222 D	2 cfu/100 mL	All	Auckland
Preparations				
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		1, 2, 3, 6	Auckland
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Peter Boniface
KTP Signatory

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Certificate of Analysis
Laboratory Reference:200527-108

Attention:	Paul Murphy	*Final Report:*	**371215-0**	*Replaces Report*	**370982-0**
Client:	**GISBORNE DISTRICT COUNCIL**	*Report Issue Date:*	**13-Jul-2020**		
Address:	**PO Box 747, Gisborne, 4040**	*Received Date:*	**27-May-2020**		
Client Reference:	**Managed Aquifer Recharge**	*Sampled By:*	**Kathryn Sharman**		
Purchase Order:	**3700110012201**	*Quote Reference :*	**5880**		

Tonalid and galaxolid were analysed by APHA 6410B modified. The detection limits are listed below.
Amended report: Report reissued with the Enterococci results for sample 200527-108-2
Amended report: Replaces interim

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200527-108-1**	**200527-108-2**	**200527-108-3**	**200527-108-5**
Client Sample ID:		20202377	20202378	20202379	20202380
Sample Date/Time		26/05/2020 09:43	26/05/2020 10:17	26/05/2020 10:49	26/05/2020 11:09
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	598 Bushmere Road MAR Headworks outlet
Chemistry Detailed					
Anions					
Bromide	mg/L	0.0891	0.0731	0.031	0.027
Chloride	mg/L	20.9	17.7	10.1	9.33
Nitrate (as N)	mg/L	0.0029	<0.002	0.1	0.0656
Nitrite (as N)	mg/L	<0.002	<0.002	<0.002	<0.002
Sulphate	mg/L	61.1	63.4	93.5	90.9
Ion Balance (Anions/Cations) by Calculation					
Anion Total	meq/L	7.7 *	7.4 *	5.3 *	5.0 *
Cation Total	meq/L	8.3 *	7.1 *	5.1 *	4.9 *
meq/L Difference	meq/L	0.57 *	0.26 *	0.17 *	0.97e-1 *
Percent Difference	%	3.6 *	1.8 *	1.6 *	0.97 *
Sum of Anions + Cations	meq/L	16 *	14 *	10 *	10 *
Sample Parameters and Field Testing					
Laboratory Arrival Temperature	°C	10.4	10.4	10.4	10.4
Laboratory Arrival Time		08:45:00 AM	08:45:00 AM	08:45:00 AM	08:45:00 AM
General Testing					
Bicarbonate Alkalinity (as HCO3)	mg/L	360	340	190	180
Carbonate Alkalinity (as CO3)	mg/L	<2.0	<2.0	<1.0	<1.0
Dissolved Ammoniacal Nitrogen (as N)	mg/L	1.1	1.5	0.013	0.013
Hydroxide Alkalinity (as CaCO3)	mg/L	<2.0	<2.0	<1.0	<1.0
Total Alkalinity (as CaCO3)	mg/L	290	280	150	140
Total Nitrogen (as N)	mg/L	1.2	1.8	0.22	0.2
Turbidity (Infrared Light Source)	FNU	26.9 *	10.3 *	0.24 *	5.84 *
Turbidity	NTU	25	9.1	0.20	4.1
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Arsenic (Dissolved)	mg/L	0.0011	0.0028	0.00047	0.00047
Cadmium (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (Dissolved)	mg/L	94	79	67	63
Iron (Dissolved)	mg/L	0.057	0.0059	0.0068	<0.002
Magnesium (Dissolved)	mg/L	11	8.8	6.9	6.8
Manganese (Dissolved)	mg/L	0.37	0.44	0.055	0.00083

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200527-108-1**	**200527-108-2**	**200527-108-3**	**200527-108-5**
Client Sample ID:		20202377	20202378	20202379	20202380
Sample Date/Time:		26/05/2020 09:43	26/05/2020 10:17	26/05/2020 10:49	26/05/2020 11:09
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	598 Bushmere Road MAR Headworks outlet
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Potassium (Dissolved)	mg/L	6.4	5.9	2.8	2.6
Sodium (Dissolved)	mg/L	57	50	26	26
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	0.0036	0.0046	0.0005	0.00051
Calcium (Total)	mg/L	92	77	64	61
Iron (Total)	mg/L	2.6	1.7	0.024	0.11
Magnesium (Total)	mg/L	11	9.0	6.7	6.7
Manganese (Total)	mg/L	0.37	0.45	0.054	0.015
Potassium (Total)	mg/L	6.0	5.7	2.6	2.5
Sodium (Total)	mg/L	52	48	25	25
Organics					
Adhoc investigation					
Comments		Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Galaxolide	mg/L	<0.0001 *	<0.0001 *	<0.0001 *	<0.0001 *
Tonalid	mg/L	<0.0001 *	<0.0001 *	<0.0001 *	<0.0001 *
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry					
17 alpha-ethynylestradiol	µg/L	<0.02	<0.02	<0.02	<0.02
beta-Estradiol	µg/L	<0.02	<0.02	<0.02	<0.02
Estriol	µg/L	<0.004	<0.004	<0.004	<0.004
Estrone	µg/L	<0.004	<0.004	<0.004	<0.004
Ethinylestradiol	µg/L	<0.04	<0.04	<0.04	<0.04
Total Estrogen	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry					
AMPA	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate	µg/L	<0.04	<0.04	<0.04	<0.04
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Acetochlor	µg/L	<0.1	<0.1	<0.1	<0.1
Alachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desisopropyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine	µg/L	<0.1	<0.1	<0.1	<0.1
Azaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Azinphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Benalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Bitertanol	µg/L	<0.1	<0.1	<0.1	<0.1
Bromacil	µg/L	<0.1	<0.1	<0.1	<0.1
Butachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Carbaryl	µg/L	<0.1	<0.1	<0.1	<0.1
Carbofuran	µg/L	<0.1	<0.1	<0.1	<0.1
Chlorfluazuron	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos methyl	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos	µg/L	<0.1	<0.1	<0.1	<0.1
Chlortoluron	µg/L	<0.1	<0.1	<0.1	<0.1
Cyanazine	µg/L	<0.1	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.1	<0.1	<0.1	<0.1
Dichlofluanid	µg/L	<40	<40	<40	<40
Dichlorvos	µg/L	<0.1	<0.1	<0.1	<0.1
Difenoconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Dimethoate	µg/L	<0.1	<0.1	<0.1	<0.1
Diphenylamine	µg/L	<2.0	<2.0	<2.0	<2.0
Diuron	µg/L	<0.1	<0.1	<0.1	<0.1

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200527-108-1**	**200527-108-2**	**200527-108-3**	**200527-108-5**
Client Sample ID:		20202377	20202378	20202379	20202380
Sample Date/Time:		26/05/2020 09:43	26/05/2020 10:17	26/05/2020 10:49	26/05/2020 11:09
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	598 Bushmere Road MAR Headworks outlet
Organics					
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Fenpropimorph	µg/L	<0.1	<0.1	<0.1	<0.1
Fluazifop butyl	µg/L	<0.1	<0.1	<0.1	<0.1
Fluometuron	µg/L	<0.1	<0.1	<0.1	<0.1
Flusilazole	µg/L	<0.1	<0.1	<0.1	<0.1
Fluvalinate tau	µg/L	<2.0	<2.0	<2.0	<2.0
Furalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Haloxyfop methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Hexaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Hexazinone	µg/L	<0.1	<0.1	<0.1	<0.1
Imazapyr	µg/L	<0.1	<0.1	<0.1	<0.1
IPBC	µg/L	<0.1	<0.1	<0.1	<0.1
Kresoxim methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Linuron	µg/L	<0.1	<0.1	<0.1	<0.1
Malathion	µg/L	<0.1	<0.1	<0.1	<0.1
Metalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Metolachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Metribuzin	µg/L	<0.1	<0.1	<0.1	<0.1
Metsulfuron	µg/L	<0.05	<0.05	<0.05	<0.05
Molinate	µg/L	<0.1	<0.1	<0.1	<0.1
Myclobutanil	µg/L	<0.1	<0.1	<0.1	<0.1
Naled	µg/L	<1.0	<1.0	<1.0	<1.0
Norflurazon	µg/L	<0.1	<0.1	<0.1	<0.1
Oryzalin	µg/L	<4.0	<4.0	<4.0	<4.0
Oxadiazon	µg/L	<0.1	<0.1	<0.1	<0.1
Paclobutrazol	µg/L	<0.1	<0.1	<0.1	<0.1
Parathion Ethyl	µg/L	<1.0	<1.0	<1.0	<1.0
Pendimethalin	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimicarb	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimiphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Prochloraz	µg/L	<0.1	<0.1	<0.1	<0.1
Prometryne	µg/L	<0.1	<0.1	<0.1	<0.1
Propachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Propanil	µg/L	<0.1	<0.1	<0.1	<0.1
Propazine	µg/L	<0.1	<0.1	<0.1	<0.1
Propiconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Pyriproxifen	µg/L	<0.1	<0.1	<0.1	<0.1
Quizalofop ethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Simazine	µg/L	<0.1	<0.1	<0.1	<0.1
Simetryn	µg/L	<0.1	<0.1	<0.1	<0.1
Sulfentrazone	µg/L	<2.0	<2.0	<2.0	<2.0
TCMTB	µg/L	<0.1	<0.1	<0.1	<0.1
Tebuconazol	µg/L	<0.1	<0.1	<0.1	<0.1
Terbacil	µg/L	<0.1	<0.1	<0.1	<0.1
Terbufos	µg/L	<1.0	<1.0	<1.0	<1.0
Terbumeton	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine	µg/L	<0.1	<0.1	<0.1	<0.1
Terbutryn	µg/L	<0.1	<0.1	<0.1	<0.1
Thiabendazole	µg/L	<0.1	<0.1	<0.1	<0.1
Thiobencarb	µg/L	<0.1	<0.1	<0.1	<0.1
Tolylfluanide	µg/L	<40	<40	<40	<40
Triazophos	µg/L	<0.1	<0.1	<0.1	<0.1
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry					

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200527-108-1**	**200527-108-2**	**200527-108-3**	**200527-108-5**
Client Sample ID:		20202377	20202378	20202379	20202380
Sample Date/Time:		26/05/2020 09:43	26/05/2020 10:17	26/05/2020 10:49	26/05/2020 11:09
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	598 Bushmere Road MAR Headworks outlet
Organics					
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry					
Acesulfame	ng/L	<20	<20	<20	<20
Atenolol	ng/L	<0.5	<0.5	<0.5	<0.5
Benzophenone	ng/L	<20	<20	<20	<20
Bupropion	ng/L	<0.5	<0.5	<0.5	<0.5
Caffeine	ng/L	60	5	30	3
Carbamazepine	ng/L	<0.5	<0.5	<0.5	<0.5
Ciprofloxacin	ng/L	<20	<20	<20	<20
Cotinine	ng/L	20	20	20	10
DEET	ng/L	<20	<20	<20	<20
Diclofenac	ng/L	<2	<2	<2	<2
Diltiazem	ng/L	<0.5	<0.5	<0.5	<0.5
Diphenhydramine	ng/L	<20	<20	<20	<20
Doxycycline	ng/L	<20	<20	<20	<20
Fluoxetine	ng/L	<0.5	<0.5	<0.5	<0.5
Gabapentin	ng/L	<0.5	<0.5	<0.5	<0.5
Gemfibrozil	ng/L	<0.5	<0.5	<0.5	<0.5
Ibuprofen	ng/L	<100	<100	<100	<100
Lamotrigine	ng/L	<0.5	<0.5	<0.5	<0.5
Metoprolol	ng/L	<0.5	<0.5	<0.5	<0.5
Naproxen	ng/L	<20	<20	<20	<20
Norcotinine	ng/L	<1	<1	<1	8
Paracetamol	ng/L	40	3	20	<2
Sucralose	ng/L	<0.5	<0.5	<0.5	<0.5
Sulfamethoxazole	ng/L	0.9	<0.5	<0.5	<0.5
Triclocarban	ng/L	<20	<20	<20	<20
Triclosan	ng/L	<0.5	<0.5	<0.5	<0.5
Trimethoprim	ng/L	<0.5	0.7	<0.5	<0.5
Varenicline	ng/L	<0.5	<0.5	<0.5	<0.5
Venlafaxine	ng/L	<0.5	<0.5	<0.5	<0.5
Microbiology					
Enterococci by Membrane Filtration					
Enterococci	cfu/100 mL	<1.6	210	<1.6	20
Escherichia coli by Membrane Filtration					
Escherichia coli	cfu/100 mL	<1.6	<1.6	<1.6	33
Faecal coliforms by Membrane Filtration					
Faecal coliforms	cfu/100 mL	<1.6	<1.6	<1.6	34

Sample Details		WATERS	WATERS
Lab Sample ID:		**200527-108-6**	**200527-108-7**
Client Sample ID:		20202381	20202382
Sample Date/Time		26/05/2020 12:08	26/05/2020 11:32
Description:		599 Bushmere Road GPE069	Waipaoa River at Infiltration Chamber
Chemistry Detailed			
Anions			
Bromide	mg/L	0.567	-
Chloride	mg/L	249	-
Nitrate (as N)	mg/L	0.0025	-
Nitrite (as N)	mg/L	0.002	-
Sulphate	mg/L	0.47	-
Ion Balance (Anions/Cations) by Calculation			

Sample Details (continued)		WATERS	WATERS
Lab Sample ID:		**200527-108-6**	**200527-108-7**
Client Sample ID:		20202381	20202382
Sample Date/Time:		26/05/2020 12:08	26/05/2020 11:32
Description:		599 Bushmere Road GPE069	Waipaoa River at Infiltration Chamber
Chemistry Detailed			
Ion Balance (Anions/Cations) by Calculation			
Anion Total	meq/L	17 *	-
Cation Total	meq/L	16 *	-
meq/L Difference	meq/L	0.83 *	-
Percent Difference	%	2.5 *	-
Sum of Anions + Cations	meq/L	33 *	-
Sample Parameters and Field Testing			
Laboratory Arrival Temperature	°C	10.4	10.4
Laboratory Arrival Time		08:45:00 AM	08:45:00 AM
General Testing			
Bicarbonate Alkalinity (as HCO3)	mg/L	600	-
Carbonate Alkalinity (as CO3)	mg/L	<4.0	-
Dissolved Ammoniacal Nitrogen (as N)	mg/L	3.0	-
Hydroxide Alkalinity (as CaCO3)	mg/L	<4.0	-
Total Alkalinity (as CaCO3)	mg/L	490	-
Total Nitrogen (as N)	mg/L	3.5	-
Total Suspended Solids	mg/L	-	350
Turbidity (Infrared Light Source)	FNU	69.7 *	72.1 *
Turbidity	NTU	60	70
Metals			
Dissolved Metals by ICP-MS—Trace (Received Filtered)			
Arsenic (Dissolved)	mg/L	0.0048	-
Cadmium (Dissolved)	mg/L	<0.0005	-
Calcium (Dissolved)	mg/L	200	-
Iron (Dissolved)	mg/L	0.58	-
Magnesium (Dissolved)	mg/L	24	-
Manganese (Dissolved)	mg/L	1.2	-
Potassium (Dissolved)	mg/L	9.1	-
Sodium (Dissolved)	mg/L	87	-
Total Metals by ICP-MS—Trace (Default Digest)			
Arsenic (Total)	mg/L	0.013	-
Calcium (Total)	mg/L	200	-
Iron (Total)	mg/L	5.6	-
Magnesium (Total)	mg/L	23	-
Manganese (Total)	mg/L	1.2	-
Potassium (Total)	mg/L	8.6	-
Sodium (Total)	mg/L	83	-
Organics			
Adhoc investigation			
Comments		Analysed by GCMS *	-
Galaxolide	mg/L	<0.0001 *	-
Tonalid	mg/L	<0.0001 *	-
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry			
17 alpha-ethynylestradiol	µg/L	<0.02	-
beta-Estradiol	µg/L	<0.02	-
Estriol	µg/L	<0.004	-
Estrone	µg/L	<0.004	-
Ethinylestradiol	µg/L	<0.04	-
Total Estrogen	µg/L	<0.04	-
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry			
AMPA	µg/L	<0.04	-
Glyphosate	µg/L	<0.04	-
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry			

Sample Details (continued)		WATERS	WATERS
Lab Sample ID:		**200527-108-6**	**200527-108-7**
Client Sample ID:		20202381	20202382
Sample Date/Time:		26/05/2020 12:08	26/05/2020 11:32
Description:		599 Bushmere Road GPE069	Waipaoa River at Infiltration Chamber
Organics			
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry			
Acetochlor	µg/L	<0.1	-
Alachlor	µg/L	<0.1	-
Atrazine desethyl	µg/L	<0.1	-
Atrazine desisopropyl	µg/L	<0.1	-
Atrazine	µg/L	<0.1	-
Azaconazole	µg/L	<0.1	-
Azinphos methyl	µg/L	<0.1	-
Benalaxyl	µg/L	<0.1	-
Bitertanol	µg/L	<0.1	-
Bromacil	µg/L	<0.1	-
Butachlor	µg/L	<0.1	-
Carbaryl	µg/L	<0.1	-
Carbofuran	µg/L	<0.1	-
Chlorfluazuron	µg/L	<0.4	-
Chlorpyrifos methyl	µg/L	<0.4	-
Chlorpyrifos	µg/L	<0.1	-
Chlortoluron	µg/L	<0.1	-
Cyanazine	µg/L	<0.1	-
Diazinon	µg/L	<0.1	-
Dichlofluanid	µg/L	<40	-
Dichlorvos	µg/L	<0.1	-
Difenoconazole	µg/L	<0.1	-
Dimethoate	µg/L	<0.1	-
Diphenylamine	µg/L	<2.0	-
Diuron	µg/L	<0.1	-
Fenpropimorph	µg/L	<0.1	-
Fluazifop butyl	µg/L	<0.1	-
Fluometuron	µg/L	<0.1	-
Flusilazole	µg/L	<0.1	-
Fluvalinate tau	µg/L	<2.0	-
Furalaxyl	µg/L	<0.1	-
Haloxyfop methyl	µg/L	<0.1	-
Hexaconazole	µg/L	<0.1	-
Hexazinone	µg/L	<0.1	-
Imazapyr	µg/L	<0.1	-
IPBC	µg/L	<0.1	-
Kresoxim methyl	µg/L	<0.1	-
Linuron	µg/L	<0.1	-
Malathion	µg/L	<0.1	-
Metalaxyl	µg/L	<0.1	-
Metolachlor	µg/L	<0.1	-
Metribuzin	µg/L	<0.1	-
Metsulfuron	µg/L	<0.05	-
Molinate	µg/L	<0.1	-
Myclobutanil	µg/L	<0.1	-
Naled	µg/L	<1.0	-
Norflurazon	µg/L	<0.1	-
Oryzalin	µg/L	<4.0	-
Oxadiazon	µg/L	<0.1	-
Paclobutrazol	µg/L	<0.1	-
Parathion Ethyl	µg/L	<1.0	-
Pendimethalin	µg/L	<0.1	-
Pirimicarb	µg/L	<0.1	-
Pirimiphos methyl	µg/L	<0.1	-
Prochloraz	µg/L	<0.1	-

Sample Details (continued)		WATERS	WATERS
Lab Sample ID:		**200527-108-6**	**200527-108-7**
Client Sample ID:		20202381	20202382
Sample Date/Time:		26/05/2020 12:08	26/05/2020 11:32
Description:		599 Bushmere Road GPE069	Waipaoa River at Infiltration Chamber
Organics			
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry			
Prometryne	µg/L	<0.1	-
Propachlor	µg/L	<0.1	-
Propanil	µg/L	<0.1	-
Propazine	µg/L	<0.1	-
Propiconazole	µg/L	<0.1	-
Pyriproxifen	µg/L	<0.1	-
Quizalofop ethyl	µg/L	<0.1	-
Simazine	µg/L	<0.1	-
Simetryn	µg/L	<0.1	-
Sulfentrazone	µg/L	<2.0	-
TCMTB	µg/L	<0.1	-
Tebuconazol	µg/L	<0.1	-
Terbacil	µg/L	<0.1	-
Terbufos	µg/L	<1.0	-
Terbumeton	µg/L	<0.1	-
Terbuthylazine desethyl	µg/L	<0.1	-
Terbuthylazine	µg/L	<0.1	-
Terbutryn	µg/L	<0.1	-
Thiabendazole	µg/L	<0.1	-
Thiobencarb	µg/L	<0.1	-
Tolylfluanide	µg/L	<40	-
Triazophos	µg/L	<0.1	-
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry			
Acesulfame	ng/L	<20	-
Atenolol	ng/L	<0.5	-
Benzophenone	ng/L	<20	-
Bupropion	ng/L	<0.5	-
Caffeine	ng/L	20	-
Carbamazepine	ng/L	<0.5	-
Ciprofloxacin	ng/L	<20	-
Cotinine	ng/L	20	-
DEET	ng/L	<20	-
Diclofenac	ng/L	<2	-
Diltiazem	ng/L	<0.5	-
Diphenhydramine	ng/L	<20	-
Doxycycline	ng/L	<20	-
Fluoxetine	ng/L	<0.5	-
Gabapentin	ng/L	<0.5	-
Gemfibrozil	ng/L	<0.5	-
Ibuprofen	ng/L	<100	-
Lamotrigine	ng/L	<0.5	-
Metoprolol	ng/L	<0.5	-
Naproxen	ng/L	<20	-
Norcotinine	ng/L	<1	-
Paracetamol	ng/L	10	-
Sucralose	ng/L	<0.5	-
Sulfamethoxazole	ng/L	<0.5	-
Triclocarban	ng/L	<20	-
Triclosan	ng/L	<0.5	-
Trimethoprim	ng/L	<0.5	-
Varenicline	ng/L	<0.5	-
Venlafaxine	ng/L	<0.5	-
Microbiology			
Enterococci by Membrane Filtration			
Enterococci	cfu/100 mL	<1.6	-

Sample Details (continued)	WATERS	WATERS
Lab Sample ID:	**200527-108-6**	**200527-108-7**
Client Sample ID:	20202381	20202382
Sample Date/Time:	26/05/2020 12:08	26/05/2020 11:32
Description:	599 Bushmere Road GPE069	Waipaoa River at Infiltration Chamber

Microbiology

Escherichia coli by Membrane Filtration			
Escherichia coli	cfu/100 mL	<1.6	-
Faecal coliforms by Membrane Filtration			
Faecal coliforms	cfu/100 mL	<1.6	-

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Detailed				
Anions				
Bromide	APHA (online edition) 4110 B	0.005 mg/L	1, 2, 3, 5, 6	Auckland
Chloride	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 5, 6	Auckland
Nitrate (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 5, 6	Auckland
Nitrite (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 5, 6	Auckland
Sulphate	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 5, 6	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 5, 6	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 5, 6	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	1, 2, 3, 5, 6	Auckland
Percent Difference	APHA (online edition) 1030 E		1, 2, 3, 5, 6	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		1, 2, 3, 5, 6	Auckland
Sample Parameters and Field Testing				
Laboratory Arrival Temperature	APHA (online edition) 2550 B		All	Auckland
Laboratory Arrival Time	APHA (online edition) 2550 B		All	Auckland
General Testing				
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 5, 6	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 5, 6	Auckland
Dissolved Ammoniacal Nitrogen (as N) by Colorimetry/ Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	1, 2, 3, 5, 6	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 5, 6	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 5, 6	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	1, 2, 3, 5, 6	Auckland
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D / 2540 E	0.2 mg/L	7	Auckland
Turbidity (Infrared Light Source) by Nephelometry	ISO 7027-1:2016	0.05 FNU	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtered)				
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 5, 6	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	1, 2, 3, 5, 6	Auckland
Calcium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 5, 6	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 5, 6	Auckland
Magnesium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 5, 6	Auckland
Manganese (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 5, 6	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.02 mg/L	1, 2, 3, 5, 6	Auckland
Sodium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 5, 6	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 5, 6	Auckland
Calcium (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 5, 6	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 5, 6	Auckland
Magnesium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 5, 6	Auckland

Metals				
Total Metals by ICP-MS—Trace (Default Digest)				
Manganese (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 5, 6	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	1, 2, 3, 5, 6	Auckland
Sodium (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 5, 6	Auckland
Organics				
Adhoc investigation				
Comments	As specified above		1, 2, 3, 5, 6	Auckland
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry				
17 alpha-ethynylestradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 5, 6	Auckland
beta-Estradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 5, 6	Auckland
Estriol	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 5, 6	Auckland
Estrone	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 5, 6	Auckland
Ethinylestradiol	SPE cleanup, LC MS/MS	0.04 µg/L	1, 2, 3, 5, 6	Auckland
Total Estrogen	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 5, 6	Auckland
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry				
AMPA	In-house by LC-MS	0.04 µg/L	1, 2, 3, 5, 6	Auckland
Glyphosate	In-house by LC-MS	0.04 µg/L	1, 2, 3, 5, 6	Auckland
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Acetochlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Alachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Atrazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Atrazine desisopropyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Atrazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Azaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Azinphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Benalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Bitertanol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Bromacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Butachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Carbaryl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Carbofuran	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Chlorfluazuron	In-house by LC-MS	0.4 µg/L	1, 2, 3, 5, 6	Auckland
Chlorpyrifos methyl	In-house by LC-MS	0.4 µg/L	1, 2, 3, 5, 6	Auckland
Chlorpyrifos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Chlortoluron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Cyanazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Diazinon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Dichlofluanid	In-house by LC-MS	40 µg/L	1, 2, 3, 5, 6	Auckland
Dichlorvos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Difenoconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Dimethoate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Diphenylamine	In-house by LC-MS	2 µg/L	1, 2, 3, 5, 6	Auckland
Diuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Fenpropimorph	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Fluazifop butyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Fluometuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Flusilazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Fluvalinate tau	In-house by LC-MS	2 µg/L	1, 2, 3, 5, 6	Auckland
Furalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Haloxyfop methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Hexaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Hexazinone	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Imazapyr	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
IPBC	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Kresoxim methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Linuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Malathion	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Metalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Metolachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland

Organics

Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Metribuzin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Metsulfuron	In-house by LC-MS	0.05 µg/L	1, 2, 3, 5, 6	Auckland
Molinate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Myclobutanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Naled	In-house by LC-MS	1 µg/L	1, 2, 3, 5, 6	Auckland
Norflurazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Oryzalin	In-house by LC-MS	4 µg/L	1, 2, 3, 5, 6	Auckland
Oxadiazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Paclobutrazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Parathion Ethyl	In-house by LC-MS	1 µg/L	1, 2, 3, 5, 6	Auckland
Pendimethalin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Pirimicarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Pirimiphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Prochloraz	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Prometryne	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Propachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Propanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Propazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Propiconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Pyriproxifen	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Quizalofop ethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Simazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Simetryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Sulfentrazone	In-house by LC-MS	2 µg/L	1, 2, 3, 5, 6	Auckland
TCMTB	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Tebuconazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Terbacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Terbufos	In-house by LC-MS	1 µg/L	1, 2, 3, 5, 6	Auckland
Terbumeton	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Terbuthylazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Terbuthylazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Terbutryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Thiabendazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Thiobencarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Tolylfluanide	In-house by LC-MS	40 µg/L	1, 2, 3, 5, 6	Auckland
Triazophos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 5, 6	Auckland
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry				
Acesulfame	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Atenolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Benzophenone	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Bupropion	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Caffeine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Carbamazepine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Ciprofloxacin	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Cotinine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
DEET	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Diclofenac	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 5, 6	Auckland
Diltiazem	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Diphenhydramine	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Doxycycline	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Fluoxetine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Gabapentin	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Gemfibrozil	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Ibuprofen	Instrumental Techniques by LC/MS 2.70	100 ng/L	1, 2, 3, 5, 6	Auckland
Lamotrigine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Metoprolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Naproxen	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Norcotinine	Instrumental Techniques by LC/MS 2.70	1 ng/L	1, 2, 3, 5, 6	Auckland
Paracetamol	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 5, 6	Auckland

Organics				
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry				
Sucralose	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Sulfamethoxazole	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Triclocarban	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 5, 6	Auckland
Triclosan	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Trimethoprim	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Varenicline	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Venlafaxine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 5, 6	Auckland
Microbiology				
Enterococci by Membrane Filtration				
Enterococci	APHA (online edition) 9230 C	2 cfu/100 mL	1, 2, 3, 5, 6	Auckland
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	1, 2, 3, 5, 6	Auckland
Faecal coliforms by Membrane Filtration				
Faecal coliforms	APHA (online edition) 9222 D	2 cfu/100 mL	1, 2, 3, 5, 6	Auckland
Preparations				
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		1, 2, 3, 5, 6	Auckland
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		1, 2, 3, 5, 6	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Peter Boniface
KTP Signatory

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Certificate of Analysis
Laboratory Reference:200625-154

Attention:	Hilltop Sampler	*Final Report:*	**371073-0**
Client:	**GISBORNE DISTRICT COUNCIL**	*Report Issue Date:*	**10-Jul-2020**
Address:	**PO Box 747, Gisborne, 4040**	*Received Date:*	**25-Jun-2020**
Client Reference:	**Managed Aquifer Recharge**	*Sampled By:*	**Jaquetta Udy**
Purchase Order:	**3700110012201**	*Quote Reference :*	**5880**

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200625-154-1**	**200625-154-2**	**200625-154-3**	**200625-154-6**
Client Sample ID:		20202699	20202700	20202701	20202702
Sample Date/Time		24/06/2020 09:14	24/06/2020 09:55	24/06/2020 10:30	24/06/2020 11:06
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Chemistry Detailed					
Anions					
Bromide	mg/L	0.132	0.0667	0.029	0.52
Chloride	mg/L	29.8	16.2	9.51	126
Nitrate (as N)	mg/L	0.002	0.0021	<0.002	0.0027
Nitrite (as N)	mg/L	0.0035	0.0027	<0.002	0.0044
Sulphate	mg/L	55.3	62.0	94.5	0.61
Ion Balance (Anions/Cations) by Calculation					
Anion Total	meq/L	8.4 *	7.3 *	5.3 *	15 *
Cation Total	meq/L	8.7 *	7.4 *	5.3 *	14 *
meq/L Difference	meq/L	0.34 *	0.90e-1 *	0.20e-1 *	0.75 *
Percent Difference	%	2.0 *	0.61 *	0.19 *	2.6 *
Sum of Anions + Cations	meq/L	17 *	15 *	11 *	29 *
Sample Parameters and Field Testing					
Laboratory Arrival Temperature	°C	12.3	12.3	12.3	12.3
Laboratory Arrival Time		01:42:00 PM	01:42:00 PM	01:42:00 PM	01:42:00 PM
General Testing					
Bicarbonate Alkalinity (as HCO3)	mg/L	390	340	190	700
Carbonate Alkalinity (as CO3)	mg/L	<4.0	<4.0	<2.0	<4.0
Dissolved Ammoniacal Nitrogen (as N)	mg/L	0.98	1.4	0.017	2.8
Hydroxide Alkalinity (as CaCO3)	mg/L	<4.0	<4.0	<2.0	<4.0
Total Alkalinity (as CaCO3)	mg/L	320	280	150	580
Total Nitrogen (as N)	mg/L	1.1	1.6	0.088	3.0
Turbidity (Infrared Light Source)	FNU	28.9 *	14.6 *	0.77 *	67.7 *
Turbidity	NTU	26	12	0.60	60
Metals					
Dissolved Metals by ICP-MS—Trace (Received Filtered)					
Arsenic (Dissolved)	mg/L	0.0037	0.0042	0.00059	0.013
Cadmium (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (Dissolved)	mg/L	100	82	71	170
Iron (Dissolved)	mg/L	2.7	0.98	0.012	5.8
Magnesium (Dissolved)	mg/L	10	8.5	6.7	19
Manganese (Dissolved)	mg/L	0.37	0.43	0.022	1.2
Potassium (Dissolved)	mg/L	6.1	5.6	2.5	8.1
Sodium (Dissolved)	mg/L	59	54	26	81
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	0.0038	0.0043	0.00057	0.013
Calcium (Total)	mg/L	94	78	67	180

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200625-154-1**	**200625-154-2**	**200625-154-3**	**200625-154-6**
Client Sample ID:		20202699	20202700	20202701	20202702
Sample Date/Time:		24/06/2020 09:14	24/06/2020 09:55	24/06/2020 10:30	24/06/2020 11:06
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Metals					
Total Metals by ICP-MS—Trace (Default Digest)					
Iron (Total)	mg/L	2.7	1.1	0.023	5.8
Magnesium (Total)	mg/L	11	9.0	7.3	21
Manganese (Total)	mg/L	0.4	0.45	0.026	1.2
Potassium (Total)	mg/L	6.4	5.9	2.7	9.2
Sodium (Total)	mg/L	56	52	27	76
Organics					
Adhoc investigation					
Comments		Analysed by GC/MS *	Analysed by GC/MS *	Analysed by GC/MS *	Analysed by GC/MS *
Galaxolide	mg/L	<0.0001 *	<0.0001 *	<0.0001 *	<0.0001 *
Tonalid	mg/L	<0.0001 *	<0.0001 *	<0.0001 *	<0.0001 *
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry					
17 alpha-ethynylestradiol	µg/L	<0.02	<0.02	<0.02	<0.02
beta-Estradiol	µg/L	<0.02	<0.02	<0.02	<0.02
Estriol	µg/L	<0.004	<0.004	<0.004	<0.004
Estrone	µg/L	<0.004	<0.004	<0.004	<0.004
Ethinylestradiol	µg/L	<0.04	<0.04	<0.04	<0.04
Total Estrogen	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry					
AMPA	µg/L	<0.04	<0.04	<0.04	<0.04
Glyphosate	µg/L	<0.04	<0.04	<0.04	<0.04
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Acetochlor	µg/L	<0.1	<0.1	<0.1	<0.1
Alachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine desisopropyl	µg/L	<0.1	<0.1	<0.1	<0.1
Atrazine	µg/L	<0.1	<0.1	<0.1	<0.1
Azaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Azinphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Benalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Bitertanol	µg/L	<0.1	<0.1	<0.1	<0.1
Bromacil	µg/L	<0.1	<0.1	<0.1	<0.1
Butachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Carbaryl	µg/L	<0.1	<0.1	<0.1	<0.1
Carbofuran	µg/L	<0.1	<0.1	<0.1	<0.1
Chlorfluazuron	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos methyl	µg/L	<0.4	<0.4	<0.4	<0.4
Chlorpyrifos	µg/L	<0.1	<0.1	<0.1	<0.1
Chlortoluron	µg/L	<0.1	<0.1	<0.1	<0.1
Cyanazine	µg/L	<0.1	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.1	<0.1	<0.1	<0.1
Dichlofluanid	µg/L	<40	<40	<40	<40
Dichlorvos	µg/L	<0.1	<0.1	<0.1	<0.1
Difenoconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Dimethoate	µg/L	<0.1	<0.1	<0.1	<0.1
Diphenylamine	µg/L	<2.0	<2.0	<2.0	<2.0
Diuron	µg/L	<0.1	<0.1	<0.1	<0.1
Fenpropimorph	µg/L	<0.1	<0.1	<0.1	<0.1
Fluazifop butyl	µg/L	<0.1	<0.1	<0.1	<0.1
Fluometuron	µg/L	<0.1	<0.1	<0.1	<0.1
Flusilazole	µg/L	<0.1	<0.1	<0.1	<0.1
Fluvalinate tau	µg/L	<2.0	<2.0	<2.0	<2.0
Furalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Haloxyfop methyl	µg/L	<0.1	<0.1	<0.1	<0.1

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200625-154-1**	**200625-154-2**	**200625-154-3**	**200625-154-6**
Client Sample ID:		20202699	20202700	20202701	20202702
Sample Date/Time:		24/06/2020 09:14	24/06/2020 09:55	24/06/2020 10:30	24/06/2020 11:06
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Organics					
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry					
Hexaconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Hexazinone	µg/L	<0.1	<0.1	<0.1	<0.1
Imazapyr	µg/L	<0.1	<0.1	<0.1	<0.1
IPBC	µg/L	<0.1	<0.1	<0.1	<0.1
Kresoxim methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Linuron	µg/L	<0.1	<0.1	<0.1	<0.1
Malathion	µg/L	<0.1	<0.1	<0.1	<0.1
Metalaxyl	µg/L	<0.1	<0.1	<0.1	<0.1
Metolachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Metribuzin	µg/L	<0.1	<0.1	<0.1	<0.1
Metsulfuron	µg/L	<0.05	<0.05	<0.05	<0.05
Molinate	µg/L	<0.1	<0.1	<0.1	<0.1
Myclobutanil	µg/L	<0.1	<0.1	<0.1	<0.1
Naled	µg/L	<1.0	<1.0	<1.0	<1.0
Norflurazon	µg/L	<0.1	<0.1	<0.1	<0.1
Oryzalin	µg/L	<4.0	<4.0	<4.0	<4.0
Oxadiazon	µg/L	<0.1	<0.1	<0.1	<0.1
Paclobutrazol	µg/L	<0.1	<0.1	<0.1	<0.1
Parathion Ethyl	µg/L	<1.0	<1.0	<1.0	<1.0
Pendimethalin	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimicarb	µg/L	<0.1	<0.1	<0.1	<0.1
Pirimiphos methyl	µg/L	<0.1	<0.1	<0.1	<0.1
Prochloraz	µg/L	<0.1	<0.1	<0.1	<0.1
Prometryne	µg/L	<0.1	<0.1	<0.1	<0.1
Propachlor	µg/L	<0.1	<0.1	<0.1	<0.1
Propanil	µg/L	<0.1	<0.1	<0.1	<0.1
Propazine	µg/L	<0.1	<0.1	<0.1	<0.1
Propiconazole	µg/L	<0.1	<0.1	<0.1	<0.1
Pyriproxifen	µg/L	<0.1	<0.1	<0.1	<0.1
Quizalofop ethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Simazine	µg/L	<0.1	<0.1	<0.1	<0.1
Simetryn	µg/L	<0.1	<0.1	<0.1	<0.1
Sulfentrazone	µg/L	<2.0	<2.0	<2.0	<2.0
TCMTB	µg/L	<0.1	<0.1	<0.1	<0.1
Tebuconazol	µg/L	<0.1	<0.1	<0.1	<0.1
Terbacil	µg/L	<0.1	<0.1	<0.1	<0.1
Terbufos	µg/L	<1.0	<1.0	<1.0	<1.0
Terbumeton	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine desethyl	µg/L	<0.1	<0.1	<0.1	<0.1
Terbuthylazine	µg/L	<0.1	<0.1	<0.1	<0.1
Terbutryn	µg/L	<0.1	<0.1	<0.1	<0.1
Thiabendazole	µg/L	<0.1	<0.1	<0.1	<0.1
Thiobencarb	µg/L	<0.1	<0.1	<0.1	<0.1
Tolylfluanide	µg/L	<40	<40	<40	<40
Triazophos	µg/L	<0.1	<0.1	<0.1	<0.1
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry					
Acesulfame	ng/L	<20	<20	<20	<20
Atenolol	ng/L	<0.5	<0.5	<0.5	<0.5
Benzophenone	ng/L	<20	<20	<20	<20
Bupropion	ng/L	<0.5	<0.5	<0.5	<0.5
Caffeine	ng/L	9	3	5	2
Carbamazepine	ng/L	<0.5	<0.5	1	<0.5
Ciprofloxacin	ng/L	<20	<20	<20	<20
Cotinine	ng/L	9	5	3	2
DEET	ng/L	<20	<20	<20	<20

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		**200625-154-1**	**200625-154-2**	**200625-154-3**	**200625-154-6**
Client Sample ID:		20202699	20202700	20202701	20202702
Sample Date/Time:		24/06/2020 09:14	24/06/2020 09:55	24/06/2020 10:30	24/06/2020 11:06
Description:		598 Bushmere Road-MAR injection Bore 350 GPE068	598 Bushmere Road-MAR injection bore 75 m GPE067	598 Bushmere Road MAR Pilot bore GPE 065	599 Bushmere Road GPE069
Organics					
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry					
Diclofenac	ng/L	<2	<2	<2	<2
Diltiazem	ng/L	<0.5	<0.5	<0.5	<0.5
Diphenhydramine	ng/L	<20	<20	<20	<20
Doxycycline	ng/L	<20	<20	<20	<20
Fluoxetine	ng/L	<0.5	<0.5	<0.5	<0.5
Gabapentin	ng/L	<0.5	<0.5	<0.5	<0.5
Gemfibrozil	ng/L	<0.5	<0.5	<0.5	<0.5
Ibuprofen	ng/L	<100	<100	<100	<100
Lamotrigine	ng/L	0.9	3	40	<0.5
Metoprolol	ng/L	<0.5	<0.5	0.9	<0.5
Naproxen	ng/L	<20	<20	<20	<20
Norcotinine	ng/L	6	2	5	<1
Paracetamol	ng/L	<2	6	10	<2
Sucralose	ng/L	<0.5	<0.5	<0.5	<0.5
Sulfamethoxazole	ng/L	<0.5	<0.5	2	<0.5
Triclocarban	ng/L	<20	<20	<20	<20
Triclosan	ng/L	<0.5	<0.5	<0.5	<0.5
Trimethoprim	ng/L	<0.5	<0.5	<0.5	<0.5
Varenicline	ng/L	<0.5	<0.5	<0.5	<0.5
Venlafaxine	ng/L	<0.5	<0.5	<0.5	<0.5
Microbiology					
Enterococci by Membrane Filtration					
Enterococci	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Escherichia coli by Membrane Filtration					
Escherichia coli	cfu/100 mL	<1.6	<1.6	<1.6	<1.6
Faecal coliforms by Membrane Filtration					
Faecal coliforms	cfu/100 mL	<1.6	<1.6	<1.6	<1.6

Sample Details		WATERS
Lab Sample ID:		**200625-154-7**
Client Sample ID:		20202703
Sample Date/Time		24/06/2020 11:30
Description:		Waipaoa River at Infiltration Chamber
Sample Parameters and Field Testing		
Laboratory Arrival Temperature	°C	12.3
Laboratory Arrival Time		01:42:00 PM
General Testing		
Total Suspended Solids	mg/L	838
Turbidity (Infrared Light Source)	FNU	880 *
Turbidity	NTU	650

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Analyst's Notes

The Nitrite (as N) analysis for sample 598 Bushmere Road-MAR injection Bore 350 GPE068 commenced beyond the holding time of 2 Days

The Nitrate (as N) analysis for sample 598 Bushmere Road-MAR injection Bore 350 GPE068 commenced beyond the holding time of 2 Days

The Nitrite (as N) analysis for sample 598 Bushmere Road-MAR injection bore 75m GPE067

The Nitrate (as N) analysis for sample 598 Bushmere Road-MAR injection bore 75m GPE067

The Nitrite (as N) analysis for sample 598 Bushmere Road MAR Pilot bore GPE065 commenced beyond the holding time of 2 Days

The Nitrate (as N) analysis for sample 598 Bushmere Road MAR Pilot bore GPE065 commenced beyond the holding time of 2 Days

The Nitrite (as N) analysis for sample 599 Bushmere Road GPE069 commenced beyond the holding time of 2 Days

The Nitrate (as N) analysis for sample 599 Bushmere Road GPE069 commenced beyond the holding time of 2 Days

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Detailed				
Anions				
Bromide	APHA (online edition) 4110 B	0.005 mg/L	1, 2, 3, 6	Auckland
Chloride	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 6	Auckland
Nitrate (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 6	Auckland
Nitrite (as N)	APHA (online edition) 4110 B	0.002 mg/L	1, 2, 3, 6	Auckland
Sulphate	APHA (online edition) 4110 B	0.02 mg/L	1, 2, 3, 6	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	1, 2, 3, 6	Auckland
Percent Difference	APHA (online edition) 1030 E		1, 2, 3, 6	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		1, 2, 3, 6	Auckland
Sample Parameters and Field Testing				
Laboratory Arrival Temperature	APHA (online edition) 2550 B		All	Auckland
Laboratory Arrival Time	APHA (online edition) 2550 B		All	Auckland
General Testing				
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 6	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 6	Auckland
Dissolved Ammoniacal Nitrogen (as N) by Colorimetry/ Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	1, 2, 3, 6	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 6	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	1, 2, 3, 6	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	1, 2, 3, 6	Auckland
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D / 2540 E	0.2 mg/L	7	Auckland
Turbidity (Infrared Light Source) by Nephelometry	ISO 7027-1:2016	0.05 FNU	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtered)				
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	1, 2, 3, 6	Auckland
Calcium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 6	Auckland
Magnesium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Manganese (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 6	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.02 mg/L	1, 2, 3, 6	Auckland
Sodium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 6	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	1, 2, 3, 6	Auckland
Calcium (Total)	APHA (online edition) 3125 B by ICPMS	0.010 mg/L	1, 2, 3, 6	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	1, 2, 3, 6	Auckland
Magnesium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	1, 2, 3, 6	Auckland
Manganese (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	1, 2, 3, 6	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	1, 2, 3, 6	Auckland
Sodium (Total)	APHA (online edition) 3125 B by ICPMS	0.1 mg/L	1, 2, 3, 6	Auckland

Organics				
Adhoc investigation				
Comments	As specified above		1, 2, 3, 6	Auckland
Estrogen (As Received) by Liquid Chromatography-Mass Spectrometry				
17 alpha-ethynylestradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 6	Auckland
beta-Estradiol	SPE cleanup, LC MS/MS	0.02 µg/L	1, 2, 3, 6	Auckland
Estriol	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Estrone	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Ethinylestradiol	SPE cleanup, LC MS/MS	0.04 µg/L	1, 2, 3, 6	Auckland
Total Estrogen	SPE cleanup, LC MS/MS	0.004 µg/L	1, 2, 3, 6	Auckland
Glyphosate & AMPA by Liquid Chromatography-Mass Spectrometry				
AMPA	In-house by LC-MS	0.04 µg/L	1, 2, 3, 6	Auckland
Glyphosate	In-house by LC-MS	0.04 µg/L	1, 2, 3, 6	Auckland
Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Acetochlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Alachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Atrazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Atrazine desisopropyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Atrazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Azaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Azinphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Benalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Bitertanol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Bromacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Butachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Carbaryl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Carbofuran	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Chlorfluazuron	In-house by LC-MS	0.4 µg/L	1, 2, 3, 6	Auckland
Chlorpyrifos methyl	In-house by LC-MS	0.4 µg/L	1, 2, 3, 6	Auckland
Chlorpyrifos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Chlortoluron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Cyanazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Diazinon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Dichlofluanid	In-house by LC-MS	40 µg/L	1, 2, 3, 6	Auckland
Dichlorvos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Difenoconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Dimethoate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Diphenylamine	In-house by LC-MS	2 µg/L	1, 2, 3, 6	Auckland
Diuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Fenpropimorph	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Fluazifop butyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Fluometuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Flusilazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Fluvalinate tau	In-house by LC-MS	2 µg/L	1, 2, 3, 6	Auckland
Furalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Haloxyfop methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Hexaconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Hexazinone	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Imazapyr	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
IPBC	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Kresoxim methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Linuron	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Malathion	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Metalaxyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Metolachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Metribuzin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Metsulfuron	In-house by LC-MS	0.05 µg/L	1, 2, 3, 6	Auckland
Molinate	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Myclobutanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Naled	In-house by LC-MS	1 µg/L	1, 2, 3, 6	Auckland
Norflurazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland

Organics

Organonitrogen & Organophosphorus Pesticides by Liquid Chromatography-Mass Spectrometry				
Oryzalin	In-house by LC-MS	4 µg/L	1, 2, 3, 6	Auckland
Oxadiazon	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Paclobutrazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Parathion Ethyl	In-house by LC-MS	1 µg/L	1, 2, 3, 6	Auckland
Pendimethalin	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Pirimicarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Pirimiphos methyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Prochloraz	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Prometryne	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Propachlor	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Propanil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Propazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Propiconazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Pyriproxifen	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Quizalofop ethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Simazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Simetryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Sulfentrazone	In-house by LC-MS	2 µg/L	1, 2, 3, 6	Auckland
TCMTB	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Tebuconazol	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Terbacil	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Terbufos	In-house by LC-MS	1 µg/L	1, 2, 3, 6	Auckland
Terbumeton	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Terbuthylazine desethyl	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Terbuthylazine	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Terbutryn	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Thiabendazole	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Thiobencarb	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Tolylfluanide	In-house by LC-MS	40 µg/L	1, 2, 3, 6	Auckland
Triazophos	In-house by LC-MS	0.1 µg/L	1, 2, 3, 6	Auckland
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry				
Acesulfame	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Atenolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Benzophenone	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Bupropion	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Caffeine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Carbamazepine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Ciprofloxacin	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Cotinine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
DEET	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Diclofenac	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 6	Auckland
Diltiazem	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Diphenhydramine	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Doxycycline	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Fluoxetine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Gabapentin	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Gemfibrozil	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Ibuprofen	Instrumental Techniques by LC/MS 2.70	100 ng/L	1, 2, 3, 6	Auckland
Lamotrigine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Metoprolol	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Naproxen	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Norcotinine	Instrumental Techniques by LC/MS 2.70	1 ng/L	1, 2, 3, 6	Auckland
Paracetamol	Instrumental Techniques by LC/MS 2.70	2 ng/L	1, 2, 3, 6	Auckland
Sucralose	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Sulfamethoxazole	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Triclocarban	Instrumental Techniques by LC/MS 2.70	20 ng/L	1, 2, 3, 6	Auckland
Triclosan	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Trimethoprim	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Varenicline	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland

Organics				
Pharmaceutical and Personal Care Products by Liquid Chromatography-Mass Spectrometry				
Venlafaxine	Instrumental Techniques by LC/MS 2.70	0.5 ng/L	1, 2, 3, 6	Auckland
Microbiology				
Enterococci by Membrane Filtration				
Enterococci	APHA (online edition) 9230 C	2 cfu/100 mL	1, 2, 3, 6	Auckland
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	1, 2, 3, 6	Auckland
Faecal coliforms by Membrane Filtration				
Faecal coliforms	APHA (online edition) 9222 D	2 cfu/100 mL	1, 2, 3, 6	Auckland
Preparations				
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		1, 2, 3, 6	Auckland
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		1, 2, 3, 6	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Peter Boniface
KTP Signatory

checked: Panan 2/7/2020

Gisborne District Council groundwater MAR samples

Lab ID	Sample ID	Date/Time sampled		Parameter	Result	Units	Detection limit
CMB200686	598 Bushmere Rd MAR Injection bore 350m GPE068	12-May-20		Somatic bacteriophage according to USEPA method 1602*	0	PFU per 100 mL	<1 PFU per 100 mL
CMB200687	598 Bushmere Rd MAR Injection Bore 75m GPE067	12-May-20		Somatic bacteriophage according to USEPA method 1602	0	PFU per 100 mL	<1 PFU per 100 mL
CMB200688	598 Bushmere Rd GPE065	12-May-20		Somatic bacteriophage according to USEPA method 1602	0	PFU per 100 mL	<1 PFU per 100 mL
CMB200689	599 Bushmere Rd GPE069	12-May-20		Somatic bacteriophage according to USEPA method 1602	0	PFU per 100 mL	<1 PFU per 100 mL
CMB200690	Waipaoa River @ Infiltration Chamber	12-May-20		Somatic bacteriophage according to USEPA method 1602	66	PFU per 100 mL	<1 PFU per 100 mL
CMB200691	598 Bushmere Rd MAR Headworks Outlet	12-May-20		Somatic bacteriophage according to USEPA method 1602	9	PFU per 100 mL	<1 PFU per 100 mL

* USEPA-a (2001) Method 1602: Male-specific (F+) and somatic coliphage in Water by Single Agar Layer (SAL) procedure. Washington, DC: Office of Water, USEPA.

checked: Panan 2/7/2020

Gisborne District Council groundwater MAR samples

Lab ID	Sample ID	Date/Time sampled		Parameter	Result	Units	Detection limit
CMB200800	598 Bushmere Rd MAR Injection bore 350m GPE068	**2-Jun-20**		**Somatic bacteriophage according to USEPA method 1602***	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200799	598 Bushmere Rd MAR Injection Bore 75m GPE067	**2-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200798	598 Bushmere Rd MAR Pilot Bore GPE065	**2-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200801	599 Bushmere Rd GPE069	**2-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**

* USEPA-a (2001) Method 1602: Male-specific (F+) and somatic coliphage in Water by Single Agar Layer (SAL) procedure. Washington, DC: Office of Water, USEPA.

checked: Panan 2/7/2020

Gisborne District Council groundwater MAR samples

Lab ID	Sample ID	Date/Time sampled		Parameter	Result	Units	Detection limit
CMB200838	598 Bushmere Rd MAR Injection bore 350m GPE068	**24-Jun-20**		**Somatic bacteriophage according to USEPA method 1602***	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200839	598 Bushmere Rd MAR Injection Bore 75m GPE067	**24-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200840	598 Bushmere Rd MAR Pilot Bore GPE065	**24-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200841	599 Bushmere Rd GPE069	**24-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**0**	**PFU per 100 mL**	**<1 PFU per 100 mL**
CMB200842	Waipaoa River @ Infiltration Chamber	**24-Jun-20**		**Somatic bacteriophage according to USEPA method 1602**	**95**	**PFU per 100 mL**	**<1 PFU per 100 mL**

* USEPA-a (2001) Method 1602: Male-specific (F+) and somatic coliphage in Water by Single Agar Layer (SAL) procedure. Washington, DC: Office of Water, USEPA.

ATTACHMENT 4

Current Gisborne MAR Injection Trial Resource Consent

Consents granted by GDC to Gisborne District Council

To drill up to three bores (LB-2016-107112-00)
Take Surface Water from the Waipaoa River (WS-2016-107114-00), and
Discharge Water to Land, and Water to Water via injection (DW-2016-107113-00)

Conditions for Resource Consent

GISBORNE DISTRICT COUNCIL

A resource consent:

a) Under section 9(2)(a) of the Resource Management Act 1991 and Rule 5.2.4 of the Proposed Gisborne Regional Freshwater Plan to undertake a restricted discretionary activity being to Install up to three Bores, take water for the purposes of pump testing and the associated discharge of drilling fluids and water to land (LB-2016-107112-00); and

b) Under section 14(2)(a) of the Resource Management Act 1991 and Rule 4.1.7 of the Proposed Gisborne Regional Freshwater Plan to undertake a restricted discretionary activity being to Take and Use Water from the Waipaoa River as a 'B' block allocation WS-2016-107114-00); and

c) Under section 15(1)(a) and (b) of the Resource Management Act 1991 and Rule 5.2.8 of the Proposed Gisborne Regional Freshwater Plan to undertake a discretionary activity being to Discharge Water to Water via Injection (DW-2016-107113-00).

subject to the following conditions:

Purpose

1. For the purpose of drilling up to 3 bores, taking water from the Waipaoa River under a B Block allocation and discharging water to water (via injection) and to land associated with the Poverty Bay Flats managed aquifer recharge pilot trial **Phase 2** of the Makauri Aquifer.

Location

2. The activities authorised under this consent shall be located at 555 Matawai Road, Gisborne as shown on the plan entitled *Golder Associates – Injection Bore Location* dated August 2016

Map Reference

3. At or about map references NZTM 2028441, 5714961 and NZTM 2027989, 5715196.

Legal Description

4. Injection Bore and Pilot Bores: Lot 28 DP 1154 and Lot 24 DP1154

   Water Intake and Infiltration Gallery: Part sec 2 SO 8571 and Crown Owned River (Waipaoa River)

Drilling Works

5. Any works carried out in conjunction with this consent shall be in general accordance with the depth and location information supplied in support of the application.

6. During the construction of the bore, the consent holder shall ensure that recoverable drilling fluids shall be discharged to land in a manner where it shall not enter water.

7. The consent holder shall complete any maintenance works required for the bore(s) and associated equipment within 14 days as specified by notice in writing from the District Council's Consents Manger hereafter referred to as the GC Manager.

8. All bores installed under this resource consent shall meet the requirements of schedule 12 of the Proposed Gisborne Regional Freshwater Plan **(now Appendix H21: Bore Construction Requirements of the Tairāwhiti Resource Management Plan)**.

9. A plot bore shall be installed within 30 metres of the main injection bore. The pilot bore shall be fitted with a piezometer and monitoring equipment to inform the monitoring reports required by consent condition 35.

10. The consent holder shall collect drill cuttings from the pilot bore required by condition 9 and analyses for minerals in accordance with the recommendations contained within the resource consent application document and accompanying reports submitted 17 May 2016.

11. No injection bore authorised by the consent shall be installed within 100 metres of any other existing consented abstraction bore in the Makauri Aquifer.

Notification of Drilling Works

12. The consent holder shall email water.infor@gdc.govt.nz at least 24 hours before commencing any drilling activity that is authorised by this resource consent

Bore Detail

13. Within one month of completion of the bore installations, the consent holder shall forward to the Gisborne District Council, a detailed bore log for each bore installed and as-built construction diagram.

14. The bore log, required under condition 13, shall, as a minimum, describe:

    (a) Location of the bore or well (including property address and NZTM Grid Reference or Global Positioning System (GPS) co-ordinates);

    (b) Bore head pressure or Depth to water level (whichever is applicable);

    (c) The purpose of the bore or well;

    (d) Records of pump test(s), detailing flow rates, drawdown at specific times, and any information analysis;

    (e) Actual bore depth and diameter;

    (f) Full construction details (including final casing and screen details);

    (g) A bore log showing the depths of geological strata intercepted by the bore;

    (h) The temperature of the bore water; and

    (i) The method of drilling.

15. The as built construction diagram, required under condition 13 shall show the final cross-sectional construction of the bore (including bore depth, casing and screen details).

Surface Water Take and Use

16. The daily quantity of water taken from Waipaoa River for the purposes of the pilot trial shall not exceed 1901 cubic metres.

17. The instantaneous rate of take from the Waipaoa River shall not exceed 22 litres per second at any time.

18. Abstraction from the Waipaoa River shall only occur when the flow at Kanakanaia and Matawhero, as measured by Gisborne District Council is greater than 4000 litres per second.

19. Abstraction from the Waipaoa River**:**

    (a) shall only occur during ~~**the period 1 May to 30 September each year**~~ **periods when the flow of the Waipaoa River at Kanakania is greater than 4,000 litres per second; and**

    (b) **shall not occur when the flow of the Waipaoa River at Kanakania has been at or below 4,100 litres per second for a consecutive period of 5 or more days;**

    for the duration of this resource consent.

20. Water shall only be used for the purpose of completing ~~a~~ **the Phase 2** pilot trial of injecting water into the Makauri Aquifer, or in the case of discharging water to land in accordance with the resource consent application document.

21. The total volume of water abstracted from the Waipaoa River under this consent shall not exceed ~~**110,000 cubic metres, being 10,000 cubic metres for a pre-trial injection and 100,000 cubic metres for the injection trial**~~ **378,000 cubic metres per year**.

22. Surface water abstraction shall only occur from the infiltration gallery as detailed in the application for this consent.

23. Should adverse effects in the Waipaoa River or Makauri Aquifer be identified, then the injection or taking of water by this permit shall only occur as specifically authorised by the GDC Manager.

Water Use Monitoring

24. The consent holder shall install a water meter on each pump head/intake prior to the exercise of this consent. The water meter/s shall:

    (a) meet the Resource Management (Measuring and Reporting of Water Takes) Regulations 2010;

    (b) be installed and maintained in accordance with manufacturer's specifications, and to the satisfaction of the Gisborne District Council;

    (c) be installed at a location that will ensure the entire water take is measured;

    (d) be sealed and as tamper-proof as practicable;

    (e) be suited to the qualities of the water it is measuring (such as temperature, algae content and sediment content);

    (f) be able to be fitted with a recording device; and

    (g) be able to measure both cumulative water abstraction and the instantaneous rate of take to an accuracy of ±5%.

25. The water meter shall be verified by a suitably qualified operator within two months of the exercise of this resource consent. Within one month of verification being undertaken, the consent holder shall provide appropriate evidence of verification to the Gisborne District Council.

26. All practicable measures shall be taken to ensure that the water meter and recording device are fully functional at all times. All malfunctions of the water meter shall be reported to the required by condition 27 for the period between 1 July and 30 June of the preceding year.

Discharge of Water to Makauri Aquifer

27. The rate of water injected into the Makauri Aquifer shall not exceed 22 litres per second and the total volume of water injected under this consent shall not exceed ~~110~~**365**,000 cubic metres **per year for two years~~, being 10,000 cubic metres for a pre-trial injection and 100,000~~ cubic metres for the injection trial**.

28. The injection of water into the Makauri Aquifer and associated controls and monitoring shall be undertaken in general accordance with the Australian Guidelines for Water Recycling – Managed Aquifer Recharge document number 24 (July 2009).

29. Water shall only be injected into the Makauri Aquifer via the injection bore authorised under this consent.

30. The consent holder shall install a suitable filter/s inline before injection water enters the Makauri aquifer to treat water prior to injection.

31. No water shall be discharged into the Makauri Aquifer if the following discharge limits have been exceeded:

    (a) A concentration of E.coli of 100 cfu/100ml; and

    (b) Turbidity of **50**~~100~~ NTU; or

    (c) Any amended limit(s) adjusted with the approval of an independent and suitably qualified and experienced professional and certified by the GDC Manager.

32. Prior to seeking certification of any amended limits, the consent holder shall seek input from mana whenua. The consent holder shall advise, in writing, the Council of any advice received from mana whenua and how that advice has been incorporated into decision making.

Pilot Trial Monitoring and Reporting

33. The consent holder must undertake the activity in general accordance with the application and accompanying reports submitted 17th May 2016 to the Bay of Plenty Regional Council except to the extent that these are required to be modified to comply with the conditions of this permit.

34. The consent holder shall, 20 working days prior to any ~~**drilling**~~ **injection** occurring under this consent, lodge a**n updated** Management Plan with the GDC Manager. The Consent Holder shall not commence works authorised by this consent until the **updated** Management Plan has been certified in writing by the GDC Manager acting in a technical certification capacity. The **updated** Management Plan shall be peer reviewed by an independent and suitably qualified professional that is experienced in reviewing such a management plan. The objectives of the **updated** Management Plan for **Phase 2 of the** Poverty Bay MAR Trial are to provide guidance for the **construction,** operation, monitoring and mitigation of the injection bore and flow system. This management plan shall incorporate methods and monitoring as per the resource consent application and shall include, but not be limited to:

~~**(a) Drilling plan: including as built design, location, water volume metering, Method of drilling, Grouting and sealing, pump testing, observation bore design, rock sampling and aquifer testing. The drilling plan shall comply with schedule 12 of the Proposed Gisborne District Council's Regional Freshwater Plan. The Drilling and Aquifer Testing Plan will guide the injection construction bore requirements and aquifer testing;**~~

~~(c)~~(b) Water injection plan: including methods used, rates, volumes of water to be injected and levels of treatment, monitoring and recording of rates and volumes and water quality on a regular basis (continuous where possible) including suspended sediment, bacterial contaminants and clogging, go/no go decisions and trial closure. The Water Injection Plan will outline the site operational plan, management of source water quality parameters, specifically suspended sediment, bacterial contaminants and management of clogging and any borehead overflow issues;

~~(d)~~(c) Pilot trial **(Phase 2)** monitoring plan: including a wider district wide monitoring plan that shall report on water quality and hydraulic water level responses for a period not less than three months following the completion of injection. The Monitoring and Mitigation Plan will outline the position of groundwater level and quality monitoring sites, disinfection by-product management and objectives of each monitoring site and schedule of automated and manual monitoring at each site and detail parameters to be measured. **As discussed in Section 8.7 of the AEE, the plan will include installation of two new purpose-built monitoring bores and the addition of three additional existing bores to the monitoring network subject to bore condition assessments. The plan will include installation of automated and telemetered pressure sensors at existing and new monitoring sites to enable real monitoring of bore static water levels.** The plan will contain alert and trigger levels in terms of water quality and water level responses, so as to ensure early intervention occurs to avoid the occurrence of effects that adversely impact on the land use activities of any neighbouring land owners.

At all times the consent holder must comply with the certified Management Plan.

35. ~~**Post bore installation, and p**~~**P**rior to any discharge/injection of surface water into the Makauri Aquifer, the Management Plan referred to in condition 33 shall be updated and re-certified in writing by the GDC Manager.

~~**36. Following the pre-injection trial of 10,000 m^3 the consent holder shall provide a report to the GDC Manager on the performance of this preliminary trial, with particular reference to the water quality and water quantity effects that arose. Any updates to the Management Plan referred to in condition 33 that are required based on the results of the preliminary trial shall be made and re-certified in writing by the GDC Manager. The commencement of the main trial shall not commence until this reporting and potential re-certification (if required) has been completed.**~~

37. By 31 December of each year when the injection trial has been undertaken the consent holder shall prepare a report describing the trial activities that have taken place, the monitoring data obtained and any trial activities planned for the upcoming year. This report shall be provided to the GDC Manager and the Community Liaison Group.

38. Within four weeks of granting the consent, the consent holder shall commence a collaborative process with mana whenua that will ensure mana whenua input into decisions regarding the design, implementation and evaluation of the monitoring programme for the trial. The monitoring and evaluation programme shall include the development and implementation of a process for monitoring and assessing the cultural health of the Makauri Aquifer and Waipaoa River.

39. A minimum of three (3) sets of water quality monitoring samples shall be taken from bores that are identified in the resource consent application document as pre-injection sample bores. The timing shall be determined in the Management Plan required by condition 33.

40. A copy of these consent conditions and the certified Management Plan shall be held on site and accessible for all staff and contractors.

41. Within three months of completing the post-trial monitoring, the consent holder shall convene a workshop to consider methods for assessing changes in cultural health of waterbodies potentially affected by the Managed Aquifer Recharge injection trial. Following the workshop, and within one month, the consent holder shall provide a report to the Community Liaison Group, providing recommendations for monitoring the cultural health of waterbodies should a more comprehensive Managed Aquifer Replenishment programme be promoted or instigated by the consent holder.

42. The consent holder shall be responsible for all person(s) and contracted operations related to the exercise of this consent/permit and ensure that all persons on site are aware of the conditions of consent and ensure compliance with the permit/consent conditions.

Liaison Groups

43. The consent holder shall establish a Community Liaison Group (CLG) to provide an ongoing point of contact between the consent holder and the community in relation to the operation and monitoring of the injection trial. The consent holder shall send invitations for the first meeting of the CLG within four weeks of the commencement of this consent.

44. The consent holder shall invite members of the stakeholder reference group established during the consultation period of developing the proposal and application for the injection trial. At the time of this invitation, the consent holder shall ask such persons whether they wish to receive further invitations to the GLC meetings.

45. If a positive response is received (whether by main, email, telephone message or in person), that person shall be invited to CLG meetings until the consent holder is advised that such invitations are no longer desired. The consent holder may also invite any other representative(s) of local tangata whenua, the Consent Authority, and/or any other person who may be able to provide assistance, to attend CLG meetings.

Cultural Impact Assessment and Monitoring

46. Prior to the commencement of this consent, the consent holder shall commission a cultural impact assessment of the proposed Phase 2 trial, taking into account recommendations provided in the review by Dr Nick Roskruge (Land Management Group 2017) and to be undertaken in collaboration with Rongowhakaata Iwi Trust. Amongst other matters the cultural impact assessment shall set out the formal relationship between the consent holder and the Rongowhakaata Iwi Trust and the manner in which representatives of the Rongowhakaata Iwi Trust are to participate in the implementation of the cultural impact assessment with respect to implementation, monitoring and reporting on outcomes

47. The cultural impact assessment shall be submitted to and be approved by the GDC Manager, prior to works commencing as follows:

(a) Where the cultural impact assessment submitted to the GDC Manager is supported by the Rongowhakaata Iwi Trust, the approval by the GDC Manager shall be limited to acceptance of the document; and

(b) Where the cultural impact assessment submitted to the GDC Manager is not supported by the Rongowhakaata Iwi Trust is must be accompanied by details of

the matters that have not been agreed and the position of the two parties. The approval by the GDC Manager in this instance shall include acting in a professional capacity to determine the final content of the cultural impact assessment.

Review of Consent Conditions

~~48.~~50. The Gisborne District Council may serve notice on the permit holder of its intention to review the conditions of this resource consent in accordance with section 128 of the Resource Management Act 1991. Such a review will be within one month after the first anniversary of the commencement of this resource consent, or at monthly intervals during the works and thereafter within one month after each subsequent anniversary, for the following reasons:

(a) To require the consent holder to adopt the best practicable option to remove or reduce any adverse effects on the environment; or

(b) To deal with any other adverse effects on the environment on which the exercise of this permit may have an influence; or

(c) To review the appropriateness of consent conditions if there are changes to relevant national standards, regulations or guidelines or the Council's relevant regional and district level plans. Should any adverse effects be identified in the exercising of this consent, further activity shall only occur as specifically authorised by the GDC Manager.

Resource Management Charges

~~49.~~51. The consent holder shall pay to the Gisborne District Council any administration, inspection or monitoring charges payable in respect of this resource consent. Any such charges shall be either fixed or additional charges set in accordance with section 36 of the Resource Management Act 1991 and section 150 of the Local Government Act 2002.

Term of Consent

~~51.~~52. This consent shall expire on 14 November 2021.

The Resource Consent hereby authorised is granted under the Resource Management Act 1991 by the consent authority subject to its servants and agents being permitted access to the relevant parts of the site at all times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or taking samples and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes:

1. *This consent does not authorise the holder to modify or disturb any archaeological or listed historic sites within the area affected by this consent. Should any artefacts, bones or any other sites of archaeological significant be discovered within the area affected by this operation, written authorisation should be obtained from Heritage New Zealand before any damage, modification or destruction is undertaken.*

2. *The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractor(s).*