LEVIN LANDFILL JANUARY 2020 QUARTERLY GROUNDWATER, SURFACE WATER AND LEACHATE MONITORING REPORT

PREPARED FOR HOROWHENUA DISTRICT COUNCIL

February 2020

Stantec

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Executive Summary

Horowhenua District Council (HDC) is required to carry out quarterly compliance monitoring of groundwater and surface water at the Levin Landfill, as part of the conditions on Resource Consents DP6009, DP6010, DP6011 and DP102259. This report summarises the findings for the January 2020 quarterly monitoring event, including monitoring results for:

- Background (natural) groundwater
- The landfill leachate pond effluent
- Groundwater bores within the new landfill and irrigation area
- Shallow aquifers, down-gradient of the old landfill
- The deep aquifer,
- Hokio Stream, and
- The Tatana Drain.

Stantec has reviewed the results of this monitoring on behalf of HDC.

Monitoring for other aspects of the landfill operations, such as landfill gas, air quality/odour, stormwater and soil, are reported annually as per resource consent requirements.

Samples were collected from 23 groundwater bores, the landfill leachate effluent and four surface water sites during January 2020 from around and on the Levin Landfill, and were analysed for the parameters set out in Discharge Permit 6010.

These samples were collected progressively over a 7-day period, which is an acceptable timeframe over which to obtain samples at such a spatially diverse set of monitoring locations.

The resource consent for the landfill (namely discharge permit 6010) contains compliance limits for the quality of deeper and shallow groundwater, which are based upon the Drinking Water Standards for New Zealand – Maximum Acceptable Values (DWSNZ MAVs) and Guideline Values for aesthetic determinants (DWSNZ GVs), the ANZECC 2000 Livestock Drinking Water (ANZECC LDW) trigger values respectively. Compliance limits for surface water are based on the ANZECC 2000 Aquatic Ecosystem (ANZECC AE) 95% trigger values as provided under the revised Resource Consent Condition approved in December 2019.

The January 2020 monitoring results have been assessed against these limits, where they are applicable.

Seven non-compliances with resource consent conditions were recorded at five monitoring locations as follows:

- Exceedance of DWSNZ MAV for manganese (at bore C2DD) in the deep gravel aquifer
- The ANZECC AE 95% trigger values for nitrate-N, ammoniacal-N and dissolved manganese were exceeded at Tatana Property drain (TD1)
- The ANZECC AE 95% trigger values for nitrate-N were exceeded at all three monitoring locations within Hokio Stream (HS1, HS2, and HS3).

The January 2020 results were also considered within the context of background water quality, both within the groundwater aquifers (shallow and deep bores) and the surface water receiving environment. For example, low pH at background bore G1S, and elevated aluminium and iron concentrations in the same bore indicate that groundwater could be being impacted by up-gradient activities unrelated to the landfill operations.

Results from a sample of effluent taken from the leachate pond were within the range of data obtained from previous monitoring events and are generally well below those recorded at typical Class 1 landfills in New Zealand.

Horowhenua District Council

Levin Landfill January 2020 Quarterly Groundwater, Surface Water and Leachate Monitoring Report

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1. Introduction

Horowhenua District Council (HDC) first commissioned Stantec New Zealand (then Montgomery Watson) to carry out environmental reporting for the discharge consent monitoring undertaken at the Levin Landfill site in the early 2000s. Until recently, monitoring has been undertaken every three months at 27 locations, as required by the previous resource consent conditions (namely for discharge permit 6010). There were 23 boreholes penetrating the sand and gravel aquifers; three surface water sampling locations within Hokio Stream and a leachate sampling point as shown in the Site Plan in Appendix A. In addition, HDC had agreed to undertake voluntary surface water monitoring at four locations along the Tatana Property drain.

The review of the resource consent conditions was finalised in December 2019. Changes have been made to some of the surface water and groundwater monitoring conditions, but HDC has not been able to act on all the changes. For instance, three more groundwater monitoring bores (Xs1, Xs2 and Xd1) are required, as is a new surface water sampling location on the Hokio Stream (HS1A). The sampling that was done in the January 2020 sampling round has been in line with what has been done previously, but different parameters have been applied to assess the surface water sampling results, as required by the new consent conditions.

The Levin Landfill site is comprised of two landfills: one old, closed and unlined landfill and one new, lined and active landfill. The new landfill footprint is being developed in stages. The most recent stage is Stage 3C which was developed in 2017, though landfill operations are now occurring over the top of Stages 1A, 2 and 3C.

The Levin Landfill site is located above two identified aquifers, a shallow sand aquifer and a deeper gravel aquifer. The shallow aquifer is unconfined, has a low to moderate permeability, and flows in a northerly direction. The deeper gravel aquifer is a confined to semi-confined aquifer. Horizons Regional Council hydrology staff advised that '*the general confined groundwater flow direction is towards the west*'. Groundwater quality in the area is highly variable because of interaction with peat deposits that are prevalent in the area, localised effects such as from grazing activities, droppings from scavenging birds and from nitrogen-fixing plants such as gorse.

Since July 2010 groundwater has been tested for dissolved metals and nutrients rather than for total concentrations of these parameters. For simplicity, results from monitoring undertaken prior to July 2010 (when the analyses undertaken were for total metal and nutrient concentrations) have not been compared to the results from July 2010 onwards.

The resource consent review process initiated in 2015 for this site was finalised by the Environment Court in December 2019. The process resulted in revised resource consent conditions. At the time of preparing this Quarterly Report the revised conditions are still in the process of being implemented. Wherever possible, compliance has been assessed against the revised consent conditions.

This report presents the results for the January 2020 quarterly monitoring round.

2. Groundwater and Surface Water Monitoring

2.1 Sample Analysis

Samples were collected by Downer (a contractor to HDC) between 8 and 15 January 2020. Samples were couriered overnight and analysed by Eurofins ELS Ltd in Lower Hutt, Wellington, the following day.

The sampling programme for April 2020 - January 2023 is summarised in the schedule in Appendix B. From July 2019, faecal coliform counts analyses have been included within the indicator and comprehensive analytical suites, as agreed by HDC with the Horizons Regional Council (HRC). This means that faecal coliform counts will be assessed more frequently throughout each year, as compared to past monitoring.

Groundwater samples taken from the boreholes, surface water samples from Hokio Stream, and samples of landfill leachate effluent were analysed for the indicator suite of parameters which are outlined in Table 2-1. Surface water samples collected from the Tatana Property drain were analysed based on a specific parameter list agreed to by Horizons Regional Council, as detailed in Section 2.7. In future, sampling of the Tatana Drain will follow the comprehensive and indicator suite of parameters used for other surface water sampling.

Note that following the revision of the resource consent conditions, which were approved in December 2019, soluble carbonaceous BOD5 (scBOD5) and soluble mercury has been added to the indicator suite of parameters. Monitoring of these additional parameters will commence in the April 2020 sampling round.

Table 2-1: Indicator Parameters

Type	Parameters
Characteristics	pH Electrical Conductivity (EC)
Oxygen demand	Chemical Oxygen Demand (COD), $scBOD_5$++
Nutrients*	Nitrate nitrogen (NO_3-N), Ammoniacal-nitrogen (NH_4-N)
Metals*	Aluminium, Iron**, Lead, Manganese, Nickel
Other elements	Boron, Chloride, Sodium**, Mercury++
Biological+	Faecal coliforms

Note: *Analyses performed for nutrients and metals are for dissolved rather than total concentrations. **Selected bores as per stormwater consent 102559
+Faecal coliforms added from July 2019 onwards (see Appendix B)
++Soluble carbonaceous BOD_5 ($scBOD_5$) and Soluble Mercury added as per revised consent conditions for Discharge Permit 6010, December 2019.

Note regarding interpretation of results below detection limits

For those chemical constituents which were found to be present in concentrations below laboratory detection limits during the reporting period, the results have been set at 50% of the laboratory detection limit, and a median calculated on this basis. This is standard practice when dealing with chemical concentrations in water. However, the same rule cannot be applied for faecal coliforms in the context of the Levin Landfill.

The laboratory detection limit for faecal coliforms is 4 CFU/100mL. As the resource consent requires that groundwater results for faecal coliforms be compared against the DWSNZ (for compliance), which sets a value of NIL (I.e. 0 CFU/100mL), we have chosen to indicate where faecal coliforms were not detected, rather than calculating a median as we would for chemical constituents (described above). This method has been applied in all instances where faecal coliforms are assessed for compliance with the DWSNZ.

2.2 Background Groundwater Quality

Water quality from the natural **background water up-gradient from the landfill site is not subject to any consent conditions**. However, for comparison purposes, both the ANZECC LDW trigger values and the DWSNZ guidelines were used to benchmark the quality of water up-gradient from the landfill site.

Groundwater samples were collected from two background bores situated hydraulically up-gradient from both the new and old landfills to the southeast of the site (bores G1S and G1D, Site Plan, Appendix A). These two bores were constructed in late 2009 to sample background water quality from the two main hydrogeological units.

The results are presented in Table 2-2. Bore F3 is also included in the background table as it is near the southern boundary of the landfill site (and further west) and is unlikely to be impacted by landfill activities. A full laboratory report containing analytical results is presented in Appendix C.

Table 2-2: Background Monitoring Results for January 2020

Determinant	Units	DWSNZ MAV	ANZECC LDW	G1S	G1D	F3
Water level	mBGL	-	-	14.21	14.8	2.83
pH	-	7 to 8.5*	6 to 9	**6.6**	7.2	7.5
Conductivity	mS/m	-	-	81.6	28.0	18.4

Determinant	Units	DWSNZ MAV	ANZECC LDW	G1S	G1D	F3
scBOD5	mg/L	-	-	new	new	new
COD	mg/L	-	-	107	*7.5*	*7.5*
Faecal coliforms	CFU/100ml	NIL	100	*ND*	*ND*	*ND*
Chloride	mg/L	250*	-	156	31.5	14.7
Nitrate-N	mg/L	11.3	90.3	0.05	*0.005*	1.19
Ammoniacal-N	mg/L	1.17	-	0.04	0.09	*0.005*
Sodium	mg/L	200*	-	117	32.0	20.6
Dissolved Aluminium	mg/L	0.1*	5	**0.113**	*0.001*	*0.001*
Dissolved Boron	mg/L	1.4	5	*0.015*	0.05	0.03
Dissolved Iron	mg/L	0.2*	-	**4.62**	**0.70**	*0.005*
Dissolved Lead	mg/L	0.01	0.1	0.0006	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	0.4	-	0.136	0.0645	*0.00025*
Dissolved Nickel	mg/L	0.08	1	0.0020	*0.00025*	*0.00025*
Dissolved Mercury	mg/L	0.007	0.002	new	new	new

Notes:
*denotes guideline values for aesthetic determinants (G.V.).
Bold – denotes an exceedance of the relevant DWSNZ guidelines.
Underlined – denotes an exceedance of the ANZECC LDW Trigger Values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
'ND' indicates where faecal coliforms were not detected.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

The result in Table 2-2 indicate that all background bores (G1S, G1D and F3) contain groundwater that has concentrations of all monitored parameters within the ANZECC LDW trigger values.

There were four exceedances of the DWSNZ limits during the January 2020 monitoring round:

- pH in bore G1S was below the DWSNZ GV
- Dissolved Aluminium concentration in bore G1S was above the DWSNZ GV
- Dissolved Iron concentrations in bore G1S and G1D were above the DWSNZ GV

It is noted that bores G1S and G1D are background bores and therefore exceedances of the DWSNZ in these bores do not constitute non-compliances with the consent conditions.

2.3 Groundwater Quality Hydraulically Down-Gradient of the New Landfill

Monitoring is carried out within the two main hydrogeological units for bores hydraulically up-gradient of the old landfill and hydraulically down-gradient of the new landfill.

2.3.1 Shallow Aquifer

Bores D1, D2, D3(r), D4, D5, D6 and E1S (Refer to Site Plan, Appendix A) are located hydraulically up-gradient of the old landfill, but down-gradient of the new landfill. This means they are uninfluenced by potential leaching from the old landfill and can act as a warning system for any leaching from the new landfill. Borehole D4 is likely to show any leaching from the new landfill. Borehole D5 is located at the south western corner of the site and is expected to provide an indication of shallow background groundwater quality because it is unlikely to be influenced by either landfill. It is unlikely that leachate from the new landfill will significantly affect groundwater quality due to the leachate collection system which is in place at the new landfill; however, these bores would still give early warning of any potential problems.

The results from the January 2020 monitoring round for these bores are presented in Table 2-3 . The results have been compared with the ANZECC LDW trigger values as per the consent conditions. The full laboratory report is included in Appendix C.

There were no exceedances of the ANZECC LDW trigger values during the January 2020 monitoring round and so the **results comply with the resource consent conditions**.

Table 2-3: D-Series and E1S Monitoring Bore Results for January 2020

Determinant	Units	ANZECC LDW	D1	D2	D3(r)	D4	D5	D6	E1S
Water level	mBGL	-	16.72	21.35	4.67	8.7	9.76	16.23	11.327
pH	-	6 to 9	7.6	6.8	7.2	7.7	7.9	7.1	7.1
Conductivity	mS/m	-	46.6	31.1	22.0	31.5	29.4	29.1	26.6
scBOD5	mg/L	-	new	new	new	new	new	new	new
COD	mg/L	-	*7.5*	36	18	*7.5*	*7.5*	*7.5*	19
Faecal coliforms	CFU/100ml	100	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Chloride	mg/L	-	30.3	32.9	22.0	49.2	30.0	14.2	29.7
Nitrate-N	mg/L	90.3	10.6	*0.05*	0.29	*0.005*	1.34	11.1	*0.005*
Ammoniacal-N	mg/L	-	*0.005*	0.43	0.17	0.21	0.01	*0.005*	0.16
Sodium	mg/L	-	39.4	26.0	25.10	31.4	29.4	26.7	25.80
Dissolved Aluminium	mg/L	5	0.009	0.026	0.002	*0.001*	*0.001*	*0.001*	0.006
Dissolved Boron	mg/L	5	0.05	0.05	0.03	*0.015*	0.03	0.05	*0.015*
Dissolved Iron	mg/L	-	0.02	14.9	2.95	0.831	0.06	*0.005*	4.22
Dissolved Lead	mg/L	0.1	*0.00025*	0.0014	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	-	0.0050	0.332	0.193	0.175	0.0148	*0.00025*	0.219
Dissolved Nickel	mg/L	1	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*
Dissolved Mercury	mg/L	0.002	new	new	new	new	new	new	new

Notes:
Bold – denotes an exceedance of the ANZECC LDW trigger values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
'ND' indicates where faecal coliforms were not detected.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

2.3.2 Deep Gravel Aquifer

Bores E1D, C2DD, E2D and G1D all penetrate the deeper gravel aquifer. Deep groundwater flow is assumed to be towards the northwest. Boreholes E2D and C2DD are located to the north-northwest of both the landfills and are therefore considered to be hydraulically down gradient of both landfills. Borehole E1D is located to the southwest of the old landfill and it is therefore considered that this bore would be unlikely to be affected by either landfill.

Results for the January 2020 compliance monitoring round are presented in Table 2-4. The results have been compared with the DWSNZ as per the discharge consent 6010. The full laboratory report is included in Appendix C.

Table 2-4: Results for Monitoring Bores within the Deep Aquifer for January 2020

Determinant	Units	DWSNZ MAV	E1D	C2DD	E2D
Water level	mBGL	-	11.25	2.59	5.7
pH	-	7 to 8.5*	7.9	8.0	8.0
Conductivity	mS/m	-	45.8	55.2	34.6
scBOD5	mg/L	-	new	new	new
COD	mg/L	-	*7.5*	*7.5*	20
Faecal coliforms	CFU/100ml	NIL	*ND*	*ND*	*ND*
Chloride	mg/L	250*	38.2	41.0	45.0
Nitrate-N	mg/L	11.3	*0.005*	*0.005*	*0.005*
Ammonia-N	mg/L	1.17	0.19	0.33	0.29
Sodium	mg/L	200*	37.2	39.4	30.0
Dissolved Aluminium	mg/L	0.1*	0.003	*0.001*	*0.001*
Dissolved Boron	mg/L	1.4	0.06	0.07	*0.015*
Dissolved Iron	mg/L	0.2*	0.05	0.04	0.07
Dissolved Lead	mg/L	0.01	*0.00025*	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	0.4	0.274	**0.701**	0.232
Dissolved Nickel	mg/L	0.08	*0.00025*	*0.00025*	*0.00025*
Dissolved Mercury	mg/L	0.007	new	new	new

Notes:
* denotes guideline values for aesthetic determinants (G.V.).
Bold – denotes an exceedance of the relevant DWSNZ (2008) standard.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
n/r – not required to be tested during this monitoring period.
'ND' indicates where faecal coliforms were not detected.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

There was **one exceedance of the resource consent conditions** in samples from the deep gravel aquifer during the January 2020 sampling round, i.e.

- Dissolved manganese concentration in bore C2DD exceeded the DWSNZ MAV.

2.4 Impact of Old Landfill on Groundwater Quality

Water sampling is carried out to characterise the groundwater quality in a series of shallow bores situated hydraulically down-gradient from the old unlined landfill. The Series B boreholes are located within 50 m of the old landfill in a line along its northern edge. The Series C boreholes are located further down the hydraulic gradient from the old landfill towards Hokio Beach Road to detect whether leachate is moving off site. Borehole E2S is located northwest of the old landfill to detect any leachate moving directly

towards the nearest house down-stream of the site. Bore G2S was installed in late 2009 and is located to the north of the landfill site, hydraulically down-gradient of the old landfill by Hokio Road and the entrance road to the landfill (See Site Plan, Appendix A).

The results from the January 2020 consent monitoring round for these bores are presented in Table 2-5 and have been compared with the ANZECC LDW trigger values as per the discharge consent 6010. The full laboratory report is included in Appendix C.

There were no exceedances of the ANZECC LDW trigger values during the January 2020 monitoring round and so these **results show compliance with the resource consent conditions**.

Table 2-5: Results from Shallow Boreholes Down-Gradient from the Old Landfill for January 2020

Determinant	Units	ANZECC LDW	E2S	B1	B2	B3	C1	C2	C2DS	G2S
Water level	mBGL	-	4.79	1.14	1.45	0.1	0.31	0.42	2.3	2.38
pH	-	6 to 9	7.9	7.8	7.1	7.0	7.0	6.9	6.7	6.9
Conductivity	mS/m	-	44.5	167	176	254	143	372	182	267
scBOD5	mg/L	-	new	new	new	new	new	new	new	new
COD	mg/L	-	27	69	84	150	76	157	97	69
Faecal coliforms	CFU/100ml	100	*ND*	20	4	*ND*	*ND*	8	*ND*	*ND*
Chloride	mg/L	-	41.8	283	94.7	172	252	524	124	616
Nitrate-N	mg/L	90.3	*0.005*	8.16	44.2	0.02	*0.005*	*0.005*	*0.05*	*0.005*
Ammoniacal-N	mg/L	-	0.25	9.79	43.8	140	0.41	181	1.71	0.02
Sodium	mg/L	-	42.7	132	99.6	129	157	256	108	281
Dissolved Aluminium	mg/L	5	*0.001*	0.004	0.011	0.005	0.005	0.024	0.010	*0.001*
Dissolved Boron	mg/L	5	0.04	0.53	1.02	0.80	0.47	1.64	0.52	1.15
Dissolved Iron	mg/L	-	0.03	0.02	1.34	1.40	3.35	0.48	20.2	0.08
Dissolved Lead	mg/L	0.1	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	-	0.389	8.56	3.43	3.86	0.323	0.0820	2.93	0.416
Dissolved Nickel	mg/L	1	*0.00025*	0.0019	0.0021	0.0106	0.0009	0.0052	0.0026	0.0038
Dissolved Mercury	mg/L	0.002	new	new	new	new	new	new	new	new

Notes:
Bold – denotes an exceedance of the ANZECC LDW trigger values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
n/r – not required to be tested during this monitoring period.
'ND' indicates where faecal coliforms were not detected.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

2.5 Groundwater Quality Down-Gradient of the Irrigation Area

The F-series boreholes intersect the shallow aquifer down-gradient of the area that was used to irrigate leachate from 2004 to October 2008. All leachate is now pumped to the Levin Wastewater Treatment Plant. The F1 borehole is located within the area where leachate from the new landfill was irrigated. F2 and F3 boreholes are located in an area that was set aside for leachate irrigation but never used as such. It is expected that bores F2 and F3 would therefore be representative of background groundwater quality.

The results from the F series boreholes are presented in Table 2-6 and have been compared with the ANZECC LDW trigger values, as per the discharge consent 6010. The full laboratory report is included in Appendix C.

There were no exceedances of the ANZECC LDW trigger values during the January 2020 monitoring round and so the **results show compliance with the resource consent conditions**.

Table 2-6: Results from Monitoring Bores in the Irrigation Area for January 2020

Determinant	Units	ANZECC LDW	F1	F2	F3
Water level	mBGL	-	7.97	5.27	2.83
pH	-	6 to 9	7.8	7.5	7.5
Conductivity	mS/m	-	43.4	22.2	18.4
scBOD5	mg/L	-	new	new	new
COD	mg/L	-	*7.5*	*7.5*	*7.5*
Faecal coliforms	CFU/100ml	100	*ND*	*ND*	*ND*
Chloride	mg/L	-	51.0	22.7	14.7
Nitrate-N	mg/L	90.3	1.47	0.55	1.19
Ammoniacal-N	mg/L	-	*0.005*	*0.005*	*0.005*
Sodium	mg/L	-	38.4	24.7	20.60
Dissolved Aluminium	mg/L	5	*0.001*	*0.001*	*0.001*
Dissolved Boron	mg/L	5	0.03	0.04	0.03
Dissolved Iron	mg/L	-	*0.005*	*0.005*	*0.005*
Dissolved Lead	mg/L	0.1	*0.00025*	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	-	0.0028	0.0050	*0.00025*
Dissolved Nickel	mg/L	1	*0.00025*	*0.00025*	*0.00025*
Dissolved Mercury	mg/L	0.002	new	new	new

Notes:
Bold – denotes an exceedance of the ANZECC LDW trigger values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
n/r – not required to be tested during this monitoring period.
'ND' indicates where faecal coliforms were not detected.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

2.6 Leachate Effluent Results

Leachate effluent from the landfill is **not subject to any water quality consent conditions**. However, for comparison purposes, typical leachate characteristics for landfills published by the Waste Management Institute New Zealand (*Technical Guidelines for Disposal to Land*, August 2018, WasteMINZ) have been compared against the leachate quality monitoring results (Table 2-7). The full laboratory report is included in Appendix C. Table 2-7 shows that the concentrations of monitored parameters for leachate effluent samples collected in January 2020 were well within the typical ranges to be expected for this type of landfill.

Table 2-7: Results from Leachate Effluent Monitoring for January 2020

Determinant	Units	Typical Leachate Characteristics*	Leachate
		(range)	Effluent
pH		5.9 - 8.5	7.7
Conductivity	mS/m	308 – 27,900	1430
scBOD5	mg/L	-	new
COD	mg/L	84 – 5,090	2220
E.coli	CFU/100mL		new
Faecal coliforms	CFU/100mL	-	12
Chloride	mg/L	45 – 2,584	1010
Nitrate-N	mg/L	-	*0.50*
Ammonia-N	mg/L	3.4 – 1,440	1270
Sodium	mg/L	50 – 4,000**	815
Dissolved Aluminium	mg/L	-	0.506
Dissolved Boron	mg/L	0.54 – 20.1	5.97
Dissolved Iron	mg/L	1.6 – 220	4.42
Dissolved Lead	mg/L	0.001 - 0.42	0.0017
Dissolved Manganese	mg/L	0.3 - 45***	1.15
Dissolved Nickel	mg/L	0.02 – 2.05**	0.107
Dissolved Mercury	mg/L	0.2 - 50	new

Notes:
* for Class 1-type landfills, Table 5-5, p82, Technical Guidelines for Disposal to Land, WasteMINZ August 2018 (same as Table 4.2 of the CAE Landfill Guidelines 2000, but corrections made to Table 5-5 in line with Table 4.2).
**Data taken from Table 5-4, p81 of the same guideline, for parameters for which no differences in concentrations between the phases of landfill development could be observed
***Data taken from Table 5-4, p81 of the same guideline, for parameters during the methanogenic phase.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

Note that in terms of the revised resource consent conditions, monthly sampling of leachate in accordance with the comprehensive suite of parameters is to occur for a period of two years.

2.7 Tatana Property Drain

A drain is located on the Tatana property (see Site Plan in Appendix A). Since July 2015 HDC has agreed to sample surface water from the drain for a selection of parameters that were set by HRC. Four sampling points were selected to represent the top of the drain (SW1), middle of the drain (SW2 and SW3) and lower drain (SW4).

The revised consent conditions have now reduced the extent of sampling to one location. This is known as 'TD1' and it is the same sampling location as previous 'SW1'.

Results from the January 2020 sampling round are presented in Table 2-8 and have been compared with the ANZECC 2000 Aquatic Ecosystem (ANZECC AE) 95% trigger values as per the revised resource consent conditions.

Monitoring for scBOD5 and soluble mercury concentrations, required under the revised conditions, is in the process of being implemented and monitoring is expected to commence during the April 2020 monitoring round.

Table 2-8: Tatana's Drain Results for January 2020

Determinant	Units	ANZECC AE (95%)	TD1 (formerly SW1)
pH		-	7.4
Faecal coliforms	CFU/100ml	-	200
Total Suspended Solids	mg/L	-	536
Conductivity	mS/m	-	261
scBOD5	mg/L	2	new
COD	mg/L	-	346
Total Kjeldahl Nitrogen	mg/L	-	111
BOD5-Total	mg/L	-	56
Chloride	mg/L	-	215
Nitrite-N	mg/L	-	0.15
Nitrate-N	mg/L	0.16	**3.08**
Ammoniacal-N	mg/L	2.1	**100**
Total-N	mg/L	-	100
Dissolved Iron	mg/L	-	0.30
Dissolved Manganese	mg/L	1.9	**0.998**
Dissolved Mercury	mg/L	0.0006	new

Notes:
Bold – denotes an exceedance of the ANZECC AE 95% protection level trigger values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

There were **three exceedances of the resource consent conditions** in samples from the Tatana Drain property at TD1 during the January 2020 sampling round for:

- Nitrate-N
- Ammoniacal-N
- Dissolved manganese.

2.8 Hokio Stream

Surface water grab samples are obtained from Hokio Stream at sites HS1, HS2 and HS3 (refer to Appendix A) to investigate whether groundwater containing leachate is having an adverse environmental effect on the stream. Site HS1 is situated up-stream of the old landfill, HS2 is situated alongside the old landfill and up-stream of the Tatana Property Drain discharge, and HS3 is located approximately 50m down-stream of the landfill site property boundary and the Tatana Property Drain discharge. Samples from these monitoring locations on Hokio Stream are analysed for indicator parameters every six months (as shown in Appendix B).

Results from the January 2020 sampling round are presented in Table 2-9 and have been compared with the ANZECC 2000 Aquatic Ecosystem (ANZECC AE) 95% trigger values as per the revised resource consent conditions.

Monitoring for scBOD5 and soluble mercury concentrations and a new monitoring location 'HS1A' located further upstream from HS1, is now added as per the revised Resource Consent conditions.

The revised conditions are in the process of being implemented and monitoring expected to commence during the April 2020 monitoring round.

Table 2-9: Hokio Stream Results for January 2020

Determinant	Units	ANZECC AE (95%)	HS1A (new)	HS1	HS2	HS3
pH		-	new	7.8	7.8	7.7
Conductivity	mS/m	-	new	24.9	25.7	25.9
scBOD5	mg/L	2	new	new	new	new
COD	mg/L	-	new	51	48	53
Faecal coliforms	CFU/100ml	-	new	810	650	580
Chloride	mg/L	-	new	24.7	25.2	25.5
Nitrate-N	mg/L	0.16	new	**0.30**	**0.30**	**0.31**
Ammonia-N	mg/L	2.1	new	0.12	0.16	0.18
Sodium	mg/L	-	new	18.0	17.4	18.5
Dissolved Aluminium	mg/L	0.055	new	0.021	0.023	0.014
Dissolved Boron	mg/L	0.37	new	0.05	0.05	0.05
Dissolved Iron	mg/L	-	new	0.05	0.05	0.04
Dissolved Lead	mg/L	0.0034	new	*0.00025*	*0.00025*	*0.00025*
Dissolved Manganese	mg/L	1.9	new	0.0404	0.0424	0.0475
Dissolved Nickel	mg/L	0.011	new	*0.00025*	*0.00025*	*0.00025*
Dissolved Mercury	mg/L	0.0006	new	new	new	new

Notes:
Bold – denotes an exceedance of the ANZECC AE 95% protection level trigger values.
All `<' values have been reported as half the detection limit for statistical purposes and are expressed in italics.
'new' denotes added parameter as per the revised resource consent conditions (December 2019). Monitoring to commence in April 2020.

There were **three exceedances of the resource consent condition** in samples from the Tatana Drain property at TD1 during the January 2020 sampling round for:

- Nitrate-N in samples from HS1, HS2 and HS3.

3. Discussion

3.1 Sampling Quality Control and Assurance

The landfill extends over a significant area and there are a large number of sampling locations. However, it is important that the length of the sampling period is kept as brief as possible because a sampling period that is too long may make comparisons of results between rounds less valid. This current monitoring round was carried out over a 7-day period between 8 and 15 January 2020. This is a significant improvement over the timespan of previous quarterly monitoring rounds. The length of the monitoring period (7 days to obtain all the January 2020 samples) has progressively shortened since the October and July 2019 rounds when it took over 11 days and 20 days respectively to obtain all the samples. This monitoring period is within the recommended period (i.e. obtaining all samples within seven days) and therefore the results can be interpreted with greater certainty.

Note the monitoring for scBOD5 and soluble mercury, required as per revised Resource Consent Conditions (December 2019), is in the process of being implemented and monitoring expected to commence during the April 2020 monitoring round.

3.2 Background Groundwater Quality

Water quality from the natural background water up-gradient from the landfill site is not subject to any consent conditions.

Results since 2010 from the background bores indicate that low pH values are representative of background water quality in the shallow sand aquifer (G1S). The deeper gravel aquifer (G1D) has pH levels that are slightly higher, but which occasionally dip below the DWSNZ lower guideline of 7.

The aluminium concentration at the G1S bore (0.113mg/L) was marginally above the DWSNZ MAV value of 0.1mg/L. The current result was not within the historical result range recorded at this bore which has a median of 0.014mg/L.

Iron concentrations have fluctuated considerably at both the G1S and G1D bores since monitoring began and are occasionally above the DWSNZ GV. During the January 2020 sampling round, iron concentrations at G1S exceeded the DWSNZ GV of 0.2mg/L but were within the historical results ranges recorded at this bore. Elevated iron concentrations in groundwater are likely to be related to hydrogeological conditions found at the site and this phenomenon is common in groundwater in this area.

The monitoring results suggest that the quality of background groundwater may be being impacted by local ground conditions and/or activities up-gradient of the landfill. In particular, background bore G1S consistently records elevated concentrations of a range of parameters and therefore may not be suitable to use for reference background water quality. The suitability of G1S as a background bore will be further assessed prior to issue of the next annual compliance report (for 2019/2020).

3.3 Shallow Aquifer Groundwater Quality

3.3.1 Hydraulically Up-gradient from the Old landfill

Sampling results from the January 2020 monitoring round show that water quality in the shallow monitoring bores hydraulically up-gradient from the old landfill complies with the discharge consent conditions.

Previous quarterly and annual reports noted that nitrate nitrogen concentrations have been consistently elevated in bores D1 and D6 when compared to background (G1S) and bore D4, as shown in Figure 3-1. The concentration of nitrate nitrogen appeared to be steadily increasing until around October 2018 when the concentration began to fall. This recent decreasing trend has persisted throughout the 2019 quarterly monitoring rounds and is again reflected in these latest monitoring results.

Bores D1 and D6 are located down gradient of the new landfill, with bore D1 located hydraulically up-gradient of the leachate effluent pond and bore D6 located down gradient of the leachate pond. Other leachate indicators such as boron, chloride and ammoniacal nitrogen are all consistent with background concentrations and the historical record.

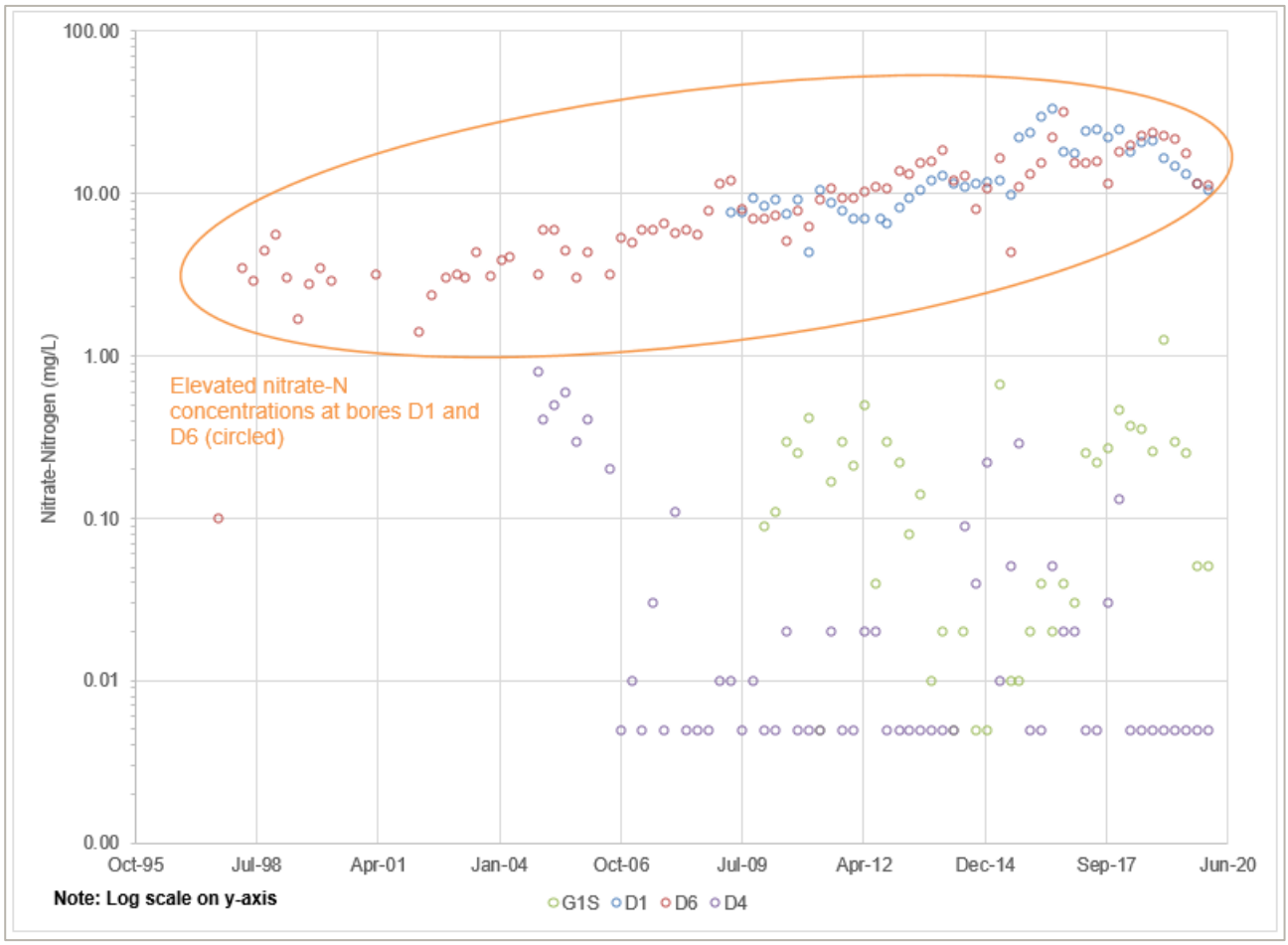


Figure 3-1: Nitrate Nitrogen Concentrations in the D-Series Bores

In previous quarterly reports it was recommended that further investigations be carried out to identify the possible cause (or causes) of the elevated levels of nitrate nitrogen in bores D1 and D6.

Such investigations should include regular monitoring of groundwater levels to be undertaken in all the bores monitored for the 2019-2020 monitoring period so that groundwater flow and the depth of the unsaturated zone can be assessed. This will enable more conclusions to be drawn as to the source of the elevated nitrate nitrogen concentrations and conductivity values.

3.3.2 Irrigation area

Sampling results from all shallow bores located hydraulically down-gradient of the irrigation area[1] (F series bores) are consistent with historical results and comply with the discharge consent conditions.

Historical trends of leachate indicators chloride, boron and ammoniacal nitrogen concentrations in the F-series bores are generally stable and do not show any indication of an increasing trend.

3.3.3 Hydraulically Down-gradient from the Old landfill

During the January 2020 sampling round there were no exceedances of the resource consent conditions for monitored parameters in samples from the shallow bores.

[1] Irrigation of leachate within this area ceased in October 2008.

Bores C1 and G2S are located down gradient of the old landfill to the east. These bores have consistently recorded low concentrations of ammoniacal nitrogen, with G2S often recording concentrations below the detection limit. These bores are likely to be located beyond the eastern edge of the leachate plume.

Bores B1, B2, B3 and C2 all appear to be located and screened within the leachate plume and consistently show significantly elevated concentrations of ammoniacal nitrogen. Historical results for all four bores are plotted in Figure 3-2 below. It is noted that the concentration of ammoniacal nitrogen in bore C2 has been increasing since 2009, while the concentration in B1 has fallen. It is possible that the leachate plume flow direction has shifted, thus resulting in a different spatial distribution of results from that being observed five years ago. The regular monitoring of the groundwater levels in the bores over the 2019-2020 monitoring period will allow further conclusions to be drawn in the next annual report.

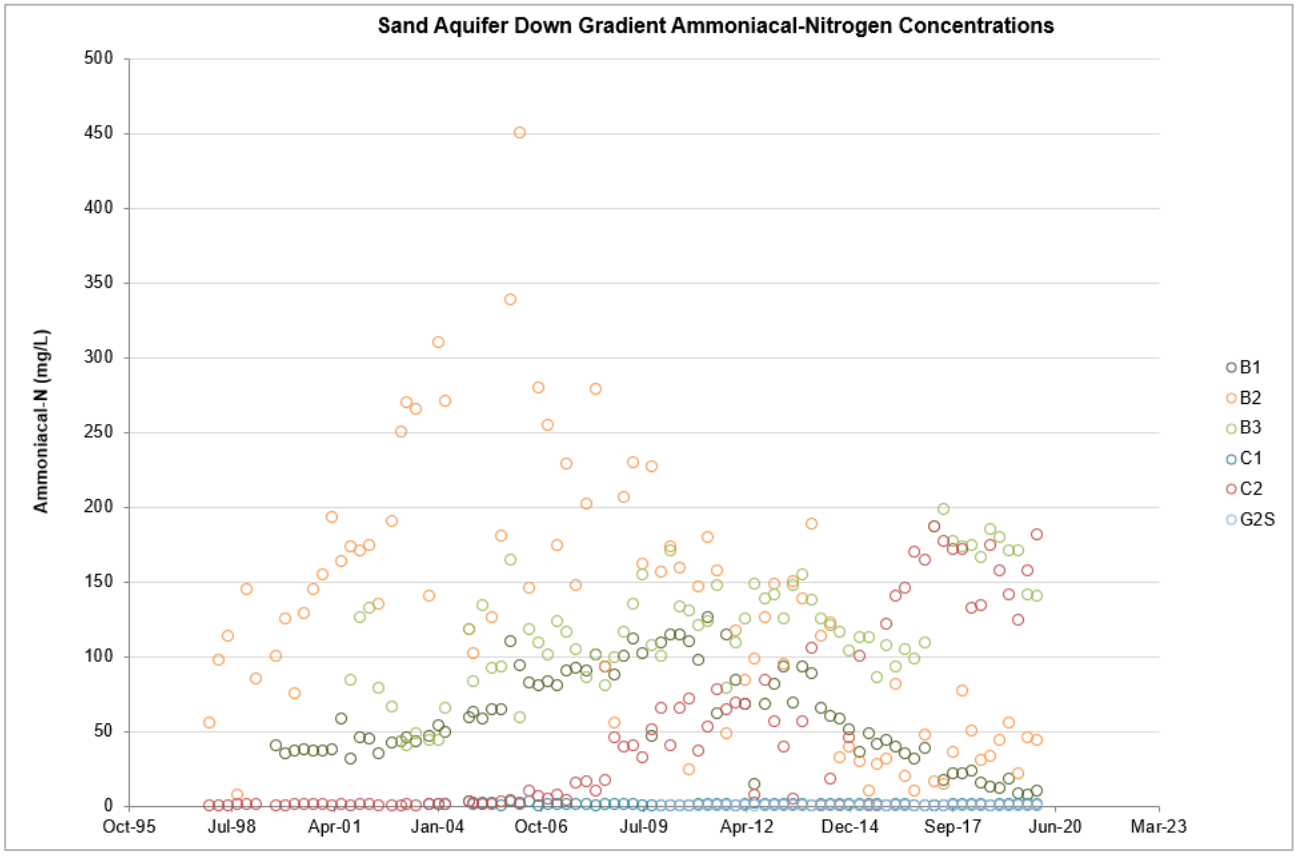


Figure 3-2: Ammoniacal Nitrogen Concentrations in Shallow Bores Screened in the Leachate Plume

Other key leachate indicators, boron, conductivity and chloride are also all elevated in concentrations within the bores that are located and screened in the leachate plume, as would be expected.

The leachate plume appears to have a confined radius northward and is not extending to the north-west or the north-east. The leachate plume width was estimated to be 300-500m in 2014.

3.4 Deep Aquifer Groundwater Quality

The concentration of manganese exceeded the DWSNZ MAV at C2DD within the deep gravel aquifer, in the January 2020 monitoring round. However, it is noted that the manganese concentration at C2DD (0.701mg/L) was consistent with historical results and representative of background groundwater quality in the area.

3.5 Leachate Effluent

Monitoring results from the leachate effluent samples are not required to meet either the ANZECC LDW trigger values or DWSNZ standards. Results from the January 2020 monitoring round were all within the

typical leachate composition range for Class 1 landfills published in the WasteMINZ 2018 Technical Guidelines for Disposal to Land.

3.6 Tatana Property Drain

Under the revised resource consent conditions approved in December 2019, monitoring location 'SW1' is now re-designated as 'TD1', and sampling at locations 'SW2', 'SW3' and 'SW4' has been discontinued. Soluble carbonaceous BOD5 (scBOD5) and soluble mercury concentrations were added to the current analytical parameter list. The new conditions are in the process of being implemented and monitoring for those additional parameters expected to commence during the April 2020 monitoring round.

Under the revised conditions, the Tatana Property drain samples are now assessed against the ANZECC AE 95% trigger values.

During this January 2020 monitoring period, there were **three exceedances of the resource consent conditions** in samples from the Tatana Drain property at TD1 where nitrate-N, ammoniacal-N and dissolved manganese exceeded the ANZECC AE 95% trigger values.

3.7 Hokio Stream

Under the revised resource consent conditions, a new monitoring location (HS1A), located upstream of HS1, was added to Hokio Stream monitoring locations, and scBOD5 and soluble mercury concentrations added to the current analytical parameter list. The new conditions are in the process of being implemented and monitoring at HS1A and for the new parameters is expected to commence during the April 2020 monitoring round.

Under the revised conditions, the Hokio Stream samples are now assessed against the ANZECC AE 95% trigger values.

During this January 2020 monitoring period, there were **three exceedances of the resource consent conditions** in samples from the Hokio Stream where nitrate-N exceeded the ANZECC AE 95% trigger values at HS1, HS2 and HS3.

3.8 Consent Compliance

Discharge permit 6010 states that quarterly and annual monitoring results should comply with the ANZECC LDW trigger values in the shallow groundwater aquifer (sand aquifer) and surface water bodies. Samples from the deep groundwater (gravel aquifer) should comply with the DWSNZ. Should any parameters exceed these standards, the permit holder shall report to the Regional Council as soon as practicable on the significance of the results and, where the change can be attributed to the influence of landfill leachate, consult with the Regional Council to determine if further investigations or remedial measures are required.

Deeper gravel aquifer

There w**as one exceedance** of the resource consent conditions in samples from the deep gravel aquifer during the January 2020 sampling round:

- Manganese concentration in bore C2DD exceeded the DWSNZ MAV.

Tatana Property drain

There were **three exceedances** of the resource consent conditions during the January 2020 sampling round for samples obtained from the Hokio Stream sampling location at TD1:

- Nitrate-N exceeded the ANZECC AE 95% trigger value
- Ammoniacal-N exceeded the ANZECC AE 95% trigger value
- Dissolved manganese exceeded the ANZECC AE 95% trigger value.

Hokio stream

There were **three exceedances** of the resource consent condition during the January 2020 sampling round for samples obtained from the Hokio Stream:

- Nitrate-N concentration in HS1, HS2 and HS3 exceeded the ANZECC AE 95% trigger value.

4. Conclusions

Monitoring results obtained in the January 2020 sampling round suggest that the groundwater at the background monitoring sites is being impacted by local ground conditions and/or activities up-gradient of the landfill.

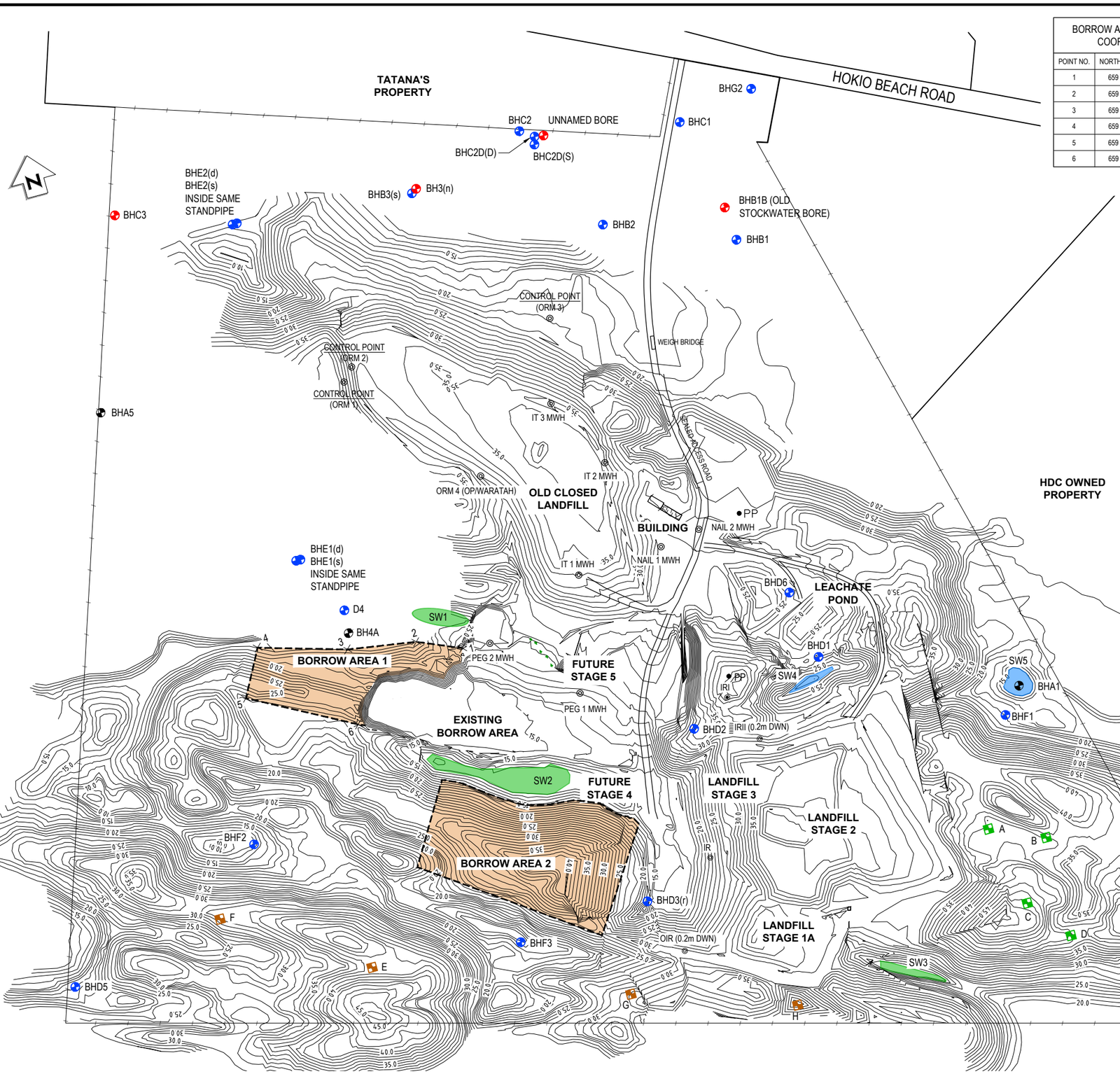
During the January 2020 monitoring period there were seven exceedances of the resource consent conditions, as summarised in the following paragraphs.

The deep-water bore C2DD located immediately down-gradient hydraulically of the old unlined landfill showed a manganese concentration above the DWSNZ MAV. The concentration of manganese at this bore is consistent with historical results and is representative of typical ground water quality in the area.

There were three exceedances of consent limits shown in samples from surface water monitoring at the Hokio Stream; these were for nitrate-N upstream of the old landfill (HS1), mid-stream (HS2) and downstream (HS3) of the old landfill, with these all showing values above the ANZECC AE 95% trigger values. Additionally, there were three exceedances of consent limits shown in samples from surface water monitoring at the Tatana Property drain where nitrate-N, ammoniacal-N and dissolved manganese at TD1 all exceeded the ANZECC AE 95% trigger values. The significant increase in the number of exceedances for surface monitoring was brought about from the change in comparable trigger values with the ANZECC AE 95% trigger values were much lower than the previous ANZECC LDW trigger values.

Appendices

Appendix A Site Plans



DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

BORROW AREA 1 SET-OUT COORDINATES		
POINT NO.	NORTHINGS mN	EASTINGS mE
1	659 230.38	276 453.28
2	659 247.32	276 413.49
3	659 257.33	276 349.62
4	659 280.93	276 269.42
5	659 238.49	276 246.50
6	659 187.34	276 341.04

BORE LOCATIONS AND DETAILS						
BORE HOLE NO	NORTHING mN	EASTING mE	R.L. (m)	DEPTH OF WELL (m)	PIEZOMETER DIAMETER (mm)	FUNCTION
A1	659 060.15	276 944.89	12.95			SHALLOW AQUIFER
A2 (DESTROYED)						SHALLOW AQUIFER
A3 (DESTROYED)						SHALLOW AQUIFER
A4	659 271.67	276 354.72	10.10			SHALLOW AQUIFER
A5	659 530.47	276 185.91	9.62			SHALLOW AQUIFER
B1	659 561.81	276 797.35	9.04	4.3	40	SHALLOW AQUIFER
B1B (STOCK BORE)	659 530.08	276 799.91	9.28	10		
B2	659 576.32	276 683.50	9.42	3.5	50	SHALLOW AQUIFER
B3(s)	659 651.19	276 519.52	7.76	2.83	50	SHALLOW AQUIFER
B3(n)	659 654.26	276 524.38	7.49	2.33	32	DEEP AQUIFER
C1	659 649.64	276 777.83	7.47	3.60	50	SHALLOW AQUIFER
C2	659 680.80	276 631.22	7.50	2.81	32	SHALLOW AQUIFER
C2D(s)	659 671.19	276 641.63	10.13	12.88	32	SHALLOW AQUIFER
C2D(d)	659 671.19	276 641.63	10.11	18.85	32	DEEP AQUIFER
C3	659 704.29	276.246.89	7.22	2.8	32	SHALLOW AQUIFER
D1	659 134.97	276 771.65	27.46	23.69	50	EARLY DETECTION
D2	659 101.02	276 642.06	32.12	29.46	50	EARLY DETECTION
D3-DESTROYED						
D4	659 293.20	276 356.60	20.50	17.0		SHALLOW AQUIFER
D5	659 020.80	276 022.40	17.8	18		SHALLOW AQUIFER BACKGROUND
D6	659 200.31	276 761.08	26.41	16.07	50	EARLY DETECTION
E1(d)	659 349.54	276 329.48	20.91	37.80	32	SHALLOW AQUIFER
E1(s)	659 349.54	276 329.48	20.91	20.05	32	DEEP AQUIFER
E2(s)	659 667.30	276 354.69	13.15	15.24	32	SHALLOW AQUIFER
E2(d)	659 667.30	276 354.69	13.15	28.66	32	DEEP AQUIFER
F1	659 037.10	276 925.50	18.90	15.0	50	SHALLOW AQUIFER LEACHATE IRRIGATION
F2	659 105.00	276 218.00	13.50	10.2	50	SHALLOW AQUIFER LEACHATE IRRIGATION
F3	658 951.7	276 434.0	16.70	10.5	50	SHALLOW AQUIFER LEACHATE IRRIGATION
G1(s) [4]	658 786	277 046	24	15	50	SHALLOW AQUIFER BACKGROUND
G1(d) [4]	658 786	277 046	24	31.5	50	DEEP AQUIFER BACKGROUND
G2 [4]	659 673	276 835	8	4	50	SHALLOW AQUIFER
D3(r) REINSTATED [4]	658 953	276 552	18	10	50	EARLY DETECTION
COORDINATES ARE IN TERMS OF NEW ZEALAND GEODETIC DATUM 1949: WANGANUI CIRCUIT						

COORDINATES OF SURVEY CONTROL MARKS			
PT	NORTHING mN	EASTING mE	RL
ORM 1	659 498.38	276 412.21	38.94
ORM 2	659 510.09	276 422.72	34.98
ORM 3	659 505.14	276 612.86	21.10
ORM 4(OP/W)	659 380.16	276 511.94	30.92
MWH NAIL 1	659 272.67	276 656.87	27.61
MWH NAIL 2	659 278.98	276 695.22	28.40
MWH IT 1	659 267.33	276 576.02	30.03
MWH IT 2	659 361.94	276 627.00	33.70
MWH IT 3	659 428.24	276 593.00	32.74
MWH PEG 1	659 160.94	276 548.30	32.99
MWH PEG 2	659 227.86	276 479.35	30.49
IRII	659 075.85	276 698.70	30.04
OIR	658 903.62	276 579.37	30.35
IRI	659 121.09	276 679.47	40.00
IR	276 625.10	658 981.29	21.30
COORDINATES ARE IN TERMS OF NEW ZEALAND GEODETIC DATUM 1949: WANGANUI CIRCUIT			

SOIL MONITORING LOCATIONS	CO-ORDINATES		LEVEL (m)
	NORTHING mN	EASTING mE	
PEG A	658 938.80	276 882.30	39.2
PEG B	658 917.00	276 932.10	39.5
PEG C	658 862.70	276 899.00	46.1
PEG D	658 822.90	276 930.40	40.4
PEG E	658 965.50	276 294.00	36.6
PEG F	659 046.20	276 169.10	32.9
PEG G	658 878.00	276 520.20	32.6
PEG H	658 827.40	276 667.60	23.5

NOTES:

1. LEVELS ARE TOP OF STANDPIPE. WHERE THERE IS NO STANDPIPE, LEVELS ARE TOP OF PVC PIPE.
2. BHA2, BHA3 AND BHD3 HAVE BEEN LOST DUE TO SITE WORKS.
3. "A" SERIES BORE HOLES ARE AUGER HOLES ONLY AND MAY NOT BE ABLE TO BE LOCATED.
4. BORES INSTALLED IN AUG 2009. DETAILS ARE APPROXIMATE.
5. CONTOUR INTERVALS: 5m MAJOR, 1m MINOR

LEGEND

- MONITOR BORES CURRENTLY SAMPLED (FROM JAN 2010)
- BORES NOT SAMPLED
- SHALLOW HANDAUGER STANDPIPES NOT ABLE TO BE LOCATED
- SOIL SAMPLING LOCATION PEG - MONITORED
- SOIL SAMPLING LOCATION PEG - NOT MONITORED
- EXISTING STORMWATER SOAKAGE AREA
- PROPOSED STORMWATER SOAKAGE AREA
- PROPOSED BORROW AREAS

NOT FOR CONSTRUCTION

REV	REVISIONS	BCJ DRN	PSL CHK	PSL APP	26.08.19 DATE
A	FOR INFORMATION				

SURVEYED	MWH	
DESIGNED	N/A	-
DRAWN	Brent James	08.2019
CAD REVIEW	Brent James	26.08.19
APPROVED	Phil Landmark	26.08.19
PROF REGISTRATION:		

Stantec

Client:

HOROWHENUA DISTRICT COUNCIL
LEVIN LANDFILL

MONITORING BORES, SOIL SAMPLING LOCATIONS & BORROW AREAS
SITE PLAN, LOCATION AND DETAILS

Status Stamp: **FOR INFORMATION ONLY**
Date Stamp: **26.08.19**
Scales: 1:2000 (A1) 1:4000 (A3)
Drawing No.: 310101088-19-001-G001
Rev.: A

26/08/2019 9:35 a.m.

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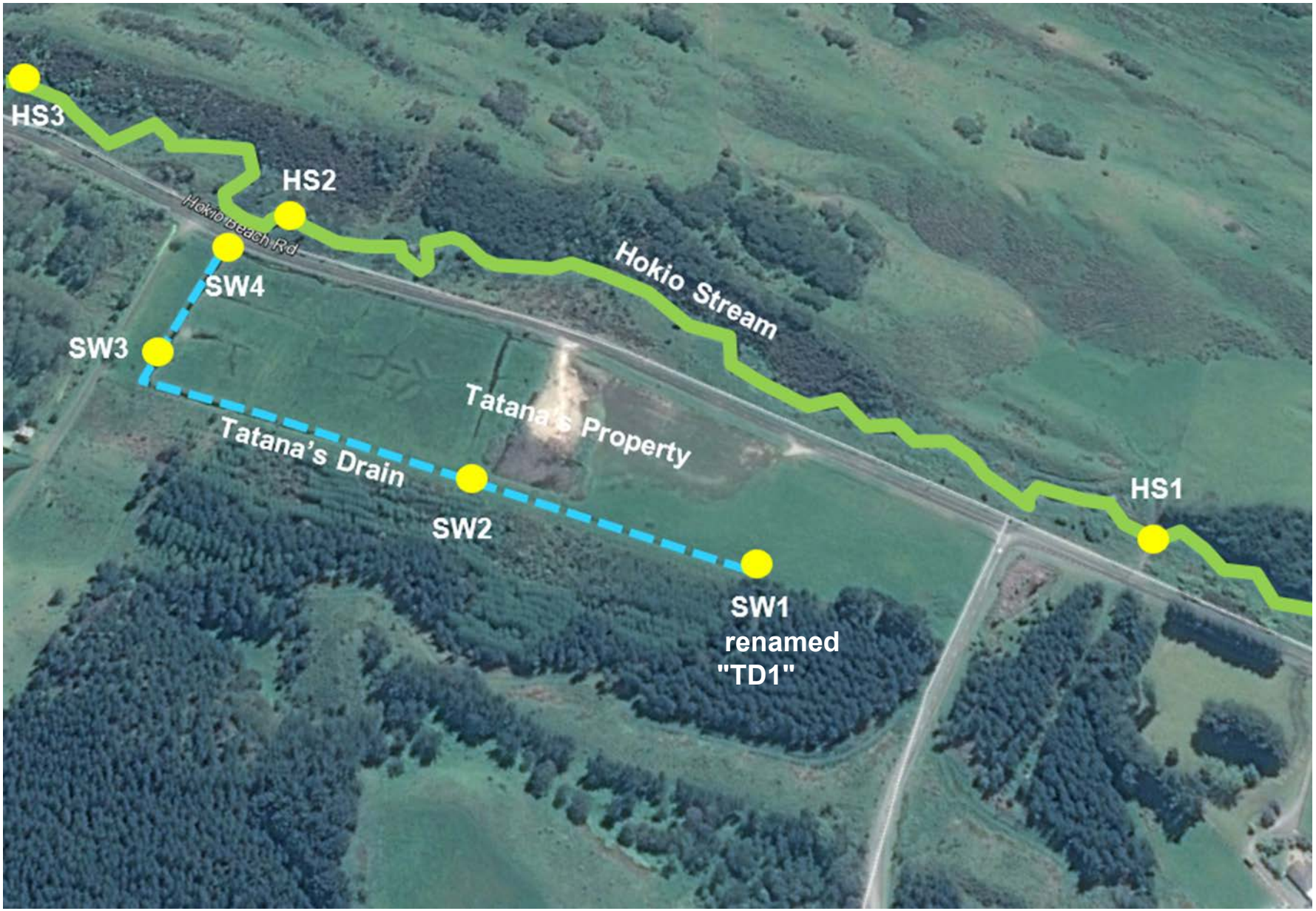

Hokio Stream (“HS”) and Tatana’s Property Drain (“SW”) Monitoring Locations

Appendix B Sampling Schedule

LEVIN LANDFILL - SUMMARY OF SURFACE AND GROUNDWATER MONITORING REQUIREMENTS (April 2020 - January 2023).

(The testing regime is based on Consent Conditions following the completion of the 2015 Resource Consent Review process).

Reports Due		Sampling Month	Table A (Condition 3, DP 6010)					Table B (Condition 3, DP 6010)																			Table C (Condition 3, DP 6010)					
			Deep Aquifer Bores					Shallow Aquifer Bores																	Irrigation Bores				Hokio Stream[4]				Tatana Drain	Leachate Pond[5]	
Annual	Quarterly		C2dd	E1d	E2d	G1d	Xd1[1]	C1	C2	C2ds	D4	B1	B2	B3s	E1s	E2s	D1[2]	D2[2]	D3r[2]	D6[2]	G1s	G2s	Xs1[1]	Xs2[1]	D5[3]	F1[3]	F2[3]	F3[3]	HS1	HS1A	HS2	HS3	TD1		
	May-20	Apr-20	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A					C	Monthly Comprehensive for 2 Years	A
Sep-20	Aug-20	Jul-20	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW	Monthly Comprehensive for 2 Years	Monthly Comprehensive for 2 Years	Monthly Comprehensive for 2 Years	Monthly Comprehensive for 2 Years	I		
	Nov-20	Oct-20	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW					C		A
	Feb-21	Jan-21	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW					I		
	May-21	Apr-21	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A					C		A
Sep-21	Aug-21	Jul-21	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW					I		
	Nov-21	Oct-21	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW					C		A
	Feb-22	Jan-22	I	I + SW	I	I	C	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	C	C	I	I	I	I + SW					I		
	May-22	Apr-22	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	C + A	Discontinue after 2 years	C	C	C	C	C + A	
Sep-22	Aug-22	Jul-22	I	I + SW	I	I	I	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	I	I	I	I	I	I + SW		I	I	I	I	I	
	Nov-22	Oct-22	I	I + SW	I	I	I	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	I	I	I	I	I	I + SW		C	C	C	C	C	
	Feb-23	Jan-23	I	I + SW	I	I	I	I	I	I	I + SW	I	I	I	I + SW	I + SW	I	I + SW	I + SW	I	I + SW	I	I	I	I	I	I	I + SW		I	I	I	I	I	
			Measure groundwater level and sample all bores for CH_4, CO_2 and O_2 each time that groundwater is sampled (Condition 4a of DP 6011)																																

Notes:

(1) Bores to be developed by Consent Holder
(2) See table below
(3) If irrigation re-commences then the annual sampling is to change from comprehensive + 3 times indicator to bi-annual comprehensive + indicator (Clause D of Condition 3, DP 6010) .
(4) See table below
(5) See table below
C Comprehensive list (see below)
I Indicator list (see below)
A Pesticide and SVOC analysis
SW Add sodium and iron analysis (for stormwater consent 102559)

A reduction in sampling frequency at any **groundwater monitoring point** is conditional on (Clauses A - D of Condition 3, DP 6010):

A. Completion of the initial monitoring program;
B. Good consistency of groundwater sample analysis results, or a clearly identified reason for inconsistent results that excludes the contaminant source being landfill operations, stored waste or leachate;
C. No decline in groundwater quality as determined from indicator parameter trends over a period of four consecutive sampling rounds;
D. If a well being monitored on a conditional frequency becomes non-compliant with condition C, the monitoring frequency for that well should return to the initial monitoring frequency until conditions B and C are again being fulfilled.

(2) If site management planning indicates any **early detection monitoring well** is likely to become buried or otherwise destroyed within the following year as a result of normal operations (Clauses E - H, Condition 3, DP 6010):

E. This must be communicated to the regional council;
F. A replacement well is to be constructed in a position agreed upon with Horizons Regional Council
G. The replacement well should be installed in a position suitable to act as a early detection well and be classed as an early detection well;
H. The replacement well should be constructed as a nested well (or two separate wells) with screens positioned in both shallow and deep aquifers.

(4) A reduction in sampling frequency at the **Hokio Stream monitoring locations (HS1A, HS2 and HS3)** is conditional on (Clauses I - L, Condition 3 of DP 6010):

I. No signficant increases in the concentrations between monitoring sites HS1A and HS3, for parameters exceeding the trigger values contained in Table C1 at Site HS3.
J. A statistical analysis approach is to be used to determine if there is a significant increase in contaminant levels between HS1A and HS3.
K. Following the 24 month monitoring period, there shall be no significant increases in concentrations between monitoring sites HS1A and HS3.
L. If the Hokio Stream monitoring locations are being sampled on a conditional frequency and do not meet condition K, the monitoring frequency for all three monitoring locations (HS1A, HS2 and HS3) shall return to the base case intensive monitoring until conditions J and K are again being fulfilled.

(5) A reduction in sampling frequency at the **leachate pond outlet** is conditional on (Clauses M - P, Condition 3, DP 6010):

M. Completion of the initial 2 year monitoring program;
N. Good consistency of water sample analysis results, or a clearly identified reason for inconsistent results;
O. No decline in water quality over a period of four consecutive sampling rounds;
P. If the leachate pond outlet is being sampled on a conditional frequency and becomes non-compliant with condition O, the monitoring frequency should return to the base case intensive monitoring until conditions N and O are again being fulfilled.

COMPREHENSIVE PARAMETER LIST (Table E of Condition 3, DP 6010)

Characterising parameters	pH
	electrical conductivity (EC)
	alkalinity
	total hardness
	suspended solids
Oxygen demand	COD and $scBOD_5$
Nutrients*	NO3-N, NH4-N, DRP and SO_4
Metals*	Al, As, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Zn and Hg
Other elements	B, Ca, Cl, K and Na
Organics	Total organic carbon, total phenols, volatile acids
Biological	E. coli

* Analyses performed for nutrients and metals are for dissolved rather than total concentrations

INDICATOR PARAMETER LIST (Table F, Condition 3, DP 6010)

Characterising parameters	pH
	electrical conductivity (EC)
Oxygen demand	COD and $scBOD_5$
Nutrients*	NO3-N and NH4-N
Metals*	AL, Mn, Ni, Pb and Hg
Other elements	B and Cl
Biological+	E. coli

* Analyses performed for nutrients and metals are for dissolved rather than total concentrations

+ E. coli added from April 2019 sampling onwards

Appendix C Analytical Results

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Eurofins ELS Limited

Analytical Report

Downer EDI Levin - Landfill
P O Box 642
LEVIN 5540
Attention: Bruce Marshall

Report Number: 19/57885
Issue: 1
27 January 2020

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-01	Levin Landfill quarterly SW5		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148266-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.8		15/01/2020	Jennifer Mont KTP
0002	Suspended Solids - Total	18	g/m³	15/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	116	mS/m	15/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	62	g/m³	15/01/2020	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	11.0	g/m³	15/01/2020	Marylou Cabral KTP
0085	BOD5 - Total	12	g/m³	22/01/2020	Gordon McArthur KTP
0602	Chloride	98.7	g/m³	17/01/2020	Amit Kumar KTP
0603	Nitrite - Nitrogen	0.17	g/m³	17/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.41	g/m³	17/01/2020	Amit Kumar KTP
0719	Ammonia Nitrogen	8.9	g/m³	17/01/2020	Divina Lagazon KTP
2127	Total Nitrogen	10.8	g/m³	21/01/2020	Athena Cao
6717	Iron - Dissolved	0.21	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	1.12	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	250	cfu/100ml	15/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		15/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-02	Levin Landfill quarterly SW4		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148265-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	8.0		15/01/2020	Jennifer Mont KTP
0002	Suspended Solids - Total	50	g/m³	15/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	103	mS/m	15/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	117	g/m³	15/01/2020	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	12.1	g/m³	15/01/2020	Marylou Cabral KTP
0085	BOD5 - Total	22	g/m³	16/01/2020	Gordon McArthur KTP
0602	Chloride	97.9	g/m³	17/01/2020	Amit Kumar KTP
0603	Nitrite - Nitrogen	0.20	g/m³	17/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	1.02	g/m³	17/01/2020	Amit Kumar KTP
0719	Ammonia Nitrogen	6.5	g/m³	17/01/2020	Divina Lagazon KTP
2127	Total Nitrogen	11.4	g/m³	21/01/2020	Athena Cao
6717	Iron - Dissolved	0.19	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.834	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	4,600	cfu/100ml	15/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		15/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-03	Levin Landfill quarterly SW3		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148264-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.7		15/01/2020	Jennifer Mont KTP
0002	Suspended Solids - Total	14	g/m³	15/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	91.1	mS/m	15/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	92	g/m³	15/01/2020	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	14.4	g/m³	15/01/2020	Marylou Cabral KTP
0085	BOD5 - Total	21	g/m³	16/01/2020	Gordon McArthur KTP
0602	Chloride	101	g/m³	17/01/2020	Amit Kumar KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-03	Levin Landfill quarterly SW3		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148264-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0603	Nitrite - Nitrogen	0.59	g/m³	17/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	5.99	g/m³	17/01/2020	Amit Kumar KTP
0719	Ammonia Nitrogen	10.9	g/m³	17/01/2020	Divina Lagazon KTP
2127	Total Nitrogen	18.8	g/m³	21/01/2020	Athena Cao
6717	Iron - Dissolved	0.26	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.179	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	380	cfu/100ml	15/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		15/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-04	Levin Landfill quarterly SW2		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148263-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.6		15/01/2020	Jennifer Mont KTP
0002	Suspended Solids - Total	383	g/m³	15/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	176	mS/m	15/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	393	g/m³	15/01/2020	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	62.6	g/m³	15/01/2020	Marylou Cabral KTP
0085	BOD5 - Total	191	g/m³	16/01/2020	Gordon McArthur KTP
0602	Chloride	174	g/m³	17/01/2020	Amit Kumar KTP
0603	Nitrite - Nitrogen	0.53	g/m³	17/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	1.96	g/m³	21/01/2020	Shanel Kumar KTP
0719	Ammonia Nitrogen	50.1	g/m³	17/01/2020	Divina Lagazon KTP
2127	Total Nitrogen	60.3	g/m³	21/01/2020	Athena Cao
6717	Iron - Dissolved	0.43	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.879	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	71,800	cfu/100ml	16/01/2020	Yuemei Yu KTP
P1859	Sample Filtration	Completed		17/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-05	Levin Landfill quarterly SW1		14/01/2020 00:00	15/01/2020 10:02	0

Notes: 148262-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.4		15/01/2020	Jennifer Mont KTP
0002	Suspended Solids - Total	536	g/m³	15/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	261	mS/m	15/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	346	g/m³	15/01/2020	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	111	g/m³	15/01/2020	Marylou Cabral KTP
0085	BOD5 - Total	56	g/m³	16/01/2020	Gordon McArthur KTP
0602	Chloride	215	g/m³	17/01/2020	Amit Kumar KTP
0603	Nitrite - Nitrogen	0.15	g/m³	17/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	3.08	g/m³	17/01/2020	Amit Kumar KTP
0719	Ammonia Nitrogen	100	g/m³	17/01/2020	Divina Lagazon KTP
2127	Total Nitrogen	100	g/m³	21/01/2020	Athena Cao
6717	Iron - Dissolved	0.30	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.998	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	200	cfu/100ml	15/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		15/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-06	Levin HS2		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148258-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.8		14/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	25.7	mS/m	14/01/2020	Marylou Cabral KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-06	Levin HS2		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148258-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0081	Chemical Oxygen Demand	48	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	25.2	g/m³	15/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.30	g/m³	15/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.16	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.023	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.05	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0424	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	17.4	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	650	cfu/100ml	14/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-07	Levin HS3		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148257-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.7		14/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	25.9	mS/m	14/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	53	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	25.5	g/m³	15/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.31	g/m³	15/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.18	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.014	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.04	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0475	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	18.5	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	580	cfu/100ml	14/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-08	Levin HS1		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148256-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.8		14/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	24.9	mS/m	14/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	51	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	24.7	g/m³	16/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.30	g/m³	16/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.12	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.021	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.05	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0404	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	18.0	g/m³	16/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	810	cfu/100ml	14/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-09	Levin G2s		08/01/2020 00:00	08/01/2020 14:20	0

Notes: 148255-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	6.9		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	267	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	69	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	616	g/m³	15/01/2020	Shanel Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	15/01/2020	Shanel Kumar KTP
0760	Ammonia Nitrogen	0.02	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	1.15	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.08	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.416	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0038	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	281	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	08/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		08/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-10	Levin G1D		08/01/2020 00:00	08/01/2020 14:20	0

Notes: 148254-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.2		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	28.0	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	< 15	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	31.5	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.09	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.70	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0645	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	32.0	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	08/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		08/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-11	Levin G1S		08/01/2020 00:00	08/01/2020 14:20	0

Notes: 148253-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	6.6		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	81.6	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	107	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	156	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.05	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.04	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.113	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	< 0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	4.62	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	0.0006	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.136	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0020	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	117	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	08/01/2020	Juana Tamayo KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-11	Levin G1S		08/01/2020 00:00	08/01/2020 14:20	0

Notes: 148253-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-12	Levin F3		08/01/2020 00:00	09/01/2020 09:14	0

Notes: 148252-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.5		09/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	18.4	mS/m	09/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	< 15	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	14.7	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	1.19	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	< 0.01	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	20.6	g/m³	10/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-13	Levin F2		08/01/2020 00:00	09/01/2020 09:14	0

Notes: 148251-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.5		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	22.2	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	< 15	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	22.7	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.55	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	< 0.01	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.04	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	< 0.01	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0050	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	24.7	g/m³	10/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-14	Levin F1		08/01/2020 00:00	09/01/2020 09:14	0

Notes: 148250-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.8		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	43.4	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	< 15	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	51.0	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	1.47	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	< 0.01	g/m³	10/01/2020	Shanel Kumar KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-14	Levin F1		08/01/2020 00:00	09/01/2020 09:14	0

Notes: 148250-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0028	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	38.4	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-15	Levin E2s		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148249-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.9		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	44.5	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	27	g/m³	13/01/2020	Marylou Cabral KTP
0602	Chloride	41.8	g/m³	10/01/2020	Divina Lagazon KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
0760	Ammonia Nitrogen	0.25	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	14/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.04	g/m³	14/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.03	g/m³	14/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.389	g/m³	14/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	42.7	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-16	Levin E2d		09/01/2020 00:00	09/01/2020 14:14	0

Notes: 148248-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	8.0		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	34.6	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	20	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	45.0	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.29	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	< 0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.07	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.232	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	30.0	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-17	Levin E1s		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148247-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.1		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	26.6	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	19	g/m³	13/01/2020	Marylou Cabral KTP
0602	Chloride	29.7	g/m³	10/01/2020	Divina Lagazon KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-17	Levin E1s		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148247-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0605	Nitrate - Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
0760	Ammonia Nitrogen	0.16	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.006	g/m³	14/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	< 0.03	g/m³	14/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	4.22	g/m³	14/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.219	g/m³	14/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	25.8	g/m³	14/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-18	Levin E1d		09/01/2020 00:00	09/01/2020 14:14	0

Notes: 148246-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.9		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	45.8	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	< 15	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	38.2	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.19	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.003	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.06	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.05	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.274	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	37.2	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-19	Levin D6		09/01/2020 00:00	10/01/2020 09:18	0

Notes: 148245-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.1		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	29.1	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	< 15	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	14.2	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	11.1	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	< 0.01	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	26.7	g/m³	10/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-20	Levin D5		08/01/2020 00:00	09/01/2020 09:14	0

Notes: 148244-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.9		09/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	29.4	mS/m	09/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	< 15	g/m³	09/01/2020	Gordon McArthur KTP
0602	Chloride	30.0	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	1.34	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.01	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.06	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0148	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	29.4	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-21	Levin D4		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148243-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.7		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	31.5	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	< 15	g/m³	13/01/2020	Marylou Cabral KTP
0602	Chloride	49.2	g/m³	10/01/2020	Divina Lagazon KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
0760	Ammonia Nitrogen	0.21	g/m³	10/01/2020	Divina Lagazon KTP
1819	Iron - Dissolved	0.831	g/m³	14/01/2020	Shanel Kumar KTP
1834	Sodium - Dissolved	31.4	g/m³	14/01/2020	Shanel Kumar KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	14/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	< 0.03	g/m³	14/01/2020	Shanel Kumar KTP
6717	~~Iron - Dissolved~~	~~0.83~~	g/m³	14/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.175	g/m³	14/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6731	~~Sodium - Dissolved~~	~~32.0~~	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-22	Levin D3r		09/01/2020 00:00	10/01/2020 09:18	0

Notes: 148242-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.2		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	22.0	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	18	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	22.0	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.29	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.17	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.03	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	2.95	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.193	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-22	Levin D3r		09/01/2020 00:00	10/01/2020 09:18	0

Notes: 148242-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
6731	Sodium - Dissolved	25.1	g/m³	10/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-23	Levin D2		09/01/2020 00:00	10/01/2020 09:18	0

Notes: 148241-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	6.8		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	31.1	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	36	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	32.9	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.10	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.43	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.026	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	14.9	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	0.0014	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.332	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	26.0	g/m³	10/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-24	Levin D1		09/01/2020 00:00	10/01/2020 09:18	0

Notes: 148240-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.6		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	46.6	mS/m	10/01/2020	Gordon McArthur KTP
0081	Chemical Oxygen Demand	< 15	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	30.3	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	10.6	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	< 0.01	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.009	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.05	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.02	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0050	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	39.4	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-25	Levin C2ds		13/01/2020 00:00	13/01/2020 16:40	0

Notes: 148239-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	6.7		13/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	182	mS/m	13/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	97	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	124	g/m³	16/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.10	g/m³	16/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	1.71	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.010	g/m³	16/01/2020	Shanel Kumar KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-25	Levin C2ds		13/01/2020 00:00	13/01/2020 16:40	0

Notes: 148239-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
6707	Boron - Dissolved	0.52	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	20.2	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	2.93	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0026	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	108	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	14/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-26	Levin C2dd		09/01/2020 00:00	09/01/2020 14:14	0

Notes: 148238-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	8.0		09/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	55.2	mS/m	09/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	< 15	g/m³	10/01/2020	Gordon McArthur KTP
0602	Chloride	41.0	g/m³	09/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	09/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.33	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	< 0.002	g/m³	10/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.07	g/m³	10/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.04	g/m³	10/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.701	g/m³	10/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	< 0.0005	g/m³	10/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	39.4	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	09/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		09/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-27	Levin C2		13/01/2020 00:00	13/01/2020 16:40	0

Notes: 148237-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	6.9		13/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	372	mS/m	13/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	157	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	524	g/m³	15/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	15/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	181	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.024	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	1.64	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.48	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.0820	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0052	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	256	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	8	cfu/100ml	14/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-28	Levin C1		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148236-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.0		10/01/2020	Gordon McArthur KTP
0055	Conductivity at 25°C	143	mS/m	10/01/2020	Gordon McArthur KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-28	Levin C1		10/01/2020 00:00	10/01/2020 14:35	0

Notes: 148236-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0081	Chemical Oxygen Demand	76	g/m³	13/01/2020	Marylou Cabral KTP
0602	Chloride	252	g/m³	13/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 0.01	g/m³	13/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	0.41	g/m³	10/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.005	g/m³	14/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.47	g/m³	14/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	3.35	g/m³	14/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	14/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	0.323	g/m³	14/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0009	g/m³	14/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	157	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	10/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		10/01/2020	Daniel Fitzpatrick

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-29	Levin B3s		13/01/2020 00:00	13/01/2020 16:40	0

Notes: 148235-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.0		13/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	254	mS/m	13/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	150	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	172	g/m³	16/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	0.02	g/m³	16/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	140	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.005	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.80	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	1.40	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	3.86	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0106	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	129	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	< 4	cfu/100ml	14/01/2020	Sunita Raju KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-30	Levin B2		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148234-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.1		14/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	176	mS/m	14/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	84	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	94.7	g/m³	16/01/2020	Shanel Kumar KTP
0605	Nitrate - Nitrogen	44.2	g/m³	16/01/2020	Shanel Kumar KTP
0760	Ammonia Nitrogen	43.8	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.011	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	1.02	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	1.34	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	3.43	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0021	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	99.6	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	4	cfu/100ml	14/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-31	Levin Leachate Pond		13/01/2020 00:00	13/01/2020 16:40	0

Notes: 148233-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.7		13/01/2020	Jennifer Mont KTP
0055	Conductivity at 25°C	1,430	mS/m	13/01/2020	Jennifer Mont KTP
0081	Chemical Oxygen Demand	2,220	g/m³	15/01/2020	Marylou Cabral KTP
0602	Chloride	1,010	g/m³	16/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	< 1.00	g/m³	16/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	1,270	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.506	g/m³	17/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	5.97	g/m³	17/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	4.42	g/m³	17/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	0.0017	g/m³	17/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	1.15	g/m³	17/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.107	g/m³	17/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	815	g/m³	17/01/2020	Sharon van Soest KTP
M0102	Faecal Coliforms	12	cfu/100ml	15/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
19/57885-32	Levin B1		14/01/2020 00:00	14/01/2020 14:34	0

Notes: 148232-0 Levin Landfill

	Test	Result	Units	Test Date	Signatory
0001	pH	7.8		14/01/2020	Marylou Cabral KTP
0055	Conductivity at 25°C	167	mS/m	14/01/2020	Marylou Cabral KTP
0081	Chemical Oxygen Demand	69	g/m³	16/01/2020	Marylou Cabral KTP
0602	Chloride	283	g/m³	16/01/2020	Amit Kumar KTP
0605	Nitrate - Nitrogen	8.16	g/m³	16/01/2020	Amit Kumar KTP
0760	Ammonia Nitrogen	9.79	g/m³	15/01/2020	Divina Lagazon KTP
6701	Aluminium - Dissolved	0.004	g/m³	16/01/2020	Shanel Kumar KTP
6707	Boron - Dissolved	0.53	g/m³	16/01/2020	Shanel Kumar KTP
6717	Iron - Dissolved	0.02	g/m³	16/01/2020	Shanel Kumar KTP
6718	Lead - Dissolved	< 0.0005	g/m³	16/01/2020	Shanel Kumar KTP
6721	Manganese - Dissolved	8.56	g/m³	16/01/2020	Shanel Kumar KTP
6724	Nickel - Dissolved	0.0019	g/m³	16/01/2020	Shanel Kumar KTP
6731	Sodium - Dissolved	132	g/m³	21/01/2020	Shanel Kumar KTP
M0102	Faecal Coliforms	20	cfu/100ml	14/01/2020	Juana Tamayo KTP
P1859	Sample Filtration	Completed		14/01/2020	Ruth Ashton .

Comments:

Sampled by customer using ELS approved containers.

Test Methodology:

Test	Methodology	Detection Limit
pH	Dedicated pH meter following APHA Online Edition Method 4500 H.	0.1
Suspended Solids - Total	APHA Online Edition Method 2540 D	3 g/m³
Conductivity at 25°C	APHA Online Edition Method 2510 B.	0.1 mS/m
Chemical Oxygen Demand	APHA Online Edition Method 5220 D.	15 g/m³
Total Kjeldahl Nitrogen	APHA Online Edition 4500-N(org) B	0.8 g/m³
BOD5 - Total	APHA Online Edition Method 5210 B.	1 g/m³
Chloride	Ion Chromatography following APHA 4110B.	0.02 g/m³
Nitrite - Nitrogen	Ion Chromatography following APHA 4110B.	0.01 g/m³
Nitrate - Nitrogen	Ion Chromatography following APHA 4110B.	0.01 g/m³
Ammonia Nitrogen	Discrete Analyser. In House method based on ISBN 0117516139.	0.01 g/m³
Ammonia Nitrogen	Flow Injection Autoanalyser following APHA Online Edition Method 4500 NH3-H.	0.01 g/m³

Test	Methodology	Detection Limit
Iron - Dissolved	ICP-OES following APHA Online Edition Method 3120 B (modified).	0.005 g/m³
Sodium - Dissolved	ICP-OES following APHA Online Edition Method 3120 B (modified).	0.02 g/m³
Total Nitrogen	Flow Injection Autoanalyser following APHA Online Edition Method 4500-NO3 I. Persulphate digestion follows APHA Online Edition 4500-N C.	0.05 g/m³
Aluminium - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.002 g/m³
Boron - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.03 g/m³
Iron - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.01 g/m³
Lead - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.0005 g/m³
Manganese - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.0005 g/m³
Nickel - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified).	0.0005 g/m³
Sodium - Dissolved	ICP-MS following APHA Online Edition method 3125 (modified)	0.01 g/m³
Faecal Coliforms	APHA 9222D:Online Edition	1 cfu/100ml
Sample Filtration	Sample filtered through 0.45 micron filter following APHA Online Edition Method 3030B.	n/a

Unless otherwise stated, all tests are performed in Wellington.

The laboratory is not responsible for the information provided by the customer which can affect the validity of the results.

"<" means that no analyte was found in the sample at the level of detection shown. Detection limits are based on a clean matrix and may vary according to individual sample.

g/m3 is the equivalent to mg/L and ppm.

Samples will be retained for a period of time, in suitable conditions appropriate to the analyses requested.

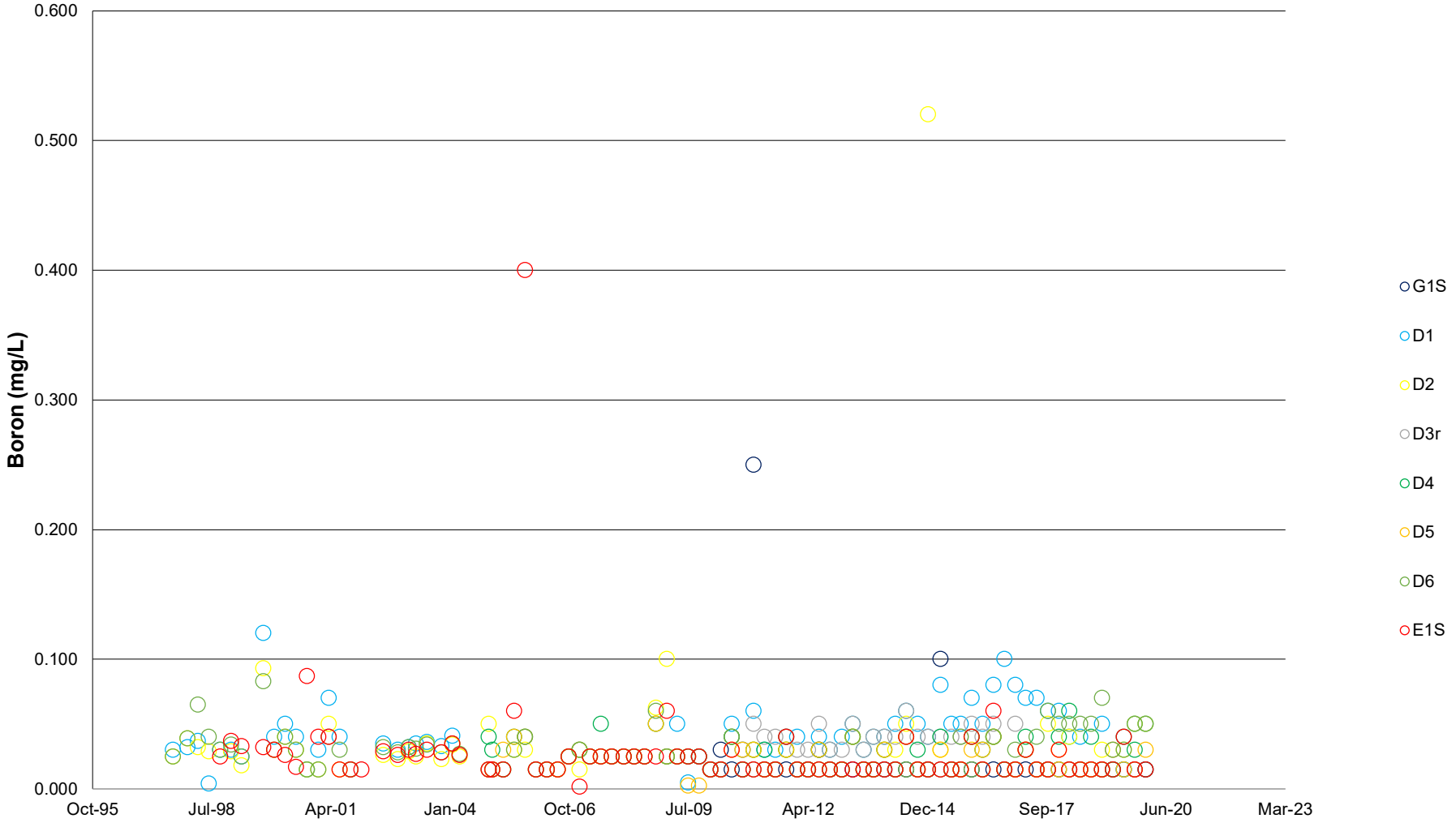
Report Released By

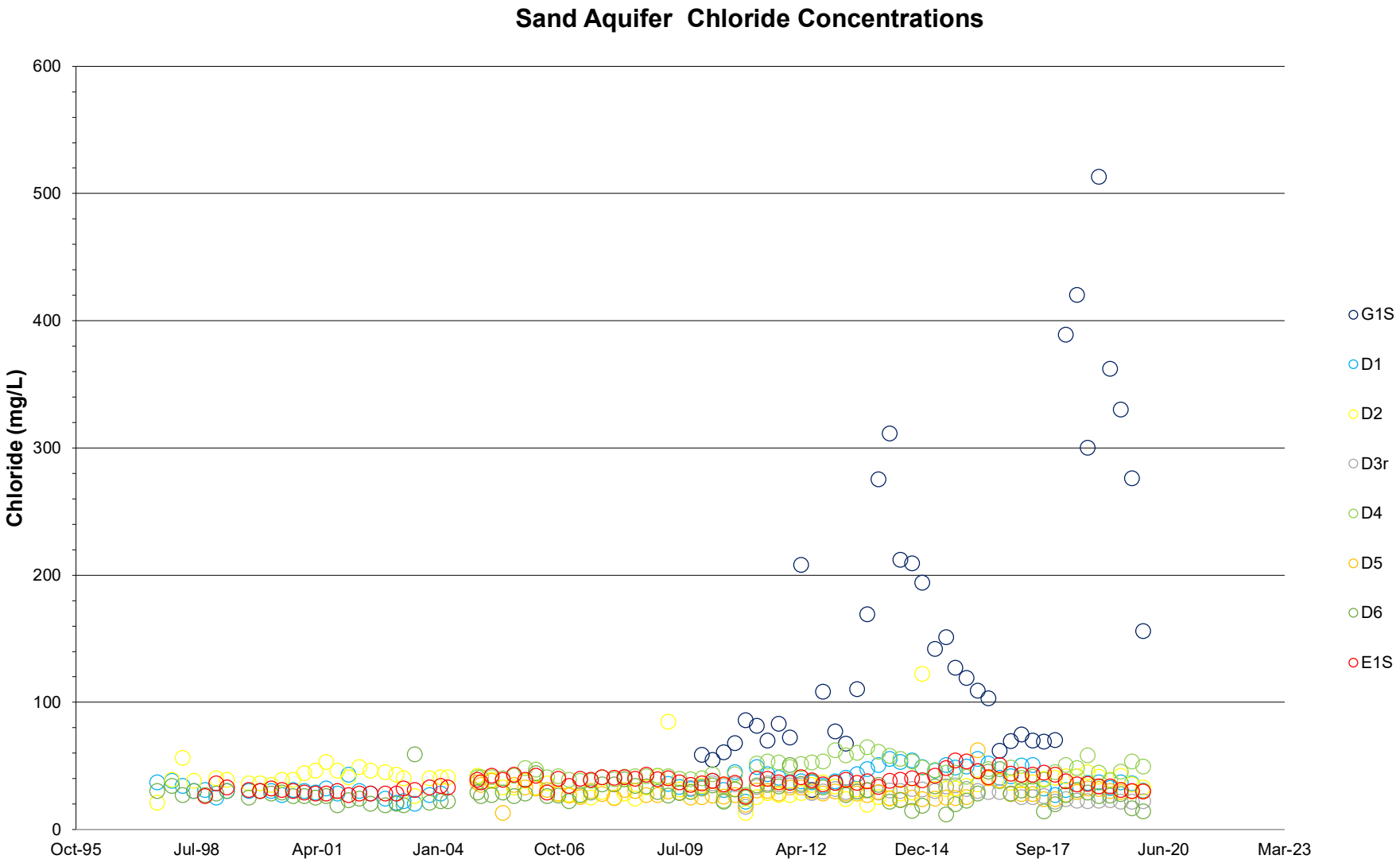
Rob Deacon

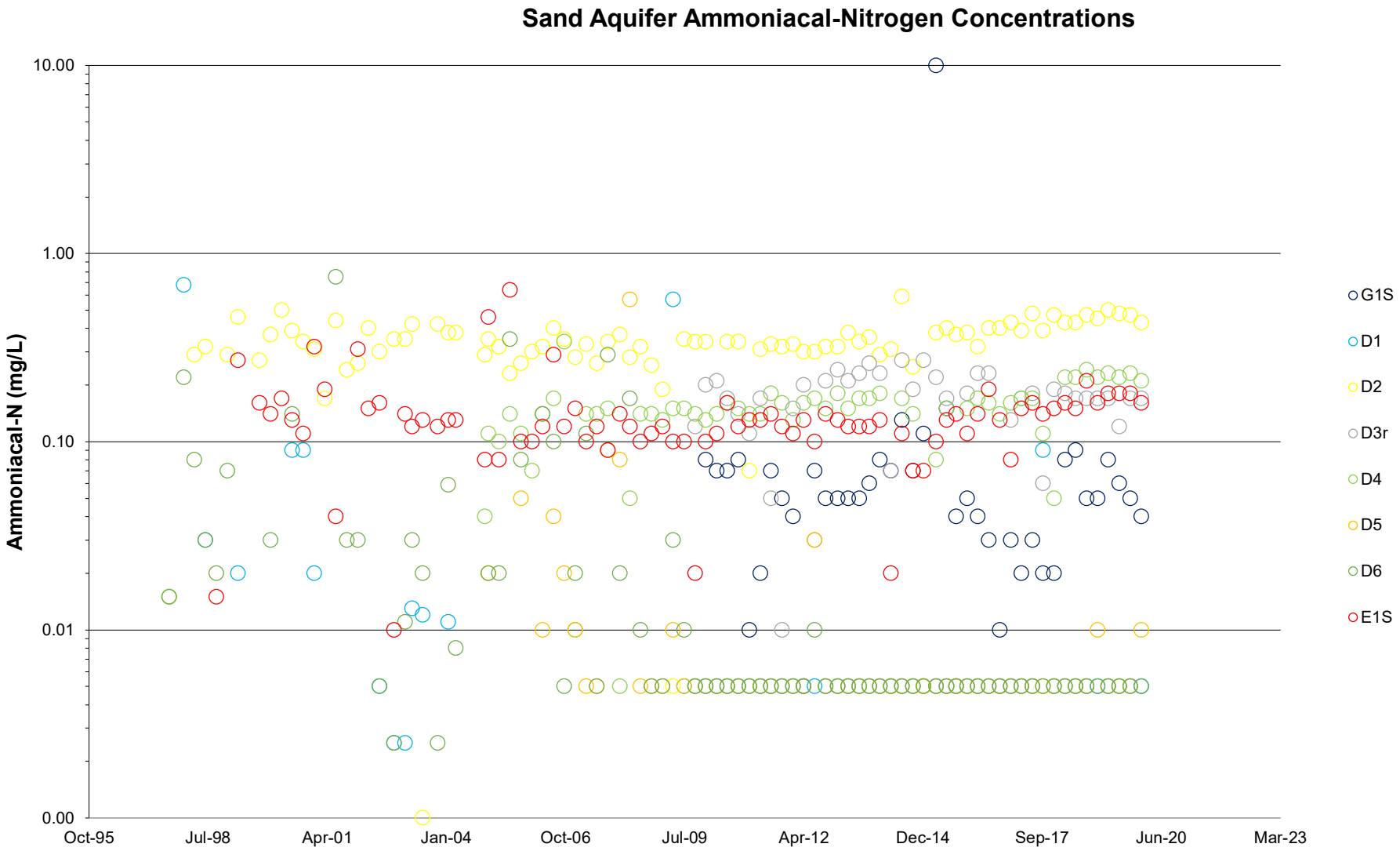
This laboratory is accredited by International Accreditation New Zealand and its reports are recognised in all countries affiliated to the International Laboratory Accreditation Co-operation Mutual Recognition Arrangement (ILAC-MRA). The tests reported have been performed in accordance with our terms of accreditation, with the exception of tests marked "not IANZ", which are outside the scope of this laboratory's accreditation.

Appendix D Historical Result Graphs

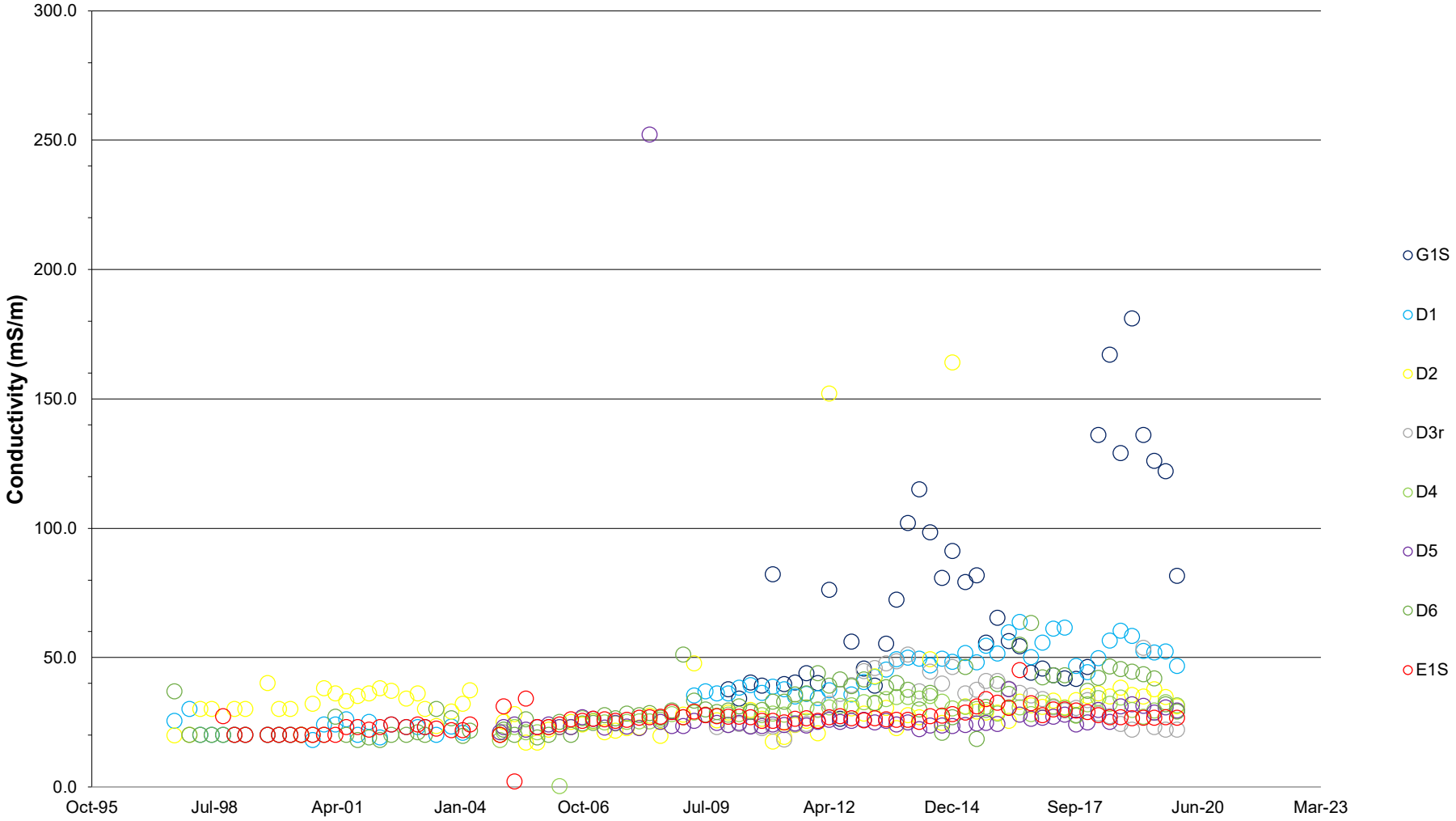
Sand Aquifer Boron Concentrations

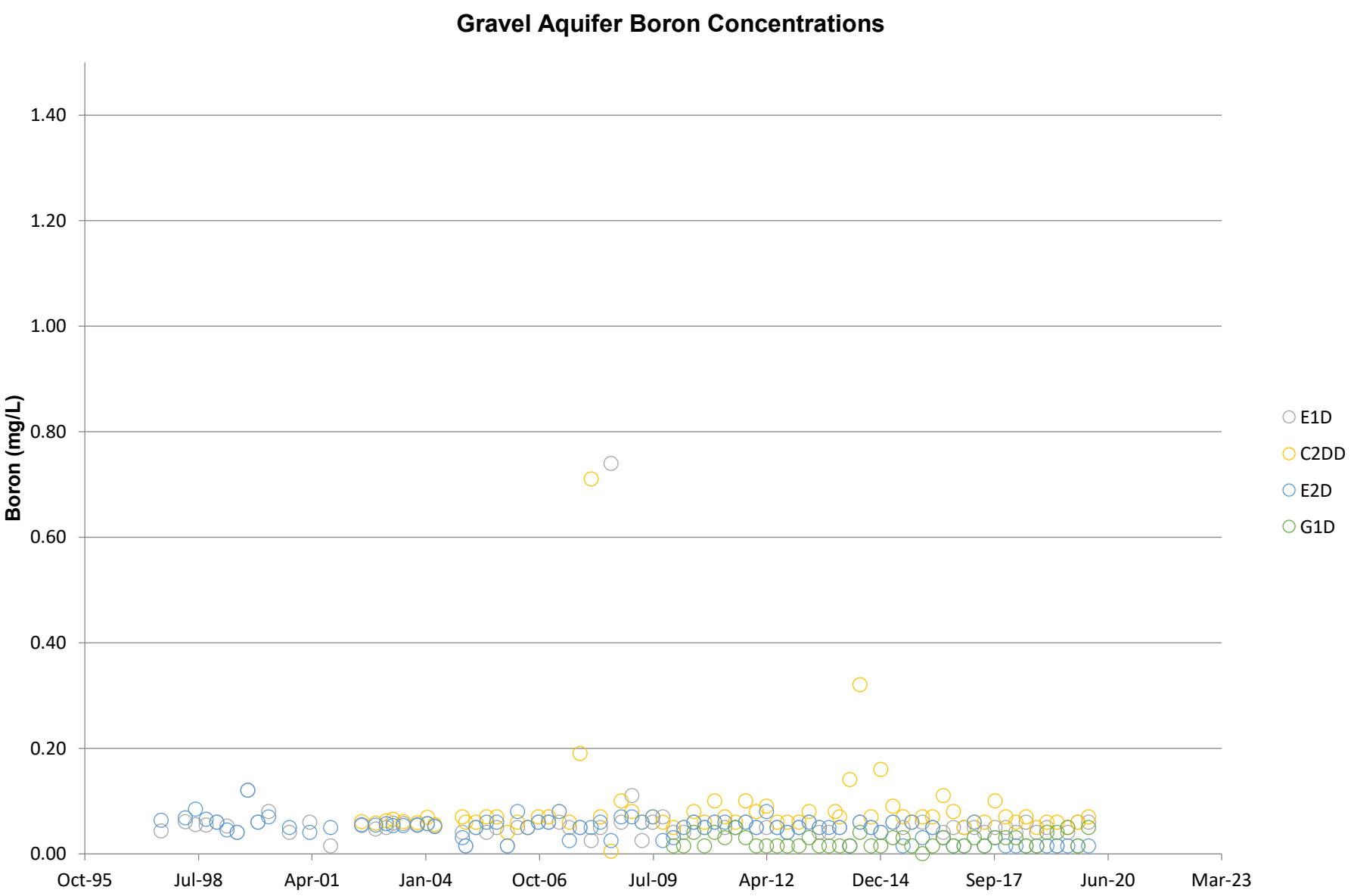


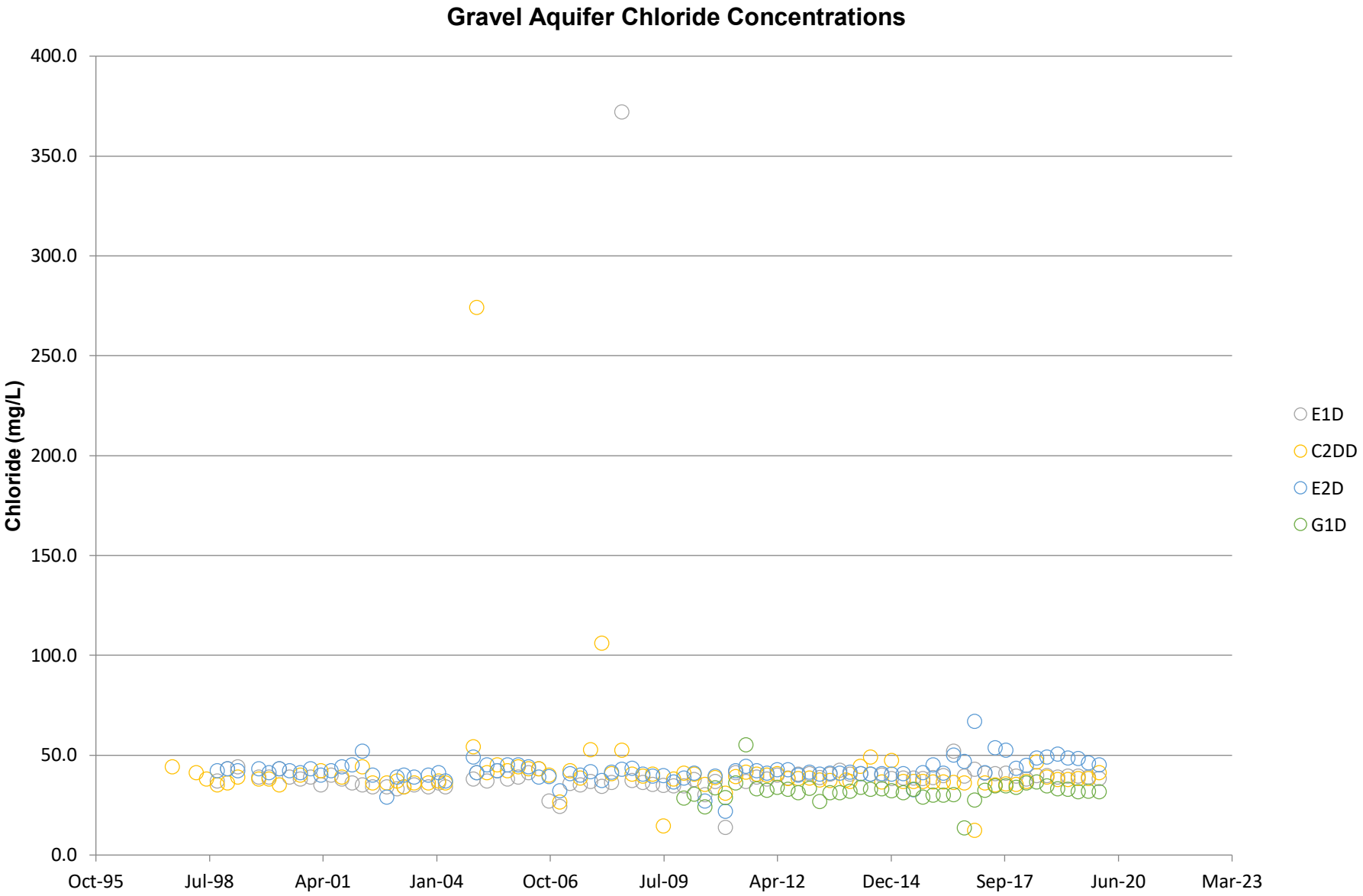

Sand Aquifer Chloride Concentrations
Chloride (mg/L)
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
G1S
D1
D2
D3r
D4
D5
D6
E1S

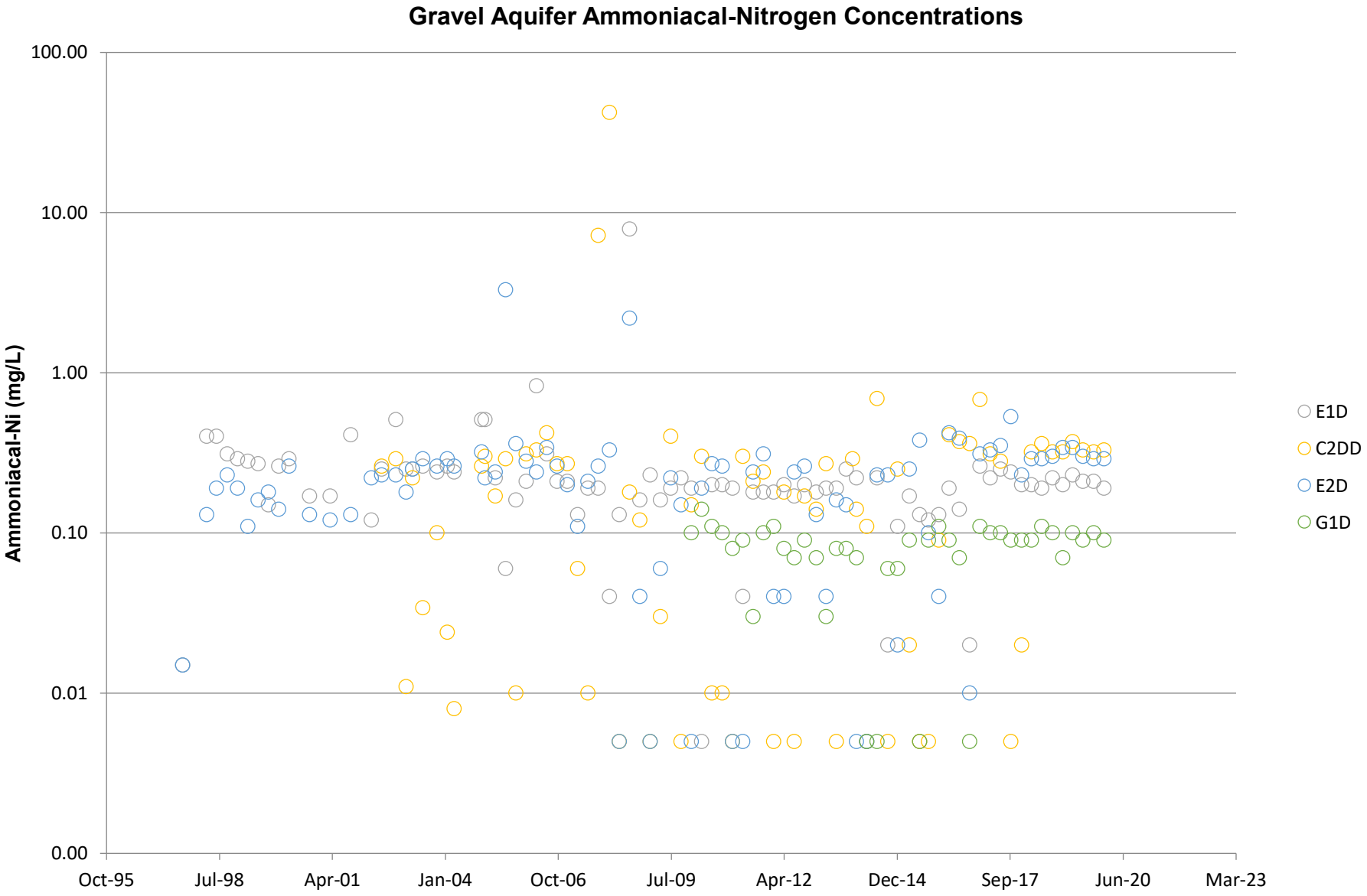

Sand Aquifer Ammoniacal-Nitrogen Concentrations
Ammoniacal-N (mg/L)
10.00
1.00
0.10
0.01
0.00
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
G1S
D1
D2
D3r
D4
D5
D6
E1S

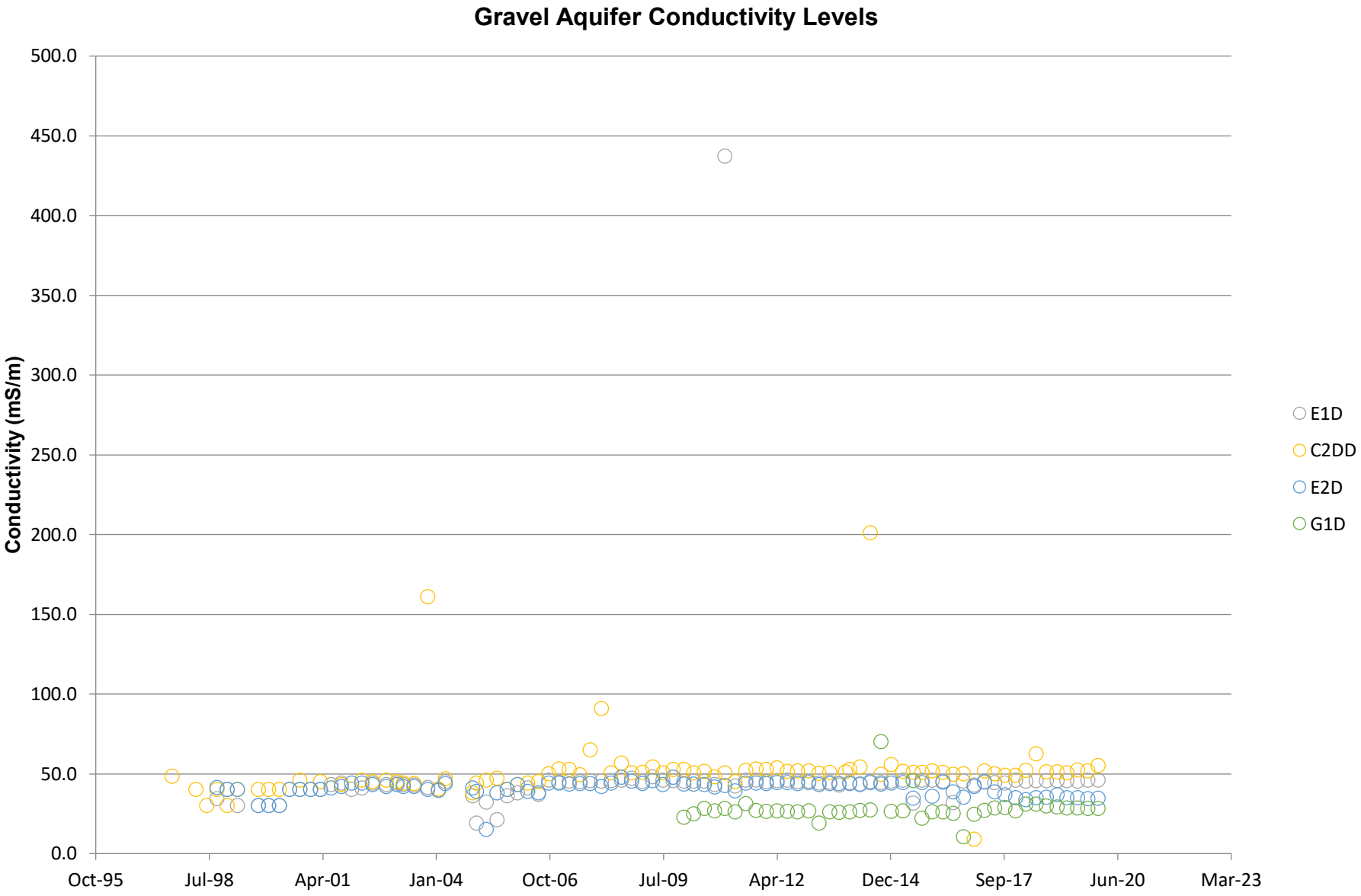
Sand Aquifer Conductivity Levels

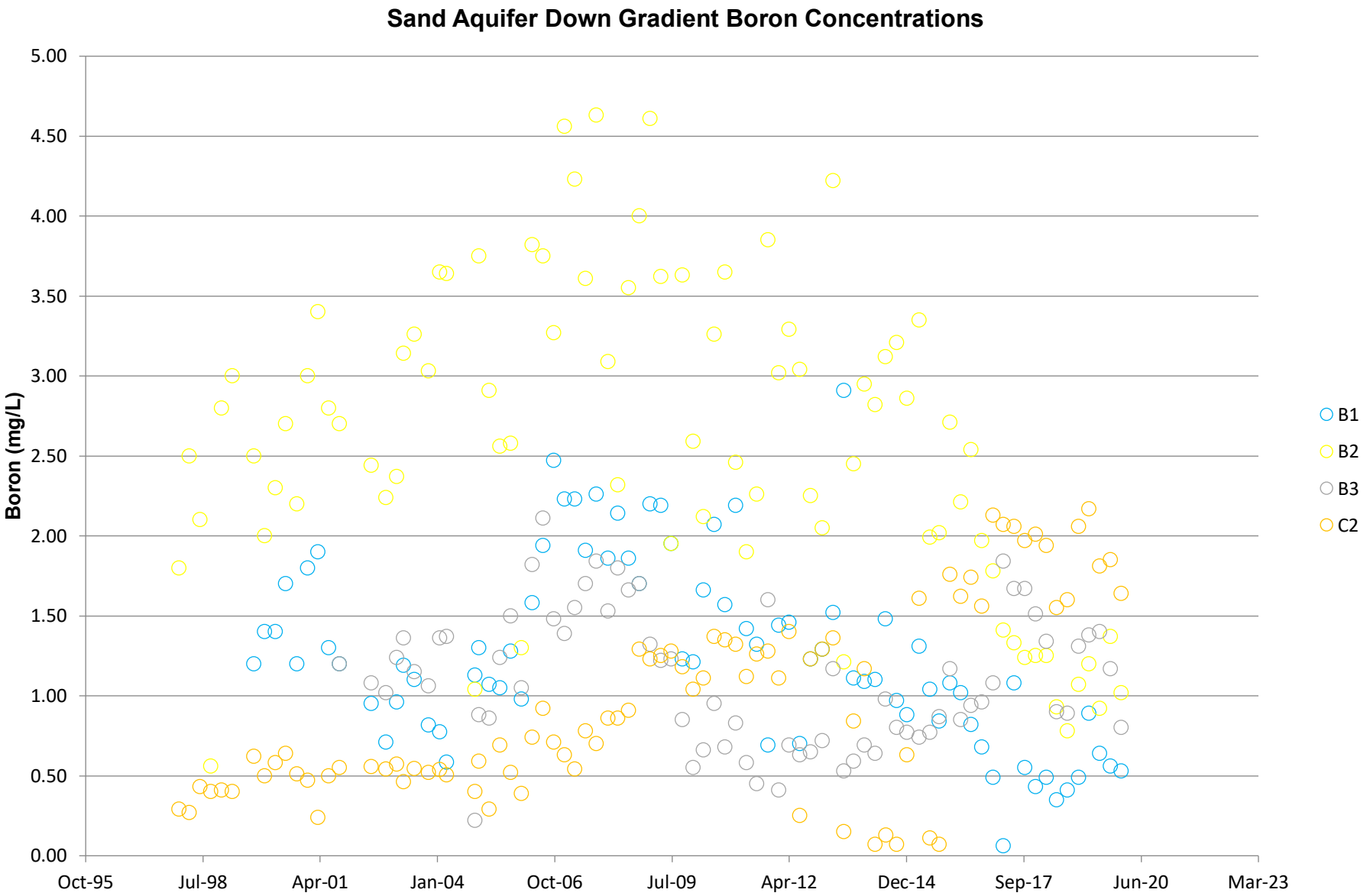


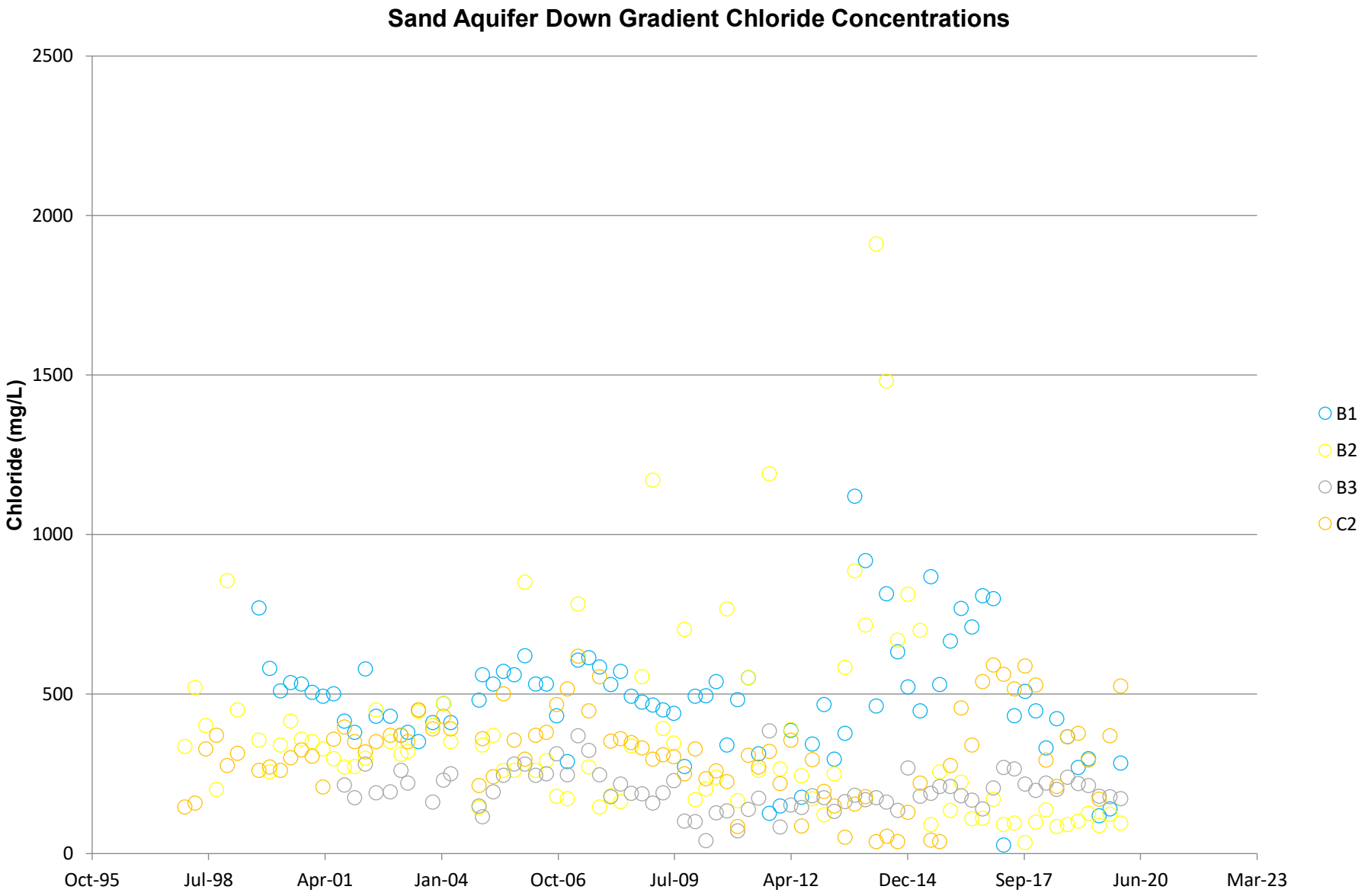

Gravel Aquifer Boron Concentrations
Boron (mg/L)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
E1D
C2DD
E2D
G1D

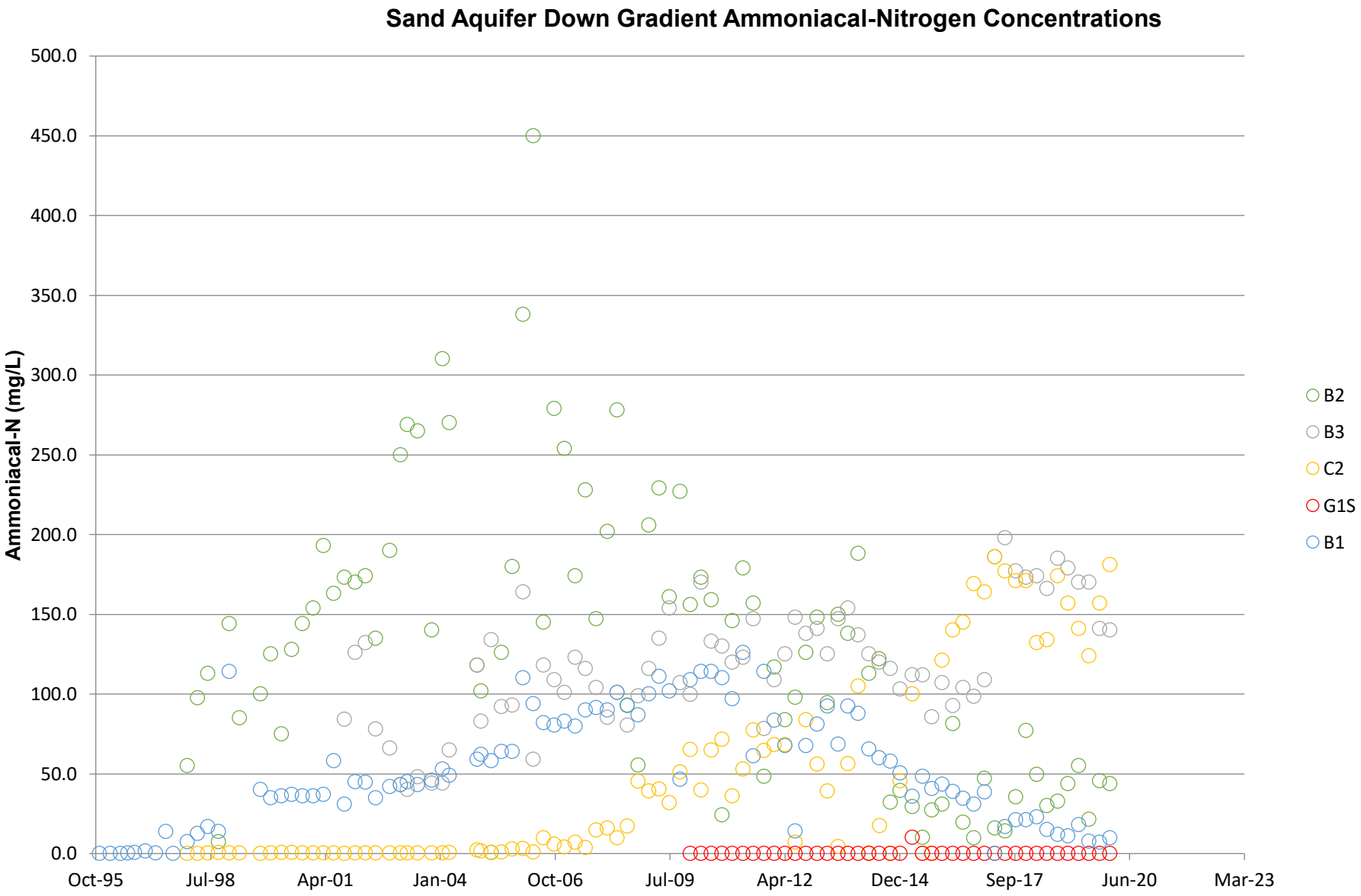

Gravel Aquifer Chloride Concentrations
Chloride (mg/L)
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
E1D
C2DD
E2D
G1D

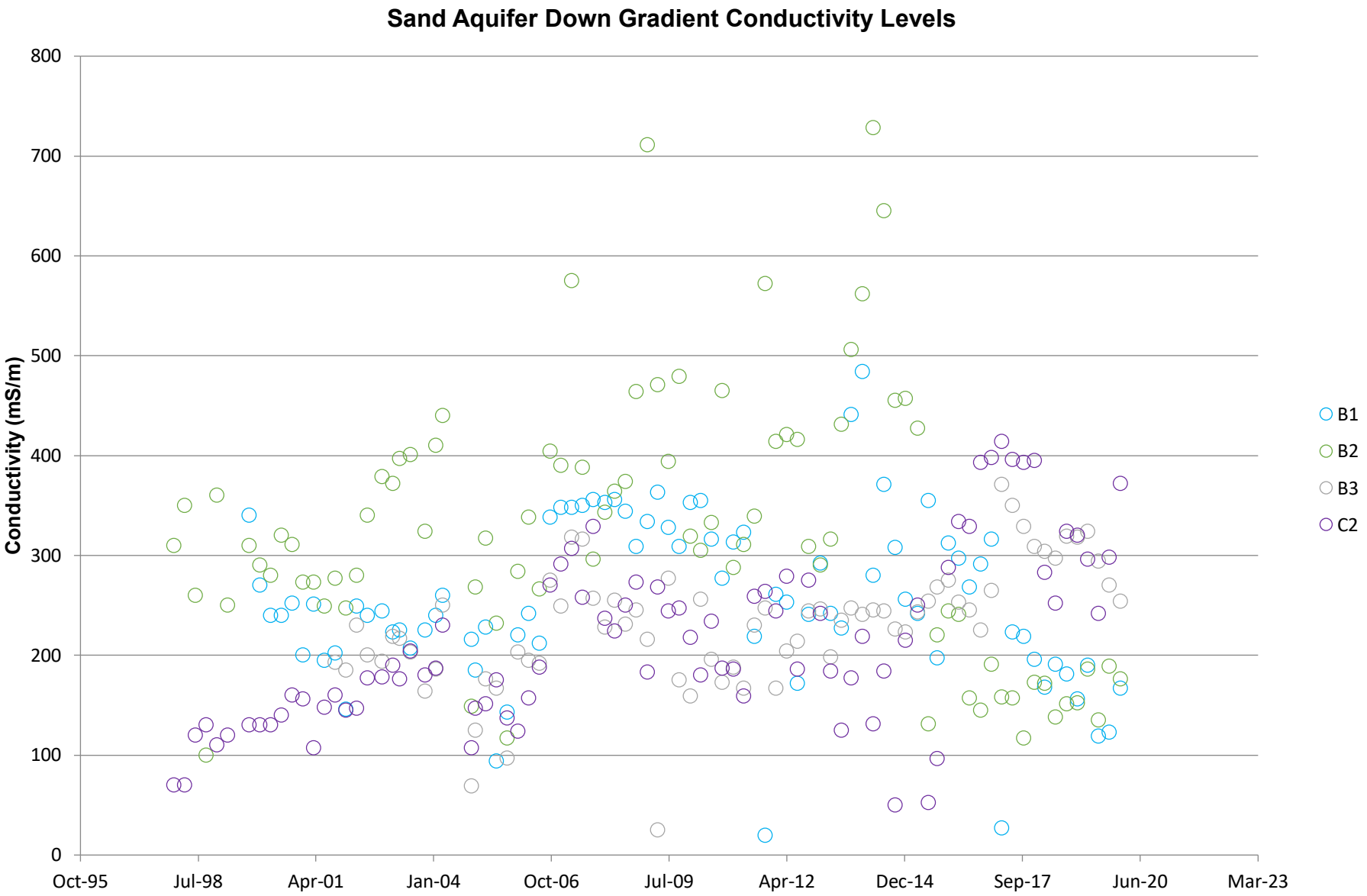

Gravel Aquifer Ammoniacal-Nitrogen Concentrations
Ammoniacal-Ni (mg/L)
100.00
10.00
1.00
0.10
0.01
0.00
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
E1D
C2DD
E2D
G1D

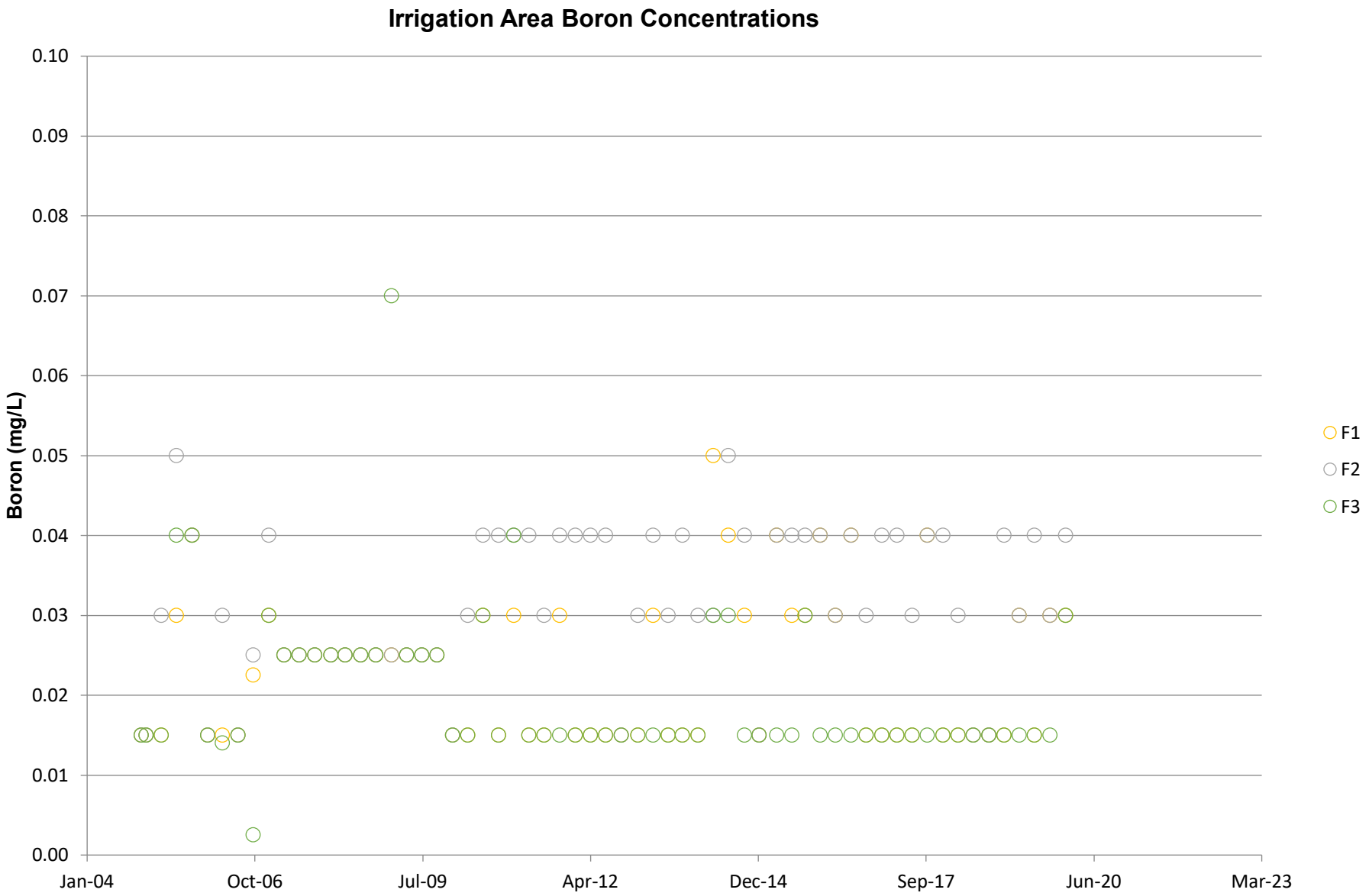

Gravel Aquifer Conductivity Levels
Conductivity (mS/m)
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
E1D
C2DD
E2D
G1D

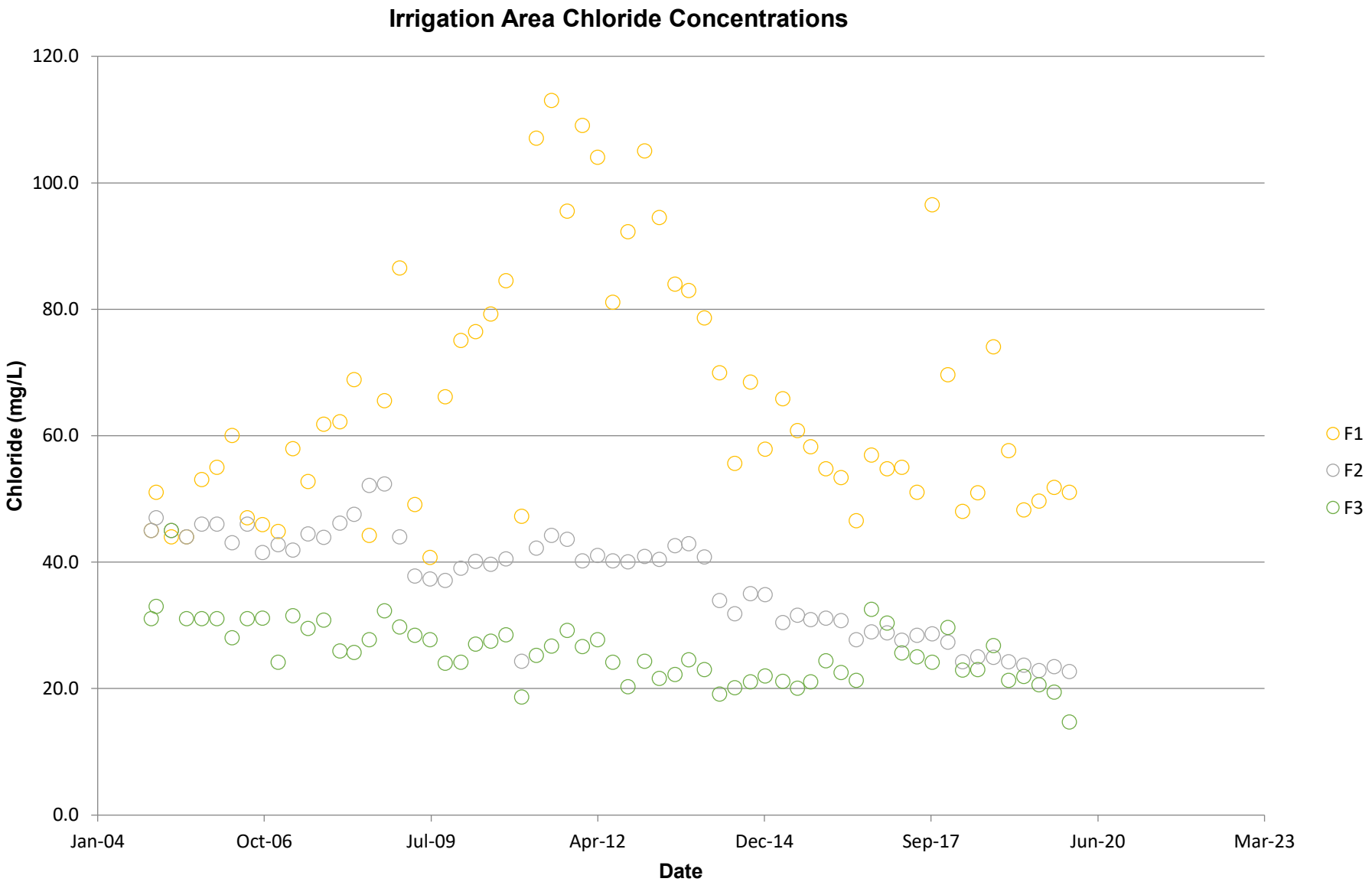

Sand Aquifer Down Gradient Boron Concentrations
Boron (mg/L)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
B1
B2
B3
C2

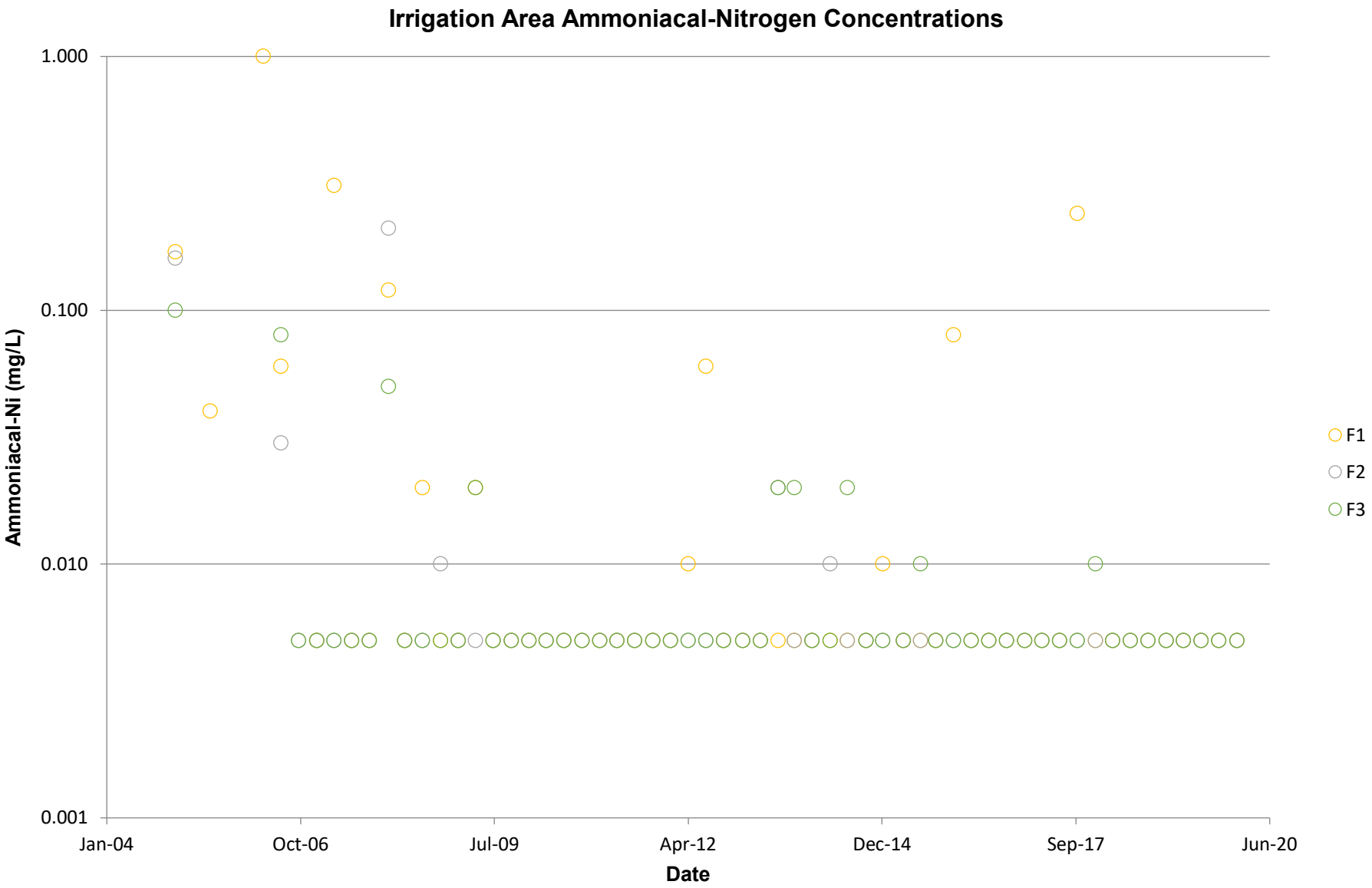

Sand Aquifer Down Gradient Chloride Concentrations
Chloride (mg/L)
2500
2000
1500
1000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
B1
B2
B3
C2

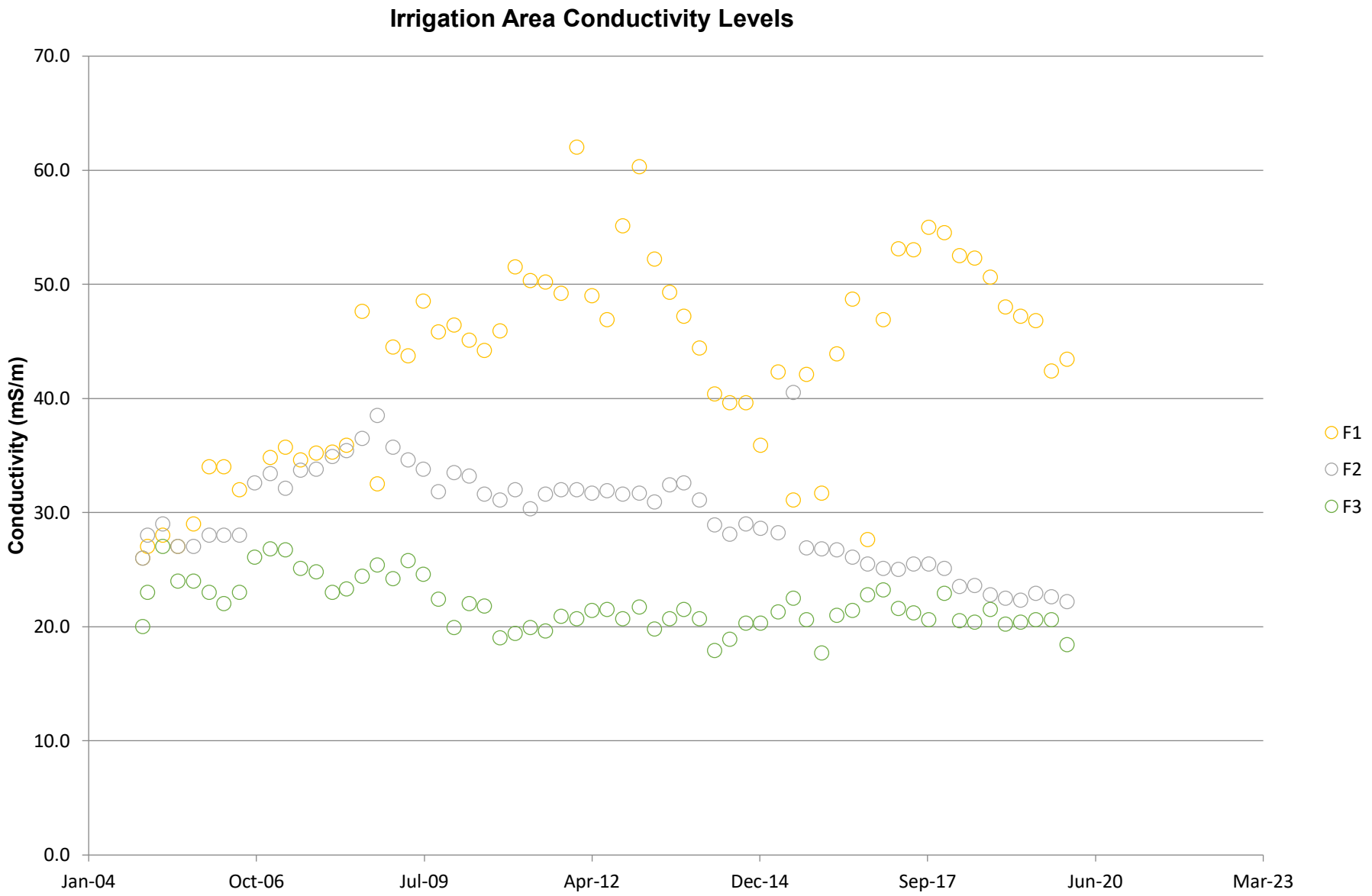

Sand Aquifer Down Gradient Ammoniacal-Nitrogen Concentrations
Ammoniacal-N (mg/L)
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
B2
B3
C2
G1S
B1

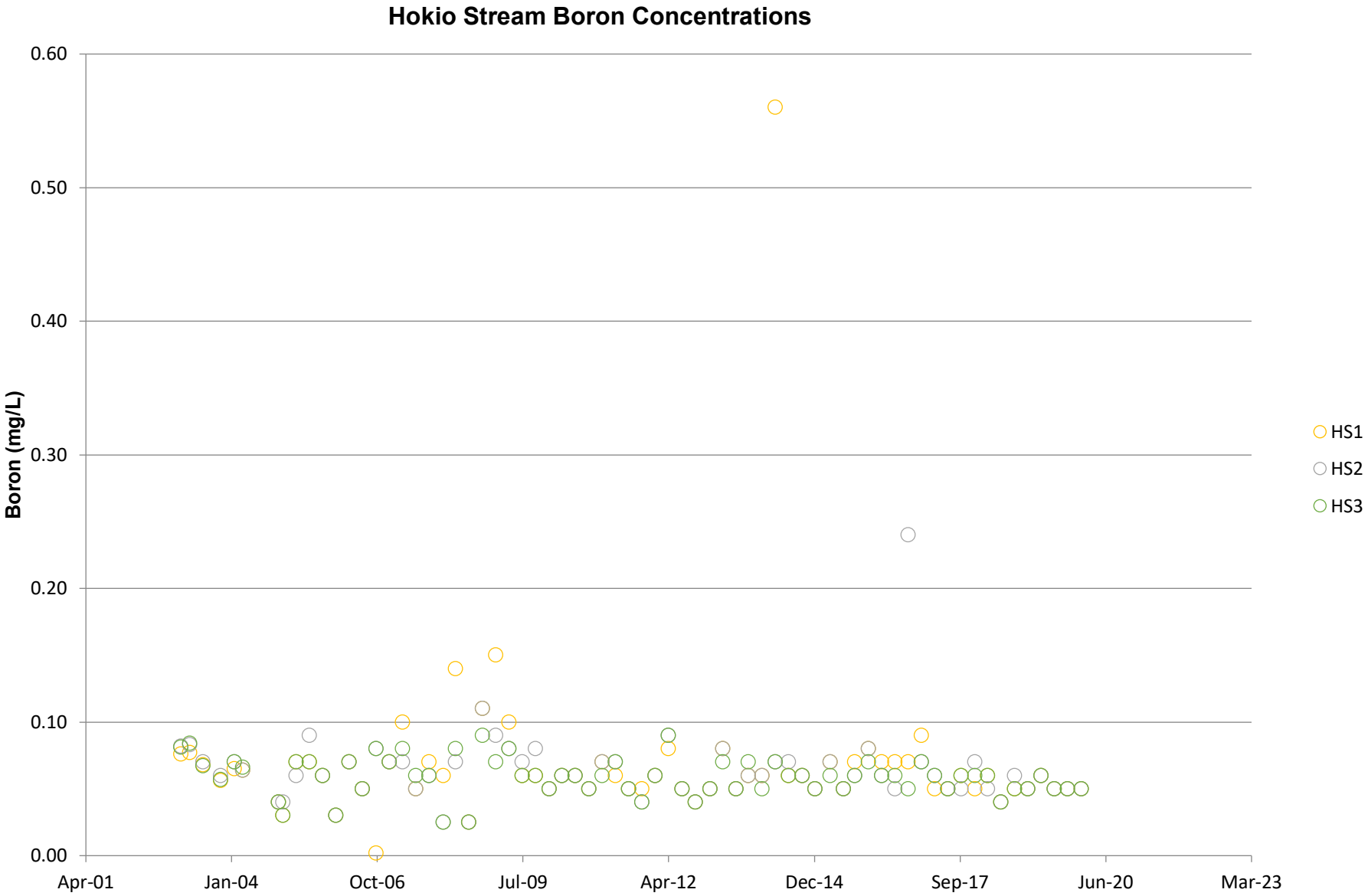

Sand Aquifer Down Gradient Conductivity Levels
Conductivity (mS/m)
800
700
600
500
400
300
200
100
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
B1
B2
B3
C2

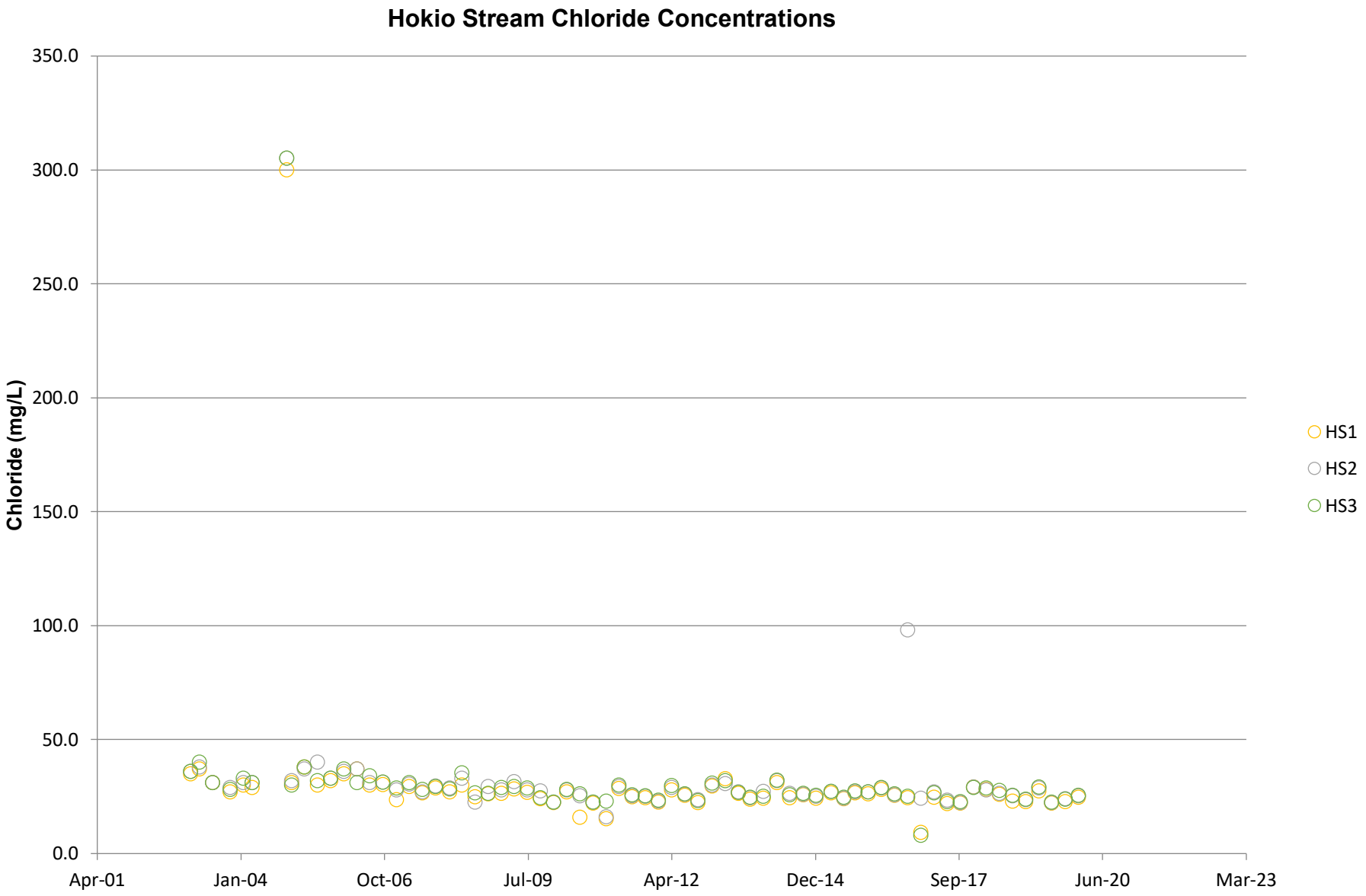

Irrigation Area Boron Concentrations
Boron (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
F1
F2
F3

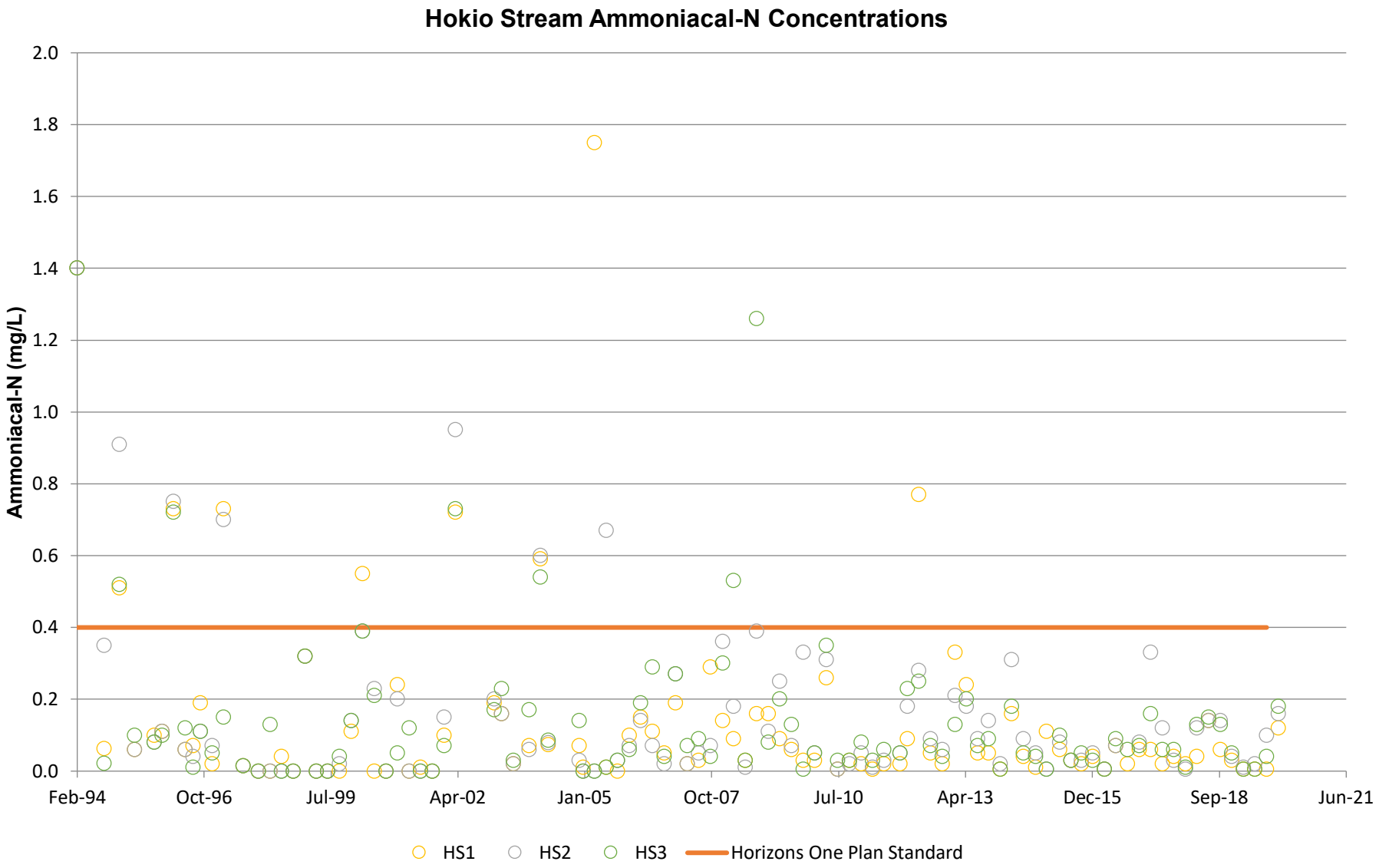

Irrigation Area Chloride Concentrations
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Chloride (mg/L)
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
Date
F1
F2
F3

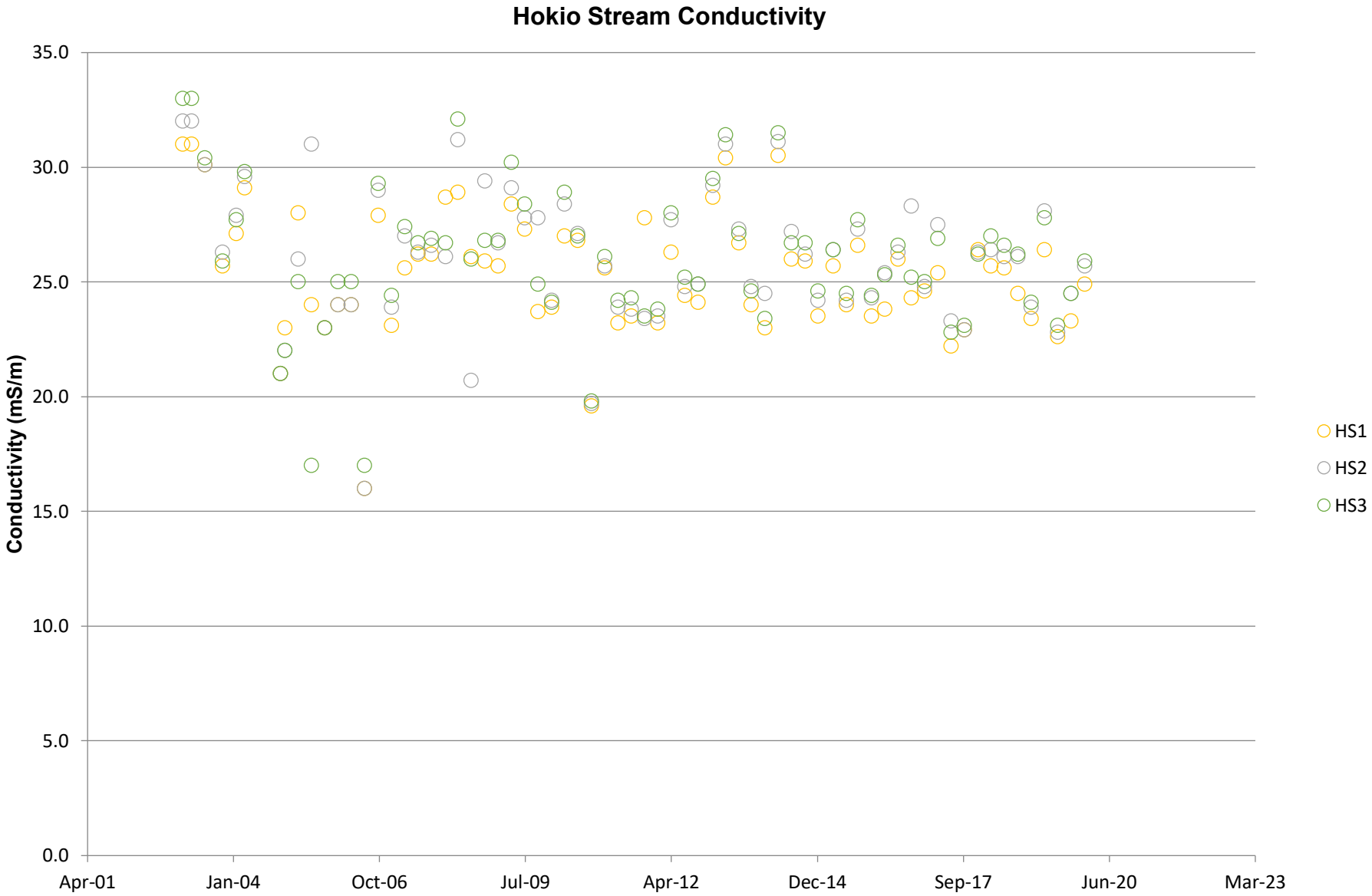

Irrigation Area Ammoniacal-Nitrogen Concentrations
1.000
0.100
0.010
0.001
Ammoniacal-Ni (mg/L)
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date
F1
F2
F3


Irrigation Area Conductivity Levels
Conductivity (mS/m)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
F1
F2
F3


Hokio Stream Boron Concentrations
Boron (mg/L)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
HS1
HS2
HS3


Hokio Stream Chloride Concentrations
Chloride (mg/L)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
HS1
HS2
HS3


Hokio Stream Ammoniacal-N Concentrations
Ammoniacal-N (mg/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Feb-94
Oct-96
Jul-99
Apr-02
Jan-05
Oct-07
Jul-10
Apr-13
Dec-15
Sep-18
Jun-21
HS1
HS2
HS3
Horizons One Plan Standard


Hokio Stream Conductivity
Conductivity (mS/m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
HS1
HS2
HS3

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