BYRON SHIRE COUNCIL

2022 Annual Water Contamination Report

Myocum Landfill

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Myocum Landfill, Byron Shire Council

Document Control

Revision	Status	Author	Reviewed	Authorised	Date
0	Draft	C. Lisle	T. Fitzroy	BSC	25/10/2022
1	Final	C.Lisle	Council	BSC	31/10/2022
2	Revised Final	C.Lisle	T Fitzroy	BSC	31/10/2022

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1. Introduction

Byron Shire Council (BSC or Council) operates the Myocum Landfill, located on Lot 1 DP1052900, 115 The Manse Road, Myocum NSW 2481 under Environmental Protection Licence (EPL) No. 6057 dated 22 March 2022 for Waste Disposal activities. A second licence (EPL13127 - 4 September 2020) is active for the site under the Byron Resource Recovery Centre for additional activities not covered under EPL6057. The site is located approximately 4.5km south of Mullumbimby and 12km Northwest of Byron Bay. The site location is shown in the local context in Figure 1-1. The neighbouring property to the west is also under Byron Shire Council ownership as the Myocum Quarry located on Lot 1 DP591441 under EPL12600.

In accordance with the Environmental Protection Licence 6057, BSC implements an environmental monitoring program, as presented in the Landfill Environmental Management Plan (Maunsell 2006), and incorporates:

- Regional and Alluvial groundwater monitoring;
- Surface water monitoring;
- Leachate monitoring;
- Landfill gas monitoring; and
- Noise monitoring.

In 2003 the landfill monitoring program commenced, coinciding with the reopening of the landfill following an extended period of closure.

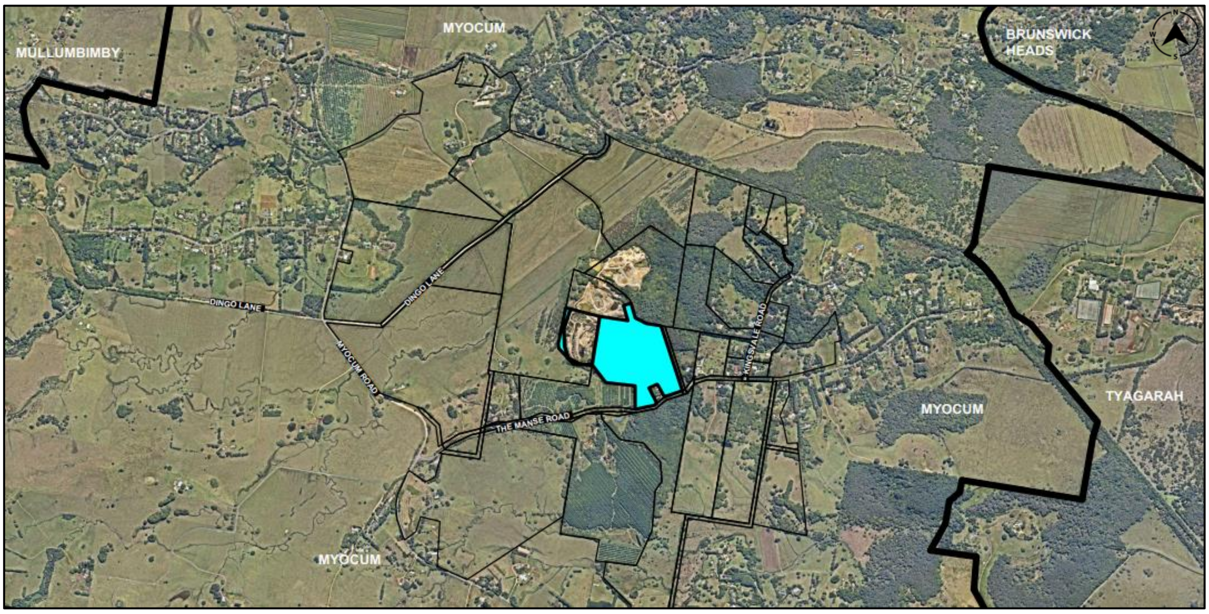

Figure 1-1: Myocum Landfill site in the locality (Image Source: NearMap 3 October 2021).

1.1 Project Aims and Objectives

As part of Council's annual reporting requirements to the NSW Environment Protection Authority (EPA), submission of an Annual Water Contamination Report consisting of a summary assessment of water quality monitoring for Myocum Landfill during the previous 12 month period is required. This report aims to present the monitoring data for the period ranging from September 2021 to August 2022, in accordance with condition E1 of EPL6057 for submission by the 3rd of November 2021. Licence conditions relevant to this report are outlined in Section 1.2.

Key project objectives are to:

- Report all monitoring actions and results between September 2021 – August 2022;
- Compare monitoring results to past collected data and stated water quality trigger values;
- Evaluate any human and/or environmental impacts resulting from the operation of the landfill; and
- Recommend mitigation measures for any identified human and/or environmental impacts.

1.2 Licence Conditions

Under the NSW EPA EPL6057, BSC is required to submit an Annual Water Contamination Report. As a minimum, this report must include the following:

Alluvial Groundwater:

(a) A tabular and graphical representation of the results of all alluvial groundwater monitoring undertaken for Monitoring Points 4 – 5 over the previous 12 months period in accordance with condition M2.

(b) Comparison of the results with the most relevant ANZECC/NWQMS triggers (see Table 1-1) and with results from previous annual reporting periods, including as assessment of any changes and trends over time.

(c) Evaluation of the nature and level of (and changes to) any human health and environmental risks to alluvial groundwaters and any other environmentally sensitive receivers.

(d) An assessment of whether the current detection monitoring program should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(e) Any further mitigation measures proposed to be implemented for the subsequent 12 month period to further reduce contamination levels and risks to human health and the environment.

Regional Groundwater:

(a) A tabular and graphical representation of the results of all regional groundwater monitoring undertaken for monitoring Points 1-3 and 23-24 over the previous 12 month period in accordance with condition M2.

(b) Comparison of the results with the contamination trigger levels (see Table 1-1) and with results from previous annual reporting periods, including an assessment of any changes and trends over time.

(c) Evaluation of the nature and level of (and changes to) any human health and environmental risks to regional groundwaters and any other environmentally sensitive receivers.

(d) An assessment of whether the current monitoring regime should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(e) Any further mitigation measures proposed to be implemented for the subsequent 12 month period to further reduce contamination levels and risks to human health and the environment.

Surface Water:

(f) A tabular and graphical representation of the results of all surface water monitoring undertaken for monitoring Points 6, 8 and 33 over the previous 12 month period in accordance with condition M2.

(g) Comparison of the results with the contamination trigger levels (see Table 1-1) and with results from previous annual reporting periods, including an assessment of any changes and trends over time.

(h) Evaluation of the nature and level of (and changes to) any human health and environmental risks to surface waters and any other environmentally sensitive receivers.

(i) An assessment of whether the current monitoring regime should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(j) Any further mitigation measures proposed to be implemented for the subsequent 12 month period to further reduce contamination levels and risks to human health and the environment.

Table 1-1: Water Quality Triggers

	Regional Groundwater (NSW EPA, 2011)	Alluvial Groundwater (ANZECC, 2006)	Surface Water (NSW EPA, 2011)
pH	2.9 – 6.7	6.5 – 8.5	6.5 – 9.0
Conductivity (µS/cm)	3,800	2,200	610
Calcium (mg/L)	2.0	-	20.7
Sodium (mg/L)	65	-	70
Potassium (mg/L)	1.0	-	11.8
Alkalinity (mg/L)	13.5	-	116
Chloride (mg/L)	118	-	150
Ammonia (mg/L)	1.74	1.43	0.36
Total Organic Carbon (mg/L)	13	-	20.3
Nitrate (mg/L)	1.87	-	3.4
Manganese (mg/L)	0.63	2.5	2.5
Sulphate (mg/L)	26.0	-	100
Magnesium (mg/L)	5.0	-	50
Iron (mg/L)	0.08	1	1
Dissolved Oxygen (mg/L)	-	-	> 6.0

2. Relevant Background Information

The climate of coastal northern New South Wales is sub-tropical, characterised by warm and wet summers with generally dry and mild winters. A summary of the monthly rainfall records from Myocum Landfill between September 2021 and August 2022 is provided in Table 2-1. Shown in Figure 2-1, monthly rainfall totals recorded generally differ from the historical median over 19 years.

Over the past 12 months reporting period, there have been eight above-average rainfall periods in October, November, December 2021, January, February, March, May and July 2022, with two high rainfall periods in February, March and May 2022 and below-average rainfall recorded in April and June 2022.

Table 2-1: Summary of monthly rainfall records at Myocum Landfill - Data taken from BOM station 58216 (2002-2022)

	2021				2022							
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Actual (mm)	39.8	91.8	162.6	136.4	226.0	421.4	629.2	69.4	206.6	33.8	127.6	33.6
Median (mm)	38.2	70.4	61.2	108.6	144.2	170.1	149.6	132.5	109.0	133.0	71.2	41.3

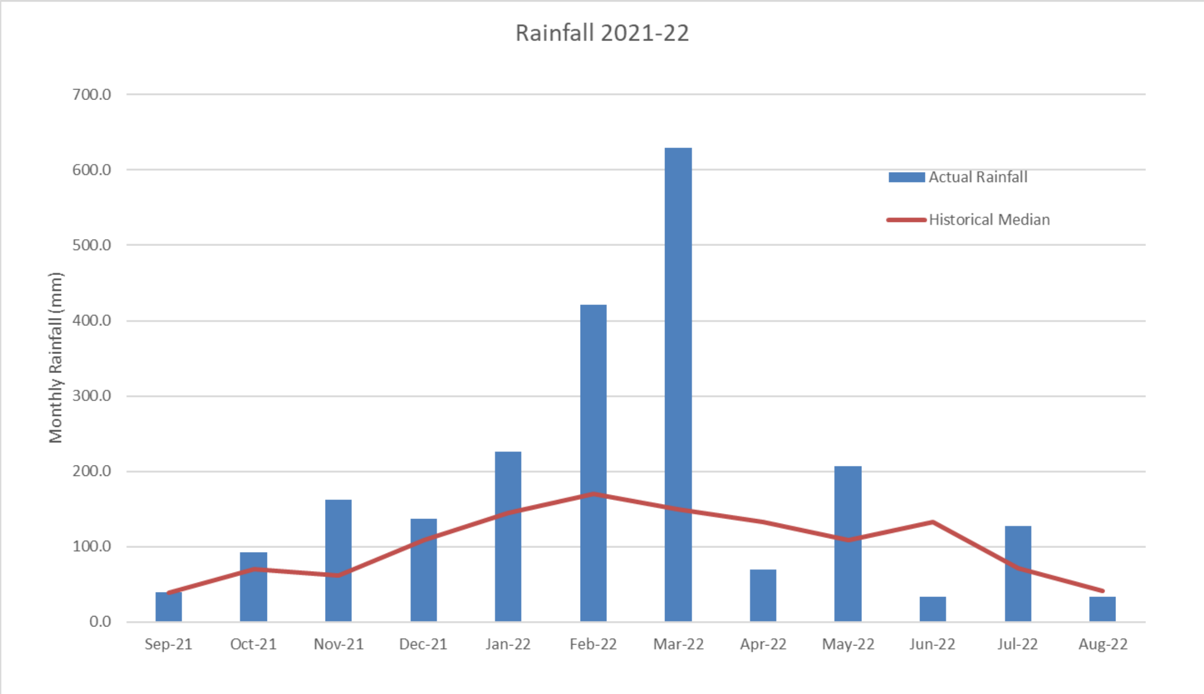

Figure 2-1: Monthly rainfall at Myocum Landfill between September 2021 and August 2022 and Historical Median - Data taken from BOM station 58216 (2002-2022)

2.1 Landfill Description

In 2003, subject to the requirements of the EPL6057 and following landfill remediation works associated with leachate management, BSC recommenced landfilling activities at Myocum Landfill to accept general solid putrescible waste to a maximum limit of 20,000t per annum plus other wastes specified in the EPL6057. In 2006, the NSW EPA approved the expansion of landfill operations to the south, termed 'Southern Expansion'. There are two main landfilling areas within the Myocum Landfill:

- Northern Landfill (Original), accepting waste between 1976-2007 (not between 2000-03 due to leachate remediation works)
- Southern Landfill, accepting waste between 2007 to 2014

The Myocum Landfill currently operates as a transfer station, accepting waste from the entire Byron Shire area for transport to a Queensland licenced waste facility.

The layout of the Myocum Landfill is shown in Figure 2-2, showing:

- The original northern landfill area;
- Southern expansion area;
- Landfill infrastructure;
- Resource Recovery infrastructure;
- Site sheds and offices; and
- Neighbouring land uses and receiving environments.

Figure 2-2: Layout of Myocum Landfill (Image Source: NearMap 3 October 2021)

2.2 Topography, Drainage and Geology

During the Mesozoic era (252-66 million years ago) the land formations surrounding the Myocum Landfill (and wider Claremont-Moreton Basin) was shaped via heat and pressure caused by tectonics. These landforms are a sequence of old fashioned metamorphosed sedimentary rocks consisting of chert quartzite and argillite-claystone deposited during the Palaeozoic Era (541-252 million years ago). The soils present within the landfill area are a mixture of yellow and red podzolic, with yellow podzolic in dominance generally comprised of fine-grained clay sediments associated with the residual weathered bedrock and/or localised alluvium deposits (Maunsell, 2002).

The topography of the site is characterised by undulating slopes with a generally westerly aspect; there has been a substantial modification of ground surface due to the landfill operations and quarrying on the neighbouring allotment. To the west of the site is the flood plain with minor tributaries of the Brunswick River including Pipeclay Creek. Drainage from upslope of the landfill facility is captured and directed to the north in an unnamed drainage line that meets Pipeclay Creek.

The landfill site can be delineated into sub-catchments with a variety of surface types and areas. There are three main catchments within the Myocum Landfill, each further made up of minor sub-catchments:

1. The northern catchment drains generally to the north with surface flow being directed to the sediment basin and ephemeral creek in the far north of the site (Northern Sediment Dam).
2. The southern catchment drains to the Southern Sediment Dam and an ephemeral creek running along the southern boundary of the site.
3. The western catchment is predominantly vegetated on relatively undisturbed (not landfill) soil areas with an existing management and conveyance system that is adequate.

Hydrogeology

Two groundwater systems have been located within and surrounding the Myocum Landfill based on previous site investigations:

1. Regional Aquifer within fractured bedrock; and
2. The perched alluvial aquifer within the alluvial soils along creek valley.

The groundwater level within the Regional Aquifer has historically ranged between RL 10 to 32m with movement generally in a northerly direction following the topography. There is a local depression within the Regional Aquifer within the Quarry area, due to the extraction of material within the quarry. Recharge of the Regional Aquifer is most likely to occur via rainfall infiltration on the surrounding hillsides.

The perched alluvial aquifer has been recorded between RL 10 to 16m and is adjacent to the northern landfill face. Groundwater depth decreases with topography, in a northerly direction, again resulting in a northerly flow of groundwater likely to generally follow topography. Recharge of the alluvial aquifer is most likely to occur via direct surface water to infiltration along the creek valley.

2.4 Monitoring Regime

In accordance with EPL 6057, BSC monitors water quality parameters in both the Regional and Alluvial Aquifers along with surface waters to the north and south of the landfill. Figure 2-3 displays the location of monitoring sites within and adjoining Myocum Landfill. Table 2-2 details relevant EPA and BSC Monitoring Point identification, general location and specific ground/surface water systems monitored. Water quality samples from the regional and alluvial aquifer monitoring sites, surface water monitoring sites and leachate monitoring sites were obtained on the:

- 15 November 2021;
- 10 February 2022;
- 5 May 2022; and
- 11 August 2022.

Table 2-2: Summary of water quality monitoring sites at Myocum Landfill relevant to condition M2.3

Monitoring Aspect and min. frequency	BSC Monitoring Site	EPA Monitoring Point	General Location
Groundwater Regional Aquifer Required every six months.	MW01	EPA 01	Northern edge of landfill (within Northern Sediment Dam)
	MW02	EPA 02	Southern edge of landfill (upgradient from Southern Expansion)
	MW03	EPA 03	Western edge of landfill, within Myocum Quarry
	MW06	EPA 23	Southern edge of landfill (adjacent Southern Expansion)
	MW07	EPA 24	Within customer interface area to the west of landfill

Monitoring Aspect and min. frequency	BSC Monitoring Site	EPA Monitoring Point	General Location
Alluvial Aquifer Required every six months.	MW04	EPA 04	Northern edge of landfill, adjacent Northern Sediment Dam
	MW05	EPA 05	Northern edge of landfill, downstream from Northern Sediment Dam
Surface Water Required every six months at a time when flow occurs.	SW1	EPA 33	Simpsons Creek tributary (accessed from Myocum Rd, 1km to the west of landfill site)
	SDP1	EPA 06	Surface Water Discharge Point 1 for the Northern Sediment Dam outlet.
	SDP2	EPA 08	Surface Water Discharge Point 2 for the Southern Sediment Dam outlet.
Leachate Required every six months.	LSA	EPA 09	Leachate sump at leachate interception trench, downstream of Northern edge of landfill
	LSB	EPA 10	Leachate sump on the crest of Southern Landfill
	LTB	EPA 11	Leachate Tank B, downstream of Northern edge of landfill
	LSE	EPA 25	Leachate sump on the south-western edge of landfill

In addition to the monitoring sites listed in Table 2-2, Condition M2.5 of the EPL requires testing of the leak detection drain sump (LDS – EPA 32) each time water is removed. Monitoring has been undertaken at EPA 32 for the past five annual reporting periods, with monitoring occurring concurrently with the quarterly water quality monitoring regime.

Monitoring of Leachate Storage Areas 1 (LS1) and 2 (LS2) has been ongoing in addition to the monitoring sites listed in Table 2-2. LS2 is sampled at leachate discharge point LDP2 (EPA 13) and has been monitored since 2014 with sampling typically in line with the existing monitoring regime. LS1 has only been sampled three times with sampling occurring at LDP1 (EPA 12), no sampling of LS1 occurred this reporting period.

Figure 2-3: Myocum Landfill Monitoring Points (Image Source: NearMap 3 October 2021).

Water samples were taken by Tweed Laboratory Centre in accordance with AS/NZS 5667:1998 *Standards on the sampling of waters, waste waters, sediments and sludges*. Samples were transported on ice under chain of custody to the Tweed Laboratory Centre for analysis on the parameters listed in Table 2-3 in accordance with AS ISO 7025:2018 – *General requirements for the competence of testing and calibration laboratories*. Tweed Laboratory Centre is NATA accredited for Accreditation No: 12754 (Chemical Testing – public testing service), and Accreditation No: 13538 (Biological Testing – public testing service).

Table 2-3: List of parameters at each EPA Monitoring Point

EPA Monitoring Points	List of Parameters		
EPA 1-5, 23 & 24 Regional and Alluvial Groundwater	pH Temperature Electrical Conductivity Standing Water Level Calcium Sodium	Magnesium Alkalinity Sulphate Chloride Potassium Manganese	Ammonia (as N) Nitrate (as N) Total Organic Carbon Iron
EPA 6, 8 & 33 Surface Water	pH Temperature Electrical Conductivity Calcium Sodium Total Suspended Solids	Magnesium Alkalinity Sulphate Chloride Potassium Dissolved Oxygen	Manganese Ammonia (as N) Nitrate (as N) Total Organic Carbon Iron
EPA 9, 10, 11, 12, 13, 25 & 32 Leachate	pH Temperature Arsenic Calcium Sodium Fluoride	Magnesium Alkalinity Sulphate Chloride Potassium Organochlorine Pesticides	Manganese Ammonia (as N) Nitrate (as N) Total Organic Carbon Iron Total Phenolics

3. Monitoring Results and Discussion

3.1 Groundwater Levels

For this report, the network of monitoring bores at the landfill for both the Alluvial and Regional aquifers have been categorised as either upslope or downslope to better investigate the potential contamination of groundwater resulting from the presence and operation of the landfill. Based on the range of relative groundwater levels (RLs), the location of the landfill and surrounding topography, each monitoring bore can be classified as either being upslope or downslope from the landfill, as shown in Table 3-1. Groundwater levels for the current monitoring period are shown in Table 3-1.

Table 3-1: Monitored Groundwater Levels

Bore No.		EPA No.	Bore Location	Monitored Groundwater Levels (mRL)			
				Nov 21	Feb 22	May 22	Aug 22
Regional Aquifer	MW01	EPA 01	**Downslope** of Northern Landfill	4.7	2.60	3.70	3.40
	MW02	EPA 02	**Upslope** of Southern Landfill	9.9	5.30	0.70	4.20
	MW03	EPA 03	Base of Myocum Quarry, **Downslope**	0.7	0.80	0.80	0.80
	MW06	EPA 23	**Upslope** of Southern Landfill	12.5	8.00	4.20	6.60
	MW07	EPA 24	West of Landfill, **Downslope**	24.4	22.10	21.40	22.90
Alluvial Aquifer	MW04	EPA 04	20m **Downslope** of leachate inception trench	3.7	3.20	3.30	3.40
	MW05	EPA 05	70m **Downslope** of Northern Landfill face	5.8	3.20	4.30	4.50

Groundwater levels for both alluvial and regional bores as presented in Figures 3-1 and 3-2 show that increases to the groundwater level during the May monitoring event were consistent with the increased rainfall during the previous months. Levels were not reported during the August 2020 monitoring event for the 2020 reporting period and as such shows a break in data leading into the current monitoring period. It is also noted that MW05 (EPA 05) was recorded as dry during the August 2021 monitoring event and as such, no groundwater level was recorded.

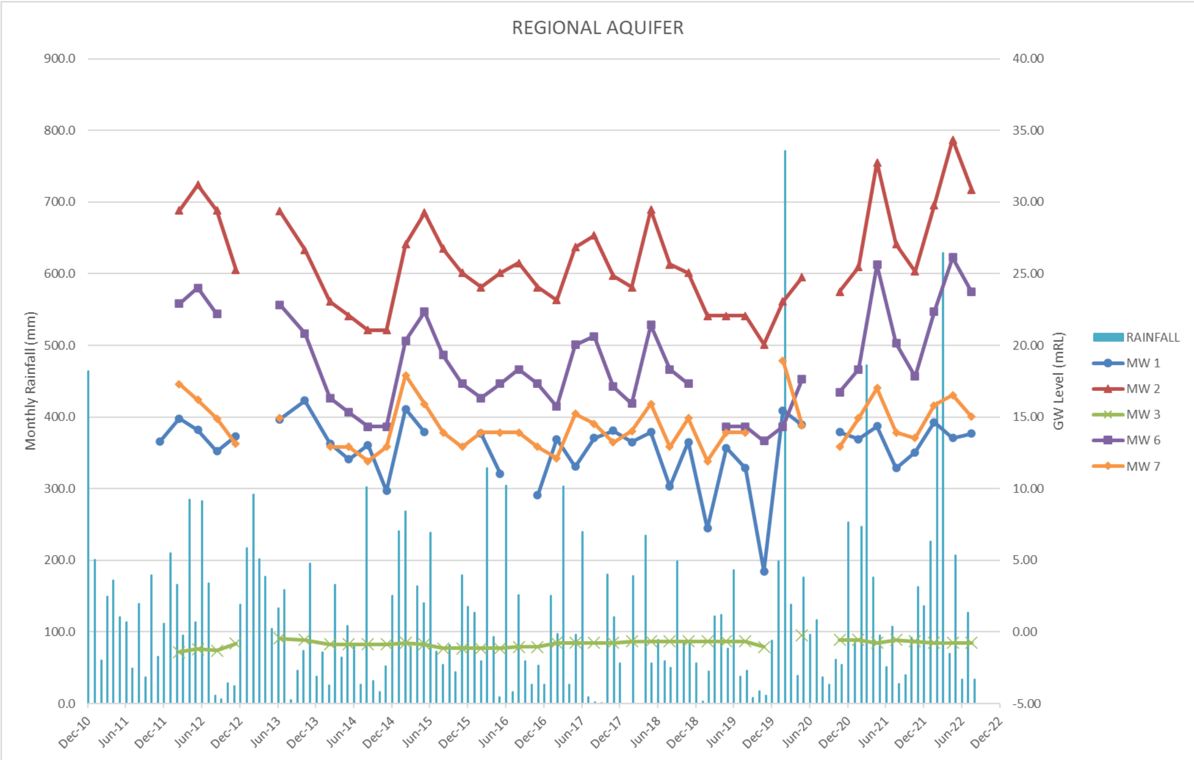

Figure 3-1: Regional Groundwater Levels and Monthly Rainfall

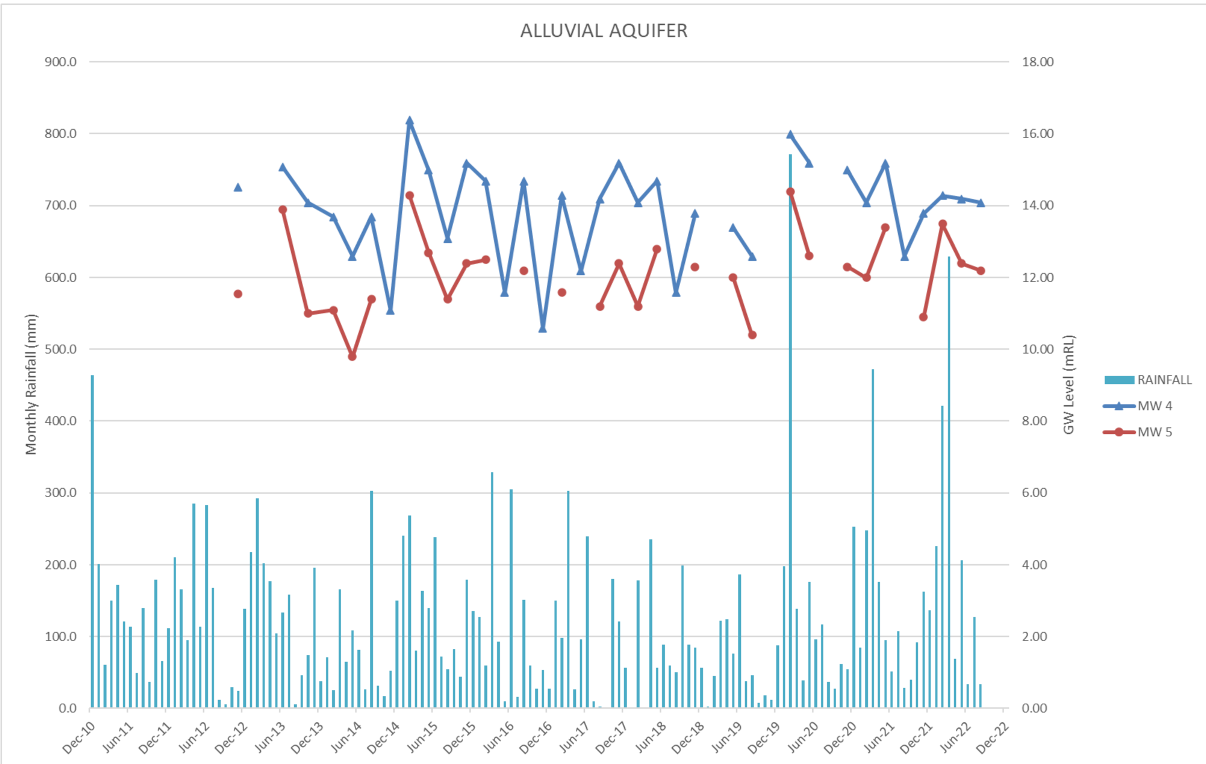

Figure 3-2: Alluvial Groundwater Levels and Monthly Rainfall

The groundwater levels provided in the graphs above and in Table 3-1 are generally consistent with previous results and seasonal fluctuations and indicate that the surfaces of the regional and alluvial aquifers are representative of the pre-development drainage configuration of the site and fluctuate with rainfall. These trends are presented in Figures 3-1 and 3-2.

Table 3-2 presents accumulated rainfall data over a 1-8 week period leading up to each sampling date. Rainfall conditions prior to ground and surface water sampling were variable across the four sampling events.

Table 3-2: Rainfall preceding sample date

Sample date	Preceding cumulative rainfall (mm)					
	1 week	2 weeks	3 weeks	4 weeks	6 weeks	8 weeks
12-Nov-21	31.00	33.40	50.40	109.40	155.80	156.80
11-Feb-22	19.40	111.40	180.00	259.00	323.60	359.60
12-May-22	27.80	52.60	66.00	76.60	120.80	582.60
21-Aug-22	2.80	14.20	18.40	23.60	69.40	149.00

This assessment of cumulative rainfall shows that a significant amount of rainfall occurred leading up to the February 2022 and May 2022 monitoring events.

3.2 Water Quality

For each of the specified water management units (regional groundwater, alluvial groundwater and surface waters), a comparison of the collected data with the *stated water quality triggers* (as per Table 1-1) are required, along with:

- An assessment of any spatial or temporal change in water quality;
- An evaluation (if any) of the nature and level (and changes to) of human health and environmental risks to water management units and other environmentally sensitive receivers;
- An assessment of whether the current monitoring program is adequate in detecting a full suite of possible leachate contaminants; and
- Any mitigation measures are recommended to be implemented for the next 12 months to reduce contamination levels and risks to human health.

Table 3-3 outlines EPA monitoring sites and their applicable water management unit in which they are designed to monitor. The results of the 2021/22 ground and surface water monitoring at Myocum Landfill are provided in tabular form in Table 3-4, showing raw results and any exceedances in *stated water quality triggers* (as per Table 1-1). Appendix A presents graphs for groundwater and surface water quality from all EPA monitoring points from early 2003 through to mid-2021.

Table 3-3: Reference site monitoring locations

Water Management Unit	Monitoring Site
Regional groundwater	EPA Points 1, 2, 3, 23 and 24
Alluvial groundwater	EPA Points 4 and 5
Surface water	EPA Points 6, 8 and 33
Leachate	EPA Points 9, 10, 11, 12, 13, 25 and 32

Table 3-4: Tabulated summary of regional, alluvial and surface water monitoring results between September 2021 and August 2022. Shaded cells indicate exceedances against defined trigger levels.

BSC Point	EPA Point	Date	pH	Temp °C	Conductivity uS/cm	Alkalinity mg/L	Sulphate Filtered mg/L	Chloride mg/L	Calcium Filtered mg/L	Magnesium mg/L	Sodium Filtered mg/L	Potassium Filtered mg/L	Iron Total mg/L	Manganese Total mg/L	Manganese Filtered mg/L	Ammonia as N mg/L	Nitrate as N mg/L	Total Organic Carbon mg/L	Dissolved Oxygen mg/L	Total Suspended Solids mg/L
Regional Aquifer WQ Triggers			2.9 - 6.7	No Trigger	3,800	13.5	26.0	118	2.0	5.0	65	1.0	0.08	0.63	No Trigger	1.74	1.87	13	No Trigger	
MW1	EPA 01	15-Nov-21	6.1	20.9	384	79.00	37.00	42.00	30.00	4.70	16.00	9.60	22.60	1.40	1.40	2.55	0.05	13.00		
MW1	EPA 01	10-Feb-22	6.0	22.4	323	63.00	42.00	26.00	24.00	4.20	15.00	8.70	17.00	1.20	1.20	2.34	0.08	13.00		
MW1	EPA 01	05-May-22	3.7	21.6	227	20.00	33.00	24.00	18.00	3.20	13.00	6.60	6.69	0.70	0.70	0.02	1.78	8.90		
MW1	EPA 01	11-Aug-22	6.0	17.2	364	105.00	31.00	38.00	25.00	4.50	16.00	7.50	43.70	1.35	1.35	2.54	<0.02	21.00		
MW2	EPA 02	15-Nov-21	6.1	20.9	167	<1.00	14.00	28.00	1.00	4.30	17.00	0.90	0.94	0.05	0.05	<0.02	2.11	1.00		
MW2	EPA 02	10-Feb-22	4.3	22.6	167	<1.00	14.00	28.00	1.10	4.50	18.00	0.94	0.58	0.06	0.06	<0.02	1.78	1.60		
MW2	EPA 02	05-May-22	4.2	22.7	181	0.70	11.00	32.00	0.40	4.20	18.00	0.50	1.49	0.06	0.06	<0.02	2.78	0.70		
MW2	EPA 02	11-Aug-22	4.3	21.0	179	98.00	11.00	30.00	11.00	4.30	19.00	0.50	0.39	0.06	0.06	<0.02	2.94	1.10		
MW3	EPA 03	15-Nov-21	5.6	21.2	517	21.00	12.00	130.00	11.00	10.00	61.00	1.60	1.25	4.10	4.10	0.02	0.03	0.50		
MW3	EPA 03	10-Feb-22	5.5	23.5	486	23.00	14.00	120.00	13.00	10.00	61.00	1.60	1.26	1.28	1.28	<0.02	0.04	1.00		
MW3	EPA 03	05-May-22	5.5	21.6	477	13.00	13.00	130.00	10.00	9.60	58.00	1.50	1.49	0.44	0.44	<0.02	0.03	0.80		
MW3	EPA 03	11-Aug-22	5.5	17.3	523	91.00	13.00	140.00	11.00	10.00	61.00	1.60	2.26	6.81	6.81	<0.02	0.00	0.50		
MW6	EPA 23	15-Nov-21	4.0	20.9	291	<1.00	17.00	65.00	0.50	4.00	37.00	0.80	2.43	0.74	0.74	<0.02	0.72	1.10		
MW6	EPA 23	10-Feb-22	4.1	21.1	300	<1.00	19.00	63.00	0.60	4.30	41.00	0.80	0.50	0.54	0.54	<0.02	0.64	1.10		
MW6	EPA 23	05-May-22	4.2	21.8	265	13.00	14.00	62.00	2.60	4.10	36.00	1.10	1.13	0.31	0.31	<0.02	0.74	1.40		
MW6	EPA 23	11-Aug-22	5.1	20.1	261	116.00	15.00	65.00	3.10	4.10	35.00	1.00	1.26	0.31	0.31	<0.02	0.79	2.00		
MW7	EPA 24	15-Nov-21	5.2	23.6	292	17.00	8.20	40.00	14.00	5.50	16.00	8.60	23.50	8.33	8.33	0.05	12.10	3.60		
MW7	EPA 24	10-Feb-22	5.2	23.6	348	14.00	7.90	40.00	18.00	7.40	19.00	10.00	2.85	9.45	9.45	<0.02	16.20	3.40		
MW7	EPA 24	05-May-22	5.2	23.5	301	13.00	16.00	44.00	11.00	5.10	21.00	6.80	4.28	10.90	10.90	<0.02	8.89	2.60		
MW7	EPA 24	11-Aug-22	5.3	22.5	274	139.00	13.00	40.00	14.00	4.50	18.00	6.90	9.14	5.76	5.76	<0.02	8.14	3.10		
Alluvial Aquifer WQ Triggers			6.5 - 8.5	No Trigger	2,200	No Trigger							1.0	2.5	No Trigger	1.43	No Trigger			
MW4	EPA 04	15-Nov-21	5.4	20.6	328	20.00	41.00	47.00	13.00	3.50	24.00	13.00	1.46	0.89	0.89	3.46	0.38	7.30		
MW4	EPA 04	10-Feb-22	6.0	23.1	223	39.00	22.00	27.00	13.00	2.90	17.00	11.00	0.43	0.55	0.55	0.99	0.43	8.50		
MW4	EPA 04	05-May-22	5.8	21.8	254	35.00	26.00	32.00	11.00	3.00	21.00	9.90	1.77	0.69	0.69	2.02	0.12	8.80		
MW4	EPA 04	11-Aug-22	5.9	19.4	271	109.00	36.00	34.00	14.00	3.40	19.00	11.00	1.94	0.86	0.86	2.25	0.02	7.60		
MW5	EPA 05	15-Nov-21	5.9	19.6	333	69.00	23.00	42.00	30.00	4.30	16.00	15.00	8.41	0.33	0.33	0.39	0.62	12.00		
MW5	EPA 05	10-Feb-22	6.6	24.4	272	97.00	6.20	20.00	29.00	3.80	13.00	11.00	3.64	0.51	0.51	1.05	0.00	12.00		
MW5	EPA 05	05-May-22	6.3	21.7	363	80.00	38.00	32.00	30.00	4.60	18.00	12.00	18.40	0.74	0.74	2.07	0.00	14.00		
MW5	EPA 05	11-Aug-22	6.1	18.1	307	103.00	31.00	32.00	23.00	3.70	17.00	10.00	11.10	0.67	0.67	1.61	0.00	11.00		
Surface Water WQ Triggers			6.5 - 9.0	No Trigger	610	116	100	150	20.7	50	70	11.8	1.0	2.5	No Trigger	0.36	3.4	20.3	> 6.0	No Trigger
SDP1	EPA 06	15-Nov-21	8.1	26.8	362	94.00	21.00	45.00	38.00	4.40	15.00	17.00	1.12	0.15	0.15	<0.02	0.09	14.00	10.00	15.00
SDP1	EPA 06	10-Feb-22	8.6	24.1	284	98.00	12.00	20.00	33.00	4.10	15.00	12.00	0.87	0.02	0.02	0.69	0.18	13.00	11.00	23.00
SDP1	EPA 06	05-May-22	7.3	19.6	874	120.00	63.00	40.00	53.00	6.70	22.00	23.00	3.43	0.62	0.62	2.53	0.05	25.00	5.30	47.00
SDP1	EPA 06	11-Aug-22	7.3	15.1	383	116.00	34.00	37.00	31.00	4.20	20.00	9.40	1.61	0.29	0.44	7.09	0.25	11.00	5.50	19.00
SDP2	EPA 08	15-Nov-21	7.6	27.2	591	124.00	25.00	94.00	41.00	8.40	47.00	24.00	0.30	0.22	0.22	0.05	0.05	16.00	7.50	4.00
SDP2	EPA 08	10-Feb-22	8.7	31.0	569	31.00	17.00	67.00	44.00	9.80	44.00	30.00	0.37	0.03	0.03	0.07	2.68	23.00	11.00	10.00
SDP2	EPA 08	05-May-22	8.1	23.4	874	220.00	26.00	110.00	61.00	16.00	61.00	49.00	0.86	0.06	0.06	1.02	3.03	30.00	9.80	27.00
SDP2	EPA 08	11-Aug-22	8.4	16.5	582	101.00	21.00	90.00	43.00	9.90	42.00	27.00	0.94	0.29	0.29	0.36	3.95	15.00	13.00	18.00
SW1	EPA 33	15-Nov-21	6.8	22.1	389	66.00	3.10	80.00	13.00	11.00	40.00	3.40	2.85	1.00	1.00	0.09	0.02	9.70	3.00	21.00
SW1	EPA 33	10-Feb-22	6.7	20.7	251	55.00	2.40	42.00	11.00	8.50	27.00	0.70	2.36	0.36	0.36	<0.02	<0.02	8.60	2.30	9.00
SW1	EPA 33	05-May-22	6.7	18.7	301	66.00	2.30	50.00	13.00	9.90	31.00	1.20	1.44	0.36	0.36	0.01	<0.02	6.70	3.30	3.00
SW1	EPA 33	11-Aug-22	6.7	13.5	336	114.00	4.40	66.00	10.00	9.90	36.00	1.30	4.71	0.59	0.59	0.21	0.07	3.80	7.00	39.00

3.3 Alluvial Groundwater

As shown in Table 3-4, several parameters monitored within the alluvial groundwater system exceeded the nominated trigger values. These include:

- Ammonia in both upslope and downslope monitoring bores EPA 04 and 05
- pH in both upslope and downslope monitoring bores EPA 04 and 05
- Iron within upslope and downslope monitoring bores EPA 04 and 05

Within the upslope bore EPA 04, ammonia concentrations exceeded the predefined water quality trigger value of 1.43mg/L in three of four sample values in this reporting period, with EPA 05 exceeding trigger concentrations for two out of the three samples taken.

The closure of the northern landfill area, enhanced stormwater management works and general site management over the past years has resulted in a general improvement in the water quality in the alluvial groundwater. Appendix A displays results from all data gathered from the alluvial groundwater management unit between 2003 and 2021. These results show that over the past 18 years of data collection, there is a general decrease in conductivity, sodium, sulphate, magnesium, chloride and potassium concentrations, with an increase in iron concentration.

Ammonia concentrations in EPA 04 (MW04) have increased in recent monitoring events with EPA 05 (MW05) remaining consistently below the trigger level. While ammonia is entering the alluvial groundwater system, it appears to be rapidly attenuated within the groundwater system. This is resulting in limited export of ammonia off-site and shows compliance with the predetermined WQ trigger value of 1.43 mg/L in bore EPA 05. This is shown in Figure 3-3.

Iron concentrations in all samples collected from the upslope and downslope monitoring bores EPA 04 and EPA 05 exceeded the trigger value of 1.0mg/L. Figure 3-4 shows an upward trend of elevated iron concentration in samples collected from the downslope monitoring bore EPA 05 since 2012.

3.3.1 Nature and level of human health and environmental risk

No contaminants have been recorded within any of the alluvial monitoring bores that would pose immediate human health risks.

All pH levels within both monitoring bores EPA 04 and 05 are outside (below) the nominated trigger range. This is possibly caused by naturally acidic groundwater in the broader alluvial aquifer (caused by alluvial geology) (AWC, 2015).

As stated previously, ammonia concentrations in monitoring bore EPA 04 (upslope) exceed the nominated trigger value of 1.43mg/L, potentially posing an environmental risk to the downstream receiving environment. A review of the four-point median (Figure 3-3) shows a slight increase in Ammonia concentration in recent months at EPA 04 (MW05) which needs to be monitored closely in the future.

That being said, the downstream monitoring bore EPA 05 records ammonia values routinely below the trigger value suggesting flow into the receiving environment complies with the nominated trigger value. The discontinuation of landfilling and the continued improvement in the operation and management of the Myocum Landfill is resulting in the reduced environmental risk of the downslope alluvial aquifer.

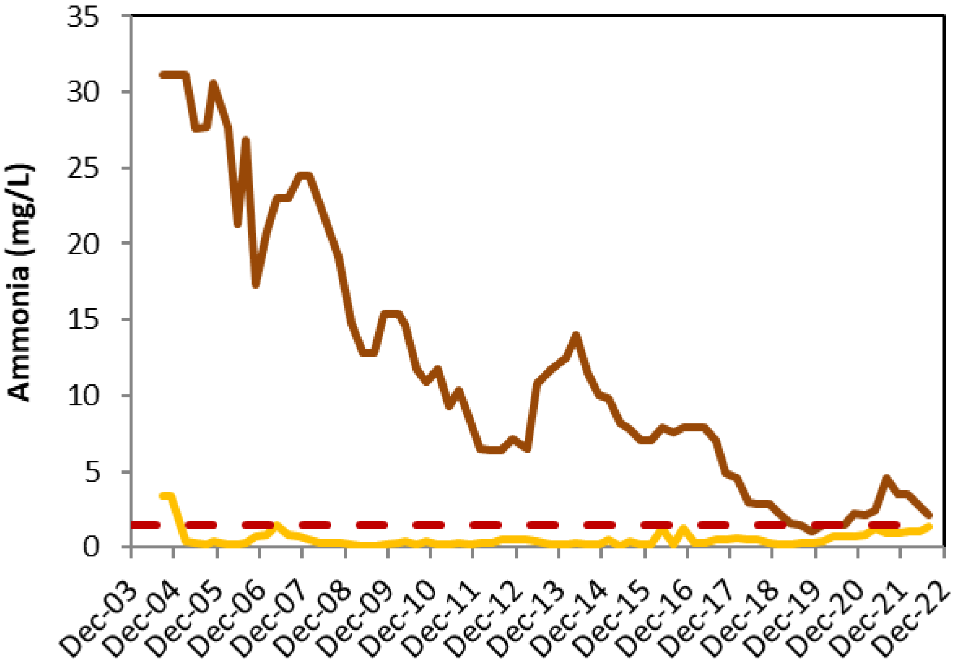

Figure 3-3: Running 4pt Median for Alluvial Groundwater Ammonia values

Although iron concentration in the downstream monitoring bore (EPA 05) regularly exceeds the trigger value, as shown in Figure 3-4, there is a low risk of human health concerns. Iron concentrations have been found to be elevated in many of the other monitoring bores onsite, including upslope regional bores. Refer to Sections 3.4 and 3.5 below.

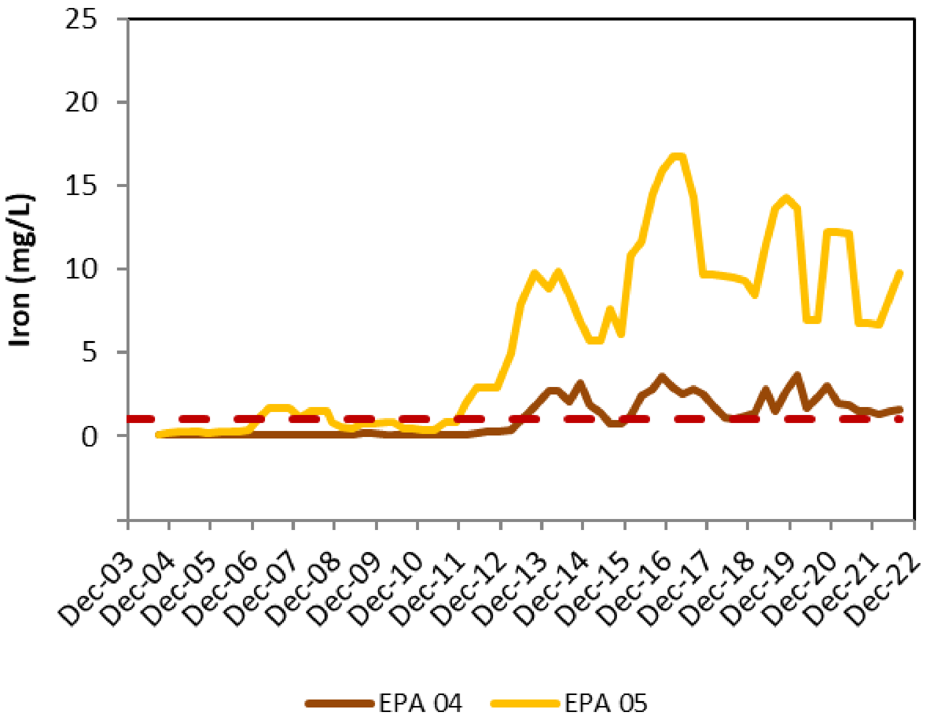

Figure 3-4: Running 4pt Median for Alluvial Groundwater Iron values

3.3.2 Augmenting the current monitoring regime

The current monitoring program employed to assess the potential impacts of the Myocum Landfill on the alluvial aquifer adequately monitors water quality within the aquifers moving in a northerly direction. The sampling regime provides a good temporal scale of data collection, allowing the assessment of the continued reduction of ammonia concentration within monitoring bore EPA 04 and the continued compliance of alluvial aquifer water quality in downslope monitoring bore EPA 05.

3.4 Regional Groundwater

3.4.1 Upslope bores – EPA 2 and EPA 23

Two of the five regional groundwater bores can be viewed as 'upslope bores' (Bores EPA 02 and 23) and hence be used to infer whether the operation of the Myocum Landfill is impacting the regional groundwater system. As shown in Table 3-4, upslope monitoring bores EPA 02 and 23 were compliant with most monitoring parameters; the exceptions being Nitrate and Potassium (EPA 02 only), Manganese (for EPA 23 only) and Iron (for both EPA 02 and EPA 23):

- All Iron concentrations for the regional aquifer upstream monitoring bores during the reporting period exceeded the trigger value of 0.08mg/L.
- Three Nitrate value from monitoring bore EPA 02 was above the trigger value of 1.87mg/L, however, all results from monitoring bore EPA 23 were below the trigger value.
- One Potassium exceedance for EPA 023 occurred on May 2022 monitoring event.
- Monitoring bore EPA 23 had one exceedance of Manganese which occurred on the 15th of November 2020.
- Due to the location of upslope monitoring bores EPA 02 and 23, the aforementioned exceedances are unlikely to be the result of the operation of the landfill. Observed increases in Nitrate, Potassium and Iron are possibly the results of other catchments / climatic influences, including upslope domestic onsite wastewater treatment/disposal systems (nitrate) and/or dry/wet conditions surrounding sampling resulting in more mobile Iron within the soil column (AWC, 2015).

3.4.2 Downslope bores – EPA 1, EPA 3, and EPA 24

The remaining three regional groundwater monitoring bores (EPA 01, 03 and 24) are located downslope of the landfill as shown in Figure 2-3:

- Within the Northern Sediment Dam (EPA 01);
- Within the quarry to the west of the landfill (EPA 03); and
- Just north of the weighbridge (EPA 24).

This network of bores has been located to track potential groundwater contaminants in the regional aquifer to the west and north-west of the site, in a similar direction to the topography of the site.

As shown in Table 3-4, the Ammonia trigger value of 1.74mg/L, the Sulphate trigger value of 26mg/L, and the Total Organic Carbon trigger value of 13.0mg/L were exceeded in monitoring bore EPA 01 (MW01), however concentrations at the other two downstream bores complied with the trigger. The Nitrate trigger value of 1.87mg/L was exceeded in monitoring bore EPA 24 (MW07). Alkalinity exceeded in monitoring bores EPA 01 and 03 (MW03) over the entire reporting period and during the May monitoring event for EPA 24. The Chloride values exceeded the trigger value of 118mg/L in monitoring bore EPA 03 only. Iron levels exceeded the trigger value of 0.08mg/L in every monitoring event of this reporting period for all three downstream groundwater monitoring bores.

Additionally, numerous test analytes in all three sampling bores consistently exceeded their nominated trigger values, including:

- Calcium
- Magnesium
- Potassium
- Manganese

Appendix A shows results for all historical data from the regional groundwater management unit from 2003 to the current reporting period. Calcium, Alkalinity and Sulphate values markedly increased at the 2008 time period at the EPA 01 and 24 monitoring sites, values have since decreased and have become relatively stable, they do however generally exceed the trigger values assigned. Monitoring site EPA 01 has had elevated levels of Calcium and Alkalinity since 2015.

Based on the results above the following parameters were assessed using medians over time, to smooth out spikes/ low and observe longer-term trends. The following parameters were assessed further below;

EPA 01 (MW01)

- Ammonia
- Total Organic Carbon
- Sulphate
- Iron

EPA 24 (MW07)

- Nitrate
- Iron

Select running four-point median results from the downslope monitoring bores EPA 01, 03 and 24 are shown in Figure 3-5.

Figure 3-5a: Iron Regional Groundwater Medians

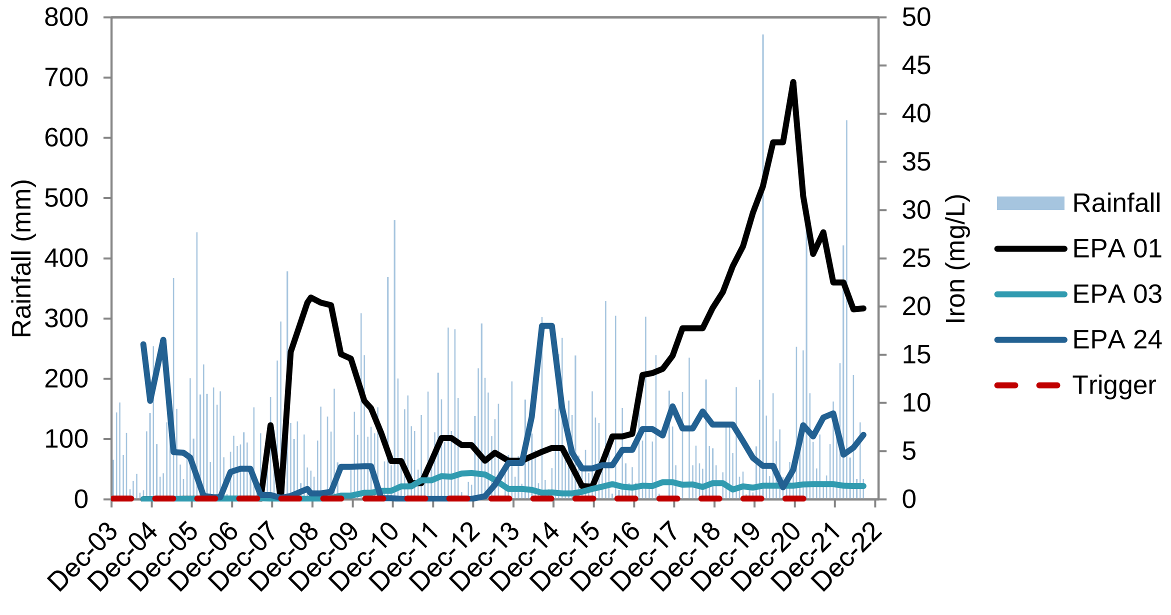

Figure 3-5b: Ammonia Regional Groundwater Medians

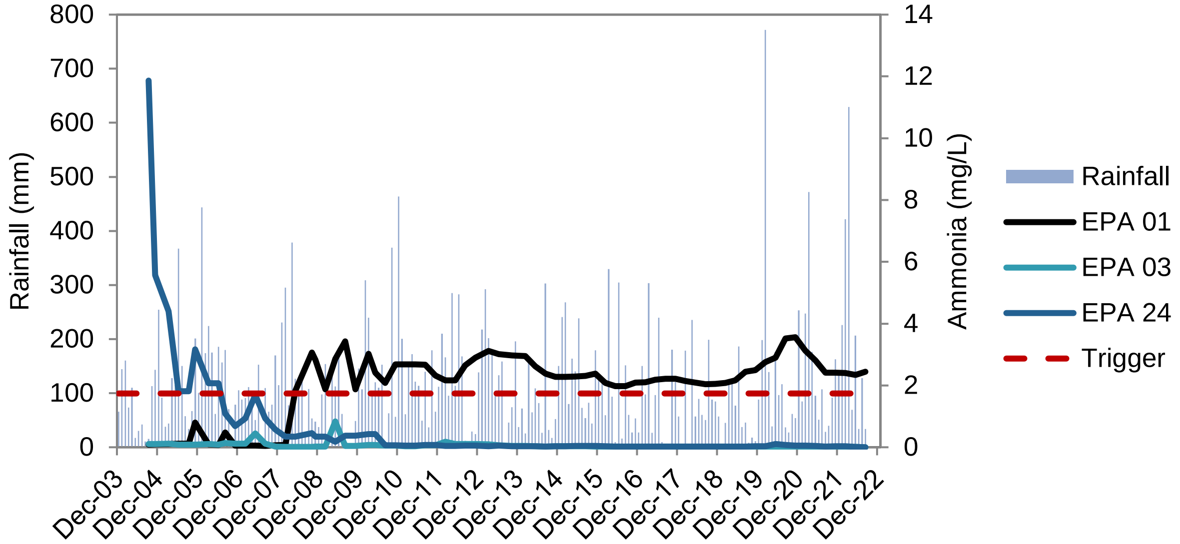

Figure 3-5c: Nitrate Regional Groundwater Medians

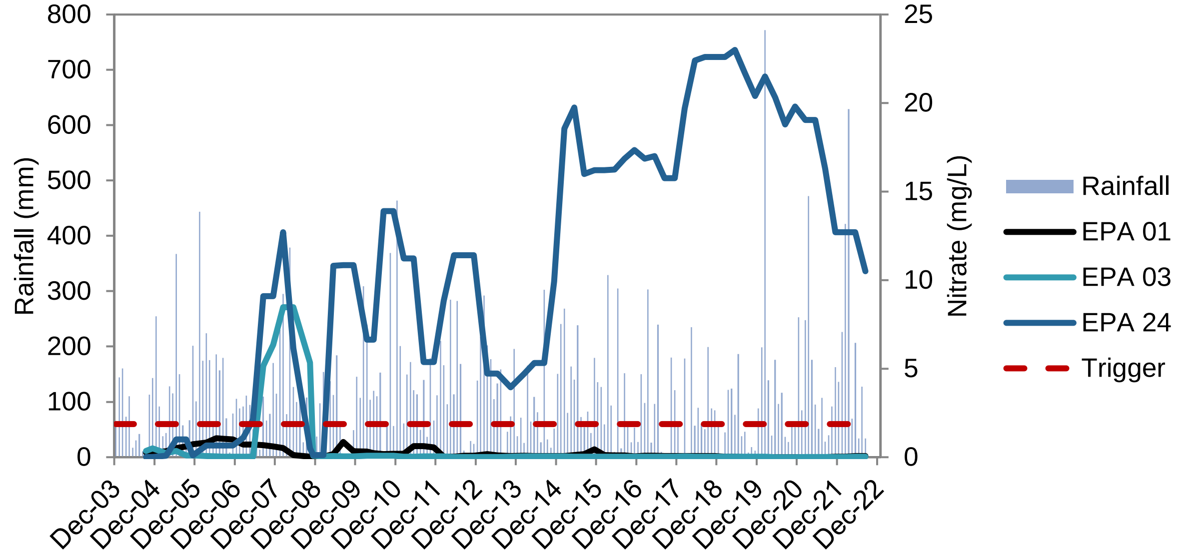

Figure 3-5d: Manganese Regional Groundwater Medians

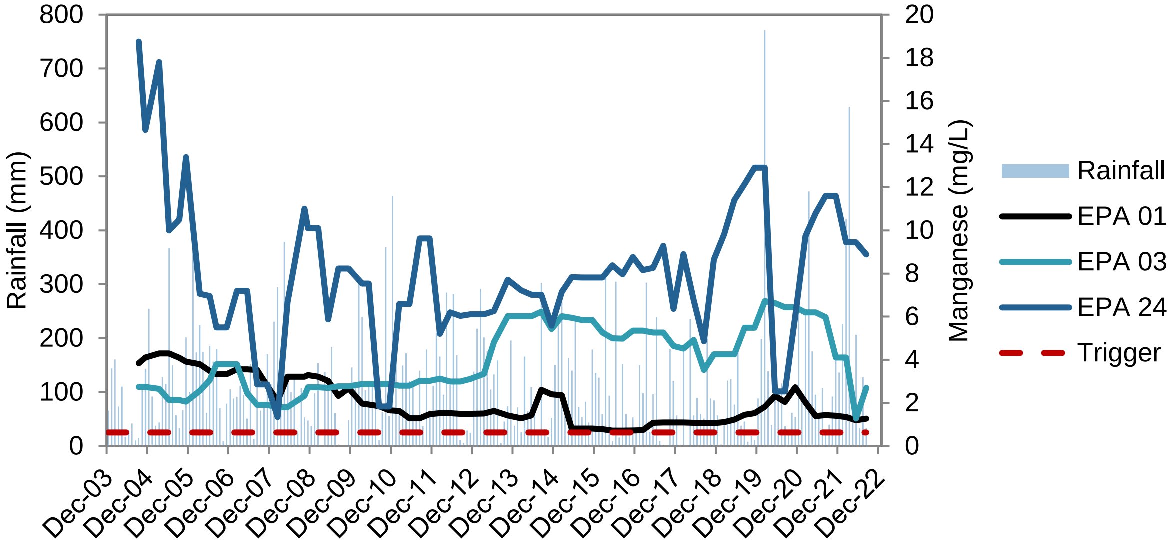

Figure 3-5e: Total Organic Carbon Regional Groundwater Medians

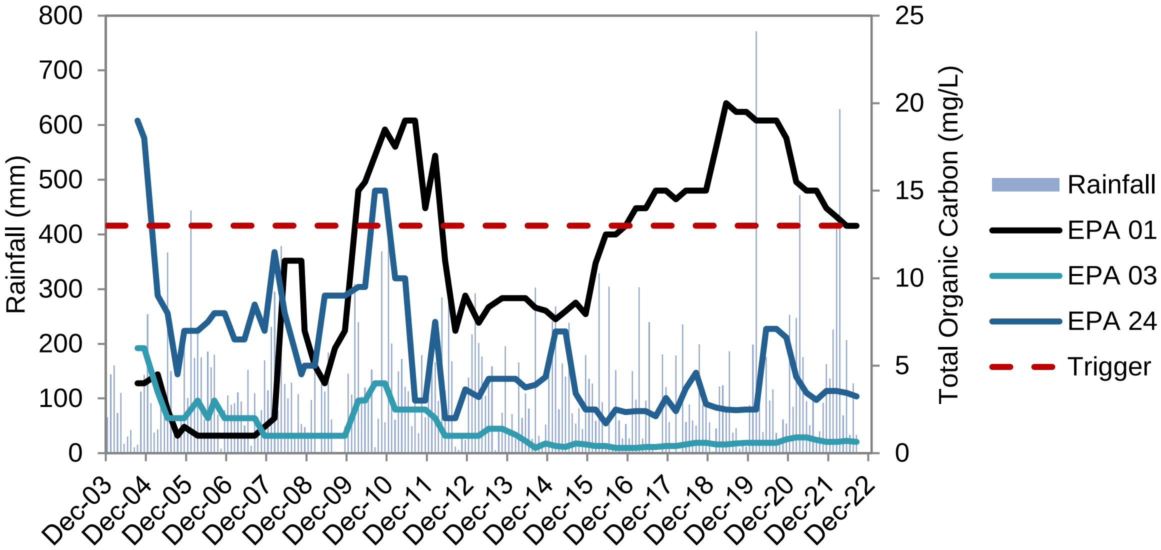

Figure 3-5f: Sulphate Regional Groundwater Medians

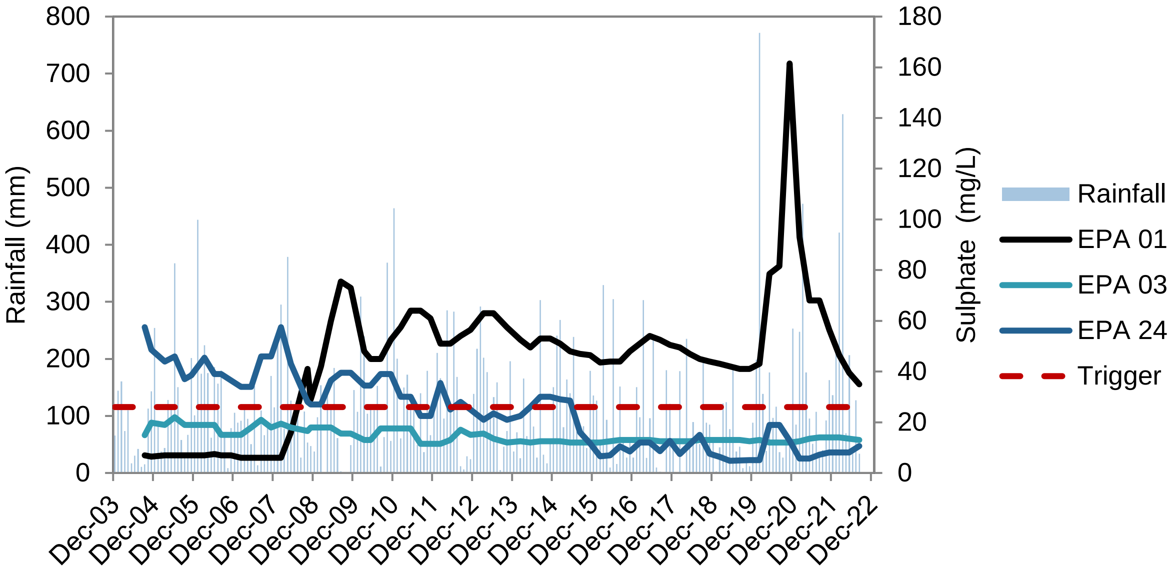

Figure 3-5: Running 4pt Medians for select analytes for Downstream Regional Aquifer Monitoring Bores

As shown in Figure 3-5b, Ammonia concentrations within EPA 01 (northern side of landfill) increased significantly in 2008, and thereafter plateaued until 2019 and has remained relatively consistent in recent reporting periods. In reference to the alluvial groundwater sampling bores that are both upslope (EPA 04) and downslope (EPA 05) of this regional monitoring bore (refer to Figure 3-3), Ammonia contained within the alluvial groundwater management unit may be entering the deeper regional groundwater management unit, hence resulting in the observed presence of low concentrations of Ammonia. As observed with the alluvial monitoring bores, this observed impact likely reduces with distance from the landfill. All Ammonia concentrations recorded for EPA 01 during this monitoring period exceeded the trigger value of 1.74mg/L, however, the other two downstream bores' (MW03 and MW07) Ammonia concentrations complied with the trigger.

3.4.3 Nature and level of environmental risk

No contaminants have been recorded within any of the regional monitoring bores at concentrations that would pose significant human health risks.

Many contaminants within monitoring bores EPA 01, EPA 03 and EPA 24 exceeded their nominated trigger value, and as such pose a potential level of environmental risk. The location of EPA 01 is within the Northern Sediment Basin (upstream of SDP1 – EPA 06), and since 2008 has yielded results vastly different to that collected prior to 2008. As such, water taken from monitoring bore EPA 01 is not viewed as being indicative of the wider regional aquifer. There is potential that this bore is directly connected to Northern Sediment Dam, MW04 and MW05 (EPA 04 and 05) with results suggesting this relationship.

Although there is an exceedance of some analytes in the upslope bores, there is a higher degree of exceedance in the downslope bores. This may indicate the landfill site as a contamination source for the regional groundwater aquifer. For example, alkalinity, sulphate, chloride, calcium, sodium and magnesium during the current monitoring period exceed their trigger values in the downslope monitoring bores; however, values are generally compliant in the upslope monitoring bores.

In addition, Council is currently actioning recommended actions by NSW EPA in letter dated 28th October 2021 – *Monitoring And Concentration Limit Requirements,* in particular Condition 2D which states that *the Licensee must provide the EPA with a hydrogeological assessment undertaken by a suitably qualified and experienced person to identify the source of groundwater contamination at EPA point 1, 4 and 5 by 5pm on 31 March 2023. The Licensee must provide* *the EPA with a hydrogeological assessment undertaken by a suitably qualified and experienced person to identify the source of groundwater contamination at EPA point 1, 4 and 5. The hydrogeological assessment must include hydrogeochemistry and/or isotopic signatures for 13C-DIC and 15N-NH4+ and tritium.*

3.4.4 Augmenting the current monitoring regime

The monitoring regime provides a good temporal scale of data collection and a wide variety of analytes associated with assessing both environmental and human health risks. There are, however, some issues with the location of downslope monitoring bores, highlighted in the previous annual reports. The location of monitoring bores EPA 01 and EPA03 may yield results that may inadequately describe the quality of the regional aquifer. These results need to be investigated further.

Council has liaised with the EPA concerning potentially decommissioning monitoring bore EPA 01 and installing another downslope regional monitoring bore north of the Northern Sediment Basin. Council will continue to liaise with the EPA regarding this, however, both parties need to be cognisant of any unintended impacts on any inconsistency that may arise when analysing new well data with historic data sets. Council had scheduled this project for early 2022, however due to recent natural disaster (floods) has rescheduled this for 2022-2023 licence period.

While monitoring bore EPA 03 is yielding fairly consistent results since 2003, its location within the operating quarry and low depth to groundwater (due to quarrying activities), has in the past not represented the best location to assess the impact of the landfill on the broader downslope regional aquifer (AWC, 2015). This was due to the regional aquifer surrounding monitoring bore EPA 03 possibly being subjected to localised hydraulic and quality impacts associated with the operation of the quarry. The integrity of MW01 (EPA 01) should be assessed prior to the next monitoring event.

3.5 Surface Water

Surface water sampling sites are located at the spillway of both sediment dams, and within the Simpson Creek Tributary, 1km west of the landfill site. It is important to note that results presented from sites EPA (Surface Water Discharge Point 1) 06 and EPA 08 (SDP2) do not represent waters discharging to the receiving environment, as samples are taken from water within the sediment basins (at the spillway end), not from water overtopping the spillway. Table 3-4 shows recorded values for the current monitoring period and Appendix A shows graphs containing the collated historical water quality values.

During the 2021-22 monitoring period, all Calcium values recorded from monitoring sites EPA 06 and EPA 08 exceeded the trigger value of 20.7mg/L. Ammonia levels at EPA06 have increased significantly but are below peaks observed in 2019. All Potassium levels for EPA 08 and one event for EPA 06 exceeded the trigger level of 11.8mg/L. Additionally, several isolated trigger exceedances occurred with other analytes, namely:

- All four Iron values at EPA 06
- One of the four Alkalinity values at EPA 08
- Single exceedance occurrences for Conductivity, Iron, Nitrate and Total Organic Carbons for EPA 08

The furthest downstream background surface water monitoring site in the Simpsons Creek tributary (SW1 - EPA 33) only exceeded Iron water quality triggers, which is unlikely to be caused by landfill operations. Dissolved Oxygen levels were below the trigger value of 6mg/L for all occurrences. DO is a highly variable water quality parameter with concentrations constantly affected by complex biological and physical influencing environmental factors (e.g., diffusion and aeration, photosynthesis, respiration and decomposition, seasonal temperature, the amount of naturally occurring organic matter, salinity, algal presence, and the time of day the sample was taken). Although the monitoring point EPA 33 is required to have samples taken and results compared with the relevant trigger values, the licence identifies the monitoring point as a background surface water monitoring point. The licence may require updating to reflect site conditions.

Iron is observed at elevated levels naturally within the region and is highly mobile within the soil and groundwater environment. During low rainfall conditions, it is probable that the concentration of iron within the surface and shallow groundwater system increases due to lack of dilution from rainfall and enhanced oxidation and mobilisation of iron-bound clay particles within the wider soil profiles surrounding monitoring point EPA 33 (AWC, 2015). Median values for iron recorded at EPA 33 have steadily increased since 2011, with an increase in 2015 and 2019 and decrease in more recent events for EPA 33 as shown in Figure 3-6e.

Since environmental monitoring commenced at Myocum Landfill, water quality within monitoring sites EPA 06 and EPA 08 has consistently exceeded trigger values for potassium and calcium as shown in Figures 3-6b and 3-6c respectively.

Chloride results sampled from the Northern Sediment Dam (EPA 06) in August 2021 have seen a spike above trigger levels as shown in Figure 3-7 raw monitoring results (not median). The exact cause of this spike is unknown, with chloride never exceeding trigger levels for Chloride in this sediment dam historically. This spike may be related to recent works to clean out and block the old stormwater pipe that is adjacent to the sediment dam. To this end, Chloride should be monitored further in future monitoring events.

Figure 3-6a: Conductivity Surface Water Medians

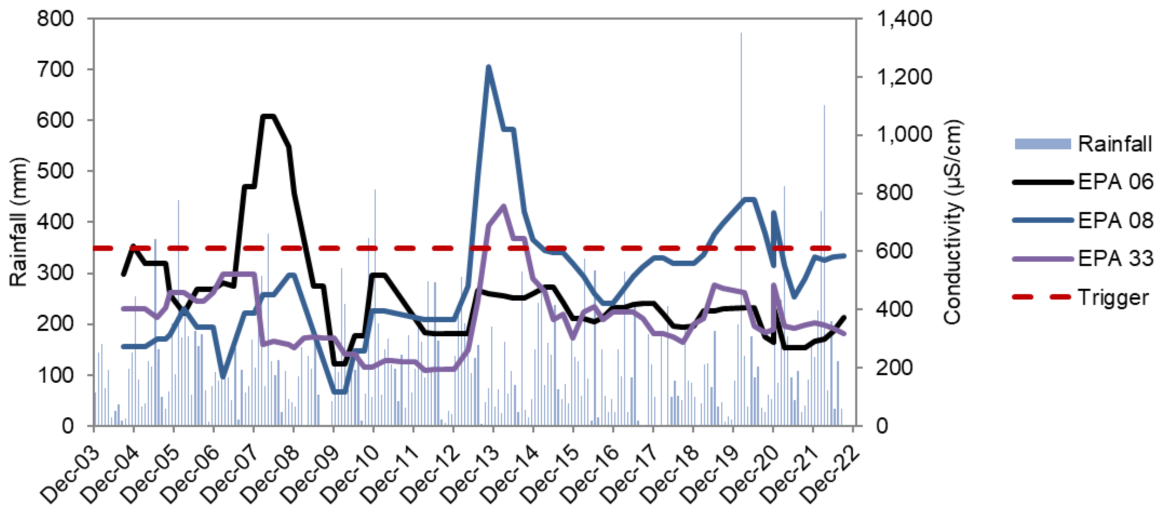

Figure 3-6b: Potassium Surface Water Medians

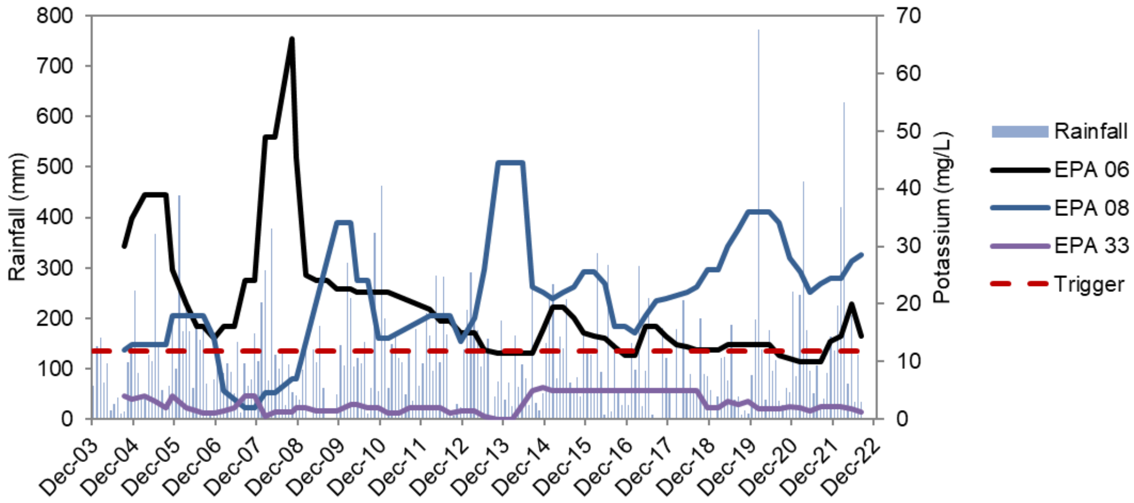
800
700
600
500
400
300
200
100
0
Rainfall (mm)
70
60
50
40
30
20
10
0
Potassium (mg/L)
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
Dec-18
Dec-19
Dec-20
Dec-21
Dec-22
Rainfall
EPA 06
EPA 08
EPA 33
Trigger

Figure 3-6c: Calcium Surface Water Medians

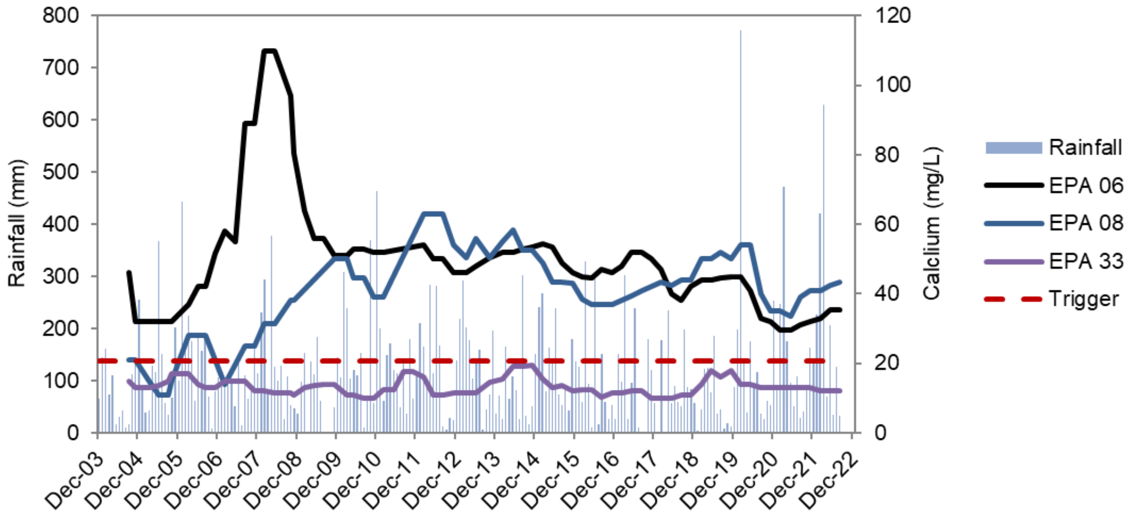

Figure 3-6d: Ammonia Surface Water Medians

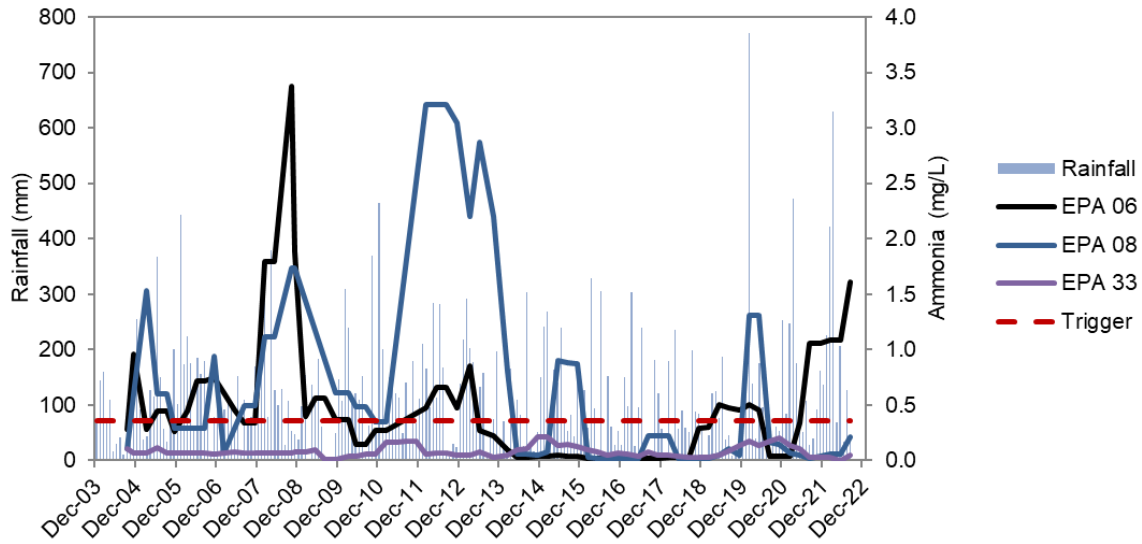

Figure 3-6e: Iron Surface Water Medians

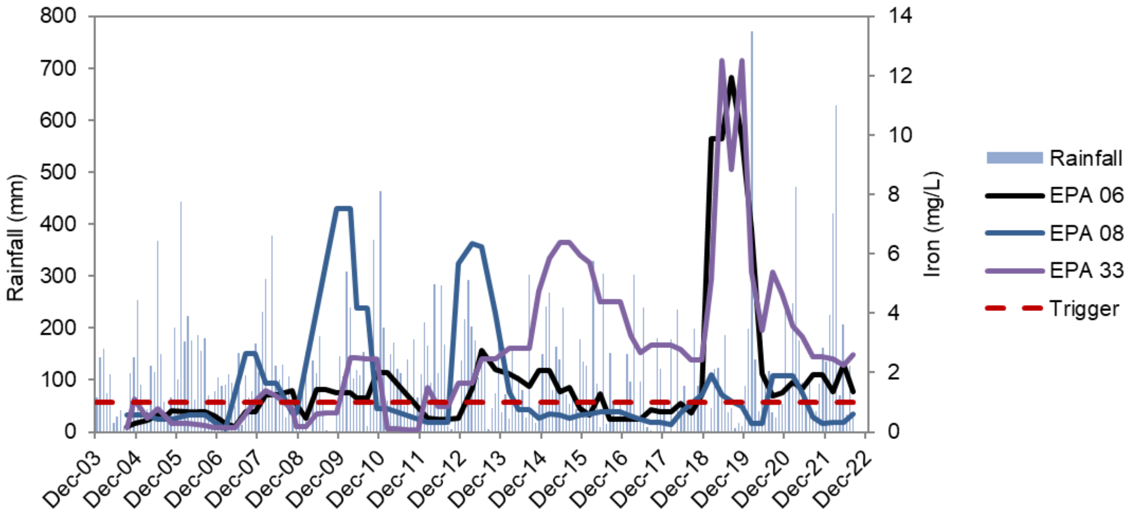

Figure 3-6: Running 4pt medians for select analytes for Surface water monitoring locations.

Chloride Surface Water Concentration Levels (Actual)

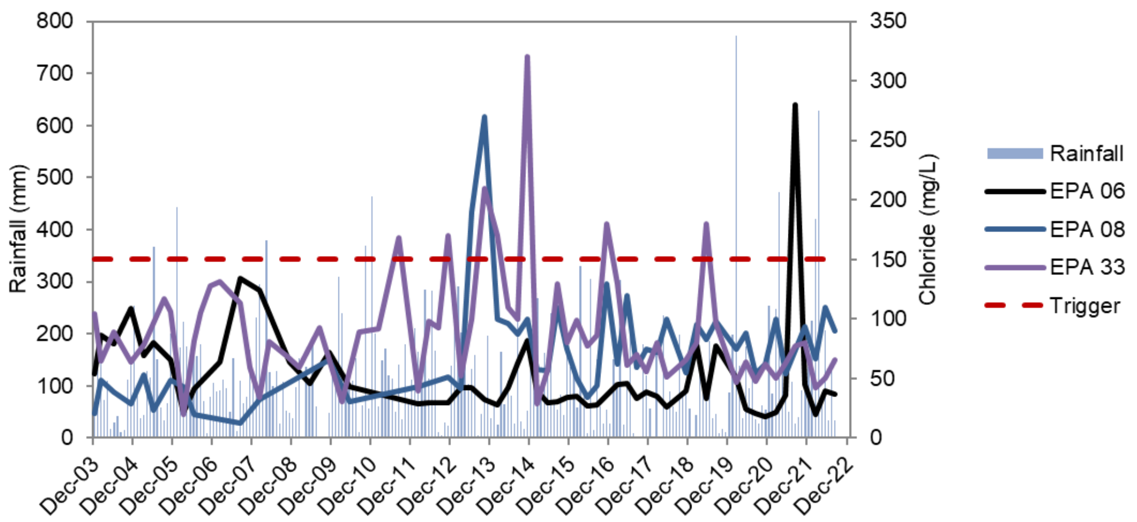

Figure 3-7: All results for Chloride Surface Water levels from 2003 to the current 2021 reporting period.

Based on the data above and appraisal of the Monitoring Review – Myocum Landfill (Tim Fitzroy & Associates, 2021), there appears to be a correlation between concentrations of Ammonia, Iron, Chloride, Nitrate and Calcium in the Northern Sediment Dam (EPA 06) and rainfall. In particular, events that resulted in leachate expression from Leachate Storage Area 2 which likely entered the sediment dams on site causing spikes in a number of concentrations. This is particularly evident with respect to Ammonia and Nitrate concentration levels in early 2020. This relationship further extends to MW01 (EPA 01) where spikes in concentrations of Ammonia, Iron, Chloride and Calcium also increased during these periods. Recent rainfall events in early 2022 appear to be following this trend.

3.5.1 Nature and level of environmental risk

No contaminants have been recorded at any of the surface water monitoring locations that would pose significant human health risks and are generally deemed low risk.

Numerous contaminants within monitoring points EPA 06 and 08 exceeded their nominated trigger values (Alkalinity, Total Organic Carbon, Potassium, Calcium, Chloride and Iron), however, these contaminants are mostly restricted to salts, which pose minor concern for the environment at the concentrations observed.

It is important to reiterate that the data reported for monitoring points EPA 06 and EPA 08 is collected from within the ponds, rather than stormwater exiting the ponds during wet weather events. As such, high salt concentrations of the water are expected at certain times of the year, based on rainfall and evaporation patterns diluting or concentrating salts within the water column of the sediment ponds.

3.5.2 Augmenting the current monitoring regime

The current monitoring program employed to assess the potential impacts of the Myocum Landfill on the surface water adequately monitors water quality. The sampling regime provides a good temporal scale of data collection.

3.6 Leachate

Comparison of groundwater and surface water quality against leachate water quality from select leachate monitoring sites is prompted based on the assessment of contamination spikes in several monitoring locations listed earlier. Appendix B shows historical graphs for leachate water quality. Table 3-5 presents the monitoring results for the leachate locations sampled during the current monitoring period.

3.6.1 Northern Landfilling area

Leachate Sump A (LSA - EPA 09) which monitors the leachate interception trench has historically been compared with alluvial groundwater monitoring points EPA 04 and 05 (MW04 and 05). LSA levels have remained relatively consistent over the past several years with the exception of the recent six months which shows an increase in Nitrate levels.

Leachate Tank (LTB - EPA 11) downstream of the northern edge of the landfill shows varying levels for almost all contaminants. Low concentrations are recorded typically after high rainfall events. In particular, this is observed in the February 2020 and February 2022 monitoring events.

3.6.2 Southern Landfilling area

The results from the monitoring of Leachate Sump E (LSE – EPA 25) show similar trends to those seen in Leachate Tank (LTB - EPA 11), with low concentrations recorded during and/or after high rainfall events. It is noted that Nitrate levels were higher than normal during the November 2021 monitoring event.

Leachate Detection Sump (LDS – EPA 32) results for the 2021 monitoring period are relatively consistent with the historical water quality results provided. Water quality levels for Leachate Sump B (LSB – EPA 10) have been unmonitored since 2012 with monitoring recommencing in August 2021.

3.6.3 Leachate storage areas

Monitoring of Leachate Storage Area 2 (LS2) from the discharge point LDP2 (EPA 13), has shown inconsistent results and no noticeable trends. That being said, a low concentration point for the May 2021 monitoring event was seen for the following parameters: Conductivity, Alkalinity, Sodium, Potassium, Chloride, Ammonia, Magnesium, Sulphate, Arsenic and Fluoride.

Table 3-5: Tabulated summary of leachate water quality monitoring results between September 2020 and August 2021

Sample Location	EPA Point	Date	pH	Temp °C	Conductivity uS/cm	Alkalinity mg/L	Sulphate Filtered mg/L	Chloride mg/L	Calcium Filtered mg/L	Magnesium mg/L	Sodium Filtered mg/L	Potassium Filtered mg/L	Arsenic mg/L	Iron Total mg/L	Manganese Total mg/L	Fluoride mg/L	Ammonia as N mg/L	Nitrate as N mg/L	Total Organic Carbon mg/L	Total Phenols ug/L	Total Organochlorine Pesticides ug/L
LSA	EPA 09	15-Nov-21	6.1	19.9	531	69	48.0	73	39	6.0	39	15.0	0.000	0.16	0.328	0.04	0.95	5.81	8.1	< 1	<8
LSA	EPA 09	10-Feb-22	6.4	22.7	306	76	17.0	28	22	4.0	22	14.0	0.000	0.86	0.706	0.04	1.86	1.90	12.0	< 1	< 1
LSA	EPA 09	05-May-22	6.0	21.4	2,794	64	42.0	86	26	5.8	53	15.0	<0.001	0.27	0.779	0.04	5.00	6.27	13.0	< 4	< 4
LSA	EPA 09	11-Aug-22	5.8	17.9	657	76	39.0	94	31	6.7	59	16.0	<0.001	0.46	1.25	0.01	6.49	5.17	13.0	< 12	<8
LSB	EPA 10	10-Nov-21	8.0	30.2	8,929	4	34.0	1,200	111	46.0	720	291.0	0.021	3.09	0.957	0.23	650.00	1.8	305.0	< 4	<8
LSB	EPA 10	10-Feb-22	7.5	30.8	7,284	2,941	26.0	670	131	46.0	570	243.0	0.02	8.58	1.55	0.02	534.00	0.94	265.0	< 4	< 4
LSB	EPA 10	05-May-22	7.5	30.6	7,986	3,219	29.0	1,020	124	45.0	584	242.0	0.023	7.36	1.46	0.25	579.00	<0.02	274.0	< 4	< 4
LSB	EPA 10	11-Aug-22	7.5	27.8	8,218	3,216	29.0	950	129	46.0	621	249.0	0.023	8.41	1.69	0.20	576.00	4.09	282.0	< 12	< 16
LTB	EPA 11	10-Nov-21	7.8	21.7	5,397	2,340	33.0	550	122	40.0	345	146.0	0.008	6.11	0.39	0.18	372.00	0.74	165.0	<4	<8
LTB	EPA 11	10-Feb-22	7.8	22.4	3,002	1,191	42.0	270	90	26.0	202	86.0	0.004	3.99	0.47	0.10	188.00	4.81	75.0	< 1	< 4
LTB	EPA 11	05-May-22	7.3	22.3	2,794	1,044	16.0	250	104	24.0	172	77.0	0.004	8.38	1.02	0.12	153.00	10.80	60.0	< 4	< 4
LTB	EPA 11	11-Aug-22	7.4	18.3	2,390	787	54.0	320	78	21.0	155	60.0	0.004	9.67	2.26	0.07	133.00	3.93	63.0	< 12	< 16
LSE	EPA 25	10-Nov-21	8.1	24.9	9,682	3,772	46.0	1,350	101	50.0	812	335.0	0.025	3.29	0.732	0.29	694.00	0.02	305.0	< 4	< 8
LSE	EPA 25	10-Feb-22	7.9	25.3	8,325	3,198	34.0	900	85	48.0	749	294.0	0.021	4.95	1.01	0.24	580.00	0.51	265.0	< 4	< 4
LSE	EPA 25	05-May-22	7.9	22.5	3,815	3,007	35.0	250	104	50.0	708	260.0	0.029	8.86	1.04	0.26	561.00	0.3	285.0	< 4	< 4
LSE	EPA 25	11-Aug-22	7.9	18.3	8,752	3,139	33.0	1,250	89	51.0	774	281.0	0.027	7.46	1.17	0.26	572.00	1.01	330.0	< 12	< 8
LDS	EPA 32	10-Nov-21	7.7	22.5	1,050	246	199.0	110	142	6.8	60	18.0	0.002	1.26	0.732	0.09	0.09	5.99	43.0	<4	<8
LDS	EPA 32	10-Feb-22	7.4	21.8	709	174	71.0	69	95	5.1	44	7.2	0.003	5.93	0.438	0.07	1.96	1.14	35.0	<1	<1
LDS	EPA 32	05-May-22	7.7	21.5	740	161	73.0	88	96	4.4	47	5.7	0.002	2.91	0.481	0.08	0.55	1.19	32.0	<4	<4
LDS	EPA 32	11-Aug-22	7.2	19.6	764	172	82.0	88	101	4.8	49	6.2	0.002	6.15	0.306	0.06	0.45	1.15	35.0	<12	<8
LDP2	EPA 13	10-Nov-21	8.1	25.6	4,241	1,623	25.0	400	98	32.0	306	134.0	0.008	4.64	0.477	0.15	271.00	0.95	117.0	9	<8
LDP2	EPA 13	10-Feb-22	7.5	26.3	2,435	829	11.0	320	102	35.0	161	163.0	0.011	5.57	1.53	0.10	76.60	0.92	130.0	<4	<4
LDP2	EPA 13	05-May-22	8.1	20.2	2,989	1,080	59.0	290	94	23.0	202	87.0	0.006	4.38	1.11	0.12	170.00	0.23	78.0	<4	<4
LDP2	EPA 13	11-Aug-22	8.1	15.7	3,939	1,444	30.0	450	86	29.0	289	112.0	0.008	4.25	0.896	0.12	249.00	<0.72	105.0	<12	<8

4. Conclusion

Presented in this report is recent ground and surface water data collected during the monitoring period between September 2021 and August 2022, along with all historical data collected since 2003. Water quality within both the alluvial and regional groundwater management units were presented, along with surface water in the site sediment dams and one off-stream permanent creek system (Simpsons Creek). Leachate water quality was also presented to characterise leaching quality on site.

4.1 Alluvial Groundwater

Groundwater data collected from the alluvial aquifer indicate historical landfilling activities are impacting water quality. Ammonia concentration in monitoring point EPA 04 routinely exceeds the trigger value. This contamination is, however, not apparent in the downslope monitoring point EPA 05, indicating rapid attenuation within the alluvial aquifer system. This environmental impact has improved considerably since 2003, with compliant results likely to be achieved in the coming years, based on the trajectory of the monitoring data.

No contaminants have been recorded within any of the alluvial monitoring bores that would pose human health risks.

No augmentation is recommended for assessing the potential impacts of the Myocum Landfill on the alluvial aquifer.

4.2 Regional Groundwater

Monitoring points EPA 02 and 23 represent upslope monitoring points that provide a good reference point to review the potential impact of the landfill on the regional groundwater aquifer. The regional aquifer downslope of the landfill has an elevated range of contaminants compared with the upslope aquifer, mainly restricted to salts.

A substantial change occurred in water quality results sourced from EPA 01 in 2008. Concentrations of Alkalinity and Calcium increased markedly. Median values have remained high for Ammonia and Sulphate.

Council will continue to investigate the integrity of EPA 01 and EPA 03 in sampling the regional aquifer, and will continue to liaise with the EPA regarding the installation of a new regional aquifer bore in place of EPA 01 north of the Northern Sediment Dam, and also relocating EPA 03.

No contaminants have been recorded within any of the regional monitoring bores that would pose human health risks.

4.3 Surface Water

Sampling results from monitoring sites EPA 06 and 08 presented in this report represent water within the respective sediment basins, rather than the actual flow of water entering the receiving environment. Numerous salts within the sediment basins exceed their nominated trigger values, however, the risk to the environment is considered low due to the presumed dilution of these salts with the increased stormwater flow that occurs in a discharge event.

No contaminants have been recorded that would pose human health risks within any of the surface water monitoring sites.

5. References

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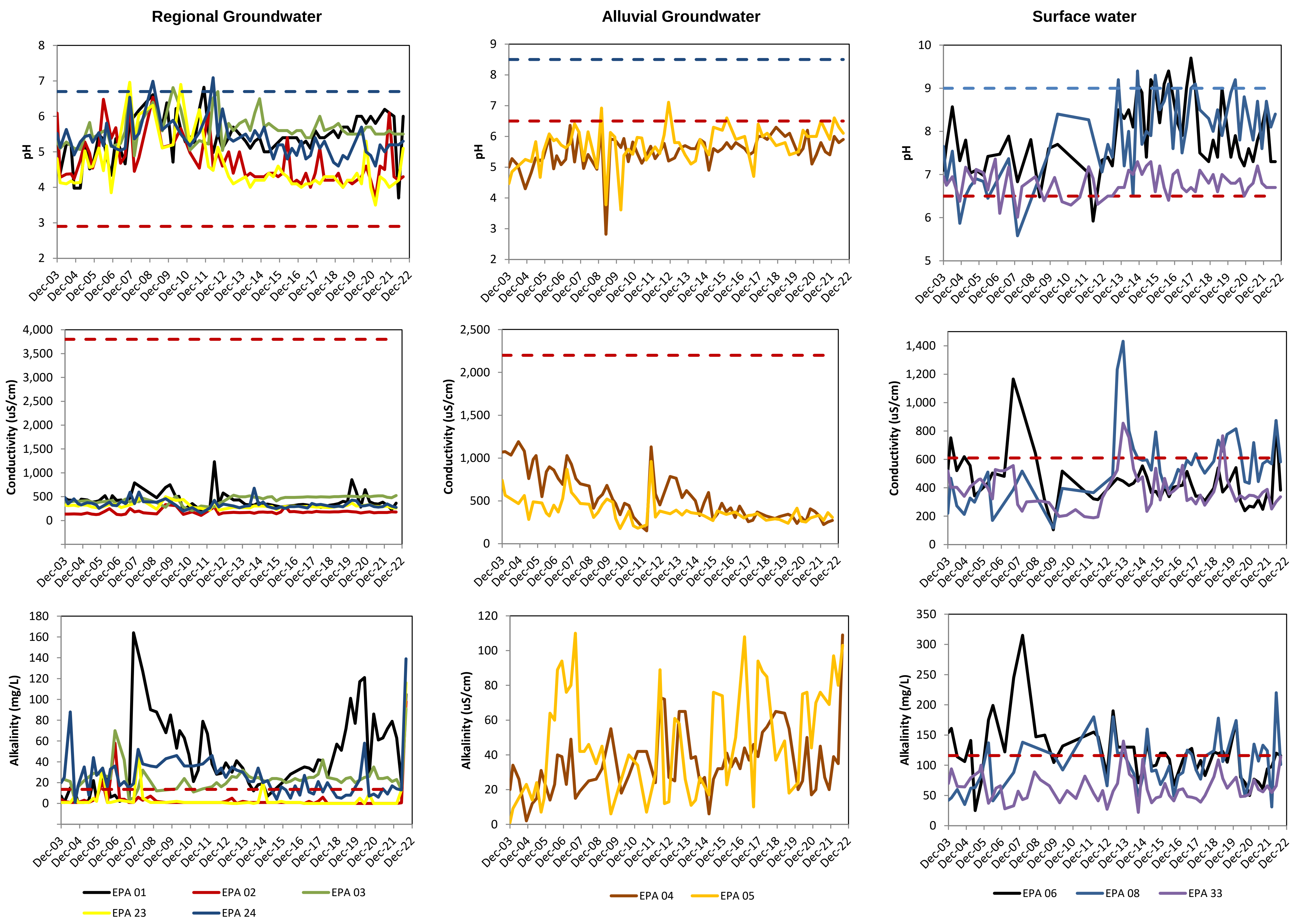
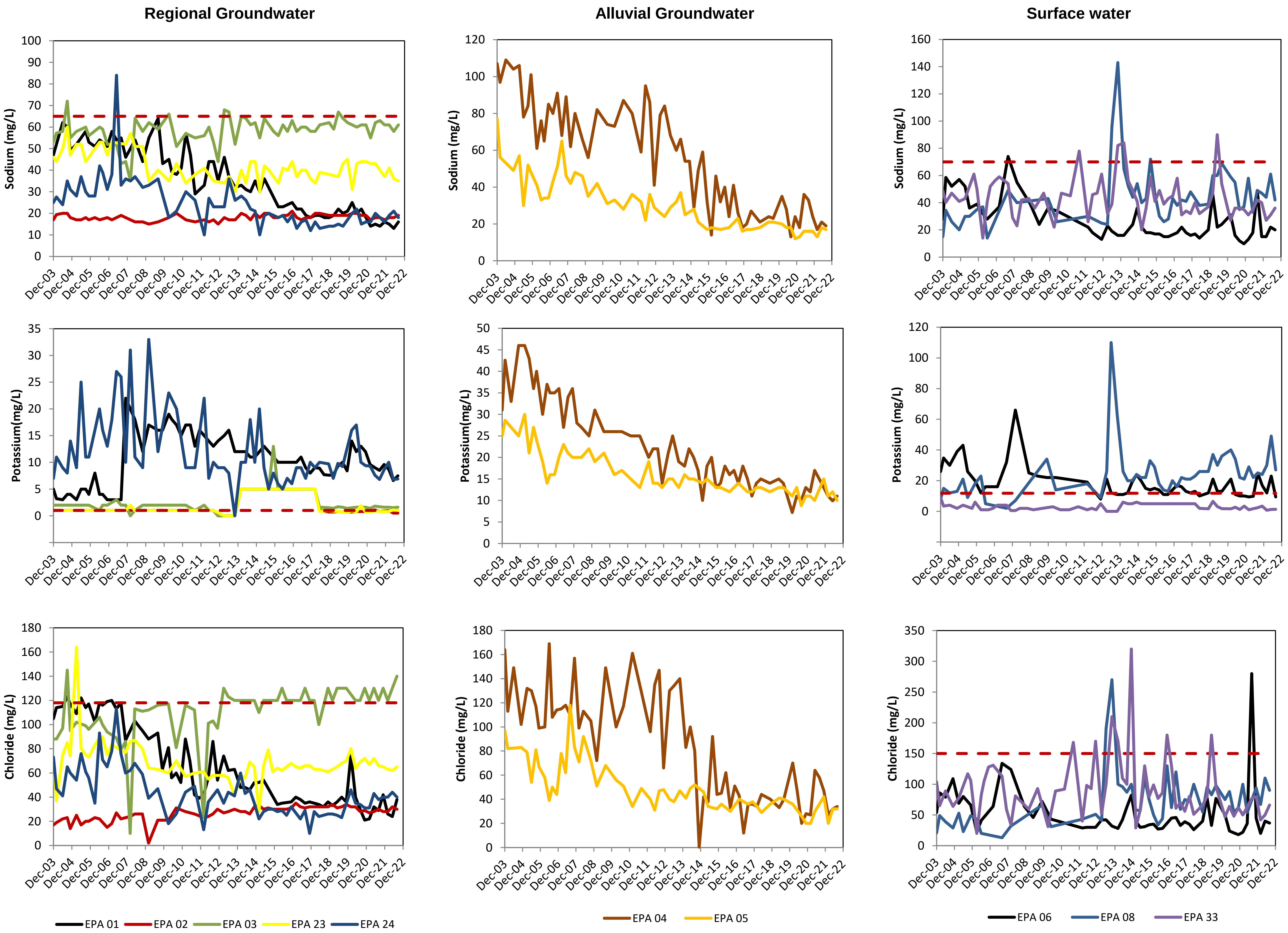
Maunsell (2002), Myocum Landfill Remediation Project – Landfill Environmental Management Plan - Revised 2008, prepared on behalf of Byron Shire Council.

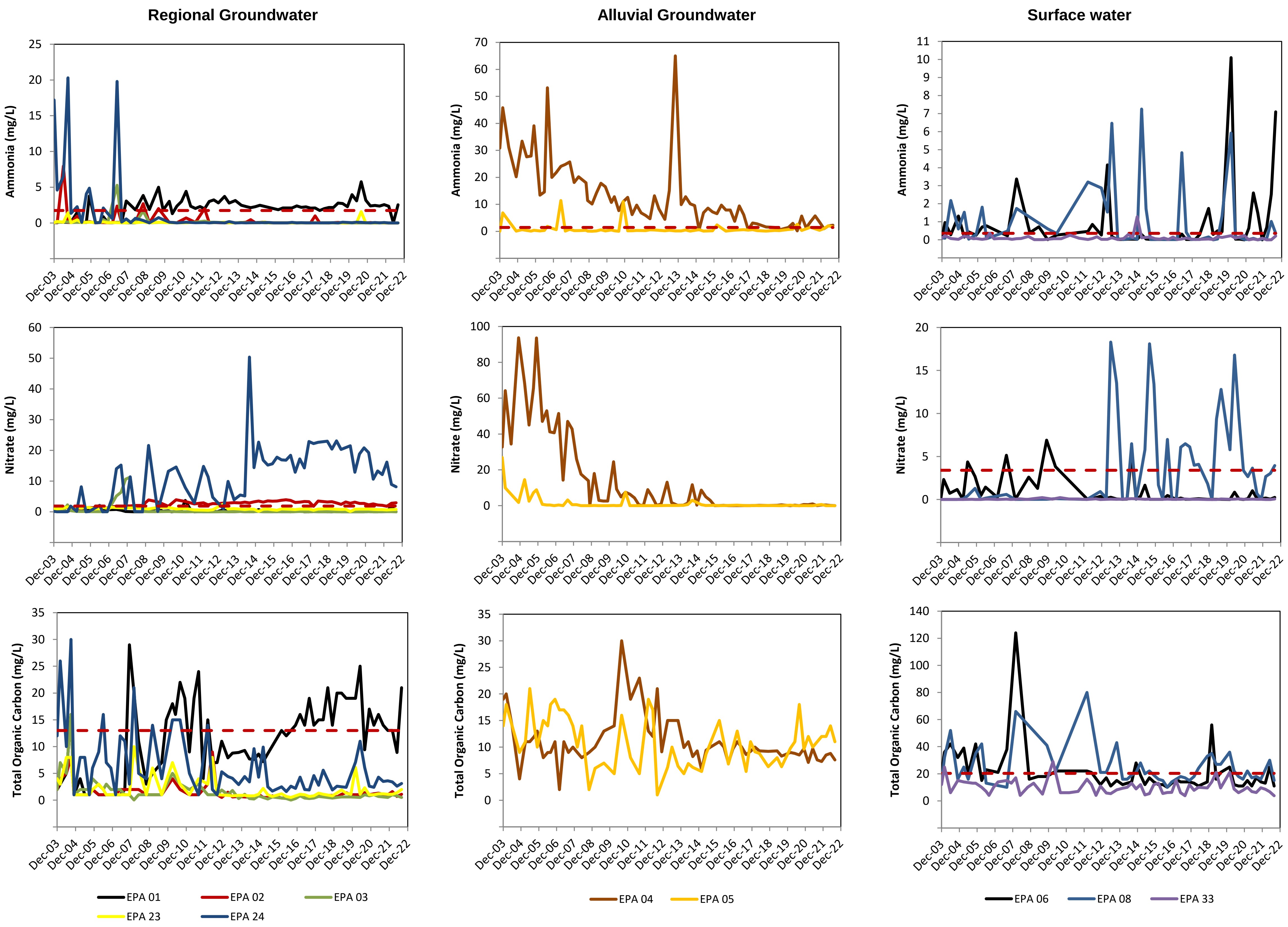
Tim Fitzroy & Associates (2021), Monitoring Review – Myocum Landfill.

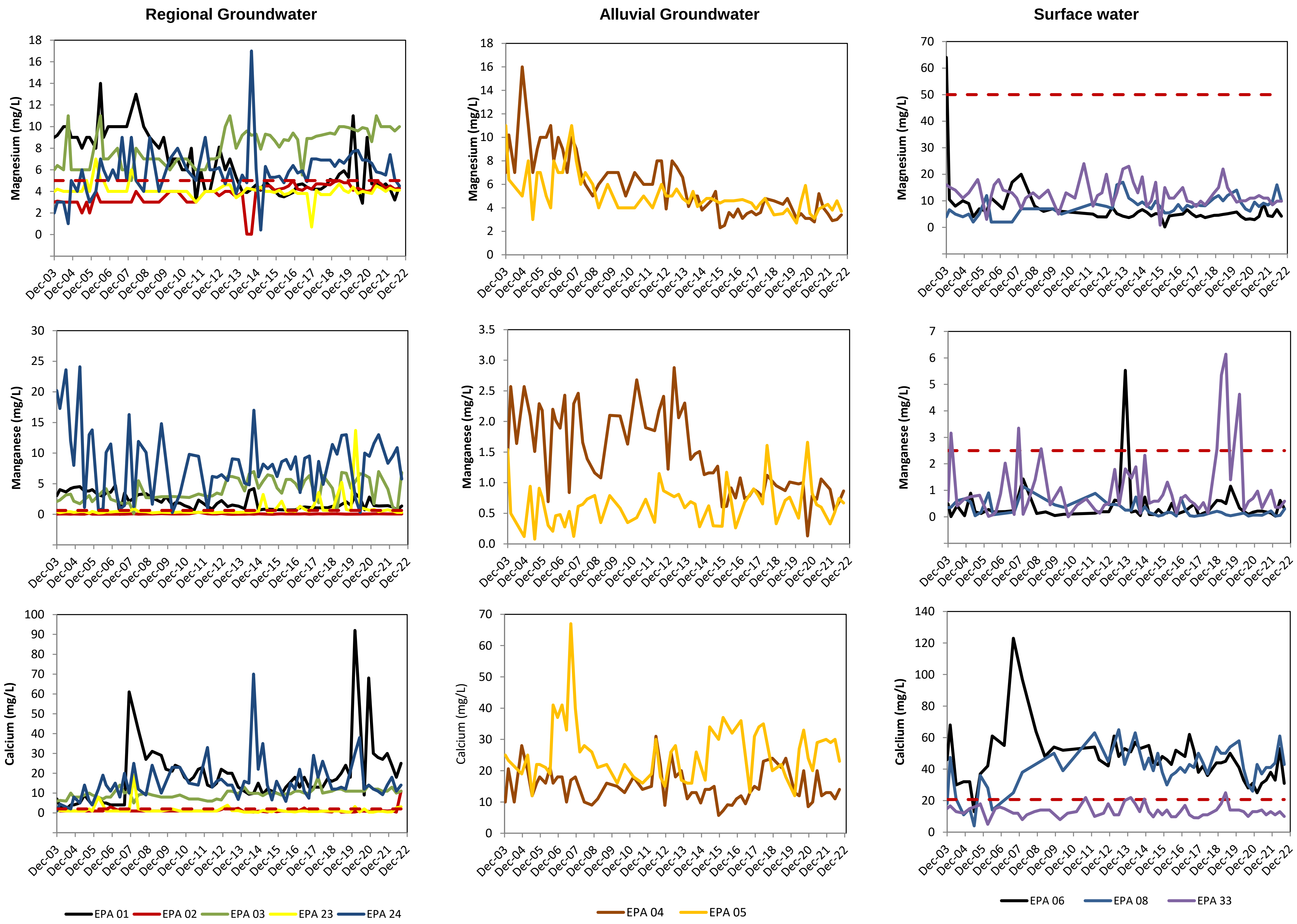
APPENDIX A Regional Groundwater, Alluvial Groundwater and Surface Water Monitoring Results between 2003 and 2022



Regional Groundwater
Alluvial Groundwater
Surface water
pH
Conductivity (uS/cm)
Alkalinity (mg/L)
Alkalinity (uS/cm)
Dec-03 Dec-04 Dec-05 Dec-06 Dec-07 Dec-08 Dec-09 Dec-10 Dec-11 Dec-12 Dec-13 Dec-14 Dec-15 Dec-16 Dec-17 Dec-18 Dec-19 Dec-20 Dec-21 Dec-22
EPA 01
EPA 02
EPA 03
EPA 23
EPA 24
EPA 04
EPA 05
EPA 06
EPA 08
EPA 33

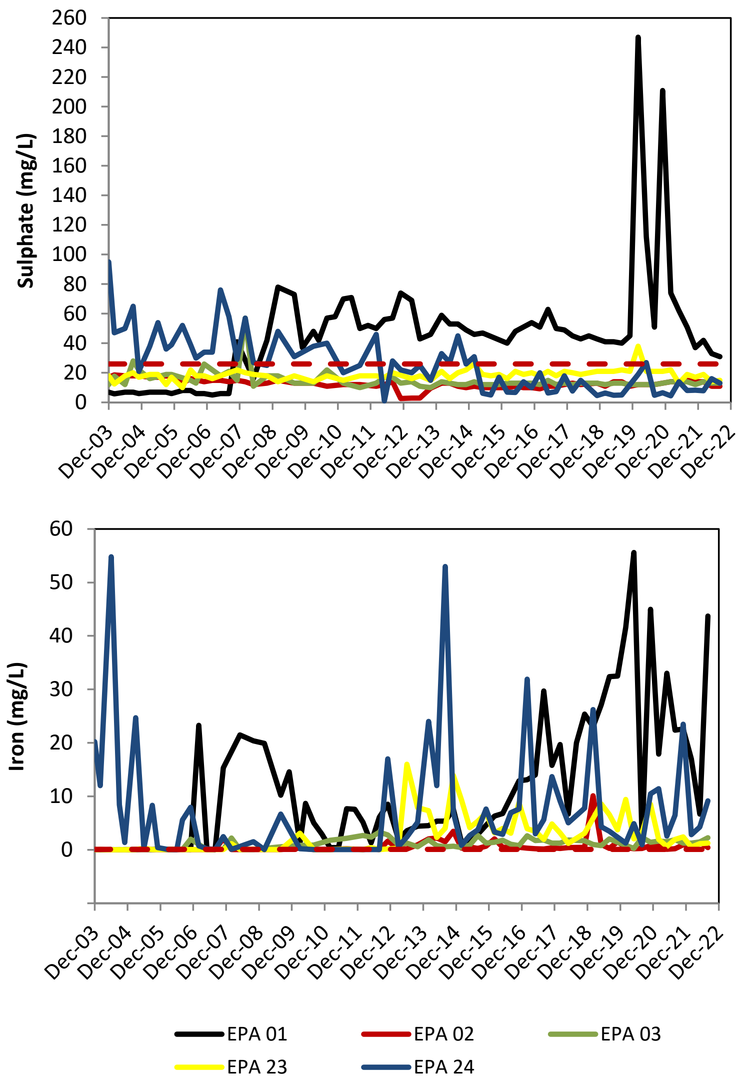

Regional Groundwater
Alluvial Groundwater
Surface water
Sodium (mg/L)
Potassium(mg/L)
Potassium (mg/L)
Chloride (mg/L)
Dec-03 Dec-04 Dec-05 Dec-06 Dec-07 Dec-08 Dec-09 Dec-10 Dec-11 Dec-12 Dec-13 Dec-14 Dec-15 Dec-16 Dec-17 Dec-18 Dec-19 Dec-20 Dec-21 Dec-22
EPA 01 EPA 02 EPA 03 EPA 23 EPA 24
EPA 04 EPA 05
EPA 06 EPA 08 EPA 33


Regional Groundwater
Alluvial Groundwater
Surface water
Ammonia (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Dec-03 Dec-04 Dec-05 Dec-06 Dec-07 Dec-08 Dec-09 Dec-10 Dec-11 Dec-12 Dec-13 Dec-14 Dec-15 Dec-16 Dec-17 Dec-18 Dec-19 Dec-20 Dec-21 Dec-22
EPA 01
EPA 02
EPA 03
EPA 23
EPA 24
EPA 04
EPA 05
EPA 06
EPA 08
EPA 33

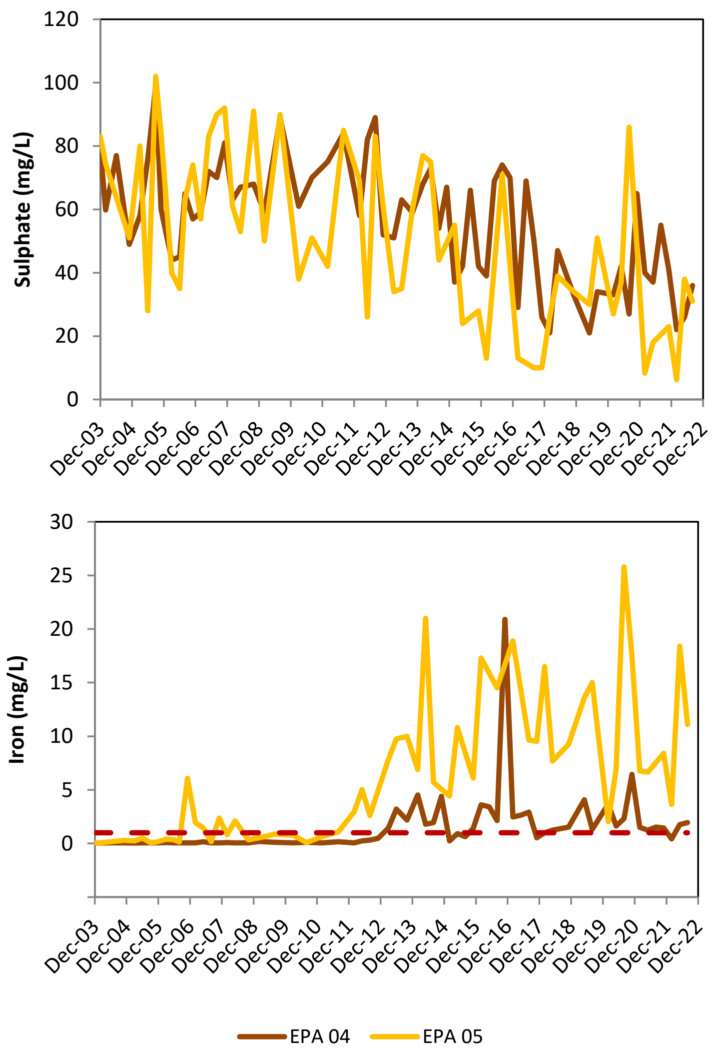


Regional Groundwater
Alluvial Groundwater
Surface water
Magnesium (mg/L)
Manganese (mg/L)
Calcium (mg/L)
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
Dec-18
Dec-19
Dec-20
Dec-21
Dec-22
EPA 01
EPA 02
EPA 03
EPA 23
EPA 24
EPA 04
EPA 05
EPA 06
EPA 08
EPA 33

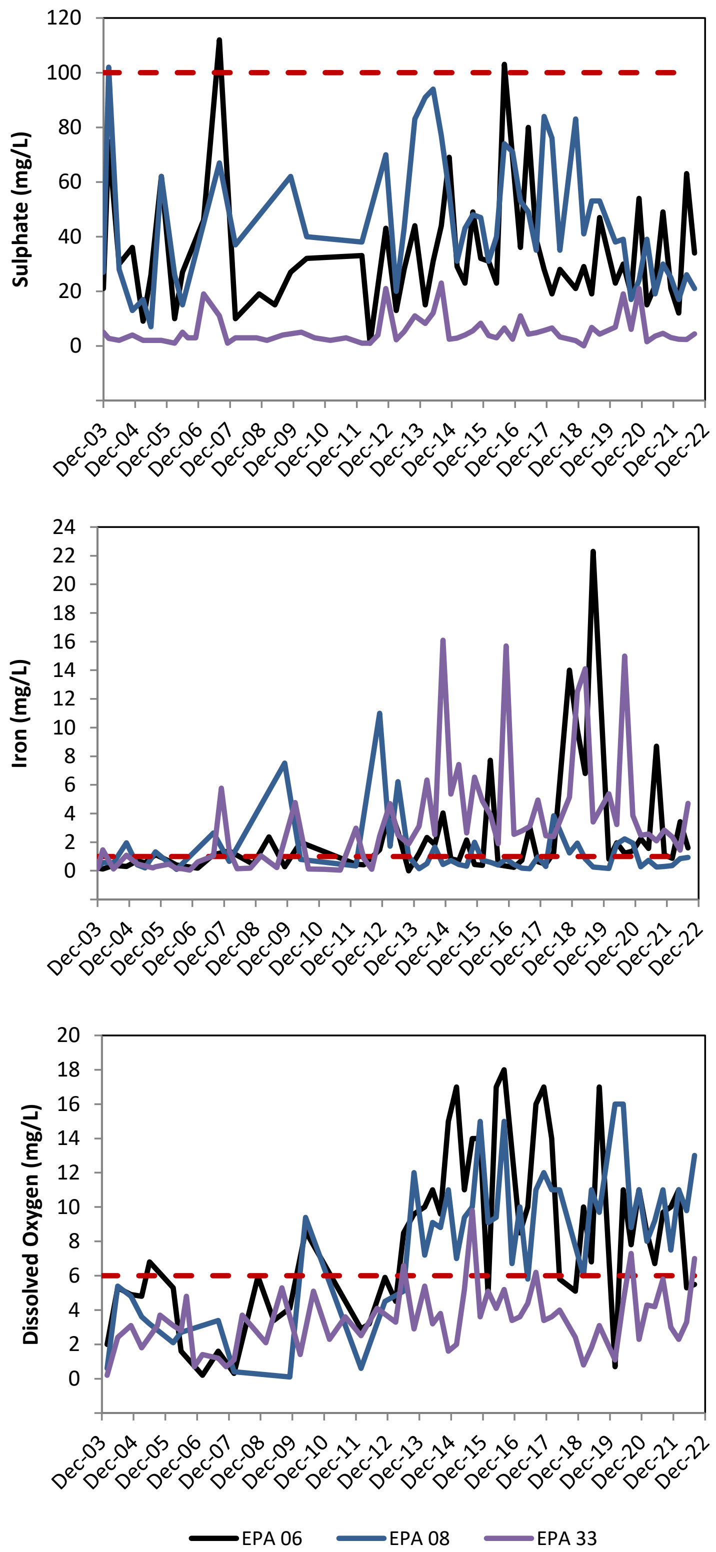
Regional Groundwater



Alluvial Groundwater



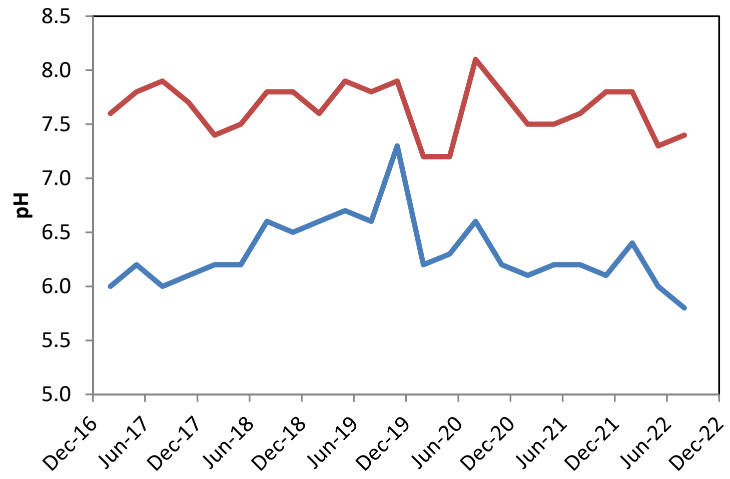
Surface water

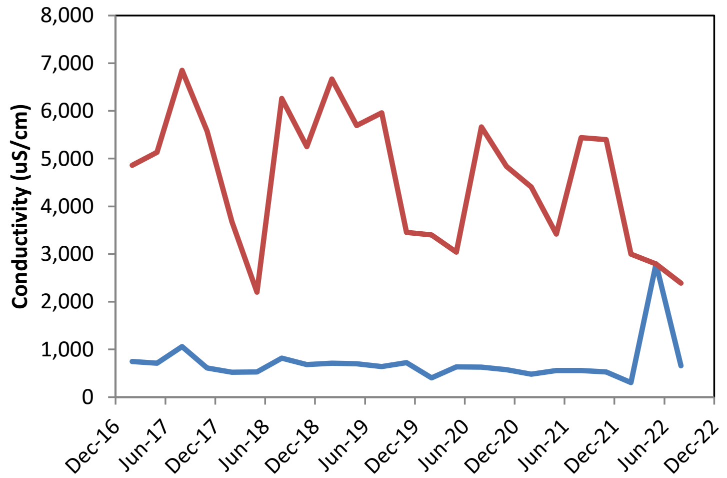


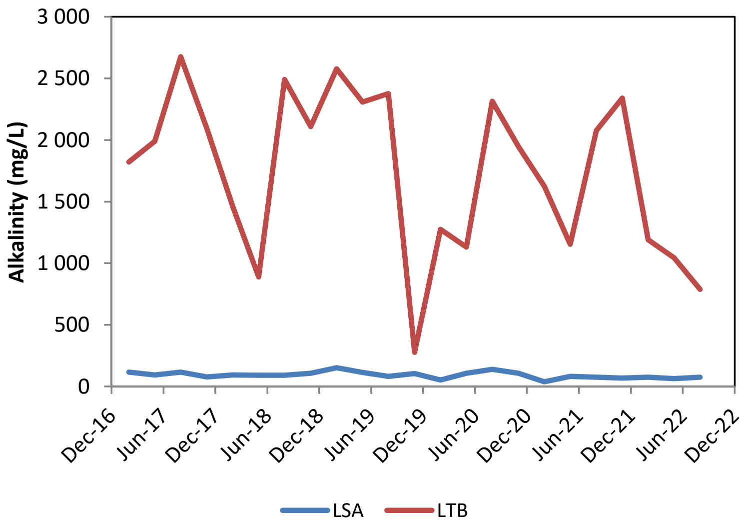
APPENDIX B Leachate Water Quality Results between 2017 and 2022

LEACHATE

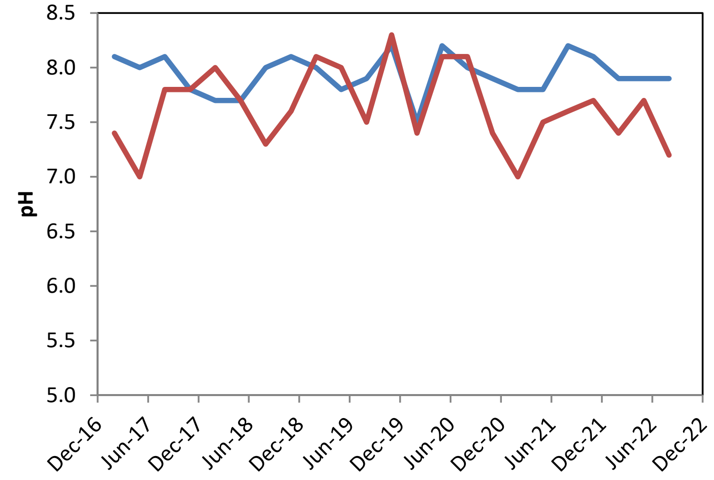
Northern Landfill

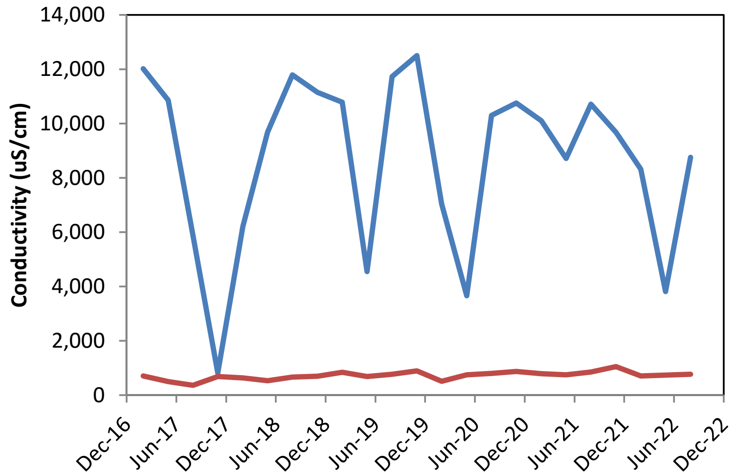


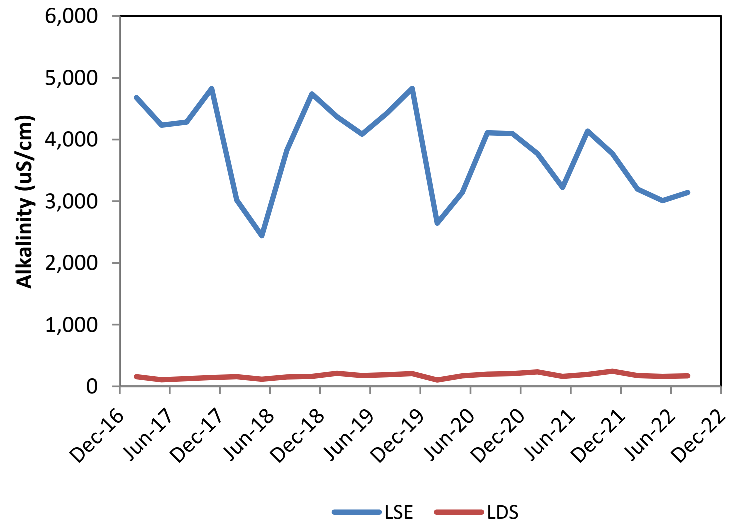




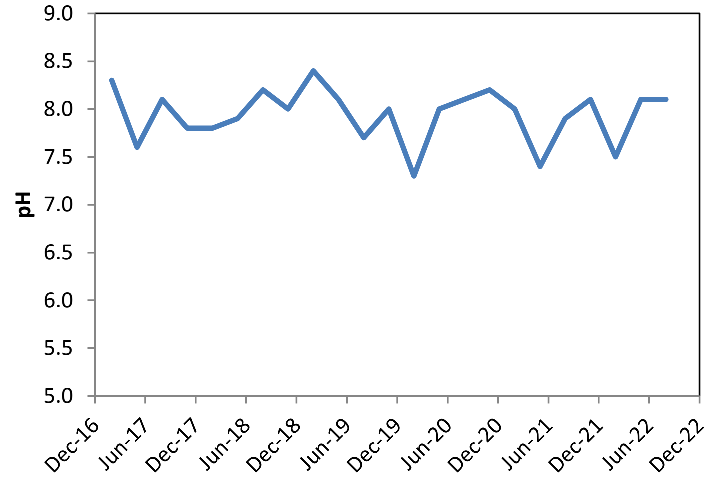
Southern Landfill

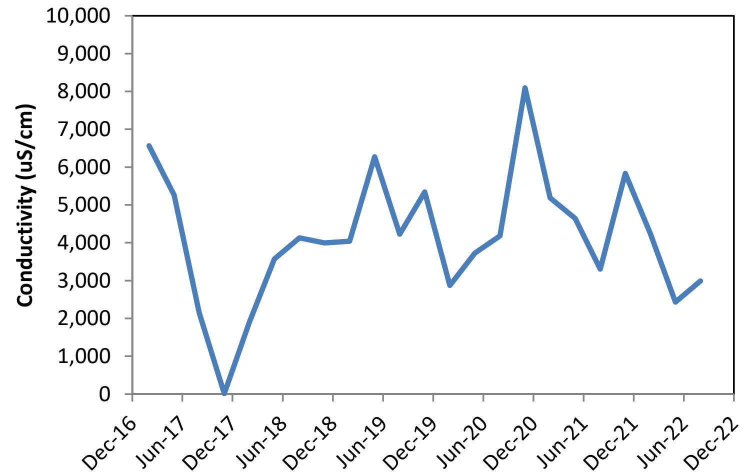


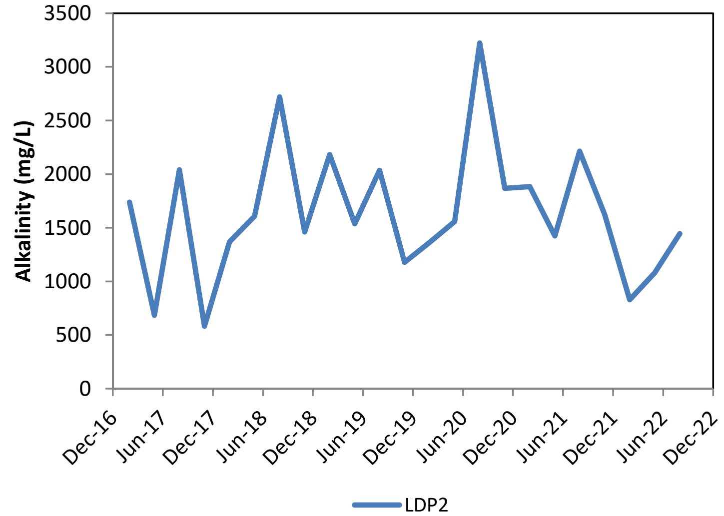




Storage Tanks

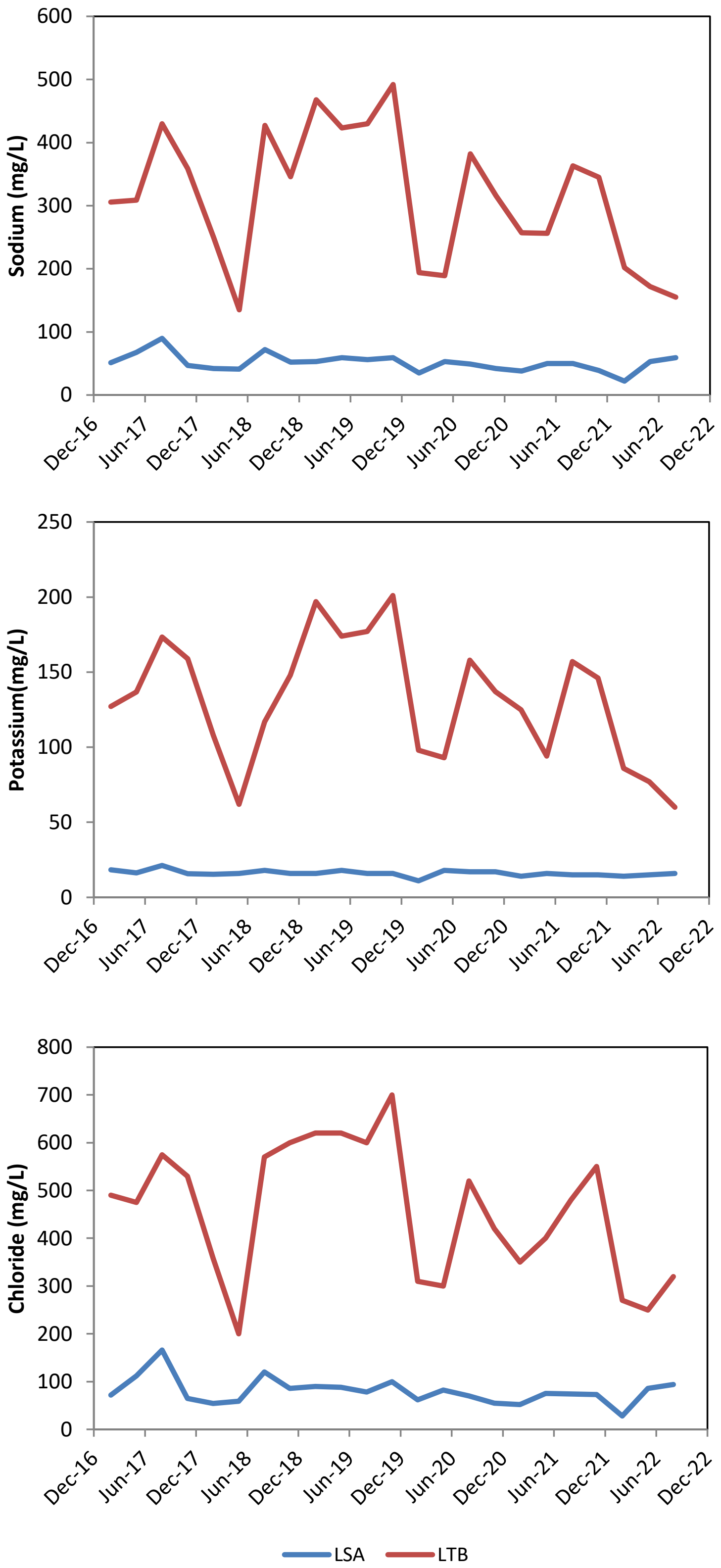




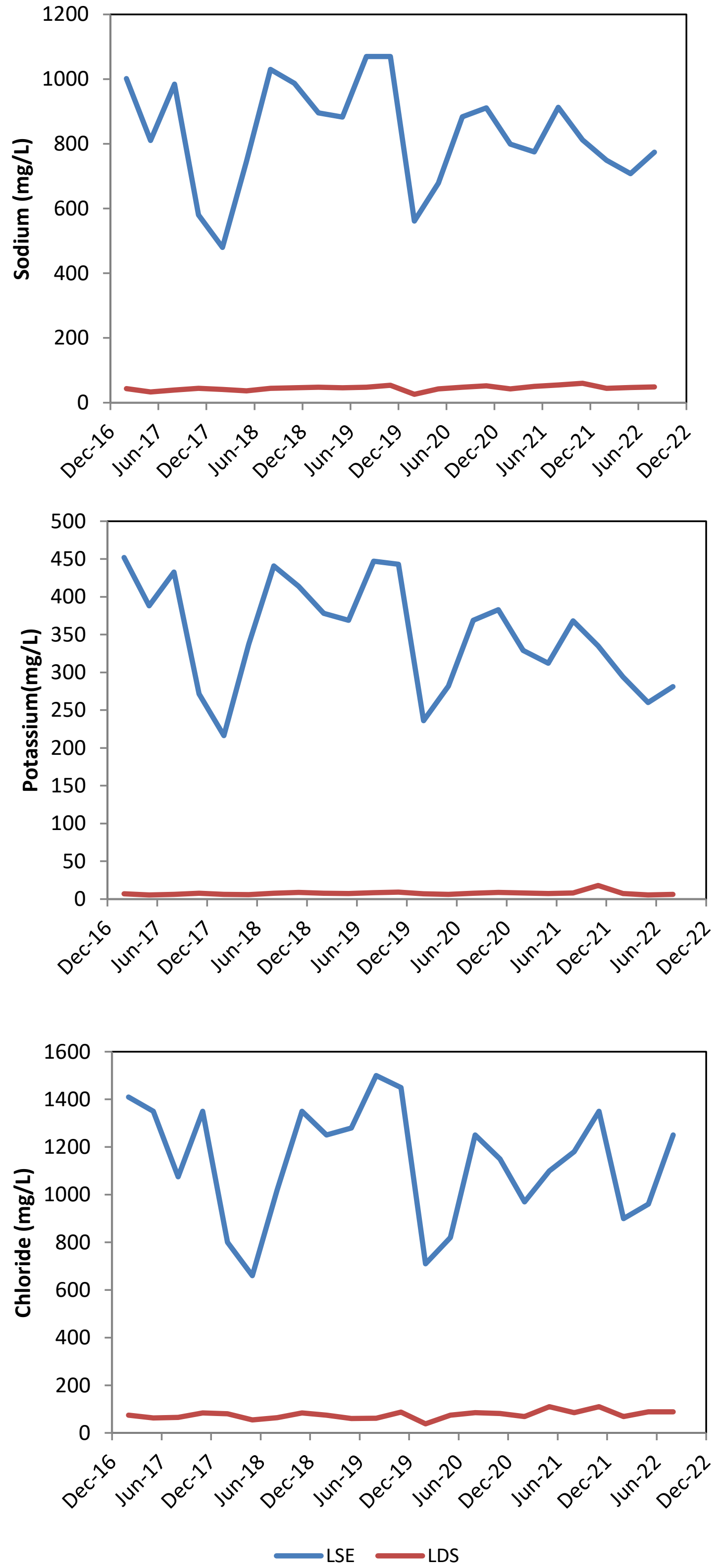


LEACHATE

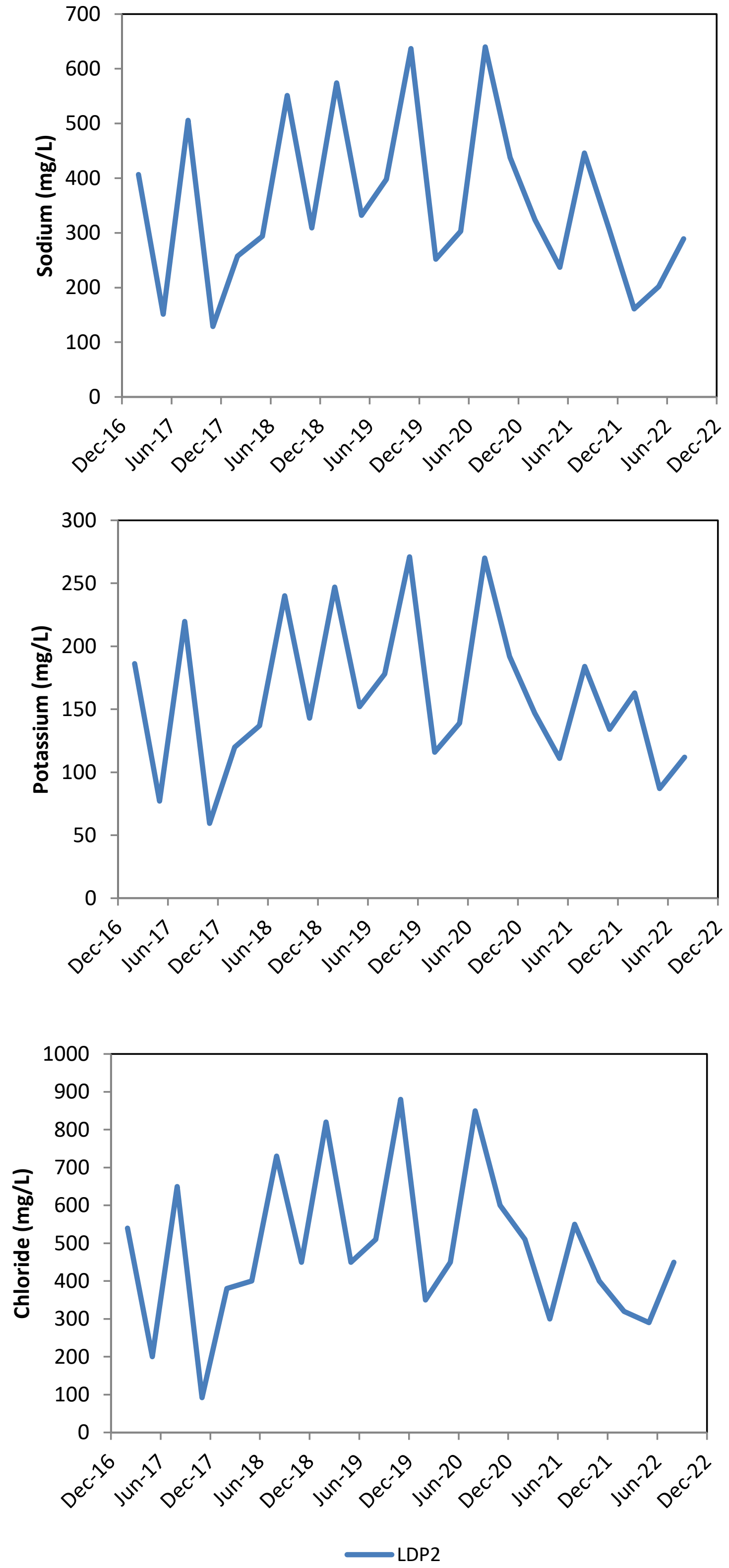
Northern Landfill



Southern Landfill

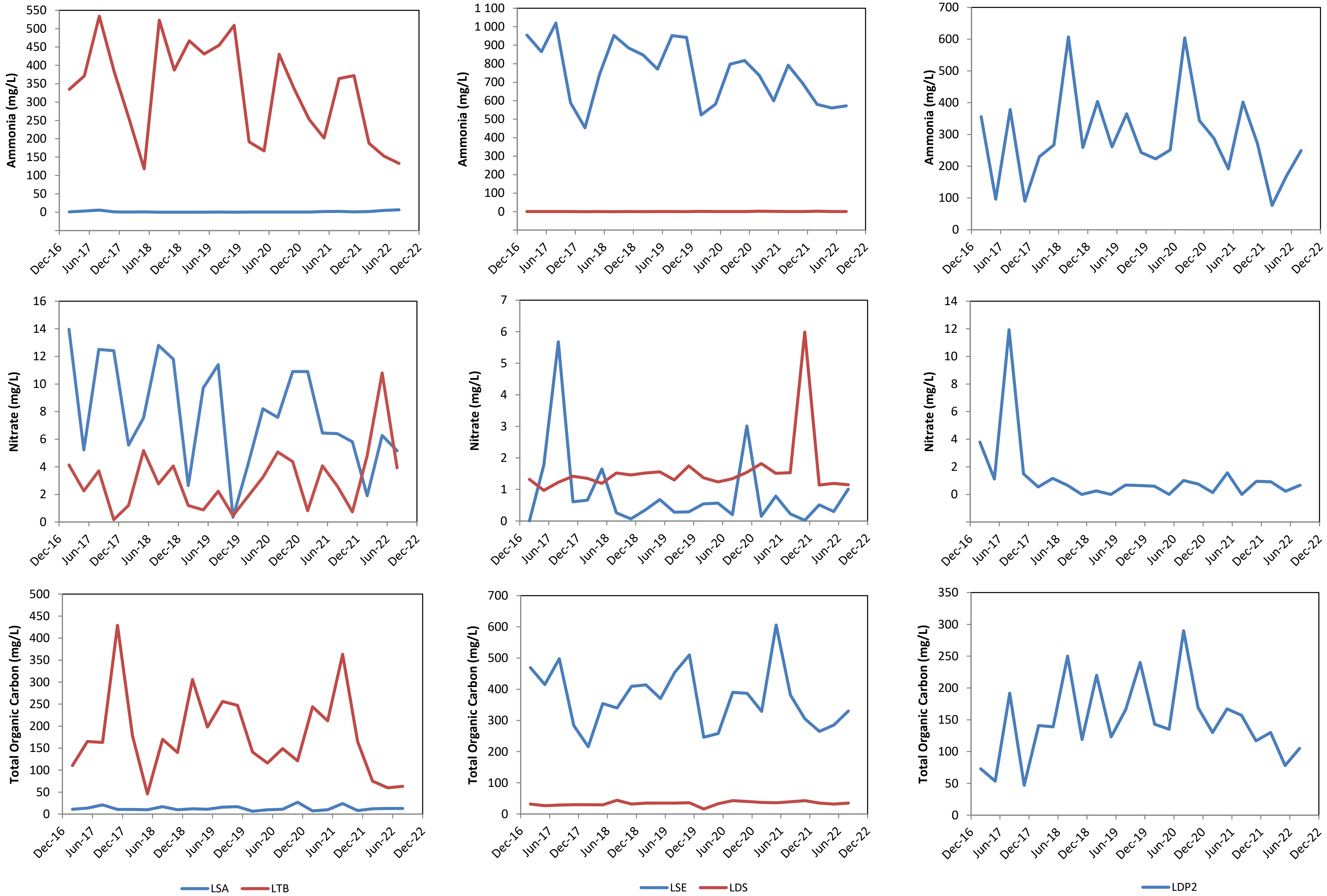


Storage Tanks



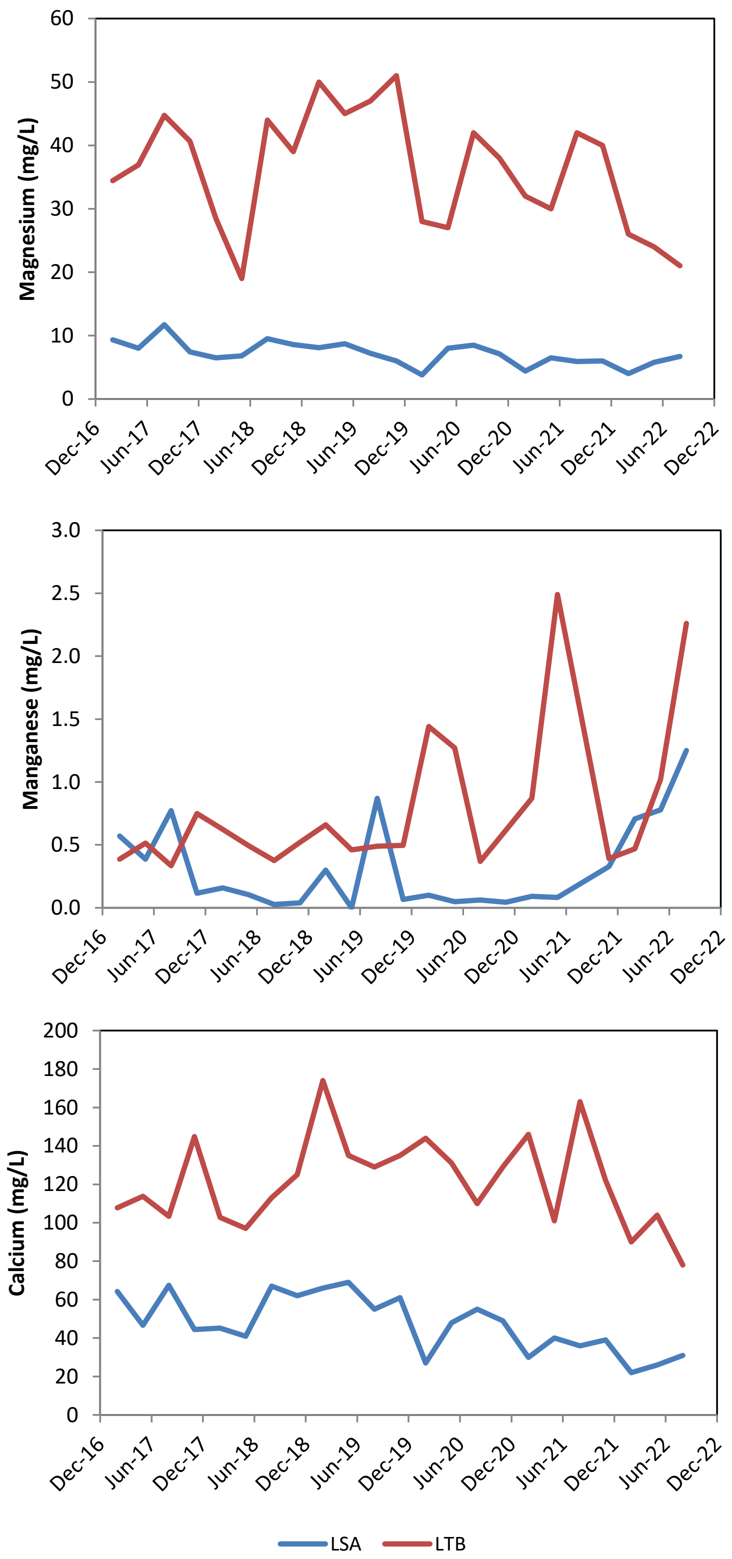
LEACHATE

Northern Landfill | **Southern Landfill** | **Storage Tanks**



LEACHATE

Northern Landfill



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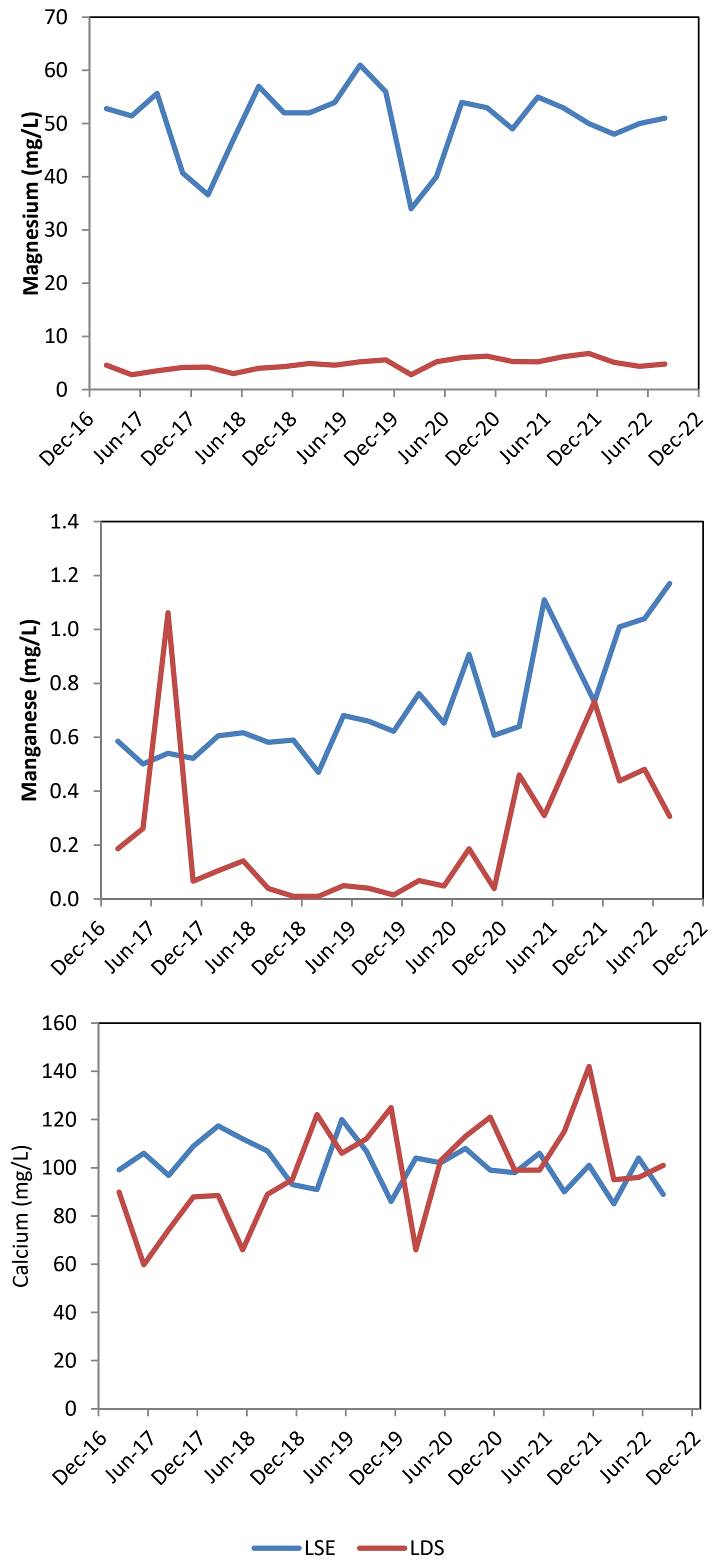
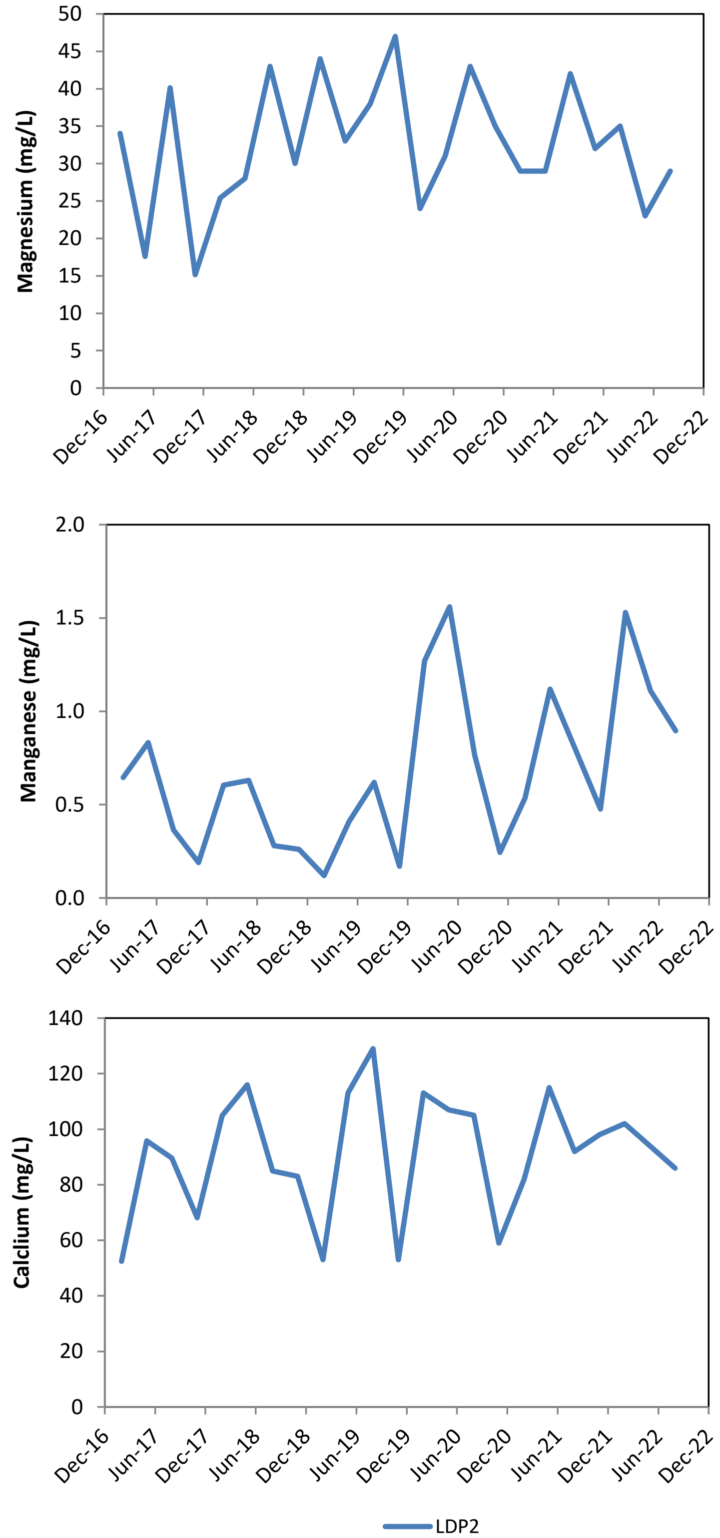
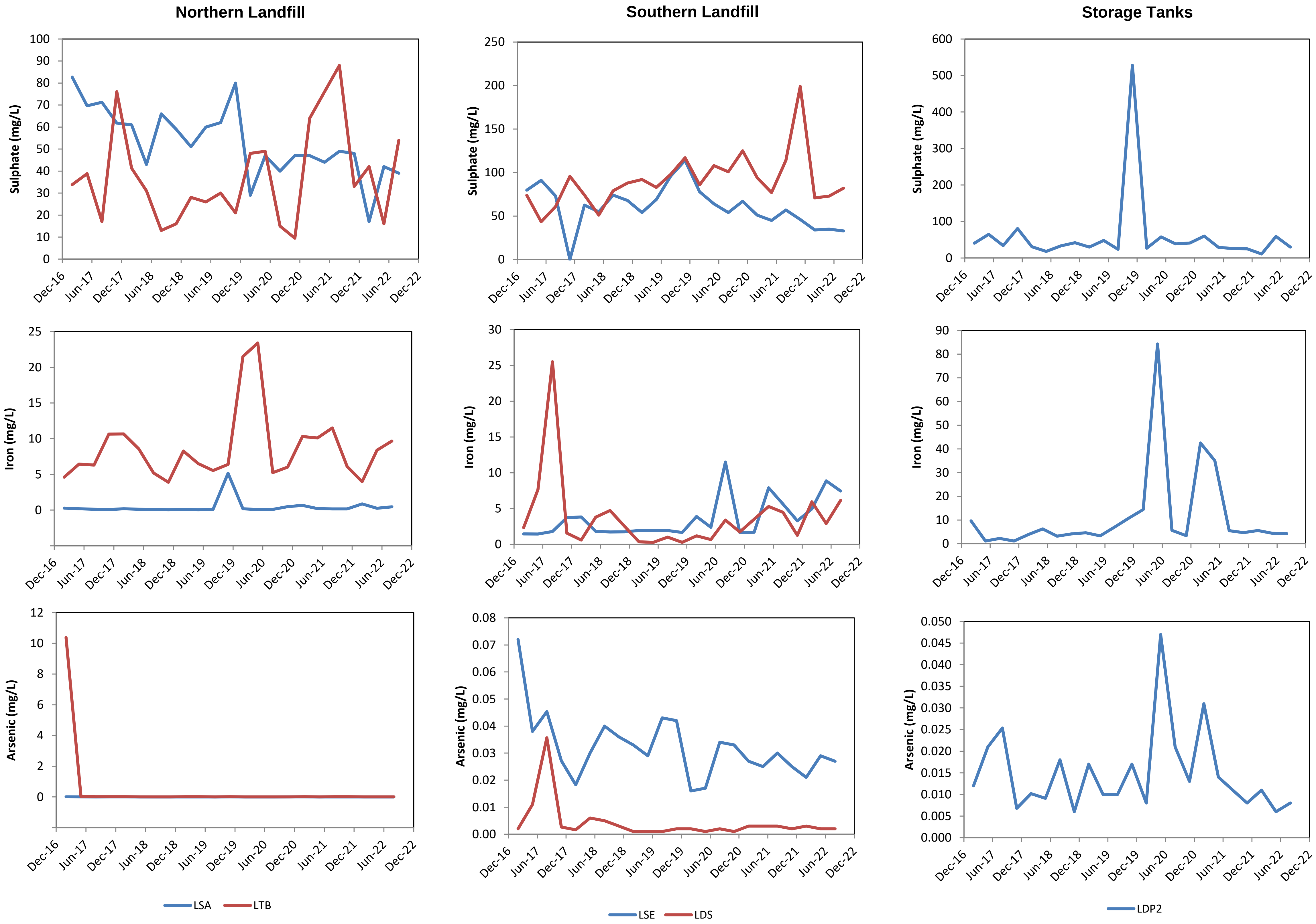


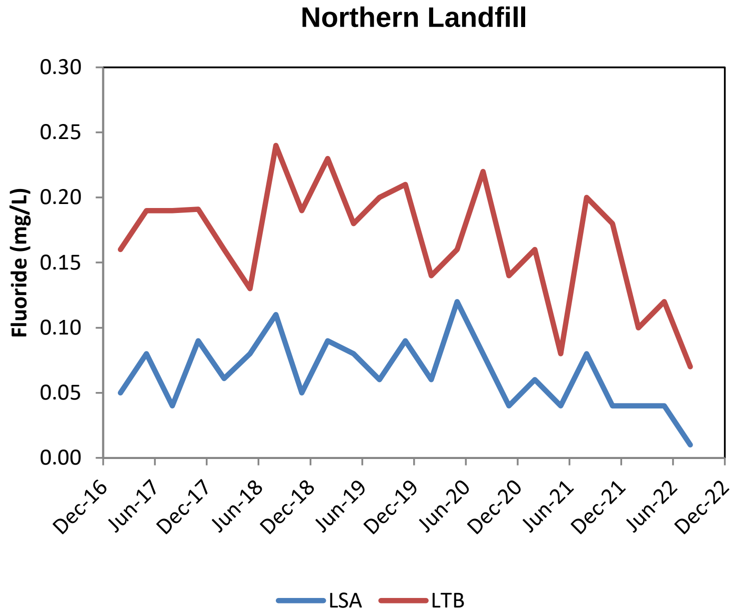
Storage Tanks



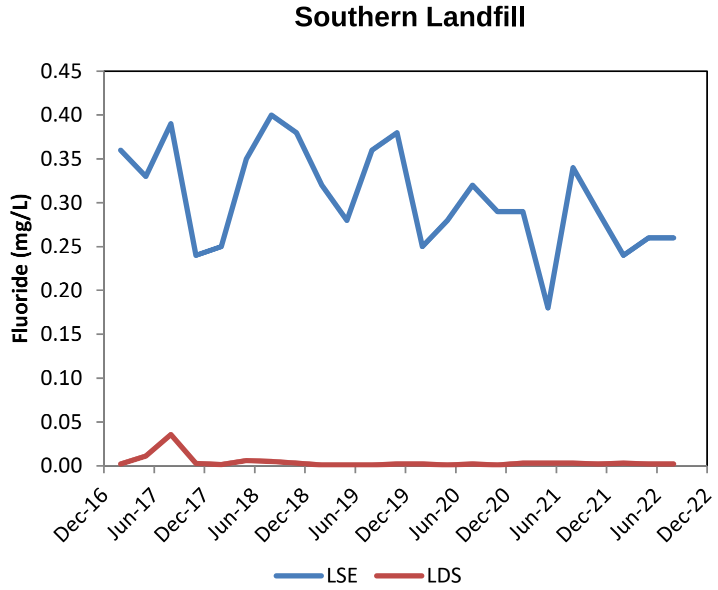
LEACHATE


Northern Landfill
Southern Landfill
Storage Tanks
Sulphate (mg/L)
Iron (mg/L)
Arsenic (mg/L)
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19
Dec-19
Jun-20
Dec-20
Jun-21
Dec-21
Jun-22
Dec-22
LSA
LTB
LSE
LDS
LDP2

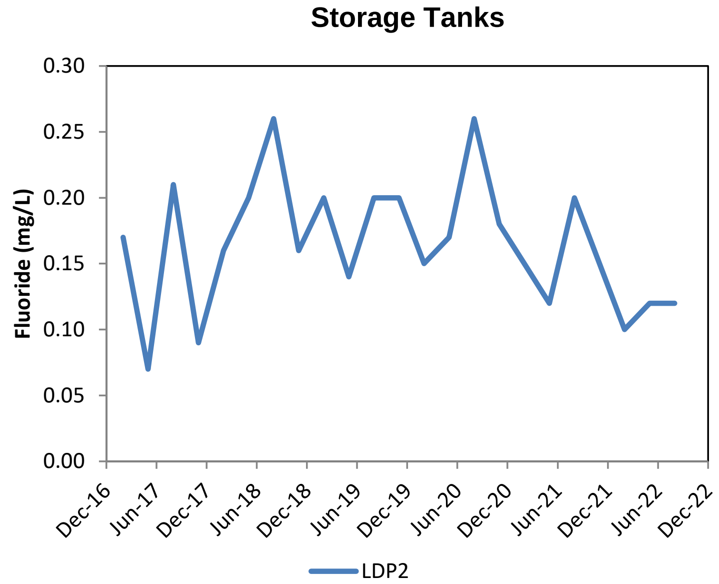
LEACHATE



Northern Landfill
Fluoride (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19
Dec-19
Jun-20
Dec-20
Jun-21
Dec-21
Jun-22
Dec-22
LSA
LTB



Southern Landfill
Fluoride (mg/L)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19
Dec-19
Jun-20
Dec-20
Jun-21
Dec-21
Jun-22
Dec-22
LSE
LDS



Storage Tanks
Fluoride (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19
Dec-19
Jun-20
Dec-20
Jun-21
Dec-21
Jun-22
Dec-22
LDP2