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Annual Report on Water and Gas Monitoring 2020-2021

Kempsey Landfill Water and Gas Monitoring
638 Crescent Head Road, Kempsey

Prepared for
Kempsey Shire Council

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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1. Introduction

1.1 Overview

This revised annual report presents the results of groundwater, surface water and gas monitoring for the period October 2020 to July 2021 at the Kempsey Landfill Site located at 638 Crescent Head Road, South Kempsey New South Wales (NSW). The revised report was prepared to address NSW EPA reporting requirements and supersedes the Rev 1 annual report dated 27 August 2021. Monitoring was commissioned by Kempsey Shire Council (KSC).

The Kempsey landfill site is located at 638 Crescent Head Road, South Kempsey (Part Lot 7008 DP96356).

The site is licensed by the Environment Protection Authority under Environmental Protection Licence (EPL) 6269. The EPL notice specifies requirements for surface water, groundwater, leachate and gas monitoring including test locations, analytes and threshold concentrations. Monitoring was conducted with reference to EPL 6269 requirements.

The site is located within undeveloped land adjacent to the Maria National Park approximately 10 km southwest of Kempsey.

1.2 Background and Objectives

The KSC Environmental Protection Licence (EPL 6269) authorises the scheduled activity of Waste Disposal (application to land) at the Kempsey Landfill site on Crescent Head Road South Kempsey. KSC is required to undertake compliance monitoring as part of the licence conditions that allow the site to operate.

Conditions M2.2 and M2.3 of the EPL outline air emissions monitoring and water/ leachate monitoring requirements. Conditions M2.4, M2.5 and M2.6 of the EPL outline the groundwater, surface water and leachate reporting requirements.

The objective of this report is to meet the ELP requirements related to groundwater, surface water and gas monitoring for the 2020-2021 reporting period, specifically conditions M2.2, M2.3, M2.4, M2.5 and M2.6.

1.3 Scope of Work

This report presents the results of the groundwater, surface water / leachate and gas monitoring program undertaken from October 2020 to July 2021. The following work tasks were undertaken:

- Q1 - First quarterly monitoring event, October 2020 (KCS nominated Task 2);
  - Manual water level gauging, purging and sampling of five groundwater monitoring wells;
  - Sampling of three surface water locations, one leachate location and one effluent location;
  - Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site;
- Q2 - Second quarterly monitoring event, January 2021 (KCS nominated Task 1);
  - Manual water level gauging of five groundwater monitoring wells;
  - Sampling of three surface water locations, one leachate location and one effluent location;
  - Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site;
- Q3 – Third quarterly monitoring event, April 2021 (KCS nominated Task 4);
  - Manual water level gauging, purging and sampling of five groundwater monitoring wells;
  - Sampling of three surface water locations, one leachate location and one effluent location;
  - Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site;
- Q4 - Fourth quarterly monitoring event, July 2021 (KCS nominated Task 3);
  - Manual water level gauging of five groundwater monitoring wells;
  - Sampling of three surface water locations, one leachate location and one effluent location;
  - Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site.
- Assessment of the results of monitoring against the EPL 6269;
- Preparation of this report.

Due to significant rainfall, KSC requested additional sampling and analysis on surface waters from location L8 (leachate dam) which was conducted on 9 Nov 2020 following Q1 sampling.

The locations of the groundwater / gas monitoring wells, surface water and gas monitoring area are shown on Drawing 1 in Appendix A.

2. Site Identification

Site Address	638 Crescent Head Road, Kempsey NSW 2440
Legal Description	Part Lot 7008 DP96356
Area	Approx. 12 Ha
Zoning	1(a1) Rural “A1” Zone
Elevation	Approx. 16 to 50 mAHD
Local Council Area	Kempsey Shire Council
Current Use	Landfill and waste management facility
Surrounding Uses	Crown Reserve

3. Environmental Setting (ERM 2020)

3.1 Topography

The original topography of the site has been disrupted by the former quarry operation and by the landfill operation. Despite this, the original landform is evident to some degree. The site is located on the slope of a ridge with southwest aspect. The highest natural elevation at the site is on the ridge in the northern portion of the site at approximately 49 m Australian Height Datum.

3.2 Hydrology

The landform of the site slopes to the southwest providing natural drainage to the lower end of the site, in the vicinity of the sediment retention dam (S7). A small, unnamed ephemeral watercourse is located adjacent to the western portion of the site, upon which the surface water monitoring location S4, S5 and S6 are located (see Drawing 1 in Appendix A). The unnamed ephemeral watercourse adjacent to the west of the site drainage only has flow during and immediately following high rainfall events. Another first order ephemeral watercourse meets with the unnamed ephemeral watercourse adjacent to the western portion of the site and this watercourse is sourced from within the rural residential area west of the site. The site catchment drains to Reedy Creek approximately two kilometres to the southwest of the site. Reedy Creek flows directly into the Maria River approximately five kilometres south of the landfill.

Surface water flow from capped areas of the site is directed into a perimeter spoon drain into the sediment retention dam (S7) sediment retention dam prior to being reused at the site (irrigation or dust suppression), evaporated or flowing on from the site to the unnamed ephemeral watercourse during overflow events or via active discharge.

Leachate from the landfill cells is managed within the leachate dam (L8) for on-site irrigation and evaporation.

3.3 Hydrogeology

Previous drilling activities conducted by RCA (2000) encountered the groundwater between 12 and 17 metres below the existing ground surface. RCA (2000) indicated that the groundwater beneath the site is confined by clay and weathered mudstone layers above the groundwater and bedrock below, particularly beneath the southern portion of the site. The groundwater is present in the less weathered mudstone, siltstone and sandstone layers.

Regional groundwater flow direction in the vicinity of the site is generally to the south / south-west, which is the same as the catchment area draining and existing landforms. This is consistent with field observations of the five groundwater monitoring wells (BH1, BH1/02, BH2, BH3 and BH4) at the site conducted over previous reporting periods.

3.4 Geology

Reference to the NSW Seamless Geology dataset, made available by the NSW Government Department of Regional New South Wales the site is underlain by Kempsey Beds which typically comprises sandstone, mudstone, siltstone, and conglomerate.

Reference to the Kempsey 1:100,000 scale Soil Landscape Sheet indicates the site is mapped as comprising residual soils of the Kundabung landscape.

The Kundabung landscape is characterised by “undulating rises with broad crests, extensive foot slopes and drainage plains on Permian mudstones of the Kempsey and Beechwood beds”. The soils within this landscape are characterised as “water erosion hazard, foundation hazards, shallow soils, erodible, sodic, acidic soils with low wet bearing strength and low permeability”.

Reference to the NSW Acid Sulfate Soil Risk Map indicates the site is not mapped within an acid sulfate soils area.

4. Site History and Use

The Site was originally a clay quarry, in 1985 it was granted Development Consent to become a landfill and occupy approximately four hectares. Further Development Consents were granted in August of 2002 for an additional 0.5 hectares and December of 2003 for up to a total of 12 hectares.

The existing Kempsey landfill site is located within Lot 7008 DP96356, 638 Crescent Head Road, South Kempsey. The landfill area is generally positioned centrally within the lot and is surrounded by undeveloped rural land and mature trees as can be seen in Figure 1 below.

The Site consists of an operational landfill area, a completed landfill area and an area designated for future use. The current on-site buildings consist of a machinery shed, a pump shed, a heavy vehicle weighbridge and office, truck wheel wash, a waste transfer station and an area for recyclables materials and off-site processing materials.

5. Site Specific Trigger Levels

The site specific trigger levels applied for the ground and surface water monitoring are provided in the EPL 6269 and are shown in Table 1 below.

Table 1: EPL 6269 Site specific trigger levels

Pollutant	Units of measure	Groundwater Trigger Level	Surface Water Trigger Level
Ammonia	mg/L	0.9	0.9
Conductivity	µS/cm	1065	1065
Magnesium	mg/L	10.05	10.05
Nitrate	mg/L	0.7	0.7
pH	pH	6.5-8.0	6.5-8.0
Calcium	mg/L	NA	2.05
Chloride	mg/L	NA	54.49
Iron	mg/L	NA	1.84
Manganese	mg/L	NA	1.9
Sodium	mg/L	NA	34
Sulfate	mg/L	NA	3.1
TOC	mg/L	NA	33.1
Total Phenolics	mg/L	NA	0.32
Alkalinity (as CaCo3)	mg/L	NA	12.283
Potassium	mg/L	NA	2.282
TSS	mg/L	NA	33.415
DO	mg/L	NA	12.057

The criteria for the surface and ground gas monitoring are in reference to the Environmental Guidelines for Solid waste landfills (NSW EPA, 2016) as follows:

- Subsurface methane criteria – 1 % (v/v); and
- Surface methane – 500 ppm.

6. Field Work Methods

6.1 Overview and Schedule

Groundwater, surface water and gas monitoring was conducted with reference to the EPL as presented in Table 2 below.

Table 2: Quarterly Monitoring Tasks

Quarterly Round	Sampling Date	Description	Comment
Q1 1st Quarter monitoring event (KCS Task 2)	29 October 2020	Surface water sampling and laboratory analysis	Approximately 64.4 mm of rainfall on the day of monitoring. Approximately 94.8 mm of rainfall in the preceding week.
	29 October 2020	Groundwater gauging	
	29 October 2020	Groundwater sampling and laboratory analysis	
	9 October 2020	Methane gas monitoring (building, bores and surface)	
Q2 2nd Quarter monitoring event (KCS Task 1)	27 January 2021	Surface water sampling and laboratory analysis	No rainfall on the day of monitoring. Approximately 0.8 mm of rainfall in the preceding week.
	27 January 2021	Groundwater gauging	
	27 January 2021	Methane gas monitoring (building, bores and surface)	
Q3 3rd Quarter monitoring event (KCS Task 4)	27 and 28 April 2021	Surface water sampling and laboratory analysis	No rainfall on the day of monitoring. No rainfall in the preceding week.
	27 April 2021	Groundwater gauging	
	27 April 2021	Groundwater sampling and laboratory analysis	
	27 April 2021	Methane gas monitoring (building, bores and surface)	
Q4 4th Quarter monitoring event (KCS Task 3)	6 July 2021	Surface water sampling and laboratory analysis	No rainfall on the day of monitoring. Approximately 29.2 mm of rainfall in the preceding week.
	6 July 2021	Groundwater gauging	
	5 July 2021	Methane gas monitoring (building, bores and surface)	

6.2 Groundwater

6.2.1 Groundwater Monitoring Locations

A summary of groundwater bore/well monitoring locations is presented below:

- BH1 (EPL Point 1):
  - Located up-hydraulic gradient of the site and is intended to be representative of background groundwater conditions.

- BH2 (EPL Point 2):
  - Located down gradient and to the south of the landfill, near the sediment retention dam.
- BH3 (EPL Point 3):
  - Located on the western side of the site within the landfill fence-line, near an existing storm water spoon drain.
- BH4 (EPL Point 12):
  - The western-most monitoring well outside the landfill fence-line, located between the sediment retention pond and leachate dam.
- BH1-02 (EPL Point 14):
  - Located to the south of the landfill boundary.

Refer to Drawing 1 in Appendix A for approximate well locations.

6.2.2 Groundwater Well Gauging, Purging and Sampling

Prior to purging and sampling of wells (BH1, BH1/02, BH2, BH3 and BH4), an oil-water interface meter was used to measure the depth to groundwater and assess the possible presence of a floating product within each well. Refer to Drawing 1 in Appendix A for approximate well locations.

Prior to sampling, the wells were purged using a MP10 MicroPurge low-flow water sampler or Clearview disposal single-check valve bailers until steady pH, EC, turbidity and temperature readings were achieved. Field parameters were measured using a calibrated portable meter.

The groundwater level was allowed to recover from the effects of purging prior to sampling. Groundwater samples were collected under strict QA / QC protocols and placed directly into laboratory prepared containers for analysis. The samples were delivered to the laboratory within the recommended holding times for analysis.

The headspace at the top of each well was also screened for the presence of volatile organic compounds (VOCs) using a calibrated Photo-ionisation detector (PID).

The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard Chain-of-Custody (COC) form. Copies of completed forms are contained in Appendix C.

Gauging, groundwater purging and sampling were undertaken by a geo-environmental engineer from DP.

6.2.3 Groundwater Analysis

Laboratory testing for groundwater samples was undertaken by Envirolab Services Pty Ltd (Envirolab), a National Association of Testing Authorities, Australia (NATA) registered laboratory. The analytical methods used are shown on the laboratory sheets in Appendix E.

Groundwater analysis was undertaken bi-annually (Q1 and Q3) at locations BH1, BH2, BH3, BH4, BH01-2 for the following parameters as per the EPL:

- Ammonia, Electrical Conductivity, Magnesium, Nitrate, pH, Standing water level, Temperature;
- Monitoring for dissolved oxygen (DO) was also conducted, together with screening of groundwater headspace for volatile organic compounds using a Photo-ionisation detector (PID).

6.3 Surface Water

6.3.1 Surface Water Monitoring Locations

A summary of surface water sampling locations is presented below:

- S4 (EPL Point 4):
  - Located upstream from the site and is considered to be representative of background surface water conditions.
- S5 (EPL Point 5):
  - Located directly downstream from the site and sediment retention dam overflow. S5 is also located downstream from input from the first order stream that meets with the unnamed ephemeral watercourse located adjacent to the western portion of the site.
- S6 (EPL Point 6):
  - Located further downstream of the site than S5.
- S7 (EPL Point 7):
  - Located at the outlet of the site sediment retention pond.
- L8 (EPL Point 8):
  - Located within the leachate dam and utilised to monitor the composition of leachate and allow comparisons with the other surface water locations on and offsite, to assess potential impacts associated with the operation of the landfill.

Refer to Drawing 1 in Appendix A for approximate sampling locations.

6.3.2 Surface Water Sampling

Surface water samples (S4, S5, S6, S7 and S8) were collected using a long-handled ‘swing sampler’, directly into new laboratory prepared sampling bottles for each sampling event. Sampling was undertaken to minimise the disturbance of surface water sediments. Refer to Drawing 1 in Appendix A for approximate surface water sample locations.

In-situ measurements of pH, electrical conductivity (EC), oxidation-reduction potential (ORP), dissolved oxygen (DO), turbidity and temperature were taken using a calibrated multi-parameter meter following collection of each surface water sample. The headspace of surface water collected was also screened for the presence of VOCs using a calibrated PID.

Samples were collected under strict QA/QC protocols and delivered to the laboratory within the recommended holding times for analysis. The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard Chain-of-Custody (COC) form. Copies of completed forms are contained in Appendix C.

6.3.3 Surface Water Analysis

Laboratory testing for groundwater and surface water samples was undertaken by Envirolab Services Pty Ltd (Envirolab), a National Association of Testing Authorities, Australia (NATA) registered laboratory. The analytical methods used are shown on the laboratory sheets in Appendix E.

Surface water analysis was undertaken quarterly (Q1, Q2, Q3 and Q4) at locations S4, S5, S6, S7, L8 for the following parameters as per the EPL:

- Alkalinity, Ammonia, Calcium, Chloride, Electrical Conductivity, Dissolved Oxygen, Fluoride, Iron, Magnesium, Manganese, Nitrate, pH, Potassium, Sodium, Sulfate, Temperature, Total organic carbon, Total Phenolics, Total suspended solids.

6.4 Gas Monitoring

6.4.1 Monitoring Wells

Landfill gas monitoring was carried out in wells BH1, BH1/02, BH2, BH3 and BH4, with reference to DP standard operating procedures and NSW EPA (2020). The monitoring method is described as follows:

- Record the barometric pressure;
- Connect the tube on the calibrated landfill gas analyser (GA5000) to the quick connect gas fitting on the well cap; and
- Set the analyser pump on and record concentrations of methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide, generally at 30 second intervals, until concentrations have generally stabilised.

The general weather conditions and atmospheric pressure were recorded during the monitoring event.

6.4.2 Landfill Surface and Enclosed Spaces (Buildings)

Surface gas monitoring comprised traversing the southern portion of the landfill surface on foot, taking measurements of methane concentrations close to the ground surface and client nominated buildings.

Methane measurements were made within buildings (i.e. Office, Shed 1, Shed 2 and Shed 3) as instructed by the client (i.e. generally each corner, centre, sinks, drains etc as described in Table D5 in Appendix D). Refer to Drawing 1 in Appendix A for approximate building locations.

Surface landfill gas monitoring was carried out in accordance with DP standard operating procedures and (NSW EPA, 2020). The monitoring method is described as follows:

- Methane was measured in the atmosphere approximately 5 cm above the landfill surface;

- Transects were generally conducted at 25 m spacings where accessible and methane was measured at approximately 25 m intervals along each transect;
- Further monitoring was undertaken at client nominated enclosed structures / buildings, as shown in Drawing 1;
- The monitoring was performed on a calm day (where possible) during a period of relatively low and stable atmospheric pressure and where wind speed was estimated less than 10 km/h;
- Measurements were taken using a TDL-500 Laser Methane Detector capable of detecting concentrations of methane between 0 and 10,000 ppm;
- The methane detector was calibrated prior to use (undertaken by equipment supplier).

6.5 Quality Assurance / Quality Control

6.5.1 Field QA / QC

Quality assurance and quality control (QA/QC) procedures were adopted throughout the field sampling programme and comprised the following:

- Following standard operating procedures;
- Storage of samples under secure, temperature-controlled conditions;
- Use of chain of custody documentation for the handling, transport and delivery of samples to the selected laboratory.

The overall assessment of QA/QC presented in Appendix C.

6.5.2 Laboratory QA/QC

The NATA accredited chemical laboratory undertook in-house QA/QC procedures involving the routine testing of:

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;
- Analysis of control standards;
- Calibration standards and blanks;
- Statistical analysis of QC data.

An assessment of the laboratory QA/QC data quality is presented in Appendix C.

7. Field Work Results

7.1 Groundwater Level Monitoring

The results of water level gauging for each monitoring round are shown in Table D1 Appendix D. Historic groundwater levels are also presented in Figure D1 in Appendix D. Groundwater levels for the last year of monitoring are plotted against rainfall (Kempsey Airport) in Figure D1A in Appendix D. It is noted that there was significant rainfall in the 2020-2021 (i.e. 2023.4 mm for a 12 month period), compared to the 2019-2020 monitoring period (ie 301.4 mm).

Prior to 2019 there was a general trend of slowly dropping water levels with the exception of BH1 as shown in Figure D1. Gauging in BH1 indicated sporadic levels with significant response to rainfall suggesting that the well is compromised and is not providing accurate water levels within the formation (refer to Figure D1 and D1A).

The results of the measured values indicate a slight rise in the groundwater during the January 2021 monitoring period when compared to the initial October 2020 monitoring event. A slight rise is again evident in the April 2021 monitoring event with the exception of BH4. The July 2021 monitoring event indicated a drop within BH1 with the remaining wells staying generally consistent to the measured April 2021 monitoring values.

Groundwater flow is inferred to be flowing to the southwest which is consistent with the southwest orientated land formation.

7.2 Groundwater Quality Monitoring - Field

The groundwater field parameters measured during purging and sampling for Q1 and Q3 monitoring events are shown in Table D2 Appendix D.

The field parameters indicated the following:

- pH ranging from 4.3 – 6.8 pH indicating generally neutral to slightly acidic conditions;
- Electrical Conductivity ranging from 0.06 to 2.02 mS/cm indicating generally fresh to brackish conditions;
- Both oxidative and reductive water conditions; and
- Generally minimal to moderately turbidity, clear, grey and brown groundwater. Turbid conditions were observed in BH1, BH01-2 and BH4 in Q3.

The results of PID screening on headspace at the top of BH1 and BH2 in Q1 suggested the absence of gross volatile organic compounds (ie <1 ppm) as indicated in Tables F1 Appendix F.

The results of PID screening on headspace at the top of BH10-2, BH3, and BH4 in Q1 suggested the possible presence of volatile organic compounds as indicated in Table F1 Appendix F. PID screening was not conducted in Q3 due to equipment malfunction.

Observations made during purging and sampling generally indicated the absence of visual or olfactory evidence of gross contamination to groundwater at the locations sampled (i.e. general absence of staining, odours, free product etc).

Graphed representation of historical field observations (EC and pH) is presented Appendix G.

7.3 Surface Water Quality Monitoring - Field

The surface water field parameters measured during sampling for each monitoring round are shown in Table D2 Appendix D.

The field parameters indicated the following for surface waters (excluding L8 leachate dam):

- pH ranging from 4.2 – 9.0 pH indicating generally slightly acidic to alkaline conditions;
- Electrical Conductivity ranging from 0.14 to 0.938 mS/cm indicating generally fresh to brackish conditions;
- Generally oxidative water conditions with high dissolved oxygen; and
- A range of slight to very turbid, clear, green, and brown surface water.

The field parameters for L8 (Leachate Dam) indicated the following:

- pH ranging from 7.2 – 9.4 pH indicating generally acidic to alkaline conditions;
- Electrical Conductivity ranging from 1.29 to 2.8 mS/cm indicating generally fresh to brackish conditions;
- Generally oxidative water conditions with high dissolved oxygen; and
- A range of slightly to moderately turbid pale green, brown water.

Observations made during surface water sampling generally indicated the absence of visual or olfactory evidence of gross contamination to the surface water bodies at the locations sampled (i.e. general absence of staining, odours, free product etc).

Slight hydrogen sulfide odour was noted in surface waters as follows:

- S6 and L8 (Leachate Dam) – Q2;
- S5 and L8 (Leachate Dam) – Q3;
- S5 and S6 – Q4.

Graphed representation of historical field observations (EC and pH) is presented Appendix G.

7.4 Gas Monitoring

7.4.1 Monitoring Wells

The results of gas monitoring within the monitoring wells are shown in Table D3, Appendix D. It is noted that subsurface methane readings did not exceed the criteria of 1 % (10000 ppm) during monitoring events between October 2020 and July 2021.

7.4.2 Landfill Surface

The results of methane monitoring across the landfill surface are shown in Table D4, Appendix D. The results indicated a total of six exceedances of the monitoring criteria (500 ppm) that were found in Q4 of the methane monitoring for October 2020 to July 2021. The approximate locations of the exceedances are shown in Figure 1 below (E1 to E6).

The results of surface methane monitoring are summarised in Table 3 below:

Table 3: Surface Methane Monitoring Exceedances – October 2020 to July 2021 Events

Location			Methane (ppm)			
			2020-2021			
			Q1	Q2	Q3	Q4
ID	Easting	Nothing	9/11/2020	27/01/2021	27/04/2021	5/07/2021
E1	488394.915	6555797.286	*	*	*	1125
E2	488217.706	6555939.691	*	*	*	936
E3	488250.644	6555889.368	*	*	*	2950
E4	488436.099	6555793.225	*	*	*	850
E5	488465.102	6555796.996	*	*	*	3480
E6	488477.864	6555818.458	*	*	*	2100

Notes to table

Excedence of 500 ppm criteria

* Datapoint found in future monitoring round

Figure 1: Surface Methane Monitoring – 5 July 2021
(Reported as Q4 in Table D4, Appendix D) (E1 to E6 – exceedances marked in yellow)

The results of surface methane monitoring indicated the presence of localised elevated surface methane above the criteria at locations E1 to E6. Vegetation over the monitoring area generally comprised surface grasses with some localised sparse vegetation. Additional targeted monitoring of surface methane was conducted within selected areas of sparse vegetation. Monitoring generally suggested that there was no obvious correlation between elevated methane concentrations and localised areas of sparse vegetation.

Methane detections for the remainder of the assessed area were below 100 ppm.

7.4.3 Buildings (Enclosed Spaces)

The results of methane monitoring within nominated buildings for each event are shown in Table D5, Appendix D. The results indicated the general absence of significant methane concentrations within buildings (i.e., <6ppm).

8. Discussion

8.1 Groundwater

8.1.1 Field Observations

The groundwater field parameters measured during purging and sampling for Q1 and Q3 monitoring events are shown in Table D2 Appendix D and were discussed in Section 7.2 above.

Observations made during purging and sampling generally indicated the absence of visual or olfactory evidence of gross contamination to groundwater at the locations sampled (i.e. general absence of staining, odours, free product etc).

8.1.2 Groundwater Analytical Results

The results of analytical testing of groundwater are included in the laboratory report sheets in Appendix E. The results of testing are summarised in Tables F2 and F5 against the adopted site criteria in Appendix F. Graphical representation of historical analytical results for selected parameters are presented in Appendix G. Laboratory analytical reports are in Appendix E.

A summary of the analytical results, together with comments on EPL criteria exceedances and historical trends are provided in Annual Reporting Tables H1, H2, H3, H12 and H13 in Appendix H.

Exceedances of EPL trigger levels for each bore and quarterly monitoring round are summarised below:

Table 4: Exceedances of the EPL 6269 Tigger Levels - Groundwater

Groundwater Well I.D	Analytes Exceeding the Groundwater Trigger Levels	
	October 2020	April 2021
BH01-2	EC, pH, Mg	EC
BH1	pH	pH
BH2	EC, Mg	EC, Mg
BH3	EC, pH, Mg	EC, pH, Mg
BH4	EC, pH, Mg	pH, Mg

The results of biannual groundwater monitoring indicate several exceedances above the site trigger levels, namely pH, EC, and magnesium. Groundwater monitoring concentrations were generally within the range of historical data. An elevated nitrate concentration was found in BH01-2 during the previous annual monitoring round. It is noted that sporadic elevated nitrate concentrations have been observed historically in BH1, however, the elevated results were not replicated in subsequent monitoring events from this annual return (refer to Figure G2 in Appendix G). The elevated sporadic nitrate concentrations may therefore be spurious.

8.2 Surface Water

8.2.1 Field Observations

The surface water field parameters measured during sampling for Q1, Q2, Q3 and Q4 monitoring events are shown in Table D2 Appendix D and were discussed in Section 7.3 above.

Observations made during surface water sampling generally indicated the absence of visual or olfactory evidence of gross contamination to the surface water bodies at the locations sampled (i.e. general absence of staining, odours, free product etc). Slight hydrogen sulfide odour was noted in surface waters at S5 and S6, and within the Leachate Dam at L8.

8.2.2 Surface Water Analytical Results

The results of analytical testing of surface water are included in the laboratory report sheets in Appendix E. The results of testing are summarised in Tables F2, F3, F4 and F6 against the adopted site criteria in Appendix F. Graphical representation of historical analytical results for selected parameters are presented in Appendix G. Laboratory analytical reports are in Appendix E.

A summary of the analytical results, together with comments on EPL criteria exceedances and historical trends are provided in Annual Reporting Tables H4, H5, H6, H7 and H8 in Appendix H.

Exceedances of EPL trigger levels for each location and quarterly monitoring round are summarised below:

Table 5: Exceedances of the EPL 6269 Tigger Levels – Surface Water

Sampling Location	Analytes Exceeding the Surface Water Trigger Levels			
	October 2020	**January 2021**	**April 2021**	**July 2021**
L8	EC, pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, Nitrate, TOC, TSS	EC, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Nitrate, TOC, TSS	EC, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TOC	DO, EC, pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TOC, TSS
S4	pH, Fe, Sulfate, TSS	No exceedances	DO	pH
S5	Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate, Nitrate, TSS	Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate, TOC	Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate, Ammonia	pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TSS
S6	Ca, Cl, Mg, K, Na, Sulfate,	pH, Alkalinity (total), Ca, K	Fe, Alkalinity (total), Ca, K, Na	pH, Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate, TSS
S7	Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, Nitrate, TOC, TSS	Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, TOC	DO, Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate, Ammonia, TOC, TSS	pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, Nitrate, TSS

Various exceedances of the EPL trigger levels have been found for surface waters as presented in the table above. As expected, the leachate dam (L8) exceeded the EPL trigger levels consistently during the annual monitoring period. Surface water monitoring concentrations were generally within the range of historical data (refer to Appendix G (graphs) and Appendix H (Annual Return). Some elevated results were found for some parameters as shown on the graphs in Appendix G. Locations S5, S6 and S7 had several exceedances, namely alkalinity, cations, anions, and sulfate. Analytes such as ammonia, nitrate, TOC and TSS sporadically exceeded the trigger levels.

As requested by KSC, additional monitoring was conducted at L8 (leachate dam) on 9 Nov 2020 and 2 Dec 2020 following Q1 sampling due to significant rain events. The results of monitoring of L8 on 9 Nov 2020 and 2 Dec 2020 were commensurate with Q1 monitoring on 29 Oct 2020.

We understand that KSC conduct monitoring of surface waters during any discharge events from the sediment retention dam (i.e., S7) of leachate dam (L8).

Recorded rainfall (Kempsey Airport) for the last year of monitoring are presented in Figure D1A in Appendix D. It is noted that there was significant rainfall on 16 December 2020 (109.2 mm), 19 March 2021 (225.8 mm) and 22 March 2021 (179.6 mm) The months which recorded elevated rainfall during the current 2020/2021 monitoring period are presented below:

- October 2020 – 124 mm;
- December 2020 – 374 mm;
- January 2021 – 156 mm;
- February 2021 - 202 mm;
- March 2021 – 822 mm.

8.3 Gas Monitoring

The results of gas monitoring are summarised below:

- Monitoring Wells:
  - The results of monitoring indicated the general absence of methane concentrations within groundwater wells (ie <1ppm). All results were below the acceptance criteria.
- Landfill Surface:
  - In summary, a total of six exceedances of the surface methane monitoring criteria were observed (all in Q4);
  - Exceedances were generally found to be localised and not associated with areas with sparse vegetation;
  - Elevated methane concentrations were observed within the western portion of the monitoring area, and the south eastern portion of the monitoring area.
- Buildings (Enclosed Spaces):
  - The results indicated the general absence of significant methane concentrations within buildings. All results were below the acceptance criteria.

9. Conclusion

9.1 Groundwater

Groundwater monitoring data from the current 2020-2021 reporting period is generally consistent with historical monitoring data, although various parameters continue to be reported outside the EPL defined trigger levels.

Previous assessment by ERM indicated that BH1 is not well connected to the same regional water bearing zone as the other groundwater monitoring locations. This is supported by the observed fluctuating groundwater levels at BH1 in historic and current monitoring events. On this basis ERM indicated that groundwater quality at BH1 should not be compared to the results of other groundwater monitoring locations.

Based on the results of historic and current monitoring, landfill operations are unlikely to represent a significant risk to human health or ecological receptors during the current reporting period.

9.2 Surface Water

Surface water monitoring data from the current 2020- 2021 reporting period is generally consistent with historical monitoring data, although various parameters continue to be reported outside the EPL defined trigger levels. It is noted that the watercourses adjacent to the site are ephemeral. As a consequence, water quality will vary depending on climatic conditions, the presence of waters and the magnitude of flow within the watercourses. Sampling of surface waters has been conducted from both flowing and stagnant waters within watercourses as indicated in Table D2 in Appendix D. Variable water quality is likely to be present as a result of climatic conditions (ie flushing of watercourses and sampling from stagnant ponds within watercourses).

A number of outliers were observed as indicated on the graphs in Appendix G and the Annual Reporting tables in Appendix H. Some results may be spurious or influenced by elevated turbidity as discussed in Section 8.2.2 above. Continual monitoring and interpretation of future results will confirm possible trends and potential impacts where present.

The presence of analytes in downstream surface waters suggest that stormwater runoff from the landfill site is potentially influencing surface water quality when compared to upstream water quality.

The results of historic and current surface water monitoring generally suggest the absence of significant impacts to human health or ecological receptors as a result of landfill operations.

9.3 Gas Monitoring

The results of gas monitoring continue to indicate the general absence of elevated methane concentration within groundwater wells and Buildings (enclosed spaces) monitored within the site.

Surface methane monitoring has indicated some elevated results and localised exceedances. Continued surface methane monitoring is recommended in accordance with the EPL. Where possible, areas/locations found to contain previous elevated results should be targeted.

Due to the elevated surface methane concentrations observed over a number of monitoring events, additional investigation is recommended to confirm subsurface conditions and capping within the western portion of the surface monitoring area and within the south-eastern portion of the monitoring area.

If additional surface methane monitoring and investigation identifies elevated reproducible results, remediation measures may be required to ensure that capping is performing as required.

10. Recommendations

The following recommendations are made based on the findings of this report:

- Replace BH1 monitoring well in order to allow a more representative assessment of baseline (upgradient) groundwater conditions;
- KSC conduct a review of current site and surface water management strategies to identify potential areas for improvement to minimise the risk of migration and impacts to receiving waters (including capacity of dams, irrigation and reuse procedures, discharge procedures and catchment/containment design);
- KSC consider a review and amendment of the trigger levels for monitoring based on the historic data set;
- Surface gas monitoring:
    - Continue surface methane monitoring in accordance with the EPL;
    - Also target areas/locations found to contain localised elevated results;
    - Conduct targeted investigation to assess the presence and condition of capping within areas observed to contain elevated methane concentrations.
- Continue monitoring surface water, groundwater and gas in accordance with the EPL.

11. References

NSW EPA. (2016). *Environmental Guidelines, Solid Waste Landfills, Second Edition, 2016.* NSW Environment Protection Authority.

NSW EPA. (2020). *Assessment and Management of Hazardous Ground Gases.* NSW Environment Protection Authority.

ERM (2020). Annual Water and Leachate Monitoring Report 2019-2022, Environmental Resources Management Australia Pty Ltd

12. Limitations

Douglas Partners (DP) has prepared this report for this project at 638 Crescent Head Road, Kempsey with reference to DP's proposal PMQ200062.P.001.Rev0 dated 20 August 2020 and acceptance received from Gavin Hughes dated 18 September 2020. The work was carried out under an AS4122 contract dated 13 October 2020. This report is provided for the exclusive use of Kempsey Shire Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

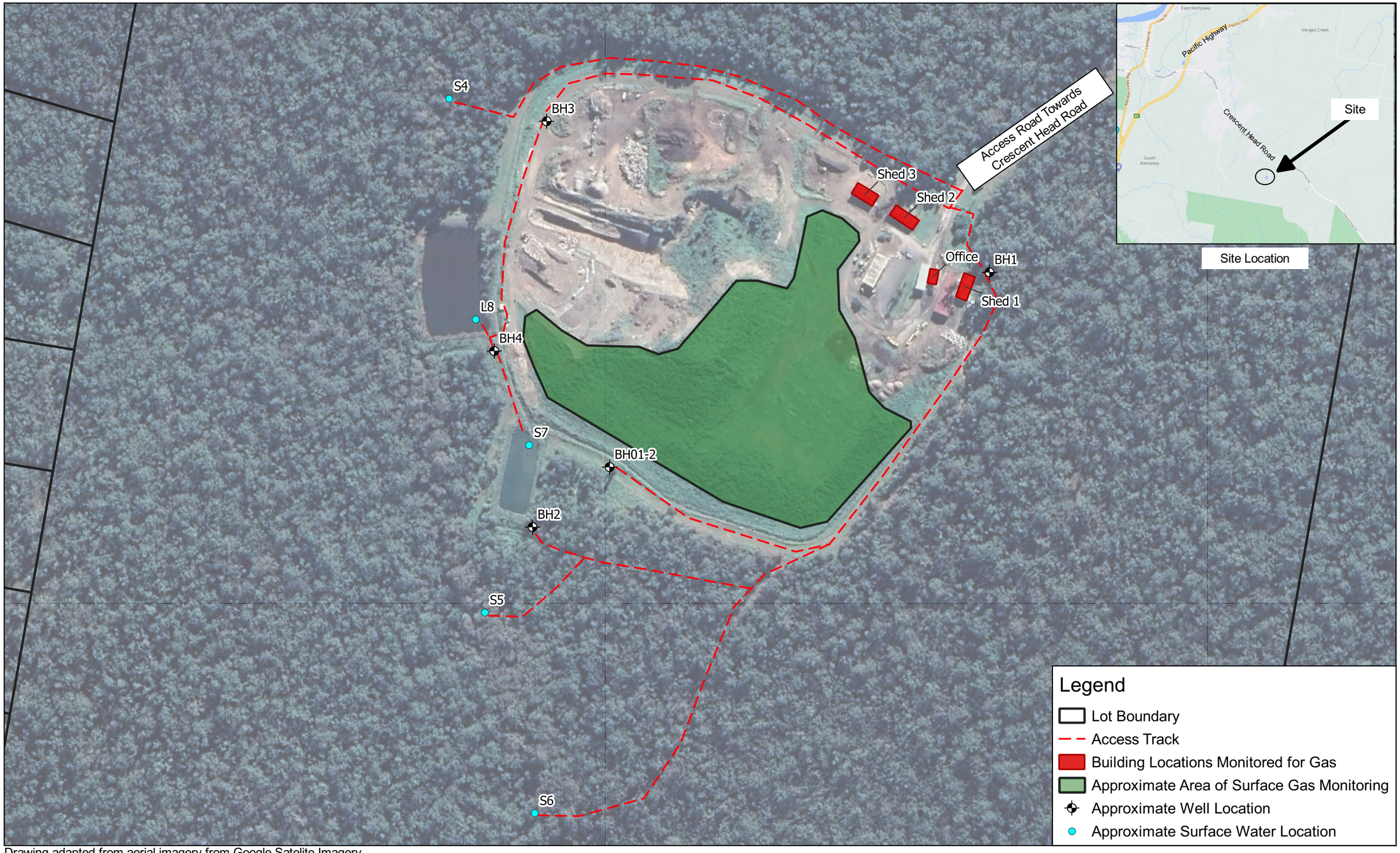
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

Test Location Plan



Drawing adapted from aerial imagery from Google Satelite Imagery.

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Kempsey Shire Council		
OFFICE: Port Macquarie	DRAWN BY: JCL	
SCALE: 1:3000 @A3	DATE: 24.August.2021	

TITLE: **Test Location Plan**
Proposed Kempsey Landfill Water and Gas Monitoring
638 Crescent Head Road, Kempsey

N

Project:	89781.00
DRAWING No:	1
REVISION:	0

DP.QGIS.A3LandscapeDrawingLayout.DftA

Appendix B

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix C

Quality Assurance / Quality Control Report
Chain of Custody Sheets (Field and Despatch)
Laboratory Sample Receipts

Appendix C
Quality Assurance Quality Control Report
638 Crescent Head Road, Kempsey

C1.0 Field and Laboratory Data Quality Assurance and Quality Control

The field and laboratory data quality assurance and quality control (QA/QC) procedures and results are summarised in the following Table 1. Reference should be made to the field work methodology and the laboratory results / certificates of analysis for further details.

Table 1: Field and Laboratory Quality Control

Item	Evaluation / Acceptance Criteria	Compliance
Analytical laboratories used	NATA accreditation	C
Holding times	Various based on type of analysis	C
Intra-laboratory replicates	5% 10% of primary samples; <30% RPD	NC
Laboratory / Reagent Blanks	1 per batch; <PQL	C
Matrix Spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Surrogate Spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Control Samples	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Standard Operating Procedures (SOP)	Adopting SOP for all aspects of the sampling field work	C

Notes:
C = compliance; PC = partial compliance; NC = non-compliance

C2.0 Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQIs) as outlined in NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013):

- Completeness: a measure of the amount of usable data from a data collection activity;

- Comparability: the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness: the confidence (qualitative) of data representativeness of media present on-site;
- Precision: a measure of variability or reproducibility of data; and
- Accuracy: a measure of closeness of the data to the 'true' value.

Table 2: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Systematic and selected target locations sampled.
	Preparation of chain of custody records.
	Preparation of field groundwater sampling sheets.
	Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody.
	Samples analysed for contaminants of potential concern based on the EPL
	Completion of chain of custody (COC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed in Section 1.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced sampler(s) used.
	Use of NATA registered laboratories, with test methods the same or similar between laboratories.
	Satisfactory results for laboratory QC samples.
Representativeness	Target media sampled.
	Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs.
	Samples were extracted and analysed within holding times.
	Samples were analysed in accordance with the COC.
Precision	Field staff followed standard operating procedures.
	Satisfactory results for all other field and laboratory QC samples.
Accuracy	Field staff followed standard operating procedures.
	Satisfactory results for all laboratory QC samples.

It is noted that intra-laboratory replicates were not conducted during monitoring, however, satisfactory results for all other field and laboratory QC samples were received. Based on the above, it is considered that the DQIs have been generally complied with.

C3.0 Conclusion

Based on the results of the field QA and field and laboratory QC, and evaluation against the DQIs it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

C4.0 Reference

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

Douglas Partners Pty Ltd

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan

Sample Login Details

Your reference	89781.00, Kemosin
Envirolab Reference	254662
Date Sample Received	30/10/2020
Date Instructions Received	30/10/2020
Date Results Expected to be Reported	On Hold

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	11 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	17.5
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	Salinity as NaCl *	NOx as N in water	Nitrate as N in water	Ammonia as N in water	Phosphate as P in water	Total Nitrogen in water	Total Suspended Solids	Metals in Waters -Total	HM in water - total	HM in water - dissolved	Microbiologocal Testing	On Hold
BH1														✓
BH3														✓
BH4														✓
BH2														✓
BH01-2														✓
L8														✓
S4														✓
S5														✓
S6														✓
S7														✓
D1														✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitorin	**Order Number**	141267		12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
BH01-2	5	29/10/20	W	P	●	●	●							Envirolab Quote:
BH1	1	29/10/20	W	P	●	●	●							20SYD319
BH2	4	29/10/20	W	P	●	●	●							
BH3	2	29/10/20	W	P	●	●	●							
BH4	3	29/10/20	W	P	●	●	●							
S4	7	29/10/20	W	P	●		●	●	●	●	●	●	●	
S5	8	29/10/20	W	P	●		●	●	●	●	●	●	●	
S6	9	29/10/20	W	P	●		●	●	●	●	●	●	●	
S7	10	29/10/20	W	P	●		●	●	●	●	●	●	●	
L8	6	29/10/20	W	P	●		●	●	●	●	●	●	●	
PQL (S) mg/kg												**ANZECC PQLs req'd for all water analytes** ☐		

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No: 254662

Metals to Analyse: 8HM unless specified here: Iron, manganese

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: James Cudmore **Address:** James.Cudmore@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: **Received by:** **Date & Time:**

Updated COC 02/11/2020.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 89751.00	**Suburb/Town:** Kemosh	**To:** ENVIROLAB.
DP Order No: 153404	**DP Contact Person:** JOSH COWAN	
Prior Storage: Esky ☑ Fridge ☐ Shelved ☐		**Ph:** **Attn:**

Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)

Sample				Analytes										Notes
DP ID	Date Sampled	Type S-soil W-water	Lab ID											
BH1	29/10/20	W	1											ON HOLD
BH3			2											SEE JOEL
BH4			3											COWAN.
BH2			4											FOR
BH01-2			5											COC
L8			6											
S4			7											
S5			8											
S6			9											
S7			10											
D1			11											
PQL (S) mg/kg														
PQL (W) mg/L	ANZECC PQLs req'd for all water analytes ☐													

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 254662
Date Received:
Time Received: 30/10/2020 1415
Received By: CC
Temp: Cool/Ambient 8.1°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

*Metals to Analyse (Please circle) As, Cd, Cr, Cu, Pb, Zn, Hg, Ni, Mn, Fe

Total number of samples in container: 11

Date relinquished: 29/10/20 By: JSC

Results required by:

☐ Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☑ Standard

SAMPLES RECEIVED BY LAB
Please sign and date to acknowledge receipt of samples and return by email

Signature:

Date: 30-10-2020

Lab Ref: 254662

Send results to:
Douglas Partners Pty Ltd
Address: .....
.....
.....
.....
Email: .....

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan, James Cudmore

Sample Login Details

Your reference	89781.00, Kempsey Landfill Water & Gas Monitoring
Envirolab Reference	260383
Date Sample Received	28/01/2021
Date Instructions Received	28/01/2021
Date Results Expected to be Reported	04/02/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	22.5
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Total Phenolicsin Water	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Organic Carbon	Total Suspended Solids	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	HM in water - dissolved	HM in water - total
S4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitoring	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
~~BH01-2~~	—	—	W	P	●	●	●							Envirolab Quote:
~~BH1~~	—	—	W	P	●	●	●							20SYD319
~~BH2~~	—	—	W	P	●	●	●							
~~BH3~~	—	—	W	P	●	●	●							
~~BH4~~	—	—	W	P	●	●	●							
S4	—	27/1/21	W	P	●		●	●	●	●	●	●	●	Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200
S5	—	27/1/21	W	P	●		●	●	●	●	●	●	●	Job No: 260383
S6	—	27/1/21	W	P	●		●	●	●	●	●	●	●	Date Received: 28/01/21
S7	—	27/1/21	W	P	●		●	●	●	●	●	●	●	Time Received: 10:25
														Received By: RL
														Temp: Cool/Ambient
														Cooling: Ice/Icepack
														Security: Intact/Broken/None
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here: Iron, manganese

Lab Report/Reference No:

Total number of samples in container: 12 **Relinquished by:** JSC **Transported to laboratory by:** TNT

Send Results to: James Cudmore **Address** James.Cudmore@douglaspartners.com.au + Joel **Phone:** 0413 810 422 **Fax:**

Signed: **Received by:** **Date & Time:** 28/01/21 10:25

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan

Sample Login Details

Your reference	89781.00, Kempsey Landfill Water & Gas Monitoring
Envirolab Reference	267791
Date Sample Received	28/04/2021
Date Instructions Received	28/04/2021
Date Results Expected to be Reported	05/05/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	7 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Total Phenolicsin Water	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Organic Carbon	Total Suspended Solids	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	HM in water - dissolved	HM in water - total
BH01-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitoring	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)		

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
BH01-2	1		W	P	●	●	●							Envirolab Quote:
BH1	2		W	P	●	●	●							20SYD319
BH2	3		W	P	●	●	●							
BH3	4		W	P	●	●	●							
BH4	5		W	P	●	●	●							
~~S4~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	
S5	6		W	P	●		●	●	●	●	●	●	●	
S6	7		W	P	●		●	●	●	●	●	●	●	
~~S7~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

ENVIROLAB GROUP
Environmental Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 260791
Date Received: 28/4/21
Time Received: 13:00
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here: Iron, manganese

Total number of samples in container: 21 **Relinquished by:** JSC **Transported to laboratory by:** TNT

Send Results to: James Cudmore **Address** James.Cudmore@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: **Received by:** **Date & Time:**

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Newcastle
Attention	Jason Lambert

Sample Login Details

Your reference	89781.00, Kempsey Landfill Water & Gas Monitoring
Envirolab Reference	273515
Date Sample Received	07/07/2021
Date Instructions Received	07/07/2021
Date Results Expected to be Reported	14/07/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Total Phenolicsin Water	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Organic Carbon	Total Suspended Solids	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	HM in water - dissolved	HM in water - total
S4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitorin	**Order Number**	154247		12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	JCL	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, jason.lambert@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
S4	1	5/7/21	W	P	●		●	●	●	●	●	●	●	
S5	2	"	W	P	●		●	●	●	●	●	●	●	
S6	3	"	W	P	●		●	●	●	●	●	●	●	
S7	4.	"	W	P	●		●	●	●	●	●	●	●	
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here: Iron, manganese

Lab Report/Reference No: 273515.

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: Jason Lambert **Address:** jason.lambert@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: **Received by:** CAS GEOFF **Date & Time:** 7-7-21 11:40

Douglas Partners
Geotechnics / Environment / Groundwater

17.5

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitorin	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
BH01-2		9/11/20	W	P	●	●	●							Envirolab Quote:
BH1			W	P	●	●	●							20SYD319
BH2			W	P	●	●	●							
BH3			W	P	●	●	●							
BH4			W	P	●	●	●							
S4			W	P	●		●	●	●	●	●	●	●	
S5			W	P	●		●	●	●	●	●	●	●	
S6			W	P	●		●	●	●	●	●	●	●	
S7			W	P	●		●	●	●	●	●	●	●	
L8	1	9/11/20	W	P	●		●	●	●	●	●	●	●	
PQL (S) mg/kg														ANZECC PQLs req'd for all water analytes ☐

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 255348
Date Received: 10/11/20
Time Received: 1048
Received By: [illegible]
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here: Iron, manganese

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: James Cudmore **Address** James.Cudmore@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: [signature] **Received by:** [illegible] **Date & Time:** 10/11/20 1045

Douglas Partners
Geotechnics / Environment / Groundwater

17.5

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitoring	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐		No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
~~BH01-2~~		~~9/11/20~~	~~W~~	~~P~~	●	●	●							Envirolab Quote:
~~BH1~~			~~W~~	~~P~~	●	●	●							20SYD319
~~BH2~~			~~W~~	~~P~~	●	●	●							
~~BH3~~			~~W~~	~~P~~	●	●	●							Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200
~~BH4~~			~~W~~	~~P~~	●	●	●							
~~S4~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Job No: 255348
~~S5~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Date Received: 10/11/20
~~S6~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Time Received: 1045
~~S7~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Received By: AM / Temp: Cool/Ambient
L8	1	9/11/20	W	P	●		●	●	●	●	●	●	●	Cooling: Ice/Icepack / Security: Intact/Broken/None
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here: Iron, manganese

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: James Cudmore **Address** James.Cudmore@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: [signature] **Received by:** AJ SUU [signature] **Date & Time:** 10/11/20 1045

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

17.5

Project No:	89781.00	**Suburb:**	Kempsey	**To:**	Envirolab Services Pty Ltd
Project Name:	Kempsey Landfill Water & Gas Monitoring	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Cowan, Joel	**Sampler:**	James Cudmore	**Attn:**	Jacinta / Aileen
Emails:	Joel.Cowan@douglaspartners.com.au, james.cudmore@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐		No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

DP ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Ammonia	Magnesium	Nitrate	Ionic Balance	Heavy Metals (dissolved and total)	Flouride	Total Organic Carbon	Total Phenolics	Total Suspended Solids	Notes/preservation
~~BH01-2~~		~~9/11/20~~	~~W~~	~~P~~	●	●	●							Envirolab Quote:
~~BH1~~			~~W~~	~~P~~	●	●	●							20SYD319
~~BH2~~			~~W~~	~~P~~	●	●	●							
~~BH3~~			~~W~~	~~P~~	●	●	●							
~~BH4~~			~~W~~	~~P~~	●	●	●							Envirolab Services, 12 Ashley St, Chatswood NSW 2067, Ph: (02) 9910 6200
~~S4~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Job No: 255348
~~S5~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Date Received: 10/11/20
~~S6~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Time Received: 1045
~~S7~~			~~W~~	~~P~~	●		●	●	●	●	●	●	●	Received By: CM; Temp: Cool/Ambient
L8	1	9/11/20	W	P	●		●	●	●	●	●	●	●	Cooling: Ice/Icepack; Security: Intact/Broken/None
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here: Iron, manganese

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: James Cudmore **Address** James.Cudmore@douglaspartners.com.au **Phone:** 0413 810 422 **Fax:**

Signed: [signature] **Received by:** AJ SMI CMM **Date & Time:** 10/11/20 1045

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan, James Cudmore

Sample Login Details

Your reference	89781.00, Kempsey Landfill Water & Gas Monitoring
Envirolab Reference	255348
Date Sample Received	10/11/2020
Date Instructions Received	10/11/2020
Date Results Expected to be Reported	17/11/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	1 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	17.5
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Total Phenolicsin Water	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Organic Carbon	Total Suspended Solids	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	HM in water - dissolved	HM in water - total
L8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Appendix D

Tabulated Field Work Results:

Table D1: Groundwater Levels During Monitoring Period (2020-2021)

Table D2: Groundwater and Surface Water Field Parameters During Monitoring Period (2020-2021)

Table D3: Gas Monitoring - Groundwater Wells (2020-2021)

Table D4: Methane Monitoring - Surface (2020-2021)

Table D5: Methane Monitoring - Buildings (2020-2021)

Table D1: Groundwater Levels During Monitoring Period

Well ID	Task #	Sampling Date	TOC Elevation (mAHD)	Depth to Water (mTOC)	Reduced Water Elevation (mAHD)
BH1	2	29/10/2020	50.165	22.186	27.979
BH01-2	2	29/10/2020	29.637	3.030	26.607
BH2	2	29/10/2020	25.716	2.325	23.391
BH3	2	29/10/2020	29.779	6.700	23.079
BH4	2	29/10/2020	26.348	3.200	23.148
BH1	1	3/02/2021	50.165	20.440	29.725
BH01-2	1	3/02/2021	29.637	5.560	24.077
BH2	1	3/02/2021	25.716	1.830	23.886
BH3	1	3/02/2021	29.779	5.910	23.869
BH4	1	3/02/2021	26.348	1.720	24.628
BH1	4	27/04/2021	50.165	20.130	30.035
BH01-2	4	27/04/2021	29.637	5.400	24.237
BH2	4	27/04/2021	25.716	1.600	24.116
BH3	4	27/04/2021	29.779	5.300	24.479
BH4	4	27/04/2021	26.348	2.400	23.948
BH1	3	6/07/2021	50.165	22.780	27.385
BH01-2	3	6/07/2021	29.637	5.390	24.247
BH2	3	6/07/2021	25.716	1.680	24.036
BH3	3	6/07/2021	29.779	5.465	24.314
BH4	3	6/07/2021	26.348	2.410	23.938

Notes

- TOC - Top of Casing
- AHD - Australian Hieght Datum

Table D2: Groundwater and Surface Water Field Parameters During Monitoring Period

Test Location ID	Task #	Sampling Date	Temp (°C)	pH	Eh (ORPmV)	EC (mS/cm)	EC (µS/cm)	Turbidity (NTU)	DO (ppm)	DO (%)	Comments			
											Turbidity	Colour	Odour	Flow
BH1	2	29/10/2020	17.9	4.3	234	0.29	289	173	0.0	-	Slight	Brown	No odour	-
BH01-2	2	29/10/2020	20.2	5.8	33	1.59	1590	477	0.0	-	Moderate	Grey	No odour	-
BH2	2	29/10/2020	18.7	6.7	-30	1.64	1640	313	6.0	-	Moderate	Pale grey	No odour	-
BH3	2	29/10/2020	18.2	6.4	-4	1.60	1600	17	0.0	-	Minimal	Clear	No odour	-
BH4	2	29/10/2020	18.6	6.4	-9	2.02	2020	205	0.0	-	Moderate	Pale grey	No odour	-
S4	2	29/10/2020	17.9	6.2	137	0.19	188	36	4.3	-	Minimal	Pale brown	No odour	No flow
S5	2	29/10/2020	17.7	6.9	-37	0.94	938	225	1.1	-	Moderate	Pale brown	No odour	No flow
S6	2	29/10/2020	17.7	6.6	66	0.66	658	65	5.2	-	Slight	Clear	No odour	No flow
S7	2	29/10/2020	20.9	4.2	36	0.91	909	782	4.2	-	High	Brown	No odour	No flow
L8	2	29/10/2020	21.6	8.8	0.73	2.44	2440	208	5.3	-	Moderate	Pale green	No odour	No flow
L8	2	9/11/2020	23.7	8.4	104	2.53	2530	189	-	161.9	Slight	Pale green	No odour	No flow
L8	2	2/12/2020	31.2	8.5	87	2.80	2800	113	-	107.3	Slight	Pale green	No odour	No flow
S4	1	27/01/2021	29.5	7	180	0.14	140	0	-	56.8	Minimal	Pale brown	No odour	No flow
S5	1	27/01/2021	26.8	7.1	233	0.54	540	4	-	63.2	Minimal	Pale brown	No odour	No flow
S6	1	27/01/2021	27.5	8.1	151	0.48	481	0	-	100.7	Minimal	Pale brown	Slight H2S	No flow
S7	1	27/01/2021	33.7	7.9	164	0.82	820	44	-	122.2	Slight	Pale brown	No odour	No flow
L8	1	27/01/2021	32.4	7.2	125	1.29	1290	104	-	25	Slight	Pale green	Slight H2S	No flow
BH1	4	27/04/2021	20.1	6.2	7	0.06	60	78	-	101.3	Slight	Pale brown	No odour	-
BH01-2	4	27/04/2021	20.1	6.6	108	1.48	1480	38	-	102.8	Minimal	Pale grey	No odour	-
BH2	4	27/04/2021	19.6	6.8	-71	1.53	1530	44	-	99.9	Minimal	Pale grey	No odour	-
BH3	4	27/04/2021	20.6	6.3	-15	1.93	1930	35	-	100.2	Minimal	Pale grey	No odour	-
BH4	4	27/04/2021	20.2	6.5	-48	1.83	1830	28	-	102	Minimal	Pale grey	No odour	-
S4	4	28/04/2021	16.5	7.7	46	0.15	150	14	-	122	Minimal	Pale brown	No odour	No flow
S5	4	27/04/2021	18.3	7.3	-13	0.49	490	29	-	119.9	Minimal	Pale brown	Slight H2S	No flow
S6	4	27/04/2021	18.1	7.1	60	0.18	180	40	-	113.7	Minimal	Pale brown	No odour	No flow
S7	4	28/04/2021	17.8	7.8	49	0.76	760	91	-	137	Slight	Pale brown	No odour	No flow
L8	4	28/04/2021	18.6	7.6	54	2.36	2360	79	-	119.3	Slight	Brown	Slight H2S	No flow
S4	3	6/07/2021	12.2	8.3	96	0.10	96	14	7.4	70	Minimal	Clear	No odour	No flow
S5	3	6/07/2021	12.5	8.3	107	0.50	500	100	10.3	100	Slight	Clear	Slight H2S	No flow
S6	3	6/07/2021	12.5	8.8	67	0.32	320	140	8.1	65	Slight	Clear	Slight H2S	No flow
S7	3	6/07/2021	16.9	9	41	0.60	600	160	6.0	63	Slight	Clear	No odour	No flow
L8	3	6/07/2021	16.9	9.4	53	2.26	2260	260	18.8	197	Moderate	Green	No odour	No flow

Notes

Turdidty descriptor - 0 to 50 - minimal, 50 to 200 - slight, 200 to 500 - moderate, 500+ high

BH - Borehole - Groundwater Well

S - Surface Water Testing Locations

L - Leachate Testing Location

EC - Electrical conductivity

DO - Dissolved oxygen

ORP - Oxidation reduction potential

Table D3: Gas Well Field Parameters

Well ID	Task #	Sampling Date	Max Methane (ppm)	Max Carbon Dioxide (%)	Oxygen (%)	Max Hydrogen Sulfide (ppm)	Max Carbon Monoxide (ppm)	Comments	
								Weather Conditions	Atmospheric Pressure (Mb)
BH1	2	9/11/2020	0.2	0.3	20.9	0.0	0.0	Overcast	1021
BH01-2	2	9/11/2020	0.1	0.1	20.9	1.0	0.0	Overcast	1021
BH2	2	9/11/2020	0.3	0.1	20.7	0.0	0.0	Overcast	-
BH3	2	9/11/2020	0.0	0.1	20.7	0.0	1.0	Overcast	-
BH4	2	9/11/2020	0.0	0.0	21.0	0.0	1.0	Overcast	-
BH1	1	27/01/2021	0.0	0.0	19.9	0.0	2.0	Clear	1001
BH01-2	1	27/01/2021	0.0	0.1	18.9	1.0	4.0	Clear	1005
BH2	1	27/01/2021	0.0	0.0	19.7	0.0	6.0	Clear	-
BH3	1	27/01/2021	0.0	0.0	19.8	0.0	7.0	Clear	-
BH4	1	27/01/2021	0.0	0.0	20.5	0.0	7.0	Overcast	-
BH1	4	27/04/2021	0.1	0.2	20.6	0.0	1.0	Clear	-
BH01-2	4	27/04/2021	0.0	0.4	20.4	1.0	2.0	Clear	-
BH2	4	27/04/2021	0.0	0.1	20.2	1.0	2.0	Clear	-
BH3	4	27/04/2021	0.0	0.1	20.9	0.0	2.0	Clear	-
BH4	4	27/04/2021	0.0	0.1	20.4	1.0	2.0	Clear	-
BH1	3	6/07/2021	0.0	0.8	20.2	1.0	0.0	Clear	1012
BH01-2	3	6/07/2021	0.0	0.6	19.9	0.0	0.0	Clear	1014
BH2	3	6/07/2021	0.0	0.1	19.8	1.0	0.0	Clear	1014
BH3	3	6/07/2021	0.0	0.1	19.4	1.0	0.0	Clear	1013
BH4	3	6/07/2021	0.0	0.3	19.4	1.0	0.0	Clear	1015
Crieria (EPL 6269)			10000	NC	NC	NC	NC	NA	NA

Notes

- ppm = parts per million
- Criteria of Subsurface methane 10000 ppm / 1 % (v/v) (NSW EPA, 2016 and the EPL 6229)

Table D4: Detected Surface Gas During Monitoring Period

Task	Date	Easting	Northering	Methane (ppm)	Task	Date	Easting	Northering	Methane (ppm)
1	27/01/2021	488461	6555956	2	3	6/07/2021	488261	6555892	**2948**
1	27/01/2021	488472	6555887	1	3	6/07/2021	488270	6555884	1
1	27/01/2021	488398	6555972	1	3	6/07/2021	488288	6555871	1
1	27/01/2021	488391	6555968	12	3	6/07/2021	488312	6555858	1
1	27/01/2021	488394	6555966	23	3	6/07/2021	488339	6555838	308
1	27/01/2021	488359	6550592	5	3	6/07/2021	488349	6555836	138
1	27/01/2021	488361	6555911	7	3	6/07/2021	488372	6555828	2
4	27/04/2021	488471	6555976	7	3	6/07/2021	488385	6555819	1
4	27/04/2021	488467	6555980	15	3	6/07/2021	488414	6555803	70
4	27/04/2021	488472	6555011	10	3	6/07/2021	488436	6555793	**848**
4	27/04/2021	488456	6555019	17	3	6/07/2021	488444	6555788	19
4	27/04/2021	488450	6555006	22	3	6/07/2021	488460	6555794	8
4	27/04/2021	488448	6555969	3	3	6/07/2021	488466	6555796	**3478**
4	27/04/2021	488433	6555953	2	3	6/07/2021	488467	6555808	23
4	27/04/2021	488423	6555960	18	3	6/07/2021	488478	6555818	**2098**
4	27/04/2021	488443	6555964	13	3	6/07/2021	488483	6555823	29
4	27/04/2021	488411	6555970	14	3	6/07/2021	488493	6555841	4
4	27/04/2021	488405	6555973	30	3	6/07/2021	488493	6555842	1
4	27/04/2021	488397	6555965	37	3	6/07/2021	488448	6555808	43
4	27/04/2021	488389	6555942	28	3	6/07/2021	488434	6555814	148
4	27/04/2021	488380	6555946	47	3	6/07/2021	488415	6555829	3
4	27/04/2021	488383	6555921	8	3	6/07/2021	488398	6555839	1
4	27/04/2021	488350	6555914	3	3	6/07/2021	488384	6555850	1
4	27/04/2021	488271	6555911	7	3	6/07/2021	488369	6555862	1
4	27/04/2021	488256	6555900	8	3	6/07/2021	488354	6555873	1
4	27/04/2021	488302	6555830	2	3	6/07/2021	488337	6555885	1
4	27/04/2021	488454	6555806	9	3	6/07/2021	488321	6555896	1
4	27/04/2021	488479	6555886	2	3	6/07/2021	488306	6555919	1
3	6/07/2021	488527	6555859	1	3	6/07/2021	488327	6555910	1
3	6/07/2021	488515	6555844	1	3	6/07/2021	488343	6555900	1
3	6/07/2021	488513	6555842	3	3	6/07/2021	488355	6555894	1
3	6/07/2021	488496	6555818	13	3	6/07/2021	488374	6555879	1
3	6/07/2021	488493	6555815	1	3	6/07/2021	488390	6555865	1
3	6/07/2021	488482	6555807	23	3	6/07/2021	488411	6555849	1
3	6/07/2021	488474	6555793	26	3	6/07/2021	488426	6555841	3
3	6/07/2021	488466	6555786	86	3	6/07/2021	488478	6555940	47
3	6/07/2021	488457	6555778	250	3	6/07/2021	488359	6555905	32
3	6/07/2021	488394	6555797	**1123**	3	6/07/2021	488386	6555903	108
3	6/07/2021	488341	6555824	37	3	6/07/2021	488400	6555891	5
3	6/07/2021	488300	6555852	5	3	6/07/2021	488409	6555970	3
3	6/07/2021	488277	6555864	1	3	6/07/2021	488397	6555968	12
3	6/07/2021	488254	6555872	7	3	6/07/2021	488391	6555957	25
3	6/07/2021	488217	6555939	**936**	3	6/07/2021	488384	6555947	29
3	6/07/2021	488217	6555942	12	3	6/07/2021	488374	6555929	2
3	6/07/2021	488234	6555936	36	3	6/07/2021	488389	6555916	1
3	6/07/2021	488243	6555924	12	3	6/07/2021	488472	6556000	7
3	6/07/2021	488247	6555912	14	3	6/07/2021	488481	6556018	1
3	6/07/2021	488250	6555905	208	3	6/07/2021	488465	6556031	53
3	6/07/2021	488251	6555899	123					

Notes

Methane (CH4) surface gas reading above 500 ppm (NSW EPA, 2016 and the EPL 6229)

Surface methane was not detected during the Task 2 monitoring event (October 2020)

Table D5: Surface Gas Witihin Buildings During Monitoring Period

Task #	Location		Date	Methane (ppm)	Task #	Location		Date	Methane (ppm)
2	Shed 1	-	9/11/2020	0.0	4	Shed 2	Middle	27/04/2021	4.9
	Shed 1	-	9/11/2020	0.1		Shed 2	Entrance	27/04/2021	4.6
	Shed 2	-	9/11/2020	0.0		Shed 3	North cnr	27/04/2021	2.1
	Office	-	9/11/2020	0.0		Shed 3	South cnr	27/04/2021	5.0
	Office	-	9/11/2020	0.1		Shed 3	East cnr	27/04/2021	2.5
	Office	Sink	9/11/2020	0.1		Shed 3	West cnr	27/04/2021	5.3
1	Shed 1	North cnr	27/01/2020	5.5		Office	North end	27/04/2021	2.8
	Shed 1	South cnr	27/01/2020	0.5		Office	South end	27/04/2021	2.8
	Shed 1	East cnr	27/01/2020	1.3		Office	West end	27/04/2021	2.7
	Shed 1	West cnr	27/01/2020	1.4		Office	East end	27/04/2021	3.2
	Shed 1	Bathroom Sink	27/01/2020	0.4		Office	Kitchen Sink	27/04/2021	2.8
	Shed 1	Drain	27/01/2020	0.8		Office	Drain	27/04/2021	2.7
	Shed 1	Outside	27/01/2020	0.4		Office	Entrance	27/04/2021	5.4
	Shed 2	North cnr	27/01/2020	0.0	3	Shed 1	North cnr	6/07/2021	1.0
	Shed 2	South cnr	27/01/2020	0.0		Shed 1	South cnr	6/07/2021	1.0
	Shed 2	East cnr	27/01/2020	0.0		Shed 1	East cnr	6/07/2021	1.0
	Shed 2	West cnr	27/01/2020	0.1		Shed 1	West cnr	6/07/2021	1.0
	Shed 3	North cnr	27/01/2020	0.0		Shed 1	Drain	6/07/2021	1.0
	Shed 3	South cnr	27/01/2020	0.0		Shed 1	Sink	6/07/2021	1.0
	Shed 3	East cnr	27/01/2020	0.0		Shed 1	Outside	6/07/2021	0.1
	Shed 3	West cnr	27/01/2020	0.0		Shed 2	North cnr	6/07/2021	0.1
	Office	North end	27/01/2020	0.0		Shed 2	South cnr	6/07/2021	0.1
	Office	South end	27/01/2020	0.0		Shed 2	East cnr	6/07/2021	0.1
	Office	West end	27/01/2020	0.0		Shed 2	West cnr	6/07/2021	0.1
	Office	East end	27/01/2020	0.0		Shed 2	Middle	6/07/2021	82.0
	Office	Kitchen Sink	27/01/2020	0.0		Shed 2	Entrance	6/07/2021	0.1
	Office	Drain	27/01/2020	0.0		Shed 3	North cnr	6/07/2021	4.5
3	Shed 1	North cnr	27/04/2021	2.2		Shed 3	South cnr	6/07/2021	4.3
	Shed 1	South cnr	27/04/2021	2.3		Shed 3	East cnr	6/07/2021	3.4
	Shed 1	East cnr	27/04/2021	2.2		Shed 3	West cnr	6/07/2021	3.3
	Shed 1	West cnr	27/04/2021	2.2		Office	North end	6/07/2021	1.0
	Shed 1	Bathroom Sink	27/04/2021	0.0		Office	South end	6/07/2021	5.5
	Shed 1	Drain	27/04/2021	2.5		Office	West end	6/07/2021	1.0
	Shed 1	Outside	27/04/2021	0.0		Office	East end	6/07/2021	1.0
	Shed 2	North cnr	27/04/2021	2.9		Office	Kitchen Sink	6/07/2021	1.0
	Shed 2	South cnr	27/04/2021	3.9		Office	Drain	6/07/2021	1.0
	Shed 2	East cnr	27/04/2021	3.1		Office	Bathroom Sink	6/07/2021	1.0
	Shed 2	West cnr	27/04/2021	3.2		Office	Entrance	6/07/2021	0.5

Notes

- ppm - parts per million
- Criteria of Subsurface methane 10000 ppm / 1 % (v/v) (NSW EPA, 2016 and the EPL 6229)

Appendix E

Laboratory Report Sheets

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CERTIFICATE OF ANALYSIS 260383

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan, James Cudmore
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kempsey Landfill Water & Gas Monitoring**
Number of Samples	4 Water
Date samples received	28/01/2021
Date completed instructions received	28/01/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	04/02/2021
Date of Issue	03/02/2021

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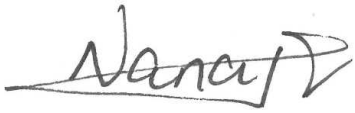
Results Approved By
Diego Bigolin, Team Leader, Inorganics
Hannah Nguyen, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water					
Our Reference		260383-1	260383-2	260383-3	260383-4
Your Reference	UNITS	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water
Date Sampled		27/1/21	27/1/21	27/1/21	27/1/21
Date extracted	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Date analysed	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

Miscellaneous Inorganics					
Our Reference		260383-1	260383-2	260383-3	260383-4
Your Reference	UNITS	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water
Date Sampled		27/1/21	27/1/21	27/1/21	27/1/21
Date prepared	-	28/01/2021	28/01/2021	28/01/2021	28/01/2021
Date analysed	-	28/01/2021	28/01/2021	28/01/2021	28/01/2021
Ammonia as N in water	mg/L	0.006	0.20	0.024	0.36
Nitrate as N in water	mg/L	<0.005	0.03	<0.005	<0.005
Fluoride, F	mg/L	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	mg/L	29	41	33	52
Total Suspended Solids	mg/L	7	19	13	24

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CERTIFICATE OF ANALYSIS 254662

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kemosin**
Number of Samples	11 Water
Date samples received	30/10/2020
Date completed instructions received	02/11/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	06/11/2020
Date of Issue	06/11/2020

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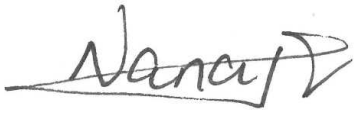
Results Approved By
Diego Bigolin, Team Leader, Inorganics
Hannah Nguyen, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water						
Our Reference		254662-6	254662-7	254662-8	254662-9	254662-10
Your Reference	UNITS	L8	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date extracted	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Date analysed	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Miscellaneous Inorganics						
Our Reference		254662-1	254662-2	254662-3	254662-4	254662-5
Your Reference	UNITS	BH1	BH3	BH4	BH2	BH01-2
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Date analysed	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Ammonia as N in water	mg/L	0.36	0.11	0.10	0.074	0.045
Nitrate as N in water	mg/L	0.22	0.082	0.053	0.04	0.008

Miscellaneous Inorganics						
Our Reference		254662-6	254662-7	254662-8	254662-9	254662-10
Your Reference	UNITS	L8	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Date analysed	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Ammonia as N in water	mg/L	38	0.014	0.061	0.050	2.4
Nitrate as N in water	mg/L	1.1	0.13	2.9	0.54	3.8
Fluoride, F	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	mg/L	57	22	28	13	34
Total Suspended Solids	mg/L	270	41	74	17	290

Ion Balance						
Our Reference		254662-1	254662-2	254662-3	254662-4	254662-5
Your Reference	UNITS	BH1	BH3	BH4	BH2	BH01-2
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Date analysed	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Magnesium - Dissolved	mg/L	1.0	30	31	17	19

Ion Balance						
Our Reference		254662-6	254662-7	254662-8	254662-9	254662-10
Your Reference	UNITS	L8	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	05/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020
Date analysed	-	05/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020
Calcium - Dissolved	mg/L	67	1.5	19	10	40
Potassium - Dissolved	mg/L	44	2.0	15	7.3	18
Sodium - Dissolved	mg/L	290	19	68	76	86
Magnesium - Dissolved	mg/L	30	2.9	10	12	13
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	410	7	21	7	67
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	410	7	21	7	67
Sulphate, SO4	mg/L	78	13	57	56	64
Chloride, Cl	mg/L	400	30	110	120	140
Ionic Balance	%	-4.0	-2.0	4.0	4.0	5.0

HM in water - dissolved						
Our Reference		254662-6	254662-7	254662-8	254662-9	254662-10
Your Reference	UNITS	L8	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Date analysed	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Iron-Dissolved	µg/L	88	290	410	280	300
Manganese-Dissolved	µg/L	530	22	25	160	330

HM in water - total						
Our Reference		254662-6	254662-7	254662-8	254662-9	254662-10
Your Reference	UNITS	L8	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water	Water
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date prepared	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Date analysed	-	03/11/2020	03/11/2020	03/11/2020	03/11/2020	03/11/2020
Iron-Total	µg/L	1,900	2,100	2,300	1,600	4,700
Manganese-Total	µg/L	620	86	47	160	380

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Total Phenolics in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	[NT]
Date analysed	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	6	<0.05	<0.05	0	103	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254662-2
Date prepared	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	02/11/2020
Date analysed	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	02/11/2020
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.36	0.36	0	103	111
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.22	0.23	4	106	111
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	6	<0.1	<0.1	0	89	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	6	57	[NT]		101	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	6	270	260	4	98	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	254662-8
Date prepared	-			[NT]	6	02/11/2020	02/11/2020		[NT]	02/11/2020
Date analysed	-			[NT]	6	02/11/2020	02/11/2020		[NT]	02/11/2020
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	6	38	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	6	1.1	[NT]		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	7	<0.1	[NT]		[NT]	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	[NT]	7	22	21	5	[NT]	105
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	7	41	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	7	02/11/2020	02/11/2020		[NT]	[NT]
Date analysed	-			[NT]	7	02/11/2020	02/11/2020		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	7	0.014	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	7	0.13	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254662-2
Date prepared	-			03/11/2020	1	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Date analysed	-			03/11/2020	1	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	103	96
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	101	100
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	82	#
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1.0	1.0	0	103	107
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254662-7
Date prepared	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Date analysed	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Iron-Dissolved	µg/L	10	Metals-022	<10	6	88	98	11	107	#
Manganese-Dissolved	µg/L	5	Metals-022	<5	6	530	530	0	106	109

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254662-8
Date prepared	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Date analysed	-			03/11/2020	6	03/11/2020	03/11/2020		03/11/2020	03/11/2020
Iron-Total	µg/L	10	Metals-022	<10	6	1900	2000	5	107	#
Manganese-Total	µg/L	5	Metals-022	<5	6	620	630	2	103	120

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

NO3 - out of recommended holding time

8 HM in water - dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab. Note: there is a possibility some elements may be underestimated.

8 HM in water - total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Ion Balance - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Ion Balance					
Our Reference		260383-1	260383-2	260383-3	260383-4
Your Reference	UNITS	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water
Date Sampled		27/1/21	27/1/21	27/1/21	27/1/21
Date prepared	-	28/01/2021	28/01/2021	28/01/2021	28/01/2021
Date analysed	-	28/01/2021	28/01/2021	28/01/2021	28/01/2021
Calcium - Dissolved	mg/L	1.2	23	5.9	42
Potassium - Dissolved	mg/L	2.0	10	5.2	15
Sodium - Dissolved	mg/L	17	60	32	90
Magnesium - Dissolved	mg/L	1.6	9.7	4.7	13
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	11	110	39	130
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	17
Total Alkalinity as $CaCO_3$	mg/L	11	110	39	150
Sulphate, SO4	mg/L	1	4	2	29
Chloride, Cl	mg/L	24	86	47	130
Ionic Balance	%	2.0	1.0	2.0	1.0

HM in water - dissolved					
Our Reference		260383-1	260383-2	260383-3	260383-4
Your Reference	UNITS	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water
Date Sampled		27/1/21	27/1/21	27/1/21	27/1/21
Date prepared	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Date analysed	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Iron-Dissolved	µg/L	840	2,400	1,300	660
Manganese-Dissolved	µg/L	11	260	62	55

HM in water - total					
Our Reference		260383-1	260383-2	260383-3	260383-4
Your Reference	UNITS	S4	S5	S6	S7
Type of sample		Water	Water	Water	Water
Date Sampled		27/1/21	27/1/21	27/1/21	27/1/21
Date prepared	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Date analysed	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Iron-Total	µg/L	1,000	2,600	1,700	1,500
Manganese-Total	µg/L	20	270	73	160

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Date analysed	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			28/01/2021	2	28/01/2021	28/01/2021		28/01/2021	[NT]
Date analysed	-			28/01/2021	2	28/01/2021	28/01/2021		28/01/2021	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	2	0.20	[NT]		88	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	2	0.03	[NT]		106	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	2	<0.1	[NT]		113	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	2	41	[NT]		102	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	2	19	19	0	104	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			28/01/2021	1	28/01/2021	28/01/2021		28/01/2021	[NT]
Date analysed	-			28/01/2021	1	28/01/2021	28/01/2021		28/01/2021	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1.2	1.2	0	96	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	2.0	2.0	0	94	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	17	16	6	90	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1.6	1.6	0	99	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	11	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	11	[NT]		109	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	1	[NT]		89	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	24	[NT]		92	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	2.0	[NT]		[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Date analysed	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	112	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Date analysed	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Iron-Total	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	114	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

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CERTIFICATE OF ANALYSIS 267791

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kempsey Landfill Water & Gas Monitoring**
Number of Samples	7 Water
Date samples received	28/04/2021
Date completed instructions received	28/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/05/2021
Date of Issue	05/05/2021

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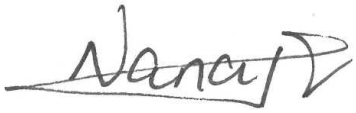
Results Approved By
Diego Bigolin, Team Leader, Inorganics
Hannah Nguyen, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water			
Our Reference		267791-6	267791-7
Your Reference	UNITS	S5	S6
Date Sampled		27/04/2021	27/04/2021
Type of sample		Water	Water
Date extracted	-	29/04/2021	29/04/2021
Date analysed	-	29/04/2021	29/04/2021
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05

Miscellaneous Inorganics						
Our Reference		267791-1	267791-2	267791-3	267791-4	267791-5
Your Reference	UNITS	BH01-2	BH1	BH2	BH3	BH4
Date Sampled		27/04/2021	27/04/2021	27/04/2021	27/04/2021	27/04/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/04/2021	29/04/2021	29/04/2021	29/04/2021	29/04/2021
Date analysed	-	29/04/2021	29/04/2021	29/04/2021	29/04/2021	29/04/2021
Ammonia as N in water	mg/L	0.031	1.3	0.096	0.085	0.11
Nitrate as N in water	mg/L	0.15	<0.005	<0.005	<0.005	0.006

Miscellaneous Inorganics			
Our Reference		267791-6	267791-7
Your Reference	UNITS	S5	S6
Date Sampled		27/04/2021	27/04/2021
Type of sample		Water	Water
Date prepared	-	29/04/2021	29/04/2021
Date analysed	-	29/04/2021	29/04/2021
Ammonia as N in water	mg/L	6.7	0.67
Nitrate as N in water	mg/L	0.04	0.03
Fluoride, F	mg/L	<0.1	<0.1
Total Organic Carbon	mg/L	29	24
Total Suspended Solids	mg/L	16	6

Ion Balance						
Our Reference		267791-1	267791-2	267791-3	267791-4	267791-5
Your Reference	UNITS	BH01-2	BH1	BH2	BH3	BH4
Date Sampled		27/04/2021	27/04/2021	27/04/2021	27/04/2021	27/04/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/04/2021	28/04/2021	28/04/2021	28/04/2021	28/04/2021
Date analysed	-	28/04/2021	28/04/2021	28/04/2021	28/04/2021	28/04/2021
Magnesium - Dissolved	mg/L	10	<0.5	17	30	36

Ion Balance			
Our Reference		267791-6	267791-7
Your Reference	UNITS	S5	S6
Date Sampled		27/04/2021	27/04/2021
Type of sample		Water	Water
Date prepared	-	28/04/2021	28/04/2021
Date analysed	-	28/04/2021	28/04/2021
Calcium - Dissolved	mg/L	20	7.0
Potassium - Dissolved	mg/L	10	5.4
Sodium - Dissolved	mg/L	50	36
Magnesium - Dissolved	mg/L	7.3	5.2
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	110	49
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	110	49
Sulphate, SO4	mg/L	10	2
Chloride, Cl	mg/L	62	43
Ionic Balance	%	-2.0	5.0

HM in water - dissolved			
Our Reference		267791-6	267791-7
Your Reference	UNITS	S5	S6
Date Sampled		27/04/2021	27/04/2021
Type of sample		Water	Water
Date prepared	-	30/04/2021	30/04/2021
Date analysed	-	30/04/2021	30/04/2021
Iron-Dissolved	µg/L	1,200	1,400
Manganese-Dissolved	µg/L	60	160

HM in water - total			
Our Reference		267791-6	267791-7
Your Reference	UNITS	S5	S6
Date Sampled		27/04/2021	27/04/2021
Type of sample		Water	Water
Date prepared	-	05/05/2021	05/05/2021
Date analysed	-	05/05/2021	05/05/2021
Iron-Total	µg/L	3,300	2,300
Manganese-Total	µg/L	210	170

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			29/04/2021	[NT]	[NT]	[NT]	[NT]	29/04/2021	[NT]
Date analysed	-			29/04/2021	[NT]	[NT]	[NT]	[NT]	29/04/2021	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	267791-2
Date prepared	-			29/04/2021	7	29/04/2021	29/04/2021		29/04/2021	29/04/2021
Date analysed	-			29/04/2021	7	29/04/2021	29/04/2021		29/04/2021	29/04/2021
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	7	0.67	0.64	5	102	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	7	0.03	0.03	0	97	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	7	<0.1	[NT]		99	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	7	24	[NT]		104	98
Total Suspended Solids	mg/L	5	Inorg-019	<5	7	6	[NT]		94	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	267791-6
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	29/04/2021
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	29/04/2021
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	79
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	94

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			28/04/2021	1	28/04/2021	28/04/2021		28/04/2021	[NT]
Date analysed	-			28/04/2021	1	28/04/2021	28/04/2021		28/04/2021	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	90	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	10	10	0	97	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	115	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			30/04/2021	[NT]	[NT]	[NT]	[NT]	30/04/2021	[NT]
Date analysed	-			30/04/2021	[NT]	[NT]	[NT]	[NT]	30/04/2021	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	100	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/05/2021	[NT]	[NT]	[NT]	[NT]	05/05/2021	[NT]
Date analysed	-			05/05/2021	[NT]	[NT]	[NT]	[NT]	05/05/2021	[NT]
Iron-Total	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	102	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

NT	Not tested
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INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
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Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
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Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Dissolved Metals: no filtered, preserved sample was received for#6,7, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.
Note: there is a possibility some elements may be underestimated.

Dissolved Metals: The preserved samples provided for 267791-6 and 7 were not identified as either total or dissolved, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.
Note: there is a possibility some elements may be underestimated.

Total Metals: The preserved samples provided for 267791-6 and 7 were not identified as either total or dissolved, therefore the analysis was conducted from the unpreserved sample.
Note: there is a possibility some elements may be underestimated

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CERTIFICATE OF ANALYSIS 273515

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kempsey Landfill Water & Gas Monitoring**
Number of Samples	4 Water
Date samples received	07/07/2021
Date completed instructions received	07/07/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	14/07/2021
Date of Issue	12/07/2021

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Results Approved By
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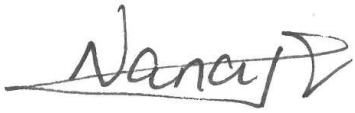
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water					
Our Reference		273515-1	273515-2	273515-3	273515-4
Your Reference	UNITS	S4	S5	S6	S7
Date Sampled		05/07/21	05/07/21	05/07/21	05/07/21
Type of sample		Water	Water	Water	Water
Date extracted	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Date analysed	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

Miscellaneous Inorganics					
Our Reference		273515-1	273515-2	273515-3	273515-4
Your Reference	UNITS	S4	S5	S6	S7
Date Sampled		05/07/21	05/07/21	05/07/21	05/07/21
Type of sample		Water	Water	Water	Water
Date prepared	-	07/07/2021	07/07/2021	07/07/2021	07/07/2021
Date analysed	-	07/07/2021	07/07/2021	07/07/2021	07/07/2021
Ammonia as N in water	mg/L	0.041	1.4	0.19	1.5
Nitrate as N in water	mg/L	0.02	0.23	0.10	0.92
Fluoride, F	mg/L	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	mg/L	17	31	19	31
Total Suspended Solids	mg/L	<5	58	85	34

Ion Balance					
Our Reference		273515-1	273515-2	273515-3	273515-4
Your Reference	UNITS	S4	S5	S6	S7
Date Sampled		05/07/21	05/07/21	05/07/21	05/07/21
Type of sample		Water	Water	Water	Water
Date prepared	-	07/07/2021	07/07/2021	07/07/2021	07/07/2021
Date analysed	-	07/07/2021	07/07/2021	07/07/2021	07/07/2021
Calcium - Dissolved	mg/L	1	31	9.5	45
Potassium - Dissolved	mg/L	2	12	5.9	15
Sodium - Dissolved	mg/L	14	69	45	71
Magnesium - Dissolved	mg/L	2	11	7.3	11
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	10	120	34	150
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	10	120	34	150
Sulphate, SO4	mg/L	1	28	17	40
Chloride, Cl	mg/L	21	100	85	100
Ionic Balance	%	1.0	0	-4.0	0

HM in water - dissolved					
Our Reference		273515-1	273515-2	273515-3	273515-4
Your Reference	UNITS	S4	S5	S6	S7
Date Sampled		05/07/21	05/07/21	05/07/21	05/07/21
Type of sample		Water	Water	Water	Water
Date prepared	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Date analysed	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Iron-Dissolved	µg/L	500	900	870	600
Manganese-Dissolved	µg/L	16	190	82	57

HM in water - total					
Our Reference		273515-1	273515-2	273515-3	273515-4
Your Reference	UNITS	S4	S5	S6	S7
Date Sampled		05/07/21	05/07/21	05/07/21	05/07/21
Type of sample		Water	Water	Water	Water
Date prepared	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Date analysed	-	08/07/2021	08/07/2021	08/07/2021	08/07/2021
Iron-Total	µg/L	890	3,000	2,000	2,700
Manganese-Total	µg/L	22	210	85	180

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Total Phenolics in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	273515-2
Date extracted	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Date analysed	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	99	92

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	273515-2
Date prepared	-			07/07/2021	1	07/07/2021	07/07/2021		07/07/2021	07/07/2021
Date analysed	-			07/07/2021	1	07/07/2021	07/07/2021		07/07/2021	07/07/2021
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.041	0.038	8	107	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.02	0.01	67	102	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	98	104
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	17	18	6	103	104
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	<5	[NT]		80	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			07/07/2021	1	07/07/2021	07/07/2021		07/07/2021	[NT]
Date analysed	-			07/07/2021	1	07/07/2021	07/07/2021		07/07/2021	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1	1	0	95	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	2	2	0	94	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	14	14	0	85	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	2	2	0	97	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	10	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	10	[NT]		113	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	1	1	0	107	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	21	20	5	89	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	1.0	[NT]		[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	273515-2
Date prepared	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Date analysed	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Iron-Dissolved	µg/L	10	Metals-022	<10	1	500	500	0	95	113
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	16	17	6	95	95

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	273515-2
Date prepared	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Date analysed	-			08/07/2021	1	08/07/2021	08/07/2021		08/07/2021	08/07/2021
Iron-Total	µg/L	10	Metals-022	<10	1	890	780	13	104	120
Manganese-Total	µg/L	5	Metals-022	<5	1	22	20	10	100	109

Result Definitions

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NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
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Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
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Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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CERTIFICATE OF ANALYSIS 255348

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan, James Cudmore
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kempsey Landfill Water & Gas Monitoring**
Number of Samples	1 Water
Date samples received	10/11/2020
Date completed instructions received	10/11/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	17/11/2020
Date of Issue	16/11/2020

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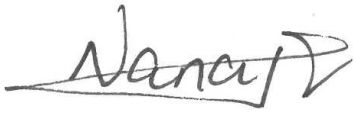
Results Approved By
Diego Bigolin, Team Leader, Inorganics
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water		
Our Reference		255348-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date extracted	-	11/11/2020
Date analysed	-	11/11/2020
Total Phenolics (as Phenol)	mg/L	<0.05

Miscellaneous Inorganics		
Our Reference		255348-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	10/11/2020
Date analysed	-	10/11/2020
Ammonia as N in water	mg/L	43
Nitrate as N in water	mg/L	0.64
Fluoride, F	mg/L	<0.1
Total Organic Carbon	mg/L	59
Total Suspended Solids	mg/L	18

Ion Balance		
Our Reference		255348-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	10/11/2020
Date analysed	-	10/11/2020
Calcium - Dissolved	mg/L	65
Potassium - Dissolved	mg/L	42
Sodium - Dissolved	mg/L	300
Magnesium - Dissolved	mg/L	29
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	410
Carbonate Alkalinity as $CaCO_3$	mg/L	<5
Total Alkalinity as $CaCO_3$	mg/L	410
Sulphate, SO4	mg/L	74
Chloride, Cl	mg/L	410
Ionic Balance	%	-4.0

HM in water - dissolved		
Our Reference		255348-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	11/11/2020
Date analysed	-	11/11/2020
Iron-Dissolved	µg/L	140
Manganese-Dissolved	µg/L	180

HM in water - total		
Our Reference		255348-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	11/11/2020
Date analysed	-	11/11/2020
Iron-Total	µg/L	1,000
Manganese-Total	µg/L	330

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Date analysed	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/11/2020	1	10/11/2020	10/11/2020		10/11/2020	[NT]
Date analysed	-			10/11/2020	1	10/11/2020	10/11/2020		10/11/2020	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	43	[NT]		100	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.64	[NT]		108	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	91	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	59	58	2	95	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	18	[NT]		99	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/11/2020	[NT]	[NT]	[NT]	[NT]	10/11/2020	[NT]
Date analysed	-			10/11/2020	[NT]	[NT]	[NT]	[NT]	10/11/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	109	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date prepared	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Date analysed	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	86	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Date analysed	-			11/11/2020	[NT]	[NT]	[NT]	[NT]	11/11/2020	[NT]
Iron-Total	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	110	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	110	[NT]

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CERTIFICATE OF ANALYSIS 255348-A

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	**89781.00, Kempsey Landfill Water & Gas Monitoring**
Number of Samples	1 Water
Date samples received	10/11/2020
Date completed instructions received	20/11/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	27/11/2020
Date of Issue	27/11/2020

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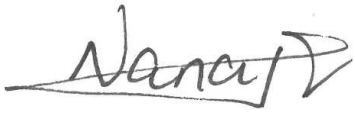

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date extracted	-	23/11/2020
Date analysed	-	24/11/2020
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	120
Surrogate toluene-d8	%	101
Surrogate 4-BFB	%	100

Miscellaneous Inorganics		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	20/11/2020
Date analysed	-	20/11/2020
Formaldehyde in waters	mg/L	0.1
COD	mg O_2 /L	410
Total Cyanide	mg/L	<0.004
TKN in water	mg/L	65
Organic Nitrogen as N	mg/L	22

Metals in Waters - Total		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	23/11/2020
Date analysed	-	23/11/2020
Phosphorus - Total	mg/L	0.5

HM in water - dissolved		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	23/11/2020
Date analysed	-	23/11/2020
Arsenic-Dissolved	µg/L	4
Cadmium-Dissolved	µg/L	<0.1
Chromium-Dissolved	µg/L	11
Copper-Dissolved	µg/L	15
Lead-Dissolved	µg/L	<1
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	11
Zinc-Dissolved	µg/L	9

PFAS in Waters Extended		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Date prepared	-	23/11/2020
Date analysed	-	23/11/2020
Perfluorobutanesulfonic acid	µg/L	0.20
Perfluoropentanesulfonic acid	µg/L	0.07
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.44
Perfluoroheptanesulfonic acid	µg/L	0.03
Perfluorooctanesulfonic acid PFOS	µg/L	0.58
Perfluorodecanesulfonic acid	µg/L	<0.02
Perfluorobutanoic acid	µg/L	0.20
Perfluoropentanoic acid	µg/L	0.46
Perfluorohexanoic acid	µg/L	0.64
Perfluoroheptanoic acid	µg/L	0.30
Perfluorooctanoic acid PFOA	µg/L	0.90
Perfluorononanoic acid	µg/L	0.02
Perfluorodecanoic acid	µg/L	<0.02
Perfluoroundecanoic acid	µg/L	<0.02
Perfluorododecanoic acid	µg/L	<0.05
Perfluorotridecanoic acid	µg/L	<0.1
Perfluorotetradecanoic acid	µg/L	<0.5
4:2 FTS	µg/L	<0.01
6:2 FTS	µg/L	0.01
8:2 FTS	µg/L	<0.02
10:2 FTS	µg/L	<0.02
Perfluorooctane sulfonamide	µg/L	<0.1
N-Methyl perfluorooctane sulfonamide	µg/L	<0.05
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.1
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.05
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.5
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.02
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	102
Surrogate $^{13}C_2$ *PFOA*	%	102
Extracted ISTD $^{13}C_3$ *PFBS*	%	117
Extracted ISTD $^{18}O_2$ *PFHxS*	%	109
Extracted ISTD $^{13}C_4$ *PFOS*	%	85
Extracted ISTD $^{13}C_4$ *PFBA*	%	100

PFAS in Waters Extended		
Our Reference		255348-A-1
Your Reference	UNITS	L8
Type of sample		Water
Date Sampled		09/11/2020
Extracted ISTD $^{13}C_3$ *PFPeA*	%	108
Extracted ISTD $^{13}C_2$ *PFHxA*	%	94
Extracted ISTD $^{13}C_4$ *PFHpA*	%	108
Extracted ISTD $^{13}C_4$ *PFOA*	%	114
Extracted ISTD $^{13}C_5$ *PFNA*	%	107
Extracted ISTD $^{13}C_2$ *PFDA*	%	87
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	81
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	58
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	50
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	149
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	127
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	96
Extracted ISTD $^{13}C_8$ *FOSA*	%	134
Extracted ISTD d_3 *N MeFOSA*	%	100
Extracted ISTD d_5 *N EtFOSA*	%	80
Extracted ISTD d_7 *N MeFOSE*	%	122
Extracted ISTD d_9 *N EtFOSE*	%	113
Extracted ISTD d_3 *N MeFOSAA*	%	94
Extracted ISTD d_5 *N EtFOSAA*	%	87
Total Positive PFHxS & PFOS	µg/L	1.0
Total Positive PFOA & PFOS	µg/L	1.5
Total Positive PFAS	µg/L	3.9

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-067	Samples are digested in acid with a known excess of potassium dichromate then titrated against ammonium ferrous sulphate in accordance with APHA latest edition 5220 C.
Inorg-113	Formaldehyde in waters and solids (1:5 extract) using colourimetric analysis and/or LC-DAD.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Date analysed	-			24/11/2020	[NT]	[NT]	[NT]	[NT]	24/11/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	119	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	119	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	123	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	123	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	108	[NT]	[NT]	[NT]	[NT]	93	[NT]
Surrogate toluene-d8	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate 4-BFB	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	255348-A-1
Date prepared	-			20/11/2020	[NT]	[NT]	[NT]	[NT]	20/11/2020	20/11/2020
Date analysed	-			20/11/2020	[NT]	[NT]	[NT]	[NT]	20/11/2020	20/11/2020
Formaldehyde in waters	mg/L	0.1	Inorg-113	<0.1	[NT]	[NT]	[NT]	[NT]	103	92
COD	mg O_2 /L	50	Inorg-067	<50	[NT]	[NT]	[NT]	[NT]	97	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	[NT]	[NT]	[NT]	[NT]	91	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Organic Nitrogen as N	mg/L	0.2		<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Date analysed	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	114	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Date analysed	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	101	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]

QUALITY CONTROL: PFAS in Waters Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Date analysed	-			23/11/2020	[NT]	[NT]	[NT]	[NT]	23/11/2020	[NT]
Perfluorobutanesulfonic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluoropentanesulfonic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	82	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	91	[NT]
Perfluorodecanesulfonic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorobutanoic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	88	[NT]
Perfluoropentanoic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorohexanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	88	[NT]
Perfluoroheptanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	87	[NT]
Perfluorononanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorodecanoic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	80	[NT]
Perfluoroundecanoic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorododecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	91	[NT]
Perfluorotridecanoic acid	µg/L	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorotetradecanoic acid	µg/L	0.5	Org-029	<0.5	[NT]	[NT]	[NT]	[NT]	82	[NT]
4:2 FTS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	90	[NT]
6:2 FTS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
8:2 FTS	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	81	[NT]
10:2 FTS	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorooctane sulfonamide	µg/L	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	78	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	95	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	84	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.5	Org-029	<0.5	[NT]	[NT]	[NT]	[NT]	77	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	96	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	84	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	111	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: PFAS in Waters Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	110	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	107	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	92	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	112	[NT]	[NT]	[NT]	[NT]	107	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	107	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	93	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	110	[NT]	[NT]	[NT]	[NT]	111	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	115	[NT]	[NT]	[NT]	[NT]	113	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	93	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	106	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	81	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	147	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	95	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	131	[NT]	[NT]	[NT]	[NT]	120	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	82	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	123	[NT]	[NT]	[NT]	[NT]	132	[NT]

QUALITY CONTROL: PFAS in Waters Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	123	[NT]	[NT]	[NT]	[NT]	130	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	123	[NT]	[NT]	[NT]	[NT]	128	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	108	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Appendix F

Tabulated Laboratory Results:

Table F1 - Field and Laboratory Results for Groundwater - October 2020 - Q1

Table F2 - Field and Laboratory Results for Surface water - October 2020 - Q1

Table F3 - Field and Laboratory Results for Surface water – January 2021 - Q2

Table F4 - Field and Laboratory Results for Groundwater - April 2021 - Q3

Table F5 - Field and Laboratory Results for Surface water - April 2021 - Q3

Table F6 - Field and Laboratory Results for Surface water - July 2021 - Q4

Table F1 - Field and Laboratory Results for Groundwater - October 2020

Analyte		Units	PQL	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	Field_ID	BH01-2	BH1	BH2	BH3	BH4
						LocCode	BH01-2	BH1	BH2	BH3	BH4
						WellCode					
						Sampled Date	29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
						NEPM 2013 Table 1C GILs, Fresh Waters					
Field	Dissolved Oxygen (Filtered)	mg/L					0	0	6	0	0
	EC (field)	uS/cm			1065		1590	289	1640	1600	2020
	pH (Field)	pH_Units			6.5 - 8.0		5.8	4.3	6.7	6.4	6.4
	PID	ppm					29.5	<1	<1	77	16
	Temp	oC					20.2	17.9	18.7	18.2	18.6
Ion Balance	Magnesium (Filtered)	mg/L	0.5		10.05		19	1	17	30	31
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		0.045	0.36	0.074	0.11	0.1
	Nitrate (as N)	mg/L	0.005	0.7	0.7		0.008	0.22	0.04	0.082	0.053

Notes
Only EPL Trigger Levels exceedances highlighted

Table F2 - Field and Laboratory Results for Surface water - October and November 2020

Analytes		Units	PQL	ANZECC 2000 FW 95%	EPL Surface Water Trigger Levels Licence 6269	Field_ID	L8	L8*	S4	S5	S6	S7
						LocCode	L8	L8*	S4	S5	S6	S7
						WellCode						
						Sampled Date	29/10/2020	9/11/2020*	29/10/2020	29/10/2020	29/10/2020	29/10/2020
						NEPM 2013 Table 1C GILs, Fresh Waters						
Field	Dissolved Oxygen (Filtered)	mg/L			12.057		5.25	13	4.3	1.06	5.23	4.19
	EC (field)	uS/cm			1065		2440	2530	188	938	658	909
	pH (Field)	pH_Units			6.5 - 8.0		8.4	8.4	6.2	6.9	6.6	7.4
	Temp	oC					21.6	23.7	17.9	17.7	17.7	20.9
HM in water - dissolved	Iron (Filtered)	mg/L	0.01		1.84		0.088	0.14	0.29	0.41	0.28	0.3
	Manganese (Filtered)	mg/L	0.005	1.9	1.9	1.9	0.53	0.18	0.022	0.025	0.16	0.33
HM in water - total	Iron	mg/L	0.01		1.84		1.9	1	2.1	2.3	1.6	4.7
	Manganese	mg/L	0.005	1.9	1.9	1.9	0.62	0.33	0.086	0.047	0.16	0.38
Ion Balance	Alkalinity (Carbonate)	mg/L	5				<5	<5	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L	5				<5	<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L	5		12.283		410	410	7	21	7	67
	Alkalinity (Bicarbonate as CaCO3)	mg/L	5				410	410	7	21	7	67
	Calcium (Filtered)	mg/L	0.5		2.05		67	69	1.5	19	10	40
	Chloride	mg/L	1		54.49		400	410	30	110	120	140
	Ionic Balance	%					-4	-4	-2	4	4	5
	Magnesium (Filtered)	mg/L	0.5		10.05		30	29	2.9	10	12	13
	Potassium (Filtered)	mg/L	0.5		2.282		44	42	2	15	7.3	18
	Sodium (Filtered)	mg/L	0.5		34		290	300	19	68	76	86
	Sulphate	mg/L	1		3.1		78	74	13	57	56	64
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		38	43	0.014	0.061	0.05	2.4
	Fluoride	mg/L	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Nitrate (as N)	mg/L	0.005	0.7	0.7		1.1	0.64	0.13	2.9	0.54	3.8
	TOC	mg/L	1		33.1		57	59	22	28	13	34
	TSS	mg/L	5		33.415		270	18	41	74	17	290
Total Phenolics	Phenolics Total	mg/L	0.05	0.32	0.32		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Notes
Only EPL Trigger Level Exceedances highlighted
* Additional monitoring round requested by coucil

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Laboratory Results

Table F3 - Field and Laboratory Results for Surface water - January 2021

Analytes		Units	PQL	ANZECC 2000 FW 95%	EPL Surface Water Trigger Levels Licence 6269	Field_ID	L8	S4	S5	S6	S7
						LocCode	L8	S4	S5	S6	S7
						WellCode					
						Sampled Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021	27/01/2021
						NEPM 2013 Table 1C GILs, Fresh Waters					
Field	Dissolved Oxygen (Filtered)	mg/L			12.057		2.07	4.69	5.22	8.32	10.1
	EC (field)	uS/cm			1065		1290	140	540	151	820
	pH (Field)	pH_Units			6.5 - 8.0		7.2	7	7.1	8.1	7.9
	Temp	oC					32.4	29.5	26.8	27.5	33.7
HM in water - dissolved	Iron (Filtered)	mg/L	0.01		1.84		0.36	0.84	2.4	1.3	0.66
	Manganese (Filtered)	mg/L	0.005	1.9	1.9	1.9	0.016	0.011	0.26	0.062	0.055
HM in water - total	Iron	mg/L	0.01		1.84		-	1	2.6	1.7	1.5
	Manganese	mg/L	0.005	1.9	1.9	1.9	-	0.02	0.27	0.073	0.16
Ion Balance	Alkalinity (Carbonate)	mg/L	5				28	<5	<5	<5	17
	Alkalinity (Hydroxide) as CaCO3	mg/L	5				<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L	5		12.283		150	11	110	39	150
	Alkalinity (Bicarbonate as CaCO3)	mg/L	5				120	11	110	39	130
	Calcium (Filtered)	mg/L	0.5		2.05		32	1.2	23	5.9	42
	Chloride	mg/L	1		54.49		240	24	86	47	130
	Ionic Balance	%					1	2	1	2	1
	Magnesium (Filtered)	mg/L	0.5		10.05		17	1.6	9.7	4.7	13
	Potassium (Filtered)	mg/L	0.5		2.282		25	2	10	5.2	15
	Sodium (Filtered)	mg/L	0.5		34		170	17	60	32	90
	Sulphate	mg/L	1		3.1		38	1	4	2	29
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		0.31	0.006	0.2	0.024	0.36
	Fluoride	mg/L	0.1				<0.1	<0.1	<0.1	<0.1	<0.1
	Nitrate (as N)	mg/L	0.005	0.7	0.7		1.8	<0.005	0.03	<0.005	<0.005
	TOC	mg/L	1		33.1		38	29	41	33	52
	TSS	mg/L	5		33.415		48	7	19	13	24
Total Phenolics	Phenolics Total	mg/L	0.05	0.32	0.32		-	<0.05	<0.05	<0.05	<0.05

Notes

Only EPL Trigger Level Exceedances highlighted

Table F4 - Field and Laboratory Results for Groundwater - April 2021

Analyte		Units	PQL	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	Field_ID	BH01-2	BH1	BH2	BH3	BH4
						LocCode	BH01-2	BH1	BH2	BH3	BH4
						WellCode					
						Sampled Date	27/04/2021	27/04/2021	27/04/2021	27/04/2021	27/04/2021
						NEPM 2013 Table 1C GILs, Fresh Waters					
Field	Dissolved Oxygen (Filtered)	mg/L					9.6	9.3	9.3	9.3	9.5
	EC (field)	uS/cm			1065		1480	60	1530	1930	1830
	pH (Field)	pH_Units			6.5 - 8.0		6.6	6.2	6.8	6.3	6.5
	PID	ppm					-	-	-	-	-
	Temp	oC					20.1	20.1	19.6	20.6	20.2
Ion Balance	Magnesium (Filtered)	mg/L	0.5		10.05		10	<0.5	17	30	36
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		0.031	1.3	0.096	0.085	0.11
	Nitrate (as N)	mg/L	0.005	0.7	0.7		0.15	<0.005	<0.005	<0.005	0.006

Notes
Only EPL Trigger Levels exceedances highlighted
DO mg/L interpolated based on field reading of DO %

Table F5- Field and Laboratory Results for Surface water - April 2021

Analytes		Units	PQL	ANZECC 2000 FW 95%	EPL Surface Water Trigger Levels Licence 6269	Field_ID	L8	S4	S5	S6	S7
						LocCode	L8	S4	S5	S6	S7
						WellCode					
						Sampled Date	28/04/2021	28/04/2021	27/04/2021	27/04/2021	28/04/2021
						NEPM 2013 Table 1C GILs, Fresh Waters					
Field	Dissolved Oxygen (Filtered)	mg/L			12.057		11.5	12.2	11.5	11.1	13.3
	EC (field)	uS/cm			1065		2360	150	490	180	760
	pH (Field)	pH_Units			6.5 - 8.0		7.6	7.7	7.3	7.1	7.8
	Temp	oC					18.6	16.5	18.3	18.1	17.8
HM in water - dissolved	Iron (Filtered)	ug/L	0.01		1840		2500	440	1200	1400	1500
	Manganese (Filtered)	ug/L	0.005	1900	1900	1900	620	22	60	160	260
HM in water - total	Iron	ug/L	0.01		1840		-	870	3300	2300	3200
	Manganese	ug/L	0.005	1900	1900	1900	-	23	210	170	270
Ion Balance	Alkalinity (Carbonate)	mg/L	5				<5	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L	5				<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L	5		12.283		720	10	110	49	190
	Alkalinity (Bicarbonate as CaCO3)	mg/L	5				720	10	110	49	190
	Calcium (Filtered)	mg/L	0.5		2.05		51	1.1	20	7	38
	Chloride	mg/L	1		54.49		380	27	62	43	100
	Ionic Balance	%					-14	-8	-2	5	-6
	Magnesium (Filtered)	mg/L	0.5		10.05		21	1.6	7.3	5.2	9.3
	Potassium (Filtered)	mg/L	0.5		2.282		52	1.3	10	5.4	18
	Sodium (Filtered)	mg/L	0.5		34		310	15	50	36	75
	Sulphate	mg/L	1		3.1		8	3	10	2	26
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		100	0.1	6.7	0.67	10
	Fluoride	mg/L	0.1				<0.1	<0.1	<0.1	<0.1	<0.1
	Nitrate (as N)	mg/L	0.005	0.7	0.7		<0.005	<0.005	0.04	0.03	0.03
	TOC	mg/L	1		33.1		70	16	29	24	42
	TSS	mg/L	5		33.415		26	12	16	6	94
Total Phenolics	Phenolics Total	mg/L	0.05	0.32	0.32		<0.05	<0.05	<0.05	<0.05	<0.05

Notes
Only EPL Trigger Level Exceedances highlighted
DO mg/L interpolated based on field reading of DO %

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Table F6 - Field and Laboratory Results for Surface water - July 2021

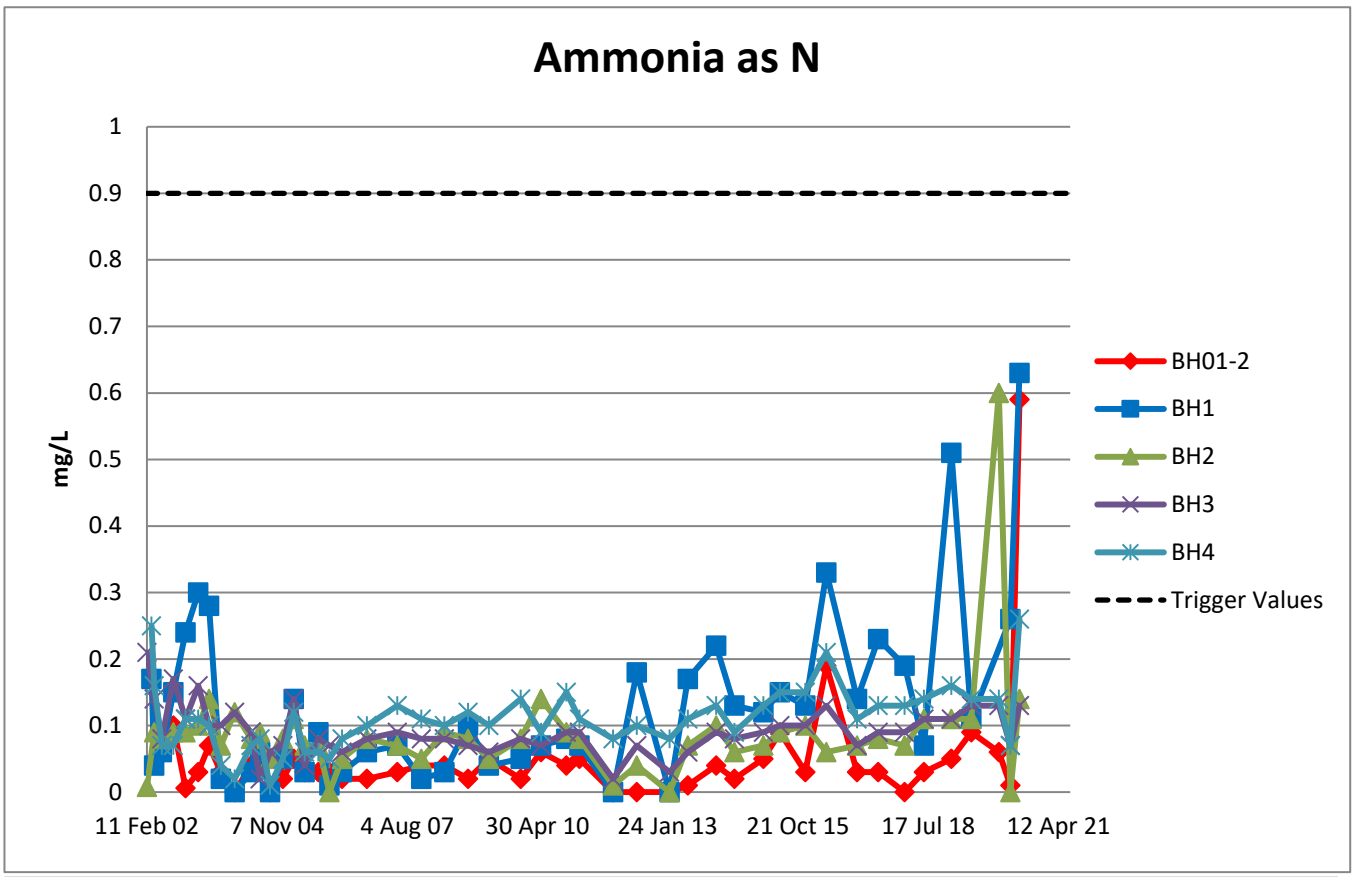
Analytes		Units	PQL	ANZECC 2000 FW 95%	EPL Surface Water Trigger Levels Licence 6269	Field_ID	L8	S4	S5	S6	S7
						LocCode	L8	S4	S5	S6	S7
						WellCode					
						Sampled Date	5/07/2021	5/07/2021	5/07/2021	5/07/2021	5/07/2021
						Lab Received Date	7/07/2021	7/07/2021	7/07/2021	7/07/2021	7/07/2021
						NEPM 2013 Table 1C GILs, Fresh Waters					
Field	Dissolved Oxygen (Filtered)	mg/L			12.057		18.8	7.35	10.3	8.1	5.96
	EC (field)	uS/cm			1065		2260	96	500	320	600
	pH (Field)	pH_Units			6.5 - 8.0		9.4	8.3	8.3	8.8	9
	Temp	oC					16.9	12.2	12.5	12.5	16.9
HM in water - dissolved	Iron (Filtered)	mg/L	0.01		1.84		1.3	0.5	0.9	0.87	0.6
	Manganese (Filtered)	mg/L	0.005	1.9	1.9	1.9	0.34	0.016	0.19	0.082	0.057
HM in water - total	Iron	mg/L	0.01		1.84		Not tested	0.89	3	2	2.7
	Manganese	mg/L	0.005	1.9	1.9	1.9	Not tested	0.022	0.21	0.085	0.18
Ion Balance	Alkalinity (Carbonate)	mg/L	5				<5	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L	5				<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L	5		12.283		780	10	120	34	150
	Alkalinity (Bicarbonate as CaCO3)	mg/L	5				780	10	120	34	150
	Calcium (Filtered)	mg/L	0.5		2.05		52	1	31	9.5	45
	Chloride	mg/L	1		54.49		390	21	100	85	100
	Ionic Balance	%					-14	1	0	-4	0
	Magnesium (Filtered)	mg/L	0.5		10.05		24	2	11	7.3	11
	Potassium (Filtered)	mg/L	0.5		2.282		70	2	12	5.9	15
	Sodium (Filtered)	mg/L	0.5		34		320	14	69	45	71
	Sulphate	mg/L	1		3.1		14	1	28	17	40
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9		120	0.041	1.4	0.19	1.5
	Fluoride	mg/L	0.1				0.1	<0.1	<0.1	<0.1	<0.1
	Nitrate (as N)	mg/L	0.005	0.7	0.7		0.1	0.02	0.23	0.1	0.92
	TOC	mg/L	1		33.1		91	17	31	19	31
	TSS	mg/L	5		33.415		2300	<5	58	85	34
Total Phenolics	Phenolics Total	mg/L	0.05	0.32	0.32		<0.05	<0.05	<0.05	<0.05	<0.05

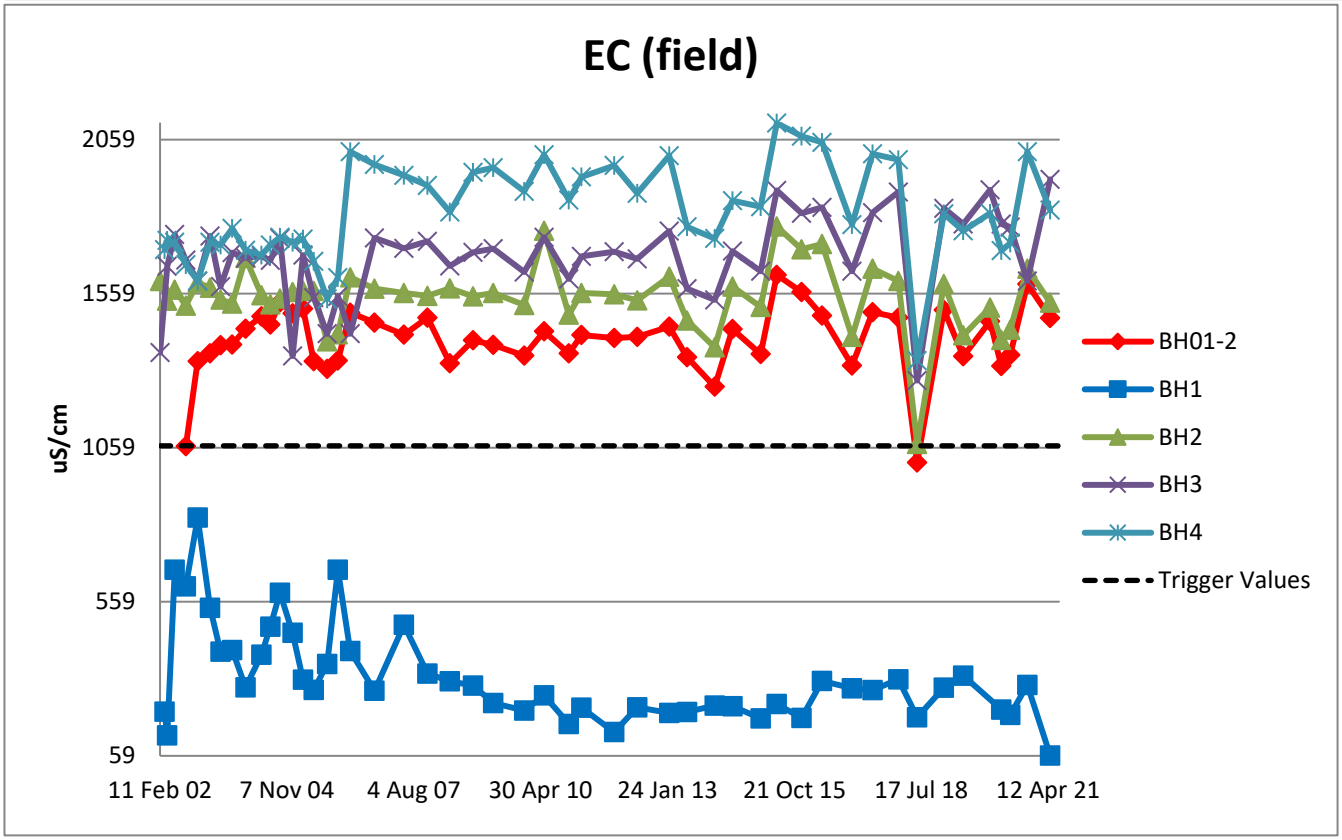
Notes
Only EPL Trigger Level Exceedances highlighted

Appendix G

Graphed Historical Data:

Figure G1 – Groundwater Chemistry (Ammonia and EC) vs Time
Figure G2 – Groundwater Chemistry (Magnesium and Nitrate) vs Time
Figure G3 – Groundwater Chemistry (pH) vs Time
Figure G4 – Surface Water Chemistry (Chloride and EC) vs Time
Figure G5 – Surface Water Chemistry (Iron and Magnesium) vs Time
Figure G6 – Surface Water Chemistry (Manganese and Nitrate) vs Time
Figure G7 – Surface Water Chemistry (pH and Potassium) vs Time
Figure G8 – Surface Water Chemistry (Sodium and Sulfate) vs Time
Figure G9 – Surface Water Chemistry (TSS and TOC) vs Time





Groundwater Ammonia Vs Time (Feb 2002 - April 2021)	**Figure G1**
Groundwater EC Vs Time (Feb 2002 - April 2021)	
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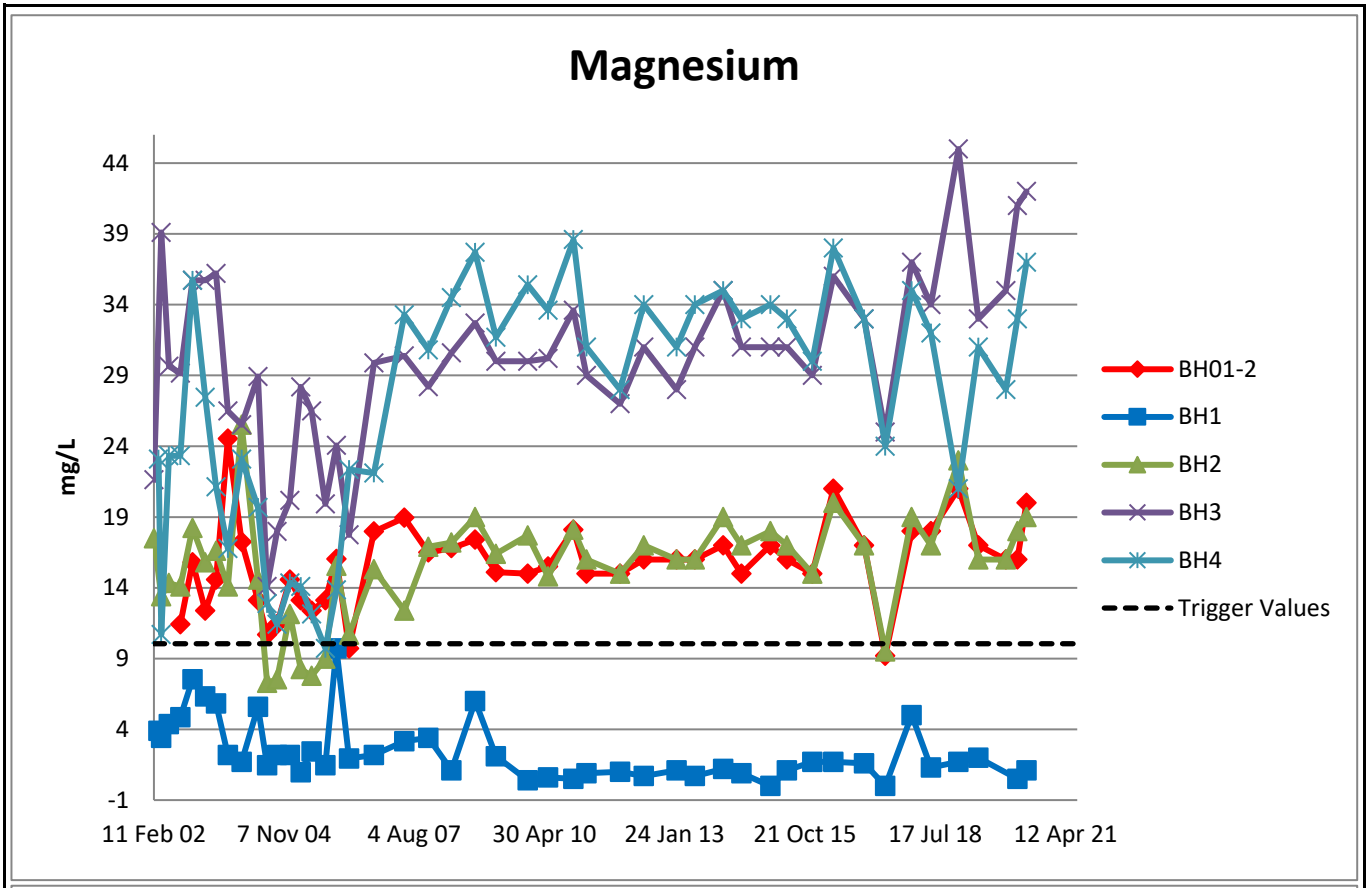

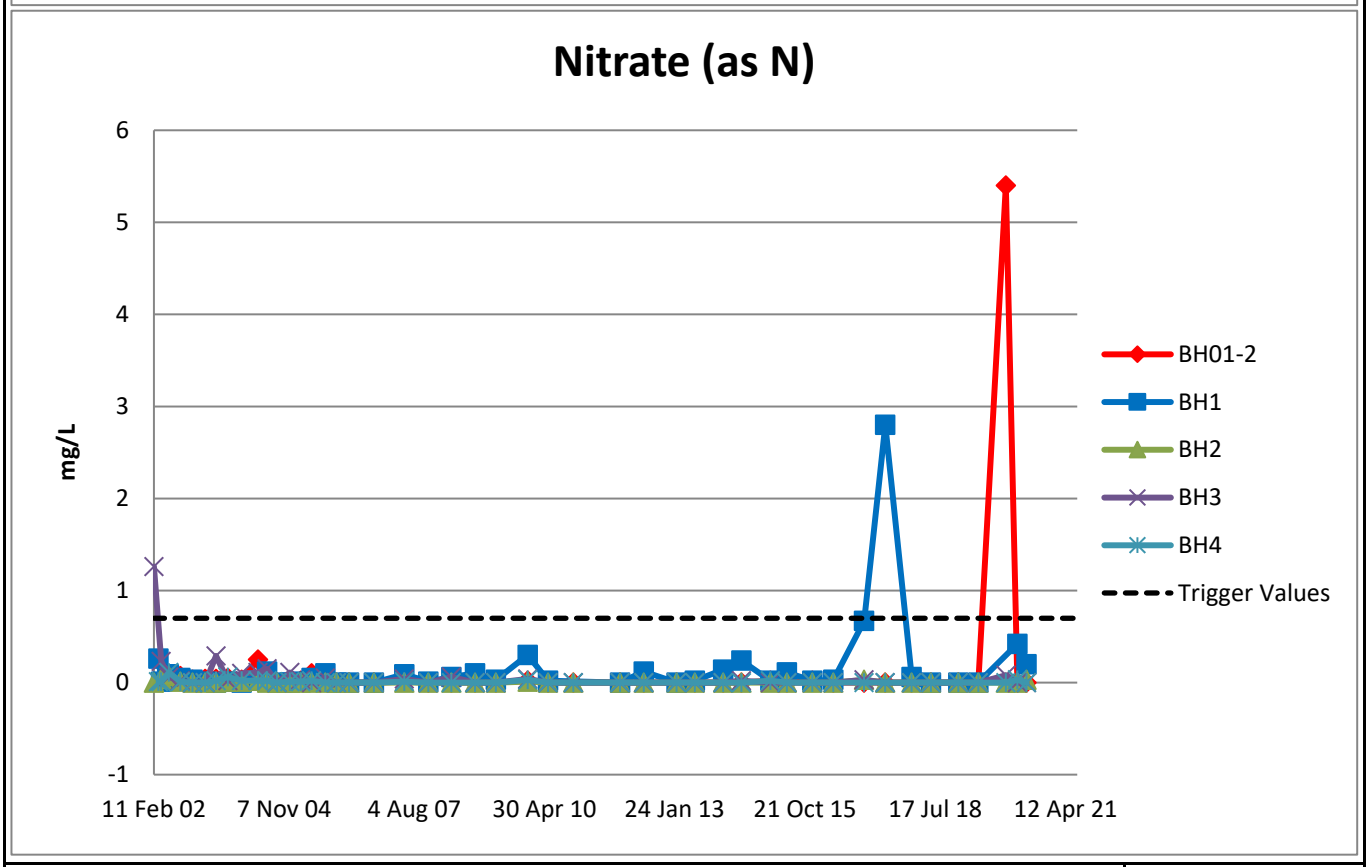

Groundwater Magnesium Vs Time (Feb 2002 - April 2021)	**Figure G2**
Groundwater Nitrate (as N) Vs Time (Feb 2002 - April 2021)	
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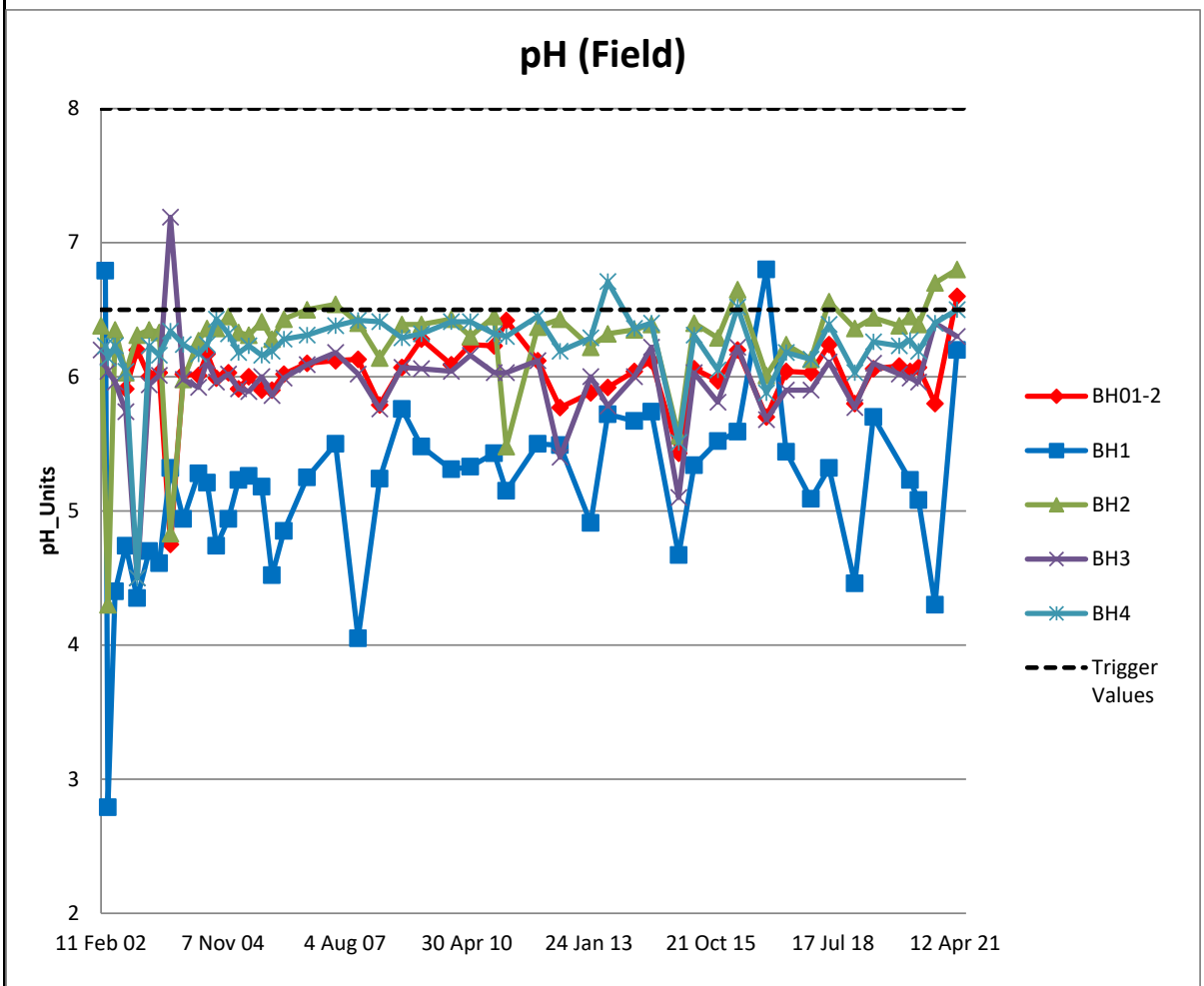

Groundwater pH Vs Time (Feb 2002 - April 2021)

Figure G3

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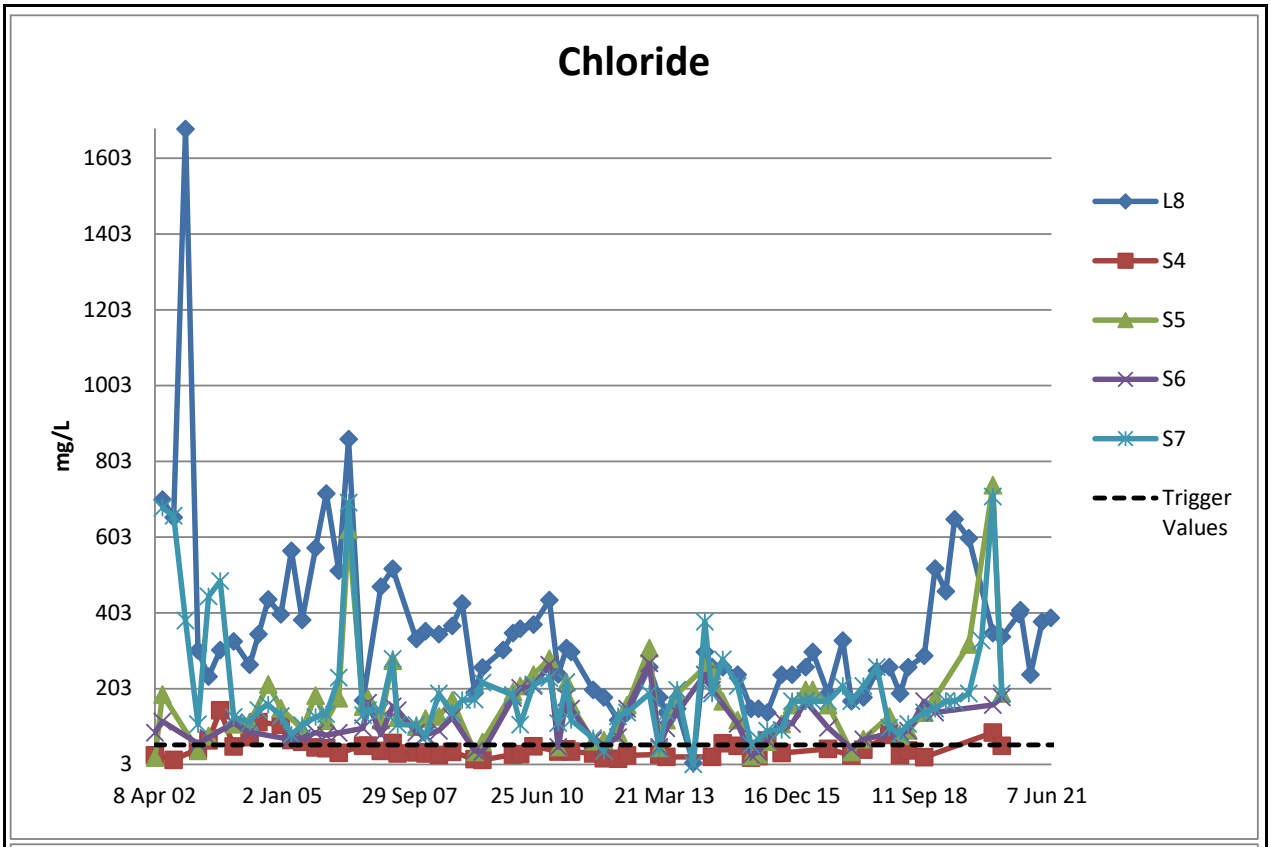

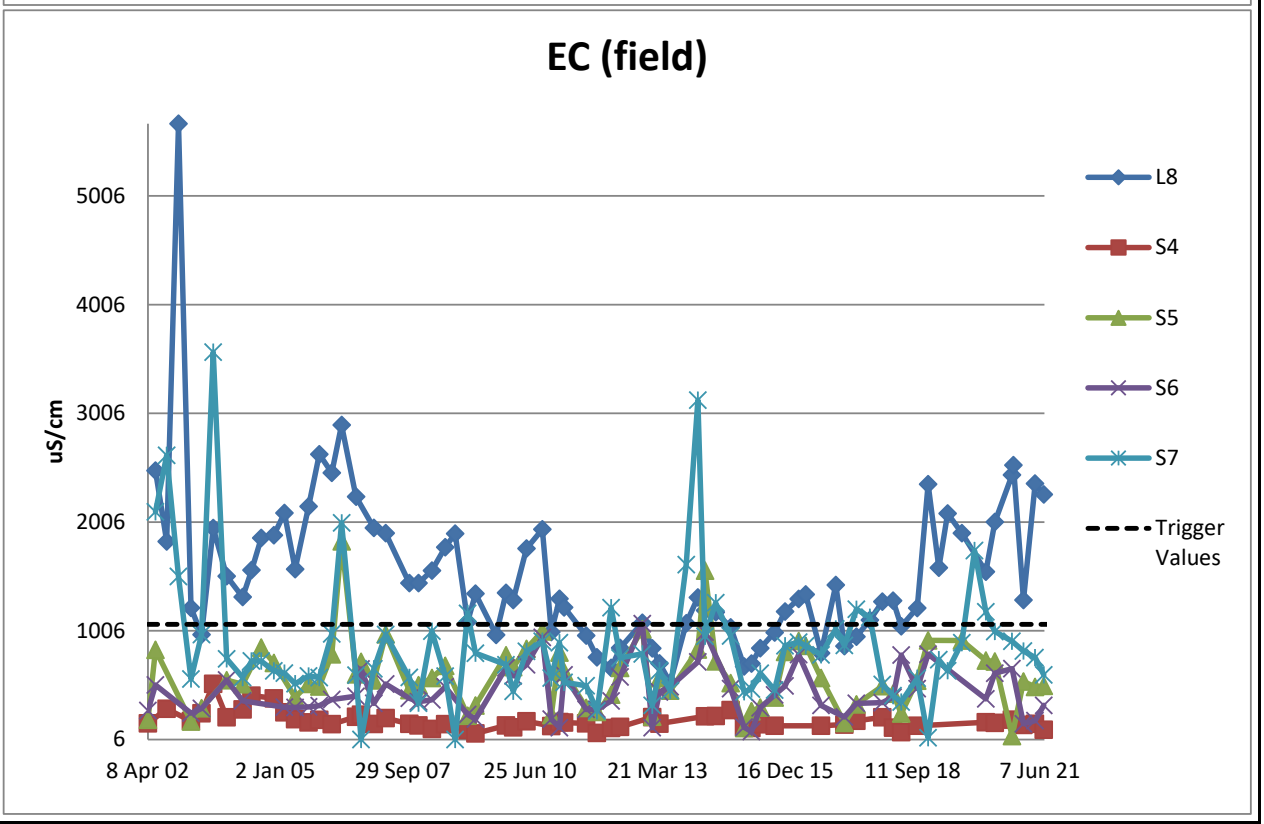

Surface Water Chloride Vs Time (Feb 2002 - July 2021)	**Figure G4**
Surface Water EC Vs Time (Feb 2002 - July 2021)	
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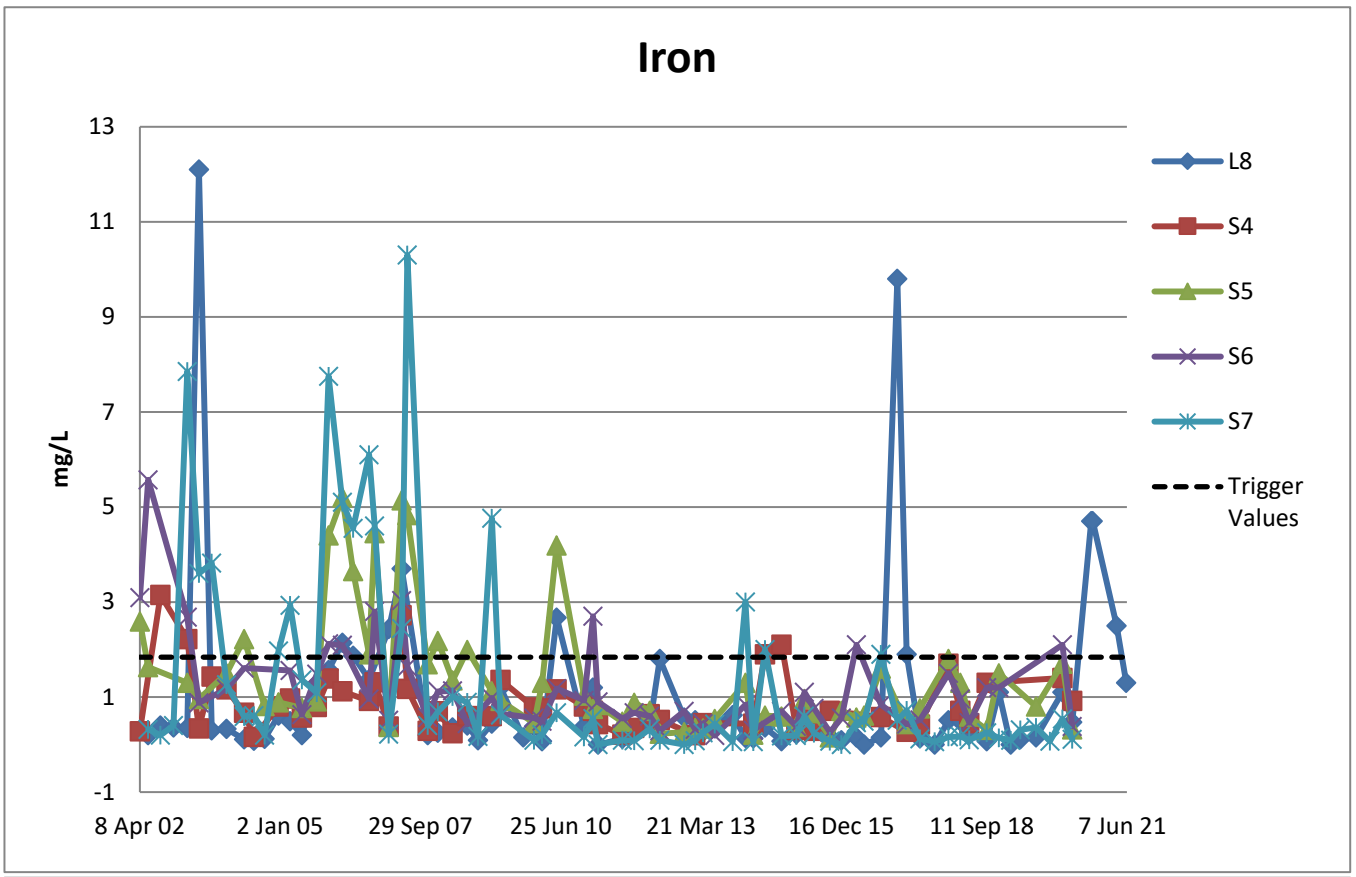

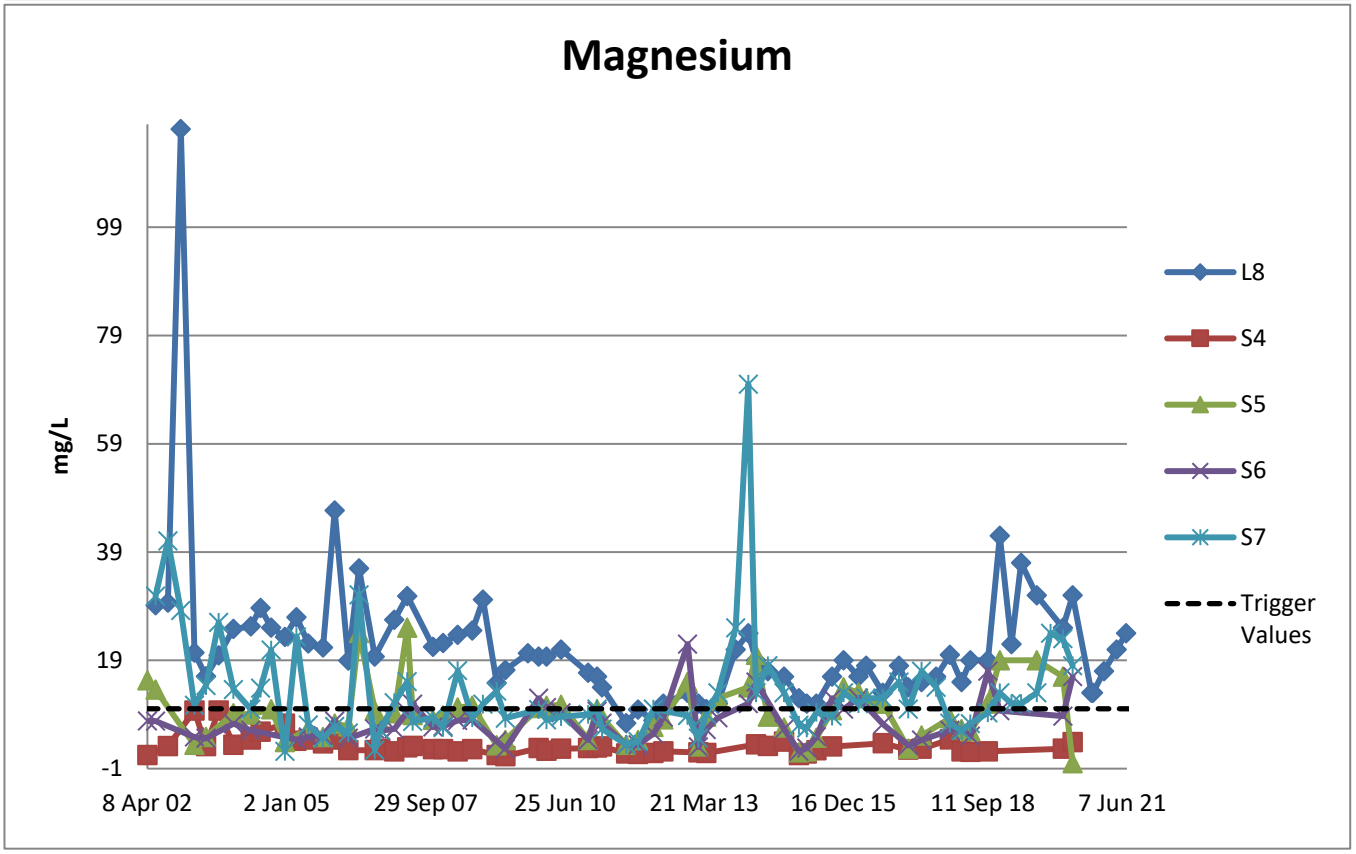

Surface Water Iron Vs Time (Feb 2002 - July 2021)

Surface Water Magnesium Vs Time (Feb 2002 - July 2021)

Figure G5

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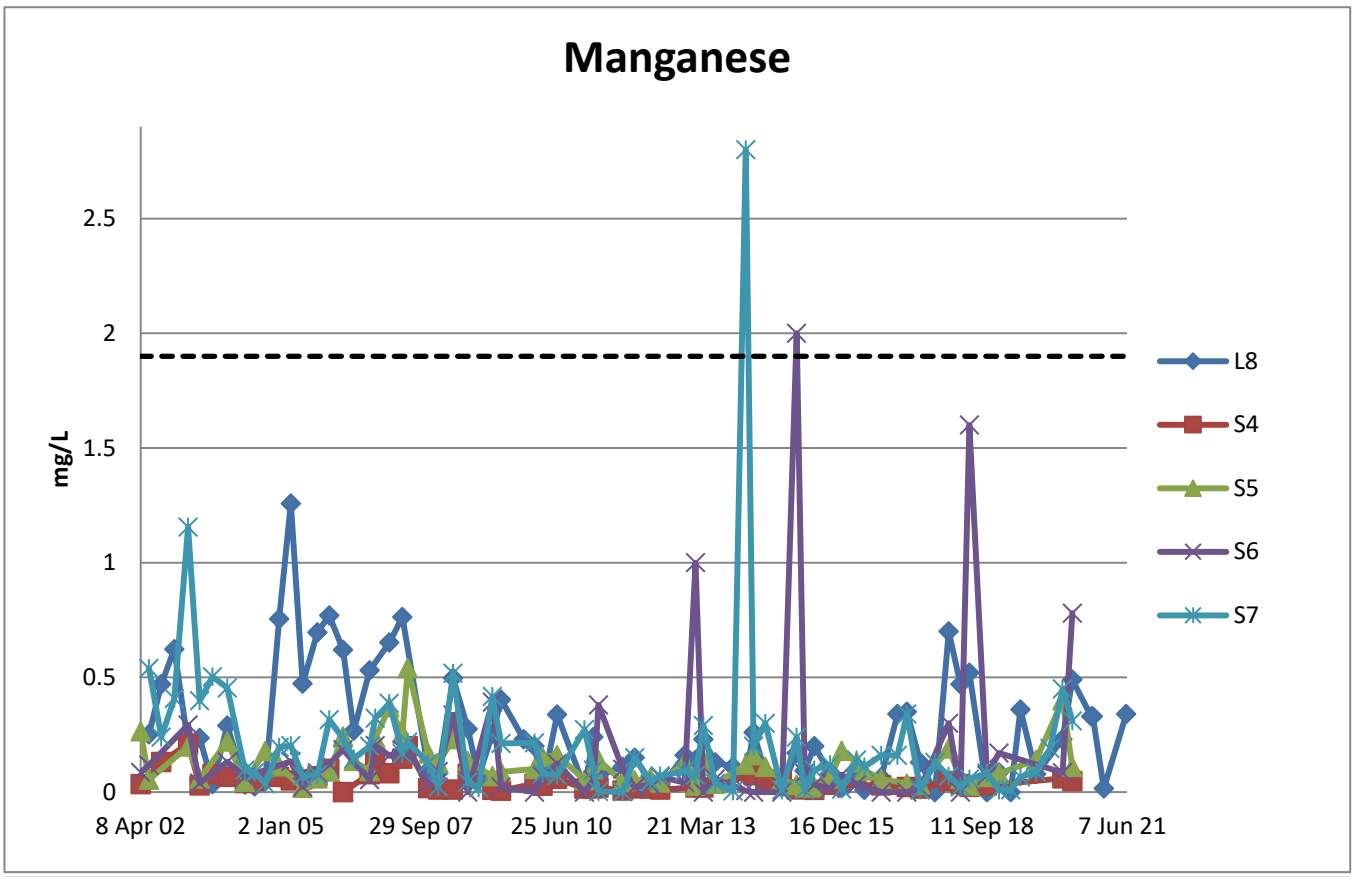

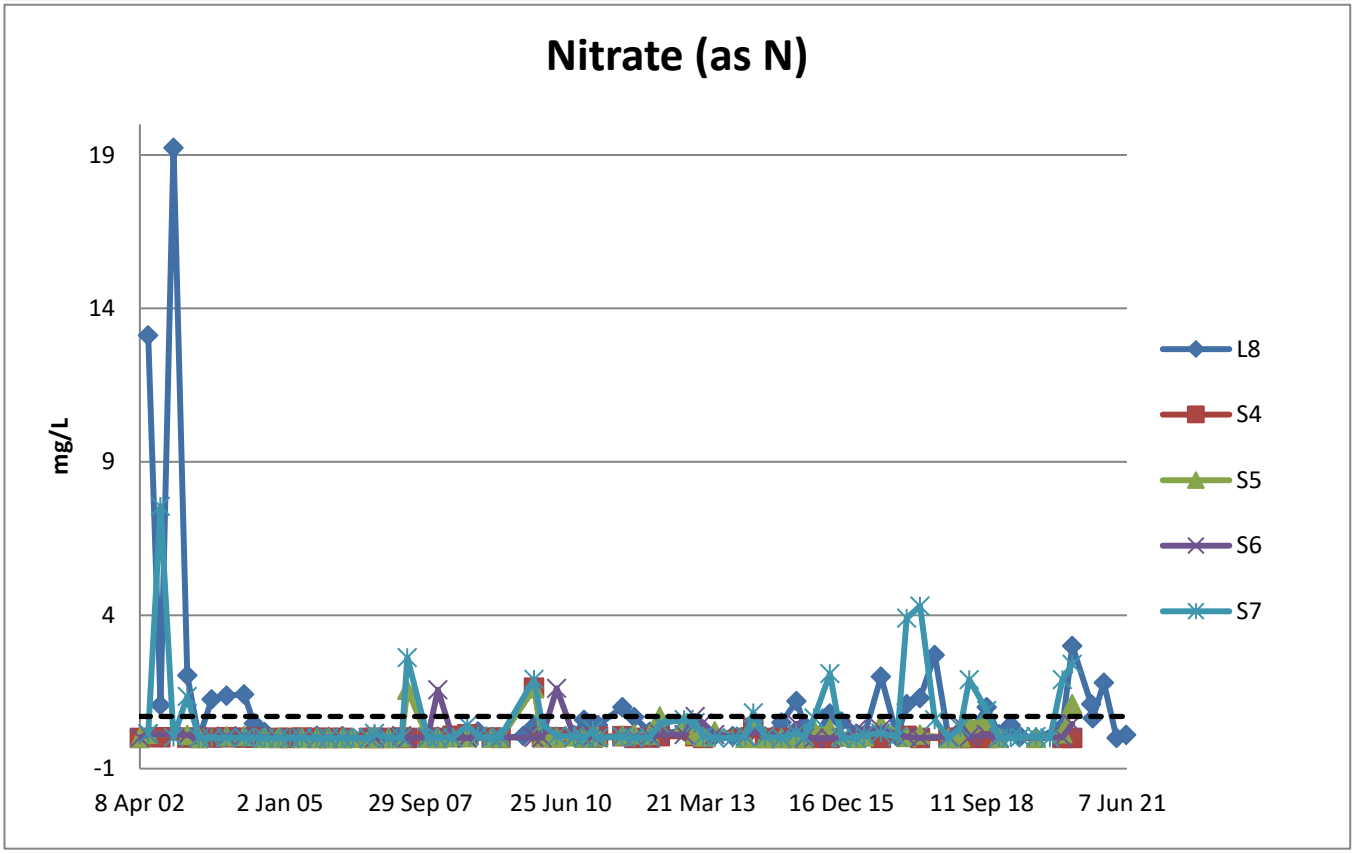

Surface Water Manganese Vs Time (Feb 2002 - July 2021)

Surface Water Nitrate (as N) Vs Time (Feb 2002 - July 2021)

Figure G6

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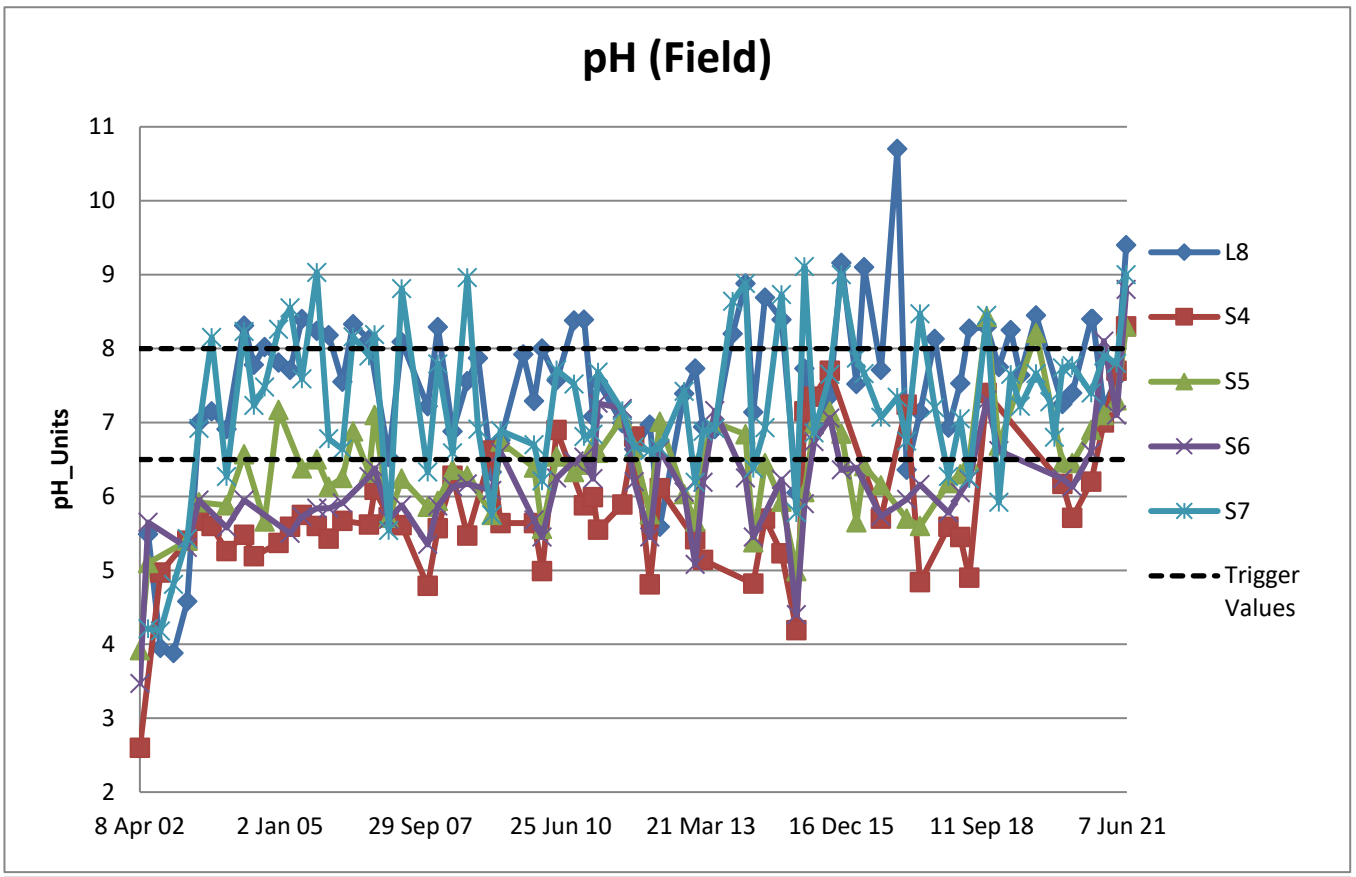

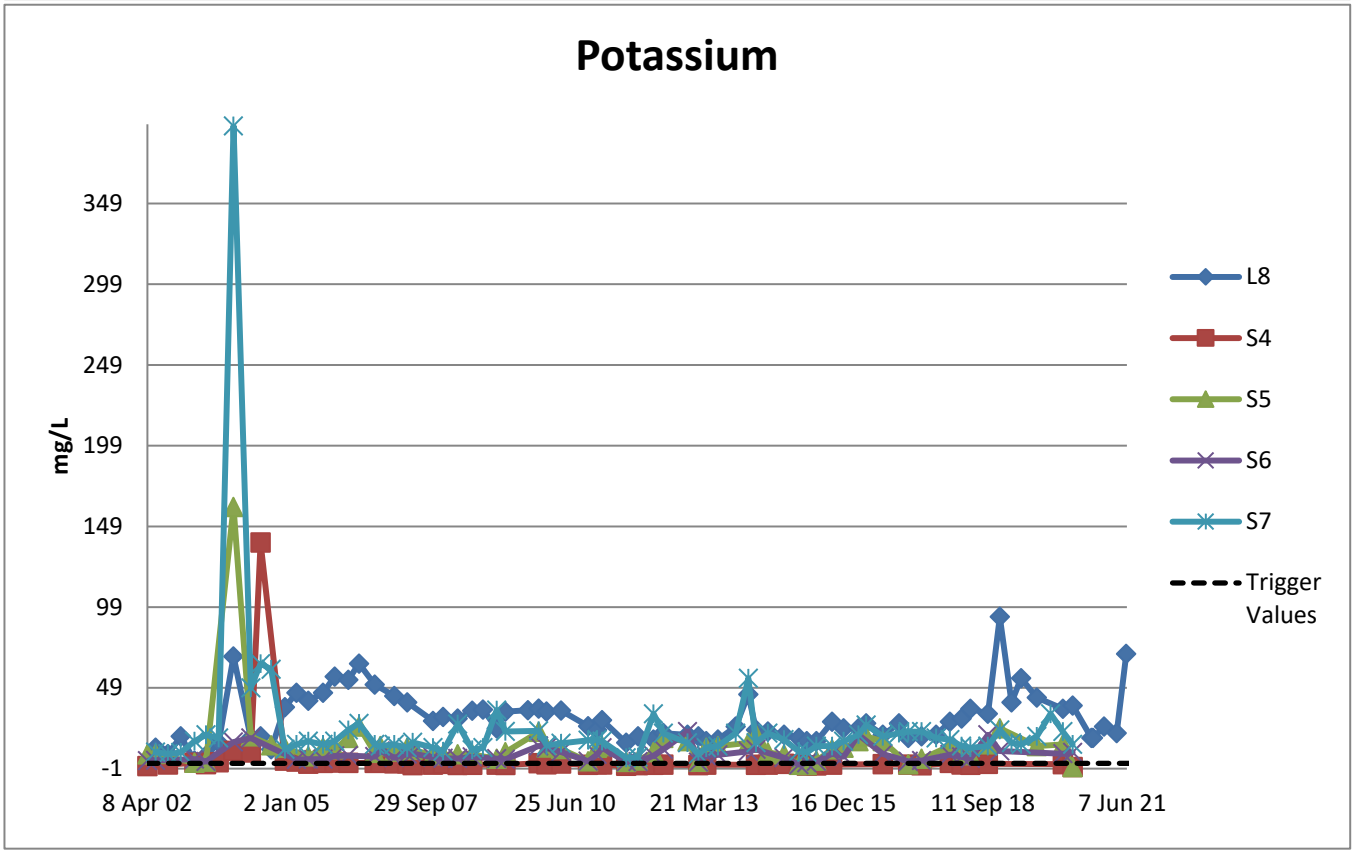

Surface Water pH Vs Time (Feb 2002 - July 2021)	**Figure G7**
Surface Water Potassium Vs Time (Feb 2002 - July 2021)	
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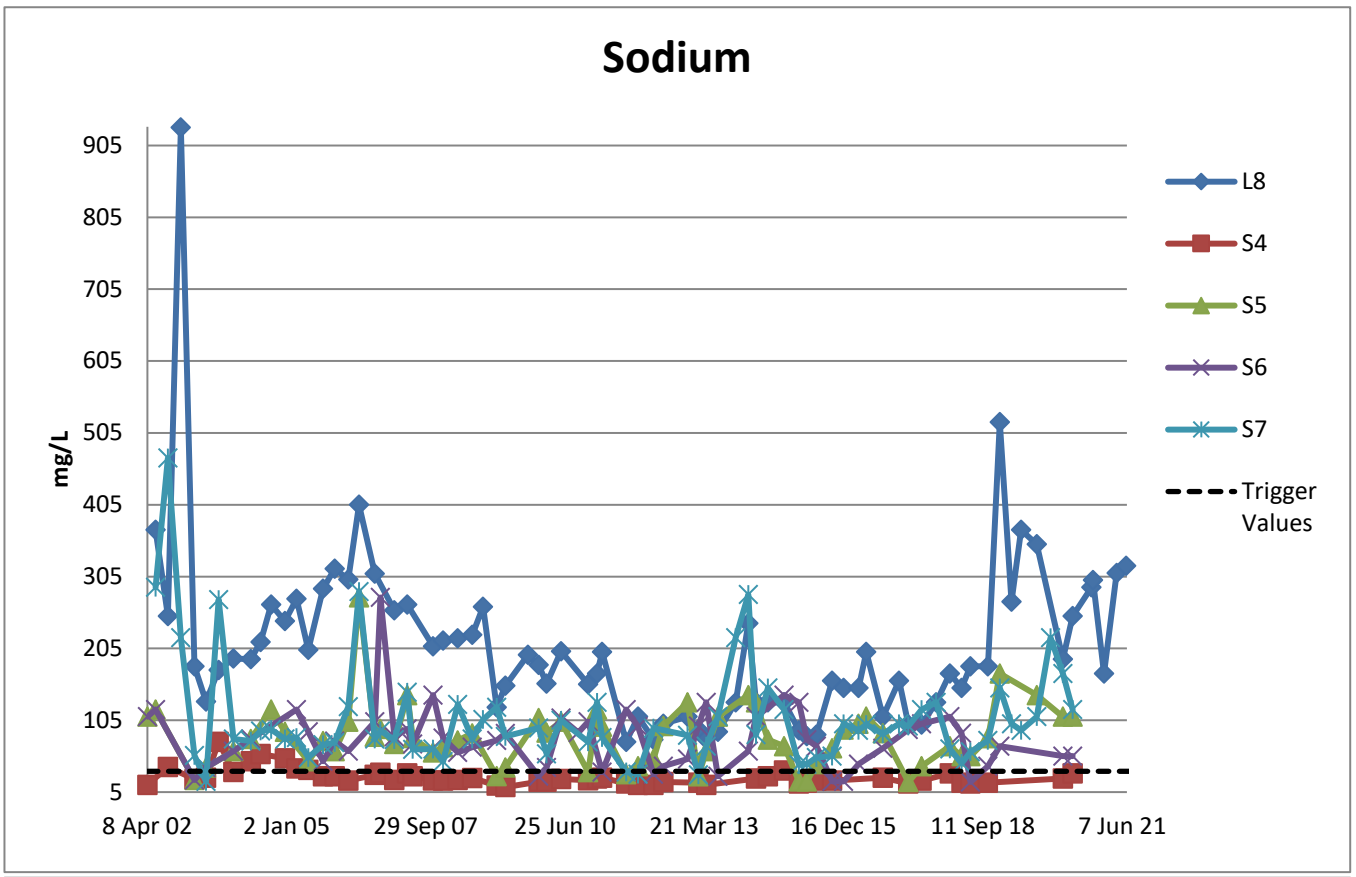

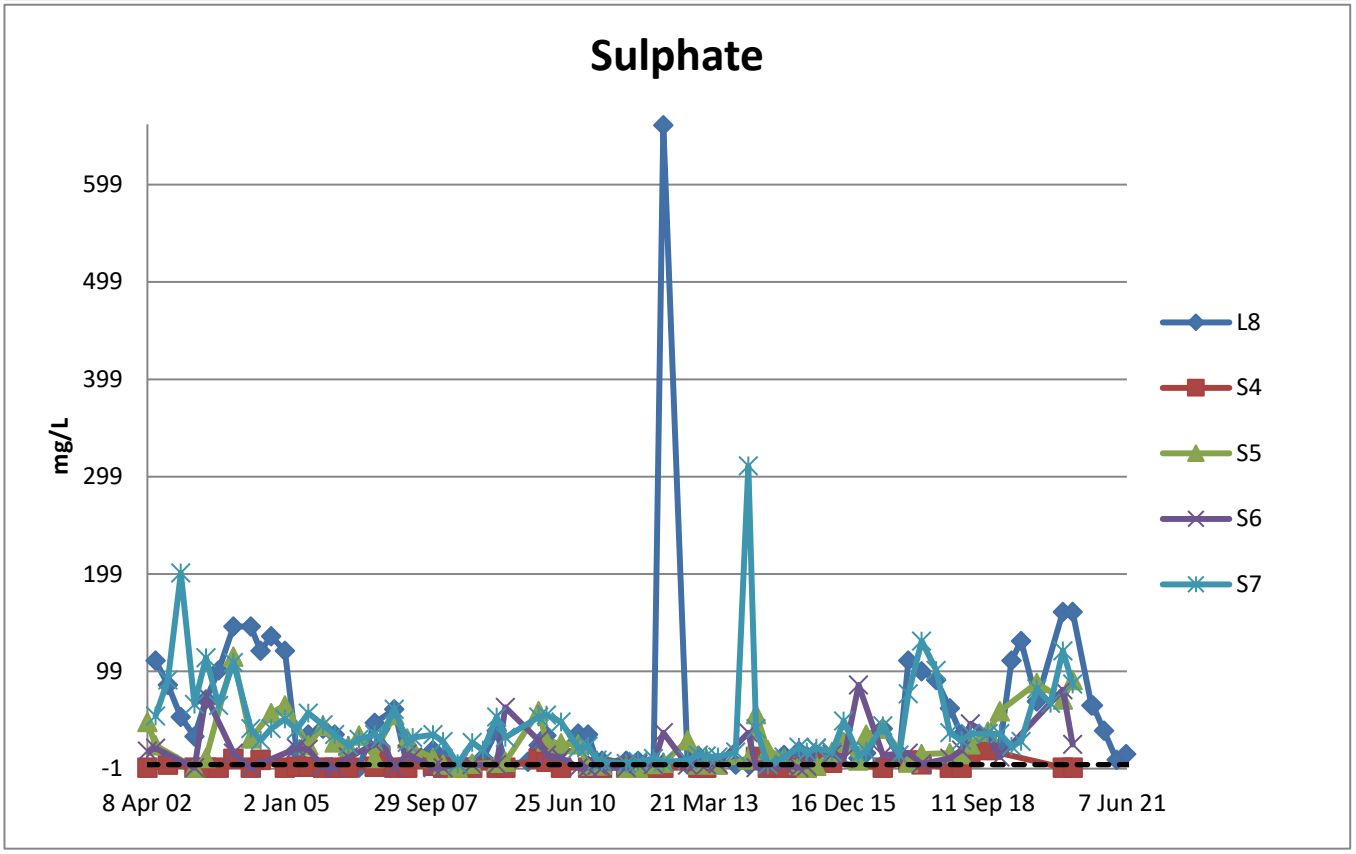

Surface Water Sodium Vs Time (Feb 2002 - July 2021)	**Figure G8**
Surface Water Sulfate Vs Time (Feb 2002 - July 2021)	
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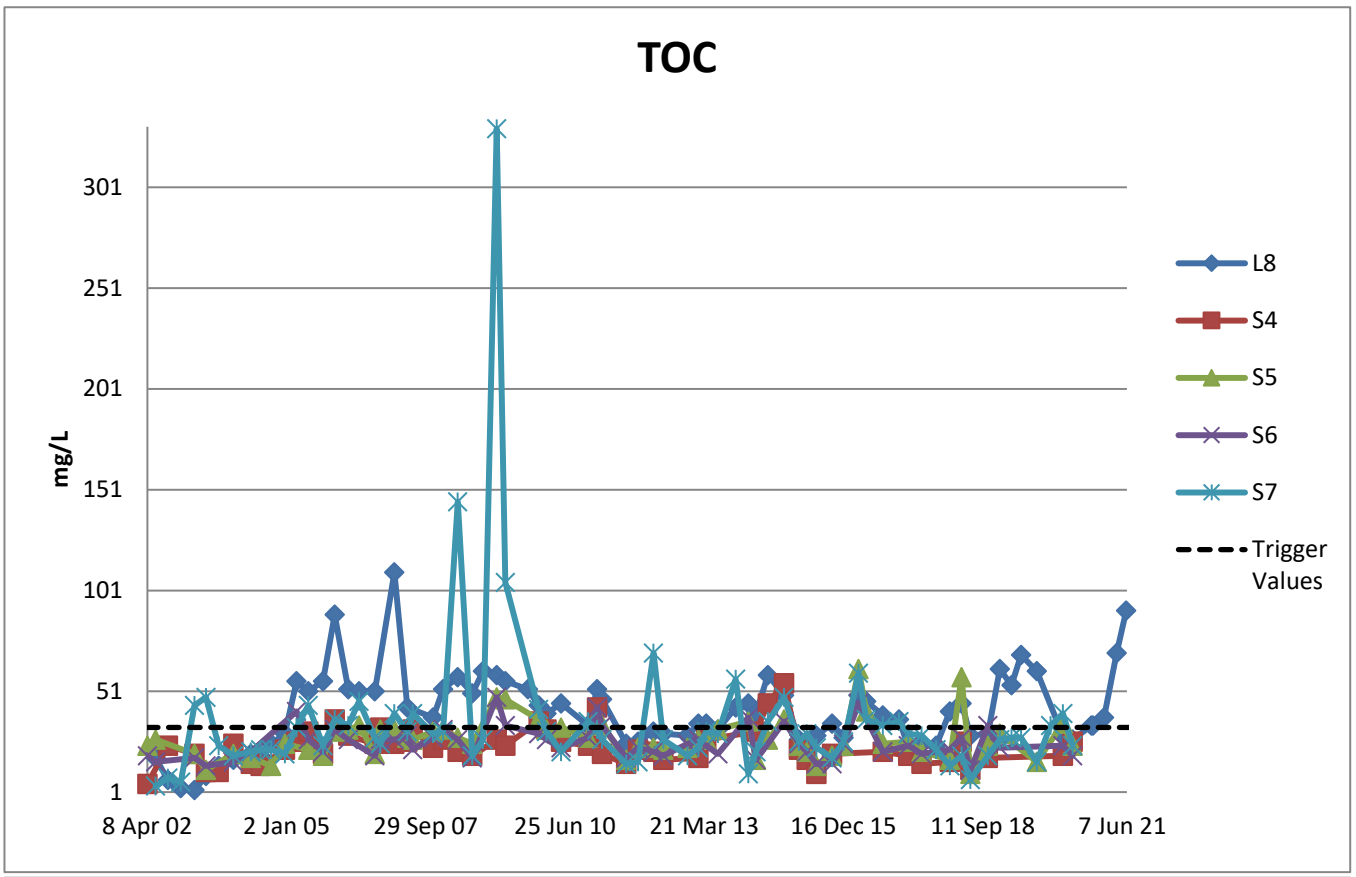

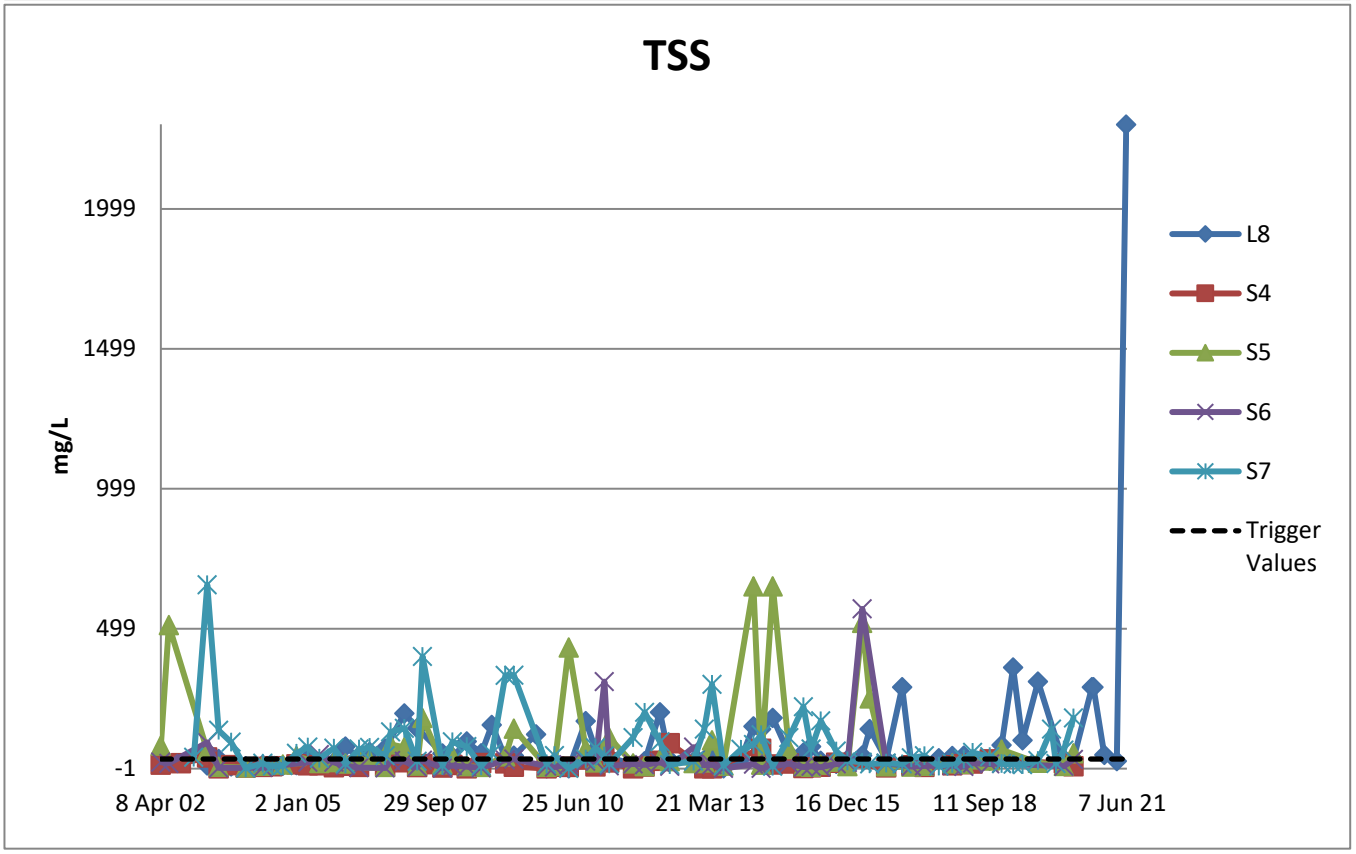

Surface Water TOC Vs Time (Feb 2002 - July 2021)

Surface Water TSS Vs Time (Feb 2002 - July 2021)

Figure G9

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Appendix H

Tabulated Annual Return Data

Table H1: Annual Return Reporting Values for Monitoring Point 1 (BH1) (2020 to 2021)

Table H2: Annual Return Reporting Values for Monitoring Point 2 (BH2) (2020 to 2021)

Table H3: Annual Return Reporting Values for Monitoring Point 3 (BH3) (2020 to 2021)

Table H4: Annual Return Reporting Values for Monitoring Point 4 (S4) (2020 to 2021)

Table H5: Annual Return Reporting Values for Monitoring Point 5 (S5) (2020 to 2021)

Table H6: Annual Return Reporting Values for Monitoring Point 6 (S6) (2020 to 2021)

Table H7: Annual Return Reporting Values for Monitoring Point 7 (S7) (2020 to 2021)

Table H8: Annual Return Reporting Values for Monitoring Point 8 (L8) (2020 to 2021)

Table H9: Annual Return Reporting Values for Monitoring Point 9 (Methane Buildings) (2020 to 2021)

Table H10: Annual Return Reporting Values for Monitoring Point 10 (Methane Surface) (2020 to 2021)

Table H11: Annual Return Reporting Values for Monitoring Point 11 (Methane in Groundwater Bores) (2020 to 2021)

Table H12: Annual Return Reporting Values for Monitoring Point 12 (BH4) (2020 to 2021)

Table H13: Annual Return Reporting Values for Monitoring Point 14 (BH01-2) (2020 to 2021)

Table H1: Annual Return Reporting Values for Monitoring Point 1 (BH1) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Ammonia	mg/l	2	0.4	0.8	1.3
Conductivity	uS/cm	2	60	175	289
Magnesium	mg/l	2	0.5	0.8	1.0
Nitrate	mg/l	2	0.0	0.1	0.2
pH	pH	2	4.3	5.3	6.2
Standing Water Level	AHD	4	27.385	28.781	30.035
Temperature	°C	2	17.9	19.0	20.1

Table H2: Annual Return Reporting Values for Monitoring Point 2 (BH2) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Ammonia	mg/l	2	0.1	0.1	0.1
Conductivity	uS/cm	2	1530	1585	1640
Magnesium	mg/l	2	17.0	17.0	17.0
Nitrate	mg/l	1	0.0	0.0	0.0
pH	pH	2	6.7	6.8	6.8
Standing Water Level	AHD	4	23.391	23.857	24.116
Temperature	°C	2	18.7	19.2	19.6

Table H3: Annual Return Reporting Values for Monitoring Point 3 (BH3) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Ammonia	mg/l	2	0.1	0.1	0.1
Conductivity	uS/cm	2	1600	1765	1930
Magnesium	mg/l	2	30.0	30.0	30.0
Nitrate	mg/l	2	0.0	0.0	0.1
pH	pH	2	6.3	6.4	6.4
Standing Water Level	AHD	4	23.079	23.935	24.479
Temperature	°C	2	18.2	19.4	20.6

Table H4: Annual Return Reporting Values for Monitoring Point 4 (S4) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Alkalinity (As Calcium Carbonate)	mg/l	4	7.0	9.5	11.0
Ammonia	mg/l	4	0.0	0.0	0.1
Calcium	mg/l	4	1.0	1.2	1.5
Chloride	mg/l	4	21.0	25.5	30.0
Conductivity	uS/cm	4	96.0	143.5	188.0
Dissolved Oxygen	mg/l	4	4.0	6.5	12.2
Fluoride	mg/l	4	0.1	0.1	0.1
Iron	mg/l	4	0.3	110.4	440.0
Magnesium	mg/l	4	1.6	2.0	2.9
Manganese	mg/l	4	0.0	5.5	22.0
Nitrate	mg/l	4	0.0	0.0	0.1
pH	pH	4	6.2	7.3	8.3
Potassium	mg/l	4	1.3	1.8	2.0
Sodium	mg/l	4	14.0	16.3	19.0
Sulfate	mg/l	4	1.0	4.5	13.0
Temperature	°C	4	12.2	19.0	29.5
Total Organic Carbon	mg/l	4	16.0	21.0	29.0
Total Phenolics	mg/l	4	0.1	0.1	0.1
Total Suspended Solids	mg/l	4	5.0	16.3	41.0

Table H5: Annual Return Reporting Values for Monitoring Point 5 (S5) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Alkalinity (As Calcium Carbonate)	mg/l	4	21.0	90.3	120.0
Ammonia	mg/l	4	0.1	2.1	6.7
Calcium	mg/l	4	19.0	23.3	31.0
Chloride	mg/l	4	62.0	89.5	110.0
Conductivity	uS/cm	4	490.0	617.0	938.0
Dissolved Oxygen	mg/l	4	1.1	6.4	11.5
Fluoride	mg/l	4	0.1	0.1	0.1
Iron	mg/l	4	0.4	300.9	1200.0
Magnesium	mg/l	4	7.3	9.5	11.0
Manganese	mg/l	4	0.0	15.1	60.0
Nitrate	mg/l	4	0.0	0.8	2.9
pH	pH	4	6.9	7.4	8.3
Potassium	mg/l	4	10.0	11.8	15.0
Sodium	mg/l	4	50.0	61.8	69.0
Sulfate	mg/l	4	4.0	24.8	57.0
Temperature	°C	4	12.5	18.8	26.8
Total Organic Carbon	mg/l	4	28.0	32.3	41.0
Total Phenolics	mg/l	4	0.1	0.1	0.1
Total Suspended Solids	mg/l	4	16.0	41.8	74.0

Table H6: Annual Return Reporting Values for Monitoring Point 6 (S6) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Alkalinity (As Calcium Carbonate)	mg/l	4	7.0	32.3	49.0
Ammonia	mg/l	4	0.0	0.2	0.7
Calcium	mg/l	4	5.9	8.1	10.0
Cholride	mg/l	4	43.0	73.8	120.0
Conductivity	uS/cm	4	151.0	327.3	658.0
Dissolved Oxygen	mg/l	4	4.0	7.4	11.1
Fluoride	mg/l	4	0.1	0.1	0.1
Iron	mg/l	4	0.3	350.6	1400.0
Magnesium	mg/l	4	4.7	7.3	12.0
Manganese	mg/l	4	0.1	40.1	160.0
Nitrate	mg/l	3	0.0	0.2	0.5
pH	pH	4	6.6	7.7	8.8
Potassium	mg/l	4	5.2	6.0	7.3
Sodium	mg/l	4	32.0	47.3	76.0
Sulfate	mg/l	4	2.0	19.3	56.0
Temperature	°C	4	12.5	19.0	27.5
Total Organic Carbon	mg/l	4	13.0	22.3	33.0
Total Phenolics	mg/l	4	0.1	0.1	0.1
Total Suspended Solids	mg/l	4	6.0	30.3	85.0

Table H7: Annual Return Reporting Values for Monitoring Point 7 (S7) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Alkalinity (As Calcium Carbonate)	mg/l	4	67.0	139.3	190.0
Ammonia	mg/l	4	0.4	3.6	10.0
Calcium	mg/l	4	38.0	41.3	45.0
Chloride	mg/l	4	100.0	117.5	140.0
Conductivity	uS/cm	4	600.0	772.3	909.0
Dissolved Oxygen	mg/l	4	4.0	7.5	13.3
Fluoride	mg/l	4	0.1	0.1	0.1
Iron	mg/l	4	0.3	375.4	1500.0
Magnesium	mg/l	4	9.3	11.6	13.0
Manganese	mg/l	4	0.1	65.1	260.0
Nitrate	mg/l	4	0.0	1.2	3.8
pH	pH	4	7.4	8.0	9.0
Potassium	mg/l	4	15.0	16.5	18.0
Sodium	mg/l	4	71.0	80.5	90.0
Sulfate	mg/l	4	26.0	39.8	64.0
Temperature	°C	4	16.9	22.3	33.7
Total Organic Carbon	mg/l	4	31.0	39.8	52.0
Total Phenolics	mg/l	4	0.1	0.1	0.1
Total Suspended Solids	mg/l	4	24.0	110.5	290.0

Table H8: Annual Return Reporting Values for Monitoring Point 8 (L8) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Alkalinity (As Calcium Carbonate)	mg/l	4	150.0	515.0	780.0
Ammonia	mg/l	4	0.3	65.8	120.0
Calcium	mg/l	4	32.0	51.0	69.0
Chloride	mg/l	4	240.0	355.0	410.0
Conductivity	uS/cm	4	1290.0	2110.0	2530.0
Dissolved Oxygen	mg/l	4	2.1	9.9	18.8
Fluoride	mg/l	4	0.1	0.1	0.1
Iron	mg/l	4	0.1	625.5	2500.0
Magnesium	mg/l	4	17.0	22.8	29.0
Manganese	mg/l	4	0.0	155.1	620.0
Nitrate	mg/l	4	0.0	0.6	1.8
pH	pH	4	7.2	8.2	9.4
Potassium	mg/l	4	25.0	47.3	70.0
Sodium	mg/l	4	170.0	275.0	320.0
Sulfate	mg/l	4	8.0	33.5	74.0
Temperature	°C	4	16.9	22.9	32.4
Total Organic Carbon	mg/l	4	38.0	64.5	91.0
Total Phenolics	mg/l	3	0.1	0.1	0.1
Total Suspended Solids	mg/l	4	18.0	598.0	2300.0

Table H9: Annual Return Reporting Values for Monitoring Point 9 (Methane Buildings) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Methane	%	76	0.000000	0.000003	0.000082

Table H10: Annual Return Reporting Values for Monitoring Point 10 (Methane Surface) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Methane	%	97	0.000001	0.000142	0.003478

Table H11: Annual Return Reporting Values for Monitoring Point 11 (Methane in Groundwater Bores) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Methane	%	20	0.000000	0.000000	0.000000

Table H12: Annual Return Reporting Values for Monitoring Point 12 (BH4) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Ammonia	mg/l	2	0.1	0.1	0.1
Conductivity	uS/cm	2	1830	1925	2020
Magnesium	mg/l	2	31.0	33.5	36.0
Nitrate	mg/l	2	0.0	0.0	0.1
pH	pH	2	6.4	6.5	6.5
Standing Water Level	AHD	4	23.148	23.916	24.628
Temperature	°C	2	18.6	19.4	20.2

Table H13: Annual Return Reporting Values for Monitoring Point 14 (BH01-2) (2020 to 2021)

Analyte	Units	Annual Return Reporting Values			
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value
Ammonia	mg/l	2	0.0	0.0	0.0
Conductivity	uS/cm	2	1480	1535	1590
Magnesium	mg/l	2	10.0	14.5	19.0
Nitrate	mg/l	2	0.0	0.1	0.2
pH	pH	2	5.8	6.2	6.6
Standing Water Level	AHD	4	24.077	24.792	26.607
Temperature	°C	2	20.1	20.2	20.2