



Douglas Partners

Geotechnics | Environment | Groundwater

Annual Report on
Water and Gas Monitoring 2022-2023

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

Prepared for
Kempsey Shire Council

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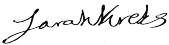

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Annual Report on Water and Gas Monitoring 2022-2023

Kempsey Landfill Water and Gas Monitoring

638 Crescent Head Road, Kempsey

1. Introduction

1.1 Overview

This annual report presents the results of groundwater, surface water and gas monitoring for the period October 2022 to July 2023 at the Kempsey Landfill Site located at 638 Crescent Head Road, South Kempsey New South Wales (NSW). 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 2022-2023 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 2022 to July 2023. The following work tasks were undertaken:

- Q1 - First quarterly monitoring event, September 2022;
 - o Manual water level gauging, purging and sampling of five groundwater monitoring wells;
 - o Sampling of three surface water locations, one leachate location and one effluent location;
 - o Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site.
- Q2 - Second quarterly monitoring event, January 2023;
 - o Manual water level gauging of five groundwater monitoring wells;
 - o Sampling of three surface water locations, one leachate location and one effluent location;
 - o Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site.
- Q3 – Third quarterly monitoring event, April 2023;
 - o Manual water level gauging, purging and sampling of five groundwater monitoring wells;
 - o Sampling of three surface water locations, one leachate location and one effluent location;
 - o Methane gas monitoring within the five groundwater bores, landfill surface and enclosed spaces within the site.
- Q4 - Fourth quarterly monitoring event, July 2023;
 - o Manual water level gauging of five groundwater monitoring wells;
 - o Sampling of three surface water locations, one leachate location and one effluent location;
 - o 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.

KSC requested additional sampling and analysis on surface waters from locations S7 and L8 which was conducted on 30 March 2023, approximately 27 days before Q3 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 m AHD
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 m and 17 m 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 CaCo ₃)	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	26 September 2022	Groundwater gauging	No rainfall on the day of monitoring. Approximately 110 mm of rainfall in the preceding week.
		Groundwater sampling and laboratory analysis	
	27 September 2022	Surface water sampling and laboratory analysis	Approximately 0.2 mm on the day of monitoring.
		Methane gas monitoring (building, bores and surface)	
Q2 2nd Quarter monitoring event	10 January 2023	Surface water sampling and laboratory analysis	No rainfall on the day of monitoring. Approximately 57.6 mm of rainfall in the preceding week.
		Groundwater gauging	
		Methane gas monitoring (building, bores and surface)	
Q3 3rd Quarter monitoring event	26 April 2023	Surface water sampling and laboratory analysis	Approximately 0.4 mm of rainfall on the day of monitoring. Approximately 3 mm of rainfall in the preceding week.
		Methane gas monitoring (building, bores and surface)	
	27 April 2023	Groundwater gauging	Approximately 1.4 mm of rainfall on the day of monitoring.
		Groundwater sampling and laboratory analysis	
Q4 4 th Quarter monitoring event	4 July 2023	Groundwater gauging	Approximately 3.6 mm rainfall on the day of monitoring. No rainfall recorded in the preceding week.
		Methane gas monitoring (building, bores and surface)	
	5 July 2023	Surface water sampling and laboratory analysis	Approximately 3.2 mm rainfall on the day of monitoring.

6.2 Groundwater

6.2.1 Groundwater Monitoring Locations

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

- BH1 (EPL Point 1):
 - o Located up-hydraulic gradient of the site and is intended to be representative of background groundwater conditions.
- BH2 (EPL Point 2):
 - o Located down gradient and to the south of the landfill, near the sediment retention dam.
- BH3 (EPL Point 3):
 - o Located on the western side of the site within the landfill fence-line, near an existing storm water spoon drain.
- BH4 (EPL Point 12):
 - o The western-most monitoring well outside the landfill fence-line, located between the sediment retention pond and leachate dam.
- BH1-02 (EPL Point 14):
 - o 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 F.

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):
 - o Located upstream from the site and is considered to be representative of background surface water conditions.

- S5 (EPL Point 5):
 - o 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):
 - o Located further downstream of the site than S5.
- S7 (EPL Point 7):
 - o Located at the outlet of the site sediment retention pond.
- L8 (EPL Point 8):
 - o 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. It is noted that during this annual reporting period an additional four buildings are present in the north-east corner of the site. These buildings were added to the scope of monitoring during the Q4 round in order to comply with the EPL (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 either using a Huberg Laser or TDL-500 Laser Methane Detector subject to availability 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 for the last two years of monitoring are plotted against rainfall (Kempsey Airport) in Figure G1 in Appendix G. It is noted that there was significant rainfall in the 2020-2021 and 2021-2022 monitoring periods (i.e. 2023.4 mm and 1575.8 mm respectively for a 12 month period), compared to the 2022-2023 monitoring period (985.2 mm).

Prior to 2019 there was a general trend of slowly dropping water levels with the exception of BH1. Previous 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, currently the Bore is obstructed and as such groundwater level cannot be accurately monitored at this monitoring point (refer to Table D1 and Figure G1).

Groundwater levels have generally increased over the 2022-2023 reporting period by up to about 0.5m.

Groundwater levels in BH1 continue to be sporadic and are not believed to provide accurate groundwater levels at this location.

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 5.3 – 6.7 pH indicating generally neutral to acidic conditions;
- Electrical Conductivity ranging from 0.96 to 2.03 mS/cm indicating generally fresh to brackish conditions;
- Both oxidative and reductive water conditions; and
- Generally minimal to slight turbidity, clear, grey and brown groundwater.

The results of PID screening on headspace at the top of each well also suggested the absence of gross volatile organic compounds (i.e. <1 ppm) as indicated in Tables F1 and F4 in Appendix F.

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). A minor hydrogen sulfide odour was noted in BH2 and BH4 during the Q1 monitoring period, and again in BH2 in the Q3 monitoring round.

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. Additional sampling and testing of location S7 (sediment retention dam) and L8 (leachate dam) was conducted approximately 27 days before Q3 monitoring (i.e. 30 March 2023) at the request of KSC.

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

- pH ranging from 5.4 – 9.7 pH indicating generally acidic to alkaline conditions;
- Electrical Conductivity ranging from 0.07 to 2.31 mS/cm indicating generally fresh to brackish conditions;
- Generally oxidative water conditions with high dissolved oxygen; and
- A range of slight to moderate turbidity, clear, and brown surface water.

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

- pH ranging from 6.8 – 8.1 pH indicating generally acidic to alkaline conditions;
- Electrical Conductivity ranging from 1.00 to 5.13 mS/cm indicating generally fresh to brackish conditions;
- Generally oxidative water conditions with high dissolved oxygen; and
- A slight turbidity, orange-brown, red-brown, 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).

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 gas monitoring within wells for event Q2 was not conducted due to equipment malfunction. The results of monitoring in Q1 (26 and 27 September 2022), Q3 (27 April 2023) and Q4 (4 and 5 July 2023) indicated the general absence of methane concentrations within groundwater wells (i.e. <1ppm), which is consistent with gas monitoring in the previous year.

7.4.2 Landfill Surface

The summary results of methane monitoring across the landfill surface are shown in Table D4, Appendix D. The results indicated a total of eight exceedances of the monitoring criteria (500 ppm) in Q1 through to Q4 during the monitoring period October 2022 to July 2023. The approximate locations of the exceedances are shown in Figure 1 below (E1 to E14).



Figure 1: Approximate locations of methane monitoring (Q4)

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

Table 3: Summary of Methane Monitoring Exceedances – October 2022 to July 2023

Location			Methane (ppm)			
			2022-2023			
			Q1	Q2	Q3	Q4
ID	Easting	Nothing	27/09/2022	10/01/2023	26/04/2023	4/07/2023
E1	488395	6555797	6 - 20	N/A	N/A	N/A
E2	488218	6555940	5 - 10	30 - 120	16 - 65	5 - 10
E3	488251	6555889	100 - 550	10 - 60	3 - 10	N/A
E4	488436	6555793	0 - 1	N/A	2 - 4	N/A
E5	488465	6555797	N/A	N/A	N/A	N/A
E6	488478	6555818	0 - 0.4	0 - 5	N/A	N/A
E7	488345	6555919	0 - 1	0 - 1	5 - 9	5 - 10
E8	488457	6555765	100 - 585	300 - 550	33 - 204	4000 - 6000
E9	488238	6555908	500 - 9000	20 - 120	5 - 6	40 - 50
E10	488339	6555865	-	60 - 2100	30 - 58	5 - 10
E11	488277	6555839	*	300 - 9000	3 - 4	10 - 20
E12	488327	6555911	*	*	60 - 912	40 - 160
E13	488463	6555796	*	*	*	2500 - 4000
E14	488257	6555892	*	*	*	2000 - 2100

Notes to Table:

Exceedance of 500 ppm criteria

N/A not accessible

* Datapoint found in future monitoring round

The results of surface methane monitoring indicated the presence of localised elevated methane at the following locations; E3, E8, E9, E10, E11, E12, E13 and E14. Surface vegetation generally comprised grasses with some localised bare areas. Additional targeted monitoring of surface methane was conducted within selected bare areas. Monitoring generally suggested that there was no direct correlation between bare vegetation areas and elevated methane concentrations.

In summary, a total of ten exceedances of the surface methane monitoring criteria were observed (three in Q1, three in Q2, one in Q3 and three in Q4).

A number of previous locations containing elevated surface methane concentration were not accessible due to the presence of a fill stockpile (i.e., locations E1, E4, E5 and E6). We understand that the stockpile is temporary and contains natural soils that will be progressively used as day cover for future landfill activities. The fill stockpile may therefore be present over this area for an extended period.

The results of monitoring generally suggests the presence of elevated methane concentrations within the western portion of the monitoring area (in the vicinity of former location E3), and the south eastern portion of the monitoring area (in the vicinity of former location E5).

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. <7.5ppm).

8. Discussion

8.1 Groundwater

8.1.1 Field Observations

The groundwater field parameters measured during purging and sampling for Q2 and Q4 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). A minor hydrogen sulfide odour was noted in BH2 and BH4 during the Q1 monitoring round, and again in BH2 in Q3 monitoring round.

During the 2022-2023 annual monitoring period, BH1 was blocked by obstruction and sampling was not able to be completed.

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 F1 and F4 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 in Table 4 below:

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

Groundwater Well I.D	Analytes Exceeding the EPL Groundwater Trigger Levels	
	Q1 - September 2022	Q3 - April 2023
BH01-2	EC, pH, Mg	pH, Mg
BH1	-	-
BH2	EC, Mg	pH, Mg
BH3	EC, pH, Mg	EC, pH, Mg
BH4	EC, pH, Mg	EC, pH, Mg

During the October 2022 to July 2023 monitoring period, BH1 was blocked by an obstruction in the groundwater well and sampling was not able to be completed. Groundwater monitoring concentrations were generally within the range of historical data. An elevated nitrate concentration was found in BH3 during the previous annual monitoring round. It is noted that sporadic elevated nitrate concentrations have been observed historically for a number of bores, however, the elevated results were not in subsequent monitoring events (refer to Figure G2 in Appendix G). The previous 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).

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, F5 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 in Table 5 below:

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

Sampling Location	Analytes Exceeding the Surface Water Trigger Levels			
	Q1 - October 2022	Q2 – January 2023	Q3 - April 2023	Q4 – July 2023
L8 (Leachate Dam)	EC, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, Nitrate, TOC	pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulphate, Ammonia, TOC, TSS	pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TOC, TSS	EC, pH, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TOC, TSS
S4	pH, Fe, TSS	*	pH	*
S5	Fe, Alkalinity (total), TSS	pH, Fe, Alkalinity (total), Ca, K, Na, Sulfate, Ammonia	pH, Fe, Alkalinity (total), Ca, K, Na, Sulfate, Ammonia	EC, pH, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, TOC
S6	Fe, Alkalinity (total), TSS	*	pH, Alkalinity (total), Ca, Cl, K, Na, Sulfate, Ammonia	pH, Fe, Alkalinity (total), Ca, Cl, K, Na, Sulfate
S7	Fe, Mn, Alkalinity (total), Ca, Cl, K, Na, Sulfate, Ammonia, Nitrate, TOC, TSS	Alkalinity (total), Ca, Cl, K, Na, Sulfate	Alkalinity (total), Ca, Cl, K, Na, Sulfate, Ammonia, TSS	EC, Fe, Alkalinity (total), Ca, Cl, Mg, K, Na, Sulfate, Ammonia, Nitrate, TSS

Notes to table:

* Sample location was dry

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. For example, elevated Nitrate was found at S7 in the Q4 monitoring event (i.e., within historical range for leachate water – L8). The low water level and elevated turbidity in the sediment dam could account for the elevated nitrate at S7 during this event. Whilst nitrate was historically high at S7, there appears to be no significant environmental impact downgradient as nitrate levels at S5 and S6 (downstream locations) are below EPL trigger levels.

As requested by KSC, additional monitoring was conducted at S7 (sediment retention dam) and L8 (leachate dam) on 30 March 2023, approximately 27 days before Q3 sampling. Water levels at S7 were observed to be elevated during sampling on 30 March 2023. Water levels with S7 were observed to be lower during the Q3 sampling event 27 days later. The results of monitoring of S7 and L8 on 30 March 2023 were commensurate with Q3 monitoring on 26 April 2023. Surface water quality at S5 (downgradient location) in Q3 showed slightly elevated calcium, potassium, sodium, and sulphate. The results from the subsequent monitoring round Q4 in downgradient location S5, however, were commensurate with historical results (i.e. suggesting the absence of significant impacts).

Monitoring of surface waters during any discharge events from the sediment retention dam (i.e., S7) or leachate dam (L8) should be conducted by KSC. There were no discharge monitoring results provided by KSC for the current monitoring period.

Recorded rainfall (Kempsey Airport) for the last two years of monitoring are presented in Figure G1 in Appendix G. It is noted that there was significantly less rainfall in the 2022 – 2023 monitoring period (i.e., 985.2 mm) compared to the 2020-2021 and 2021-2022 monitoring periods (i.e., 2023.4 mm and 1575.8 mm respectfully for a 12-month period). The months which recorded elevated rainfall during the current 2021/2022 monitoring period are presented below:

- October 2022 – 150 mm;
- January 2023 – 142.8 mm;
- March 2023 – 125.4 mm.

8.3 Gas Monitoring

The results of gas monitoring are summarised below:

- Monitoring Wells:
 - o The results of monitoring indicated the general absence of methane concentrations within groundwater wells (i.e. <1ppm). All results were below the acceptance criteria.
- Buildings (Enclosed Spaces):
 - o The results indicated the general absence of significant methane concentrations within buildings. All results were below the acceptance criteria.
- Landfill Surface:

- o In summary, a total of eight exceedances of the surface methane monitoring criteria were observed (two in Q1, three in Q2, none in Q3 and three in Q4);
- o Exceedances were generally found to be localised and not associated with areas with sparse vegetation;
- o Based on a number of quarterly monitoring events, elevated methane concentrations were generally observed within the western portion of the monitoring area (in the vicinity of former location E3), and the southeastern portion of the monitoring area (in the vicinity of former location E5);
- o A number of previous locations containing elevated surface methane concentrations (i.e. locations E1, E4, E5 and E6) were not accessible due to the presence of a temporary fill stockpile.

Surface methane monitoring has indicated some elevated results and localised exceedances.

It is understood that Council conducted localised capping rehabilitation works associated methane exceedance areas E8, E11 and E13, and a perimeter leachate drain (due to erosion). Council indicated that consultants were engaged to remove and install the new perimeter leachate drainage system, and rehabilitate landfill capping and provide aftercare management. Council indicated that the works were constructed in accordance with the regulatory requirements (i.e. NSW EPA Environmental Guidelines, Solid Waste Landfill (2016)). DP were not involved in rehabilitation works at the landfill.

9. Conclusion

9.1 Groundwater

Groundwater monitoring data from the current 2022-2023 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 previous monitoring events. On this basis ERM indicated that groundwater quality at BH1 should not be compared to the results of other groundwater monitoring locations. In addition to this, an obstruction in BH1 precluded sampling and testing of groundwater at this location. The obstruction may also preclude groundwater sampling at this location in future monitoring events.

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 2022-2023 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 (i.e. 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.

Surface water quality monitoring at S5 (downgradient location) in Q3 showed slightly elevated calcium, potassium, sodium and sulphate parameters. The results from the subsequent monitoring round Q4 in downgradient location S5, however, were commensurate with historical results.

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, which is consistent with previous monitoring at the landfill.

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. We understand that Council has undertaken some localised capping rehabilitation works associated with methane exceedance locations E11 and E13. Further assessment is recommended to confirm that the rehabilitation measures undertaken by Council are appropriate and have addressed the potential risks associated with elevated methane results. Further monitoring and investigation is also recommended to confirm subsurface conditions and capping within other areas identified to contain methane exceedance in order to confirm possible capping rehabilitation requirements.

Continued surface methane monitoring is recommended in accordance with the EPL. Where possible, areas/locations found to contain previous elevated results should be targeted.

It is noted that stockpiled fill is present over a significant portion of the monitored area. Surface methane monitoring should also be conducted at the perimeter of the stockpile and at the surface where accessible during future quarterly monitoring events. Monitoring should also be conducted following the removal of stockpiled materials from this area.

If additional surface methane monitoring and investigation identifies elevated reproducible results, further remediation/rehabilitation measures may be required to ensure that capping is performing as required. Future rehabilitation works should be conducted in accordance with the EPL and relevant regulatory requirements including validation.

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, drainage systems, 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:
 - o Continue surface methane monitoring in accordance with the EPL;
 - o Target areas/locations found to contain localised elevated results;
 - o Conduct gas monitoring at the perimeter and surface of the of the stockpile located over the monitored area (during future quarterly monitoring events);
 - o Conduct gas monitoring following the removal of the stockpiled materials from the monitored area;
 - o Conduct targeted investigation to assess the presence and condition of capping within areas observed to contain elevated methane concentrations;
 - o Further assessment is recommended to confirm that the capping rehabilitation measures undertaken by Council and have addressed the potential risk associated with elevated methane results.
- KSC ensure that future rehabilitation works are conducted in accordance with the EPL and relevant regulatory requirements including validation;
- Continue monitoring surface water, groundwater, and gas in accordance with the EPL.

11. References

CRC CARE. (2017). *Risk-based Management and Remediation Guidance for Benzo(a)pyrene*. Technical Report no. 39: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

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

NSW EPA. (1995). *Contaminated Sites, Sampling Design Guidelines*. NSW Environment Protection Authority.

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.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land*. Contaminated Land Guidelines: NSW Environment Protection Authority.

NSW EPA. (2022). *Contaminated Sites, Sampling Design Guidelines*. NSW Environment Protection Authority.

12. Limitations

Douglas Partners Pty Ltd (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. It is noted that DP were not involved in any surface water discharge monitoring, nor capping rehabilitation works conducted by Council at the site.

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.

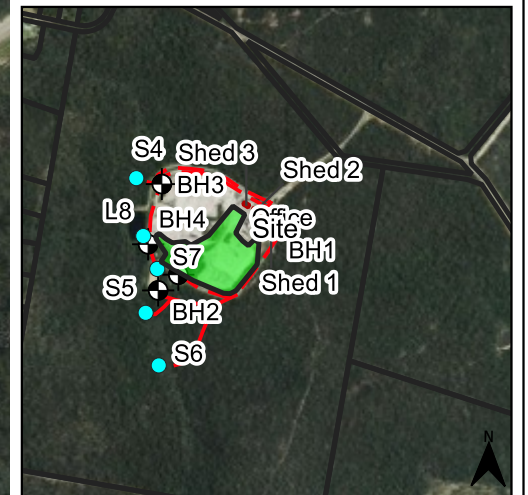
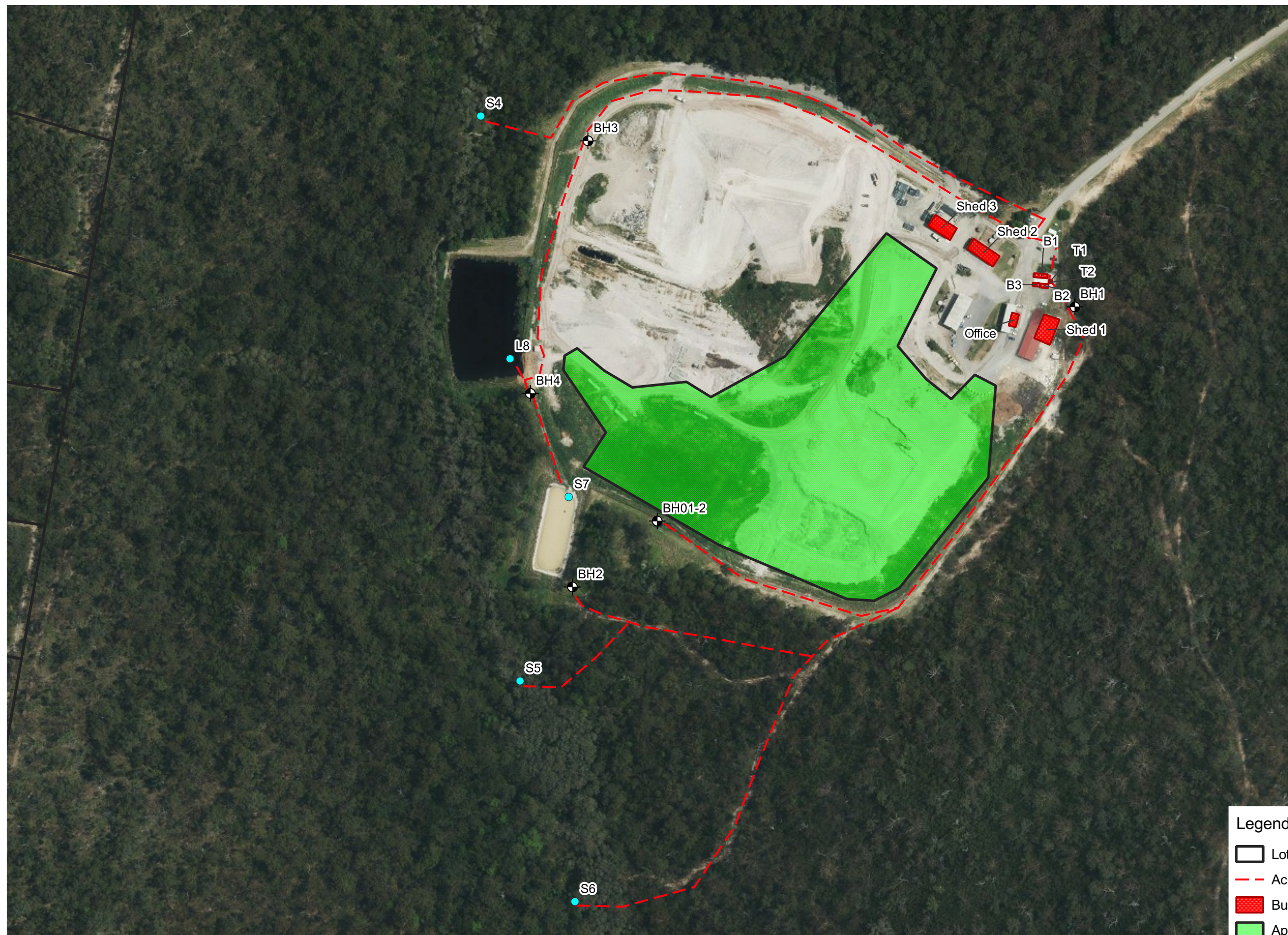
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation,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



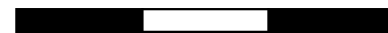
Site Location

Legend

-  Lot Boundary
-  Access Tracks
-  Building Locations Monitored for Gas
-  Approximate Area of Surface Gas Monitoring
-  Approximate Surface Water Location
-  Approximate Well Location

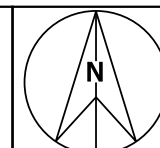
NOTE:
1. Drawing adapted from Metromap Image dated 22.11.2022.

0 50 100 150 m



CLIENT:	Kempsey Shire Council
OFFICE:	Port Macquarie
DRAWN BY:	PLH
SCALE:	1:3000@A3
DATE:	21.August.2023

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



Project:	89781.00
DRAWING No:	1
REVISION:	0

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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 2022 to 2023

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	PC
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

The RPD results were all within the acceptable range, with the exception of those indicated in Table 2. The exceedances are not, however, considered to be of concern given that:

- The typically low actual concentrations of the replicate pairs where some RPD exceedances occurred;
- The concentrations with elevated RPD values were found to be below the EPL Trigger Levels (Licence 6269);
- The duplicate samples were taken from surface water locations which have natural variability;

- All concentration values with a high RPD were within the mean of annual return reporting values for the 2022 to 2023 reporting period;
- All other QA/QC parameters met the data quality indicators.

In summary, the QC data is determined to be of sufficient quality to be considered acceptable for the assessment.

Table 2: Relative Percentage Difference

			Field ID	S4	D-20220927	RPD	S6	D1/SBK	RPD
			Sampled Date/Time	27/09/2021	27/09/2021		5/07/2023	5/07/2023	
Method_Type	ChemName	Units	PQL						
Ion Balance	Carbonate Alkalinity as CaCO3	mg/l	5	<5.0	<5.0	0	<5.0	<5.0	0
	Alkalinity (Hydroxide) as CaCO3	mg/l	5	<5.0	<5.0	0	<5.0	<5.0	0
	Alkalinity (total) as CaCO3	mg/l	5	12.0	6.0	67	24.0	23.0	4
	Alkalinity (Bicarbonate as CaCO3)	mg/l	5	12.0	6.0	67	24.0	23.0	4
	Chloride	mg/l	1	13.0	20.0	42	170.0	170.0	0
	Ionic Balance	%		-8.0	-13.0	48	-6.0	-6.0	0
	Sodium (Filtered)	mg/l	0.5	10.0	9.9	1	76.0	74.0	3
	Sulphate	mg/l	1	2.0	2.0	0	11.0	11.0	0
Miscellaneous Inorganics	Ammonia as N (Filtered)	mg/l	0.005	0.017	0.019	11	0.017	0.73	191
	Fluoride	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	Nitrate (as N) (Filtered)	mg/l	0.005	0.01	0.1	164	<0.005	<0.005	0
	TOC	mg/l	1	16.0	16.0	0	18.0	20.0	11
	TSS	mg/l	5	280.0	180.0	43	16.0	28.0	55
HM in water - dissolved	Iron (Filtered)	mg/l	0.01	0.57	0.46	21	0.67	0.76	13
	Manganese (Filtered)	mg/l	0.005	0.007	0.006	15	0.18	0.2	11
HM in water - total	Iron	mg/l	0.01	2.3	2.5	8	2.4	2.5	4
	Manganese	mg/l	0.005	0.029	0.028	4	0.24	0.25	4
Ion Balance	Calcium (Filtered)	mg/l	0.5	<0.5	0.6	18	12.0	13.0	8
	Magnesium (Filtered)	mg/l	0.5	1.0	1.0	0	8.1	8.6	6
	Potassium (Filtered)	mg/l	0.5	0.9	0.9	0	8.9	8.8	1
Total Phenolics in Water	Phenolics Total	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0

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 3: 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.

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 References

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

Project No: 89781.00	Client Project Name: Kempsey Landfill Water and Gas Monitoring
Client: Kempsey Shire Council	Location: 638 Crescent Head Road, Kempsey
Project Manager: Cowan, Joel	DP Lab Received By: _____ Date: _____
Do samples contain 'potential' HBM? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If YES, then handle, transport and store in accordance with FPM HAZID)	

Field						For Despatch to			Notes			
Sample ID	Depth (m)	Duplicate Sample	Sample Type	Container Type	ASS Samples	Sampling				Lab 1 ^A	Lab 2 ^B	Lab 3 ^C
			S - soil W - water	G - glass P - plastic		By	Date	Time		Date	Date	Date
BH01-2	-		W	P	-	NLM/JLL	26/9/22	0100	27/9/22			
BH1	-		W	P	-	↓	↓	↓	↓			BH1 not sampled.
BH2	-		W	P	-	↓	↓	↓	↓			
BH3	-		W	P	-	↓	↓	↓	↓			
BH4	-		W	P	-	↓	↓	1700	↓			
S4	-	D-20220927	W	P	-	NLM/JLL	27/9/22	0700				
S5	-		W	P	-	↓	↓	↓	↓			
S6	-		W	P	-	↓	↓	↓	↓			
S7	-		W	P	-	↓	↓	↓	↓			
L8	-		W	P	-	↓	↓	1200	↓			



* Default storage: glass containers in fridge, plastic containers shelved, ASS in freezer, water samples in fridge
 A Provide name of Lab 1 Envirolab B Provide name of Lab 2 C Provide name of Lab 3

Project No: 89781.00	Client Project Name: Kempsey Landfill Water and Gas Monitoring
Client: Kempsey Shire Council	Location: 638 Crescent Head Road, Kempsey
Project Manager: Cowan, Joel	DP Lab Received By: _____ Date: _____
Do samples contain 'potential' HBM? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If YES, then handle, transport and store in accordance with FPM HAZID)	

Field						For Despatch to			Notes			
Sample ID	Depth (m)	Duplicate Sample	Sample Type	Container Type	ASS Samples	Sampling				Lab 1 ^A	Lab 2 ^B	Lab 3 ^C
			S - soil W - water	G - glass P - plastic		By	Date	Time		Date	Date	Date
S4	-		W									
S5	-		W	P		SPAC/JJC	10/12/23	1:55	10/1/23			
S6	-											
S7	-		W	P		SPAC/JJC	10/1/2023	2:25	10/1/23			
L8	-		W	P		SPAC/JJC	↓	2:15	↓			



* Default storage: glass containers in fridge, plastic containers shelved, ASS in freezer, water samples in fridge
 A Provide name of Lab 1 Envirolab B Provide name of Lab 2 C Provide name of Lab 3

Project No: 89781.00	Client Project Name: Kempsey Landfill Water and Gas Monitoring
Client: Kempsey Shire Council	Location: 638 Crescent Head Road, Kempsey
Project Manager: Cowan, Joel	DP Lab Received By: _____ Date: _____
Do samples contain 'potential' HBM? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If YES, then handle, transport and store in accordance with FPM HAZID)	

Field						For Despatch to			Notes			
Sample ID	Depth (m)	Duplicate Sample	Sample Type	Container Type	ASS Samples	Sampling				Lab 1 ^A	Lab 2 ^B	Lab 3 ^C
			S - soil W - water	G - glass P - plastic		By	Date	Time		Date	Date	Date
BH01-2	-		W	P	-	27/04						
BH1	-		W	P	-	27/04						
BH2	-		W	P	-	27/04						
BH3	-		W	P	-	27/04						
BH4	-		W	P	-	27/04						
S4	-		W	P	-	26/04						SW
S5	-		W	P	-	26/04						SW
S6	-		W	P	-	26/04						
S7	-		W	P	-	26/04						
L8	-		W	P	-	26/04						



980243064281-8



980243064292-8

* Default storage: glass containers in fridge, plastic containers shelved, ASS in freezer, water samples in fridge
 A Provide name of Lab 1 Envirolab B Provide name of Lab 2 C Provide name of Lab 3

Project No: 89781.00	Client Project Name: Kempsey Landfill Water and Gas Monitoring
Client: Kempsey Shire Council	Location: 638 Crescent Head Road, Kempsey
Project Manager: Cowan, Joel	DP Lab Received By: _____ Date: _____
Do samples contain 'potential' HBM? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If YES, then handle, transport and store in accordance with FPM HAZID)	

Field						For Despatch to			Notes			
Sample ID	Depth (m)	Duplicate Sample	Sample Type	Container Type	ASS Samples	Sampling				Lab 1 ^A	Lab 2 ^B	Lab 3 ^C
			S - soil W - water	G - glass P - plastic		By	Date	Time		Envirodata Date	Date	Date
S4	-		W	P	-	SKL/BR	5/7/20	7:30				
S5	-		W	P	-	↓	↓	↓	✓			
S6	-	A/SBK	W	P	-	↓	↓	↓	✓			
S7	-		W	P	-	↓	↓	↓	✓			
L8	-		W	P	-	↓	↓	10:00	✓			




Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number: NC231150	15 Ashely Street, Chatswood
Email: joel.cowan/jason.lambert@douglaspartners.com.au		Attn: Sample receipt

Turnaround time: Standard 72 hour 48 hour 24 hour Same day

Prior Storage: Fridge Freezer Esky Shelf

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

Lab ID	Sample ID			Date Sampled	Sample Type	Container Type	Analytes										Notes/ Preservation/ Additional Requirements					
	Location / Other ID						Groundwater			Surface Water												
							S - soil W - water M - Material	G - glass P - plastic	Ammonia	Magnesium (dissolved)	Nitrate	Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N	Fluoride		Total Phenolics	Total Suspended Solids (TSS)	Total Organic Carbon (TOC)		
1	BH01-2			26/9/22	W		✓	✓	✓													
	BH1				W		✓	✓	✓													
2	BH2				W		✓	✓	✓													
3	BH3				W		✓	✓	✓													
4	BH4				W		✓	✓	✓													
5	S4			27/9/22	W					✓	✓	✓	✓	✓	✓	✓	✓	✓				
6	S5				W					✓	✓	✓	✓	✓	✓	✓	✓	✓				
7	S6				W					✓	✓	✓	✓	✓	✓	✓	✓	✓				
8	S7				W					✓	✓	✓	✓	✓	✓	✓	✓	✓				
9	L8				W					✓	✓	✓	✓	✓	✓	✓	✓	✓				
10	D-70220927																					ON HOLD


Envirolab Services
 12 Ashley St
 Chatswood NSW 2067
 Ph: (02) 9910 6200
Job No: 306808
 Date Received: 20-9-22
 Time Received: 1300
 Received By: TOHAN
 Temp: Cool/Ambient
 Cooling: Icepack
 Security: Intact/Broken/None

Metals to analyse: as above

Number of samples in container: 10

Transported to laboratory by:

Send results to: Douglas Partners Pty Ltd

Address: 2/32 Geebung Dr, Port Macquarie NSW 2444

Phone: 65815992

Relinquished by: JLL

Date: 27/9/22

Signed:

Project No: 89781.00

Suburb: Kempsey

Project Manager: Joel Cowan

LAB RECEIPT

Lab Ref. No: 306808

Received by: TOHAN

Date & Time: 20-9-22 1300

Signed:


To: Envirolab Services

Dispatch date:

Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number:	15 Ashely Street, Chatswood
Email: joel.cowan/jason.lambert@douglaspartners.com.au		Attn: Sample receipt
Turnaround time: <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 72 hour <input type="checkbox"/> 48 hour <input type="checkbox"/> 24 hour <input type="checkbox"/> Same day		

Prior Storage: Fridge Freezer Esky Shelf Do samples contain 'potential' HBM? No Yes (If YES, then handle, transport and store in accordance with FPM HAZID)

Lab ID	Sample ID			Date Sampled	Sample Type	Container Type	Analytes										Notes/ Preservation/ Additional Requirements
							Groundwater			Surface Water							
	Location / Other ID	Depth from	Depth to				S - soil W - water M - Material	G - glass P - plastic	Ammonia	Magnesium (dissolved)	Nitrate	Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N	Fluoride	
	S4	-	-		W				✓	✓	✓	✓	✓	✓	✓	✓	
1	S5	-	-		W				✓	✓	✓	✓	✓	✓	✓	✓	
	S6	-	-		W				✓	✓	✓	✓	✓	✓	✓	✓	
2	S7	-	-		W				✓	✓	✓	✓	✓	✓	✓	✓	
3	L8	-	-		W				✓	✓	✓	✓	✓	✓	✓	✓	


 Envirolab Services
 12 Ashley St
 Chatswood NSW 2067
 Tel: (02) 9910 6200
 Job No: 314239
 Date Received: 11/1/23
 Time Received: 1500
 Received By: AB
 Temp: Cool/Ambient
 Cooling: Ice/icepack
 Security: Intact/Broken/None

Metals to analyse: as above		LAB RECEIPT	
Number of samples in container:		Transported to laboratory by:	
Send results to: Douglas Partners Pty Ltd		Lab Ref. No: 314239	
Address: 232 Geebung Dr, Port Macquarie NSW 2444		Received by: A.B.M.	
Phone: 65815992		Date & Time: 11/1/23 1000	
Relinquished by:		Signed: <i>ABM</i>	
Date:		To: Envirolab Services	
Project No: 89781.00		Suburb: Kempsey	
Project Manager: Joel Cowan		Dispatch date:	

Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number:	15 Ashely Street, Chatswood
Email: joel.cowan/jason.lambert@douglaspartners.com.au		Attn: Sample receipt
Turnaround time: <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 72 hour <input type="checkbox"/> 48 hour <input type="checkbox"/> 24 hour <input type="checkbox"/> Same day		
Prior Storage: <input type="checkbox"/> Fridge <input type="checkbox"/> Freezer <input checked="" type="checkbox"/> Esky <input type="checkbox"/> Shelf Do samples contain 'potential' HBM? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (If YES, then handle, transport and store in accordance with FPM-HAZID)		


Lab ID	Sample ID	Location / Other ID	Date Sampled	Sample Type	Container Type	Analytes										Notes/ Preservation/ Additional Requirements	
						Groundwater					Surface Water						
						S - soil W - water M - Material	G - glass P - plastic	Ammonia	Magnesium (dissolved)	Nitrate	Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N	Fluoride		Total Phenolics
1	S7		30/3	W	G/P						✓	✓	✓	✓	✓	✓	
2	L8		30/3	W	G/P						✓	✓	✓	✓	✓	✓	

319997

Metals to analyse: as above						LAB RECEIPT					
Number of samples in container: 2			Transported to laboratory by: Courier			Lab Ref. No:					
Send results to: Douglas Partners Pty Ltd						Received by: CM					
Address: 2/32 Geebung Dr, Port Macquarie NSW 2444			Phone: 65815992			Date & Time: 3/3 1100					
Relinquished by: Joel Cowan			Date:			Signed: CM					
Project No: 89781.00			Suburb: Kempsey			To: Envirolab Services					
Project Manager: Joel Cowan						Dispatch date:					

Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number: NC231636	Sampler: SPX
Email: joel.cowan/jason.lambert@douglaspartners.com.au	Attn: Sample receipt	
Turnaround time: <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 72 hour <input type="checkbox"/> 48 hour <input type="checkbox"/> 24 hour <input type="checkbox"/> Same day		
Prior Storage: <input type="checkbox"/> Fridge <input type="checkbox"/> Freezer <input checked="" type="checkbox"/> Esky <input type="checkbox"/> Shelf		
Do samples contain 'potential' HBM? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (If YES, then handle, transport and store in accordance with FPM HAZID)		

Lab ID	Sample ID			Date Sampled	Sample Type	Container Type	Analytes										Notes/ Preservation/ Additional Requirements	
	Location / Other ID						Groundwater			Surface Water								
							S - soil W - water M - Material	G - glass P - plastic	Ammonia	Magnesium (dissolved)	Nitrate	Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N	Fluoride		Total Phenolics
1	L8			26/04/23	W	P					✓	✓	✓	✓	✓	✓	✓	
2	S4			26/04/23	W	P					✓	✓	✓	✓	✓	✓	✓	
3	S5			26/04/23	W	P					✓	✓	✓	✓	✓	✓	✓	
4	S6			26/04/23	W	P					✓	✓	✓	✓	✓	✓	✓	
5	S7			26/04/23	W	P					✓	✓	✓	✓	✓	✓	✓	
					W													
					W													
					W													
					W													
					W													


Envirolab
 1st Floor
 Chatswood NSW 1585
 Ph: (02) 9919 1300
 Job No: 321830
 Date Received: 27/4/23
 Time Received: 1530
 Received By: KW
 Temp: Cool/Ambient
 Cooling: Ice/Icepack
 Security: Intact/Broke:

Metals to analyse: as above		LAB RECEIPT	
Number of samples in container:	Transported to laboratory by: Courier	Lab Ref. No: 321830	
Send results to: Douglas Partners Pty Ltd	Phone: 65815992	Received by: KW	
Address: 2/32 Geebung Dr, Port Macquarie NSW 2444	Date: 26/04/23	Date & Time: 27/4/23	
Relinquished by:	Signed: <i>Joel</i>	Signed: KW	
Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services	
Project Manager: Joel Cowan		Dispatch date:	

Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number: NC231686	Sampler: SBK/PR
Email: joel.cowan/jason.lambert@douglaspartners.com.au	Attn: Sample receipt	
Turnaround time: <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 72 hour <input type="checkbox"/> 48 hour <input type="checkbox"/> 24 hour <input type="checkbox"/> Same day		

Prior Storage: Fridge Freezer Esky Shelf **Do samples contain 'potential' HBM?** No Yes (If YES, then handle, transport and store in accordance with FPM HAZID)

Lab ID	Sample ID		Date Sampled	Sample Type	Container Type	Analytes										Notes/ Preservation/ Additional Requirements	
						Groundwater			Surface Water								
	Location / Other ID						S - soil W - water M - Material	G - glass P - plastic	Ammonia	Magnesium (dissolved)	Nitrate	Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N		Fluoride
1	BH01-2		27/4/23	W		✓	✓	✓									
	BH1			W		✓	✓	✓									
2	BH2		27/4/23	W		✓	✓	✓									
3	BH3		27/4/23	W		✓	✓	✓									
4	BH4		27/4/23	W		✓	✓	✓									
	S4			W		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	S5			W		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	S6			W		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	S7			W		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	LB			W		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Envirolab Services
12 Ashley St
Chatswood NSW 1587
Ph: (02) 9490 9200

322011
Time Received: 01/05/23 1030

Metals to analyse: as above

Number of samples in container: _____ **Transported to laboratory by:** LOUWIEV

Send results to: Douglas Partners Pty Ltd

Address: 2/32 Geebung Dr, Port Macquarie NSW 2444 **Phone:** 65815992

Relinquished by: _____ **Date:** 27/04/23 **Signed:** *[Signature]*

Project No: 89781.00 **Suburb:** Kempsey

Project Manager: Joel Cowan

LAB RECEIPT

Lab Ref. No: 322011

Received by: ELSYD

Date & Time: 01/05/23, 1030

Signed: *[Signature]*

To: Envirolab Services

Dispatch date: _____

Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan	Order Number: NC231880	Sampler: SBK / PR
Email: joel.cowan/sarah.krebs@douglaspartners.com.au		Attn: Sample receipt
Turnaround time: <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 72 hour <input type="checkbox"/> 48 hour <input type="checkbox"/> 24 hour <input type="checkbox"/> Same day		

Prior Storage: Fridge Freezer Esky Shelf **Do samples contain 'potential' HBM?** No Yes (If YES, then handle, transport and store in accordance with F

Lab ID	Sample ID			Date Sampled	Sample Container Type		Analytes										Notes/ Preservation/ Additional Requirements			
					S - soil W - water M - Material	G - glass P - plastic	Groundwater			Surface Water										
	Ammonia	Magnesium (dissolved)	Nitrate				Iron and Manganese (Total and dissolved)	Ionic Balance	Ammonia as N	Nitrate as N	Fluoride	Total Phenolics	Total Suspended Solids (TSS)	Total Organic Carbon (TOC)						
	WA			5/7/23	W	P														
1	S5			↓	W															
2	S6				W															
3	S7				W															
4	L8				W															
5	DV/SEK				W															

Envirolab Services
12 Ashley St
Chatswood NSW 157
Ph: (02) 9439 200

Received:
Time Received:
Received By: AW
Temp: Cool/Ambient
Cooling: Ice/None
Security: Intact

327305
6/7/23
1000
①

Metals to analyse: as above	LAB RECEIPT	
Number of samples in container:	Lab Ref. No:	
Send results to: Douglas Partners Pty Ltd	Received by:	
Address: 2/32 Geebung Dr, Port Macquarie NSW 2444	Date & Time:	
Relinquished by: SBK	Date: 5/7/23	Signed: [Signature]
Project No: 89781.00	Suburb: Kempsey	To: Envirolab Services
Project Manager: Joel Cowan		Dispatch date:



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
Envirolab Reference	306808
Date Sample Received	28/09/2022
Date Instructions Received	28/09/2022
Date Results Expected to be Reported	05/10/2022

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	10 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	6
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:



Sample ID	Total Phenolics in 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		✓	✓							✓									
BH02		✓	✓							✓									
BH03		✓	✓							✓									
BH04		✓	✓							✓									
S4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D-20220927	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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.

SAMPLE RECEIPT ADVICE

Client Details

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

Sample Login Details

Your reference	89781.00, Kempsey
Envirolab Reference	314239
Date Sample Received	11/01/2023
Date Instructions Received	11/01/2023
Date Results Expected to be Reported	18/01/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	3 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	7
Cooling Method	Ice Pack
Sampling Date Provided	Not Provided on the COC

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	Total Phenolics in 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
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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.

SAMPLE RECEIPT ADVICE

Client Details

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

Sample Login Details

Your reference	89781.00, Kempsey
Envirolab Reference	319997
Date Sample Received	31/03/2023
Date Instructions Received	31/03/2023
Date Results Expected to be Reported	11/04/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	2 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	6
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	Total Phenolics in 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
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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.

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Newcastle
Attention	Joel Cowan

Sample Login Details

Your reference	89781.00 Kempsey
Envirolab Reference	321830
Date Sample Received	27/04/2023
Date Instructions Received	27/04/2023
Date Results Expected to be Reported	04/05/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	5 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	Total Phenolics in Water	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness	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 - total	HM in water - dissolved	Total Suspended Solids	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Organic Carbon	
L8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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.

SAMPLE RECEIPT ADVICE

Client Details

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

Sample Login Details

Your reference	89781.00, Kempsey
Envirolab Reference	322011
Date Sample Received	01/05/2023
Date Instructions Received	01/05/2023
Date Results Expected to be Reported	08/05/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	16
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	Ammonia as N in water	Nitrate as N in water	Cations in water Dissolved
BH01-2	✓	✓	✓
BH2	✓	✓	✓
BH3	✓	✓	✓
BH4	✓	✓	✓

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.

SAMPLE RECEIPT ADVICE

Client Details

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

Sample Login Details

Your reference	89781.00, Kempsey
Envirolab Reference	327305
Date Sample Received	06/07/2023
Date Instructions Received	06/07/2023
Date Results Expected to be Reported	13/07/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	5 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	6
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	Total Phenolics in Water	HM in water - total	HM in water - dissolved	Ammonia as N in water	Nitrate as N in water	Fluoride, F	Total Suspended Solids	Total Organic Carbon	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance
S5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D1/SBK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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 (2022-2023)
- Table D2: Groundwater and Surface Water Field Parameters (2022 – 2023)
- Table D3: Gas Monitoring – Groundwater Wells 92022 – 2023)
- Table D4: Methane Monitoring – Surface (2022 – 2023)
- Table D5: Methane Monitoring – Buildings (2022 – 2023)

Table D1: Groundwater Levels During Monitoring Period (2022-2023)

Well ID	Quarterly Round	Sampling Date	TOC Elevation (mAHD)	Depth to Water (mTOC)	Reduced Water Elevation (mAHD)
BH1	Q1	26/09/2022	50.17	11.68	38.49
BH1-2		26/09/2022	29.64	4.53	25.11
BH2		26/09/2022	25.72	0.90	24.82
BH3		26/09/2022	29.78	4.43	25.35
BH4		26/09/2022	26.35	2.30	24.05
BH1	Q2	10/01/2022	50.17	*	*
BH1-2		10/01/2022	29.64	*	*
BH2		10/01/2022	25.72	*	*
BH3		10/01/2022	29.78	*	*
BH4		10/01/2022	26.35	*	*
BH1	Q3	27/04/2023	50.17	N/A	N/A
BH1-2		27/04/2023	29.64	4.96	24.68
BH2		27/04/2023	25.72	1.26	24.46
BH3		27/04/2023	29.78	4.96	24.82
BH4		27/04/2023	26.35	2.38	23.97
BH1	Q4	4/07/2023	50.17	N/A	N/A
BH1-2		4/07/2023	29.64	4.72	24.92
BH2		4/07/2023	25.72	1.07	24.65
BH3		5/07/2023	29.78	4.59	25.19
BH4		5/07/2023	26.35	2.36	23.99

Notes

- TOC - Top of Casing
- AHD - Australian Height Datum
- * - equipment malfunction
- N/A - measurement not taken due to obstruction in well

Table D2: Groundwater and Surface Water Field Parameters During Monitoring Period (2022-2023)

Test Location ID	Quarterly Round	Sampling Date	Temp (°C)	pH	Eh (ORPmV)	EC (µS/cm)	EC (mS/cm)	Turbidity (NTU)	DO (ppm)	Comments			
										Turbidity	Colour	Odour	Flow
BH1-2	Q1	26/09/2022	18.00	5.3	70	1080	1.08	114	2.5	Slight	-	nil	n/a
BH1		26/09/2022	Well blocked by obstruction. No Measurements Taken										
BH2		26/09/2022	18.10	6.7	-97	1640	1.64	66	56.6	High	-	H2S odour	n/a
BH3		26/09/2022	20.90	5.9	-18	2030	2.03	17	5.2	Clear	-	nil	n/a
BH4		26/09/2022	19.00	6.3	-18	2000	2.00	15	2.1	High	-	H2S odour	n/a
L8		27/09/2022	19.60	7.8	88	2560	2.56	37	1.6	Slight	Red Brown	nil	still
S4		27/09/2022	15.22	6.4	102	71	0.07	84	9.6	Minimal	Brown	nil	still
S5		27/09/2022	14.40	7.6	80	113	0.11	130	7.8	Slight	Brown	nil	still
S6		27/09/2022	14.50	6.6	122	121	0.12	65	5.6	Slight	Brown	nil	still
S7		27/09/2022	18.00	7.6	34	780	0.78	980	4.6	Very	Pale Brown	nil	still
S4	Q2	10/01/2022	-	-	-	-	-	-	-	-	-	-	Dry
S5		10/01/2022	24.02	6.7	119	450	0.45	492	4.8	Moderate	Brown	N/A	Still
S6		10/01/2022	-	-	-	-	-	-	-	-	-	-	Dry
S7		10/01/2022	30.52	9.7	13	2310	2.31	84	9.9	Minimal	Pale Brown	N/A	Still
L8		10/01/2022	29.88	8.1	65	4840	4.84	116	3.5	Slight	Red Brown	N/A	Still
BH1-2	Q3	27/04/2023	19.33	5.6	53	900	0.90	284	32.1	Moderate	pale brown	nil	-
BH1		27/04/2023	Well blocked by obstruction. No Measurements Taken										
BH2		27/04/2023	19.31	6.4	-24	916	0.92	27	22.2	Minimal	clear	H2S odour	-
BH3		27/04/2023	21.00	5.8	35	1120	1.12	24	6.1	Minimal	clear	nil	-
BH4		27/04/2023	23.50	5.4	100	1110	1.11	285	95.0	Minimal	brown	nil	-
L8		26/04/2023	19.40	6.8	141	1000	1.00	304	8.5	Moderate	brown	nil	still
S4		26/04/2023	18.81	5.4	165	71	0.07	21	2.6	Clear	pale brown	nil	still
S5		26/04/2023	18.76	6.2	126	415	0.42	56	1.5	Minimal	pale brown	nil	still
S6		26/04/2023	19.00	6.2	62	361	0.36	90	1.8	Slight	brown	nil	still
S7		26/04/2023	22.45	8.8	26	402	0.40	1000	7.8	Very	pale brown	nil	still
S4	Q4	5/07/2023	-	-	-	-	-	-	-	-	-	-	Dry
S5		5/07/2023	12.25	6.6	89	1410	1.41	67	0.9	Minimal	pale brown	nil	Still
S6		5/07/2023	12.56	6.8	34	617	0.62	314	0.4	Minimal	pale brown	nil	Still
S7		5/07/2023	11.20	7.1	129	1430	1.43	>1000	0.9	High	pale brown	nil	Still
L8		5/07/2023	13.31	8.1	122	5130	5.13	50	3.3	Moderate	orange brown	nil	Still

Notes:

Turbidity 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 Monitoring - Groundwater Wells (2022-2023)

Well ID	Quarterly Round	Sampling Date	Max Methane (ppm)	Max Carbon Dioxide (%)	Oxygen (%)	Max Hydrogen Sulfide (ppm)	Max Carbon Monoxide (ppm)	Comments	
								Weather Conditions	Atmospheric Pressure (Mb)
BH1	Q1	26/09/2022	0.00	1.40	17.60	3.00	4.00	Overcast	1011
BH1-2		26/09/2022	0.00	0.10	21.40	3.00	1.00	Overcast	1012
BH2		26/09/2022	0.00	0.20	21.30	2.00	1.00	Overcast	1013
BH3		26/09/2022	0.00	0.10	20.70	0.00	0.00	Overcast	1014
BH4		26/09/2022	0.10	0.10	20.80	1.00	1.00	Overcast	1011
BH1	Q2	10/01/2022	-	-	-	-	-	-	-
BH1-2		10/01/2022	-	-	-	-	-	-	-
BH2		10/01/2022	-	-	-	-	-	-	-
BH3		10/01/2022	-	-	-	-	-	-	-
BH4		10/01/2022	-	-	-	-	-	-	-
BH1	Q3	27/04/2023	0.10	0.10	21.20	0.00	0.00	overcast/cloudy	1022
BH1-2		27/04/2023	0.10	0.20	21.20	0.00	0.00	overcast/cloudy	1023
BH2		27/04/2023	0.00	0.10	21.30	0.00	0.00	overcast/cloudy	1022
BH3		27/04/2023	0.00	0.10	20.70	1.00	0.00	overcast/cloudy	1021
BH4		27/04/2023	0.00	0.10	20.90	0.00	0.00	overcast/cloudy	1023
BH1	Q4	4/07/2023	0.10	0.10	20.60	0.00	0.00	Overcast	1012
BH1-2		4/07/2023	0.00	0.10	20.90	0.00	1.00	Overcast	1010
BH2		4/07/2023	0.00	0.30	20.70	0.00	0.00	Overcast	1010
BH3		5/07/2023	0.10	0.10	20.90	0.00	1.00	Overcast	1012
BH4		5/07/2023	0.10	0.10	21.00	0.00	0.00	Sunny	1012
Criteria (EPL 6269)			10000	NC	NC	NC	NC	NA	NA

Notes

ppm - parts per million

Criteria of Subsurface methane 12500 ppm / 1.25 % (v/v) (EPL 6269)

Notification to the EPA is required within 24 hours of result (>12,500 ppm)

Table D4: Methane Monitoring - Surface (2022-2023)

Location			Methane (ppm)			
			Q1	Q2	Q3	Q4
ID	Easting	Nothing	27/09/2022	10/01/2023	26/04/2023	4/07/2023
E1	488394.92	6555797.29	6 - 20	N/A	N/A	N/A
E2	488217.71	6555939.69	5 - 10	30 - 120	16 - 65	5 - 10
E3	488250.64	6555889.37	100 - 550	10 - 60	3 - 10	N/A
E4	488436.10	6555793.23	0 - 1	N/A	2 - 4	N/A
E5	488465.10	6555797.00	N/A	N/A	N/A	N/A
E6	488477.86	6555818.46	0 - 0.4	0 - 5	N/A	N/A
E7	488345.20	6555919.48	0 - 1	0 - 1	5 - 9	5 - 10
E8	488457.42	6555765.02	100 - 585	300 - 550	33 - 204	4000 - 6000
E9	488238.41	6555908.33	500 - 9000	20 - 120	5 - 6	40 - 50
E10	488339.44	6555865.27	-	60 - 2100	30 - 58	5 - 10
E11	488276.75	6555838.58	*	300 - 9000	3 - 4	10 - 20
E12	488326.70	6555911.00	*	*	60 - 912	40 - 160
E13	488463.10	6555796.00	*	*	*	2500 - 4000
E14	488257.40	6555892.00	*	*	*	2000 - 2100

Notes to table

 Methane (CH₄) surface gas reading above 500 ppm (NSW EPA, 2016 and the EPL 6269)

N/A not accessible

* Datapoint found in future monitoring round

Table D5: Methane Monitoring - Buildings (2022-2023)

Location		Methane (ppm)			
		Q1	Q2	Q3	Q4
		27/09/2022	10/01/2023	26/04/2023	4/07/2023
Shed 1	North cnr	0.2	0.1	2.7	1.4
	South cnr	0.0	0	2.8	1.5
	East cnr	0.2	0	3.4	1.8
	West cnr	1.1	0	4.9	2
	Drain	0.5	0	3.1	1.8
	Bathroom Sink	0.4	0	4.5	2.0
	Outside	0.1	0	3.2	2.1
Shed 2	North cnr	0.0	N/A	4.4	2.0
	South cnr	0.1	N/A	3.9	3.6
	East cnr	0.3	N/A	3.8	1.8
	West cnr	0.2	N/A	4.7	1.8
	Middle	0.2	N/A	4.3	1.8
	Entrance	0	N/A	3.9	2.2
Shed 3	North cnr	0.1	0	3.2	2.0
	South cnr	0.0	0	3.8	1.8
	East cnr	0.1	0	2.8	1.8
	West cnr	0.1	0	2.9	2.0
Office	North end	7.5	0	4.3	3.6
	South end	6.5	0	3.3	1.9
	West end	6	0	3.3	2.3
	East end	6	0	3.3	3.3
	Kitchen Sink	6.5	0	3.1	3.4
	Drain	6.5	0	3.1	7
	Bathroom sink	7.5	0	3.2	2
	Entrance	0.4	0	3.1	2.1
B1 ¹	North cnr	*	*	*	2.6
	South cnr	*	*	*	2.4
	East cnr	*	*	*	2.3
	West cnr	*	*	*	2.3
B2 ¹	North cnr	*	*	*	2.3
	South cnr	*	*	*	2.4
	East cnr	*	*	*	2.1
	West cnr	*	*	*	2.3
B3 ¹	North cnr	*	*	*	2.2
	South cnr	*	*	*	2.2
	East cnr	*	*	*	2.3
	West cnr	*	*	*	2.1
T1 ¹	sink	*	*	*	2.2
	room	*	*	*	2.1
T2 ¹	sink	*	*	*	2.4
	room	*	*	*	2.3

Notes

Criteria of Subsurface methane 10000 ppm / 1 % (v/v) (NSW EPA, 2016 and the EPL 6269)

ppm - parts per million

N/A not accessible

* Datapoint found in future monitoring round

¹ New building location monitored from Q4 2023 (4/7/2023)

Appendix E

Laboratory Report Sheets



Envirolab Services Pty Ltd

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CERTIFICATE OF ANALYSIS 306808

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
Number of Samples	10 Water
Date samples received	28/09/2022
Date completed instructions received	28/09/2022

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 06/10/2022

Date of Issue 06/10/2022

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Results Approved By

Diego Bigolin, Inorganics Supervisor
Giovanni Agosti, Group Technical Manager
Loren Bardwell, Development Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Total Phenolics in Water						
Our Reference		306808-5	306808-6	306808-7	306808-8	306808-9
Your Reference	UNITS	S4	S5	S6	S7	L8
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	04/10/2022	04/10/2022	04/10/2022	04/10/2022	04/10/2022
Date analysed	-	04/10/2022	04/10/2022	04/10/2022	04/10/2022	04/10/2022
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Total Phenolics in Water		
Our Reference		306808-10
Your Reference	UNITS	D-20220927
Date Sampled		27/09/2021
Type of sample		Water
Date extracted	-	04/10/2022
Date analysed	-	04/10/2022
Total Phenolics (as Phenol)	mg/L	<0.05

Miscellaneous Inorganics						
Our Reference		306808-1	306808-2	306808-3	306808-4	306808-5
Your Reference	UNITS	BH01-2	BH02	BH03	BH04	S4
Date Sampled		26/09/2022	26/09/2022	26/09/2022	26/09/2022	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Ammonia as N in water	mg/L	0.031	0.077	0.090	0.11	0.017
Nitrate as N in water	mg/L	0.03	0.04	0.01	0.007	0.01
Fluoride, F	mg/L	[NA]	[NA]	[NA]	[NA]	<0.1
Total Organic Carbon	mg/L	[NA]	[NA]	[NA]	[NA]	16
Total Suspended Solids	mg/L	[NA]	[NA]	[NA]	[NA]	280

Miscellaneous Inorganics						
Our Reference		306808-6	306808-7	306808-8	306808-9	306808-10
Your Reference	UNITS	S5	S6	S7	L8	D-20220927
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Ammonia as N in water	mg/L	0.18	0.21	6.8	80	0.019
Nitrate as N in water	mg/L	0.23	0.29	3.9	3.3	0.10
Fluoride, F	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	mg/L	18	20	38	180	16
Total Suspended Solids	mg/L	460	44	450	23	180

Ion Balance						
Our Reference		306808-1	306808-2	306808-3	306808-4	306808-5
Your Reference	UNITS	BH01-2	BH02	BH03	BH04	S4
Date Sampled		26/09/2022	26/09/2022	26/09/2022	26/09/2022	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	28/09/2022
Calcium - Dissolved	mg/L	[NA]	[NA]	[NA]	[NA]	<0.5
Potassium - Dissolved	mg/L	[NA]	[NA]	[NA]	[NA]	0.9
Sodium - Dissolved	mg/L	[NA]	[NA]	[NA]	[NA]	10
Magnesium - Dissolved	mg/L	17	15	33	29	1
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	[NA]	[NA]	[NA]	[NA]	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	[NA]	[NA]	[NA]	[NA]	12
Carbonate Alkalinity as CaCO ₃	mg/L	[NA]	[NA]	[NA]	[NA]	<5
Total Alkalinity as CaCO ₃	mg/L	[NA]	[NA]	[NA]	[NA]	12
Sulphate, SO ₄	mg/L	[NA]	[NA]	[NA]	[NA]	2
Chloride, Cl	mg/L	[NA]	[NA]	[NA]	[NA]	13
Ionic Balance	%	[NA]	[NA]	[NA]	[NA]	-8.0

Ion Balance						
Our Reference		306808-6	306808-7	306808-8	306808-9	306808-10
Your Reference	UNITS	S5	S6	S7	L8	D-20220927
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	30/09/2022
Date analysed	-	28/09/2022	28/09/2022	28/09/2022	28/09/2022	30/09/2022
Calcium - Dissolved	mg/L	2	2	16	27	0.6
Potassium - Dissolved	mg/L	2	2	14	48	0.9
Sodium - Dissolved	mg/L	13	15	81	280	9.9
Magnesium - Dissolved	mg/L	1	1	6.3	15	1
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	15	16	85	540	6
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	15	16	85	540	6
Sulphate, SO ₄	mg/L	3	3	23	15	2
Chloride, Cl	mg/L	19	21	130	390	20
Ionic Balance	%	-6.0	-5.0	-6.0	-16	-13

HM in water - dissolved						
Our Reference		306808-5	306808-6	306808-7	306808-8	306808-9
Your Reference	UNITS	S4	S5	S6	S7	L8
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Date analysed	-	30/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022
Iron-Dissolved	µg/L	570	490	470	560	6,600
Manganese-Dissolved	µg/L	7	24	14	78	260

HM in water - dissolved		
Our Reference		306808-10
Your Reference	UNITS	D-20220927
Date Sampled		27/09/2021
Type of sample		Water
Date prepared	-	30/09/2022
Date analysed	-	30/09/2022
Iron-Dissolved	µg/L	460
Manganese-Dissolved	µg/L	6

HM in water - total						
Our Reference		306808-5	306808-6	306808-7	306808-8	306808-9
Your Reference	UNITS	S4	S5	S6	S7	L8
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/10/2022	04/10/2022	04/10/2022	04/10/2022	04/10/2022
Date analysed	-	04/10/2022	04/10/2022	04/10/2022	04/10/2022	04/10/2022
Iron-Total	µg/L	2,300	2,100	1,900	4,700	6,700
Manganese-Total	µg/L	29	38	20	110	280

HM in water - total		
Our Reference		306808-10
Your Reference	UNITS	D-20220927
Date Sampled		27/09/2021
Type of sample		Water
Date prepared	-	04/10/2022
Date analysed	-	04/10/2022
Iron-Total	µg/L	2,500
Manganese-Total	µg/L	28

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically 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 +/- 15% ie total anions = total cations +/-15%.
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.

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			04/10/2022	[NT]	[NT]	[NT]	[NT]	04/10/2022	[NT]
Date analysed	-			04/10/2022	[NT]	[NT]	[NT]	[NT]	04/10/2022	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	306808-6
Date prepared	-			28/09/2022	5	28/09/2022	28/09/2022		28/09/2022	28/09/2022
Date analysed	-			28/09/2022	5	28/09/2022	28/09/2022		28/09/2022	28/09/2022
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	5	0.017	0.017	0	90	87
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	5	0.01	0.01	0	93	85
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	5	<0.1	<0.1	0	112	104
Total Organic Carbon	mg/L	1	Inorg-079	<1	5	16	16	0	102	96
Total Suspended Solids	mg/L	5	Inorg-019	<5	5	280	290	4	96	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	306808-5
Date prepared	-			28/09/2022	1	28/09/2022	28/09/2022		28/09/2022	28/09/2022
Date analysed	-			28/09/2022	1	28/09/2022	28/09/2022		28/09/2022	28/09/2022
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	<0.5	[NT]		90	90
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	0.9	[NT]		83	82
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	10	[NT]		91	78
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	17	17	0	89	89
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	12	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	12	[NT]		96	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	5	2	2	0	97	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	5	13	13	0	101	[NT]
Ionic Balance	%		Inorg-040	[NT]	5	-8.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	306808-6
Date prepared	-			[NT]	5	28/09/2022	28/09/2022		[NT]	28/09/2022
Date analysed	-			[NT]	5	28/09/2022	28/09/2022		[NT]	28/09/2022
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	1	[NT]		[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	80
Chloride, Cl	mg/L	1	Inorg-081	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	94

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	306808-6
Date prepared	-			30/09/2022	5	30/09/2022	30/09/2022		30/09/2022	30/09/2022
Date analysed	-			30/09/2022	5	30/09/2022	30/09/2022		30/09/2022	30/09/2022
Iron-Dissolved	µg/L	10	Metals-022	<10	5	570	560	2	92	#
Manganese-Dissolved	µg/L	5	Metals-022	<5	5	7	7	0	92	93

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - total				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	306808-6
Date prepared	-			04/10/2022	5	04/10/2022	04/10/2022		04/10/2022	04/10/2022
Date analysed	-			04/10/2022	5	04/10/2022	04/10/2022		04/10/2022	04/10/2022
Iron-Total	µg/L	10	Metals-022	<10	5	2300	1900	19	101	#
Manganese-Total	µg/L	5	Metals-022	<5	5	29	27	7	104	101

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.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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 sample #5, 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 applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

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

The mass imbalance may be caused by other ions that have not been measured.



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CERTIFICATE OF ANALYSIS 314239

Client Details

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

Sample Details

Your Reference	89781.00, Kempsey
Number of Samples	3 Water
Date samples received	11/01/2023
Date completed instructions received	11/01/2023

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 18/01/2023

Date of Issue 18/01/2023

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Results Approved By

Diego Bigolin, Inorganics Supervisor
Loren Bardwell, Development Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Total Phenolics in Water				
Our Reference		314239-1	314239-2	314239-3
Your Reference	UNITS	S5	S7	L8
Type of sample		Water	Water	Water
Date extracted	-	12/01/2023	12/01/2023	12/01/2023
Date analysed	-	12/01/2023	12/01/2023	12/01/2023
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05

Miscellaneous Inorganics				
Our Reference		314239-1	314239-2	314239-3
Your Reference	UNITS	S5	S7	L8
Type of sample		Water	Water	Water
Date prepared	-	11/01/2023	11/01/2023	11/01/2023
Date analysed	-	11/01/2023	11/01/2023	11/01/2023
Ammonia as N in water	mg/L	3.8	0.027	160
Nitrate as N in water	mg/L	0.26	0.54	0.10
Fluoride, F	mg/L	<0.1	0.2	0.2
Total Organic Carbon	mg/L	28	59	190
Total Suspended Solids	mg/L	1,900	120	75

Ion Balance				
Our Reference		314239-1	314239-2	314239-3
Your Reference	UNITS	S5	S7	L8
Type of sample		Water	Water	Water
Date prepared	-	11/01/2023	11/01/2023	11/01/2023
Date analysed	-	11/01/2023	11/01/2023	11/01/2023
Calcium - Dissolved	mg/L	7.8	41	51
Potassium - Dissolved	mg/L	7.9	29	100
Sodium - Dissolved	mg/L	40	360	550
Magnesium - Dissolved	mg/L	5.2	22	29
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	49	60	1,100
Carbonate Alkalinity as CaCO ₃	mg/L	<5	69	<5
Total Alkalinity as CaCO ₃	mg/L	49	130	1,100
Sulphate, SO ₄	mg/L	35	66	23
Chloride, Cl	mg/L	73	640	960
Ionic Balance	%	-16	-4.0	-22

HM in water - dissolved				
Our Reference		314239-1	314239-2	314239-3
Your Reference	UNITS	S5	S7	L8
Type of sample		Water	Water	Water
Date prepared	-	12/01/2023	12/01/2023	12/01/2023
Date analysed	-	12/01/2023	12/01/2023	12/01/2023
Iron-Dissolved	µg/L	570	<10	10,000
Manganese-Dissolved	µg/L	70	<5	460

HM in water - total				
Our Reference		314239-1	314239-2	314239-3
Your Reference	UNITS	S5	S7	L8
Type of sample		Water	Water	Water
Date prepared	-	12/01/2023	12/01/2023	12/01/2023
Date analysed	-	12/01/2023	12/01/2023	12/01/2023
Iron-Total	µg/L	9,800	790	11,000
Manganese-Total	µg/L	350	48	460

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically 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 +/- 15% ie total anions = total cations +/-15%.
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.

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	314239-2
Date extracted	-			12/01/2023	1	12/01/2023	12/01/2023		12/01/2023	12/01/2023
Date analysed	-			12/01/2023	1	12/01/2023	12/01/2023		12/01/2023	12/01/2023
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	103	97

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	314239-2
Date prepared	-			11/01/2023	1	11/01/2023	11/01/2023		11/01/2023	11/01/2023
Date analysed	-			11/01/2023	1	11/01/2023	11/01/2023		11/01/2023	11/01/2023
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	3.8	3.8	0	108	96
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.26	0.26	0	93	99
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	93	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	28	28	0	101	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	1900	1800	5	95	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			11/01/2023	1	11/01/2023	11/01/2023		11/01/2023	[NT]
Date analysed	-			11/01/2023	1	11/01/2023	11/01/2023		11/01/2023	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	7.8	7.6	3	91	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	7.9	7.9	0	84	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	40	40	0	89	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	5.2	5.1	2	91	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	49	47	4	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	49	47	4	97	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	35	34	3	110	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	73	73	0	106	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	-16	-15	-6	[NT]	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			12/01/2023	2	12/01/2023	12/01/2023		12/01/2023	[NT]
Date analysed	-			12/01/2023	2	12/01/2023	12/01/2023		12/01/2023	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	2	<10	<10	0	94	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	2	<5	<5	0	97	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - total				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	314239-2
Date prepared	-			12/01/2023	1	12/01/2023	12/01/2023		12/01/2023	12/01/2023
Date analysed	-			12/01/2023	1	12/01/2023	12/01/2023		12/01/2023	12/01/2023
Iron-Total	µg/L	10	Metals-022	<10	1	9800	9300	5	107	#
Manganese-Total	µg/L	5	Metals-022	<5	1	350	360	3	104	106

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.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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

The mass imbalance in sample #3 may be caused by other ions that have not been measured.

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

CERTIFICATE OF ANALYSIS 319997

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
Number of Samples	2 Water
Date samples received	31/03/2023
Date completed instructions received	31/03/2023

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	11/04/2023
Date of Issue	11/04/2023
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Diego Bigolin, Inorganics Supervisor
 Giovanni Agosti, Group Technical Manager
 Loren Bardwell, Development Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Total Phenolics in Water			
Our Reference		319997-1	319997-2
Your Reference	UNITS	S7	L8
Date Sampled		30/03/2023	30/03/2023
Type of sample		Water	Water
Date extracted	-	05/04/2023	05/04/2023
Date analysed	-	05/04/2023	05/04/2023
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05

Miscellaneous Inorganics			
Our Reference		319997-1	319997-2
Your Reference	UNITS	S7	L8
Date Sampled		30/03/2023	30/03/2023
Type of sample		Water	Water
Date prepared	-	31/03/2023	31/03/2023
Date analysed	-	31/03/2023	31/03/2023
Ammonia as N in water	mg/L	0.51	71
Nitrate as N in water	mg/L	0.89	1.0
Fluoride, F	mg/L	<0.1	0.1
Total Organic Carbon	mg/L	22	110
Total Suspended Solids	mg/L	380	27

Ion Balance			
Our Reference		319997-1	319997-2
Your Reference	UNITS	S7	L8
Date Sampled		30/03/2023	30/03/2023
Type of sample		Water	Water
Date prepared	-	31/03/2023	31/03/2023
Date analysed	-	31/03/2023	31/03/2023
Calcium - Dissolved	mg/L	19	42
Potassium - Dissolved	mg/L	10	97
Sodium - Dissolved	mg/L	65	380
Magnesium - Dissolved	mg/L	6.2	25
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	39	530
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5
Total Alkalinity as CaCO ₃	mg/L	39	530
Sulphate, SO ₄	mg/L	46	46
Chloride, Cl	mg/L	99	640
Ionic Balance	%	0	-13

HM in water - dissolved			
Our Reference		319997-1	319997-2
Your Reference	UNITS	S7	L8
Date Sampled		30/03/2023	30/03/2023
Type of sample		Water	Water
Date prepared	-	03/04/2023	03/04/2023
Date analysed	-	03/04/2023	03/04/2023
Iron-Dissolved	µg/L	40	7,400
Manganese-Dissolved	µg/L	67	370

HM in water - total			
Our Reference		319997-1	319997-2
Your Reference	UNITS	S7	L8
Date Sampled		30/03/2023	30/03/2023
Type of sample		Water	Water
Date prepared	-	04/04/2023	04/04/2023
Date analysed	-	04/04/2023	04/04/2023
Iron-Total	µg/L	3,700	6,900
Manganese-Total	µg/L	100	320

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically 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 +/- 15% ie total anions = total cations +/-15%.
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.

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			05/04/2023	[NT]	[NT]	[NT]	[NT]	05/04/2023	[NT]
Date analysed	-			05/04/2023	[NT]	[NT]	[NT]	[NT]	05/04/2023	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	101	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			31/03/2023	1	31/03/2023	31/03/2023		31/03/2023	[NT]
Date analysed	-			31/03/2023	1	31/03/2023	31/03/2023		31/03/2023	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.51	[NT]		106	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.89	[NT]		99	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	[NT]		102	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	22	[NT]		100	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	380	380	0	93	[NT]

QUALITY CONTROL: Ion Balance					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			31/03/2023	[NT]	[NT]	[NT]	[NT]	31/03/2023	[NT]
Date analysed	-			31/03/2023	[NT]	[NT]	[NT]	[NT]	31/03/2023	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	105	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	88	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	108	[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, SO ₄	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date prepared	-			03/04/2023	[NT]	[NT]	[NT]	[NT]	03/04/2023	[NT]
Date analysed	-			03/04/2023	[NT]	[NT]	[NT]	[NT]	03/04/2023	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	87	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	91	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - total				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date prepared	-			04/04/2023	[NT]	[NT]	[NT]	[NT]	04/04/2023	[NT]
Date analysed	-			04/04/2023	[NT]	[NT]	[NT]	[NT]	04/04/2023	[NT]
Iron-Total	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	106	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	99	[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.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.



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CERTIFICATE OF ANALYSIS 321830

Client Details

Client	Douglas Partners Newcastle
Attention	Joel Cowan
Address	Box 324 Hunter Region Mail Centre, Newcastle, NSW, 2310

Sample Details

Your Reference	89781.00 Kempsey
Number of Samples	5 Water
Date samples received	27/04/2023
Date completed instructions received	27/04/2023

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 04/05/2023

Date of Issue 04/05/2023

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Diego Bigolin, Inorganics Supervisor
Loren Bardwell, Development Chemist
Nick Sarlamis, Assistant Operation Manager

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: 89781.00 Kempsey

Total Phenolics in Water						
Our Reference		321830-1	321830-2	321830-3	321830-4	321830-5
Your Reference	UNITS	L8	S4	S5	S6	S7
Date Sampled		26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
Date analysed	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Ion Balance						
Our Reference		321830-1	321830-2	321830-3	321830-4	321830-5
Your Reference	UNITS	L8	S4	S5	S6	S7
Date Sampled		26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Calcium - Dissolved	mg/L	52	1	24	15	28
Potassium - Dissolved	mg/L	110	1	14	9.5	15
Sodium - Dissolved	mg/L	490	14	89	62	94
Magnesium - Dissolved	mg/L	29	2	9.2	8.5	9.6
Hardness	mgCaCO ₃ /L	250	11	97	73	110
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	790	7	56	25	62
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	790	7	56	25	62
Sulphate, SO ₄	mg/L	42	<1	46	30	48
Chloride, Cl	mg/L	820	29	170	130	180
Ionic Balance	%	-15	-4.0	-5.0	-5.0	-4.0

Client Reference: 89781.00 Kempsey

HM in water - total						
Our Reference		321830-1	321830-2	321830-3	321830-4	321830-5
Your Reference	UNITS	L8	S4	S5	S6	S7
Date Sampled		26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023	01/05/2023
Date analysed	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023	01/05/2023
Manganese-Total	µg/L	480	29	120	57	140
Iron-Total	µg/L	7,400	1,200	2,100	1,400	860

HM in water - dissolved						
Our Reference		321830-1	321830-2	321830-3	321830-4	321830-5
Your Reference	UNITS	L8	S4	S5	S6	S7
Date Sampled		26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
Date analysed	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
Iron-Dissolved	µg/L	7,200	420	260	260	20
Manganese-Dissolved	µg/L	390	18	83	42	12

Miscellaneous Inorganics						
Our Reference		321830-1	321830-2	321830-3	321830-4	321830-5
Your Reference	UNITS	L8	S4	S5	S6	S7
Date Sampled		26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Total Suspended Solids	mg/L	38	7	19	17	56
Ammonia as N in water	mg/L	94	0.017	0.10	0.006	0.042
Nitrate as N in water	mg/L	0.058	0.098	0.36	0.065	0.63
Fluoride, F	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	mg/L	150	23	17	14	16

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically 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 +/- 15% ie total anions = total cations +/-15%.
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.

Client Reference: 89781.00 Kempsey

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	321830-2
Date extracted	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	28/04/2023
Date analysed	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	28/04/2023
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	101	94

Client Reference: 89781.00 Kempsey

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	321830-2
Date prepared	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	27/04/2023
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	27/04/2023
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	52	52	0	106	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	110	110	0	107	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	490	480	2	88	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	29	29	0	101	[NT]
Hardness	mgCaCO ₃ /L	3	Metals-020	[NT]	1	250	250	0	[NT]	[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	790	[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	790	[NT]		93	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	42	36	15	114	122
Chloride, Cl	mg/L	1	Inorg-081	<1	1	820	830	1	108	115
Ionic Balance	%		Inorg-040	[NT]	1	-15	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	5	27/04/2023	27/04/2023		[NT]	[NT]
Date analysed	-			[NT]	5	27/04/2023	27/04/2023		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	28	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	15	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	94	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	9.6	[NT]		[NT]	[NT]
Hardness	mgCaCO ₃ /L	3	Metals-020	[NT]	5	110	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	62	62	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	62	62	0	[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	5	48	[NT]		[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	5	180	[NT]		[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	5	-4.0	[NT]		[NT]	[NT]

Client Reference: 89781.00 Kempsey

QUALITY CONTROL: HM in water - total				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date prepared	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Date analysed	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	108	[NT]
Iron-Total	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	112	[NT]

Client Reference: 89781.00 Kempsey

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W7	[NT]
Date prepared	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	[NT]
Date analysed	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	7200	7200	0	93	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	390	400	3	96	[NT]

Client Reference: 89781.00 Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	321830-2
Date prepared	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	27/04/2023
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	27/04/2023
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	38	[NT]		104	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	94	94	0	106	90
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.058	0.05	15	107	86
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.1	0.2	67	115	111
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	150	150	0	100	[NT]

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	4	27/04/2023	27/04/2023		[NT]	[NT]
Date analysed	-			[NT]	4	27/04/2023	27/04/2023		[NT]	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	4	17	12	34	[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	4	0.006	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	4	0.065	[NT]		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	4	<0.1	[NT]		[NT]	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	[NT]	4	14	[NT]		[NT]	[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.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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 322011

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
Number of Samples	4 Water
Date samples received	01/05/2023
Date completed instructions received	01/05/2023

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 08/05/2023

Date of Issue 08/05/2023

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Loren Bardwell, Development Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics					
Our Reference		322011-1	322011-2	322011-3	322011-4
Your Reference	UNITS	BH01-2	BH2	BH3	BH4
Date Sampled		27/04/2023	27/04/2023	27/04/2023	27/04/2023
Type of sample		Water	Water	Water	Water
Date prepared	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023
Date analysed	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023
Ammonia as N in water	mg/L	0.024	0.067	0.074	0.095
Nitrate as N in water	mg/L	0.007	<0.005	<0.005	<0.005

Cations in water Dissolved					
Our Reference		322011-1	322011-2	322011-3	322011-4
Your Reference	UNITS	BH01-2	BH2	BH3	BH4
Date Sampled		27/04/2023	27/04/2023	27/04/2023	27/04/2023
Type of sample		Water	Water	Water	Water
Date digested	-	02/05/2023	02/05/2023	02/05/2023	02/05/2023
Date analysed	-	02/05/2023	02/05/2023	02/05/2023	02/05/2023
Magnesium - Dissolved	mg/L	18	17	40	31

Method ID	Methodology Summary
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.
Metals-020	Determination of various metals by ICP-AES.

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Date analysed	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	[NT]	[NT]	107	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	102	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Cations in water Dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			02/05/2023	1	02/05/2023	02/05/2023		02/05/2023	[NT]
Date analysed	-			02/05/2023	1	02/05/2023	02/05/2023		02/05/2023	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	18	18	0	115	[NT]

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Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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

Nutrients

Samples were out of the recommended holding time for this analysis.

CERTIFICATE OF ANALYSIS 327305

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
Number of Samples	5 Water
Date samples received	06/07/2023
Date completed instructions received	06/07/2023

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	13/07/2023
Date of Issue	13/07/2023
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Diego Bigolin, Inorganics Supervisor
 Loren Bardwell, Development Chemist
 Nick Sarlamis, Assistant Operation Manager

Authorised By

Nancy Zhang, Laboratory Manager

Total Phenolics in Water						
Our Reference		327305-1	327305-2	327305-3	327305-4	327305-5
Your Reference	UNITS	S5	S6	S7	L8	D1/SBK
Date Sampled		05/07/2023	05/07/2023	05/07/2023	05/07/2023	05/07/2023
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Date analysed	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

HM in water - total						
Our Reference		327305-1	327305-2	327305-3	327305-4	327305-5
Your Reference	UNITS	S5	S6	S7	L8	D1/SBK
Date Sampled		05/07/2023	05/07/2023	05/07/2023	05/07/2023	05/07/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Date analysed	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Iron-Total	µg/L	1,400	2,400	5,200	9,700	2,500
Manganese-Total	µg/L	260	240	260	650	250

HM in water - dissolved						
Our Reference		327305-1	327305-2	327305-3	327305-4	327305-5
Your Reference	UNITS	S5	S6	S7	L8	D1/SBK
Date Sampled		05/07/2023	05/07/2023	05/07/2023	05/07/2023	05/07/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/07/2023	10/07/2023	10/07/2023	10/07/2023	10/07/2023
Date analysed	-	10/07/2023	10/07/2023	10/07/2023	10/07/2023	10/07/2023
Iron-Dissolved	µg/L	260	670	20	8,200	760
Manganese-Dissolved	µg/L	220	180	200	530	200

Miscellaneous Inorganics						
Our Reference		327305-1	327305-2	327305-3	327305-4	327305-5
Your Reference	UNITS	S5	S6	S7	L8	D1/SBK
Date Sampled		05/07/2023	05/07/2023	05/07/2023	05/07/2023	05/07/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Date analysed	-	07/07/2023	07/07/2023	07/07/2023	07/07/2023	07/07/2023
Ammonia as N in water	mg/L	1.4	0.017	0.91	120	0.73
Nitrate as N in water	mg/L	0.20	<0.005	12	0.37	<0.005
Fluoride, F	mg/L	<0.1	<0.1	0.1	0.2	<0.1
Total Suspended Solids	mg/L	23	16	410	66	28
Total Organic Carbon	mg/L	36	18	16	200	20

Ion Balance						
Our Reference		327305-1	327305-2	327305-3	327305-4	327305-5
Your Reference	UNITS	S5	S6	S7	L8	D1/SBK
Date Sampled		05/07/2023	05/07/2023	05/07/2023	05/07/2023	05/07/2023
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/07/2023	06/07/2023	06/07/2023	06/07/2023	06/07/2023
Date analysed	-	06/07/2023	06/07/2023	06/07/2023	06/07/2023	06/07/2023
Calcium - Dissolved	mg/L	32	12	41	55	13
Potassium - Dissolved	mg/L	18	8.9	23	150	8.8
Sodium - Dissolved	mg/L	210	76	190	570	74
Magnesium - Dissolved	mg/L	19	8.1	22	33	8.6
Hardness	mgCaCO ₃ /L	160	65	190	270	69
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	53	24	50	1,200	23
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	53	24	50	1,200	23
Sulphate, SO ₄	mg/L	44	11	120	15	11
Chloride, Cl	mg/L	400	170	300	1,000	170
Ionic Balance	%	-3.0	-6.0	4.0	-22	-6.0

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically 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 +/- 15% ie total anions = total cations +/-15%.
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. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			07/07/2023	1	07/07/2023	07/07/2023		07/07/2023	[NT]
Date analysed	-			07/07/2023	1	07/07/2023	07/07/2023		07/07/2023	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	107	[NT]

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - total					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	327305-2
Date prepared	-			10/07/2023	1	07/07/2023	07/07/2023		10/07/2023	10/07/2023
Date analysed	-			10/07/2023	1	07/07/2023	07/07/2023		10/07/2023	10/07/2023
Iron-Total	µg/L	10	Metals-022	<10	1	1400	1400	0	90	#
Manganese-Total	µg/L	5	Metals-022	<5	1	260	260	0	90	#

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	327305-2
Date prepared	-			10/07/2023	1	10/07/2023	10/07/2023		10/07/2023	10/07/2023
Date analysed	-			10/07/2023	1	10/07/2023	10/07/2023		10/07/2023	10/07/2023
Iron-Dissolved	µg/L	10	Metals-022	<10	1	260	250	4	90	#
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	220	210	5	89	#

Client Reference: 89781.00, Kempsey

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	327305-2
Date prepared	-			07/07/2023	1	07/07/2023	07/07/2023		07/07/2023	07/07/2023
Date analysed	-			07/07/2023	1	07/07/2023	07/07/2023		07/07/2023	07/07/2023
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	1.4	1.3	7	101	102
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.20	0.21	5	99	111
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	100	100
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	23	[NT]		106	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	36	35	3	101	112

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	3	07/07/2023	07/07/2023		[NT]	[NT]
Date analysed	-			[NT]	3	07/07/2023	07/07/2023		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	3	0.91	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	3	12	[NT]		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	3	0.1	[NT]		[NT]	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	3	410	450	9	[NT]	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	[NT]	3	16	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	327305-2
Date prepared	-			06/07/2023	1	06/07/2023	06/07/2023		06/07/2023	06/07/2023
Date analysed	-			06/07/2023	1	06/07/2023	06/07/2023		06/07/2023	06/07/2023
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	32	[NT]		98	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	18	[NT]		101	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	210	[NT]		103	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	19	[NT]		102	[NT]
Hardness	mgCaCO ₃ /L	3	Metals-020	[NT]	1	160	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	53	51	4	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	53	51	4	105	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	44	42	5	103	119
Chloride, Cl	mg/L	1	Inorg-081	<1	1	400	400	0	112	97
Ionic Balance	%		Inorg-040	[NT]	1	-3.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	3	06/07/2023	06/07/2023		[NT]	[NT]
Date analysed	-			[NT]	3	06/07/2023	06/07/2023		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	3	41	41	0	[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	3	23	23	0	[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	3	190	190	0	[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	3	22	22	0	[NT]	[NT]
Hardness	mgCaCO ₃ /L	3	Metals-020	[NT]	3	190	190	0	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	[NT]	3	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	3	50	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	3	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	3	50	[NT]		[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	3	120	[NT]		[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	3	300	[NT]		[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	3	4.0	[NT]		[NT]	[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.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

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

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

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

The mass inbalance may be caused by other ions that have not been measured.

Appendix F

- Appendix F: Tabulated Laboratory Results:
- Table F1 – Field and Laboratory Results for Groundwater –
October 2022 – Q1
 - Table F2 – Field and Laboratory Results for Surface Water -
October 2022 – Q1
 - Table F3 – Field and Laboratory Results for Surface Water –
January 2023 – Q2
 - Table F4 – Field and Laboratory Results for Additional Surface
Water Monitoring Round – March 2023
 - Table F5 - Field and Laboratory Results for Groundwater –
April 2023 – Q3
 - Table F6 – Field and Laboratory Results for Surface Water –
April 2023 – Q3
 - Table F7 – Field and Laboratory Results for Surface Water –
July 2023 – Q4

Table F1 - Field and Laboratory Results for Groundwater - September 2022 - Q1

Analyte	Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	BH1	BH2	BH3	BH4	BH1-2
				MP1	MP2	MP3	MP12	MP14
				-	26/09/2022	26/09/2022	26/09/2022	26/09/2022
Field	Dissolved Oxygen (Filtered)	mg/L		-	56.60	5.20	2.08	2.50
	EC (Field)	µS/cm		1065	1640	2030	2000	1080
	pH (Field)	pH_Units		6.5 - 8.0	6.70	5.90	6.30	5.30
	PID (Top of Well)	ppm		<1	<1	<1	<1	<1
	Temp	°C		-	18.10	20.90	19.00	18.00
Ion Balance	Magnesium (Filtered)	mg/L		10.05	15.00	33.00	29.00	17.00
Miscellaneous Inorganics	Ammonia as N	mg/L	0.9	0.9	0.08	0.09	0.11	0.03
	Nitrate (as N)	mg/L	0.7	0.7	0.04	0.01	0.01	0.03

Notes

Only EPL Trigger Levels exceedances highlighted

Table F2 - Field and Laboratory Results for Surface water - September 2022 - Q1

Analytes	Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	S4	S5	S6	S7	L8	
				MP4	MP5	MP6	MP7	MP8	
				27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	
Field	Dissolved Oxygen (Filtered)	mg/L		12.057	9.58	7.8	5.6	4.6	1.6
	EC (field)	µS/cm		1065	71	113	121	780	2560
	pH (Field)	pH_Units		6.5 - 8.0	6.4	7.6	6.6	7.6	7.8
	Temp	°C			15.22	14.4	14.5	18	19.6
HM in water - dissolved	Iron (Filtered)	mg/L		1.84	0.57	0.49	0.47	0.56	6.6
	Manganese (Filtered)	mg/L	1.9	1.9	0.007	0.024	0.014	78	0.26
HM in water - total	Iron	mg/L		1.84	2.3	2.1	1.9	4.7	6.7
	Manganese	mg/L	1.9	1.9	0.029	0.038	0.02	0.11	0.28
Ion Balance	Alkalinity (Carbonate)	mg/L			<5	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L			<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L		12.283	12	15	16	85	540
	Alkalinity (Bicarbonate as	mg/L			12	15	16	85	540
	Calcium (Filtered)	mg/L		2.05	<0.5	2	2	16	27
	Chloride	mg/L		54.49	13	19	21	130	390
	Ionic Balance	%			-8	-6	-5	-6	-16
	Magnesium (Filtered)	mg/L		10.05	1	1	1	6.3	15
	Potassium (Filtered)	mg/L		2.282	0.9	2	2	14	48
	Sodium (Filtered)	mg/L		34	10	13	15	81	280
Sulphate	mg/L		3.1	2	3	3	23	15	
Miscellaneous Inorganics	Ammonia as N	mg/L	0.9	0.9	0.017	0.18	0.21	6.8	80
	Fluoride	mg/L			<0.1	<0.1	<0.1	<0.1	<0.1
	Nitrate (as N)	mg/L	0.7	0.7	0.01	0.23	0.29	3.9	3.3
	TOC	mg/L		33.1	16	18	20	38	180
	TSS	mg/L		33.415	280	460	44	450	23
Total Phenolics	Phenolics Total	mg/L	0.32	0.32	<0.05	<0.05	<0.05	<0.05	<0.05

Notes

Only EPL Trigger Level Exceedances highlighted

Table F3 - Field and Laboratory Results for Surface water - January 2023 - Q2

Analytes	Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	S4	S5	S6	S7	L8
				MP4 10/01/2022	MP5 10/01/2022	MP6 10/01/2022	MP7 10/01/2022	MP8 10/01/2022
Field	Dissolved Oxygen (Filtered)	mg/L	12.057	-	4.77	-	9.92	3.46
	EC (field)	µS/cm	1065	-	450	-	2310	4840
	pH (Field)	pH_Units	6.5 - 8.0	-	6.7	-	9.7	8.1
	Temp	°C		-	24.0	-	30.5	29.9
HM in water - dissolved	Iron (Filtered)	mg/L	1.84	-	0.57	-	<0.01	10
	Manganese (Filtered)	mg/L	1.9	-	0.07	-	<0.005	0.46
HM in water - total	Iron	mg/L	1.84	-	9.8	-	790	11
	Manganese	mg/L	1.9	-	0.35	-	0.048	0.46
Ion Balance	Alkalinity (Carbonate)	mg/L		-	<5	-	69	<5
	Alkalinity (Hydroxide) as CaCO ₃	mg/L		-	<5	-	<5	<5
	Alkalinity (total) as CaCO ₃	mg/L	12.283	-	49	-	130	1100
	Alkalinity (Bicarbonate as	mg/L		-	49	-	60	1100
	Calcium (Filtered)	mg/L	2.05	-	7.8	-	41	51
	Chloride	mg/L	54.49	-	73	-	640	960
	Ionic Balance	%		-	-16	-	-4.0	-22
	Magnesium (Filtered)	mg/L	10.05	-	5.2	-	22	29
	Potassium (Filtered)	mg/L	2.282	-	7.9	-	29	100
	Sodium (Filtered)	mg/L	34	-	40	-	360	550
Miscellaneous Inorganics	Sulphate	mg/L	3.1	-	35	-	66	23
	Ammonia as N	mg/L	0.9	-	3.8	-	0.027	160
	Fluoride	mg/L		-	<0.1	-	0.2	0.2
	Nitrate (as N)	mg/L	0.7	-	0.26	-	0.54	0.10
	TOC	mg/L	33.1	-	28	-	59	190
Total Phenolics	TSS	mg/L	33.415	-	1900	-	120	75
	Phenolics Total	mg/L	0.32	-	<0.05	-	<0.05	<0.05

Notes

Only EPL Trigger Level Exceedances highlighted

Table F4 - Field and Laboratory Results for Surface water - 30 March 2023 (Event Based Sampling)

Analytes	Units	PQL	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	S7	L8	
					MP7 30/03/2023	MP8 30/03/2023	
Field	Dissolved Oxygen	mg/L		12.057	4.4	3.02	
	EC (field)	µS/cm		1065	6930	3070	
	pH (Field)	pH_Units		6.5 - 8.0	9.4	8.3	
	Temp	°C			21.8	24.4	
	PID Headspace	ppm			<1	<1	
HM in water - dissolved	Iron (Filtered)	mg/L	0.01	1.84	0.04	7.4	
	Manganese (Filtered)	mg/L	0.005	1.9	0.067	0.37	
HM in water - total	Iron	mg/L	0.01	1.84	3.7	6.9	
	Manganese	mg/L	0.005	1.9	0.1	0.32	
Ion Balance	Alkalinity (Carbonate)	mg/L	5		<5	<5	
	Alkalinity (Hydroxide) as CaCO3	mg/L	5		<5	<5	
	Alkalinity (total) as CaCO3	mg/L	5		12.283	530	
	Alkalinity (Bicarbonate as	mg/L	5			39	530
	Calcium (Filtered)	mg/L	0.5		2.05	19	42
	Chloride	mg/L	1		54.49	99	640
	Ionic Balance	%				0	-13
	Magnesium (Filtered)	mg/L	0.5		10.05	10	97
	Potassium (Filtered)	mg/L	0.5		2.282	0	0
	Sodium (Filtered)	mg/L	0.5		34	0	0
Sulphate	mg/L	1		3.1	0	0	
Miscellaneous Inorganics	Ammonia as N	mg/L	0.005	0.9	0.9	65	380
	Fluoride	mg/L	0.1			0	0
	Nitrate (as N)	mg/L	0.005	0.7	0.7	46	46
	TOC	mg/L	1		33.1	0	0
	TSS	mg/L	5		33.415	0	0
Total Phenolics	Phenolics Total	mg/L	0.05	0.32	0.32	0	0

Notes

Only EPL Trigger Level Exceedances highlighted

Table F5 - Field and Laboratory Results for Groundwater - April 2023 - Q3

Analyte	Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	BH1	BH2	BH3	BH4	BH1-2
				MP1	MP2	MP3	MP12	MP14
				-	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Field	Dissolved Oxygen (Filtered)	mg/L		-	22.20	6.10	95.00	32.10
	EC (Field)	µS/cm		1065	916.00	1120.00	1110.00	900.00
	pH (Field)	pH_Units		6.5 - 8.0	6.41	5.75	5.35	5.60
	PID (Top of Well)	ppm		<1	<1	<1	<1	<1
	Temp	°C		-	19.31	21.00	23.50	19.33
Ion Balance	Magnesium (Filtered)	mg/L		10.05	17	40	31	18
Miscellaneous Inorganics	Ammonia as N	mg/L	0.9	0.9	0.067	0.074	0.095	0.024
	Nitrate (as N)	mg/L	0.7	0.7	<0.005	<0.005	<0.005	0.007

Notes

Only EPL Trigger Levels exceedances highlighted

Table F6 - Field and Laboratory Results for Surface water - April 2023 - Q3

Analytes	Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	S4	S5	S6	S7	L8	
				MP4	MP5	MP6	MP7	MP8	
				26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023	
Field	Dissolved Oxygen (Filtered)	mg/L		12.057	2.55	1.47	1.77	7.77	8.46
	EC (field)	µS/cm		1065	71	415	361	402	1000
	pH (Field)	pH_Units		6.5 - 8.0	5.4	6.2	6.2	8.8	6.8
	Temp	°C			18.81	18.76	19	22.45	19.4
HM in water - dissolved	Iron (Filtered)	mg/L		1.84	0.42	0.26	0.26	0.02	7.2
	Manganese (Filtered)	mg/L	1.9	1.9	0.018	0.083	0.042	12	0.39
HM in water - total	Iron	mg/L		1.84	1.2	2.1	1.4	0.86	7.4
	Manganese	mg/L	1.9	1.9	0.029	0.12	0.057	0.14	0.48
Ion Balance	Alkalinity (Carbonate)	mg/L			<5	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L			<5	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L		12.283	7	56	25	62	790
	Alkalinity (Bicarbonate as	mg/L			7	56	25	62	790
	Calcium (Filtered)	mg/L		2.05	1	24	15	28	52
	Chloride	mg/L		54.49	29	170	130	180	820
	Ionic Balance	%			-4.0	-5.0	-5.0	-4.0	-15
	Magnesium (Filtered)	mg/L		10.05	2	9.2	8.5	9.6	29
	Potassium (Filtered)	mg/L		2.282	1	14	9.5	15	110
	Sodium (Filtered)	mg/L		34	14	89	62	94	490
Sulphate	mg/L		3.1	<1	46	30	48	42	
Miscellaneous Inorganics	Ammonia as N	mg/L	0.9	0.9	0.017	0.10	0.006	0.042	94
	Fluoride	mg/L			<0.1	<0.1	<0.1	<0.1	0.1
	Nitrate (as N)	mg/L	0.7	0.7	0.098	0.36	0.065	0.63	0.058
	TOC	mg/L		33.1	23	17	14	16	150
	TSS	mg/L		33.415	7	19	17	56	38
Total Phenolics	Phenolics Total	mg/L	0.32	0.32	<0.05	<0.05	<0.05	<0.05	<0.05

Notes

Only EPL Trigger Level Exceedances highlighted

Table F7 - Field and Laboratory Results for Surface water - July 2023 - Q4

Analytes		Units	ANZECC 2000 FW 95%	EPL Groundwater Trigger Levels Licence 6269	S4	S5	S6	S7	L8
					MP4	MP5	MP6	MP7	MP8
					5/07/2023	5/07/2023	5/07/2023	5/07/2023	5/07/2023
Field	Dissolved Oxygen (Filtered)	mg/L		12.057	-	0.901	0.395	0.916	3.25
	EC (field)	µS/cm		1065	-	1410	617	1430	5130
	pH (Field)	pH_Units		6.5 - 8.0	-	6.6	6.8	7.1	8.05
	Temp	°C			-	12.25	12.56	11.2	13.31
HM in water - dissolved	Iron (Filtered)	mg/L		1.84	-	0.26	0.67	0.02	8.2
	Manganese (Filtered)	mg/L	1.9	1.9	-	0.22	0.18	0.2	0.53
HM in water - total	Iron	mg/L		1.84	-	1.4	2.4	5.2	9.7
	Manganese	mg/L	1.9	1.9	-	0.26	0.24	0.26	0.65
Ion Balance	Alkalinity (Carbonate)	mg/L			-	<5	<5	<5	<5
	Alkalinity (Hydroxide) as CaCO3	mg/L			-	<5	<5	<5	<5
	Alkalinity (total) as CaCO3	mg/L		12.283	-	53	24	50	1200
	Alkalinity (Bicarbonate as	mg/L			-	53	24	50	1200
	Calcium (Filtered)	mg/L		2.05	-	32	12	41	55
	Chloride	mg/L		54.49	-	400	170	300	1000
	Ionic Balance	%			-	-3	-6	4	-22
	Magnesium (Filtered)	mg/L		10.05	-	19	8.1	22	33
	Potassium (Filtered)	mg/L		2.282	-	18	8.9	23	150
	Sodium (Filtered)	mg/L		34	-	210	76	190	570
Sulphate	mg/L		3.1	-	44	11	120	15	
Miscellaneous Inorganics	Ammonia as N	mg/L	0.9	0.9	-	1.4	0.017	0.91	120
	Fluoride	mg/L			-	<0.1	<0.1	0.1	0.2
	Nitrate (as N)	mg/L	0.7	0.7	-	0.2	<0.005	12	0.37
	TOC	mg/L		33.1	-	36	18	16	200
	TSS	mg/L		33.415	-	23	16	410	66
Total Phenolics	Phenolics Total	mg/L	0.32	0.32	-	<0.05	<0.05	<0.05	<0.05

Notes

Only EPL Trigger Level Exceedances highlighted

Appendix G

Appendix G: Graphed Historical Data

Figure G1: Rainfall Data and Groundwater Levels 2020 – 2023

Figure G2: Groundwater Chemistry (Ammonia and EC) vs Time

Figure G3: Groundwater Chemistry (Magnesium and Nitrate) vs Time

Figure G4: Groundwater Chemistry (pH) vs Time

Figure G5: Surface Water Chemistry (Chloride and EC) vs Time

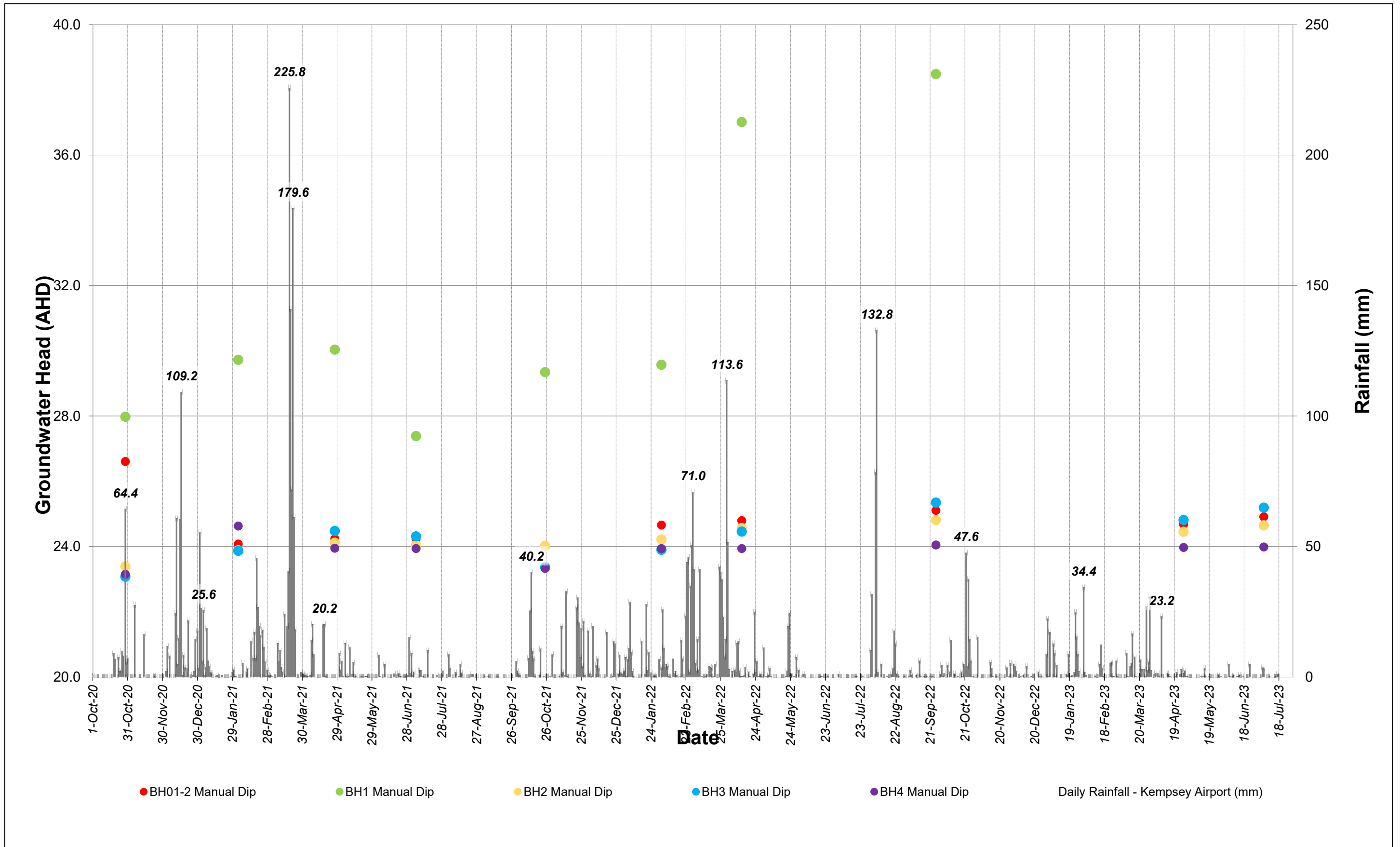
Figure G6: Surface Water Chemistry (Iron and Magnesium) vs Time

Figure G7: Surface Water Chemistry (Manganese and Nitrate) vs Time

Figure G8: Surface Water Chemistry (pH and Potassium) vs Time

Figure G9: Surface Water Chemistry (Sodium and Sulfate) vs Time

Figure G10: Surface Water Chemistry (TSS and TOC) vs Time

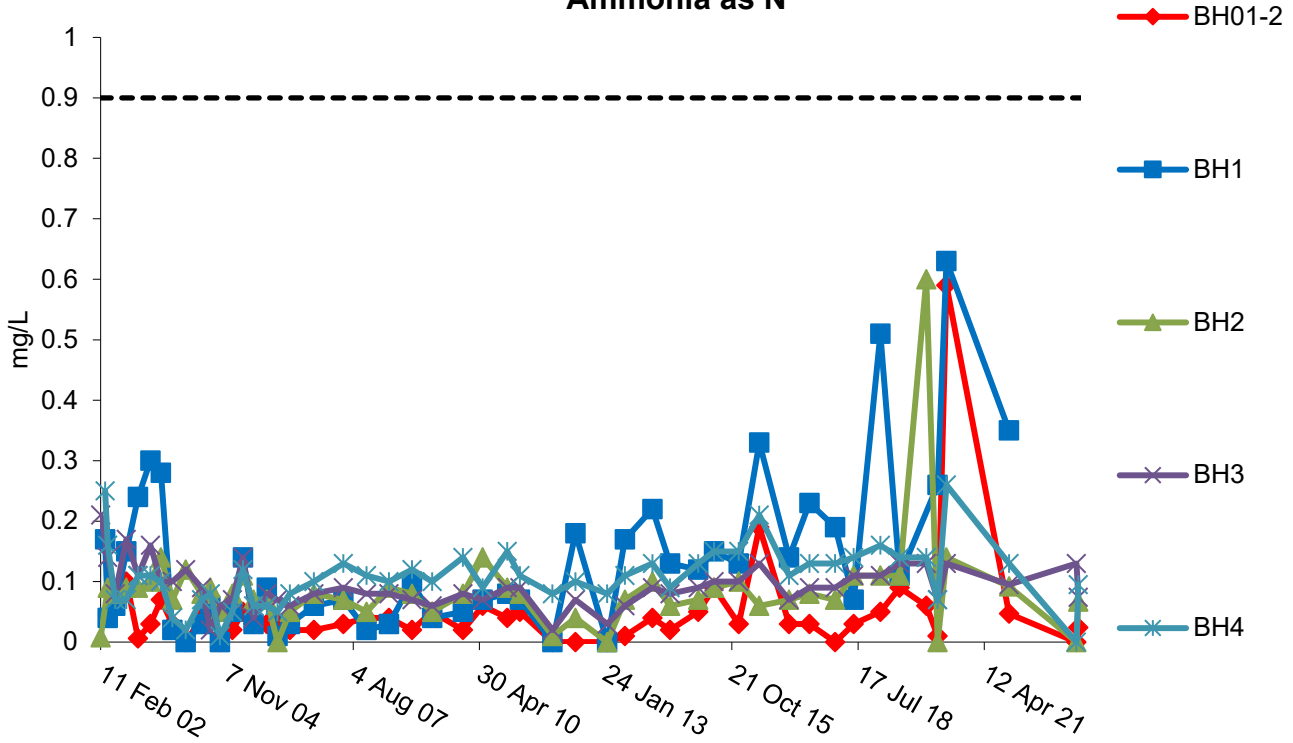


CLIENT: Kempsey Shire Council
 OFFICE: Port Macquarie DRAWN BY: SBK
 SCALE: N/A DATE: 25 July 2023

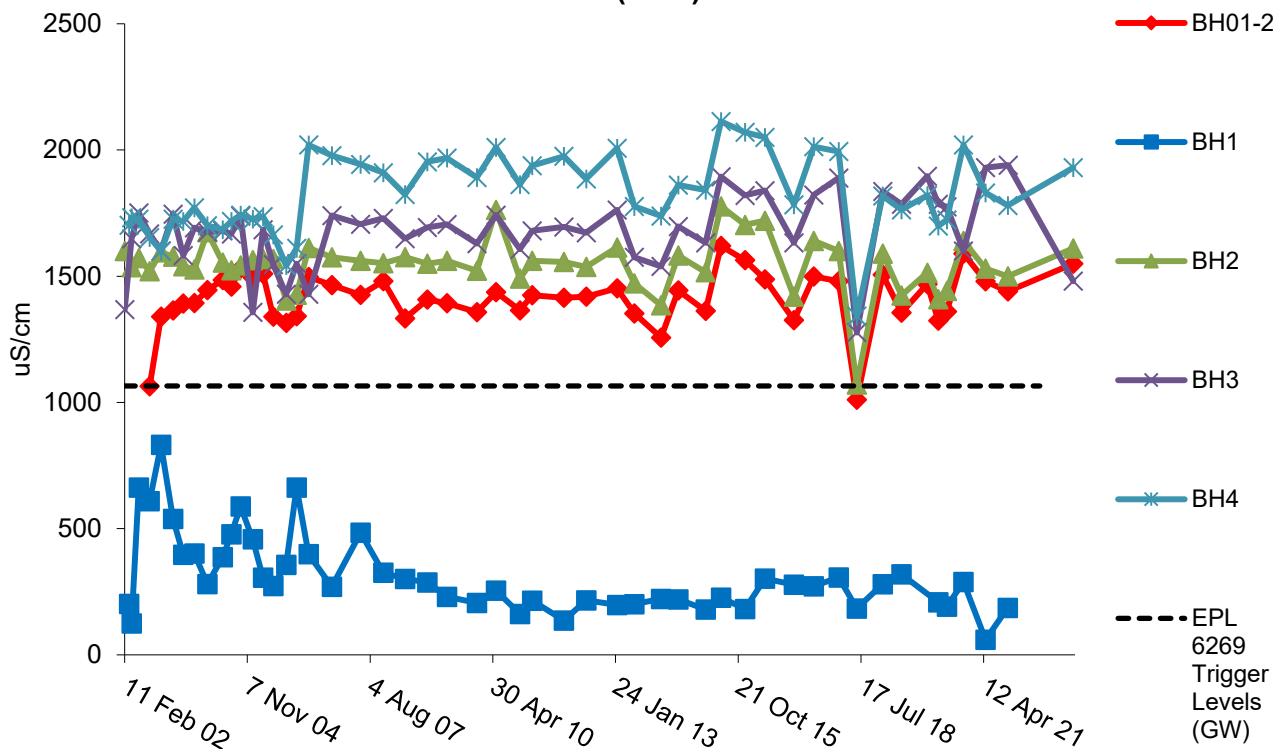
Groundwater Level vs Rainfall (2020 to 2023)
Kempsey Landfill
538 Crescent Head Road, Kempsey

PROJECT NO: 89781.00
 FIGURE NO: G1
 REVISION: 0

Ammonia as N



EC (field)



Groundwater Ammonia Vs Time (Feb 2002 - April 2023)

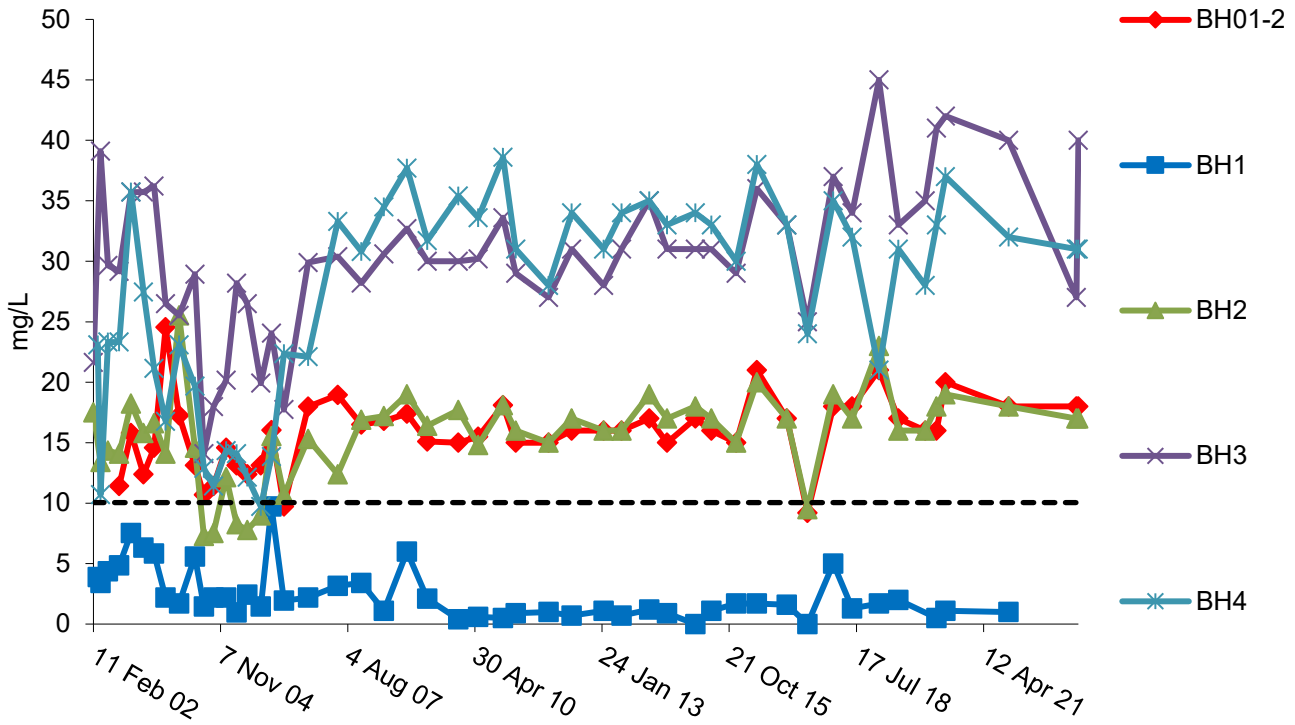
Groundwater EC Vs Time (Feb 2002 - April 2023)

Figure G2

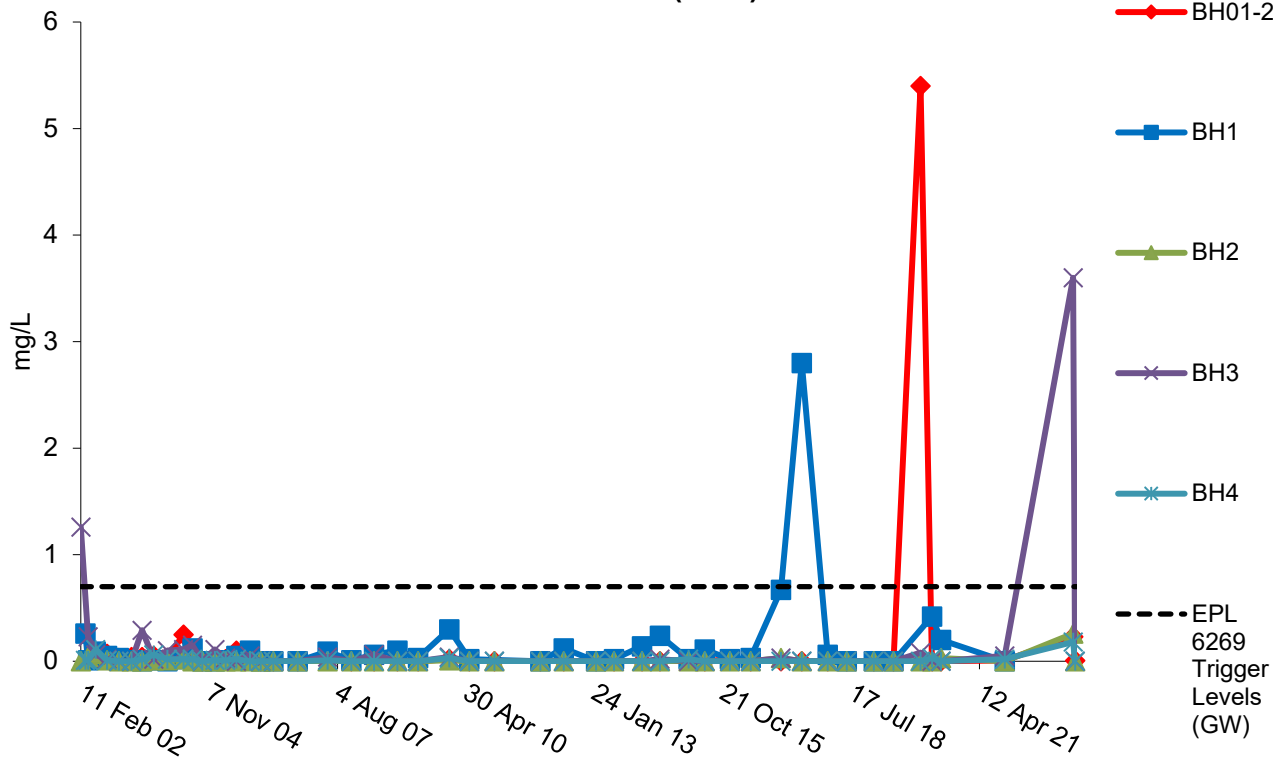
Project No: 89781.00
Kempsey Landfill



Magnesium



Nitrate (as N)



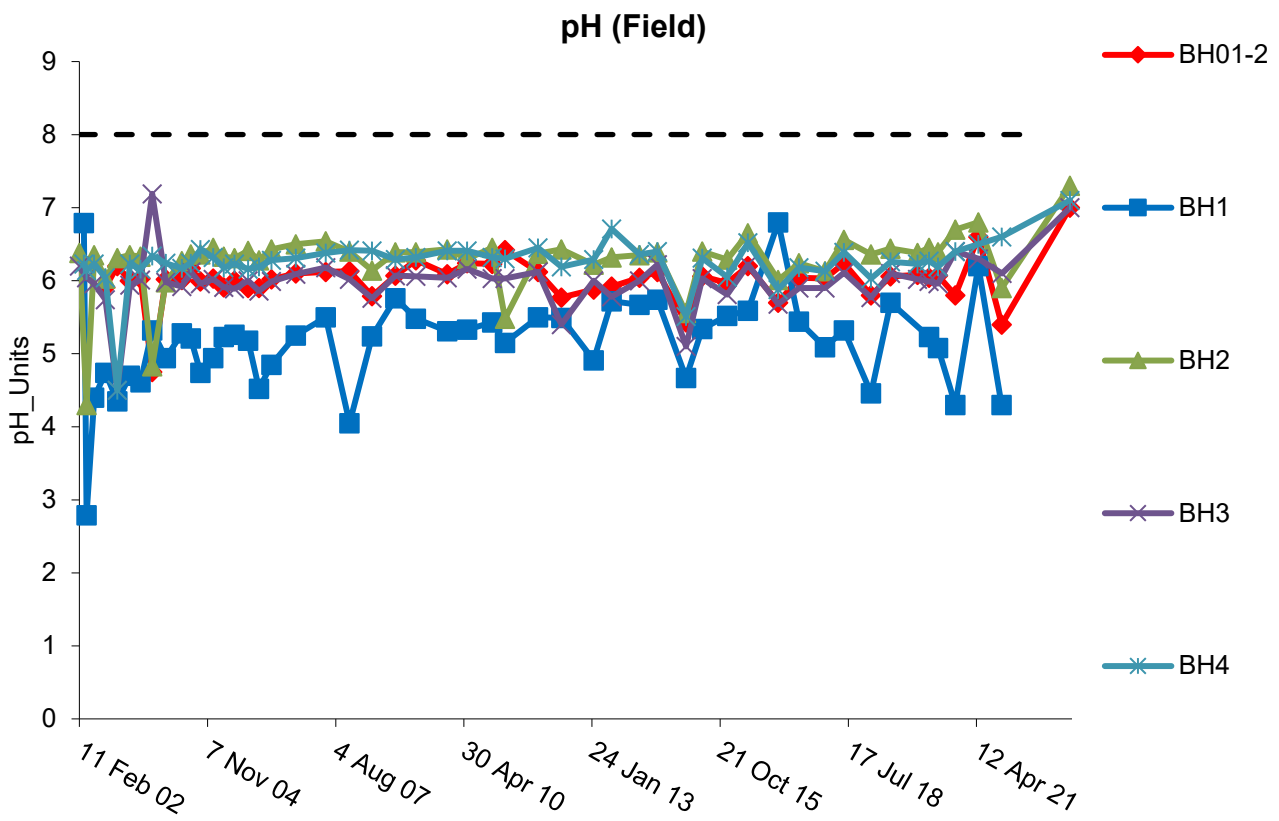
Groundwater Magnesium Vs Time (Feb 2002 - April 2023)

Groundwater Nitrate (as N) Vs Time (Feb 2002 - April 2023)

**Figure
G3**

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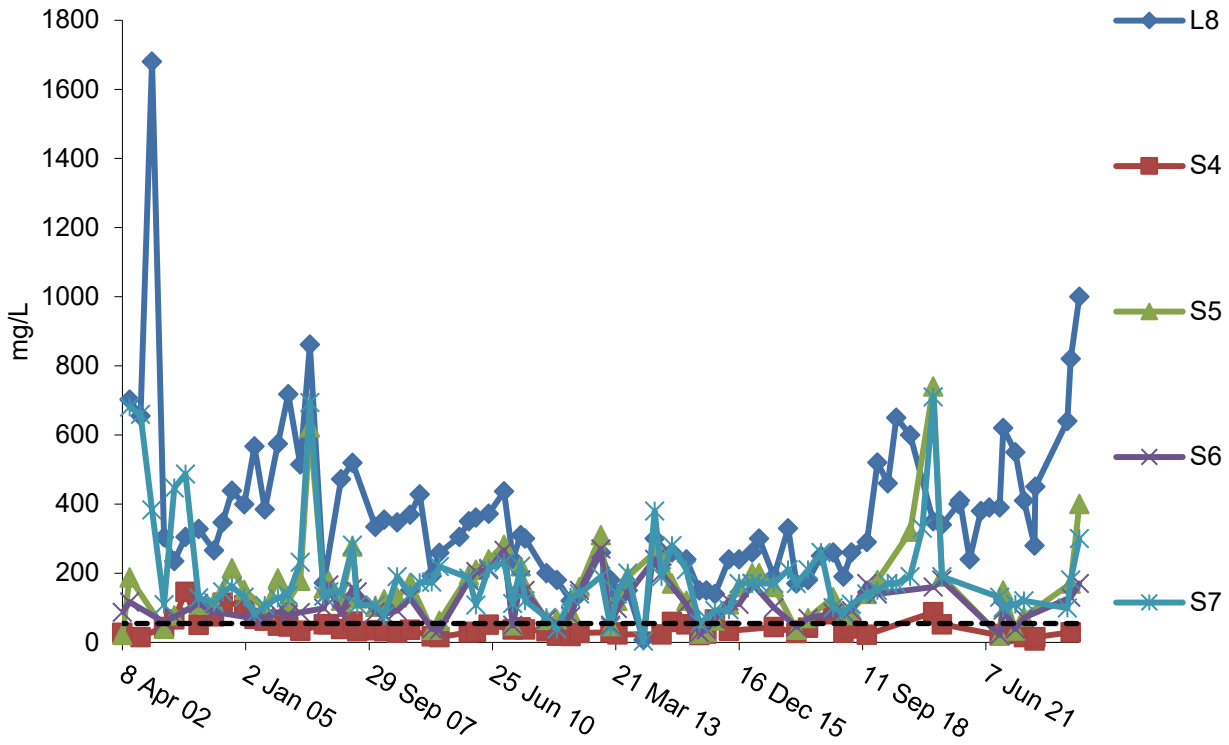
Groundwater pH Vs Time (Feb 2002 - April 2023)

**Figure
G4**

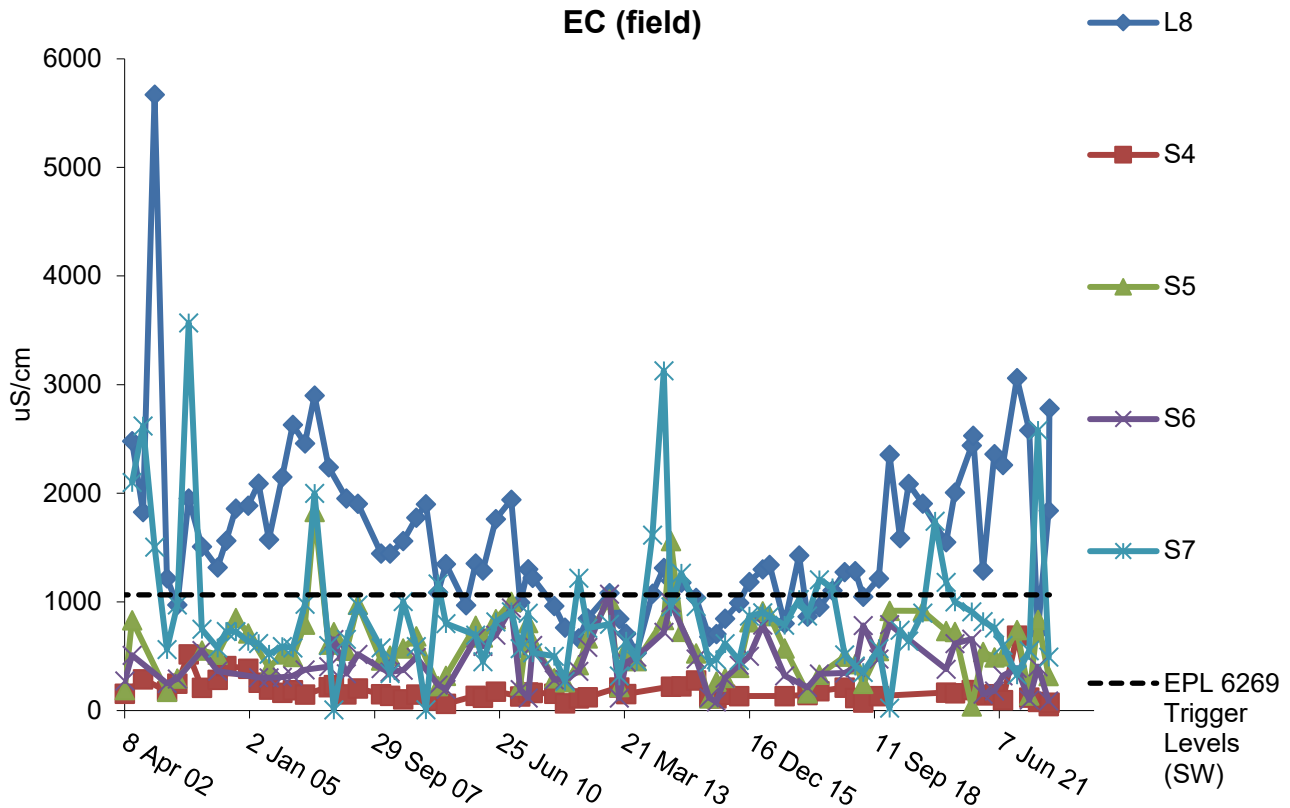
Project No: 89781.00
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Chloride



EC (field)



Surface Water Chloride Vs Time (Feb 2002 - July 2023)

Surface Water EC Vs Time (Feb 2002 - July 2023)

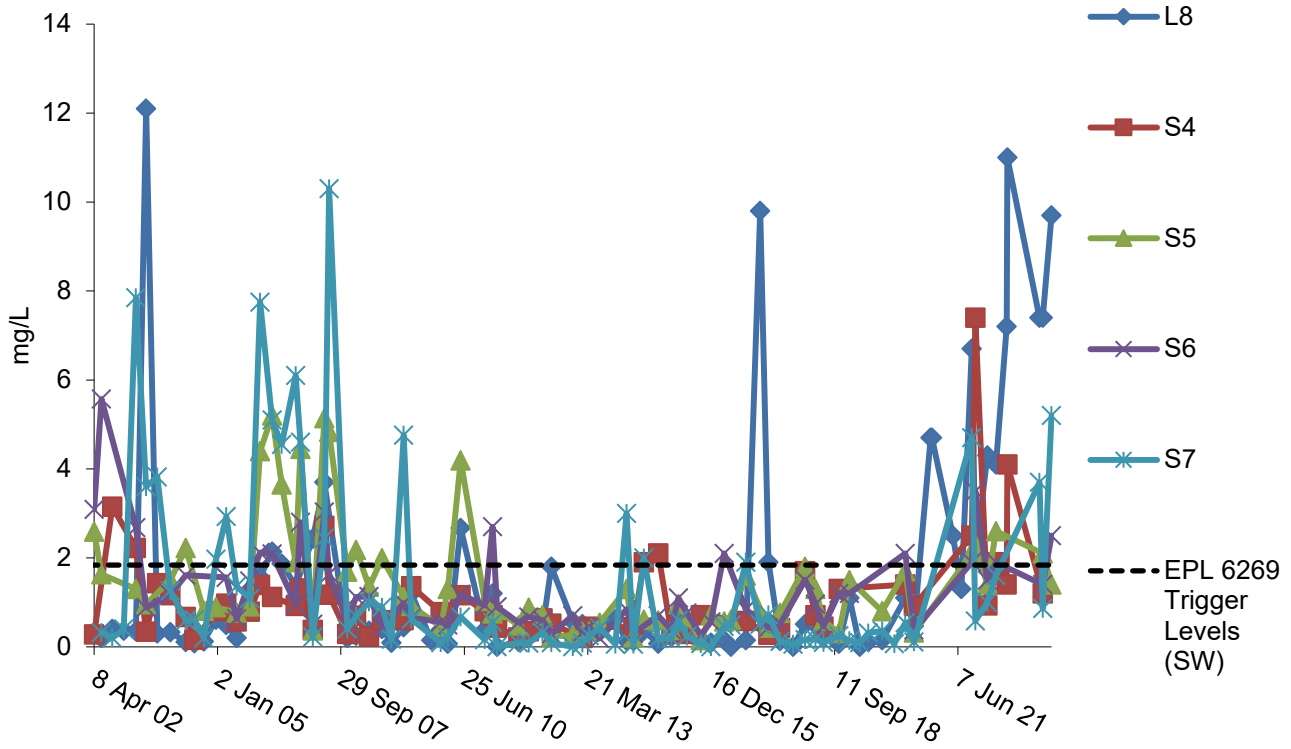
**Figure
G5**

**Project No: 89781.00
Kempsey Landfill**

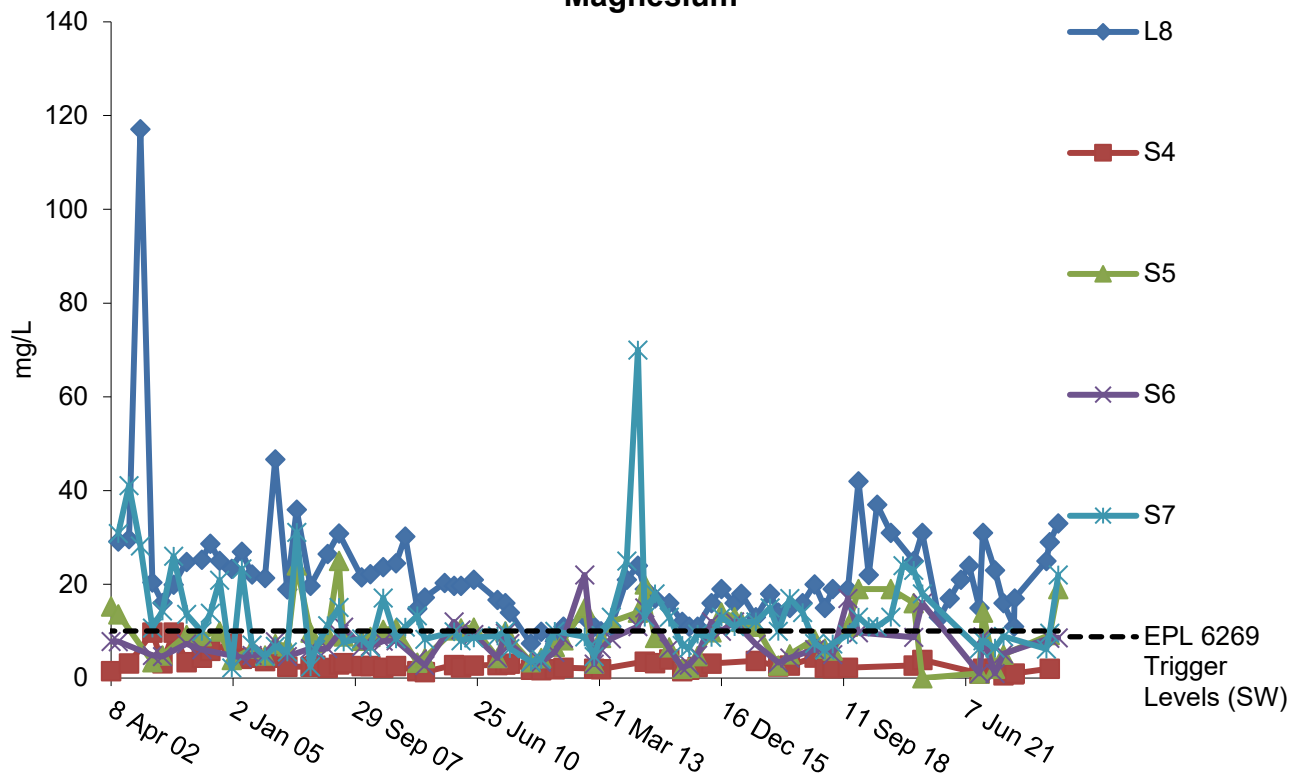


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Iron



Magnesium



Surface Water Iron Vs Time (Feb 2002 - July 2023)

Surface Water Magnesium Vs Time (Feb 2002 - July 2023)

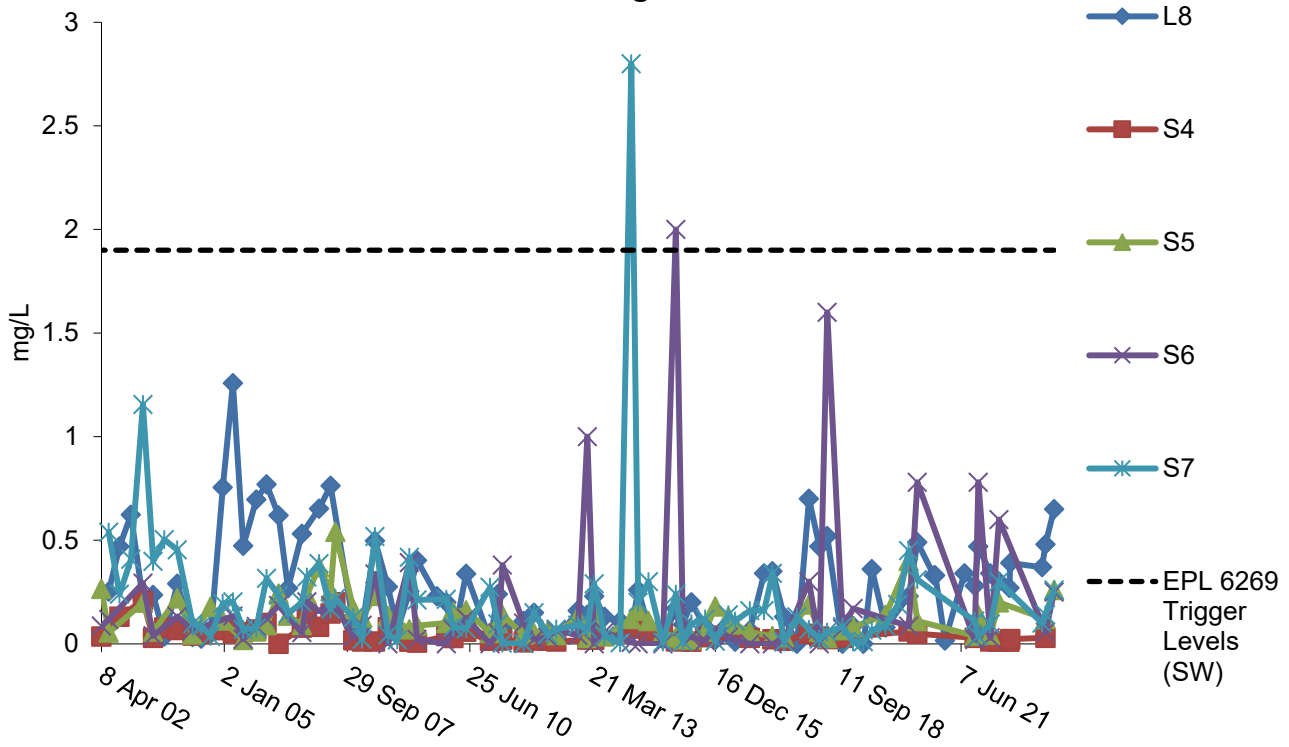
**Figure
G6**

Project No: 89781.00
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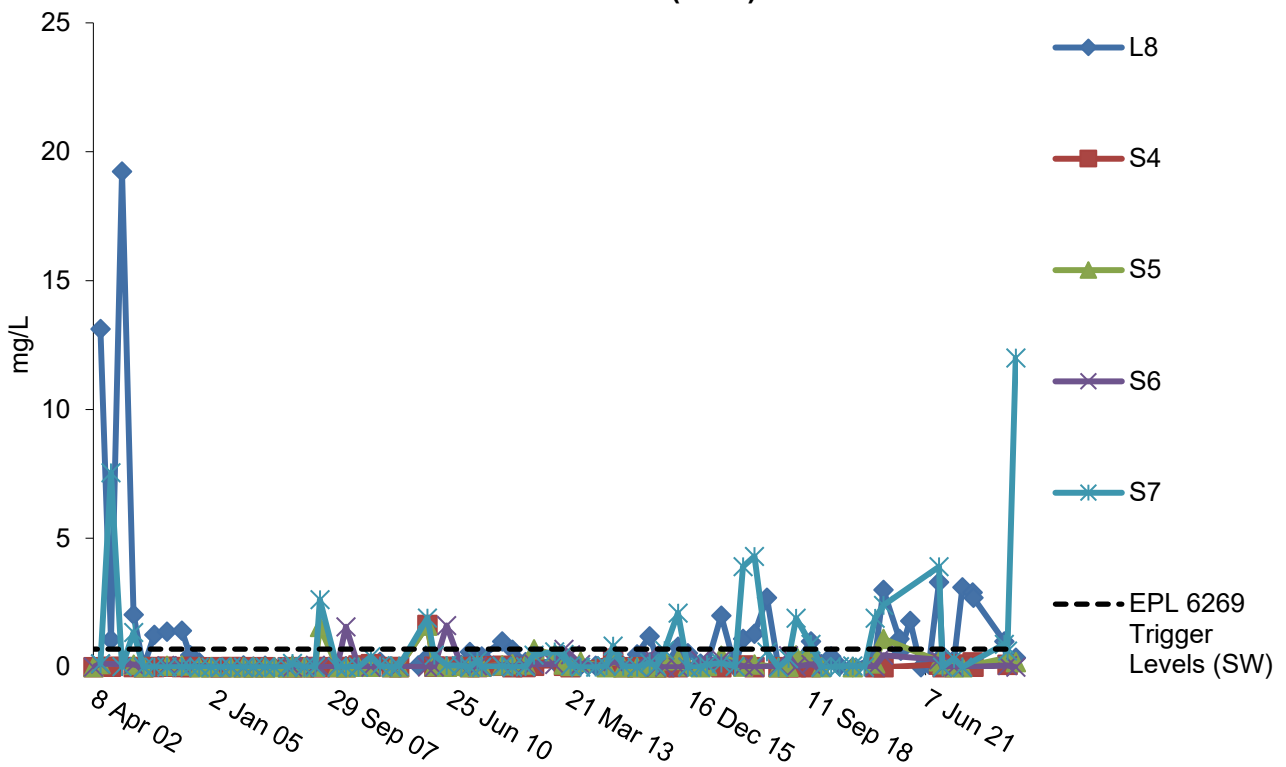


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Manganese



Nitrate (as N)



Surface Water Manganese Vs Time (Feb 2002 - July 2023)

Surface Water Nitrate (as N) Vs Time (Feb 2002 - July 2023)

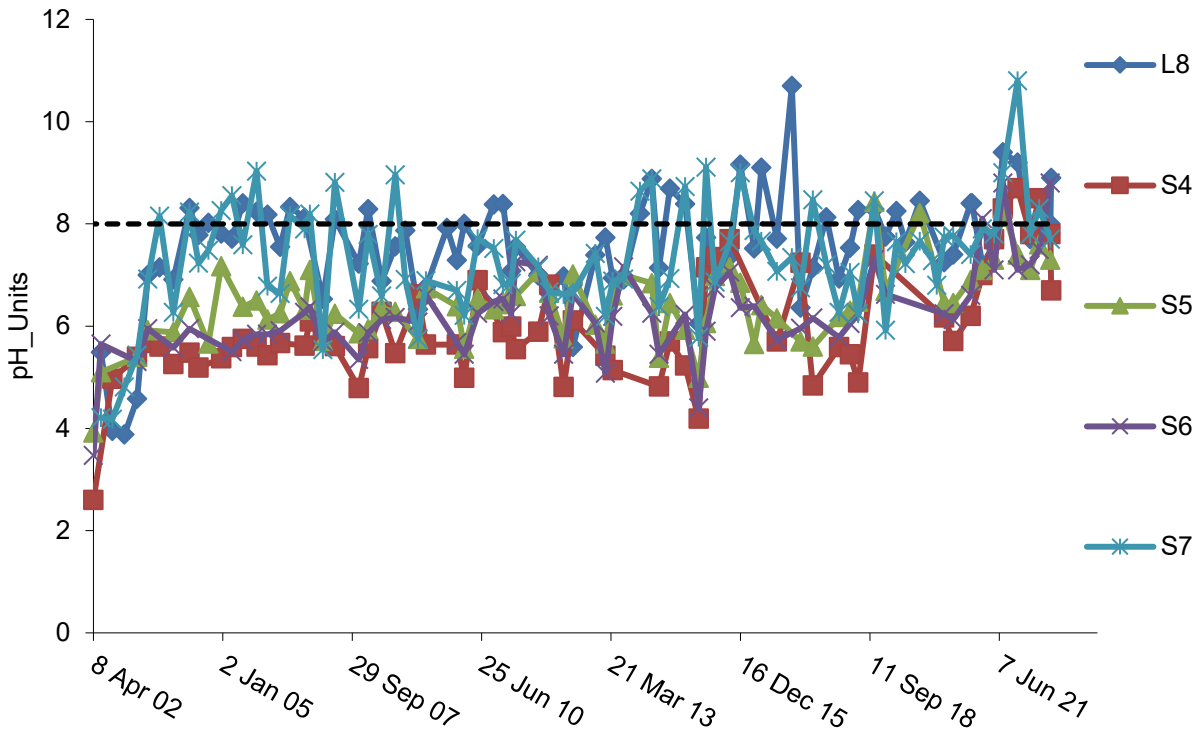
**Figure
G7**

**Project No: 89781.00
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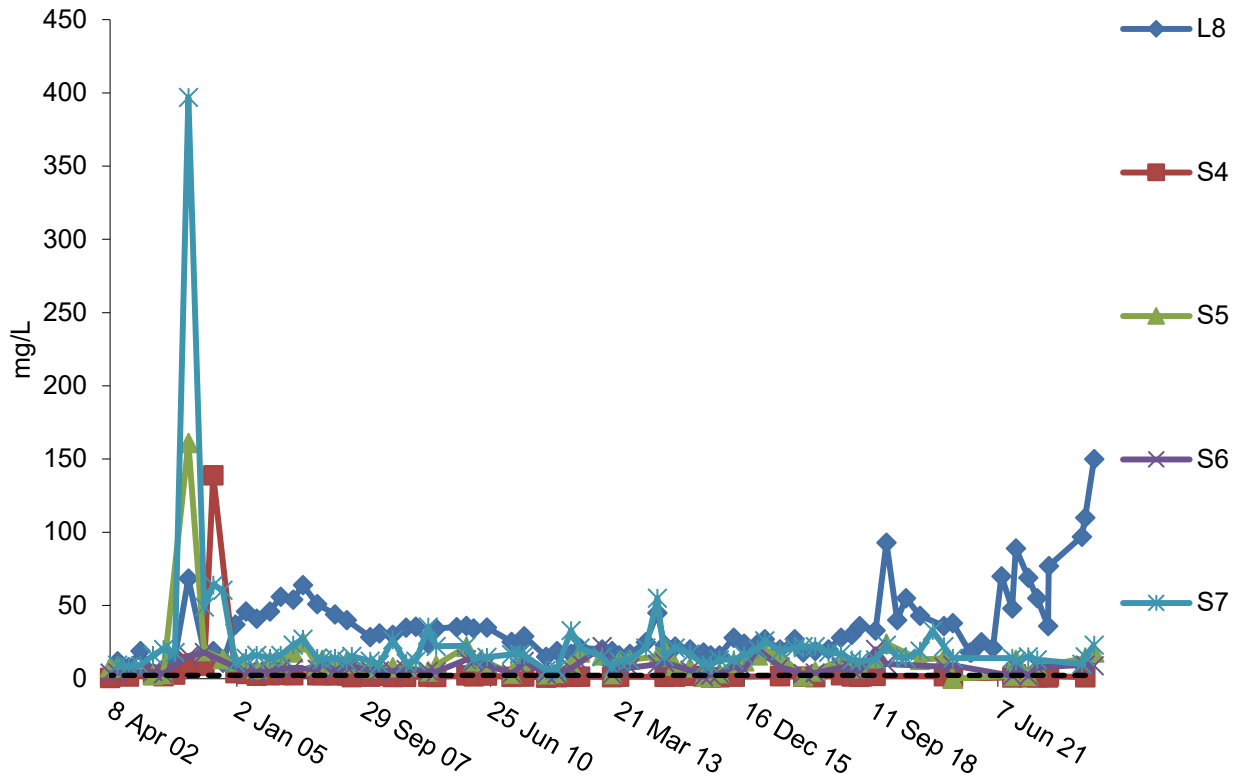


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pH (Field)



Potassium



Surface Water pH Vs Time (Feb 2002 - July 2023)

Surface Water Potassium Vs Time (Feb 2002 - July 2023)

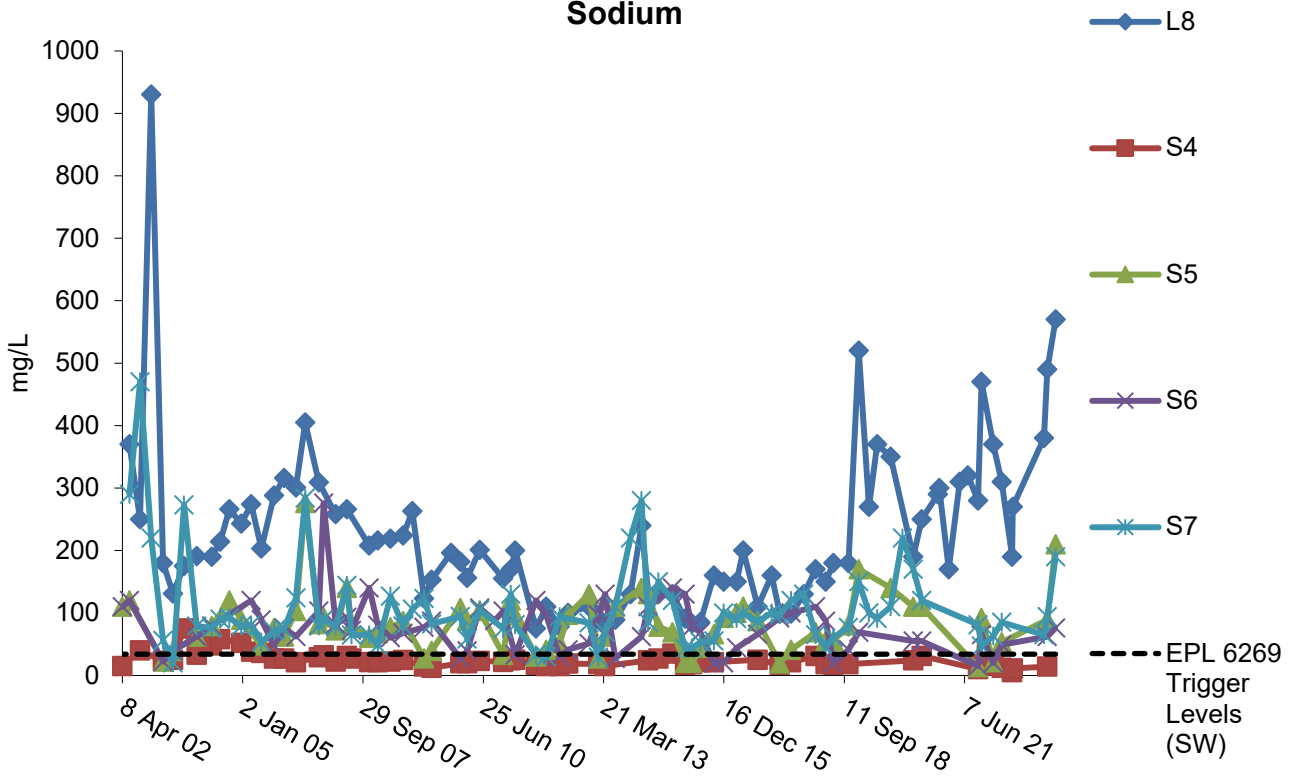
**Figure
G8**

**Project No: 89781.00
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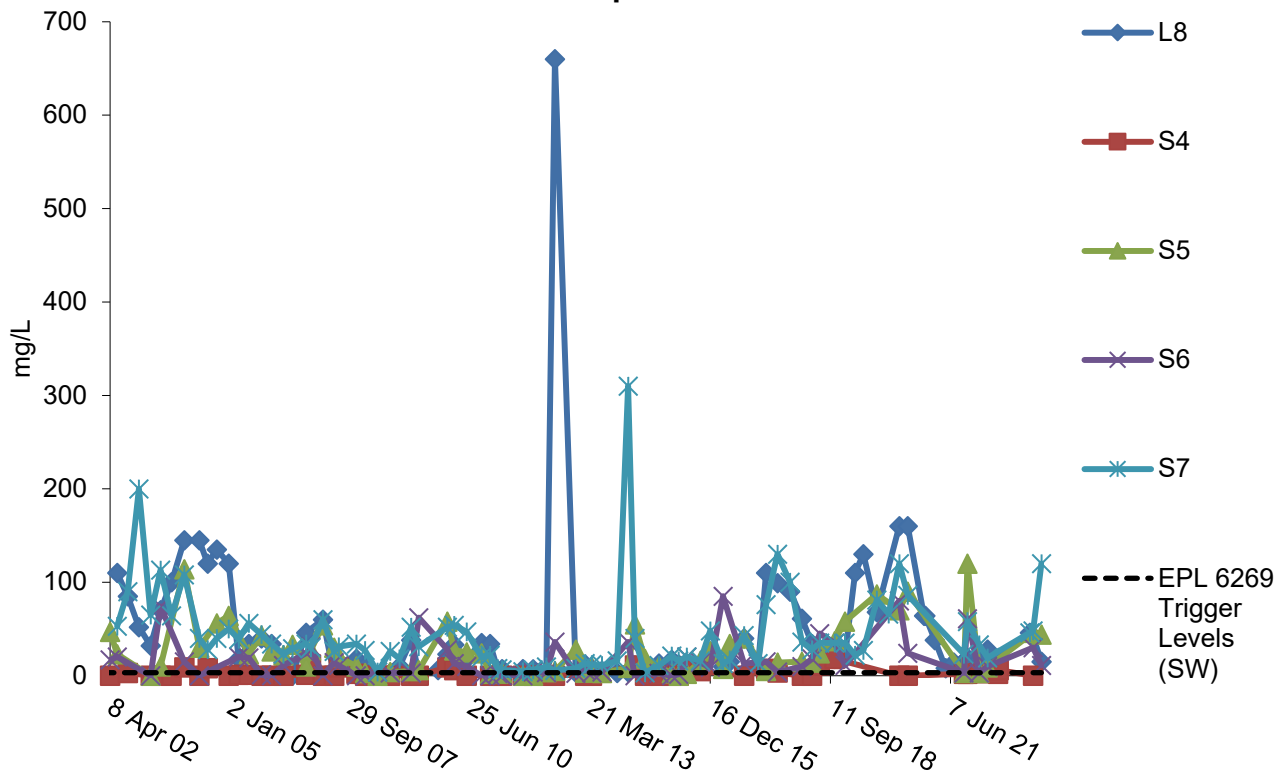


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Sodium



Sulphate



Surface Water Sodium Vs Time (Feb 2002 - July 2023)

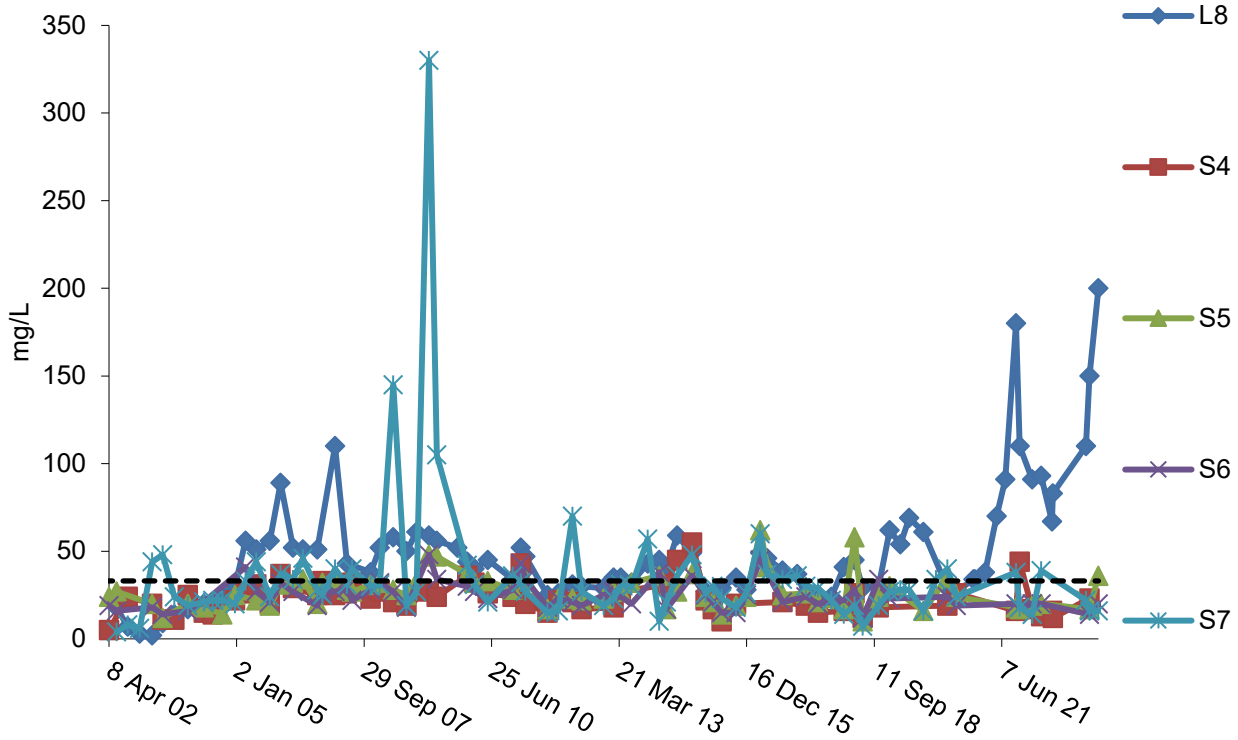
Surface Water Sulfate Vs Time (Feb 2002 - July 2023)

**Figure
G9**

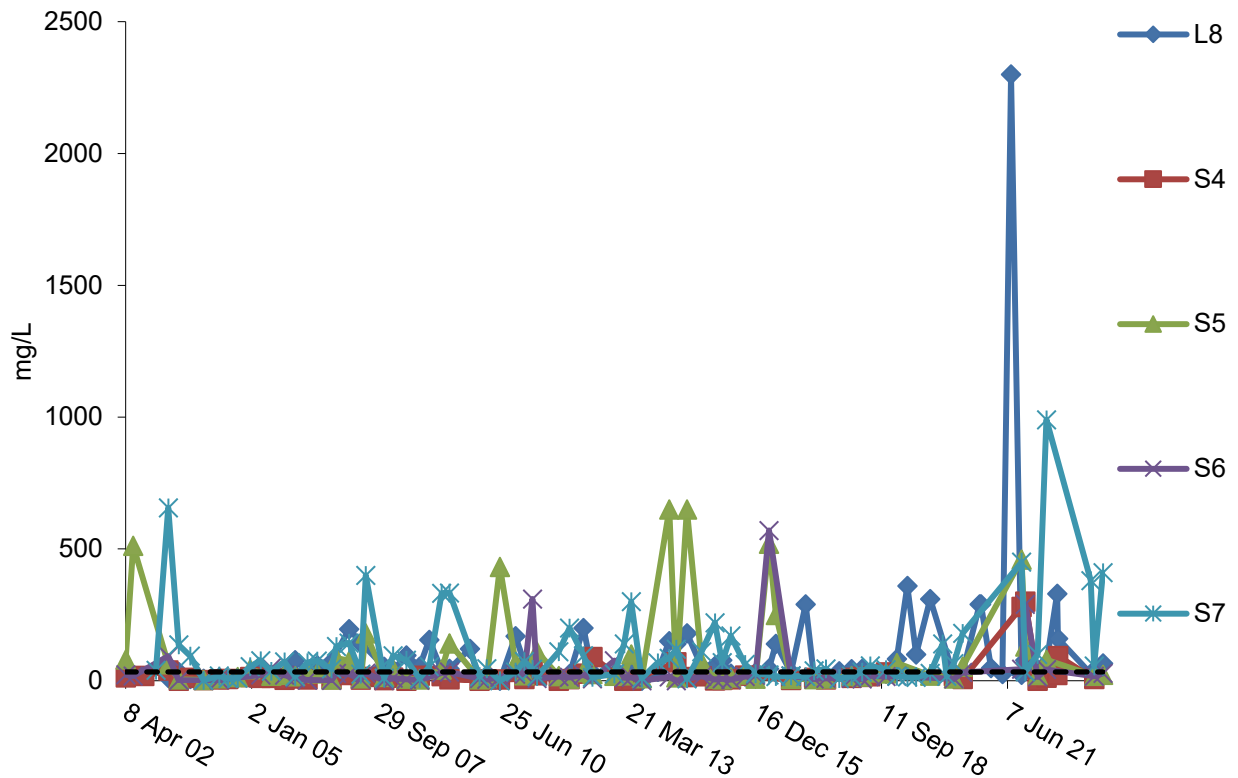
**Project No: 89781.00
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TOC



TSS



Surface Water TOC Vs Time (Feb 2002 - July 2023)

Surface Water TSS Vs Time (Feb 2002 - July 2023)

Figure G10

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Appendix H

Appendix H: Tabulated Annual Return Data

Table H1: Annual Return Reporting Values for Monitoring Point 1 (BH1)
(2022 to 2023)

Table H2: Annual Return Reporting Values for Monitoring Point 2 (BH2)
(2022 to 2023)

Table H3: Annual Return Reporting Values for Monitoring Point 3 (BH3)
(2022 to 2023)

Table H4: Annual Return Reporting Values for Monitoring Point 4 (S4)
(2022 to 2023)

Table H5: Annual Return Reporting Values for Monitoring Point 5 (S5)
(2022 to 2023)

Table H6: Annual Return Reporting Values for Monitoring Point 6 (S6)
(2022 to 2023)

Table H7: Annual Return Reporting Values for Monitoring Point 7 (S7)
(2022 to 2023)

Table H8: Annual Return Reporting Values for Monitoring Point 8 (L8)
(2022 to 2023)

Table H9: Annual Return Reporting Values for Monitoring Point 9
(Methane Buildings) (2022 to 2023)

Table H10: Annual Return Reporting Values for Monitoring Point 10
(Methane Surface) (2022 to 2023)

Table H11: Annual Return Reporting Values for Monitoring Point 11
(Methane in Groundwater Bores) (2022 to 2023)

Table H12: Annual Return Reporting Values for Monitoring Point 12
(BH4) (2022 to 2023)

Table H13: Annual Return Reporting Values for Monitoring Point 14
(BH01-2) (2022 to 2023)

Table H1: Annual Return Reporting Values for Monitoring Point 1 (BH1) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Ammonia	mg/l	0	-	-	-	Within historical data and below trigger level
Conductivity	µS/cm	0	-	-	-	Within historical data and below trigger level
Magnesium	mg/l	0	-	-	-	Within historical data and below trigger level
Nitrate	mg/l	0	-	-	-	Within historical data and below trigger level
pH	pH	0	-	-	-	Fluctuating as per historical data
Standing Water Level	AHD	2	38.485	44.325	50.165	Water level has increased and is within historical data
Temperature	°C	0	-	-	-	Consistent with historical data

Table H2: Annual Return Reporting Values for Monitoring Point 2 (BH2) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Ammonia	mg/l	1	0.077	0.077	0.077	Decreased and are within historical data and trigger levels
Conductivity	µS/cm	2	916	1278	1640	Consistent with historical data and exceed trigger levels
Magnesium	mg/l	1	15.0	15.0	15.0	Consistent with historical data and exceed trigger levels
Nitrate	mg/l	1	0.04	0.040	0.040	Slightly increased, within historical data and below trigger levels
pH	pH	2	6.4	6.6	6.7	Slightly increased, within trigger levels
Standing Water Level	AHD	3	24.455	24.640	24.816	Slightly increased and within historical data
Temperature	°C	2	18.10	18.71	19.31	Consistent with historical data

Table H3: Annual Return Reporting Values for Monitoring Point 3 (BH3) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Ammonia	mg/l	1	0.090	0.090	0.090	Within historical data and below trigger level
Conductivity	µS/cm	2	1120	1575	2030	Slightly decreased, below historical data and within trigger levels
Magnesium	mg/l	1	33.0	33.0	33.0	Within historical data and above trigger level
Nitrate	mg/l	1	0.01	0.010	0.010	Elevated (possible spurious), exceed trigger level
pH	pH	2	5.8	5.8	5.9	Slightly increased, within trigger levels
Standing Water Level	AHD	3	24.816	25.118	25.349	Slightly increased, within historical data
Temperature	°C	2	20.90	20.95	21.00	Consistent with historical data

Table H4: Annual Return Reporting Values for Monitoring Point 4 (S4) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Alkalinity (As Calcium Carbonate)	mg/l	1	12.0	12	12.0	Average slightly exceeding trigger level
Ammonia	mg/l	1	0.017	0.017	0.017	Within historical data and below trigger level
Calcium	mg/l	1	0.5	0.5	0.5	Within historical data and below trigger level
Chloride	mg/l	1	13	13	13	Within historical data and below trigger level
Conductivity	µS/cm	2	71	71	71	Within historical data and below trigger level
Dissolved Oxygen	mg/l	2	2.55	6.07	9.58	Slightly increasing, average above trigger level
Fluoride	mg/l	1	0.1	0.1	0.1	Within historical data and below trigger level
Iron (Filtered)	mg/l	2	0.42	0.50	0.57	Elevated result for Q1, within historical data
Magnesium	mg/l	1	1.0	1.0	1.0	Within historical data and below trigger level
Manganese (Filtered)	mg/l	2	0.007	0.013	0.018	Within historical data and below trigger level
Nitrate	mg/l	1	0.01	0.01	0.010	Within historical data and below trigger level
pH	pH	2	5.4	5.9	6.4	Slightly increasing, average above trigger level
Potassium	mg/l	1	0.9	0.9	0.9	Within historical data and below trigger level
Sodium	mg/l	1	10	10.0	10.0	Within historical data and below trigger level
Sulfate	mg/l	2	1	1.5	2	Within historical data and below trigger level
Temperature	°C	2	15.22	17.02	18.81	Consistent with historical data
Total Organic Carbon	mg/l	1	16	16	16	Within historical data and average below trigger level
Total Phenolics	mg/l	2	0.05	0.05	0.05	Within historical data and below trigger level
Total Suspended Solids	mg/l	1	280	280	280	Elevated result for Q1, within historical data for Q3 and Q4

Table H5: Annual Return Reporting Values for Monitoring Point 5 (S5) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Alkalinity (As Calcium Carbonate)	mg/l	2	15.0	34.0	53.0	Average exceeding trigger level
Ammonia	mg/l	2	0.18	0.790	1.400	Within historical data, Q3 and Q4 exceed trigger level
Calcium	mg/l	2	2.0	17.0	32.0	Within historical data, Q1, Q3 and Q4 exceeds trigger level
Chloride	mg/l	2	19	210	400	Within historical data, Q1 and Q3 exceeds trigger level
Conductivity	µS/cm	4	113	597	1410	Within historical data and below trigger level
Dissolved Oxygen	mg/l	4	0.90	3.74	7.80	Within historical data, Q4 exceeds trigger level
Fluoride	mg/l	3	0.1	0.1	0.1	Within historical data and below trigger level
Iron (Filtered)	mg/l	4	0.00	0.25	0.49	Within historical data and below trigger level
Magnesium	mg/l	2	1.0	10.0	19.0	Within historical data, Q1 exceeds trigger level
Manganese (Filtered)	mg/l	4	0.000	0.082	0.220	Within historical data and below trigger level
Nitrate	mg/l	2	0.2	0.215	0.230	Within historical data and below trigger level
pH	pH	4	6.2	6.8	7.6	Within historical data
Potassium	mg/l	2	2.0	10.0	18.0	Within historical data, Q1, Q3 and Q4 exceeds trigger level
Sodium	mg/l	2	13.0	111.5	210.0	Within historical data, Q1 and Q3 exceeds trigger level
Sulfate	mg/l	2	3	23.5	44	Average exceeding trigger level
Temperature	°C	4	12.25	17.36	24.02	Consistent with historical data
Total Organic Carbon	mg/l	2	18	27	36	Within historical data and below trigger level
Total Phenolics	mg/l	4	0.05	0.05	0.05	Within historical data and below trigger level
Total Suspended Solids	mg/l	2	23	242	460	Within historical data, Q1, Q3 and Q4 exceeds trigger level

Table H6: Annual Return Reporting Values for Monitoring Point 6 (S6) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Alkalinity (As Calcium Carbonate)	mg/l	2	16.0	20.0	24.0	Within historical data, Q1, Q2 and Q3 exceed trigger level
Ammonia	mg/l	2	0.017	0.114	0.210	Within historical data, Q3 exceeds trigger level
Calcium	mg/l	2	2.0	7.0	12.0	Within historical data, Q1 and Q3 exceeds trigger level
Chloride	mg/l	2	21	95.5	170	Within historical data, Q1 and Q3 exceeds trigger level
Conductivity	µS/cm	3	121	366	617	Within historical data and below trigger level
Dissolved Oxygen	mg/l	3	0.40	2.59	5.60	Within historical data and below trigger level
Fluoride	mg/l	2	0.1	0.1	0.1	Within historical data and below trigger level
Iron (Filtered)	mg/l	3	0.26	0.47	0.67	Within historical data
Magnesium	mg/l	2	1.0	4.6	8.1	Within historical data and below trigger level
Manganese (Filtered)	mg/l	3	0.014	0.079	0.180	Within historical data and below trigger level
Nitrate	mg/l	2	0.005	0.148	0.290	Within historical data and below trigger level
pH	pH	3	6.2	6.5	6.8	Within historical data, Q4 exceeds trigger level
Potassium	mg/l	2	2.0	5.5	8.9	Within historical data, Q1, Q3 and Q4 exceeds trigger level
Sodium	mg/l	2	15	45.5	76.0	Within historical data, Q1 and Q3 exceeds trigger level
Sulfate	mg/l	2	3	7	11	Within historical data, Q1 and Q3 exceeds trigger level
Temperature	°C	3	12.56	15.35	19.00	Consistent with historical data
Total Organic Carbon	mg/l	2	18	19	20	Within historical data and below trigger level
Total Phenolics	mg/l	3	0.05	0.05	0.05	Within historical data and below trigger level
Total Suspended Solids	mg/l	2	16	30	44	Within historical data, Q1 and Q4 exceeds trigger level

Table H7: Annual Return Reporting Values for Monitoring Point 7 (S7) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Alkalinity (As Calcium Carbonate)	mg/l	3	39.0	58.0	85.0	Within historical data and exceeds trigger level
Ammonia	mg/l	3	0.510	2.740	6.800	Within historical data, Q3 and Q4 exceeds trigger level
Calcium	mg/l	3	16.0	25.3	41.0	Within historical data and exceeds trigger level
Chloride	mg/l	3	99	176	300	Within historical data and exceeds trigger level
Conductivity	µS/cm	5	402	1139	2310	Within historical data, Q3 elevated and exceeds trigger level
Dissolved Oxygen	mg/l	5	0.92	5.86	9.92	Within historical data, Q2, Q3 and Q4 exceeds trigger level
Fluoride	mg/l	3	0.1	0.1	0.1	Within historical data and below trigger level
Iron (Filtered)	mg/l	4	0.02	10.15	40.00	Within historical data and within trigger level
Magnesium	mg/l	3	6.2	11.5	22.0	Within historical data
Manganese (Filtered)	mg/l	4	0.012	16.823	67.000	Within historical data and below trigger level
Nitrate	mg/l	3	0.890	5.597	12.000	Within historical data
pH	pH	5	7.1	8.3	9.7	Within historical data, Q1 and Q3 exceeds trigger level
Potassium	mg/l	3	10.0	15.7	23.0	Within historical data and exceeds trigger level
Sodium	mg/l	3	65.0	112.0	190.0	Within historical data and exceeds trigger level
Sulfate	mg/l	3	23	63	120	Within historical data and exceeds trigger level
Temperature	°C	5	11.20	20.85	30.52	Consistent with historical data
Total Organic Carbon	mg/l	3	16	25	38	Within historical data, Q3 and Q4 exceeds trigger level
Total Phenolics	mg/l	5	0.05	0.05	0.05	Within historical data and below trigger level
Total Suspended Solids	mg/l	3	380	413	450	Q1 and Q2 within historical data, exceeds trigger level and Q3 and Q4 elevated

Table H8: Annual Return Reporting Values for Monitoring Point 8 (L8) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Alkalinity (As Calcium Carbonate)	mg/l	3	530.0	756.7	1200.0	Within historical data and exceeds trigger level
Ammonia	mg/l	3	71.000	90.333	120.000	Within historical data and exceeds trigger level
Calcium	mg/l	3	27.0	41.3	55.0	Within historical data and exceeds trigger level
Chloride	mg/l	3	390	677	1000	Within historical data and exceeds trigger level
Conductivity	µS/cm	5	1000	3320	5130	Within historical data, Q1, Q2 and Q4 exceeds trigger level
Dissolved Oxygen	mg/l	5	1.60	3.96	8.46	Within historical data, Q2 and Q4 exceeds trigger level
Fluoride	mg/l	3	0.1	0.1	0.2	Within historical data and below trigger level
Iron (Filtered)	mg/l	5	0.01	1484.40	7400.00	Within historical data, Q2, Q3 and Q4 exceeds trigger level
Magnesium	mg/l	3	15.0	24.3	33.0	Within historical data and exceeds trigger level
Manganese (Filtered)	mg/l	5	0.000	74.236	370.000	Within historical data and below trigger level
Nitrate	mg/l	3	0.370	1.557	3.300	Within historical data and Q3 and Q4 exceeds trigger level
pH	pH	5	6.8	7.8	8.3	Within historical data, Q1 and Q4 exceeds trigger level
Potassium	mg/l	3	48.0	98.3	150.0	Within historical data and exceeds trigger level
Sodium	mg/l	3	280.0	410.0	570.0	Within historical data and exceeds trigger level
Sulfate	mg/l	3	15	25	46	Within historical data and exceeds trigger level
Temperature	°C	5	13.31	21.32	29.88	Consistent with historical data
Total Organic Carbon	mg/l	3	110	163	200	Within historical data and exceeds trigger level
Total Phenolics	mg/l	5	0.05	0.05	0.05	Within historical data and below trigger level
Total Suspended Solids	mg/l	3	23	39	66	Within historical data, Q1, Q3 and Q4 exceeds trigger level

Table H9: Annual Return Reporting Values for Monitoring Point 9 (Methane Buildings) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Methane	%	100	0.000001	0.000003	0.000017	No exceedances recorded

Table H10: Annual Return Reporting Values for Monitoring Point 10 (Methane Surface) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Methane	%	462	0.000001	0.000061	0.010099	Total of 5 localised exceedances (1 in Q1, 1 in Q3 and 3 in Q4)

Table H11: Annual Return Reporting Values for Monitoring Point 11 (Methane in Groundwater Bores) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Methane	%	15	0.000000	0.000000	0.000000	No exceedances recorded

Table H12: Annual Return Reporting Values for Monitoring Point 12 (BH4) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Ammonia	mg/l	1	0.110	0.110	0.110	Slightly decreased, within historical data and below trigger level
Conductivity	µS/cm	2	1110	1555	2000	Slightly increased, within historical data and exceed trigger level
Magnesium	mg/l	1	29.0	29.0	29.0	Slightly decreased, within historical data and exceed trigger level
Nitrate	mg/l	1	0.01	0.01	0.01	Slightly increased, within historical data and below trigger level
pH	pH	2	5.4	5.8	6.3	Slightly increased, below trigger level
Standing Water Level	AHD	3	23.973	24.003	24.048	Slightly increased, within historical data
Temperature	°C	2	19.00	21.25	23.50	Consistent with historical data

Table H13: Annual Return Reporting Values for Monitoring Point 14 (BH01-2) (2022 to 2023)

Analyte	Units	Annual Return Reporting Values				Comments
		Qty	Lowest Sample Value	Mean of Sample	Highest Sample Value	
Ammonia	mg/l	1	0.031	0.031	0.031	Slightly decreased, within historical data and below trigger level
Conductivity	µS/cm	2	900	990	1080	Slightly increased, within historical data and exceed trigger level
Magnesium	mg/l	1	17.0	17.0	17.0	Slightly decreased, within historical data and exceed trigger level
Nitrate	mg/l	1	0.03	0.03	0.03	Slightly increased, within historical data and below trigger level
pH	pH	2	5.3	5.5	5.6	Slightly increased, below trigger level
Standing Water Level	AHD	3	24.676	24.899	25.107	Slightly increased, within historical data
Temperature	°C	2	18.00	18.67	19.33	Consistent with historical data