



ANNUAL ENVIRONMENTAL MONITORING REPORT (AEMR) OCTOBER 2021

**DUNMORE RECYCLING & WASTE DEPOT
44 BUCKLEYS ROAD,
DUNMORE, NSW, 2529**

ENVIRONMENT PROTECTION LICENCE (EPL) 5984

Prepared For: **Shellharbour City Council**
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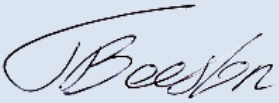

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The project was conducted through close liaison with Shellharbour City Council (SCC) and ALS Environmental.

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EXECUTIVE SUMMARY

Environment & Natural Resource Solutions (ENRS Pty Ltd) were commissioned as independent environmental consultants by *ALS Environmental* (Wollongong) on behalf of *Shellharbour City Council* (SCC) to prepare the Annual Environmental Monitoring Report (AEMR) for the Dunmore Recycling and Waste Depot (*herein referred to as the Site*).

This (AEMR) summarises the results of field testing and laboratory analysis conducted by ALS for the 2020-2021 monitoring period, and provides the necessary data assessment and analysis to meet requirements of the Site's Environment Protection Licence/s (EPL's); No.5984 and No.12903.

The Site was established in 1945 and has been managed by Shellharbour Council (SC) since 1983. The Site accepts putrescible and non-putrescible waste within its managed landfill cell. Recycling activities conducted at the site include Resource Recovery Centre, Revolve Centre and Food Organics and garden Organics (FOGO) processing.

Waste regulation in NSW is administered by the EPA under the Protection of the Environment Operations (POEO) Act (1997); the *Waste Avoidance and Resource Recovery Act* (2001).

The Site operates under the conditions of two (2) EPLs:

- **EPL No. 5984.** Landfill activities. Consisting of; extractive activities, waste disposal and composting.
- **EPL No. 12903.** Resource recovery activities. Consisting of; composting and waste storage within the FOGO Facilities and Resource Recovery Centre.

A copy of the relevant EPL sections outlining the sampling requirements are provided in **Appendix A** (EPL No. 5984). ENRS note that EPL No. 12903 does not specify sample points.

The objectives of this AEMR are to:

- Meet the environmental monitoring requirements of Sites EPLs; No. 5984 and 12903;
- Assess and analyse the environmental monitoring data for the Site against NSW EPA endorsed criteria;
- Identify trends of the environmental monitoring data over the reporting period;
- Identify any on-site or off-site impacts associated with operation of the Site;
- Advise SCC if the current environmental monitoring program is providing adequate information to identify potential environmental impacts from existing operations (if any) and provide recommendations on improvement to the monitoring program if required; and
- Document monitoring results in an Annual Environmental Monitoring Report.

The scope of work for this AEMR comprised the collation, assessment and reporting of Site data made available to ENRS from the 2020-2021 monitoring period in regard to the following tasks:

- Review previous reports and document the hydrogeological setting;
- Tabulate results of all monitoring data for both water and dust samples, collected and provided by ALS as required by the EPLs for the respective reporting period.

- Analysis and interpretation of all monitoring data (water, dust and landfill surface gas);
- Review all quarterly environmental monitoring reports from the 2020 reporting period and available data from the last three (3) years;
- Identification of any deficiencies in environmental performance identified by the monitoring data, trends or environmental incidents, and identification of remedial actions taken or proposed to be taken to address these deficiencies; and
- Recommendations on improving the environmental performance of the facility including improvement to the monitoring program.

Based on the findings obtained during the 2020-2021 monitoring program the following conclusions and recommendations are provided:

- Shallow groundwater flow is expected to mimic topography with low hydraulic gradients flowing towards the south and southeast towards Rocklow creek. The nearest sensitive receptors are likely to include; recreational users of the Minnamurra River estuary environs; down gradient stakeholders; and downgradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems near discharge zones;
- Groundwater throughout the monitoring period reported exceedances of the assessment criteria for; ammonia, heavy metals, nitrate and salinity (EC) within multiple groundwater bores including; BH-1c, BH-3, BH-4, BH-9, BH-12r, BH-13, BH-14, BH-15, BH-19r, BH-21 and BH-22. This was considered to be consistent with historical values;
- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) were generally reported within the adopted Site Assessment Criteria. Within the 2020-2021 monitoring period a single exceedance for ammonium was reported above the ANZECC (2000) guidelines for the last sampling round at in SWC-down. All previous sampling events reported satisfactory results in all Rocklow Creek sample locations;
- Surface gas methane monitoring reported satisfactory results all within the adopted assessment criteria;
- Dust deposition gauges recorded satisfactory results below the guidelines provided in AS3580.10.1. Monitoring should continue in accordance with EPL 5984 requirements;
- No non-compliances with the EPL were reported during the 2020-2021 annual monitoring period;
- Based on this review of the 2020-2021 annual monitoring period, contaminants associated with the landfill cell, leachate dam/s and general site uses are considered to be relatively consistent with the range of historical results;
- Should any change in Site conditions or incident occur which causes a potential environmental impact, a suitable environmental professional should be engaged to further assess the Site and consider requirements for any additional monitoring; and
- This report must be read in conjunction with the attached Statement of Limitations.

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1.1 PROJECT BACKGROUND

1.1.1 Site History

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1.2 OBJECTIVES

The objectives of this AEMR are to:

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2.0 SITE DESCRIPTION

2.1 LOCATION

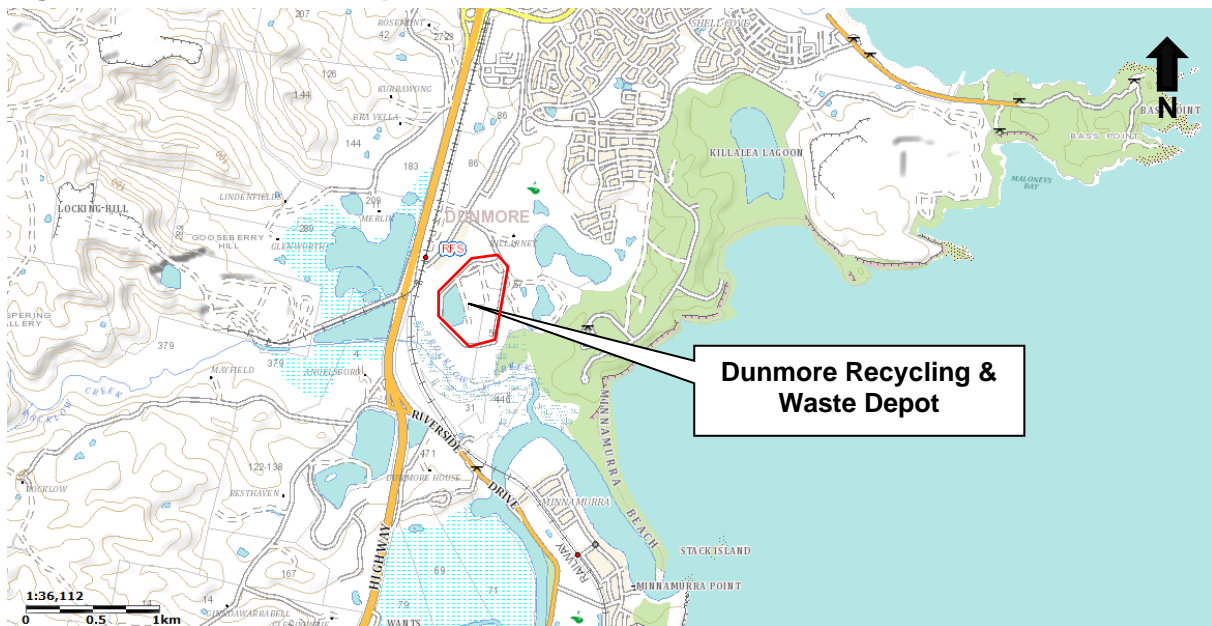
The Site is located at 44 Buckleys Road, Dunmore, NSW, 2529, legally defined as Lot 21 in Deposited Plan 653009 and Lot 1 Deposited Plan 419907. The Site is situated approximately three and a half (3.5) kilometres southwest of the Shellharbour town centre. The area’s regional location is defined in **Figure 1** below. Details of the Site boundary and sampling points are provided in the Site Plan (see **Figure 2**). The key features required to identify the Site are summarised in **Table 1**.

Table 1: Site Identification

Aspect	Description
Site	Dunmore Recycling and Waste Depot
Street Address	44 Buckleys Road, Dunmore, NSW 2529
Site Area	72.36 hectares

Aspect	Description
Title Identifier	Lot 21 DP 653009, Lot 1 DP 419907
Zoning	RU1 Primary Production
Local Government Area	Shellharbour City Council

Figure 1: Site Location Map



Source: SIX Maps (<https://maps.six.nsw.gov.au/>) (cited 16/01/2020)

2.2 SURROUNDING LANDUSE

The current activities and operations on adjacent properties and the surrounding area include:

Table 2: Surrounding Land use

Direction	Land Use
North:	Buckleys Road, commercial infrastructure and open grassland. Residential dwellings along the northwest border of the Site. Golf course further to the northeast.
East:	Dunmore Resources and Recycling facility immediately to the east, bushland to the southeast.
South:	Bushland, Rocklow Creek (300m from landfill activities). Further to Kiama Community Recycling Centre and Riverside Drive.
West:	Bushland to the southwest, scattered trees immediately to the west and further to the Princes Highway. Boral Quarries complex beyond the Highway. Residential dwellings to the Northwest.

2.2.1 Sensitive Receptors

The nearest sensitive receptors are likely to include:

- Recreational users of the Minnamurra River estuary environs;
- Down gradient stakeholders; and
- Down gradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems (GDE) near discharge zones.

2.3 TOPOGRAPHY & DRAINAGE

A review of the current series Albion Park (90281N) 1:25,000 topographic map sheet was conducted to assess the regional topography and to identify potential runoff and groundwater controls in the region. Topography provides a useful indicator for groundwater controls including gradient and flow path.

The Site presents low topographic relief, remaining between approximately 3-5 mAHD across the entirety of the Site. The regional topographic gradient trends south-southeast towards Rocklow Creek and Minnamurra River.

2.4 SOIL LANDSCAPE

The previous annual monitoring report (Environmental Earth Sciences 2018) reported the soil profile at the Site as organic, black, massive sandy loam topsoil overlying loose bleached light grey sand with iron staining in the subsoil.

Review of the online *Shellharbour City Council Acid Sulphate Soil Risk Map* indicates that the Site lies within a **Class 3** area, suggesting that works beyond 1 metre below the ground level (mbGL) have the potential to encounter Acid Sulphate Soils (ASS).

2.5 GEOLOGY

A review of the Site geology was undertaken with reference to the Wollongong 1:250,000 geological series sheet (Si56.9) and the Shellharbour-Kiama area coastal quaternary 1:50,000 geology sheet. The Site is predominately underlain by the Quaternary alluvial deposits (Qal) characterised as Holocene backbarrier flat; marine sand, silt, clay, gravel and shell (Qhbf). The northern most corner of the site is intersected by the Gerringong Volcanics (Pbb) characterised by Latite. Based on the mapped geology, previous investigations and borehole logs, the Site infrastructure including the landfill cell is located within the alluvial deposits.

2.6 HYDROGEOLOGY

Groundwater resources in the area are expected to be associated with *Shallow unconfined* alluvial and unconsolidated systems, generally less than 20 m in depth with moderate to high transmissivity, variable water quality, and strongly controlled by rainfall recharge.

2.6.1 Existing Bores

A network of groundwater monitoring bores is installed at the Site to provide specific data on the quality and nature of groundwater. Given the spatial distribution of the bores and disturbed ground condition expected within the land fill cell, groundwater contours could not be accurately mapped.

A review of the *NSW Office of Water (NOW)* existing bore records was conducted to develop the conceptual understanding of regional groundwater conditions, including aquifer depths, yields, water quality, and distribution. A search of the Bureau of Meteorology Australian Groundwater Explorer groundwater database identified a total of eighty-eight (88) registered bores within one and a half (1.5) kilometres of the Site (see **Figure 5**). Registered bores in the area are predominantly associated with the Landfill Site and with the quarry complex (*Boral Site*) to the west of the EPL Site. The majority of bores are registered for monitoring purposes, excluding a single well (GW044447), which is registered for stock and domestic purposes. The stock bore is located approximately one (1) kilometre to the north of the Site, on the western side of the Princes Highway, which is considered to be up gradient of the Site and not in direct hydraulic connectivity. Registered bore depths are between 1.25 m and 22 m. Bore records indicate shallow unconsolidated aquifer systems.

2.6.2 Flow Regime

Previous reports (*Environmental Earth Sciences, 2018*) have identified that groundwater flows vary across the Site, but the general trend is south, towards Rocklow Creek.

Based on the unconfined nature of the aquifers, the shallow groundwater flow is inferred to mimic topography with low to moderate hydraulic gradients flowing towards the south.

The Site and adjoining land, was largely unsealed with potential for local recharge from rainfall infiltration. Likely discharge areas are predominantly to the south and east of the Site including swamps and Rocklow Creek. The waterbodies surrounding the Site are recognised as State Environmental Planning Policy No.14 (SEPP14) registered wetlands and Proximity Areas for Coastal Wetlands border the eastern, southern and western boundaries of the Site.

2.7 SURFACE WATER

The Site topography indicates that surface water flow will generally trend to the east towards off Site wetlands and southeast towards Rocklow Creek. These present the primary regional drainage structures for natural surface water and runoff. A series of stormwater infrastructure is present at the Site which is expected to capture run off. Infrastructure includes but not limited to; stormwater drains; sedimentation ponds; levee banks; collection and diversion drains; and leachate dams.

3.0 ASSESSMENT CRITERIA

3.1 CONTAMINANTS OF POTENTIAL CONCERN

This section of the report provides a summary of the Contaminants of Potential Concern (CoPC) associated with the Site. CoPC's are identified in the Sites EPL/s which document the

CoPC and water quality indicators required to be monitored. Analytical requirements for all water sampling are provided in Appendix A.

3.2 WATER QUALITY GUIDELINES

Nationally developed guidelines are provided in the National Water Quality Management Strategy (NWQMS): Guidelines for Groundwater Protection in Australia (ARMCANZ & ANZECC 1995). For the purpose of this assessment, the relevant criteria selected to protect environmental values are summarised in **Table 3** below:

Table 3: Groundwater Assessment Criteria

Environmental Value	Relevant Guideline
Ecosystems / Health Screening Levels	ANZG (2018) (Australian and New Zealand Guidelines for Fresh and Marine Water Quality).
	National Environment Protection Measure (NEPM) (2013).
Drinking Water	Australian Drinking Water Guidelines (ADWG) (2018)

3.2.1 ANZG Guidelines

The relevant criteria for this water quality assessment are the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG;2018). The ANZG (2018) provide Default Guideline Values (DGVs) for four (4) levels of protection categorised by the percentage of species possibly affected, being 80%, 90%, 95% or 99% of species. Values for a level of protection for 95% of species in a marine environment have been adopted and are displayed in **Table 4**. Where DVGs are not available reference is made against the ANZECC (2000) Trigger Values (TVs). The *NSW Office of Water* (DECCW;2007) endorsed groundwater management guidelines recommend assessment for aquatic ecosystems based on the **95 per cent of species level of protection**.

Table 4: Adopted Guideline Criteria

Parameter	Groundwater Guideline	Surface water Guideline
Ammonia	0.9 mg/L	0.9 mg/L
Nitrate	10.6 mg/L	10.6 mg/L
pH	6.5-8.0 pH units	6.5-8.0 pH units
Soluble Iron	0.3 mg/L	0.3 mg/L
Manganese	1.9 mg/L	1.9 mg/L
Electrical Conductivity	125-2200 µS/cm	125-2200 µS/cm

3.2.2 National Environmental Protection Measure (NEPM)

The NSW EPA has endorsed the use of the Groundwater Investigation Levels (GILs) given in the 2013 ASC NEPM ‘Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater’. The latest NEPM provide a framework for risk-based assessment of groundwater contamination.

Groundwater Health Screening Levels (HSLs) are provided for four (4) land use categories for vapour intrusion (Table 1A[4]) associated with Total Recoverable Hydrocarbons TRH (F1 & F2) and BTEX compounds.

NEPM	Description of Land use Categories
HIL A	Residential A with garden/accessible soil also includes children’s day care centres, preschools and primary schools.
HIL B	Residential B with minimal opportunities for soil access; includes buildings with fully and permanently paved yard space such as high-rise buildings and apartments.
HIL C	Recreational C includes public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and unpaved footpaths.
HIL D	Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.
GILs	Groundwater Investigation Levels (GILs) should be applied based on the receiving environment and groundwater resources. GILs are provided in NEPM Table 1C for; Fresh Waters; Marine Waters; and Drinking Water;
EILs	Ecological Investigation Levels (EILs) for common contaminants in the top two (2) metres of soil based on three (3) generic land use settings: <ul style="list-style-type: none"> • Areas of ecological significance; • Urban residential areas and public open space; and Commercial and industrial land uses.

3.3 DUST DEPOSITION ASSESSMENT CRITERIA

Criteria for collection and assessment of dust deposition concentrations are provided within the Australian standard AS3580.10.1 - Methods for sampling and analysis of ambient air; method 10.1- Determination of particulate matter - Deposited matter - Gravimetric method. AS3580.10.1 provides an acceptable level of 4 g/m²/month.

3.4 SURFACE METHANE GAS ASSESSMENT CRITERIA

The NSW EPA Solid Waste Landfill Guidelines 2nd Edition (2016) provides sampling methodologies and threshold for surface methane gas concentrations at landfill sites. The acceptable threshold for capped landfills is 500 parts per million (ppm) at 5 cm above the capping surface.

4.0 SAMPLING METHODOLOGY

Field sampling was conducted by *ALS Environmental* (Wollongong) as commissioned by SCC on quarterly basis. ENRS understands that sampling was conducted in accordance with ALS sampling protocols with reference to current industry standards and Code of Practices. The following sub-sections provide a summary of the sampling methodologies.

Monitoring frequency is defined by the EPL’s and is designed to capture necessary site data to support assessment of Site conditions (quarterly and annual), any long-term trends or

overflow events. Monitoring is conducted quarterly and annually for selected analytes with additional overflow and event-based sampling triggered by Site conditions.

4.1 WATER SAMPLING

4.1.1 Location of Water Monitoring Points

Groundwater and surface water monitoring requirements are defined by the EPL No. 5984, as provided in Appendix A. The water sampling regime includes; five (5) surface waters, one (1) located onsite and four (4) located off-site; twelve (12) groundwater monitoring wells surrounding the landfill operations; and two (1) leachate point. Sampling locations are illustrated in **Figure 2** attached.

4.1.2 Depth to Water

Prior to sampling, the depth to the groundwater table was measured from the top of casing (TOC) using a water dipper and clear disposable bailer. The bores were inspected for the presence of hydrocarbon and the thickness of any LNAPL was measured visually in clear disposable bailers. **No LNAPL was identified in monitoring Wells.**

4.1.3 Sample Collection

Sampling is conducted independently by *ALS Environmental* under contract with SCC. Chain of Custody records and field sheets are provided in Appendix D. ENRS understand sampling is conducted in accordance with *ALS* sampling protocols.

4.1.4 Groundwater Sampling

Groundwater wells were sampled in order of distance from any areas of known contamination to ensure that lower contaminated wells are sampled before likely higher contaminated wells. Groundwater bores were purged prior to sampling by removing at least three (3) well volumes or low flow parameter stabilisation methods applied with field sheets provided to document pumping volumes and field parameters. Samples were collected using clear disposal bailers. and were sealed in laboratory-prepared sampling containers appropriate for the analysis. All samples were stored on ice immediately after their collection and transported to the laboratory under Chain of Custody (CoC) documentation.

Surface water and leachate samples were collected using as 'grab samples' from the midpoint of the structure and at mid-depth.

Any loss of volatile compounds was kept to a minimum by employing the following sampling techniques:

- Minimal practical disturbance during sampling;
 - Samples placed in sample containers as soon as possible;
 - Sample containers contain zero headspace;
 - Samples placed directly on ice and transported to the laboratory as soon as possible;
- and

- Employing the most appropriate analytical method to minimise volatile losses at the laboratory.

4.1.5 Field Testing

Field testing was conducted during bore purging and sampling to record physical water parameters. A multi-probe water quality meter was used to measure the following parameters:

- Oxygen Reduction Potential (ORP, representing redox).
- Electrical Conductivity (Salinity - EC);
- Temperature; and
- pH (Acidity).

4.2 DUST DEPOSITION SAMPLING

Measurement of dust deposition was carried out in accordance with the Australian Standard AS3580.10.1 (2016). This Australian Standard provides a mean of determining the mean surface concentration of deposited matter from the atmosphere. The 2020-2021 monitoring period was the first year of the four (4) dust monitoring points.

Dust collection gauges were set up for a one (1) month period between the dates; Q1 13/11/2020-15/12/2020; Q2 12/02/2021-17/03/2021; Q3 14/05/2021-16/06/2021; and Q4 12/08/2021-14/09/2021. A total of four (4) dust monitoring locations were considered adequate to assess site conditions.

4.3 SURFACE METHANE GAS MONITORING

The concentration of methane gas (in units of ppm) at the Site was carried out in accordance with EPA Guidelines Solid Waste Landfill 2nd Edition 2016. On the day of sampling the wind speed was below 10 km/hr. Testing was conducted using a calibrated *LaserOne* portable gas monitor specifically designed for landfill gas monitoring. A calibration Certificate is provided in **Appendix F**.

One field technician commenced data collection along transect lines in a grid pattern across the landfill surface at 25-metre spacings. A site plan depicting the sampled transect line is provide in **Figure 3**. Transects were recorded using a Magellan *SporTrak* GPS. The concentration of methane gas was measured at a height of 5 cm above the ground in areas with intermediate or final cover over the emplaced waste. Whenever possible the concentration of methane gas was also recorded in any buildings located within a distance of 250 m of the deposited waste. Any depressions or surface fissures away from the sampling grid were also investigated.

4.4 LABORATORY ANALYSIS

ALS, a NATA accredited laboratory, was contracted by SCC to undertake the sample analysis in accordance with current standards. Laboratory QA/QC results are detailed in the Laboratory reports contained in the appendices section of this report.

4.5 FLARE MONITORING

Landfill gases are formed through bacterial action on emplaced waste and are a normal by-product of Landfilling operations. Landfill gas is a mixture of many different gases, typically its major components include methane and carbon dioxide. Smaller concentrations of nitrogen, oxygen, ammonia, sulphides, hydrogen, carbon monoxide, and nonmethane organic compounds (NMOCs) and Volatile Organic Compounds (VOC's) may also be present.

When operated efficiently the use of a gas flare to burn landfill gas can significantly reduce emissions of methane, NMOCs and VOC's.

The flare is monitored, maintained and operated by *LGI LTD*. Copies of LFG reports for the relevant reporting period are included as **Appendix G**.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

5.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) are required to define the quality and quantity of data needed to support management decisions. The process for establishing DQO's is documented by Australian Standard: AS 4482.1-2005 and referenced by the National Environment Protection (Assessment of Site Contamination) Measure (NEPC;2013). The DQO's for the investigation were to obtain representative data to allow assessment of:

- groundwater quality;
- The risks posed to human health and the environment, including potential future users of the Site; and
- The requirements for any further investigative works.

The assessment was conducted to a standard consistent with generally accepted and current professional consulting practice for such an investigation. The evaluation criteria adopted for the investigation are summarised in **Table 5**.

Table 5: Data Quality Objectives

DQO	Evaluation Criteria
Documentation completeness	Completion of field records, chain of custody documentation, laboratory test certificates from NATA-accredited laboratories.
Data comparability	Use of appropriate techniques for the sampling, storage and transportation of samples. Use of NATA accredited laboratory using NEPM endorsed procedures.
Data representativeness	Adequate sampling coverage of all areas of environmental concern at the Site, and selection of representative samples.
Precision and accuracy for sampling and analysis	Use properly trained and qualified field personnel and achieve field and laboratory QA/ QC criteria.

5.2 QA/QC PROCEDURES

Data provided for the purpose of this report by SC was prepared by ALS. ALS is NATA accredited for the laboratory testing. The QA/QC indicators as provided to ENRS either all complied with the required standards, or showed variations that would have no significant effect on the quality of the data or the conclusions of this environmental assessment. Therefore, the data is considered acceptable for use in this assessment.

It should be noted that whilst the EPL does not require field duplicates, ENRS recommend sampling include rinsate samples and field duplicates at the standard rate of 1 in 10, or field QA/QC is conducted in accordance with ALS procedures.

5.3 EPL NON-COMPLIANCE

Monitoring requirements are defined by the EPL.

6.0 WATER QUALITY RESULTS

Laboratory results for groundwater and surface water were provided to ENRS for tabulation and comparison with relevant EPL assessment criteria. A summary of results is provided in **Table 7 - Table 10** with comparison against the relevant Site Assessment Criteria (SAC). The laboratory certificates of analysis are provided in Appendix B.

6.1 OVERFLOW RESULTS

No overflow event was recorded over the 2020-2021 reporting period.

6.2 FIELD TESTING

Field testing is conducted by ALS during sampling to record physical water parameters. A water quality meter is used to measure the following parameters in the field:

- Electrical Conductivity (Salinity);
- pH (Acidity); and
- Dissolved Oxygen (surface waters only).

6.3 PHYSICAL INDICATORS

6.3.1 Depth

Groundwater

Depth of ground water to TOC ranged between **0.69 mbgl** (BH-15, 13/09/2021) to **4.88 mbgl** (BH-14, 16/12/2020). Although trending down slightly in the 2020-2021 monitoring period ground water levels remain consistent with historical data of groundwaters

6.3.2 Temperature

Groundwater

Temperature of groundwater, leachate and selective surface waters was in the 2020-2021 monitoring period ranged between **14.9 degrees Celsius** (BH-15, 13/09/2021) and **25.9 degrees Celsius** (BH-1C, 16/12/2020).

Surface Waters

Surface water temperature at SWP-1 was **12.5 degrees Celsius** (14/09/2021)

Leachate

Leachate Temperatures at the leachate Tank (LP-1) ranged between Depth **16.2 degrees Celsius** (14/09/2021) and **26.9 degrees Celsius** (17/03/2021).

6.3.3 Salinity (EC & TDS)

Salinity is reported by the laboratory as either Electrical Conductivity (EC) or Total Dissolved Solids (TDS). The ANZECC guidelines document a conversion ratio for of 0.68 mg/L = 0.68 EC ($\mu\text{S/cm}$). Table 3.3.3 of the ANZECC (2000) guidelines document default TV for EC in lowland freshwater rivers between **125 $\mu\text{S/cm}$ - 2,200 $\mu\text{S/cm}$** (~1,500 mg/L).

Groundwater

During the 2020 - 2021 monitoring period, salinity ranged between; **2,210 $\mu\text{S/cm}$** (BH-19r, 16/03/2020) and **10,400 $\mu\text{S/cm}$** (BH-15, 16/12/2020). Seven (7) sites reported salinity values in excess of freshwater SAC of **2,200 $\mu\text{S/cm}$** in the 2020-2021 monitoring period. With the exception of BH-13 and BH-9 which remained consistent with previous monitoring events, all other groundwater monitoring locations trended downwards with respect to salinity over the 2020-2021 monitoring period.

In the final monitoring round of September 2021 only five (5) of twelve (12) sites reported salinity values in excess of freshwater SAC of 2,200 $\mu\text{S/cm}$. **7,130 $\mu\text{S/cm}$** (BH-1c), **2,300 $\mu\text{S/cm}$** (BH-15), **4,450 $\mu\text{S/cm}$** (BH-9), **2,370 $\mu\text{S/cm}$** (BH-21) and **2,850 $\mu\text{S/cm}$** (BH-18).

Surface Waters

Electrical Conductivity results for onsite surface water (SWP-1, 14/09/2021) was **820 $\mu\text{S/cm}$** which corresponds to a calculated Total Dissolved Solids result of **533 mg/L**. These results are below the TV.

Electrical conductivity for offsite surface waters ranged between **5,890 $\mu\text{S/cm}$** (SWC-2, 14/09/2021) to **18,300 $\mu\text{S/cm}$** (SWC-down, 17/06/2021).

Calculated Total Dissolved Solids results for offsite surface waters located along Rocklow Creek ranged between **3,991 mg/L** (SWC-2, 14/09/2021) to **11,895 mg/L** (SWC-down, 17/06/2021). The results are consistent with a tidal creek.

Leachate

Salinity in leachate is expected to vary significantly with leachate concentration and stormwater dilution. Leachate salinity for the 2020-2021 monitoring period ranged from **10,400 $\mu\text{S/cm}$** (LP1, 14/09/2021) and **16,700 $\mu\text{S/cm}$** (LP1, 17/06/2021) which are above the TV.

6.3.4 Dissolved Oxygen

Levels of Dissolved Oxygen (DO) were measured in the field during sampling. DO reflects the equilibrium between oxygen-consuming processes and oxygen-releasing processes. DO can initiate redox reactions resulting in the uptake or release of nutrients. Low DO concentrations can result in adverse effects on many aquatic organisms which depend on oxygen for their efficient metabolism. At reduced DO concentrations many compounds become increasingly toxic, for example Zinc, Lead, Copper, phenols, cyanide, hydrogen sulphide and Ammonia.

The ANZECC (2000) guidelines Table 3.3.2 outlines a range between 85% to 110% saturation for low land rivers. Assuming a water temperature of 18°C this is equivalent to approximately 7-11 mg/L or ppm.

Surface Waters

Dissolved Oxygen at SWP-1 ranged from **2.88 mg/L** (17/06/2021) to **4.16 mg/L** (14/09/2021). Both results are below the TV.

Dissolved Oxygen for the offsite surface waters at Rocklow Creek ranged from **6.91 mg/L** (SWC-down, 14/09/2021) to **9.20 mg/L** (SWC-down, 16/06/2021). With the exception of the **6.91 mg/L** (SWC-down, 14/09/2021) result all other Dissolved Oxygen results were compliant to the TV requirements.

Leachate

Dissolved oxygen at LP1 (Leachate Tank) ranged from **1.26 mg/L** (15/12/2020 & 17/03/2021) and **6.63 mg/L** (14/09/2021). Both results are below the TV.

6.3.5 pH

pH is a measure of hydrogen activity. pH determines the balance between positive hydrogen ions (H⁺) and negative hydroxyl ions (OH⁻) and provides a test of water acidity (low pH) or alkalinity (high pH). Most natural freshwaters have a pH in the range 6.5 to 8.0. Changes in pH may affect the physiological functioning of biota and affect the toxicity of contaminants. Both increases and decreases in pH can result in adverse effects, although decreases are likely to cause more significant problems. Low pH indicates acidic conditions which may increase the mobility of heavy metals, whilst high pH indicates alkaline conditions which may also generate Ammonia. Previous investigations of other regional Landfill Sites in the Illawarra-Shoalhaven (Forbes Rigby;1996) report regionally acidic groundwater with low readings in the range of 4.3 pH associated with silica saturation and oxidation of accessory marcasites grains (iron sulphide).

Groundwater

Groundwater pH was reported between **pH 6.4** (BH-14, 16/06/2021) and **pH 7.6** (BH-4, 16/06/2021). With the exception of the **pH 6.4** (BH-14, 16/06/2021) result all groundwater results were reported within the ANZECC recommended range of pH 6.5-8.0. The results are largely within the historical range of values.

Surface Water

Surface water for the 2020-2021 monitoring period reported pH values of between **pH 7.20** (SWP-1, 17/03/2021) and **pH 7.8** (SWC-2, SWC-down, SWC-down2, 16/12/2020).

Leachate

Throughout the 2020-2021 monitoring period leachate pH at LP-1 was reported between 7.6 (14/09/2021) and 8.1 (15/12/2020). All results are consistent with the TV.

pH results throughout the 2020-2021 monitoring period are generally consistent with previous years.

6.3.6 Total Suspended Solids (TSS)

TSS provides a measure of turbidity reported as the mass of fine inorganic particles suspended in the water. Measurement of TSS provides a valuable indication of the sediment and potential nutrient load. Elevated TSS decreases light penetration whilst phosphorus is absorbed onto sediment surfaces.

TSS was reported for surface water only. Concentrations for the 2020-2021 monitoring period were reported between **<5 mg/L** (SWP-1, 17/06/2021, SWC-2, 15/12/2020, 17/03/2021, 16/06/2021, SWC-up 16/06/2020, SWC-down, 16/06/2020, 17/03/2021, 14/09/2021 & SWC-down2, 17/06/2021, 14/09/2021) and **46 mg/L** (SWC-up, 01/02/2021). All results were below the **50mg/L** TV.

TSS results are generally consistent with historical results.

6.4 INORGANIC ANALYTES

Nutrients

Water samples were analysed for select nutrients including Ammonia, Ammonium, Nitrate and Nitrite. The most bio-available forms of Nitrogen are Ammonium (NH₄⁺) and Nitrate (NO₃⁻). Ammonia is an oxygen-consuming compound and is toxic to aquatic biota at elevated concentrations. Ammonia toxicity increases under low oxygen levels and higher pH.

6.4.1 Ammonia

Groundwater

For the 2020-2021 monitoring period, ammonia was measured within groundwater monitoring bores between **0.12 mg/L** (BH14, 16/03/2021) and **372 mg/L** (BH-1c, 13/09/2021). With the exception of BH-18 all groundwater wells reported at least one (1) exceedance of the adopted trigger value of **0.91 mg/L** throughout the monitoring period. This is consistent with historical values.

Surface Water

Ammonia in surface water samples ranged from **0.04 mg/L** (SWP-1, 14/09/2021) to **0.94 mg/L** (SWC-down, 14/09/2021). The result **0.94 mg/L** (SWC-down, 14/09/2021) was the only surface water result that exceeded the adopted trigger value of **0.91 mg/L** during the monitoring period.

Leachate

Ammonia in leachate was reported between **809 mg/L** (LP1, 01/08/2021) and **1960 mg/L** (LP1, 17/03/2021). High ammonia concentrations are expected in untreated leachate.

6.4.2 Nitrate

Groundwater

Results for Nitrate in groundwater were reported between **<0.1 mg/L** in multiple bores and **32 mg/L** (BH-14, 16/03/2021). A total of four (4) groundwater wells reported exceedances above the TV of 0.7mg/L throughout the 2020-2021 monitoring period, including BH-3, BH-15, BH-13 and BH-14.

Surface Water

A single exceedance to the Nitrate TV was reported for Rocklow Creek surface water sample **2.58 mg/L** (SWC-up; 15/12/2020). The Nitrate concentration of all subsequent samples was below the TV of **0.7mg/L**.

Leachate

Nitrate concentration of leachate (LP-1) was consistent at **<0.1mg/L** throughout the 2020-2021 monitoring period.

6.4.3 Nitrite

Groundwater

Results for Nitrate in groundwater were reported between **<0.01 mg/L** in multiple bores and **0.08 mg/L** (BH-3, 16/03/2021). No exceedances were reported for nitrite during the 2020-2021 monitoring period.

Surface Water

During the 2020-2021 monitoring period surface water SWP-1 consistently reported results of **<0.01 mg/L**.

Leachate

Leachate LP1 result ranged from **<0.01 mg/L** (14/09/2021) to **0.1 mg/L** (15/12/2020, 17/03/2021 & 17/06/2021). All results are below the accepted TV.

Anions

6.4.4 Chloride

Groundwater

Results for Chloride in groundwater were reported between **11 mg/L** in (BH-18, 13/09/2021) and **1,360 mg/L** (BH-15, 16/12/2020). Results for BH-15 have been trending down since 11/03/2020, all other groundwater results are generally consistent with historical data.

Surface Water

During the 2020-2021 monitoring period chloride results for surface water SWP-1 ranged from **137 mg/L** (17/03/2021) and **352 mg/L** (16/06/2021).

Leachate

Chloride at the Leachate Tank (LP-1) ranged between **1420 mg/L** (17/06/2021) and **1860 mg/L** (14/09/2021) Results are consistent with historical data.

6.4.5 Fluoride

Groundwater

Results for Fluoride in groundwater were reported between **<0.1 mg/L** in multiple bores and **0.6 mg/L** (BH-14, 13/09/2021).

Surface Water

Surface water results ranged from of **0.2 mg/L** (SWP-1, 14/09/2021) and **0.6 mg/L** (SWC-down, 14/09/2021).

Leachate

Leachate results at the leachate tank (LP-1) ranged from **0.4 mg/L** (17/03/2021, 17/06/2021 & 14/09/2021) to **0.5 mg/L** (15/11/2020). Results are consistent with historical data.

6.4.6 Sulphate

Groundwater

Results for Sulphate in groundwater were reported between **<0.1 mg/L** (BH-1c, 16/03/2021) and **495 mg/L** (BH-15, 16/3/2021).

Surface Water

Sulphate in surface water ranged from **4 mg/L** (SWP-1, 17/03/2021) and **2690 mg/L** (SWC-down, 15/12/2020).

Leachate

Sulphate levels in the leachate tank (LP-1) ranged from **<10 mg/L** (17/03/2021, 17/06/2021, 14/09/2021) to **20 mg/L** (15/12/2020)

6.4.7 Total Alkalinity

Surface Water

Total Alkalinity at SWP-1 ranged from **189 mg/L** (17/03/2021) to **345 mg/L** (15/12/2020). Results are consistent with historical data.

Leachate

Total Alkalinity in Leachate (LP-1) ranged from **2,990 mg/L** (17/03/2021) to **6,880 mg/L** (14/09/2020). Results are consistent with historical data.

6.4.8 Bicarbonate Alkalinity

Groundwater

Bicarbonate in groundwaters ranged from **78 mg/L** (BH-16, 16/06/2021) to **2,460 mg/L** (BH-1C, 16/12/2020). Results are generally consistent with historical data.

Metals & Metalloids

6.4.9 Manganese (Total Mn)

Groundwater

Manganese was analysed in groundwater, surface water and leachate sampling points. Concentrations of Manganese in groundwater for the 2020-2021 monitoring period were reported between **0.051 mg/L** (BH-18, 16/06/2021) and **0.685 mg/L** (BH-9, 16/03/2021).

Surface Water

Manganese at SWP-1 ranged from **0.229 mg/L** (14/09/2021) to **1.38 mg/L** (15/12/2020).

Leachate

Leachate concentrations were reported between **0.422 mg/L** (Tank, 15/12/2020) and **0.687 mg/L** (Tank, 14/09/2021). These values are below the adopted TV (1.9 mg/L 95% of Species - freshwater) and are considered acceptable. Concentrations of Manganese should continue to be reviewed during subsequent monitoring events.

6.4.10 Iron (Total Fe)

Iron was measured in selected surface water samples including SWP-1 and Leachate Tank.

Surface Water

Concentrations of total iron within onsite surface water were reported between **0.24 mg/L** (SWP-1, 15/12/2020) and **0.67 mg/L** (SWP-1, 14/09/2021).

Leachate

Concentration of iron at the leachate Tank (LP-1) was reported between **1.25 mg/L** (17/06/2021) and **5.06 mg/L** (15/12/2020).

6.4.11 Iron (Dissolved Fe)

Groundwater

Dissolved iron was measured within selected groundwater and surface water sampling points. Groundwater results were reported between the laboratory lower limit of detection of **<0.05 mg/L** and **14.3 mg/L** (BH1c, 13/09/2021).

6.4.12 Calcium

Calcium was measured within selected groundwater and surface water sampling points.

Groundwater

Groundwater results were reported between **33 mg/L** (BH-18, 16/06/2021) and **285 mg/L** (BH9, 16/06/2021).

Surface Water

Calcium in surface water ranged from **34 mg/L** (SWP-1, 17/06/2021) to **430 mg/L** (SWC-down & SWC-down 2, 15/12/2020).

Leachate

Calcium concentrations in Leachate (LP-1) ranged from **20 mg/L** (15/12/2020) to **213 mg/L** (14/09/2021)

Results are consistent with historical data.

6.4.13 Potassium

Potassium was measured within selected groundwater and surface water sampling points.

Groundwater

Groundwater results were reported between the laboratory **4 mg/L** BH-18, 16/06/2021 & 13/09/2021) and **350 mg/L** (BH15, 16/03/2021). Potassium levels in groundwaters are generally consistent with historical data.

Surface Water

Potassium levels in the offsite groundwaters ex Rocklow Creek ranged from **45 mg/L** (SWC-up, 17/06/2021) to **375 mg/L** (SWC-down 2, 15/12/2020). Surface water results for Potassium are generally trending down with respect to historical data.

Organic Analytes

6.4.14 Total Organic Carbon

Total Organic Carbon (TOC) provides a measure of the total concentration of organic material in a water sample. TOC is typically higher in surface water than groundwater, however high TOC is also characteristic of leachate from landfill. TOC provides a marker for biological activity associated with contaminant degradation and can be used to delineate contaminant plumes. TOC influences geochemical processes by:

- acting as proton donors/acceptors;
- providing pH buffering;
- participating in mineral dissolution/precipitation reactions; and
- providing carbon substrate for microbe-based biodegradation.

TOC was reported during the 2020-2021 monitoring period at the following concentrations:

Groundwater

*TOC levels ranged between **2 mg/L** (BH-18; 16/06/2021) and **219 mg/L** (BH-1c; 16/03/2021);*

Surface Water

*TOC levels ranged between **3 mg/L** (SWC- down 2; 16/06/2021) and **17 mg/L** (SWP-1; 14/09/2021)*

Leachate

TOC levels ranged between **128 mg/L** (Tank; 14/09/2021) and **3540 mg/L** (Tank; 17/03/2021).

7.0 DUST GAUGE RESULTS

The below table provides the results of the dust depositions results. A total of four (4) dust collectors were onsite for one (1) month for each sampling round, in general accordance with AS3580.10.1. A total of four (4) quarterly (Q) rounds were conducted over the 2020-2021 monitoring period; Q1 13/11/2020 - 15/12/2020; Q2 12/03/2021 – 17/03/2021; Q3 14/05/2021 – 16/06/2021; and Q4 13/06/2021 – 14/09/2021. A summary of results is provided in **Table 6** below.

Table 6: Summary of Dust Gauge Results

Sample ID	Criteria (g/m ² /month)	Total Insoluble Matter (g/m ² /month)			
		Q1	Q2	Q3	Q4
DDG1	4	0.8	0.9	<0.1	1.4
DDG2		0.7	0.6	0.1	1.1
DDG3		2.6	2.2	0.4	2.8
DDG4		5.5	2.5	0.2	3.5

Results for depositional dust during the 2020-2021 annual monitoring period generally reported levels of dust below the adopted assessment criteria of **4 g/m²/month**. An exceedance was recorded for DDG4 in the Q1 sampling period. Specification by the laboratory of the Q1 dust contents identified raised levels of combustible matter and ash. Historical weather data from the Bureau of Meteorology confirm that the Q1 sampling period was associated with high winds and low rainfall. The combustible matter was most likely explained by the close proximity of DDG4 to the FOGO facility and garden waste drop off area, the high ash levels were most likely based in windblown dust with a significant contribution coming from external crushing operations and offsite stockpiles of crushed aggregates.

Given that no ash generation activities occur as part of Site operations, the results were considered satisfactory. Dust gauge locations are provided in **Figure 2** attached. It is recommended that monitoring is continued in accordance with EPL 5984.

8.0 SURFACE METHANE GAS RESULTS

The surface gas monitoring from the 2020-2021 monitoring period *DID NOT* detect any levels of methane above the EPA license limits of 500 ppm. The results were considered satisfactory. A table of results is provided in Appendix D.

9.0 ANNUAL ENVIRONMENTAL ASSESSMENT

9.1 MONITORING POINT SUMMARY

Field measurements and NATA laboratory results for dust and methane results from the annual 2020-2021 monitoring period reported satisfactory results. Water results including leachate, groundwater, onsite and offsite surface water reported concentrations of analytes within the range historical values. Water results from the last four (4) years have been tabulated and presented **Charts 1-59** attached.

Groundwater and surface water within the Site boundary generally reported multiple high levels of analytes considered to be characteristic of landfill and leachate. Offsite sample locations within Rocklow Creek generally reported satisfactory results. A single exceedance for ammonia was recorded in Rocklow Creek upstream sample SWC-down on the 1st August 2021.

Generally, all dust gauges reported satisfactory results over the 2020-2021 monitoring period. A single exceedance was recorded for DDG4 in the Q1 sampling period between 11/12/19-16/01/20 identified high ash loadings. Subsequent rounds reported satisfactory results.

Results of surface methane gas monitoring recorded satisfactory results. The landfill surface cap was therefore considered intact and effective during the monitoring period.

9.2 ENVIRONMENTAL MANAGEMENT

9.2.1 Landfill Operations

ENRS understand ‘solid’ waste (general solid waste putrescible and non-putrescible) landfill operations are ongoing at the Site. Landfill practices should be conducted in accordance with the Site’s Landfill Environmental Management Plan (LEMP) and the EPA Solid Waste Landfill Guidelines (EPA; 2016).

9.3 ENVIRONMENTAL SAFEGUARDS

Appropriate management actions are required to continue to prevent and detect potential groundwater and surface water pollution. The nearest sensitive receptors for any uncontrolled Site water and leachate include; areas of adjoining bushland; recreational users of the Minnamurra River estuary environs, down gradient stakeholders; and down gradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems (GDE).

It is recommended that any drainage and detention structures are inspected annually by a suitably qualified environmental professional to assess their structural integrity and identify the need for any maintenance (such as removal of deep rooted vegetation, sediment, and re-lining).

Access tracks to sampling points should be inspected prior to each quarterly sampling events. Continue to review annual surface and groundwater monitoring results from up and down gradient of the land fill cells and offsite sampling locations within Rocklow Creek. Continue to monitor surface methane gas in order to assess the capping integrity of the landfill cells.

9.4 MONITORING PROGRAM

The water, dust and surface methane monitoring program are required to demonstrate that Site activities are not generating any off-site pollution. The Site’s EPL’s and monitoring regime should be reviewed annually.

Review of the 2020-2021 monitoring results indicate no significant change in environmental conditions at the Site over the past three (3) years. Future sampling events should continue to monitor the key indicators of leachate within surface and ground waters, especially concentration of ammonia and nitrate.

Should monitoring continue to report any significant changes in analyte concentrations the need for additional monitoring locations should be reviewed, including additional groundwater monitoring bores both up and down gradient locations of areas with analytical exceedances.

It is recommended that water quality results from future monitoring rounds continue be forwarded to a suitably qualified environmental professional for review within the laboratory holding time to compare against relevant guidelines and identify any irregularities so that additional testing may be conducted within the holding time.

10.0 CONCLUSIONS

Based on the findings obtained during the 2020-2021 monitoring program the following conclusions and recommendations are provided:

- Shallow groundwater flow is expected to mimic topography with low hydraulic gradients flowing towards the south and southeast towards Rocklow creek. The nearest sensitive receptors are likely to include; recreational users of the Minnamurra River estuary environs; down gradient stakeholders; and downgradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems near discharge zones;
- Groundwater throughout the monitoring period reported exceedances of the assessment criteria for; ammonia, heavy metals, nitrate and salinity (EC) within multiple groundwater bores including; BH-1c, BH-3, BH-4, BH-9, BH-12r, BH-13, BH-14, BH-15, BH-19r, BH-21 and BH-22. This was considered to be consistent with historical values;
- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) were generally reported within the adopted Site Assessment Criteria. Within the 2020-2021 monitoring period a single exceedance for ammonium was reported above the ANZECC (2000) guidelines for the last sampling round at in SWC-down. All previous sampling events reported satisfactory results in all Rocklow Creek sample locations;
- Surface gas methane monitoring reported satisfactory results all within the adopted assessment criteria;
- Dust deposition gauges recorded satisfactory results below the guidelines provided in AS3580.10.1. Monitoring should continue in accordance with EPL 5984 requirements;
- No non-compliances with the EPL were reported during the 2020-2021 annual monitoring period;
- Based on this review of the 2020-2021 annual monitoring period, contaminants associated with the landfill cell, leachate dam/s and general site uses are considered to be relatively consistent with the range of historical results;
- Should any change in Site conditions or incident occur which causes a potential environmental impact, a suitable environmental professional should be engaged to further assess the Site and consider requirements for any additional monitoring; and
- This report must be read in conjunction with the attached Statement of Limitations.

11.0 LIMITATIONS

This report and the associated services performed by ENRS are in accordance with the scope of services set out in the contract between ENRS and the Client. The scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

ENRS derived the data in this report primarily from visual inspections, examination of available records, interviews with individuals with information about the site, and if requested, limited sample collection and analysis made on the dates indicated. In preparing this report, ENRS has relied upon, and presumed accurate, certain information provided by government authorities, the Client and others identified herein. The report has been prepared on the basis that while ENRS believes all the information in it is deemed reliable and accurate at the time of preparing the report, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by the Client arising from or in connection with the supply or use of the whole or any part of the information in the report through any cause whatsoever.

Limitations also apply to analytical methods used in the identification of substances (or parameters). These limitations may be due to non-homogenous material being sampled (i.e., the sample to be analysed may not be representative), low concentrations, the presence of 'masking' agents and the restrictions of the approved analytical technique. As such, non-statistically significant sampling results can only be interpreted as 'indicative' and not used for quantitative assessments.

The data, findings, observations, conclusions and recommendations in the report are based solely upon the state of the site at the time of the investigation. The passage of time, manifestation of latent conditions or impacts of future events (e.g., changes in legislation, scientific knowledge, land uses, etc) may render the report inaccurate. In those circumstances, ENRS shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of the report.

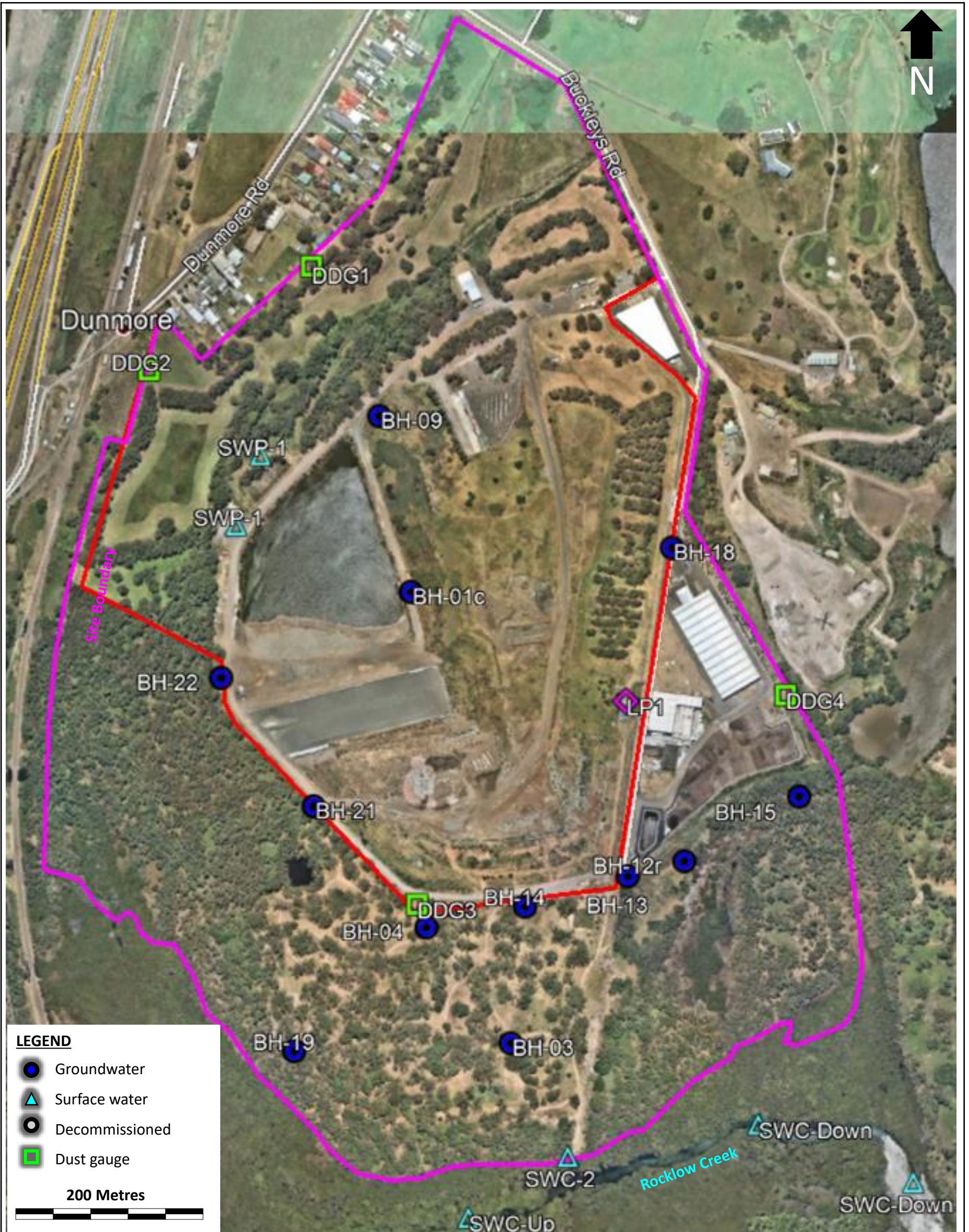
This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between ENRS and the Client. ENRS accepts no liability or responsibility whatsoever and expressly disclaims any responsibility for or in respect of any use of or reliance upon this report by any third party or parties.

It is the responsibility of the Client to accept if the Client so chooses any recommendations contained within and implement them in an appropriate, suitable and timely manner.

12.0 REFERENCES

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FIGURES



LEGEND

- Groundwater
- ▲ Surface water
- Decommissioned
- Dust gauge

200 Metres

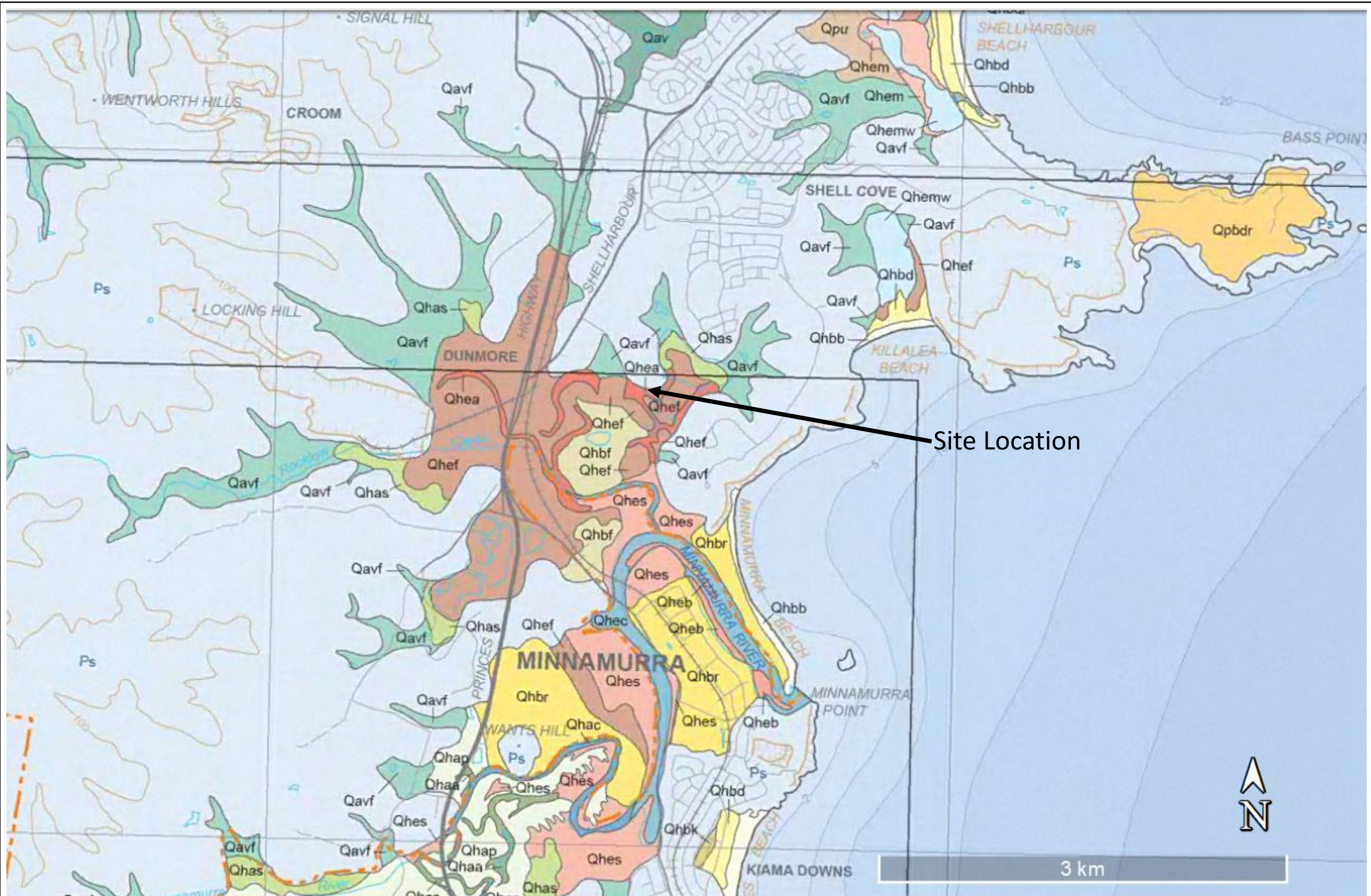


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Client:	Shellharbour City Council	Drawn:	PL	Figure:	2
Project:	ENRS0033	Source:	NearMaps	Date:	21/05/2021
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW	Scale:	NA	Title:	Site Plan
		Status:	Rev 2		



Client:	Shellharbour City Council	Drawn:	PL	Figure:	3
Project:	ENRS0033	Source:	SixMaps	Date:	16/03/2020
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW	Scale:	NA	Title:	Surface Gas Sample transects
		Status:	Rev 1		

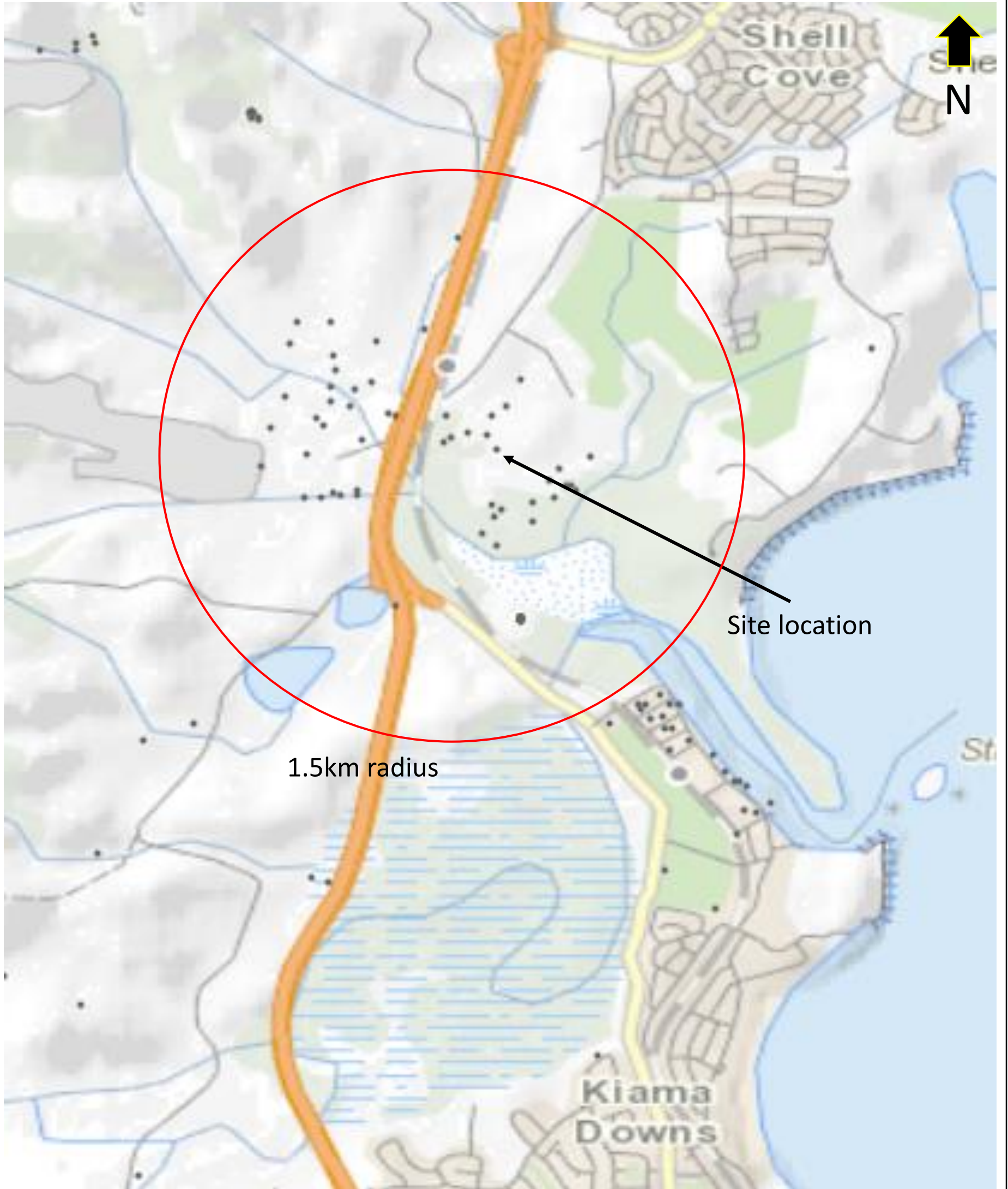


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Client:	Shellharbour City Council	Drawn:	PL	Figure:	4
Project:	ENRS0033	Source:	Geological Survey of NSW	Date:	16/01/2020
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	See figure	Title:	Site Geology
		Status:	Rev 1		



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Client:	Shellharbour City Council	Drawn:	PL	Figure:	5
Project:	ENRS0033	Source:	NSW Office of Water	Date:	30/12/2021
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	NA	Title:	Registered Bores
		Status:	Rev 1		

TABLES

TABLE 7: Total Concentration Results Quarterly Water Monitoring Results - August 2021: Dunmore Recycling and Waste Depot

GILs -Trigger Values for Freshwater (Protection of 95% of Species) ^A																												
-																												
GILs -Trigger Values for Marine Water (Protection of 95% of Species) ^A																												
-																												
Australian Drinking Water Guidelines (2018) ^C																												
Health																												
-																												
Aesthetic																												
250 - - - 180 - 0.1 0.3 0.3 - 0.5 - - - 250 - - 6.5 - 8.5 - -																												
Lab Report.	Sample No.	Sample type	EPA No.	Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Total Organic Carbon	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Dissolved Oxygen	Suspended Solids (SS)	pH	Electrical Conductivity	Temperature	Depth to Water (m) (TOC)	Comments	
					Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH	µS/cm	°C	m		
					Laboratory PQL	1	1	1	1	1	0.001	0.05	0.05	0.1	0.01	0.01	0.01	1	1	1	1	0.01	5	0.01	1	0.1	-	-
	BH-1c	861	3	16/12/2020	861	130			212	0.093		7.96	0.4	338	0.03	<0.10	176	2460	2460	<10			7	7360	25.9	3.39		
	BH-3	255	5	16/12/2020	255	138			30	0.193		1.85	0.2	37.4	0.06	11.1	17	399	399	82			7.3	1770	20.3	3.15		
	BH-4	280	6	16/12/2020	280	218			20	0.228		6.25	0.1	10.3	<0.01	<0.01	20	706	706	170			7	2250	21.2	4.41		
	BH-9	434	18	16/12/2020	434	208			59	0.628		6.12	0.4	77.9	<0.01	<0.01	78	1580	1580	88			6.8	4090	20.4	3.48		
	BH-12r	325	17	16/12/2020	325	246			59	0.516		4.75	0.2	5.79	0.04	0.28	29	729	729	318			6.7	2560	22.5	4.43		
	BH-13	113	10	16/12/2020	113	206			31	0.106		0.06	0.3	0.28	0.04	14.9	15	697	697	208			6.8	1790	22.3	4.32		
	BH-14	215	11	16/12/2020	215	106			32	0.15		<0.05	0.6	0.26	0.06	3.44	31	468	468	165			6.6	1680	22.5	4.88		
	BH-15	1360	7	16/12/2020	1360	88			298	0.28		10	0.3	31.3	<0.10	<0.10	73	373	373	435			6.8	5330	21.3	0.79		
	BH-18	0	25	16/12/2020																								
	BH-19R	266	16	16/12/2020	266	152			23	0.154		1.5	0.1	5.67	0.13	0.12	21	553	553	218			7.2	1960	20.5	4.56		
	BH-21	0	23	16/12/2020																								
	BH-22	0	24	16/12/2020																								
	SWP-1	251	1	15/12/2020	251	56	34	193	15	1.38	0.24	0.12						334	345	77		14	7.5					
	SWC-up	18600	20	15/12/2020	18600	428	1200	10200	367	0.1	<0.50	<0.50		<0.01	<0.01	2.58		131	131	2660		5	7.7					
	SWC-2	0	19	15/12/2020						0.1	<0.50	<0.50		0.04	<0.01	0.06		133	133			<5	7.8					
	SWC-down	19100	21	15/12/2020	19100	430	1200	10200	364	<0.1	<0.50	<0.50		0.1	<0.01	<0.01		132	132	2690		<5	7.8					
	SWC-down 2	18800	22	15/12/2020	18800	430	1220	10400	375	<0.1	<0.50	<0.50		0.03	<0.01	<0.01		130	130	2680		17	7.8					
	Leachate Tank LP1	1530	2	15/12/2020	1530	20			48	0.422	5.06		0.5	1260	<0.10	<0.10	673	4980	4980	<20	1.26		8.1	14400	24.4			
Investigation Investigation levels apply to typical slightly-moderately disturbed systems. Trigger Levels for 95% of species. See ANZECC & ARM CANZ (2000) for guidance on applying these levels to different ecosystem conditions. Also the same as the NEPM (2013) EILs.																												
ANZECC 2001 ANZG 2018 - pH Upper and Lower Limit for NSW Lowland Rivers (Table 3.3.2).																												
Investigation Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).																												
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Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the Technical Note for Investigation of Service Station Sites (EPA2014).																												
E Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the T																												
					MIN	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
					MAX	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
					Mean	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

TABLE 8: Total Concentration Results Quarterly Water Monitoring Results - August 2021: Dunmore Recycling and Waste Depot

GILs -Trigger Values for Freshwater (Protection of 95% of Species) ^A																												
-																												
GILs -Trigger Values for Marine Water (Protection of 95% of Species) ^A																												
-																												
Australian Drinking Water Guidelines (2018) ^C																												
Health																												
-																												
Aesthetic																												
250 - - - 180 - 0.1 0.3 0.3 - 0.5 - - - 250 - - 6.5 - 8.5 - -																												
Lab Report.	Sample No.	Sample type	EPA No.	Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Total Organic Carbon	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Dissolved Oxygen	Suspended Solids (SS)	pH	Electrical Conductivity	Temperature	Depth to Water (m) (TOC)	Comments	
					Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH	µS/cm	°C	mbgl		
					Laboratory PQL	1	1	1	1	1	0.001	0.05	0.05	0.1	0.01	0.01	0.01	1	1	1	1	0.01	5	0.01	1	0.1	-	-
	BH-1c	834	3	16/03/2021	834	122			202	0.102		13.3	0.3	340	<0.01	<0.01	219	2260	2260	<1			7.1	7300	19.8	3.31		
	BH-3	309	5	16/03/2021	309	126			27	0.234		4	0.1	42.5	0.02	1.49	17	482	482	97			7.3	2000	18.8	2.14		
	BH-4	244	6	16/03/2021	244	182			22	0.212		6.03	0.1	16.6	<0.01	<0.01	16	725	725	172			7	2170	19.1	4.37		
	BH-9	465	18	16/03/2021	465	190			60	0.685		5.85	0.4	96.4	<0.01	<0.01	51	1810	1810	98			7.2	4240	19.3	3.3		
	BH-12r	330	17	16/03/2021	330	206			53	0.444		6.41	0.2	8.93	0.02	0.17	58	797	797	185			6.8	2550	22	4.4		
	BH-13	112	10	16/03/2021	112	180			26	0.172		0.67	0.2	1.43	<0.01	2.01	25	646	646	215			6.9	1750	20.7	4.4		
	BH-14	231	11	16/03/2021	231	102			18	0.121		<0.05	0.5	0.36	0.06	17.2	37	548	548	130			6.7	1860	21.3	4.83		
	BH-15	1320	7	16/03/2021	1320	108			350	0.358		11.2	0.2	1.65	<0.01	17.4	106	445	445	495			6.8	6250	19.4	0.86		
	BH-18	17	25	16/03/2021	17	36			7	0.118		1.41	0.2	0.79	<0.01	<0.01	12	186	186	4			6.7	3960	21	2.32		
	BH-19R	0	16	16/03/2021																								
	BH-21	389	23	16/03/2021	389	127			16	0.276		0.77	0.4	3.4	<0.01	0.62	35	540	540	429			7.2	2770	22.3	3.12		
	BH-22	263	24	16/03/2021	263	138			27	0.089		0.58	0.4	1.24	<0.01	<0.01	21	476	476	312			7.5	2110	19.7	2.75		
	SWP-1	137	1	17/03/2021	137	34	18	94	12	0.406	0.35	0.15						189	189	4		21	7.2					
	SWC-up	11300	20	17/03/2021	11300	314	896	7320	261	0.077	0.89	<0.10		0.28	<0.01	0.01		167	167	1860		46	7.3					
	SWC-2	0	19	17/03/2021						0.037	0.2	<0.50		0.24	<0.01	<0.01		152	152			<5	7.6					
	SWC-down	14300	21	17/03/2021	14300	376	1100	9120	326	0.027	0.16	<0.10		0.24	<0.01	0.02		136	136	2210		6	7.7					
	SWC-down 2	13100	22	17/03/2021	13100	355	1050	8730	308	0.024	<0.10	<0.50		0.16	<0.01	0.01		139	139	2040		<5	7.5					
	Leachate Tank LP1	1420	2	17/06/2021	1420	73			525	0.476	1.25		0.4	1610	<0.10	<0.10	869	6470	6470	<10	3.56		7.7	16700	25			

Investigation Investigation levels apply to typical slightly-moderately disturbed systems. Trigger Levels for 95% of species. See ANZECC & ARMCANZ (2000) for guidance on applying these levels to different ecosystem conditions. Also the same as the NEPM (2013) EILs.
 ANZECC 2001 ANZG 2018 - pH Upper and Lower Limit for NSW Lowland Rivers (Table 3.3.2).
 Investigation Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).
 NEPM (2013) NEPM (2013 Table 1(A) Groundwater HSLs for vapour intrusion (Sand 2m-4m)
 Netherlands (Netherlands (2000) Circular on Target Values and Intervention Values for Soil Remediation, Ministry of Housing, Spatial Planning and the Environment, Netherlands Government (Dutch Intervention Value/Indicative of Serious Contamination).
 Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the Technical Note for Investigation of Service Station Sites (EPA2014).
 E Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the T

TABLE 9: Total Concentration Results Quarterly Water Monitoring Results - August 2021: Dunmore Recycling and Waste Depot

GILs -Trigger Values for Freshwater (Protection of 95% of Species) ^A		-	-	-	-	-	1.9	-	-	-	0.9 (pH 8)	-	0.7	-	-	-	-	-	-	-	6.5 - 8.5	2200	-	-	-	-		
GILs -Trigger Values for Marine Water (Protection of 95% of Species) ^A		-	-	-	-	-	-	-	-	-	0.91 (pH 8)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Australian Drinking Water Guidelines (2018) ^C		Health	-	-	-	-	-	0.5	-	-	1.5	-	3	50	-	-	-	-	-	-	-	6.5 - 8.5	-	-	-	-		
		Aesthetic	250	-	-	180	-	0.1	0.3	0.3	-	0.5	-	-	-	-	-	250	-	-	-	6.5 - 8.5	-	-	-	-		
Lab Report.	Sample No.	Sample type	EPA No.	Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Total Organic Carbon	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Dissolved Oxygen	Suspended Solids (SS)	pH	Electrical Conductivity	Temperature	Depth to Water (m) (TOC)	Comments	
					Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH	µS/cm	°C	m		
					Laboratory PQL	1	1	1	1	1	0.001	0.05	0.05	0.1	0.01	0.01	0.01	1	1	1	1	0.01	5	0.01	1	0.1	-	-
	BH-1c	865	3	16/06/2021	865	143			207	0.118		13.1	0.2	318	<0.01	<0.01	168	1630	1630	<10			7	7080	24	2.93		
	BH-3	155	5	16/06/2021	155	156			32	0.098		0.29	0.2	15.6	0.08	11.6	11	259	259	97			7.2	1430	18.7	3.01		
	BH-4	227	6	16/06/2021	227	233			17	0.223		5.22	<0.1	10.8	<0.01	<0.01	21	411	411	172			7.6	2090	19	4.21		
	BH-9	630	18	16/06/2021	630	285			74	0.467		5.3	0.4	98.8	<0.01	<0.01	91	1050	1050	98			6.9	5000	17.3	2.86		
	BH-12r	275	17	16/06/2021	275	239			84	0.527		11.2	0.2	6.68	<0.01	0.49	24	351	351	185			6.7	2270	21.8	4.19		
	BH-13	118	10	16/06/2021	118	174			18	0.146		1.1	0.2	1.48	<0.01	5.2	18	369	369	139			6.7	1490	20.7	4.17		
	BH-14	102	11	16/06/2021	102	102			24	0.062		0.09	0.5	0.12	0.2	32	35	190	190	134			6.4	1320	21.4	4.58		
	BH-15	527	7	16/06/2021	527	83			232	0.248		6.34	0.2	20.4	<0.01	0.01	34	187	187	434			6.9	3260	15.78	0.7		
	BH-18	10	25	16/06/2021	10	33			4	0.051		0.96	0.1	0.16	<0.01	<0.01	2	78	78	4			6.7	2590	20.7	2.03		
	BH-19R	0	16	16/06/2021																								
	BH-21	338	23	16/06/2021	338	127			20	0.321		0.93	0.3	4.28	<0.01	0.01	31	315	315	346			7.1	2570	21.9	1.81		
	BH-22	234	24	16/06/2021	234	138			26	0.096		0.71	0.3	1.38	<0.01	<0.01	23	356	356	222			7.4	2070	19.1	2.46		
	SWP-1	352	1	17/06/2021	352	62	53	314	14	0.439	0.29	0.22	0.4	0.22	<0.01	<0.01	16	256	256	234	2.88	<5	7.4	2070				
	SWC-up	2230	20	17/06/2021	2230	81	143	1180	45	0.067	0.8	<0.05	0.3	0.14	<0.01	0.29	5	85	85	358	9	14	7.4	7330				
	SWC-2	2270	19	17/06/2021	2270	89	170	1410	54	0.059	0.75	0.1	0.3	0.14	<0.01	0.28	6	92	92	411	8.9	<5	7.5	8630				
	SWC-down	2900	21	17/06/2021	2900	91	177	1480	57	0.048	0.66	<0.05	0.3	0.18	<0.01	0.28	7	82	82	419	9.2	<5	7.5	9030				
	SWC-down 2	3320	22	17/06/2021	3320	100	206	1740	66	0.042	0.65	<0.05	0.3	0.11	<0.01	0.26	3	102	102	476	9.01	15	7.5	7560				
	Leachate Tank LP1	1420	2	17/06/2021	1420	73			525	0.476	1.25		0.4	1610	<0.10	<0.10	869	6470	6470	<10	3.56		7.7	16700	25			

Investigation Investigation levels apply to typical slightly-moderately disturbed systems. Trigger Levels for 95% of species. See ANZECC & ARMCANZ (2000) for guidance on applying these levels to different ecosystem conditions. Also the same as the NEPM (2013) EILs.
 ANZECC 2001 ANZG 2018 - pH Upper and Lower Limit for NSW Lowland Rivers (Table 3.3.2).
 Investigation Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).
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 Netherlands (Netherlands (2000) Circular on Target Values and Intervention Values for Soil Remediation, Ministry of Housing, Spatial Planning and the Environment, Netherlands Government (Dutch Intervention Value/Indicative of Serious Contamination).
 Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the Technical Note for Investigation of Service Station Sites (EPA2014).
 E Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the T

	MIN	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
MAX	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Mean	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

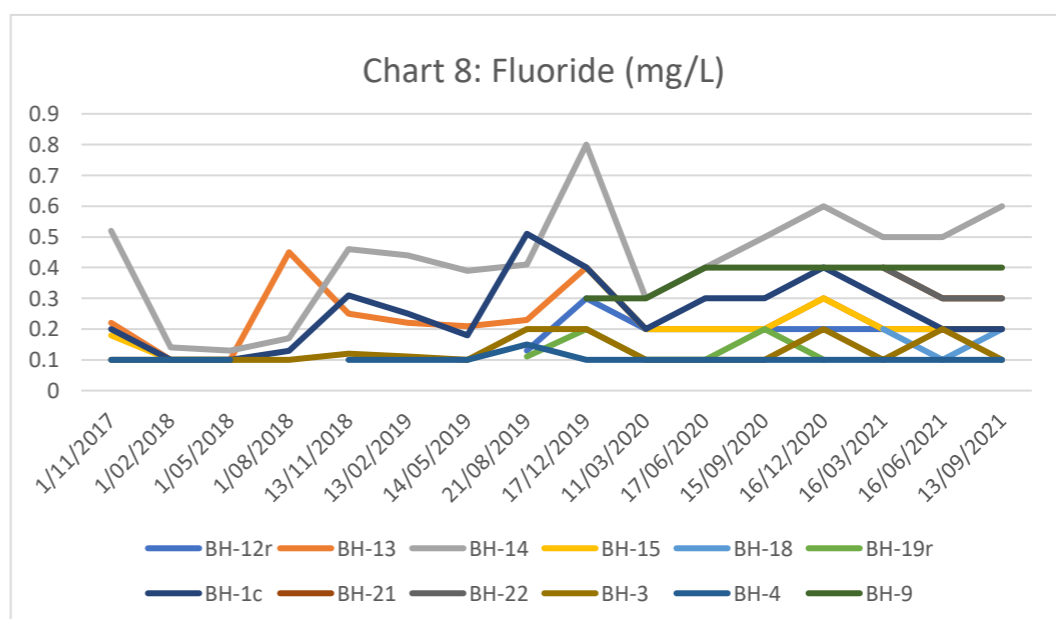
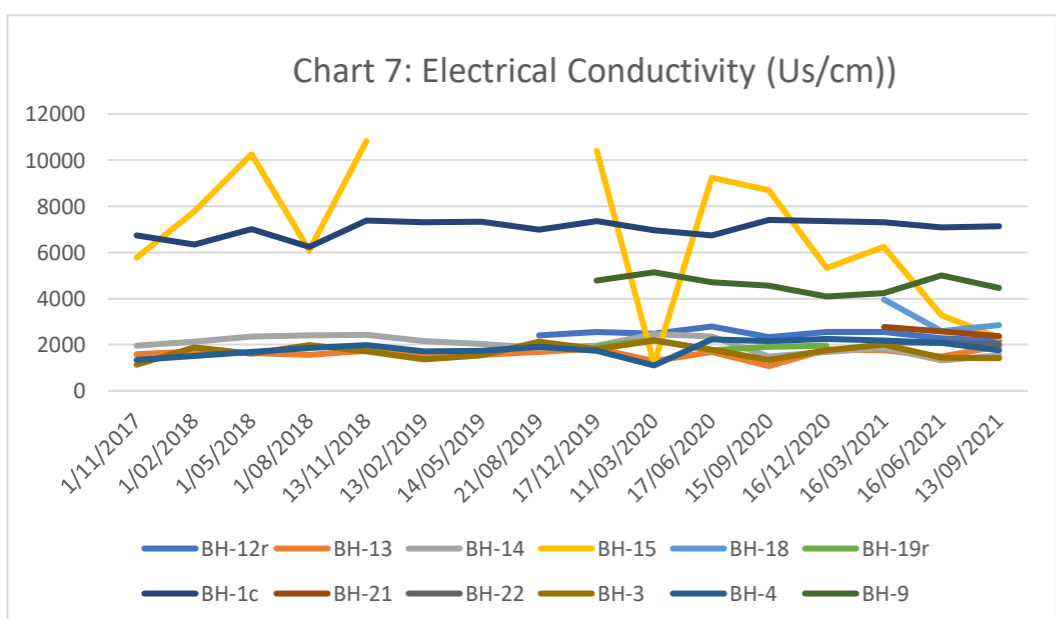
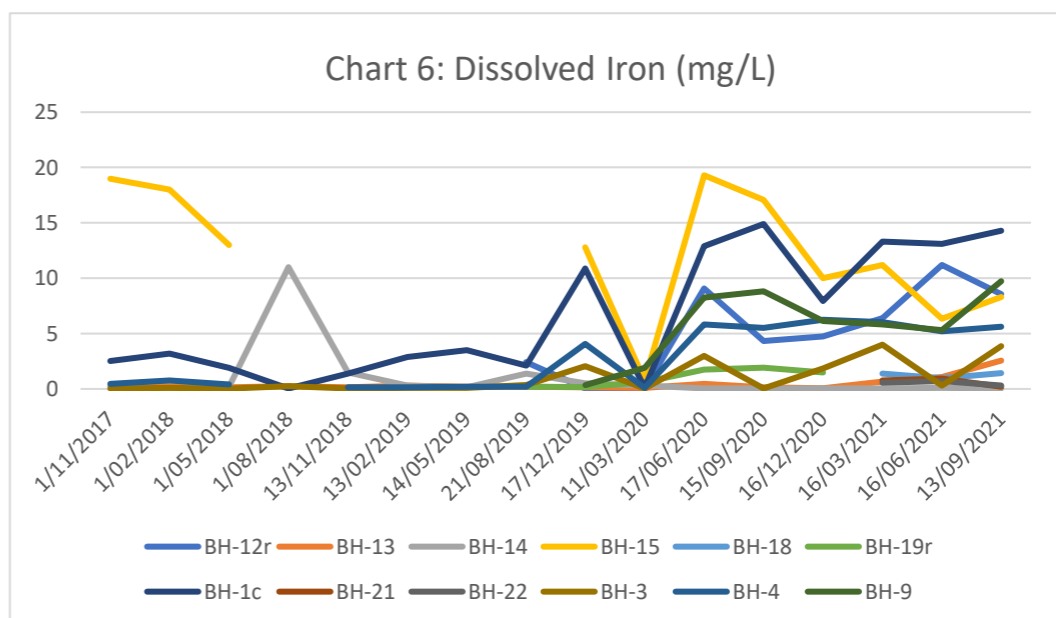
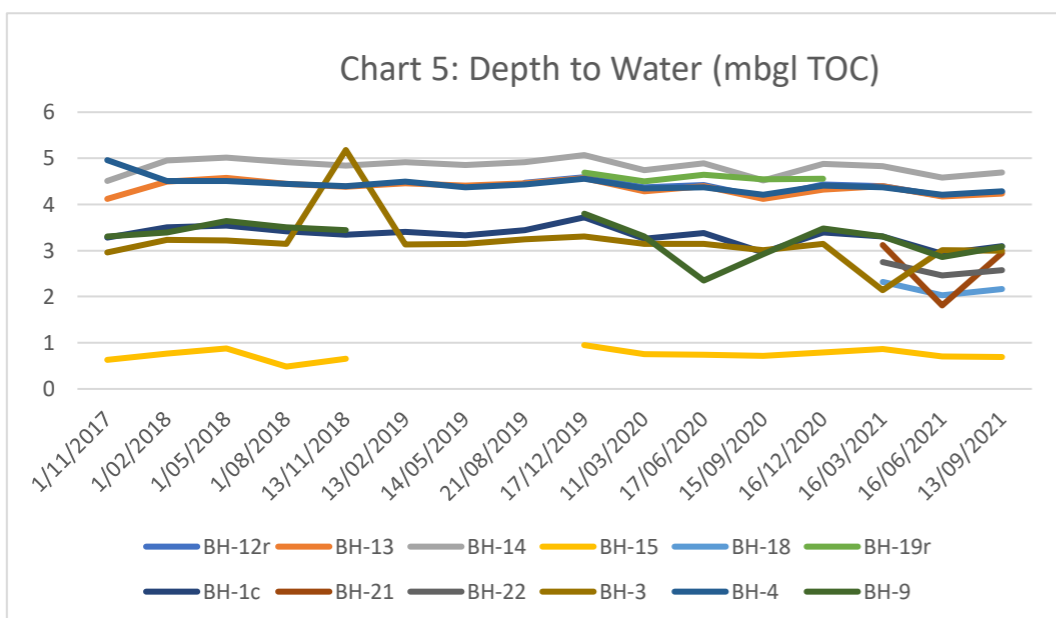
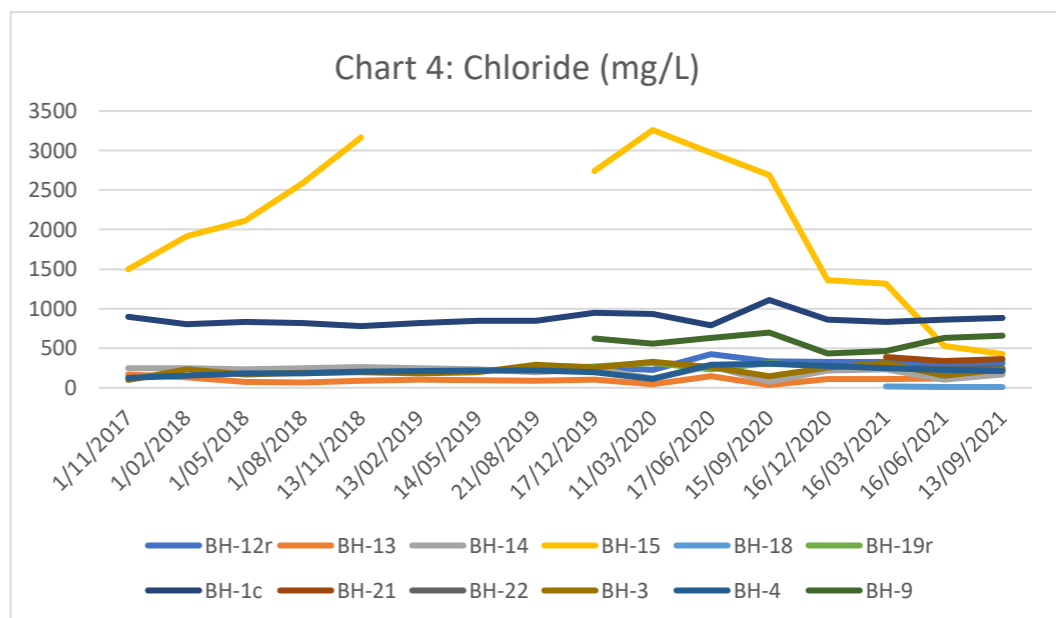
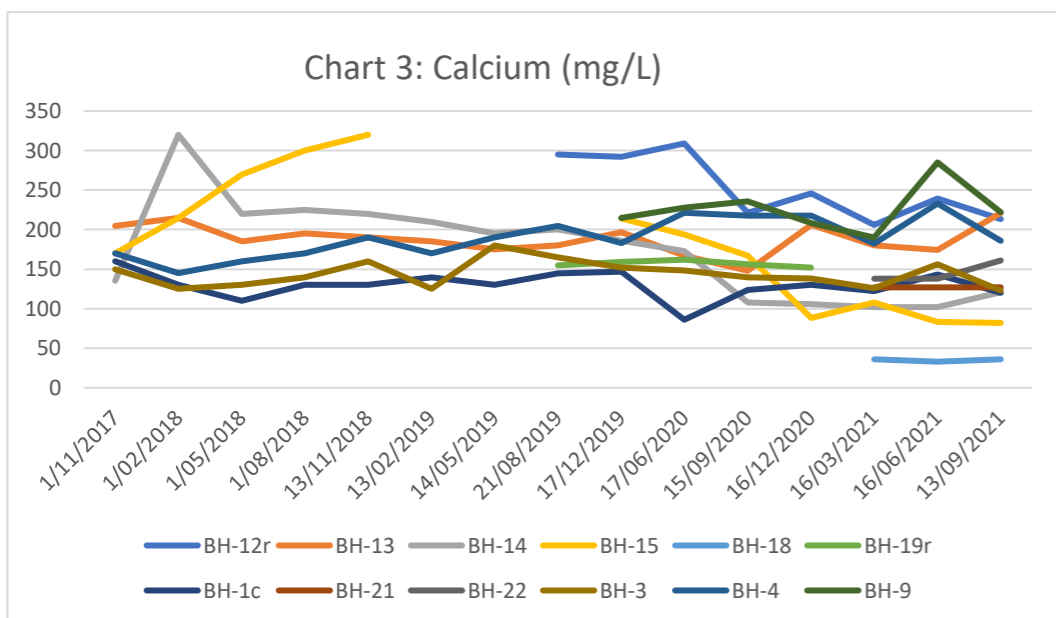
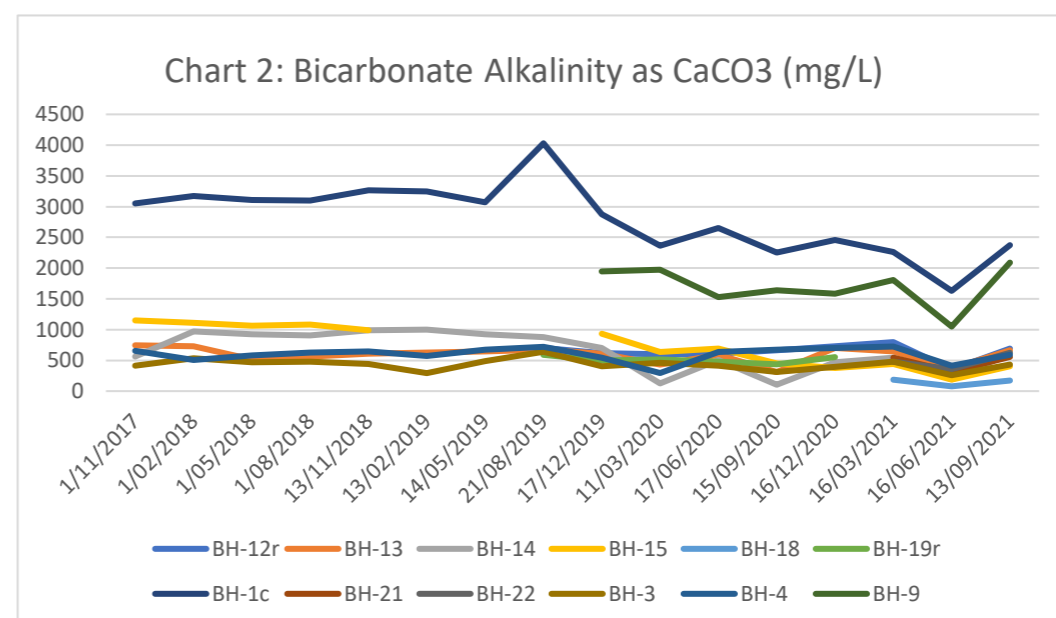
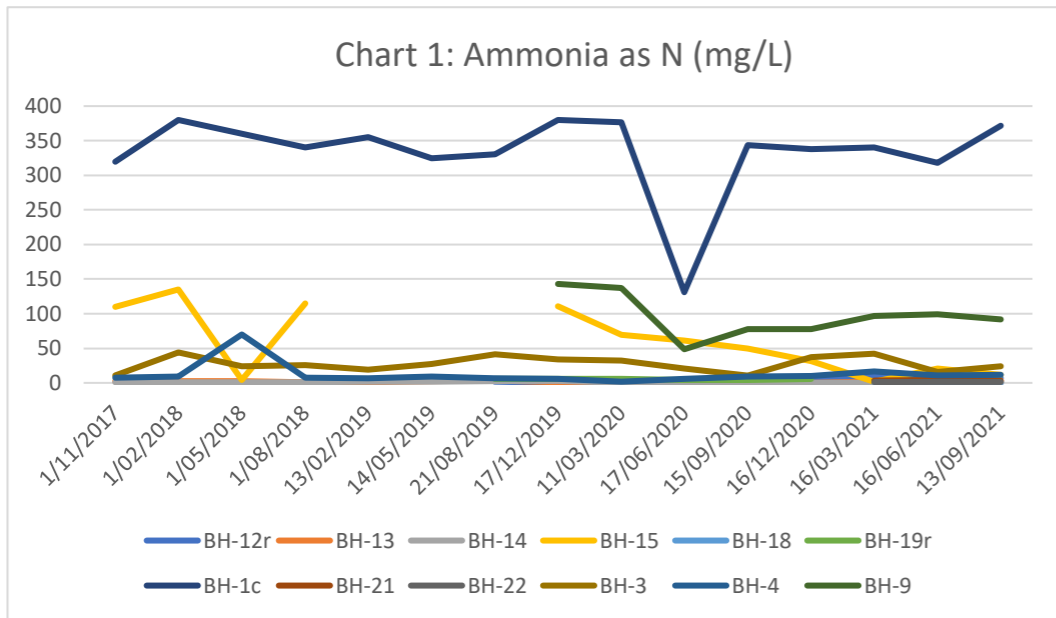
TABLE 10: Total Concentration Results Quarterly Water Monitoring Results - August 2021: Dunmore Recycling and Waste Depot

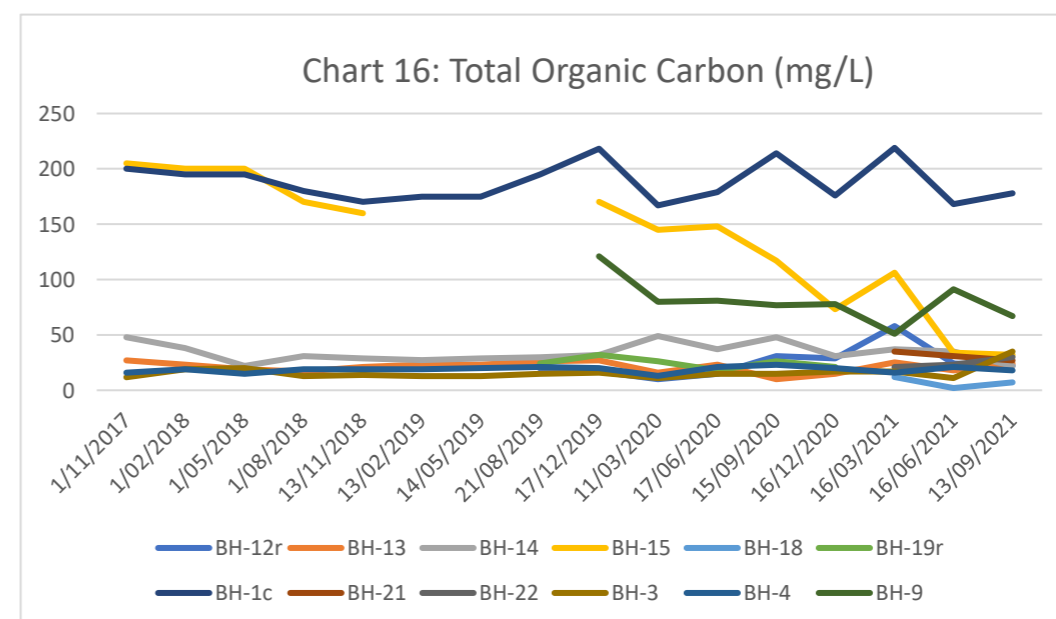
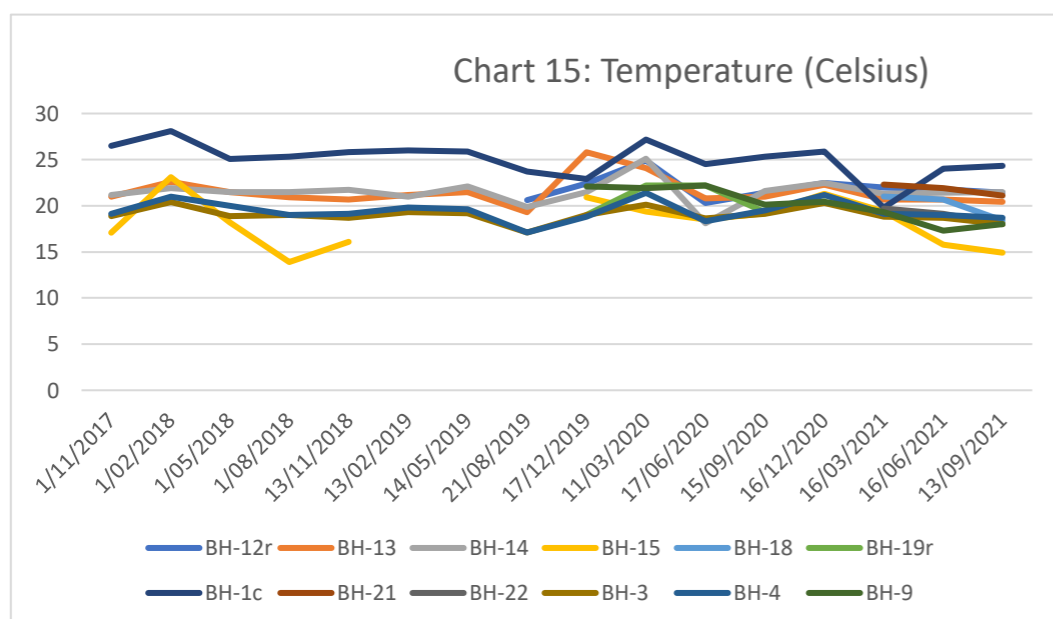
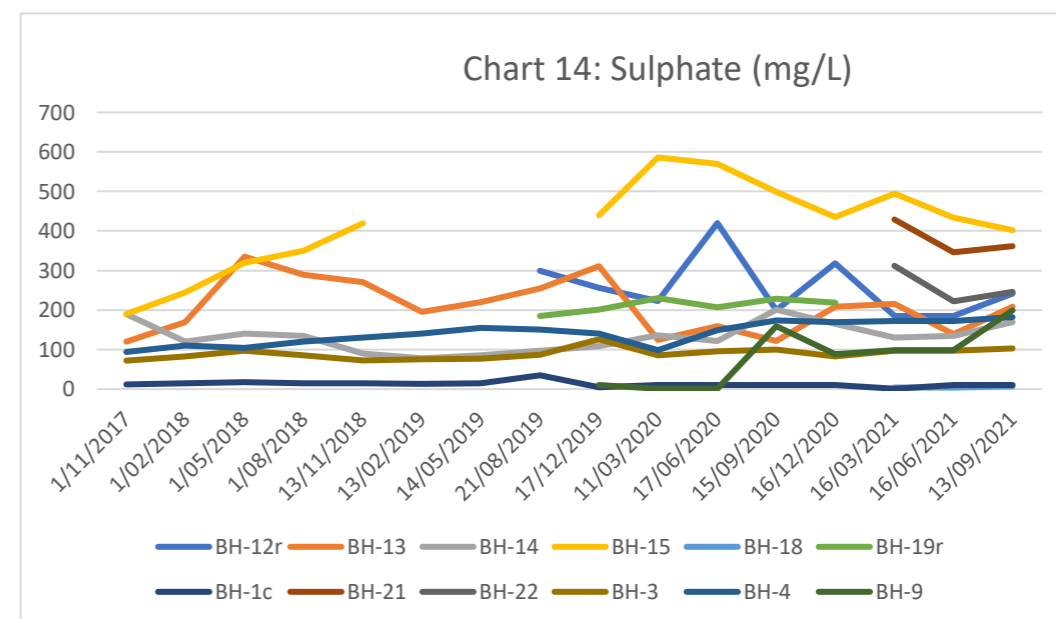
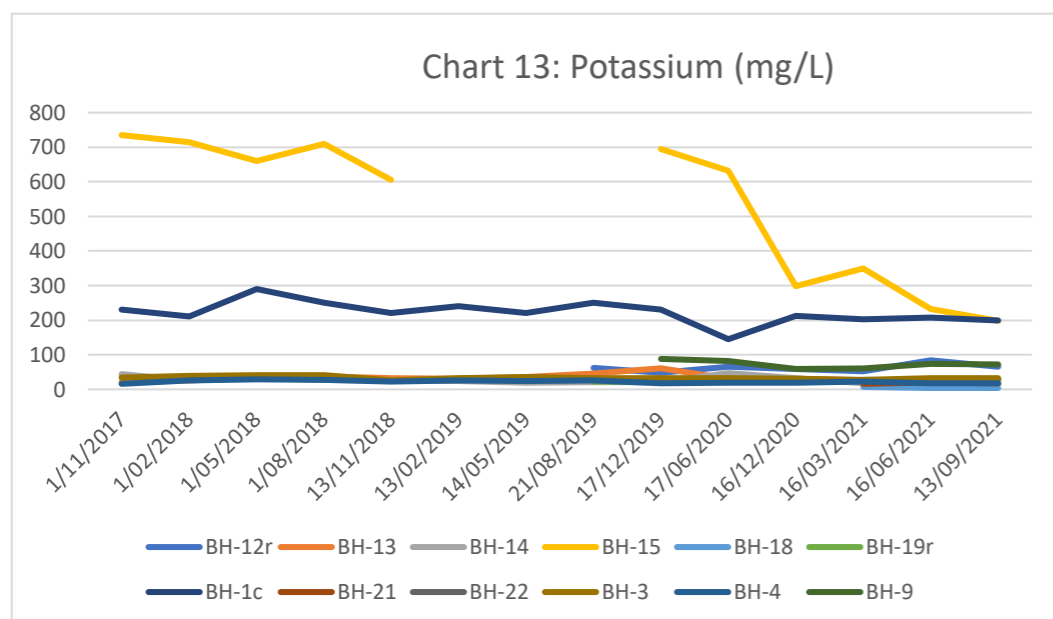
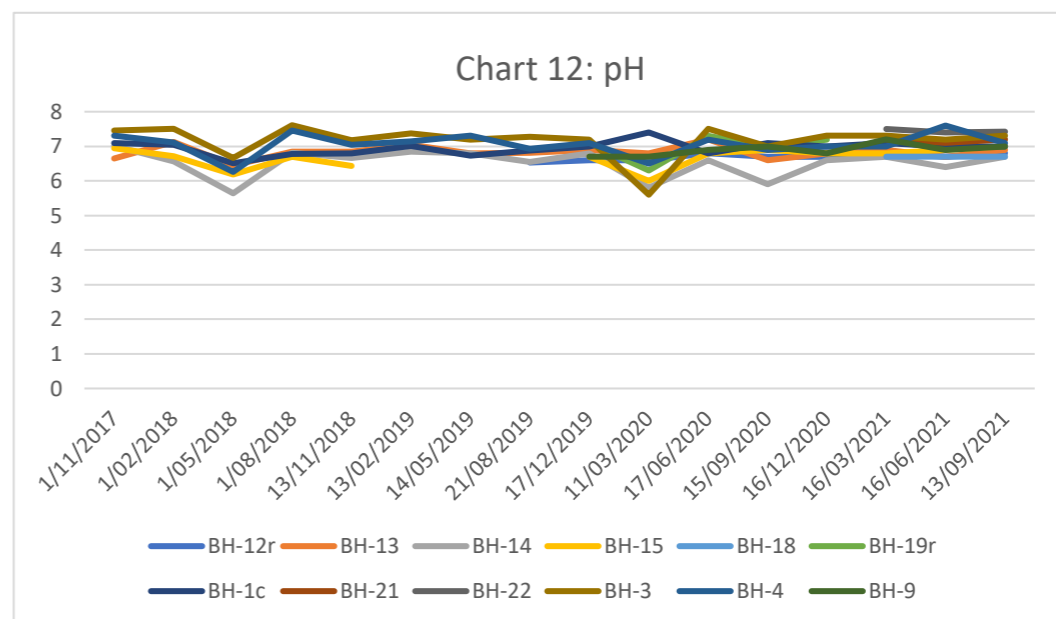
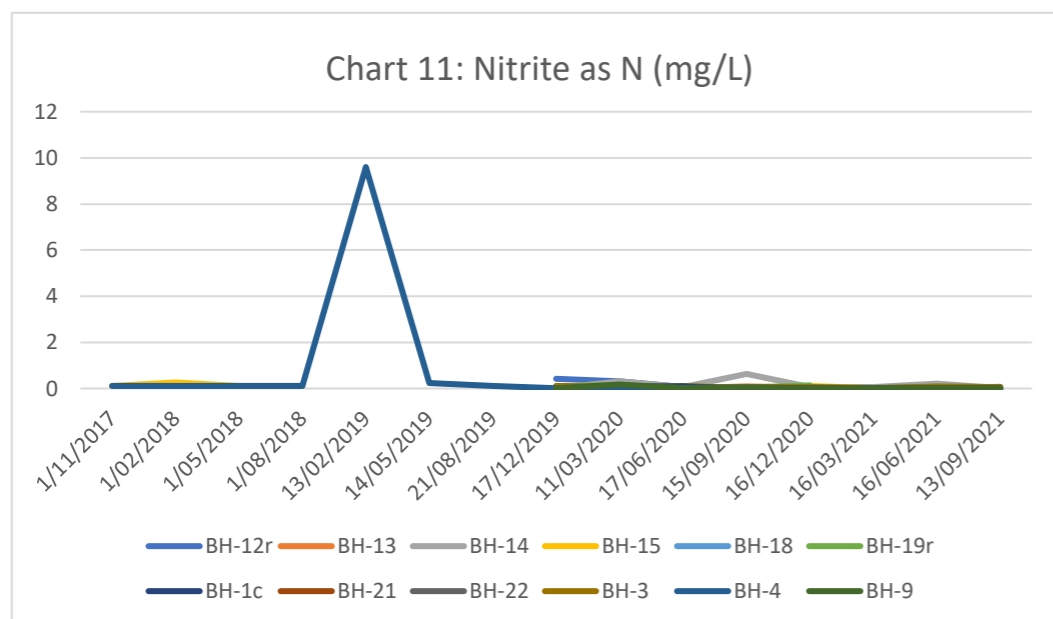
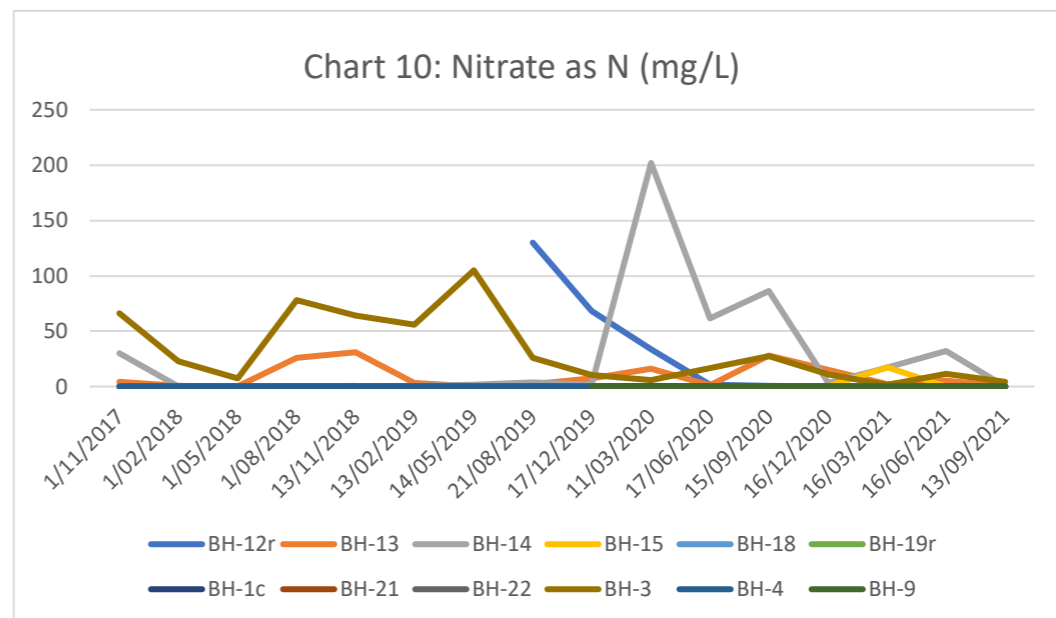
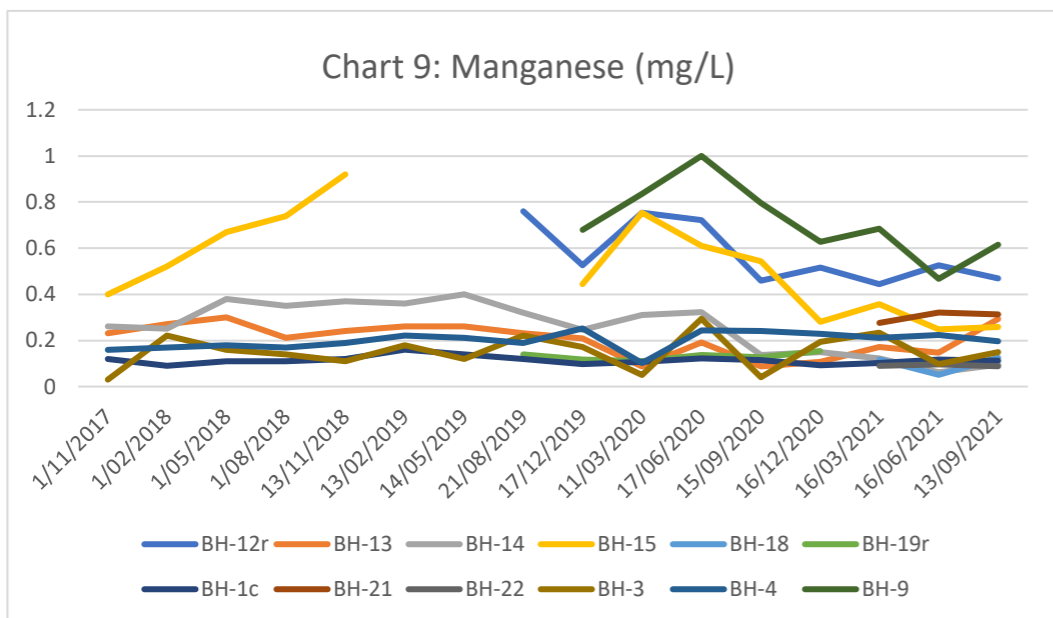
GILs -Trigger Values for Freshwater (Protection of 95% of Species) ^A																											
-																											
GILs -Trigger Values for Marine Water (Protection of 95% of Species) ^A																											
-																											
Australian Drinking Water Guidelines (2018) ^C																											
Health																											
-																											
Aesthetic																											
250 - - - 180 - 0.1 0.3 0.3 - 0.5 - - - 250 - - 6.5 - 8.5 - -																											
Lab Report.	Sample No.	Sample type	EPA No.	Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Total Organic Carbon	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Dissolved Oxygen	Suspended Solids (SS)	pH	Electrical Conductivity	Temperature	Depth to Water (m bgl TOC)	Comments
Units					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH	µS/cm	°C	mbgl	
Laboratory PQL					1	1	1	1	1	0.001	0.05	0.05	0.1	0.01	0.01	0.01	1	1	1	1	0.01	5	0.01	1	0.1	-	-
	BH-1c	884	3	13/09/2021	884	120			199	0.113		14.3	0.2	372	<0.01	<0.01	178	2370	2370	<10			7	7130	24.3	3.1	
	BH-3	234	5	13/09/2021	234	123			33	0.15		3.84	0.1	23.9	0.06	4.52	35	433	433	103			7.3	1420	18	3	
	BH-4	208	6	13/09/2021	208	186			18	0.197		5.62	<0.1	12	<0.01	0.08	18	588	588	182			7.1	1750	18.7	4.28	
	BH-9	661	18	13/09/2021	661	222			72	0.616		9.73	0.4	92	<0.01	<0.01	67	2090	2090	199			7	4450	18	3.08	
	BH-12r	316	17	13/09/2021	316	213			66	0.469		8.56	0.2	6.44	<0.01	0.05	22	696	696	241			6.8	2170	21.4	4.27	
	BH-13	215	10	13/09/2021	215	221			28	0.294		2.56	0.2	3.14	<0.01	0.35	24	667	667	209			6.9	1930	20.4	4.24	
	BH-14	168	11	13/09/2021	168	121			14	0.095		<0.05	0.6	0.98	<0.01	0.05	22	621	621	170			6.7	1530	21.5	4.69	
	BH-15	427	7	13/09/2021	427	82			198	0.259		8.31	0.2	11.9	<0.01	0.05	32	402	402	402			7	2300	14.9	0.69	
	BH-18	11	25	13/09/2021	11	36			4	0.125		1.43	0.2	0.46	<0.01	0.01	7	173	173	7			6.7	2850	18.4	2.16	
	BH-19R	214	16	13/09/2021	214	139			25	0.112		1.11	0.1	4.58	<0.01	0.07	16	495	495	196			7.2	1530	18.4	4.54	
	BH-21	363	23	13/09/2021	363	127			17	0.314		0.2	0.3	2.98	0.07	0.07	27	557	557	362			7.2	2370	21.1	2.95	
	BH-22	246	24	13/09/2021	246	161			28	0.088		0.31	0.3	1.38	<0.01	<0.01	30	623	623	246			7.43	2020	18	2.58	
	SWP-1	161	1	14/09/2021	161	48	28	132	12	0.229	0.67	0.06	0.2	0.04	<0.01	<0.01	17	285	285	68	4.16	15	7.6	820	12.5		
	SWC-up	2420	20	14/09/2021	2420	79	154	1240	46	0.095	0.61	0.08	0.3	0.24	<0.01	0.23	8	142	142	343	7.71	16	7.3	6140	13		
	SWC-2	2440	19	14/09/2021	2440	78	142	1160	50	0.092	0.67	0.2	0.3	0.61	<0.01	0.22	8	149	149	349	7.86	8	7.4	5890	12.6		
	SWC-down	7400	21	14/09/2021	7400	194	486	4060	149	0.08	0.46	0.08	0.5	0.94	<0.01	0.13	7	155	155	1360	6.91	<5	7.3	18300	13.6		
	SWC-down 2	3690	22	14/09/2021	3690	102	233	1860	71	0.077	0.62	0.05	0.4	0.43	<0.01	0.2	8	141	141	541	7.78	<5	7.4	8750	12.8		
	Leachate Tank LP1	1420	2	17/06/2021	1420	73			525	0.476	1.25		0.4	1610	<0.10	<0.10	869	6470	6470	<10	3.56		7.7	16700	25		

Investigation Investigation levels apply to typical slightly-moderately disturbed systems. Trigger Levels for 95% of species. See ANZECC & ARM CANZ (2000) for guidance on applying these levels to different ecosystem conditions. Also the same as the NEPM (2013) EILs.
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 Investigation Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).
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 Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the Technical Note for Investigation of Service Station Sites (EPA2014).
 E Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the T

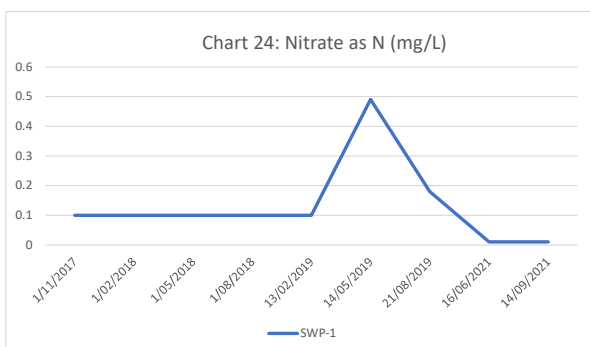
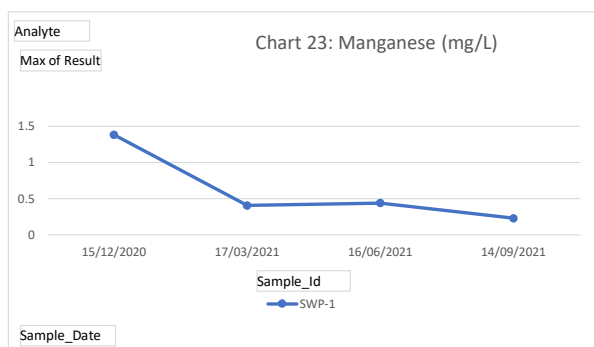
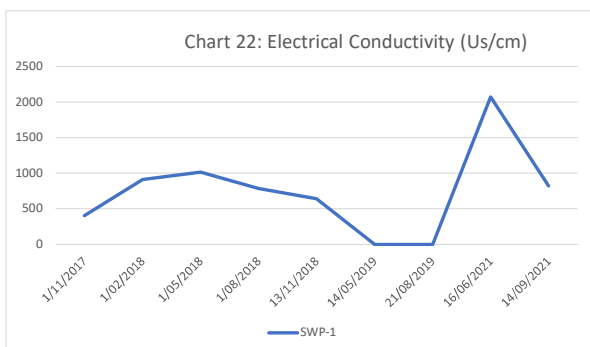
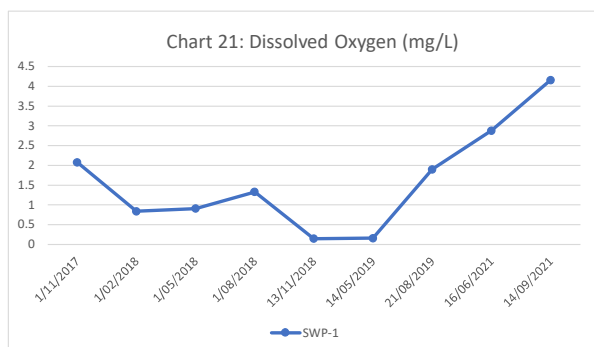
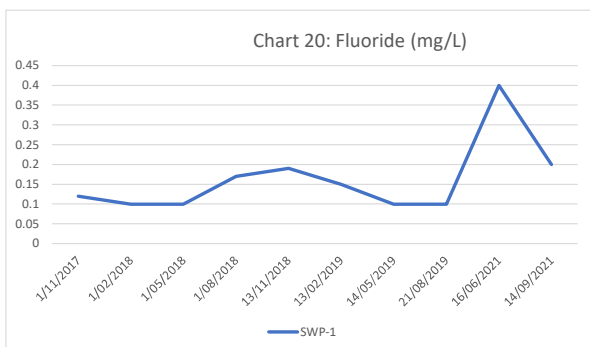
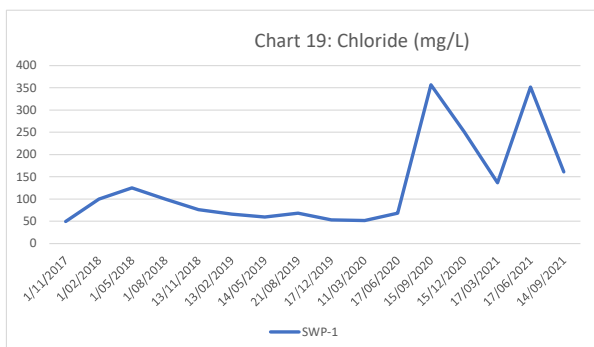
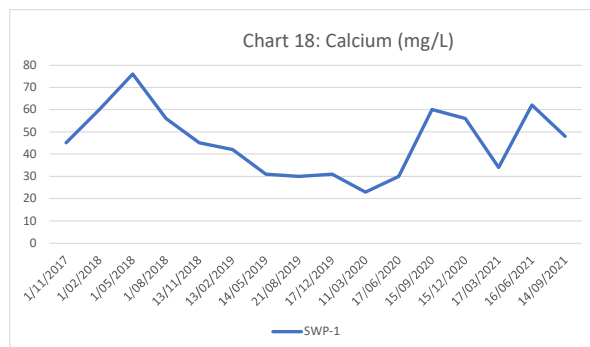
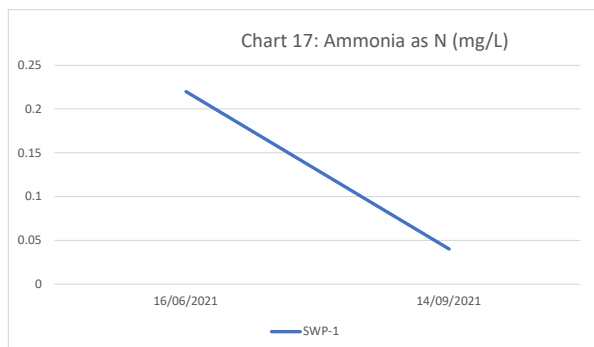
CHARTS

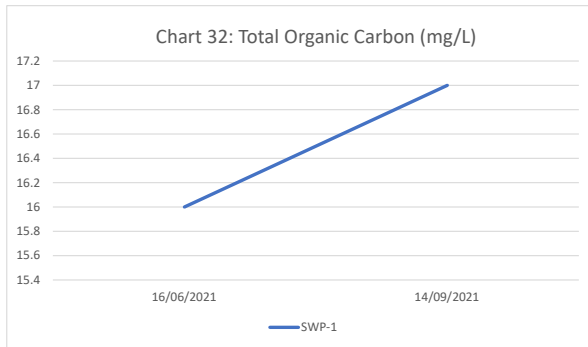
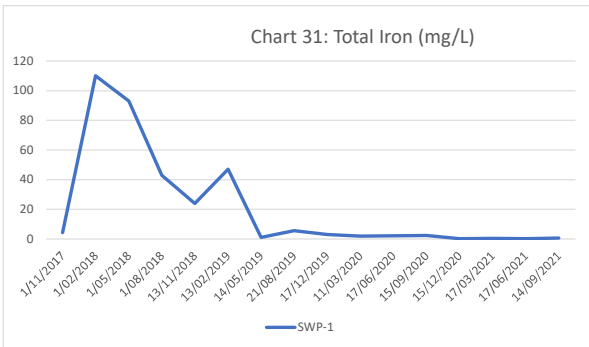
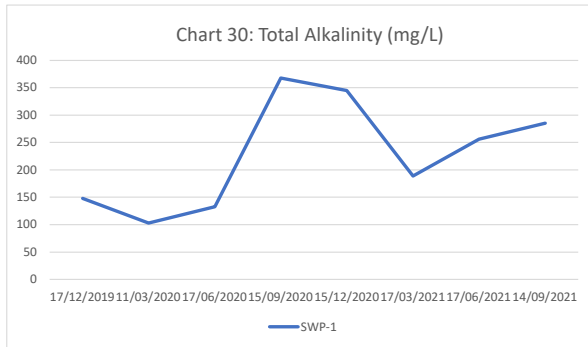
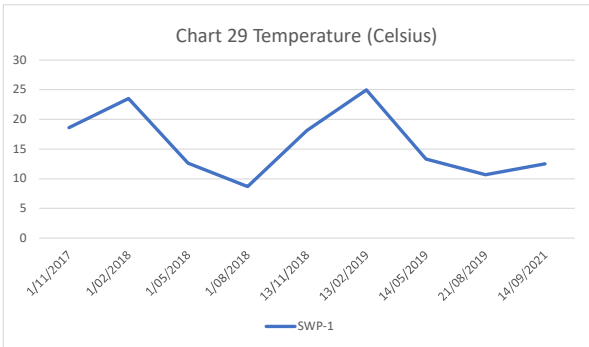
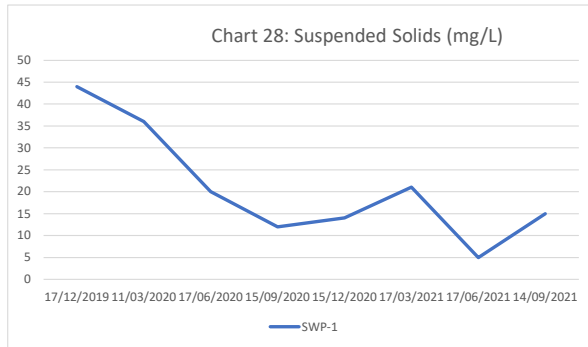
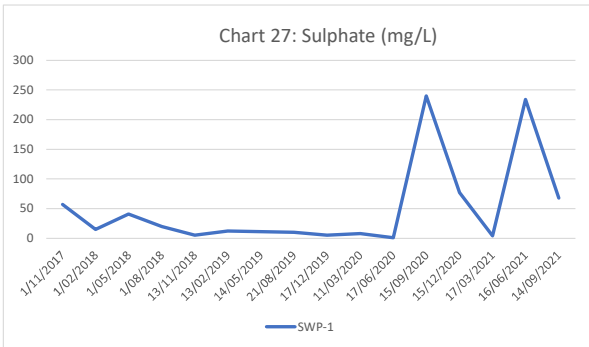
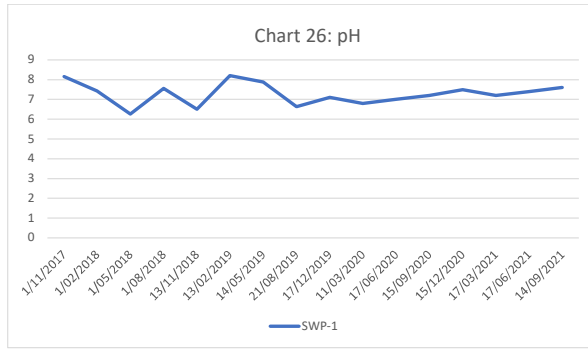
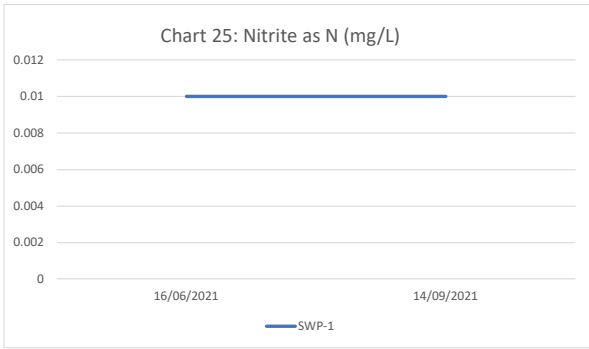
Charts 1-16: Groundwater Charts



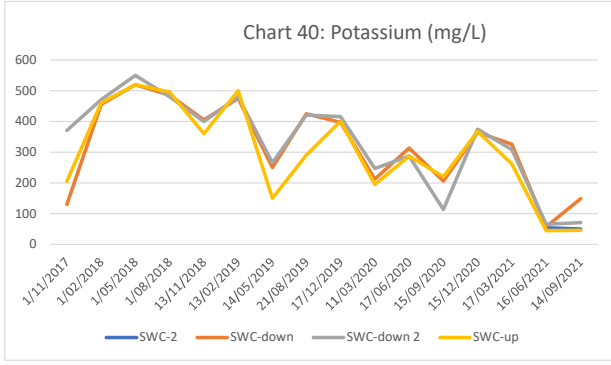
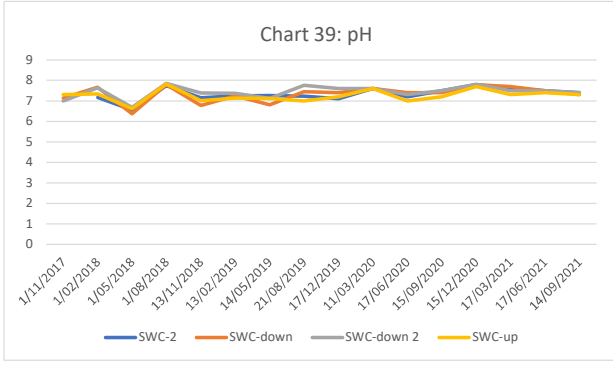
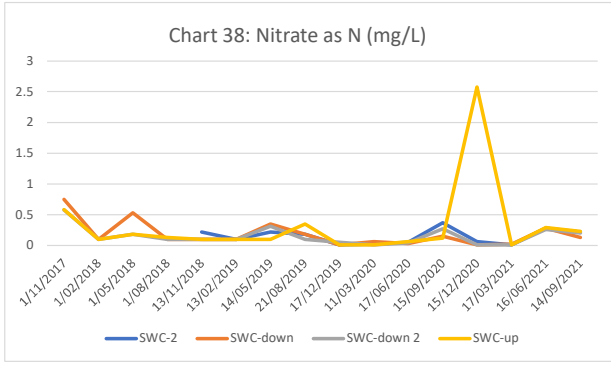
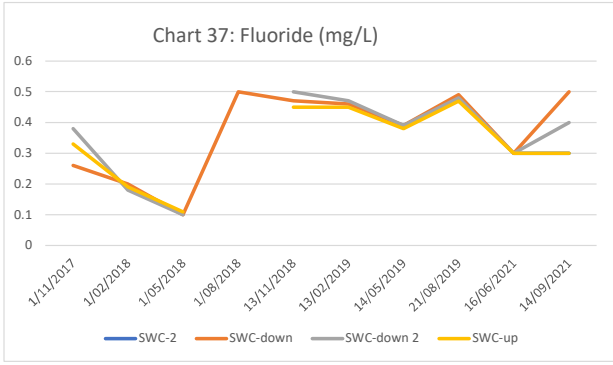
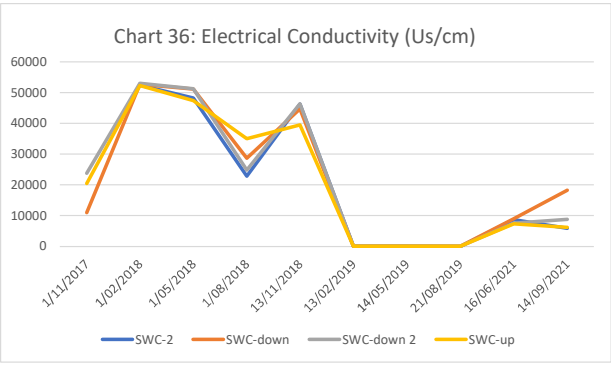
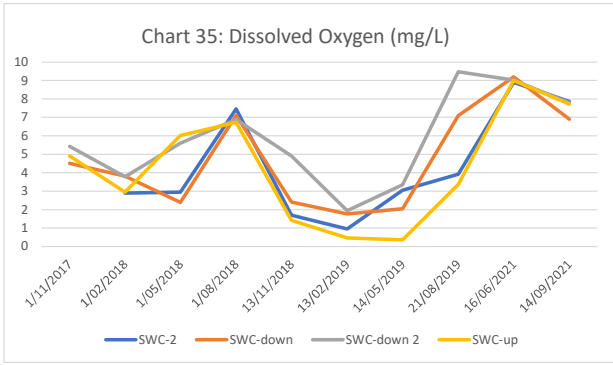
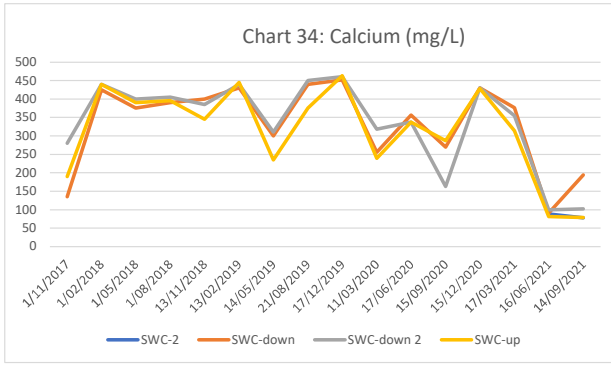
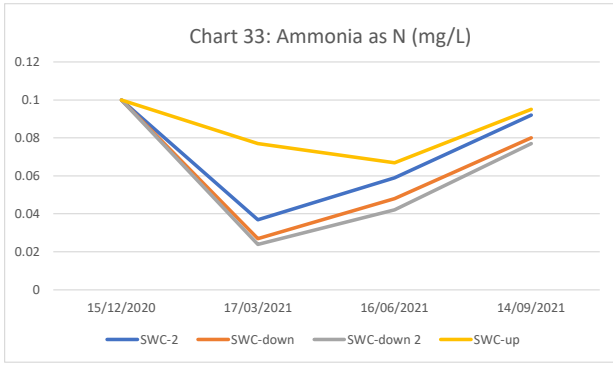


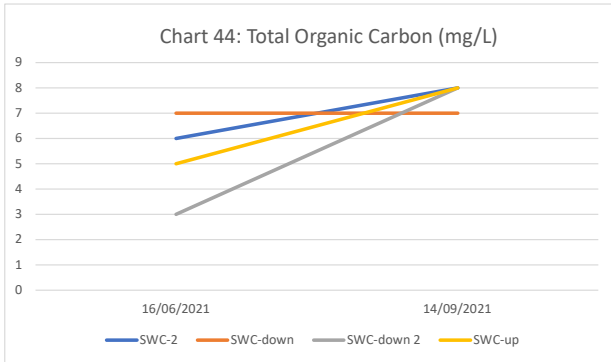
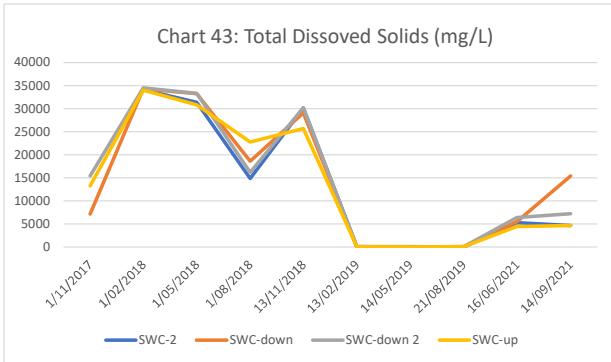
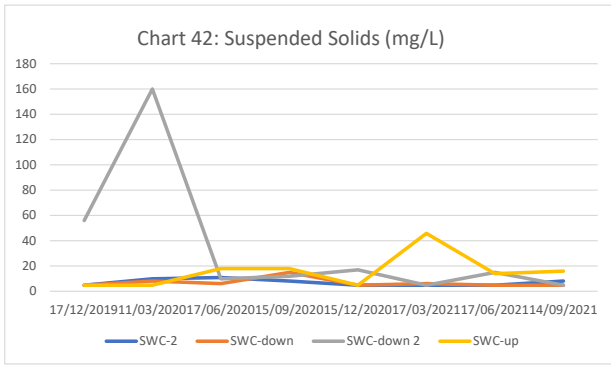
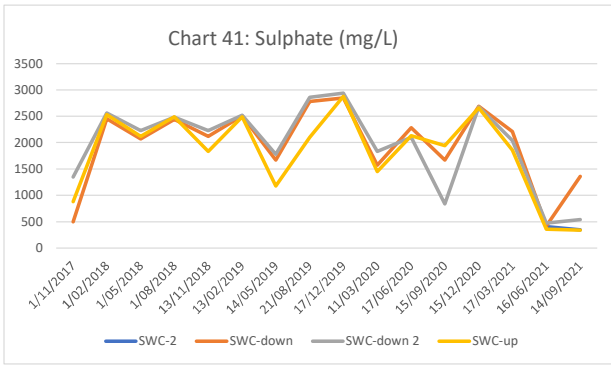
Charts 17-32: Onsite Surface Water Charts



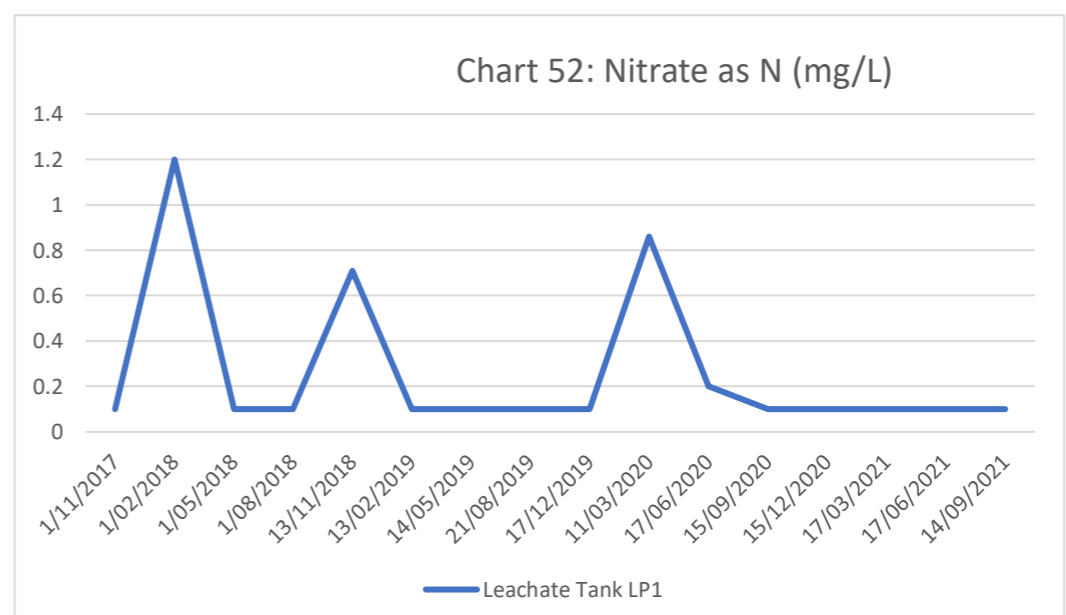
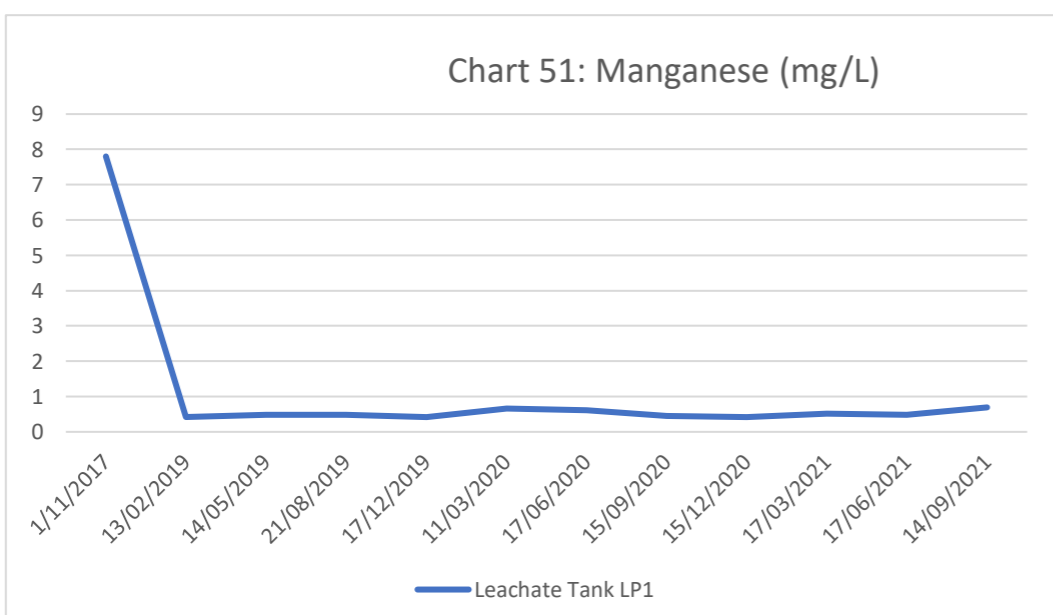
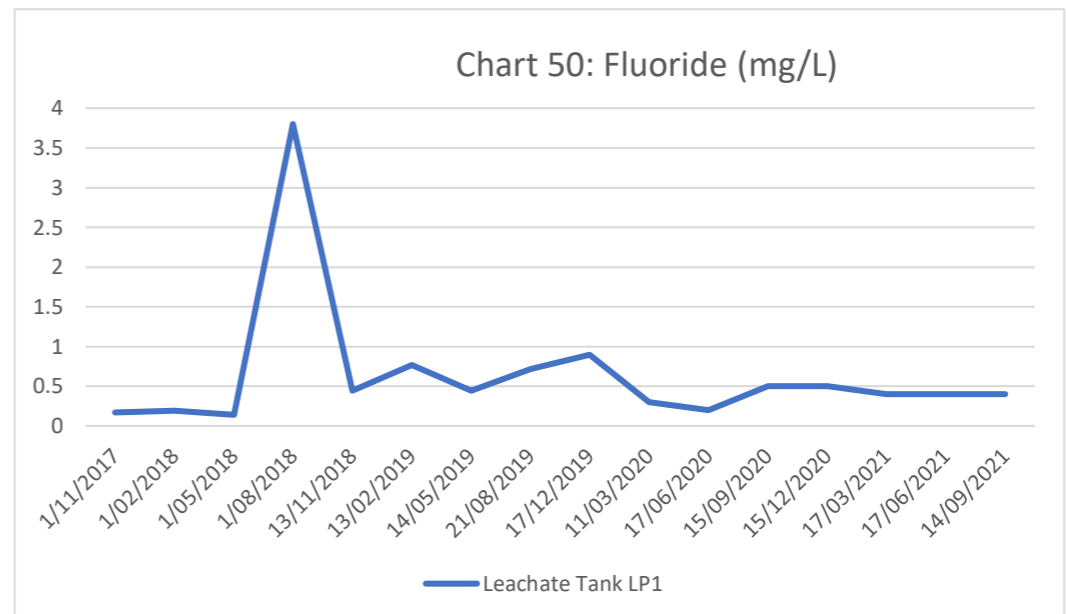
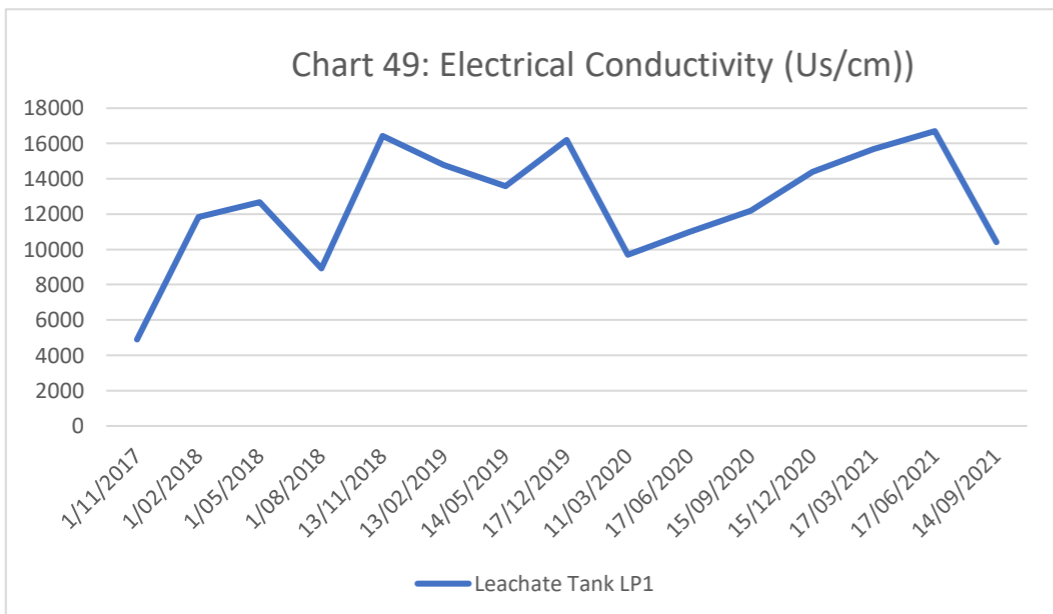
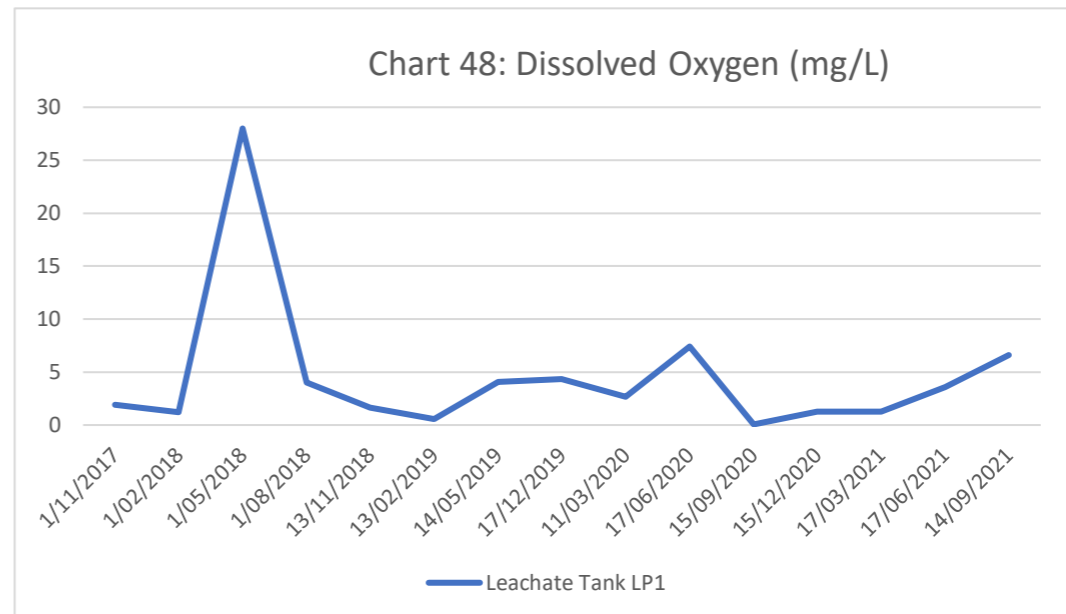
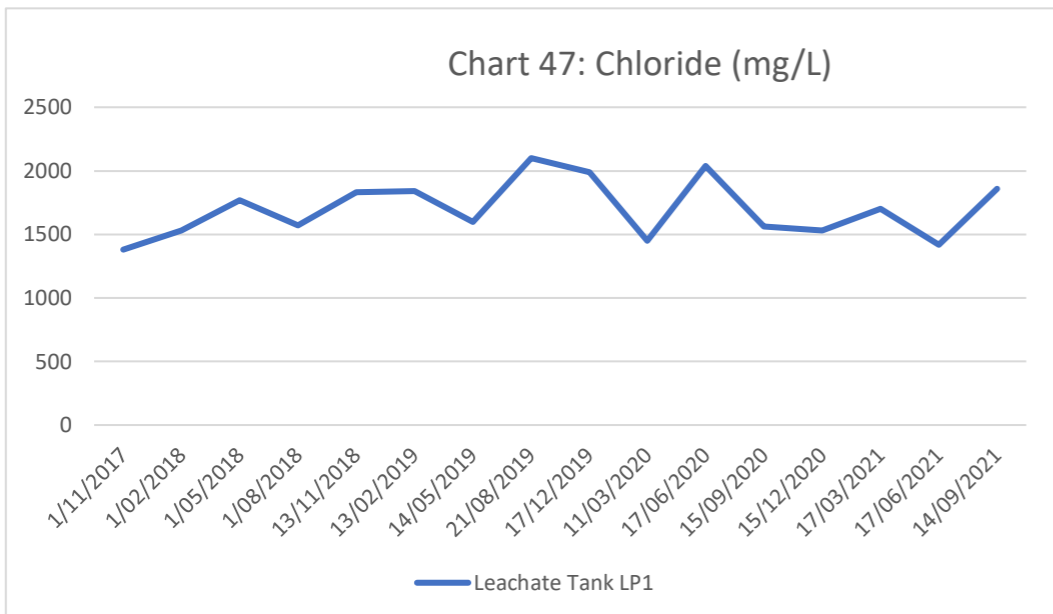
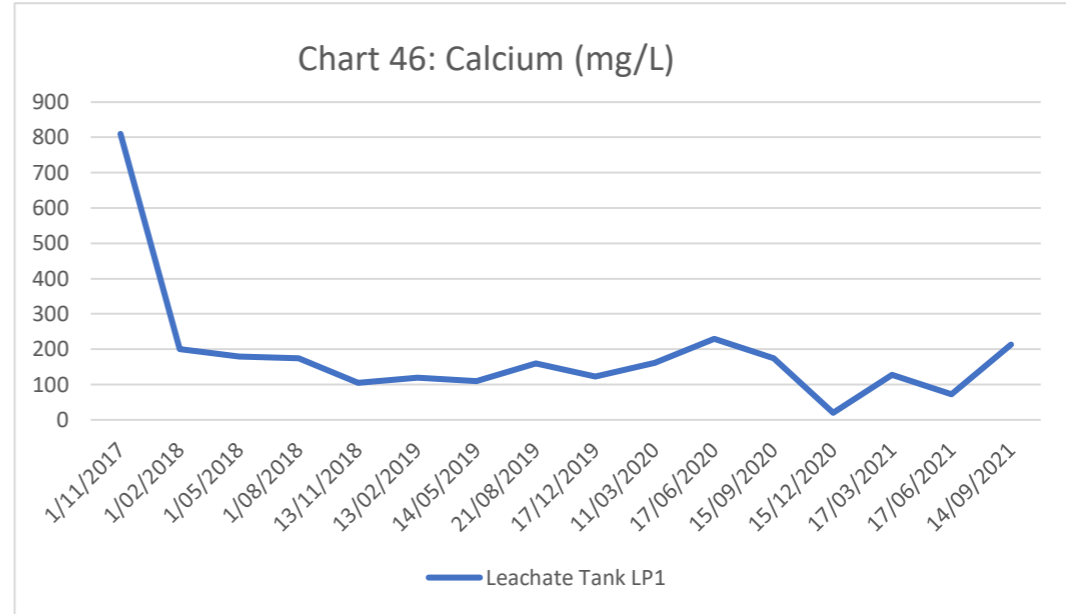
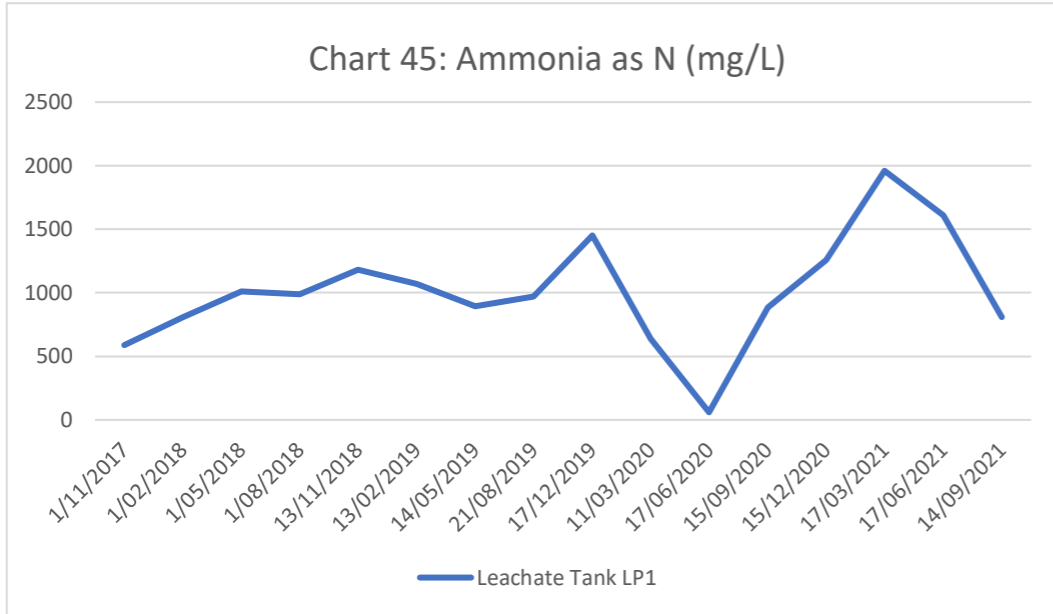


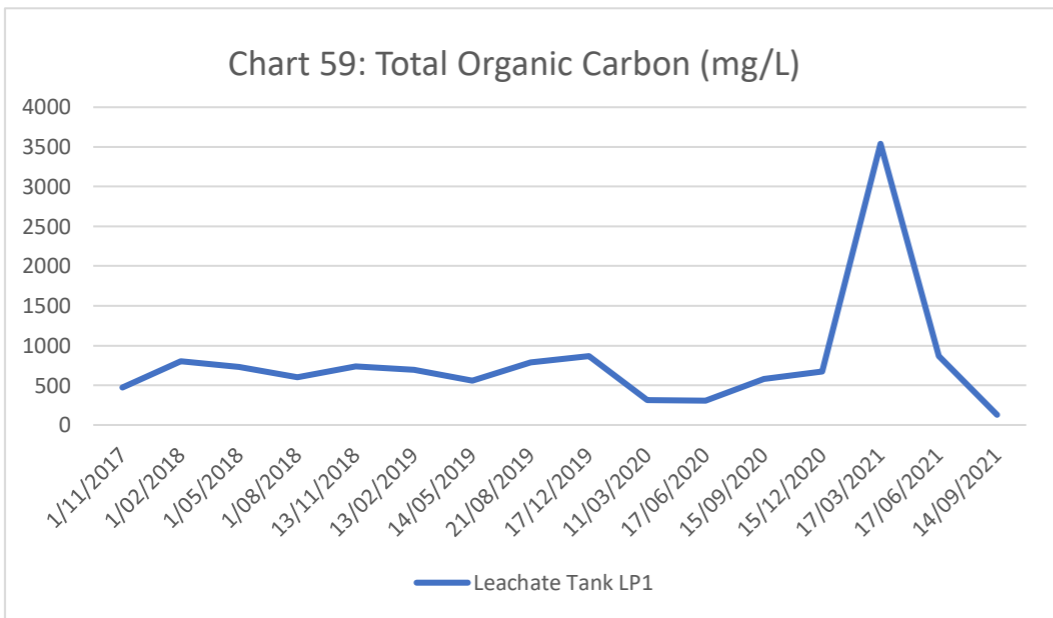
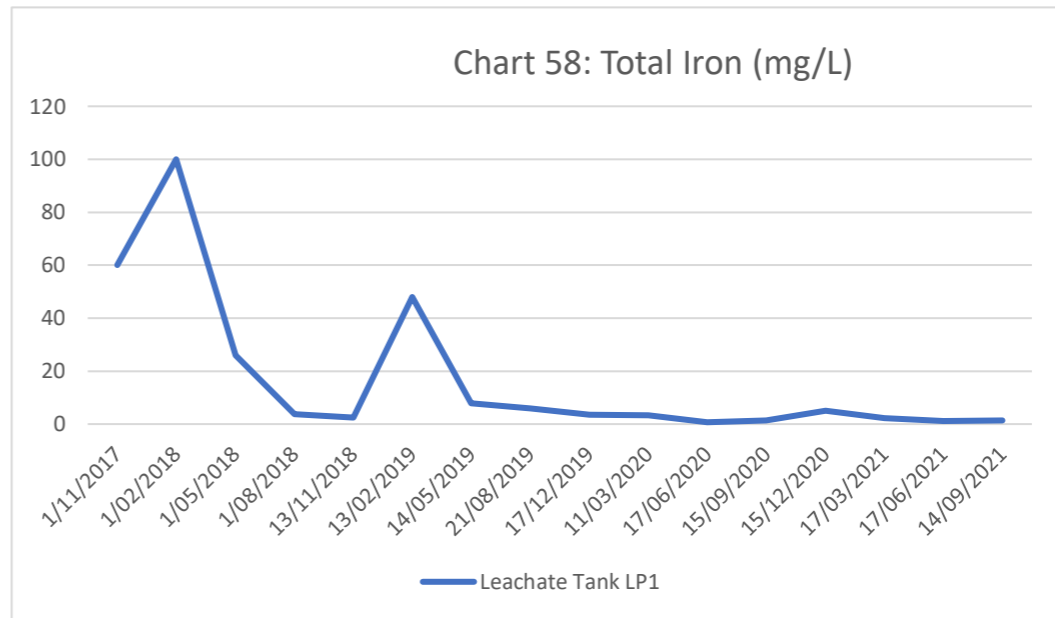
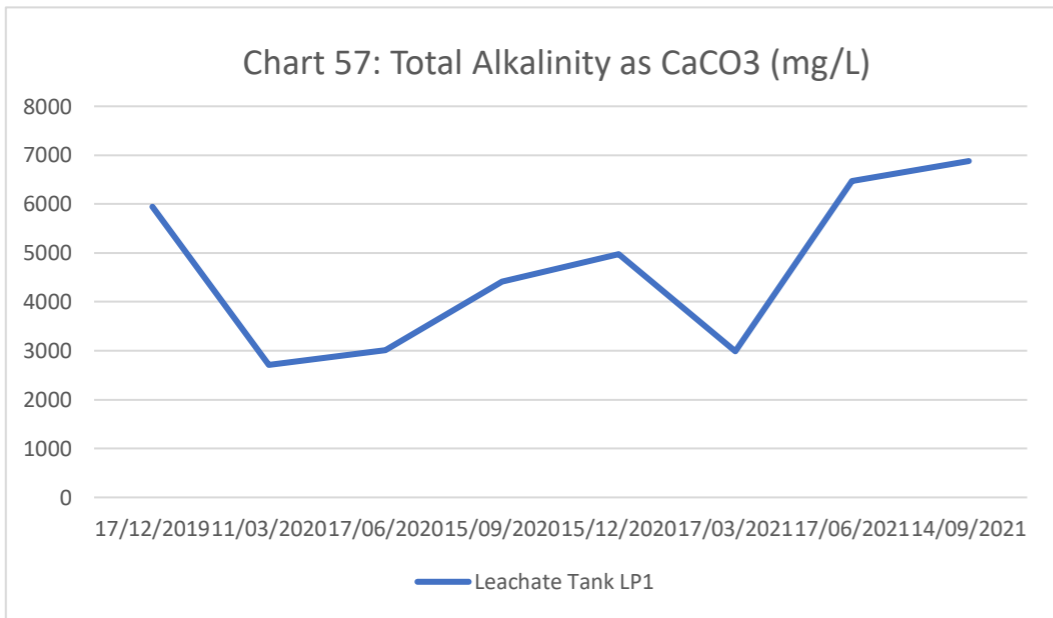
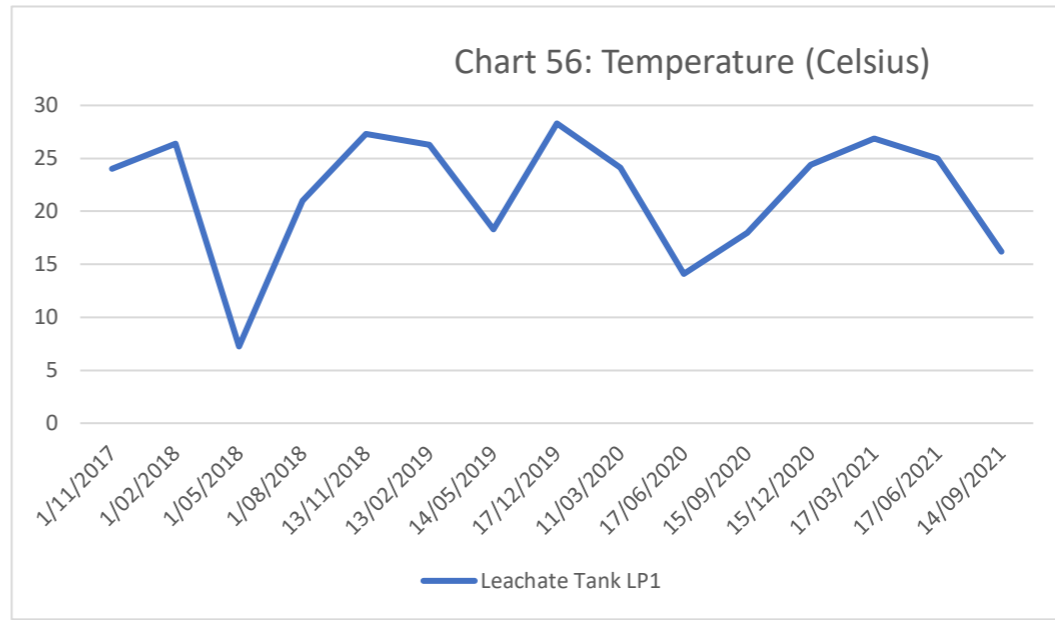
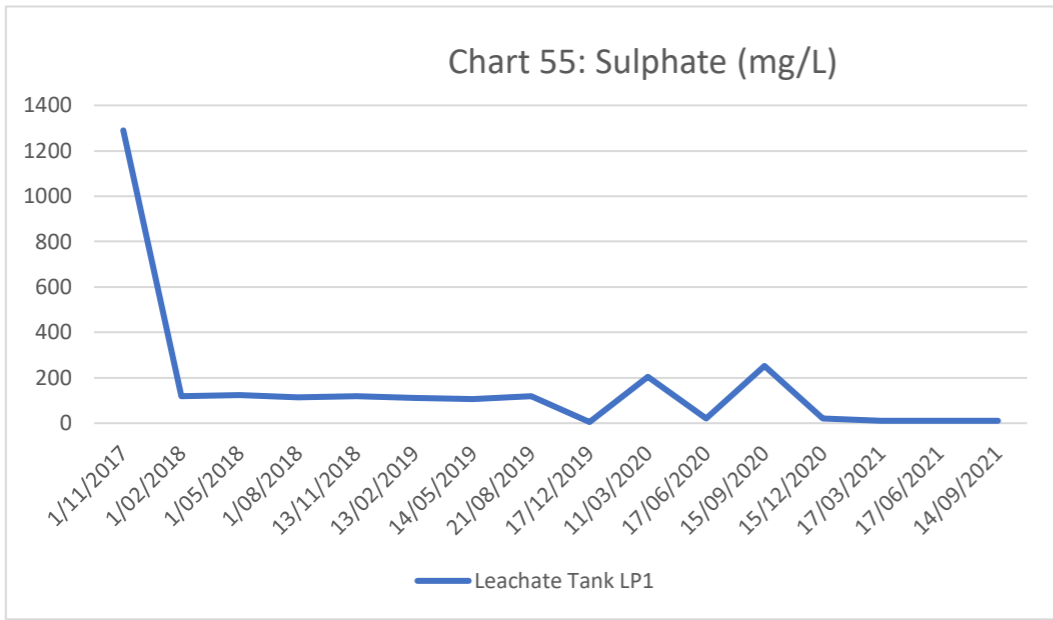
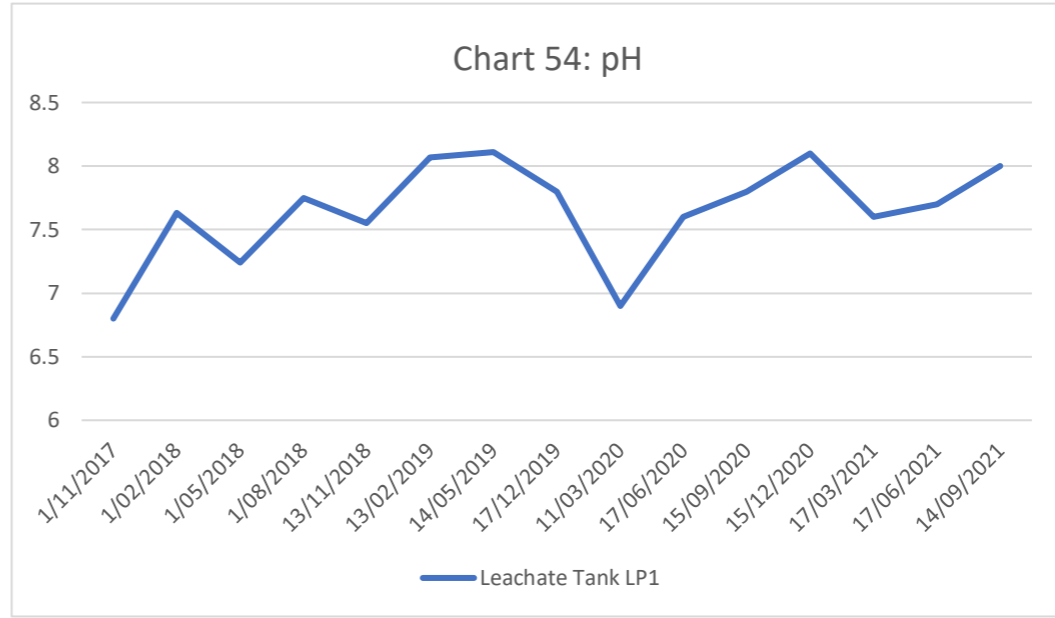
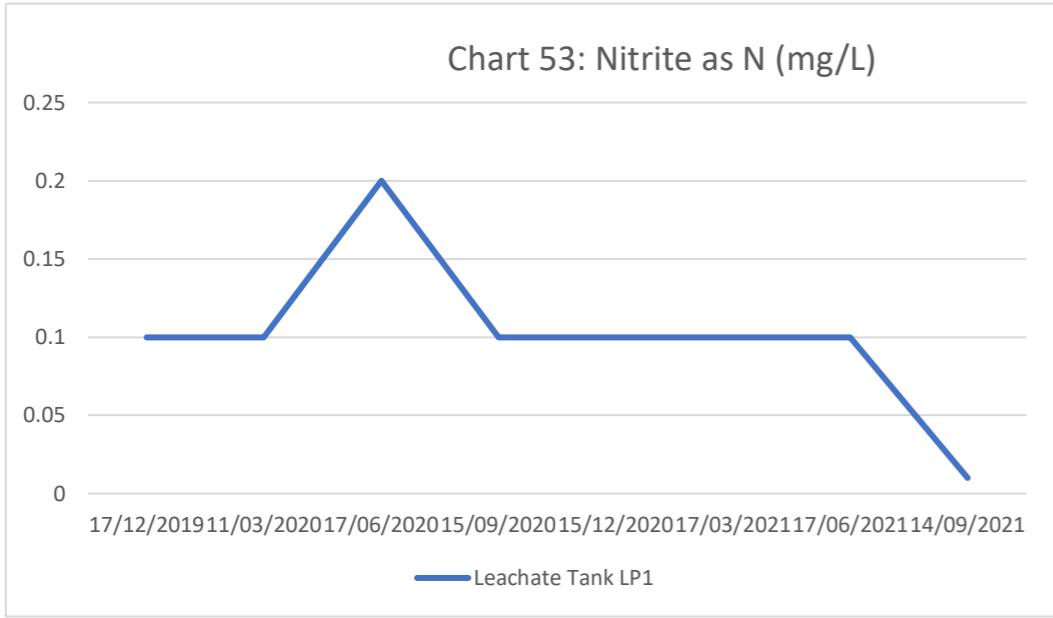
Charts 33-44: Rocklow Creek Surface Water Charts





Charts 45-59 Leachate Water Quality Charts





APPENDICES

Appendix A

EPL 5984 Sampling Point Summary (NSW EPA, 10/05/2021)

2	Leachate monitoring	Leachate tank labelled LP1 on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
3	Groundwater monitoring	BH1c - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
5	Groundwater monitoring	BH3 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
6	Groundwater monitoring	BH4 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
7	Groundwater monitoring	BH15 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
10	Groundwater monitoring	BH13 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
11	Groundwater monitoring	BH14 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
16	Groundwater monitoring	BH19 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
17	Groundwater monitoring	BH12R - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).

18	Groundwater monitoring	BH9 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
19	Surface Water Monitoring	SWC_2 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
20	Surface Water Monitoring	SWC_UP - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
21	Surface Water Monitoring	SWC_DOWN - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
22	Surface Water Monitoring	SWC_DOWN2 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
23	Groundwater Monitoring	BH21 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).
24	Groundwater monitoring	BH22 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).
25	Groundwater monitoring	BH18 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).

Appendix B

Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Water Samples



CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodpark Rd, Smithfield NSW 2176
Ph: 02 8784 8555 E: samplesydney@alsenviro.com

Brisbane: 32 Shand St, St. Johns QLD 4033
Ph: 07 3243 7222 E: samplesbrisbane@alsenviro.com

Melbourne: 2-4 Wastail Rd, Springvale VIC 3171
Ph: 03 8549 0500 E: samplesmelbourne@alsenviro.com

Perth: 10 Hed Way, Malaga WA 6009
Ph: 09 9209 7655 E: samplesperth@alsenviro.com

Newcastle: 5 Rosegum Rd, Warabruk NSW 2304
Ph: 02 4563 9433 E: samplesnewcastle@alsenviro.com

Townsville: 14-15 Deanna Ct, Bohle QLD 4678
Ph: 07 4706 0600 E: townsville@alsenviro.com

Adelaide: 2-1 Burma Rd, Pockra SA 5095
Ph: 08 8338 0860 E: adelaide@alsenviro.com

Launceston: 27 Wellington St, Launceston TAS 7250
Ph: 03 6331 2153 E: launceston@alsenviro.com

CLIENT: Shellharbour City Council	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	<input type="checkbox"/> Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No Fridge / frozen ice bricks present upon receipt? Yes No Random Sample Temperature on Receipt: () °C Other comment:
OFFICE: 41 Burrell St WOLLONGONG NSW 2500	<input type="checkbox"/> Non Standard or urgent TAT (List due date):		
PROJECT: Dunmore Quarterly Ground Waters EPL	ALS QUOTE NO.: WO/030/19 TENDER	COC SEQUENCE NUMBER (Circle)	
ORDER NUMBER:		COC: 1 2 3 4 5 6 7	
PROJECT MANAGER: Joel Culton		OF: 1 2 3 4 5 6 7	
SAMPLER: Robert Dalio	SAMPLER MOBILE:	RELINQUISHED BY: Robert	RECEIVED BY: [Signature]
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 13.9.21 14:25	DATE/TIME: 13.9.21 14:25
Email Reports to:			
Email Invoice to:			
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: CC reports to:			

Environmental Division
Wollongong
Work Order Reference
EW2103851



Telephone: 02 4225312

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					
						Ammonia	NT-2A (Alka, So4, Cl, F), Filtered Ca, K	TOC	Dissolved Fe & Mn	NT-4 (NO2, NO3)	
1	BH1C	13.9.21 9:20	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
2	BH3	12:25	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
3	BH4	13:15	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
4	BH9	8:45	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
5	BH12R	11:05	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
6	BH13	10:40	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
7	BH14	11:55	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
8	BH15	11:25	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
9	BH19R	12:50	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
10	BH18	8:00	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
13	BH21	10:05	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
11	BH22	9:40	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
12	Duplicate	8:00	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & SWL
TOTAL					10						

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: EW2103851	Page	: 1 of 8
Amendment	: 1	Laboratory	: Environmental Division NSW South Coast
Client	: SHELLHARBOUR CITY COUNCIL	Contact	: Aneta Prosaroski
Contact	: Joel Coulton	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Address	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	Telephone	: +61 2 4225 3125
Telephone	: ----	Date Samples Received	: 13-Sep-2021 14:25
Project	: Dunmore Quarterly Groundwaters EPL	Date Analysis Commenced	: 13-Sep-2021
Order number	: 126450	Issue Date	: 11-Oct-2021 16:04
C-O-C number	: ----		
Sampler	: Robert DaLio		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER GROUNDWATERS		
No. of samples received	: 13		
No. of samples analysed	: 13		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aneta Prosaroski	Client Liaison Officer	Laboratory - Wollongong, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- ED041G: LOR raised for Sulfate on sample no:1 due to sample matrix.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the Chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- Amendment (11/10/2021): This report has been amended following a change to the EN67 result reported for sample BH21, BH22 & Field Duplicate 011, 012, 013. due to a sequence error on COC.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Sampling and groundwater depth measurements completed by ALS Wollongong via inhouse sampling method EN/67.11 Groundwater Sampling Via Bailer Method.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.
- Sample collection of Ground Waters by in-house EN67 where the "surface layer of the aquifer was sampled".
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH1C	BH3	BH4	BH9	BH12R
Sampling date / time				13-Sep-2021 09:20	13-Sep-2021 12:25	13-Sep-2021 13:15	13-Sep-2021 08:45	13-Sep-2021 11:05	
Compound	CAS Number	LOR	Unit	EW2103851-001	EW2103851-002	EW2103851-003	EW2103851-004	EW2103851-005	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.0	7.3	7.1	7.0	6.8	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	7130	1420	1750	4450	2170	
EA116: Temperature									
Temperature	----	0.1	°C	24.3	18.0	18.7	18.0	21.4	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	2870	433	688	2090	596	
Total Alkalinity as CaCO3	----	1	mg/L	2870	433	688	2090	596	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	103	162	199	241	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	884	234	208	661	316	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	120	123	186	222	213	
Potassium	7440-09-7	1	mg/L	199	33	18	72	66	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.113	0.150	0.197	0.616	0.459	
Iron	7439-89-6	0.05	mg/L	14.3	3.84	5.62	9.73	8.55	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	<0.1	0.5	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	372	23.9	12.0	92.0	6.44	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.06	<0.01	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	4.52	0.08	<0.01	0.05	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	4.58	0.08	<0.01	0.05	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	178	35	18	67	22	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH1C	BH3	BH4	BH9	BH12R
Sampling date / time				13-Sep-2021 09:20	13-Sep-2021 12:25	13-Sep-2021 13:15	13-Sep-2021 08:45	13-Sep-2021 11:05	
Compound	CAS Number	LOR	Unit	EW2103851-001	EW2103851-002	EW2103851-003	EW2103851-004	EW2103851-005	
				Result	Result	Result	Result	Result	
QWI-EN 67.11 Sampling of Groundwaters									
Standing Water Level	----	0.01	m AHD	3.10	3.00	4.28	3.08	4.27	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH13	BH14	BH15	BH19R	BH18
Sampling date / time				13-Sep-2021 10:40	13-Sep-2021 11:55	13-Sep-2021 11:25	13-Sep-2021 12:50	13-Sep-2021 08:00	
Compound	CAS Number	LOR	Unit	EW2103851-006	EW2103851-007	EW2103851-008	EW2103851-009	EW2103851-010	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	6.9	6.7	7.0	7.2	6.7	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	1930	1530	2300	1530	285	
EA116: Temperature									
Temperature	----	0.1	°C	20.4	21.5	14.9	18.4	18.4	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	667	521	402	495	173	
Total Alkalinity as CaCO3	----	1	mg/L	667	521	402	495	173	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	209	170	402	195	7	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	215	168	427	214	11	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	221	121	82	139	36	
Potassium	7440-09-7	1	mg/L	28	14	198	25	4	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.294	0.095	0.259	0.112	0.125	
Iron	7439-89-6	0.05	mg/L	2.56	<0.05	8.31	1.11	1.43	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.5	0.2	0.1	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	3.14	0.98	11.9	4.58	0.46	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.35	0.05	0.05	0.07	0.01	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.35	0.05	0.05	0.07	0.01	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	24	22	32	16	7	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH13	BH14	BH15	BH19R	BH18
Sampling date / time				13-Sep-2021 10:40	13-Sep-2021 11:55	13-Sep-2021 11:25	13-Sep-2021 12:50	13-Sep-2021 08:00	
Compound	CAS Number	LOR	Unit	EW2103851-006	EW2103851-007	EW2103851-008	EW2103851-009	EW2103851-010	
				Result	Result	Result	Result	Result	
QWI-EN 67.11 Sampling of Groundwaters									
Standing Water Level	----	0.01	m AHD	4.24	4.69	0.69	4.54	2.16	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID		BH22	Duplicate	BH21	----	----
		Sampling date / time		13-Sep-2021 09:40	13-Sep-2021 08:00	13-Sep-2021 10:05	----	----
Compound	CAS Number	LOR	Unit	EW2103851-011	EW2103851-012	EW2103851-013	-----	-----
				Result	Result	Result	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	7.4	6.7	7.2	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	2020	285	2370	----	----
EA116: Temperature								
Temperature	----	0.1	°C	18.0	18.4	21.1	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	623	177	557	----	----
Total Alkalinity as CaCO3	----	1	mg/L	623	177	557	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	245	7	362	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	324	12	363	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	161	36	127	----	----
Potassium	7440-09-7	1	mg/L	28	4	17	----	----
EG020F: Dissolved Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.088	0.124	0.314	----	----
Iron	7439-89-6	0.05	mg/L	0.31	1.42	0.20	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.3	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.38	0.46	2.98	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.07	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.07	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	30	7	27	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH22	Duplicate	BH21	----	----
Sampling date / time				13-Sep-2021 09:40	13-Sep-2021 08:00	13-Sep-2021 10:05	----	----	
Compound	CAS Number	LOR	Unit	EW2103851-011	EW2103851-012	EW2103851-013	-----	-----	
				Result	Result	Result	----	----	
QWI-EN 67.11 Sampling of Groundwaters									
Standing Water Level		----	0.01	m AHD	2.58	2.16	2.95	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EG020F: Dissolved Metals by ICP-MS

(WATER) EK057G: Nitrite as N by Discrete Analyser

(WATER) EK058G: Nitrate as N by Discrete Analyser

(WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser

(WATER) ED045G: Chloride by Discrete Analyser

(WATER) ED037P: Alkalinity by PC Titrator

(WATER) EK040P: Fluoride by PC Titrator

(WATER) ED041G: Sulfate (Turbidimetric) as SO4 2- by DA

(WATER) ED093F: Dissolved Major Cations

(WATER) EP005: Total Organic Carbon (TOC)

CERTIFICATE OF ANALYSIS

Work Order : **EW2103855**
Client : **SHELLHARBOUR CITY COUNCIL**
Contact : Joel Coulton
Address : LAMERTON HOUSE, LAMERTON CRESCENT
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529

Telephone : ----
Project : Dunmore Quarterly Leachate
Order number : 138956
C-O-C number : ----
Sampler : Megan Gould, Robert DaLio
Site : DUNMORE LANDFILL TENDER
Quote number : WO/030/19 TENDER LEACHATE
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 4
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia

Telephone : +61 2 4225 3125
Date Samples Received : 14-Sep-2021 15:37
Date Analysis Commenced : 14-Sep-2021
Issue Date : 21-Sep-2021 09:48



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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aneta Prosaroski	Client Liaison Officer	Laboratory - Wollongong, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the Chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- EK057G: LOR raised for Nitrite on sample no:1 due to sample matrix.
- ED041G: LOR raised for Sulfate on sample no:1 due to sample matrix.
- EK059G:LOR raised due to sample matrix.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/67.10 Wastewaters
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	Leachate Sump	----	----	----	----
Sampling date / time			14-Sep-2021 11:35	----	----	----	----	
Compound	CAS Number	LOR	Unit	EW2103855-001	-----	-----	-----	-----
				Result	----	----	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	8.2	----	----	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	11100	----	----	----	----
EA116: Temperature								
Temperature	----	0.1	°C	16.5	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	6060	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	6060	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	2100	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	179	----	----	----	----
Potassium	7440-09-7	1	mg/L	434	----	----	----	----
EG020T: Total Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.434	----	----	----	----
Iron	7439-89-6	0.05	mg/L	1.81	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	987	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.10	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.10	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	----	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	131	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Leachate Sump	----	----	----	----
Sampling date / time				14-Sep-2021 11:35	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2103855-001	-----	-----	-----	-----	-----
Result				Result	----	----	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	1.26	----	----	----	----	----
Dissolved Oxygen - % Saturation	----	0.1	% saturation	13.2	----	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) ED093F: Dissolved Major Cations

(WATER) EP005: Total Organic Carbon (TOC)

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EG020T: Total Metals by ICP-MS

(WATER) EK057G: Nitrite as N by Discrete Analyser

(WATER) EK058G: Nitrate as N by Discrete Analyser

(WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser

(WATER) ED045G: Chloride by Discrete Analyser

(WATER) ED037P: Alkalinity by PC Titrator

(WATER) EK040P: Fluoride by PC Titrator

(WATER) ED041G: Sulfate (Turbidimetric) as SO4 2- by DA

CERTIFICATE OF ANALYSIS

Work Order : **EW2103856**
Client : **SHELLHARBOUR CITY COUNCIL**
Contact : Joel Coulton
Address : LAMERTON HOUSE, LAMERTON CRESCENT
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529

Telephone : ----
Project : Dunmore Quarterly Leachate Tank EPL
Order number : 138956
C-O-C number : ----
Sampler : Megan Gould, Robert DaLio
Site : DUNMORE LANDFILL TENDER
Quote number : WO/030/19 TENDER LEACHATE
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 4
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia

Telephone : +61 2 4225 3125
Date Samples Received : 14-Sep-2021 15:38
Date Analysis Commenced : 14-Sep-2021
Issue Date : 21-Sep-2021 11:54



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aneta Prosaroski	Client Liaison Officer	Laboratory - Wollongong, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/67.9 Marine Waters
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				Leachate Storage Tank LP1	----	----	----	----
				Sampling date / time	14-Sep-2021 11:30	----	----	----
Compound	CAS Number	LOR	Unit	EW2103856-001	-----	-----	-----	-----
				Result	----	----	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	8.0	----	----	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	10400	----	----	----	----
EA116: Temperature								
Temperature	----	0.1	°C	15.2	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	5680	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	5680	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1860	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	213	----	----	----	----
Potassium	7440-09-7	1	mg/L	374	----	----	----	----
EG020T: Total Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.679	----	----	----	----
Iron	7439-89-6	0.05	mg/L	1.32	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	809	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.10	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.10	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	----	----	----	----
EP005: Total Organic Carbon (TOC)								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Leachate Storage Tank LP1	----	----	----	----
Sampling date / time				14-Sep-2021 11:30	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2103856-001	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EP005: Total Organic Carbon (TOC) - Continued									
Total Organic Carbon	----	1	mg/L	128	----	----	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	4.63	----	----	----	----	----
Dissolved Oxygen - % Saturation	----	0.1	% saturation	47.0	----	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) ED093F: Dissolved Major Cations

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(WATER) ED037P: Alkalinity by PC Titrator

(WATER) EK040P: Fluoride by PC Titrator

(WATER) ED041G: Sulfate (Turbidimetric) as SO4 2- by DA



CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodperk Rd. Smithfield NSW 2176
Ph: 02 8784 8555 E: samples.sydney@alsenviro.com

Brisbane: 32 Shand St. Stafford QLD 4063
Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com

Melbourne: 2-4 Westall Rd. Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com

Perth: 10 Hed Way. Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsenviro.com

Newcastle: 5 Rosegum Rd. Warabrook NSW 2304
Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com

Townsville: 14-15 Desma Ct. Bohle QLD 4818
Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com

Adelaide: 2-1 Burma Rd. Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsenviro.com

Launceston: 27 Wellington St. Launceston TAS 7250
Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: Shellharbour City Council	TURNAROUND REQUIREMENTS : <input type="checkbox"/> Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle) Clarity Seal intact? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA Free ice / frozen ice bricks present upon receipt? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA Random Sample Temperature on Receipt: <input type="checkbox"/> C Other comment: <i>62</i>														
OFFICE: 41 Burrell St WOLLONGONG NSW 2500	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):															
PROJECT: Dunmore Quarterly Surface Waters EPL	ALS QUOTE NO.: WO/030/19 TENDER	COC SEQUENCE NUMBER (Circle) COC: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table> OF: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table>	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	2	3	4	5	6	7										
1	2	3	4	5	6	7										
ORDER NUMBER:																
PROJECT MANAGER: Joel Culton																
SAMPLER: <i>Megan Gould, Robert Dalic</i>	SAMPLER MOBILE:	RELINQUISHED BY: <i>Robert</i>														
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RECEIVED BY: <i>Aneta</i>														
Email Reports to :		DATE/TIME: <i>14/9/21</i>														
Email Invoice to :		DATE/TIME: <i>14/9/21</i>														
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:	CC reports to:	RELINQUISHED BY:														
		RECEIVED BY:														
		DATE/TIME:														
		DATE/TIME:														

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
	LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	TSS	NT-1, NT-2A <i>(Ionic Balance)</i>	TOC, NT-4, NH3, Total Mn	Dissolved and Total Fe	Turbidity	NH3, NH4 & NO3	TSS, TDS, TOC	
	1	SWP1	<i>14.9.21</i>	<i>14:00</i>	W		✓	✓	✓	✓				Field Tests - pH, EC, DO & Temp
	2	SWC_2		<i>8:00</i>	W			✓		✓		✓	✓	Field Tests - pH, EC, DO & Temp
	3	SWC_UP		<i>7:55</i>	W			✓		✓	✓	✓	✓	Field Tests - pH, EC, DO & Temp
	4	SWC_DOWN		<i>8:05</i>	W			✓		✓	✓	✓	✓	Field Tests - pH, EC, DO & Temp
	5	SWC_DOWN_2		<i>8:10</i>	W			✓		✓	✓	✓	✓	Field Tests - pH, EC, DO & Temp
						TOTAL	10							

Environmental Division
Wollongong
Work Order Reference
EW2103854



Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: EW2103854	Page	: 1 of 5
Amendment	: 1	Laboratory	: Environmental Division NSW South Coast
Client	: SHELLHARBOUR CITY COUNCIL	Contact	: Aneta Prosaroski
Contact	: Joel Coulton	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Address	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	Telephone	: +61 2 4225 3125
Telephone	: ----	Date Samples Received	: 14-Sep-2021 15:35
Project	: Dunmore Quarterly Surface Water EPL	Date Analysis Commenced	: 14-Sep-2021
Order number	: 138956	Issue Date	: 30-Nov-2021 12:47
C-O-C number	: ----		
Sampler	: Megan Gould, Robert DaLio		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER SURFACE WATER		
No. of samples received	: 5		
No. of samples analysed	: 5		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- Analytical Results

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Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



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- Amendment (30/11/2021): This report has been amended and re-released to allow the reporting of additional analytical data, specifically method EG020A-T (Mn) for sample SWP1, SWC_2, UP, Down and Down 2. (001 - 005)
- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/67.6 Rivers and Streams.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/67.4 Lakes and Reservoirs
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SWP1 Point 1	SWC_2 Point 19	SWC_UP Point 20	SWC_Down Point 21	SWC_DOWN_2 Point 22
Sampling date / time				14-Sep-2021 14:00	14-Sep-2021 08:00	14-Sep-2021 07:55	14-Sep-2021 08:05	14-Sep-2021 08:10	
Compound	CAS Number	LOR	Unit	EW2103854-001	EW2103854-002	EW2103854-003	EW2103854-004	EW2103854-005	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.6	7.4	7.3	7.3	7.4	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	820	5890	6140	18300	8750	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	----	4640	4660	15400	7180	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	15	8	15	<5	<5	
EA045: Turbidity									
Turbidity	----	0.1	NTU	18.0	----	8.2	6.7	8.4	
EA116: Temperature									
Temperature	----	0.1	°C	12.5	12.6	13.0	13.6	12.8	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	285	149	142	155	141	
Total Alkalinity as CaCO3	----	1	mg/L	285	149	142	155	141	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	68	349	343	1360	541	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	151	2440	2420	7400	3690	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	48	78	79	194	102	
Magnesium	7439-95-4	1	mg/L	26	142	154	486	223	
Sodium	7440-23-5	1	mg/L	132	1160	1240	4060	1860	
Potassium	7440-09-7	1	mg/L	12	50	46	149	71	
EG020F: Dissolved Metals by ICP-MS									
Iron	7439-89-6	0.05	mg/L	0.06	0.20	0.08	0.08	0.05	
EG020T: Total Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.229	0.092	0.095	0.080	0.077	
Iron	7439-89-6	0.05	mg/L	0.67	0.57	0.61	0.46	0.52	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.3	0.5	0.4	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SWP1 Point 1	SWC_2 Point 19	SWC_UP Point 20	SWC_Down Point 21	SWC_DOWN_2 Point 22
Sampling date / time				14-Sep-2021 14:00	14-Sep-2021 08:00	14-Sep-2021 07:55	14-Sep-2021 08:05	14-Sep-2021 08:10	
Compound	CAS Number	LOR	Unit	EW2103854-001	EW2103854-002	EW2103854-003	EW2103854-004	EW2103854-005	
				Result	Result	Result	Result	Result	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.61	0.24	0.94	0.43	
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	14798-03-9_N	0.01	mg/L	0.04	0.61	0.24	0.94	0.43	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.22	0.23	0.13	0.20	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.22	0.23	0.13	0.20	
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	11.4	79.1	78.2	240	118	
∅ Total Cations	----	0.01	meq/L	10.6	67.3	71.7	230	106	
∅ Ionic Balance	----	0.01	%	3.58	8.03	4.34	2.14	5.35	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	17	8	8	7	8	
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	4.16	7.86	7.71	6.91	7.78	



Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

- (WATER) ED093F: Dissolved Major Cations
- (WATER) EP005: Total Organic Carbon (TOC)
- (WATER) EK055G: Ammonia as N by Discrete Analyser
- (WATER) EG020F: Dissolved Metals by ICP-MS
- (WATER) EG020T: Total Metals by ICP-MS
- (WATER) EK057G: Nitrite as N by Discrete Analyser
- (WATER) EK058G: Nitrate as N by Discrete Analyser
- (WATER) EK059G: Nitrite plus Nitrate as N (NO_x) by Discrete Analyser
- (WATER) EA025: Total Suspended Solids dried at 104 ± 2 °C
- (WATER) EA015: Total Dissolved Solids dried at 180 ± 5 °C
- (WATER) EK055G-NH₄: Ammonium as N by DA
- (WATER) EN055: Ionic Balance
- (WATER) ED045G: Chloride by Discrete Analyser
- (WATER) ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA
- (WATER) EK040P: Fluoride by PC Titrator
- (WATER) ED037P: Alkalinity by PC Titrator
- (WATER) EA045: Turbidity

Appendix C

Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Dust Samples



CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodpark Rd, Smithfield NSW 2176
Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
 Newcastle: 5 Rosegum Rd, Warabrook NSW 2304
Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com


Brisbane: 32 Shand St, Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
 Townsville: 14-15 Deema Ct, Bohle QLD 4818
Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com

Melbourne: 2-4 Westall Rd, Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
 Adelaide: 2-1 Burma Rd, Pooraka SA 5095
Ph: 08 8359 0800 E: adelaide@alsenviro.com

Perth: 10 Hod Way, Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsenviro.com
 Launceston: 27 Wellington St, Launceston TAS 7250
Ph: 03 8331 2158 E: launceston@alsenviro.com

CLIENT: Shellharbour City Council	TURNAROUND REQUIREMENTS: <input type="checkbox"/> Standard TAT (List due date): (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	<input type="checkbox"/> Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: Dunmore	ALS QUOTE NO.: WO/030/19 TENDER	COC SEQUENCE NUMBER (Circle)		Custody Seal Intact? Yes No N/A	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PROJECT: Dunmore Dust	ORDER NUMBER:	COC: 1 2 3 4 5 6 7	OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C	Other comment:
PROJECT MANAGER: Joel Culton	SAMPLER: Robert De Leo	SAMPLER MOBILE:	RELINQUISHED BY: Robert	RECEIVED BY: Aneta	RELINQUISHED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 14.9.21. 14:45	DATE/TIME: 14/9/21	DATE/TIME:	RECEIVED BY:
Email Reports to :	Email Invoice to :			DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: CC reports to:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	A04 (Ash, CM, TIS)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	DDG1	14.9.21 10:53	AIR			✓							Environmental Division Wollongong Work Order Reference EW2103849  Telephone: 02 42253126
	DDG2	10:53	AIR			✓							
	DDG3	14:00	AIR			✓							
	DDG4	10:15	AIR			✓							
TOTAL					10								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order : **EW2103849**
Client : **SHELLHARBOUR CITY COUNCIL**
Contact : Joel Coulton
Address : LAMERTON HOUSE, LAMERTON CRESCENT
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529

Telephone : ----
Project : Dunmore Landfill Dust
Order number : 138956
C-O-C number : ----
Sampler : Robert DaLio
Site : DUNMORE LANDFILL TENDER
Quote number : WO/030/19 TENDER DUST
No. of samples received : 4
No. of samples analysed : 4

Page : 1 of 2
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia

Telephone : +61 2 4225 3125
Date Samples Received : 14-Sep-2021 15:32
Date Analysis Commenced : 16-Sep-2021
Issue Date : 24-Sep-2021 10:53



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- Analytical work for this work order will be conducted at ALS Newcastle.
- Sample exposure period is 33 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/66.1 Sampling and Siting of Dust Depositon Gauges.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST
 (Matrix: AIR)

Sample ID

				DDG1 12/08/2021 - 14/09/2021	DDG2 12/08/2021 - 14/09/2021	DDG3 12/08/2021 - 14/09/2021	DDG4 12/08/2021 - 14/09/2021	----
Sampling date / time				14-Sep-2021 10:53	14-Sep-2021 10:50	14-Sep-2021 14:00	14-Sep-2021 10:15	----
Compound	CAS Number	LOR	Unit	EW2103849-001	EW2103849-002	EW2103849-003	EW2103849-004	-----
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m ² .month	0.8	0.8	1.5	2.5	----
Ash Content (mg)	----	1	mg	16	15	30	49	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m ² .month	0.6	0.3	1.3	1.0	----
Combustible Matter (mg)	----	1	mg	12	6	24	19	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m ² .month	1.4	1.1	2.8	3.5	----
Total Insoluble Matter (mg)	----	1	mg	28	21	54	68	----

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(AIR) EA125: Combustible Matter

(AIR) EA120: Ash Content

(AIR) EA141: Total Insoluble Matter

QUALITY CONTROL REPORT

Work Order	: EW2103849	Page	: 1 of 3
Client	: SHELLHARBOUR CITY COUNCIL	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Contact	: Aneta Prosaroski
Address	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Telephone	: ----	Telephone	: +61 2 4225 3125
Project	: Dunmore Landfill Dust	Date Samples Received	: 14-Sep-2021
Order number	: 138956	Date Analysis Commenced	: 16-Sep-2021
C-O-C number	: ----	Issue Date	: 24-Sep-2021
Sampler	: Robert DaLio		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER DUST		
No. of samples received	: 4		
No. of samples analysed	: 4		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**
-



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EW2103849	Page	: 1 of 4
Client	: SHELLHARBOUR CITY COUNCIL	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Telephone	: +61 2 4225 3125
Project	: Dunmore Landfill Dust	Date Samples Received	: 14-Sep-2021
Site	: DUNMORE LANDFILL TENDER	Issue Date	: 24-Sep-2021
Sampler	: Robert DaLio	No. of samples received	: 4
Order number	: 138956	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: AIR

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA120: Ash Content								
Dust Gauge (Bottle) - Copper Sulfate (EA120) DDG1 - 12/08/2021 - 14/09/2021, DDG3 - 12/08/2021 - 14/09/2021,	DDG2 - 12/08/2021 - 14/09/2021, DDG4 - 12/08/2021 - 14/09/2021	14-Sep-2021	----	----	----	16-Sep-2021	12-Mar-2022	✔
EA125: Combustible Matter								
Dust Gauge (Bottle) - Copper Sulfate (EA125) DDG1 - 12/08/2021 - 14/09/2021, DDG3 - 12/08/2021 - 14/09/2021,	DDG2 - 12/08/2021 - 14/09/2021, DDG4 - 12/08/2021 - 14/09/2021	14-Sep-2021	----	----	----	16-Sep-2021	12-Mar-2022	✔
EA141: Total Insoluble Matter								
Dust Gauge (Bottle) - Copper Sulfate (EA141) DDG1 - 12/08/2021 - 14/09/2021, DDG3 - 12/08/2021 - 14/09/2021,	DDG2 - 12/08/2021 - 14/09/2021, DDG4 - 12/08/2021 - 14/09/2021	14-Sep-2021	----	----	----	16-Sep-2021	12-Mar-2022	✔



Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**
-



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Ash Content (AC)	EA120	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Ash content in deposited dust.
Combustible Matter (CM)	EA125	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Combustible Matter in deposited dust.
Total Insoluble Matter (TIM)	EA141	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Total Insoluble solids in deposited dust.

Appendix D

Surface Gas (Methane) Field Sheets

ALS Landfill Emissions Report

Client: Shellharbour City Council

Date: 8/09/2021

Site: Dunmore

Sampler(s) Robert DaLio, Megan Gould

Transact / Location	Point	GPS North	GPS East	CH4 Conc (ppm)	Comments
A	1	6168 181	302 346	1.9	
A	2	6168 157	302 347	2.6	
A	3-8				No Access, Overgrown
B	1	6168 016	302 327	1.3	
B	2	6168 053	302 333	1.3	Methane Cage
B	3	6168 087	302 332	2.9	
B	4	6168 105	302 331	1.9	
B	5	6168 128	302 332	1.1	
B	6	6168 148	302 331	1.1	
B	7	6168 170	302 330	1.4	
B	8	6167 187	302 333	1.7	
C	1	6167 205	302 284	1.2	
C	2	6167 139	302 301	1.3	
C	3	6167 089	302 313	2.6	

C	4	6167 025	302 318	1.4	
C	5	6167 971	302 317	1.3	
C	6	6168 875	302 304	1.1	
D	1	6167 941	302 291	0.6	
D	2	6167 950	302 292	0.5	
D	3	6168 966	302 291	0.4	
D	4	6168 980	302 290	0.4	
D	5	6168 997	302 282	0.5	
D	6	6168 011	302 283	0.5	
D 7-9		Grassy area overgrown inaccessible			
E	1	6168 014	302 249	0.6	
E	2	6167 999	302 255	0.7	
E	3	6167 990	302 261	1.0	
E	4	6167 982	302 265	0.8	
E	5	6167 966	302 270	0.6	
E	6	6167 952	302 271	0.4	
E	7	6167 935	302 274	0.5	
E	8	6167 921	302 279	0.5	
F	1	6167 929	302 252	1.0	
F	2	6167 945	302 249	1.0	
F	3	6167 959	302 240	0.8	

F	4	6168 978	302 231	0.6	
F	5	6168 000	302 229	0.7	
F	6	6168 026	302 220	0.6	
F	7	6168 053	302 215	0.5	
F	8-13				Very Overgrown, inaccessible
G	1	6168 220	302 161	1.0	
G	2	6168 225	302 184	1.0	
G	3	6168 246	302 208	0.9	
G	4	6168 267	302 240	0.9	
H	1	6168 293	302 247	3.0	
H	2	6168 287	302 206	3.0	
H	3	6168 263	302 178	3.1	
H	4	6168 232	302 151	3.1	
H	5	6168 178	302 098	3.1	
H	6	6168 121	302 037	3.1	
H	7	6168 070	301 992	3.1	
H	8	6168 016	301 970	3.1	
H	9	6167 946	302 969	3.1	
H	10	6167 919	302 438	3.0	
H	11	6168 022	302 464	2.4	
H	12	6167 988	302 480	1.8	
H	13	6167 965	302 494	1.7	

H	14	6167 933	302 520	1.5	
H	15	6167 919	302 528	2.8	
H	16	6167 914	302 516	1.5	
H	17	6167 889	302 485	1.7	
H	18	6167 891	302 477	1.6	
H	19	6167 933	302 445	1.7	
H	20	6167 967	302 429	1.9	
H	21	6167 719	302 383	1.2	
H	22	6167 783	302 390	1.5	
H	23	6167 827	302 393	1.5	
H	24	6167 866	302 406	1.6	
H	25	6167 928	302 415	1.3	
H	26	6168 006	301 422	1.6	
H	27	6168 071	302 434	1.6	
H	28	6168 187	302 389	1.7	
H	29	6168 258	301 973	1.7	Freshly excavated top soil
H	30	6167 877	302 973	1.2	Freshly excavated top soil
H	31	6167 812	302 034	1.7	Freshly excavated top soil
H	32	6167 753	302 085	3.2	
H	33	6167 696	301 145	2.0	
H	34	6167 682	302 199	1.8	
H	35	6167 689	302 273	2.1	
H	36	6167 705	302 337	1.2	

I	1	6167 933	301 144	2.0
I	2	6167 935	302 099	0.9
I	3	6167 934	302 051	0.9
I	4	6167 935	301 999	1.0
J	1	6168 149	302 101	0.8
J	2	6168 123	302 110	0.8
J	3	6168 088	302 122	0.7
J	4	6168 050	302 136	0.8
J	5	6168 004	302 154	0.8
K	1	6168 334	302 294	0.9
K	2	6168 345	302 336	0.9
K	3	6168 365	302 356	0.9
K	4	6168 398	302 334	0.9
K	5	6168 394	302 299	0.7
K	6	6168 368	302 269	0.7
K	7	6168 370	302 293	0.6
K	8	6168 382	302 327	0.7
L	1	6168 558	302 226	1.4
L	2	6168 493	302 188	1.5

L	3	6168 450	302 145	1.5	
L	4	6168 399	302 117	1.5	
L	5	6168 348	302 69	1.6	
L	6	6168 300	302 026	1.6	
Compressor Shed					
	1			3.2	outside the shed, locked
Office					
	1			2.0	outside the office, door locked
Community Recycling Centre					
	1			3.3	
OLD Weighbridge					
	1			1.7	
OLD Weighbridge Toilet					
	1			143.0	
Revolve Shop					
	1			2.4	
Building Truckwash					
	1			0.7	
New Weighbridge					
	1			2.0	
Methane Blank (Pre testing)					
				1.7	Taken at entrance to Dunmore site before main gate
Methane Blank (Post testing)					
				0.8	Taken at entrance to Dunmore site before main gate
Comments:					
Sampling performed in accordance to EPA Environmental Guidelines Solid Waste Landfills, Second Edition, 2016 Gas concentrations are reported as raw values without correction for background concentration.					

Appendix E

Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Overflow Event

NONE RECORDED - NOT USED

Appendix F

Calibration Certificates

Date: 21.6.21

Attn: Meelan Liew
Air-Met Scientific Pty. Ltd.
7-11 Ceylon Street
Nunawading
Vic. 3131

O/N 728865

Calibration Verification Certificate # 5193

Manufacture/Model : Gazomat Inspectra Laser CH4 analyser
S/N : 5070713
Gases Monitored : CH4, 0-100%

		Specification +/-10%
Gas used N2 BOC High Purity reads	: 0.0ppm	
Gas used CAC 10ppm CH4 in Air reads	: 10.7ppm	(9-11ppm) Conforms
Gas used CAC 500ppm CH4 in Air reads	: 540ppm	(450-550ppm) Conforms
Gas used CAC 2500ppm CH4 in Air reads	: 2548ppm	(2250-2750ppm) Conforms
Gas used CAC 1.0% CH4 in Air reads	: 10433ppm (1.0%)	(0.9-1.1%) Conforms
Gas used CAC 2.5% CH4 in Air reads	: 2.6%	(2.25-2.75%) Conforms
Gas used Linde 99.9% CH4 reads	: 105.8%	(90-110%) Conforms

Comments : Calibration OK

Next Service/calibration Due : 21.6.22

Stephen Hurst
ANRI Instruments & Controls Pty Ltd

SIN, DIN or Batch number	Operational Limits	Certified Value	Meter ID	Date	pH	pH 7 Junction potential	EC (µS/cm)	DO (% or mg/L)	ORP (mV)	Turbidity (NTU)	Chlorine (mg/L)	Analyst/ Comments
S201/003	+/- 0.1	7.00		27.10.20	7.04	13.06	84	100%	229	NTU		RM
S201/007	+/- 0.1	4.00		28.10.20	4.00	16.05	146.9	100%	217 - 240	NTU		RM
S201/006	+/- 0.1	10.00		29.10.20	3.93	10.17	1412	100%	217 - 240	NTU		RM
	7.15 - 7.25			30.10.20	4.02	10.53	10000	<0.2	217 - 240			RM
	Chk Std / CRM			06.07.20	6.55	13.58	1421	100%	217 - 240			RM
	79 - 88			07.07.20	7.02	9.98	1412	100%	217 - 240			RM
	142 - 151			08.07.20	7.01	9.98	1421	100%	217 - 240			RM
	1369 - 1454			09.07.20	7.02	9.98	1411	100%	217 - 240			RM
	9700 - 10300			10.07.20	7.01	9.98	1421	100%	217 - 240			RM
	12493 - 13266			11.07.20	7.02	9.98	1412	100%	217 - 240			RM
	108446 - 115154			12.07.20	7.01	9.98	1412	100%	217 - 240			RM
	Chk Std / CRM			13.07.20	7.02	9.98	1412	100%	217 - 240			RM
	<0.2			14.07.20	7.01	9.98	1412	100%	217 - 240			RM
	95% - 105%			15.07.20	7.02	9.98	1412	100%	217 - 240			RM
	217 - 240			16.07.20	7.01	9.98	1412	100%	217 - 240			RM
				17.07.20	7.02	9.98	1412	100%	217 - 240			RM
				18.07.20	7.01	9.98	1412	100%	217 - 240			RM
				19.07.20	7.02	9.98	1412	100%	217 - 240			RM
				20.07.20	7.01	9.98	1412	100%	217 - 240			RM
				21.07.20	7.02	9.98	1412	100%	217 - 240			RM
				22.07.20	7.01	9.98	1412	100%	217 - 240			RM
				23.07.20	7.02	9.98	1412	100%	217 - 240			RM
				24.07.20	7.01	9.98	1412	100%	217 - 240			RM
				25.07.20	7.02	9.98	1412	100%	217 - 240			RM
				26.07.20	7.01	9.98	1412	100%	217 - 240			RM
				27.07.20	7.02	9.98	1412	100%	217 - 240			RM
				28.07.20	7.01	9.98	1412	100%	217 - 240			RM
				29.07.20	7.02	9.98	1412	100%	217 - 240			RM
				30.07.20	7.01	9.98	1412	100%	217 - 240			RM
				31.07.20	7.02	9.98	1412	100%	217 - 240			RM

Appendix G

Gas Flare reports

Dunmore Road Landfill - LFG REPORT JUNE 2021

Site:	Dunmore Road Landfill	Report issue date:	16-08-2021
Report month:	July 2021	Prepared by:	Matthew Tap
Prepared for:	Shellharbour City Council	Checked by:	Brendan Fraser

Comments on changes to existing system:	<p>Jan 2016 - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p>Apr 2016 - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p>June 2016 - LGI disconnected the extended gas capture system to assist the council.</p> <p>Sep 2016 - LGI disconnected the extended gas capture system to fassist council.</p> <p>Nov 2016 - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p>May 2017 - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p>November 2019 - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p>April 2020 - LGI installed flowline to sump 6 after earlier disconnection.</p> <p>February 2021: LGI installed 13 new vertical wells, including a new submain.</p>
Comments on flare operation / maintenance:	<p>July 2021: Normal operation was observed throughout the reporting period, no shutdowns occurred. LGI have had issues attending site due to lockdown restrictions and are investigating solutions to reduce the need to pump out areas of the extraction system.</p> <p>LGI installed 13 new wells within the recently completed cell, increasing the average flow from ~320m³/hr to ~430m³/hr.</p> <p>LGI has seen a decrease in flow rate due to the colder climate. We have reduced the blower speed at the flare to prevent over extracting on the collection field.</p>
Recommendations:	<p>LGI recommends council proceeds with final capping works on cell 3. As council continues to complete the second lift of cell 5a LGI recommends laterals be installed.</p> <p>LGI requests clarification on the new cell design and fill plan.</p>

FLARE DATA RESULTS:

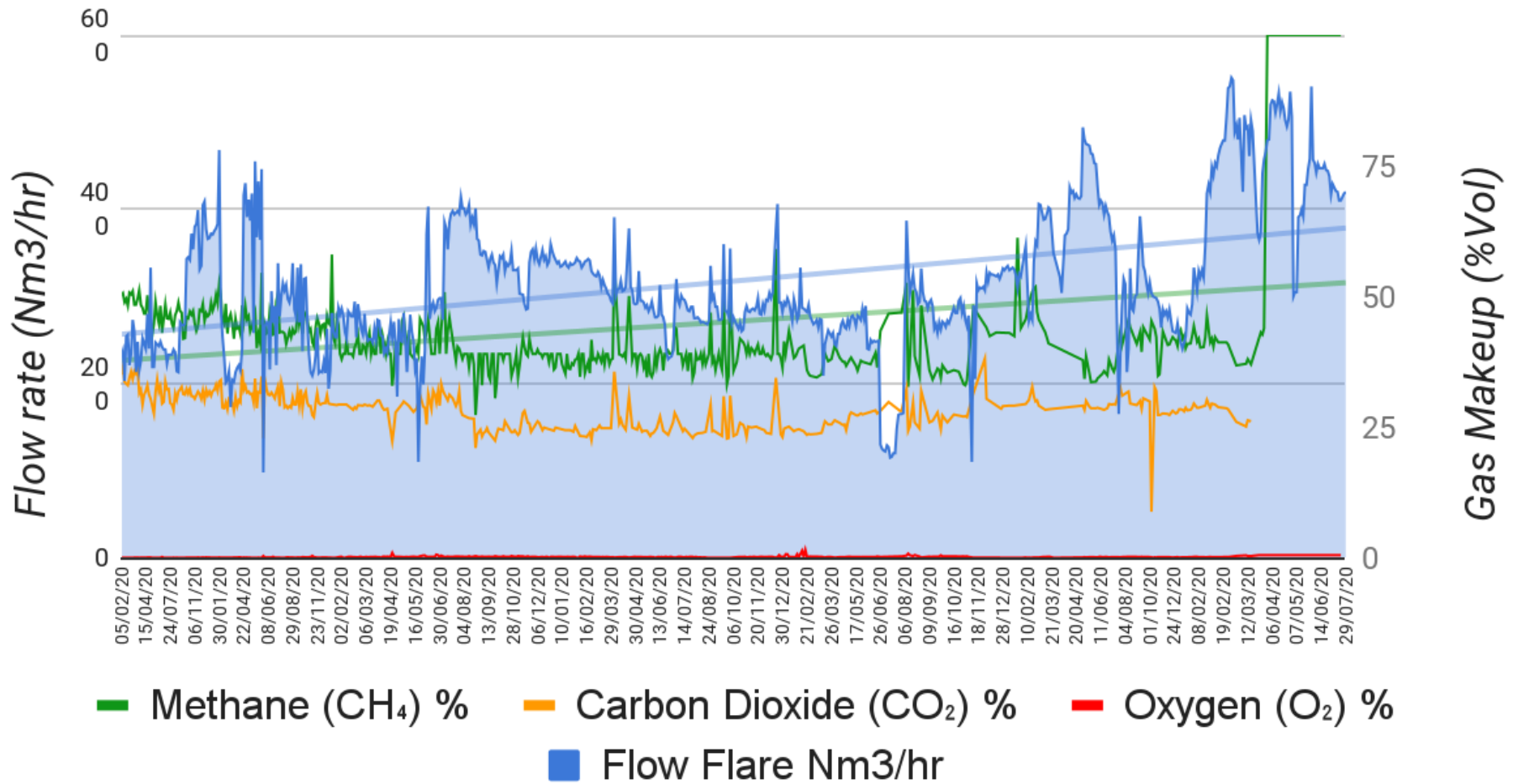
Date	CH4 %	CO2 % ¹	O2 %	STACK TEMP °C	CUMULATIVE FLOW m ³ ²	FLOW m ³ /h
06/07/2021	-	-	-	692	19,334,748	421
09/07/2021	-	-	-	715	19,365,049	420
16/07/2021	-	-	-	773	19,435,024	410
20/07/2021	-	-	-	716	19,473,531	410
29/07/2021	34.4	25	2.6	722	19,564,320 ³	420
Average	34.4	25	2.6	723		416

¹ Local LFG CO2% are recorded on site. An average value is generated remotely based on local CO2 recordings.

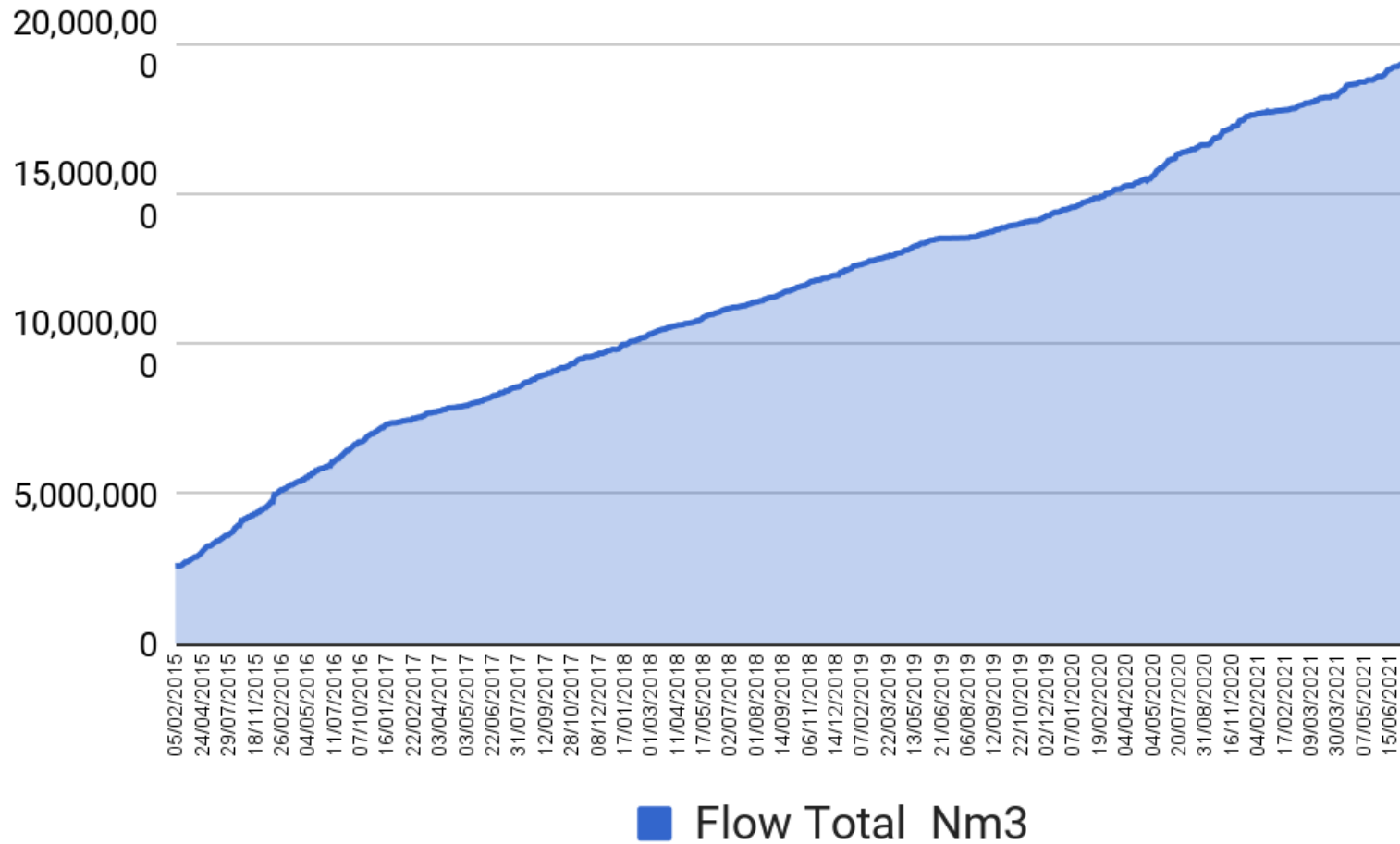
² Cumulative flow represents a snapshot recording, taken on the corresponding date. Please note that this value does not account for the volume of gas, which was combusted in the flare unit from 22 September 2014 to 30 January 2015 while the flow meter was removed for repair. LGI has provided an estimate of this additional volume to Council.

³ 19,564,320m³ of flared landfill gas up to the 29th July 2021 represents carbon abatement of approximately 139,361 tonnes of CO2 equivalent (total methane abated by gas capture system to date).

Dunmore Flare Gas Fuel Trend



Dunmore Flare Cumulative Flow



Please note:

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LANDFILL GAS MONTHLY REPORT DUNMORE



Greenhouse Gas Abatement

 <p>141,670 tonnes carbon abated¹</p>	 <p>19,886,156 m³ biogas captured</p>
 <p>7,792,105 tree seedlings grown for 10 yrs</p>	 <p>56,749 homes powered for a year</p>

people engineering a zero carbon, clean energy future

¹ 19,888,543³ of flared landfill gas up to the 01st of December 2021 represents carbon abatement of approximately 141,670 tonnes of CO₂ equivalent (total methane abated by gas capture system to date).

Site:	Dunmore	Report issue date:	14/09/2021
Report month:	August 2021	Prepared by:	Patrick Bloomer
Prepared for:	Shoalhaven City Council	Checked by:	J. North

Comments on changes to existing system:	<p>Jan 2016 - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p>Apr 2016 - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p>June 2016 - LGI disconnected the extended gas capture system to assist council.</p> <p>Sep 2016 - LGI disconnected the extended gas capture system to assist council.</p> <p>Nov 2016 - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p>May 2017 - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p>November 2019 - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p>April 2020 - LGI installed flowline to sump 6 after earlier disconnection.</p> <p>February 2021: LGI installed 13 new vertical wells, including a new submain</p>
Comments on operation / maintenance:	<p>The Geotech gas analyser, located on the flaring unit, has become unreliable, preventing gas data from being collected remotely. This in combination with COVID19 travel restrictions have caused some empty data entries.</p> <p>LGI has purchased a new gas analyser to be installed at the flare compound as soon as possible.</p> <p>Low CH4 content wells near perimeter areas and close to batter have been restricted in an attempt to increase bioactivity.</p> <p>Overall flow has been decreased during this month to combat the effects of previous cold weather dampening CH4 content.</p>
Recommendations:	Replace the Geotech gas analyser as soon as possible.

FLARE OPERATIONAL DATA:

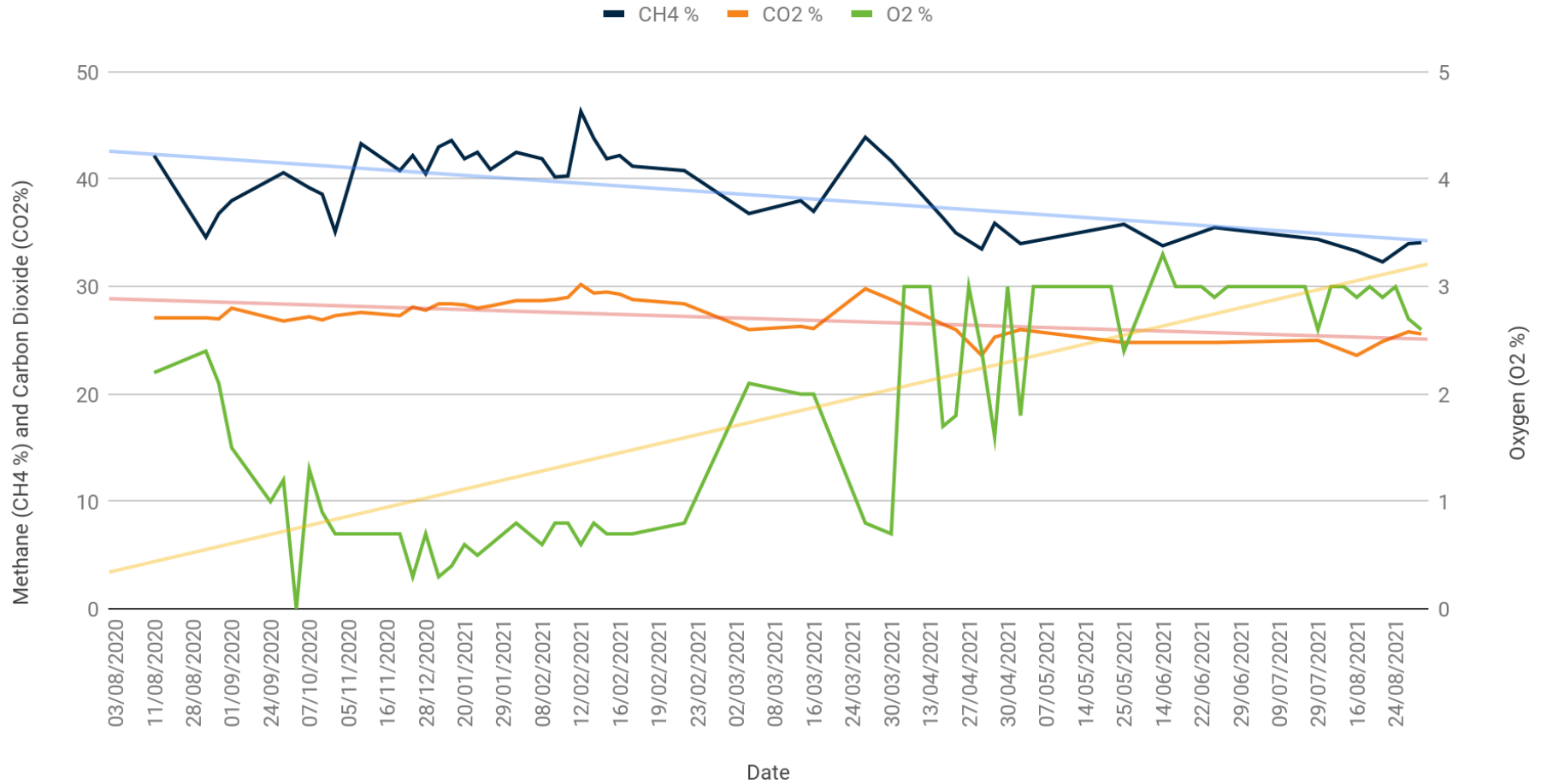
Date	CH4 %	CO2 % ²	O2 %	STACK TEMP C	CUMULATIVE FLOW m ³	FLOW m ³ /h
16/08/2021	33.3	23.6	2.9	709	19,743,688	424
20/08/2021	32.3	24.9	2.9	715	19,781,430	413
24/08/2021	N/A	N/A	3.0	673	19,820,869	385
31/08/2021	33.0	25.7	2.8	582	19,886,156	406
Average	32.86	24.7	2.9	651	-	403.8

² Local LFG CO2% is recorded on site. An average value is generated remotely based on local CO2 recordings.

³ Cumulative flow represents a snapshot recording, taken on the corresponding date.

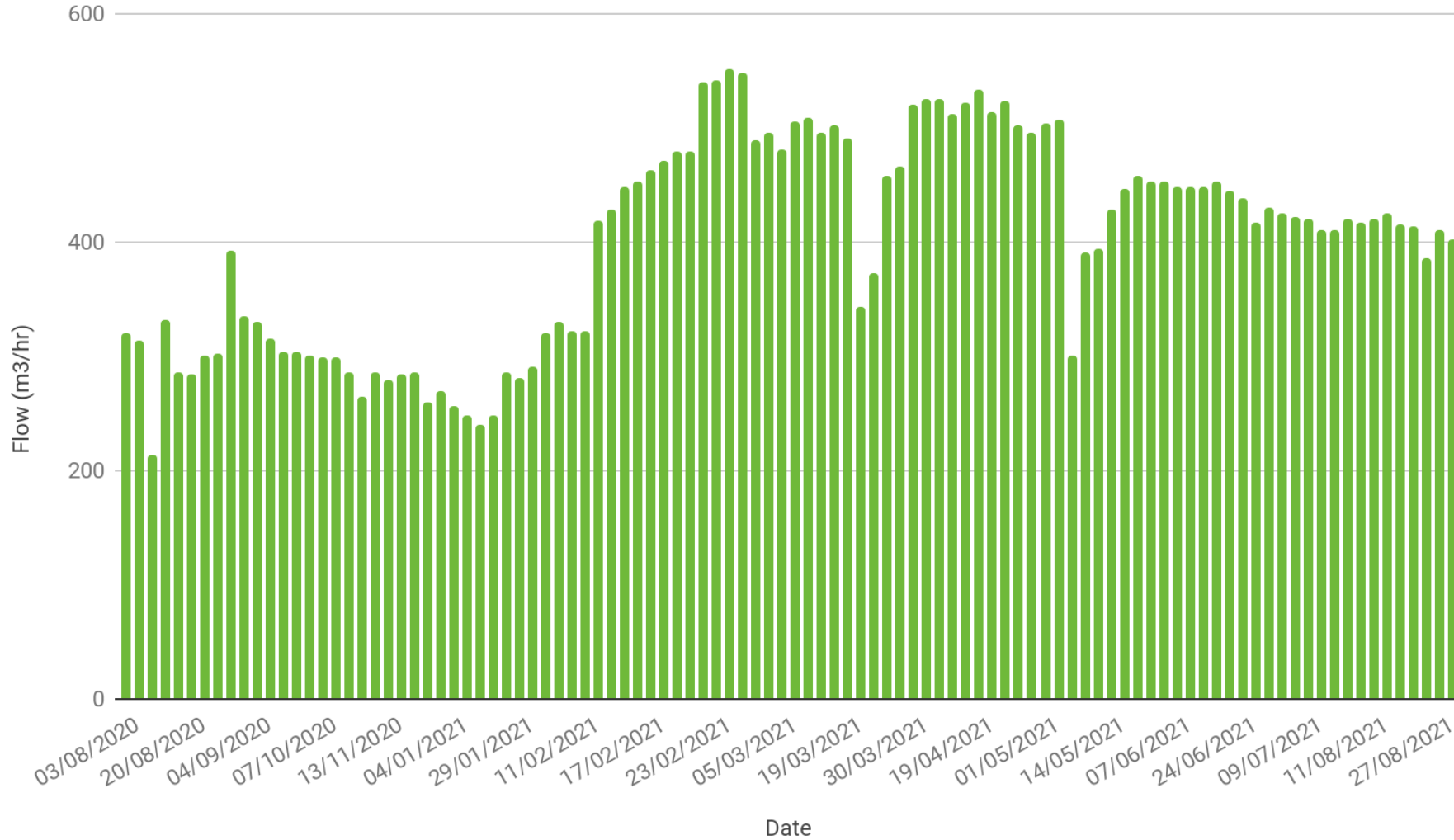


Dunmore - Methane & Carbon Dioxide



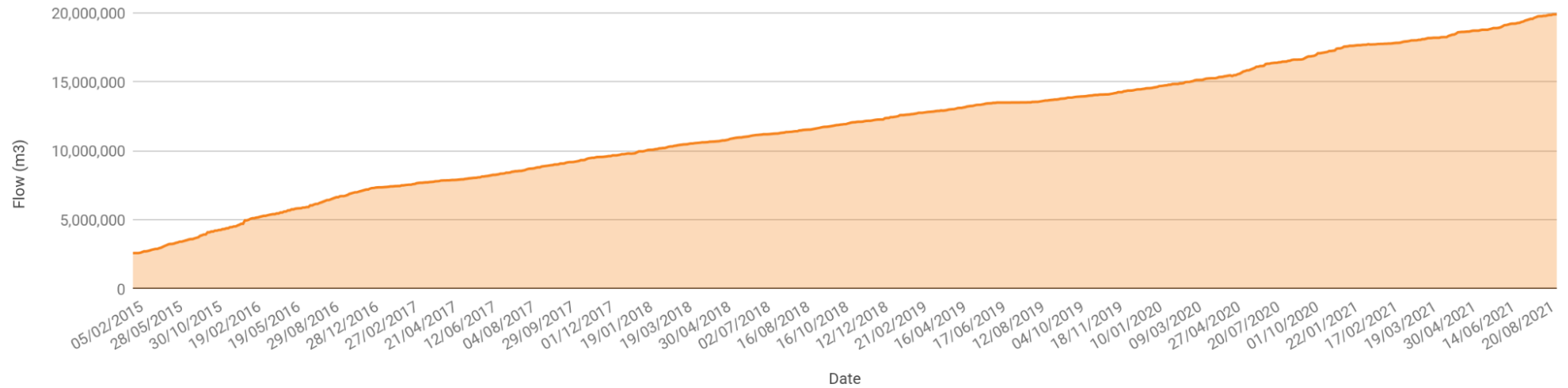


Dunmore - Flow





Dunmore - Cumulative Flow



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BIOGAS MONTHLY REPORT DUNMORE



Greenhouse Gas abatement



CARBON ABATEMENT *

170,763 tonnes
(T CO₂e abated)



BIOGAS CAPTURED ^

20,137,127 m³.



SEEDLINGS PLANTED

2,846,047 seedlings planted
for 10yrs.

people engineering a zero carbon, clean energy future

* 20,137,127 of flared landfill gas up to 1 October 2021 represents carbon abatement of approximately 170,763 tonnes of CO₂ equivalent (total methane abated by gas capture system to date).

^ Biogas captured is the cumulative flow reading at the last day of the month.

Site:	Dunmore	Report issue date:	11/10/2021
Report month:	September 2021	Prepared by:	Patrick Bloomer
Prepared for:	Shoalhaven City Council	Checked by:	Jarryd Doran

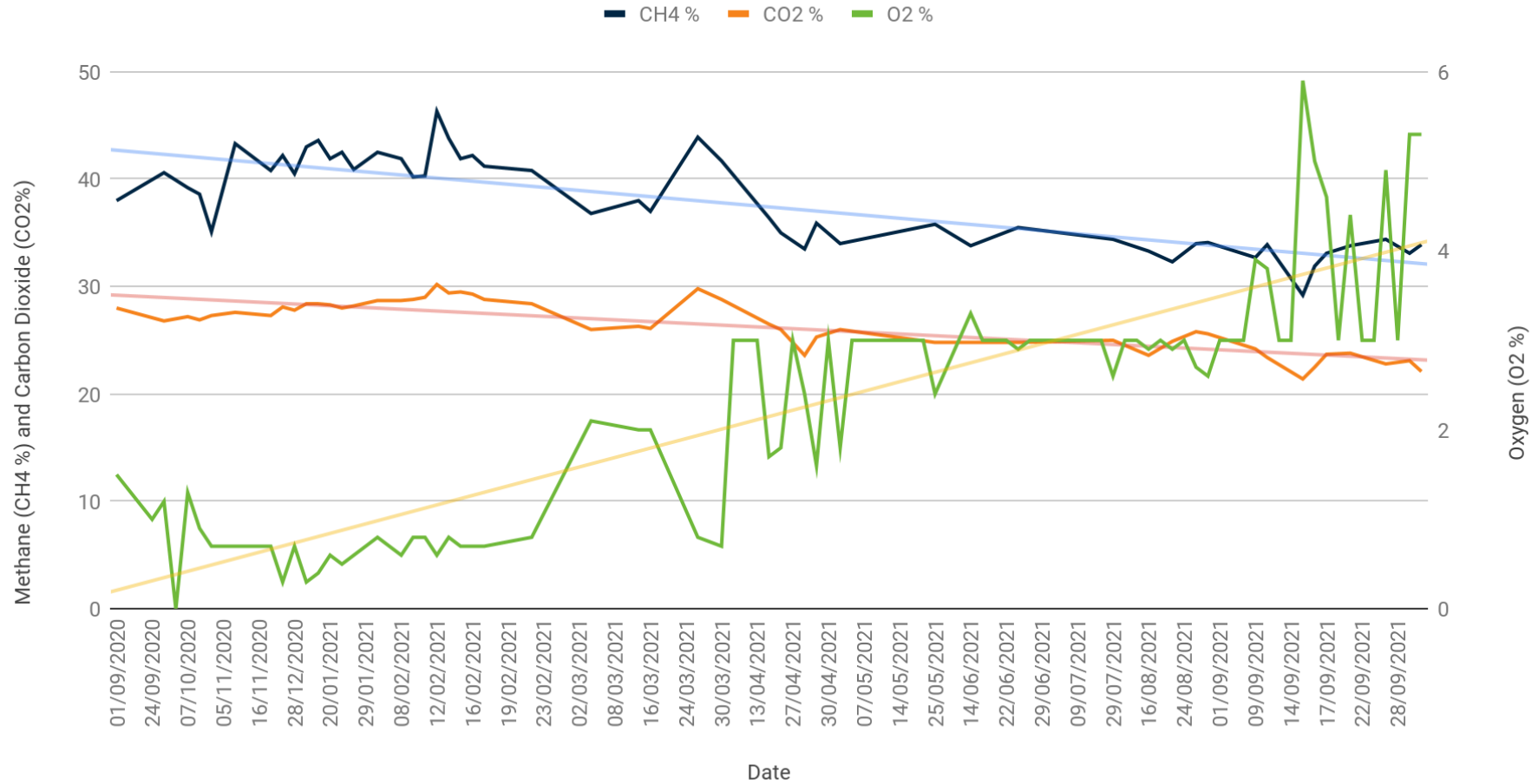
Comments on changes to existing system:	<p>January 2016 - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p>April 2016 - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p>June 2016 - LGI disconnected the extended gas capture system to assist council.</p> <p>September 2016 - LGI disconnected the extended gas capture system to fassist council.</p> <p>November 2016 - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p>May 2017 - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p>November 2019 - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p>April 2020 - LGI installed flowline to sump 6 after earlier disconnection.</p> <p>February 2021 - LGI installed 13 new vertical wells, including a new submain</p>
Comments on operation / maintenance:	High oxygen readings this month are due to a suspected breach in the infrastructure, LGI is currently in the process of tracing the leak so repairs can be made.
Recommendations:	LGI will assess replacing the gas analyser

Flare Operational Data:

Date	CH4 %	CO2 %	O2 %	STACK TEMP C	CUMULATIVE FLOW m3	FLOW m3/h
09/09/2021	33.9	23.4	3.8	609	19,964,926	372
16/09/2021	31.9	22.5	5	590	20,026,881	342
24/09/2021	34.4	22.8	4.9	582	20,087,402	324
30/09/2021	33.9	22.1	5.3	630	20,133,642	338
Average	33.525	22.7	4.75	603	-	344

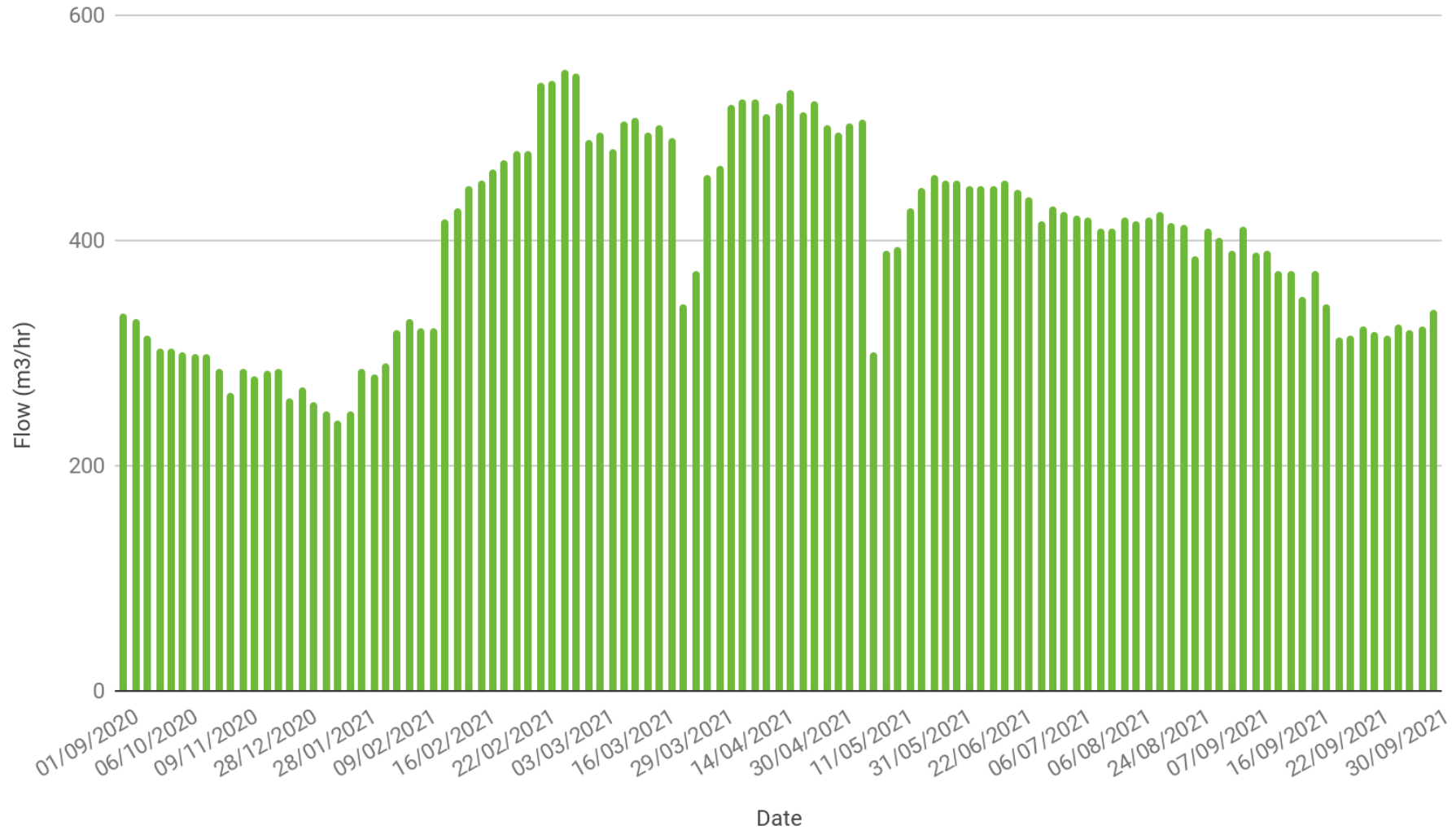


Dunmore- Methane, Carbon Dioxide & Oxygen



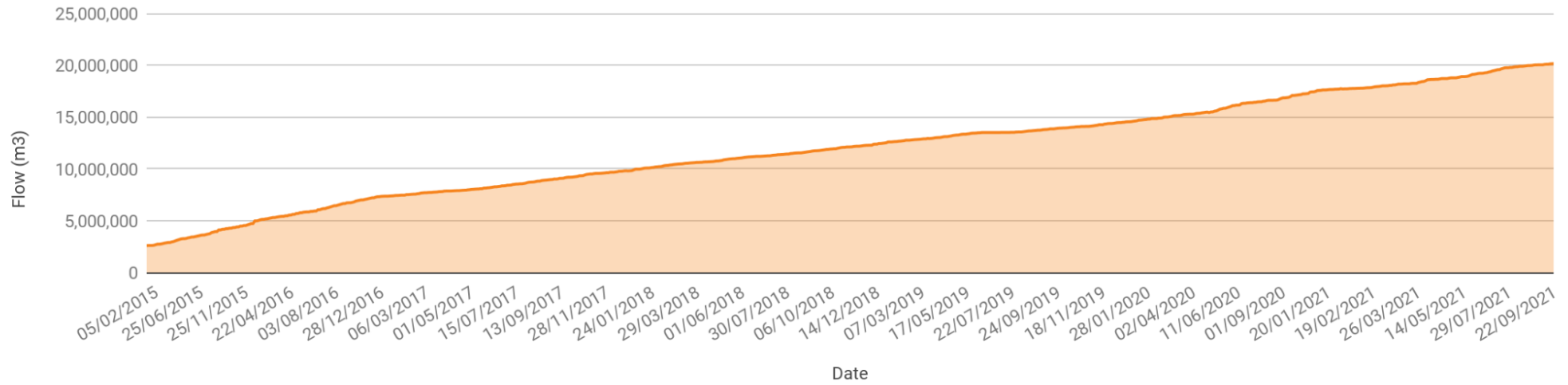


Dunmore - Flow Rate





Dunmore - Cumulative Flow



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Appendix H

**Albion Park Weather Data Ex Bureau of Meteorology November
December 2020**

Albion Park, New South Wales

November 2020 Daily Weather Observations



Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C					km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	13.5	19.7	20.6			S	65	12:20	17.4	86	8	SSW	33	1015.1	16.4	86	7	SSW	37	1019.6
2	Mo	15.2	21.4	5.8			S	35	23:09	19.3	69	8	SE	24	1027.7	20.1	64	2	ESE	20	1026.6
3	Tu	9.3	21.0	0			NE	28	13:42	18.4	65			Calm	1027.0	20.3	62		NE	19	1023.4
4	We	9.7	24.2	0			ENE	37	11:08	20.6	64		N	11	1016.7	22.1	73		ENE	26	1010.6
5	Th	13.1	16.4	14.0			SSW	69	17:03	13.2	92	8	SSE	17	1011.0	13.4	85	8	SSW	17	1011.9
6	Fr	12.2	19.5	8.0			WSW	57	03:36	15.8	62	8	SW	20	1019.3	17.9	59		ESE	20	1017.0
7	Sa	12.1	19.6	0			S	50	14:12	17.7	71	1	NNW	2	1020.8	19.1	56	5	S	28	1023.1
8	Su	12.4	20.2	0			ESE	33	11:02	17.8	56		S	17	1029.5	17.7	66	8	ESE	13	1028.2
9	Mo	12.3	20.8	0			NE	30	14:33	17.9	67	8	W	4	1028.3	20.3	57		NE	19	1025.3
10	Tu	9.3	22.0	0			NE	35	12:09	18.5	62	1	NNW	15	1024.8	20.8	61		NE	24	1020.6
11	We	10.6	23.2	0			NE	37	10:37	19.9	70		NNE	13	1019.0	22.5	79		NE	28	1015.2
12	Th	14.1	25.8	0			ENE	31	14:40	20.9	84	8	ENE	13	1009.9	24.3	76	4	ENE	20	1006.3
13	Fr	17.8	28.0	0.8			W	63	15:17	22.5	74	3	SSW	9	1004.6	25.3	61	6	E	22	1000.4
14	Sa	12.9	24.2	3.8			ENE	28	13:07	21.1	63		W	2	1009.3	23.0	67		ENE	17	1008.6
15	Su	11.6	25.6	0			NE	33	12:12	21.4	67		ENE	7	1015.8	24.4	79		ENE	20	1014.4
16	Mo	17.9	35.7	0			W	56	13:35	24.0	73	7	NE	9	1010.3	34.3	26	1	W	31	1008.2
17	Tu	15.3	22.0	0			E	31	10:40	19.8	70	8	ESE	15	1020.1	18.3	73	8	ESE	15	1020.4
18	We	15.6	22.8	0			ENE	37	13:48	18.7	81	8	WNW	4	1025.5	22.1	58		NE	26	1022.5
19	Th	11.7	24.2	0			NE	48	13:01	21.5	65	7	NNW	22	1023.0	24.2	68		NE	30	1018.9
20	Fr	14.9	27.8	0			S	43	17:41	22.9	79		NE	19	1016.6	26.1	70		NE	20	1013.9
21	Sa	14.9	23.9	0			SE	35	10:23	20.9	67	4	SSE	9	1023.0	20.8	72	8	ESE	15	1020.7
22	Su	14.4	25.5	0			NE	28	11:40	21.1	72	8	N	7	1017.4	23.3	79	8	NE	7	1013.2
23	Mo	19.3	27.4	5.0			WSW	61	14:22	22.6	90	8	ESE	6	1007.1	26.8	53	8	W	20	1004.1
24	Tu	17.0	24.1	0			ESE	37	12:53	19.8	71	8	SSW	15	1012.3	20.7	64	8	SE	22	1011.5
25	We	15.9	24.3	1.0			ENE	33	15:26	18.2	89		WSW	7	1015.7	22.1	73		NE	22	1012.6
26	Th	13.6	28.8	0			S	52	17:49	23.8	66		W	2	1011.7	28.1	56		NE	19	1009.9
27	Fr	14.3	33.8	0			NE	31	14:00	19.7	68	8	SW	7	1019.2	23.5	73		NE	24	1014.1
28	Sa	17.2	41.8	0			NW	46	11:35	33.8	37		N	15	1007.8	40.9	15		NW	22	1003.8
29	Su	24.5	39.4	0			WNW	98	11:51	33.5	29		NW	24	998.3	34.3	28	1	W	74	996.2
30	Mo	16.4	23.3	0			ENE	33	12:51	20.0	66	8	E	7	1018.4	21.7	71	6	ENE	22	1016.3
Statistics for November 2020																					
Mean		14.3	25.2							20.8	69	6		11	1016.8	23.2	63	5		23	1014.6
Lowest		9.3	16.4							13.2	29	1		Calm	998.3	13.4	15	1	NE	7	996.2
Highest		24.5	41.8	20.6			WNW	98		33.8	92	8	SSW	33	1029.5	40.9	86	8	W	74	1028.2
Total				59.0																	

Observations were drawn from Albion Park (Shellharbour Airport) (station 068241)
Some cloud observations are from automated equipment; these are different to those made by a human observer and may not appear every day.

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Albion Park, New South Wales

December 2020 Daily Weather Observations



Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9am					3pm						
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C					km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	18.1	26.5	0			NE	50	12:05	22.7	66	8	N	26	1012.8	25.8	73		NE	24	1006.8
2	We	18.1	21.6	5.2			SSE	48	01:21	20.0	77	8	SSE	13	1019.4	19.6	69	8	SE	17	1020.6
3	Th	15.0	22.6	2.8			NE	31	13:16	17.3	99	8		Calm	1023.2	20.5	83	8	NE	19	1019.7
4	Fr	14.0	27.9	0			SSE	43	18:54	22.5	73		ENE	9	1014.8	26.3	61		NE	20	1010.6
5	Sa	16.8	26.1	0			NW	43	22:26	20.2	74	8	N	9	1012.9	22.2	80	7	NE	13	1006.0
6	Su	19.8	28.4	0			WNW	69	08:00	22.9	40		WNW	39	1002.2	27.4	23		W	39	1001.2
7	Mo	9.9	29.1	0			W	65	08:30	23.4	33		WNW	35	1004.8	27.9	23		W	31	1002.5
8	Tu	13.6	21.9	0			WSW	56	23:02	18.0	42		SSW	15	1012.9	19.9	49	3	ESE	20	1013.9
9	We	11.2	24.6	0			NE	35	12:22	20.6	54		NNW	17	1019.8	23.0	56		ENE	24	1017.0
10	Th	13.3	25.6	0			S	59	12:22	24.0	54		NE	13	1017.5	21.3	63	1	SSE	28	1021.1
11	Fr	15.6	21.6	0			S	43	12:02	17.6	55	8	S	22	1029.5	20.1	50	8	SE	19	1028.8
12	Sa	15.7	22.9	0			E	35	15:09	19.6	60	7	SSE	17	1031.2	19.9	68	7	ESE	22	1029.2
13	Su	14.4	24.5	1.6			E	35	13:17	19.6	73	8	S	4	1026.8	24.0	59		E	24	1024.0
14	Mo	16.8	24.3	4.0			NE	30	12:35	20.0	90	4	WSW	11	1021.6	23.2	65	4	NE	20	1019.7
15	Tu	18.6	25.3	3.2			NE	33	15:45	20.1	100	7	NW	7	1017.8	23.6	89	7	NE	19	1014.8
16	We	19.8	26.4	25.0			NE	44	14:53	22.1	100	7	NE	17	1012.6	26.1	85	1	NE	24	1009.1
17	Th	21.4	31.4	0.6			ENE	30	13:15	25.9	81	3	NE	11	1006.5	25.7	82	7	ESE	11	1005.0
18	Fr	19.3	31.5	3.0			W	46	09:08	31.4	55	6	WSW	17	1004.3	30.4	47	7	SSE	17	1005.4
19	Sa	17.4	20.2	0			SSE	31	01:51	18.2	77	8	S	15	1018.1	19.5	76	7	S	13	1017.2
20	Su	16.4	23.8	0			ENE	24	14:45	20.2	86	8	WSW	4	1014.1	23.1	74	1	ENE	15	1011.9
21	Mo	17.4	23.7	0			ENE	35	21:18	21.4	86	7	ENE	9	1012.8	23.3	83	1	ENE	17	1009.7
22	Tu	16.7	26.0	21.2			W	57	22:08	21.9	69	8	W	17	1001.2	24.9	50	3	WNW	22	1002.0
23	We	15.9	25.3	0			WSW	44	01:30	21.6	53		SW	17	1013.5	23.1	58		SE	26	1015.3
24	Th	14.6	26.1	0			NE	41	12:24	21.4	67		N	9	1016.4	24.0	72	1	ENE	22	1012.9
25	Fr	16.6	20.1	0			S	39	11:49	19.0	72	8	SSE	13	1020.1	19.2	64	8	SSE	19	1020.6
26	Sa	16.8	24.7	0			NNE	44	14:35	19.8	76	8	WNW	11	1020.5	24.3	64	4	NE	26	1016.5
27	Su	14.8	25.8	2.4			NE	28	14:33	22.4	72		NNE	2	1013.0	25.3	77		NE	20	1009.3
28	Mo	18.6	24.9	0			SSE	52	10:46	23.7	77	8	NNE	13	1007.1	18.7	78	8	SSE	24	1010.0
29	Tu	15.7	20.7	4.6			SSW	31	15:05	16.6	98	8	WSW	7	1015.1	19.4	82	7	SW	7	1015.1
30	We	16.5	21.0	2.0			ENE	24	12:29	20.3	80	8	SSE	13	1019.8	20.2	80	8	SSW	13	1019.6
31	Th	17.1	21.9	0			SE	22	13:06	20.0	84	8	WNW	6	1021.1	21.4	71	7	E	15	1020.6
Statistics for December 2020																					
Mean		16.3	24.7							21.1	71	7		13	1015.6	23.0	66	5		20	1014.1
Lowest		9.9	20.1							16.6	33	3		Calm	1001.2	18.7	23	1	SW	7	1001.2
Highest		21.4	31.5	25.0			WNW	69		31.4	100	8	WNW	39	1031.2	30.4	89	8	W	39	1029.2
Total				75.6																	

Observations were drawn from Albion Park (Shellharbour Airport) (station 068241)

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