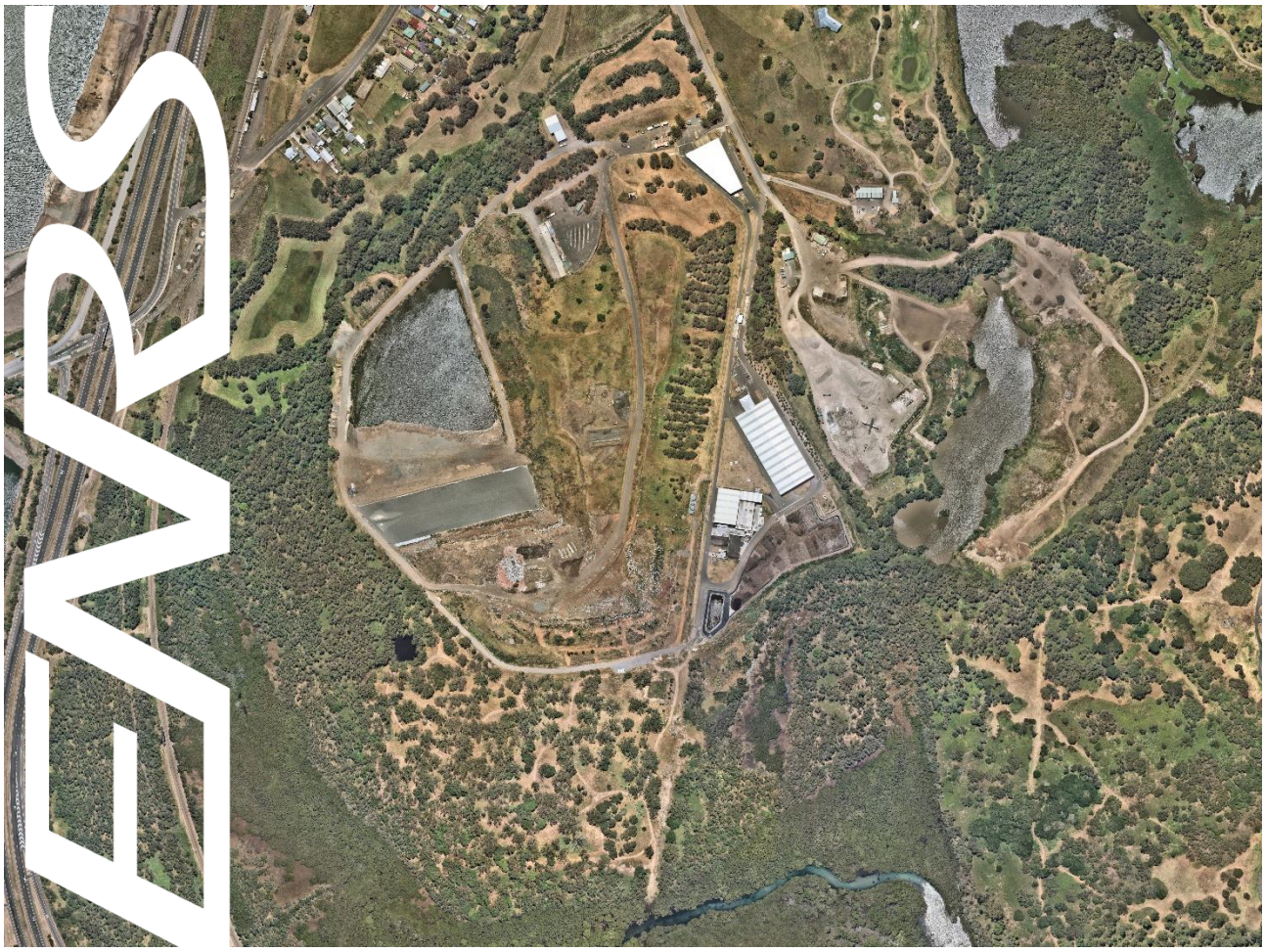

QUARTERLY ENVIRONMENTAL MONITORING REPORT (QEMR)

March 2020

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

ENVIRONMENT PROTECTION LICENCE (EPL) 5984

Prepared For: **Shellharbour City Council**

Project Number: **ENRS0033**

Date: **April 2020**

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

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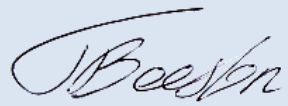	
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EXECUTIVE SUMMARY

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 Quarterly Monitoring Report for the Dunmore Recycling and Waste Depot (herein referred to as the Site).

This report summarises the results of field testing and laboratory analysis conducted by ALS for the March 2020 quarterly monitoring period. This Quarterly Report 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 Quarterly Environmental Monitoring Report 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 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 a Quarterly Environmental Monitoring Report.

The scope of work for this Quarterly Environmental Monitoring Report comprised the collation, assessment and reporting of Site data made available to ENRS from the quarterly December 2019 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);

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 March 2020 quarterly 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 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-10, BH-12r, BH-13, BH-14, BH-15, BH-19. This is consistent with previous monitoring events;
- Onsite surface water samples (SWP-1, SW-2, SWP-4 and SWP-5) reported concentrations of leachate indicators below onsite groundwater samples for the selected analytes;
- 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. Concentrations of ammonium and nitrate were below the ANZECC (2000) trigger values for marine waters. This is consistent with previous monitoring events;
- The existing monitoring locations and sampling regime (specified in EPL 5984) is generally considered to provide a suitable assessment of surface water, leachate and groundwater conditions;
- 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 March 2020 quarterly monitoring period;

- Based on this review of the quarterly March 2020 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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1.0 INTRODUCTION

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 Quarterly Monitoring Report for the Dunmore Recycling and Waste Depot (herein referred to as the Site).

This report summarises the results of field testing and laboratory analysis conducted by ALS for the March 2020 quarterly monitoring period. This Quarterly Report 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.

1.1 PROJECT BACKGROUND

1.1.1 Site History

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.

1.1.2 EPL Requirements

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.
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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.

1.2 OBJECTIVES

The objectives of this Quarterly Environmental Monitoring Report 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 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 a Quarterly Environmental Monitoring Report.

1.3 SCOPE OF WORK

The scope of work for this Quarterly Environmental Monitoring Report comprised the collation, assessment and reporting of Site data made available to ENRS from the quarterly December 2019 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);
- 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.

2.0 SITE DESCRIPTION

2.1 LOCATION

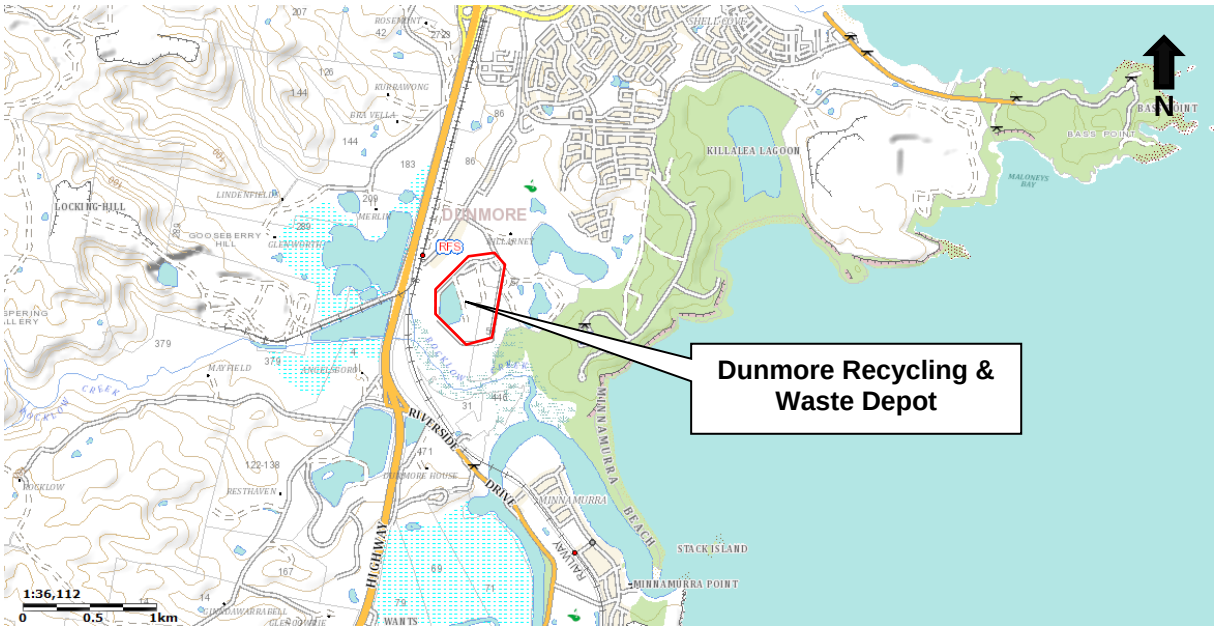
The Site is located at 44 Buckleys Road, Dunmore, NSW, 2529, legally defined as Lot 21 in Deposited Plan 653009 and Lot 1 Deposited Plan 419907. The Site is situated approximately three and a half (3.5) kilometres southwest of the Shellharbour town centre. The area's regional location is defined in **Figure 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
Title Identifier	Lot 21 DP 653009, Lot 1 DP 419907

Aspect	Description
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.

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 aquifer, the shallow groundwater flow is inferred to mimic topography with low to moderate hydraulic gradients flowing towards the south.

The Site and adjoining land, is 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, dust and surface gas sampling are provided in Appendix A, Error! Reference source not found., and Appendix B, respectively.

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 ANZECC 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	0.91 mg/L	1.88 mg/L
Nitrate	10.6 mg/L	10.6 mg/L
pH	6.5-8.5 pH units	6.5-8.5 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	-

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: • 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/m^2/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* during between January and March 2020. 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. In summary the sampling regime collected samples from; eight (8) surface waters; nine (9) groundwater monitoring wells; and two (2) leachate points. 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.

Dust collection gauges were set up for a one (1) month period between the ***11th February*** and ***10th March 2020***. A total of four (4) dust monitoring locations were considered adequate to assess site conditions. ENRS note that the December 2019 quarterly sampling was the first event to four (4) dust gauges.

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 E.

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. The concentration of methane gas was also recorded in any buildings located within a distance of 250 m of the deposited waste, and 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 *SC* 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.

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. ENRS understand the March 2020 quarterly monitoring results identified no non-compliance with the terms of 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 8** with comparison against the relevant Site Assessment Criteria (SAC). Exceedances of relevant guidelines are also summarised in **Table 6**. The laboratory certificates of analysis are provided in Appendix B.

6.1 OVERFLOW RESULTS

ENRS understand no overflow events were recorded during the March 2020 quarterly monitoring period. Hence, no water samples were collected by *ALS* and no results are presented for this 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

6.3 PHYSICAL INDICATORS

6.3.1 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 (µS/cm). Table 3.3.3 of the ANZECC (2000) guidelines document default TV for EC in lowland rivers between 125 µS/cm - 2,200 µS/cm (~1,500 mg/L).

Groundwater

Salinity in groundwater is typically higher than surface water due to mineral dissolution. Groundwater salinity at the Site was generally reported below the SAC of 2,200 µS/cm. Exceedances were reported in two (2) groundwater bores: **2,460 µS/cm (BH-14)** and **6,970 µS/cm (BH-1)**.

Leachate

Leachate salinity for the quarterly March 2020 monitoring period was reported to be **9,700 µS/cm** (LP1) and **12,300 µS/cm** (Sump) which is above the TV.

6.3.2 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 sulfide 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.

Dissolved Oxygen was recorded for Leachate only, at **0.17 mg/L** (Sump) and **3.0 mg/L** (LP1).

6.3.3 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).

Surface Water

Surface water reported pH values of between **pH 6.8** (SWP-1) and **pH 9.0** (SWP-4).

Groundwater

Groundwater pH was reported between **pH 5.6** (BH-3) and **pH 7.4** (BH-1c). Three (3) exceedances were reported above the ANZECC recommended range of pH 6.5-8.0 including: **pH 5.6** (BH-3), **pH 5.8** (BH-14) and **pH 6.0** (BH-15). The results are largely within the historical range of values.

6.3.4 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. Concentrations were reported between **<5 mg/L** (SWC-up) and **160 mg/L** (SWC-down 2).

6.4 INORGANIC ANALYTES

6.4.1 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.

Ammonia

Ammonia was measured within groundwater monitoring bores between **0.04 mg/L** (BH-14) and **377 mg/L** (BH-1c). Six (6) out of the nine (9) groundwater wells reported exceedances over the adopted trigger value of 0.91 mg/L. This is considered consistent with historical values.

Ammonia in leachate was reported at **638 mg/L** (LP1) and **1,000 mg/L** (Sump). The result is considered characteristic of untreated leachate.

Ammonium

Ammonium was measured at Rocklow Creek surface water monitoring locations between **0.04 mg/L** (SWC-up) and **0.08 mg/L** (SWC-down 2). Results are below the adopted trigger value of 1.88 mg/L and are considered satisfactory.

Nitrate

Results for Nitrate in groundwater were reported between **0.09 mg/L** (BH-15) and **202 mg/L** (BH-14). A total of four (4) exceedances in groundwater were reported above the TV of 0.7mg/L including: **202 mg/L** (BH-14), **33.7 mg/L** (BH-12r), **16 mg/L** (BH-13) and **5.77 mg/L** (BH-3).

Nitrate in Rocklow Creek surface water samples were all reported below the TV of 0.7mg/L. The results are considered satisfactory.

Nitrate in leachate was reported between **0.12 mg/L** (Sump) and **0.86 mg/L** (LP1).

6.4.2 Metals & Metalloids

Magnesium (Total Mg)

Magnesium was analysed in selected surface water samples. Concentrations of magnesium in surface water were reported between **8 mg/L** (SWP-1) and **832 mg/L** (SWC-down 2).

Manganese (Total Mn)

Manganese was analysed in groundwater and leachate sampling points. Concentrations of Manganese in groundwater were reported between **0.05 mg/L** (BH-3) and **0.835 mg/L** (BH-9). Leachate concentrations were reported as **0.616 mg/L** (Sump) and **0.657 mg/L** (LP1). 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.

6.5 ORGANIC ANALYTES

6.5.1 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 monitoring period at the following concentrations:

- Groundwater; between **10 mg/L** (BH-12r) and **167 mg/L** (BH-1c).
- Leachate; **315 mg/L** (LP1) and **356 mg/L** (Sump).

6.6 SUMMARY OF WATER QUALITY EXCEEDANCES

The following table provides a summary of exceedances above the adopted assessment criteria for the collected water samples.

Table 6: Summary of Quarterly Water Monitoring Exceedances

Sample ID	Exceedances		Comments
	Results	Guideline	
BH-1c	Ammonia 377 mg/L EC 6,970 µS/cm	0.91 mg/L 125-2200 µS/cm	Exceedances of Amonina, Nitrate, pH and Salinity (EC) were encountered in multiple wells at the Site. Concentrations are within range of historical data sets.
BH-3	Ammonia 32.5 mg/L Nitrate 5.77 mg/L pH 5.6	0.91 mg/L 0.7 mg/L 6.5-8.0 pH	
BH-4	Ammonia 1.8 mg/L	0.91 mg/L	
BH-9	Ammonia 137 mg/L EC 5,140 µS/cm	0.91 mg/L 125-2200 µS/cm	
BH-12r	EC 2,470 µS/cm Nitrate 33.7 mg/L	125-2200 µS/cm 0.7 mg/L	
BH-13	Nitrate 16 mg/L	0.7 mg/L	
BH-14	Nitrate 202 mg/L pH 5.8 EC 2,460 µS/cm	0.7 mg/L 6.5-8.0 pH 125-2200 µS/cm	
BH-15	Ammonia 69.6 mg/L pH 6	0.91 mg/L 6.5-8.0 pH	
BH-19r	Ammonia 5.5 mg/L EC 2210 µS/cm	0.91 mg/L 125-2200 µS/cm	
SWP-1	No exceedances		Minor exceedances within sampled onsite surface water monitoring locations above the protection 95% of species (freshwater and marine water).
SWP-2	No exceedances		
SWP-4	pH 9.0	6.5-8.5 pH units	
SWP-5	Dry		
SWC-up	No exceedances		No exceedances within Rocklow Creek surface water monitoring locations above the protection 95% of species (freshwater and marine water).
SWC-down	No exceedances		
SWC-down 2	No exceedances		
Leachate Sump	Ammonia 1,000 mg/L EC 12,300 µS/cm	0.91 mg/L 125-2,200 µS/cm	Considered to be characteristic of untreated leachate material.
Leachate Tank LP1	Ammonia 638mg/L EC 9,700 µS/cm Nitrate 0.86 mg/L	0.91 mg/L 125-2,200 µS/cm 0.7 mg/L	

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 between 11th February 2020 and 10th March 2020, in general accordance with AS3580.10.1.

Table 7: Summary of Dust Gauge Results

Sample ID	Guideline Criteria (g/m^2/month)	Total Insolvable Matter (g/m^2/month)	Comments
DDG1	4	**1.2**	Satisfactory
DDG2		**0.7**	Satisfactory
DDG3		**1.8**	Satisfactory
DDG4		**1.9**	Satisfactory

Results for depositional dust during the March 2020 quarterly monitoring period reported levels of dust between below the adopted assessment criteria of **4 g/m^2/month**. The results are therefore considered satisfactory. Dust gauge locations are provided in **Figure 2** attached. It is recommended that monitoring is continued as part of the quarterly regime.

8.0 SURFACE METHANE GAS RESULTS

The surface gas monitoring from the March 2020 quarterly monitoring period reported levels of methane between 1.4 ppm and 26.7 ppm which is below the EPA license limits of 500 ppm. The results are considered satisfactory. A table of results is provided in Appendix D.

9.0 ENVIRONMENTAL ASSESSMENT

9.1 MONITORING POINT SUMMARY

Field measurements and laboratory water quality results from the quarterly March 2020 quarterly monitoring period reported concentrations analytes generally within the range historical values. Groundwater and surface water within the Site boundary reported high levels of analytes considered to be characteristic of landfill and leachate. Offsite sample locations within Rocklow Creek reported satisfactory results. Results are considered to be consistent with historical monitoring events.

All dust gauges were reported below the site assessment criteria which was considered satisfactory. Monitoring should continue to establish baseline conditions and/or causes of the dust.

Results of surface methane gas monitoring recorded satisfactory results. The landfill surface cap is therefore considered intact and effective.

10.0 CONCLUSION AND RECOMMENDATIONS

Based on the findings obtained during the March 2020 quarterly 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 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-10, BH-12r, BH-13, BH-14, BH-15, BH-19. This is consistent with previous monitoring events;
- Onsite surface water samples (SWP-1, SW-2, SWP-4 and SWP-5) reported concentrations of leachate indicators below onsite groundwater samples for the selected analytes;
- 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. Concentrations of ammonium and nitrate were below the ANZECC (2000) trigger values for marine waters. This is consistent with previous monitoring events;
- The existing monitoring locations and sampling regime (specified in EPL 5984) is generally considered to provide a suitable assessment of surface water, leachate and groundwater conditions;
- 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 March 2020 quarterly monitoring period;
- Based on this review of the quarterly March 2020 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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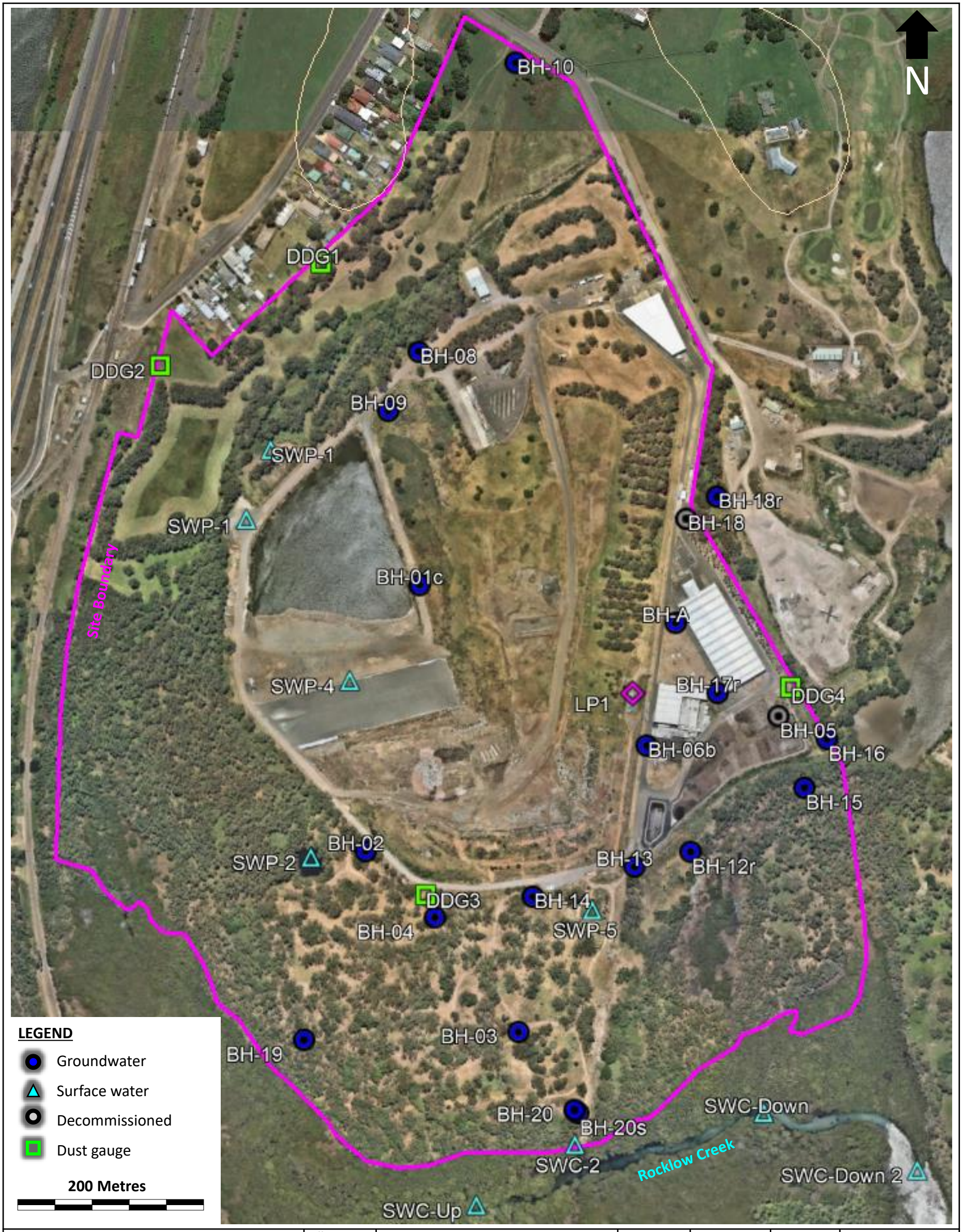
FIGURES



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Client:	**Shellharbour City Council**	Drawn:	**PL**	Figure:	**2**
Project:	**ENRS0033**	Source:	**NearMaps**	Date:	**4/02/2020**
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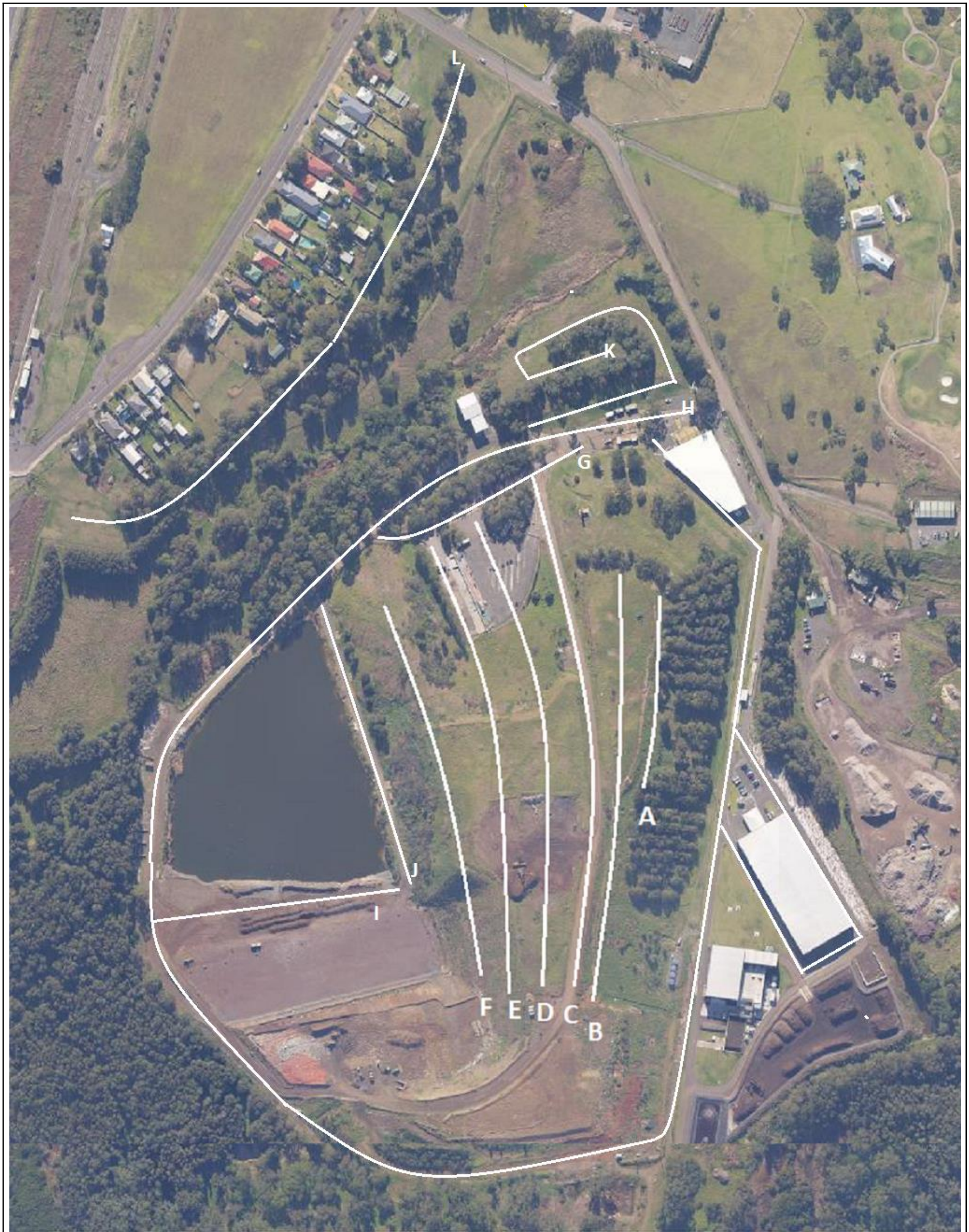

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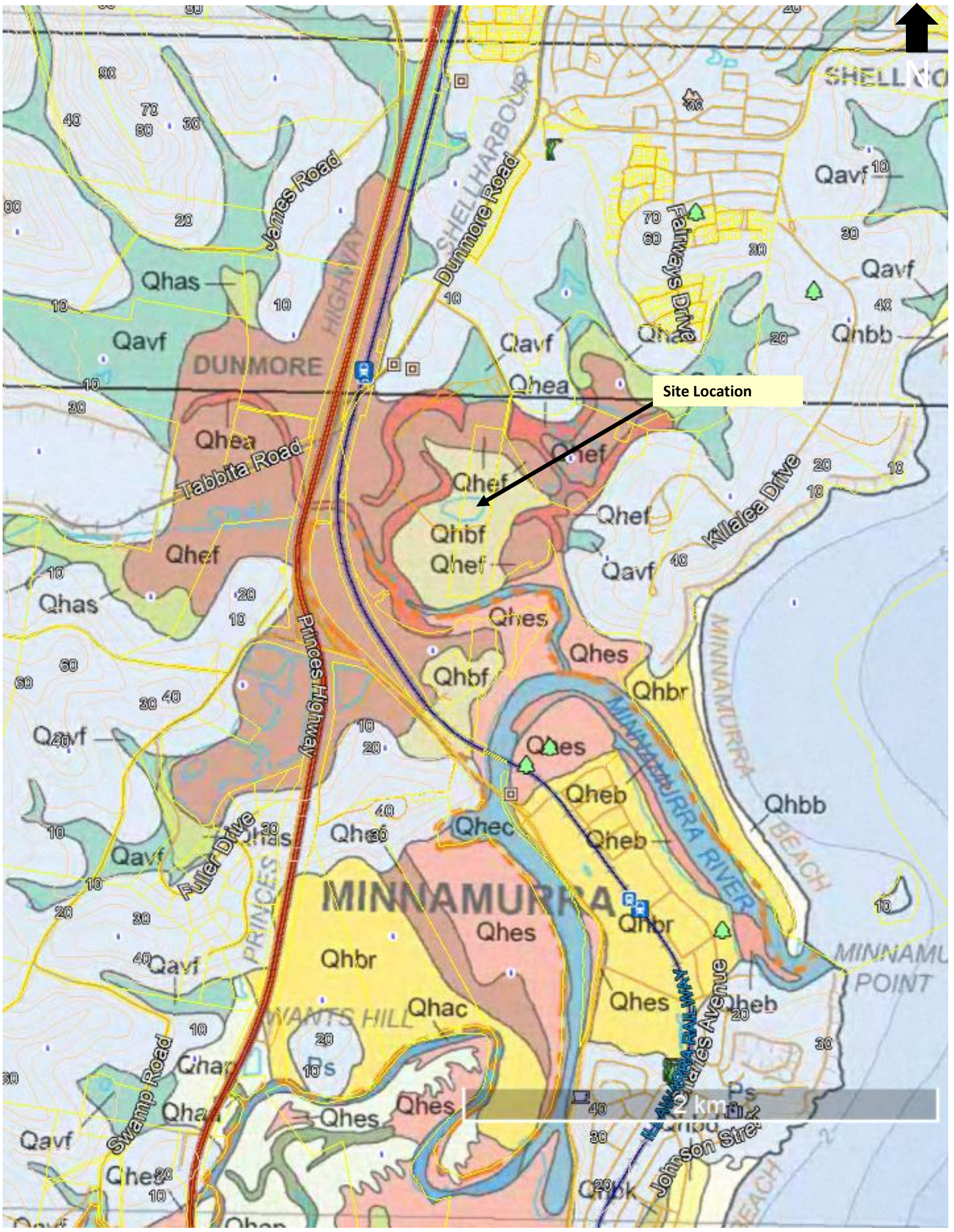
Client:	**Shellharbour City Council**	Drawn:	**PL**	Figure:	**3**
Project:	**ENRS0033**	Source:	**SixMaps**	Date:	**16/03/2020**
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW	Scale:	**NA**	Title:	**Surface Gas Sample transects**
		Status:	**Rev 1**		



ENRS *Environment & Natural Resource Solutions* 108 Jerry Bailey Road, Shoalhaven Heads, NSW, 2535 Tel: 02 4448 5490 Fax: 02 90374708 projects@enrs.com.au www.enrs.com.au	Client:	**Shellharbour City Council**	Drawn:	**PL**	Figure:	**4**
	Project:	**ENRS0033**	Source:	**DPI**	Date:	**16/01/2020**
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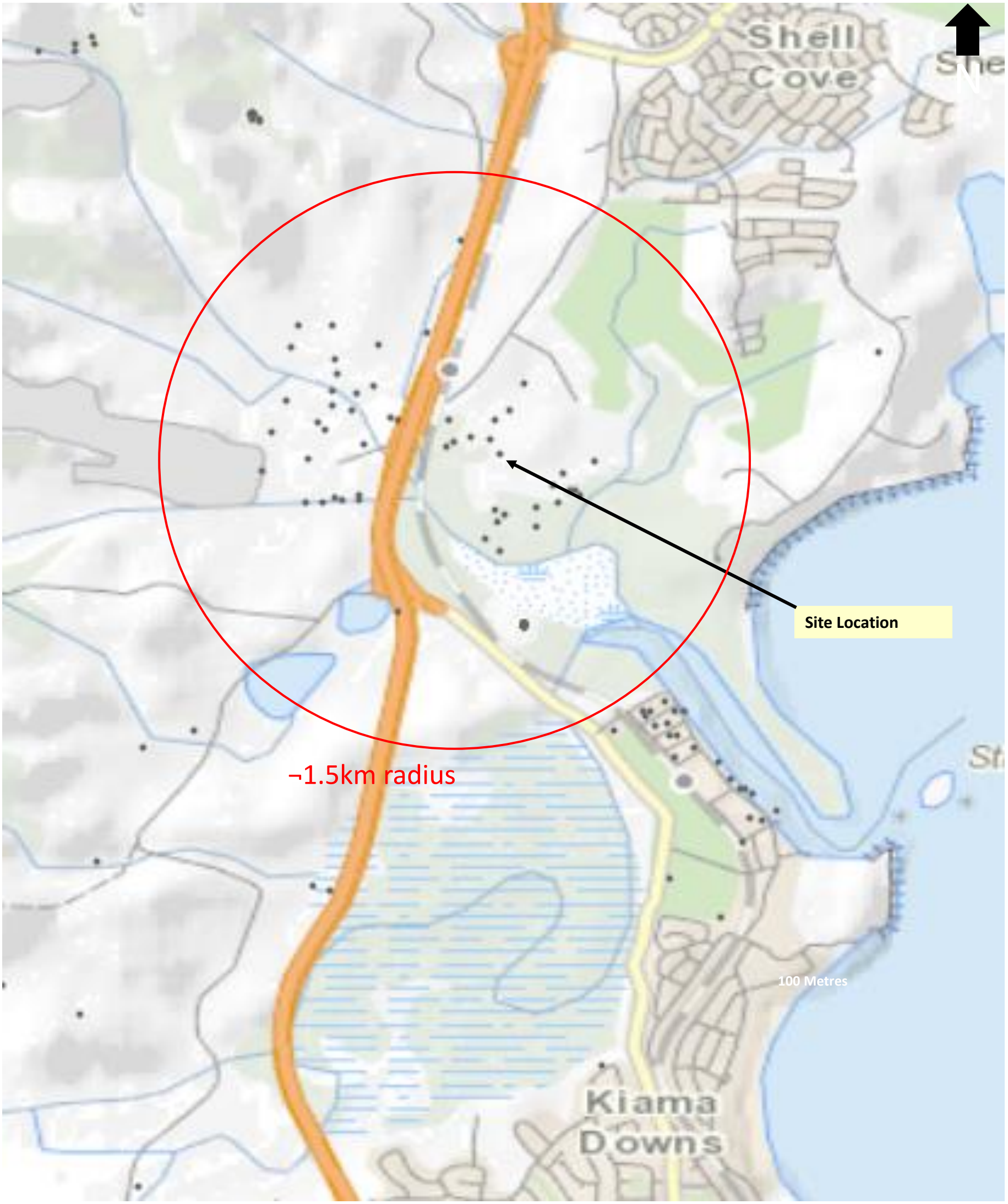

ENRS *Environment & Natural Resource Solutions* 108 Jerry Bailey Road, Shoalhaven Heads, NSW, 2535 Tel: 02 4448 5490 Fax: 02 90374708 projects@enrs.com.au www.enrs.com.au	Client:	**Shellharbour City Council**	Drawn:	**PL**	Figure:	**5**
	Project:	**ENRS0033**	Source:	**SixMaps**	Date:	**16/01/2020**
	Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW	Scale:	**NA**	Title:	**Registered Bores**
			Status:	**Rev 1**		

TABLES

TABLE 8: Total Concentration Results

EPL Quarterly Water Monitoring Results - March 2020: Dunmore Recycling and Waste Depot

GILs -Trigger Values for Freshwater (Protection of 95% of Species) [A]			-	-	-	-	-	1.9	-	-	-	0.9 (pH 8)	0.9 (pH 8)	-	0.7	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5 - 8.0	2200	-		
GILs -Trigger Values for Marine Water (Protection of 95% of Species) [A]			-	-	-	-	-	-	-	-	-	0.91 (pH 8)	0.91 (pH 8)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Australian Drinking Water Guidelines (2018) [C]	Health		-	-	-	-	-	0.5	-	-	1.5	-	-	3	50	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5 - 8.0	-	-		
	Aesthetic		250	-	-	180	-	0.1	0.3	0.3	-	0.5	0.5	-	-	-	-	-	-	-	-	-	250	-	-	-	5	-	-	-	6.5 - 8.0	-	-		
Sample No.		Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Ammonium as N	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Total Organic Carbon	Biochemical Oxygen Demand	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Dissolved Oxygen	Dissolved Oxygen - % Saturation	Suspended Solids (SS)	Turbidity	Total Anions	Total Cations	Ionic Balance	pH	Electrical Conductivity	Temperature	Depth to Water (mbgl 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	mg/L	mg/L	mg/L	mg/L	%	mg/L	NTU	meq/L	meq/L	meq/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	0.01	0.01	1	2	1	1	1	1	1	0.01	0.1	5	0.1	0.01	0.01	0.01	0.01	1	0.1	-		-
Groundwater Bores	BH-1c	11/03/2020	934	-	-	-	-	0.107	-	0.11	0.2	377.0	-	0.08	0.26	0.34	167	-	<1	<1	2360	2360	<10	-	-	-	-	-	-	-	7.4	6970	27.2	3.26		-
	BH-3	11/03/2020	328	-	-	-	-	0.050	-	0.05	0.1	32.5	-	0.05	5.77	5.82	11	-	<1	<1	460	460	86	-	-	-	-	-	-	-	5.6	2180	20.1	3.15		-
	BH-4	11/03/2020	112	-	-	-	-	0.102	-	0.10	<0.1	1.8	-	0.02	0.64	0.66	13	-	<1	<1	294	294	99	-	-	-	-	-	-	-	6.5	1100	21.4	4.35		-
	BH-9	11/03/2020	560	-	-	-	-	0.835	-	1.91	0.3	137.0	-	0.17	0.06	0.23	80	-	<1	<1	1970	1970	<1	-	-	-	-	-	-	-	6.7	5140	21.9	3.3		-
	BH-12r	11/03/2020	226	-	-	-	-	0.753	-	<0.05	0.2	0.1	-	0.30	33.70	34.00	10	-	<1	<1	597	597	223	-	-	-	-	-	-	-	6.6	2470	24.9	4.37		-
	BH-13	11/03/2020	48	-	-	-	-	0.087	-	0.09	0.2	0.2	-	0.06	16.00	16.10	16	-	<1	<1	434	434	125	-	-	-	-	-	-	-	6.8	1300	24.1	4.29		-
	BH-14	11/03/2020	115	-	-	-	-	0.310	-	0.31	0.3	0.04	-	0.30	202.00	202.00	49	-	<1	<1	125	125	136	-	-	-	-	-	-	-	5.8	2460	25.1	4.74		-
	BH-15	11/03/2020	3260	-	-	-	-	0.754	-	0.75	0.2	69.6	-	0.03	0.09	0.12	145	-	<1	<1	639	639	586	-	-	-	-	-	-	-	6	1160	19.4	0.75		-
	BH-19r	11/03/2020	315		-	-		0.110	-	0.63	0.1	5.5	-	0.16	0.41	0.57	26	-	<1	<1	517	517	230	-	-	-	-	-	-	-	6.3	2210	22.2	4.5		-
Surface Water	SWP-1	11/03/2020	52	23	8	31	12	-	2.05	0.90	-	-	-	-	-	-	-	-	<1	<1	103	103	8	-	-	36	9	4	3	3	6.8	-	-	-		-
	SWP-2	11/03/2020	315	72	40	230	24	-	0.10	<0.05	-	-	-	-	-	-	-	-	<1	14	407	421	181	-	-	6	3	21	18	9	7.6	-	-	-		-
	SWP-4	11/03/2020	422	32	55	329	18	-	0.08	<0.05	-	-	-	-	-	-	29	4	<1	49	272	321	300	-	-	25	13	25	21	8	9	-	-	-		Sand Mine Dam
	SWP-5	11/03/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Dry
Rocklow Creek	SWC-up	11/03/2020	9520	239	631	5280	194	-	0.48	0.07	-	-	0.04	<0.01	0.01	0.01	-	-	<1	<1	128	128	1450	-	-	<5	5	301	298	0	7.6	-	23	-		-
	SWC-2	11/03/2020	-	-	-	-	-	-	0.70	0.05	-	-	0.06	<0.01	0.02	0.02	-	-	<1	<1	146	146	-	-	-	10	-	-	-	-	7.6	-	20	-		-
	SWC-down	11/03/2020	10400	256	697	5760	212	-	0.39	0.06	-	-	0.06	<0.01	0.06	0.06	-	-	<1	<1	123	123	1570	-	-	8	5	328	326	0	7.6	-	22	-		-
	SWC-down 2	11/03/2020	11900	318	832	6950	247	-	10.50	<0.10	-	-	0.08	<0.01	0.01	0.01	-	-	<1	<1	122	122	1830	-	-	160	52	376	393	2	7.6	-	22	-		-
Leachate	Leachate Sump	11/03/2020	1480	21	-	-	36	0.616	2.74	-	0.4	1000	-	<0.10	0.12	0.12	352	-	<1	<1	3720	3720	204	0.17	1.9	-	-	-	-	-	7.2	12300	29	-		-
	Leachate Tank LP1	11/03/2020	1450	161	-	-	221	0.657	3.26	-	0.3	638	-	<0.10	0.86	0.86	315	-	<1	<1	2710	2710	205	3	32	-	-	-	-	-	6.9	9700	24.1	-		-

[A] 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 sames as the NEPM (2013) EILs.
[B] ANZG 2018 - pH Upper and Lower Limit for NSW Lowland Rivers (Table 3.3.2).
[C] Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).

APPENDICES

Appendix A

EPL 5984 Sampling Point Summary (NSW EPA, 04/03/2020)

1		Overflow drain	Catch drain collecting overflows from Sediment Dams 1 & 2 and labelled SWP1 on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
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).

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: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 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph 03 9549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-4 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 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 6331 2158 E: launceston@alsenviro.com

CLIENT:	Shellharbour City Council	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	41 Burelli St WOLLONGONG NSW 2500		
PROJECT:	Dunmore Quarterly Ground Waters EPL	**ALS QUOTE NO.:**	WO/030/19 TENDER
ORDER NUMBER:			
PROJECT MANAGER:	Joel Culton		
SAMPLER:		**SAMPLER MOBILE:**	
COC emailed to ALS? (YES / NO)		**EDD FORMAT (or default):**	
Email Reports to :			
Email Invoice to :			

COC SEQUENCE NUMBER (Circle)

COC:	1	2	3	4	5	6	7
OF:	1	2	3	4	5	6	7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Aneka	Arrian		
DATE/TIME: 11/3/20	DATE/TIME: 11/3/20	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	Ammonia	NT-2A (Alka, So4, Cl, Fl) Filtered Ca, K	TOC	Dissolved Fe & Mn	NT-4 (NO2, NO3)				Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	BH1C	11/3/20 11:49	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH3	11:35	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH4	12:52	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH15	14:20	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH13	13:45	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH14	13:05	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
				TOTAL	10									

Environmental Division
Wollongong
Work Order Reference
EW2001278

Telephone : 02 42253125

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.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW2001278**	Page	: 1 of 4
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 4/13 Geary Pl, North Nowra 2541 Australia NSW Australia
Telephone	: ----	Telephone	: +61 2 4225 3125
Project	: Dunmore Quarterly Groundwaters EPL	Date Samples Received	: 11-Mar-2020 16:00
Order number	: 126450	Date Analysis Commenced	: 11-Mar-2020
C-O-C number	: ----	Issue Date	: 18-Mar-2020 16:32
Sampler	: Glenn Davies		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER GROUNDWATERS		
No. of samples received	: 6		
No. of samples analysed	: 6		

ilac-MRA NATA

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. 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.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 analysis due to sample matrix.
- Sampling and Field Tests supplied by ALS Wollongong.
- Sampling completed as per EN/67.11 Groundwater Sampling.
- Field tests completed on day of sampling/receipt.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	BH1C Point 3	BH3 Point 5	BH4 Point 6	BH15 Point 7	BH13 Point 10
			Client sampling date / time	11-Mar-2020 11:49	11-Mar-2020 11:35	11-Mar-2020 12:52	11-Mar-2020 14:20	11-Mar-2020 13:43
Compound	CAS Number	LOR	Unit	EW2001278-001	EW2001278-002	EW2001278-003	EW2001278-004	EW2001278-005
				Result	Result	Result	Result	Result
EA005FD: Field pH								
pH	----	0.1	pH Unit	7.4	5.6	6.5	6.0	6.8
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	6970	2180	1100	1160	1300
EA116: Temperature								
Temperature	----	0.1	°C	27.2	20.1	21.4	19.4	24.1
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	2360	460	294	639	434
Total Alkalinity as CaCO3	----	1	mg/L	2360	460	294	639	434
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	86	99	586	125
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	934	328	112	3260	48
EG020F: Dissolved Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.107	0.050	0.102	0.754	0.087
Iron	7439-89-6	0.05	mg/L	17.3	<0.05	0.46	25.7	<0.05
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	<0.1	0.2	0.2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	377	32.5	1.77	69.6	0.15
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	0.08	0.05	0.02	0.03	0.06
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.26	5.77	0.64	0.09	16.0
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.34	5.82	0.66	0.12	16.1
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	167	11	13	145	16
QWI-EN 67.11 Sampling of Groundwaters								
Standing Water Level	----	0.01	m AHD	3.26	3.15	4.35	0.75	4.29

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	BH14 Point 11	----	----	----	----
				Client sampling date / time	11-Mar-2020 13:05	----	----	----	----
Compound	CAS Number	LOR	Unit		EW2001278-006	--------	--------	--------	--------
					Result	----	----	----	----
EA005FD: Field pH									
pH	----	0.1	pH Unit		5.8	----	----	----	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		2460	----	----	----	----
EA116: Temperature									
Temperature	----	0.1	°C		25.1	----	----	----	----
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		125	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		125	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		136	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		115	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		0.310	----	----	----	----
Iron	7439-89-6	0.05	mg/L		0.06	----	----	----	----
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		0.04	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		0.30	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		202	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		202	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		49	----	----	----	----
QWI-EN 67.11 Sampling of Groundwaters									
Standing Water Level	----	0.01	m AHD		4.74	----	----	----	----

4483883

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 Desma 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: 2-4 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ La... Ph: (

Environmental Division
Wollongong
Work Order Reference
EW2001327

Telephone : 02 42253125

CLIENT:	Shellharbour City Council	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	41 Burelli St WOLLONGONG NSW 2500		
PROJECT:	Dunmore Quarterly Ground Waters	ALS QUOTE NO.:	WO/030/19 TENDER
ORDER NUMBER:			
PROJECT MANAGER:	Joel Culton		
SAMPLER:		SAMPLER MOBILE:	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to :			
Email Invoice to :			

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RE
Amelia	Arrian	
DATE/TIME: 11/3/20	DATE/TIME: 11/3/20	D/

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

No	N/A
No	N/A
C	

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	Ammonia	NT-2A (Alka, So4, Cl, Fl) Filtered Ca, K	TOC	Dissolved Fe & Mn	NT-4 (NO2, NO3)				Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	BHA	11.3.20 15:40	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH2	12:32	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH9	11:56	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH10	11.21	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH12R	13:50	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
*	BH16	13/3 13:00	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH17R	15:36	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
*	BH18R	13/3 13:30	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH19R	12:41	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH20	15:15	W			✓	✓	✓	✓	✓				Field Tests - pH, EC, Temp & SWL
	BH20s	12:33	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.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW2001327-AA**	Page	: 1 of 3
Amendment	: **1**		
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 4/13 Geary Pl, North Nowra 2541 Australia NSW Australia
Telephone	: ----	Telephone	: +61 2 4225 3125
Project	: Dunmore Quarterly Groundwaters	Date Samples Received	: 11-Mar-2020 16:00
Order number	: 126450	Date Analysis Commenced	: 11-Mar-2020
C-O-C number	: ----	Issue Date	: 09-Apr-2020 09:44
Sampler	: Glenn Davies		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER GROUNDWATERS		
No. of samples received	: 3		
No. of samples analysed	: 3		

ilac-MRA NATA

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. 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.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, 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.**
- Sampling and Field Tests supplied by ALS Wollongong.
- Sampling completed as per EN/67.11 Groundwater Sampling.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	BH9	BH12R	BH19R	----	----
			Client sampling date / time	11-Mar-2020 11:56	11-Mar-2020 13:58	11-Mar-2020 12:41	----	----
Compound	CAS Number	LOR	Unit	EW2001327-003	EW2001327-005	EW2001327-009	--------	--------
				Result	Result	Result	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	6.7	6.6	6.3	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	5140	2470	2210	----	----
EA116: Temperature								
Temperature	----	0.1	°C	21.9	24.9	22.2	----	----
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	1970	597	517	----	----
Total Alkalinity as CaCO3	----	1	mg/L	1970	597	517	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	223	230	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	560	226	315	----	----
EG020F: Dissolved Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.835	0.753	0.110	----	----
Iron	7439-89-6	0.05	mg/L	1.91	<0.05	0.63	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.1	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	137	0.10	5.46	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	0.17	0.30	0.16	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.06	33.7	0.41	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.23	34.0	0.57	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	80	10	26	----	----
QWI-EN 67.11 Sampling of Groundwaters								
Standing Water Level	----	0.01	m AHD	3.30	4.37	4.50	----	----

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 Desma 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 0890 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 6331 2158 E: launceston@alsenviro.com

CLIENT:	Shellharbour City Council
OFFICE:	Dunmore
PROJECT:	Dunmore Dust
ORDER NUMBER:	
PROJECT MANAGER:	Joel Culton
SAMPLER:	SAMPLER MOBILE:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to :	
Email Invoice to :	

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: WO/030/19 TENDER

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Glenn	[signature]		
DATE/TIME: 10/3/20	DATE/TIME: 11/3/20 16:45	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	10·3·20 11:00	AIR			✓								
	DDG2	11:10	AIR			✓								
	DDG3	10:54	AIR			✓								
	DDG4	11:30	AIR			✓								
				TOTAL	10									

Environmental Division
Wollongong
Work Order Reference
EW2001273

Telephone : 02 42253125

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 G
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW2001273**	Page	: 1 of 2
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 4/13 Geary Pl, North Nowra 2541 Australia NSW Australia
Telephone	: ----	Telephone	: +61 2 4225 3125
Project	: Dunmore Landfill Dust	Date Samples Received	: 09-Mar-2020 16:18
Order number	: 126450	Date Analysis Commenced	: 13-Mar-2020
C-O-C number	: ----	Issue Date	: 18-Mar-2020 16:31
Sampler	: ----		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER DUST		
No. of samples received	: 4		
No. of samples analysed	: 4		

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. 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.

Signatories	*Position*	*Accreditation Category*
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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.**
- 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.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)				Client sample ID	**DDG1 11/02/2020 - 10/03/2020**	**DDG2 11/02/2020 - 10/03/2020**	**DDG3 11/02/2020 - 10/03/2020**	**DDG4 11/02/2020 - 10/03/2020**	**----**
				Client sampling date / time	10-Mar-2020 11:00	10-Mar-2020 11:10	10-Mar-2020 10:54	10-Mar-2020 11:30	----
Compound	*CAS Number*	*LOR*	*Unit*		**EW2001273-001**	**EW2001273-002**	**EW2001273-003**	**EW2001273-004**	**--------**
					Result	Result	Result	Result	----
EA120: Ash Content									
Ash Content	----	0.1	g/m².month		**0.7**	**0.4**	**0.6**	**1.3**	**----**
Ash Content (mg)	----	1	mg		**12**	**7**	**10**	**21**	**----**
EA125: Combustible Matter									
Combustible Matter	----	0.1	g/m².month		**0.5**	**0.3**	**1.2**	**0.6**	**----**
Combustible Matter (mg)	----	1	mg		**8**	**5**	**20**	**10**	**----**
EA141: Total Insoluble Matter									
Total Insoluble Matter	----	0.1	g/m².month		**1.2**	**0.7**	**1.8**	**1.9**	**----**
Total Insoluble Matter (mg)	----	1	mg		**20**	**12**	**30**	**31**	**----**

Appendix D

Surface Gas (Methane) Field Sheets

ALS Landfill Emissions Report

Client: Shellharbour City Council
Site: Dunmore
Date: 10/03/2020
Sampler(s) Glenn Davies, Aneta Prosaroski

Transact / Location	Point	GPS North	GPS East	CH4 Conc (ppm)	Comments
A	1	6168 326	302 461	2.4	
A	2	6168 309	302 457	3.0	
A	3	6168 3291	302 455	2.5	
A	4	6168 268	302 445	2.4	
A	5	6168 250	302 453	3.5	
A	6	6168 232	302 448	3.9	
A	7	6168 217	302 441	2.9	
A	8	6168 196	302 434	2.5	
B	1	6168 328	302 455	2.5	
B	2	6168 311	302 465	2.3	
B	3	6168 289	302 438	2.2	
B	4	6168 272	302 439	2.3	
B	5	6168 259	302 439	2.4	
B	6	6168 249	302 439	2.6	
B	7	6168 234	302 438	3.7	
B	8	6168 222	302 435	6.0	
B	9	6168 206	302 433	2.6	
B	10	6168 195	302 432	2.6	
C	1	6168 25	302 392	2.7	
C	2	6168 52	302 399	3.0	
C	3	6168 94	302 404	2.5	
C	4	6168 124	302 409	2.4	
C	5	6168 176	302 415	2.3	
C	6	6168 209	302 417	2.1	
C	7	6168 257	302 413	2.1	
C	8	6168 302	302 406	2.1	
C	9	6168 355	302 391	2.2	
C	10	6168 408	302 376	2.2	
C	11	6168 422	302 371	2.3	
C	12	6168 440	302 367	2.3	
C	13	6168 469	302 371	2.4	
D	1	6168 232	302 389	2.4	
D	2	6168 217	302 385	2.5	
D	3	6168 195	302 384	2.5	
D	4	6168 163	302 392	2.8	
D	5	6168 128	302 395	2.5	
D	6	6168 110	302 391	2.4	
D	7	6168 100	302 392	2.4	
D	8	6168 086	302 391	2.3	
D	9	6168 063	302 384	2.2	
E	1	6168 066	302 380	2.0	
E	2	6168 076	302 379	2.1	
E	3	6168 083	302 380	2.2	
E	4	6168 092	302 379	2.4	
E	5	6168 102	302 377	2.4	
E	6	6168 125	302 368	2.2	
E	7	6168 144	302 355	2.6	
E	8	6168 177	302 339	2.6	
E	9	6168 200	302 335	3.8	
E	10	6168 225	302 331	2.6	
F	1	6168 098	302 361	1.7	
F	2	6168 117	302 357	1.4	
F	3	6168 149	302 343	1.5	
F	4	6168 177	302 327	1.4	
F	5	6168 200	302 317	1.5	
F	6	6168 218	302 314	1.2	
G	2	6168 459	302 352	2.1	
G	3	6168 438	302 320	2.2	
G	4	6168 415	302 285	2.2	
G	5	6168 406	302 252	2.3	

H	1	6168 162	302 408	2.2	
H	2	6168 109	302 355	2.3	
H	3	6168 056	302 320	2.4	
H	4	6168 019	302 289	2.5	
H	5	6168 430	302 257	2.6	
H	6	6168 398	302 225	2.7	
H	7	6168 344	302 173	2.6	
H	8	6168 310	302 140	2.5	
H	9	6168 274	302 106	2.4	
H	10	6168 231	302 078	2.5	
H	11	6168 162	302 72	2.8	
H	12	6168 109	302 70	2.9	
H	13	6168 056	302 82	2.4	
H	14	6168 019	302 119	9.0	
H	15	6167 989	302 151	12.0	
H	16	6167 954	302 181	8.0	
H	17	6167 925	302 209	3.0	
H	18	6167 901	302 233	2.6	
H	19	6167 875	302 272	2.4	
H	20	6167 872	302 318	2.5	
H	21	6167 877	302 367	2.7	
H	22	6167 886	302 412	3.6	
H	23	6167 899	302 464	5.6	
H	24	6168 482	302 521	2.2	
H	25	6168 415	302 555	2.2	
H	26	6168 331	302 547	2.2	
H	27	6168 292	302 541	2.2	New Weighbridge
H	28	6168 250	302 490	2.2	
H	29	6168 220	302 561	2.2	
H	30	6168 200	302 576	2.2	
H	31	6168 168	302 596	2.2	
H	32	6168 142	302 614	2.2	
H	33	6168 110	302 635	2.2	
H	34	6168 090	302 642	2.3	Organic Garden Waste
H	35	6168 071	302 601	2.0	
H	36	6168 088	302 581	2.0	
H	37	6168 114	302 565	2.0	
H	38	6168 150	302 542	2.1	
I	1	6168 125	302 101	3.6	
I	2	6168 130	302 143	3.5	
I	3	6168 130	302 194	3.9	
I	4	6168 127	302 253	3.1	
J	1	6168 146	302 267	2.8	
J	2	6168 189	302 255	2.4	
J	3	6168 239	302 237	2.6	
J	4	6168 292	302 218	2.4	
J	5	6168 284	302 199	2.5	
K	1	6168 516	302 362	2.2	
K	2	6168 529	302 390	2.2	
K	3	6168 541	302 424	2.3	
K	4	6168 554	302 464	2.3	
K	5	6168 588	302 446	2.3	
L	1	6168 587	302 410	2.3	
L	2	6168 572	302 375	2.3	
L	3	6168 563	302 427	2.2	
L	4	6168 551	302 390	2.3	
L	5	6168 545	302 376	2.3	
L	6	6168 532	302 349	2.2	
Compressor Shed	1	6167 950	302 185	3.7	
Site Offices	1	6168 197	302 557	2.2	
Revolve Centre	1	6168 474	302472	2.2	
Truckwash Building	1			2.3	
Landfill Weighbridge (Tip Face)	1	6168 488	302 421	2.6	
Landfill Weighbridge (Tip Face) - Toilet	1			26.7	
Methane Blank (Pre testing)				2.0	Taken at entrance to Dunmore site before main gate
Methane Blank (Post testing)				1.9	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

Calibration Certificates

CERTIFICATION OF CALIBRATION

Issued by: QED Environmental Systems Ltd.

Calibration certificate number 19250 H-01371

Instrument Laser One Serial number 19250

Description of the calibration procedure:

The calibration is verified with certified gas bottle. The maximum error of the instrument as specified in the datasheet.

Gas verification from 0-1000ppm CH4

Full scale (ppm)	Gas concentration (ppm)	Response 1 (ppm)	Response 2 (ppm)	Response 3 (ppm)	Average response (ppm)	Maximum error (ppm)	Maximum error (% F.s.)	Maximum error %
1000	0	0	0	0	0.00	0.00	0.00	0.00
1000	3.2	3.1	3	3.1	3.07	0.20	0.02	0.02
1000	10.3	10	10	10	10.00	0.30	0.03	0.03
1000	107	100	100	100	100.00	7.00	0.70	0.70
1000	1000	1000	1000	1000	1000.00	0.00	0.00	0.00

Uncertainty	0.70		%
Max % error	0.70		% FS

Gas verification from 0-100% vol CH4

Full scale (%vol)	Gas concentration (%vol)	Response 1 (%vol)	Response 2 (%vol)	Response 3 (%vol)	Average response (%vol)	Maximum error (%vol)	Maximum error (% F.s.)	Maximum error %
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	1.00	1.00	1.00	1.00	1.00	1.00	10.00	10.00

Uncertainty	10.00		%
Max % error	10.00		% FS

CERTIFICATION OF CALIBRATION

Issued by: QED Environmental Systems Ltd.

Environmental conditions during calibration

Temperature	21.4	C
Pressure	1004	mBar

Gas bottles used for calibration

Gas	Cylinder number	Expiry date	Gas
Synthetic Air	S1624403EE	19/05/2023	Synthetic Air
3 ppm	143123SG	11/04/2024	CH4
10 ppm	114031SG	11/04/2024	CH4
100 ppm	S1100861	10/04/2024	CH4
1000 ppm	S1100299S	10/04/2024	CH4
1.0 vol	S1198415S	10/04/2024	CH4

Calibration results Pass

Next scheduled calibration 25/11/2020

Calibration date 25/11/2019

Calibration done by Laura McBride