



HYDROGEOLOGICAL ASSESSMENT (HA) – LEACHATE DAM

**WEST NOWRA RECYCLING & WASTE FACILITY
FLATROCK ROAD
MUNDAMIA, NSW, 2540**

Environment Protection Licence (EPL) 5877

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EXECUTIVE SUMMARY

Environment & Natural Resource Solutions (ENRS Pty Ltd) were commissioned as independent hydrogeological consultants by Shoalhaven City Council (SCC) to conduct a Hydrogeological Assessment (HA) for the Leachate Dam at the West Nowra Recycling and Waste Facility (*herein referred to as the Site*). ENRS understand this investigation is required in anticipation of the operation of the Leachate Dam for storage of landfill generated leachate from the proposed landfill stage 4 extension area, to characterise the surrounding soil and groundwater, and identify any risks to water bodies and other sensitive receptors in the locality.

This HA summarises the results of borehole investigations, groundwater testing and laboratory analysis conducted between October 2017 and March 2018 in general accordance with the NSW EPA (2016) *Environmental Guidelines for Solid Waste Landfills*, and the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*.

The objectives of this HA are to:

- Characterise the soil and groundwater conditions surrounding the Leachate Dam;
- Identify any risks to water bodies and other sensitive receptors in the locality; and
- Assess the suitability of the Leachate Dam for ongoing operation and provide recommendations for additional investigations and management, if required.

The scope of work for this HA comprised the collection, assessment and reporting of Site data in regard to the following tasks:

- Review available Site specific data and document the hydrogeological setting (previous reports, geology maps, groundwater bore records, and Council records). Document nearby receiving waterways and sensitive receptors;
- Conduct six (6) rounds of monthly groundwater sampling in GW6 and GW7, commencing in October 2017;
- Supervise installation of nested piezometers adjacent GW6;
- Conduct one (1) round of groundwater sampling in nested piezometers GW6D and GW6S in March 2018 in conjunction with sampling in GW6 and GW7;
- Tabulate the monitoring results from GW6, GW6D, GW6S and GW7;
- Tabulate historic monitoring results from monitoring points in proximity to the Leachate Dam to establish background levels for groundwater quality (BH6, BH7, BH11 and BH13);
- Compare groundwater quality against EPA endorsed Trigger Values to identify any elevated levels, trends, or Areas of Environmental Concern (AEC);
- Describe the monitoring results to characterise the soil and groundwater conditions surrounding the Leachate Dam;
- Document the investigation results and provide an assessment of the Leachate Dam integrity with recommendations for additional investigations and Site management.

Based on the data reviewed during this HA, the following conclusions are provided:

- Groundwater monitoring was undertaken in bores GW6, GW6D, GW6S and GW7 positioned immediately up hydrogeological gradient and down hydrogeological gradient of the existing Leachate Dam. The bores GW6 and GW7 were installed by GHD (2017) with nested piezometers GW6D and GW6S installed subsequently by ENRS (2018) to support assessment of stratigraphic groundwater conditions in the area and investigate the integrity of the existing Leachate Dam;
- Six (6) rounds of groundwater monitoring were undertaken in GW6 and GW7 between October 2017 and March 2018. One round of groundwater monitoring was undertaken in GW6D and GW6S in March 2018. Samples were submitted to ALS Environmental, a NATA accredited laboratory, and analysed for the complete suite of analytes required by the Site EPL 5877;
- The monitoring locations and sampling techniques are considered suitable to assess groundwater conditions in vicinity of the existing Leachate Dam. The QA/QC indicators 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 HA. It is therefore concluded that the QA/QC results are adequate, and the quality of the **data is acceptable for use in this assessment**.
- Groundwater quality was noted to be high in TDS in GW6, GW6S and GW7 associated with the Site geology which comprises marine sedimentary rocks and residual clays;
- Results for pH in groundwater at the Site generally reported low to neutral pH levels within the range of historical levels, which is satisfactory. In general the groundwater at the Site is characterised by low pH approaching 4 pH units whilst the Leachate Dam reports more alkaline waters between 7 and 8.5 pH units;
- Concentrations of potential key leachate indicators up hydraulic gradient of the Leachate Dam in GW6 and GW6D, namely Ammonia, were reported above the adopted Trigger Values whilst concentrations down hydraulic gradient of the Leachate Dam in GW7 were below the adopted TVs. However, it is noted that all concentrations were within the range of historical values for monitoring points upgradient of the Leachate Dam; Similarly Total Organic Carbon (TOC) was higher in GW6 with 15-24 mg/L and GW6D with 22 mg/L TOC compared with 2-5 mg/L in GW7;
- Review of available Council records indicates that GW6, GW6D and GW6S are located up gradient of the Leachate Dam in an area which has been disturbed by the former Stage 1 landfilling activities, including unlined excavations and trenches. Hence, the elevated ammonia in GW6 and GW6D is assessed to be unrelated to the Leachate Dam and should be assessed separately under standard site operation requirements;
- It should be noted that GW7 is positioned immediately downgradient of the Leachate Dam and provides the primary sentinel bore for detecting any impacts on groundwater associated with the Leachate Dam. Groundwater quality in GW7 reported concentrations of potential key landfill indicators and CoPC either

below the adopted TVs or within the range of historical levels for downgradient bores at the Site. Hence, the groundwater conditions in GW7, downgradient of the existing Leachate Dam, do not present any indicators of impacts from landfill operations or potential leaks from the existing Leachate Dam;

- Independent assessment of the existing Leachate Dam base clay liner (GHD 2018) reports the coefficient of permeability for the Clay is compliant with the NSW EPA (2016) Solid Waste Landfill guidelines; and
- Based on the data reviewed during this Hydrogeological Assessment, ENRS conclude there is unlikely to be any direct hydraulic connection between the existing Leachate Dam and the surrounding soil and groundwater, or any associated risks posed by the ongoing operation of the Leachate Dam to water bodies and other sensitive receptors in the locality.

Based on the findings obtained during this HA the following recommendations are provided:

- Further investigation into concentrations of potential key leachate indicators reported above the adopted Trigger Values in GW6 and GW6D to characterise the vertical and horizontal extent of these indicators. Such works should form the basis of a separate investigation; and
- Should any change in Site conditions or incident occur which causes a potential environmental impact, ENRS should be notified to further assess the Site and consider requirements for any additional management.

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1.0 INTRODUCTION

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1.1 PROJECT BACKGROUND

1.1.1 Site History

The Site is licenced as a general solid waste (putrescible and non-putrescible) facility. Operations commenced in 1975. The disposal of hazardous and toxic waste, with the exception of asbestos, has been prohibited since 1986. Landfilling of waste is staged as follows:

- Stage 1 - closed and rehabilitated, after commencing in 1975;
- Stage 2 – operational with partial rehabilitation;
- Stage 3 – operational and landfilling, HDPE lined; and
- Stage 4 – future proposed landfilling, subject to regulatory approval.

1.1.2 Legislation and Planning Requirements

Waste regulation in NSW is administered by the EPA under the Protection of the Environment Operations (POEO) Act (1997) and the Waste Avoidance and Resource Recovery Act (2001). The Site is required to operate under the terms and conditions of EPA Environment Protection Licence (EPL) Number 5877. Separate to the requirements of the EPL, general obligations of licensees are set out in the POEO Act. The current EPL (varied 7th December 2017) stipulates the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1 (refer to EPL 5877) at designated monitoring/discharge points or utilisation areas comprising (see **Appendix A**);

- Three (3) Surface Water monitoring points (EPA ID No's 5, 6, & 7);
- Two (2) Overflow Drains (EPA ID No's 2, and 3);
- Leachate monitoring points (EPA ID No's 1, 25, and 27);
- One (1) Irrigation Utilisation Area (EPA ID No. 26); and
- Seventeen (17) Groundwater monitoring points (8, 9, 11, 13, 14, 17, 18, 20, 21, 29 – 36).

1.2 OBJECTIVES

The objectives of this HA are to:

- Characterise the soil and groundwater conditions surrounding the Leachate Dam;
- Identify any risks to water bodies and other sensitive receptors in the locality; and
- Assess the suitability of the Leachate Dam for ongoing operation and provide recommendations for additional investigations and management, if required.

1.3 SCOPE OF WORK

The scope of work for this HA comprised the collection, assessment and reporting of Site data in regard to the following tasks:

- Review available Site specific data and document the hydrogeological setting (previous reports, geology maps, groundwater bore records, and Council records). Document nearby receiving waterways and sensitive receptors;
- Conduct six (6) rounds of monthly groundwater sampling in GW6 and GW7, commencing in October 2017;
- Supervise installation of nested piezometers adjacent GW6;
- Conduct one (1) round of groundwater sampling in nested piezometers GW6D and GW6S in March 2018 in conjunction with sampling in GW6 and GW7,
- Tabulate the monitoring results from GW6, GW6D, GW6S and GW7;
- Tabulate historic monitoring results from monitoring points in proximity to the Leachate Dam to establish background levels for groundwater quality (BH6, BH7, BH11 and BH13);
- Compare groundwater quality against EPA endorsed Trigger Values to identify any elevated levels, trends, or Areas of Environmental Concern (AEC);
- Describe the monitoring results to characterise the soil and groundwater conditions surrounding the Leachate Dam;
- Document the investigation results and provide an assessment of the Leachate Dam integrity with recommendations for additional investigations and Site management.

1.4 PREVIOUS REPORTS

The Site is subject of regular annual environmental reports which collate the results of quarterly, annual and event based monitoring required to comply with conditions of EPL5877. The available monitoring data from these annual reports has been utilised in this HA report to assess background conditions in monitoring Wells in proximity to the Leachate Dam.

The Leachate Dam has also been subject to geotechnical investigations by GHD (2018). The GHD investigations comprised a review of the design and construction of the Leachate Dam supported by test pits, borehole installations (GW6 and GW7) and laboratory permeability testing of the existing clay liner.

The following points summarise the key findings of the GHD investigation:

- A review of SCC Leachate Dam design and construction notes shows a typical section through the dam with a GCL over the floor and walls of the dam and a 300mm thick cover of select material over the GCL. The GCL and select material extend up the inside walls of the dam to RL35.17. The plan is signed off as Work as Executed. The GCL used was equivalent to the Geofabrics product ELCOSEAL X1000 which has a typical hydraulic conductivity of 1×10^{-11} m/sec;
- At the time of the investigation the existing Leachate Dam was approximately half full. Site observations report the dam walls and floor exhibit no evidence of erosion or deformation that would influence the performance of the dam to contain leachate;
- Following dewatering of the dam to lower the water level, three (3) shallow test pits were excavated in the exposed base clay liner material to collect samples (TP01 to TP03) for permeability testing on 18 October 2017;
- Results of the laboratory permeability test results on three (3) clay liner samples report permeability lower than the specified maximum;
- The drilling of boreholes and installation of monitoring bores was carried out on 27 September 2017. Two (2) boreholes, including one upstream (GW6) and one downstream (GW7) of the existing Leachate Dam were drilled to a maximum depth of 9.0m. Groundwater inflow was observed in GW6 at approximately 0.8m below ground surface, and in GW7 at a depth of about 2.5m below ground surface;
- GHD note also, as a further indicator of the integrity of the Leachate Dam liner, that testing of groundwater samples taken from monitoring points downstream of the Leachate Dam have not revealed any evidence of leakage of leachate from the dam;
- The existing Leachate Dam has been constructed to the standard and quality required by the Environmental Guidelines: Solid Waste Landfills, 1996. The WAE drawings for the Leachate Dam, from 1997, demonstrate that the existing Leachate Dam is suitable for purpose and has been licenced to store landfill generated leachate from landfill stages 1, 2 and 3. Sampling and testing of the clay liner as reported above has concluded that the clay base liner is at least 300mm thick and has a coefficient of permeability lower than the limit specified in the Environmental Guidelines: Solid Waste Landfills, 1996; and
- The Environmental Guidelines: Solid Waste Landfills, 1996 requirements refer to new dams and landfill base liners which are not relevant to the scope of this investigation. The proposed storage of landfill generated leachate from stage 4 will be within existing appropriately licenced leachate management infrastructure.

2.0 SITE DESCRIPTION

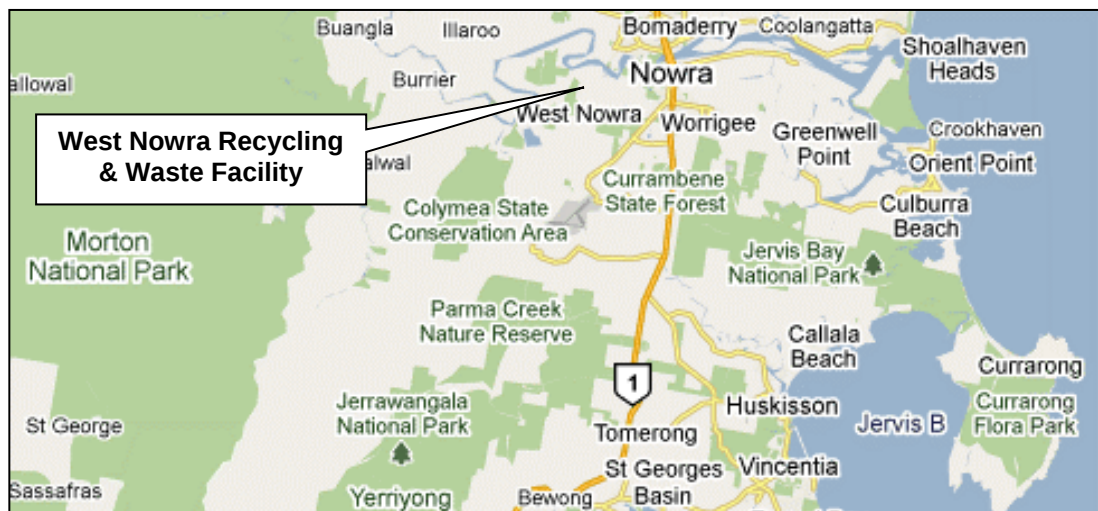
2.1 LOCATION

The Site is located on Flatrock Road, Mundamia, NSW, 2540. The Site is situated approximately five (5) kilometres west-southwest of the Nowra town centre. The area's regional location is defined in **Figure 1**. 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	West Nowra Recycling and Waste Facility
Street Address	Flatrock Road, Mundamia, NSW 2540
Site Area	~50 hectares (Stages 1-3) ~14.5 Hectares (Stage 4)
Title Identifier	Lot 437, DP 808415 – E3 (Environmental Management) Lot 436, DP 808415 – SP2 (Infrastructure) Lot 1, DP 1018193 - SP2 (Infrastructure) Lot 1, DP 847203 – SP2 (Infrastructure) Lot 1, DP 870268 – SP2 (Infrastructure) Lot 1, DP 1104402 – SP2 (Infrastructure)
Zoning	Infrastructure and Environmental Management
Local Gov. Area	Shoalhaven City Council

Figure 1 Site Location Map



2.2 SURROUNDING LANDUSE

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

Table 2: Surrounding Landuse

Direction	Land use
North:	Shoalhaven River ~1.5 Km
East:	Commercial properties (~100 m) and Cabbage Tree Creek (~150 m)
South:	Rural residential / farmland ~200 m
West:	Sandy Creek (150 m) and forested Crown Land

2.3 TOPOGRAPHY AND SURFACE WATER

A review of the current series Nowra (90283S) 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 (see **Figure 3**).

The Site presents relatively low topographic relief between approximately 50 mAHD (south eastern boundary) and 30 mAHD (north western boundary). The Site slopes down to the northwest towards Sandy Creek which flows north into the Shoalhaven River.

2.4 SOIL LANDSCAPE

Previous investigations (E2W 2008) report the soil profile at the Site consists of silty-clay and sandy-clay sediments. Soil depths range from 1.5 m to 3.5 m at Stage 1 and 2, and up to 7 m at Stage 3.

2.5 GEOLOGY

A review of the Site geology was undertaken with reference to the Wollongong 1:250,000 geological series sheet (Si5609). The Site is located near the south eastern boundary of the Sydney Basin in an area underlain by Permian sediments of the Shoalhaven Group and Megalong Conglomerate subgroup, comprising Nowra Sandstone (Psn).

2.6 HYDROGEOLOGY

Groundwater in the area is expected to be associated with two (2) primary forms of aquifer systems;

1. *Shallow unconfined* alluvial and unconsolidated systems, generally less than 20m in depth with low transmissivity, and variable water quality strongly controlled by rainfall recharge; and
2. *Deep fractured rock* and dual porosity aquifers hosted by the Shoalhaven Group sedimentary rock sequence. Typically, deeper than 20 metres at depths significantly greater than the interface with the landfill activities, similarly low transmissivity, high iron and variable salinity.

Fifteen (15) groundwater monitoring bores are installed at the Site to provide specific data on the quality and nature of groundwater. Four (4) additional groundwater

monitoring bores have been installed adjacent (up and down gradient) to the existing Leachate Dam for the purposes of the investigation; three (3) upgradient (GW6, GW6D and GW6S) and one (1) downgradient (GW7). Automated water level loggers were deployed in GW6 and GW7 on 4th December 2017 to record the Standing Water Level (SWL) and programmed to record on a six (6) hourly interval. Water level Hydrographs for the data from these loggers for the period 4/12/17 to 9/01/2018 is provided in **Appendix E**. During this period a slow increase in standing water level (SWL) was observed in GW7, likely associated with:

- Rainfall recharge at commencement of the 4 December 2017 – 9 January 2018 monitoring period; and
- Water level recovery following the December sampling event (4/12/2017).

Minor fluctuations in the SWL was observed in both GW6 and GW7 which do not appear to correlate with rainfall events recorded during the monitoring period. More information regarding the water level in the Leachate Dam and ongoing monitoring of SWLs in GW6 and GW7 is required to draw conclusions regarding the correlation of water levels in the Leachate Dam and SWLs in GW6 and GW7.

Review of GW6 construction identified that the monitoring bore had been screened across the regolith/base of weathering interface and water samples previously collected from the bore were likely a combination of groundwater hosted in the regolith and groundwater hosted in the sedimentary rock. Subsequently, nested piezometers were installed up gradient of the Leachate Dam to further characterise the shallow and deep groundwater intersected in GW6;

- GW6D screened between 5-9 mbgl to target groundwater in the unweathered sandstone; and
- GW6S screened between 0.5-2 m to target groundwater in the regolith.

It is noted that other monitoring bores in the vicinity of the investigation area (BH4a, BH6, BH7, BH11 and BH13) are screened at shallower intervals than GW6, GW6D and GW7. However, for the purpose of this investigation historic data collected from monitoring bores proximal to the Leachate Dam and data pertaining the Leachate Dam has been used for comparison against data collected from GW6, GW6D, GW6S and GW7.

Bores have been grouped as follows to support identification of historical values and background water quality in the area:

- Upgradient of the Leachate Dam (GW6, GW6D, GW6S and BH13); and
- Downgradient of the Leachate Dam (GW7, BH6, BH7 and BH11)

A summary of bore construction details is provided in **Appendix B**.

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. The database search did not identify any registered production bores within one (1) kilometre of the Site area (see **Figure 5**). All bores in proximity to the area are registered for monitoring purposes.

Groundwater beneath the Site is expected to be associated with both shallow unconfined systems, and deeper dual porosity rock aquifers. Shallow groundwater

flow is inferred to mimic topography with low hydraulic gradients flowing west-northwest towards Sandy Creek (see **Figure 2**). The Site, and adjoining land, is largely unsealed with potential for local recharge from rainfall infiltration. Likely discharge areas are identified in **Figure 3**, along Sandy Creek and Cabbage Tree Creek approaching the Shoalhaven River. The nearest sensitive receptors are likely to include:

- Recreational users of the Sandy Creek and Shoalhaven River environs;
- Down gradient stakeholders (primarily rural); and
- Down gradient alluvial aquifers, Sandy Creek, and Groundwater Dependent Ecosystems (GDE) near discharge zones.

2.7 SURFACE WATER

The Site topography generally slopes west from a north-south ridgeline (~51 mAHD) towards Sandy Creek (~30 mAHD) on the western boundary (refer to **Figure 2**). Stormwater is intercepted by a system of cut-off drains which direct water around the Site and into collection dams.

2.8 WATER MANAGEMENT STRUCTURES

A number of existing structures have been constructed on Stages 1, 2 and 3 to manage surface water, leachate and groundwater. These include but are not limited to:

- Sediment dam - stormwater collection;
- First flush dam;
- Stage 1, 2 and 3 - groundwater collection curtain/drain;
- Landfill generated leachate is piped to the Leachate Dam; and
- Landfill cells leachate collection drains.

3.0 WATER QUALITY ASSESSMENT CRITERIA

3.1 CONTAMINANTS OF POTENTIAL CONCERN

Based on the Site history of landfilling and ongoing use as a waste and recycling facility the Contaminants of Potential Concern (CoPC) include but are not limited to those defined in **Table 3**.

Table 3: Contaminants of Potential Concern

Historical Activities	Potential Contaminants	Dispersion Mechanism
General Landfill activities	Heavy Metals	Landfill leachate, spills, leaks, groundwater migration, overflow events.
	Alkanes / Total Recoverable Hydrocarbons (TRH), Benzene Toluene Ethylbenzene, Xylenes (BTEX)	
	Organic acids (pH, Electrical Conductivity [EC]),	
	Ammonia	

Source adapted from: AS4482.1-2005 Table J1 Contaminants listed by Industry Type.

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 2013). The relevant criteria to protect environmental values are:

Table 4: Groundwater Assessment Criteria

Environmental Value	Relevant Guideline
Ecosystems / Health Screening Levels	<u>AWQG (fresh & marine ecosystem guidelines ANZECC 2000); ASC NEPM (2013); and Health Screening Levels for Petroleum Hydrocarbons in Soil & Groundwater (CRC CARE, Sept. 2011)</u>
Drinking Water	<u>ADWG (2017)</u>
Recreational Use	<u>GMRRW (NHMRC 2008)</u>
Agriculture (irrig. & stock)	<u>AWQG (Irrigation & Stock water guidelines)</u>
Effluent Irrigation	<u>Environmental Guidelines (NSW EPA 2004)</u>

3.2.1 ANZECC Guidelines

The relevant criteria for this water quality assessment are the Australian and New Zealand Guidelines for Fresh and Marine Waters (ANZECC Guidelines) Trigger Values (TV) for fresh water. Where the EPL does not dictate limits ENRS has adopted the assessment criteria considered most appropriate for the potential contaminants of concern, based on the receiving freshwater and estuarine environments and the historical level of disturbance at the Site. The adopted assessment criteria Trigger Values are provided in **Table 7** and **Table 8**. The Trigger Values are categorised by the per cent of species possibly affected. The OEH (DECC;2007) endorsed groundwater management guidelines recommend assessment for aquatic ecosystems based on the 95 per cent of species level of protection.

For selected heavy metals, the standard TV may be recalculated based on the impact of water hardness, pH, and alkalinity. These modifications require consideration in fresh waters (up to 2,500 mg/L or 4,000µS/cm salinity) where they may affect the bioavailability of potentially toxic metals. In those cases, a hardness-modified trigger value (HMTV) may be derived to support a site specific assessment. The metal hardness-dependent algorithms (ANZECC 2000) are listed below:

- Cadmium HMTV = $TV (H/30)^{0.89}$
- Chromium(III) HMTV = $TV (H/30)^{0.82}$
- Copper HMTV = $TV (H/30)^{0.85}$
- Lead HMTV = $TV (H/30)^{1.27}$
- Nickel HMTV = $TV (H/30)^{0.85}$
- Zinc HMTV = $TV (H/30)^{0.85}$

Where:

- HMTV, hardness-modified trigger value (µg/L);
- TV, trigger value (µg/L) at a hardness of 30 mg/L as CaCO₃; and
- H, measured hardness (mg/L as CaCO₃) of fresh surface water (<2.5%).

pH modified TV are also available for further assessment of total Ammonia for waters within pH range 6 to 9 (i.e. TV at pH=7 is 2.18 mg/L). pH TV are provided in ANZECC Table 8.3.7 (ANZECC 2000). Where pH is less than 6 a conservative approach should be adopted, TV for pH 6 may be applied.

3.2.2 National Environmental Protection Measure (NEPM)

The EPA has endorsed the use of the Groundwater Investigation Levels (GILs) given in the amended National Environment Protection (Assessment of site Contamination) Measure (NEPM;2013) 'Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater'. The ASC NEPM (2013) provide a framework for risk-based assessment of groundwater contamination with Screening Levels for four (4) 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.

The appropriate HSL's should be selected based on the; landuse; aquifer medium (sand, silt, clay); and depth of watertable.

The ASC NEPM (2013) also provide **Groundwater Investigation Levels (GILs)** which should be applied based on the receiving environment and potential use of groundwater resources. GILs are provided in NEPM Table 1C for; Fresh Waters; Marine Waters; and Drinking Water. In addition to the HILs the amended NEPM (2013) provides the following Site Assessment Criteria (SAC):

- **Management Limits** for petroleum hydrocarbon compounds (Table 1 B(7));
- **Health Screening Levels (HSLs)** potential vapour intrusion (Table 1A[4]) which should be selected based on the; landuse; medium (sand, silt, clay); and depth.;
- **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
 - Commercial and industrial land uses.

4.0 SAMPLING METHODOLOGY

4.1 GROUNDWATER SAMPLING LOCATIONS

Groundwater samples were collected from the following monitoring bores adjacent the existing Leachate Dam;

- GW6 (upgradient - installed by GHD 2017);

- GW6D and GW6S (upgradient installed by ENRS 2018); and
- GW7 (downgradient - installed by GHD 2017).

Monitoring bore locations are illustrated in **Figure 2**. A summary of bore construction details is provided in **Appendix B**.

4.2 SAMPLING FREQUENCY

Sampling of GW6 and GW7 was undertaken during the 1st week of each month during a six (6) month period commencing in October 2017.

Sampling of GW6D and GW6S was undertaken on 12th March 2018 after the construction and development of each bore.

4.3 SAMPLE COLLECTION

Prior to sampling, the depth to the groundwater table was measured and recorded in field sheets. Samples were collected after purging at least three (3) to five (5) Well volumes or field parameters stabilised within 10 per cent of the previous reading.

Groundwater samples for dissolved metal analysis were field filtered, using a disposable 0.45 µm membrane filter, prior to collection in acid preserved containers. Samples were sealed in laboratory-prepared sampling containers appropriate for the analysis and clearly labelled with the sample identification. All samples were stored on ice immediately after their collection and transported to the laboratory under Chain of Custody (COC) documentation. Only dedicated downhole tubing was deployed, or pumping equipment decontaminated between sites to avoid cross contamination.

4.4 FIELD TESTING

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

- Temperature;
- Electrical Conductivity (Salinity - EC);
- pH (Acidity);
- Oxygen Reduction Potential (Redox/ORP/Eh); and
- Dissolved Oxygen (where water quality permitted testing)

Calibration certificates are provided in **Appendix C** with a summary of field testing results presented in .

4.5 LABORATORY ANALYSIS

ALS Environmental (ALS), NATA registered laboratory was contracted to undertake the laboratory analysis in accordance with NATA Approved methods.

5.0 QUALITY ASSURANCE & QUALITY CONTROL DISCUSSION

5.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) are required to;

1. Clarify the study objectives;
2. Define appropriate types of data to collect; and
3. Specify the tolerable levels of potential decision making errors.

The process for establishing DQO's is documented in Australian Standard: AS 4482.1-2005 and referenced by the National Environment Protection (Assessment of the site Contamination) Measure (NEPC;2013). The evaluation criteria (Decision Rules) adopted for the investigation are summarised in **Table 5**.

Table 5 Data Quality Objectives

Step	DQO	Evaluation Criteria / Decision Rules
1	State the problem	This assessment is required to consider the suitability of the Leachate Dam for storage of leachate from Stage 4.
2	Identify the decision	➤ Is the Leachate Dam impacting groundwater in the locality; ➤ Is there a risk from the Leachate Dam to water ways or sensitive receptors? ➤ Is the monitoring regime adequate to obtain the required data to assess the site?
3	Identify inputs to the decision	➤ Monitoring regime documented in the Site EPL; ➤ Historical Site data; ➤ GHD (2018) geotechnical investigation report; ➤ ENRS Site data (field measurements, observations, and laboratory data) gathered during this scope of work; ➤ QAQC results.
4	Define the study boundaries	The immediate ground in the locality of the Leachate Dam and downgradient surface and groundwater.
5	Develop a decision rule	➤ Was the assessment conducted to a standard consistent with generally accepted and current professional consulting practice for such an investigation? ➤ Has the program adequately delineated the location, nature, and degree of any ground contamination at selected sampling locations; ➤ Has the program adequately assessed the risk posed by any contamination to human health and the environment, including potential future users of the site; and surrounds? and ➤ Has the program outlined requirements for any further investigative, monitoring and/or remediation works?
6	Specify limits on decision errors	Precision measured as Relative Per cent Difference is expected to be: ➤ RPD criteria of $\leq 30\%$, for concentrations $\geq 10\times$ LOR; ➤ RPD criteria of $\leq 75\%$, for concentrations between $5-10\times$ LOR; and ➤ RPD criteria of $\leq 100\%$, for concentrations $< 5\times$ LOR.

Step	DQO	Evaluation Criteria / Decision Rules
7	Optimise design for obtaining data	Nested piezometers both up and down gradient of investigation area. Sampling in accordance with SAQP and ENRS SOPs in general accordance with the NSW EPA (2016) <i>Environmental Guidelines for Solid Waste Landfills</i> , and the NSW DEC (2007) <i>Guidelines for the Assessment and Management of Groundwater Contamination</i> .

5.2 FIELD QUALITY ASSURANCE & QUALITY CONTROL

The Quality Assurance and Quality Control (QA/QC) protocols used during the fieldwork are shown in **Table 6**. Refer to **Appendix D** for sample Chain of Custody (COC) documentation and **Appendix C** for equipment calibration certificates.

Table 6: Field QA/QC

Protocol	Description
Sampling Team	Site personnel comprised only experienced and qualified environmental professionals trained in conducting site contamination investigations.
Sample Method	Low flow (peristaltic) pump suitable for CoPC. Samples obtained in laboratory prepared bottles with preservatives appropriate for the required analysis.
Sample Equipment	All sample equipment disposed or decontaminated between sample sites.
Field Screening	Visual and manual inspection of sample materials for potential contamination recorded on field sheets.
Chain of Custody Forms	All samples logged and transferred under appropriately completed Chain of Custody (COC) forms with Sample Receipts issued by the laboratory.
Blind Field Duplicate	In general, one (1) blind field duplicate collected per 20 samples and submitted for analysis accompanied by COC forms. Duplicate samples were not considered necessary due to the limited number of samples obtained.
Rinsate / Trip Blank	In general, one (1) trip blank and/or rinsate per sampling event where equipment is decontaminated and re-used between sampling sites. Note, only the water level interface probe was re-used between sites. Samples were obtained using a surface mounted low flow pump drawing through disposable tubing designated for each sample site. Hence, rinsate samples were not considered necessary for this assessment.

5.3 LABORATORY ANALYTICAL METHODS

Analysis of samples was conducted by ALS. ALS is NATA accredited for the selected analysis. Laboratory QA/QC results are detailed in the Laboratory report contained in the Appendices section of this report.

5.4 QUALITY ASSURANCE & QUALITY CONTROL DISCUSSION

A summary of the Data Quality performance is provided in **Table 7**.

Table 7: Data Quality Objectives and Criteria

DQO	Evaluation Criteria	Status
Documentation completeness	➤ Completion of field records; ➤ chain of custody documentation; ➤ equipment calibration; and NATA laboratory COA.	✓
Data comparability	➤ Use of appropriate techniques for the sampling, storage and transportation of sample media; ➤ Use of NATA certified laboratory using NEPM endorsed procedures; Comparison with previous site information, if any.	✓
Data representativeness	➤ Adequate sampling coverage of Site area, AEC's, down gradient and upgradient boundaries; ➤ Selection of representative samples from each sampling location; Analysis for CoPC.	✓
Precision and accuracy for sampling and analysis	➤ Use only trained and qualified field personnel; ➤ Calibration certificates for field equipment; ➤ Appropriate sampling and field techniques; ➤ Decontamination procedures; ➤ Achieve laboratory QC criteria; and ➤ Achieve QA/QC requirements for RPDs and Recovery	✓

The laboratory was NATA accredited and the Limit of Resolution (LOR) were within the acceptable levels for the investigation criteria. Laboratory certificates of analysis provided in **Appendix D** indicate that for the samples collected during the scope of works, sampling techniques, transport procedures and laboratory analysis were satisfactory. In summary, the QA/QC indicators 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 Water Quality Assessment. It is therefore concluded that the QA/QC results are adequate, and the quality of the **data is acceptable for use in this assessment**.

6.0 GROUNDWATER QUALITY RESULTS

Groundwater samples were collected monthly in GW6 and GW7 between October 2017 and March 2018. Additional groundwater samples were collected in GW6D and GW6S in March 2018. Samples were submitted to a NATA accredited laboratory (ALS) for analysis. No significant rainfall events were recorded immediately prior to sampling. Upon receipt, the NATA accredited laboratory results were tabulated for comparison against relevant guideline thresholds and available historical background levels from EPL monitoring points proximal to the Site, as reported in **Table 18: Summary of Results (Oct 2017-March 2018)**. Certificates of laboratory analysis are provided in **Appendix D**.

6.1 KEY LEACHATE INDICATORS

For the purpose of this investigation key indicator analytes were selected to identify any potential hydrogeological connection between the Leachate Dam and groundwater intercepted in GW6, GW6D, GW6S, and GW7. Groundwater results for Ammonia, pH, TDS, and TOC in these bores have been assessed against historic data from proximal monitoring points and the Leachate Dam.

6.1.1 Ammonia as N

Groundwater samples were analysed for select nutrients including Ammonia, Nitrate, Phosphorus (P) and Phosphate. 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.

6.1.2 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 at the West Nowra Site by Forbes Rigby (1996) report acidic groundwater with a low pH of 4.3 associated with silica saturation and oxidation of accessory marcasite grains (iron sulphide) within weathered sandstone at the Site which belongs to the Shoalhaven Group and Nowra Sandstone formation (marine sediments).

6.1.3 Total Dissolved Solids (TDS)

Salinity is reported as Electrical Conductivity (EC) and Total Dissolved Solids (TDS). The ANZECC guidelines apply a ratio for filterable residue (1 mg/L) = 0.68 EC (µS/cm). In general, fresh water is less than 1,000 mg/L or 1,470 µS/cm.

6.1.4 Total Organic Carbon (TOC)

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.

6.2 LEACHATE DAM RESULTS

The Leachate Dam and subject of this assessment is located on the western side of the Site and has been monitored annually since 2008, as per the requirements of EPL 5877. A summary of annual water quality monitoring data is provided below in **Table 8** with minimum, maximum and average results for key leachate indicators; Ammonia, pH, TDS, and TOC.

Table 8: Summary of Leachate Dam Water Quality (February 2008 – 2017)

Leachate Dam			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	2.61 mg/L (Feb 2010)	43.1 mg/L (Nov 2015)	15.96 mg/L
pH	pH 7.9 (Nov 2015)	pH 8.9 (Feb 2013)	pH 8.48
Total Dissolved Solids	716 mg/L (Feb 2017)	2300 mg/L (Feb 2013)	1671 mg/L
Total Organic Carbon	24 mg/L (Feb 2017)	120 mg/L (May 2009)	43.46 mg/L

6.3 UP-GRADIENT OF THE LEACHATE DAM

6.3.1 BH13

BH13 is positioned upgradient and approximately 45 metres due east of the Leachate Dam, and has been monitored quarterly since 2007 in accordance with EPL 5877. A summary of quarterly monitoring data is provided below in **Table 9**.

The results reports a range in key leachate indicators generally outside the range of values identified in the Leachate Dam, which shows BH13 is unlikely to be in direct hydraulic connection with the Leachate Dam, which is satisfactory.

Table 9: Summary of BH13 monitoring data (Nov. 2007 – Aug. 2017)

BH13			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	0.03 mg/L (multiple occurrences)	1.61 mg/L (Aug 2010)	0.5 mg/L
pH	pH 3.6 (Aug 2009)	pH 5.3 (Nov 2012)	pH 4.62
Total Dissolved Solids	1420 mg/L (Feb 2014)	3560 mg/L (Feb 2017)	1892.75 mg/L
Total Organic Carbon	0.2 mg/L (Sep 2015)	17 mg/L (Nov 2013)	5.65 mg/L

6.3.2 GW6

GW6 is positioned approximately 5 metres upgradient and east of the Leachate Dam, and has been monitored monthly since October 2017. A summary of monthly monitoring data is provided below in **Table 10**.

The results reports a relatively neutral pH and low to moderate TDS, less than 2000 mg/L, which is satisfactory. However, concentrations of Ammonia and TOC are moderately elevated. Given the bore is located hydraulically up gradient of the Leachate Dam these levels are likely to be associated with background conditions

within an area which has previously been disturbed by landfilling operations. This assessment is further supported by drilling observations (GHD;2018) which noted dry conditions until water inflow was observed at a depth of 8.0 metres. The final depth to water in GW6 ranged between approximately 1-2 metres below ground level which indicates the aquifer in GW6 is semi confined with a pressure head significantly higher than the intersected aquifer depth.

The water quality in GW6 is recommended to be investigated as part of the general site operations and EPL requirements separate to this Leachate Dam assessment.

Table 10: Summary of GW6 monitoring data (Oct. 2017 - March 2018)

GW6			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	35 mg/L (Jan 2018)	71.8 mg/L (Oct 2017)	51.3 mg/L
pH	pH 5.66 (Jan 2018)	pH 6.36 (Oct 2017)	pH 6.00
Total Dissolved Solids	1590 mg/L (Nov 2017)	2120 mg/L (Oct 2017)	1803.33 mg/L
Total Organic Carbon	15 mg/L (Jan 2018)	27 mg/L (Oct 2017)	20.5 mg/L

6.3.3 GW6D

GW6D, is a deep nested piezometer positioned upgradient and approximately 8m due east of the Leachate Dam. The piezometer was installed in March 2018 and has been subject to one (1) round of monitoring, with a summary provided in Table 11. The results show neutral pH, low salinity and moderately low ammonia and TOC.

Table 11: Summary of GW6D monitoring data (March 2018)

GW6D	
Analyte	Value Observed
Ammonia as N	4.48 mg/L
pH	pH 7.07
Total Dissolved Solids	1370 mg/L
Total Organic Carbon	22 mg/L

6.3.4 GW6S

GW6S, positioned approximately 6m due east of the Leachate Dam adjacent GW6D was installed in March 2018 and has been subject to one (1) round of monitoring, with a summary provided below in Table 12. The results show neutral pH, moderately low salinity, ammonia and TOC, which is satisfactory.

Table 12: Summary of GW6S monitoring data (March 2018)

GW6S	
Analyte	Value Observed
Ammonia as N	0.6 mg/L
pH	pH 6.25
Total Dissolved Solids	1650 mg/L

GW6S	
Analyte	Value Observed
Ammonia as N	0.6 mg/L
Total Organic Carbon	8 mg/L

6.4 DOWN-GRADIENT OF THE LEACHATE DAM

6.4.1 BH6

BH6, positioned approximately 20m due south west of the Leachate Dam has been monitored quarterly in accordance with EPL 5877 since 2008. The monitoring point had been recorded as being dry at time of inspection during ten (10) rounds of monitoring. A summary of quarterly monitoring data is provided below in Table 13.

The results report levels of key leachate indicators outside the range of Leachate Dam values, which is satisfactory.

Table 13: Summary of BH6 monitoring data: May 2008 - August 2017

BH6			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	0.02 mg/L (multiple occurrences)	4 mg/L (Aug 2008)	0.28 mg/L
pH	pH 2.2 (May 2015)	pH 5.3 (Feb 2013)	pH 4.8
Total Dissolved Solids	818 mg/L (Nov 2011)	1810 mg/L (Nov 2014)	1334.93 mg/L
Total Organic Carbon	<1mg/L (Nov 2011)	177 mg/L (Feb 2013)	13.05 mg/L

6.4.2 BH7

BH7, positioned approximately 17m due south west of the Leachate Dam has been monitored quarterly in accordance with EPL 5877 since 2007. A summary of quarterly monitoring data is provided below in Table 14. The results show neutral pH, moderately low salinity, ammonia and TOC, which is satisfactory.

Table 14: Summary of BH7 monitoring data: Nov 2007 - August 2017

BH7			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	<0.01 mg/L (multiple occurrences)	0.31 mg/L (Feb 2013)	0.09 mg/L
pH	pH 2.4 (May 2015)	pH 6.5 (Feb 2013)	pH 5.06
Total Dissolved Solids	116 mg/L (May 2010)	2070 mg/L (Feb 2016)	756.95 mg/L
Total Organic Carbon	<1 mg/L (multiple occurrences)	56 mg/L (Feb 2013)	7.88 mg/L

6.4.3 BH11

BH11, positioned approximately 55m due west of the Leachate Dam has been monitored quarterly in accordance with EPL 5877 since 2007. The monitoring point had been recorded as being dry at time of inspection during thirty-one (31) rounds of

monitoring. A summary of quarterly monitoring data is provided below in Table 15. The results show a low pH associated with background conditions, and moderately low salinity, ammonia and TOC, which is satisfactory.

Table 15: Summary of BH11 monitoring data: Nov 2007 - August 2017

BH11			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	<0.01 mg/L (multiple occurrences)	0.43 mg/L (Feb 2008)	0.21 mg/L
pH	pH 3.5 (Aug 2010)	pH 4.7 (Sep 2015)	pH 4.12
Total Dissolved Solids	204 mg/L (Feb 2012)	2390 mg/L (Feb 2013)	1462.67 mg/L
Total Organic Carbon	0.6 mg/L (Sep 2015)	34 mg/L (Feb 2008)	12.29 mg/L

6.4.4 GW7

GW7, positioned approximately 3m due west of the Leachate Dam has been monitored monthly since October 2017. A summary of monthly monitoring data is provided below in Table 16. The results show relatively neutral pH, moderately low salinity, ammonia and TOC, which is satisfactory.

Table 16: Summary of GW7 monitoring data: October 2017 - March 2018

GW7			
Analyte	Minimum Observed	Maximum Observed	Average
Ammonia as N	0.03 mg/L (Nov 2017)	0.08 mg/L (Dec 2017)	0.048 mg/L
pH	pH 5.55 (Nov 2017)	pH 6.41 (Oct 2017)	pH 5.90
Total Dissolved Solids	1450 mg/L (Feb 2018)	1770 mg/L (Oct 2017)	1650 mg/L
Total Organic Carbon	2 mg/L (multiple occurrences)	5 mg/L (Nov 2017)	3.33 mg/L

6.5 MAJOR ION CHEMISTRY

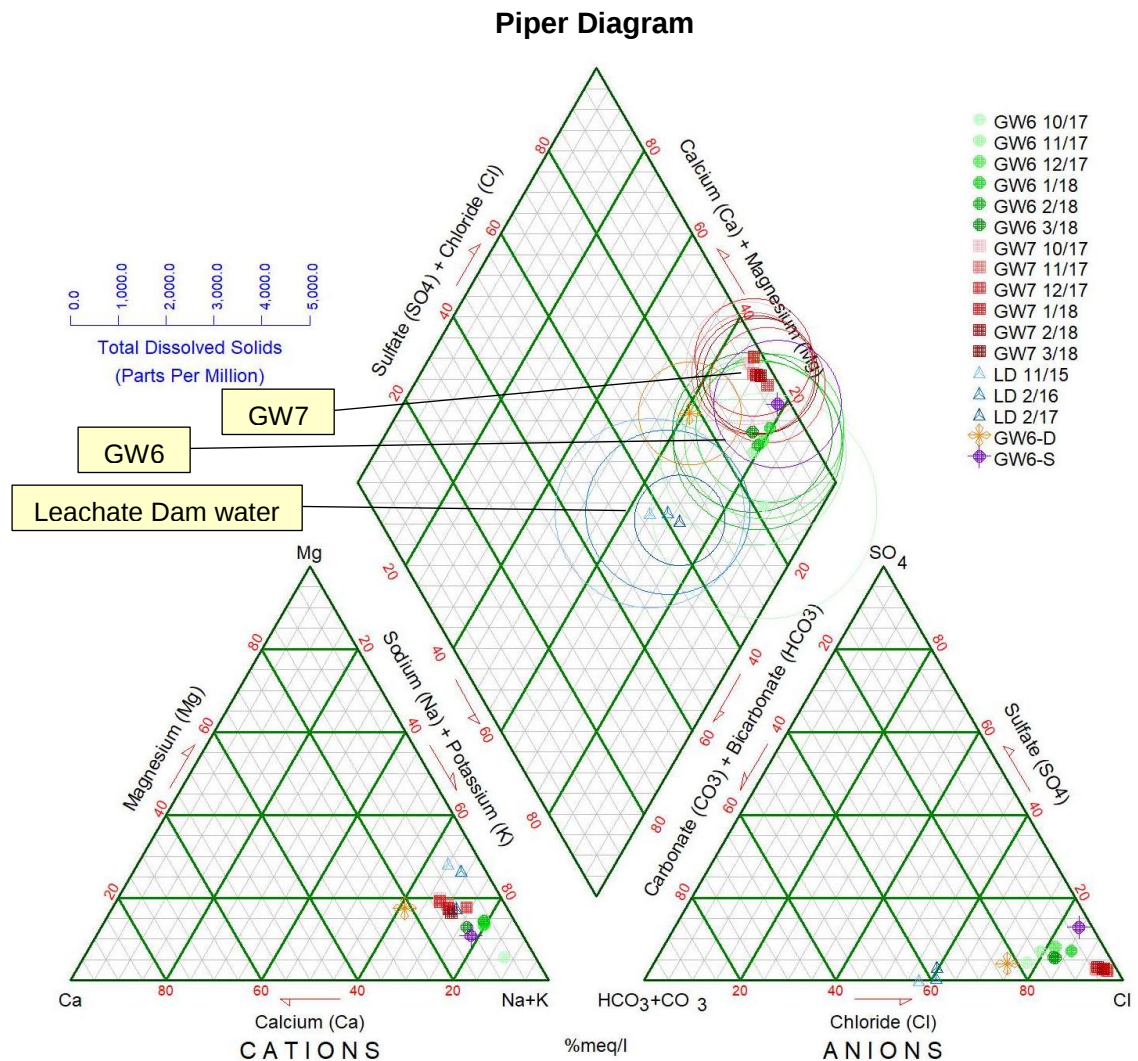
The following Piper diagram demonstrates the variation in water composition sampled in the Leachate Dam and monitoring bores GW6 (upgradient) and GW7 (down gradient).

6.5.1 Piper Diagram

The Piper diagram illustrates the relative concentrations of cations (lower left of diagram) and anions (lower right of diagram) in each sample. The cations are grouped into three (3) major divisions; Sodium (Na+) plus Potassium (K+); Calcium (Ca++); and Magnesium (Mg++). Whilst the Anions are similarly grouped into three major categories; Bicarbonate (HCO₃⁻) plus Carbonate (CO₃⁻⁻); Sulfate (SO₄⁻⁻); and Chloride (Cl⁻).

Review of the piper diagram, indicates that GW7 (red) and the Leachate Dam (blue) have three (3) distinctly different cation/anion compositions, as depicted by their position on the chart. GW6 (green), shows a spread of compositions in over the

monitoring period. It is observed that GW6D (orange) and GW6S (purple) are positioned at each end of the GW6 spread.



7.0 ENVIRONMENTAL ASSESSMENT

7.1 MONITORING POINT SUMMARY

Laboratory water quality results from the leachate investigation monitoring period report concentrations of analytes generally within the adopted guideline trigger values or the range of historic values in monitoring bores in proximity to the leachate dam. A summary of the key water quality results, trends and recommendations for monitoring points is provided in **Table 17**.

Table 17: Summary of Monitoring Period Results

Monitoring Point	Analyte		Comment
	Result	Guideline	
Leachate Dam			
Leachate Dam	2.61-43.1 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document leachate stored in the Dam is characterised by: - Variable levels of ammonia up to 43.1 mg/L - slightly alkaline pH between 7.9-8.9 - Variable TDS generally less than 2300 mg/L - Variable TOC up to 120 mg/L The piper diagram presented in section 6.5.1 demonstrates a unique composition different to groundwater in GW6 and GW7.
	pH 7.9-8.9	pH 8-6.5 (ANZECC 2000 95%)	
	716-2300 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	24-120 mg/L TOC	-	
Up-gradient of the Leachate Dam			
BH13	0.03-1.61 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Low pH and ammonia indicate HH13 is unlikely to be in direct hydraulic connection with the Leachate Dam.
	pH 3.6-5.3	pH 8-6.5 (ANZECC 2000 95%)	
	1420-3560 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	0.2-17 mg/L TOC	-	
GW6	35 -71.8 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document waters sampled are characterised by elevated ammonia, pH values lower than pH 7.9, variable TDS greater than 1590 mg/L and TOC values below 27mg/L. TDS values exceeding 1500 mg/L are of common occurrence in natural groundwater and has previously been assessed to be associated with the site geology which comprises marine sedimentary rocks and residual clays. Due to the construction of the monitoring bore is likely that waters sampled are a combination of water hosted in the regolith and water hosted in the underlying sandstone. The piper diagram presented in section 6.5.1 demonstrates a range of variability exists within cation/anion composition.
	pH 5.66-6.36	pH 8-6.5 (ANZECC 2000 95%)	
	1590-2120 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	15-27mg/L TOC	-	
GW6D	4.48 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Only one round of sampling was conducted at GW6D. Results show ammonia is present in concentrations exceeding the adopted TV. pH and TDS values are within the range of those expected to occur naturally. TOC is present at detectable concentrations. The bore is located upgradient of the Dam and should be investigated further as part of the general Site operations and EPL requirements.
	pH 7.07	pH 8-6.5 (ANZECC 2000 95%)	
	1370 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	22 mg/L TOC	-	
GW6S	0.6 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Only one round of sampling was conducted at GW6S. Results show ammonia is present in concentrations below the adopted TV.
	pH 6.25	pH 8-6.5 (ANZECC 2000 95%)	

Monitoring Point	Analyte		Comment
	Result	Guideline	
	1650 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	pH values are within the range of those expected to occur naturally. TDS values exceeding 1500 mg/L are of common occurrence in natural groundwater and has previously been assessed to be associated with the site geology which comprises marine sedimentary rocks and residual clays. TOC is present at detectable concentrations. Further monitoring is recommended in association with Site operations separate to this Leachate Dam assessment.
	8 mg/L TOC	-	
Down-gradient of the Leachate Dam			
BH6	0.02-4 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document that waters sampled from BH6 are characterised by ammonia concentrations below 4 mg/L, variable pH, TDS and TOC
	pH 2.2-5.3	pH 8-6.5 (ANZECC 2000 95%)	
	818-1810 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	<1-177 mg/L TOC	-	
BH7	<0.01-0.31mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document that waters sampled from BH7 are characterised by ammonia concentrations below 0.31 mg/L, variable pH, TDS and TOC which indicates the groundwater downgradient of the Leachate Dam is not impacted by leachate and is not in direct hydraulic connection with the Leachate Dam.
	pH 2.4-6.5	pH 8-6.5 (ANZECC 2000 95%)	
	116-2070 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	<1-56 mg/L TOC	-	
BH11	<0.01-0.43 mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document that waters sampled from BH11 are characterised by ammonia concentrations below 0.43 mg/L, variable pH, TDS and TOC.
	pH 3.5-4.7	pH 8-6.5 (ANZECC 2000 95%)	
	204-2390 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	0.6-34 mg/L TOC	-	
GW7	<0.03-0.08mg/L Ammonia as N	2.57 mg/L – pH 6 (ANZECC 2000 95%)	Results document ammonia less than 0.08 mg/L, pH values lower than pH 6.41, variable TDS in exceedance of 1450 mg/L and TOC values below 5 mg/L. TDS values exceeding 1500 mg/L are of common occurrence in natural groundwater and has previously been assessed to be associated with the site geology which comprises marine sedimentary rocks and residual clays. The piper diagram presented in section 6.5.1 demonstrates a distinct cation/anion composition different to the Leachate Dam and GW6.
	pH 5.55-6.41	pH 8-6.5 (ANZECC 2000 95%)	
	1450-1770 mg/L TDS	1500 mg/L (ANZECC 2000 95%)	
	2-5 mg/L TOC	-	

7.2 HISTORICAL DATA ASSESSMENT

This report summarises the results of six (6) rounds of groundwater sampling in monitoring bores GW6 and GW7, and one (1) round of sampling in monitoring bores GW6D and GW6S, which were installed adjacent the Leachate Dam, supported by historical data from at least the previous ten (10) years of annual and quarterly EPL monitoring at points adjacent to the Leachate Dam. In general, concentrations of key landfill leachate indicators, including Ammonia, pH and Organic Carbon were within the historical range reported for the Site.

During this assessment ENRS undertook a desktop review of existing Shoalhaven City Council (SCC;2008) Landfill Management Plans. It is noted that historic landfill practises previously employed during the “old” Stage 1 landfill involved the excavation and filling of a series of unlined trenches. From review of historic Stage 1 plans it has been noted that the outer extent of the historic Stage 1 area is proximal to the location of the existing Leachate Dam and GW6, GW6D and GW6S immediately upgradient. The available Site data indicates that GW6, GW6D and GW6S are likely constructed in an area of historically disturbed ground from former landfilling operations.

7.3 EXISTING LEACHATE DAM CLAY LINER INTEGRITY

GHD (2017) performed NATA accredited laboratory constant head permeability tests on the existing Leachate Dam’s base clay liner. Samples were collected from three (3) test pits (TP01-TP03). The test results report a coefficient of permeability (COP) range of $1 \times 10^{-10} \text{m/s}$ to $4 \times 10^{-10} \text{m/s}$ across the three (3) samples submitted for analysis. The maximum depth of investigation for the base clay liner was 300 mm.

Section 2.1 of NSW EPA (2016) Environmental Guidelines – Solid Waste Landfills stipulates that ‘the dam liner must be designed and constructed to a standard similar to that of the landfill cell liner (section 1.1)’. Section 1.1 stipulates that a compacted clay liner of 1,000mm minimum thickness and a hydraulic conductivity (also referred to as COP) of less than $1 \times 10^{-9} \text{m/s}$ be emplaced for a leachate retention system. The results of laboratory analysis, for COP, reported by GHD document that the samples collected from the base clay liner exceed this requirement.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

Based on the data reviewed during this HA, the following conclusions are provided:

- Groundwater monitoring was undertaken in bores GW6, GW6D, GW6S and GW7 positioned immediately up hydrogeological gradient and down hydrogeological gradient of the existing Leachate Dam. The bores GW6 and GW7 were installed by GHD (2017) with nested piezometers GW6D and GW6S installed subsequently by ENRS (2018) to support assessment of stratigraphic groundwater conditions in the area and investigate the integrity of the existing Leachate Dam;

- Six (6) rounds of groundwater monitoring were undertaken in GW6 and GW7 between October 2017 and March 2018. One round of groundwater monitoring was undertaken in GW6D and GW6S in March 2018. Samples were submitted to ALS Environmental, a NATA accredited laboratory, and analysed for the complete suite of analytes required by the Site EPL 5877;
- The monitoring locations and sampling techniques are considered suitable to assess groundwater conditions in vicinity of the existing Leachate Dam. The QA/QC indicators 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 HA. It is therefore concluded that the QA/QC results are adequate, and the quality of the **data is acceptable for use in this assessment**.
- Groundwater quality was noted to be high in TDS in GW6, GW6S and GW7 associated with the Site geology which comprises marine sedimentary rocks and residual clays;
- Results for pH in groundwater at the Site generally reported low to neutral pH levels within the range of historical levels, which is satisfactory. In general the groundwater at the Site is characterised by low pH approaching 4 pH units whilst the Leachate Dam reports more alkaline waters between 7 and 8.5 pH units;
- Concentrations of potential key leachate indicators up hydraulic gradient of the Leachate Dam in GW6 and GW6D, namely Ammonia, were reported above the adopted Trigger Values whilst concentrations down hydraulic gradient of the Leachate Dam in GW7 were below the adopted TVs. However, it is noted that all concentrations were within the range of historical values for monitoring points upgradient of the Leachate Dam; Similarly Total Organic Carbon (TOC) was higher in GW6 with 15-24 mg/L and GW6D with 22 mg/L TOC compared with 2-5 mg/L in GW7;
- Review of available Council records indicates that GW6, GW6D and GW6S are located up gradient of the Leachate Dam in an area which has been disturbed by the former Stage 1 landfilling activities, including unlined excavations and trenches. Hence, the elevated ammonia in GW6 and GW6D is assessed to be unrelated to the Leachate Dam and should be assessed separately under standard site operation requirements;
- It should be noted that GW7 is positioned immediately downgradient of the Leachate Dam and provides the primary sentinel bore for detecting any impacts on groundwater associated with the Leachate Dam. Groundwater quality in GW7 reported concentrations of potential key landfill indicators and CoPC either below the adopted TVs or within the range of historical levels for downgradient bores at the Site. Hence, the groundwater conditions in GW7, downgradient of the existing Leachate Dam, do not present any indicators of impacts from landfill operations or potential leaks from the existing Leachate Dam;
- Independent assessment of the existing Leachate Dam base clay liner (GHD 2018) reports the coefficient of permeability for the Clay is compliant with the NSW EPA (2016) Solid Waste Landfill guidelines; and

- Based on the data reviewed during this Hydrogeological Assessment, ENRS conclude there is unlikely to be any direct hydraulic connection between the existing Leachate Dam and the surrounding soil and groundwater, or any associated risks posed by the ongoing operation of the Leachate Dam to water bodies and other sensitive receptors in the locality.

8.2 RECOMMENDATIONS

Based on the findings obtained during this HA the following recommendations are provided:

- Further investigation into concentrations of potential key leachate indicators reported above the adopted Trigger Values in GW6 and GW6D to characterise the vertical and horizontal extent of these indicators. Such works should form the basis of a separate investigation; and
- Should any change in Site conditions or incident occur which causes a potential environmental impact, ENRS should be notified to further assess the Site and consider requirements for any additional management.

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.

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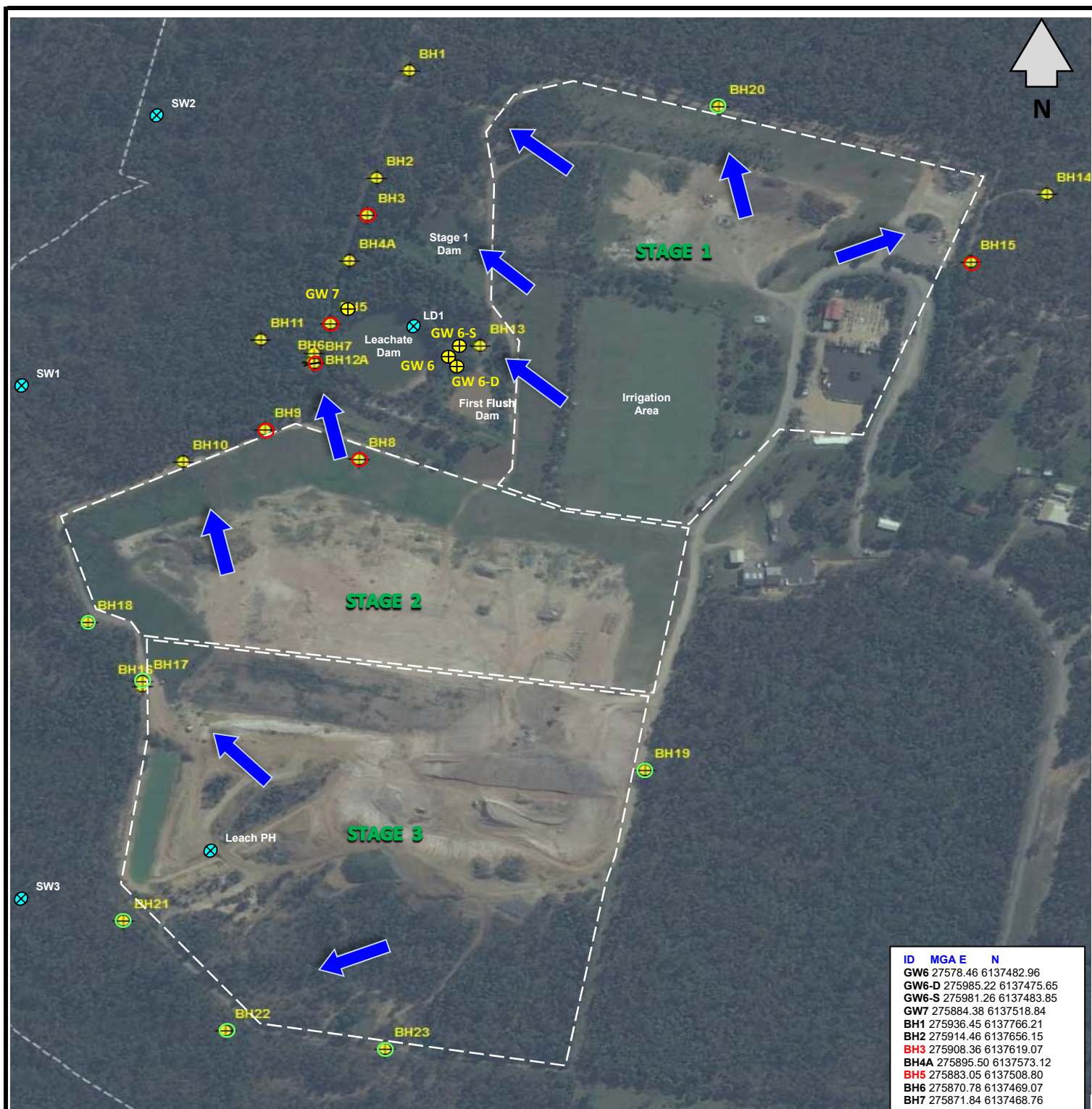
FIGURES

Figure 2 Bore Location Map

Figure 3: Site Plan

Figure 4 Topographic Map

Figure 5 Regional Geology



- ⊕ Monitoring Bore Site
- ⊕ Monitoring Bore added to current EPL 29 Sept. 2015
- ⊕ Bore removed from EPL 29 September 2015
- Inferred direction of groundwater flow
- - - Approximate Landfill Stage Area

ID	MGA E	N
GW6	27578.46	6137482.96
GW6-D	275985.22	6137475.65
GW6-S	275981.26	6137483.85
GW7	275884.38	6137518.84
BH1	275936.45	6137766.21
BH2	275914.46	6137656.15
BH3	275908.36	6137619.07
BH4A	275895.50	6137573.12
BH5	275883.05	6137508.80
BH6	275870.78	6137469.07
BH7	275871.84	6137468.76
BH8	275907.62	6137372.04
BH9	275836.04	6137399.29
BH10	275775.24	6137366.10
BH11	275831.25	6137491.27
BH12A	275871.07	6137478.69
BH13	275996.40	6137488.92
BH14	276421.18	6137653.16
BH15	276365.69	6137582.41
BH16	275750.11	6137137.29
BH17	275750.12	6137142.42
BH18	275706.99	6137201.69
BH19	276131.95	6137061.32
BH20	276171.38	6137736.01
BH21	275741.83	6136900.25
BH22	275821.38	6136791.13
BH23	275942.26	6136774.41

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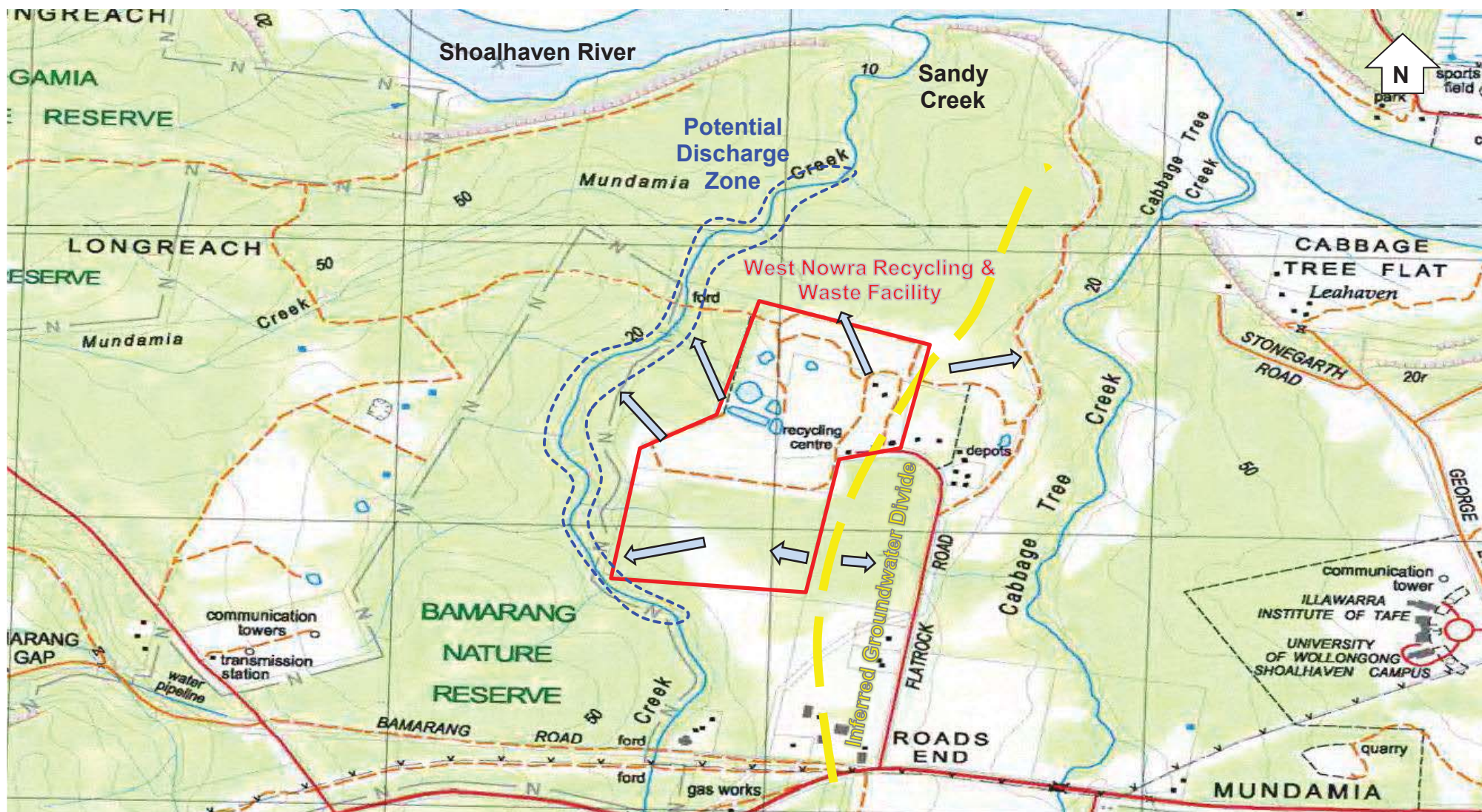
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Client: SCC
Project: ENRS
Location: WN Landfill
Paper: A4

Drawn: RL
Approved: RL
Scale: NA
Source: n.d.

Title: Bore Location Plan
Date: 7/06/2018
Figure: 2
Status: Rev 7



LEGEND

- Site Boundary
- + Surface Water Sampling Location
- x Groundwater Monitoring Bore
- Interpreted Groundwater Gradient

- - - Inferred Groundwater Flow Boundary
- - - Likely Groundwater Discharge Zone

1 Kilometre



Nowra 1:25,000 Topographic Sheet 902835

ENRS

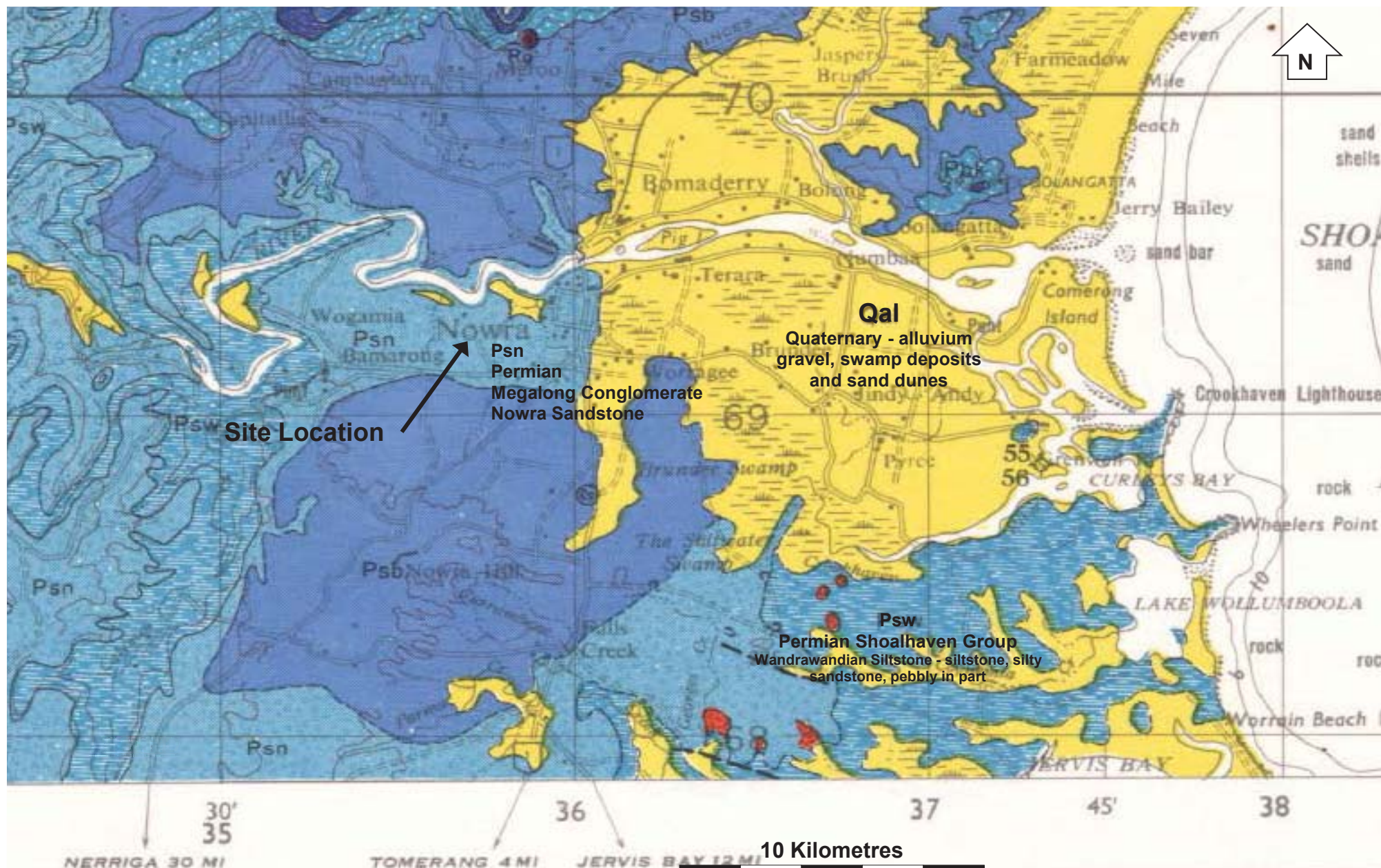
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Scale: scale bar
Revision: A
Checked: RL

Status: Rev 1
Drawn: RL
Approved: RL

Client: Shoalhaven City Council
Project: ENRS0047.4
Location: West Nowra Recycling & Waste Facility

Title: Topographic Map
Date: 15/12/2014
Figure: 3



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Scale: **scale bar**

Revision: **A**

Checked: **RL**

Status: **Rev 1**

Drawn: **RL**

Approved: **RL**

Client: **Shoalhaven City Council**

Project: **ENRS0047.4**

Location: **West Nowra Recycling & Waste Facility**

Title: **Regional Geology**

Date: **15/12/2014**

Figure: **4**



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Scale: scale bar
Revision: A
Checked: RL

Status: Rev 1
Drawn: RL
Approved: RL

Client: Shoalhaven City Council
Project: ENRS0047.4
Location: West Nowra Recycling & Waste Facility

Title: Registered Bores
Date: 15/12/2014
Figure: 5

TABLES

Table 18: Summary of Results (Oct 2017-March 2018)

GW6		ANZECC 2000 Freshwater (95% Species)	11/10/2017	3/11/2017	4/12/2017	11/01/2018	8/02/2018	12/03/2018
Alkalinity (CaCO3)	mg/L		401	286	177	120	217	204
Aluminium - Dissolved	mg/L	0.055	0.06	0.18	0.1	0.41	0.15	0.02
Aluminium - Total	mg/L	0.055	2.76	0.18	4.67	2.62	0.64	21.8
Ammonia as N	mg/L	0.9 0.9 (pH 8) - 2.57 (pH 6)	71.8	57.2	48.2	35	52.4	43.3
Arsenic - Dissolved	mg/L	0.024	0.004	0.002	<0.001	<0.001	0.003	0.01
Arsenic - Total	mg/L	0.024	0.01	0.002	0.026	0.005	0.004	<0.001
Barium - Dissolved	mg/L	-	0.311	0.242	0.233	0.196	0.29	0.465
Barium - Total	mg/L	-	0.434	0.254	0.452	0.25	0.3	1.27
Benzene	mg/L	0.95	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	-	401	286	177	120	217	204
Cadmium - Dissolved	mg/L	0.0002	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium - Total	mg/L	0.0002	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.001
Calcium	mg/L	-	50	34	33	30	34	34
Carbonate	mg/L	-	<1	<1	<1	<1	<1	<1
Chloride	mg/L	-	1020	965	837	838	893	872
Hexavalent Chromium	mg/L	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium - Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Chromium - Total	mg/L	0.001 Respective HMTV applied	0.003	<0.001	0.035	0.004	<0.001	0.078
Cobalt - Dissolved	mg/L	-	0.014	0.012	0.01	0.009	0.015	0.006
Cobalt - Total	mg/L	-	0.016	0.012	0.022	0.012	0.013	0.065
Conductivity Field	µS/cm	2200 max - 125 min	3828	-	2755	2554		3340
Conductivity Lab	µS/cm	2200 max - 125 min	3920	3740	3240	3000	3370	3310
Copper - Dissolved	mg/L	0.0014	0.004	0.005	0.006	<0.001	0.002	<0.001
Copper - Total	mg/L	0.0014 Respective HMTV applied	0.017	0.006	0.161	0.143	0.056	0.662
Ethyl- Benzene	mg/L	0.14 **	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Fluoride	mg/L	1.5 ***	0.5	0.3	0.1	0.2	0.2	0.1
Lead - Dissolved	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead - Total	mg/L	0.0034 Respective HMTV applied	0.01	<0.001	0.044	0.01	0.002	0.231
Magnesium	mg/L	-	60	47	38	38	48	37
Manganese - Dissolved	mg/L	1.9	0.557	0.511	0.467	0.418	0.637	0.36
Manganese - Total	mg/L	1.9	0.596	0.536	0.631	0.445	0.592	1.08
Mercury - Dissolved	mg/L	0.0006	<0.0001	-	-	<0.0001	<0.0001	<0.0001
Mercury - Total	mg/L	0.0006	<0.0001	<0.0001	0.0004	0.0005	0.0002	0.002
Nitrate	mg/L	0.7	<0.01	0.01	<0.01	0.02	<0.01	0.02
Nitrite	mg/L	-	<0.01	<0.01	<0.01	0.02	0.02	0.02
OCP's	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
OPP's	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosphate	mg/L	0.02 FRP*	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01
Phosphorous	mg/L	-	0.21	0.06	1.17	0.16	0.07	12
PAH (total)	mg/L	0.016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
pH Field	pH units	8 - 6.5	5.94	-	5.34	5.6	5.68	5.52
pH Lab	pH units	8 - 6.5	6.36	6.04	5.8	5.66	5.98	6.15
Potassium	mg/L	-	40	30	25	23	29	24
ORP	mV	-	157	-	286	230	364	6
Sodium	mg/L	-	486	465	417	403	478	401
Standing water level	mbTOC	-	2.9	-	2.865	2.837	2.9	2.32
Sulphate	mg/L	-	76	117	112	95	83	78
Field Temperature	°C	-	26.7	-	17.8	23	21.7	20.4
Toluene	mg/L	0.3 **	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Phenolics	mg/L	0.32	<0.05	<0.05	<0.05	<0.05	<0.05	0.24
Total Dissolved Solids	mg/L	1500 max - 85 min	2120	1850	1720	1590	1840	1700
Total Organic Carbon	mg/L	-	27	20	17	15	18	26
TPHs	mg/L							
C10-C14	mg/L	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C15-C28	mg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C29-C36	mg/L	10 **	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C6-C9	mg/L	7 (NEPM F1)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Xylene	mg/L	0.35	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc - Dissolved	mg/L	0.008	0.067	0.066	0.148	0.058	0.069	0.014
Zinc - Total	mg/L	0.008 Respective HMTV applied	0.09	1.12	0.258	0.088	0.073	0.658

Australian and New Zealand Environment and Conservation Council, Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

*ANZECC 2000 Trigger Levels for Fresh Water & Lowland Rivers (Table 3.3.2) in South East Australia

**NSW DEC (1994) Guidelines for Assessing Service Station Sites - Threshold Concentrations for Aquatic Environments - Fresh Waters

***NEPM 2013 Schedule B1 Guideline on Investigation Levels for Soil and Groundwater

****ANZECC 2000 Trigger Levels for Lowland Rivers (Table 8.2.12) in New South Wales

FRP = Filterable Reactive Phosphate

GW6 D		ANZECC 2000 Freshwater (95% Species)	11/10/2017	3/11/2017	4/12/2017	11/01/2018	8/02/2018	12/03/2018
Alkalinity (CaCO3)	mg/L		-	-	-	-	-	240
Aluminium - Dissolved	mg/L	0.055	-	-	-	-	-	<0.01
Aluminium - Total	mg/L	0.055	-	-	-	-	-	3.47
Ammonia as N	mg/L	0.9 (pH 8) - 2.57 (pH 6)	-	-	-	-	-	4.48
Arsenic - Dissolved	mg/L	0.024	-	-	-	-	-	0.003
Arsenic - Total	mg/L	0.024	-	-	-	-	-	0.024
Barium - Dissolved	mg/L	-	-	-	-	-	-	0.159
Barium - Total	mg/L	-	-	-	-	-	-	0.25
Benzene	mg/L	0.95	-	-	-	-	-	<0.001
Bicarbonate	mg/L	-	-	-	-	-	-	240
Cadmium - Dissolved	mg/L	0.0002	-	-	-	-	-	0.0001
Cadmium - Total	mg/L	0.0002	-	-	-	-	-	0.0002
Calcium	mg/L	-	-	-	-	-	-	69
Carbonate	mg/L	-	-	-	-	-	-	<1
Chloride	mg/L	-	-	-	-	-	-	466
Hexavalent Chromium	mg/L	0.001	-	-	-	-	-	<0.01
Chromium - Dissolved	mg/L	0.001	-	-	-	-	-	<0.001
Chromium - Total	mg/L	0.001 Respective HMTV applied	-	-	-	-	-	0.013
Cobalt - Dissolved	mg/L	-	-	-	-	-	-	0.021
Cobalt - Total	mg/L	-	-	-	-	-	-	0.031
Conductivity Field	µS/cm	2200 max - 125 min	-	-	-	-	-	1793
Conductivity Lab	µS/cm	2200 max - 125 min	-	-	-	-	-	1970
Copper - Dissolved	mg/L	0.0014	-	-	-	-	-	0.025
Copper - Total	mg/L	0.0014 Respective HMTV applied	-	-	-	-	-	0.057
Ethyl- Benzene	mg/L	0.14 **	-	-	-	-	-	<0.002
Fluoride	mg/L	1.5 ***	-	-	-	-	-	0.2
Lead - Dissolved	mg/L	0.0034	-	-	-	-	-	<0.001
Lead - Total	mg/L	0.0034 Respective HMTV applied	-	-	-	-	-	0.038
Magnesium	mg/L	-	-	-	-	-	-	34
Manganese - Dissolved	mg/L	1.9	-	-	-	-	-	0.33
Manganese - Total	mg/L	1.9	-	-	-	-	-	0.533
Mercury - Dissolved	mg/L	0.0006	-	-	-	-	-	<0.0001
Mercury - Total	mg/L	0.0006	-	-	-	-	-	<0.0001
Nitrate	mg/L	0.7	-	-	-	-	-	0.04
Nitrite	mg/L	-	-	-	-	-	-	<0.01
OCP's	mg/L	-	-	-	-	-	-	<0.5
OPP's	mg/L	-	-	-	-	-	-	<0.5
Phosphate	mg/L	0.02 FRP*	-	-	-	-	-	<0.01
Phosphorous	mg/L	-	-	-	-	-	-	0.89
PAH (total)	mg/L	0.016	-	-	-	-	-	<1.0
pH Field	pH units	8 - 6.5	-	-	-	-	-	6.29
pH Lab	pH units	8 - 6.5	-	-	-	-	-	7.07
Potassium	mg/L	-	-	-	-	-	-	8
ORP	mV	-	-	-	-	-	-	50
Sodium	mg/L	-	-	-	-	-	-	221
Standing water level	mbTOC	-	-	-	-	-	-	3.6
Sulphate	mg/L	-	-	-	-	-	-	35
Field Temperature	°C	-	-	-	-	-	-	21.5
Toluene	mg/L	0.3 **	-	-	-	-	-	<0.002
Total Phenolics	mg/L	0.32	-	-	-	-	-	<0.05
Total Dissolved Solids	mg/L	1500 max - 85 min	-	-	-	-	-	1370
Total Organic Carbon	mg/L	-	-	-	-	-	-	22
TPHs	mg/L							
C10-C14	mg/L	-	-	-	-	-	-	<0.05
C15-C28	mg/L	-	-	-	-	-	-	0.3
C29-C36	mg/L	10 **	-	-	-	-	-	0.19
C6-C9	mg/L	7 (NEPM F1)	-	-	-	-	-	<0.02
Xylene	mg/L	0.35	-	-	-	-	-	<0.002
Zinc - Dissolved	mg/L	0.008	-	-	-	-	-	0.133
Zinc - Total	mg/L	0.008	-	-	-	-	-	0.257

Australian and New Zealand Environment and Conservation Council, Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

*ANZECC 2000 Trigger Levels for Fresh Water & Lowland Rivers (Table 3.3.2) in South East Australia

**NSW DEC (1994) Guidelines for Assessing Service Station Sites - Threshold Concentrations for Aquatic Environments - Fresh Waters

***NEPM 2013 Schedule B1 Guideline on Investigation Levels for Soil and Groundwater

****ANZECC 2000 Trigger Levels for Lowland Rivers (Table 8.2.12) in New South Wales

FRP = Filterable Reactive Phosphate

GW6 S		ANZECC 2000 Freshwater (95% Species)	11/10/2017	3/11/2017	4/12/2017	11/01/2018	8/02/2018	12/03/2018
Alkalinity (CaCO3)	mg/L		-	-	-	-	-	39
Aluminium - Dissolved	mg/L	0.055	-	-	-	-	-	0.09
Aluminium - Total	mg/L	0.055	-	-	-	-	-	0.38
Ammonia as N	mg/L	0.9 (pH 8) - 2.57 (pH 6)	-	-	-	-	-	0.6
Arsenic - Dissolved	mg/L	0.024	-	-	-	-	-	<0.001
Arsenic - Total	mg/L	0.024	-	-	-	-	-	<0.001
Barium - Dissolved	mg/L	-	-	-	-	-	-	0.147
Barium - Total	mg/L	-	-	-	-	-	-	0.154
Benzene	mg/L	0.95	-	-	-	-	-	<0.002
Bicarbonate	mg/L	-	-	-	-	-	-	39
Cadmium - Dissolved	mg/L	0.0002	-	-	-	-	-	<0.0001
Cadmium - Total	mg/L	0.0002	-	-	-	-	-	<0.0001
Calcium	mg/L	-	-	-	-	-	-	43
Carbonate	mg/L	-	-	-	-	-	-	<1
Chloride	mg/L	-	-	-	-	-	-	717
Hexavalent Chromium	mg/L	0.001	-	-	-	-	-	<0.01
Chromium - Dissolved	mg/L	0.001	-	-	-	-	-	0.001
Chromium - Total	mg/L	0.001 Respective HMTV applied	-	-	-	-	-	0.005
Cobalt - Dissolved	mg/L	-	-	-	-	-	-	0.02
Cobalt - Total	mg/L	-	-	-	-	-	-	0.017
Conductivity Field	µS/cm	2200 max - 125 min	-	-	-	-	-	2380
Conductivity Lab	µS/cm	2200 max - 125 min	-	-	-	-	-	2560
Copper - Dissolved	mg/L	0.0014	-	-	-	-	-	<0.001
Copper - Total	mg/L	0.0014 Respective HMTV applied	-	-	-	-	-	<0.001
Ethyl- Benzene	mg/L	0.14 **	-	-	-	-	-	<0.001
Fluoride	mg/L	1.5 ***	-	-	-	-	-	0.2
Lead - Dissolved	mg/L	0.0034	-	-	-	-	-	<0.001
Lead - Total	mg/L	0.0034 Respective HMTV applied	-	-	-	-	-	<0.001
Magnesium	mg/L	-	-	-	-	-	-	26
Manganese - Dissolved	mg/L	1.9	-	-	-	-	-	1.09
Manganese - Total	mg/L	1.9	-	-	-	-	-	1.12
Mercury - Dissolved	mg/L	0.0006	-	-	-	-	-	<0.0001
Mercury - Total	mg/L	0.0006	-	-	-	-	-	<0.0001
Nitrate	mg/L	0.7	-	-	-	-	-	<0.01
Nitrite	mg/L	-	-	-	-	-	-	<0.01
OCP's	mg/L	-	-	-	-	-	-	<0.5
OPP's	mg/L	-	-	-	-	-	-	<0.5
Phosphate	mg/L	0.02 FRP*	-	-	-	-	-	<0.01
Phosphorous	mg/L	-	-	-	-	-	-	0.02
PAH (total)	mg/L	0.016	-	-	-	-	-	<1.0
pH Field	pH units	8 - 6.5	-	-	-	-	-	5.5
pH Lab	pH units	8 - 6.5	-	-	-	-	-	6.25
Potassium	mg/L	-	-	-	-	-	-	7
ORP	mV	-	-	-	-	-	-	-166
Sodium	mg/L	-	-	-	-	-	-	352
Standing water level	mbTOC	-	-	-	-	-	-	1.325
Sulphate	mg/L	-	-	-	-	-	-	148
Field Temperature	°C	-	-	-	-	-	-	22.8
Toluene	mg/L	0.3 **	-	-	-	-	-	<0.002
Total Phenolics	mg/L	0.32	-	-	-	-	-	<0.05
Total Dissolved Solids	mg/L	1500 max - 85 min	-	-	-	-	-	1650
Total Organic Carbon	mg/L	-	-	-	-	-	-	8
TPHs	mg/L							
C10-C14	mg/L	-	-	-	-	-	-	<0.05
C15-C28	mg/L	-	-	-	-	-	-	<0.1
C29-C36	mg/L	10 **	-	-	-	-	-	<0.05
C6-C9	mg/L	7 (NEPM F1)	-	-	-	-	-	<0.02
Xylene	mg/L	0.35	-	-	-	-	-	0.003
Zinc - Dissolved	mg/L	0.008	-	-	-	-	-	0.029
Zinc - Total	mg/L	0.008 Respective HMTV applied	-	-	-	-	-	0.02

Australian and New Zealand Environment and Conservation Council, Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

*ANZECC 2000 Trigger Levels for Fresh Water & Lowland Rivers (Table 3.3.2) in South East Australia

**NSW DEC (1994) Guidelines for Assessing Service Station Sites - Threshold Concentrations for Aquatic Environments - Fresh Waters

***NEPM 2013 Schedule B1 Guideline on Investigation Levels for Soil and Groundwater

****ANZECC 2000 Trigger Levels for Lowland Rivers (Table 8.2.12) in New South Wales

FRP = Filterable Reactive Phosphate

GW7		ANZECC 2000 Freshwater (95% Species)	11/10/2017	3/11/2017	4/12/2017	11/01/2018	8/02/2018	12/03/2018
Alkalinity (CaCO3)	mg/L		56	59	33	27	47	36
Aluminium - Dissolved	mg/L	0.055	0.01	0.03	0.01	0.05	0.09	<0.01
Aluminium - Total	mg/L	0.055	4.9	28.4	24	5.82	18.5	14.2
Ammonia as N	mg/L	0.9 0.9 (pH 8) - 2.57 (pH 6)	0.06	0.03	0.08	0.04	0.04	0.04
Arsenic - Dissolved	mg/L	0.024	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic - Total	mg/L	0.024	0.004	0.007	0.007	0.003	0.004	0.003
Barium - Dissolved	mg/L	-	0.207	0.181	0.194	0.18	0.205	0.183
Barium - Total	mg/L	-	0.228	0.295	0.276	0.232	0.279	0.27
Benzene	mg/L	0.95	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	-	56	59	33	27	47	36
Cadmium - Dissolved	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium - Total	mg/L	0.0002 Respective HMTV applied	0.0118	0.0124	0.0001	0.0042	0.0032	0.0019
Calcium	mg/L	-	53	48	33	54	54	49
Carbonate	mg/L	-	<1	<1	<1	<1	<1	<1
Chloride	mg/L	-	783	773	735	756	706	725
Hexavalent Chromium	mg/L	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium - Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium - Total	mg/L	0.001 Respective HMTV applied	0.005	0.026	0.035	0.006	0.019	0.016
Cobalt - Dissolved	mg/L	-	0.013	0.01	0.01	0.012	0.012	0.01
Cobalt - Total	mg/L	-	0.016	0.018	0.022	0.014	0.014	0.012
Conductivity Field	µS/cm	2200 max - 125 min	2383	-	2304	2155	2469	2226
Conductivity Lab	µS/cm	2200 max - 125 min	2450	2520	2460	2400	2340	2480
Copper - Dissolved	mg/L	0.0014	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Copper - Total	mg/L	0.0014 Respective HMTV applied	0.078	0.101	0.161	0.027	0.041	0.028
Ethyl- Benzene	mg/L	0.14 **	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Fluoride	mg/L	1.5 ***	0.2	0.2	0.1	0.1	0.2	0.1
Lead - Dissolved	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead - Total	mg/L	0.0034 Respective HMTV applied	0.037	0.057	0.044	0.021	0.026	0.021
Magnesium	mg/L	-	49	45	42	47	46	40
Manganese - Dissolved	mg/L	1.9	0.34	0.298	0.467	0.325	0.336	0.288
Manganese - Total	mg/L	1.9	0.362	0.333	0.631	0.348	0.337	0.32
Mercury - Dissolved	mg/L	0.0006	<0.0001	-	-	<0.0001	<0.0001	<0.0001
Mercury - Total	mg/L	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nitrate	mg/L	0.7	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Nitrite	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OCP's	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
OPP's	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosphate	mg/L	0.02 FRP*	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Phosphorous	mg/L	-	0.3	0.45	0.4	0.22	0.19	0.19
PAH (total)	mg/L	0.016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
pH Field	pH units	8 - 6.5	5.7	-	5.29	5.59	5.39	5.42
pH Lab	pH units	8 - 6.5	6.41	5.82	5.76	5.55	5.95	5.93
Potassium	mg/L	-	1	1	1	2	1	1
ORP	mV	-	211.5	-	238	229	35	84
Sodium	mg/L	-	315	319	333	348	355	329
Standing water level	mbTOC	-	1.27	-	1.323	1.37	1.46	0.765
Sulphate	mg/L	-	30	32	29	26	34	28
Field Temperature	°C	-	26.6	-	17.9	24.7	19	20.5
Toluene	mg/L	0.3 **	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Phenolics	mg/L	0.32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Dissolved Solids	mg/L	1500 max - 85 min	1770	1560	1720	1700	1450	1700
Total Organic Carbon	mg/L	-	2	2	4	5	3	4
TPHs	mg/L							
C10-C14	mg/L	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C15-C28	mg/L	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C29-C36	mg/L	10 **	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C6-C9	mg/L	7 (NEPM F1)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Xylene	mg/L	0.35	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc - Dissolved	mg/L	0.008	0.08	0.065	0.059	0.052	0.063	0.055
Zinc - Total	mg/L	0.008 Respective HMTV applied	1.08	1.12	0.09	0.504	0.341	0.246

Australian and New Zealand Environment and Conservation Council, Guidelines for Fresh and Marine Water Quality (ANZECC 2000)

*ANZECC 2000 Trigger Levels for Fresh Water & Lowland Rivers (Table 3.3.2) in South East Australia

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FRP = Filterable Reactive Phosphate

APPENDICES

Appendix A: EPA Sampling Locations

Location of Monitoring / Discharge Points

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Leachate Quality Monitoring		Leachate dam LD1 as shown on drawing 2824_16 referenced as EPA WOF9346
2		Overflow drain	Overflow from first flush dam DP2 as shown on drawing 2824_16 referenced as EPA WOF9346
3	Overflow drain	Overflow drain	Overflow from sedimentation dam 1 DP3 as shown on drawing 2824_16 referenced as EPA WOF9346
5	Surface water monitoring		Immediately downstream from the leachate dam at the boundary of the site as shown on drawing 2824_16 referenced as EPA WOF9346
6	Surface water monitoring		Upstream of site in Sandy Creek as shown on drawing 2824_16 referenced as EPA WOF9346.
7	Surface water monitoring		Downstream of site in Sandy Creek as shown on drawing 2824_16 referenced as EPA WOF9346.
8	Groundwater monitoring		Groundwater monitoring well labelled BH1 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275936 N6137766
9	Groundwater monitoring		Groundwater monitoring well labelled BH2 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01). E275914 N6137656
11	Groundwater monitoring		Groundwater monitoring well labelled BH4A on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275896 N6137573
13	Groundwater monitoring		Groundwater monitoring well labelled BH6 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275871 N6137469
14	Groundwater monitoring		Groundwater monitoring well labelled BH7 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275872 N6137469
17	Groundwater monitoring		Groundwater monitoring well labelled BH10 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275775 N6137366
18	Groundwater monitoring		Groundwater monitoring well labelled BH11 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275830 N6137492

20	Groundwater monitoring	Groundwater monitoring well labelled BH13 on diagram titled "Bore Location Plan" May 17/01/14 (DOC14/6276-07) E275996 N6137489
21	Groundwater monitoring	Groundwater monitoring well labelled BH14 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E276421 N6137653
25	Leachate Volume Monitoring	Pipeline from Leachate Dam (LD1) to irrigation area as shown on drawing 2824_16 referenced as EPA WOF 9346
26	Utilisation Area	Irrigation area as shown on drawing 2824_16 referenced as EPA WOF9346
27	Leachate Volume and Quality	leachate pumphouse for Stage 3
29	Groundwater monitoring	Groundwater monitoring well labelled BH16 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275750 E6137137
30	Groundwater monitoring	Groundwater monitoring well labelled BH17 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275750 N6137142
31	Groundwater monitoring	Groundwater monitoring well labelled BH18 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275707 N6137202
32	Groundwater monitoring	Groundwater monitoring well labelled BH19 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E276132 N6137061
33	Groundwater monitoring	Groundwater monitoring well labelled BH20 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E276171 N6137736
34	Groundwater Monitoring	Groundwater monitoring well labelled BH21 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275742 N6136900
35	Groundwater monitoring	Groundwater monitoring well labelled BH22 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275821 N6136791
36	Groundwater monitoring	Groundwater monitoring well labelled BH23 on diagram titled "Bore Location Plan" dated 17/01/14 (DOC14/6276-01) E275942 N6136774

Appendix B: Monitoring Bore Construction Summary

Summary of Monitoring Bore Construction Details – West Nowra

EPA Point	BORE ID	Easting	Northing	Depth mbgl	RL SCC Plan mAHD	TOC RL SCC mAHD	Screen GHD mbgl	PVC Stick Up magl
N/A	GW6	275978.46	6137482.96	9	33.32	-	1.5-7.5	0.71
N/A	GW6D	275985.22	6137475.65	9	33.86	34.567	5-9	0.71
N/A	GW6S	275981.26	6137483.85	2	33.53	34.237	0.5-2	0.71
N/A	GW7	275884.38	6137518.84	7	30.18	-	1.0-4.0	0.86
EPA Point	BORE ID	Easting	Northing	Depth mbgl	RL SCC Plan mAHD	TOC RL E2W mAHD	Screen E2W mbgl	PVC Stick Up magl
8	BH1	275936.45	6137766.21	7	35.00	47.86	1.5-2.4	N/A
9	BH2	275914.46	6137656.15	9	33.09	45.78	1.6-3.0	N/A
10	BH3	275908.36	6137619.07	7.4	31.64	44.9	1.9-2.7	N/A
11	BH4A	275895.50	6137573.12	7.25	31.83	44.7	0.5-1.7	N/A
12	BH5	275883.05	6137508.80	8.85	30.56	48.3	1.8-2.3	N/A
13	BH6	275870.78	6137469.07	9.6	32.34	49.11	1.1-2.3	N/A
14	BH7	275871.84	6137468.76	7.4	32.44	49.91	1.6-2.6	N/A
15	BH8	275907.62	6137372.04	3.15	32.62	46.62	Destroyed 1999	N/A
16	BH9	275836.04	6137399.29	7.95	36.37	47.7	Destroyed 1999	N/A
17	BH10	275775.24	6137366.10	8.75	39.62	47.1	3.8-6.7	N/A
18	BH11	275831.25	6137491.27	9.1	31.78	47.16	0.7-1.2	N/A
19	BH12A	275871.07	6137478.69	8.75	31.82	44.36	7-8	N/A
20	BH13	275996.40	6137488.92	8.2	34.67	45.49	0.2-1.0	N/A
21	BH14	276421.18	6137653.16	7	45.08	44.99	8.67-11.67	N/A
28	BH15	276365.69	6137582.41	-	45.99	N/A	N/A	N/A
29	BH16	275750.11	6137137.29	8.2	-	43.156	5.2-8.2	N/A
30	BH17	275750.12	6137142.42	12	-	43.458	9-12	N/A
31	BH18	275706.99	6137201.69	8	-	44.41	5-8	N/A
32	BH19	276131.95	6137061.32	8.2	-	49.705	5.2-8.2	N/A
33	BH20	276171.38	6137736.01	8.2	-	41.925	5.2-8.2	N/A
34	BH21	275741.83	6136900.25	-	-	N/A	N/A	N/A
35	BH22	275821.38	6136791.13	-	-	N/A	N/A	N/A
36	BH23	275942.26	6136774.41	5.63	46.62	N/A	N/A	0.55

BHXX = removed from current EPL. Monitoring no longer required.

Appendix C: Equipment Calibration Certificates



ENVIRONMENT & NATURAL RESOURCE SOLUTIONS

ABN 68 600 154 596

25 River Road, Shoalhaven Heads, NSW, 2535

T/F 02 9037 4708 M: 0401 518 443

E: projects@enrs.com.au www.enrs.com.au

EQUIPMENT CALIBRATION CERTIFICATE – TPS 90FLMV WATER QUALITY METER

This Water Quality Meter has been performance checked / calibrated* as follows:

pH	☐ pH 6.88	☒ pH 7.00	☒ pH 4.00
Conductivity	☐ 0.0mS/cm	☒ 2.76mS/cm	☐ 12.88mS/cm
TDS	☐ 0.0ppk	☐ 36ppk	☐ ppk
Dissolved Oxygen	☐ 0.00ppm in Sodium Sulphite		☒ 100% Saturation in Air
Redox (ORP)***	☐ Electrode operability test 238mV ⁺ /±10%		Actual: _____ mV
Logging Unit	☒ Electrodes cleaned/checked	☒ Charged ____v(min7.2V)	☒ Temperature

*Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information refer to supplier.

Equipment Checklist:

1. ☐90FLMV Unit. Ops Check / Battery Voltage @_____.
2. ☐pH sensor 1m
3. ☐Conductivity / TDS / Temperature k = 10 sensor 1m
4. ☐Dissolved Oxygen sensor 1m
5. ☐Redox (ORP) sensor 1m
6. ☐Battery Charger: 240v AC to 12V DC 200mA
7. ☐Instruction Manual
8. ☐Syringe with storage solution for pH, EC and ORP sensors
9. ☐Carry Case

Equipment MODEL	TPS 90FLMV WATER QUALITY METER / LOGGER
Equipment Serial No.	0311-22

Date: 11/10/2017

Checked by: Matt Lemcke

Signed:



ENVIRONMENT & NATURAL RESOURCE SOLUTIONS

ABN 68 600 154 596

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EQUIPMENT CALIBRATION CERTIFICATE – TPS 90FLMV WATER QUALITY METER

This Water Quality Meter has been performance checked / calibrated* as follows:

pH	☐ pH 6.88	☒ pH 7.00	☒ pH 4.00
Conductivity	☐ 0.0mS/cm	☒ 2.76mS/cm	☐ 12.88mS/cm
TDS	☐ 0.0ppk	☐ 36ppk	☐ ppk
Dissolved Oxygen	☐ 0.00ppm in Sodium Sulphite		☒ 100% Saturation in Air
Redox (ORP)***	☐ Electrode operability test 238mV ⁺ /±10%		Actual: _____ mV
Logging Unit	☒ Electrodes cleaned/checked	☒ Charged ____v(min7.2V)	☒ Temperature

*Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information refer to supplier.

Equipment Checklist:

1. ☐90FLMV Unit. Ops Check / Battery Voltage @_____.
2. ☐pH sensor 1m
3. ☐Conductivity / TDS / Temperature k = 10 sensor 1m
4. ☐Dissolved Oxygen sensor 1m
5. ☐Redox (ORP) sensor 1m
6. ☐Battery Charger: 240v AC to 12V DC 200mA
7. ☐Instruction Manual
8. ☐Syringe with storage solution for pH, EC and ORP sensors
9. ☐Carry Case

Equipment MODEL	TPS 90FLMV WATER QUALITY METER / LOGGER
Equipment Serial No.	0311-22

Date: 3/11/2017

Checked by: Matt Lemcke

Signed:



ENVIRONMENT & NATURAL RESOURCE SOLUTIONS

ABN 68 600 154 596

25 River Road, Shoalhaven Heads, NSW, 2535

T/F 02 9037 4708 M: 0401 518 443

E: projects@enrs.com.au www.enrs.com.au

EQUIPMENT CALIBRATION CERTIFICATE – TPS 90FLMV WATER QUALITY METER

This Water Quality Meter has been performance checked / calibrated* as follows:

pH	☐ pH 6.88	☒ pH 7.00	☒ pH 4.00
Conductivity	☐ 0.0mS/cm	☒ 2.76mS/cm	☐ 12.88mS/cm
TDS	☐ 0.0ppk	☐ 36ppk	☐ ppk
Dissolved Oxygen	☐ 0.00ppm in Sodium Sulphite		☒ 100% Saturation in Air
Redox (ORP)***	☐ Electrode operability test 238mV ⁺ /±10%		Actual: _____ mV
Logging Unit	☒ Electrodes cleaned/checked	☒ Charged ____v(min7.2V)	☒ Temperature

*Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information refer to supplier.

Equipment Checklist:

1. ☐90FLMV Unit. Ops Check / Battery Voltage @_____.
2. ☐pH sensor 1m
3. ☐Conductivity / TDS / Temperature k = 10 sensor 1m
4. ☐Dissolved Oxygen sensor 1m
5. ☐Redox (ORP) sensor 1m
6. ☐Battery Charger: 240v AC to 12V DC 200mA
7. ☐Instruction Manual
8. ☐Syringe with storage solution for pH, EC and ORP sensors
9. ☐Carry Case

Equipment MODEL	TPS 90FLMV WATER QUALITY METER / LOGGER
Equipment Serial No.	0311-22

Date: 4/12/2017

Checked by: Matt Lemcke

Signed:



ENVIRONMENT & NATURAL RESOURCE SOLUTIONS

ABN 68 600 154 596

25 River Road, Shoalhaven Heads, NSW, 2535

T/F 02 9037 4708 M: 0401 518 443

E: projects@enrs.com.au www.enrs.com.au

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TDS	☐ 0.0ppk	☐ 36ppk	☐ ppk
Dissolved Oxygen	☐ 0.00ppm in Sodium Sulphite		☒ 100% Saturation in Air
Redox (ORP)***	☐ Electrode operability test 238mV ⁺ /±10%		Actual: _____ mV
Logging Unit	☒ Electrodes cleaned/checked	☒ Charged ____v(min7.2V)	☒ Temperature

*Calibration solution traceability information is available upon request.

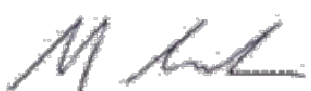
** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information refer to supplier.

Equipment Checklist:

1. ☐90FLMV Unit. Ops Check / Battery Voltage @_____.
2. ☐pH sensor 1m
3. ☐Conductivity / TDS / Temperature k = 10 sensor 1m
4. ☐Dissolved Oxygen sensor 1m
5. ☐Redox (ORP) sensor 1m
6. ☐Battery Charger: 240v AC to 12V DC 200mA
7. ☐Instruction Manual
8. ☐Syringe with storage solution for pH, EC and ORP sensors
9. ☐Carry Case

Equipment MODEL	TPS 90FLMV WATER QUALITY METER / LOGGER
Equipment Serial No.	0311-22

Date: 11/01/2018 **Checked by:** Matt Lemcke

Signed:  _____



ENVIRONMENT & NATURAL RESOURCE SOLUTIONS

ABN 68 600 154 596

25 River Road, Shoalhaven Heads, NSW, 2535

T/F 02 9037 4708 M: 0401 518 443

E: projects@enrs.com.au www.enrs.com.au

EQUIPMENT CALIBRATION CERTIFICATE – TPS 90FLMV WATER QUALITY METER

This Water Quality Meter has been performance checked / calibrated* as follows:

pH	☐ pH 6.88	☒ pH 7.00	☒ pH 4.00
Conductivity	☐ 0.0mS/cm	☒ 2.76mS/cm	☐ 12.88mS/cm
TDS	☐ 0.0ppk	☐ 36ppk	☐ ppk
Dissolved Oxygen	☐ 0.00ppm in Sodium Sulphite		☒ 100% Saturation in Air
Redox (ORP)***	☐ Electrode operability test 238mV ⁺ /±10%		Actual: _____ mV
Logging Unit	☒ Electrodes cleaned/checked	☒ Charged ____v(min7.2V)	☒ Temperature

*Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information refer to supplier.

Equipment Checklist:

1. ☐90FLMV Unit. Ops Check / Battery Voltage @_____.
2. ☐pH sensor 1m
3. ☐Conductivity / TDS / Temperature k = 10 sensor 1m
4. ☐Dissolved Oxygen sensor 1m
5. ☐Redox (ORP) sensor 1m
6. ☐Battery Charger: 240v AC to 12V DC 200mA
7. ☐Instruction Manual
8. ☐Syringe with storage solution for pH, EC and ORP sensors
9. ☐Carry Case

Equipment MODEL	TPS 90FLMV WATER QUALITY METER / LOGGER
Equipment Serial No.	0311-22

Date: 8/02/2018 **Checked by:** Matt Lemcke

Signed: 

Appendix D: Laboratory Certificates of Analysis (COA & COC)

Chain of Custody



USYDNEY 277-283 Woodpark Road Smithfield NSW 2184
Ph: 02 8754 8855 E: complex_sydney@aksjglobal.com

QNDWRA 413 Geary Place North Nova NSW 2541
Ph: 02 4423 2053 E: nova@aksjglobal.com

2WVOLLONGONG 98 Kenny Street Wollongong NSW 2500
Ph: 02 4425 2125 E: wollongong@aksjglobal.com

CLIENT: ENRS Pty Ltd		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):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: 25 River Rd Shoalhaven Heads						Custody Seal Intact? Yes No	
PROJECT: SCC West Nowra Stage 4		PROJECT NO.: ENRS0047		ALS QUOTE NO.: WO/001/17		Fries ice / frozen ice bricks present upon receipt? Yes No	
ORDER NUMBER:		PURCHASE ORDER NO.: Use Proj No.		COUNTRY OF ORIGIN:		Random Sample Temperature on Receipt: 15 °C	
PROJECT MANAGER: Rohan Last		CONTACT PH: 0401 518 443				Other comment:	
SAMPLER: ML		SAMPLER MOBILE: 0403526292		RELINQUISHED BY:		RECEIVED BY:	
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		M. Lemcke			
Email Reports to (will default to PM if no other addresses are listed): lab@enrs.com.au				DATE/TIME:..... 11/10/2017		DATE/TIME: 11.10.17 14:00	
Email Invoice to (will default to PM if no other addresses are listed):						DATE/TIME:	
						Environmental Division	

Environmental Division
Wollongong

Work Order Reference

EW1704235



Telephone : 02 42253125

[illegible]

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 = Zinc Acid HCl Preserved; VB = VOA Vial Sodium Bisulfate 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 Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; L = Lugols Iodine Preserved Bottle; STT = Sterile Sodium Thiosulfate Preserved Bottle.

CERTIFICATE OF ANALYSIS

Work Order : **EW1704235**
Client : **ENVIRONMENT & NATURAL RESOURCE SOLUTIONS**
Contact : Mr Rohan Last
Address : 25 River Rd
 Shoalhaven Heads 2535

Telephone : ----
Project : SCC West Nowra Stage 4
Order number : ENRS0047
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : WO/001/17 Blanket Quote
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 9
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW

Telephone : 02 4225 3125
Date Samples Received : 11-Oct-2017 15:00
Date Analysis Commenced : 12-Oct-2017
Issue Date : 19-Oct-2017 09:15



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
- Surrogate Control Limits

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>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, 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.

- EG020 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EK071G: LOR raised for Reactive Phosphorus on sample no:1 due to sample matrix.
- EG050G: Poor spike recovery for Hexavalent Chromium due to matrix interferences(confirmed by re-analysis).
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704235-001	EW1704235-002	-----	-----	-----
				Result	Result		----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		6.36	6.41	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3920	2450	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		----	1770	----	----	----
Total Dissolved Solids @180°C	----	10	mg/L		2120	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		----	1050	----	----	----
Suspended Solids (SS)	----	5	mg/L		192	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		401	56	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		401	56	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		76	30	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		1020	783	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		50	53	----	----	----
Magnesium	7439-95-4	1	mg/L		60	49	----	----	----
Sodium	7440-23-5	1	mg/L		486	315	----	----	----
Potassium	7440-09-7	1	mg/L		40	1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.06	0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L		0.004	0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.311	0.207	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.014	0.013	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		0.004	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.557	0.340	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.067	0.080	----	----	----

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time				11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EW1704235-001	EW1704235-002	-----	-----	-----	
				Result	Result	----	----	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	2.76	4.90	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	0.010	0.004	----	----	----	
Barium	7440-39-3	0.001	mg/L	0.434	0.228	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0118	----	----	----	
Chromium	7440-47-3	0.001	mg/L	0.003	0.005	----	----	----	
Copper	7440-50-8	0.001	mg/L	0.017	0.078	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	0.016	0.016	----	----	----	
Lead	7439-92-1	0.001	mg/L	0.010	0.037	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.090	1.08	----	----	----	
Manganese	7439-96-5	0.001	mg/L	0.596	0.362	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	
EG050G: Hexavalent Chromium by Discrete Analyser									
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.5	0.2	----	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	71.8	0.06	----	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<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	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	----	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	82.6	0.6	----	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	82.6	0.6	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.21	0.30	----	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704235-001	EW1704235-002	-----	-----	-----
				Result	Result		----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.02	<0.01	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		38.4	23.8	----	----	----
Total Cations	----	0.01	meq/L		34.7	----	----	----	----
Total Cations	----	0.01	meq/L		----	20.4	----	----	----
Ionic Balance	----	0.01	%		5.10	----	----	----	----
Ionic Balance	----	0.01	%		----	7.74	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		27	2	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	1	µg/L		<1	<1	----	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	----	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	----	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	----	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	----	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	----	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704235-001	EW1704235-002	-----	-----	-----
					Result	Result	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	----	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	----	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	----	----	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	----	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	----	----	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	----	----	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	----	----	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704235-001	EW1704235-002	-----	-----	-----
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Oct-2017 00:00	11-Oct-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704235-001	EW1704235-002	-----	-----	-----
				Result	Result		----	----	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	1	%		81.2	71.0	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		110	107	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		96.6	94.6	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		28.1	24.4	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		65.0	58.6	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%		92.6	73.4	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		78.1	70.3	----	----	----
Anthracene-d10	1719-06-8	1.0	%		87.8	94.9	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		78.8	77.5	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		119	133	----	----	----
Toluene-D8	2037-26-5	2	%		87.0	83.7	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		75.3	73.1	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	29	129
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	30	120
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	27	129
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Chain of Custody



QSYDNEY 277-288 Woodharr Road Smithfield NSW 2164
Ph 02 8794 5555 E samples.sydney@alsglobal.com

QNEWRA 413 Geary Place North Newra NSW 2541
Ph 02 4423 2683 E newsra@alsglobal.com

QWOLLONG 99 Kenny Street Wollongong NSW 2550
Ph 02 4225 3125 E wollongong@alsglobal.com

CLIENT: ENRS Pty Ltd		TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: 25 River Rd Shoalhaven Heads		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes No N/A	
PROJECT: SCC West Nowra Stage 4 PROJECT NO.: ENRS0047		ALS QUOTE NO.: WO/001/17		Free ice / frozen ice bricks present upon receipt? Yes No N/A	
ORDER NUMBER: PURCHASE ORDER NO.: Use Proj No,		COUNTRY OF ORIGIN:		Random Sample Temperature on Receipt: °C	
PROJECT MANAGER: Rohan Last CONTACT PH: 0401 518 443				Other comment:	
SAMPLER: ML SAMPLER MOBILE: 0403626292		RELINQUISHED BY:		RECEIVED BY:	
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):		M. Lemcke		DATE/TIME:	
Email Reports to (will default to PM if no other addresses are listed): lab@enrs.com.au		DATE/TIME: 3/11/2017		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):				DATE/TIME:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[illegible]

Environmental Division
Wollongong
Work Order Reference
EW1704544



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 = Airtight Unpreserved Plastic

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial BG = Lincupine Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; V = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Solts; B = Unpreserved Bag; LI = Lugol's Iodine Preserved Bottle; STT = Sterile Sodium Thiosulfate Preserved Bottle.

CERTIFICATE OF ANALYSIS

Work Order	: EW1704544	Page	: 1 of 9
Amendment	: 1		
Client	: ENVIRONMENT & NATURAL RESOURCE SOLUTIONS	Laboratory	: Environmental Division NSW South Coast
Contact	: RESULTS ADDRESS	Contact	: Aneta Prosaroski
Address	: 25 River Rd	Address	: 1/19 Ralph Black Dr, North Wollongong 2500
	Shoalhaven Heads 2535		4/13 Geary Pl, North Nowra 2541
			Australia NSW
Telephone	: 02 9037 4708	Telephone	: 02 4225 3125
Project	: SCC West Nowra Stage 4	Date Samples Received	: 03-Nov-2017 14:37
Order number	: ENRS0047	Date Analysis Commenced	: 04-Nov-2017
C-O-C number	: ----	Issue Date	: 08-Jan-2018 09:42
Sampler	: ----		
Site	: ----		
Quote number	: WO/001/17 Blanket Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		



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
- Surrogate Control Limits

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>
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	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.

- EG020 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EK057G: It has been noted that Nitrite is greater than NOx, however this difference is within the limits of experimental variation.
- EN055: Ionic Balance out of acceptable limits for sample EW1704544-1 due to analytes not quantified in this report.
- Amendment (08/01/2018): This report has been amended and re-released to allow the reporting of additional analytical data.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704544-001	EW1704544-002	-----	-----	-----
				Result	Result		----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		6.04	5.82	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3740	2520	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1850	1560	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		86	1180	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L		286	59	----	----	----
Total Alkalinity as CaCO ₃	----	1	mg/L		286	59	----	----	----
ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA									
Sulfate as SO ₄ - Turbidimetric	14808-79-8	1	mg/L		117	32	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		935	773	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		34	48	----	----	----
Magnesium	7439-95-4	1	mg/L		47	45	----	----	----
Sodium	7440-23-5	1	mg/L		465	319	----	----	----
Potassium	7440-09-7	1	mg/L		30	1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.19	0.03	----	----	----
Arsenic	7440-38-2	0.001	mg/L		0.002	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.242	0.181	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.012	0.010	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		0.005	0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.511	0.298	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.064	0.065	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.18	28.4	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704544-001	EW1704544-002	-----	-----	-----
					Result	Result	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Arsenic	7440-38-2	0.001	mg/L		0.002	0.007	----	----	----
Barium	7440-39-3	0.001	mg/L		0.254	0.295	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	0.0124	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.012	0.018	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	0.026	----	----	----
Copper	7440-50-8	0.001	mg/L		0.006	0.101	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.536	0.333	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	0.057	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.066	1.12	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		0.3	0.2	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		57.2	0.03	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		0.01	0.02	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.06	0.45	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		34.5	23.6	----	----	----
Total Cations	----	0.01	meq/L		26.6	20.0	----	----	----
Ionic Balance	----	0.01	%		13.0	8.36	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		20	2	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704544-001	EW1704544-002	-----	-----	-----
					Result	Result	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	----	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	----	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	----	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	----	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	----	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	----	----	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	----	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	----	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704544-001	EW1704544-002	-----	-----	-----
					Result	Result	----	----	----
EP068B: Organophosphorus Pesticides (OP) - Continued									
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	----	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	----	----	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	----	----	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	----	----	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2	205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1704544-001	EW1704544-002	-----	-----	-----
					Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued									
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		98.2	116	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		81.1	85.7	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		21.7	27.0	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		49.6	57.9	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%		46.5	47.4	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		74.2	81.3	----	----	----
Anthracene-d10	1719-06-8	1.0	%		75.3	93.1	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		70.5	84.7	----	----	----



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Client sample ID

				GW06	GW07	----	----	----
Client sampling date / time				03-Nov-2017 00:00	03-Nov-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1704544-001	EW1704544-002	-----	-----	-----
				Result	Result	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	2	%	117	111	----	----	----
Toluene-D8	2037-26-5	2	%	105	100	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	94.5	92.9	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	30	120
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	27	129
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128



OSYDNEY 277 280 Wondonga Road Smithfield NSW 2164
Ph: 02 8794 8855 E: samplesydney@global.com

ENOWRA 413 Garry Place North Nowra NSW 2541
Ph: 02 4422 2925 E: nowra@global.com

WOLLONGONG 52 Kenny Street Wollongong NSW 2530
Ph: 02 8225 2125 E: wollongong@global.com

CLIENT: ENRS Pty Ltd		TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)								
OFFICE: 25 River Rd Shoalhaven Heads		(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		Custody Seal Intact? Free Ice / frozen ice to receipt? Random Sample Tem Other comment:								
PROJECT: SCC West Nowra Stage 4		PROJECT NO.: ENRS0047	ALS QUOTE NO.: WO/001/17	COC SEQUENCE NUMBER (Circle)								
ORDER NUMBER:		PURCHASE ORDER NO.: Use Proj No.		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>		1	2	3	4	5	6	7
1	2	3	4	5	6	7						
PROJECT MANAGER: Rohan Last		COUNTRY OF ORIGIN:		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						
CONTACT PH: 0401 518 443		RELINQUISHED BY:		RECEIVED BY:								
SAMPLER: ML		CONTACT MOBILE: 0403526292		<i>AS</i>								
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		DATE/TIME: 4.12.17 15:00								
Email Reports to (will default to PM if no other addresses are listed): lab@enrs.com.au		DATE/TIME:..... 4/12/2017		DATE/TIME:								
Email Invoice to (will default to PM if no other addresses are listed):				DATE/TIME:								

Environmental Division
Wollongong
Work Order Reference
EW1705030



Telephone 02 42253125

[illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; CRG = Nitric Preserved CRG; SH = Sodium Hydroxide/CRG Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airweight Unpreserved Plastic
V = VOA Val HCl Preserved; VB = VOA Val Sodium Bisulfate Preserved; VS = VOA Val Sulfuric Preserved; AV = Airweight Unpreserved Val 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 Solids; B = Unpreserved Bag; LJ = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

CERTIFICATE OF ANALYSIS

Work Order	: EW1705030	Page	: 1 of 9
Amendment	: 1		
Client	: ENVIRONMENT & NATURAL RESOURCE SOLUTIONS	Laboratory	: Environmental Division NSW South Coast
Contact	: RESULTS ADDRESS	Contact	: Aneta Prosaroski
Address	: 25 River Rd Shoalhaven Heads 2535	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 4/13 Geary Pl, North Nowra 2541 Australia NSW
Telephone	: 02 9037 4708	Telephone	: 02 4225 3125
Project	: SCC West Nowra Stage 4	Date Samples Received	: 04-Dec-2017 15:00
Order number	: ----	Date Analysis Commenced	: 05-Dec-2017
C-O-C number	: ----	Issue Date	: 08-Jan-2018 09:42
Sampler	: ----		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 2		
No. of samples analysed	: 2		



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
- Surrogate Control Limits

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>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, 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.

- EG020 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- TDS by method EA-015 may bias high for sample 2 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EK057G: It has been noted that Nitrite is greater than NOx, however this difference is within the limits of experimental variation.
- EN055: Ionic Balance out of acceptable limits for sample EW1704544-1 due to analytes not quantified in this report.
- Amendment (08/01/2018): This report has been amended and re-released to allow the reporting of additional analytical data.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1705030-001	EW1705030-002	-----	-----	-----
					Result	Result	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		5.80	5.76	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3240	2460	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1720	1720	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		448	1400	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		177	33	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		177	33	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		112	29	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		837	735	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		33	51	----	----	----
Magnesium	7439-95-4	1	mg/L		38	42	----	----	----
Sodium	7440-23-5	1	mg/L		417	333	----	----	----
Potassium	7440-09-7	1	mg/L		25	1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.10	0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.233	0.194	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.010	0.011	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		0.006	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.467	0.324	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.148	0.059	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		4.67	24.0	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1705030-001	EW1705030-002	-----	-----	-----
					Result	Result	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Arsenic	7440-38-2	0.001	mg/L		0.026	0.007	----	----	----
Barium	7440-39-3	0.001	mg/L		0.452	0.276	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		0.0001	0.0115	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.022	0.018	----	----	----
Chromium	7440-47-3	0.001	mg/L		0.035	0.024	----	----	----
Copper	7440-50-8	0.001	mg/L		0.161	0.098	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.631	0.350	----	----	----
Lead	7439-92-1	0.001	mg/L		0.044	0.057	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.258	1.09	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		0.0004	<0.0001	----	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		0.1	0.1	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		48.2	0.08	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<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	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		1.17	0.40	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	0.01	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		29.5	22.0	----	----	----
Total Cations	----	0.01	meq/L		27.0	----	----	----	----
Total Cations	----	0.01	meq/L		----	20.5	----	----	----
Ionic Balance	----	0.01	%		4.42	----	----	----	----
Ionic Balance	----	0.01	%		----	3.49	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1705030-001	EW1705030-002	-----	-----	-----
					Result	Result	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		17	4	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	----	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	----	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	----	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	----	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	----	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	----	----	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	----	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				GW06	GW07	----	----	----
Client sampling date / time				04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1705030-001	EW1705030-002	-----	-----	-----
				Result	Result	----	----	----

EP068B: Organophosphorus Pesticides (OP) - Continued

Diazinon	333-41-5	0.5	µg/L	<0.5	<0.5	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	<0.5	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L	<2.0	<2.0	----	----	----
Malathion	121-75-5	0.5	µg/L	<0.5	<0.5	----	----	----
Fenthion	55-38-9	0.5	µg/L	<0.5	<0.5	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	<0.5	----	----	----
Parathion	56-38-2	2.0	µg/L	<2.0	<2.0	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	<0.5	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	<0.5	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	<0.5	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L	<0.5	<0.5	----	----	----
Prothiofos	34643-46-4	0.5	µg/L	<0.5	<0.5	----	----	----
Ethion	563-12-2	0.5	µg/L	<0.5	<0.5	----	----	----
Carbophenothion	786-19-6	0.5	µg/L	<0.5	<0.5	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	<0.5	----	----	----

EP075(SIM)B: Polynuclear Aromatic Hydrocarbons

Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g,h,i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1705030-001	EW1705030-002	-----	-----	-----
					Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		75.2	74.1	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		71.6	73.3	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		23.5	18.1	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		41.3	41.8	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%		54.0	47.1	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		61.2	70.4	----	----	----



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Client sample ID

				GW06	GW07	----	----	----
Client sampling date / time				04-Dec-2017 00:00	04-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1705030-001	EW1705030-002	-----	-----	-----
				Result	Result	----	----	----
EP075(SIM)T: PAH Surrogates - Continued								
Anthracene-d10	1719-06-8	1.0	%	70.1	74.0	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	77.4	84.6	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	2	%	108	113	----	----	----
Toluene-D8	2037-26-5	2	%	103	108	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	88.0	93.4	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Chain of Custody



OSYDNEY
Ph: 02 878
ONOWRA
Ph: 02 442
OIVOLLO
Ph: 02 422

Environmental Division
Wollongong

Work Order Reference
EW1800129



Telephone : 02 42253125

CLIENT: ENRS Pty Ltd		TURNAROUND REQUIREMENTS :		☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY	
OFFICE: 25 River Rd Shoalhaven Heads		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)				Custody Seal (if required)	
PROJECT: SCC West Nowra Stage 4		PROJECT NO.: ENRS0047		ALS QUOTE NO.: ENRS		Free ice / frozen receipt?	
ORDER NUMBER:		PURCHASE ORDER NO.: Use Proj No.		COUNTRY OF ORIGIN:		Random Samp	
PROJECT MANAGER: Rohan Last		CONTACT PH: 0401 518 443				Other common	
SAMPLER: ML		SAMPLER MOBILE: 0403526292		RELINQUISHED BY:		RECEIVED BY:	
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		M. Lemcke			
Email Reports to (will default to PM if no other addresses are listed): lab@enrs.com.au				DATE/TIME:..... 11/01/2018		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):							
COMMENTS/SPECIAL HANDLING/STORAGE REQUIREMENTS:							

[illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Ca 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; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

CERTIFICATE OF ANALYSIS

Work Order : **EW1800129**
Client : **ENVIRONMENT & NATURAL RESOURCE SOLUTIONS**
Contact : RESULTS ADDRESS
Address : 25 River Rd
 Shoalhaven Heads 2535

Telephone : 02 9037 4708
Project : SCC West Nowra Stage 4
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EN/222/17
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 9
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW
Telephone : 02 4225 3125
Date Samples Received : 11-Jan-2018 14:55
Date Analysis Commenced : 12-Jan-2018
Issue Date : 18-Jan-2018 12:36



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
- Surrogate Control Limits

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>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	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.

- EG035: Positive Hg result for EW1800129 #1 has been confirmed by reanalysis
- ED093 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EG050G: Poor spike recovery for Hexavalent Chromium due to matrix interferences(confirmed by re-analysis).
- TDS by method EA-015 may bias high for sample 2 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EK057G: It has been noted that Nitrite is greater than NOx, however this difference is within the limits of experimental variation.
- EN055: Ionic Balance out of acceptable limits for sample EW1704544-1 due to analytes not quantified in this report.
- Amendment (08/01/2018): This report has been amended and re-released to allow the reporting of additional analytical data.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800129-001	EW1800129-002	-----	-----	-----
				Result	Result		----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		5.66	5.55	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3000	2400	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1590	1700	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		504	1070	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		120	27	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		120	27	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		95	26	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		838	756	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		30	47	----	----	----
Magnesium	7439-95-4	1	mg/L		41	41	----	----	----
Sodium	7440-23-5	1	mg/L		436	304	----	----	----
Potassium	7440-09-7	1	mg/L		23	1	----	----	----
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L		28	54	----	----	----
Magnesium	7439-95-4	1	mg/L		38	47	----	----	----
Sodium	7440-23-5	1	mg/L		403	348	----	----	----
Potassium	7440-09-7	1	mg/L		21	2	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.41	0.05	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.196	0.180	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.009	0.012	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	----	----	----

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time				11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EW1800129-001	EW1800129-002	-----	-----	-----	
				Result	Result	----	----	----	
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L	0.418	0.325	----	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.058	0.052	----	----	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	2.62	5.82	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	0.005	0.003	----	----	----	
Barium	7440-39-3	0.001	mg/L	0.250	0.232	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0042	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	0.012	0.014	----	----	----	
Chromium	7440-47-3	0.001	mg/L	0.004	0.006	----	----	----	
Copper	7440-50-8	0.001	mg/L	0.143	0.027	----	----	----	
Manganese	7439-96-5	0.001	mg/L	0.445	0.348	----	----	----	
Lead	7439-92-1	0.001	mg/L	0.010	0.021	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.088	0.504	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	0.0005	<0.0001	----	----	----	
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	----	----	----	
EG050G: Hexavalent Chromium by Discrete Analyser									
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	----	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	35.0	0.04	----	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.02	0.01	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.01	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800129-001	EW1800129-002	-----	-----	-----
				Result	Result		----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L		0.16	0.22	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		28.0	22.4	----	----	----
Total Cations	----	0.01	meq/L		24.4	19.0	----	----	----
Ionic Balance	----	0.01	%		6.84	8.31	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		15	5	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	----	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	----	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	----	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	----	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	----	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	----	----	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800129-001	EW1800129-002	-----	-----	-----
					Result	Result	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	----	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	----	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	----	----	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	----	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	----	----	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	----	----	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	----	----	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				GW06	GW07	----	----	----
Client sampling date / time				11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1800129-001	EW1800129-002	-----	-----	-----
				Result	Result	----	----	----

EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued

Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----

EP080/071: Total Petroleum Hydrocarbons

C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----

EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions

C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----

EP080: BTEXN

Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L	<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----

EP068S: Organochlorine Pesticide Surrogate

Dibromo-DDE	21655-73-2	0.5	%	78.2	104	----	----	----
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Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW06	GW07	----	----	----
Client sampling date / time					11-Jan-2018 00:00	11-Jan-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800129-001	EW1800129-002	-----	-----	-----
					Result	Result	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		67.4	68.4	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		19.6	27.3	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		38.1	56.9	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%		46.6	60.7	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		68.4	81.4	----	----	----
Anthracene-d10	1719-06-8	1.0	%		89.8	88.9	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		78.7	97.1	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		131	126	----	----	----
Toluene-D8	2037-26-5	2	%		117	114	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		106	108	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Chain of Custody



OSYDNEY 277-22
Ph: 02 9784 8555

UNOWRA 413 C
Ph: 02 4423 2066

OWOLLONGON
Ph: 02 4925 3128

Environmental Division
Wollongong
Work Order Reference
EW1800542



Telephone 02 42253125.

CLIENT: ENRS Pty Ltd		TURNAROUND REQUIREMENTS :		☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY															
OFFICE: 25 River Rd Shoalhaven Heads		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)				Custody Seal Intact?															
PROJECT: SCC West Nowra Stage 4		PROJECT NO.: ENRS0047		ALS QUOTE NO.: ENRS		Free ice / frozen ice b receipt?															
ORDER NUMBER:		PURCHASE ORDER NO.: Use Proj No.		COUNTRY OF ORIGIN:		Random Sample Tem															
PROJECT MANAGER: Rohan Last		CONTACT PH: 0401 518 443		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	Other comment:	
1	2	3	4	5	6	7															
1	2	3	4	5	6	7															
SAMPLER: ML		SAMPLER MOBILE: 0403526292		RELINQUISHED BY:		RECEIVED BY:															
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		M. Lemcke																	
Email Reports to (will default to PM if no other addresses are listed): lab@enrs.com.au				DATE/TIME:..... 14/01/2018		DATE/TIME:															
Email Invoice to (will default to PM if no other addresses are listed):						8.2.18															
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL :																					

[illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Speciation bottle; 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; LI = Lugols Iodine Preserved Bottles; TTT = Sterile Sodium Thiosulfate Preserved Bottles.

CERTIFICATE OF ANALYSIS

Work Order	: EW1800542	Page	: 1 of 9
Amendment	: 1		
Client	: ENVIRONMENT & NATURAL RESOURCE SOLUTIONS	Laboratory	: Environmental Division NSW South Coast
Contact	: Mr Rohan Last	Contact	: Aneta Prosaroski
Address	: 25 River Rd Shoalhaven Heads 2535	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 4/13 Geary Pl, North Nowra 2541 Australia NSW
Telephone	: ----	Telephone	: 02 4225 3125
Project	: SCC West Nowra Stage 4	Date Samples Received	: 08-Feb-2018 12:55
Order number	: ENRS0047	Date Analysis Commenced	: 09-Feb-2018
C-O-C number	: ----	Issue Date	: 23-Feb-2018 08:52
Sampler	: Matt L		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 2		
No. of samples analysed	: 2		



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
- Surrogate Control Limits

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>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, 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.

- EG035: Positive Hg result for EW1800542 #1 has been confirmed by reanalysis
- EG020/ED093 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EG050G: Poor spike recovery for Hexavalent Chromium due to matrix interferences(confirmed by re-analysis).
- EK071G: LOR raised for Reactive Phosphorus on sample no:1 due to sample matrix.
- It has been noted that Nitrite is greater than NOx for sample 1, however this difference is within the limits of experimental variation.
- Amendment (22/02/2018): This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The specific data affected includes sample 1 Total P result.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW7	----	----	----
Client sampling date / time					08-Feb-2018 00:00	08-Feb-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800542-001	EW1800542-002	-----	-----	-----
				Result	Result		----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		5.98	5.95	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3370	2340	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1840	1450	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		80	474	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L		217	47	----	----	----
Total Alkalinity as CaCO ₃	----	1	mg/L		217	47	----	----	----
ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA									
Sulfate as SO ₄ - Turbidimetric	14808-79-8	1	mg/L		83	34	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		893	706	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		34	54	----	----	----
Magnesium	7439-95-4	1	mg/L		48	46	----	----	----
Sodium	7440-23-5	1	mg/L		478	355	----	----	----
Potassium	7440-09-7	1	mg/L		29	1	----	----	----
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L		34	54	----	----	----
Magnesium	7439-95-4	1	mg/L		46	46	----	----	----
Sodium	7440-23-5	1	mg/L		465	353	----	----	----
Potassium	7440-09-7	1	mg/L		28	2	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.15	0.09	----	----	----
Arsenic	7440-38-2	0.001	mg/L		0.003	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.290	0.205	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.015	0.012	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		0.002	<0.001	----	----	----

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID		GW6		GW7		----		----		----	
Client sampling date / time				08-Feb-2018 00:00		08-Feb-2018 00:00		----		----		----		----	
Compound		CAS Number	LOR	Unit	EW1800542-001		EW1800542-002		-----		-----		-----		
					Result		Result		----		----		----		
EG020F: Dissolved Metals by ICP-MS - Continued															
Manganese		7439-96-5	0.001	mg/L	0.637		0.336		----		----		----		
Lead		7439-92-1	0.001	mg/L	<0.001		<0.001		----		----		----		
Zinc		7440-66-6	0.005	mg/L	0.069		0.063		----		----		----		
EG020T: Total Metals by ICP-MS															
Aluminium		7429-90-5	0.01	mg/L	0.64		18.5		----		----		----		
Arsenic		7440-38-2	0.001	mg/L	0.004		0.004		----		----		----		
Barium		7440-39-3	0.001	mg/L	0.300		0.279		----		----		----		
Cadmium		7440-43-9	0.0001	mg/L	<0.0001		0.0032		----		----		----		
Cobalt		7440-48-4	0.001	mg/L	0.013		0.014		----		----		----		
Chromium		7440-47-3	0.001	mg/L	<0.001		0.019		----		----		----		
Copper		7440-50-8	0.001	mg/L	0.056		0.041		----		----		----		
Manganese		7439-96-5	0.001	mg/L	0.592		0.337		----		----		----		
Lead		7439-92-1	0.001	mg/L	0.002		0.026		----		----		----		
Zinc		7440-66-6	0.005	mg/L	0.073		0.341		----		----		----		
EG035F: Dissolved Mercury by FIMS															
Mercury		7439-97-6	0.0001	mg/L	<0.0001		<0.0001		----		----		----		
EG035T: Total Recoverable Mercury by FIMS															
Mercury		7439-97-6	0.0001	mg/L	0.0002		<0.0001		----		----		----		
EG050G: Hexavalent Chromium by Discrete Analyser															
Hexavalent Chromium		18540-29-9	0.01	mg/L	<0.01		<0.01		----		----		----		
EK040P: Fluoride by PC Titrator															
Fluoride		16984-48-8	0.1	mg/L	0.2		0.2		----		----		----		
EK055G: Ammonia as N by Discrete Analyser															
Ammonia as N		7664-41-7	0.01	mg/L	52.4		0.04		----		----		----		
EK057G: Nitrite as N by Discrete Analyser															
Nitrite as N		14797-65-0	0.01	mg/L	0.02		<0.01		----		----		----		
EK058G: Nitrate as N by Discrete Analyser															
Nitrate as N		14797-55-8	0.01	mg/L	<0.01		<0.01		----		----		----		
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser															
Nitrite + Nitrate as N		----	0.01	mg/L	<0.01		<0.01		----		----		----		
EK067G: Total Phosphorus as P by Discrete Analyser															
Total Phosphorus as P		----	0.01	mg/L	0.07		0.19		----		----		----		
EK071G: Reactive Phosphorus as P by discrete analyser															



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW7	----	----	----
Client sampling date / time					08-Feb-2018 00:00	08-Feb-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800542-001	EW1800542-002	-----	-----	-----
					Result	Result	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.10	<0.01	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		31.2	21.6	----	----	----
Total Cations	----	0.01	meq/L		27.2	21.9	----	----	----
Ionic Balance	----	0.01	%		6.97	0.88	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		18	3	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	----	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	----	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	----	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	----	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	----	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	----	----	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	----	----	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/L		<0.5	<0.5	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW7	----	----	----
Client sampling date / time					08-Feb-2018 00:00	08-Feb-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800542-001	EW1800542-002	-----	-----	-----
					Result	Result	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	----	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	----	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	----	----	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	----	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	----	----	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	----	----	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	----	----	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	----	----	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW7	----	----	----
Client sampling date / time				08-Feb-2018 00:00	08-Feb-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EW1800542-001	EW1800542-002	-----	-----	-----	
				Result	Result	----	----	----	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----	
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----	
Dibenz(a,h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----	
Benzo(g,h,i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----	
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----	
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----	
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----	
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----	
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----	
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----	
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----	
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----	
^ Total Xylenes	----	2	µg/L	<2	<2	----	----	----	
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----	
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%	80.2	68.0	----	----	----	
EP068T: Organophosphorus Pesticide Surrogate									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW7	----	----	----
Client sampling date / time					08-Feb-2018 00:00	08-Feb-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EW1800542-001	EW1800542-002	-----	-----	-----
					Result	Result	----	----	----
EP068T: Organophosphorus Pesticide Surrogate - Continued									
DEF	78-48-8	0.5	%		103	70.3	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		24.4	26.6	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		57.0	53.0	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%		43.1	38.7	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		71.3	77.6	----	----	----
Anthracene-d10	1719-06-8	1.0	%		86.6	81.4	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		72.5	63.5	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		101	95.3	----	----	----
Toluene-D8	2037-26-5	2	%		105	92.9	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		104	95.6	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

CERTIFICATE OF ANALYSIS

Work Order : **EW1801069**
Client : **ENVIRONMENT & NATURAL RESOURCE SOLUTIONS**
Contact : Mr Rohan Last
Address : 25 River Rd
 Shoalhaven Heads 2535

Telephone : ----
Project : SCC West Nowra Stage 4
Order number : ENRS0047
C-O-C number : ----
Sampler : Matt L
Site : ----
Quote number : EN/222/17
No. of samples received : 4
No. of samples analysed : 4

Page : 1 of 9
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW
Telephone : 02 4225 3125
Date Samples Received : 12-Mar-2018 09:34
Date Analysis Commenced : 13-Mar-2018
Issue Date : 16-Mar-2018 10:19



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
- Surrogate Control Limits

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>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	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.

- EG020/ED093 : It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EG035: Positive Hg result for EW1801069 #1 has been confirmed by reanalysis
- EG050: Poor spike recovery for Hexavalent Chromium due to matrix interferences(confirmed by re-analysis).
- EP080: Particular sample required dilution due to sample matrix . LOR values have been adjusted accordingly.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time					12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----
Compound	CAS Number	LOR	Unit		EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----
					Result	Result	Result	Result	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		6.15	7.07	6.25	5.93	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3310	1970	2560	2480	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1990	1370	1650	1700	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		9550	3530	33	1010	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L		204	240	39	36	----
Total Alkalinity as CaCO ₃	----	1	mg/L		204	240	39	36	----
ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA									
Sulfate as SO ₄ - Turbidimetric	14808-79-8	1	mg/L		78	35	148	28	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		872	466	717	725	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		34	69	43	49	----
Magnesium	7439-95-4	1	mg/L		37	34	26	40	----
Sodium	7440-23-5	1	mg/L		401	221	352	329	----
Potassium	7440-09-7	1	mg/L		24	8	7	1	----
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L		51	77	39	54	----
Magnesium	7439-95-4	1	mg/L		51	37	25	44	----
Sodium	7440-23-5	1	mg/L		406	236	361	349	----
Potassium	7440-09-7	1	mg/L		29	9	7	2	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.02	<0.01	0.09	<0.01	----
Arsenic	7440-38-2	0.001	mg/L		0.010	0.003	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L		0.465	0.159	0.147	0.183	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	0.0001	<0.0001	<0.0001	----
Cobalt	7440-48-4	0.001	mg/L		0.006	0.021	0.020	0.010	----
Chromium	7440-47-3	0.001	mg/L		0.001	<0.001	0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L		<0.001	0.025	<0.001	<0.001	----

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time				12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----	
Compound	CAS Number	LOR	Unit	EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----	
				Result	Result	Result	Result	----	
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L	0.360	0.330	1.09	0.288	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	
Zinc	7440-66-6	0.005	mg/L	0.014	0.133	0.029	0.055	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	21.8	3.47	0.38	14.2	----	
Arsenic	7440-38-2	0.001	mg/L	0.132	0.024	<0.001	0.003	----	
Barium	7440-39-3	0.001	mg/L	1.27	0.250	0.154	0.270	----	
Cadmium	7440-43-9	0.0001	mg/L	0.0010	0.0002	<0.0001	0.0019	----	
Cobalt	7440-48-4	0.001	mg/L	0.065	0.031	0.017	0.012	----	
Chromium	7440-47-3	0.001	mg/L	0.078	0.013	0.005	0.016	----	
Copper	7440-50-8	0.001	mg/L	0.662	0.057	<0.001	0.028	----	
Manganese	7439-96-5	0.001	mg/L	1.08	0.533	1.12	0.320	----	
Lead	7439-92-1	0.001	mg/L	0.231	0.038	<0.001	0.021	----	
Zinc	7440-66-6	0.005	mg/L	0.658	0.257	0.020	0.246	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	0.0020	<0.0001	<0.0001	<0.0001	----	
EG050G: Hexavalent Chromium by Discrete Analyser									
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.1	0.2	0.2	0.1	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	43.3	4.48	0.60	0.04	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	0.02	<0.01	<0.01	<0.01	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.02	0.04	<0.01	<0.01	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.04	0.04	<0.01	<0.01	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	12.0	0.89	0.02	0.19	----	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time					12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----
Compound	CAS Number	LOR	Unit		EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----
					Result	Result	Result	Result	----
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		30.3	18.7	24.1	21.8	----
Total Cations	----	0.01	meq/L		25.1	----	----	----	----
Total Cations	----	0.01	meq/L		----	16.0	19.8	20.1	----
Ionic Balance	----	0.01	%		9.33	----	----	----	----
Ionic Balance	----	0.01	%		----	7.52	9.83	4.02	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		26	22	8	4	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		0.24	<0.05	<0.05	<0.05	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4,4'-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4,4'-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4,4'-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time					12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----
Compound	CAS Number	LOR	Unit		EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----
					Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued									
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time				12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----
Compound	CAS Number	LOR	Unit	EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----
				Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<100	<20	<20	<20	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	µg/L	<100	300	<100	<100	----
C29 - C36 Fraction	----	50	µg/L	<50	190	<50	<50	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	490	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<100	<20	<20	<20	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<100	<20	<20	<20	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	----
>C16 - C34 Fraction	----	100	µg/L	<100	440	<100	<100	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	440	<100	<100	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<5	<1	<1	<1	----
Toluene	108-88-3	2	µg/L	<5	<2	<2	<2	----
Ethylbenzene	100-41-4	2	µg/L	<5	<2	<2	<2	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<5	<2	3	<2	----
ortho-Xylene	95-47-6	2	µg/L	<5	<2	<2	<2	----
^ Total Xylenes	----	2	µg/L	<5	<2	3	<2	----
^ Sum of BTEX	----	1	µg/L	<5	<1	3	<1	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.5	%	85.6	94.8	67.7	122	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GW6	GW6-D	GW6-S	GW7	----
Client sampling date / time					12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	12-Mar-2018 00:00	----
Compound	CAS Number	LOR	Unit		EW1801069-001	EW1801069-002	EW1801069-003	EW1801069-004	-----
					Result	Result	Result	Result	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		95.1	94.9	64.0	92.8	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		18.8	25.6	19.4	23.1	----
2-Chlorophenol-D4	93951-73-6	1.0	%		47.6	51.6	41.5	47.9	----
2,4,6-Tribromophenol	118-79-6	1.0	%		51.3	51.0	39.4	48.8	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		62.2	63.2	64.8	61.8	----
Anthracene-d10	1719-06-8	1.0	%		82.8	90.8	71.0	96.8	----
4-Terphenyl-d14	1718-51-0	1.0	%		79.8	100	66.4	90.2	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		106	109	108	108	----
Toluene-D8	2037-26-5	2	%		106	108	106	109	----
4-Bromofluorobenzene	460-00-4	2	%		101	107	103	109	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Appendix E: Standing Water Level (SWL) Data

(GW6 & GW7 for the period 4/12/2017 - 9/01/2018)

Appendix E

Groundwater Level (mAHD) December 2017 - January 2018

