

Our Ref: 217501_LET_001.docx

14 February 2018

Lithgow City Council
 PO Box 19,
 180 Mort Street
 Lithgow NSW 2790

Attention: Nigel Campbell, Waste & Recycling Coordinator

ENVIRONMENTAL MONITORING OF PORTLAND WASTE DISPOSAL DEPOT

Geolyse has completed annual groundwater monitoring at Portland Waste Disposal Depot, located off the Portland Cullen Bullen Road, approximately 2 km north of Portland, NSW.

Groundwater Levels

Groundwater was gauged at six (6) groundwater monitoring wells across the site. Groundwater gauging data is included in **Table 1** (attached), and elevation trends are shown on **Figure 1**. Observations were as follows:

- Depths to groundwater ranged from 0.05 metres below ground level (mbgl) at MP9, to 23.30 mbgl at MP5. Corrected groundwater elevations ranged from 904.85 metres Australian Height Datum (mAHD) at MP9, to 914.70 mAHD at MP5.
- Inference of groundwater elevations, calculated from available survey data from installed groundwater monitoring wells, indicates a flow direction to the north-west.

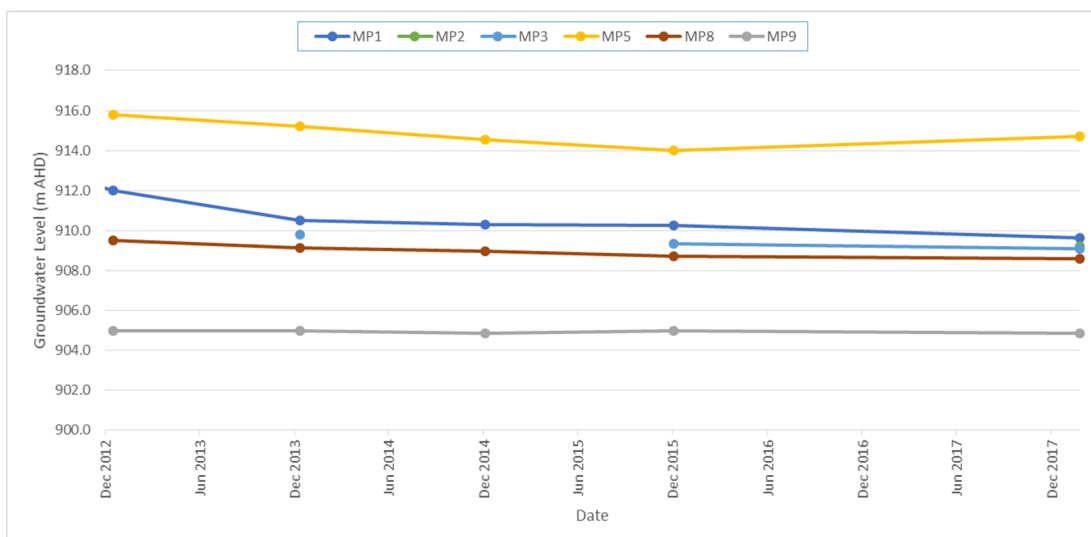
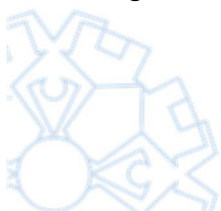


Figure 1: Portland Waste Disposal Depot – Groundwater Elevations

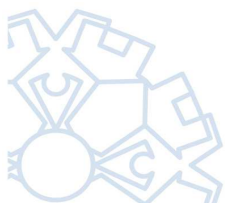


Groundwater Quality

Groundwater samples were able to be collected from wells MP2, MP5, MP8 and MP9. Samples were couriered to SGS Laboratories in Alexandria, NSW, who are NATA accredited to perform the scheduled analysis. Results of analysis are included in **Table 2** (attached), and laboratory certificates have also been appended to this letter.

Groundwater quality has been assessed by comparison to criteria (where available) adopted from Australian and New Zealand Environment and Conservation Council (ANZECC) Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 – Primary Industries: Water quality for irrigation and general water use*.

- Laboratory measured pH ranged from 5.1 at MP2 to 7.0 at MP5 and MP9. Groundwater at MP2 was below the guideline range considered suitable for pumping, irrigation and stock watering (6.0 to 8.5 pH units).
- Electrical conductivity (EC) ranged from 1,500 $\mu\text{S}/\text{cm}$ at piezometer MP5 to 3,600 $\mu\text{S}/\text{cm}$ at piezometer MP9. Corresponding total dissolved solid (TDS) concentrations (respectively 1,005 mg/L to 2,412 mg/L) identifies the surface water did not exceed the livestock watering 'loss of production' TDS tolerance limit for the most sensitive livestock category, poultry (3,000 mg/L, ANZECC & ARMCANZ, 2000).
- Total alkalinity in groundwater ranged from less than the laboratory limit of reporting (LOR) of 5 mg/L at MP2 to 710 mg/L at MP9. Groundwater alkalinity at MP5, MP8 and MP9 was above the guideline hardness value for potential fouling of waters (350 mg/L).
- Groundwater chloride concentrations ranged from 59 mg/L at MP5 to 330 mg/L at MP9. All concentrations were below the guideline value for protection of moderately sensitive crops (350 mg/L).
- Fluoride concentrations in groundwater ranged from 0.19 mg/L at MP8, to 0.25 mg/L at MP9. All concentrations were below the guideline value of 1 mg/L for long term irrigation use (up to 100 years).
- Sulfate concentrations in groundwater ranged from 420 mg/L at MP5 to 1,100 mg/L at MP9.
- Calcium concentrations ranged from 69 mg/L at MP2 to 360 mg/L at MP8.
- Magnesium concentrations ranged from 53 mg/L at MP2 to 220 mg/L at MP9.
- Potassium concentrations ranged from 6.0 mg/L at MP9 to 10.0 mg/L at MP2.
- Concentrations of sodium ranged from 86 mg/L at MP5, to 230 mg/L at MP9. Sodium concentrations did not exceed the guideline level for irrigation to moderately sensitive crops (<230 mg/L).
- Total organic carbon (TOC) in groundwater ranged from 6.3 mg/L at MP9 to 24 mg/L at MP2.
- Ammonia concentrations in groundwater ranged from 0.06 mgN/L at MP8 and MP9, to 0.83 mgN/L at MP2.
- Nitrate concentrations ranged from below the laboratory limit of reporting (LOR) of 0.025 mgN/L at MP8 and MP9, to 70 mgN/L at MP2.





- Iron concentrations ranged from below the laboratory LOR of 5 µg/L at MP5 and MP9, to 50 µg/L at MP2. No concentrations of iron were recorded to exceed the long-term (up to 100 years) irrigation guideline concentration of 200 µg/L.
- Manganese concentrations ranged from 260 µg/L at MP5 to 3,200 µg/L at MP8. Manganese concentrations at all locations exceeded the long-term (up to 100 years) irrigation guideline concentration of 200 µg/L.
- Total phenols were below the laboratory LOR of 0.01 mg/L at all groundwater monitoring points.
- Organochlorine pesticides were below respective laboratory LORs at all groundwater monitoring points.

Surface Water Discharge Monitoring

The surface water monitoring point SW1 was inspected in January 2018. No discharge was occurring at the time of inspection, and no evidence of discharge(s) having occurred prior was apparent.

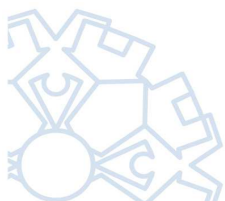
The next routine monitoring for groundwater is scheduled for January 2019. Surface water monitoring is required to take place any calendar month when a surface water discharge is recorded at an interval of not less than once every 6 months.

Please do not hesitate to contact us with any questions or comments you may have regarding this report.

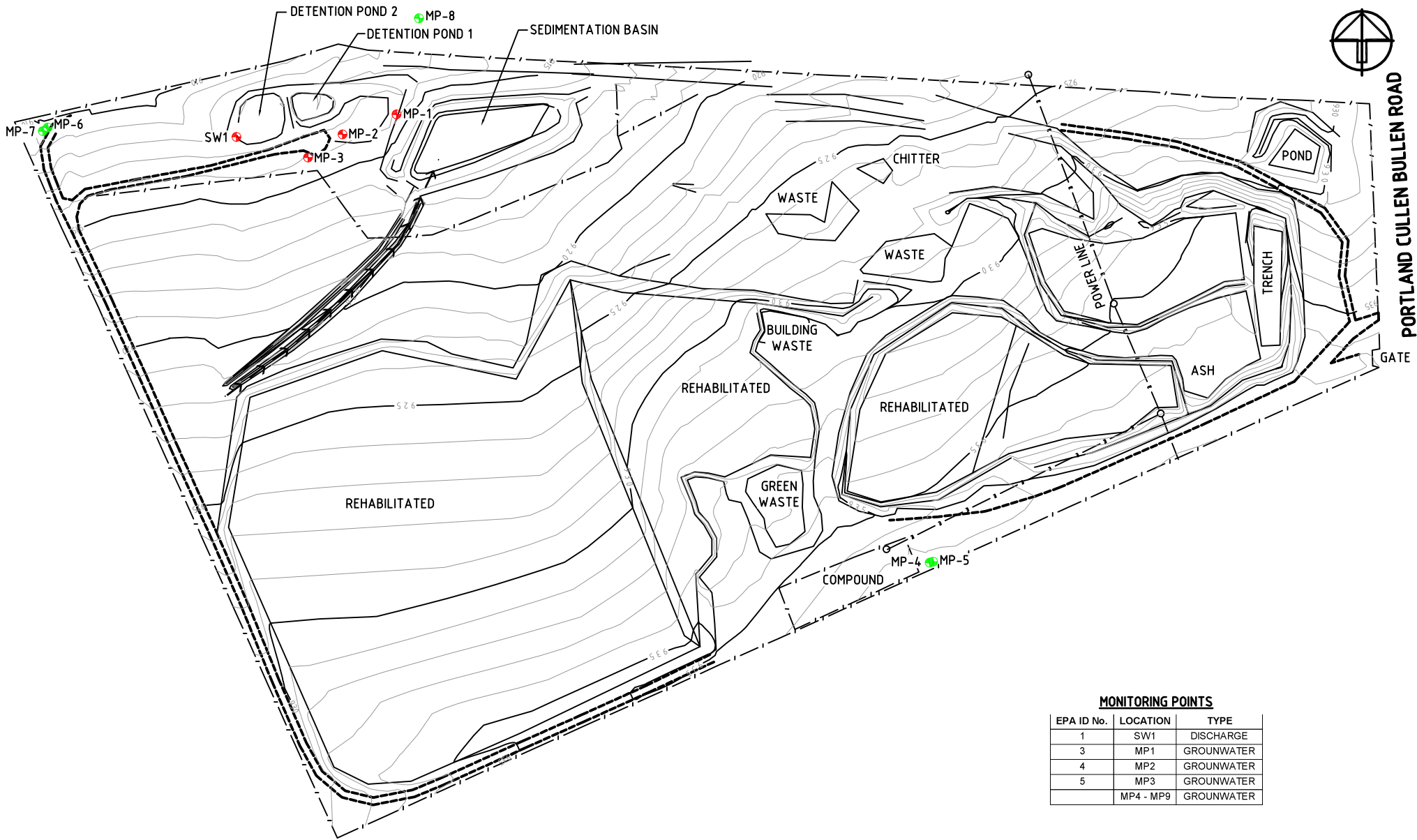
Yours faithfully
Geolyse Pty Ltd

BRENDAN STUART
Environmental Scientist

No. of Attachments – 4: Environmental Monitoring Point Locations
Table 1 – Groundwater Level Measurements
Table 2 – Results of Laboratory Analyses – January 2018
SGS Laboratories Analytical Reports – January 2018



MP-9



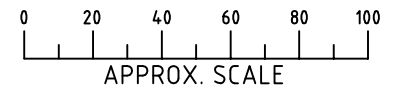
PORTLAND CULLEN BULLEN ROAD

MONITORING POINTS

| EPA ID No. | LOCATION | TYPE |
|------------|-----------|------------|
| 1 | SW1 | DISCHARGE |
| 3 | MP1 | GROUNWATER |
| 4 | MP2 | GROUNWATER |
| 5 | MP3 | GROUNWATER |
| | MP4 - MP9 | GROUNWATER |

LEGEND:

- EPA MONITORING POINT
- ADDITIONAL MONITORING POINT




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 Fax. (02) 6361 8178
 orange@geolyse.com
 www.geolyse.com

| No | DATE | DEVELOPER CHECK | PI CHECK | DETAILS |
|----|----------|-----------------|----------|------------------|
| A | 15/09/08 | - | - | ISSUED TO CLIENT |
| B | 11/05/11 | LRP | AGB | ISSUED TO CLIENT |
| C | 01/11/12 | MDH | KBF | ISSUED TO CLIENT |

PROJECT
 PORTLAND WASTE DISPOSAL DEPOT
 FILE REFERENCE: 0:\Projects\202334_01B_EV01.dwg

APPROVAL AUTHORITY
 ENVIRONMENTAL PROTECTION AUTHORITY
 EPL: 10936

CLIENT

 LITHGOW CITY COUNCIL
 180 MORT STREET,
 LITHGOW NSW 2790

DRAWING
 ENVIRONMENTAL MONITORING POINTS
 PROJECT NUMBER: 202334 DRAWING NUMBER: 01C_EV01 REV: C
 SOURCE: CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
 CONSULTING LAND, ENGINEERING AND MINING SURVEYORS



TABLE 1: PORTLAND WASTE DISPOSAL DEPOT - GROUNDWATER LEVEL RESULTS

Ground Water Levels: 24-Jan-18

Piezometer Details:

| | Ground Elev (mAHD) | Stickup (m) | Elevation Top PVC (mAHD) | Date | Measured (m) | GWL (mAHD) | Well Depth (m) | Well Base (mAHD) | Water Column (m) |
|-----|--------------------|-------------|--------------------------|------------|--------------|------------|----------------|------------------|------------------|
| MP1 | 913.700 | 0.40 | 914.100 | 24/01/2018 | 4.46 | 909.64 | 6.0 | 908.09 | 1.55 |
| MP2 | 913.600 | 0.20 | 913.800 | 24/01/2018 | 4.56 | 909.24 | 5.0 | 908.80 | 0.44 |
| MP3 | 914.200 | 0.60 | 914.800 | 24/01/2018 | 5.68 | 909.12 | 5.8 | 909.00 | 0.12 |
| MP5 | 937.200 | 0.80 | 938.000 | 24/01/2018 | 23.30 | 914.70 | 61.3 | 876.70 | 38.00 |
| MP8 | 911.800 | 0.50 | 912.300 | 24/01/2018 | 3.68 | 908.62 | 21.5 | 890.79 | 17.83 |
| MP9 | 903.800 | 1.10 | 904.900 | 24/01/2018 | 0.05 | 904.85 | 16.7 | 888.20 | 16.65 |

Definitions:

- Stickup: Height of piezometer pipe above ground surface.
- Ground Elev: Actual elevation of ground at the piezometer relative to an arbitrary datum. All ground elevations are measured to the same datum, hence Piezo GWLs are relative to each other.
- GWL: Actual elevation of groundwater at the piezometer relative to an arbitrary datum.
- NMWL: No Measured Water Level
- Measured: Depth of groundwater measured from the top of the piezometer pipe.

| Date | MP1 | | MP2 | | MP3 | | MP5 | | MP8 | | MP9 | |
|-----------|----------|------------|----------|------------|----------|------------|----------|------------|--------------|------------|----------|------------|
| | Measured | GWL (mAHD) | Measured | GWL (mAHD) | Measured | GWL (mAHD) | Measured | GWL (mAHD) | Measured | GWL (mAHD) | Measured | GWL (mAHD) |
| 1-Jun-10 | 4.21 | 909.89 | NMWL | | NMWL | | 30.20 | 907.80 | 4.48 | 907.82 | 0.00 | 904.90 |
| 15-Dec-10 | 1.23 | 912.87 | NMWL | | NMWL | | 27.37 | 910.63 | 3.44 | 908.86 | -0.05 | 904.95 |
| 29-Jun-11 | 1.30 | 912.80 | NMWL | | 5.65 | 909.15 | 25.67 | 912.33 | 3.62 | 908.68 | -0.05 | 904.95 |
| 27-Jul-11 | 1.57 | 912.53 | NMWL | | NMWL | | NMWL | | NMWL | | NMWL | |
| 6-Dec-11 | 1.14 | 912.96 | 3.85 | 909.95 | NMWL | | 25.40 | 912.60 | Bore Damaged | | -0.05 | 904.95 |
| 13-Jun-12 | 0.70 | 913.40 | NMWL | | 4.48 | 910.32 | NMWL | | NMWL | | NMWL | |
| 16-Dec-12 | 2.09 | 912.01 | NMWL | | NMWL | | 22.22 | 915.78 | 2.77 | 909.53 | -0.05 | 904.95 |
| 11-Dec-13 | 3.57 | 910.53 | NMWL | | 4.98 | 909.82 | 22.79 | 915.21 | 3.16 | 909.14 | -0.05 | 904.95 |
| 4-Dec-14 | 3.80 | 910.30 | NMWL | | NMWL | | 23.43 | 914.57 | 3.33 | 908.97 | 0.05 | 904.85 |
| 3-Dec-15 | 3.84 | 910.26 | NMWL | | 5.45 | 909.35 | 23.97 | 914.03 | 3.57 | 908.73 | -0.05 | 904.95 |
| 24-Jan-18 | 4.46 | 909.64 | 4.56 | 909.24 | 5.68 | 909.12 | 23.30 | 914.70 | 3.68 | 908.62 | 0.05 | 904.85 |

**TABLE 2: PORTLAND WASTE DISPOSAL DEPOT - RESULTS OF LABORATORY ANALYSIS
JANUARY 2018**



| Group | Analyte | LOR | Units | Sample ID Criteria | MP-2 | MP-5 | MP-8 | MP-9 |
|---------------------|-------------------------------|-------|----------|-----------------------|---------------------------|------------|------------|------------|
| | | | | | Sample Date 24/01/2018 | 24/01/2018 | 24/01/2018 | 24/01/2018 |
| Physical Parameters | pH (Lab) | 0.1 | pH Units | 6.0 - 8.5 | PS 5.1 | PS 7 | PS 6.8 | PS 7 |
| | Electrical Conductivity (Lab) | 2 | µS/cm | 4478 | 1900 | 1500 | 3400 | 3600 |
| Alkalinity | Total Alkalinity as CaCO3 | 5 | mg/L | 350 | < 5 | 420 | 630 | 710 |
| Anions | Chloride | 1 | mg/L | 350 | 260 | 59 | 310 | 330 |
| | Fluoride | 0.1 | mg/L | 1 | 0.37 | 0.2 | 0.19 | 0.25 |
| | Sulfate (SO4) | 1 | mg/L | - | 250 | 420 | 1000 | 1100 |
| Cations | Calcium (Ca) | 0.2 | mg/L | 1000 | 69 | 170 | 360 | 350 |
| | Magnesium (Mg) | 0.1 | mg/L | - | 53 | 63 | 170 | 220 |
| | Potassium (K) | 0.1 | mg/L | - | 10 | 9.1 | 7.5 | 6 |
| | Sodium (Na) | 0.5 | mg/L | 230 | 210 | 86 | 220 | 230 |
| Forms of Carbon | Total Organic Carbon | 0.2 | mg/L | - | 24 | 11 | 8 | 6.3 |
| Nutrients | Ammonia (NH3) as N | 0.01 | mg/L | - | 0.83 | 0.07 | 0.06 | 0.06 |
| | Nitrate (NO3) as N | 0.005 | mg/L | - | 70 | 0.096 | < 0.005 | - |
| | Nitrate (NO3) as N | 0.025 | mg/L | - | - | - | - | < 0.025 |
| Trace Metals | Iron (Fe) | 5 | µg/L | 200 | 50 | < 5 | 5 | < 5 |
| | Manganese (Mn) | 1 | µg/L | 200 | 1600 | 260 | 3200 | 1100 |
| Phenolics | Total Phenols | 0.01 | mg/L | - | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

TABLE 2: PORTLAND WASTE DISPOSAL DEPOT - RESULTS OF LABORATORY ANALYSIS
JANUARY 2018



| Group | Analyte | LOR | Units | Criteria | Sample ID | MP-2 | MP-5 | MP-8 | MP-9 |
|---------------|-------------------------|-----|-------|----------|-------------|------------|------------|------------|------------|
| | | | | | Sample Date | 24/01/2018 | 24/01/2018 | 24/01/2018 | 24/01/2018 |
| | | | | | PS | PS | PS | PS | PS |
| OC Pesticides | Aldrin | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Alpha BHC | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Alpha Chlordane | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Alpha Endosulfan | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Beta BHC | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Beta Endosulfan | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Delta BHC | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Dieldrin | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Endosulfan sulphate | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Endrin | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Endrin aldehyde | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Endrin ketone | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Heptachlor | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Heptachlor epoxide | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Hexachlorobenzene (HCB) | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Lindane (gamma BHC) | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Methoxychlor | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | p,p'-DDD | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | p,p'-DDE | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | p,p'-DDT | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | o,p'-DDD | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | o,p'-DDT | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | o,p'-DDE | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Gamma Chlordane | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | trans-Nonachlor | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Isodrin | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| | Mirex | 0.1 | µg/L | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |

mg/L milligrams per litre
µg/L micrograms per litre
µS/cm microsiemens per centimetre
LOR limit of reporting
PS primary sample
Criteria Criteria adopted from *Australian and New Zealand Environment and Conservation Council (ANZECC) Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 'Primary Industries: Water quality for irrigation and general water use', 2000*
 within criteria
 criteria exceeded

CLIENT DETAILS

Contact **Brendan Stuart**
 Client **GEOLYSE PTY LIMITED**
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 NSW 2800**

Telephone **61 2 68841525**
 Facsimile **(Not specified)**
 Email **bstuart@geolyse.com**

Project **217501 - Portland GD**
 Order Number **(Not specified)**
 Samples **4**

LABORATORY DETAILS

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 Laboratory **SGS Alexandria Environmental**
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 Alexandria NSW 2015**

Telephone **+61 2 8594 0400**
 Facsimile **+61 2 8594 0499**
 Email **au.environmental.sydney@sgs.com**

SGS Reference **SE174757 R0**
 Date Received **25 Jan 2018**
 Date Reported **05 Feb 2018**

COMMENTS

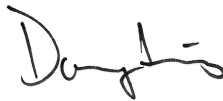
Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

Ion Chromatography - The Limit of Reporting (LOR) has been raised for NO3-N due to high conductivity of the sample requiring dilution.

SIGNATORIES



Bennet Lo
 Senior Organic Chemist/Metals Chemis



Dong Liang
 Metals/Inorganics Team Leader



Ly Kim Ha
 Organic Section Head

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------|-------|-----|--------------|--------------|--------------|--------------|
| Sample Number | | | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
| Sample Matrix | | | Water | Water | Water | Water |
| Sample Date | | | 24 Jan 2018 | 24 Jan 2018 | 24 Jan 2018 | 24 Jan 2018 |
| Sample Name | | | MP-2 | MP-5 | MP-8 | MP-9 |

OC Pesticides in Water Method: AN420 Tested: 30/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|-------------------------|-------|-----|--------------|--------------|--------------|--------------|
| Hexachlorobenzene (HCB) | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Alpha BHC | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Lindane (gamma BHC) | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Heptachlor | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aldrin | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Beta BHC | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Delta BHC | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Heptachlor epoxide | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| o,p'-DDE | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Alpha Endosulfan | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Gamma Chlordane | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Alpha Chlordane | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| trans-Nonachlor | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| p,p'-DDE | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Dieldrin | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endrin | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| o,p'-DDD | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| o,p'-DDT | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Beta Endosulfan | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| p,p'-DDD | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| p,p'-DDT | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endosulfan sulphate | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endrin aldehyde | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Methoxychlor | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endrin ketone | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Isodrin | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Mirex | µg/L | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |

Surrogates

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---|-------|-----|--------------|--------------|--------------|--------------|
| Tetrachloro-m-xylene (TCMX) (Surrogate) | % | - | 69 | 76 | 75 | 66 |

Total Phenolics in Water Method: AN289 Tested: 1/2/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------|-------|------|--------------|--------------|--------------|--------------|
| Total Phenols | mg/L | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

Anions by Ion Chromatography in Water Method: AN245 Tested: 30/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|-------------------------|-------|-------|--------------|--------------|--------------|--------------|
| Fluoride | mg/L | 0.1 | 0.37 | 0.20 | 0.19 | 0.25 |
| Chloride | mg/L | 1 | 260 | 59 | 310 | 330 |
| Nitrate Nitrogen, NO3-N | mg/L | 0.005 | 70 | 0.096 | <0.005 | <0.025† |
| Sulfate, SO4 | mg/L | 1 | 250 | 420 | 1000 | 1100 |

Alkalinity Method: AN135 Tested: 29/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------------------|-------|-----|--------------|--------------|--------------|--------------|
| Total Alkalinity as CaCO3 | mg/L | 5 | <5 | 420 | 630 | 710 |

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------|-------|-----|--------------|--------------|--------------|--------------|
| Sample Number | | | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
| Sample Matrix | | | Water | Water | Water | Water |
| Sample Date | | | 24 Jan 2018 | 24 Jan 2018 | 24 Jan 2018 | 24 Jan 2018 |
| Sample Name | | | MP-2 | MP-5 | MP-8 | MP-9 |

pH in water Method: AN101 Tested: 29/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|-----------|----------|-----|--------------|--------------|--------------|--------------|
| pH** | pH Units | 0.1 | 5.1 | 7.0 | 6.8 | 7.0 |

Conductivity and TDS by Calculation - Water Method: AN106 Tested: 29/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------------|-------|-----|--------------|--------------|--------------|--------------|
| Conductivity @ 25 C | µS/cm | 2 | 1900 | 1500 | 3400 | 3600 |

Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 29/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|--|-------|------|--------------|--------------|--------------|--------------|
| Ammonia Nitrogen, NH ₃ as N | mg/L | 0.01 | 0.83 | 0.07 | 0.06 | 0.06 |

Forms of Carbon Method: AN190 Tested: 29/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|------------------------------|-------|-----|--------------|--------------|--------------|--------------|
| Total Organic Carbon as NPOC | mg/L | 0.2 | 24 | 11 | 8.0 | 6.3 |

Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 30/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------|-------|-----|--------------|--------------|--------------|--------------|
| Calcium, Ca | mg/L | 0.2 | 69 | 170 | 360 | 350 |
| Magnesium, Mg | mg/L | 0.1 | 53 | 63 | 170 | 220 |
| Potassium, K | mg/L | 0.1 | 10 | 9.1 | 7.5 | 6.0 |
| Sodium, Na | mg/L | 0.5 | 210 | 86 | 220 | 230 |

Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 30/1/2018

| Parameter | Units | LOR | SE174757.001 | SE174757.002 | SE174757.003 | SE174757.004 |
|---------------|-------|-----|--------------|--------------|--------------|--------------|
| Iron, Fe | µg/L | 5 | 50 | <5 | 5 | <5 |
| Manganese, Mn | µg/L | 1 | 1600 | 260 | 3200 | 1100 |

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared to the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Alkalinity Method: ME-(AU)-[ENV]AN135

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery |
|---------------------------|--------------|-------|-----|----|----------|---------------|
| Total Alkalinity as CaCO3 | LB140373 | mg/L | 5 | <5 | 10% | 105% |

Ammonia Nitrogen by Discrete Analyser (AquaKem) Method: ME-(AU)-[ENV]AN291

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery |
|--|--------------|-------|------|-------|----------|---------------|
| Ammonia Nitrogen, NH ₃ as N | LB140364 | mg/L | 0.01 | <0.01 | 0% | 98% |

Anions by Ion Chromatography in Water Method: ME-(AU)-[ENV]AN245

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery |
|--------------------------------------|--------------|-------|-------|--------|----------|---------------|
| Fluoride | LB140399 | mg/L | 0.1 | <0.10 | | 93% |
| Chloride | LB140399 | mg/L | 1 | <0.05 | | 94% |
| Nitrate Nitrogen, NO ₃ -N | LB140399 | mg/L | 0.005 | <0.005 | | 94% |
| Sulfate, SO ₄ | LB140399 | mg/L | 1 | <1.0 | 1% | 93% |

Conductivity and TDS by Calculation - Water Method: ME-(AU)-[ENV]AN106

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery |
|---------------------|--------------|-------|-----|----|----------|---------------|
| Conductivity @ 25 C | LB140348 | µS/cm | 2 | <2 | 0% | 102% |

Forms of Carbon Method: ME-(AU)-[ENV]AN190

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery | MS %Recovery |
|------------------------------|--------------|-------|-----|------|----------|---------------|--------------|
| Total Organic Carbon as NPOC | LB140333 | mg/L | 0.2 | <0.2 | 1 - 4% | 99% | 102% |

Metals in Water (Dissolved) by ICPOES Method: ME-(AU)-[ENV]AN320

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery | MS %Recovery |
|---------------|--------------|-------|-----|------|----------|---------------|--------------|
| Calcium, Ca | LB140386 | mg/L | 0.2 | <0.2 | 0% | 97% | 97% |
| Magnesium, Mg | LB140386 | mg/L | 0.1 | <0.1 | 1% | 101% | 97% |
| Potassium, K | LB140386 | mg/L | 0.1 | <0.1 | 0% | 89% | 102% |
| Sodium, Na | LB140386 | mg/L | 0.5 | <0.5 | 0% | 96% | 92% |

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

OC Pesticides in Water Method: ME-(AU)-[ENV]AN420

| Parameter | QC Reference | Units | LOR | MB | LCS %Recovery |
|-------------------------|--------------|-------|-----|------|---------------|
| Hexachlorobenzene (HCB) | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Alpha BHC | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Lindane (gamma BHC) | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Heptachlor | LB140473 | µg/L | 0.1 | <0.1 | 118% |
| Aldrin | LB140473 | µg/L | 0.1 | <0.1 | 112% |
| Beta BHC | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Delta BHC | LB140473 | µg/L | 0.1 | <0.1 | 118% |
| Heptachlor epoxide | LB140473 | µg/L | 0.1 | <0.1 | NA |
| o,p'-DDE | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Alpha Endosulfan | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Gamma Chlordane | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Alpha Chlordane | LB140473 | µg/L | 0.1 | <0.1 | NA |
| trans-Nonachlor | LB140473 | µg/L | 0.1 | <0.1 | NA |
| p,p'-DDE | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Dieldrin | LB140473 | µg/L | 0.1 | <0.1 | 123% |
| Endrin | LB140473 | µg/L | 0.1 | <0.1 | 111% |
| o,p'-DDD | LB140473 | µg/L | 0.1 | <0.1 | NA |
| o,p'-DDT | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Beta Endosulfan | LB140473 | µg/L | 0.1 | <0.1 | NA |
| p,p'-DDD | LB140473 | µg/L | 0.1 | <0.1 | NA |
| p,p'-DDT | LB140473 | µg/L | 0.1 | <0.1 | 122% |
| Endosulfan sulphate | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Endrin aldehyde | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Methoxychlor | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Endrin ketone | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Isodrin | LB140473 | µg/L | 0.1 | <0.1 | NA |
| Mirex | LB140473 | µg/L | 0.1 | <0.1 | NA |

Surrogates

| Parameter | QC Reference | Units | LOR | MB | LCS %Recovery |
|---|--------------|-------|-----|-----|---------------|
| Tetrachloro-m-xylene (TCMX) (Surrogate) | LB140473 | % | - | 70% | 63% |

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

pH in water Method: ME-(AU)-[ENV]AN101

| Parameter | QC Reference | Units | LOR | LCS %Recovery |
|-----------|--------------|----------|-----|---------------|
| pH** | LB140348 | pH Units | 0.1 | 100% |

Total Phenolics in Water Method: ME-(AU)-[ENV]AN289

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery | MS %Recovery |
|---------------|--------------|-------|------|-------|----------|---------------|--------------|
| Total Phenols | LB140598 | mg/L | 0.01 | <0.01 | 6% | 100% | 95% |

Trace Metals (Dissolved) in Water by ICPMS Method: ME-(AU)-[ENV]AN318

| Parameter | QC Reference | Units | LOR | MB | DUP %RPD | LCS %Recovery |
|---------------|--------------|-------|-----|----|----------|---------------|
| Iron, Fe | LB140388 | µg/L | 5 | <5 | 0% | 110% |
| Manganese, Mn | LB140388 | µg/L | 1 | <1 | 2% | 118% |

METHOD

METHODOLOGY SUMMARY

| | |
|-------|---|
| AN020 | Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B. |
| AN101 | pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+. |
| AN106 | Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B. |
| AN135 | Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135 |
| AN190 | TOC and DOC in Water: A homogenised micro portion of sample is injected into a heated reaction chamber packed with an oxidative catalyst that converts organic carbon to carbon dioxide. The CO ₂ is measured using a non-dispersive infrared detector. The process is fully automated in a commercially available analyser. If required a sugar value can be calculated from the TOC result. Reference APHA 5310 B. |
| AN190 | Chemical oxygen demand can be calculated/estimated based on the O ₂ /C relation as 2.67*NPOC (TOC). This is an estimate only and the factor will vary with sample matrix so results should be interpreted with caution. |
| AN245 | Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO ₂ , NO ₃ and SO ₄ are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B |
| AN289 | Analysis of Total Phenols in Soil Sediment and Water: Steam distillable phenols react with 4-aminoantipyrine at pH 7.9±0.1 in the presence of potassium ferricyanide to form a coloured antipyrine dye analysed by Discrete Analyser. Reference APHA 5530 B/D. |
| AN291 | Ammonia in solution reacts with hypochlorite ions from Sodium Dichloroisocyanate, and salicylate in the presence of Sodium Nitroprusside to form indophenol blue and measured at 670 nm by Discrete Analyser. |
| AN318 | Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A. |
| AN320 | Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components . |
| AN320 | Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B. |
| AN420 | SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D). |

METHOD

METHODOLOGY SUMMARY

Calculation

Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported . APHA4500CO2 D.

FOOTNOTES

| | | | |
|-----|--|-----|--|
| IS | Insufficient sample for analysis. | LOR | Limit of Reporting |
| LNR | Sample listed, but not received. | ↑↓ | Raised or Lowered Limit of Reporting |
| * | NATA accreditation does not cover the performance of this service. | QFH | QC result is above the upper tolerance |
| ** | Indicative data, theoretical holding time exceeded. | QFL | QC result is below the lower tolerance |
| | | - | The sample was not analysed for this analyte |
| | | NVL | Not Validated |

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

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