QUARTERLY GROUNDWATER MONITORING

THE SCONE WASTE LANDFILL

Noblet Road
Scone
NSW 2337

Upper Hunter Shire Council

DLH1186_H000894

October 2016
**PROJECT NAME**
Scone Waste Landfill Groundwater Monitoring

**PROJECT ID**
DLH1186

**DOCUMENT CONTROL NUMBER**
H000894

**PREPARED FOR**
Upper Hunter Shire Council

**APPROVED FOR RELEASE BY**
Stephen Challinor

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<td>09.11.2016</td>
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# ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ACM</td>
<td>Asbestos Containing Material</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>ANZECC</td>
<td>Australian and New Zealand Environment and Conservation Council</td>
</tr>
<tr>
<td>AST</td>
<td>Above-ground Storage Tank</td>
</tr>
<tr>
<td>ASS</td>
<td>Acid Sulfate Soil</td>
</tr>
<tr>
<td>B(a)P</td>
<td>Benzo(a)Pyrene</td>
</tr>
<tr>
<td>BGL</td>
<td>Below Ground Level</td>
</tr>
<tr>
<td>BH</td>
<td>Borehole</td>
</tr>
<tr>
<td>BTEX</td>
<td>Benzene, Toluene, Ethyl Benzene, Xylene</td>
</tr>
<tr>
<td>COC</td>
<td>Chain of Custody documentation</td>
</tr>
<tr>
<td>CLM</td>
<td>Contaminated Land Management</td>
</tr>
<tr>
<td>DA</td>
<td>Development Application</td>
</tr>
<tr>
<td>DECC</td>
<td>Department of Environment and Climate Change (NSW)</td>
</tr>
<tr>
<td>DECCW</td>
<td>Department of Environment, Climate Change and Water (NSW)</td>
</tr>
<tr>
<td>DLA</td>
<td>DLA Environmental Services</td>
</tr>
<tr>
<td>DP</td>
<td>Deposited Plan</td>
</tr>
<tr>
<td>DQO</td>
<td>Data Quality Objective</td>
</tr>
<tr>
<td>EC</td>
<td>Electrical Conductivity</td>
</tr>
<tr>
<td>EIL</td>
<td>Ecological Investigation Level</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EPA</td>
<td>Environment Protection Authority (NSW)</td>
</tr>
<tr>
<td>ESL</td>
<td>Ecological Screening Level</td>
</tr>
<tr>
<td>HIL</td>
<td>Health-Based Investigation Level</td>
</tr>
<tr>
<td>LOR</td>
<td>Limit of Reporting</td>
</tr>
<tr>
<td>MW</td>
<td>Monitoring Well</td>
</tr>
<tr>
<td>NATA</td>
<td>National Association of Testing Authorities, Australia</td>
</tr>
<tr>
<td>NEPC</td>
<td>National Environment Protection Council</td>
</tr>
<tr>
<td>NEPM</td>
<td>National Environment Protection Measure</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NRMMC</td>
<td>Natural Resource Management Ministerial Council</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>OCP</td>
<td>Organochlorine Pesticides</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environmental and Heritage</td>
</tr>
<tr>
<td>OPP</td>
<td>Organophosphorus Pesticides</td>
</tr>
<tr>
<td>OH&amp;S</td>
<td>Occupational Health and Safety</td>
</tr>
<tr>
<td>PAH</td>
<td>Polycyclic Aromatic Hydrocarbons</td>
</tr>
<tr>
<td>PCB</td>
<td>Polychlorinated Biphenyls</td>
</tr>
<tr>
<td>PID</td>
<td>Photo-Ionisation Detector</td>
</tr>
<tr>
<td>PQL</td>
<td>Practical Quantification Limit</td>
</tr>
<tr>
<td>QA/QC</td>
<td>Quality Assurance and Quality Control</td>
</tr>
<tr>
<td>RAP</td>
<td>Remedial Action Plan</td>
</tr>
<tr>
<td>RPD</td>
<td>Relative Percentage Difference</td>
</tr>
<tr>
<td>SAC</td>
<td>Site Acceptance Criteria</td>
</tr>
<tr>
<td>SAQP</td>
<td>Sampling Analysis and Quality Plan</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>SWL</td>
<td>Standing Water Level</td>
</tr>
<tr>
<td>TCLP</td>
<td>Toxicity Characteristic Leaching Procedure</td>
</tr>
<tr>
<td>TRH</td>
<td>Total Recoverable Hydrocarbons</td>
</tr>
<tr>
<td>UCL</td>
<td>Upper Confidence Limit</td>
</tr>
<tr>
<td>UST</td>
<td>Underground Storage Tank</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>WHS</td>
<td>Work Health Safety</td>
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</table>
TABLE OF CONTENTS

1.0 INTRODUCTION .................................................................................................................. 1
  1.1 General ................................................................................................................................ 1
  1.2 Scope of Works ..................................................................................................................... 1

2.0 MONITORING PARAMETERS .............................................................................................. 2

3.0 SAMPLING METHODOLOGY .............................................................................................. 4
  3.1 Groundwater Sampling ......................................................................................................... 4

4.0 RESULTS .............................................................................................................................. 5

5.0 DISCUSSION ......................................................................................................................... 10

6.0 CONCLUSIONS ................................................................................................................... 12

7.0 REFERENCES ....................................................................................................................... 13

FIGURES

Figure 1 Site location regional
Figure 2 Site location local
Figure 3 Site layout with sample locations

ATTACHMENTS

Attachment 1 NATA certified analytical results
Attachment 2 YSI water quality meter calibration certificate
Attachment 3 Data log
1.0 INTRODUCTION

1.1 General

DLA Environmental Services (DLA) was commissioned by Upper Hunter Shire Council to undertake annual and quarterly surface and groundwater monitoring at The Scone Waste Landfill located on Noblet Rd, Scone. It is anticipated that quarterly monitoring will be undertaken in April, July and October with annual reporting undertaken in the January reporting period.

Quarterly water monitoring was undertaken on 6th October 2016 by staff of DLA.

1.2 Scope of Works

The scope of work provided by Upper Hunter Shire Council indicates that annual and quarterly groundwater monitoring is required at the following groundwater sampling locations:

- MWA
- MWB
- MWC
- MWD (landfill leachate monitoring well)
- MWE

Refer to Figure 3: Site Layout with Sample Locations
2.0 MONITORING PARAMETERS

The following sample analysis parameters and monitoring frequency were provided by Upper Hunter Shire Council for the Groundwater Wells. Threshold Criteria are primarily sourced from Australian and New Zealand guidelines for fresh and marine water quality (ANZECC) 2000 95% trigger values and National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 2013.

Table 1: Analytes, Threshold Criteria and Monitoring Frequency for Groundwater Monitoring Wells.

<table>
<thead>
<tr>
<th>Analytes</th>
<th>Units</th>
<th>Threshold Criteria</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NEPM 2013 and ANZECC 2000 Fresh Water 95%</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3[^f]</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9[^d]</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Organochlorine pesticides</td>
<td>mg/L</td>
<td>0.00001[^f]</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410[^g]</td>
<td>Quarterly</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5 – 8</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9[^g]</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Total organic carbon</td>
<td>mg/L</td>
<td>4</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Electrical conductivity (EC)</td>
<td>µS/cm</td>
<td>NA</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>mg/L</td>
<td>NA</td>
<td>Yearly</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand</td>
<td>mg/L</td>
<td>NA</td>
<td>Yearly</td>
</tr>
<tr>
<td>Phosphate</td>
<td>mg/L</td>
<td>0.015[^d]</td>
<td>Yearly</td>
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<tr>
<td>Arsenic III &amp; V</td>
<td>mg/L</td>
<td>0.024 (III), 0.013 (V)</td>
<td>Yearly</td>
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<tr>
<td>Aluminium</td>
<td>mg/L</td>
<td>0.055 (pH&gt; 6.5)</td>
<td>Yearly</td>
</tr>
<tr>
<td>Barium</td>
<td>mg/L</td>
<td>NA</td>
<td>Yearly</td>
</tr>
<tr>
<td>Cobalt</td>
<td>mg/L</td>
<td>0.09[^m]</td>
<td>Yearly</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>0.0014</td>
<td>Yearly</td>
</tr>
<tr>
<td>Chromium VI</td>
<td>mg/L</td>
<td>0.001[^d]</td>
<td>Yearly</td>
</tr>
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Table 1: Analytes, Threshold Criteria and Monitoring Frequency for Groundwater Monitoring Wells (cont…)

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria NEPM 2013 and ANZECC 2000 Fresh Water</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium (total)</td>
<td>mg/L</td>
<td>0.001</td>
<td>Yearly</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>0.0034</td>
<td>Yearly</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>0.0006</td>
<td>Yearly</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>0.008</td>
<td>Yearly</td>
</tr>
<tr>
<td>TPH</td>
<td>mg/L</td>
<td>0.6</td>
<td>Yearly</td>
</tr>
<tr>
<td>Benzene</td>
<td>mg/L</td>
<td>0.95</td>
<td>Yearly</td>
</tr>
<tr>
<td>Toluene</td>
<td>mg/L</td>
<td>0.18</td>
<td>Yearly</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>mg/L</td>
<td>0.08</td>
<td>Yearly</td>
</tr>
<tr>
<td>CVCs/VOCCs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Total</td>
<td>mg/L</td>
<td>NA</td>
<td>Yearly</td>
</tr>
<tr>
<td>- Tetrachlorethene (TCE)</td>
<td>mg/L</td>
<td>NA</td>
<td>Yearly</td>
</tr>
<tr>
<td>- 1,1,1-Trichloroethane (TCA)</td>
<td>mg/L</td>
<td>6500 (1,1,2 TCA)</td>
<td>Yearly</td>
</tr>
<tr>
<td>- Tetrachloroethene (PCE)</td>
<td>mg/L</td>
<td>0.05</td>
<td>Yearly</td>
</tr>
<tr>
<td>- 1,2-Dichloroethene</td>
<td>mg/L</td>
<td>0.03</td>
<td>Yearly</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>mg/L</td>
<td>0.0003</td>
<td>Yearly</td>
</tr>
<tr>
<td>PCBs</td>
<td>mg/L</td>
<td>0.0003</td>
<td>Yearly</td>
</tr>
<tr>
<td>PAHs</td>
<td>mg/L</td>
<td>0.016</td>
<td>Yearly</td>
</tr>
<tr>
<td>OPPs</td>
<td>mg/L</td>
<td>0.00002</td>
<td>Yearly</td>
</tr>
</tbody>
</table>

A - Trigger value for Aroclor 1254 used in absence of trigger value for total PCBs
B - Trigger value for Naphthalene used in absence of reliable trigger value for total PAHs
C - Trigger value of Azinphos methyl used in absence of reliable trigger value for total OPP
D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCAZN (2000) for further guidance
E - Interim working level, in absence of reliable trigger value
F - Trigger value for DDT used in absence of trigger value for total OCP
G - Filterable Reactive Phosphate
L – ANZECC 2000 Low reliability trigger value
M – ANZECC 2000 Moderate reliability trigger value
N - NEPM 2013 drinking water criteria
P - Australian Drinking Water Guidelines 2011
Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009
3.0 SAMPLING METHODOLOGY

3.1 Groundwater Sampling

Groundwater samples were collected from five well locations. Purging and sampling of monitoring wells was conducted in accordance with the NEPM 2013 Guidelines for the Assessment and Management of Groundwater Contamination (NSW DEC, 2007) and the Murray-Darling Basin Groundwater Quality Sampling Guidelines.

Wells were purged with a low flow peristaltic pump or disposable bailer whilst being measured for physiochemical stability to indicate the flow of formation water. Physiochemical properties were measured using a YSI Quatro Pro Plus Water Quality Meter and a flow through cell. Stable conditions were indicated by monitoring the measured parameters for three consecutive readings.

Groundwater samples were collected into laboratory prepared sample containers for specific analytes, i.e. into a combination of plastic unpreserved, plastic preserved, glass amber unpreserved and preserved glass vials. All samples were collected and filled into the respective sample containers so no head space remained in the sample container, with no loss of any preservation agents, where present. Groundwater samples for metals were field filtered with a 0.45 micron filter prior to placement into acid preserved plastic containers. All samples were then placed immediately into a chilled esky to prevent the loss of potential volatile components.

Decontamination procedures between sampling events and sampling locations are outlined below.

Sampling equipment was cleaned prior to sampling and between sample locations to prevent cross contamination. The cleaning procedure included:

- Washing and brush scrub with phosphate free laboratory grade detergent;
- Rinsing with water of a potable quality;
- Rinsing with deionised water; and,
- Disposable Teflon tubing was used with the low flow pump and was replaced between sample locations (Groundwater Sampling Only).

It is opinion of DLA that decontamination procedures were appropriate during groundwater sampling and that no cross contamination can be inferred.
4.0 RESULTS

All wells were sampled during the October 2016 sampling event, results are detailed below.

Refer to Table 4a – Table 4e for results. Refer to Figure 3 for sampling locations.

Table 4a – Groundwater Results Comparison October 2016

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria (mg/L)</th>
<th>MWA Jan 2016</th>
<th>MWA Apr 2016</th>
<th>MWA July 2016</th>
<th>MWA Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>630</td>
<td>700</td>
<td>620</td>
<td>580</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>430</td>
<td>460</td>
<td>460</td>
<td>430</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>7800</td>
<td>7300</td>
<td>7900</td>
<td>7400</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>ND</td>
<td>0.1</td>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3&lt;sup&gt;E&lt;/sup&gt;</td>
<td>ND</td>
<td>ND</td>
<td>0.021</td>
<td>ND</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>1100</td>
<td>1300</td>
<td>1200</td>
<td>1100</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.01</td>
<td>0.009</td>
<td>0.021</td>
<td>0.02</td>
</tr>
<tr>
<td>OCP</td>
<td>mg/L</td>
<td>0.00001&lt;sup&gt;F&lt;/sup&gt;</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410&lt;sup&gt;Q&lt;/sup&gt;</td>
<td>4</td>
<td>3.1</td>
<td>3.7</td>
<td>4.4</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5 – 8</td>
<td>7</td>
<td>7</td>
<td>7.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>2200</td>
<td>2800</td>
<td>2200</td>
<td>2100</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.2</td>
<td>0.006</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>0.24</td>
<td>0.62</td>
<td>0.36</td>
<td>0.50</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>34</td>
<td>43</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>mg/L</td>
<td>4</td>
<td>4.2</td>
<td>3</td>
<td>6.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>0.25</td>
<td>ND</td>
<td>0.03</td>
<td>0.22</td>
</tr>
<tr>
<td>EC</td>
<td>µS/cm</td>
<td>NA</td>
<td>23000</td>
<td>18000</td>
<td>21000</td>
<td>21000</td>
</tr>
</tbody>
</table>

Samples highlighted in **Bold** exceed threshold criteria
ND = No Detection above Laboratory LOR
D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance
E - Interim working level, in absence of reliable trigger value
F - Trigger value for DDT used in absence of trigger value for total OCP
Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009
NA – Not Applicable
Table 4b – Groundwater Results Comparison October 2016

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria (mg/L)</th>
<th>MWB Jan 2016</th>
<th>MWB Apr 2016</th>
<th>MWB July 2016</th>
<th>MWB Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>650</td>
<td>720</td>
<td>650</td>
<td>600</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>370</td>
<td>380</td>
<td>390</td>
<td>360</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>6000</td>
<td>6300</td>
<td>6100</td>
<td>6000</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>ND</td>
<td>0.3</td>
<td>0.24</td>
<td>0.22</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3D</td>
<td>ND</td>
<td>0.02</td>
<td>0.008</td>
<td>0.006</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>810</td>
<td>880</td>
<td>820</td>
<td>830</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9C</td>
<td>0.012</td>
<td>0.007</td>
<td>0.008</td>
<td>0.008</td>
</tr>
<tr>
<td>OCP</td>
<td>mg/L</td>
<td>0.00001F</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410Q</td>
<td>3.5</td>
<td>2.6</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5 – 8</td>
<td>7</td>
<td>7.1</td>
<td>7.1</td>
<td>6.9</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>1700</td>
<td>2300</td>
<td>1700</td>
<td>1800</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9Q</td>
<td>0.15</td>
<td>ND</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>1.3</td>
<td>1.3</td>
<td>0.95</td>
<td>1.1</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>69</td>
<td>61</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>mg/L</td>
<td>4</td>
<td>7</td>
<td>4</td>
<td>7.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>0.31</td>
<td>ND</td>
<td>ND</td>
<td>0.14</td>
</tr>
<tr>
<td>EC</td>
<td>µS/c</td>
<td>NA</td>
<td>18000</td>
<td>15000</td>
<td>16000</td>
<td>17000</td>
</tr>
</tbody>
</table>

Samples highlighted in **Bold** exceed threshold criteria
ND = No Detection above Laboratory LOR
D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance
E - Interim working level, in absence of reliable trigger value
F - Trigger value for DDT used in absence of trigger value for total OCP
Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009
NA – Not Applicable
### Table 4c – Groundwater Results Comparison October 2016

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria (mg/L)</th>
<th>MWC Jan 2016</th>
<th>MWC Apr 2016</th>
<th>MWC July 2016</th>
<th>MWC Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>56</td>
<td>290</td>
<td>55</td>
<td>67</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>750</td>
<td>660</td>
<td>730</td>
<td>630</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>630</td>
<td>3700</td>
<td>610</td>
<td>770</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>0.34</td>
<td>0.3</td>
<td>0.24</td>
<td>0.34</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3&lt;sup&gt;E&lt;/sup&gt;</td>
<td>ND</td>
<td>0.038</td>
<td>0.006</td>
<td>ND</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>110</td>
<td>420</td>
<td>93</td>
<td>120</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9&lt;sup&gt;O&lt;/sup&gt;</td>
<td>4.9</td>
<td>3.1</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td>OCP</td>
<td>mg/L</td>
<td>0.00001&lt;sup&gt;F&lt;/sup&gt;</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410&lt;sup&gt;Q&lt;/sup&gt;</td>
<td>0.9</td>
<td>1.4</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
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<td>7.2</td>
<td>7.2</td>
<td>7.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>590</td>
<td>1900</td>
<td>580</td>
<td>620</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9&lt;sup&gt;Q&lt;/sup&gt;</td>
<td>0.12</td>
<td>ND</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>ND</td>
<td>4.9</td>
<td>0.15</td>
<td>ND</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>300</td>
<td>220</td>
<td>220</td>
<td>180</td>
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<tr>
<td>Total Organic Carbon (TOC)</td>
<td>mg/L</td>
<td>4</td>
<td>21</td>
<td>9</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>EC</td>
<td>μS/cm</td>
<td>NA</td>
<td>4300</td>
<td>9600</td>
<td>3300</td>
<td>3900</td>
</tr>
</tbody>
</table>

Samples highlighted in **Bold** exceed threshold criteria

ND = No Detection above Laboratory LOR

D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance

E - Interim working level, in absence of reliable trigger value

F - Trigger value for DDT used in absence of trigger value for total OCP

Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009

NA – Not Applicable
Table 4d – Groundwater Results Comparison October 2016

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria (mg/L)</th>
<th>MWD (leachate) Jan 2016</th>
<th>MWD (leachate) Apr 2016</th>
<th>MWD (leachate) July 2016</th>
<th>MWD (leachate) Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>170</td>
<td>160</td>
<td>250</td>
<td>210</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>1200</td>
<td>2200</td>
<td>1200</td>
<td>1600</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>1000</td>
<td>2600</td>
<td>1000</td>
<td>1600</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>0.32</td>
<td>0.3</td>
<td>0.14</td>
<td>0.27</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3&lt;sup&gt;E&lt;/sup&gt;</td>
<td>0.33</td>
<td>2.2</td>
<td>0.52</td>
<td>1.2</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>110</td>
<td>230</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.87</td>
<td>0.45</td>
<td>0.960</td>
<td>0.6</td>
</tr>
<tr>
<td>OCP</td>
<td>mg/L</td>
<td>0.00001&lt;sup&gt;F&lt;/sup&gt;</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410&lt;sup&gt;Q&lt;/sup&gt;</td>
<td>110</td>
<td>180</td>
<td>120</td>
<td>140</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5 – 8</td>
<td>7.3</td>
<td>7.7</td>
<td>7.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>690</td>
<td>1900</td>
<td>630</td>
<td>1000</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9&lt;sup&gt;D&lt;/sup&gt;</td>
<td>110</td>
<td>210</td>
<td>80</td>
<td>150</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>18</td>
<td>35</td>
<td>140</td>
<td>110</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>mg/L</td>
<td>4</td>
<td>140</td>
<td>290</td>
<td>140</td>
<td>200</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>0.47</td>
<td>ND</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>EC</td>
<td>µS/cm</td>
<td>NA</td>
<td>5800</td>
<td>9600</td>
<td>5200</td>
<td>7800</td>
</tr>
</tbody>
</table>

Samples highlighted in **Bold** exceed threshold criteria
ND = No Detection above Laboratory LOR
D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance
E - Interim working level, in absence of reliable trigger value
F - Trigger value for DDT used in absence of trigger value for total OCP
Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009
NA – Not Applicable

As MWD is within the perched landfill leachate water table, the Threshold Criteria are only applicable as indicators of general water quality for comparison to the wells surrounding the landfill. Exceedances of the Threshold Criteria for MWD are expected and do not indicate contamination is leaving the site.
### Table 4e – Groundwater Results Comparison October 2016

<table>
<thead>
<tr>
<th>Sampling Parameter</th>
<th>Units</th>
<th>Threshold Criteria (mg/L)</th>
<th>MWE Jan 2016</th>
<th>MWE Apr 2016</th>
<th>MWE July 2016</th>
<th>MWE Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg/L</td>
<td>NA</td>
<td>80</td>
<td>67</td>
<td>57</td>
<td>61</td>
</tr>
<tr>
<td>Alkalinity (total)</td>
<td>mg/L</td>
<td>NA</td>
<td>750</td>
<td>890</td>
<td>970</td>
<td>900</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>NA</td>
<td>850</td>
<td>640</td>
<td>470</td>
<td>560</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>NA</td>
<td>0.35</td>
<td>0.5</td>
<td>0.30</td>
<td>0.41</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0.019</td>
<td>0.034</td>
<td>0.021</td>
<td>0.012</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>NA</td>
<td>79</td>
<td>72</td>
<td>66</td>
<td>67</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9&lt;sup&gt;0&lt;/sup&gt;</td>
<td>0.23</td>
<td>0.24</td>
<td>0.43</td>
<td>0.110</td>
</tr>
<tr>
<td>OCP</td>
<td>mg/L</td>
<td>0.00001&lt;sup&gt;f&lt;/sup&gt;</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/L</td>
<td>410&lt;sup&gt;0&lt;/sup&gt;</td>
<td>1.1</td>
<td>0.9</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td>pH</td>
<td>pH</td>
<td>6.5 – 8</td>
<td>7.4</td>
<td>7.6</td>
<td>7.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>NA</td>
<td>690</td>
<td>840</td>
<td>610</td>
<td>650</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9&lt;sup&gt;0&lt;/sup&gt;</td>
<td>0.12</td>
<td>0.026</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>0.7</td>
<td>ND</td>
<td>0.01</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>NA</td>
<td>200</td>
<td>160</td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>mg/L</td>
<td>4</td>
<td>10</td>
<td>7</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total phenolics</td>
<td>mg/L</td>
<td>0.32</td>
<td>0.02</td>
<td>ND</td>
<td>ND</td>
<td>0.01</td>
</tr>
<tr>
<td>EC</td>
<td>µS/c</td>
<td>NA</td>
<td>4600</td>
<td>3200</td>
<td>3100</td>
<td>3600</td>
</tr>
</tbody>
</table>

Samples highlighted in **Bold** exceed threshold criteria

ND = No Detection above Laboratory LOR

D – Trigger value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance

E - Interim working level, in absence of reliable trigger value

F - Trigger value for DDT used in absence of trigger value for total OCP

Q – Poor (acceptable) drinking water criteria, World Health Organisation Guidelines for Drinking-water Quality 2009

NA – Not Applicable
5.0 DISCUSSION

Due to the site's topography, the inferred hydraulic gradient is generally to the west. Wells MWA, MWB, and MWC are located down-hydraulic gradient of the landfill. Well MWE is considered to be up-hydraulic gradient of the landfill. Well MWD is located within the perched landfill water table, being the leachate within the landfill.

The water sampled from well MWD is landfill leachate and as such the Threshold Criteria is not used as a comparison, only as an indicator of current conditions. MWD is to be used as a general indicator of water quality within the landfill for comparison to the external monitoring wells.

The following exceedances of the Threshold Criteria occurred in the October 2016 sampling event:

- **MWC** exceeded the Manganese Threshold Criteria (1.9 mg/L) with a concentration of 5.6 mg/L. This is an increase from the July 2016 concentration of 5.4 mg/L and is the highest reading to date. Well MWD, the leachate well, had a minor detect of manganese, providing no indication that the Manganese is sourced from the landfill. Well MWE up-hydraulic gradient of MWC and MWD also had a minor detection reported for Manganese. The Manganese may be migrating onto the site through the local groundwater.

- Nitrate in MWB exceeded the Threshold Criteria (0.7 mg/L) with a concentration of 1.1 mg/L. This is an increase from the 0.95 mg/L reported in July 2016. Exceedances of nitrate have been consistent in MWB since October 2016. Well MWD the leachate well, had minor detection of Nitrate, giving no indication that the Nitrate in the affected wells is sourced from the landfill. The Nitrate may be migrating onto the site from the farmland to the north through the local groundwater.

- Exceedances of the Threshold Criteria (4 mg/L) for TOC occurred in wells MWA, MWB, MWC and MWE. MWA exceeded the Threshold Criteria (4 mg/L) with a TOC reading of 6.2 mg/L, increasing slightly from the July 2016 reading of 6.1 mg/L. MWB decreased to 6.6 mg/L from the July 2016 sampling event of 7.6 mg/L. MWC has exceeded the Threshold criteria (4 mg/L) consistently since October 2015 with the past two readings being the highest recorded exceedance (24 mg/L). MWE has exceeded the Threshold criteria (4 mg/L) consistently since October 2015 with the past two readings being the highest recorded exceedance (16 mg/L). The Threshold Criteria used for TOC is intended for drinking water, not groundwater. Due to the magnitude of the exceedances and the intention of the Threshold Criteria used, these exceedances are regarded as minor. The TOC concentration in MWE indicates that TOC is likely to be elevated in the local groundwater.
The following changes and detections occurred in the landfill leachate well MWD;

- Ammonia concentration has increased to 150 mg/L from the July 2016 concentration of 80 mg/L and has consistently been substantially higher than in the surrounding wells;

- Iron concentration has decreased to a minor detect from the July 2016 concentration of 0.52 mg/L.

- TOC concentration has increased to 200 mg/L from the July 2016 sampling event (140 mg/L).

All other analytes in all other wells reported detections which were within the Threshold Criteria.

Refer to Attachment 3 – Data Log

The data will be viewed on a trending basis as more results become available.
6.0 CONCLUSIONS

The results of laboratory analysis of the samples collected from the Scone Waste Landfill during the October 2016 quarterly sampling event confirmed several exceedances of the Threshold Criteria in the wells external to the landfill. The Threshold Criteria are sourced from the ANZECC 2000 Guidelines for Fresh Water 95% level of protection, NEPM 2013 and Australian Drinking Water Guidelines 2011.

The following analytes exceeded the Threshold Criteria during the October 2016 sampling event; Manganese in MWC, Nitrate in MWC, TOC in MWA, MWB, MWC and MWE. There were no other exceedances of the Threshold Criteria in the wells surrounding the landfill.

Some exceedances have been explained by local conditions or regarded as minor due to the criteria being Australian Drinking Water Guidelines. Trending of these analytes over time may indicate a seasonal fluctuation of regional groundwater conditions. All remaining exceedances are in MWD which is the leachate monitoring well. Exceeding concentrations in MWD are substantially higher than other wells, this indicates that it is unlikely that releases of landfill leachate into the local groundwater are occurring.

The elevated concentrations of Manganese, Nitrate, TOC in the landfill external wells does not indicate the concentrations are due to the landfill leachate, future testing and trending of data will allow for appropriate comparisons. Further monitoring may reveal the source and extent of elevated concentrations of particular analytes. As more data becomes available, it will become clearer which analytes are consistently elevated and may allow for determining the source of contamination.

The next water sampling event will be the annual monitoring which will be undertaken in January 2017.
7.0 REFERENCES

- Australian and New Zealand Guidelines for the Management of Contaminated Sites (ANZECC/NHMRC 1992);
- Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000);
- Chapman, G A, Murphy, C L, Tille, P J, Atkinson, G and Morse, R J, Sydney Soil Landscapes Map, Series 9130 (1989);
- Contaminated Land Management Act 1997 (NSW);
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA 2011);
- Contaminated Sites: Guidelines on Duty to Report Contamination under the Contamination Land Management Act 1997 (NSW DECC, 2009);
- Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination (NSW DEC, 2007);
- Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report (NSW EPA 1999);
- Contaminated Sites: Sampling Design Guidelines (NSW EPA 1995);
- Environmental Guidelines: Solid Waste Landfills (NSW EPA, 1996);
- Health - Based Soil Investigation Levels, Imray, P & Langley, A, National Environmental Health Forum Monographs, Soil Series No. 2 (2nd Ed), South Australian Health Commission (NEHF 1998b);
- National Environment Protection (Assessment of Site Contamination) Measure (No.1) (NEPC, 2013);
- Storage and Handling of Dangerous Goods Code of Practice 2005;
- Pacific Southwest, Region 9 Regional Screening Levels (US EPA, 2014);
- Work Health and Safety Act 2011 (NSW) and associated regulations.
- R.W. Young and others, Ferruginous weathering under cool temperate climates during the Late Pleistocene in southeastern Australia, Zeitschrift fur Geomorphologie, 38(1), 1994,
- Potassium in Drinking-water Background document for development of WHO Guidelines for Drinking-water Quality, World Health Organization, 2009
FIGURE 1 – SITE LOCATION REGIONAL
FIGURE 3 - SITE LAYOUT WITH SAMPLE LOCATIONS
ATTACHMENT 1 – NATA CERTIFIED ANALYTICAL RESULTS
## CLIENT DETAILS

<table>
<thead>
<tr>
<th>Contact</th>
<th>Stephen Challinor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>DLA ENVIRONMENTAL SERVICES PTY LTD</td>
</tr>
<tr>
<td>Address</td>
<td>42b Church St Maitland NSW 2320</td>
</tr>
<tr>
<td>Telephone</td>
<td>61 2 4933 0001</td>
</tr>
<tr>
<td>Facsimile</td>
<td>61 2 98709999</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:stephen.challinor@dlaenvironmental.com.au">stephen.challinor@dlaenvironmental.com.au</a></td>
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<tr>
<td>Project</td>
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<td>Order Number</td>
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## LABORATORY DETAILS

<table>
<thead>
<tr>
<th>Manager</th>
<th>Huong Crawford</th>
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<tr>
<td>Laboratory</td>
<td>SGS Alexandria Environmental</td>
</tr>
<tr>
<td>Address</td>
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</tr>
<tr>
<td>Telephone</td>
<td>+61 2 8594 0400</td>
</tr>
<tr>
<td>Facsimile</td>
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<td>Email</td>
<td><a href="mailto:au.environmental.sydney@sgs.com">au.environmental.sydney@sgs.com</a></td>
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## COMMENTS

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

## SIGNATORIES

- **Dong Liang**
  Metals/Inorganics Team Leader

- **Kamrul Ahsan**
  Senior Chemist

- **Ly Kim Ha**
  Organic Section Head
## Analytical Results

### OC Pesticides in Water [AN400/AN420]

**Tested:** 10/10/2016

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<td>Alpha BHC</td>
<td>µg/L</td>
<td>0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
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<td>Lindane (gamma BHC)</td>
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<td>Aldrin</td>
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<td>o,p'-DDE</td>
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<td>&lt;0.1</td>
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<td>Beta Endosulfan</td>
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<td>&lt;0.1</td>
<td>&lt;0.1</td>
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<td>p,p'-DDD</td>
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<td>Endosulfan sulphate</td>
<td>µg/L</td>
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<td>Methoxychlor</td>
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<td>Isodrin</td>
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<td>Mirex</td>
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## Total Phenolics in Water [AN289]  
**Tested: 10/10/2016**

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<td>SE157863.003</td>
<td>SE157863.004</td>
<td>SE157863.005</td>
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<tr>
<td>Total Phenols</td>
<td>mg/L</td>
<td>0.01</td>
<td>0.22</td>
<td>0.14</td>
<td>&lt;0.01</td>
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### Forms of Carbon [AN190]  Tested: 10/10/2016

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<td>Total Organic Carbon as NPOC</td>
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<td>SE157863.003</td>
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<tr>
<td>6.2</td>
<td>6.6</td>
<td>24</td>
<td>200</td>
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Ammonia Nitrogen by Discrete Analyser (Aquakem) [AN291]  Tested: 10/10/2016

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<tbody>
<tr>
<td>Ammonia Nitrogen, NH₃ as N</td>
<td>mg/L</td>
<td>0.01</td>
<td>0.14</td>
<td>0.09</td>
<td>0.04</td>
<td>150</td>
<td>0.04</td>
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<td>Chloride</td>
<td>mg/L</td>
<td>7400</td>
<td>6000</td>
<td>770</td>
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<td>Sulphate, SO4</td>
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<td>37</td>
<td>69</td>
<td>180</td>
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<td>Fluoride</td>
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<td>0.22</td>
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<td>Nitrate Nitrogen, NO3-N</td>
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## pH in water [AN101]

Tested: 10/10/2016

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<tr>
<td>pH</td>
<td>No unit</td>
<td>-</td>
<td>6.8</td>
<td>6.9</td>
<td>7.1</td>
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Conductivity and TDS by Calculation - Water [AN106]  Tested: 10/10/2016

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<tbody>
<tr>
<td>Conductivity @ 25 C</td>
<td>µS/cm</td>
<td>21000</td>
<td>17000</td>
<td>3900</td>
<td>7800</td>
<td>3600</td>
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<tr>
<td>Total Dissolved Solids (by calculation)</td>
<td>mg/L</td>
<td>12000</td>
<td>10000</td>
<td>2400</td>
<td>4700</td>
<td>2100</td>
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# ANALYTICAL RESULTS

## Alkalinity [AN135]

**Tested: 11/10/2016**

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<tbody>
<tr>
<td>Bicarbonate Alkalinity as CaCO3</td>
<td>mg/L</td>
<td>5</td>
<td>430</td>
<td>360</td>
<td>630</td>
<td>1600</td>
<td>900</td>
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<td>Carbonate Alkalinity as CaCO3</td>
<td>mg/L</td>
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<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
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<tr>
<td>Hydroxide Alkalinity as CaCO3</td>
<td>mg/L</td>
<td>5</td>
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<tr>
<td>Phenolphthalein Alkalinity as CaCO3*</td>
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<td>5</td>
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<td>&lt;5</td>
<td>&lt;5</td>
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<tr>
<td>Total Alkalinity as CaCO3</td>
<td>mg/L</td>
<td>5</td>
<td>430</td>
<td>360</td>
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<td>1600</td>
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### Acidity and Free CO2 [AN140]  Tested: 11/10/2016

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<tr>
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</tr>
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<td>MWE WATER</td>
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<tr>
<td>6/10/2016</td>
<td>200</td>
<td>150</td>
<td>86</td>
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## Metals in Water (Dissolved) by ICPOES [AN320/AN321]

**Tested:** 11/10/2016

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<tbody>
<tr>
<td>Calcium, Ca</td>
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<td>0.1</td>
<td>580</td>
<td>600</td>
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<td>210</td>
<td>81</td>
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<td>Magnesium, Mg</td>
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<td>0.1</td>
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Trace Metals (Dissolved) in Water by ICPMS [AN318]  Tested: 10/10/2016

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Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.

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+.

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.

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

Acidity by Titration: The water sample is titrated with sodium hydroxide to designated pH end point. In a sample containing only carbon dioxide, bicarbonates and carbonates, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to bicarbonate. Method reference APHA 2310 B.

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 CO2 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.

Chemical oxygen demand can be calculated/estimated based on the O2/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.

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, NO2, NO3 and SO4 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

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.

Ammonia in solution reacts with hypochlorite ions from Sodium Dichloroisocyanuate, and salicylate in the presence of Sodium Nitroprusside to form indophenol blue and measured at 670 nm by Discrete Analyser.

Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.

OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)

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 3505C and B270D).

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.
NATA accreditation does not cover the performance of this service.

Indicative data, theoretical holding time exceeded.

Not analysed.

Not validated.

Insufficient sample for analysis.

Sample listed, but not received.

* NATA accreditation does not cover the performance of this service.
** Indicative data, theoretical holding time exceeded.

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 “Total” 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:
- 1 Bq is equivalent to 27 pCi
- 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:

This document is issued, on the Client’s behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/en/terms-and-conditions. The Client’s attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company’s findings at the time of its intervention only and within the limits of Client’s instructions, if any. The Company’s sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.
ATTACHMENT 2 – YSI WATER QUALITY METER CALIBRATION CERTIFICATE
# Multi Parameter Water Meter

**Instrument** | YSI Quatro Pro Plus  
**Serial No.** | 10H100319

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## Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

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**Calibrated by:**  
Sophie Bofer

**Calibration date:**  
28/09/2016

**Next calibration due:**  
28/10/2016
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Footnote: In the table, the reported small lowercase letters indicate compliance with the applicable water quality standard. The findings are categorized into five levels: **low (L)**, **medium (M)**, **high (H)**, **very high (V)**, and **extremely high (E)**. Levels are determined based on the ratio of the measured concentration to the standard concentration.