APPENDIX F— SOILS, GROUND WATER & STAGE 1 CONTAMINATION ASSESSMENT
Dennis Partners Pty Ltd

Proposed Residential Rezoning, Lot 704 DP749885 & Lot 707 DP1032859, Bakers Drive, Crescent Head

Geotechnical Assessment

Report No. RGS20716.1-AB
20 August 2018
Dear Rob,

RE: Proposed Residential Rezoning, Lot 704 DP749885 & Lot 707 DP1032859, Bakers Drive, Crescent Head

Geotechnical Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed residential rezoning at Lot 704 DP749885 & Lot 707 DP1032859, Bakers Drive, Crescent Head.

The assessment found the site to be appropriate for residential development from a geotechnical perspective provided the recommendations and advice of this report are adopted.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Tim Morris
Associate Engineering Geologist
Table of Contents

1 INTRODUCTION .......................................................................................................................... 1

2 FIELD WORK ............................................................................................................................... 1

3 LABORATORY TESTING ................................................................................................................. 2

4 SITE CONDITIONS ....................................................................................................................... 2
  4.1 Surface conditions ................................................................................................................... 2
  4.2 Subsurface conditions ............................................................................................................ 3
  4.3 Geotechnical Terrains ............................................................................................................ 7
    4.3.1 Terrain A: Aeolian Plain ................................................................................................... 7
    4.3.2 Terrain B: Alluvial Flats ................................................................................................ 7
    4.3.3 Terrain C: Lower Slopes with Colluvial Soils ................................................................. 8
    4.3.4 Terrain C: Residual Slopes overlying Rock .................................................................. 9

5 DISCUSSION ............................................................................................................................... 9
  5.1 Foundation Conditions .......................................................................................................... 9
  5.2 Suitability of Soils for Reuse ............................................................................................... 10
  5.3 Excavation Conditions ......................................................................................................... 11
  5.4 Stormwater and Erosion Management ............................................................................... 11
  5.5 Soil Aggressivity .................................................................................................................. 12

6 SLOPE STABILITY ASSESSMENT .......................................................................................... 12
  6.1 Risk Assessment .................................................................................................................. 12
  6.2 Site Features ....................................................................................................................... 13
  6.3 Hazard Identification ......................................................................................................... 13
  6.4 Risk Evaluation for Existing Site Conditions ...................................................................... 14
  6.5 Evaluation of Risk Level .................................................................................................... 15
  6.6 Geotechnical Design Consideration ................................................................................. 15
  6.7 Excavation .......................................................................................................................... 15

7 ACID SULFATE SOILS ............................................................................................................... 16
  7.1 Presence of ASS ................................................................................................................... 16
  7.2 Assessment Methodology ................................................................................................... 16
  7.3 Laboratory Testing ............................................................................................................. 16

8 LIMITATIONS .......................................................................................................................... 17
Figures

Figure 1 Investigation Location Plan

Appendices

Appendix A Results of Field Investigations
Appendix B Results of Laboratory Testing
Appendix C AGS Risk Matrix
Appendix D Examples of Good and Poor Hillside Practice
1 INTRODUCTION

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed residential rezoning at Lot 704 DP749885 & Lot 707 DP1032859, Bakers Drive, Crescent Head.

The proposed residential development is located in an area of gently to steeply undulating topography that includes bushland and areas cleared for farming. Concept drawings indicate the development may involve:

- Site regrading works for residential subdivision. Details of proposed regrading works are not yet available;
- Construction of road pavements; and
- Construction works for associated infrastructure including water, sewer and stormwater services.

The purpose of the work described herein was to address the following issues:

- Summary of existing surface and geotechnical conditions;
- A geotechnical model of the site that includes geotechnical terrains, general foundation conditions and the depth of the soil profiles;
- Presence of groundwater;
- Presence of Acid Sulfate Soils (ASS) in the north of the site and the need for an ASS Management Plan;
- General geotechnical conditions and geotechnical constraints on development including slope stability and impact of potential instability on the proposed development;
- Preliminary site classification to AS2870-2011 Residential Slabs and Footings. Re-classification will be required in areas that undergo future regrade; and
- A conclusion as to whether the site is suitable for residential development as proposed.

The work was commissioned by Robert Dennis on behalf of Dennis Partners Pty Ltd and was undertaken in accordance with proposal number RGS20716.1.1-AA dated 10 May 2018.

2 FIELD WORK

Field work for the assessment was undertaken on 25 May 2018 and was based on the supplied drawing titled “SITE PLAN”. Fieldwork included:

- Observation of site and surrounding features relevant to the geotechnical conditions of the site; and
- Fourteen test pits undertaken by a mini excavator, logged and sampled by an Engineering Geologist.

Engineering logs of the test pits are presented in Appendix A. The locations of the test pits are shown on Figure 1. They were obtained on site by measurement relative to existing site features.
3 LABORATORY TESTING

Samples retrieved during field work were returned to a NATA registered laboratory for testing which included the following:

- Shrink-swell testing – for foundation design and preliminary site classification purposes;
- Soil aggressivity – to foundations and services; and
- Acid Sulfate Soil screening and detailed CRS analysis.

A summary of the laboratory testing undertaken on samples collected from within the site is presented in Table 1. The test reports are presented in Appendix B.

<table>
<thead>
<tr>
<th>Location</th>
<th>Depth (m)</th>
<th>Material Type</th>
<th>Plasticity Index (%)</th>
<th>Linear Shrinkage (%)</th>
<th>Shrink-Swell Index (Iss)</th>
<th>Emerson Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>0.5 – 0.8</td>
<td>Unit 3 – Alluvial</td>
<td>--</td>
<td>--</td>
<td>2.9</td>
<td>--</td>
</tr>
<tr>
<td>TP3</td>
<td>0.4 – 0.7</td>
<td>Unit 4 – Colluvial</td>
<td>--</td>
<td>--</td>
<td>1.7</td>
<td>--</td>
</tr>
<tr>
<td>TP4</td>
<td>0.5 – 1.0</td>
<td>Unit 3 – Alluvial</td>
<td>42</td>
<td>15.5</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>TP9</td>
<td>0.5 – 0.8</td>
<td>Unit 5 – Residual</td>
<td>--</td>
<td>--</td>
<td>2.6</td>
<td>--</td>
</tr>
</tbody>
</table>

4 SITE CONDITIONS

4.1 Surface conditions

The site is located to the west of Baker Drive in an area of gently to steeply undulating topography and includes the crest and north facing upper to lower undulating slopes of a large hill, locally referred to as Killuke Mountain. The hill slopes grade down to the north to an alluvial plain located at the toe of the slope that is bound by a sand plain to the north. Surface elevations across the site range from approximately RL 46m on the upper hill slopes along the southern boundary to approximately RL 1.5m along the northern boundary on the sand plain.

Slope angles on the upper slopes were up to 25° and graded down to near flat on the sand plain. The upper and middle slopes were vegetated with large eucalypts and the lower slopes and sand plain had been cleared for grazing purposes. Two gullies that include intermittent drainage lines are present on the hill slopes and drain towards the north.

An image of the site taken from the NSW Department of Property Information website is reproduced below.
Drainage of the site is via a combination of surface infiltration and overland flow towards the north. Three farm dams were present that contained water. A fourth farm dam in the central gully had been breached and did not contain water.

A selection of images of the site is presented below.

### 4.2 Subsurface conditions

The site is situated in an area underlain by the Byabarra Beds that can include lithic sandstone, siltstone and limestone. Sandstone boulders are present on the upper ridge slopes in the south of the site.

The Port Macquarie 1:100,000 Coastal Quaternary Geology Sheet indicates residual soils are present on the hill slopes in the south of the site and alluvial or colluvial deposits that can include fluvial sands, silt, gravel and clay are present at the toe of the residual slopes in the north east of the site. A low lying back barrier sand plain is located in the north of the site at the toe of the residual slopes and can include marine sand, indurated sand, silt, clay and gravels.

The test pits encountered a variable soil profile as summarised below in Table 2 and Table 3.
### Table 2: Summary of Subsurface Conditions

<table>
<thead>
<tr>
<th>Geotechnical Unit</th>
<th>Material</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TOPSOIL</td>
<td>Sandy Clayey SILT to Silty SAND to Silty Clayey SAND, fine to coarse, dark grey/grey/brown/black, trace grass root, trace gravel, fine to coarse</td>
</tr>
<tr>
<td>2</td>
<td>AEOLIAN SAND</td>
<td>SAND, fine to medium grained, white/pale grey</td>
</tr>
<tr>
<td>3</td>
<td>ALLUVIAL CLAY</td>
<td>Sandy Silty CLAY to Sandy CLAY, medium plasticity, dark grey/black, very stiff</td>
</tr>
<tr>
<td>4A</td>
<td>COLLUVIAL CLAY</td>
<td>Sandy CLAY to Sandy Gravelly CLAY to Gravelly CLAY, low to medium plasticity, pale grey/pale brown, very stiff, trace to some gravel, fine to coarse, trace cobbles</td>
</tr>
<tr>
<td>4B</td>
<td>COLLUVIAL SAND</td>
<td>Gravelly SAND to Clayey SAND, fine to coarse grained, pale grey with orange mottling, some gravel fine to coarse, trace cobbles</td>
</tr>
<tr>
<td>5</td>
<td>RESIDUAL</td>
<td>Sandy CLAY, medium plasticity, pale grey/pale orange/pale brown with orange/red mottling, very stiff</td>
</tr>
<tr>
<td>6</td>
<td>EW SANDSTONE</td>
<td>Extremely Weathered Sandstone as Sandy CLAY, medium plasticity, pale grey/pale brown with orange/brown/red mottling, hard/friable, trace gravel, fine to medium</td>
</tr>
<tr>
<td>7</td>
<td>HW SANDSTONE</td>
<td>Highly Weathered Sandstone, fine to coarse grained, pale brown/pale grey, very low to high strength, massive</td>
</tr>
</tbody>
</table>
Table 3: Summary of Subsurface Conditions

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Depth to Base of Material Layer (m)</th>
<th>Groundwater Inflow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Topsoil (Unit 1)</td>
<td>Aeolian Sand (Unit 2)</td>
</tr>
<tr>
<td>Terrain A – Aeolian Sand Plain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP6</td>
<td>0.15</td>
<td>1.8</td>
</tr>
<tr>
<td>Terrain B – Alluvial Flats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP2</td>
<td>0.3</td>
<td>1.8</td>
</tr>
<tr>
<td>TP1</td>
<td>0.2</td>
<td>0.9</td>
</tr>
<tr>
<td>TP4</td>
<td>0.2</td>
<td>1.5</td>
</tr>
<tr>
<td>TP8</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Terrain C – Lower Colluvial Slopes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP3</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>TP5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>TP7</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>TP14</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>
## Depth to Base of Material Layer (m)

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Unit 1 Topsoil</th>
<th>Unit 2 Aeolian Sand</th>
<th>Unit 3 Alluvial Clay</th>
<th>Unit 4A Colluvial Clay</th>
<th>Unit 4B Colluvial Sand</th>
<th>Unit 5 Residual</th>
<th>Unit 6 EW Sandstone</th>
<th>Unit 7 HW Sandstone</th>
<th>Groundwater Inflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP9</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.3</td>
<td>≥1.8</td>
<td>--</td>
<td>-</td>
</tr>
<tr>
<td>TP10</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.2</td>
<td>≥1.8</td>
<td>--</td>
<td>-</td>
</tr>
<tr>
<td>TP11</td>
<td>0.15</td>
<td>--</td>
<td>--</td>
<td>0.5</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>≥1.2*</td>
<td>-</td>
</tr>
<tr>
<td>TP12</td>
<td>0.3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.9</td>
<td>≥1.1*</td>
<td>-</td>
</tr>
<tr>
<td>TP13</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>--</td>
<td>--</td>
<td>≥1.2*</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table Notes:**
- Material not encountered
- ≤ Base of material layer not encountered
- *3.5T mini-excavator refusal on rock

**Terrain D – Residual Slopes Overlying Rock**
Groundwater was encountered at the depths shown in Table 3. It should be noted that fluctuations in groundwater levels can occur as a result of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of the assessment.

4.3 Geotechnical Terrains

Site observations, test pitting and laboratory testing results indicated four distinct geotechnical profiles on the site that were associated with topographical features. On this basis, the site has been divided into four geotechnical terrains as summarised in the following sections. The approximate distribution of the terrains are delineated on Figure 1.

4.3.1 Terrain A: Aeolian Plain

An aeolian sand plain was present in the north of the site. Aeolian sands (Unit 2) were exposed in the drain excavation near the northern boundary and were encountered in TP6. The test pit walls were subject to collapse below the shallow water table. It is anticipated that this area of the site would be poorly drained following high or prolonged rainfall events.

4.3.2 Terrain B: Alluvial Flats

Alluvial soils were encountered in the gently undulating alluvial flats present at the toe of the hill slopes. The soil profile typically consisted of alluvial (Unit 3A) clays overlaying colluvial clays and sands. The alluvial clay was moderately reactive with an Iss value of 2.9%. It is anticipated that this area of the site would be poorly drained following high or prolonged rainfall events. Surface soils were observed to be moist to wet at two locations at the toe of the hill slope as shown in Figure 1.
4.3.3 Terrain C: Lower Slopes with Colluvial Soils

Colluvial clays and sands (Unit 4A/4B) derived from the weathering of the sandstone rock mass on the upper hill slopes was present on the lower hill slopes in a thick profile typically >1.5m thick. The colluvial clay was moderately reactive with an Iss value of 1.7%.

Groundwater inflow was encountered in colluvial profiles with high sand and gravel content. At TP1 the colluvial profile below the water table was unstable and the test pit walls were collapsing.
4.3.4 Terrain C: Residual Slopes overlying Rock
Encountered on the middle and upper slopes in the south of the site, the profile typically consisted of residual clays (Unit 5) overlying extremely weathered sandstone (Unit 6) that graded with depth into highly weathered sandstone (Unit 7) which typically resulted in 3.5T mini-excavator refusal. High strength sandstone cobbles and boulders were present on the surface of the upper slopes. The residual clay was moderately reactive with an Iss value of 2.6%.

Upper hill slopes with sandstone cobbles and boulders on the surface.

TP11 – Residual clay soils (Unit 5) grading sharply into weathered sandstone that resulted in excavator refusal.

5 DISCUSSION
5.1 Foundation Conditions
Laboratory shrink-swell testing was undertaken on samples of clay considered representative of foundation conditions likely to be encountered. Test results are summarised in Table 1 and presented in Appendix B.

For structures or components that are similar in construction, performance expectation, and loading to a typical domestic structure, the guidance provided in AS2870-2011 “Residential Slabs and Footings” would be appropriate.

Based on the existing profiles encountered at the time of the field investigation, the terrains present are likely to be classified in accordance with Australian Standard AS2870-2011 as summarised below:

Geotechnical Terrain A  Aeolian sands. Site classifications would typically be Class A or Class S, however, disturbance of the upper sand profile during site preparation works will require re-compaction of the upper profile to ensure suitable founding conditions. Shallow water table present and building areas may require raising areas, or, incorporation of specific drainage measures during development of the subdivision.
Geotechnical Terrain B  Alluvial plains. Site classifications would typically be Class M (Moderately Reactive), or Class H1 (Highly Reactive). However, poor drainage conditions and shallow water table present in some areas may require raising of building areas, or, incorporation of specific drainage measures during development of the subdivision.

Geotechnical Terrain C  Lower hill slopes with colluvial Unit 4 clay, sand and gravel soils. Site classifications would typically be Class M (Moderately Reactive), or Class H1 (Highly Reactive). Water inflow was encountered in sand and gravel lenses at several locations from 1.3 to 1.7m and incorporation of specific drainage measures during development of the subdivision will be required in such locations.

Geotechnical Terrain D  Shallow sandy clay soils with potentially sandstone floaters or subcrop. Following site preparation works the resultant foundation conditions may comprise thin remaining natural clay soils or weathered rock where the sites would be expected to classify as Class M (Moderately Reactive) or Class S (Slightly Reactive) respectively. Should footings encounter rock outcrop or partial rock foundations, reference should be made to AS2870 as design may be required to incorporate site specific engineering principles.

The site classifications outlined above are preliminary in nature and would require confirmation following site regrade works when final site levels and natural/fill soil profiles are known.

It is noted that all fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 under Level 1 inspection and testing to be considered as Controlled Fill.

5.2 Suitability of Soils for Reuse

Geotechnical Terrain A  Aeolian sands. Due to the low-lying nature of the aeolian sand plain, excavation works are expected to be minor, however, sand soils (Unit 2) that may be encountered during service trenching would be suitable for reuse.

Geotechnical Terrain B  Alluvial flats. Due to the low-lying nature of the alluvial flats, excavation works are expected to be minor, however, clay soils that may be encountered during service trenching would be suitable for reuse.

Geotechnical Terrain C  Lower hill slopes with colluvial clay, sand and gravel soils. Clay and sand soils would generally be suitable for reuse but may require blending to produce a homogenous material. Oversize sandstone cobbles will require sorting where present.

Geotechnical Terrain D  Shallow sandy clay soils with potentially sandstone floaters or sub-crop. Clay soils would generally be suitable for reuse. Oversize sandstone cobbles or boulders will require sorting where present.
5.3 Excavation Conditions

Geotechnical Terrain A  Aeolian sands. Excavations above the water table can be undertaken with a backhoe or mini-excavator. Excavations below the water table will be subject to collapse and service trench excavations below the water table will therefore require temporary dewatering or use of shoring boxes.

Geotechnical Terrain B  Alluvial flats. Excavations above the water table can be undertaken with a backhoe or medium sized excavator. Excavations below the water table will be subject to collapse and service trench excavations below the water table will therefore require temporary dewatering or use of shoring boxes.

Geotechnical Terrain C  Colluvial slopes. Excavations above the water table can be undertaken with a backhoe or medium sized excavator. Excavations below the water table will be subject to collapse and service trench excavations below the water table will therefore require temporary dewatering or use of shoring boxes. Bulk excavations may also require temporary dewatering and/or incorporation of specific drainage measures during development of the subdivision.

Geotechnical Terrain D  Residual slopes. The RGS test pits were excavated with a 3.5T mini-excavator and encountered clay soils grading into weathered sandstone. Slow digging conditions and mini-excavator refusal at the depths shown on the attached test pit engineering logs were encountered in the weathered sandstone profile.

The weathered sandstone rock that will be encountered in deeper excavations in the upper hill slopes, ranges from low to high strength. The sandstone rock will pose excavation difficulties in confined excavations such as service trenches or footings, however, in bulk excavations it is anticipated that the upper profile will generally be rippable by a large bulldozer such as a D7 equipped with a single ripping tynne. A hydraulic rock breaker may be required in confined excavations or where bands of high strength rock are encountered in bulk excavations.

5.4 Stormwater and Erosion Management

One sample from the Geotechnical Terrain B (Alluvial Plain) was submitted for dispersion testing and was non-dispersive. The soils present in the upper profile of Geotechnical Terrain D (Residual Slopes) are susceptible to erosion on exposure. This is evidenced by rill erosion observed near the dam excavated in the south west corner of the site where soils have been left without vegetation cover. It is therefore essential that:

- Site earthworks are undertaken in accordance with a site specific erosion and sedimentation control plan;
• Earthworks should be undertaken progressively, minimising the area and length of time that any part of the site is denuded of vegetation at any one time;

• Revegetation or other erosion protection should be undertaken as soon as possible on all cut batters;

The erodibility of the soils should be taken into account in the long term stormwater management plan for the site (e.g. Sizing and ongoing management or maintenance of detention ponds).

5.5 Soil Aggressivity

Two samples were submitted to a NATA accredited laboratory for chemical aggressivity analysis. The results are presented in Appendix B and summarised below:

Aeolian Sample (TP6 0.5 – 1.0m):

- A pH of 6.01;
- Chloride contents of 8ppm;
- Sulfate contents (SO₄) of 2013ppm; and
- A resistivity of 477,327 ohm.cm.

Alluvial Sample (TP8 0.5 – 1.0m):

- A pH of 4.96;
- Chloride contents of 103ppm;
- Sulfate contents (SO₄) of less than 1000ppm; and
- A resistivity of 82,440 ohm.cm.

In accordance with AS2159-2009 both samples are considered to be mildly aggressive towards concrete and non-aggressive steel elements.

6 SLOPE STABILITY ASSESSMENT

6.1 Risk Assessment

The risk of slope instability has been assessed using the principles and protocols of the Australian Geomechanics Society publication, Practice Note Guidelines for Landslide Risk Management, 2007. This methodology represents the currently accepted state of practice for landslide risk assessment.

The slope risk assessment process involves identification of a potential slope failure event, or hazard, followed by an estimation of the likelihood of the event occurring, and the potential consequences should the event occur.
The terms used in the risk assessment process are defined below:

**Hazard:** A condition with the potential for causing an undesirable consequence.

**Likelihood:** The estimated probability that the hazardous event will occur.

**Consequence:** Loss or damage resulting from a hazard event.

**Risk:** A term combining the likelihood and consequence of an event in terms of adverse effects to property or the environment.

### 6.2 Site Features

The principal site features used in the slope risk assessment are:

- Situated on the north facing upper to lower slopes of a large hill.
- Surface slopes have generally not been modified and have surface angles of 5 - 15° on the lower to middle hill slopes and up to 25° on the upper hill slopes.
- No seepage or concentration of surface water was observed on the upper slopes.
- Sandstone boulders were observed on the surface and in the topsoil and colluvial profiles. One boulder had been dislodged from upslope and had rolled down slope, coming to rest against a large tree.
- Weathered sandstone rock was present from 0.9m on the upper slopes.
- Groundwater may concentrate at the interface between soils and the weathered sandstone and in sand/gravel lenses in the colluvial deposits.
- No evidence of instability.

### 6.3 Hazard Identification

The following potential slope stability hazards were assessed in relation to the site and the proposed development:

**Hazard 1:** Deep seated rotational or translational failure caused by sliding of the soil profile over a plane of weakness such as a clay seam or zone of water concentration within the underlying soil or rock mass. Such a failure could potentially cause extensive structural damage and require large scale, costly repairs, and possibly temporary evacuation of the building until repairs are complete;

**Hazard 2:** Small scale rotational slide and associated debris flow (<10m³) due to destabilisation of slope by potential un-retained excavations associated with future works. Such a failure could result in minor damage to adjacent structures and impact the ongoing utility of the site until repairs are undertaken;

**Hazard 3:** Toppling of rock cobbles or boulders up to 800mm size that are dislodged during excavations associated with future works and roll down slope. Such a failure could
cause minor damage to structures and impact the ongoing utility of the site until repairs are undertaken;

**Hazard 4:** Soil creep. Creep is an imperceptibly slow movement that takes place on sloping soil sites. It is an ongoing, natural slope process involving the progressive downslope movement of soils over the underlying rock profile. Creep will occur within the topsoil profile on this sloping site, and will require management by undertaking good hillside construction practice as recommended in this report.

### 6.4 Risk Evaluation for Existing Site Conditions

Table 4 summarises the factors affecting slope stability in relation to each of the hazards identified and assesses the risk of slope instability for each using the risk assessment matrix provided in Appendix B of the Australian Geomechanics Society (AGS) publication *Practice Note Guidelines for Landslide Risk Management, 2007*.

A copy of the risk matrix from the AGS document is presented in Appendix B.

**Table 4: Slope Risk Assessment Based on AGS2007 method**

<table>
<thead>
<tr>
<th>Hazard</th>
<th>H1 Deep failure</th>
<th>H2 Localised failure of unsupported cuts (Future Works)</th>
<th>H3 Toppling failure of loose boulder (Future Works)</th>
<th>H4 Soil Creep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope height</td>
<td>N/A</td>
<td>Up to 1.5m</td>
<td>Up to 1.5m</td>
<td>N/A</td>
</tr>
<tr>
<td>Cause or trigger</td>
<td>Slope deterioration followed by extreme weather (1 in 10,000yr event)</td>
<td>Cut steeper than angle of repose, unsupported, high rainfall (1 in 10yr event)</td>
<td>Boulder disturbed during earthworks rolls down slope</td>
<td>Ongoing process of slow soil movement</td>
</tr>
<tr>
<td>Proportion of slope affected</td>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
<td>1</td>
</tr>
<tr>
<td>Estimated annual probability</td>
<td>$10^{-5}$</td>
<td>$10^{-2}$</td>
<td>$10^{-2}$</td>
<td>$10^{-1}$</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Rare</td>
<td>Likely</td>
<td>Likely</td>
<td>Almost Certain</td>
</tr>
<tr>
<td>Consequence</td>
<td>Major</td>
<td>Medium</td>
<td>Minor</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Risk</td>
<td>Low</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
</tbody>
</table>
6.5 Evaluation of Risk Level

The assessment presented in Table 1 indicates a Moderate to High risk of slope instability affecting potential future excavations on this site. This risk can be reduced to Low by adopting the recommendations of this report regarding maximum unsupported cut heights, batter angles, and retaining wall design.

Provided the recommendations within this report are adopted and good engineering practices are followed, the development would then be considered to have an overall Low risk of slope instability. This risk rating would normally be considered acceptable in Australia for hillside residential construction.

6.6 Geotechnical Design Consideration

The Australian Geomechanics Society published a series of documents providing guidelines for Landslide Risk Management in 2007. The documents included recommendations on Good Hillside Practice. It is recommended that development at this site be undertaken in accordance with good hillside practice as summarised on the documents reproduced in Appendix C, and the specific recommendations of this report.

6.7 Excavation

Limiting excavations will reduce the risk of slope instability. However, the proposed development is likely to require excavations on the upper hill slopes. Excavations will encounter topsoil with boulders, colluvial sands, and weathered sandstone. 3.8T mini-excavator refusal was encountered on the weathered sandstone from 0.9m and at the depths shown on the attached engineering logs.

Cuts of less than 1.5m in soil profiles can be battered at 1V:1H (temporary) or 1V:2H (permanent), and protected against erosion. Cobbles and boulders will be encountered in the clay and upper weathered rock profile during excavation works and can be dislodged, potentially rolling down slope. Construction of a level pad and bund of earth fill may be required to prevent loose rocks rolling down slope.

In weathered rock, subject to geotechnical appraisal on bulk excavation, steeper batters may be adopted, but are likely to require face protection by pinned mesh or similar. Excavations may also need to be staged in short sections subject to geotechnical appraisal.

Groundwater inflow may be encountered at the interface between the topsoil and weathered rock and in sand/gravel lenses in the colluvial deposits. Inflows of this nature are likely to be manageable by adequate table drainage around the perimeters of the site, and provision of toe drains at the base of all excavated faces.

All cut slopes greater than 1.5m in height should be supported by engineered retaining walls constructed at the toe of the temporary batters.
7 ACID SULFATE SOILS

7.1 Presence of ASS

Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen due to the presence of iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid as a result of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

Reference to the Kundabung ASS Risk Map (DLWC, 2000) indicates there is a low probability of Potential ASS at or near the ground surface in the low lying sand plain in the north of the site.

![Plate 1: Extract from Kundabung ASS Risk Map (NSW DLWC 2000).](image)

7.2 Assessment Methodology

Investigations were undertaken at two locations (BH6 & BH8) as shown in Figure 1. Samples were collected at 0.5m intervals and the samples submitted for ASS screening by a NATA accredited laboratory.

7.3 Laboratory Testing

Samples obtained from the investigation were submitted to the NATA accredited Environmental Analysis Laboratory (EAL) and screened for the presence of ASS. The results are presented in Appendix B and indicate the following:
• The pH of the samples in distilled water ranged from 4.83 to 6.43. A pH value of less than 4 in this test is considered indicative of Actual ASS. A pH value of between 4 and 5.5 is acidic and may indicate the presence of Actual ASS. On the basis of these results the soils are not considered Actual ASS;

• The pH of the samples after oxidation in hydrogen peroxide ranged from 4.43 to 5.06. A pH value of less than 3 in this test is considered indicative of Potential ASS (PASS) and a pH value between 3 and 4.5 as being possible PASS.

• The soils assessed are not considered to be Actual or Potential ASS. However, further assessment is recommended if excavation works are proposed in areas that are identified as having a potential risk of ASS, in accordance with Council requirements.

8 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Tim Morris

Associate Engineering Geologist
Over-wet soils observed at toe of hill slope

Legend

Test Pit Location

Geotechnical Terrains

Terrain A: Aeolian Sands
Terrain B: Alluvial Flats - Poorly drained clay soils
Terrain C: Colluvial Slopes - Colluvial clays with sand and gravel lenses
Terrain D: Residual Slopes - Residual clays grading into weathered sandstone

Based on supplied drawing titled "CONTOUR PLAN"

Client: DENNIS PARTNERS

Project: PROPOSED RESIDENTIAL REZONING

BAKERS DRIVE, CRESCENT HEAD

Title: INVESTIGATION LOCATION PLAN

Job No.: RGS20716.1

Drawn By: TM

Date: 24-Jul-18

Drawing No.: Figure 1
Appendix A

Results of Field Investigations
**Material description and profile information**

<table>
<thead>
<tr>
<th>Method</th>
<th>Water</th>
<th>Samples</th>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Classification Symbol</th>
<th>Material Description: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>Moisture Condition</th>
<th>Density Index</th>
<th>CONSISTENCY</th>
<th>STRUCTURE AND ADDITIONAL OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOPSOIL: Sandy Clayey Silt, dark grey/black, Sand fine to medium grained, grass roots</td>
<td>M</td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sandy Silty CLAY: Medium plasticity, dark grey</td>
<td>M</td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gravelly SAND: Fine to coarse grained, pale grey with orange mottling, some Gravel fine to coarse grained, subangular/subrounded, some Clay, trace Cobbles to 200mm</td>
<td>M</td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hole Terminated at 1.60 m Refusal Collapsing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Consistency and Moisture Condition**

<table>
<thead>
<tr>
<th>Consistency</th>
<th>UCS (kPa)</th>
<th>Moisture Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS Very Soft</td>
<td>&lt;25</td>
<td>D Dry</td>
</tr>
<tr>
<td>S Soft</td>
<td>25 - 50</td>
<td>M Moist</td>
</tr>
<tr>
<td>F Firm</td>
<td>50 - 100</td>
<td>W Wet</td>
</tr>
<tr>
<td>St Stiff</td>
<td>100 - 200</td>
<td>W_L Plastic Limit</td>
</tr>
<tr>
<td>Vst Very Stiff</td>
<td>200 - 400</td>
<td>W_L Liquid Limit</td>
</tr>
<tr>
<td>H Hard</td>
<td>&gt;400</td>
<td></td>
</tr>
</tbody>
</table>

**Density**

<table>
<thead>
<tr>
<th>Density</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V Very Loose</td>
<td>Density Index &lt;15%</td>
</tr>
<tr>
<td>L Loose</td>
<td>Density Index 15 - 35%</td>
</tr>
<tr>
<td>MD Medium Dense</td>
<td>Density Index 35 - 65%</td>
</tr>
<tr>
<td>D Dense</td>
<td>Density Index 65 - 85%</td>
</tr>
<tr>
<td>VD Very Dense</td>
<td>Density Index 85 - 100%</td>
</tr>
</tbody>
</table>

**Drilling and Sampling**

- **SANDY CLAY:** Medium plasticity, dark grey
- **Gravelly SAND:** Fine to coarse grained, pale grey with orange mottling, some Gravel fine to coarse grained, subangular/subrounded, some Clay, trace Cobbles to 200mm

**Notes, Samples and Tests**

- U50 50mm Diameter tube sample
- CBR Bulk sample for CBR testing
- ASS Acid Sulfate Soil Sample
- B Bulk Sample

**Field Tests**

- PID Photionisation detector reading (ppm)
- DCP(x-y) Dynamic penetrometer test (test depth interval shown)
- HP Hand Penetrometer test (UCS kPa)
<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>CLASSIFICATION SYMBOL</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>CONSISTENCY</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>CONSISTENCY</th>
<th>TEST TYPE</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANDY CLAY</td>
<td>NOT ENCOUNTERED</td>
<td>0.3m</td>
<td>1.8m</td>
<td>CH</td>
<td>Sandy Clay: Medium plasticity, pale grey, with orange/red mottling</td>
<td>M &lt; W</td>
<td>VST</td>
<td>HP</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANDY GRAVELLY CLAY</td>
<td>300mm TOOTH BUCKET</td>
<td>4.0m</td>
<td>0.5m</td>
<td>CH</td>
<td>Sandy Gravely Clay: Medium plasticity, pale grey with orange/red mottling, Gravel fine to coarse grained, subangular/subrounded, Sandstone, orange</td>
<td>M</td>
<td>VST / Vs</td>
<td>HP</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOPSOIL</td>
<td>Water</td>
<td>0.3m</td>
<td>1.8m</td>
<td>SM</td>
<td>Topsoil: Silty SAND, fine to medium grained, grey, trace Clay, with grass roots</td>
<td>M</td>
<td>TOPSOIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND:**
- **Water**
  - Water Level (Date and time shown)
  - Water Inflow
  - Water Outflow
- **Strata Changes**
  - Gradiational or transitional strata
  - Definitive or distinct strata change

**Notes, Samples and Tests**
- **U₄:** 50mm Diameter tube sample
- **CBR:** Bulk sample for CBR testing
- **E:** Environmental sample
- **ASS:** Acid Sulfate Soil Sample
- **B:** Bulk Sample
- **Density**
- **Consistency**
- **UCS (kPa)**
- **Moisture Condition**

**Field Tests**
- **PID:** Photonisation detector reading (ppm)
- **DOP(x-y):** Dynamic penetrometer test (test depth interval shown)
- **HP:** Hand Penetrometer test (UCS kPa)
### Engineering Log - Test Pit

**Test Pit No:** TP3  
**Client:** Dennis Partners Pty Ltd  
**Project Name:** Proposed Residential Rezoning  
**Site Location:** Bakers Drive, Crescent Head  
**Test Location:** Refer to Figure 1

#### Equipment Type:
- 3.8T Mini Excavator
- Test Pit Length: 2.0 m  
- Width: 0.4 m  
- Surface RL: 7.0 m  
- Datum: RL

#### Drilling and Sampling

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER</th>
<th>SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION SYMBOL</th>
<th>SYMBOL</th>
<th>CONSISTENCY</th>
<th>DENSITY CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.40</td>
<td>0.0m</td>
<td><strong>TOPSOIL</strong>: Silty Clayey SAND, fine to coarse grained, dark grey/black, grass roots</td>
<td>M</td>
<td>Fb</td>
<td>SC</td>
<td>VS</td>
<td>D Dense</td>
</tr>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.20</td>
<td>0.5m</td>
<td><strong>Sandy Clay</strong>: Medium plasticity, black/dark grey</td>
<td>M</td>
<td></td>
<td>CH</td>
<td>VSt</td>
<td>D Dense</td>
</tr>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.70</td>
<td>0.5m</td>
<td><strong>Sandy Silty Clay</strong>: Medium plasticity, black/dark grey</td>
<td>M &gt; 15%</td>
<td></td>
<td></td>
<td>V</td>
<td>D Dense</td>
</tr>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.40</td>
<td>1.0m</td>
<td><strong>Pockets of Clayey SAND, fine to coarse grained</strong></td>
<td>M</td>
<td></td>
<td>CH</td>
<td>S</td>
<td>D Dense</td>
</tr>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.0m</td>
<td>1.5m</td>
<td>Pale grey/grey with orange/red mottling, trace Cobbles, subangular/subrounded Sandstone</td>
<td>M</td>
<td></td>
<td>SC</td>
<td>L</td>
<td>D Dense</td>
</tr>
<tr>
<td></td>
<td>WATER</td>
<td></td>
<td>0.0m</td>
<td>2.0m</td>
<td>Hole Terminated at 2.0 m</td>
<td></td>
<td></td>
<td></td>
<td>MD</td>
<td>D Dense</td>
</tr>
</tbody>
</table>

#### Field Tests

- **U50**: Very Loose  
- **CBR**: Bulk sample for CBR testing  
- **E**: Environmental sample  
- **ASS**: Acid Sulfate Soil Sample  
- **B**: Bulk Sample

#### Notes, Samples and Tests

- **U50**: 50mm Diameter tube sample  
- **CBR**: Bulk sample for CBR testing  
- **E**: Environmental sample  
- **ASS**: Acid Sulfate Soil Sample  
- **B**: Bulk Sample  
- **PID**: Photoionisation detector reading (ppm)  
- **DPD(x-y)**: Dynamic penetrometer test (test depth interval shown)  
- **HP**: Hand Penetrometer test (UCS kPa)

#### Consistency

- **VS**: Very Soft  
- **S**: Soft  
- **F**: Firm  
- **St**: Stiff  
- **VSt**: Very Stiff  
- **H**: Hard  
- **Fb**: Friable

#### UCS (kPa)

- **D**: Dry  
- **W**: Wet  
- **Wp**: Plastic Limit  
- **Wt**: Liquid Limit

#### Moisture Condition

- **<15%**  
- **15% - 35%**  
- **35% - 65%**  
- **65% - 85%**  
- **85% - 100%**

#### Legend:

- **Water Level**  
- **Water Inflow**  
- **Water Outflow**  
- **Gradational or transitional strata**  
- **Definitive or distinct strata change**
### Engineering Log - Test Pit

**Client:** Dennis Partners Pty Ltd  
**Project Name:** Proposed Residential Rezoning  
**Site Location:** Bakers Drive, Crescent Head  
**Test Location:** Refer to Figure 1  
**Equipment Type:** 3.8T Mini Excavator  
**Test Pit Length:** 2.0 m  
**Width:** 0.4 m  
**Surface RL:** 3.0 m  
**Datum:** RL  
**Surfacing:** CL  
**Geotechnical Log:**  

#### Drilling and Sampling

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Classification</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>Moisture Condition</th>
<th>UCS (kPa)</th>
<th>Density Index</th>
<th>Density</th>
<th>Consistency</th>
<th>Field Test</th>
<th>Consistency Index</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.5</td>
<td>CL</td>
<td>TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey, grass roots</td>
<td>M</td>
<td>HP 350</td>
<td>VS</td>
<td>D</td>
<td>VS</td>
<td>PID</td>
<td>VS</td>
<td>WATER</td>
</tr>
<tr>
<td>1.00</td>
<td>1.0</td>
<td>CH</td>
<td>Sandy Silty CLAY: Medium plasticity, dark grey</td>
<td>M &lt; w</td>
<td>HP 300</td>
<td>ACCUMULIAL</td>
<td>M</td>
<td>S</td>
<td>DCP(x-y)</td>
<td>S</td>
<td>WATER</td>
</tr>
<tr>
<td>1.50</td>
<td>1.5</td>
<td>SC</td>
<td>Gravelly Silty SAND: Fine to coarse grained, dark grey, some grey/brown mottling, some pockets of Sandy CLAY</td>
<td>M</td>
<td></td>
<td>COLLUVIAL</td>
<td>M</td>
<td>VS</td>
<td>CBR Bulk sample for CBR testing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes, Samples and Tests

- **50mm Diameter tube sample**
- **Bulk sample for CBR testing**
- **Environmental sample**
- **Acid Sulfate Soil Sample**
- **Bulk Sample**

- **Photionisation detector reading (ppm)**
- **Dynamic penetrometer test (test depth interval shown)**
- **Hand Penetrometer test (UCS kPa)**

#### CONSISTENCY

- VS: Very Soft
- S: Soft
- F: Firm
- St: Stiff
- VSt: Very Stiff
- H: Hard
- D: Dense
- VD: Very Dense

#### DENSITY

- V: Very Loose
- L: Loose
- MD: Medium Dense
- D: Dense
- VD: Very Dense

#### MOISTURE CONDITION

- D: Dry
- M: Moist
- W: Wet
- Wp: Plastic Limit
- Wf: Liquid Limit

#### TESTS

- **HP** (Hand Penetrometer test)
- **DCP** (Dynamic Penetrometer test)
- **PID** (Photionisation detector reading)

#### FIELD TESTS

- **VL** (Very Loose)
- **L** (Loose)
- **MD** (Medium Dense)
- **D** (Dense)
- **VD** (Very Dense)

---

**Legend:**  
- **Water Level (Date and time shown):** Water Level  
- **Water Inflow:** Water Inflow  
- **Water Outflow:** Water Outflow  
- **Strata Changes:** Gradational or transitional strata, Definitive or distinct strata change
### Drilling and Sampling

<table>
<thead>
<tr>
<th>Method</th>
<th>Water Samples</th>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Graphic Log</th>
<th>Material Description: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>Moisture Condition</th>
<th>UCS (kPa)</th>
<th>Density Index</th>
<th>Test Type</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm TOOTH BUCKET</td>
<td>Not Encountered</td>
<td>8.0</td>
<td>0.5</td>
<td>SM</td>
<td>TOPSOIL: Silty SAND, fine to medium grained, grey, some Clay, grass roots</td>
<td>M</td>
<td>Fb</td>
<td></td>
<td></td>
<td>TOPSOIL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.5</td>
<td>1.0</td>
<td>CL</td>
<td>Sandy CLAY: Medium plasticity, pale grey/pale brown, with orange/red mottling, some Gravel fine to coarse grained, Sandstone</td>
<td>M, VSI, Fb</td>
<td></td>
<td></td>
<td></td>
<td>COLLUVIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.0</td>
<td>1.5</td>
<td></td>
<td>From 1.0m some Cobbles increasing with depth, subrounded, Sandstone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.5</td>
<td>2.0</td>
<td></td>
<td>Grading to Clayey SAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.0</td>
<td>2.5</td>
<td></td>
<td>Hole Terminated at 2.0 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes, Samples and Tests

- **U5**: 50mm Diameter tube sample
- **CBR**: Bulk sample for CBR testing
- **E**: Environmental sample
- **ASS**: Acid Sulfate Soil Sample
- **B**: Bulk Sample

### Field Tests

- **PID**: Photionisation detector reading (ppm)
- **DCP(x-y)**: Dynamic penetrometer test (test depth interval shown)
- **HP**: Hard Penetrometer test (UCS kPa)

### Consistency

- **VS**: Very Soft
- **S**: Soft
- **F**: Firm
- **St**: Stiff
- **VSt**: Very Stiff
- **H**: Hard
- **Fb**: Friable

### UCS (kPa)

- **<25**
- **25 - 50**
- **50 - 100**
- **100 - 200**
- **200 - 400**
- **>400**

### Moisture Condition

- **D**: Dry
- **M**: Moist
- **W**: Wet
- **Wp**: Plastic Limit
- **Wl**: Liquid Limit

### Density

- **V**: Very Loose
- **L**: Loose
- **MD**: Medium Dense
- **D**: Dense
- **VD**: Very Dense

### Density Index

- **<15%**
- **15 - 35%**
- **35 - 65%**
- **65 - 85%**
- **85 - 100%**
**Material description and profile information**

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>CLASSIFICATION SYMBOL</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>DENSITY SYMBOL</th>
<th>Test Type</th>
<th>Result</th>
<th>Structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50m</td>
<td>SM</td>
<td>TOPSOIL: Silty SAND, fine to medium grained, dark grey, with grass roots</td>
<td>M</td>
<td>VS</td>
<td>VS</td>
<td>Field Test</td>
<td>TOPSOIL</td>
<td></td>
</tr>
<tr>
<td>0.5m</td>
<td>SM</td>
<td>Silty SAND: Fine to medium grained, dark grey</td>
<td>Fb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9m</td>
<td>SP</td>
<td>SAND: Fine to medium grained, white/pale grey</td>
<td>W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3m</td>
<td>SP</td>
<td>SAND: Fine to medium grained, pale grey/white, trace pale brown mottling, moderately cemented</td>
<td>VD</td>
<td></td>
<td>VD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8m</td>
<td>SP</td>
<td>Hole Terminated at 1.80 m Refusal Collapsing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONSISTENCY**

- VS: Very Soft
- S: Soft
- F: Firm
- St: Stiff
- VSt: Very Stiff
- H: Hard
- D: Dry
- M: Moist
- W: Wet
- WL: Wet Limit

**DENSITY**

- L: Loose
- MD: Medium Dense
- D: Dense
- VD: Very Dense

**DENSITY CLASSIFICATION**

- <25: Very Loose
- 25 - 50: Loose
- 50 - 100: Medium
- 100 - 200: Dense
- 200 - 400: Very Dense
- >400: Extra Dense

**MOISTURE CONDITION**

- VS: Very Soft
- S: Soft
- F: Firm
- St: Stiff
- Vst: Very Stiff
- H: Hard
- D: Dry
- M: Moist
- W: Wet
- WL: Wet Limit
**Topsoil:** Silty sand, fine to medium grained, grey, with grass roots

**Sandy Clay:** Medium plasticity, pale grey, with orange/red mottling, sand fine to coarse grained, trace gravel and cobbles to 100mm, subrounded, sandstone

Hole Terminated at 1.80 m

| SURFACE RL: 7.5 m | TP7
|-------------------|---
| TEST PIT NO:      | ---
| CLIENT: Dennis Partners Pty Ltd | ---
| PROJECT NAME:     | Proposed Residential Rezoning
| SITE LOCATION:    | Bakers Drive, Crescent Head
| TEST LOCATION:    | Refer to Figure 1
| JOB NO: RGS20716.1|
| DATE: 25/5/18     |

**Drilling and Sampling**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER</th>
<th>SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>SYMBOL</th>
<th>CONSISTENCY</th>
<th>DENSITY</th>
<th>FIELD TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>TOPSOIL: Silty sand, fine to medium grained, grey, with grass roots</td>
<td>M</td>
<td>Fb</td>
<td>TOPSOIL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CH</td>
<td>Sandy Clay: Medium plasticity, pale grey, with orange/red mottling, sand fine to coarse grained, trace gravel and cobbles to 100mm, subrounded, sandstone</td>
<td>M &lt; Wp</td>
<td>Fb</td>
<td>COLLUVIAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes, Samples and Tests**

- 50mm Diameter tube sample
- Bulk sample for CBR testing
- Environmental sample
- Acid Sulfate Soil Sample
- Bulk Sample
- Photionisation detector reading (ppm)
- Dynamic penetrometer test (test depth interval shown)
- Hand Penetrometer test (UCS kPa)

<table>
<thead>
<tr>
<th>Water Level</th>
<th>Water Inflow</th>
<th>Water Outflow</th>
<th>Consistency</th>
<th>UCS (kPa)</th>
<th>Moisture Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS &lt;25 VST</td>
<td>S Soft</td>
<td>F Firm</td>
<td>Dry M</td>
<td>25 - 50</td>
<td>Moist W Wet</td>
</tr>
<tr>
<td>F Stiff</td>
<td>VST 100 - 200</td>
<td>V Stiff 200 - 400</td>
<td>Wp Plastic Limit</td>
<td>50 - 100</td>
<td>Liquid Wp</td>
</tr>
<tr>
<td>H Hard &gt;400</td>
<td>Fb Flnable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND:**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow
- Gradational or transitional strata
- Definitive or distinct strata change

**Engineer Log**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER</th>
<th>SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>SYMBOL</th>
<th>CONSISTENCY</th>
<th>DENSITY</th>
<th>FIELD TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>TOPSOIL: Silty sand, fine to medium grained, grey, with grass roots</td>
<td>M</td>
<td>Fb</td>
<td>TOPSOIL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CH</td>
<td>Sandy Clay: Medium plasticity, pale grey, with orange/red mottling, sand fine to coarse grained, trace gravel and cobbles to 100mm, subrounded, sandstone</td>
<td>M &lt; Wp</td>
<td>Fb</td>
<td>COLLUVIAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Material Description and Profile Information

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Class</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.50</td>
<td>SM</td>
<td>TOPSOIL</td>
<td>Silty SAND, fine to medium grained, black, some Clay with grass roots in upper 150mm</td>
</tr>
<tr>
<td>1.00</td>
<td>1.50</td>
<td>CH</td>
<td>Sandy CLAY</td>
<td>Medium plasticity, grey, trace orangeshed mottling</td>
</tr>
<tr>
<td>1.50</td>
<td>1.90</td>
<td>SC</td>
<td>Clayey SAND</td>
<td>Fine to coarse grained, pale grey with orangeshed mottling</td>
</tr>
</tbody>
</table>

Hole Terminated at 1.80 m

### Notes, Samples and Tests

- **Material**: TOPSOIL
- **Depth**: 0.50 m
- **Description**: Silty SAND, fine to medium grained, black, some Clay with grass roots in upper 150mm

### CONSISTENCY

<table>
<thead>
<tr>
<th>Density</th>
<th>Very Loose</th>
<th>Loose</th>
<th>Medium Dense</th>
<th>Dense</th>
<th>Very Dense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry (D)</td>
<td>Wet (W)</td>
<td>Moist (M)</td>
<td>Plastic Limit (WPl)</td>
<td>Liquid Limit (WLL)</td>
<td></td>
</tr>
</tbody>
</table>

### CONSISTENCY

<table>
<thead>
<tr>
<th>CONSISTENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS Very Soft</td>
</tr>
<tr>
<td>S Soft</td>
</tr>
<tr>
<td>F Firm</td>
</tr>
<tr>
<td>Stiff</td>
</tr>
<tr>
<td>VSt Very Stiff</td>
</tr>
<tr>
<td>H Hard</td>
</tr>
<tr>
<td>Fb Friable</td>
</tr>
</tbody>
</table>

### MOISTURE CONDITION

<table>
<thead>
<tr>
<th>Moisture Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry (D)</td>
</tr>
<tr>
<td>Moist (M)</td>
</tr>
<tr>
<td>Wet (W)</td>
</tr>
</tbody>
</table>
### Material Description and Profile Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Water Inflow</th>
<th>Water Outflow</th>
<th>Structure and Additional Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>1</td>
<td>0</td>
<td>Typical Topsoil: Silty SAND, grey/brown, some Clay, trace tree roots</td>
</tr>
<tr>
<td>1.30</td>
<td>1</td>
<td>0</td>
<td>Sandy CLAY: Medium plasticity, pale orange/pale brown with orange mottling, Sand fine to coarse grained</td>
</tr>
<tr>
<td>1.80</td>
<td>1</td>
<td>0</td>
<td>Hole Terminated at 1.80 m</td>
</tr>
</tbody>
</table>

### Field Tests

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>CONSISTENCY</th>
<th>DENSITY CLASSIFICATION</th>
<th>SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>VS</td>
<td>V</td>
<td>M</td>
</tr>
<tr>
<td>1.30</td>
<td>VS</td>
<td>D</td>
<td>M</td>
</tr>
<tr>
<td>1.80</td>
<td>VS</td>
<td>D</td>
<td>M</td>
</tr>
</tbody>
</table>

### Notes, Samples, and Tests

- **U50**: 50mm Diameter tube sample
- **CBR**: Bulk sample for CBR testing
- **ASS**: Acid Sulfate Soil Sample
- **SM**: TOPSOIL: Silty SAND, grey/brown, some Clay, trace tree roots
- **CH**: Sandy CLAY: Medium plasticity, pale orange/pale brown with orange mottling, Sand fine to coarse grained
- **CL**: Sandy CLAY: Medium plasticity, pale grey/white, with orange/brown mottling, some Rock fabric and Gravel seams, fine to medium grained, subangular, low strength

### CONSISTENCY

- **VS**: Very Soft
- **S**: Soft
- **F**: Firm
- **St**: Stiff
- **VSt**: Very Stiff
- **H**: Hard
- **Fb**: Friable

### DENSITY CLASSIFICATION

- **W**: Wet
- **D**: Dense
- **MD**: Medium Dense
- **L**: Loose
- **D`: Medium Dense
- **V`: Very Dense

### DENSITY INDEX

- **<15%**: Very Loose
- **15 - 35%**: Loose
- **35 - 65%**: Medium Dense
- **65 - 85%**: Dense
- **>85%**: Very Dense

### MOISTURE CONDITION

- **Dry**
- **Wet**
- **Plastic Limit**
- **Liquid Limit**

### Additional Information

- **Equipment Type**: 3.8T Mini Excavator
- **Test Pit Length**: 2.0 m
- **Width**: 0.4 m
- **Surface RL**: 11.0 m
- **Date**: 25/5/18

---

**LEGEND:**
- **W**: Water Level (Date and time shown)
- **D**: Water Inflow
- **O**: Water Outflow
- **G**: Gradiational or transitional strata
- **S**: Definitive or distinct strata change

**Field Tests**

- **PID**: Photionisation detector reading (ppm)
- **DOP(x-y)**: Dynamic penetrometer test (test depth interval shown)
- **HP**: Hand Penetrometer test (UCS kPa)
### Engineering Log - Test Pit

**Client:** Dennis Partners Pty Ltd  
**Project Name:** Proposed Residential Rezoning  
**Site Location:** Bakers Drive, Crescent Head  
**Test Location:** Refer to Figure 1  
**Test Pit No.:** TP10  
**Logged By:** TLM  
**Date:** 5/5/18

### Drilling and Sampling

<table>
<thead>
<tr>
<th>Method</th>
<th>Water Samples</th>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Material Description: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>Field Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm Tooth Bucket</td>
<td>Not Encountred</td>
<td>1.80</td>
<td></td>
<td>TOPSOIL: Silty SAND, fine to coarse grained, grey/brown, some Clay, Gravel, trace Cobbles to 150mm, tree roots</td>
<td>M Fb TOPSOIL</td>
</tr>
<tr>
<td>Sandy Clay</td>
<td></td>
<td>1.50</td>
<td></td>
<td>Sandy CLAY: Medium plasticity, pale brown/pale orange with orange/red mottling</td>
<td>M &lt; W VSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td>HP 400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes, Samples and Tests**

- **U:** 50mm Diameter tube sample
- **CBR:** Bulk sample for CBR testing
- **ASS:** Acid Sulfate Soil Sample
- **B:** Bulk Sample
- **PID:** Photoionisation detector reading (ppm)
- **DOP:** Dynamic penetrometer test (test depth interval shown)
- **HP:** Hand Penetrometer test (UCS kPa)

**Legend:**

- **Water Level** (Date and time shown)
- **Water Inflow**
- **Water Outflow**
- Gradational or transitional strata
- Definitive or distinct strata change

**Graphical Log**

- **Structure and Additional Observations**

- **Hole Terminated at 1.80 m**

**Consistency**

- **VS:** Very Soft
- **V:** Very Loose
- **L:** Loose
- **M:** Medium
- **D:** Dense
- **VD:** Very Dense

**UCS (kPa)**

- **<25**
- **25 - 50**
- **50 - 100**
- **100 - 200**
- **200 - 400**
- **>400**

**Moisture Condition**

- **D:** Dry
- **W:** Wet
- **W:** Plastic Limit
- **W:** Liquid Limit
- **Density Index <15%**
- **Density Index 15 - 25%**
- **Density Index 25 - 65%**
- **Density Index 65 - 85%**
- **Density Index 85 - 100%**

---

**Notes, Samples and Tests**

- **U:** 50mm Diameter tube sample
- **CBR:** Bulk sample for CBR testing
- **ASS:** Acid Sulfate Soil Sample
- **B:** Bulk Sample
- **PID:** Photoionisation detector reading (ppm)
- **DOP:** Dynamic penetrometer test (test depth interval shown)
- **HP:** Hand Penetrometer test (UCS kPa)
### Engineering Log - Test Pit

**Client:** Dennis Partners Pty Ltd  
**Project Name:** Proposed Residential Rezoning  
**Site Location:** Bakers Drive, Crescent Head

**Test Pit No:** TP11  
**Easting:** 496160 m  
**Nording:** 6548819 m  
**Surface RL:** 38.0 m  
**Test Pit Length:** 2.0 m  
**Width:** 0.4 m  
**Datum:** RL  
**Test Pit no:** TP11  
**Client:** Dennis Partners Pty Ltd  
**Project Name:** Proposed Residential Rezoning  
**Site Location:** Bakers Drive, Crescent Head

**Equipment Type:** 3.8T Mini Excavator  
**Test Pit Location:** Refer to Figure 1

### Notes, Samples and Tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Consistency</th>
<th>UCS (kPa)</th>
<th>Moisture Condition</th>
<th>Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS</td>
<td>Very Soft</td>
<td>&lt;25</td>
<td>D</td>
<td>Dry</td>
</tr>
<tr>
<td>S</td>
<td>Soft</td>
<td>25-50</td>
<td>M</td>
<td>Moist</td>
</tr>
<tr>
<td>F</td>
<td>Firm</td>
<td>50-100</td>
<td>W</td>
<td>Wet</td>
</tr>
<tr>
<td>St</td>
<td>Stiff</td>
<td>100-200</td>
<td>W&lt;sub&gt;p&lt;/sub&gt;</td>
<td>Plastic Limit</td>
</tr>
<tr>
<td>VSt</td>
<td>Very Stiff</td>
<td>200-400</td>
<td>W&lt;sub&gt;L&lt;/sub&gt;</td>
<td>Liquid Limit</td>
</tr>
<tr>
<td>H</td>
<td>Hard</td>
<td>&gt;400</td>
<td>Fb</td>
<td>Fine</td>
</tr>
</tbody>
</table>

### Drilling and Sampling

<table>
<thead>
<tr>
<th>Method</th>
<th>Water</th>
<th>Samples</th>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>Classification</th>
<th>Symbol</th>
<th>Moisture Condition</th>
<th>Consistency</th>
<th>UCS (kPa)</th>
<th>Density Index</th>
<th>Notes, Samples and Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.15</td>
<td></td>
<td>TOPSOIL: Silty SAND, fine to coarse grained, brown, some tree roots and Cobbles to 200mm</td>
<td>SM</td>
<td>D</td>
<td>VS</td>
<td>&lt;25</td>
<td>Density Index &lt;15%</td>
<td>Hole Terminated at 1.20 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td></td>
<td>Gravelly CLAY: Low plasticity, pale brown, with Sandstone cobbles to 200mm</td>
<td>CL</td>
<td>V/St</td>
<td>VS/L</td>
<td>&gt;250</td>
<td>Density Index 15 - 35%</td>
<td>Excavator Refusal on Rock</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.95</td>
<td></td>
<td>Sandy CLAY: Low plasticity, pale grey/pale brown, some orange mottling, rock fabric, some Sandstone Gravel</td>
<td>CH</td>
<td>M</td>
<td>M</td>
<td>&lt;400</td>
<td>Density Index 35 - 65%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td>SANDSTONE: Fine to coarse grained, pale brown/pale grey, low to medium strength, massive, widdy space defects</td>
<td></td>
<td></td>
<td>H</td>
<td>&gt;400</td>
<td>Density Index 65 - 85%</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- **Legend:** Water Level (Date and time shown)  
- **Density:** V = Very Loose  
- **MC:** D = Dry  
- **MC:** V = Very Loose  
- **D:** Density Index <15%  
- **MC:** L = Loose  
- **D:** Density Index 15 - 35%  
- **D:** Medium Dense  
- **D:** Dense  
- **D:** Density Index 35 - 65%  
- **D:** Very Dense  
- **D:** Density Index 65 - 85%  
- **D:** Very Dense  
- **D:** Density Index 85 - 100%
### Field Test Results

#### Drilling and Sampling

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER</th>
<th>SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>GRAPHIC LOG</th>
<th>CLASSIFICATION SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
<td>300mm TOOTH BUCKET</td>
</tr>
</tbody>
</table>

#### Material Description and Profile Information

- **TOPSOIL**: Silty SAND, fine to coarse grained, grey/brown, trace Gravel fine to coarse grained
- **SANDY CLAY**: Medium plasticity, pale grey/pale brown, trace pale orange/orange mottling, some Rock fabric, trace Sandstone Gravel
- **SANDSTONE**: Fine to coarse grained, pale grey/pale brown, trace pale orange mottling, very low to low strength

#### Field Test Result

- Hole Terminated at 1.10 m
- Excavator Refusal on Rock

### Notes, Samples and Tests

- **50mm Diameter tube sample**
- **Bulk sample for CBR testing**
- **Acid Sulfate Soil Sample**
- **Bulk Sample**

### Drilling and Sampling Method

- **Water Level**
- **Water Inflow**
- **Water Outflow**

### Strata Changes

- **Gradational or transitional strata**
- **Definitive or distinct strata change**

### Field Tests

- **Photionisation detector reading (ppm)**
- **Dynamic penetrometer test (test depth interval shown)**
- **Hand Penetrometer test (UCS kPa)**

### Consistency

- **Very Soft**
- **Soft**
- **Firm**
- **Stiff**
- **Very Stiff**
- **Hard**

### Moisture Condition

- **Very Loose**
- **Loose**
- **Medium Dense**
- **Dense**
- **Very Dense**

### UCS (kPa)

- **Very Soft**
- **Soft**
- **Firm**
- **Stiff**
- **Very Stiff**
- **Hard**

### Density

- **Very Loose**
- **Loose**
- **Medium Dense**
- **Dense**
- **Very Dense**

### Density Index

- **<15%**
- **15 - 35%**
- **35 - 65%**
- **65 - 85%**
- **85 - 100%**
### Engineering Log - Test Pit

**CLIENT:** Dennis Partners Pty Ltd  
**PROJECT NAME:** Proposed Residential Rezoning  
**SITE LOCATION:** Bakers Drive, Crescent Head  
**TEST LOCATION:** Refer to Figure 1  
**EQUIPMENT TYPE:** 3.8T Mini Excavator  
**EASTING:** 496407 m  
**SURFACE RL:** 26.0 m  
**TEST PIT LENGTH:** 2.0 m  
**WIDTH:** 0.4 m  
**NORTHING:** 6548777 m  
**DATUM:** RL  
**DATE:** 25/5/18

#### Drilling and Sampling

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WATER</th>
<th>SAMPLES</th>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>GRADING LOG</th>
<th>CLASSIFICATION SYMBOL</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY</th>
<th>CONSISTENCY</th>
<th>DRAINAGE</th>
<th>STRATA CHANGES</th>
<th>FIELD TEST</th>
<th>RESULT</th>
<th>Structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm TOOTH BUCKET</td>
<td>Not Encountered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.5</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.5</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes, Samples and Tests
- **U** Water Level (Date and time shown)
- **E** Water Inflow
- **B** Water Outflow
- **ASS** Acid Sulfate Soil Sample
- **CBR** Bulk sample for CBR testing
- **C** Environmental sample

#### Field Tests
- **PID** Photoionisation detector reading (ppm)
- **DOP(x-y)** Dynamic penetrometer test (test depth interval shown)
- **HP** Hand Penetrometer test (UCS kPa)

#### Soil Types
- **TOPSOIL:** Silty SAND, dark brown, with Gravel, Cobbles, and tree roots, uneven profile
- **Gravelly SAND:** Fine to coarse grained, pale brown, some Clay, low plasticity, boulder to 400mm, Sandstone, subrounded, tree roots
- **SANDSTONE:** Fine to coarse grained, pale brown/pale grey, medium to high strength, massive

#### Consistency
- **VS** Very Soft
- **S** Soft
- **F** Firm
- **St** Stiff
- **VSt** Very Stiff
- **H** Hard

#### Density
- **V** Very Loose
- **L** Loose
- **MD** Medium Dense
- **D** Dense
- **VD** Very Dense

#### Moisture Condition
- **Dry**
- **Moist**
- **Wet**
- **Plastic Limit**
- **Liquid Limit**

#### Diagram
- Hole Terminated at 1.20 m
- Excavator Refusal on Rock

---

**LEGEND:**
- **Water Level (Date and time shown)**
- **Water Inflow**
- **Water Outflow**
- **Graded or transitional strata**
- **Definitive or distinct strata change**

---

**Note:** The above information is a summary of the test pit results from Dennis Partners Pty Ltd's proposed residential rezoning project at Bakers Drive, Crescent Head. The test was conducted using a 3.8T Mini Excavator, with samples taken at various depths and conditions. The soil types identified include topsoil, gravelly sand, and sandstone. The test results indicate varying conditions for water level, moisture, and density, with specific observations noted for the termination of the hole and excavator refusal on rock.
**Material description and profile information**

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>DEPTH (m)</th>
<th>GRAPHIC LOG SYMBOL</th>
<th>MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components</th>
<th>MOISTURE CONDITION</th>
<th>DENSITY CLASSIFICATION</th>
<th>CONSISTENCY</th>
<th>DENSITY INDEX</th>
<th>TEST TYPE</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40</td>
<td></td>
<td>MH</td>
<td>TOPSOIL: Sandy SILT, dark grey, some Clay, grass roots</td>
<td>M</td>
<td>D (Dry)</td>
<td>VS</td>
<td>&lt;15%</td>
<td>TOPSOIL</td>
<td></td>
</tr>
<tr>
<td>1.80</td>
<td></td>
<td>CH</td>
<td>Sandy CLAY: Medium plasticity, pale grey/pale brown, some orange/red mottling, some Gravel, fine to medium grained, subangular/subrounded</td>
<td>M &lt; Wc</td>
<td>D (Dense)</td>
<td>VS/ST</td>
<td>15 - 35%</td>
<td>COLLUVIAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HP 400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Field Tests**

- **Topsoil**
  - Water Level
  - Water Inflow
  - Water Outflow

**Attempts**

- Hole Terminated at 1.80 m
- Refusal on Boulder (Floaters?)

**Structure and additional observations**

- From 1m Sandy Gravelly CLAY, some Cobbles, Sandstone, subangular/subrounded

---

**Field Tests**

- **Consistency**
  - VS Very Soft
  - F Firm
  - W Wet
  - S Soft
  - H Hard

- **Density**
  - V Very Loose
  - L Loose
  - MD Medium Dense
  - D Dense
  - VD Very Dense

- **UCS (kPa)**
  - VS/ST Very Stiff
  - 200 - 400

- **Plastic Limit**
  - M Moist

- **Liquid Limit**
  - Wp Plastic Limit
  - W Liquid Limit

- **Designation**
  - D Dry

---

**Notes, Samples and Tests**

- 50mm Diameter tube sample
- Bulk sample for CBR testing
- Environmental sample
- Acid Sulfate Soil Sample
- Bulk Sample

**Additional Observations**

- holes and cuts
- transitions
- hard to medium dense

---

**LEGEND**

- Water Level
- Water Inflow
- Water Outflow
- Gradational or transitional strata
- Definitive or distinct strata change
Appendix B

Laboratory Test Results
# RESULTS OF ACID SULFATE SOIL ANALYSIS

4 samples supplied by Regional Geotechnical Solutions Pty Ltd on 26/07/18. Lab Job No.H2591
Analysis requested by Tim Morris. Your Job: RGS20716.1

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>EAL Lab Code</th>
<th>Texture</th>
<th>Moisture Content</th>
<th>pHF and pHFOX</th>
<th>pH change</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(% moisture of total wet weight)</td>
<td>(g moisture / g of oven dry soil)</td>
<td>pHF</td>
<td>pHFOX</td>
<td></td>
</tr>
<tr>
<td>TP6 0.5-1.0</td>
<td>H2591/1</td>
<td>Coarse</td>
<td>12.2</td>
<td>0.14</td>
<td>6.39</td>
<td>4.73</td>
</tr>
<tr>
<td>TP6 1.0-1.3</td>
<td>H2591/2</td>
<td>Coarse</td>
<td>12.9</td>
<td>0.15</td>
<td>6.43</td>
<td>5.06</td>
</tr>
<tr>
<td>TP8 0.5-1.0</td>
<td>H2591/3</td>
<td>Medium</td>
<td>17.9</td>
<td>0.22</td>
<td>4.83</td>
<td>3.52</td>
</tr>
<tr>
<td>TP8 1.5-2.0</td>
<td>H2591/4</td>
<td>Fine</td>
<td>12.2</td>
<td>0.14</td>
<td>5.73</td>
<td>4.43</td>
</tr>
</tbody>
</table>

**NOTES:**
1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
4. The Acid Base Accounting Equation is $\text{Net Acidity} = \text{Actual Acidity} + \text{Retained Acidity} + \text{Potential Sulfidic Acidity (S$_\text{NAS}$ or S$_\text{ANC}$)} - \text{Acid Neutralising Capacity/Fineness Factor}$ (Ahern et al. 2004 - full reference above).
5. Retained Acidity is required when the pH$_{KCl}$ ≤ 4.5 or where jarosite has been visually observed. Acid Neutralising Capacity is required when the Potential Sulfidic Acidity is greater than the texture dependent trigger and the pH$_{KCl}$ ≥ 6.5.
6. An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 19 mol H$^+$t; medium texture ≥ 0.06% S or 37 mol H$^+$t; fine texture ≥ 0.1% S or 62 mol H$^+$t (Ahern et al. 2004 - full reference above).
7. For projects that disturb > 1000 tonnes of soil, the coarse trigger of ≥ 0.03% S must be applied in accordance with Ahern CR, Stone Y and Blunden B (1998). Acid sulfate soils assessment guidelines. Acid Sulfate Soil Management Advisory Committee: Wollongbar, NSW, Australia.
8. Acid sulfate soil texture triggers can be related to standard soil textures: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays (Ahern et al. 1998 - full reference above).
9. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
10. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Ahern et al. 2004). This is only applied to positive values. An increased Safety Factor may be required in some cases.
11. A negative Net Acidity result indicates an excess acid neutralising capacity.
12. ‘-‘ is reported where a test is either not requested or not required. Where pH$_{KCl}$ is < 4.5 or > 6.5, zero is reported for S$_\text{NAS}$ and ANC in Net Acidity calculations, respectively.
13. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
14. ** NATA accreditation does not cover the performance of this service.
# RESULTS OF SOIL ANALYSIS (Page 1 of 1)

2 samples supplied by Regional Geotechnical Solutions Pty Ltd on 26 July, 2018 - Lab Job No. H2593

Analysis requested by Tim Morris. - Your Project: RGS20716.1
44 Bent Street WINGHAM NSW 2429

<table>
<thead>
<tr>
<th></th>
<th>Sample 1</th>
<th>Sample 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
<td><strong>EAL job No.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TP6 0.5-1.0</td>
<td>TP8 0.5-1.0</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>inhouse 12</td>
<td>H2593/1 17</td>
</tr>
<tr>
<td>Texture</td>
<td>See note 2 below. Coarse</td>
<td>Fine</td>
</tr>
<tr>
<td>Soil pH (1:5 water)</td>
<td>Rayment and Lyons 4A1 6.01</td>
<td>Rayment and Lyons 4B1 4.96</td>
</tr>
<tr>
<td>Soil Conductivity (1:5 water dS/m )</td>
<td>Rayment and Lyons 4B1 0.021</td>
<td>Rayment and Lyons 4B1 0.121</td>
</tr>
<tr>
<td>Soil Resistivity (ohm.mm)</td>
<td>** Calculation 477,327</td>
<td>82,440</td>
</tr>
<tr>
<td>Chloride (mg/kg)</td>
<td>** Water Extract- Rayment and Lyons 5A2b 8</td>
<td>103</td>
</tr>
<tr>
<td>Chloride (as %)</td>
<td>** Calculation 0.001</td>
<td>0.010</td>
</tr>
<tr>
<td>Sulfate (mg/kg)</td>
<td>** Water Extract-Apha 3120 ICPOES 2,013</td>
<td>915</td>
</tr>
<tr>
<td>Sulfate (as % SO₃)</td>
<td>** Calculation 0.161</td>
<td>0.073</td>
</tr>
<tr>
<td>Chloride / Sulfate Ratio</td>
<td>** calculation 0.004</td>
<td>0.112</td>
</tr>
</tbody>
</table>

Notes:
1. ppm = mg/kg dried soil
2. For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
3. All results as dry weight DW - soils were dried at 60°C for 48hrs prior to crushing and analysis.
4. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
5. Methods from Rayment and Lyons. Soil Chemical Methods - Australasia
6. Based on Australian Standard AS: 159-1995
8. ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

Graham Lancaster
Laboratory Manager
Appendix C

AGS Risk Matrix
QUALITATIVE MEASURES OF LIKELIHOOD

<table>
<thead>
<tr>
<th>Approximate Annual Probability</th>
<th>Implied Indicative Landslide Recurrence Interval</th>
<th>Description</th>
<th>Descriptor</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Value</td>
<td>Notional Boundary</td>
<td>10 years</td>
<td>20 years</td>
<td>The event is expected to occur over the design life</td>
</tr>
<tr>
<td>$10^{-3}$</td>
<td>5x10^5</td>
<td>100 years</td>
<td>200 years</td>
<td>The event will probably occur under adverse conditions over the design life</td>
</tr>
<tr>
<td>$10^{-4}$</td>
<td>5x10^4</td>
<td>1,000 years</td>
<td>2,000 years</td>
<td>The event could occur under adverse conditions over the design life</td>
</tr>
<tr>
<td>$10^{-5}$</td>
<td>5x10^3</td>
<td>10,000 years</td>
<td>20,000 years</td>
<td>The event might occur under very adverse circumstances over the design life</td>
</tr>
<tr>
<td>$10^{-6}$</td>
<td>5x10^2</td>
<td>100,000 years</td>
<td>200,000 years</td>
<td>The event is conceivable but only under exceptional circumstances over the design life</td>
</tr>
<tr>
<td>$10^{-7}$</td>
<td>1x10^1</td>
<td>1,000,000 years</td>
<td>2,000,000 years</td>
<td>The event is inconceivable or fanciful over the design life</td>
</tr>
</tbody>
</table>

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not vice versa.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

<table>
<thead>
<tr>
<th>Approximate Cost of Damage</th>
<th>Description</th>
<th>Descriptor</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Value</td>
<td>Notional Boundary</td>
<td>Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.</td>
<td>CATASTROPHIC</td>
</tr>
<tr>
<td>200%</td>
<td>100%</td>
<td>Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property major consequence damage.</td>
<td>MAJOR</td>
</tr>
<tr>
<td>60%</td>
<td>40%</td>
<td>Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>20%</td>
<td>10%</td>
<td>Little damage (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.5%. See Risk Matrix.)</td>
<td>MINOR</td>
</tr>
<tr>
<td>5%</td>
<td>1%</td>
<td>Little damage</td>
<td>INSIGNIFICANT</td>
</tr>
</tbody>
</table>

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.
(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other slides which may affect the property.
(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa.

Australian Geomechanics Vol 42 No 1 March 2007
## Qualitative Risk Analysis Matrix - Level of Risk to Property

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Indicative Value of Approximate Annual Probability</th>
<th>1: Catastrophic 200%</th>
<th>2: Major 60%</th>
<th>3: Medium 20%</th>
<th>4: Minor 5%</th>
<th>5: Insignificant 0.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Almost Certain</td>
<td>$10^1$</td>
<td>VH</td>
<td>VH</td>
<td>VH</td>
<td>H</td>
<td>M or L (5)</td>
</tr>
<tr>
<td>B - Likely</td>
<td>$10^3$</td>
<td>VH</td>
<td>VH</td>
<td>H</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>C - Possible</td>
<td>$10^4$</td>
<td>VH</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>VL</td>
</tr>
<tr>
<td>D - Unlikely</td>
<td>$10^4$</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td>E - Rare</td>
<td>$10^3$</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>F - Barely Credible</td>
<td>$10^4$</td>
<td>L</td>
<td>VL</td>
<td>VL</td>
<td>VL</td>
<td>VL</td>
</tr>
</tbody>
</table>

Notes:
(5) For cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment, it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

### Risk Level Implications

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Example Implications (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VH</td>
<td>Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.</td>
</tr>
<tr>
<td>H</td>
<td>Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.</td>
</tr>
<tr>
<td>M</td>
<td>May be tolerated in certain circumstances (subject to regulator’s approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.</td>
</tr>
<tr>
<td>L</td>
<td>Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.</td>
</tr>
<tr>
<td>VL</td>
<td>Acceptable. Manage by normal slope maintenance procedures.</td>
</tr>
</tbody>
</table>

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.
Appendix D

AGS - Good Hillslope Practise
Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.

**WHY ARE THESE PRACTICES GOOD?**

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

**ADOPT GOOD PRACTICE ON HILLSIDE SITES**
WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.
Dennis Partners Pty Ltd

Proposed Residential Rezoning, Baker Drive, Lot 703 & 704 DP749885 & Lot 707 DP1032859, Crescent Head

Stage 1 Contamination Assessment

Report No. RGS20716.1-AE
23 August 2018
RGS20716.1-AE

23 August 2018

Dennis Partners Pty Ltd
c/- Gem Planning Projects
23 Clarence Street
PORT MACQUARIE NSW 2444

Attention: Geraldine Haigh

Dear Geraldine,

RE: Proposed Residential Rezoning, Baker Drive, Lot 703 & 704 DP749885 & Lot 707 DP1032859, Crescent Head

Stage 1 Contamination Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a Stage 1 Contamination Assessment of Lot 703 and Lot 704 DP749885 and Lot 707 DP1032859, Baker Drive, Crescent Head. Residential rezoning is proposed for the lots which are currently zoned Rural.

The assessment found the site to be appropriate for the proposed residential development from a site contamination perspective provided the recommendations and advice of this report are adopted. Access to Lot 703 was not possible at the time of the investigation and further assessment is therefore recommended at the development approval stage.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Tim Morris

Associate Engineering Geologist
# Table of Contents

1 INTRODUCTION .......................................................................................................................... 1

2 GUIDELINES AND ASSESSMENT CRITERIA ....................................................................... 1

3 METHODOLOGY ......................................................................................................................... 2

4 SITE SETTING and HISTORY ..................................................................................................... 3
   4.1 Site Description ..................................................................................................................... 3
   4.2 Historical Aerial Photography ............................................................................................ 3
   4.3 Site Observations ................................................................................................................ 4
   4.4 NSW EPA Records .............................................................................................................. 5
   4.5 Land Title Search ............................................................................................................... 6
   4.6 Geology ............................................................................................................................... 6
   4.7 Groundwater ....................................................................................................................... 7
   4.8 Site History Summary ......................................................................................................... 7

5 SITE CONTAMINATION ASSESSMENT ............................................................................. 8
   5.1 Conceptual Site Model ........................................................................................................ 8
   5.2 Field Work .......................................................................................................................... 9
   5.3 Laboratory Testing ............................................................................................................. 10
   5.4 Quality Control .................................................................................................................. 10

6 SITE CONTAMINATION ASSESSMENT - RESULTS .............................................................. 10

7 ASSESSMENT AND CONCLUSIONS REGARDING SITE CONTAMINATION .................. 11
   7.1 Summary ............................................................................................................................. 11
   7.2 Conclusion .......................................................................................................................... 11

8 LIMITATIONS ........................................................................................................................... 12

---

# Figures

Figure 1 Investigation Location Plan
Figure 2 Historical Aerial Photograph (1967)

# Appendices

Appendix A Site History Documentation
Appendix B Results of Laboratory Testing
1 INTRODUCTION

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a Stage 1 Contamination Assessment of Lot 703 and Lot 704 DP749885 and Lot 707 DP1032859, Baker Drive, Crescent Head. Residential rezoning is proposed for the lots which are currently zoned Rural. The proposed rezoning applies to the land area above approximate RL 3.2m.

The proposed residential development is located in an area of gently to steeply undulating topography that includes bushland and areas cleared for farming. Concept drawings indicate the development may involve:

- Site regrading works
- Site preparation works for a large number of residential lots;
- Construction of road pavements; and
- Construction works for associated infrastructure including water, sewer and stormwater services.

The purpose of the work described herein was to assess the suitability of the site for residential land use with respect to the presence of site contamination resulting from past land use and activities, as well as providing discussions and recommendations regarding:

- Identification of Areas of Concern and Chemicals of Concern regarding site contamination;
- Conclusions regarding the presence of contamination at the site and its potential impacts on the proposed landuse;
- Assessment of requirements for remediation, further investigation, or ongoing management of site contamination.

The work was commissioned by Rob Dennis of Dennis Partners Pty Ltd and was undertaken in accordance with proposal number RGS20716.1-AA dated 10 May 2018.

A geotechnical assessment of the site (Report Ref. RGS20716.1-AD) was undertaken concurrently with the contamination assessment and should be read in conjunction with this report.

2 GUIDELINES AND ASSESSMENT CRITERIA

The assessment was aimed at fulfilling the requirements of a Phase 1 Contaminated Site Assessment in accordance with NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (2011).

To evaluate results and for guidance on assessment requirements, the assessment adopted the guidelines provided in the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013). The NEPM document provides a range of guidelines for assessment of contaminants for various land use scenarios. The proposed landuse is residential and as such comparison with the NEPM guideline values for residential landuse was considered appropriate. In accordance with the NEPM guideline the following criteria were adopted for this assessment:
• Health Investigation Levels (HILs) for residential land use were used to assess the potential human health impact of heavy metals and PAH;

• Health Screening Levels (HSLs) for coarse textured (sand) or fine textured (silt and clay) soils on a residential site were adopted as appropriate for the soils encountered to assess the potential human health impact of petroleum hydrocarbons and BTEX compounds;

• Ecological Investigation Levels (EILs) for residential land use were used for evaluation of the potential ecological / environmental impact of heavy metals and PAH; and

• Ecological Screening Levels (ESLs) for coarse textured (sand) soils or fine textured (silt and clay) soils on a residential land use site were adopted as appropriate for the soils encountered, to assess the potential ecological / environmental impact of petroleum hydrocarbons and BTEX compounds.

In accordance with NEPM 2013, exceedance of the criteria does not necessarily deem that remediation or cleanup is required, but is a trigger for further assessment of the extent of contamination and associated risks.

3 METHODOLOGY

In accordance with the relevant sections of the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (Amended 2013), the assessment involved the following process:

• A brief study of site history, with the aim of identifying past activities on or near the site that might have the potential to cause contamination;

• Discussion with available landholders to confirm details of site history;

• A search of Land Titles information;

• Review of available recent and historical aerial photography for the last 50 years;

• Government records of groundwater bores in the area;

• Site walkover to assess visible surface conditions and identify any evidence of contamination, or past activities that may cause contamination;

• Using the above information, characterise the site into Areas of Environmental Concern, in which the potential for contamination has been identified, and nominate Chemicals of Concern that might be associated with those activities;

• Undertake targeted sampling and analysis at the selected Areas of Concern to allow some preliminary analysis of the presence of contamination;

• Analyse samples for a suite of potential contaminants associated with the past activities;

• Evaluate the results against industry accepted criteria for the proposed landuse.

Based on the results of the site history study, judgemental sampling at selected locations was undertaken to assist in identifying potential contamination and assessing the requirement for further investigation or site management with regard to contamination.
4 SITE SETTING and HISTORY

4.1 Site Description

The site is located to the west of Baker Drive in an area of gently to steeply undulating topography and includes the crest and north facing upper to lower undulating slopes of a large hill, locally referred to as Killuke Mountain. The hill slopes grade down to the north to a low lying sand plain. Surface elevations across the site range from approximately RL 46m on the upper hill slopes along the southern boundary to approximately RL 1.5m along the northern boundary on the sand plain. The proposed rezoning applies to the land area above approximate RL 3.2m.

Slope angles on the upper slopes were up to 25° and graded down to near flat on the sand plain. The upper and middle slopes were typically vegetated with large eucalypts and the lower slopes and sand plain had been cleared for grazing purposes. Two gullies that include intermittent drainage lines are present on the hill slopes and drain towards the north.

An image of the site taken from the NSW Department of Property Information website is reproduced below.

4.2 Historical Aerial Photography

Aerial photographs of the site were purchased from the NSW Land and Property Management Authority and reviewed to assist in identifying past land uses that may contribute to site contamination. The results of the review are summarised in Table 1.
Table 1 - Aerial Photograph Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Lot 703, 704 &amp; 707</th>
<th>Surrounding Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>The ridge slopes in the south of the site are vegetated with trees while the lower ridge slopes in the north have been mostly cleared for farming. Shallow field drains are present in the cleared area and drain towards the north. Two structures (house and shed?) and a separate structure (dairy bales?) are located on the crest of a ridge spur in the centre of Lot 707.</td>
<td>The site is surrounded by bush to the west, south and east. A large dam excavation is being undertaken to the north east of the site and is associated with the Crescent Head water supply.</td>
</tr>
<tr>
<td>1991</td>
<td>The three buildings in Lot 707 are no longer visible. Two dams have been constructed at the toe of the ridge slopes. Two contour swales/drains have been constructed at the toe of the ridge, each approximately 400m in length. A farm drain has been constructed along the northern boundary. A dwelling and shed is located in Lot 703.</td>
<td>No significant change.</td>
</tr>
<tr>
<td>2005 (Google Earth)</td>
<td>A shed has been constructed in the south east corner on the lower ridge slopes in Lot 707.</td>
<td>No significant change.</td>
</tr>
<tr>
<td>2009 (Google Earth)</td>
<td>Two farm dams constructed on the sand plain near the northern site boundary</td>
<td>No significant change.</td>
</tr>
<tr>
<td>August 2018 (Google Earth)</td>
<td>The shed in the south east corner of Lot 707 has been replaced by a larger shed. Excavation works have taken place to the west of the shed on the crest of the ridge spur. A large windrow of tree debris is present in the north east corner of Lot 707.</td>
<td>The road corridor in the adjacent property to the east has been cleared of vegetation.</td>
</tr>
</tbody>
</table>

4.3 Site Observations

Fieldwork was undertaken on the 25 May 2018. Observations made during the site visit are summarised below:

- A metal shed was under construction in the south eastern corner of Lot 707;
- Three farm dams were present and each contained water. A farm dam that had been present in the central gully had been breached and did not contain water;
- An old concrete slab approximately 4m x 8m, possibly an old dairy bales, was located in the south of Lot 707 on the crest of the ridge spur. A metal machinery part, possibly an old pump, was on the floor of the slab; and
Traces of building debris were present on the crest of the ridge spur to the north of the inferred dairy bails in Lot 707. The debris included bricks, charcoal and fibre cement sheeting fragments over an area of <5m² and was in the vicinity of the inferred dwelling visible in the 1967 aerial photograph.

A selection of images of the site is presented below.

4.4 NSW EPA Records

A check with the NSW Office of Environment and Heritage website (www.environment.nsw.gov.au) revealed that no notices have been issued on the site under the Contaminated Land Management Act (1997).
4.5 Land Title Search

A list of past registered proprietors and lessors of the site was obtained from the Land Titles Office. A summary of the title details is included in Appendix A. A land title search of Lot 703 DP749885 was not undertaken.

The title history search revealed the following:

Lot 704 DP749885:

- 1903 – 1932: David Harvey, grantee;
- 1932 – 1939: Dorothea May Milligan, wife of Mervyn Henry Milligan, lorry driver;
- 1939 – 1953: William Henry Milligan, motor lorry driver;
- 1953 – 1973: Alick Milton Thurgood, farmer;
- 1973 – 1977: Cambridge Credit Corporation Limited;
- 2002 – 2017: Portofino Enterprises Pty Limited; and
- 2017 – to date: Piwila Pty Ltd, Crescent Head Sands Pty Ltd, Karen Leanne Nott, John Percival Phillips, John Kevin Phillips and Sambenlin Pty Ltd.

Lot 707 DP1032859:

- 1903 – 1932: David Harvey, grantee;
- 1932 – 1939: Dorothea May Milligan, wife of Mervyn Henry Milligan, lorry driver;
- 1939 – 1953: William Henry Milligan, motor lorry driver;
- 1953 – 1973: Alick Milton Thurgood, farmer;
- 1973 – 1977: Cambridge Credit Corporation Limited;
- 2002 – 2017: Portofino Enterprises Pty Limited; and
- 2017 – to date: Piwila Pty Ltd, Crescent Head Sands Pty Ltd, Karen Leanne Nott, John Percival Phillips, John Kevin Phillips and Sambenlin Pty Ltd.

4.6 Geology

The site is situated in an area underlain by the Byabarra Beds that can include lithic sandstone, siltstone and limestone. Sandstone boulders are present on the upper ridge slopes in the south of the site.
The Port Macquarie 1:100,000 Coastal Quaternary Geology Sheet indicates residual soils are present on the ridge slopes in the south of the site, alluvial and colluvial deposits that can include fluvial sands, silt, gravel and clay are present at the toe of the residual slopes in the north east of the site. A low lying back barrier sand plain is located in the north of the site at the toe of the residual slopes and can include marine sand, indurated sand, silt, clay and gravels.

4.7 Groundwater

A groundwater bore search on the NSW Water Information website, http://waterinfo.nsw.gov.au/gw/, indicates that there are no licensed groundwater bores within 200m of the site boundary. The nearest licensed bore is located approximately 500m to the north as shown below.

Groundwater Bore Map (From NSW Water website)

![Groundwater Bore Map](image)

Approximate area of assessment outlined in red. Nearest licensed groundwater bore located approximately 500m to the north.

The bore located approximately 500m to the north of the site had no details available.

Regional groundwater flow direction typically follows topographic slopes, which for this site would be mainly towards the north.

4.8 Site History Summary

Based on available data the chronological development of the site was undertaken as summarised below:

- Lots 704 and 707 have had various owners since 1903 including a lorry driver and a farmer;
• Aerial photographs indicate that the north of the site was mostly cleared of trees prior to 1967. The upper and middle ridge slopes are still mostly vegetated with trees;

• The 1967 aerial photograph indicate three small buildings were located in the centre of Lot 707 on the crest of a ridge spur. The buildings are inferred to comprise a possible dwelling and shed in the north and dairy bails to the south as shown in Figure 2. The buildings are not visible in the 1991 aerial photograph. The slab for the dairy bails was observed during the site walkover and traces of building debris was observed in the vicinity of the inferred dwelling. Building debris included traces of fibre cement sheeting fragments;

• The 1991 aerial photograph shows a dwelling and adjacent shed present in Lot 703;

• Google Earth image dated 2005 shows a shed located in the south eastern corner of Lot 707. The shed in the south eastern corner was being replaced by a larger metal shed at the time of the May 2018 site visit;

• Lots 704 and 707 were purchased in 2017 by Piwila Pty Ltd, Crescent Head Sands Pty Ltd, Karen Leanne Nott, John Percival Phillips, John Kevin Phillips and Sambenlin Pty Ltd; and

• Google Earth image dated August 2018, subsequent to the site visit, shows a large windrow of vegetation had been pushed up in the north eastern corner of Lot 707, presumably associated with the clearing of the adjacent road corridor. Some earthworks had also occurred in the vicinity of the inferred dwelling on the crest of the ridge spur in Lot 707.

5 SITE CONTAMINATION ASSESSMENT

5.1 Conceptual Site Model

Based on the site observations and knowledge obtained about site activities as outlined above, potential Areas of Concern and Chemicals of Concern were identified for the assessment as outlined in Table 2.
### Table 2: Conceptual Site Model

<table>
<thead>
<tr>
<th>Area of Concern</th>
<th>Mode of Potential Contamination</th>
<th>Chemicals of Concern</th>
<th>Targeted Sampling Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEC1: Soils in vicinity of former sheds/bails</td>
<td>Potential spillage of chemicals from containers including cleaning fluids/ fuel/oils, herbicide/ pesticide. Use of asbestos building materials.</td>
<td>Heavy Metals, TPH, BTEX, PAH, OC/OPP, asbestos</td>
<td>SA-02, SA-03, SA-04</td>
</tr>
<tr>
<td>AEC2: Soils in vicinity of existing dwelling/shed</td>
<td>Potential spillage of chemicals from containers including cleaning fluids/ fuel/oils, herbicide/ pesticide. Use of asbestos building materials.</td>
<td>Heavy Metals, TPH, BTEX, PAH, OC/OPP, asbestos</td>
<td>SA-01</td>
</tr>
<tr>
<td>AEC3: Soils in drainage line and along fence lines</td>
<td>Runoff from herbicides and pesticides used for agricultural purposes.</td>
<td>Heavy Metals, OC/OPP</td>
<td>SA-05, SA-06, SA-07, SA-08</td>
</tr>
</tbody>
</table>

Heavy Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc
BTEX - Benzene, Toluene, Ethylbenzene and Xylene
TPH - Total Petroleum Hydrocarbons
PAH – Polycyclic Aromatic Hydrocarbons
OC/OPP – Organochlorine and Organophosphorus Pesticides

### 5.2 Field Work

Field work for the assessment was undertaken on 25 May 2018 and included:

- Site walkover to assess visible surface conditions and identify any evidence of contamination, or past activities that may cause contamination;
- Eight test pits undertaken by a hand tools, logged and sampled by an Engineering Geologist; and
- Test pit locations were based on professional judgement with consideration of the site history and visible site features; and
- 14 test pits were undertaken as part of the geotechnical assessment. Engineering logs for these test pits are presented in Report RGS20716.1-AD which should be read in conjunction with this Report.

The locations of the hand dug test pits are shown on Figure 1. They were obtained on site by measurements relative to existing site features.

Soil samples were taken from selected depths below the topsoil using disposable gloves and hand tools which were decontaminated between sampling points using Decon90 detergent and deionised water. The samples were collected in acid-rinsed 250mL glass jars and placed in an ice-chilled cooler box.
5.3 Laboratory Testing

Samples were transported under chain-of-custody conditions to ALS Laboratory Group, a NATA accredited specialist chemical testing laboratory, to be tested for the following suite of contaminants;

- Polycyclic Aromatic Hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethyl-benzene, Xylenes (BTEX)
- Organochlorine Pesticides (OC/OPs)
- Heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, and zinc)
- Presence of asbestos

The results are presented in Appendix B.

5.4 Quality Control

Samples were obtained using industry accepted protocols for sample treatment, preservation, and equipment decontamination.

In addition to the field QC procedures, the laboratory conducted internal quality control testing including surrogates, blanks, and laboratory duplicate samples. The results are presented with the laboratory test results in Appendix B.

On the basis of the results of the field and laboratory quality control procedures and testing the data is considered to reasonably represent the concentrations of contaminants in the soils at the sample locations at the time of sampling and the results can be adopted for this assessment.

6 SITE CONTAMINATION ASSESSMENT - RESULTS

An appraisal of the laboratory test results presented in Appendix B is provided below with reference to the adopted soil investigation and screening levels discussed in Section 2.

- Concentrations of heavy metals were above detection, but were below adopted health investigation criteria for residential land use;
- Concentrations of TPH contaminants were above detection, but were below adopted health investigation criteria for a residential site;
- Concentrations of PAH and BTEX were below detection;
- Concentrations of herbicide/pesticide contaminants were below detection; and
- Asbestos was detected in the one sample of bonded cement sheeting that was collected on the surface at sample location SA-04 and submitted for analysis.
7 ASSESSMENT AND CONCLUSIONS REGARDING SITE CONTAMINATION

A Stage 1 Site Contamination Assessment was required to assess all past and present potentially contaminating activities and contamination types and confirm the property is suitable for residential use.

7.1 Summary

Based on the results outlined in this report the following points and recommendations are made:

- Considering the age of the buildings present in Lot 703 there is the potential for asbestos type building materials to have been used in their construction. Should site demolition works be proposed a hazardous material inspection of the buildings is recommended to determine if hazardous materials including asbestos are present;

- Asbestos Containing Material (ACM) was detected in the sample (SA-04) of bonded cement sheeting that was collected in the vicinity of the former dwelling in the centre of Lot 707 as shown on figure 1. The ACM was associated with surface fragments of building waste that covered an area of <5m². The ACM should be collected and disposed of offsite in accordance with Council and SafeWork Australia guidelines to an appropriately licensed waste management facility;

- Building materials and any containers of any chemicals stored within the sheds that require removal off site should be disposed of in accordance with NSW EPA and Council requirements to an appropriately licensed waste management facility; and


7.2 Conclusion

Based on the results obtained in this investigation the site is considered suitable for proposed residential land use with regard to the presence of soil contamination provided the recommendations and advice of this report are adopted, and site preparation works are conducted in accordance with appropriate site management protocols and legislative requirements.

If potentially contaminated material such as foreign materials, or, soils with strong odours are encountered during future works then RGS should be contacted.
8 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted environmental practices and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Tim Morris
Associate Engineering Geologist
Based on supplied drawing titled "CONTOUR PLAN"

**Client:** DENNIS PARTNERS  
**Project:** PROPOSED RESIDENTIAL REZONING  
**Title:** INVESTIGATION LOCATION PLAN  
**Job No.:** RGS20716.1  
**Drawn By:** TM  
**Date:** 23-Aug-18  
**Drawing No.:** Figure 1
Figure 2

HISTORICAL AERIAL PHOTOGRAPH (1967)

- Approximate Extent of Proposed Rezoning
- Shallow Field Drains
- AEC1: Dairy Bails?
- AEC1: Dwelling and Shed (?)
Appendix A

Site History Documentation
ADVANCE LEGAL SEARCHERS PTY LIMITED
(ACN 147 943 842)
ABN 82 147 943 842
18/36 Osborne Road,
Manly NSW 2095
Telephone: +612 9977 6713
Mobile: 0412 169 809
Email: search@alsearchers.com.au

28th May 2018

REGIONAL GEOTECHNICAL SOLUTIONS PTY LTD
14 / 25-27 Hurley Drive
COFFS HARBOUR NSW 2450

Attention: Tim Morris

RE: 704 Maria River Rd,
Crescent Head

Note 1: Lot 704 DP749885 (page 1)
Note 2: Lot 707 DP1032859 (page 3)

Note 1:

Current Search

Folio Identifier 704/749885 (title attached)
DP 749885 (plan attached)
Dated 26th May 2018
Registered Proprietor:
PIWILA PTY LTD
CRESCENT HEAD SANDS PTY LTD
KAREN LEANNE NOTT
JOHN PERCIVAL PHILLIPS
JOHN KEVIN PHILLIPS
SAMBENLIN PTY LTD
## Title Tree

**Lot 704 DP 749885**

Folio Identifier 704/749885

Certificate of Title Volume 13630 Folio 185

Certificate of Title Volume 12117 Folio 227

Certificate of Title Volume 3789 Folio 163

****

## Summary of proprietor(s)

**Lot 704 DP 749885**

<table>
<thead>
<tr>
<th>Year</th>
<th>Proprietor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 – 2017</td>
<td>Portofino Enterprises Pty Limited</td>
</tr>
<tr>
<td>1987 – 2002</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1978 – 1987</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1973 – 1973</td>
<td>Aldeford Pty Limited</td>
</tr>
<tr>
<td>1973 – 1973</td>
<td>Alick Milton Thurgood, farmer</td>
</tr>
<tr>
<td>1953 – 1973</td>
<td>(Portion 70 Parish Palmerston – Area 267 Acres 2 Roods 0 Perches – CTVol 3789 Fol 163) Alick Milton Thurgood, farmer</td>
</tr>
<tr>
<td>1939 – 1953</td>
<td>William Henry Milligan, motor lorry driver</td>
</tr>
<tr>
<td>1932 – 1939</td>
<td>Dorothea May Milligan, wife of Mervyn Henry Milligan, lorry driver</td>
</tr>
<tr>
<td>1903 – 1932</td>
<td>David Harvey, grantee</td>
</tr>
</tbody>
</table>

****
Note 2:

Current Search

Folio Identifier 707/1032859 (title attached)
DP 1032859 (plan attached)
Dated 26th May 2018
Registered Proprietor:
PIWILA PTY LTD
CRESCENT HEAD SANDS PTY LTD
KAREN LEANNE NOTT
JOHN PERCIVAL PHILLIPS
JOHN KEVIN PHILLIPS
SAMBENLIN PTY LTD

Title Tree
Lot 707 DP 1032859

Folio Identifier 707/1032859
Folio Identifier 707/811608
Folio Identifier 705/749885
Certificate of Title Volume 13630 Folio 185
Certificate of Title Volume 12117 Folio 227
Certificate of Title Volume 3789 Folio 163

****
## Summary of proprietor(s)
### Lot 707 DP 1032859

<table>
<thead>
<tr>
<th>Year</th>
<th>Proprietor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 – todate</td>
<td>(Lot 707 DP 1032859)</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>Piwila Pty Ltd</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>Crescent Head Sands Pty Ltd</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>Karen Leanne Nott</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>John Percival Phillips</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>John Kevin Phillips</td>
</tr>
<tr>
<td>2017 – todate</td>
<td>Sambenlin Pty Ltd</td>
</tr>
<tr>
<td>2002 – 2017</td>
<td>Portofino Enterprises Pty Limited</td>
</tr>
<tr>
<td>2001 – 2002</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1991 – 2001</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1987 – 1991</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1978 – 1987</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1978 – 1978</td>
<td>Killuke Pty Limited</td>
</tr>
<tr>
<td>1973 – 1977</td>
<td>Cambridge Credit Corporation Limited</td>
</tr>
<tr>
<td>1973 – 1973</td>
<td>Aldeford Pty Limited</td>
</tr>
<tr>
<td>1973 – 1973</td>
<td>Alick Milton Thurgood, farmer</td>
</tr>
<tr>
<td>1953 – 1973</td>
<td>Alick Milton Thurgood, farmer</td>
</tr>
<tr>
<td>1939 – 1953</td>
<td>William Henry Milligan, motor lorry driver</td>
</tr>
<tr>
<td>1932 – 1939</td>
<td>Dorothea May Milligan, wife of Mervyn Henry Milligan, lorry driver</td>
</tr>
<tr>
<td>1903 – 1932</td>
<td>David Harvey, grantee</td>
</tr>
</tbody>
</table>

****
Cadastral Records Enquiry Report: Lot 704 DP 749885

Locality: CRESCENT HEAD
LGA: KEMPSEY
Parish: PALMERSTON
County: MACQUARIE

Report Generated 9:42:42 AM, 25 May, 2018

This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For ALL ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps.
<table>
<thead>
<tr>
<th>Status</th>
<th>Surv/Comp</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP754441</td>
<td>DP1222868</td>
<td>REGISTERED SURVEY ROADS ACT, 1993</td>
</tr>
<tr>
<td>Lot(s): 216</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot(s): 358</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 08-03-2002 Folio: 1488</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVE NO. 90828 GOV. GAZ. 15-7-1977: ESTABLISHMENT OF A RESERVE TRUST AND APPOINTMENT OF CORPORATION TO MANAGE RESERVE TRUST GOV. GAZ. 8-3-2002 FOLIO 1488-1489; BAKER DRIVE RECREATION RESERVE (R90828) TRUST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot(s): 145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 21-05-2010 Folio: 2238</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED AS PART OF GOOLAWAH NATIONAL PARK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP839074</td>
<td>DP1032859</td>
<td>REGISTERED SURVEY SUBDIVISION</td>
</tr>
<tr>
<td>Lot(s): 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP1004546</td>
<td>DP822650</td>
<td>HISTORICAL SURVEY CROWN FOLIO CREATION</td>
</tr>
<tr>
<td>Lot(s): 707</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP1040744</td>
<td>DP811608</td>
<td>HISTORICAL SURVEY SUBDIVISION</td>
</tr>
<tr>
<td>Lot(s): 7026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 17-06-2011 Folio: 4479</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED AS PART OF GOOLAWAH NATIONAL PARK AFFECTING LOT 7313 DP1150869 AND LOT 7026 DP1040744</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP1073626</td>
<td>DP1120919</td>
<td>CLOSED ROAD LOT 1 DP1073626</td>
</tr>
<tr>
<td>Lot(s): 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 08-10-2004 Folio: 7908</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAUTION: This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For ALL ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP11030597</td>
<td>DP1103164</td>
<td>REGISTERED SURVEY ROADS ACT, 1993</td>
</tr>
<tr>
<td>Lot(s): 7302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 21-05-2010 Folio: 2238</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED AS PART OF GOOLAWAH NATIONAL PARK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP1150869</td>
<td>DP1103164</td>
<td>REGISTERED SURVEY ROADS ACT, 1993</td>
</tr>
<tr>
<td>Lot(s): 7314</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 19-02-2010 Folio: 866</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVATION OF CROWN LAND RESERVE NO. 1026188 AFFECTING THE LAND SHOWN BY HEAVY BLACK EDGE IN THE DIAGRAM ACCOMPANYING THIS GAZETTE NOTIFICATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP1153793</td>
<td>DP1103164</td>
<td>REGISTERED SURVEY ROADS ACT, 1993</td>
</tr>
<tr>
<td>Lot(s): 2281</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW GAZ. 04-05-1895 Folio: 19-02-2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVE NO. 22451 GOV. GAZ. 4-5-1985: ESTABLISHMENT OF RESERVE TRUST AND APPOINTMENT OF CORPORATION TO MANAGE RESERVE TRUST GOV. GAZ. 8-3-2002 FOLIO 1488-1489; POINT PLOMER DRAINAGE RESERVE (R22451) TRUST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan</td>
<td>Surv/Comp</td>
<td>Purpose</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>DP566195</td>
<td>SURVEY</td>
<td>SUBDIVISION</td>
</tr>
<tr>
<td>DP729843</td>
<td>SURVEY</td>
<td>CROWN FOLIO CREATION</td>
</tr>
<tr>
<td>DP749885</td>
<td>SURVEY</td>
<td>SUBDIVISION</td>
</tr>
<tr>
<td>DP754441</td>
<td>COMPILATION</td>
<td>CROWN ADMIN NO.</td>
</tr>
<tr>
<td>DP758302</td>
<td>COMPILATION</td>
<td>CROWN ADMIN NO.</td>
</tr>
<tr>
<td>DP792227</td>
<td>SURVEY</td>
<td>RESUMPTION OR ACQUISITION</td>
</tr>
<tr>
<td>DP822650</td>
<td>SURVEY</td>
<td>CROWN FOLIO CREATION</td>
</tr>
<tr>
<td>DP839074</td>
<td>SURVEY</td>
<td>SUBDIVISION</td>
</tr>
<tr>
<td>DP840064</td>
<td>SURVEY</td>
<td>SUBDIVISION</td>
</tr>
<tr>
<td>DP1004546</td>
<td>COMPILATION</td>
<td>CROWN FOLIO CREATION</td>
</tr>
<tr>
<td>DP1032859</td>
<td>SURVEY</td>
<td>SUBDIVISION</td>
</tr>
<tr>
<td>DP1040744</td>
<td>COMPILATION</td>
<td>DEPARTMENTAL</td>
</tr>
<tr>
<td>DP1073626</td>
<td>COMPILATION</td>
<td>CROWN FOLIO CREATION</td>
</tr>
<tr>
<td>DP1120520</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>DP1120919</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>DP1120926</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>DP1130597</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>DP1150869</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>DP1153793</td>
<td>COMPILATION</td>
<td>CROWN LAND CONVERSION</td>
</tr>
<tr>
<td>SP50632</td>
<td>COMPILATION</td>
<td>STRATA PLAN</td>
</tr>
</tbody>
</table>

**Caution:** This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For **ALL ACTIVITY PRIOR TO SEPTEMBER 2002** you must refer to the RGs Charting and Reference Maps.

Report Generated 9:42:42 AM, 25 May, 2018
Copyright © Crown in right of New South Wales, 2017
I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions circumstances and interests as are shown in the Second Schedule.

PLAN SHOWING LOCATION OF LAND
LENGTHS ARE IN METRES

PH. OF 24 BERANGHI

108.3 ha

AREA: 108.3 ha
THIS AREA DOES NOT INCLUDE
THE AREA OF THE ROADS
REDUCTION RATIO 1:2500

ESTATE AND LAND REFERRED TO
Estate in Fee Simple in Portion 70 in the Shire of Macleay, Parish of Paterson and County of Macquarie. EXCEPTING THEREOUT the roads shown in the plan hereon and the minerals reserved by the Crown Grant.

FIRST SCHEDULE

ALFRED HILTON THURLOW of Upper Macleay River, Farmer.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.

Registrar General.

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.
**FIRST SCHEDULE (continued)**

<table>
<thead>
<tr>
<th>NATURE</th>
<th>INSTRUMENT</th>
<th>NUMBER</th>
<th>DATE</th>
<th>ENTERED</th>
<th>Signature of Registrar General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer</td>
<td>6-5906</td>
<td>5-2-1972</td>
<td>18-7-1972</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>11-1237</td>
<td>5-2-1972</td>
<td>18-7-1972</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>962086</td>
<td>8-2-1977</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This deed is cancelled as to the whole.

New certificates of Title have issued on 19-6-1972 for lots in Deed No. 596049 as follows:

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>Vol/Plot</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>596049</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECOND SCHEDULE (continued)**

<table>
<thead>
<tr>
<th>NATURE</th>
<th>INSTRUMENT</th>
<th>NUMBER</th>
<th>DATE</th>
<th>PARTICULARS</th>
<th>ENTERED</th>
<th>Signature of Registrar General</th>
<th>CANCELLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amalgam</td>
<td>592775</td>
<td>1-2-1972</td>
<td></td>
<td>The Associated Security Finance Limited</td>
<td>10-7-1972</td>
<td>Discharged 8640599</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.
I certify that the person described in the First Schedule is the registered proprietor of the undernoted estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 702 in Deposited Plan 596019 at Crescent Head in the Shire of Kempsey Parish of Palmerston and County of Macquarie. EXCEPTING THEREOUT the road shown in the plan hereon and the minerals reserved by the Crown Grant.

FIRST SCHEDULE

KILKING PTY. LIMITED.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
### FIRST SCHEDULE (continued)

<table>
<thead>
<tr>
<th>NATURE</th>
<th>NUMBER</th>
<th>REGISTERED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Certificate**

Registered: 12/11/57

This folio is cancelled as to wholesaler/winner section of computer folios for lots 702, 704 and 705 in the above mentioned plan.

**Signature of Registrar General**

![Signature]

### SECOND SCHEDULE (continued)

<table>
<thead>
<tr>
<th>INSTRUMENT</th>
<th>PARTICULARS</th>
<th>REGISTERED</th>
<th>Signature of Registrar General</th>
<th>CANCELLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: created pursuant to Section 88B-Conveyancing Act, 1919.

Registered: 12/11/57

![Signature]

**NOTE:** ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED
TRANSFER
New South Wales
Real Property Act 1990

8599624M

PRIVACY NOTE: this information is legally required and will be

STAMP DUTY
Office of State Revenue is the only
certified for the purposes of the Real Property Act 1990
by the corporation named below the common seal of which
was affixed pursuant to the authority specified and in the presence
of the authorised person(s) whose signature(s) appear(s) below.
Corporation: KILLUXE PTY LIMITED (ACN 000 822 364)  
Authority:

Signature of authorised person:

Name of authorised person:
Office held:

(K)

TRANSFEROR
KILLUXE PTY LIMITED (ACN 000 822 364) (IN LIQUIDATION)

(D)
CONSIDERATION
The transferor acknowledges receipt of the consideration of $620,000.00
and as regards

(E)
ESTATE
the land specified above transfers to the transferee an estate in fee simple

(F)
SHARE
100%
TRANSFERRED

(G)
Encumbrances (if applicable):

(H)
TRANSFEE
PORTOPINO ENTERPRISES PTY LIMITED (ACN 081 246 666)

(I)
TENANCY:

(J)
DATE
8-8-02

Certified for the purposes of the Real Property Act 1990 by the person whose signature appears below.

Signatory's name: Julian J Callachor
Signatory's capacity: transferee's solicitor

Page 1 of number additional pages sequentially

Land and Property Information NSW.

All handwriting must be in block capitals.
FOLIO: 704/749885

<table>
<thead>
<tr>
<th>Recorded</th>
<th>Number</th>
<th>Type of Instrument</th>
<th>C.T. Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/11/1987</td>
<td>DP749885</td>
<td>DEPOSITED PLAN</td>
<td>FOLIO CREATED EDITION 1</td>
</tr>
<tr>
<td>15/5/2002</td>
<td>8599624</td>
<td>TRANSFER</td>
<td>EDITION 2</td>
</tr>
<tr>
<td>18/9/2013</td>
<td>AI28691</td>
<td>MORTGAGE</td>
<td>EDITION 3</td>
</tr>
<tr>
<td>11/3/2015</td>
<td>AJ325234</td>
<td>DISCHARGE OF MORTGAGE</td>
<td>EDITION 4</td>
</tr>
<tr>
<td>6/6/2017</td>
<td>AM452330</td>
<td>TRANSFER</td>
<td>EDITION 5</td>
</tr>
</tbody>
</table>

*** END OF SEARCH ***

Obtained from NSW LRS on 26 May 2018 12:40 PM AEST
© Office of the Registrar-General 2018
**NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH**

**SEARCH DATE**

26/5/2018 12:40PM

FOLIO: 707/1032859

First Title(s): VOL 3789 FOL 163

Prior Title(s): 707/811608

<table>
<thead>
<tr>
<th>Recorded</th>
<th>Number</th>
<th>Type of Instrument</th>
<th>C.T. Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/10/2001</td>
<td>DP1032859</td>
<td>DEPOSITED PLAN</td>
<td>FOLIO CREATED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDITION 1</td>
</tr>
<tr>
<td>21/3/2002</td>
<td>8449443</td>
<td>CAVEAT</td>
<td></td>
</tr>
<tr>
<td>15/5/2002</td>
<td>8599623</td>
<td>WITHDRAWAL OF CAVEAT</td>
<td></td>
</tr>
<tr>
<td>15/5/2002</td>
<td>8599624</td>
<td>TRANSFER</td>
<td></td>
</tr>
<tr>
<td>18/9/2013</td>
<td>AI28691</td>
<td>MORTGAGE</td>
<td></td>
</tr>
<tr>
<td>11/3/2015</td>
<td>AJ325234</td>
<td>DISCHARGE OF MORTGAGE</td>
<td></td>
</tr>
<tr>
<td>6/6/2017</td>
<td>AM452330</td>
<td>TRANSFER</td>
<td></td>
</tr>
</tbody>
</table>

***** END OF SEARCH *****
NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH
-----------------------------------------------------

FOLIO: 704/749885
-----

SEARCH DATE       TIME              EDITION NO    DATE
-----------       ----              ----------    ----
26/5/2018        12:40 PM               5       6/6/2017

LAND
----
LOT 704 IN DEPOSITED PLAN 749885
AT CRESCENT HEAD
LOCAL GOVERNMENT AREA KEMPSEY
PARISH OF PALMERSTON  COUNTY OF MACQUARIE
TITLE DIAGRAM DP749885

FIRST SCHEDULE
--------------
PIWILA PTY LTD
IN 4/8 SHARE
CRESCENT HEAD SANDS PTY LTD
IN 1/8 SHARE
KAREN LEANNE NOTT
JOHN PERCIVAL PHILLIPS
AS JOINT TENANTS IN 1/8 SHARE
JOHN KEVIN PHILLIPS
IN 1/8 SHARE
SAMENLIN PTY LTD
IN 1/8 SHARE
AS TENANTS IN COMMON

(T AM452330)

SECOND SCHEDULE (2 NOTIFICATIONS)
---------------
1  LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND
   CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)
2  EASEMENT(S) APPURTENANT TO THE LAND ABOVE DESCRIBED CREATED BY:
   DP749885  -RIGHT OF CARRIAGEWAY 10 WIDE

NOTATIONS
---------
UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs  PRINTED ON 26/5/2018

 Obtained from NSW LRS on 26 May 2018 12:40 PM AEST

* Any entries preceded by an asterisk do not appear on the current edition of the Certificate of Title. Warning: the information appearing under notations has not been formally recorded in the Register.

© Office of the Registrar-General 2018
### NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 707/1032859

<table>
<thead>
<tr>
<th>SEARCH DATE</th>
<th>TIME</th>
<th>EDITION NO</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/5/2018</td>
<td>12:40 PM</td>
<td>5</td>
<td>6/6/2017</td>
</tr>
</tbody>
</table>

**LAND**

LOT 707 IN DEPOSITED PLAN 1032859
AT CRESCENT HEAD
LOCAL GOVERNMENT AREA KEMPSEY
PARISH OF PALMERSTON COUNTY OF MACQUARIE

**TITLE DIAGRAM DP1032859**

**FIRST SCHEDULE**

- PIWILA PTY LTD
  IN 4/8 SHARE
- CRESCENT HEAD SANDS PTY LTD
  IN 1/8 SHARE
- KAREN LEANNE NOTT
- JOHN PERCIVAL PHILLIPS
  AS JOINT TENANTS IN 1/8 SHARE
- JOHN KEVIN PHILLIPS
  IN 1/8 SHARE
- SAMBENLIN PTY LTD
  IN 1/8 SHARE
  AS TENANTS IN COMMON (T AM452330)

**SECOND SCHEDULE (4 NOTIFICATIONS)**

1. LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)
2. DP749885 RIGHT OF CARRIAGeway 10 METRE(S) WIDE AFFECTING THE PART SHOWN SO BURDENED IN THE TITLE DIAGRAM
3. DP749885 EASEMENT FOR TRANSMISSION OF ELECTRICITY 20 METRE(S) WIDE AFFECTING THE PART SHOWN SO BURDENED IN THE TITLE DIAGRAM
4. DP1032859 EASEMENT FOR WATER SUPPLY 5 METRE(S) WIDE AND VARIABLE AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM

**NOTATIONS**

**UNREGISTERED DEALINGS: NIL**

*** END OF SEARCH ***

advlegs

PRINTED ON 26/5/2018
Appendix C

Laboratory Test Results
<table>
<thead>
<tr>
<th>Location</th>
<th>DEPTH (m)</th>
<th>TOTAL RECOVERABLE HYDROCARBONS</th>
<th>PAH</th>
<th>OC-OP PESTICIDES</th>
<th>PCB</th>
<th>Benzene</th>
<th>Presence of Asbestos</th>
<th>As</th>
<th>Cd</th>
<th>Cr*</th>
<th>Cu</th>
<th>Pb</th>
<th>Ni</th>
<th>Zn</th>
<th>Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-01</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 &lt;100 &lt;100 &lt;50 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-02</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 160 &lt;100 &lt;100 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-03</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 &lt;100 &lt;100 &lt;50 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-05</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 &lt;100 &lt;100 &lt;50 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-06</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 160 &lt;100 &lt;100 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-07</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 160 &lt;100 &lt;100 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-08</td>
<td>0 - 0.1</td>
<td>&lt;10 &lt;50 160 &lt;100 &lt;100 &lt;0.5 &lt;0.5 &lt;0.05 &lt;0.1 &lt;0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-04</td>
<td>Bonded fibro</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CRITERIA (NEPM 2013)**

- **Health Investigation Level (HIL):**
  - 300 3 6 1 Present 100 20 100 6000 300 400 7400 40
- **Health Screening Level (HSL) - Sand:**
  - 45 110 NL NL 0.5 Coarse grained soil in mg/kg
- **Health Screening Level (HSL) - Clay:**
  - 50 280 NL NL 0.7 Fine grained soil in mg/kg
- **Ecological Investigation Level (EIL):**
- **Ecological Screening Level (ESL):**
  - 180 120 300 2800 0.7 Coarse grained soil in mg/kg
  - 180 120 1300 5600 0.7 Fine grained soil in mg/kg

**NOTES:**
- Denotes concentration exceeds health based guideline for Residential land use
- Denotes concentration exceeds ecological guideline for Residential land use
- NL No Limit available
- * Total chromium
- ** Chromium III
- *** Chromium VI (speciation testing)
## CERTIFICATE OF ANALYSIS

**Work Order**: ES1815566

**Client**: REGIONAL GEO TECHNICAL SOLUTION

**Contact**: MR TIM MORRIS

**Address**: Unit 14 25-27 Hurley Drive

**Telephone**: +61 02 6553 5641

**Project**: RGS20716.1 BAKER STREET REZONING

**Order number**: ----

**C-O-C number**: ----

**Sampler**: ----

**Site**: ----

**Quote number**: EN/222/17

**No. of samples received**: 8

**No. of samples analysed**: 8

---

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
- Descriptive 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.

<table>
<thead>
<tr>
<th>Signatories</th>
<th>Position</th>
<th>Accreditation Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celine Conceicao</td>
<td>Senior Spectroscopist</td>
<td>Sydney Inorganics, Smithfield, NSW</td>
</tr>
<tr>
<td>Edwandy Fadjar</td>
<td>Organic Coordinator</td>
<td>Sydney Inorganics, Smithfield, NSW</td>
</tr>
<tr>
<td>Edwandy Fadjar</td>
<td>Organic Coordinator</td>
<td>Sydney Organics, Smithfield, NSW</td>
</tr>
<tr>
<td>Gerrad Morgan</td>
<td>Asbestos Identifier</td>
<td>Newcastle - Asbestos, Mayfield West, NSW</td>
</tr>
<tr>
<td>Ivan Taylor</td>
<td>Analyst</td>
<td>Sydney Inorganics, Smithfield, NSW</td>
</tr>
<tr>
<td>Sanjeshni Jyoti</td>
<td>Senior Chemist Volatiles</td>
<td>Sydney Organics, Smithfield, NSW</td>
</tr>
</tbody>
</table>
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.

- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200  Legend
- EA200 ‘Am’ Amosite (brown asbestos)
- EA200 ‘Ch’ Chrysotile (white asbestos)
- EA200 ‘Cr’ Crocidolite (blue asbestos)
- EA200: “UMF” Unknown Mineral Fibres. “-” indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.

- 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), Dibenzo(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for ‘TEQ Zero’ are treated as zero, for ‘TEQ 1/2LOR’ are treated as half the reported LOR, and for ‘TEQ LOR’ are treated as being equal to the reported LOR.

Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
## Analytical Results

### Client sample ID

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLIENT ID</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Matrix: SOIL</strong> (Matrix: SOIL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analytical Results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SA1 0-0.1m**

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Content</td>
<td></td>
<td>1.0</td>
<td>%</td>
<td>16.4</td>
<td>16.5</td>
<td>9.3</td>
<td>22.2</td>
<td>23.7</td>
</tr>
<tr>
<td><strong>EG005T: Total Metals by ICP-AES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>1</td>
<td>mg/kg</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>2</td>
<td>mg/kg</td>
<td>&lt;2</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>19</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>13</td>
<td>53</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>2</td>
<td>mg/kg</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>3</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>158</td>
<td>598</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td><strong>EG005T: Total Recoverable Mercury by FIMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>7439-97-6</td>
<td>0.1</td>
<td>mg/kg</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td><strong>EP066: Polychlorinated Biphenyls (PCB)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Polychlorinated biphenyls</td>
<td></td>
<td>0.1</td>
<td>mg/kg</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td><strong>EP068A: Organochlorine Pesticides (OC)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>alpha-BHC</td>
<td>319-84-6</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Hexachlorobenzene (HCB)</td>
<td>118-74-1</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>beta-BHC</td>
<td>319-85-7</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>gamma-BHC</td>
<td>58-89-9</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>delta-BHC</td>
<td>319-86-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Heptachlor</td>
<td>76-44-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Aldrin</td>
<td>309-00-2</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Heptachlor epoxide</td>
<td>1024-57-3</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td><strong>Total Chlordane (sum)</strong></td>
<td></td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>trans-Chlordane</td>
<td>5103-74-2</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>alpha-Endosulfan</td>
<td>959-98-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>cis-Chlordane</td>
<td>5103-71-9</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>60-57-1</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>4,4'-DDE</td>
<td>72-55-9</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Endrin</td>
<td>72-20-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>beta-Endosulfan</td>
<td>33213-65-9</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td><strong>Total Endosulfan (sum)</strong></td>
<td></td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>4,4'-DDD</td>
<td>72-54-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Endrin aldehyde</td>
<td>7421-93-4</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Endosulfan sulfate</td>
<td>1031-07-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
## Analytical Results

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP068A: Organochlorine Pesticides (OC) - Continued</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,4'-DDT</td>
<td>50-29-3</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Endrin ketone</td>
<td>53494-70-5</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Methoxychlor</td>
<td>72-43-5</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>^a Sum of Aldrin + Dieldrin</td>
<td>309-00-2/60-57-1</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>^a Sum of DDD + DDE + DDT</td>
<td>72-54-8/72-55-9/5-2</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td><strong>EP068B: Organophosphorus Pesticides (OP)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichlorvos</td>
<td>62-73-7</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Demeton-S-methyl</td>
<td>919-86-8</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Monocrotophos</td>
<td>6923-22-4</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>60-51-5</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Diazinon</td>
<td>333-41-5</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Chlorpyrifos-methyl</td>
<td>5598-13-0</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Parathion-methyl</td>
<td>298-00-0</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Malathion</td>
<td>121-75-5</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Fenthion</td>
<td>55-38-9</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>2921-88-2</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Parathion</td>
<td>56-38-2</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Pirimphos-ethyl</td>
<td>23505-41-1</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Chlorfenvinphos</td>
<td>470-90-6</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Bromophos-ethyl</td>
<td>4824-78-6</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Fenamiphos</td>
<td>22224-92-6</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Prothiofos</td>
<td>34643-46-4</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Ethan</td>
<td>563-12-2</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Carbophenothion</td>
<td>786-19-6</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td>Azinphos Methyl</td>
<td>86-50-0</td>
<td>0.05</td>
<td>mg/kg</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>---</td>
</tr>
<tr>
<td><strong>EP075(SIM)A: Phenolic Compounds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenol</td>
<td>108-95-2</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>2-Chlorophenol</td>
<td>95-57-8</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>95-48-7</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>3- &amp; 4-Methylnaphthalene</td>
<td>1319-77-3</td>
<td>1</td>
<td>mg/kg</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>---</td>
</tr>
<tr>
<td>2-Nitrophenol</td>
<td>88-75-5</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>2,4-Dimethylnaphthalene</td>
<td>105-67-9</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>2,4-Dichlorophenol</td>
<td>120-83-2</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
</tbody>
</table>
## Analytical Results

### Sub-Matrix: SOIL

(Matrix: SOIL)

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP075(SIM)A: Phenolic Compounds - Continued</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,6-Dichlorophenol</td>
<td>87-65-0</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Chloro-3-methylphenol</td>
<td>59-50-7</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,4,6-Trichlorophenol</td>
<td>88-06-2</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,4,5-Trichlorophenol</td>
<td>95-95-4</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentachlorophenol</td>
<td>87-86-5</td>
<td>2</td>
<td>mg/kg</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acenaphthylene</td>
<td>208-96-8</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluorene</td>
<td>86-73-7</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>85-01-8</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>206-44-0</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyrene</td>
<td>129-00-0</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(a)anthracene</td>
<td>56-55-3</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chrysene</td>
<td>218-01-9</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(b+j)fluoranthene</td>
<td>205-99-2</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td>207-08-9</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>50-32-8</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeno(1,2,3.cd)pyrene</td>
<td>193-39-5</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dibenz(a,h)anthracene</td>
<td>53-70-3</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(g,h,i)pyrène</td>
<td>191-24-2</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sum of polycyclic aromatic hydrocarbons</strong></td>
<td>0.5</td>
<td></td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benzo(a)pyrene TEQ (zero)</strong></td>
<td>0.5</td>
<td></td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benzo(a)pyrene TEQ (half LOR)</strong></td>
<td>0.6</td>
<td></td>
<td>mg/kg</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benzo(a)pyrene TEQ (LOR)</strong></td>
<td>1.2</td>
<td></td>
<td>mg/kg</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EP080/071: Total Petroleum Hydrocarbons

<table>
<thead>
<tr>
<th>Fraction</th>
<th>C6 - C9 Fraction</th>
<th>C10 - C14 Fraction</th>
<th>C15 - C28 Fraction</th>
<th>C29 - C36 Fraction</th>
<th>C10 - C36 Fraction</th>
<th>C6 - C10 Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 mg/kg</td>
<td>50 mg/kg</td>
<td>100 mg/kg</td>
<td>100 mg/kg</td>
<td>50 mg/kg</td>
<td>C6_C10 10 mg/kg</td>
</tr>
</tbody>
</table>

### EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions

<table>
<thead>
<tr>
<th>Fraction</th>
<th>C6 - C10 Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C6_C10 10 mg/kg</td>
</tr>
</tbody>
</table>
## Analytical Results

**Sub-Matrix:** SOIL  
**Matrix:** SOIL

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C6 - C10 Fraction minus BTEX (F1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C6_C10-BTEX</td>
<td>10</td>
<td>mg/kg</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>&gt;C10 - C16 Fraction</td>
<td>---</td>
<td>50</td>
<td>mg/kg</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>---</td>
</tr>
<tr>
<td>&gt;C16 - C34 Fraction</td>
<td>---</td>
<td>100</td>
<td>mg/kg</td>
<td>&lt;100</td>
<td>160</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>---</td>
</tr>
<tr>
<td>&gt;C34 - C40 Fraction</td>
<td>---</td>
<td>100</td>
<td>mg/kg</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>---</td>
</tr>
<tr>
<td>&gt;C10 - C40 Fraction (sum)</td>
<td>---</td>
<td>50</td>
<td>mg/kg</td>
<td>&lt;50</td>
<td>160</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>---</td>
</tr>
<tr>
<td>&gt;C10 - C16 Fraction minus Naphthalene (F2)</td>
<td>---</td>
<td>50</td>
<td>mg/kg</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>&lt;50</td>
<td>---</td>
</tr>
<tr>
<td>EP080: BTEXN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>100-41-4</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>meta- &amp; para-Xylene</td>
<td>108-38-3 106-42-3</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>ortho-Xylene</td>
<td>95-47-6</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>Sum of BTEX</td>
<td>---</td>
<td>0.2</td>
<td>mg/kg</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>---</td>
</tr>
<tr>
<td>Total Xylenes</td>
<td>---</td>
<td>0.5</td>
<td>mg/kg</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>---</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>1</td>
<td>mg/kg</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>---</td>
</tr>
<tr>
<td>EP066S: PCB Surrogate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decachlorobiphenyl</td>
<td>2051-24-3</td>
<td>0.1</td>
<td>%</td>
<td>76.0</td>
<td>77.0</td>
<td>106</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EP068S: Organochlorine Pesticide Surrogate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dibromo-DDE</td>
<td>21555-73-2</td>
<td>0.05</td>
<td>%</td>
<td>67.3</td>
<td>91.9</td>
<td>83.6</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EP068T: Organophosphorus Pesticide Surrogate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEF</td>
<td>78-48-8</td>
<td>0.05</td>
<td>%</td>
<td>63.5</td>
<td>61.3</td>
<td>60.3</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EP075(SIM)S: Phenolic Compound Surrogates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenol-d6</td>
<td>13127-88-3</td>
<td>0.5</td>
<td>%</td>
<td>77.5</td>
<td>75.8</td>
<td>78.0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2-Chlorophenol-D4</td>
<td>93951-73-6</td>
<td>0.5</td>
<td>%</td>
<td>79.6</td>
<td>77.6</td>
<td>78.3</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2,4,6-Tribromophenol</td>
<td>118-79-9</td>
<td>0.5</td>
<td>%</td>
<td>76.7</td>
<td>73.3</td>
<td>70.1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EP075(SIM)T: PAH Surrogates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Fluorobiphenyl</td>
<td>321-60-8</td>
<td>0.5</td>
<td>%</td>
<td>86.2</td>
<td>84.9</td>
<td>87.4</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Anthracene-d10</td>
<td>1719-06-8</td>
<td>0.5</td>
<td>%</td>
<td>87.0</td>
<td>84.8</td>
<td>87.4</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4-Terphenyl-d14</td>
<td>1718-51-0</td>
<td>0.5</td>
<td>%</td>
<td>79.4</td>
<td>79.4</td>
<td>80.5</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>EP080S: TPH(V)/BTEX Surrogates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,2-Dichloroethane-D4</td>
<td>17060-07-0</td>
<td>0.2</td>
<td>%</td>
<td>93.6</td>
<td>86.9</td>
<td>88.8</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Toluene-D8</td>
<td>2037-26-5</td>
<td>0.2</td>
<td>%</td>
<td>97.6</td>
<td>85.2</td>
<td>88.2</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
### Analytical Results

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Bromofluorobenzene</td>
<td>156-83-5</td>
<td>0.2</td>
<td>%</td>
<td>88.9</td>
<td>83.1</td>
<td>87.2</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

**Sub-Matrix:** SOIL  
**Matrix:** SOIL  
**Client sample ID:** ES1815566-001, ES1815566-002, ES1815566-003, ES1815566-005, ES1815566-006

**Client sampling date / time:** 28-May-2018 00:00, 28-May-2018 00:00, 28-May-2018 00:00, 28-May-2018 00:00, 28-May-2018 00:00
## Analytical Results

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EA055: Moisture Content (Dried @ 105-110°C)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Content</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>1.0</td>
<td>%</td>
<td>14.7</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>EG005T: Total Metals by ICP-AES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>1</td>
<td>mg/kg</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>2</td>
<td>mg/kg</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>14</td>
</tr>
<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>5</td>
<td>mg/kg</td>
<td>&lt;5</td>
<td>12</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>2</td>
<td>mg/kg</td>
<td>&lt;2</td>
<td>14</td>
</tr>
<tr>
<td>Zinc</td>
<td>7440-06-6</td>
<td>5</td>
<td>mg/kg</td>
<td>8</td>
<td>83</td>
</tr>
<tr>
<td><strong>EG035T: Total Recoverable Mercury by FIMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>7439-97-6</td>
<td>0.1</td>
<td>mg/kg</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>
### Analytical Results

**Sub-Matrix**: SOLID  
**Matrix**: SOLID

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS Number</th>
<th>LOR</th>
<th>Unit</th>
<th>Result</th>
<th>Client sampling date / time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos Detected</td>
<td>1332-21-4</td>
<td>0.1</td>
<td>g/kg</td>
<td>Yes</td>
<td>28-May-2018 00:00</td>
</tr>
<tr>
<td>Asbestos Type</td>
<td>1332-21-4</td>
<td>-</td>
<td>Ch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample weight (dry)</td>
<td>---</td>
<td>0.01</td>
<td>g</td>
<td>4.54</td>
<td></td>
</tr>
<tr>
<td>APPROVED IDENTIFIER:</td>
<td>---</td>
<td>-</td>
<td></td>
<td></td>
<td>A. SMYLIE</td>
</tr>
</tbody>
</table>

### Descriptive Results

**Sub-Matrix**: SOLID

**Method**: Compound

**EA200**: AS 4964 - 2004 Identification of Asbestos in bulk samples

**EA200**: Description  
One piece of asbestos cement sheeting approximately 40x20x4mm

---
## Surrogate Control Limits

<table>
<thead>
<tr>
<th>Sub-Matrix: SOIL</th>
<th>Recovery Limits (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compound</strong></td>
<td><strong>CAS Number</strong></td>
</tr>
<tr>
<td>EP066S: PCB Surrogate</td>
<td>2051-24-3</td>
</tr>
<tr>
<td>EP066S: Organochlorine Pesticide Surrogate</td>
<td>21655-73-2</td>
</tr>
<tr>
<td>EP068T: Organophosphorus Pesticide Surrogate</td>
<td>78-48-8</td>
</tr>
<tr>
<td>EP075(SIM): Phenolic Compound Surrogates</td>
<td>13127-88-3</td>
</tr>
<tr>
<td>EP075(SIM): PAH Surrogates</td>
<td>321-60-8</td>
</tr>
<tr>
<td>EP080S: TPH(V)/BTEX Surrogates</td>
<td>17060-07-0</td>
</tr>
<tr>
<td>1,2-Dichloroethane-D4</td>
<td>2037-26-5</td>
</tr>
<tr>
<td>4-Bromofluorobenzene</td>
<td>460-00-4</td>
</tr>
</tbody>
</table>