Preliminary Geotechnical Investigation

523 Raymond Terrace Road, Chisholm NSW

Prepared for: ACG Clovelly Road Ltd C/- ADW Johnson Pty Ltd

EP3045.001 18 April 2023

Preliminary Geotechnical Investigation

523 Raymond Terrace Road, Chisholm NSW

ACG Clovelly Road Ltd C/- ADW Johnson Pty Ltd
7/335 Hillsborough Road
Warners Bay NSW 2282

18 April 2023

Our Ref: EP3045.001

LIMITATIONS

This Preliminary Geotechnical Investigation was conducted on the behalf of ACG Clovelly Road Ltd C/- ADW Johnson Pty Ltd for the purpose/s stated in **Section 1**.

EP Risk has prepared this document in good faith, but is unable to provide certification outside of areas over which EP Risk had some control or were reasonably able to check. The report also relies upon information provided by third parties. EP Risk has undertaken all practical steps to confirm the reliability of the information provided by third parties and do not accept any liability for false or misleading information provided by these parties.

It is not possible in a Preliminary Geotechnical Investigation to present all data, which could be of interest to all readers of this report. Readers are referred to any referenced investigation reports for further data.

Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

All work conducted and reports produced by EP Risk are based on a specific scope and have been prepared for ACG Clovelly Road Ltd C/- ADW Johnson Pty Ltd and therefore cannot be relied upon by any other third parties unless agreed in writing by EP Risk.

The report(s) and/or information produced by EP Risk should not be reproduced and/or presented/reviewed except in full.

QUALITY CONTROL

Version	Author	Date	Reviewer	Date	Quality Review	Date
v1	O. Pruteanu	14.03.2023	Z. Othman	22.03.2023	J. Young	18.04.2023

DOCUMENT CONTROL

Version	Date	Reference	Submitted to
v1	*23.03.2023*	*Preliminary Geotechnical Investigation*	*ACG Clovelly Road Ltd C/- ADW Johnson Pty Ltd*

Table of Contents

List of Tables in Body of Report

List of Figures in Body of Report

List of Appendices

1 Introduction

EP Risk Management Pty Ltd (EP Risk) was engaged by ACG Clovelly Road Pty Ltd C/- ADW Johnson Pty Ltd to undertake a Preliminary Geotechnical Investigation at a property located at 523 Raymond Terrace Road, Chisholm, NSW (the Site). The site is legally defined as Lot 100 in deposited plan (DP) 847510 and is approximately 10.17 hectares (ha) in area.

The investigation is required for a Development Application (DA) to Maitland City Council for the proposed residential subdivision. This engagement is in line with the scope of works outlined in the EP16271_v1 proposal dated 23.12.2022. The proposed Lot Layout of the site is included as **Appendix A - Proposed Layout**.

1.1 Proposed Development

The Proposed Development comprises of the following main features:

- Approximately one hundred and eight (108) Residential Allotments
- Internal Roads
- One (1) Detention Basin
- Retained Riparian Corridor

Concept plans of the proposed development are provided as **Appendix A – Proposed Layout**.

1.2 Objective and Scope

The objective of the Assessment is to determine the subsurface profile conditions at the site, to provide preliminary geotechnical advice regarding the proposed development, to identify any potential geotechnical constraints/conditions and to inform the geotechnical design for the proposed infrastructure associated with the residential development.

The scope of work undertaken as part of this preliminary geotechnical investigation included the following:

- Desktop study – collection and review of available information.
- Excavating fourteen (14) test pits across the site and carrying out Dynamic Cone Penetrometer tests adjacent to test pits.
- Collection of representative disturbed, undisturbed, and bulk soil samples and carrying out of laboratory tests.

This Geotechnical Report has been prepared in accordance with our proposal and includes the findings of the investigation scope above along with:

- Interpretation of the investigation results.
- Identification of the relevant geological units.
- Indication of rock strength in term of ability to excavate.
- Characterisation of engineering properties of the identified geotechnical units.
- Preliminary Site Classification.
- Preliminary Pavement design.

2 Site Location and Description

The Site comprises a large almost rectangular shaped allotment located on the northern side of Raymond Terrace Road, in Chisholm, NSW, with surrounding land currently consisting of a mix of residential and rural land (predominantly grazing) use.

The site is covered with scattered semi mature and juvenile eucalypts and long grass. Two remnant detention basins from previous farming activity are in the southern section of the site. A large detention basin exists in the northern portion of the site, within a gully that runs in an approximately west-east direction. The detention basin is in a drainage line that connects a series of detention basins from the adjacent properties. The site has a gently sloping gradient of around 3° to 5°, from approximately 27 m AHD in the north-western portion of the site to 22 m AHD in the southern portion of the site.

Site drainage is considered to consist of surface runoff across the site following surface contours towards the drainage line in north and towards the drainage channel along the Raymond Terrace Road in the southern section of the site. A dwelling and several farming sheds are located on the southern section of the site. Photographs collected during site investigation are included in **Appendix B – Photolog**

An excerpt from the Six Maps (www.maps.six.nsw.gov.au) with the site location is shown in Figure 1.

Figure 1. Site Location

3 Desktop Study

3.1 Regional Geology

Based on the geological data sourced from the NSW Department of Industry, Resources and Energy (www.minview.geoscience.nsw.gov.au) the Site is underlain by Guadalupian aged Mulbring siltstone (**Pmtm**). The dominant siltstone lithology consists of medium to dark grey siltstone, minor claystone, sporadic thin cherty beds, rare thin sandstone and limestone beds and sporadic marine fossils. An excerpt of the geological map with the geological units is shown in Figure 2.

Figure 2. Geological Map Excerpt (Pmtm-Mulbring Siltstone-green)

3.2 Soil Landscape

The soil landscape is the Beresfield Soil Landscape comprising undulating low hills and rises on Permian sediments in the East Maitland region. The soils are described as moderately well drained, yellow and brown podzolic soils as well as brown and yellow soloths on side slopes. The limitations of the Beresfield soil landscape are high foundation hazard, water erosion hazard, seasonal waterlogging and high run-on localised lower slopes, highly acid soils and low fertility. An extract of the soil landscape map is shown in Figure 3.

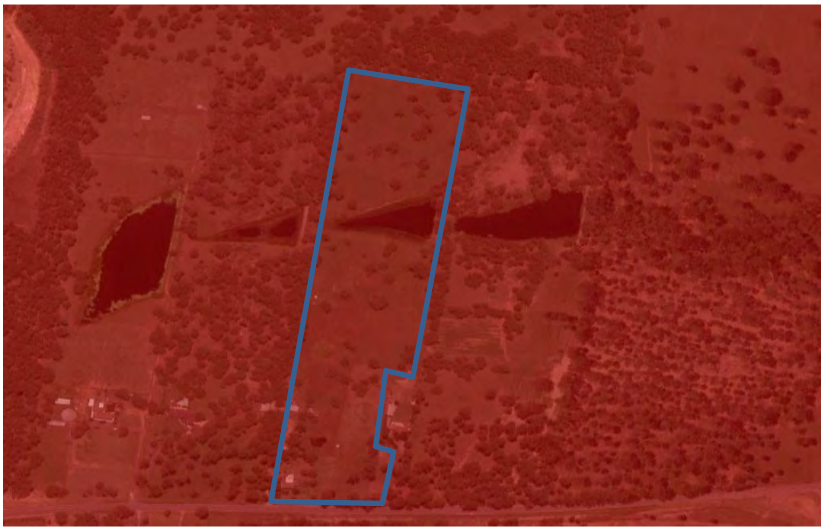


Figure 3. Soil Landscape Map Excerpt (red 9232be-Beresfield)

3.3 Mine Subsidence

With reference to the Mining Subsidence District Data Source (2016), the Site is not located within a mining subsidence district and no underground mining is shown on the NSW Planning Portal.

3.4 Acid Sulphate Soils

Reference to the Acid Sulphate Soils map (www.geo.seed.nsw.gov.au) indicates that the site is located on class 5 Acid Sulphate Soils. Works within 500m of adjacent Class 1, 2, 3, or 4 land that is below 5m AHD and by which the water table is likely to be lowered below 1m AHD on adjacent Class 1, 2, 3, or 4 land, present an environmental risk. An excerpt of the acid sulfate soil map is shown in Figure 4.

Figure 4. Acid Sulphate Soils Map Excerpt (Class 5–yellow)

4 Geotechnical Investigation

4.1 Methodology

The site investigation was carried out on 16 February 2023 under full supervision of an experienced EP Risk Geotechnical Professional in accordance with AS1726-2017 Geotechnical Site Investigations and comprised the following:

- Preparation of a Safe Work Method Statement (SWMS) and review of Dial Before You Dig services plans for the site area.
- Location and clearance for the proposed geotechnical investigation locations impacted by potential underground services.
- Carrying out excavation of fourteen (14) geotechnical investigation test pits (TP) to maximum depth of 3.0m below ground level (m BGL). The test pits were excavated using a 14 tonne Hitachi excavator fitted with a 450mm multipurpose toothed bucket.
- Dynamic Cone Penetrometer (DCP) tests adjacent to the test pits.
- Logging of soil/rocks encountered in accordance with AS 1726:2017.
- Collection of representative soil/extremely weathered material samples for laboratory testing.
- Reinstatement of test pits with spoil to pre-existing ground conditions.

The locations of the test pits were based on the proposed development layout and are presented in **Appendix C – Geotechnical Investigation Locations**. Upon completion of the investigation, the holes at each location were backfilled with excess spoil to pre-existing ground conditions.

The test pits in the southern area of the site were cleared by an accredited service locator of potential underground services associated with the previous usage of the property dwelling and farming.

4.2 Subsurface Profile

A project geological classification has been developed based on the results of the investigation and a summary of the units and their distribution is presented in Table 1 and

Table 2.

The test pit logs and accompanying explanatory notes are presented in **Appendix D – Test Pit Logs.**

Table 1. Observed Geotechnical Units

Unit #	Origin	Material	Description
Unit 1	Topsoil	Sandy CLAY	Low to medium plasticity, grey, fine to medium grained sand
Unit 2	Residual soil	Sandy/Silty CLAY	Low to high plasticity, brown, grey, orange, red, fine to medium grained sand
Unit 3a	Extremely Weathered (XW) Material	SANDSTONE	Clayey SAND, fine to coarse grained, yellow and grey
Unit 3b	Extremely Weathered (XW) Material	SILTSTONE	Sandy/Clayey SILT, low plasticity, grey and orange, fine to medium grained sand with ferruginous cementations

Table 2. Distribution of Subsurface Geological Unit Across the Investigated Locations

TP ID	Depth below ground level (m BGL)			
	Topsoil	Residual Soil	Extremely Weathered Material	
	Unit 1	Unit 2	Unit 3a	Unit 3b
TP-L1	0.0-0.28	0.28-1.5	NE	1.5-2.6*
TP-L2	0.0-0.26	0.26-2.0	NE	2.0-2.6*
TP-L3	0.0-0.25	0.25-0.7	0.7-1.1	1.1-3.0**
TP-L4	0.0-0.3	0.3-1.2	NE	1.2-2.8**
TP-L5	0.0-0.22	0.22-1.3	NE	1.3-3.0**
TP-L6	0.0-0.3	0.3-0.8	NE	0.8-3.0**
TP-L7	0.0-0.3	0.3-1.4	NE	1.4-3.0**
TP-P1	0.0-0.23	0.23-2.2	NE	2.2-2.43**
TP-P2	0.0-0.38	0.38-1.75	NE	1.75-2.6**
TP-P3	0.0-0.3	0.3-1.8	NE	1.8-2.0**
TP-P4	0.0-0.28	0.28-1.6	NE	1.6-2.1**
TP-P5	0.0-0.25	0.25-1.2	NE	1.2-2.0**
TP-P6	0.0-0.2	0.2-1.4	NE	1.4-2.3**
TP-P7	0.0-0.18	0.18-0.8	NE	0.8-2.0**

NE-not encountered
*Refusal
**Limit of the investigation

4.3 Groundwater

No groundwater was encountered during fieldwork. It should be noted that the groundwater conditions will vary with seasonal and weather conditions along with constriction related site conditions.

4.4 Laboratory Results

Geotechnical laboratory testing was carried out on selected bulk, disturbed and undisturbed samples collected during the site investigation. All testing was performed by Coffey Testing (Newcastle) and Eurofins - NATA accredited laboratories in accordance with the relevant Australian Standards and technical procedures. The detailed results of laboratory testing are presented in **Appendix E – Laboratory Test Results** and are summarised in the following sections.

4.4.1 Atterberg Limits

A summary of Atterberg Limits and Linear Shrinkage test results are presented in Table 3 and are plotted graphically in Figure 5. Testing indicates that most clayey materials are from medium to high plasticity.

Table 3. Atterberg Limits Test Results

Test Pit ID	Soil	Classification	Depth (m BGL)	Atterberg Limits			Linear Shrinkage (%)
				LL (%)	PL (%)	PI (%)	
TP-L1	Silty CLAY	CI-CH	0.5-1.0	56	21	35	15.0
TP-L3	Sandy SILT	ML	1.0-1.5	40	19	21	10.0
TP-L5	Silty CLAY	CI-CH	0.5-1.0	58	20	38	12.0
TP-L6	Clayey SILT	ML	0.8-1.5	46	19	27	11.5

LL – Liquid Limit
PL – Plastic Limit
PI – Plasticity Index

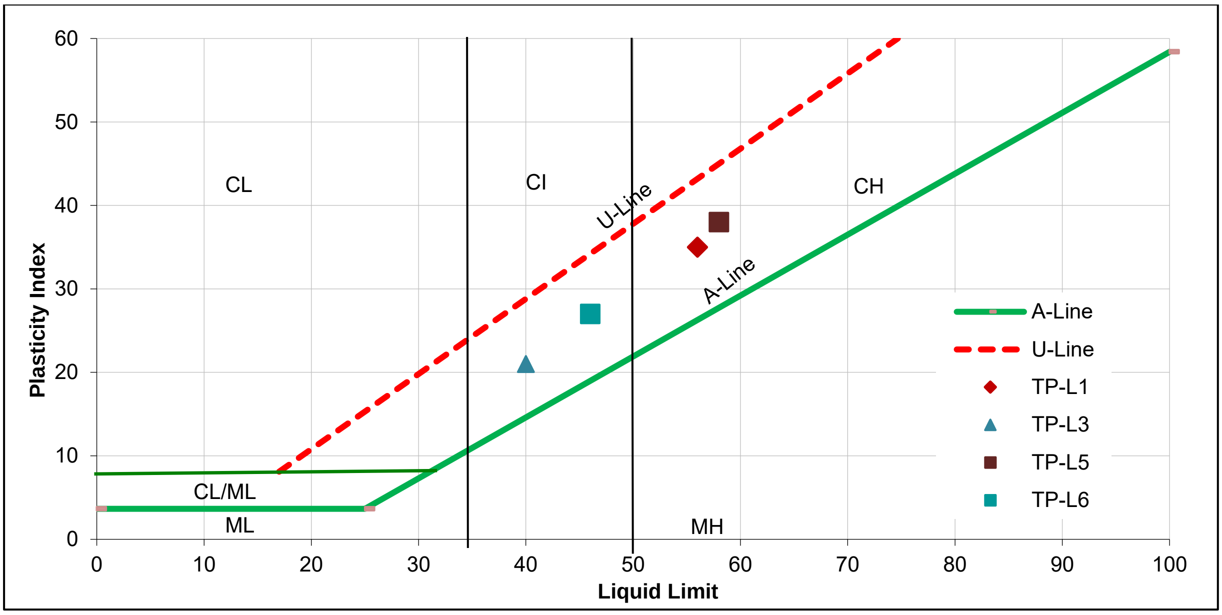


Figure 5. Atterberg Limit Plot

4.4.2 Particle Size Distribution (PSD)

Particle Size Distribution (PSD) test results undertaken on samples of subgrade containing Residual Soils are presented in Table 4 and confirms the material description on the test pit logs.

Table 4. Particle Size Distribution Test Results

Test Pit ID	Depth (m BGL)	% passing 2.36 mm sieve	% passing 75 µm sieve	Sample Description
TP-L1	0.5-1.0	97	92	Silty CLAY
TP-L3	1.0-1.5	89	76	Sandy SILT with gravel
TP-L5	0.5-1.0	93	91	Silty CLAY with gravel
TP-L6	0.8-1.5	96	94	Clayey SILT

4.4.3 Shrink-Swell

Shrink-Swell testing was undertaken on three (3) soil samples and the results are summarised in Table 5.

Table 5. Shrink-Swell Index Test Results

Test Pit ID	Soil Type	Depth (m BGL)	Shrinkage		Swell			Shrink – Swell Index (Iss%)
			Shrinkage moisture content (%)	Shrink on drying (%)	Moisture content before (%)	Moisture content after (%)	Swell on saturation (%)	
TP-L2	Silty Sandy CLAY	0.5-1.0	18.6	4.9	18.0	26.1	4.8	**4.1**
TP-L5	Silty CLAY	0.5-1.0	17.8	2.8	18.1	29.4	6.2	**3.3**
TP-L7	Silty CLAY	0.5-1.0	18.7	4.7	17.7	26.4	8.8	**5.0**

4.4.4 California Bearing Ratio (%)

CBR tests were undertaken on four (4) soil samples to inform the design CBR for the proposed pavement areas. The results of the testing are summarised in Table 6.

Table 6. California Bearing Ratio Test Results

Test ID	Depth (m BGL)	Sample Description	W[1] (%)	SOMC[2] (%)	SMDD[3] (t/m^3)	Swell (%)	CBR (%)
TP-P2	1.0-1.5	Residual Soil: Sandy CLAY	17.5	19.5	1.62	2.0	4.0[4]
TP-P4	0.5-1.5	Residual Soil: Silty CLAY	16.7	21.0	1.59	2.5	2.0[4]
TP-P5	1.2-2.0	XW SILTSTONE: Clayey SILT	14.5	18.0	1.70	2.0	3.0[4]
TP-P7	0.2-0.75	Residual Soil: Silty CLAY	18.8	22.5	1.59	2.5	2.5[4]

[1] Field Moisture Content
[2] Standard Optimum Moisture Content
[3] Standard Maximum Dry Density
[4] CBR at 2.5mm (%)
[5] CBR at 5mm (%)

CBR samples were remoulded to a target of 100% relative density at approximately standard optimum moisture content (SOMC). The samples were surcharged with 4.5kg and soaked for four days prior to penetration. According to Table 5.2: Guide to classification of expansive soils (Austroads, 2017) the soil samples tested for CBR have a low to moderate potential for expansive volume change.

4.4.5 Aggressivity

The Australian Standard AS2159-2009 Piling Code provides criteria for assessment of the level of exposure classification for steel and concrete to enable the designers to incorporate protective measures for each element into the design. The assessment criteria are based upon the pH, concentrations of Sulphate and Chloride in soil, the soil permeability, and the groundwater level.

Soil aggressivity testing was undertaken on four (4) samples recovered from test pits. An assessment of the exposure classification for each of the soil samples tested based on the above criteria is presented in Table 7.

Table 7. Aggressivity Test Results

Test Pit ID	Soil type	Sulphates (SO_4) in soil (mg/kg - ppm)	pH	Chlorides in groundwater (mg/kg-ppm)	Resistivity ohm.cm	Exposure classification	
						Aggressive to steel	Aggressive to concrete
TP-L2	XW SILTSTONE	320	5.0	410	2620	Non-aggressive	Mild
TP-L4	XW SILTSTONE	460	5.0	780	1730	Mild	Mild
TP-L5	XW SILTSTONE	210	4.9	700	2050	Non-aggressive	Mild
TP-L6	XW SILTSTONE	210	5.2	450	2720	Non-aggressive	Mild

5 Pavement Design

5.1 Design Traffic Loadings

Design traffic loadings have been selected and pavement thickness design calculations have been undertaken by EP Risk in accordance with *Maitland City Council - Manual of Engineering Standards*.

The design traffic data has been determined based on the following assumptions in Table 8.

Table 8. Recommended Road Type and Design ESA's

Road Type	Roads Identification	Design ESA's
Local - Primary	TBC	5×10^5
Collector - Secondary	TBC	1×10^6
Collector - Primary	TBC	1.5×10^6
Collector – Primary (Bus Route)	TBC	2×10^6

Where traffic data varies from the above assumptions a review of pavement design will be required particularly considering connectivity with adjacent developments.

5.2 In-Situ Testing

The DCP test can be used to provide a correlation with in-situ (field) CBR in accordance with Austroads Guidelines. The in-situ CBR values for substrata for the pavement test pits are presented in Figure 6 and the correspondent field CBR versus laboratory CBR values are presented in Table 9.

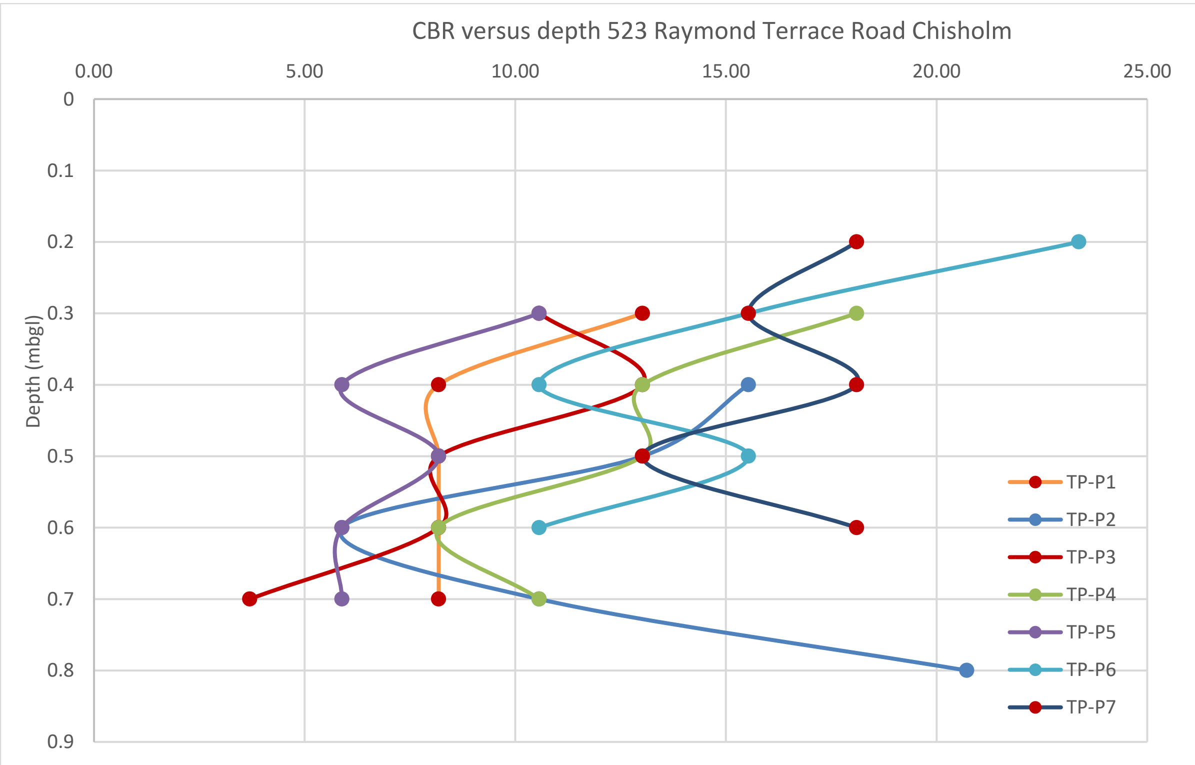


Figure 6. In-Situ CBR values

Table 9. Inferred field CBR (%) Values Versus Laboratory Results

Test Pit ID	Material Description	Depth (m BGL)		Average Field CBR (%) *	Laboratory CBR (%)
		Top	Bottom		
TP-P1	RESIDUAL SOIL: Silty CLAY	0.3	0.8	9	**
TP-P2	RESIDUAL SOIL: Sandy CLAY	0.5	1.0	13	4.0
TP-P3	RESIDUAL SOIL: Silty CLAY	0.3	0.8	8	**
TP-P4	RESIDUAL SOIL: Silty CLAY	0.3	0.8	12	2.0
TP-P5	XW SILTSTONE	0.3	0.8	7	3.0
TP-P6	RESIDUAL SOIL: Silty CLAY	0.2	0.7	15	**
TP-P7	RESIDUAL SOIL: Silty CLAY	0.2	0.7	16	2.5

* In-situ estimated CBR at anticipated design subgrade level (DSL)
**not tested

The CBR values at estimated subgrade level (0.2-0.7m) shown in Figure 6 are ranging between 3% to >20%. Overall, there is no clear correlation between the in situ CBR values with the soaked laboratory test results with all the field test results overestimating the CBR value. This can be attributed to the dry in-situ moisture condition of the soils, with samples tested for CBR approximately 2% to 4.3% dryer that the SOMC and to the ferruginous cementations contained within the soil matrix.

5.3 Design Parameters

Pavement thickness has been undertaken in accordance with Austroads AGPT02-17 Guide to Pavement Technology, Part 2: Pavement Structural Design based on the following parameters:

- Design subgrade CBR of 2.0% for Sandy/Silty CLAY and extremely weathered Siltstone and engineering fill placed as controlled fill.

- Design traffic as per Table 8.

The design subgrade has been determined in accordance with Section 5 of Austroads 2017 based on laboratory testing results and field interpretation. Whilst the design CBR is a lower bound representation of the site materials, the lower strength silty CLAY soils are likely to be the predominant subgrade material encountered following regrade. This is especially relevant considering the extremely weathered Siltstone is prone to loss of strength at elevated moisture contents and tends to breakdown to material with similar engineering properties to that of the cohesive soils (Clayey SILT and Silty CLAY). As such, a conservative design CBR is recommended at this stage of the development. The investigation is preliminary in nature and following subsequent targeted and more detailed investigations with additional CBR testing, higher subgrade design values could be adopted in particular for the sandy residual soils or weathered materials.

The CBR Swell results when compared to Table 5.2 in Austroads Guide to pavement Technology Part 2: Pavement Structural Design indicate that the soils tested have a low to moderate expansive nature and specific strategies may be required to address potential volume change due to moisture variation in the subgrade. This will largely be dependent on the vertical alignment of roads and the material present within 0.5 m of design subgrade level (DSL).

Where filling is undertaken within the road alignments, the CBR of the fill material should be considered specifically regarding the final pavement design subgrade CBR. All fill materials should generally be a minimum of CBR 3.0% based on 4-day soak when compacted to 100% standard relative density and SOMC except where the final pavement design is based on a subgrade design CBR of 2% and in such cases, advice should be sought from a geotechnical consultant regarding the suitability of the material notwithstanding the soaked CBR value.

5.4 Pavement Design

5.4.1 Flexible Unbound Pavement

The option of pavement construction utilising flexible unbound pavement materials for sandy/silty CLAY and XW Siltstone subgrade with CBR 2% is detailed in Table 10.

Table 10. Recommended Flexible Pavement Composition

Road Type	Collector – Bus Route	Collector Primary	Collector Secondary	Local Primary
Wearing Course (mm)	50 AC14*	50 AC14*	40 AC10*	30 AC10*
Basecourse (mm)	150	150	150	150
Subbase (mm)	190	170	150	135
Select (mm)	300	300	300	300
Total Thickness (mm)	680	660	630	615
Subgrade CBR	min 2%	min 2%	min 2%	min 2%
Design ESA	2×10^6	1.5×10^6	1.0×10^6	5×10^5
* AC10 AC14 (dense graded mix) with 10mm primer seal placed under the asphaltic concrete wearing surface				

A minimum of fourteen days duration shall apply prior to application of asphalt layer. That period may be extended or shortened subject to approval by Council. It is noted Maitland Council requires minimum 40mm AC14 “Heavy Duty” for Classified Roads.

For areas where the clay subgrade has a CBR swell ≥ 2.5%, it is recommended that the pavement design incorporate a 300mm select layer with minimum CBR of 30% or other measures detailed in Austroads Guidelines for managing soils with a swell potential. The design CBR needs to be confirmed on road alignment following the regrade activities on site.

5.5 Subgrade Preparation

Where construction of a new pavement is proposed, subgrade preparation should be in general accordance with the following procedures.

- Remove topsoil.
- Excavation or residual soil/ weathered bedrock to design subgrade level.
- Ripping the encountered weathered Siltstone/Sandstone to 300-350mm below DSL and recompact to a minimum 100% of SMDD. Moisture contents should be within 70% to 90% of SOMC for weathered bedrock and closer to SOMC where highly expansive subgrade materials are encountered or used as fill.
- Static proof-rolling of the exposed subgrade using a heavy (minimum 10 tonne) roller under the direction of an experienced geotechnical consultant.
- Loose or yielding areas should be excavated and replaced with compacted select fill or suitable subgrade replacement comprising material of similar consistency to the subgrade.
- Confirmation of design subgrade parameters by geotechnical consultant.
- Where filling or subgrade replacement is required, the materials employed should be free of organics or other deleterious material. The material should also have a maximum particle size of 100mm or one third of the layer thickness, with a minimum soaked CBR >2%.

Following satisfactory preparation of the subgrade, the pavement should be constructed in accordance with the recommendations or this report and Maitland City Council – Manual of Engineering Standards-Construction. In case of discrepancy clarification should be sort from Council.

5.6 Drainage

The moisture regime associated with a pavement has a major influence on the performance considering the stiffness/strength of the pavement materials is dependent on the moisture content of the material used. Accordingly, to protect the pavement materials from wetting up and softening, particular care would be required to provide a waterproof seal for the pavement materials, together with adequate surface and sub-surface drainage of the pavement and adjacent areas.

It is recommended that subsoil drainage be installed along both side of all roads within the development in accordance with Council requirements. CBR swell results from the preliminary investigation are low to moderate. Design measures and subsurface drainage measures to control subgrade swell are provided in Austroads Pavement Guide to Pavement Technology and the relevant Transport for New South Wales Supplement(s). Preferred measures shall also be discussed with Council's Representative prior to adoption in any pavement construction.

The pavement thickness designs presented above assume drained pavement conditions. The selection, construction and maintenance of appropriate drainage infrastructure would be required for adequate performance. The selection of appropriate construction materials that are relatively insensitive to moisture change is also essential in area subject to periodic inundation, even if for a relatively short period of time.

5.7 Materials

5.7.1 Specifications and Compaction Requirements

Pavement materials and compaction requirements for new pavement construction should conform to Council requirements and the following requirements outlined in Table 11.

Table 11. Material Specification and Compaction Requirements

Pavement Course	Material Specification	Compaction Requirements
Base Course DGB20 (Class 1 &2) & NGB20*	Material complying with Council Specifications with CBR > 80%, with PI ≤ 6%	Min 98% Modified (AS 1289 5.2.1)
Subbase Subbase quality crushed rock (DGS20, DGS40, GMS40, NGS20, NGS40)	Material complying with Council Specifications with CBR >30% with PI ≥2≤ 12%	Min 95% Modified (AS 1289 5.2.1)
Select Granular material	Well graded granular material with CBR min 30% and PI ≤15%	Min 100% Standard (AS 1289 5.1.1)
Subgrade or replacement	Minimum CBR ≥2% or as appropriate for the design option.	Min 100% Standard (AS 1289 5.1.1)
*NGB and NGS material cannot be used on collector category road or higher due to higher design traffic. Class 1 material should be used on sub-Arterial category roads		

Minimum testing on all potential imported pavement materials should be in accordance with TfNSW 3051 Ed 7. Pre-treatment of material prior to testing would be advisable for materials subject to breakdown.

5.7.2 Wearing Course

Wearing courses should be in accordance with Council's specifications with reference to TfNSW QA Specifications R116 for Dense Graded Asphalt. It is noted that a 40mm AC14 wearing course is utilised for classified roads in accordance with Council Specifications.

The design and construction of wearing courses should be in in consultation with the preferred supplier considering traffic volume and type. All pavement surfaces should be primer sealed prior to the application of the AC wearing course. A minimum delay of 14 days is required after the primer seal before placement of the AC wearing course.

5.7.3 Inspections

The subgrade will require inspection by an experienced geotechnical consultant after boxing out or filling to design subgrade level. The purpose of inspections is to confirm design parameters, assess the suitability of the subgrade to support the pavement, and delineate areas which may require subgrade replacement or remedial treatment prior to construction.

6 Preliminary Site Classification

Australian Standard AS 2870-2011 establishes performance requirements and specific designs for common foundation conditions as well as providing guidance on the design of footing systems using engineering principles. Site classes as defined on Table 2.1 and 2.3 of AS 2870 are presented in Table 12.

Table 12. General Definition of Site Classes

Site Class	Foundation	Characteristic Surface Movement
A	Most sand and rock sites with little or no ground movement from moisture changes	-
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes	0 – 20 mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes	20 – 40 mm
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes	40 – 60 mm
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes	60 – 75 mm
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes	> 75 mm
A to P	Filled sites (refer to clause 2.4.6 of AS 2870)	-
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.	

Reactive sites are sites consisting of clay soils that swell on wetting and shrink on drying, resulting in ground movements that can damage lightly loaded structures. The amount of ground movement is related to the physical properties of the clay and environmental factors such as climate, vegetation, and watering. A higher probability of damage can occur on reactive sites where abnormal moisture conditions occur, as defined in AS 2870, due to factors such as:

- Presence of trees on the building site or adjacent site, removal of trees prior to or after construction, and the growth of trees too close to a footing. The proximity of mature trees and their effect on foundations should be considered when determining building areas within each allotment (refer to AS 2870).
- Failure to provide adequate site drainage or lack of maintenance of site drainage, failure to repair plumbing leaks and excessive or irregular watering of gardens.
- Unusual moisture conditions caused by removal of structures, ground covers (such as pavements), drains, dams, swimming pools, tanks etc.

Regarding the performance of footings systems, AS 2870 states "footing systems designed and constructed in accordance with this Standard on a normal site (see Clause 1.3.2) that is:

a) not subject to abnormal moisture conditions; and

b) maintained, such that the original site classification remains valid and abnormal moisture conditions do not develop, are expected to usually experience no damage, a low incidence of damage category 1 and an occasional incidence of damage category 2."

Damage categories are defined in Appendix C of AS 2870, which is reproduced in CSIRO Information Sheet BTF 18, Foundation Maintenance and Footing Performance: A Homeowner's Guide attached as **Appendix F – Foundation Maintenance and Footing Performance**.

The laboratory Shrink Swell test results summarised in Table 5 indicate that the tested Silty CLAY soils returned I_{ss} values ranging from 3.3% (in TP-L5) to 5.0% (in TP-L7).

The classification of sites with controlled fill of depths greater than 0.4m (deep fill) comprising of material other than sand would be Class P. An alternative classification may however be given to sites with controlled fill where consideration is made to the potential for movement of the fill and underlying soil based on the moisture conditions at the time of construction and the long-term equilibrium moisture conditions.

Based on the subsurface profiles encountered during the Site inspection and in accordance with the AS 2870-2011; the Site in its existing condition and in the absence of abnormal moisture conditions would likely be classified as detailed in Table 13.

Table 13.Anticipated Site Classifications

Chisholm Site 523 Raymond Terrace Road	Site Classification
In Existing Condition prior to regrade	**Class M**, moderately reactive to **Class H2**, highly reactive
Following regrade activities	**Class M,** moderately reactive **to Class E,** extremely reactive

A characteristic surface movement (y_s) in the range of 38mm to 60mm has been calculated for the site dependent on the soil profile in its existing state prior to regrade, using a depth of design suction (Hs) change of 1.8 m used. Following regrade characteristic surface movement (ys) greater than 100mm has been calculated using worst case scenarios as the depth of the cracked zone is considered zero as per AS2870-2011 Clause 2.3.2. Actual site classifications will be dependent on regrade activities including depth to rock and filling depth along with the materials utilised as fill.

NB: Careful material management will be required to avoid Class E classifications and ensure best outcomes for site classifications and pavements design. Reactive fill material should be placed below 0.9m of finished design levels.

The above site classifications and footing recommendations are for the site conditions present at the time of fieldwork and consequently the site classification may need to be reviewed with consideration of any site works that may be undertaken after the investigation and this report.

Site works may include:

- Changes to the existing soil profile by cutting and filling.
- Landscaping, including trees removed or planted in the general building area; and
- Drainage and watering systems.

Designs and design methods presented in AS 2870-2011 are based on the performance requirement that significant damage can be avoided if site conditions are properly maintained. Performance requirements and foundation maintenance are outlined in Appendix B of AS 2870. The above site classification assumes that the performance requirements as set out in Appendix B of AS 2870 are acceptable and that site foundation maintenance is undertaken to avoid extremes of wetting and drying.

Details on appropriate site and foundation maintenance practices are presented in Appendix B of AS 2870-2011 and in CSIRO Information Sheet BTF 18, Foundation Maintenance and Footing Performance: A Homeowner's Guide. Adherence to the detailing requirement outlined in Section 5 of AS 2870-2011 is essential, Section 5.6. Additional requirements for Classes M, H1, H2 and E sites, including architectural restrictions, plumbing and drainage requirements.

7 General Construction Considerations

7.1 Excavation Assessment and Excavations Stability

The test pits excavation was undertaken using a 14t Hitachi excavator. Only two test pits were terminated by refusal in bedrock in the northern section of the site. From the site observation all the test pits in extremely weathered siltstone and sandstone were readily excavated up to 3.0m BGL. Due to the type of rock encountered on site (mostly siltstone) and the estimated very low strength, no rock samples were collected for testing.

Excavatability conditions have not been assessed beyond the depths to which the test pits were excavated; however, the following general comments regarding rock mass excavatability conditions can be made:

- Rock strength as well as rock mass defect (joint) spacing could be expected to control rock mass excavatability. Rock strength is likely to be variable.
- Excavatability could be expected to be dependent on the plant used, the experience of the operator and the degree of confinement within the excavation.

It is recommended that long-term excavations are either battered at 2H:1V or flatter and protected against erosion or be supported by engineer designed and suitably constructed retaining walls. Excavations may be battered steeper than 2H:1V in rock materials, subject to specific geotechnical Investigation.

Excavations or trenches in the Silty/Sandy CLAY and extremely weathered rock could be expected to stand close to vertical in the short-term. The open excavations should be protected for erosion at all the time.

Where personnel are to enter excavations, options for short-term excavations include benching or battering back of the excavations to 1H:1V or the support of excavations within the residual soil and extremely weathered rock profile.

The excavation recommendations provided above should be considered with reference to the Safe Work Australia Code of Practice ‘Excavation Work’, dated October 2018 - Model Code of Practice: Excavation work (safeworkaustralia.gov.au)

7.2 Retaining Walls

All retaining walls should be designed by an engineer. Design of retaining walls should:

- Consider surcharge loading from slopes and structures above the wall.
- Take into account loading from any proposed compaction of fill behind the wall.
- Provide adequate surface and subsurface drainage behind all retaining walls, including a free draining granular backfill to prevent the build-up of hydrostatic pressures behind the wall.
- Utilise materials that are not susceptible to deterioration.
- Ensure walls are founded in materials appropriate for the loading conditions.

Footings for proposed retaining walls should be founded below any topsoil within stiff or better clay or weathered rock.

7.3 Filling and Material Management

Fill should be placed and compacted in accordance with AS 3798-2007. It is expected that construction of a suitable fill platform to support structural loads, such as pavements, ground slabs, footing and stiffened raft slabs, would include the following:

- Stripping of topsoil.
- Removal of any unsuitable soil (if applicable).
- Wet material where encountered will likely require treatment or moisture re-conditioning (drying and blending with dryer fill material) prior to placement and compaction.
- Proof rolling of the exposed subgrade to detect any weak or deforming areas of subgrade that should be excavated and replaced with compacted fill.
- Placement of fill in horizontal layers with compaction of each layer to a minimum dry density ratio of 95% Standard Relative Density (Australian Standard AS 1289 Clause 5.1.1) at moisture contents of 85-115% of SOMC and 98% Standard for fill in ≥2m depth. Fill within 0.5m of design subgrade in road alignments is to be compacted to 100% standard relative density at a 70-100% of SOMC. All fill materials should be supported by properly designed and constructed retaining walls or else battered at a slope of 2H:1V or flatter and protected against erosion by vegetation or similar and the provision of adequate drainage.

7.3.1 Material Management

The material management during regrade for this site will be important due to the presence of highly reactive cohesive soils (Iss >4%) and depth to the rock 2.2m BGL in some areas of the site. Where highly reactive cohesive materials are used for filling more than 2.5m depth the characteristic surface movement is larger than 75mm and as such the lot classification would be Class E (extremely reactive).

Good material management should be employed for this site to avoid lot classification with Class E. Reactive / Expansive clay materials should be placed as close to SOMC as practical to minimise their swell potential and preferentially placed in lower layers of the deeper fill areas.

Materials excavated on Site apart from topsoil (and other deleterious materials or uncontrolled fill) are considered suitable for re-use as engineering fill. Some materials will likely require treatment such as blending and moisture re-conditioning to produce suitable structural fill, subject to further assessment and weather conditions prior to and during construction. It is noted that silty clays were encountered in areas of the Site. While these materials have suitable bearing capacity when dry they are prone to softening (loss or strength) when wet and can present trafficability and compaction issues when at elevated moisture contents. Material should be managed during regrade to allow use of required design CBR and lower reactivity material in the top 500mm of filling and subgrade preparation to provide better outcome for pavement construction and site classification.

7.4 Geotechnical Design Parameters

The geotechnical parameters for the proposed development have been assessed based on results of the site and laboratory tests of the ground investigation. These are provided for the different geological units: soils in Table 14 and for bedrock in Table 15. The design parameters for bedrock have been assumed based on the observations during site investigation.

The low consistency topsoil layer has been considered unsuitable for shallow foundations and no design parameters have been calculated for these units.

Table 14. Geotechnical Design Parameters-soil

Geotechnical Units	Bulk Unit Weight (kN/m3)	Undrained Cohesion Cu (kPa)	Drained Cohesion c' (kPa)	Drained friction angle ϕ' (°)	Poisson's Ratio (-)	Elastic Modulus E' (MPa)	Earth Pressure coefficient ka	Earth pressure coefficient kp
RESIDUAL SOIL Silty/Sandy CLAY (stiff or better)	19	50-75	3-5	26	0.3	15	0.39	2.56

The allowable bearing capacity for the stiff or better residual soil (stiff or better) is estimated to75kPa to 125kPa.

Table 15.Geotechnical Design Parameters-rock

Geotechnical Unit (strength)	Bulk Unit Weight (kN/m3)	Bearing pressure (MPa)*	Ultimate shaft adhesion (kPa)**	Poisson's Ratio (-)	Elastic Modulus E' (MPa)
SILTSTONE very low (Class V)	20	0.7	50	0.3	50

*) Bearing pressure to limit the settlement to <1% of minimum footing size
**) clean socket of roughness category R2 or better

8 Basin Construction

A detention basin is proposed to be constructed within the proposed development. No specific testing has been undertaken at this location, but the Atterberg Limits test results indicate that the soils are appropriate for use in a homogeneous or zoned embankment. Additional testing (dispersity and permeability tests) is recommended to be conducted prior to basin construction. A zoned embankment may be preferred to allow the use of a lesser quality materials on downstream embankment construction and higher plasticity material used in the clay core.

Permanent and temporary sediment and water detention basin should be designed and constructed in accordance with Councils Engineering Guidelines and the requirements from Error! Reference source not found.

Table 16. Drainage Basin materials and compaction requirements

Zone	Material Specifications	Compaction Requirements
1- Clay Core / Clay Liner & Embankment Material	Liquid limit >50% 10% < Plasticity Index (PI) < 50%, Permeability <10^{-9}m/s Emerson Class >4 Maximum Particle Size <50mm Percentage Clay Content >25	98% standard relative density AS1289 5.7.1 at a moisture content of -1 to +3% of standard optimum moisture
2 - Outer Embankment Material (lower standard)	10%< PI <50%, Permeability < 10^{-7}m/s Emerson Class >2 Maximum Particle Size <75mm Percentage Clay Content >20 %	95% standard relative density AS1289 5.7.1 at a moisture content of -2 to +2% of standard optimum moisture
Topsoil	Suitable for sustaining planned vegetation plantings	Not applicable
Cut-Off Trench / Keyway	Minimum Stiff (CL-CH) Clay or better.	Minimum 2.4m wide and keyed into a minimum depth of 0.5 m into impervious material (compaction as per Zone 1)
Batter Slopes	1 Vertical: 6 Horizontal (Impoundment) 1 Vertical: 3 Horizontal (External)	
Spillway	Constructed in accordance with Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia (Geoscience Australia), 2019.	

Higher plasticity material should be used selectively in the construction of the basin, with the higher plasticity and lower permeability materials used in the construction of the key trench and clay core where a zone embankment is utilised.

8.1 Basin Construction Guidelines

Basins shall be designed and constructed in accordance with Council Engineering Guidelines and the following recommendations.

Embankments should be battered at a slope of 1V:3H or flatter for downstream batters or for batters above the permanent water level and 1V:6H for impoundment areas below the permanent water level or as otherwise agreed with Council or handrails installed to assist egress.

Earthworks and testing shall be undertaken in accordance with AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Developments. Table 16 above provides material requirements guidelines and compaction specifications for the construction of a zoned or non-zoned basin embankment. A zoned embankment can be considered where material of specified quality is limited. In this case attention will be required the location of the core and how it interfaces with the existing embankment.

8.1.1 Foundation Preparation for Embankments

Foundation preparation for foundations for new embankments could generally be expected to comprise the following:

- Removal of topsoil and residual soils and excavation of the cut-off trench into stiff or better impervious material and to a minimum depth of 0.5m.
- Inspection by an experienced geotechnical consultant to confirm the suitability of the foundation.
- Proof rolling of the exposed foundation area under the embankment with a heavy (minimum 10 tonne static) roller.
- Soft or weak areas detected during the proof rolling excavated and replaced with compacted fill / subgrade replacement comprising low permeability clay.
- Compaction of the various zones to achieve a minimum dry density ratio as detailed in Table 16.
- Protection of the prepared foundation to prevent excessive wetting or drying prior to placement of embankment fill material.
- Formation of the embankment in accordance with the above recommendations and specifications.

It is recommended that trafficking of the material exposed at foundation level be minimised during construction to prevent the permanent deformation of the subgrade or foundation.

Any abrupt changes between founding conditions, e.g., transition from rock to soil should be eliminated during foundation preparation. This could be expected to involve foundation preparation practices such as selective grading or mixing of material to provide a transition between material types and moisture / density control of subgrade compaction.

Impoundment Area

The finished surface of the impoundment area should be treated as indicated below following excavation:

- Ripping of impoundment area excluding constructed embankments to a depth of 300mm and re-compaction as per Zone 1.
- If rock is exposed at the surface; subject to geotechnical inspection it will either require ripping and re-compaction or over excavation and lining with a minimum of 300mm of Zone 1 material, and
- Protection of subgrade to prevent drying cracking of the subgrade prior to filling of the basin.

8.1.2 Cut Off Trench / Keyway

A critical aspect is the construction of the cut-off trench. A cut-off trench or keyway should be a minimum of 2.4 m width or 1.5 times the height of the Basin at the bottom of the trench. The keyway is intended to minimise seepage under the embankment and increase the stability of the Basin embankment and should be designed and constructed accordingly. This includes extending the layer a minimum of 500 mm into stiff or better impervious clay or rock and backfilled with the appropriate quality clay that is thoroughly compacted to the specification requirements.

8.1.3 Vegetation

Topsoil should be spread over the exposed surfaces of the embankment to a depth of at least 150 mm and sown with pasture grass to establish a good cover as soon as possible. Never allow any vegetation larger than pasture grass to become established on or near the embankment. Tree roots, especially eucalyptus tree roots can cause the core to crack resulting in failure of the Basin. As a rule of thumb, trees and shrubs should be kept to a minimum distance of 1.5 times the height of the tree away from the embankment of the Basins. This especially applies to eucalypts.

8.1.4 Basin Construction Reference

All works and materials used in construction of the basins should be designed and constructed in accordance with Council's specific requirements detailed in their Engineering Design and Construction Guidelines or as specified within this report. Where discrepancies occur clarification should be sought from Council on their requirements.

Earthworks and testing should generally be undertaken in accordance with AS3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments".

9 References

- Austroads AGPT05-19, "Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design," Austroads Ltd, October 2019
- Austroads AGPT02-17, "Guide to Pavement Technology Part 2: Pavement Structural Design," Austroads Ltd, 2017.
- Australian Standard AS2870-2011 "Residential slabs and footing"
- Australian Standard AS3798-2007 "Guideline on earthworks for commercial and residential developments".
- Australian Standard AS2159-2009, "Piling - Design & Installation," Standards Australia, 2009
- eSPADE, Online website of NSW Office of Environment and heritage (www.environment.nsw.gov.au)
- Geological Survey of NSW, "Newcastle Coalfield regional Geology 1:100,000 Geological Series Sheet
- NSW Department of Planning and Environment, Resources and Geoscience (www.resourcesandgeoscience.nsw.gov.au)
- Maitland City Council – Manual of Engineering Standards.
- TfNSW QA Specification 3051 (Ed 7 Rev 0), "Granular Base and Subbase Materials for Surfaced Road Pavements," Roads and Maritime Services, April 2011
- TfNSW QA Specification 3051 (Ed 7 Rev 0), "Granular Base and Subbase Materials for Surfaced Road Pavements," Roads and Maritime Services, August 2018.
- www.minview.geoscience.nsw.gov.au accessed on 21.02.2023.

Appendix A

PROPOSED LAYOUT

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
D	18.04.23	INITIAL ISSUE	L.K.	N.D.	DATUM: N/A CONTOUR INTERVAL: N/A	A1 1:500 / A3 1:1000	

drawing title: MASTER PLAN OPTION 2 SHEET 1

location: 523 RAYMOND TERRACE ROAD CHISHOLM

council: MCC

dwg ref: 190873-MP-002

client: ACG CLOVELLY ROAD PTY LTD

adw johnson

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411
www.adwjohnson.com.au

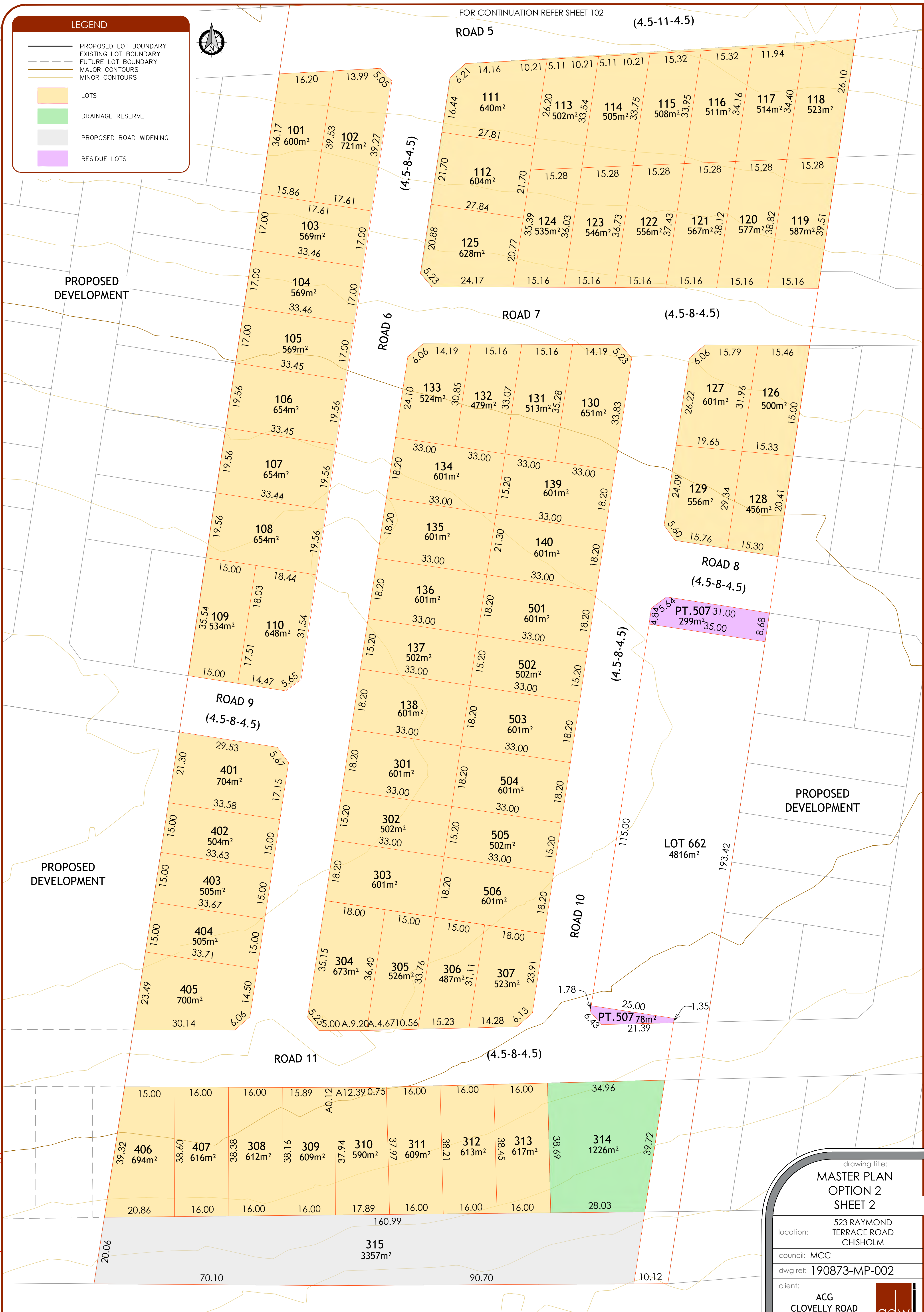
working beyond expectations

urban design • visualisation • development feasibility • surveying • town planning • social impact • superintendency • infrastructure • civil engineering • project management

190873-MP-002[D]

Plotted By: Nathan Delaney Plot Date: 18/04/23 9:07:15AM Cad File: S:\190873\DWG\PLANNING\MP\190873-MP-002[D].DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.



190873-MP-002[D]

drawing title: MASTER PLAN OPTION 2 SHEET 2

location: 523 RAYMOND TERRACE ROAD CHISHOLM

council: MCC

dwg ref: 190873-MP-002

client: ACG CLOVELLY ROAD PTY LTD

adw johnson

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
D	18.04.23	INITIAL ISSUE	L.K.	N.D.	DATUM: N/A CONTOUR INTERVAL: N/A	A1 1:500 / A3 1:1000	

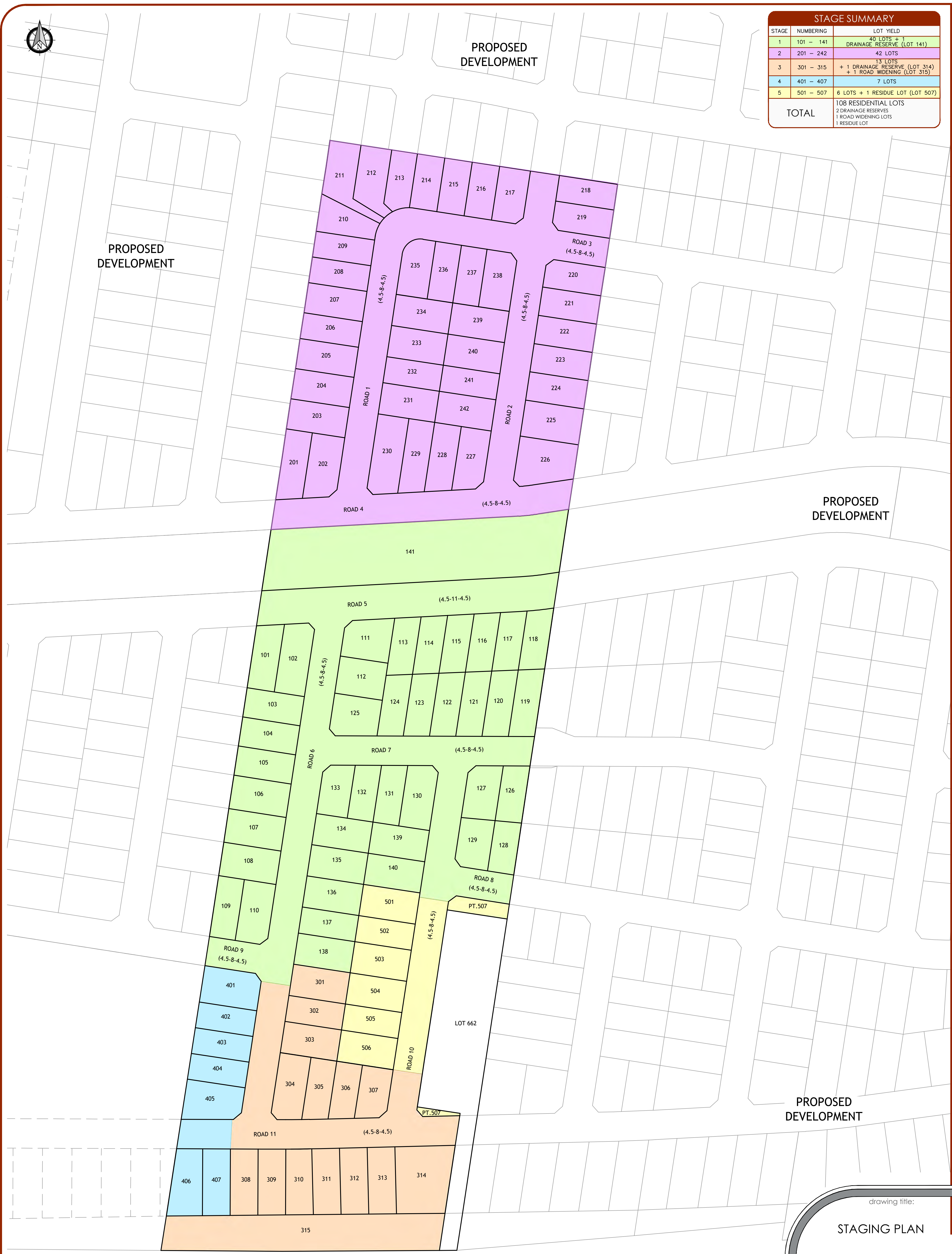
central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411
www.adwjohnson.com.au

working beyond expectations

• urban design • visualisation • development feasibility • surveying • town planning • social impact • superintendency • infrastructure • civil engineering • project management

Plotted By: Nathan Delaney Plot Date: 18/04/23 9:06:58AM Cad File: S:\190873\DWG\PLANNING\MP\190873-MP-002[D].DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.



STAGE SUMMARY

STAGE	NUMBERING	LOT YIELD
1	101 – 141	40 LOTS + 1 DRAINAGE RESERVE (LOT 141)
2	201 – 242	42 LOTS
3	301 – 315	13 LOTS + 1 DRAINAGE RESERVE (LOT 314) + 1 ROAD WIDENING (LOT 315)
4	401 – 407	7 LOTS
5	501 – 507	6 LOTS + 1 RESIDUE LOT (LOT 507)
TOTAL		108 RESIDENTIAL LOTS 2 DRAINAGE RESERVES 1 ROAD WIDENING LOTS 1 RESIDUE LOT

drawing title:

STAGING PLAN

location: 523 RAYMOND TERRACE ROAD CHISHOLM

council: MCC

dwg ref: 190873-MP-003

client: ACG CLOVELLY ROAD PTY LTD

adw johnson

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
B	18.04.23	INITIAL ISSUE	L.K.	N.D.	DATUM: N/A CONTOUR INTERVAL: N/A	A1 1:500 0 12.5 25.0m A3 1:1000	

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411

www.adwjohnson.com.au

working beyond expectations

• urban design • visualisation • development feasibility • surveying • town planning • social impact • superintendency • infrastructure • civil engineering • project management

190873-MP-003[B]

Plotted By: Nathan Delaney Plot Date: 18/04/23 9:13:41AM Cad File: S:\190873\DWG\PLANNING\MP\190873-MP-003[B].DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.

Appendix B

PHOTOLOG

	**Plate 1** **Description: Looking towards Raymond Terrace Road** **Date:16.02.2023**
	**Plate 2** **Description: Looking NW from the southern part of the site** **Date: 16.02.2023**

	**Plate 3** **Description: looking south from the central area of the site** **Date: 16.02.2023**
	**Plate 4** **Description: Looking north from the central area of the site** **Date: 16.02.2023**

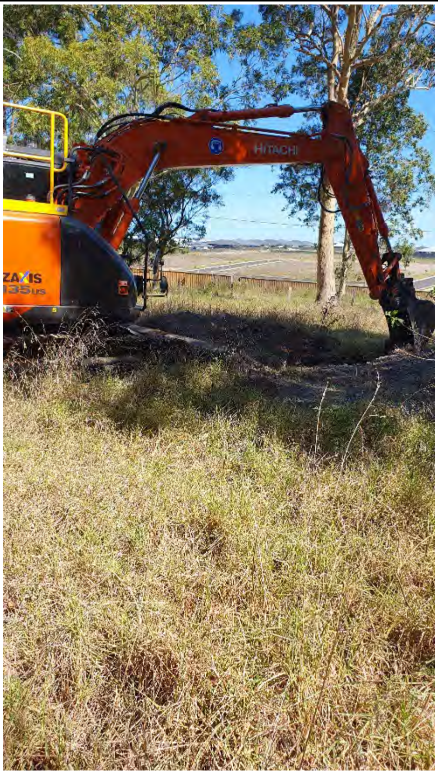
	**Plate 5** **Description: Excavating test pit in the southern section of the site** **Date: 16.02.2023**
	**Plate 6** **Description: Site dwelling** **Date: 16.02.2023**

	**Plate 7** **Description: General view northern sections of the site** **Date: 16.02.2023**
	**Plate 8** **Description: Looking south from the northern part of the site** **Date: 16.02.2023**

	**Plate 9** **Description:** **Dam view** **Date: 16.02.2023**
	**Plate 10** **Description:** **Farming shed on site** **Date: 16.02.2023**

	**Plate 11** **Description: Sheds and anthropogenic material** **Date: 16.02.2023**
	**Plate 12** **Description: Looking north towards the dam** **Date: 16.02.2023**

Appendix C

GEOTECHNICAL INVESTIGATION LOCATIONS

EP RISK

Preliminary Geotechnical Investigation
523 Raymond Terrace Road, Chisholm, NSW

Appendix C - Geotechnical Investigation Locations

www.eprisk.com.au

Job No: EP3045
Date: 22/02/2023
Drawing Ref: Fig 1
Version No: v1

N

0 30 60 90 m
Approximate Scale Only

Coordinate System: WGA 84
Drawn by: MC Checked by: OP
Scale of regional map not shown
Source: Near Map / Six Map

Appendix D

TEST PIT LOGS

EP RISK

Soil Logging Symbols

CLAYS

- CLAY
- silty CLAY
- sandy CLAY
- gravelly CLAY

SILTS

- SILT
- clayey SILT
- sandy SILT
- gravelly SILT

SANDS

- SAND
- clayey SAND
- silty SAND
- gravelly SAND

GRAVELS

- GRAVEL
- clayey GRAVEL
- silty GRAVEL
- sandy GRAVEL

SEDIMENTARY ROCK

- SANDSTONE
- SILTSTONE
- SHALE
- CONGLOMERATE

FILL

- FILL
- CONCRETE
- ASPHALT

GROUNDWATER WELL SYMBOLS

- WELL SCREEN
- CASING – filter pack
- CASING – backfill
- CASING – bentonite seal
- CASING – grout seal
- BACKFILL

OTHER

- TOPSOIL – sandy SILT
- TOPSOIL – highly organic

Rock Description Explanation Sheet (1 of 2)

Weathering Condition (Degree of Weathering):

The degree of weathering is a continuum from fresh rock to soil. Boundaries between weathering grades may be abrupt or gradational.

Rock Material Weathering Classification		
Weathering Grade	**Symbol**	**Definition**
Residual Soil	RS	Soil-like material developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume, but the material has not been significantly transported.
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded in water, but substance fabric and rock structure still recognisable.
Highly Weathered Rock	HW	Strong discolouration is evident throughout the rock mass, often with significant change in the constituent minerals. The intact rock strength is generally much weaker than that of the fresh rock.
Moderately Weathered Rock	MW	Modest discolouration is evident throughout the rock fabric, often with some change in the constituent minerals. The intact rock strength is usually noticeably weaker than that of the fresh rock.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

Notes:

1. Minor variations within broader weathering grade zones will be noted on the engineering borehole logs.
2. Extremely weathered rock is described in terms of soil engineering properties.
3. Weathering may be pervasive throughout the rock mass or may penetrate inwards from discontinuities to some extent.
4. The 'Distinctly Weathered (DW)' class as defined in AS1726-2017 is divided to incorporate HW and MW in the above table. The symbol DW should not be used.

Strength Condition (Intact Rock Strength):

Strength of Rock Material (Based on Point Load Strength Index, corrected to 50mm diameter – $I_{s(50)}$. Field guide used if no tests available. Refer to AS 4133.4.1-2007.				
Term	**Symbol**	**Point Load Index (MPa) $I_{s(50)}$**		**Field Guide to Strength**
Very Low	VL	>0.03	≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3cm thick can be broken by finger pressure.
Low	L	>0.1	≤0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3	≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	>1	≤3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Notes:

1. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects.
2. Anisotropy of rock material samples may affect the field assessment of strength.
3. Extremely Low Strength ('EL') is now not considered a description of rock strength in line with the updated AS1726-2017 as by definition EL rock should be described in terms of soil properties.

Rock Description Explanation Sheet (2 of 2)

Discontinuity Description: Refer to AS1726-2017, Table A10.

Anisotropic Fabric	
BED	Bedding
FOL	Foliation
LIN	Mineral lineation
Defect Type	
LP	Lamination Parting
Pt	Bedding Parting
FP	Cleavage / Foliation Parting
Jt	Joint
SZ	Sheared Zone
CZ	Crushed Zone
BZ	Broken Zone
HFZ	Highly Fractured Zone
AZ	Alteration Zone
VN	Vein

Roughness (e.g. Planar, Smooth is abbreviated Pln / Sm)		**Class**
Stepped (Stp)	Rough or irregular (R or Irr)	I
	Smooth (Sm)	II
	Slickensided (Sl)	III
Undulating (Un)	Rough (R)	IV
	Smooth (Sm)	V
	Slickensided (Sl)	VI
Planar (Pln)	Rough (R)	VII
	Smooth (Sm)	VIII
	Slickensided (Sl)	IX

Aperture		**Infilling**		
Closed	CD	No visible coating or infill	Clean	Cn
Open	OP	Surfaces discoloured by mineral/s	Stain	St
Filled	FL	Visible mineral or soil infill <1mm	Veneer	Vr
Tight	TI	Visible mineral or soil infill >1mm	Coating	Ct

Other	
Clay	Clay
Fe	Iron
Co	Coal
Carb	Carbonaceous
Sinf	Soil Infill Zone
Qz	Quartz
Ca	Calcite
Chl	Chlorite
Py	Pyrite
Int	Intersecting
Inc	Incipient
DI	Drilling Induced
H	Horizontal
V	Vertical

Note: Describe 'Zones' and 'Coatings' in terms of composition and thickness (mm).

Discontinuity Spacing: On the geotechnical borehole log, a graphical representation of defect spacing vs depth is shown. This representation takes into account all the natural rock defects occurring within a given depth interval, excluding breaks induced by the drilling / handling of core. Refer to AS1726-2017, BS5930-1999.

Defect Spacing			**Bedding Thickness (Sedimentary Rock Stratification)**	
Spacing/Width (mm)	Descriptor	Symbol	Descriptor	Spacing/Width (mm)
			Thinly Laminated	< 6
<20	Extremely Close	EC	Thickly Laminated	6 – 20
20 – 60	Very Close	VC	Very Thinly Bedded	20 – 60
60 – 200	Close	C	Thinly Bedded	60 – 200
200 – 600	Medium	M	Medium Bedded	200 – 600
600 – 2000	Wide	W	Thickly Bedded	600 – 2000
2000 – 6000	Very Wide	VW	Very Thickly Bedded	> 2000
>6000	Extremely Wide	EW		

Defect Spacing in 3D	
Term	**Description**
Blocky	Equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

Defect Persistence (areal extent)
Trace length of defect given in metres

Symbols:

The list below provides an explanation of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

Test Results			
PI	Plasticity Index	c'	Effective Cohesion
LL	Liquid Limit	c_u	Undrained Cohesion
LI	Liquidity Index	c'_R	Residual Cohesion
DD	Dry Density	ϕ'	Effective Angle of Internal Friction
WD	Wet Density	ϕ_u	Undrained Angle of Internal Friction
LS	Linear Shrinkage	ϕ'_R	Residual Angle of Internal Friction
MC	Moisture Content	c_v	Coefficient of Consolidation
OC	Organic Content	m_v	Coefficient of Volume Compressibility
WPI	Weighted Plasticity Index	$c_{\alpha\varepsilon}$	Coefficient of Secondary Compression
WLS	Weighted Linear Shrinkage	e	Voids Ratio
DoS	Degree of Saturation	ϕ'_{cv}	Constant Volume Friction Angle
APD	Apparent Particle Density	q_t / q_c	Piezocone Tip Resistance (corrected / uncorrected)
s_u	Undrained Shear Strength	q_d	PANDA Cone Resistance
q_u	Unconfined Compressive Strength	$I_{s(50)}$	Point Load Strength Index
TCR	Total Core Recovery	*RQD*	Rock Quality Designation

Test Symbols	
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetration Test
CPTu	Cone Penetrometer (Piezocone) Test
PANDA	Variable Energy DCP
PP	Pocket Penetrometer Test
U50	Undisturbed Sample 50 mm (nominal diameter)
U100	Undisturbed Sample 100mm (nominal diameter)
UCS	Uniaxial Compressive Strength
Pm	Pressuremeter
FSV	Field Shear Vane
DST	Direct Shear Test
PR	Penetration Rate
PLI	Point Load Index Test (axial)
D	Point Load Test (diametral)
L	Point Load Test (irregular lump)

Groundwater level	Water Inflow	Water Outflow

Test Pit No: TP-L1

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374700.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373064.00	Bearing	---	Ground Level	

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0–0.3		CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F to St	2, 9, 6		TOPSOIL
E			0.3–1.5		CI-CH	Silty CLAY: medium to high plasticity, brown, grey and orange, trace fine to medium grained sand	<PL	VSt and St	6, 6, 4, 4, 4, 6, 5, 5, 5, 8, 8, 15	B	RESIDUAL SOIL
E			1.5–2.6		ML	Extremely weathered Siltstone recovered as Sandy SILT, low plasticity, grey and orange, fine to medium grained sand	<<PL	H	15		EXTREMELY WEATHERED ROCK
			2.6			Test Pit TP-L1 Terminated at 2.60 m					Refusal

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation
	TP-L1

Test Pit No: TP-L2

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374639.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	372988.00	Bearing	---	Ground Level	

Method	Water	RL (m)	Depth (m)	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0	CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey and brown, fine to medium grained sand	<<PL	St and VSt	4, 6, 5		TOPSOIL
			0.26	CI-CH	Silty Sandy CLAY: medium to high plasticity, grey, brown and orange, fine to medium grained sand	<PL	St and VSt	7, 6, 4, 5, 4, 5	U50	RESIDUAL SOIL
			0.9	CL-CI	Silty CLAY: low to medium plasticity, pale grey and orange	<PL	St and VSt / H	5, 5, 6, 6, 8, 9, 8, 14, 13, 13	B	
			2.0	ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, pale grey and orange	<PL	H		D	EXTREMELY WEATHERED ROCK
			2.60		Test Pit TP-L2 Terminated at 2.60 m					Refusal

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-L2	

Engineering Log - Test Pit

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374595.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373050.00	Bearing	---	Ground Level	

EXCAVATION				MATERIAL DESCRIPTION					TESTING, SAMPLING & OTHER INFORMATION		
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered				CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F / VSt to H	3, 5, 8		TOPSOIL
					CI-CH	Silty CLAY: medium to high plasticity, grey and red	<PL	VSt to H	9, 8, 8, 6		RESIDUAL SOIL
			1		SC	Extremely weathered Sandstone, recovered as Clayey SAND, fine to coarse grained, yellow and grey	D	VD and D	8, 11, 12, 9		EXTREMELY WEATHERED ROCK
			2		ML	Extremely weathered Siltstone recovered as Sandy SILT, low plasticity, grey, with ferruginous cementations (50mm-100mm)	<<PL	VSt to H	8, 8, 15, 14	B	
			3								

Remarks: Test Pit TP-L3 Terminated at 3.00 m — Target depth

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-L3	

Engineering Log - Test Pit

Test Pit No: TP-L4

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374437.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373059.00	Bearing	---	Ground Level	

Method	Water	RL (m)	Depth (m)	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	DCP Results (blows/100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0–0.3	CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F	1, 2, 8		TOPSOIL
			0.3–1.2	CL-CI	Silty CLAY: low to medium plasticity, brown and orange	<PL	VSt and H	7, 6, 8, 11, 9, 10, 10, 9, 10	B	RESIDUAL SOIL
			1.2–2.8	ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-100mm)				D	EXTREMELY WEATHERED ROCK
			2.80		Test Pit TP-L4 Terminated at 2.80 m					Target depth

Remarks:

EP RISK

EP3045 - 523 Raymond Terrace Road, Chisholm, NSW
Preliminary Geotechnical Investigation

TP-L4

Test Pit No: TP-L5

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374334.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373007.00	Bearing	---	Ground Level	

EXCAVATION | MATERIAL DESCRIPTION | TESTING, SAMPLING & OTHER INFORMATION

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered				ML	TOPSOIL: Sandy SILT: low plasticity, grey, fine to medium grained sand	<<PL	F	2, 5		TOPSOIL
					CL-CI	Silty CLAY: medium to high plasticity, brown and orange, with ferruginous cementations (20mm-50mm)	<PL	VSt	9, 6, 5, 7, 9, 10, 11, 12, 8, 13, 12	B U50	RESIDUAL SOIL
			1								
			2		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (70mm-100mm)	<<PL	VSt and H		D	EXTREMELY WEATHERED ROCK
			3								

Remarks: Test Pit TP-L5 Terminated at 3.00 m — Target depth

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-L5	

Engineering Log - Test Pit

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374237.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	372994.00	Bearing	---	Ground Level	

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0–0.3		CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F (0.0–0.1); VSt	1, 7, 7		TOPSOIL
			0.3–0.8		CL-CI	Silty CLAY: low to medium plasticity, grey and orange	<PL	VSt	8, 9, 7, 7, 8		RESIDUAL SOIL
			0.8–3.0			Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-100mm)	<PL	VSt to H	10, 11, 10	B (1.1–1.5); D (2.8–3.0)	EXTREMELY WEATHERED ROCK

Remarks: Test Pit TP-L6 Terminated at 3.00 m — Target depth

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-L6	

Test Pit No: TP-L7

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374137.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	372963.00	Bearing	---	Ground Level	

EXCAVATION: Method E; Water: Not Encountered

Depth (m)	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	DCP Results (blows/100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
0.0–0.3	CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F to St	2, 3, 8		TOPSOIL
0.3–1.4	CL-CI	Silty CLAY: low to medium plasticity, brown and orange	<PL	VSt	7, 7, 6, 7, 8, 7, 8, 5, 5, 6, 9	U50 (0.5–0.8)	RESIDUAL SOIL
1.4–3.0	ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-75mm)	<PL	H	12, 15	B (1.7–2.5)	EXTREMELY WEATHERED ROCK

Remarks: Test Pit TP-L7 Terminated at 3.00 m — Target depth

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation
	TP-L7

Test Pit No: TP-P1

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374681.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373103.00	Bearing	---	Ground Level	

EXCAVATION | MATERIAL DESCRIPTION | TESTING, SAMPLING & OTHER INFORMATION

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered				CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F	2, 6		TOPSOIL
			1, 2		CI-CH	Silty CLAY: medium to high plasticity, grey and orange mottled	<PL	St and VSt	10, 6, 4, 4, 4, 4, 4, 6, 6, 7, 7, 7, 8	B	RESIDUAL SOIL
								H	18, 19		
					ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, pale grey and red with ferruginous cementations (50mm-100mm)					EXTREMELY WEATHERED ROCK
			3			Test Pit TP-P1 Terminated at 2.43 m					Target depth

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-P1	

Test Pit No: TP-P2

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374634.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373010.00	Bearing	---	Ground Level	

EXCAVATION / MATERIAL DESCRIPTION / TESTING, SAMPLING & OTHER INFORMATION

Method	Water	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered	CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey and brown, fine to medium grained sand	<<PL	VSt and H	TOPSOIL
E		CI-CH	Silty CLAY: medium to high plasticity, grey and orange	<PL	VSt and H / St and VSt	RESIDUAL SOIL
E		CL-CI	Sandy CLAY: low to medium plasticity, pale grey and orange, fine to coarse grained sand	<PL	St and VSt / VSt and H	
E		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange, with ferruginous cementations (120mm-150mm)	<PL	VSt and H	EXTREMELY WEATHERED ROCK
			Test Pit TP-P2 Terminated at 2.60 m			Target depth

Depth (m): 1, 2, 3

DCP Results (blows/100mm): 10, 11, 11, 8, 7, 6, 3, 5, 9, 11, 8, 7, 10, 12, 10, 11, 13, 14

Samples: B (approx. 1.0 m – 1.5 m)

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation
	TP-P2

Test Pit No: TP-P3

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374538.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373083.00	Bearing	---	Ground Level	

EXCAVATION | MATERIAL DESCRIPTION | TESTING, SAMPLING & OTHER INFORMATION

Method	Water	RL (m)	Depth (m)	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.00–0.30	CL	TOPSOIL: Clayey SILT: low plasticity, grey	<<PL			TOPSOIL
E			0.30–1.80	CL-CI	Silty CLAY: low to medium plasticity, grey and orange, with ferruginous cementations (50mm-100mm)	~PL (0.3–1.2); <PL (1.2–1.8)	St to VSt (0.3–0.7); F (0.7–1.1); St to VSt (1.1–1.8)	B (0.5–1.0)	RESIDUAL SOIL
E			1.80–2.00	ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey with ferruginous cementations (50mm-75mm)	<PL	VSt to H		EXTREMELY WEATHERED ROCK
			2.00		Test Pit TP-P3 Terminated at 2.00 m				Target depth

Tests – DCP Results (blows/100mm):

Depth (m)	DCP
0.0–0.1	5
0.1–0.2	10
0.2–0.3	13
0.3–0.4	5
0.4–0.5	6
0.5–0.6	4
0.6–0.7	4
0.7–0.8	2
0.8–0.9	2
0.9–1.0	1
1.0–1.1	2
1.1–1.2	4
1.2–1.3	4
1.3–1.4	4
1.4–1.5	5
1.5–1.6	5
1.6–1.7	6
1.7–1.8	9
1.8–1.9	10
1.9–2.0	

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-P3	

Test Pit No: TP-P4

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374461.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	372986.00	Bearing	---	Ground Level	

EXCAVATION				MATERIAL DESCRIPTION					TESTING, SAMPLING & OTHER INFORMATION		
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0–0.28		CL-CI	TOPSOIL: Sandy SILT: low to medium plasticity, grey, fine to medium grained sand	<<PL	St and VSt	3, 8, 8		TOPSOIL
			0.28–1.6		CL-CI	Silty CLAY: low to medium plasticity, brown and orange	<PL		8, 6, 6, 4, 5, 6, 5, 3, 4, 5, 8, 6, 9	B	RESIDUAL SOIL
			1.6–2.1		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-100mm)			9, 8		EXTREMELY WEATHERED ROCK
			2.1			Test Pit TP-P4 Terminated at 2.10 m					Target depth

Remarks:

EP3045 - 523 Raymond Terrace Road, Chisholm, NSW
Preliminary Geotechnical Investigation

TP-P4

Test Pit No: TP-P5

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374325.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373048.00	Bearing	---	Ground Level	

EXCAVATION				MATERIAL DESCRIPTION					TESTING, SAMPLING & OTHER INFORMATION		
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.00–0.25		CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	F	2, 10, 8		TOPSOIL
			0.25–1.20		CL-CI	Silty CLAY: low to medium plasticity, grey and orange	<PL	St and VSt	5, 3, 4, 3, 3, 5, 5, 3, 3		RESIDUAL SOIL
			1.20–2.00		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-100mm)		St and VSt / H	7, 8, 7, 6, 12	B	EXTREMELY WEATHERED ROCK
			2.00			Test Pit TP-P5 Terminated at 2.00 m					Target depth

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation	
	TP-P5	

Test Pit No: TP-P6

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374267.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	372955.00	Bearing	---	Ground Level	

EXCAVATION | MATERIAL DESCRIPTION | TESTING, SAMPLING & OTHER INFORMATION

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered				CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	St and VSt	2, 13		TOPSOIL
			1		CL-CI	Silty CLAY: low to medium plasticity, brown and orange	<PL		10, 7, 5, 7, 5, 5, 3, 4, 3, 4, 4, 6	B	RESIDUAL SOIL
			2		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (50mm-100mm)		H	13		EXTREMELY WEATHERED ROCK
			3			Test Pit TP-P6 Terminated at 2.30 m					Target depth

Remarks:

EP RISK

EP3045 - 523 Raymond Terrace Road, Chisholm, NSW
Preliminary Geotechnical Investigation

TP-P6

Test Pit No: TP-P7

Engineering Log - Test Pit

SHEET 1 OF 1

Client	ACG Clovelly Road Pty Ltd c/- ADW Johnson Pty Ltd	Project No.	EP3045
Project	Preliminary Geotechnical and Environmental Investigation	Logged By	OP
Location	523 Raymond Terrace Road Chisholm	Checked By	OP

Started Excavation	16.2.23	Northing	6374168.00	Slope	90°	Equipment	Hitachi 14t Excavator
Completed Excavation	16.2.23	Easting	373021.00	Bearing	---	Ground Level	

EXCAVATION				MATERIAL DESCRIPTION					TESTING, SAMPLING & OTHER INFORMATION		
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification	Description of Soil (soil type: plasticity/grainsize, colour and other components)	Moisture Condition	Consistency	Tests DCP Results (blows/ 100mm)	Samples	Additional Comments (material origin, pocket penetrometer values, investigation observations)
E	Not Encountered		0.0–0.2		CL-CI	TOPSOIL: Sandy CLAY: low to medium plasticity, grey, fine to medium grained sand	<<PL	St	3, 10		TOPSOIL
			0.2–0.8		CL-CI	Silty CLAY: low to medium plasticity, brown and orange	<PL	VSt to H	8, 7, 8, 6, 8, 7	B	RESIDUAL SOIL
			0.8–2.0		ML	Extremely weathered Siltstone recovered as Clayey SILT, low plasticity, grey and orange with ferruginous cementations (75mm-125mm)			7, 7, 8, 8, 8, 8		EXTREMELY WEATHERED ROCK
			2.0			Test Pit TP-P7 Terminated at 2.00 m					Target depth

Remarks:

EP RISK	EP3045 - 523 Raymond Terrace Road, Chisholm, NSW Preliminary Geotechnical Investigation
	TP-P7

Appendix E

LABORATORY TEST RESULTS

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

coffey TESTING

Report No: CBR:NEWC23S-01317
Issue No: 1

California Bearing Ratio Test Report

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

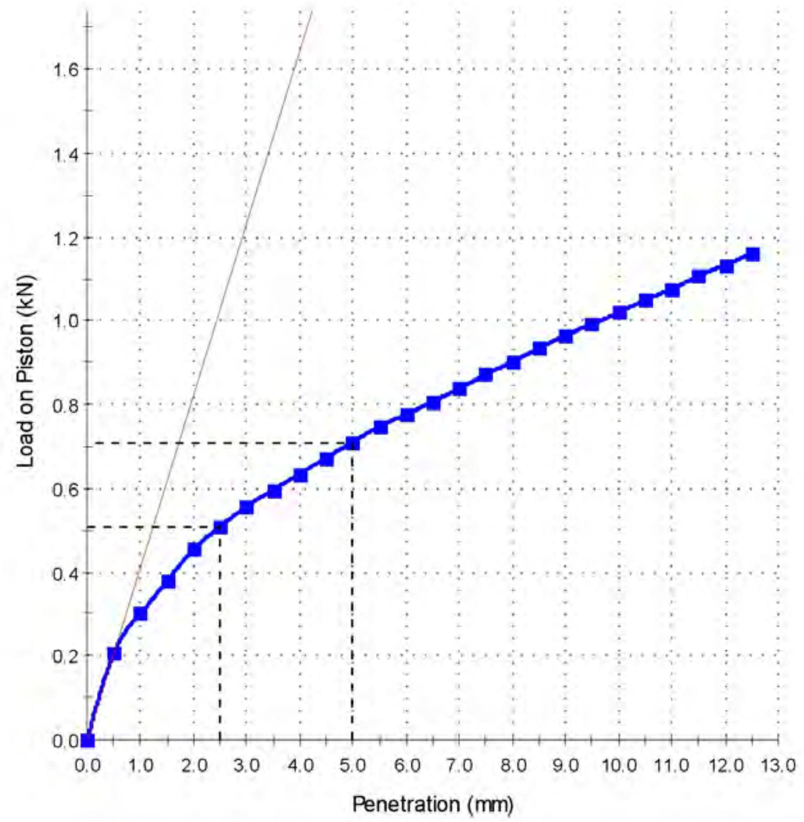
Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01317	**Sampling Method:**	Submitted by client*
Client ID:		**Material:**	Existing Ground
Date Sampled:	16/02/2023	**Source:**	On-Site
Date Submitted:	21/02/2023	**Specification:**	No Specification
Date Tested:	3/03/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-P2, Depth:1.0 - 1.5m		

Load vs Penetration



Test Results

AS 1289.6.1.1

CBR at 2.5mm (%):	**4.0**
Dry Density before Soaking (t/m³):	1.64
Density Ratio before Soaking (%):	101.0
Moisture Content before Soaking (%):	19.6
Moisture Ratio before Soaking (%):	99.5
Dry Density after Soaking (t/m³):	1.61
Density Ratio after Soaking (%):	99.0
Swell (%):	2.0
Moisture Content of Top 30mm (%):	23.8
Moisture Content of Remaining Depth (%):	20.7
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	98
Plasticity Determination Method:	Visual/Tactile

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Report No: NEWC23S-01317-1
Issue No: 1

Material Test Report

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01317
Date Sampled:	16/02/2023
Source:	On-Site
Material:	Existing Ground
Specification:	No Specification
Sampling Method:	Submitted by client*
Project Location:	Chisholm, NSW
Sample Location:	TP-P2 Depth:1.0 - 1.5m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	17.5	
Date Tested		22/02/2023	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.62**	
Standard OMC (%)		**19.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		1	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		24/02/2023	

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

California Bearing Ratio Test Report

Report No: CBR:NEWC23S-01318
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.: NA	**TRN:** NA

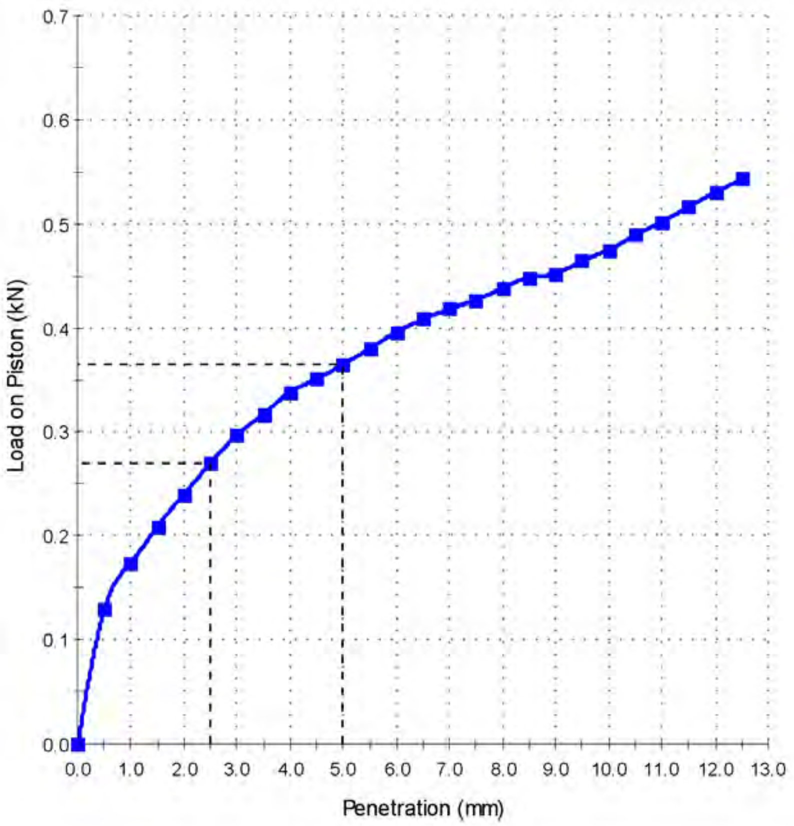
Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01318	**Sampling Method:**	Submitted by client*
Client ID:		**Material:**	Existing Ground
Date Sampled:	16/02/2023	**Source:**	On-Site
Date Submitted:	21/02/2023	**Specification:**	No Specification
Date Tested:	3/03/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-P4, Depth:0.5 - 1.5m		

Load vs Penetration



Test Results

AS 1289.6.1.1

CBR at 2.5mm (%):	**2.0**
Dry Density before Soaking (t/m³):	1.61
Density Ratio before Soaking (%):	101.0
Moisture Content before Soaking (%):	20.9
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.57
Density Ratio after Soaking (%):	99.0
Swell (%):	2.5
Moisture Content of Top 30mm (%):	28.4
Moisture Content of Remaining Depth (%):	23.5
Compaction Hammer Used:	Standard AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	66
Plasticity Determination Method:	Visual/Tactile

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Report No: NEWC23S-01318-1
Issue No: 1

Material Test Report

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.: NA	**TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01318
Date Sampled:	16/02/2023
Source:	On-Site
Material:	Existing Ground
Specification:	No Specification
Sampling Method:	Submitted by client*
Project Location:	Chisholm, NSW
Sample Location:	TP-P4 Depth:0.5 - 1.5m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	16.7	
Date Tested		22/02/2023	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.59**	
Standard OMC (%)		**21.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		1	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		24/02/2023	

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

California Bearing Ratio Test Report

Report No: CBR:NEWC23S-01319
Issue No: 1

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

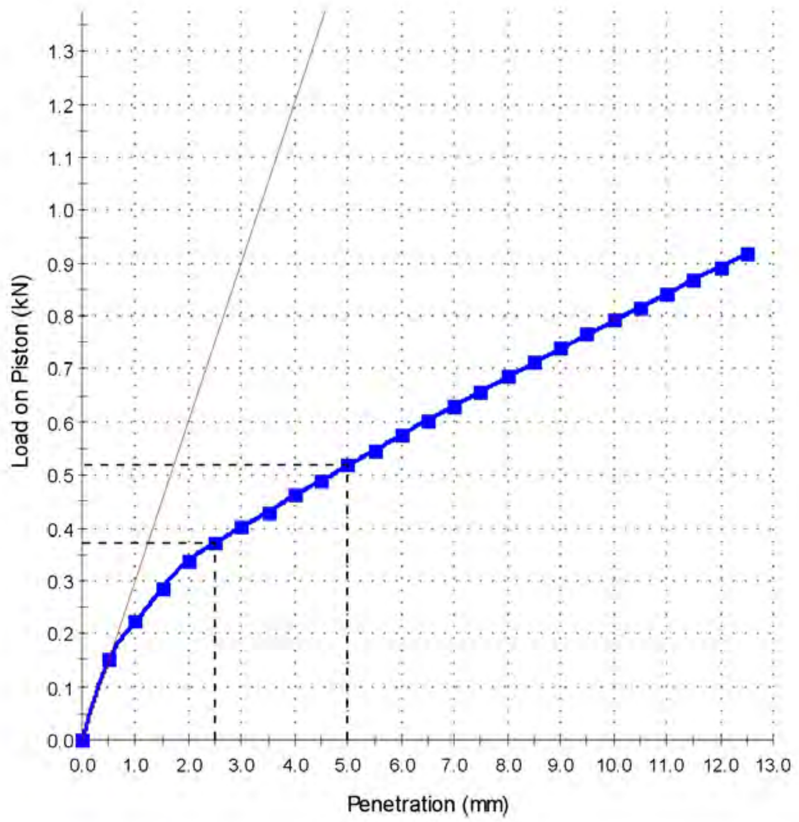
Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01319	**Sampling Method:**	Submitted by client*
Client ID:		**Material:**	Existing Ground
Date Sampled:	16/02/2023	**Source:**	On-Site
Date Submitted:	21/02/2023	**Specification:**	No Specification
Date Tested:	3/03/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-P5, Depth:1.2 - 2.0m		

Load vs Penetration



Test Results

AS 1289.6.1.1

CBR at 2.5mm (%):	**3.0**
Dry Density before Soaking (t/m³):	1.71
Density Ratio before Soaking (%):	101.0
Moisture Content before Soaking (%):	18.0
Moisture Ratio before Soaking (%):	100.0
Dry Density after Soaking (t/m³):	1.68
Density Ratio after Soaking (%):	99.0
Swell (%):	2.0
Moisture Content of Top 30mm (%):	22.8
Moisture Content of Remaining Depth (%):	20.3
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	3
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	73
Plasticity Determination Method:	Visual/Tactile

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Material Test Report

Report No: NEWC23S-01319-1
Issue No: 1

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID: NEWC23S-01319
Date Sampled: 16/02/2023
Source: On-Site
Material: Existing Ground
Specification: No Specification
Sampling Method: Submitted by client*
Project Location: Chisholm, NSW
Sample Location: TP-P5
Depth:1.2 - 2.0m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	14.5	
Date Tested		22/02/2023	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.70**	
Standard OMC (%)		**18.0**	
Retained Sieve (mm)		19	
Oversize Material (%)		3	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		24/02/2023	

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

California Bearing Ratio Test Report

Report No: CBR:NEWC23S-01320
Issue No: 1

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

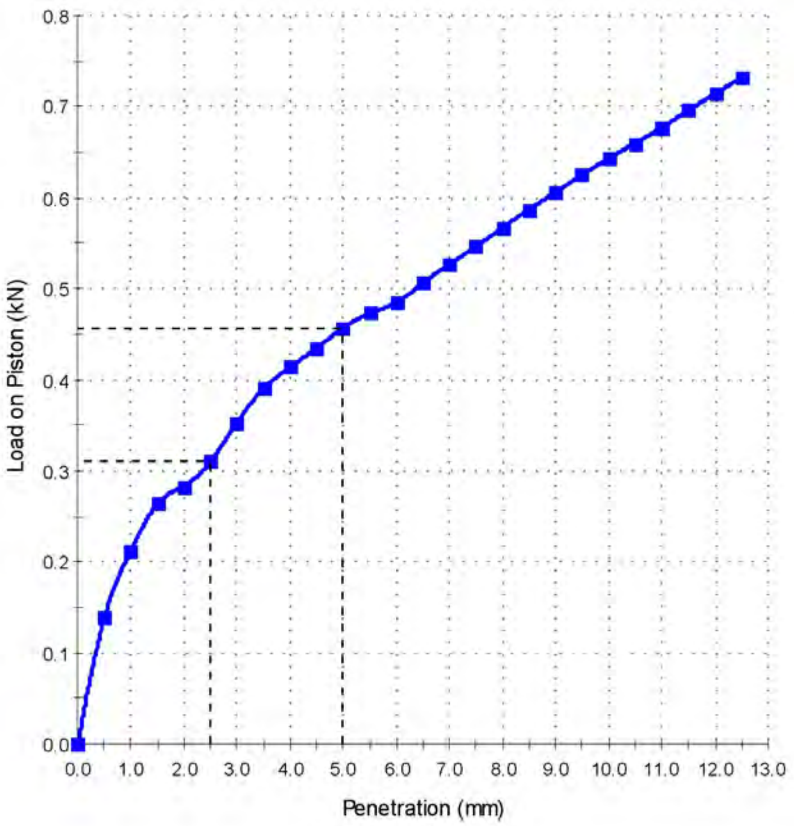
Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01320	**Sampling Method:**	Submitted by client*
Client ID:		**Material:**	Existing Ground
Date Sampled:	16/02/2023	**Source:**	On-Site
Date Submitted:	21/02/2023	**Specification:**	No Specification
Date Tested:	3/03/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-P7, Depth:0.2 - 0.75m		

Load vs Penetration



Test Results

AS 1289.6.1.1

CBR at 2.5mm (%):	**2.5**
Dry Density before Soaking (t/m³):	1.60
Density Ratio before Soaking (%):	100.5
Moisture Content before Soaking (%):	22.4
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.57
Density Ratio after Soaking (%):	98.5
Swell (%):	2.5
Moisture Content of Top 30mm (%):	29.2
Moisture Content of Remaining Depth (%):	23.7
Compaction Hammer Used:	Standard AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	70
Plasticity Determination Method:	Visual/Tactile

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Report No: NEWC23S-01320-1
Issue No: 1

Material Test Report

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID: NEWC23S-01320
Date Sampled: 16/02/2023
Source: On-Site
Material: Existing Ground
Specification: No Specification
Sampling Method: Submitted by client*
Project Location: Chisholm, NSW
Sample Location: TP-P7
Depth:0.2 - 0.75m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.8	
Date Tested		22/02/2023	
Standard MDD (t/m³)	AS 1289.5.1.1	**1.59**	
Standard OMC (%)		**22.5**	
Retained Sieve (mm)		19	
Oversize Material (%)		1	
Curing Time (h)		96	
LL Method		Visual / Tactile Assessment	
Date Tested		24/02/2023	

Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

coffey TESTING

Material Test Report

Report No: NEWC23S-01313-1
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.: NA	**TRN:** NA

NATA

ilac-MRA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01313
Date Sampled:	16/02/2023
Source:	On-Site
Material:	Existing Ground
Specification:	No Specification
Sampling Method:	Submitted by client*
Project Location:	Chisholm, NSW
Sample Location:	TP-L1 Depth:0.5 - 1.0m

Other Test Results

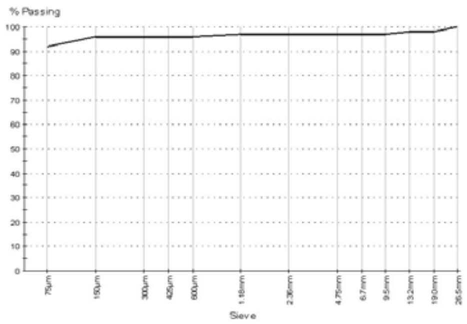
Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-Dried	
Preparation	AS 1289.1.1	Dry-Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	15.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	56	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	21	
Plasticity Index (%)	AS 1289.3.3.1	35	
Date Tested		24/02/2023	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying By:	Oven
Date Tested:	24/02/2023
Note:	Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	98	
13.2mm	98	
9.5mm	97	
6.7mm	97	
4.75mm	97	
2.36mm	97	
1.18mm	97	
600µm	96	
425µm	96	
300µm	96	
150µm	96	
75µm	92	

Chart



Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

coffey TESTING

Material Test Report

Report No: NEWC23S-01314-1
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.: NA	**TRN:** NA

NATA ilac-MRA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01314
Date Sampled:	16/02/2023
Source:	On-Site
Material:	Existing Ground
Specification:	No Specification
Sampling Method:	Submitted by client*
Project Location:	Chisholm, NSW
Sample Location:	TP-L3 Depth:1.0 - 1.5m

Other Test Results

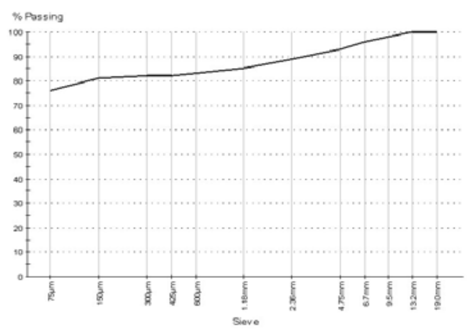
Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-Dried	
Preparation	AS 1289.1.1	Dry-Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	40	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	21	
Date Tested		24/02/2023	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying By:	Oven
Date Tested:	23/02/2023
Note:	Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	100	
9.5mm	98	
6.7mm	96	
4.75mm	93	
2.36mm	89	
1.18mm	85	
600µm	83	
425µm	82	
300µm	82	
150µm	81	
75µm	76	

Chart



Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Material Test Report

Report No: NEWC23S-01315-1
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.:	NA
TRN:	NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID:	NEWC23S-01315
Date Sampled:	16/02/2023
Source:	On-Site
Material:	Existing Ground
Specification:	No Specification
Sampling Method:	Submitted by client*
Project Location:	Chisholm, NSW
Sample Location:	TP-L5 Depth:05 - 1.0m

Other Test Results

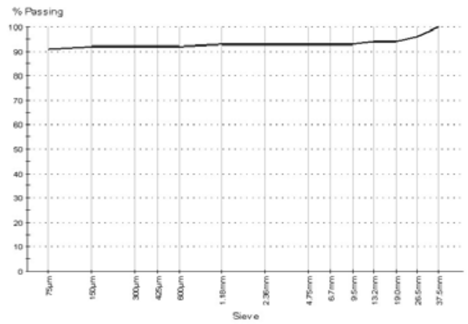
Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-Dried	
Preparation	AS 1289.1.1	Dry-Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	12.0	
Mould Length (mm)		254	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	58	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	20	
Plasticity Index (%)	AS 1289.3.3.1	38	
Date Tested		24/02/2023	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying By:	Oven
Date Tested:	24/02/2023
Note:	Sample Washed

Sieve Size	% Passing	Limits
37.5mm	100	
26.5mm	96	
19.0mm	94	
13.2mm	94	
9.5mm	93	
6.7mm	93	
4.75mm	93	
2.36mm	93	
1.18mm	93	
600µm	92	
425µm	92	
300µm	92	
150µm	92	
75µm	91	

Chart



Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

coffey TESTING

Material Test Report

Report No: NEWC23S-01316-1
Issue No: 1

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jason Condran
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 4/03/2023

Sample Details

Sample ID: NEWC23S-01316
Date Sampled: 16/02/2023
Source: On-Site
Material: Existing Ground
Specification: No Specification
Sampling Method: Submitted by client*
Project Location: Chisholm, NSW
Sample Location: TP-L6
Depth:0.8 - 1.5m

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-Dried	
Preparation	AS 1289.1.1	Dry-Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.5	
Mould Length (mm)		249.5	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	46	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	27	
Date Tested		24/02/2023	

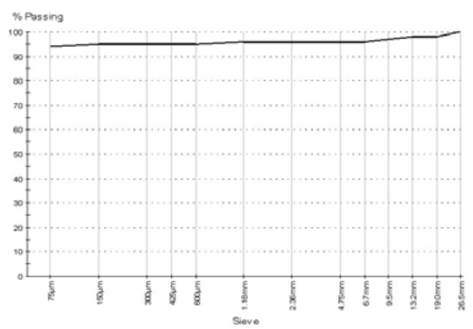
Particle Size Distribution

Method: AS 1289.3.6.1
Drying By: Oven
Date Tested: 24/02/2023

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	98	
13.2mm	98	
9.5mm	97	
6.7mm	96	
4.75mm	96	
2.36mm	96	
1.18mm	96	
600µm	95	
425µm	95	
300µm	95	
150µm	95	
75µm	94	

Chart



Comments

*Results relate only to the items tested or sampled.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

coffey TESTING

Shrink Swell Index Report

Report No: SSI:NEWC23S-01310
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.: NA	**TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Greg Eveleigh
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 2/03/2023

Sample Details

Sample ID:	NEWC23S-01310	**Sampling Method:**	Submitted by client*
Date Sampled:	16/02/2023	**Material:**	Existing Ground
Date Submitted:	21/02/2023	**Source:**	On-Site
Date Tested:	21/02/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-L2, Depth:0.50 - 1.0m		
Borehole Number:	TP-L2		
Borehole Depth (m):	0.5-1.0		

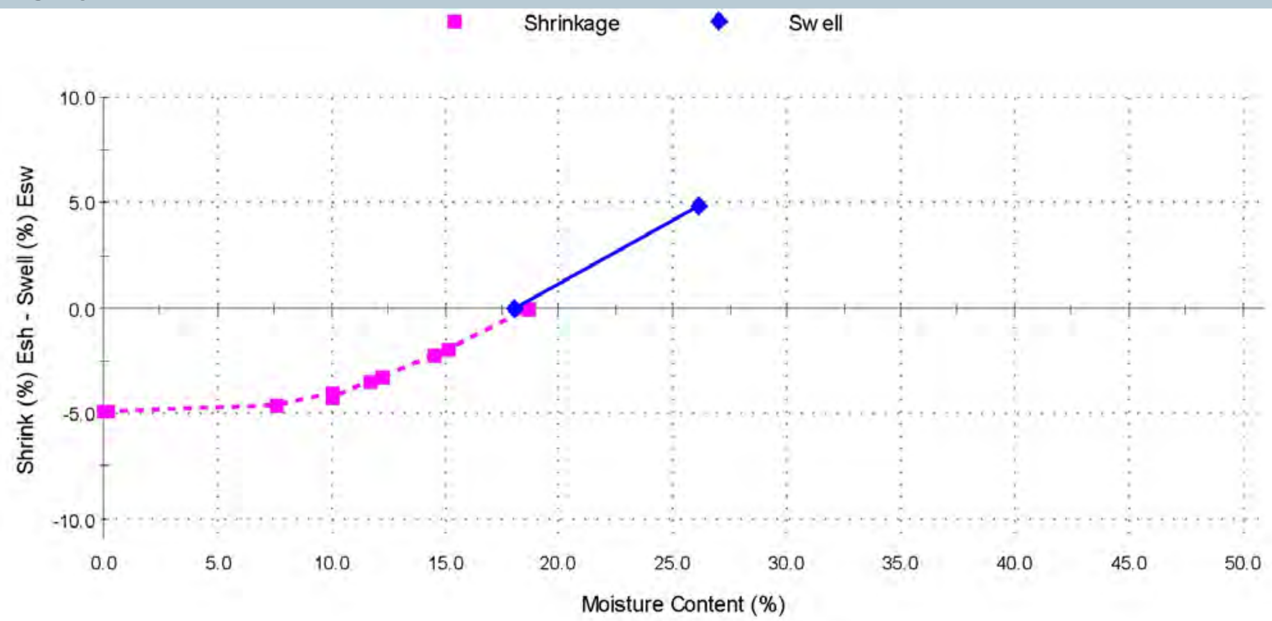
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	4.8
Moisture Content before (%):	18.0
Moisture Content after (%):	26.1
Est. Unc. Comp. Strength before (kPa):	+600
Est. Unc. Comp. Strength after (kPa):	150

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	4.9
Shrinkage Moisture Content (%):	18.6
Est. inert material (%):	<5
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 4.1

Comments

Clay, medium to high plasticity, pale brown/brown.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Report No: SSI:NEWC23S-01311
Issue No: 1

Shrink Swell Index Report

Client: EP Risk Management
3/19 Bolton Street
Newcastle NSW 2300

Principal:
Project No.: TESTNEWC00948AA
Project Name: EP3045 ACGCR Chisholm NSW
Lot No.: NA **TRN:** NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Greg Eveleigh
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 2/03/2023

Sample Details

Sample ID:	NEWC23S-01311	**Sampling Method:**	Submitted by client*
Date Sampled:	16/02/2023	**Material:**	Existing Ground
Date Submitted:	21/02/2023	**Source:**	On-Site
Date Tested:	22/02/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-L5, Depth:0.5 - 1.0m		
Borehole Number:	TP-L5		
Borehole Depth (m):	0.5-1.0		

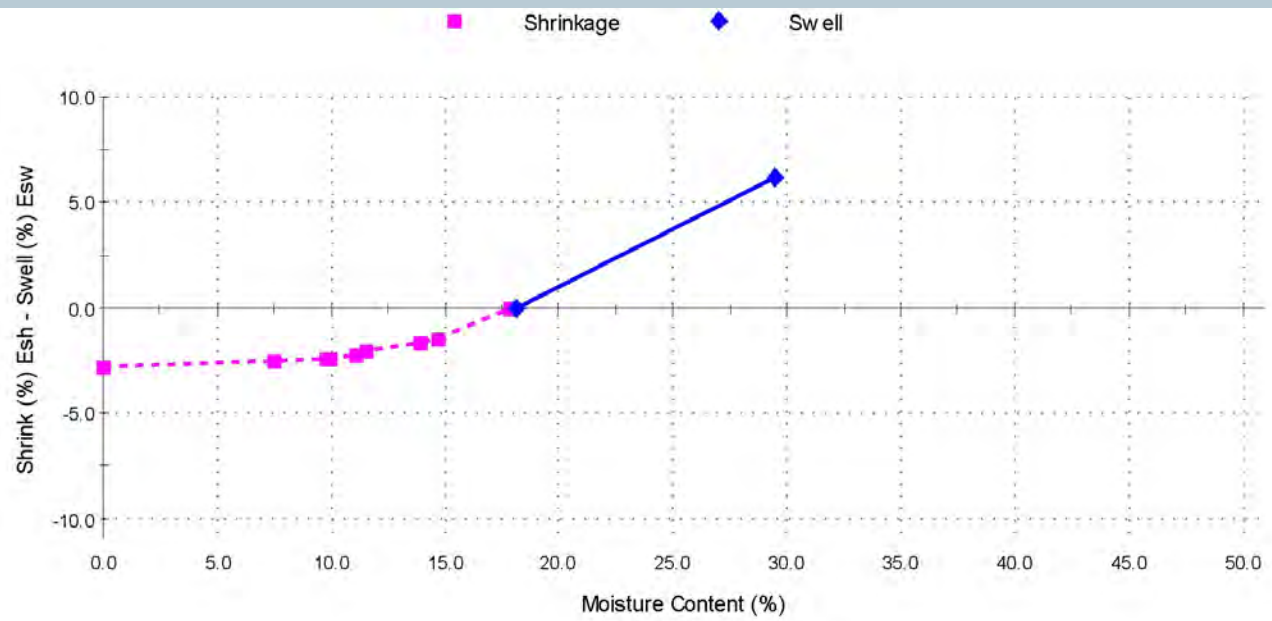
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	6.2
Moisture Content before (%):	18.1
Moisture Content after (%):	29.4
Est. Unc. Comp. Strength before (kPa):	+600
Est. Unc. Comp. Strength after (kPa):	180

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	2.8
Shrinkage Moisture Content (%):	17.8
Est. inert material (%):	15-25
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Slight

Shrink Swell



Shrink Swell Index - Iss (%): 3.3

Comments

Clay, medium to high plasticity, mottled pale brown/brown.

Newcastle Laboratory

Coffey Testing Pty Ltd
ABN 92 114 364 046
16 Callistemon Close
Warabrook NSW 2304

Phone: +61 2 4016 2300

Shrink Swell Index Report

Report No: SSI:NEWC23S-01312
Issue No: 1

Client:	EP Risk Management 3/19 Bolton Street Newcastle NSW 2300
Principal:	
Project No.:	TESTNEWC00948AA
Project Name:	EP3045 ACGCR Chisholm NSW
Lot No.:	NA
TRN:	NA

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Greg Eveleigh
(Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 2/03/2023

Sample Details

Sample ID:	NEWC23S-01312	**Sampling Method:**	Submitted by client*
Date Sampled:	16/02/2023	**Material:**	Existing Ground
Date Submitted:	21/02/2023	**Source:**	On-Site
Date Tested:	21/02/2023		
Project Location:	Chisholm, NSW		
Sample Location:	TP-L7, Depth:0.5 - 1.0m		
Borehole Number:	TP-L7		
Borehole Depth (m):	0.5-1.0		

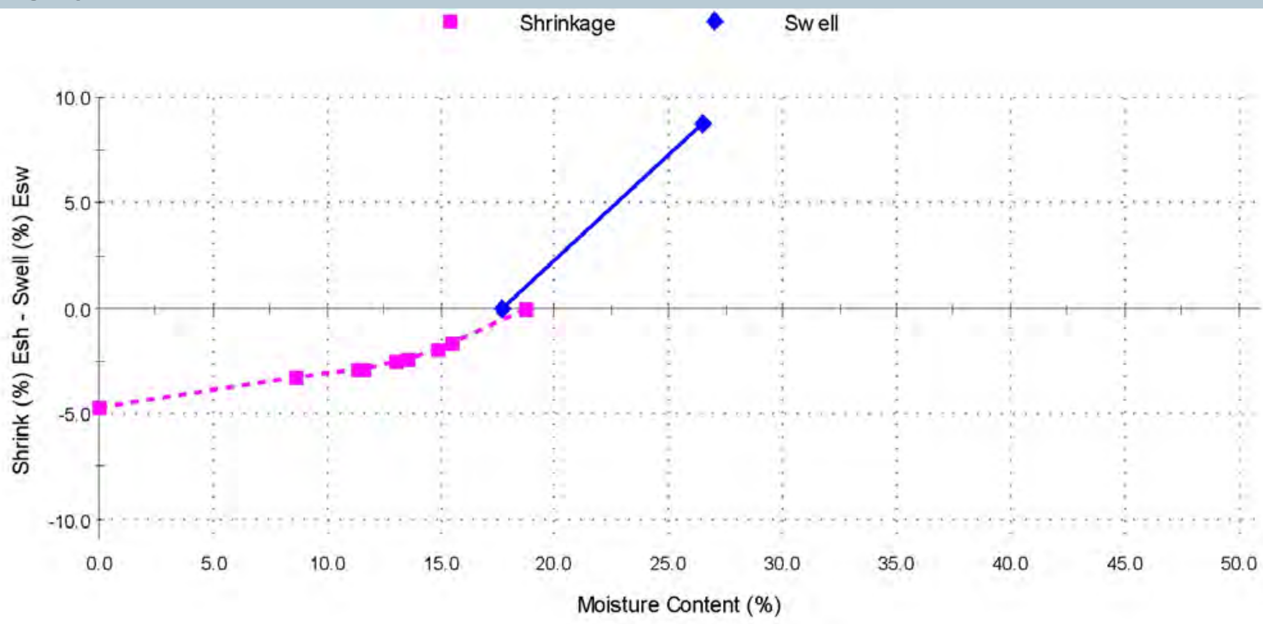
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	8.8
Moisture Content before (%):	17.7
Moisture Content after (%):	26.4
Est. Unc. Comp. Strength before (kPa):	510
Est. Unc. Comp. Strength after (kPa):	240

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	4.7
Shrinkage Moisture Content (%):	18.7
Est. inert material (%):	<5
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 5.0

Comments

Clay, medium to high plasticity, grey.

CERTIFICATE OF ANALYSIS

Work Order	: **ES2305239**	Page	: 1 of 34
Amendment	: **(Preliminary Report)**		
Client	: **EP RISK MANAGEMENT**	Laboratory	: Environmental Division Sydney
Contact	: MR Mathew Cheshire	Contact	: Jason Dighton
Address	: 3/19 BOLTON STREET NEWCASTLE NSW 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: EP3045	Date Samples Received	: 17-Feb-2023 08:41
Order number	: EP3045	Date Analysis Commenced	: 20-Feb-2023
C-O-C number	: ----	Issue Date	: 24-Feb-2023 19:25
Sampler	: Mathew Cheshire		
Site	: ----		
Quote number	: SY/497/20 V3 Primary analysis only		
No. of samples received	: 65		
No. of samples analysed	: 27		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. 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.

Signatories	*Position*	*Accreditation Category*
Alana Smylie	Team Leader - Asbestos	Newcastle - Asbestos, Mayfield West, NSW
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract 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.

This report contains preliminary authorised results. The report may contain semi-quantitative results. Any result presented in this preliminary report may be subject to change in the final report.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, 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.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- Corrosion assessment for Concrete and Steel piles in soil per Australian Standard AS2159-2009 uses a combination of soil and groundwater data (Tables 6.4.2 C & 6.5.2 C). In the absence of groundwater data, assessment has been made against soil criteria only. Refer to AS2159-2009 section 6.4 for further interpretation of corrosion assessment. ALS is not NATA accredited for Corrosion Assessment comments
- EA167: Soil Condition A – High permeability soils (e.g. sands and gravels) which are in groundwater
- EA167: Soil Condition B – Low permeability soils (e.g. silts and clays) or all soils above groundwater
- EG005T: Poor precision was obtained for Iron on sample ES2305239 # 043. Confirmed by re-digestion and reanalysis.
- EG035: Positive Mercury result ES2305239 #55 has been confirmed by reanalysis.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EA200N: Asbestos weights and percentages are not covered under the Scope of NATA Accreditation.
  Weights of Asbestos are based on extracted bulk asbestos, fibre bundles, and/or ACM and do not include respirable fibres (if present)
  The Asbestos (Fines and Fibrous) weight is calculated from the extracted Fibrous Asbestos and Asbestos Fines as an equivalent weight of 100% Asbestos
  Percentages for Asbestos content in ACM are based on the 2013 NEPM default values.
  All calculations of percentage Asbestos under this method are approximate and should be used as a guide only.
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres

- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200 Legend
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200N: ALS laboratory procedures and methods used for the identification and quantitation of asbestos are consistent with AS4964-2004 and the requirements of the 2013 NEPM for Assessment of Site Contamination
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		TP_P4_0.1	TP_L3_0.1	TP_P3_0.1	TP_P2_0.1	TP_L1_0.1
		Sampling date / time		16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-001	ES2305239-005	ES2305239-009	ES2305239-013	ES2305239-017
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	7.5	6.0	9.0	9.2	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	No	----	----
Asbestos Type	1332-21-4	-	--	----	----	-	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	No	----	----
Sample weight (dry)	----	0.01	g	----	----	286	----	----
Synthetic Mineral Fibre	----	-	--	----	----	No	----	----
Organic Fibre	----	-	--	----	----	No	----	----
APPROVED IDENTIFIER:	----	-	--	----	----	A. SMYLIE	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	<0.0004	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	<0.001	----	----
ø Weight Used for % Calculation	----	0.0001	kg	----	----	0.286	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	<0.0004	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	11	<5	7	<5	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	18	6	11	11	----
Copper	7440-50-8	5	mg/kg	<5	<5	<5	<5	----
Lead	7439-92-1	5	mg/kg	12	13	12	11	----
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	----
Zinc	7440-66-6	5	mg/kg	7	12	10	22	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
beta-BHC	319-85-7	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
gamma-BHC	58-89-9	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
delta-BHC	319-86-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Heptachlor	76-44-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P4_0.1	TP_L3_0.1	TP_P3_0.1	TP_P2_0.1	TP_L1_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-001	ES2305239-005	ES2305239-009	ES2305239-013	ES2305239-017
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Aldrin	309-00-2	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
^ Total Chlordane (sum)	----	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
trans-Chlordane	5103-74-2	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
cis-Chlordane	5103-71-9	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Dieldrin	60-57-1	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
4.4`-DDE	72-55-9	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Endrin	72-20-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
4.4`-DDD	72-54-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
4.4`-DDT	50-29-3	0.2	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Endrin ketone	53494-70-5	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Methoxychlor	72-43-5	0.2	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Monocrotophos	6923-22-4	0.2	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Dimethoate	60-51-5	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Diazinon	333-41-5	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Parathion-methyl	298-00-0	0.2	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Malathion	121-75-5	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Fenthion	55-38-9	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Parathion	56-38-2	0.2	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P4_0.1	TP_L3_0.1	TP_P3_0.1	TP_P2_0.1	TP_L1_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-001	ES2305239-005	ES2305239-009	ES2305239-013	ES2305239-017
				Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued								
Fenamiphos	22224-92-6	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Prothiofos	34643-46-4	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Ethion	563-12-2	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Carbophenothion	786-19-6	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
Azinphos Methyl	86-50-0	0.05	mg/kg	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	----

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P4_0.1	TP_L3_0.1	TP_P3_0.1	TP_P2_0.1	TP_L1_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-001	ES2305239-005	ES2305239-009	ES2305239-013	ES2305239-017
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	75.5	72.4	74.8	72.9	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	Not Authorised	Not Authorised	Not Authorised	Not Authorised	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	88.0	95.6	92.2	94.9	----
2-Chlorophenol-D4	93951-73-6	0.5	%	84.0	92.4	88.5	91.1	----
2.4.6-Tribromophenol	118-79-6	0.5	%	81.3	99.1	95.7	101	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	102	108	104	107	----
Anthracene-d10	1719-06-8	0.5	%	98.6	108	104	108	----
4-Terphenyl-d14	1718-51-0	0.5	%	92.7	98.3	95.1	96.7	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	95.2	93.8	94.7	109	103
Toluene-D8	2037-26-5	0.2	%	85.3	85.9	77.6	92.1	88.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P4_0.1	TP_L3_0.1	TP_P3_0.1	TP_P2_0.1	TP_L1_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-001	ES2305239-005	ES2305239-009	ES2305239-013	ES2305239-017
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
4-Bromofluorobenzene	460-00-4	0.2	%	92.1	89.2	84.3	96.0	91.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P1_0.1	TP_L5_0.1	TP_P5_0.1	TP_L4_0.1	TP_L7_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-021	ES2305239-027	ES2305239-031	ES2305239-035	ES2305239-039
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	----	13.7	----	12.5	11.8
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	----	----	No
Asbestos Type	1332-21-4	-	--	----	----	----	----	-
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	----	----	No
Sample weight (dry)	----	0.01	g	----	----	----	----	414
Synthetic Mineral Fibre	----	-	--	----	----	----	----	No
Organic Fibre	----	-	--	----	----	----	----	No
APPROVED IDENTIFIER:	----	-	--	----	----	----	----	A. SMYLIE
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	----	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	----	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	----	----	----	0.414
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	----	----	<0.0004
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	<5	----	5	14
Cadmium	7440-43-9	1	mg/kg	----	<1	----	<1	<1
Chromium	7440-47-3	2	mg/kg	----	7	----	7	22
Copper	7440-50-8	5	mg/kg	----	<5	----	10	<5
Lead	7439-92-1	5	mg/kg	----	9	----	15	9
Nickel	7440-02-0	2	mg/kg	----	3	----	5	<2
Zinc	7440-66-6	5	mg/kg	----	19	----	57	11
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	----	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	<0.1	----	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
beta-BHC	319-85-7	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
gamma-BHC	58-89-9	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
delta-BHC	319-86-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Heptachlor	76-44-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P1_0.1	TP_L5_0.1	TP_P5_0.1	TP_L4_0.1	TP_L7_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-021	ES2305239-027	ES2305239-031	ES2305239-035	ES2305239-039
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Aldrin	309-00-2	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
^ Total Chlordane (sum)	----	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
trans-Chlordane	5103-74-2	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
cis-Chlordane	5103-71-9	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Dieldrin	60-57-1	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
4.4`-DDE	72-55-9	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Endrin	72-20-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
4.4`-DDD	72-54-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
4.4`-DDT	50-29-3	0.2	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Endrin ketone	53494-70-5	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Methoxychlor	72-43-5	0.2	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Monocrotophos	6923-22-4	0.2	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Dimethoate	60-51-5	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Diazinon	333-41-5	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Parathion-methyl	298-00-0	0.2	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Malathion	121-75-5	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Fenthion	55-38-9	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Parathion	56-38-2	0.2	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P1_0.1	TP_L5_0.1	TP_P5_0.1	TP_L4_0.1	TP_L7_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-021	ES2305239-027	ES2305239-031	ES2305239-035	ES2305239-039
				Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued								
Fenamiphos	22224-92-6	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Prothiofos	34643-46-4	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Ethion	563-12-2	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Carbophenothion	786-19-6	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
Azinphos Methyl	86-50-0	0.05	mg/kg	----	Not Authorised	----	Not Authorised	Not Authorised
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	**0.6**	----	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	**1.2**	----	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	----	<10	<10
C10 - C14 Fraction	----	50	mg/kg	----	<50	----	<50	<50
C15 - C28 Fraction	----	100	mg/kg	----	<100	----	<100	<100
C29 - C36 Fraction	----	100	mg/kg	----	<100	----	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	<50	----	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	----	<10	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P1_0.1	TP_L5_0.1	TP_P5_0.1	TP_L4_0.1	TP_L7_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-021	ES2305239-027	ES2305239-031	ES2305239-035	ES2305239-039
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	<10	----	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	----	<50	----	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	----	<100	----	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	----	<100	----	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	<50	----	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	<50	----	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	----	<0.5	----	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	----	<1	----	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	72.5	----	76.3	82.4
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	----	Not Authorised	----	Not Authorised	Not Authorised
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	----	Not Authorised	----	Not Authorised	Not Authorised
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	----	96.1	----	92.6	88.2
2-Chlorophenol-D4	93951-73-6	0.5	%	----	92.2	----	86.8	84.1
2.4.6-Tribromophenol	118-79-6	0.5	%	----	95.4	----	93.0	87.9
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	----	109	----	103	99.6
Anthracene-d10	1719-06-8	0.5	%	----	109	----	104	99.7
4-Terphenyl-d14	1718-51-0	0.5	%	----	98.3	----	93.3	90.1
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	107	98.8	83.6	102	93.1
Toluene-D8	2037-26-5	0.2	%	91.9	81.3	102	86.4	88.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P1_0.1	TP_L5_0.1	TP_P5_0.1	TP_L4_0.1	TP_L7_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-021	ES2305239-027	ES2305239-031	ES2305239-035	ES2305239-039
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
4-Bromofluorobenzene	460-00-4	0.2	%	93.5	86.3	108	86.5	92.7

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P7_0.1	TP_L6_0.1	TP_L6_0.5	TP_P6_0.1	TP_L2_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-041	ES2305239-043	ES2305239-044	ES2305239-045	ES2305239-047
				Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract								
pH (CaCl2)	----	0.1	pH Unit	----	----	4.2	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	5.6	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	83	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	----	----	46.8	----	----
Moisture Content	----	1.0	%	11.9	----	----	12.0	7.6
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	67	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	2.49	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	No	No	----	No	----
Asbestos Type	1332-21-4	-	--	-	-	----	-	----
Asbestos (Trace)	1332-21-4	5	Fibres	No	No	----	No	----
Sample weight (dry)	----	0.01	g	417	360	----	408	----
Synthetic Mineral Fibre	----	-	--	No	No	----	No	----
Organic Fibre	----	-	--	No	No	----	No	----
APPROVED IDENTIFIER:	----	-	--	A. SMYLIE	A. SMYLIE	----	A. SMYLIE	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	<0.0004	<0.0004	----	<0.0004	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	<0.001	<0.001	----	<0.001	----
ø Weight Used for % Calculation	----	0.0001	kg	0.417	0.360	----	0.408	----
ø Fibrous Asbestos >7mm	----	0.0004	g	<0.0004	<0.0004	----	<0.0004	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	6.6	2.6	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	1.8	7.5	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	0.4	0.2	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	0.1	1.2	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	8.8	11.9	----	----
Exchangeable Sodium Percent	----	0.1	%	----	1.2	10.6	----	----
EG005(ED093)T: Total Metals by ICP-AES								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P7_0.1	TP_L6_0.1	TP_L6_0.5	TP_P6_0.1	TP_L2_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-041	ES2305239-043	ES2305239-044	ES2305239-045	ES2305239-047
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued								
Iron	7439-89-6	0.005	%	----	----	0.943	----	----
Arsenic	7440-38-2	5	mg/kg	8	----	----	18	6
Cadmium	7440-43-9	1	mg/kg	<1	----	----	<1	<1
Chromium	7440-47-3	2	mg/kg	14	----	----	26	9
Copper	7440-50-8	5	mg/kg	<5	----	----	<5	<5
Lead	7439-92-1	5	mg/kg	11	----	----	19	14
Nickel	7440-02-0	2	mg/kg	2	----	----	2	2
Zinc	7440-66-6	5	mg/kg	11	----	----	33	23
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	<0.1	<0.1
EP004: Organic Matter								
Organic Matter	----	0.5	%	----	----	0.8	----	----
Total Organic Carbon	----	0.5	%	----	----	<0.5	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	----	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
beta-BHC	319-85-7	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
gamma-BHC	58-89-9	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
delta-BHC	319-86-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Heptachlor	76-44-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Aldrin	309-00-2	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Heptachlor epoxide	1024-57-3	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
^ Total Chlordane (sum)	----	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
trans-Chlordane	5103-74-2	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
alpha-Endosulfan	959-98-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
cis-Chlordane	5103-71-9	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Dieldrin	60-57-1	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
4.4`-DDE	72-55-9	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Endrin	72-20-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
beta-Endosulfan	33213-65-9	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
4.4`-DDD	72-54-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P7_0.1	TP_L6_0.1	TP_L6_0.5	TP_P6_0.1	TP_L2_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-041	ES2305239-043	ES2305239-044	ES2305239-045	ES2305239-047
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Endrin aldehyde	7421-93-4	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Endosulfan sulfate	1031-07-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
4.4`-DDT	50-29-3	0.2	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Endrin ketone	53494-70-5	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Methoxychlor	72-43-5	0.2	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Demeton-S-methyl	919-86-8	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Monocrotophos	6923-22-4	0.2	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Dimethoate	60-51-5	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Diazinon	333-41-5	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Parathion-methyl	298-00-0	0.2	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Malathion	121-75-5	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Fenthion	55-38-9	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Chlorpyrifos	2921-88-2	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Parathion	56-38-2	0.2	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Chlorfenvinphos	470-90-6	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Bromophos-ethyl	4824-78-6	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Fenamiphos	22224-92-6	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Prothiofos	34643-46-4	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Ethion	563-12-2	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Carbophenothion	786-19-6	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
Azinphos Methyl	86-50-0	0.05	mg/kg	Not Authorised	----	----	Not Authorised	Not Authorised
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P7_0.1	TP_L6_0.1	TP_L6_0.5	TP_P6_0.1	TP_L2_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-041	ES2305239-043	ES2305239-044	ES2305239-045	ES2305239-047
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	----	----	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	----	----	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	----	----	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	----	----	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	----	----	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	----	----	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	----	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_P7_0.1	TP_L6_0.1	TP_L6_0.5	TP_P6_0.1	TP_L2_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-041	ES2305239-043	ES2305239-044	ES2305239-045	ES2305239-047
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	----	----	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	----	----	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	74.5	----	----	79.4	99.5
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	Not Authorised	----	----	Not Authorised	Not Authorised
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	Not Authorised	----	----	Not Authorised	Not Authorised
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	90.8	----	----	92.8	95.4
2-Chlorophenol-D4	93951-73-6	0.5	%	85.9	----	----	88.9	90.4
2.4.6-Tribromophenol	118-79-6	0.5	%	87.6	----	----	92.3	91.8
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	100	----	----	105	108
Anthracene-d10	1719-06-8	0.5	%	100	----	----	104	107
4-Terphenyl-d14	1718-51-0	0.5	%	90.5	----	----	96.0	98.0
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	101	----	----	99.1	101
Toluene-D8	2037-26-5	0.2	%	92.6	----	----	85.0	82.4
4-Bromofluorobenzene	460-00-4	0.2	%	90.5	----	----	89.3	88.2

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_L2_2.4-2.6	TP_L4_2.5	TP_L5_2.5	TP_L6_2.5-3.0	SP01_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-051	ES2305239-052	ES2305239-053	ES2305239-054	ES2305239-055
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.0	5.0	4.9	5.2	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	382	577	488	367	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	13.1	11.9	11.6	13.0	----
Moisture Content	----	1.0	%	----	----	----	----	9.8
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	2620	1730	2050	2720	----
EA167: Corrosion Classification (per AS2159-2009)								
ø Exposure Classification - Concrete Piles Soil Condition A	----	-	-	Moderate	Moderate	Moderate	Moderate	----
ø Exposure Classification - Concrete Piles Soil Condition B	----	-	-	Mild	Mild	Mild	Mild	----
ø Exposure Classification - Steel Piles Soil Condition A	----	-	-	Mild	Mild	Mild	Non Aggressive	----
ø Exposure Classification - Steel Piles Soil Condition B	----	-	-	Non Aggressive	Non Aggressive	Non Aggressive	Non Aggressive	----
ED040S: Soluble Major Anions								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	320	460	210	210	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	410	780	700	450	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	----	----	----	11
Cadmium	7440-43-9	1	mg/kg	----	----	----	----	<1
Chromium	7440-47-3	2	mg/kg	----	----	----	----	6
Copper	7440-50-8	5	mg/kg	----	----	----	----	18
Lead	7439-92-1	5	mg/kg	----	----	----	----	21
Nickel	7440-02-0	2	mg/kg	----	----	----	----	9
Zinc	7440-66-6	5	mg/kg	----	----	----	----	81
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	----	0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	----	----	----	<0.1
EP068A: Organochlorine Pesticides (OC)								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_L2_2.4-2.6	TP_L4_2.5	TP_L5_2.5	TP_L6_2.5-3.0	SP01_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-051	ES2305239-052	ES2305239-053	ES2305239-054	ES2305239-055
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	----	Not Authorised
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	----	Not Authorised
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	----	Not Authorised
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	----	Not Authorised
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	----	Not Authorised
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	----	Not Authorised
Aldrin	309-00-2	0.05	mg/kg	----	----	----	----	Not Authorised
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	----	Not Authorised
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	----	Not Authorised
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	----	Not Authorised
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	----	Not Authorised
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	----	Not Authorised
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	----	Not Authorised
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	----	Not Authorised
Endrin	72-20-8	0.05	mg/kg	----	----	----	----	Not Authorised
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	----	Not Authorised
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	----	----	----	Not Authorised
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	----	Not Authorised
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	----	Not Authorised
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	----	Not Authorised
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	----	Not Authorised
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	----	Not Authorised
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	----	Not Authorised
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	----	----	----	Not Authorised
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	----	----	----	Not Authorised
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	----	----	----	Not Authorised
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	----	----	----	Not Authorised
Monocrotophos	6923-22-4	0.2	mg/kg	----	----	----	----	Not Authorised
Dimethoate	60-51-5	0.05	mg/kg	----	----	----	----	Not Authorised
Diazinon	333-41-5	0.05	mg/kg	----	----	----	----	Not Authorised
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	----	----	----	Not Authorised
Parathion-methyl	298-00-0	0.2	mg/kg	----	----	----	----	Not Authorised
Malathion	121-75-5	0.05	mg/kg	----	----	----	----	Not Authorised

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_L2_2.4-2.6	TP_L4_2.5	TP_L5_2.5	TP_L6_2.5-3.0	SP01_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-051	ES2305239-052	ES2305239-053	ES2305239-054	ES2305239-055
				Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued								
Fenthion	55-38-9	0.05	mg/kg	----	----	----	----	Not Authorised
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	----	----	----	Not Authorised
Parathion	56-38-2	0.2	mg/kg	----	----	----	----	Not Authorised
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	----	----	----	Not Authorised
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	----	----	----	Not Authorised
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	----	----	----	Not Authorised
Fenamiphos	22224-92-6	0.05	mg/kg	----	----	----	----	Not Authorised
Prothiofos	34643-46-4	0.05	mg/kg	----	----	----	----	Not Authorised
Ethion	563-12-2	0.05	mg/kg	----	----	----	----	Not Authorised
Carbophenothion	786-19-6	0.05	mg/kg	----	----	----	----	Not Authorised
Azinphos Methyl	86-50-0	0.05	mg/kg	----	----	----	----	Not Authorised
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	----	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	----	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	----	----	----	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	----	----	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	----	----	----	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	----	----	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	----	----	----	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	----	----	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	----	----	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	----	----	----	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	----	----	----	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	----	----	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	----	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	----	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	----	----	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	----	----	----	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	----	----	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	----	----	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	----	----	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	----	----	<10

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_L2_2.4-2.6	TP_L4_2.5	TP_L5_2.5	TP_L6_2.5-3.0	SP01_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-051	ES2305239-052	ES2305239-053	ES2305239-054	ES2305239-055
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C10 - C14 Fraction	----	50	mg/kg	----	----	----	----	<50
C15 - C28 Fraction	----	100	mg/kg	----	----	----	----	<100
C29 - C36 Fraction	----	100	mg/kg	----	----	----	----	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	----	----	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	----	----	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	----	----	----	<10
>C10 - C16 Fraction	----	50	mg/kg	----	----	----	----	<50
>C16 - C34 Fraction	----	100	mg/kg	----	----	----	----	<100
>C34 - C40 Fraction	----	100	mg/kg	----	----	----	----	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	----	----	----	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	----	----	----	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	----	----	----	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	----	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	----	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	----	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	----	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg	----	----	----	----	<0.2
^ Total Xylenes	----	0.5	mg/kg	----	----	----	----	<0.5
Naphthalene	91-20-3	1	mg/kg	----	----	----	----	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	----	**81.6**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	----	----	----	----	**Not Authorised**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	----	----	----	----	**Not Authorised**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	----	----	----	----	**75.9**
2-Chlorophenol-D4	93951-73-6	0.5	%	----	----	----	----	**85.4**
2.4.6-Tribromophenol	118-79-6	0.5	%	----	----	----	----	**92.9**
EP075(SIM)T: PAH Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP_L2_2.4-2.6	TP_L4_2.5	TP_L5_2.5	TP_L6_2.5-3.0	SP01_0.1
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2305239-051	ES2305239-052	ES2305239-053	ES2305239-054	ES2305239-055
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
2-Fluorobiphenyl	321-60-8	0.5	%	----	----	----	----	101
Anthracene-d10	1719-06-8	0.5	%	----	----	----	----	93.8
4-Terphenyl-d14	1718-51-0	0.5	%	----	----	----	----	111
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	----	----	----	----	102
Toluene-D8	2037-26-5	0.2	%	----	----	----	----	88.4
4-Bromofluorobenzene	460-00-4	0.2	%	----	----	----	----	86.8

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SP02_0.1	SP03_0.1	BH_01_0.1	QC01	----
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	----
Compound	*CAS Number*	*LOR*	*Unit*	ES2305239-057	ES2305239-059	ES2305239-061	ES2305239-062	--------
				Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	4.4	8.2	11.4	9.6	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	8	<5	6	5	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	7	9	10	10	----
Copper	7440-50-8	5	mg/kg	11	5	20	10	----
Lead	7439-92-1	5	mg/kg	7	11	26	15	----
Nickel	7440-02-0	2	mg/kg	10	6	12	4	----
Zinc	7440-66-6	5	mg/kg	45	72	137	58	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
beta-BHC	319-85-7	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
gamma-BHC	58-89-9	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
delta-BHC	319-86-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Heptachlor	76-44-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Aldrin	309-00-2	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
^ Total Chlordane (sum)	----	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
trans-Chlordane	5103-74-2	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
cis-Chlordane	5103-71-9	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Dieldrin	60-57-1	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
4.4`-DDE	72-55-9	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Endrin	72-20-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
4.4`-DDD	72-54-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----

(Preliminary Report)

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SP02_0.1	SP03_0.1	BH_01_0.1	QC01	----
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2305239-057	ES2305239-059	ES2305239-061	ES2305239-062	--------
				Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDT	50-29-3	0.2	mg/kg	Not Authorised	Not Authorised	<0.2	Not Authorised	----
Endrin ketone	53494-70-5	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Methoxychlor	72-43-5	0.2	mg/kg	Not Authorised	Not Authorised	<0.2	Not Authorised	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Monocrotophos	6923-22-4	0.2	mg/kg	Not Authorised	Not Authorised	<0.2	Not Authorised	----
Dimethoate	60-51-5	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Diazinon	333-41-5	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Parathion-methyl	298-00-0	0.2	mg/kg	Not Authorised	Not Authorised	<0.2	Not Authorised	----
Malathion	121-75-5	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Fenthion	55-38-9	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Parathion	56-38-2	0.2	mg/kg	Not Authorised	Not Authorised	<0.2	Not Authorised	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Fenamiphos	22224-92-6	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Prothiofos	34643-46-4	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Ethion	563-12-2	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Carbophenothion	786-19-6	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
Azinphos Methyl	86-50-0	0.05	mg/kg	Not Authorised	Not Authorised	<0.05	Not Authorised	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SP02_0.1	SP03_0.1	BH_01_0.1	QC01	----
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2305239-057	ES2305239-059	ES2305239-061	ES2305239-062	--------
				Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SP02_0.1	SP03_0.1	BH_01_0.1	QC01	----
			Sampling date / time	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	16-Feb-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2305239-057	ES2305239-059	ES2305239-061	ES2305239-062	--------
				Result	Result	Result	Result	----
EP080: BTEXN - Continued								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	107	77.2	93.6	74.0	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	Not Authorised	Not Authorised	90.5	Not Authorised	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	Not Authorised	Not Authorised	94.6	Not Authorised	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	74.5	76.1	96.6	84.8	----
2-Chlorophenol-D4	93951-73-6	0.5	%	84.9	86.6	87.0	79.5	----
2.4.6-Tribromophenol	118-79-6	0.5	%	83.9	91.2	77.7	77.9	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	102	103	102	94.7	----
Anthracene-d10	1719-06-8	0.5	%	94.4	95.4	99.9	94.1	----
4-Terphenyl-d14	1718-51-0	0.5	%	113	114	99.2	85.6	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	97.5	106	103	108	----
Toluene-D8	2037-26-5	0.2	%	90.7	91.0	107	92.2	----
4-Bromofluorobenzene	460-00-4	0.2	%	93.7	97.2	106	98.7	----

(Preliminary Report)

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RW01	TRIP BLANK	TRIP SPIKE	----	----
			Sampling date / time	16-Feb-2023 00:00	13-Feb-2023 00:00	13-Feb-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2305239-064	ES2305239-065	ES2305239-066	--------	--------
				Result	Result	Result	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
^ Total Polychlorinated biphenyls	----	1	µg/L	<1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.5	µg/L	<0.5	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L	<0.5	----	----	----	----
beta-BHC	319-85-7	0.5	µg/L	<0.5	----	----	----	----
gamma-BHC	58-89-9	0.5	µg/L	<0.5	----	----	----	----
delta-BHC	319-86-8	0.5	µg/L	<0.5	----	----	----	----
Heptachlor	76-44-8	0.5	µg/L	<0.5	----	----	----	----
Aldrin	309-00-2	0.5	µg/L	<0.5	----	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L	<0.5	----	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/L	<0.5	----	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L	<0.5	----	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/L	<0.5	----	----	----	----
Dieldrin	60-57-1	0.5	µg/L	<0.5	----	----	----	----
4.4`-DDE	72-55-9	0.5	µg/L	<0.5	----	----	----	----
Endrin	72-20-8	0.5	µg/L	<0.5	----	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L	<0.5	----	----	----	----
4.4`-DDD	72-54-8	0.5	µg/L	<0.5	----	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L	<0.5	----	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L	<0.5	----	----	----	----
4.4`-DDT	50-29-3	2.0	µg/L	<2.0	----	----	----	----
Endrin ketone	53494-70-5	0.5	µg/L	<0.5	----	----	----	----
Methoxychlor	72-43-5	2.0	µg/L	<2.0	----	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/L	<0.5	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RW01	TRIP BLANK	TRIP SPIKE	----	----
			Sampling date / time	16-Feb-2023 00:00	13-Feb-2023 00:00	13-Feb-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2305239-064	ES2305239-065	ES2305239-066	--------	--------
				Result	Result	Result	----	----
EP068A: Organochlorine Pesticides (OC) - Continued								
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.5	µg/L	<0.5	----	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L	<0.5	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.5	µg/L	<0.5	----	----	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L	<0.5	----	----	----	----
Monocrotophos	6923-22-4	2.0	µg/L	<2.0	----	----	----	----
Dimethoate	60-51-5	0.5	µg/L	<0.5	----	----	----	----
Diazinon	333-41-5	0.5	µg/L	<0.5	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	----	----	----	----
Parathion-methyl	298-00-0	2.0	µg/L	<2.0	----	----	----	----
Malathion	121-75-5	0.5	µg/L	<0.5	----	----	----	----
Fenthion	55-38-9	0.5	µg/L	<0.5	----	----	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	----	----	----	----
Parathion	56-38-2	2.0	µg/L	<2.0	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	----	----	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	----	----	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	----	----	----	----
Fenamiphos	22224-92-6	0.5	µg/L	<0.5	----	----	----	----
Prothiofos	34643-46-4	0.5	µg/L	<0.5	----	----	----	----
Ethion	563-12-2	0.5	µg/L	<0.5	----	----	----	----
Carbophenothion	786-19-6	0.5	µg/L	<0.5	----	----	----	----
Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	----	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	----	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RW01	TRIP BLANK	TRIP SPIKE	----	----
			Sampling date / time	16-Feb-2023 00:00	13-Feb-2023 00:00	13-Feb-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2305239-064	ES2305239-065	ES2305239-066	--------	--------
				Result	Result	Result	----	----
EP075(SIM)A: Phenolic Compounds - Continued								
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----

Analytical Results

Sub-Matrix: WATER
(Matrix: WATER)

Compound	CAS Number	LOR	Unit	RW01	TRIP BLANK	TRIP SPIKE	----	----
Sampling date / time				16-Feb-2023 00:00	13-Feb-2023 00:00	13-Feb-2023 00:00	----	----
				ES2305239-064	ES2305239-065	ES2305239-066	--------	--------
				Result	Result	Result	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	**14**	----	----
Toluene	108-88-3	2	µg/L	<2	<2	**14**	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	**15**	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	**14**	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	**15**	----	----
^ Total Xylenes	----	2	µg/L	<2	<2	**29**	----	----
^ Sum of BTEX	----	1	µg/L	<1	<1	**72**	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	**17**	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	1	%	**60.8**	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.5	%	**71.7**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.5	%	**96.4**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	**24.2**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	**46.1**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%	**52.6**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	**53.2**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%	**54.9**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	**54.5**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**100**	**98.4**	**101**	----	----
Toluene-D8	2037-26-5	2	%	**89.4**	**84.0**	**95.1**	----	----
4-Bromofluorobenzene	460-00-4	2	%	**88.5**	**87.2**	**99.1**	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	*Sample ID - Sampling date / time*	*Analytical Results*
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	TP_P3_0.1 - 16-Feb-2023 00:00	Soil sample.
EA200: Description	TP_L7_0.1 - 16-Feb-2023 00:00	Soil sample.
EA200: Description	TP_P7_0.1 - 16-Feb-2023 00:00	Soil sample.
EA200: Description	TP_L6_0.1 - 16-Feb-2023 00:00	Soil sample.
EA200: Description	TP_P6_0.1 - 16-Feb-2023 00:00	Soil sample.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	45	134
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates - Continued			

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA200: AS 4964 - 2004 Identification of Asbestos in Soils

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA152: Soil Particle Density

(SOIL) EA200N: Asbestos Quantification (non-NATA)

Appendix F

FOUNDATION MAINTENANCE AND FOOTING PERFORMANCE

Foundation Maintenance and Footing Performance: A Homeowner's Guide

BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

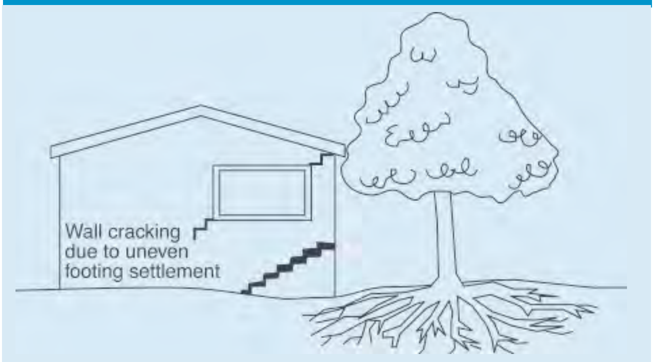
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

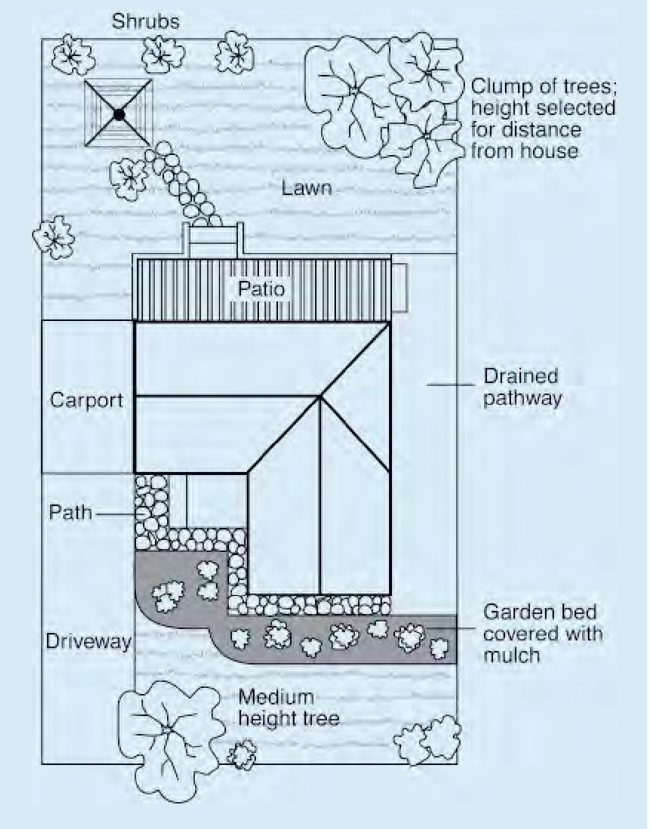
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation
In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden
The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees
Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs
State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation
Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

Distributed by

CSIRO PUBLISHING PO Box 1139, Collingwood 3066, Australia

Freecall 1800 645 051 Tel (03) 9662 7666 Fax (03) 9662 7555 www.publish.csiro.au

Email: publishing.sales@csiro.au