Preliminary Geotechnical Assessment

173 McFarlanes Road, Chisholm, NSW

Prepared for: Allam Homes c/- ADW Johnson Pty Ltd
EP1655.002 2 June 2020

APPROVED COMPANY ISO 9001 Quality Management Systems QMS Certification Services

APPROVED COMPANY AS/NZS 4801 OH&S Management Systems QMS Certification Services

APPROVED COMPANY ISO 14001 Environmental Management Systems QMS Certification Services

EP RISK

Preliminary Geotechnical Assessment

173 McFarlanes Road, Chisholm, NSW

Allam Homes c/- ADW Johnson Pty Ltd
27 Lawson Street
Penrith NSW 2751

2 June 2020

Our Ref: EP1655.002

LIMITATIONS

This Preliminary Geotechnical Assessment was conducted for Allam Homes 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 Assessment 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.

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1 Introduction

1.1 Overview

EP Risk Management Pty Ltd (EP Risk) was engaged by Allam Homes c/- ADW Johnson Pty Ltd (ADW Johnson) to undertake a Preliminary Geotechnical Assessment (the Assessment) of a property located at 173 McFarlanes Road, Chisholm, New South Wales (NSW) (the Site). The Site location and regional map is illustrated in **Figure 1**.

It is understood that the Site is proposed to be redeveloped into a low-density residential subdivision (Proposed Development) and that the Assessment is required for due diligence purposes.

1.2 Objective

The objective of the Assessment is to assess the subsurface profile conditions at the Site to provide preliminary geotechnical advice regarding the Proposed Development and identify any potential geotechnical constraints and provide preliminary pavement advice a preliminary site classifications as part of the due diligence. This assessment was undertaken concurrently with a Preliminary Site Investigation also for due diligence purposes and reported under separate title, reference EP1655.001.

1.3 Scope of Work

The scope of work completed to achieve those objectives included:

- A site walk over and inspection to observe on-site and off-site conditions and determine locations for subsurface investigations.
- Excavation of 19 test pits and advancement of 3 test bores in targeted areas across the Site to a maximum depth of 2.5 metres below ground level (m BGL).
- Sampling of representative subsurface / subgrade materials encountered during investigation.
- Submission of selected samples in the proposed road locations to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.
- Based on the results of field investigations and analytical testing, prepare a Preliminary Geotechnical Report in accordance with the relative guidelines for pavement thickness design in accordance with Maitland City Council's (Council) Manual of Engineering Standards (MoES) and preliminary site classification accordance with Australian Standard AS2870-2011 residential slabs and footings.
- Provide comment on any potential geotechnical constrains observed during site inspection and subsurface investigations.

2 Site Description

2.1 Site Identification

The Site Identification details are presented in **Table 1**.

Table 1 – Site Identification

Item	Description
Address	173 McFarlanes Road, Chisholm, NSW (**Figure 1**)
Legal description	Lot 32 in Deposited Plan (DP) 778111
Approximate Area	20 hectare (ha)
Municipality	Maitland City Council (Council)
Zoning	The Maitland LEP 2011 identifies the Site as RU1 General Residential and RU2 Rural Landscape

2.2 Site Inspection and Observations

As of 8 May 2020, the Site comprised of a large rectangular shaped lot situated to the south of McFarlanes Road. The land use comprised rural/agricultural land primarily used for grazing with the majority of the Site vegetation comprising of open pasture with numerous mature eucalypt trees scattered and clustered across the Site. The tree where of higher density in the two gullies which transect the site and in front of the existing dwelling providing screening from McFarlanes Road. EP Risk undertook a site inspection on 1st May 2020 comprising of a site walkover and visual assessment to determine suitable locations for subsurface investigations. The general Site features and infrastructure observed during the inspection are presented in **Figure 2**. Site features observed during the site inspection is summarised below with photos attached as **Appendix A**.

- Brick residential dwelling located in the northern portion of the Site (**Plate 1**);
- Machinery shed located adjacent to residential dwelling (**Plate 2**);
- Cattle yard located in the northern portion of the Site (**Plate 3**);
- The Site comprised rural/agricultural grazing land with gentle slope gradients ranging generally from 2^o – 4^o and locally steeper in drainage lines with elevation ranging from approximately R.L 27m AHD in the south east Corner to R.L 4m AHD in the north west corner of the Site (**Plate 4**);
- A large dam (Dam 01) is located in the southern portion of the Site (**Plate 5**);
- A natural drainage line (gully) located in the southern portion of the Site, connecting to Dam 01 (**Plate 10**);
- Two smaller dams, located close to each other (Dam 02 and Dam 03) are located in the central portion of the Site (**Plates 6 and 7**) within a natural drainage line that fall to the north west;
- Several fill mounds are located across the Site comprising of buried anthropogenic waste including brick, concrete, steel and tin (**Plates 9, 11, 12 and 13**);
- Typical sub surface ground conditions comprised of residual sandy silty CLAY with shallow bedrock (sandstone) (**Plates 14 and 15**);
- A marked watercourse run roughly along the western boundary outside of the site and is shown to enter in the far northeast corner of the site.

3 Investigation Methodology

3.1 Fieldwork

Field investigation was undertaken on the 8th May 2020 and comprised the advancement of excavation of nineteen (19) test pits and advancement of three (3) test bores via 5 tonne excavator fitted with a 450 mm multipurpose bucket and 300mm solid flight spiral auger. Test locations were advanced to a maximum depth of 2.5 m BGL. Dynamic Cone Penetrometer (DCP) tests were undertaken adjacent to each location to aid in determining the strength of the subgrade.

All fieldwork including logging of subsurface profiles and collection of samples was carried out by and in the presence of a technical officer from EP Risk. Test pits were located by handheld GPS from a KMZ file and the approximate locations are shown on **Figure 1**.

Subsurface conditions are summarised in Section 4.2 and detailed in engineering logs in **Appendix B**.

3.2 Laboratory Testing

Laboratory testing on selected samples recovered during fieldwork comprised of the following:

- Five four-day soaked California Bearing Ratio (CBR) tests to assess subgrade strength.
- Three shrink swell index (*Iss*) test.

Results of laboratory testing are detailed in the report sheets attached in **Appendix C** and summarised in Section 4.3 of this report.

4 Investigation Findings

4.1 Published Data

Based on the information contained in the Newcastle Coalfield Regional Geological Map 9231 (Edition 1, 1995) the Site is underlain by Late Permian Age siltstone and sandstone from the Mulbring Siltstone Formation of the Maitland Group. The formation is known to contain siltstone and sandstone derived from the weathering of the parent rock.

Based on the soil landscapes data sourced from the NSW Office of Environment and Heritage (OEH) most of the Site is located within the Beresfield residual soil landscape with a small portion on the north western boundary potential located within Hunter alluvial.

Mining Subsidence District Data Source (2016), The Site is not located within a mining subsidence district.

4.2 Subsurface Conditions

The subsurface conditions encountered in the test pits advanced across the Site are detailed on the report log sheets, attached in **Appendix B** with locations shown on **Figure 2**. A summary of subsurface conditions is presented in **Table 2**. In general, the subsurface can be summarised as follows:

Table 2 – Geotechnical Units

Unit	Material	Description / Depth Encountered	Comment
1a	Topsoil	Dry, loose, sandy SILT from 0.0 to 0.9 m BGL	-
1b	Fill	silty sandy CLAY with gravel/ sandy SILT with gravel from 0.0 to 0.2 m BGL	Identified at TB01 (driveway) and TB02 adjacent to machinery shed.

Table 2 – Geotechnical Units			
Unit	Material	Description / Depth Encountered	Comment
1c	Fill	Sandy SILT from 0.0 to 1.2 m BGL.	Identified within fill mounds with anthropogenic material in areas across the Site.
2a	Colluvium (slope wash?)	sandy silty CLAY from 0.2 to 2.5 m BGL	TP06 and TP07 in the lower elevation of the Site (north west corner), stiff -very stiff.
3a	Residual	Natural sandy silty CLAY/sandy CLAY of medium plasticity from 0.1 to 2 m BGL	Stiff to hard.
3b	XW Sandstone	Fine to medium grained from 0.8 m BGL	Extremely to Distinctly weathered.

A general summary of the subsurface conditions encountered across the site is presented in **Table 3**.

Table 3 – Summary of subsurface conditions			
Test Pit ID	Depth of Topsoil/ **Fill** (m BGL)	Depth to Rock (mBGL)	Summary of subsurface profile
TB01	**0.2**	NE	FILL (silty sandy CLAY with gravel) / sandy silty CLAY / sandy CLAY
TB02	**0.4**	NE	FILL (sandy SILT with gravel) / sandy CLAY
TP03	0.2	NE	TOPSOIL (sandy SILT with some clay) / sandy silty CLAY
TP04	0.1	1.2	TOPSOIL (sandy SILT) / sandy silty CLAY / sandy CLAY / XW[1] Sandstone
TP05	0.1	0.8	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TP06	0.9	NE[2]	TOPSOIL (sandy SILT) / sandy silty CLAY (slope wash)
TP07	0.2	NE	TOPSOIL (sandy SILT) / sandy silty CLAY (slope wash)
TP08	0.1	0.9	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TP09	**1.2**	NE	FILL (sandy SILT with building waste) / sandy silty CLAY
TP10	0.1	0.9	TOPSOIL (sandy SILT) / sandy silty CLAY / sandy CLAY / XW Sandstone
TP11	0.1	0.8	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TP12	**0.4**	NE	FILL (sandy SILT with building waste) / sandy silty CLAY
TP13	**0.3**	1.5	FILL sandy SILT with ash) / sandy silty CLAY / XW Sandstone
TP14	**0.5**	1.5	FILL (sandy SILT with ash) / sandy silty CLAY / XW Sandstone
TP15	**1.0**	1.5	FILL (sandy SILT with ash) / sandy silty CLAY / XW Sandstone
TP16	**0.4**	1.0	FILL (sandy SILT with ash) / sandy silty CLAY / XW Sandstone
TP17	0.1	1.0	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TP18	0.3	1.6	TOPSOIL (sandy SILT) / sandy CLAY / XW Sandstone
TP19	0.1	1.7	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TP20	0.1	0.9	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone
TB21	0.2	NE	TOPSOIL (sandy SILT) / sandy silty CLAY
TP22	0.1	0.9	TOPSOIL (sandy SILT) / sandy silty CLAY / XW Sandstone

No groundwater or seepage was encountered in the test pits at the time of fieldwork. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions.

[1] Extremely weathered sandstone
[2] Not encountered

The sandstone bedrock encountered during test pitting was initially extremely weathered becoming distinctly weathered with depth and ranged from very low to medium strength. Higher strength rock could be expected at greater depth than investigation limits, however, is not expected to pose excavation issues with large capacity equipment based on experience on proximate development within the same formation.

Detailed soil profile logs are attached as **Appendix B.**

4.3 Laboratory Results

Results of laboratory CBR, Shrink Swell Index and aggressivity results are detailed in report sheets attached in **Appendix C** and summarised in the following tables.

Table 4 – Summary Laboratory CBR Test Results

Test Pit ID	Depth (m BGL)	Material Description	W[3] (%)	SOMC[4] (%)	SMDD[5] (t/m^3)	Swell (%)	CBR (%)
TP04	0.5-0.7	sandy silty CLAY	21.8	23.5	1.57	1.5	2.5[6]
TP08	0.5-0.7	sandy silty CLAY	24.7	24.5	1.55	1.5	2[7]
TP17	0.5-0.7	sandy silty CLAY	19.1	21.0	1.61	2.0	2[7]
TP18	0.5-0.8	sandy CLAY	23.5	22.0	1.59	3.5	2[7]
TP22[8]	0.6-0.9	sandy silty CLAY	17.7	21.5	1.59	1.5	3.5[7]

CBR samples were remoulded to a target of 100% relative density at approximately standard optimum moisture content (SOMC) and surcharged with 4.5 kg and soaked for four days prior to penetration.

DCP testing undertaken at test pit locations indicate in-situ CBR value ranging from 2% to >10% for the sandy silty clay surficial soils which is consistent with laboratory CBR testing of the surficial sandy silty clay soil tested in the laboratory which indicated CBR values of between 2.0% 3.5%. The underling sandstone has a higher CBR value which will range from CBR 5% to greater than 10% depending on the degree of weathering based on experience on other developments in proximity to the Site. The DCP is moisture sensitive and it should be noted that testing was undertaken during a relatively long wet period and therefore lower CBR could be expected.

The field moisture contents ranged between 3% below (dry of) SOMC to 1.5% above (wet of) SOMC at the time of investigation, undertaken following a period of extended wet weather.

The CBR Swell results when compared to Table 5.2 Guide to classification of expansive soils in Austroads [5] indicate that the soils tested have a moderate to highly expansive (TP18) 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 0.5m of design subgrade level (DSL).

[3] Field moisture content.
[4] Standard Optimum Moisture Content.
[5] Standard Maximum Dry Density.
[6] CBR at 2.5mm
[7] CBR at 5mm
[8] Identified as TP16 on laboratory report.

5 Preliminary Pavement Thickness Design

5.1 Design Traffic

Design traffic loadings and pavement thickness design calculation has been undertaken by EP Risk in accordance with *Maitland City Council Manual of Engineering Standards* [1].

The design traffic data has been determined on the basis of the following assumptions in **Table 5**.

Table 5 – Recommended Road Type and Design ESA's

Road Type	Roads Identification	Design ESA's
Collector - Secondary	TBC	1.0×10^6
Local - Primary	TBC	5.0×10^5
Local - Secondary	TBC	2.0×10^5

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

5.1.1 Design Parameters

Pavement thickness has been undertaken in accordance with Austroads AGPT02-17 Guide to Pavement Technology, Part 2: Pavement Structural Design [4] based on the following parameters for site materials.

- Design subgrade CBR of 2% for sandy silty CLAY and 5% for sandy CLAY (weathered rock) subgrade placed as controlled fill.
- A Design subgrade CBR of >6% is also provided where weathered rock is encountered of significant length of road alignment to warrant a change in pavement thickness
- In situ CBR correlations indicated value in the order of 2% to >10% at proposed design subgrade level. ('DSL') and will require confirmation following finalisation of vertical and horizontal road layouts,

The design subgrade has been determined in accordance with Section 5 of Austroads 2017 [4] on the basis of both laboratory and field-testing results.

Where filling is undertaken greater than 0.5 m depth, the CBR of the fill material should be undertaken into account for the design CBR. All fill materials should be a minimum of CBR 2.0% or 5% dependent on the pavement thickness option adopted based on 4-day soak when compacted to 100% standard relative density and SOMC.

5.2 Subgrade Preparations

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

- Stripping of topsoil
- Excavation and replacement of any uncontrolled fill as engineered fill in accordance with AS3798-2007[9].
- Excavation or fill to design subgrade level.
- 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 of material of similar consistency to the subgrade.
- 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 soaked CBR > 5%.

Following satisfactory preparation of the subgrade, the pavement should be placed in accordance with the designer's recommendations.

5.2.1 Option 1 – Flexible Unbound Pavement (Clay 2%)

The option of pavement reconstruction utilising flexible unbound pavement materials is detailed in **Table 6.**

Table 6 – Recommended Flexible Unbound Pavement Compositions (Clay 2%)

Road Type	Collector	Local - Primary	Local - Secondary
Wearing Course (mm)	40 AC14*	30 AC10*	30 AC10*
Basecourse (mm)	150	150	150
Subbase (mm)	150	150	150
Select (mm)	300	300	300
Total Thickness (mm)	640	630[9]	630[9]
Subgrade CBR%	min 2%	min 2%	min 2%
Allowable DESA	1×10^6	5×10^5	2×10^5

Notes:
*AC 14 and AC10 with 10mm primer seal placed under all asphaltic concrete wearing surfaces.

5.2.2 Option 2– Flexible Unbound Pavement (Clay 5%)

The option of pavement reconstruction utilising flexible unbound pavement materials is detailed in **Table 7**.

Table 7 – Recommended Flexible Unbound Pavement Compositions (Clay 5%)

Road Type	Collector	Local - Primary	Local - Secondary
Wearing Course (mm)	45 AC14*	30 AC10*	30 AC10*
Basecourse (mm)	150	150	150
Subbase (mm)	230	210	170
Select (mm)	-	-	-
Total Thickness (mm)	425	390	350
Subgrade CBR%	min 5%	min 5%	min 5%
Allowable DESA	1×10^6	5×10^5	2×10^5

Notes: *AC14 and AC10 with 10mm primer seal placed under all asphaltic concrete wearing surfaces.

[9] Minimum coverage required due to potentially expansive subgrade

5.2.3 Option 3– Flexible Unbound Pavement (Weathered Rock Subgrade >6%)

The option of pavement reconstruction utilising flexible unbound pavement materials is detailed in Table 8.

Table 8 – Recommended Flexible Unbound Pavement Compositions (Weathered Rock Subgrade >CBR 6%)

Road Type	Collector	Local - Primary	Local - Secondary
Wearing Course (mm)	40 AC14*	30 AC10*	30 AC10*
Basecourse (mm)	150	150	150
Subbase (mm)	160	145	120
Select (mm)	-	-	-
Total Thickness (mm)	355	325	300
Subgrade CBR%	min >6 %	min >6 %	min >6 %
Allowable DESA	1×10^6	5×10^5	2×10^5

Notes: *AC14 and AC10 with 10mm primer seal placed under all asphaltic concrete wearing surfaces.

A minimum of fourteen days duration shall apply prior to application of subsequent asphalt layer(s). That period may be extended or shortened subject to approval by Council.

The determination of a weather rock subgrade suitable to adopt a CBR 6% subgrade should be undertaken by a geotechnical consultant or suitably qualified council engineer. Extremely weathered siltstone and sandstone breaks down readily to produce low CBR similar to the clay subgrade materials.

DCP testing is recommended at subgrade to determine the appropriate pavement thickness design option to be adopted.

6 Preliminary Site Classification

Australian Standard AS 2870-2011[5] 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 9**.

Table 9 – 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 experience usually 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 C**.

The laboratory Shrink Swell test results summarised in **Table 5** indicate that the tested natural sandy silty clay soils range from moderate to highly reactive, with *Iss* values of 3.7 % to 4.3%. It is noted that reworking of the clay materials could increase reactivity.

Based on the subsurface profiles encountered during the Investigation and laboratory Shrink Swell test results, along with prior experience on the site and in accordance with the AS 2870-2011; the Site would likely have classification generally ranging from **Class M**, moderately reactive to **Class H1,** highly reactive in existing condition with some area potentially being classified as **Class H1,** highly reactive and **Class E,** extremely reactive where filling is undertaken with significant thicknesses of reactive clay in excess of 1m or depth of rock is greater than 1.8m . Site Classification of **Class S,** slightly reactive and **Class A,** stable may also be applicable where shallow rock is encountered, and footing are uniformly founded on competent rock. Any areas of uncontrolled fill or areas disturbed during tree removal will require remediation to avoid **Class P**, classifications.

Characteristic surface movements in the order of 35mm to 55mm has been calculated for the Site in its existing condition, Various conditions for the Site dependent on the soil profile, and potential depth of fill at test locations have also be calculated with characteristic surface movements in the order of 85mm for worst case scenarios, which are considered unlikely with careful earthworks management.

The site classification is preliminary, and it should be noted that development can include other geotechnical studies and care should be taken that single laboratory results are not allocated to the full depth of the soil profile, as biased site classifications can result. The soil reactivity will vary across the Site with depth and location.

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, and the Australian Geoguide (LR8) Hillside Construction Practice.

Adherence to the detailing requirement outlined in Section 5 of AS 2870-2011 is essential, in particular 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 Excavations

Excavatability conditions have not been assessed beyond the depths to which the test pits were advanced using a 5-tonne excavator. The weathered rock encountered at depths ranging from 0.8– >2.5 m was estimated to be of very low / low strength to medium strength and refusal was encountered prior to target depth in fourteen (14) or the twenty two (22) test pits undertaken. It should be noted that weathered rock could potentially be encountered at higher levels outside of the test pit locations resulting in machine refusal at shallower depths. This is particularly relevant if smaller excavation equipment is used. The area is known to have higher strength rock at shallow depths therefore it could be anticipated that hard excavation may be encountered quickly once rock is encountered. Based on experience on development proximate to the site, excavation should be achievable with D8 size dozers with single ripper or large capacity excavators.

Where excavation significantly below the depths reached in the test pits and detailed above is proposed it would be considered prudent to make allowance for hydraulic rock hammer excavation or use of large capacity (20-30 tonne) excavator with a single ripper attachment. Considerable caution should be taken during rock excavation using hydraulic rock hammers or jack hammers in proximity to existing structures due to the potential for direct transmission of ground vibration to proximate buildings and structures.

7.2 Excavation Stability

Excavations or trenches in the silty and sandy silty clay soils and extremely weathered rock could be expected to stand close to vertical in the short-term. Sandy sily clay soils were encountered within various areas of the Site down to depths of >2.5m and unsupported short-term excavations or trenches may undergo some local slumping into the excavation, particularly following heavy or extended rainfall periods.

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.

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 assessment. The excavation recommendations provided above should be completed in reference to the Safe Work Australia Code of Practice ‘Excavation Work’, dated 31 July 2014.

7.3 Filling

Fill should be placed and compacted in accordance with AS 3798-2007 [6]. It is expected that construction of a suitable fill platform to support structural loads, such as ground slabs and stiffened raft slabs, would include the following:

- Stripping of topsoil.
- Proof rolling of the exposed subgrade to detect any weak or deforming areas of subgrade that should be excavated and replaced with compacted fill.
- Site materials will likely require treatment or moisture re-conditioning prior to placement and compaction.
- 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) in residential areas and at moisture contents of 85-115% of SOMC. 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 and preferably as close to SOMC to reduce the potential for volume change in the expansive clays..

All fill 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.

Materials excavated on Site with the exception of topsoil, and other deleterious materials such as uncontrolled fill, alluvial silts and clays if encountered are considered suitable for re-use as engineering fill. Some materials will likely require treatment or moisture re-conditioning, subject to further assessment and weather conditions prior to and during construction.

It is noted that materials of moderate to high reactivity are evident at the Site. Care should be taken in the utilisation of site material to avoid increasing existing site classifications. Reactive materials should preferably be used in the base of deeper fill areas.

7.4 Subgrade Preparations

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

- Excavation to design subgrade level, removal of any uncontrolled fill (any uncontrolled fill material will require removal), with ripping to 300-350mm below design subgrade level and recompact to a minimum 100% of SMDD. Moisture contents should be within 60 to 90% of SOMC **but generally within 2% of SOMC for moderately expansive and highly expansive subgrade**
- 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 of material of similar consistency to the subgrade.
- 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 soaked CBR > 3% or 5% depending on the pavement option adopted.
- Where a select layer is to be utilised in construction of the pavement. The material shall be well graded granular material with minimum 4 day soaked CBR of 30% and PI ≤12%. The select layer should be compacted to a minimum 100% of SMDD. Moisture contents should be within 60 to 90% of SOMC.

Following satisfactory preparation of the subgrade, the pavement should be placed in accordance with the requirements of the appropriate section of this report and council Manual of Engineering Standards [1] depending on the subgrade type.

7.5 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.

Subsoil drainage shall be provided on both sides of the road pavements and in all road stormwater pipe trenches in accordance with Council's standard drawings SD035 & SD003, and additionally as required by

Council, or the geotechnical engineer where for example, drains are considered necessary where sub-soil moisture problems are encountered. The type, location and extent of subsoil drainage may vary depending on pavement materials or in-situ conditions. The subgrade should be constructed with sufficient cross fall (in general 3%) to assist in reducing retention time for moisture entering the pavement. The subsoil drains should be placed under or at the back or kerb and the shoulder sealed with a low permeability material to prevent moisture ingress into the pavement. Sealing of shoulder / verges with low permeability material where kerb and gutter is not employed is recommended to reduce potential for moisture ingress into the pavement.

The pavement thickness designs presented above assume drained pavement conditions. The selection, construction and maintenance of appropriate drainage mechanisms 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.

Drainage should be in accordance with Section 8 of Chapter 007 CONSTRUCTION – ROADS, DRAINAGE, CONCRETE of the Council MoES.

8 Conclusions and Recommendations

EP Risk was engaged by Allam Homes c/- ADW Johnson to undertake a Preliminary Geotechnical Assessment for a property located at 173 McFarlanes Road, Chisholm, NSW. The purpose of the Assessment was to assess the subsurface profile conditions at the Site to provide preliminary geotechnical advice in regards the proposed redevelopment of the Site into a low-density residential development.

The Site comprised of a large rectangular shaped lot situated to the south of McFarlanes Road. The land use comprised rural/agricultural land with most of the Site cleared of vegetation with the exception of mature eucalypt trees scattered and clustered across the Site. Topographically the Site had gentle sloping gradients facing north west with elevations ranging from 27 metres above m AHD in the south eastern portions of the Site to 4 m AHD in the lower north western corner of the Site. Regional geology comprises of late Permian age siltstone and sandstone from the Maitland Group.

Field investigation was undertaken on 8 May 2020 and comprised the advancement of excavation of 19 test pits and advancement of 3 test bores via 5 tonne excavated fitted with a 450 mm multipurpose bucket and 300 spiral auger. Test locations were advanced to a maximum depth of 2.5 m BGL. Soil samples considered representative of the subsurface conditions at the Site were collected and submitted to a NATA accredited geotechnical laboratory for analysis. DCP tests were also conducted in geotechnical test pits/bores locations to aid in the assessment of in situ subgrade strength.

Due to the low CBRs value obtained and the expansive nature of the sandy silty clay soils, the provision for a select layer in areas during the construction is considered prudent to facilitate construction based on elevated moisture conditions encountered and previous experience in the areas where wet weather is encountered. A 300 mm select layer using a CBR of minimum 30% has been incorporate in the CBR2% pavement Option 1. Alternately lime stabilisation of the stabilisation of the subgrade could be considered depending on the earthworks balance for the Site.

Preliminary Site Classification indicates that **Class M**, moderately reactive to Class **H2**, highly reactive could be expected in the existing condition. Following development **Class M** to **H2** would be the predominant classification following regrade. Actual Site classifications will be dependent on the depth of rock and earthworks undertaken however care management of earthworks will be required to avoid **Class E,** Extremely reactive classifications due to the reactivity of the surficial clay soils.

Rock was encountered in 14 of the 22 test pits/bores undertaken within a depth of 2.5m BGL. Refusal was encountered prior to the target depth of 2.5 mBGL in 14 of the 22 test pits/bores undertaken using a 5-tonne excavator. It would be recommended to undertake trial excavation using a 20-30 tonne excavator where excavation significantly beyond the depth of refusal encountered prior to development.

Based on observation of site soils, watercourses and ponded water, along with previous experience in the area. sediment basins could be designed for “Type C” soils. It is recommended once the location of basins are fixed that confirmation testing is undertaken. Site clays should be suitable for water detention retention structures.

Low lying areas in the north western corner of the site are likely to provide trafficability issues following heavy or extended rainfall periods.

9 Closure

From a geotechnical perspective there are no constraints prohibitive to the proposed development as a low to medium density residential subdivision. The reactivity and expansive nature of the Site soils will add to the cost of the development due to the need for thicker pavements requiring a select and or minimum granular thickness to address potential volume change due to moisture variation in the subsoil profile. This will largely be dependant somewhat on the final vertical and horizontal layout of the subdivision.

Preliminary site classifications in the existing condition range from Class M, moderately reactive to Class H1, highly reactive. However following earthwork increase of Classifications to Class H2 highly reactive and potentially Class E, extremely reactive could be anticipated. Careful earthworks management and use of less reactive materials in fill area within 1m of the finished surface level within allotments and design subgrade levels will be required to obtain the best classification and pavement outcomes. Site classification outcomes improve with time in areas of regrade with the reestablishment of the cracked zone which can take up to 5 years to establish depending on prevailing seasonal weather condition during and post construction. Locally the cracked zone is generally established with 2 years with normal temperature variations and annual rainfall.

Weathered rock encountered at depths ranging from 0.8m – >2.5 m was estimated to be of very low / low strength to medium strength and refusal was encountered prior to target depth in fourteen (14) or the twenty two (22) test pits/bores undertaken. Based on previous experience on proximate developments the rock should be excavatable with D8 size dozers with single ripper or large capacity excavators.

Minor uncontrolled fill was encountered in isolated areas of the Site comprising of buried iron sheeting, concrete, brick and other debris which will need to be addressed during development. For details refer to EP Risk Report EP1655.001 "*Preliminary Site Investigation-173 McFarlanes Road, Chisholm*" dated June 2020.

The site conditions and construction requirements for development are considered similar to surrounding developments in the Chisholm / Thornton North at the Waterford, DHA and Homeworld subdivisions but are slightly different to those encountered during the first stages of development at Sophia Waters, where the reactivity of the soils are lower and availability of weathered rock allowed better pavement outcomes.

10 References

[1] Maitland City Council – Manual of Engineering Standards

[2] Austroads AGPT05-11, “Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design,” Austroads Ltd, October 2011.

[3] RMS QA Specification 3051 (Ed 7 Rev 0), “Granular Base and Subbase Materials for Surfaced Road Pavements,” Roads and Maritime Services, August 2018.

[4] Austroads AGPT02-17, “Guide to Pavement Technology Part 2: Pavement Structural Design,” Austroads Ltd, 2017.

[5] Australian Standard AS2870-2011 “Residential slabs and footing”

[6] Australian Standard AS3798-2007 “Guideline on earthworks for commercial and residential developments”.

Figures

EP RISK

www.eprisk.com.au

Preliminary Geotechnical Assessment
173 McFarlanes Road, Chisholm, NSW

Figure 1 – Site Location

Job No: EP1655.002
Date: 31/05/2020
Drawing Ref: EP1655.002 Fig1_Site Location
Version No: v1

N

0 150 300 600
Approximate Scale Only (m)

Co-ordinate system: MGA 56
Drawn by: SL Checked by: JY
Scale of regional map not shown
Source: Google Maps

APPROVED COMPANY ISO 9001 Quality Management Systems QMS
APPROVED COMPANY AS/NZS 4801 OH&S Management Systems QMS
APPROVED COMPANY ISO 14001 Environmental Management Systems QMS

EP RISK

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Preliminary Geotechnical Assessment
173 McFarlanes Road, Chisholm

Figure 2 – Site Layout

Job No: EP1655.002
Date: 31/05/2020
Drawing Ref: Fig2
Version No: v1

N

0 4 8 16
Approximate Scale Only (m)

Co-ordinate system: MGA 56
Drawn by: SL Checked by: JY
Scale of regional map not shown
Source: Google Maps

APPROVED COMPANY ISO 9001 Quality Management Systems QMS
APPROVED COMPANY AS/NZS 4801 OH&S Management Systems QMS
APPROVED COMPANY ISO 14001 Environmental Management Systems QMS

Appendix A
SITE PHOTOGRAPHS

Plate 1 – Brick residential dwelling located in the northern portion of the Site.
Date: 8/5/2020

Plate 2 – Machinery shed located adjacent to residential dwelling.
Date: 8/5/2020

Plate 3 – Cattle yard located in the northern portion of the Site.
Date: 8/5/2020

Plate 4 – Typical topography of the Site.
Date: 1/5/2020

Plate 5 – Large dam (Dam 01) located in the southern portion of the Site.
Date: 8/5/2020

Plate 6 – Dam 02 located in the central portion of the Site towards the western boundary.
Date: 8/5/2020

Plate 7 – Dam 03 located in the central portion of the
Date: 8/5/2020

Plate 8 – Disturbed natural ground in the north western portion of the Site.
Date: 8/5/2020

Plate 9 – Buried concrete and brick located between Dam 02 and Dam 03.
Date: 8/5/2020

Plate 10 – Natural ephemeral drainage line (gully) located in the southern portion of the Site, connecting to Dam 01.
Date: 8/5/2020

Plate 11 – Fill mound (TP15) located near gully in southern portion of Site.
Date: 8/5/2020

Plate 12 – Buried iron roofing sheets (TP12) located near Dam 01.
Date: 8/5/2020

Plate 13 – Stockpiles of cut concrete slab and brick (AM03 and AM04) located near Dam 01.
Date: 8/5/2020

Plate 14 – Typical sub surface conditions observed across the Site.
Date: 8/5/2020

Plate 15 – Typical sub surface conditions observed across the Site.
Date: 8/5/2020

Appendix B
SOIL PROFILE LOGS

TB01

PROJECT NUMBER EP1655
PROJECT NAME PSI and Geotech
CLIENT Allam Homes
ADDRESS 173 McFarlanes Road, Chisholm, NSW

DRILLING DATE 8/5/2020
DRILLING COMPANY ARSK Civil
DRILLER -
DRILLING METHOD 5 T Excavator
TOTAL DEPTH 1.5

EASTING 373060.75
NORTHING 6375308.08
SURFACE ELEVATION 13
LOGGED BY SL
CHECKED BY JY

COMMENTS Driveway

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
	7	TB01_0.1		FILL: silty sandy CLAY with some gravel, medium plasticity, fine to medium grained, orange brown.	D-M	V Stiff	
	9			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.			
0.5	8						
	8						
	11			sandy CLAY: medium plasticity, fine to medium grained, orange-brown/red.		Hard	
	Ref						
1							
1.5				EOI at 1.5 m BGL			

TB02

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 373014.31
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375206.01
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 19
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.5	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TB01_0.1		FILL: sandy SILT, non plastic, fine to medium grained, pale brown, small to medium angular gravel.	D-M		
0.5	10			sandy CLAY: medium plasticity, fine to medium grained, red-brown mottled light grey, trace small to medium sub angular gravel.		V Stiff	
	10						
	15					Hard	
1	Ref			As above. Pale grey-white.			
1.5				EOI at 1.5 m BGL			

TP03

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372941.03
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375289.38
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 17
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.5	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP03_0.1 ASS01		TOPSOIL: sandy SILT with some clay, non plastic, fine to medium grained, pale brown.	D		
	13			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.	D-M	V Stiff	
	10						
0.5		ASS02					
	12						
	7						
	8					Hard	
1	Ref						
				As above. Grey-brown.			
		ASS03					
1.5				EOI at 1.5 m BGL			

TP04

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372935.39
PROJECT NAME Preliminary Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375341.96
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 13
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.3	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP04_0.1 ASS04		TOPSOIL: sandy SILT, non plastic, fine to medium grained, dark brown.	D		
	8			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey.	D-M	V Stiff	
	6						
0.5	7	TP04_0.5 ASS05					
	12						
	21					Hard	
	Ref						
1		ASS06					
				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1.5				EOI at 1.3 m BGL			

TP05

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372889.03
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375318.00
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 11
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP05_0.1 ASS07		TOPSOIL: sandy SILT, non plastic, fine to medium grained, dark brown.	D		
	1			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey.	D-M	Soft	
	5					Firm	
0.5	5	ASS08					
	7					V Stiff	
	12						
				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D	Hard	
	Ref						
1				EOI at 1 m BGL			
1.5							

TP06

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372806.67
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375289.90
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 7
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 2.5	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
0		TP06_0.1		TOPSOIL: sandy SILT, non plastic, fine to medium grained, brown.	D		
0.5							
1	12	TP06_1.0 ASS09		sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled dark grey, trace small rounded gravel.	D-M	V Stiff	
	10						
	8						
	4					Stiff	
1.5		ASS10					
	5			sandy silty CLAY (slope wash): medium to high plasticity, fine to medium grained, grey mottled red-brown and orange.			
	5						
	4						
2		ASS11					
2.5				EOI at 2.5 m BGL			

TP07

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372777.62
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375318.03
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 7
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 2.2	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP07_0.1 ASS12		TOPSOIL: sandy SILT some clay, non plastic, fine to medium grained, brown.	D		
	11			sandy silty CLAY (slope wash): medium to high plasticity, fine to medium grained, grey mottled red-brown and orange.	D-M	V Stiff	
	7	ASS13					
0.5	6						
						Stiff	
	4						
	5						
		ASS14					
1	4						
	5						
	4						
	4						
1.5	6						
	5						
		ASS15					
2							
				EOI at 2.2 m BGL			
2.5							

TP08

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372856.84
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375204.81
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 13
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.2	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP08_0.1 ASS16		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale brown.	D		
	10 7			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.	D-M	V Stiff	
0.5	5	ASS17 CBR Shrink Swell				Stiff	
	6						
	14					Hard	
	17			XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1	Ref						
				EOI at 1.2 m BGL			

TP09

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372806.93
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375125.01
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 12
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 2	**CHECKED BY** JY

COMMENTS Fill area approximately 10m x 8m

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
0.5		TP09_0.5 ACM01 ACM01_ID		FILL: sandy SILT, non plastic, fine to medium grained, brown.	D		Building waste (metal, brick, concrete, steel)
1							
1.5		TP09_1.5		sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.	D-M		
2				EOI at 2 m BGL			

TP10

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372856.84
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375204.81
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 13
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP10_0.05 ASS18		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale brown.	D		
	3 4 5	ASS19		sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.	D-M	Stiff	
0.5	19 Ref			sandy CLAY: medium plasticity, fine to medium grained, orange-brown mottled light grey.		Hard	
				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1				EOI at 1 m BGL			

TP11

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372915.36
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375045.01
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 21
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP11_0.1		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale grey.	D		
0.5				sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M		
				As above. Pale grey mottle red.			
1				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1.5				EOI at 1 m BGL			

TP12

PROJECT NUMBER EP1655
PROJECT NAME PSI and Geotech
CLIENT Allam Homes
ADDRESS 173 McFarlanes Road, Chisholm, NSW

DRILLING DATE 8/5/2020
DRILLING COMPANY ARSK Civil
DRILLER -
DRILLING METHOD 5 T Excavator
TOTAL DEPTH 1.8

EASTING 372753.51
NORTHING 6374977.05
SURFACE ELEVATION 14
LOGGED BY SL
CHECKED BY JY

COMMENTS Fill area approximately 10 m x 12 m

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP12_0.2		FILL: sandy SILT, non plastic, fine to medium grained, pale brown, small to medium angular gravel.	D		Corrugated iron sheets
0.5	12	TP12_0.5		sandy silty CLAY: medium plasticity, fine to medium grained, brown mottled grey, trace small rounded gravel.	D-M	V Stiff	
	12			As above. Red-brown.			
	9						
	8						
1	8						
	9						
	12						
1.5	14					Hard	
	16						
				EOI at 1.8 m BGL			

TP13

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372757.85
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374876.23
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 18
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.6	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP13_0.2		FILL: sandy SILT, non plastic, fine to medium grained, pale brown, small to medium angular gravel.	D		Some ash. Area possibley used for fire.
	16			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	V Stiff	
0.5	7						
	9						
	6						
	5						
1	9						
	12						
				As above. Pale grey mottle red.		Hard	
	Ref						
1.5				XW SANDSTONE: fine to medium grained, light grey mottled orange.			
				EOI at 1.6 m BGL			

TP14

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372839.66
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374872.87
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 16
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.6	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP14_0.2		FILL: sandy SILT, non plastic, fine to medium grained, pale grey-orange, small to medium angular gravel.	D		Some ash. Area possibley used for fire.
0.5	9	TP14_0.6		sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	V Stiff	
	6						
	8						
1	8						
	9						
				As above. Pale grey mottle red.			
	12					Hard	
	16						
1.5	Ref			XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
				EOI at 1.6 m BGL			

TP15

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372907.61
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374834.99
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 22
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.6	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
0		TP15_0.2		FILL: sandy SILT, non plastic, fine to medium grained, pale brown, small to medium angular gravel.	D		Some ash. Area possibley used for fire.
1				sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M		
1.5				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
				EOI at 1.6 m BGL			

TP16

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING**
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING**
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION**
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.2	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP16_0.1		FILL: sandy SILT, non plastic, fine to medium grained, pale brown, small to medium angular gravel.	D		Some ash. Area possibley used for fire.
0.5	7 7 10	TP16_0.5		sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	V Stiff	
1	16 Ref			XW SANDSTONE: fine to medium grained, light grey mottled orange.	D	Hard	
1.5				EOI at 1.2 m BGL			

TP17

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372966.79
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374953.09
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 29
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.2	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP17_0.1		TOPSOIL: sandy SILT, non plastic, fine to medium grained, dark brown.	D		
	6 8 12			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	V Stiff	
0.5		CBR Shrink Swell				Hard	
	18 Ref						
1				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1.5				EOI at 1.2 m BGL			

TP18

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372946.21
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374747.41
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 25
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.7	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP18_0.1		TOPSOIL: sandy SILT with some clay, non plastic, fine to medium grained, dark brown.	D		
	5			sandy CLAY: medium plasticity, fine to medium grained, red-brown mottled light grey, trace small to medium sub angular gravel.	D-M	Stiff	
0.5	5	CBR Shrink Swell					
	3						
	3						
	4						
1	6					V Stiff	
	6			As above. Pale grey mottle red.			
	8						
1.5	9						
	12			XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
				EOI at 1.7 m BGL			

TP19

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372802.59
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375025.72
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 16
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.8	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP19_0.1		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale brown.	D		
	4			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	Stiff	
	4						
0.5	6	CBR					
	5						
				As above. Pale grey mottle red.			
	7						
	8						
1							
	10					Hard	
	12						
	16						
1.5	Ref						
				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
				EOI at 1.8 m BGL			

TP20

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372914.13
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374912.17
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 25
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP20_0.1		TOPSOIL: sandy SILT with some clay, non plastic, fine to medium grained, pale brown.	D		
	2			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	Firm	
	3						
	4						
0.5							
	12					Hard	
	Ref						
				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
1				EOI at 1 m BGL			
1.5							

TB21

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 373014.31
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6375206.01
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 19
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1	**CHECKED BY** JY

COMMENTS Cattle yard

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TB21_0.05		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale brown.	D		
				sandy silty CLAY: medium plasticity, fine to medium grained, red-brown mottled grey, trace small rounded gravel.	D-M		
0.5							
1				EOI at 1 m BGL			
1.5							

TP22

PROJECT NUMBER EP1655	**DRILLING DATE** 8/5/2020	**EASTING** 372718.21
PROJECT NAME PSI and Geotech	**DRILLING COMPANY** ARSK Civil	**NORTHING** 6374786.28
CLIENT Allam Homes	**DRILLER** -	**SURFACE ELEVATION** 24
ADDRESS 173 McFarlanes Road, Chisholm, NSW	**DRILLING METHOD** 5 T Excavator	**LOGGED BY** SL
	TOTAL DEPTH 1.3	**CHECKED BY** JY

COMMENTS

Depth (m)	DCP (blows per 150)	Samples	Graphic Log	Material Description: Soil type, plasticity/particle characteristics, colour, minor components	Moisture	Consistency	Additional Observations
		TP22_0.05		TOPSOIL: sandy SILT, non plastic, fine to medium grained, pale brown.	D		
	12			sandy silty CLAY: medium plasticity, fine to medium grained, red-brown, trace small rounded gravel.	D-M	Hard	
	12						
0.5	12						
	12	CBR					
	20						
	Ref			sandy CLAY: medium plasticity, fine to medium grained, light grey mottled red brown, trace small to medium sub angular gravel.			
1				XW SANDSTONE: fine to medium grained, light grey mottled orange.	D		
				EOI at 1.3 m BGL			
1.5							

Appendix C
LABORATORY TEST REPORTS

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:NEWC20S-03927
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

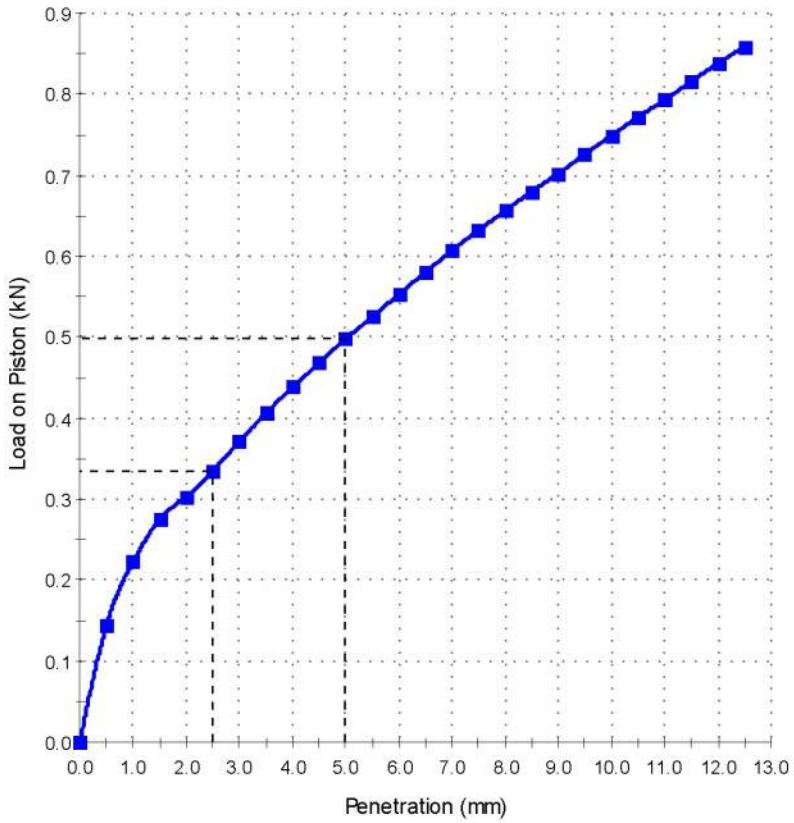
Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Chris Blackford (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 29/05/2020

Sample Details

Sample ID:	NEWC20S-03927	**Sampling Method:**	Submitted by client
Client ID:	-	**Material:**	Existing Ground
Date Sampled:	8/05/2020	**Source:**	On-Site
Date Submitted:	13/05/2020	**Specification:**	No Specification
Date Tested:	29/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP04 - 0.5 - 0.7m		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**2.5**
Dry Density before Soaking (t/m³):	1.57
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	23.3
Moisture Ratio before Soaking (%):	99.5
Dry Density after Soaking (t/m³):	1.54
Density Ratio after Soaking (%):	98.5
Swell (%):	1.5
Moisture Content of Top 30mm (%):	27.8
Moisture Content of Remaining Depth (%):	24.2
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	75
Plasticity Determination Method:	Visual/Tactile Assessment
———— AS 1289.2.1.1 ————	
In Situ (Field) Moisture Content (%):	21.8

Comments

Samples tested and reported as received from client.

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:NEWC20S-03928
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

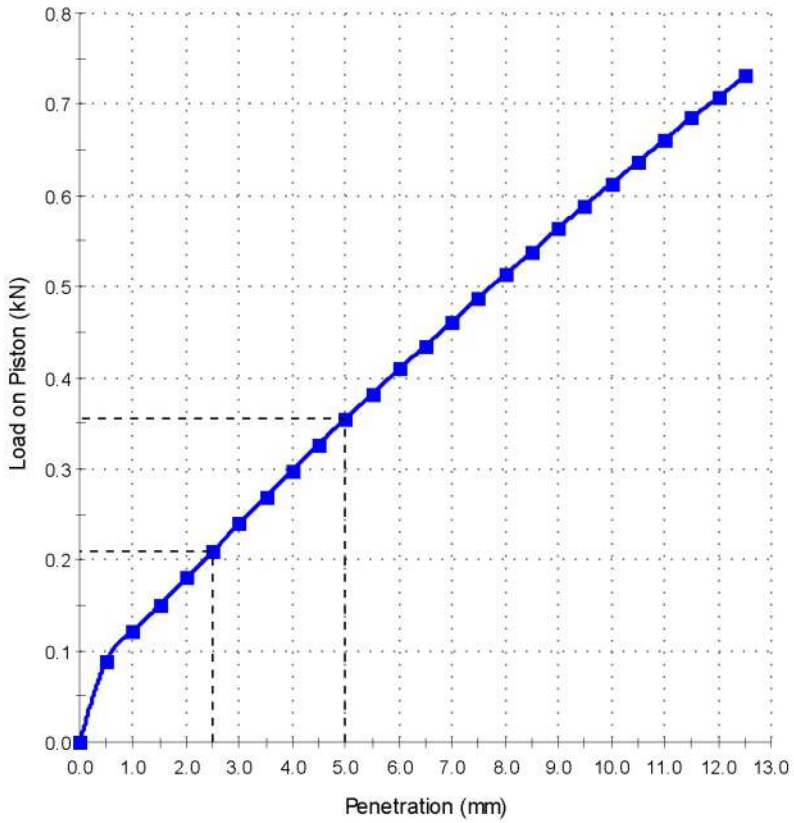
Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Chris Blackford (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 29/05/2020

Sample Details

Sample ID:	NEWC20S-03928	**Sampling Method:**	Submitted by client
Client ID:	-	**Material:**	Existing Ground
Date Sampled:	8/05/2020	**Source:**	On-Site
Date Submitted:	13/05/2020	**Specification:**	No Specification
Date Tested:	26/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP08 - 0.5 - 0.7m		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 5.0mm (%):	**2.0**
Dry Density before Soaking (t/m³):	1.55
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	24.5
Moisture Ratio before Soaking (%):	100.5
Dry Density after Soaking (t/m³):	1.53
Density Ratio after Soaking (%):	99.0
Swell (%):	1.5
Moisture Content of Top 30mm (%):	30.5
Moisture Content of Remaining Depth (%):	24.2
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	96
Plasticity Determination Method:	Visual/Tactile Assessment
——— AS 1289.2.1.1 ———	
In Situ (Field) Moisture Content (%):	24.7

Comments

Samples tested and reported as received from client.

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:NEWC20S-03929
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

Accredited for compliance with ISO/IEC 17025 - Testing.
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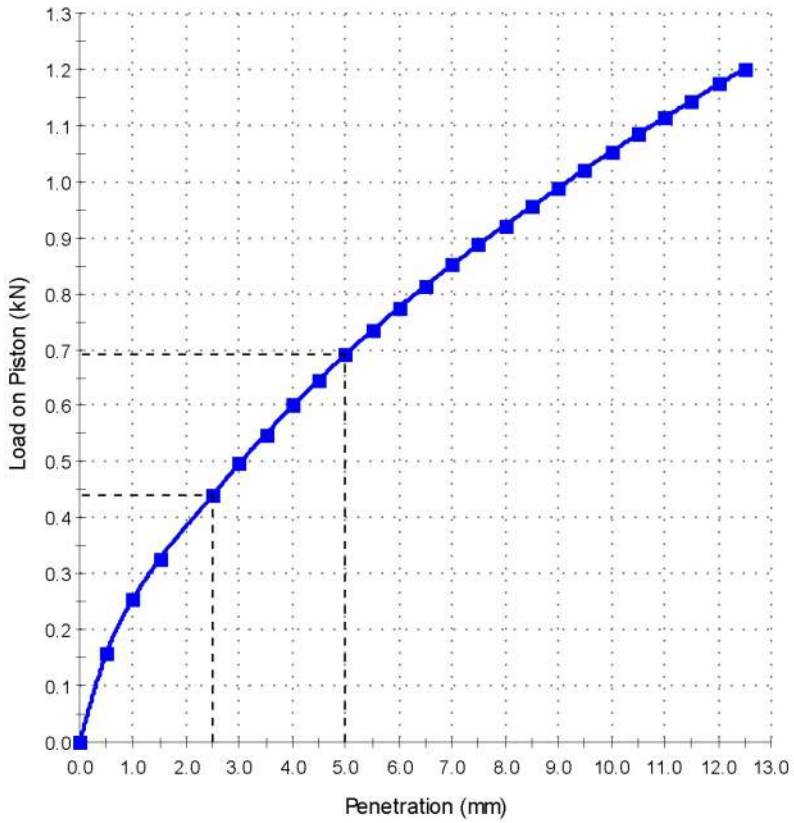
Approved Signatory: Chris Blackford (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 29/05/2020

Sample Details

Sample ID:	NEWC20S-03929	**Sampling Method:**	Submitted by client
Client ID:	-	**Material:**	Existing Ground
Date Sampled:	8/05/2020	**Source:**	On-Site
Date Submitted:	13/05/2020	**Specification:**	No Specification
Date Tested:	26/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP16 - 0.6 - 0.9m		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 5.0mm (%):	**3.5**
Dry Density before Soaking (t/m³):	1.60
Density Ratio before Soaking (%):	100.5
Moisture Content before Soaking (%):	21.2
Moisture Ratio before Soaking (%):	98.5
Dry Density after Soaking (t/m³):	1.57
Density Ratio after Soaking (%):	98.5
Swell (%):	1.5
Moisture Content of Top 30mm (%):	26.6
Moisture Content of Remaining Depth (%):	24.1
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	95
Plasticity Determination Method:	Visual/Tactile Assessment
——— AS 1289.2.1.1 ———	
In Situ (Field) Moisture Content (%):	17.7

Comments

Samples tested and reported as received from client.

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:NEWC20S-03930
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

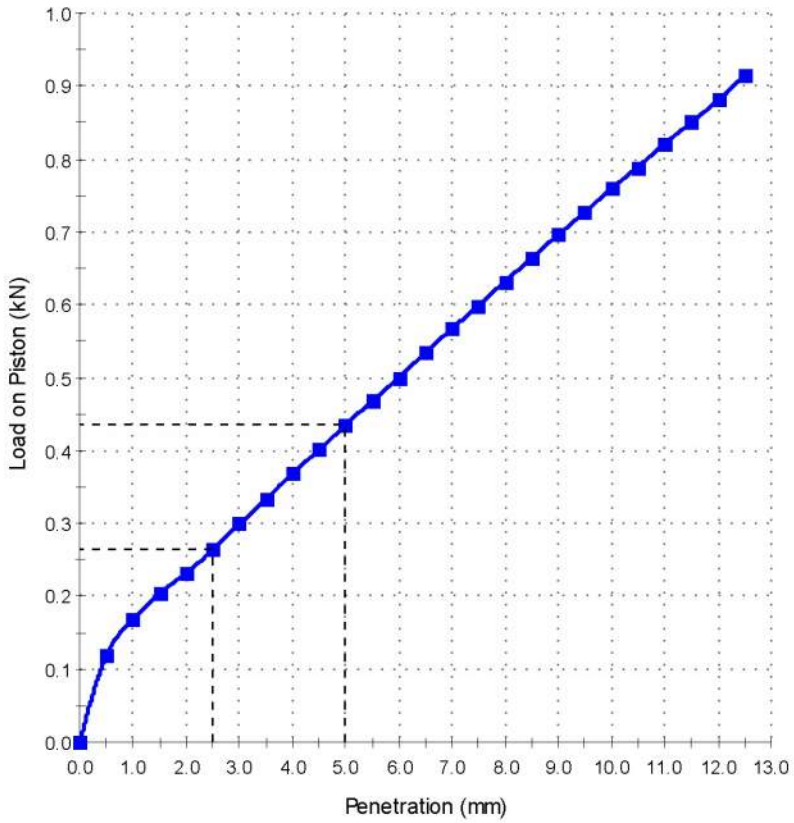
Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Chris Blackford (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 29/05/2020

Sample Details

Sample ID:	NEWC20S-03930	**Sampling Method:**	Submitted by client
Client ID:	-	**Material:**	Existing Ground
Date Sampled:	8/05/2020	**Source:**	On-Site
Date Submitted:	13/05/2020	**Specification:**	No Specification
Date Tested:	26/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP17 - 0.5 - 0.7m		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 5.0mm (%):	**2.0**
Dry Density before Soaking (t/m³):	1.62
Density Ratio before Soaking (%):	100.5
Moisture Content before Soaking (%):	20.8
Moisture Ratio before Soaking (%):	98.5
Dry Density after Soaking (t/m³):	1.59
Density Ratio after Soaking (%):	98.5
Swell (%):	2.0
Moisture Content of Top 30mm (%):	27.3
Moisture Content of Remaining Depth (%):	22.0
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	93
Plasticity Determination Method:	Visual/Tactile Assessment
———— AS 1289.2.1.1 ————	
In Situ (Field) Moisture Content (%):	19.1

Comments

Samples tested and reported as received from client.

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:NEWC20S-03931
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

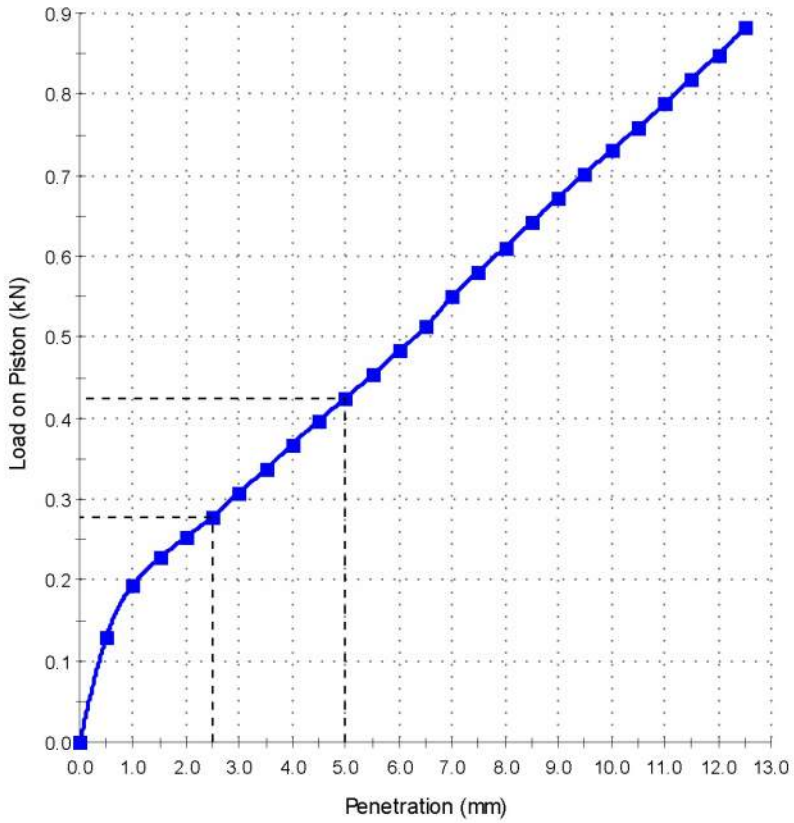
Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Chris Blackford (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 29/05/2020

Sample Details

Sample ID:	NEWC20S-03931	**Sampling Method:**	Submitted by client
Client ID:	-	**Material:**	Existing Ground
Date Sampled:	8/05/2020	**Source:**	On-Site
Date Submitted:	13/05/2020	**Specification:**	No Specification
Date Tested:	26/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP18 - 0.5 - 0.8m		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 5.0mm (%):	**2.0**
Dry Density before Soaking (t/m³):	1.60
Density Ratio before Soaking (%):	100.5
Moisture Content before Soaking (%):	21.9
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.55
Density Ratio after Soaking (%):	97.5
Swell (%):	3.5
Moisture Content of Top 30mm (%):	27.8
Moisture Content of Remaining Depth (%):	23.0
Compaction Hammer Used:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	92
Plasticity Determination Method:	Visual/Tactile Assessment
——— AS 1289.2.1.1 ———	
In Situ (Field) Moisture Content (%):	23.5

Comments

Samples tested and reported as received from client.

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:NEWC20S-03928
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Greg Eveleigh (Geotechnician)
NATA Accredited Laboratory Number:431
Date of Issue: 1/06/2020

Sample Details

Sample ID:	NEWC20S-03928	**Sampling Method:**	Submitted by client
Date Sampled:	8/05/2020	**Material:**	Existing Ground
Date Submitted:	13/05/2020	**Source:**	On-Site
Date Tested:	26/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP08 - 0.5 - 0.7m		
Borehole Number:	-		
Borehole Depth (m):	-		

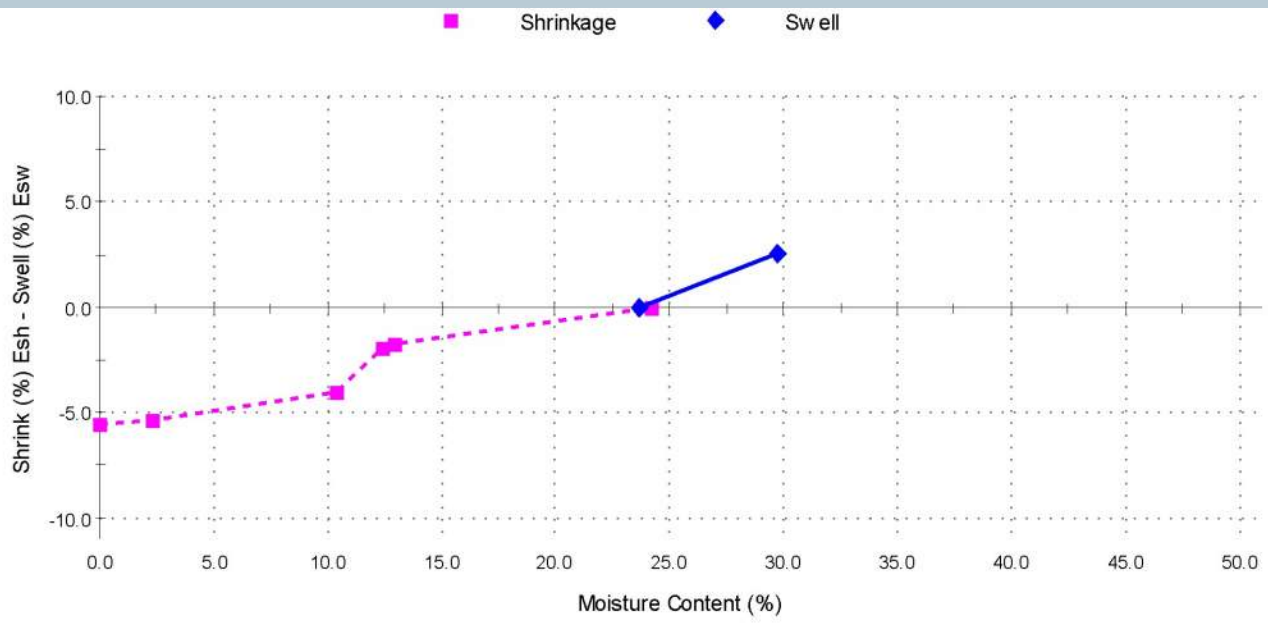
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	2.6
Moisture Content before (%):	23.6
Moisture Content after (%):	29.7
Est. Unc. Comp. Strength before (kPa):	390
Est. Unc. Comp. Strength after (kPa):	150

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	5.6
Shrinkage Moisture Content (%):	24.2
Est. inert material (%):	
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 3.8

Comments

Clay, high plasticity, brown.
remoulded

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:NEWC20S-03931
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Greg Eveleigh (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 1/06/2020

Sample Details

Sample ID:	NEWC20S-03931	**Sampling Method:**	Submitted by client
Date Sampled:	8/05/2020	**Material:**	Existing Ground
Date Submitted:	13/05/2020	**Source:**	On-Site
Date Tested:	27/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP18 - 0.5 - 0.8m		
Borehole Number:	-		
Borehole Depth (m):	-		

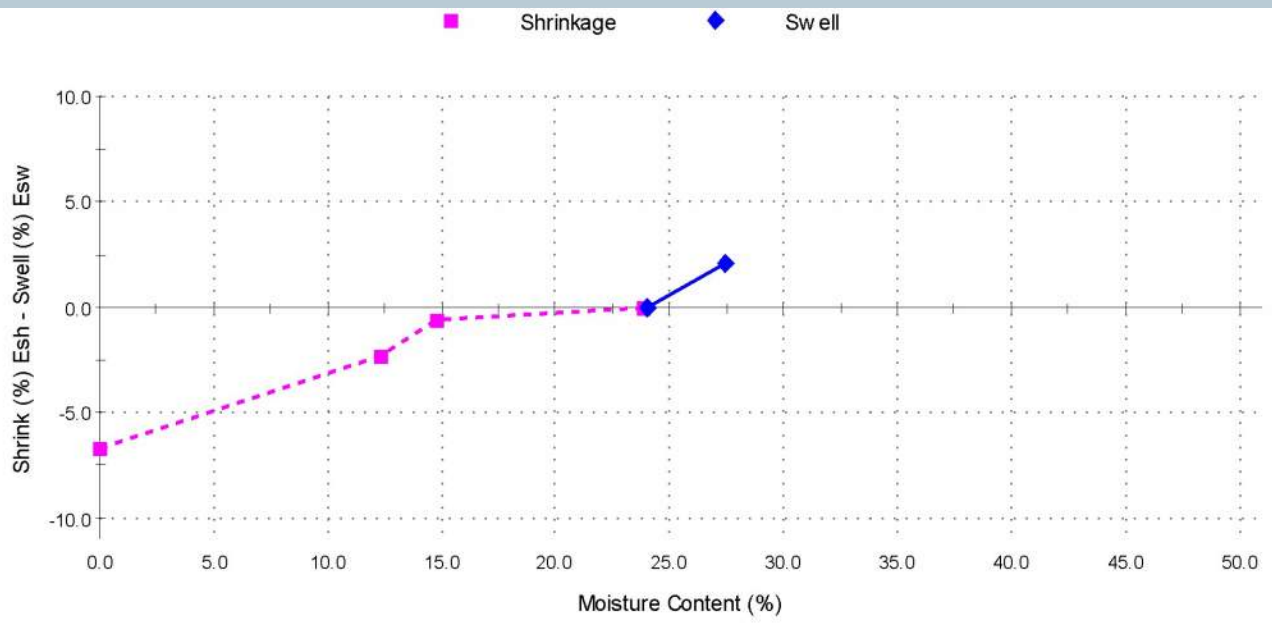
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	2.1
Moisture Content before (%):	24.0
Moisture Content after (%):	27.4
Est. Unc. Comp. Strength before (kPa):	200
Est. Unc. Comp. Strength after (kPa):	140

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	6.7
Shrinkage Moisture Content (%):	23.9
Est. inert material (%):	0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 4.3

Comments

Clay, high plasticity, grey/brown.
Remoulded

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:NEWC20S-03932
Issue No: 1

Client:	EP Risk Management PO Box 57 Lochinvar NSW 2321
Principal:	
Project No.:	TESTNEWC00101AA
Project Name:	EP1655 - Harris Property Geotech
Lot No.:	**TRN:**

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Greg Eveleigh (Geotechnician)
WORLD RECOGNISED ACCREDITATION
NATA Accredited Laboratory Number:431
Date of Issue: 1/06/2020

Sample Details

Sample ID:	NEWC20S-03932	**Sampling Method:**	Submitted by client
Date Sampled:	8/05/2020	**Material:**	Existing Ground
Date Submitted:	13/05/2020	**Source:**	On-Site
Date Tested:	27/05/2020		
Project Location:	Chisholm, NSW		
Sample Location:	TP19 - 0.5 - 0.7m		
Borehole Number:	-		
Borehole Depth (m):	-		

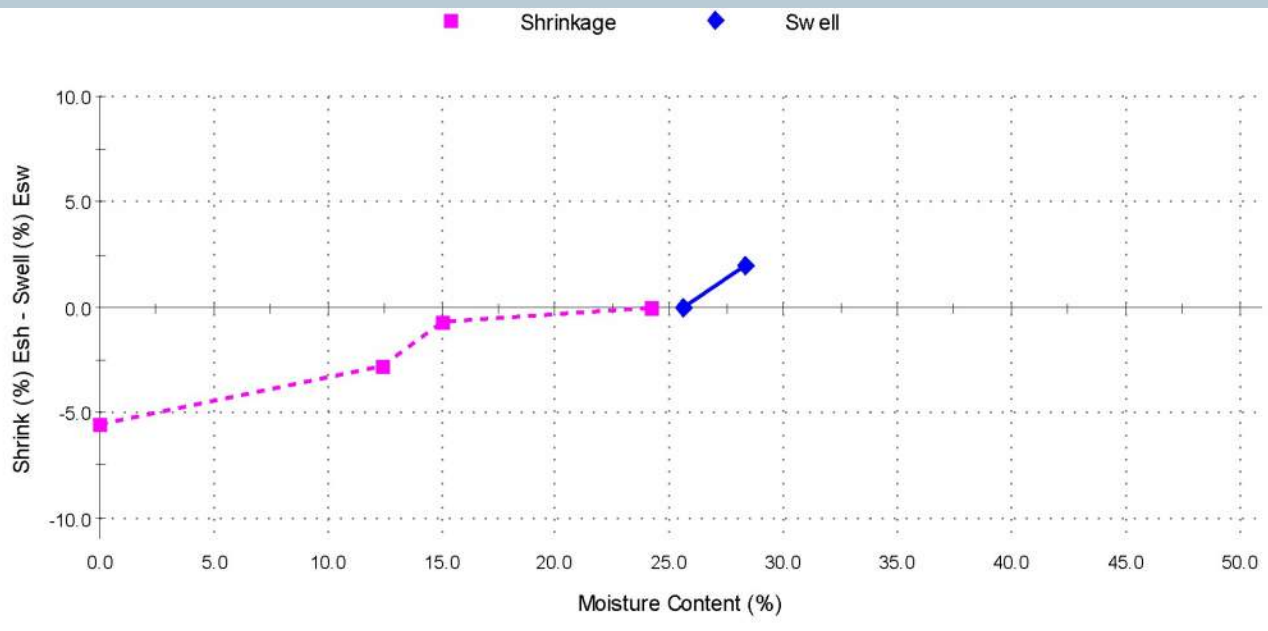
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	2.0
Moisture Content before (%):	25.6
Moisture Content after (%):	28.3
Est. Unc. Comp. Strength before (kPa):	210
Est. Unc. Comp. Strength after (kPa):	180

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	5.6
Shrinkage Moisture Content (%):	24.1
Est. inert material (%):	0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 3.7

Comments

Clay, high plasticity, mottled orange/brown.
Remoulded