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Our Ref: PSM3939-004L REV3

15 July 2021

Project Strategy
c/- Altis Property Partners
PO Box 271
SUTHERLAND NSW 1499
amurr@projectstrategy.com.au

Attention: Anthony Murr

Dear Anthony

RE: 884-928 MAMRE ROAD, KEMPS CREEK - DA APPLICATION RESULTS OF GEOTECHNICAL INVESTIGATION

1. Introduction

This letter presents the factual results of the geotechnical investigation conducted on 22 September 2020 at two neighbouring properties (the Site) at 884-903 Mamre Road (Lot 53 DP 259135) on the northern side and 904-928 Mamre Road, Kemps Creek (Lot 52 DP 259135) on the southern side. The work has been conducted in accordance with PSM proposal (PSM3939-002L) dated 31 August 2020 and for a State Significant Development Application to the NSW Department of Planning, Industry and Environment (DPIE) for the proposed development involving Bulk Earthworks, Infrastructure Works, Sixteen (16) Lot Torrens Title Subdivision Works for the Site with an approximate area of 202,470 m^2 and a 38,960 m^2 warehouse building on Lot 2 of the Site.

This report has initially been prepared in accordance with the geotechnical report requirement noted in Draft Mamre Road Precinct Development Control Plan (DCP) dated November 2020 and updated based on the following revised drawings:

- Proposed Subdivision Plan Drawings by Landpartners (ref. SY074794.000.5.8_GDA2020 Rev H, dated 12 July 2021)
- Masterplan Drawings by Nettletontribe (ref. 11894_DA004 Issue: P8, dated 13 July 2021)
- Bulk Earthworks & Cut/Fill Plan Drawings by Costin Roe Consulting (ref. CO14021.00-SSDA300 Issue: F, dated 2 July 2021).

2. Background

To assist in the geotechnical investigation, we were provided with the following documents:

- Precinct Plan
- Area Plan
- Draft architectural plan.
- Costin Roe drawings CO1402.100-DA310-C “Cut/Fill Plan Stage 1” and DA311-B Cut/Fill Plan “Cut/Fill Plan Stage 2”

PSM understand that at this stage, the proposed development will comprise a subdivision industrial development requiring:

- Vegetation clearing
- Infrastructure works
- Development of warehouses
- Road and hardstand paved areas.

Based on Costin Roe drawings, we understand the proposed earthworks comprises:

- Cut depth: Up to 6 m
- Fill depth. Up to 6 m.

3. Geotechnical Investigation

As requested by Altis, PSM have completed a geotechnical investigation for the area.

3.1 Fieldwork

The fieldwork was undertaken on 22 September 2020 comprising 10 test pits excavated with a 5-tonne excavator. The test pits were excavated to depths of between 1.3 m and 3.0 m.

A PSM geotechnical engineer was present on a full-time basis and undertook the following tasks:

- Directing test pit locations
- Preparing tabulated logs of materials encountered
- Collection of disturbed soil samples for further testing.

The test locations were recorded with a hand-held GPS unit with a horizontal accuracy of approximately +/- 5m. Figure 1 presents the locality plan and investigation locations.

At the completion of the fieldwork, the test pits were backfilled with excavated soil and lightly tamped with the excavator bucket.

Figures 2 to 6 present selected site photographs.

Appendix A presents the tabulated field logs and Appendix B presents the test pit photographs.

3.2 Geotechnical Laboratory Results

3.2.1 California Bearing Ratio (CBR)

Three (3) bulk soil samples were recovered for CBR testing.

The following sample preparation was undertaken prior to CBR testing:

- Compact to 98% standard MDD, at optimum moisture content (OMC)
- Four (4) day-soaked sample; and
- 4.5 kg surcharge.

Table 1 presents a summary of the CBR test results. The test results are included in Appendix C.

Table 1 – CBR Test Results

Sample ID (depth)	Material Description	Soaked CBR (%)	OMC (%)	Standard Maximum Dry Density (t/m^3)	Swell (%)
TP01 (0.5 – 1.0 m)	CLAY	1.5*	20.5	1.70	4.5
TP06 (0.5 m)	CLAY	1.0*	22.2	1.60	4.5
TP10 (0.5 m)	CLAY	2.0*	19.5	1.72	4.5

[1] Indicates Soaked CBR value at 2.5 mm penetration.

3.2.2 Analytical Laboratory Testing

Five (5) soil samples were retrieved by a PSM geotechnical engineer for testing in a NATA accredited analytical laboratory. The following tests were undertaken on the disturbed soil samples:

- Cation Exchange Capacity (CEC) of calcium, magnesium, potassium and sodium
- Exchange sodium percentage
- Soil pH
- Chlorides
- Sulphates
- Moisture content
- Resistivity
- Electrical conductivity.

Table 2 presents a summary of the results. The results are included in Appendix D.

3.2.3 Soil Chemistry

The laboratory test results summarised in Table 2 indicate the following:

- pH of the soil samples analysed ranged from 5.3 to 6.0, with an average of 5.6
- Concentrations of chlorides in samples analysed ranged from 40 mm/kg to 1340 mm/kg
- Concentrations of sulphates in samples analysed ranged from 20 mm/kg to 150 mm/kg
- Cation Exchange Capacity (CEC) in samples analysed ranged from 6.2 meq/100g to 20.1 meq/100g
- Exchange Sodium Percentage (ESP) in samples analysed ranged from 11.5% to 31.0%
- Electrical Conductivity at 25°C in samples analysed ranged from 60 uS/cm to 712 uS/cm
- Resistivity at 25°C in samples analysed ranged from 1400 ohm.cm to 16700 ohm.cm.

Table 2 - Summary of Laboratory Test Results

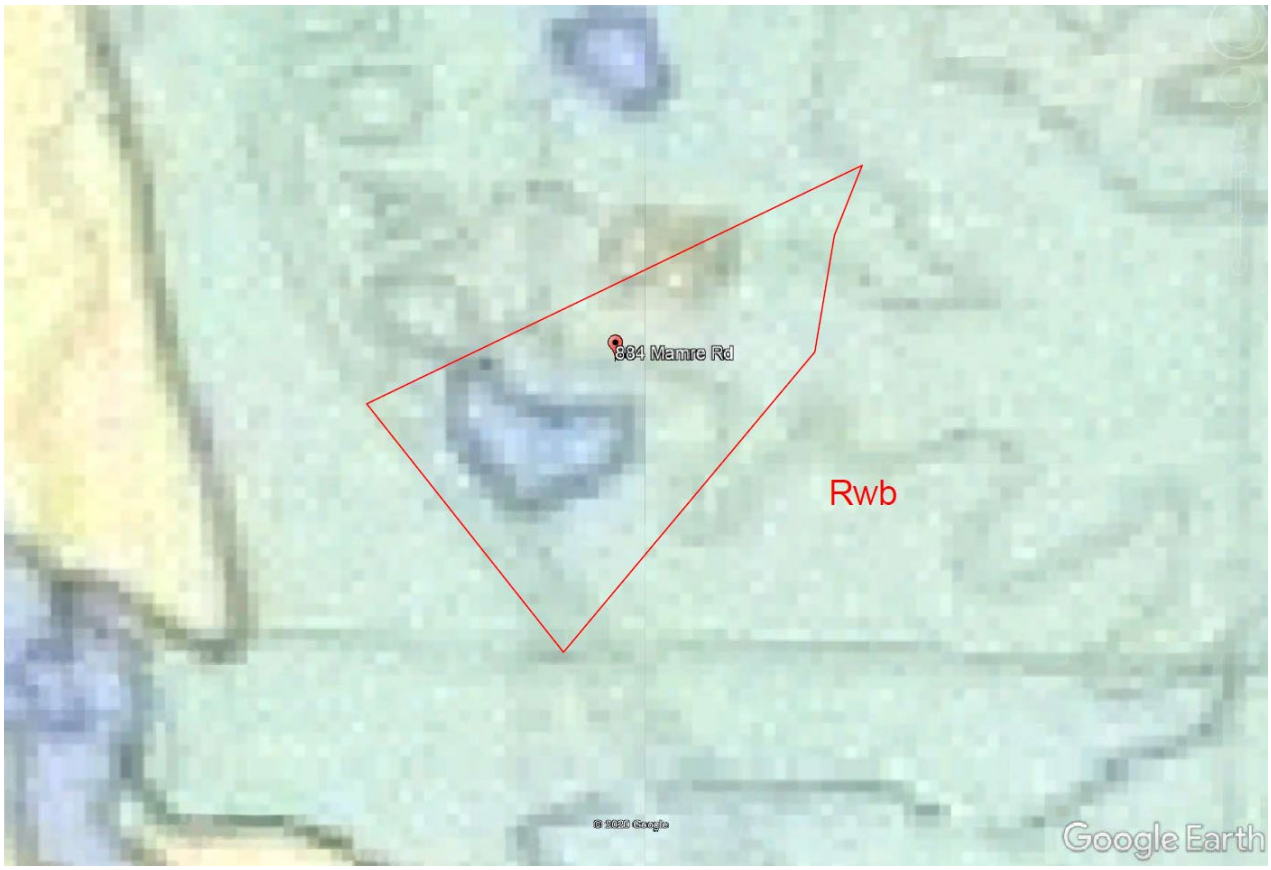
Sample ID	pH	Moisture Content [%]	Chloride By Discrete Analyser [mg/kg]	Soluble Sulphate by icpaes [mg/kg]	Exchangeable Cations [meq/100g]					ESP [%]	Electrical Conductivity @25°C (uS/cm)	Resistivity @25°C (ohm.cm)
					Ca	Mg	K	Na	CEC			
TP02 – 1.0 m	5.3	13.1	1340	150	<0.1	4.1	<0.1	1.9	6.2	31.0	712	1400
TP04 – 0.5 m	5.4	21.9	130	120	2.3	14.1	0.3	3.3	20.1	16.6	168	5950
TP05 – 0.5 m	5.5	15.8	310	140	0.9	12.4	0.2	4.3	17.9	24.1	288	3470
TP07 – 0.5 m	6.0	22.2	<100	20	1.2	13.1	0.2	3.4	17.9	19.0	60	16700
TP09 – 0.5 m	5.8	18.9	40	30	3.4	8.1	0.1	1.5	13.1	11.5	60	16700

4. Site Conditions

4.1 Geological Setting

The geological map of Penrith indicates that the site is underlain by Bringelly Shale of the Wianamatta Group (Rwb) consisting of shale, carbonaceous claystone, claystone, laminate and fine to medium grained lithic sandstone, rare coal and tuff.

Inset 1 presents the geological map of the site.



Inset 1: Penrith Geological Map Indicating Approximate Site Location

4.2 Surface Conditions

The site is located in Kemps Creek bounded by Mamre Road to southwest and private property along the other boundaries. The following observations were made on Lot 53 during the fieldwork:

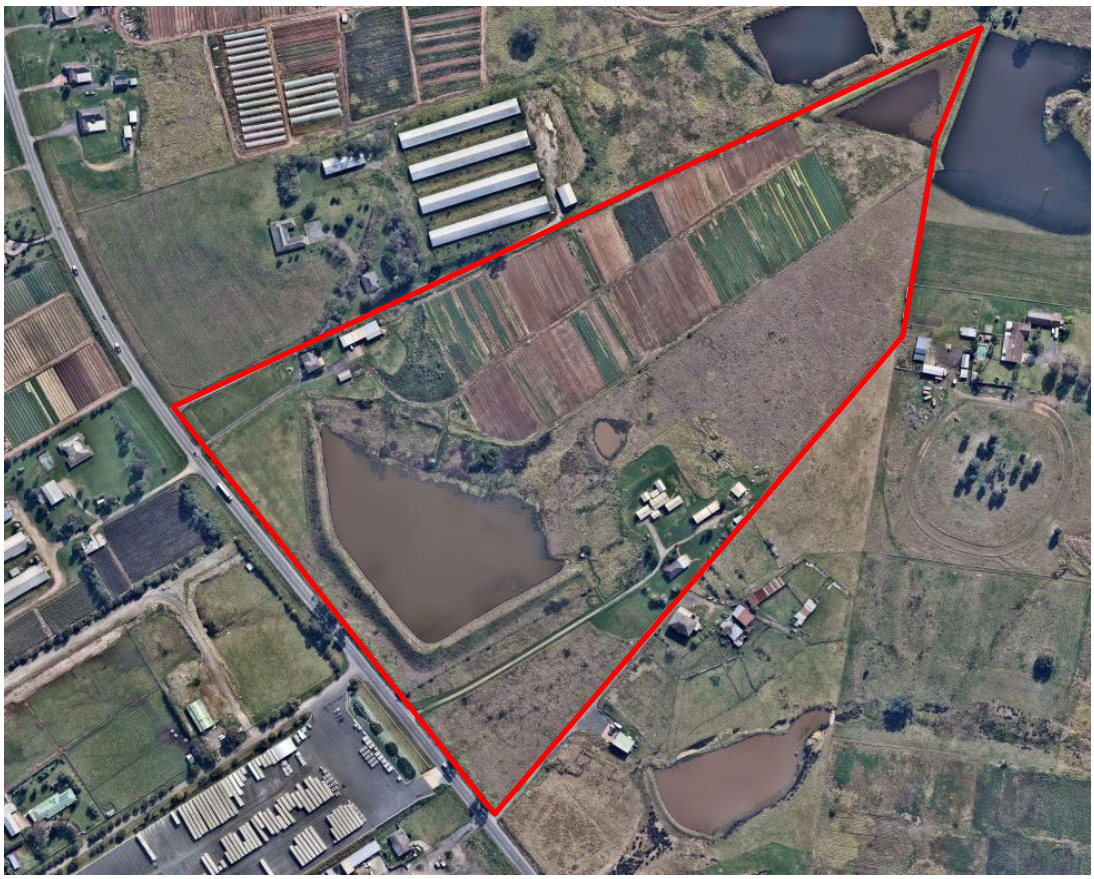
- Grass, trees and crops were observed on the property
- Cropped areas covered the majority of the surface
- A residential dwelling was connected to property entrance through a paved road
- A large pond was located on southwestern side of the property shared with Lot 52
- A triangular shaped pond was located at the northeastern corner of the property surrounded by uncontrolled vegetation.

The following observations were made on Lot 52 during the fieldwork:

- Grass, trees and crops were observed on the property
- Uncontrolled vegetated areas covered the majority of the surface
- A number of residential dwellings and sheds were observed connected to property entrance through an unpaved road. The road is paved in the vicinity of the dwellings
- A small pond is located at the centre of the property.

Inset 2 and Inset 3 present aerial photos on the site in 2010 and 2020. It is noted from the photos that surface conditions have remained mainly unchanged expect for the size of the pond on western side of the site.

Inset 2: Nearmap Aerial Image in August 2010, Showing Surface Conditions



Inset 3: Nearmap Aerial Image in August 2020, Showing Surface Conditions

4.3 Subsurface Conditions

The subsurface conditions encountered within the test pits are summarised in Table 3.

Table 3 – Summary of Inferred Subsurface Conditions Encountered in Test Pits

Inferred Unit	Inferred Top of Unit Depth Below Ground Surface (m)	Description
TOPSOIL	0.0	CLAY to CLAY trace gravel; dark brown, non-plastic to low plasticity, sub-rounded to sub-angular gravel, up to 5 mm, moist, soft to firm consistency, roots, grass and worms observed.
NATURAL SOIL	0.1 – 0.2	CLAY to CLAY trace gravel; medium to high plasticity, red, orange, brown and grey, sub-rounded to sub-angular gravel up to 10 mm, moist, firm to very stiff consistency, roots and weathered shale fragments observed.
BEDROCK	0.9 – 2.8	SHALE; red brown and grey, extremely too highly weathered, very low to medium strength.

Existing fill is observed around the embankment for the existing basins (Refer to Figure 7). We expect this fill to have been placed with minimum compaction and control as part of farm dam construction in the past, e.g., uncontrolled fill. It will require to be removed and replaced in accordance with PSM bulk earthworks specification.

Table 4 presents the approximate depth below ground level of the top of the inferred geotechnical units encountered in the test pits.

Table 4 - Depth Below Ground Surface of Top of Inferred Geotechnical Units

Test Pits	Depth Below Ground Surface of Top of Inferred Geotechnical Units (m)			
	TOPSOIL	NATURAL SOIL	BEDROCK	EOH.[1]
TP01	0.00	0.20	2.70	3.00
TP02	0.00	0.20	1.80	2.00*
TP03	0.00	0.10	1.00	1.60*
TP04	0.00	0.20	0.90	1.00*
TP05	0.00	0.10	0.90	1.50*
TP06	0.00	0.20	1.50	2.40*
TP07	0.00	0.20	1.70	2.00*
TP08	0.00	0.10	2.80	3.00
TP09	0.00	0.15	1.20	1.30*
TP10	0.00	0.20	1.20	1.60*

[1] EOH = End of Hole

* Practical refusal using 5 tonne excavators.

4.4 Groundwater

We did not observe any water inflow in the test pits. No long-term groundwater monitoring was undertaken.

As shown in Inset 3, the site comprises existing basins at the front and rear of the property.

5. Discussion

5.1 Assessment of Analytical Laboratory Testing

5.1.1 Salinity Assessment

Site Investigations for Urban Salinity (DLWC 2002) classify soil salinity based on electrical conductivity (ECe). The method of conversion from EC1:5 to ECe (electrical conductivity of saturated extract) is based on DLWC (2002) and given by ECe = EC1:5 x M, where M is the multiplication factor based on “Soil Texture Group”.

The “Soil Texture Group” of the samples tested were assessed during our investigation. The salinity classification for the soil samples that were tested are presented in Table 5.

Table 5 - Salinity Classification

Sample ID	EC1:5 (dS/m)	Soil Type	M	ECe (dS/m)	Salinity Class
TP02 – 1.0 m	0.712	Heavy Clay	6	4.272	Moderately Saline
TP04 – 0.5 m	0.168	Heavy Clay	6	1.008	Non-Saline
TP05 – 0.5 m	0.288	Heavy Clay	6	1.728	Non-Saline
TP07 – 0.5 m	0.060	Light Clay	6	0.360	Non-Saline
TP09 – 0.5 m	0.060	Heavy Clay	6	0.360	Non-Saline

It is assessed that the soils on site are classified as “Non-Saline” to “Moderately Saline”. We have referred to Clause 4.8.2 of Australian Standard AS3600-2009 “Concrete Structures” and note that the assessed soil electrical conductivity (ECe) is below the upper limit of the “A2” exposure classification for all samples.

5.1.2 Corrosivity / Aggressivity

Table 6.4.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for concrete piles based on sulphates in the soil and groundwater, soil and groundwater pH, and chlorides in groundwater. On the basis of the soil sulphates and pH testing completed we assess the exposure classification for concrete piles in the soil to be “Non-aggressive”.

Table 6.5.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for steel piles based on resistivity, soil and groundwater pH, and chlorides in soil and groundwater. On the basis of soil chlorides, resistivity and pH testing completed we assess the exposure classification for steel piles in the soil to be “Mild”.

5.1.3 Sodicity

Sodicity provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil. Soil sodicity is classified based on the Exchangeable Sodium Percentage (ESP) which is the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity (DLWC, 2002).

The Exchangeable Sodium Percentages calculated from these laboratory results, ranging from 11.5% to 31.0%, indicates that the soils on site are highly sodic when compared to criteria listed in “Site Investigations for Urban Salinity”, DLWC (2002).

5.2 Bulk Earthworks Specification and Interim Geotechnical Design Advice

We have prepared separate documents for the following:

- Interim Geotechnical Design Advice (IGDA) for the proposed development. Refer to PSM3939-005L (Appendix E)
- Bulk Earthworks Specification. Refer to PSM4169-006S (Appendix F).

Should there be any queries, do not hesitate to contact the undersigned.

For and on behalf of
PELLS SULLIVAN MEYNINK

BRYAN TAM
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Encl.

Figure 1	Locality Plan
Figure 2	Selected Site Photographs (1 of 6)
Figure 3	Selected Site Photographs (2 of 6)
Figure 4	Selected Site Photographs (3 of 6)
Figure 5	Selected Site Photographs (4 of 6)
Figure 6	Selected Site Photographs (5 of 6)
Figure 7	Selected Site Photographs (6 of 6)
Appendix A	Tabulated Borehole Logs
Appendix B	Test Pit Photos
Appendix C	CBR Test Results
Appendix D	Analytical Test Results
Appendix E	PSM3939-005L (IGDA)
Appendix F	PSM3939-006S (Bulk Earthworks Specification)

294700 294800 294900 295000 295100 295200 295300 295400 295500 295600 295700 295800

6252900 6252800 6252700 6252600 6252500 6252400 6252300 6252200

TP01 TP02 TP03 TP04 TP05 TP06 TP07 TP08 TP09 TP10

Legend

- Apprxoimate Site Boundary
- Test Pit Locations

Notes:
1. Image obtained from Nearmap of the site conditions on 3 August 2020.

N

Scale 1:3,000

0 50 100 150 m

Scale (m)

P S M

Created By: M.B.	Revision: 0
Date: 23 Sep 2020	Paper Size: A3

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Kemps Creek, NSW

GEOTECHNICAL INVESTIGATION
LOCALITY PLAN

PSM3939-004L | Figure 1

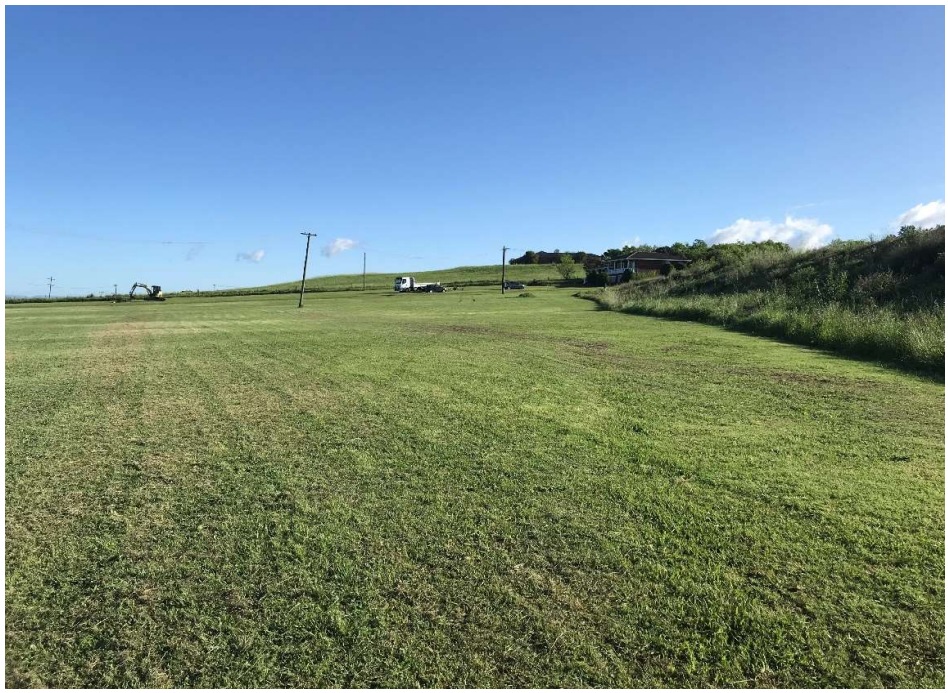

Photo 1 - Lot 53 general site conditions facing northwest at TP02 (22/09/2020)

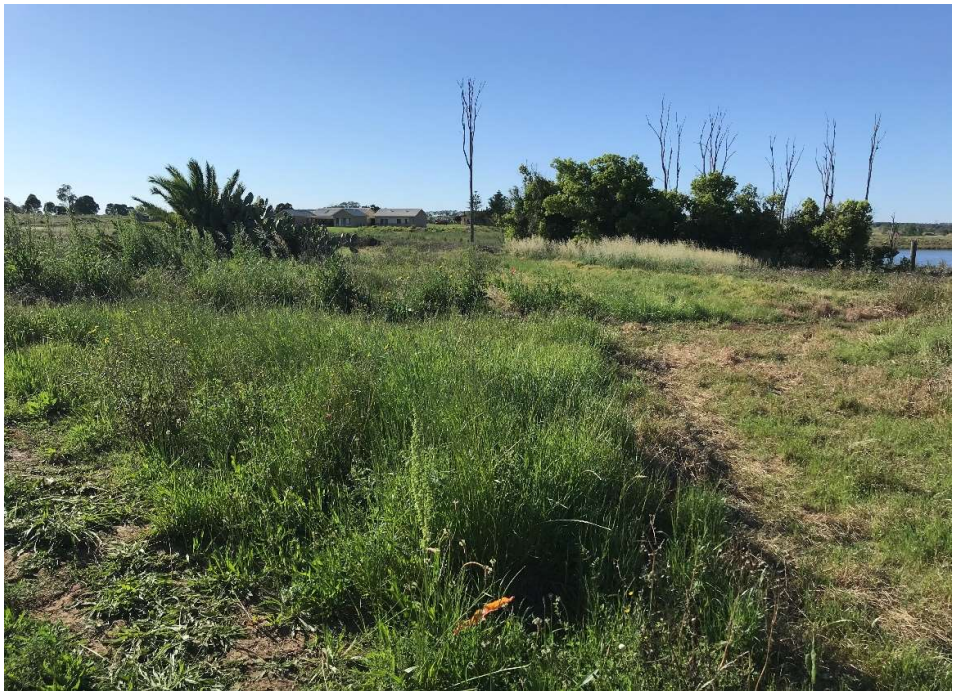

Photo 2 - Lot 53 general site conditions facing southeast at TP03 (22/09/2020)

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GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (1 of 6)

PSM3939-004L	FIGURE 2

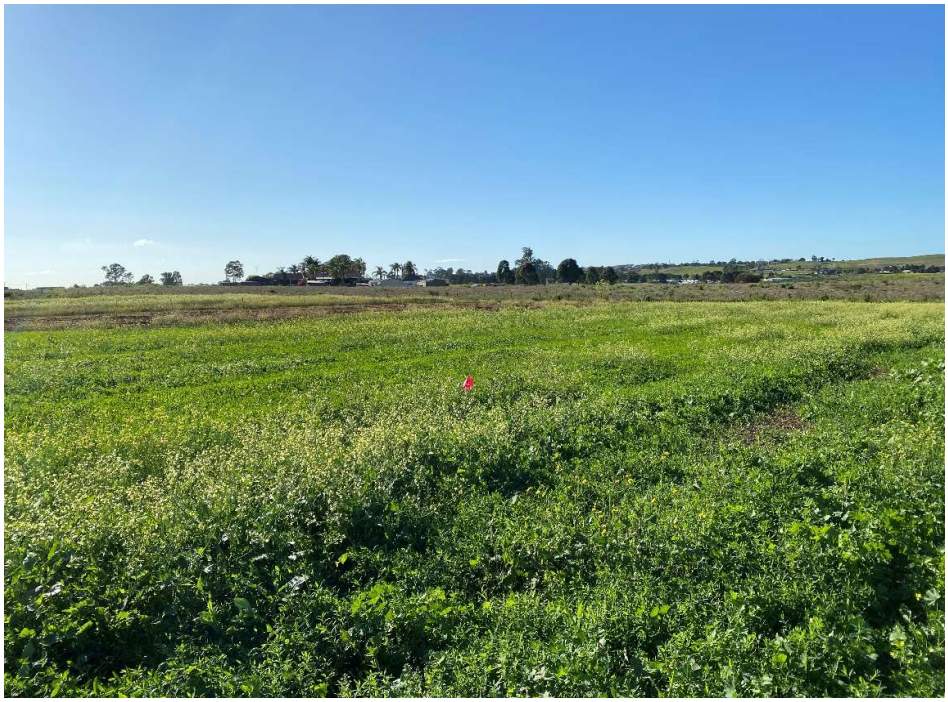

Photo 3 - Lot 53 general site conditions facing southeast at TP04 (22/09/2020)

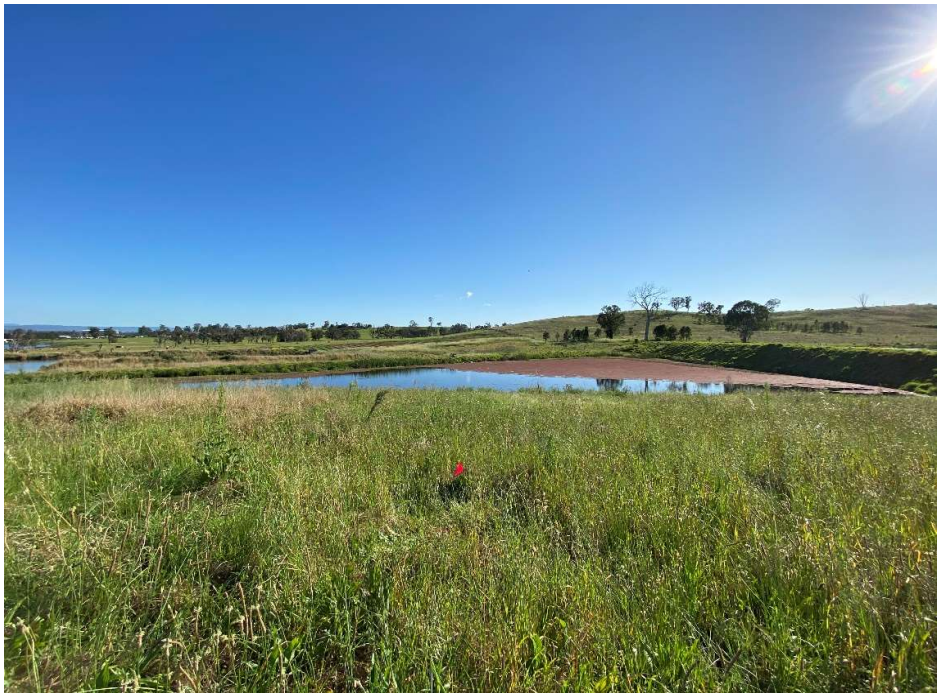

Photo 4 - Lot 53 general site conditions facing north at TP05 (22/09/2020)

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Kemps Creek, NSW
GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (2 of 6)

PSM3939-004L	FIGURE 3

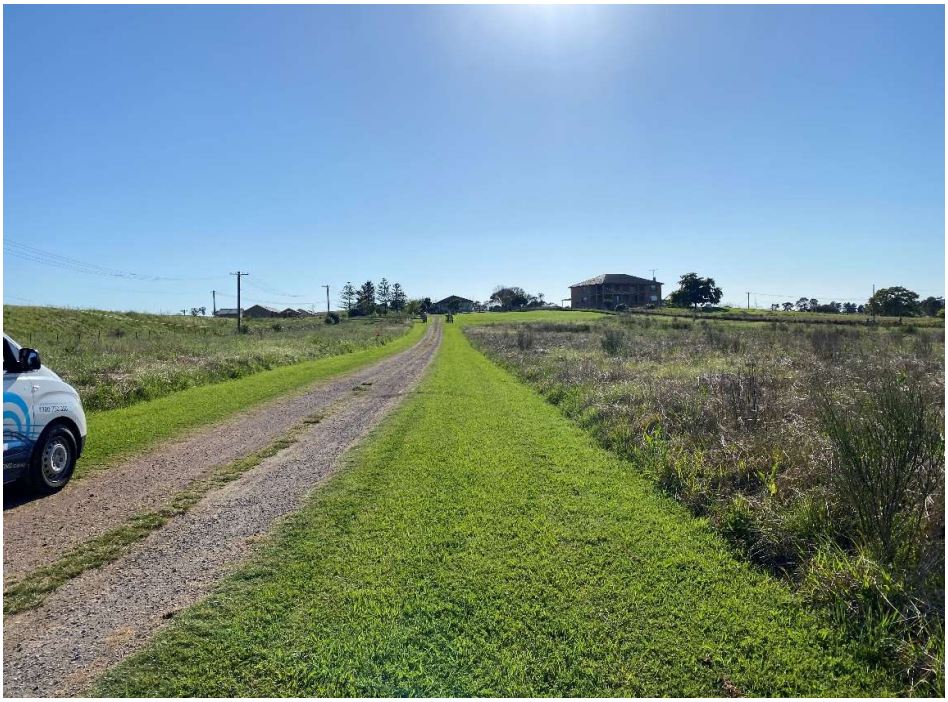

Photo 5 - Lot 52 general site conditions facing northeast at property entrance (22/09/2020)

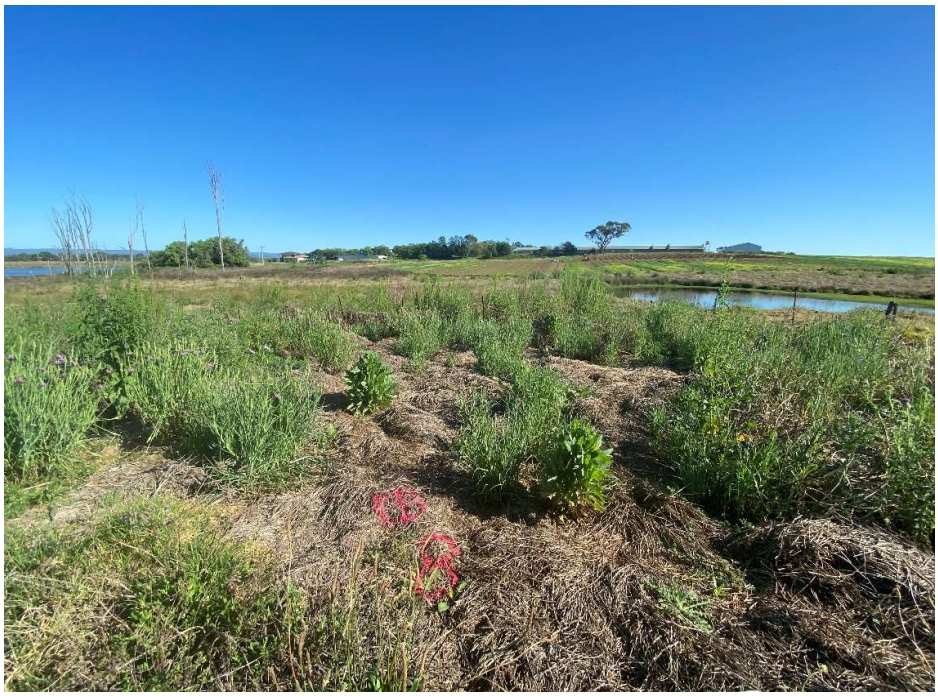

Photo 6 - Lot 52 general site conditions facing northwest at TP08 (22/09/2020)

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GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (3 of 6)

PSM3939-004L	FIGURE 4

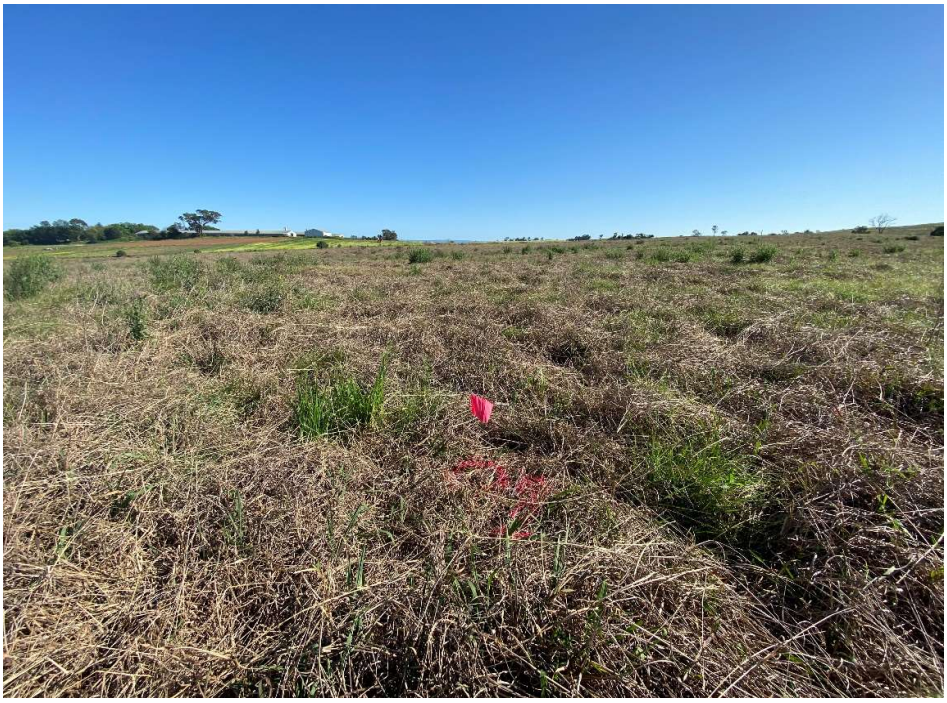

Photo 7 - Lot 52 general site conditions facing northwest at TP09 (22/09/2020)

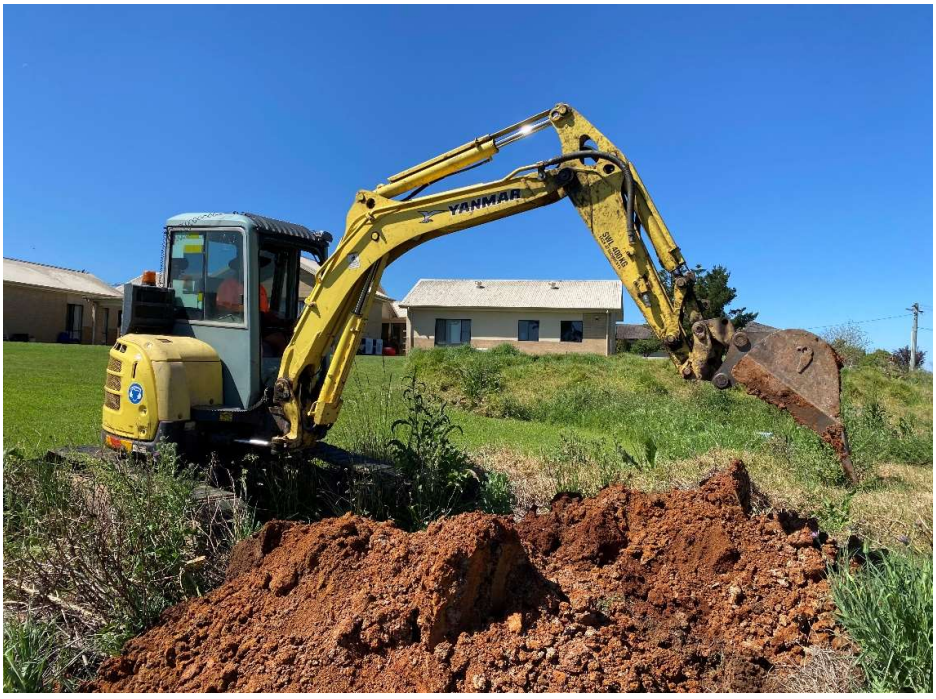

Photo 8 - 5 tonne excavator at TP08 (22/09/2020)

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GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (4 of 6)

PSM3939-004L	FIGURE 5

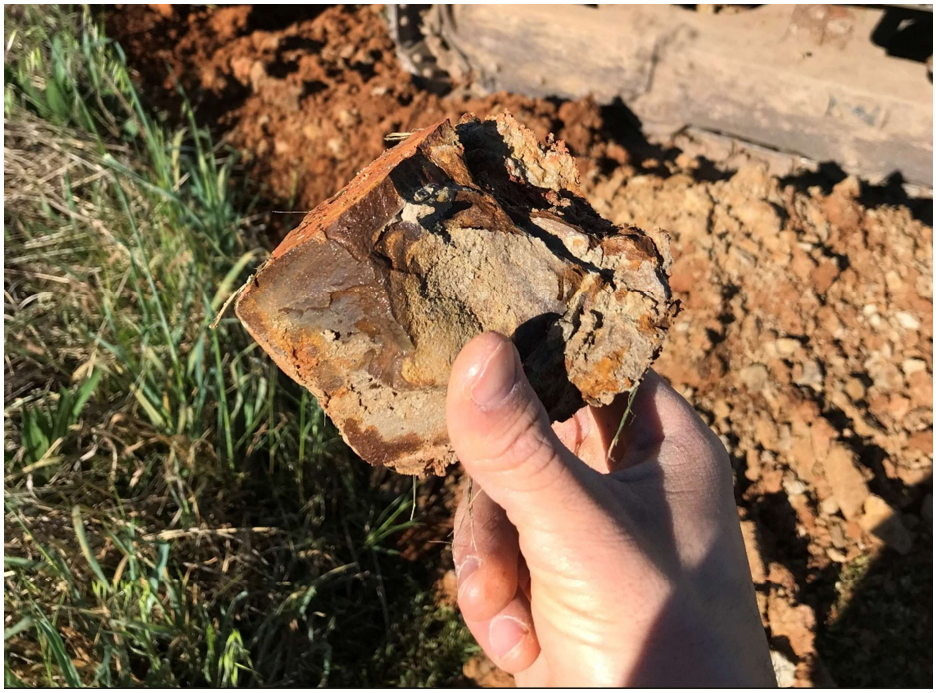

Photo 9 - Typical SHALE unit encountered

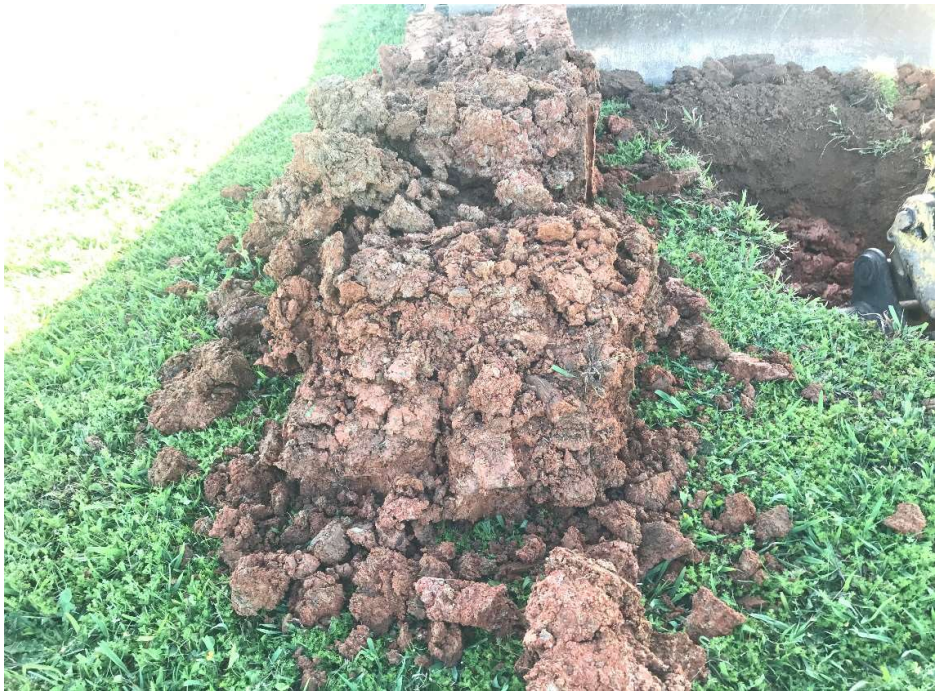

Photo 10 - Typical CLAY unit encountered

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Kemps Creek, NSW

GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (5 of 6)

PSM3939-004L	FIGURE 6

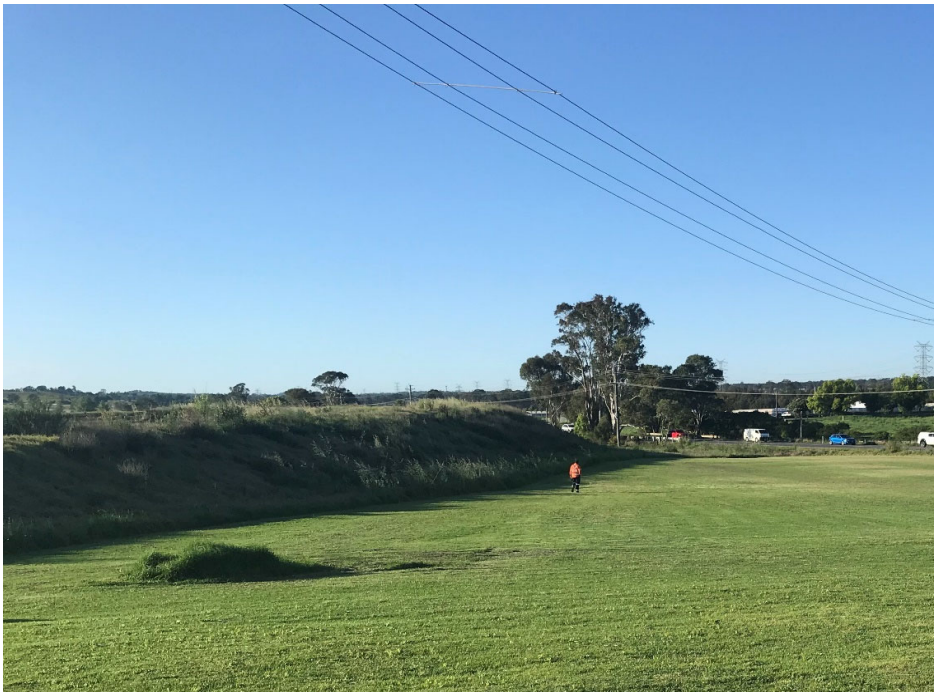

Photo 11 - Existing Fill around the dam, southwestern side of the property

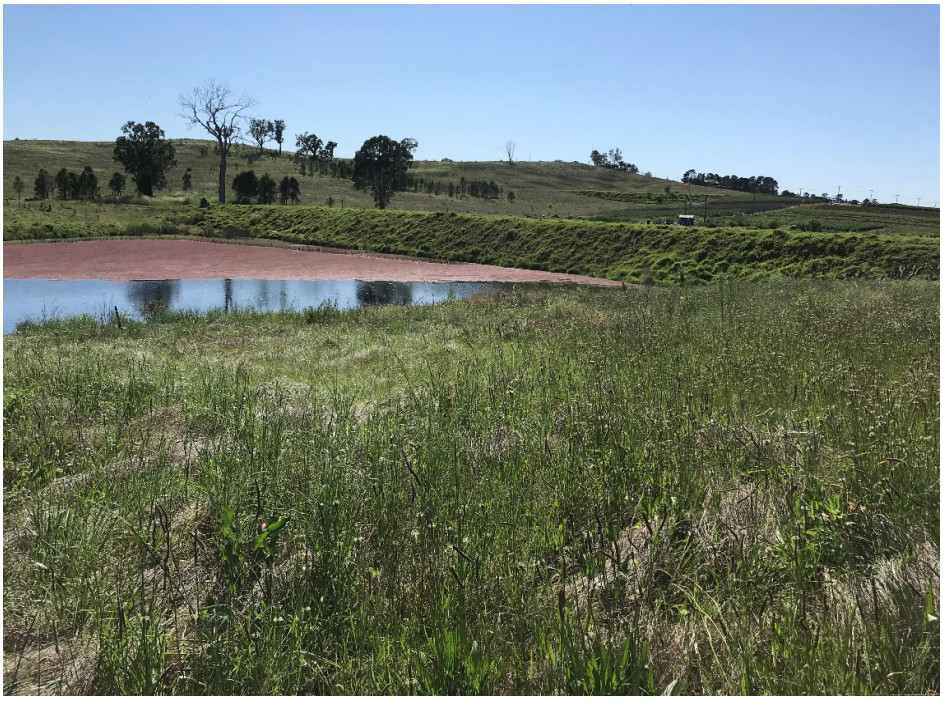

Photo 12 - Existing Fill around the dam, northeastern corner of the property

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Kemps Creek, NSW

GEOTECHNICAL INVESTIGATION
SELECTED SITE PHOTOGRAPHS (6 of 6)

PSM3939-004L	FIGURE 7

Appendix A
Tabulated Borehole Logs

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP01 (294927 mE, 6252547 mN)	0 – 0.2	CLAY with gravel; dark brown, low plasticity, sub-rounded gravel up to 15 mm, moist condition, firm consistency, grass and roots observed.	TOPSOIL
	0.2 – 2.7	CLAY; red- brown-grey, high plasticity, moist condition, stiff to very stiff consistency, roots observed. Becomes grey and yellow at 1.5 m. Weathered shale fragments from 2.0 m.	NATURAL SOIL CBR at 0.5 m – 1.0 m
	2.7 – 3.0	SHALE; red-brown, extremely weathered, very low strength.	BEDROCK
	3.0	Excavation terminated at 3.0 m.	Target Depth

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP02 (295001 mE, 6252434 mN)	0 – 0.2	CLAY trace gravel; dark brown, non-plastic to low plasticity, sub-angular gravel up to 5 mm, moist condition, firm consistency, grass and roots observed.	TOPSOIL
	0.2 – 1.8	CLAY; red-brown, medium to high plasticity, moist condition, stiff consistency, roots observed. Becomes grey at 1.5 m.	NATURAL SOIL Environment sample at 1.0 m
	1.8 – 2.0	SHALE; red-brown, highly weathered, very low to low strength.	BEDROCK
	2.0	Excavation terminated at 2.0 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP03 (295144 mE, 6252545 mN)	0 – 0.1	CLAY; dark brown, low plasticity, soft to firm consistency, grass and roots observed.	TOPSOIL
	0.1 – 1.0	CLAY; red-brown, high plasticity, moist condition, stiff consistency, roots observed.	NATURAL SOIL
	1.0 – 1.6	SHALE; red-brown and grey, highly weathered, very low to low strength. Becomes low strength at 1.5 m.	BEDROCK
	1.6	Excavation terminated at 1.6 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP04 (295326 mE, 6252691 mN)	0 – 0.2	CLAY with gravel; dark brown, non-plastic to low plasticity, sub-rounded gravel up to 10 mm, moist condition, firm consistency, grass and roots observed.	TOPSOIL
	0.2 – 0.9	CLAY; red-brown and grey, high plasticity, moist condition, very stiff consistency.	NATURAL SOIL Environment sample at 0.5 m
	0.9 – 1.0	SHALE; red-brown and grey, highly weathered, very low to low strength.	BEDROCK
	1.0	Excavation terminated at 1.0 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP05 (295503 mE, 6252782 mN)	0 – 0.1	CLAY trace gravel; dark brown, low plasticity, moist condition, soft consistency, sub-rounded gravel up to 5 mm, grass and roots observed.	TOPSOIL
	0.1 – 0.9	CLAY; red-brown, high plasticity, moist condition, stiff consistency.	NATURAL SOIL CBR at 0.5 m
	0.9 – 1.5	SHALE; pale brown and grey, highly weathered, very low to low strength.	BEDROCK
	1.5	Excavation terminated at 1.5 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP06 (295179 mE, 6252266 mN)	0 – 0.2	CLAY trace gravel; grey-brown, low plasticity, angular gravel up to 5 mm, moist to wet condition, soft consistency, grass, roots and worms observed.	TOPSOIL
	0.2 – 1.5	CLAY; red and orange-brown, high plasticity, moist condition, stiff consistency, roots observed. Becomes grey and very stiff at 1.0 m.	NATURAL SOIL CBR at 0.5 m
	1.5 – 2.4	SHALE; red-brown, extremely to highly weathered, very low to low strength.	BEDROCK
	2.4	Excavation terminated at 2.4 m.	Practical Refusal

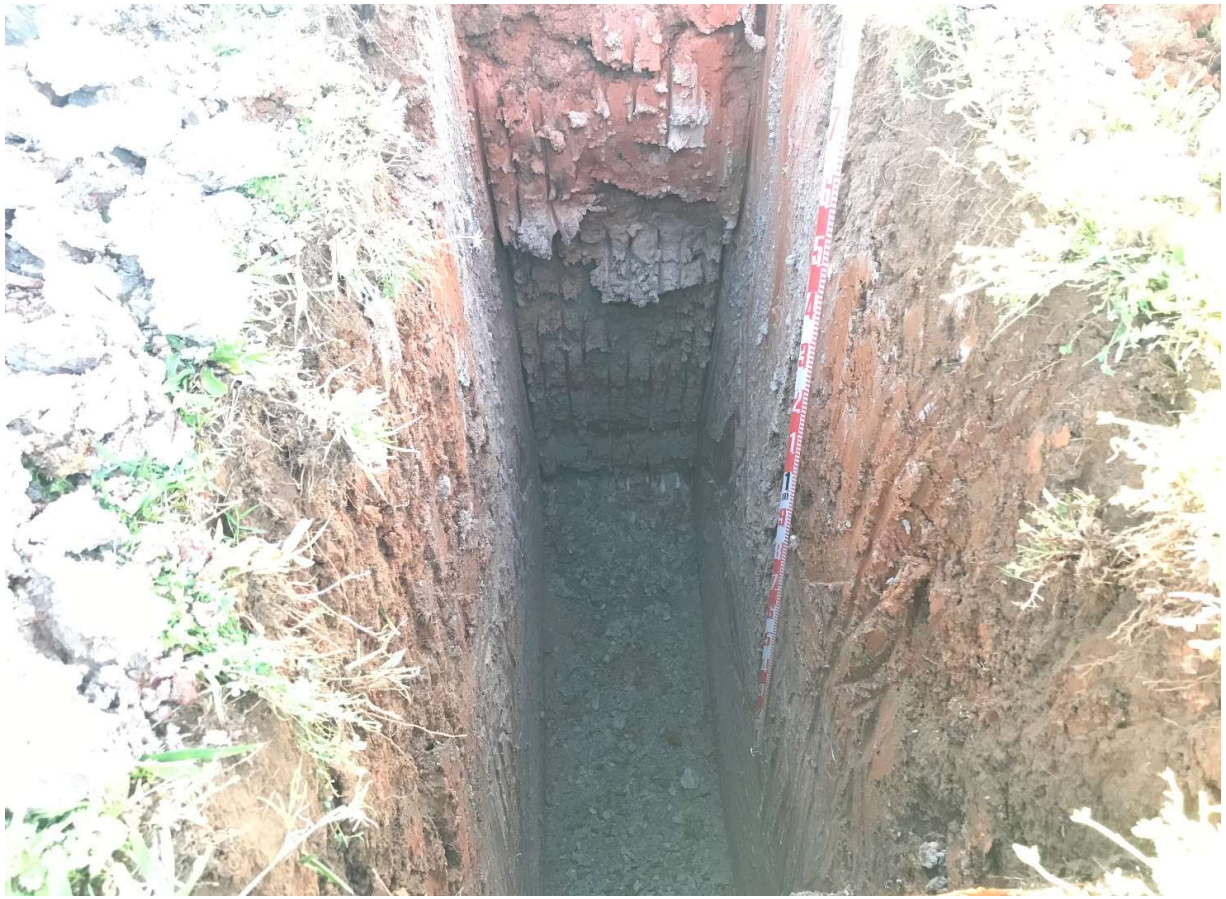
Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP07 (295269 mE, 6252341 mN)	0 – 0.2	CLAY; dark brown, low plasticity, soft consistency, grass and roots observed.	TOPSOIL
	0.2 – 1.7	CLAY trace gravel; red-brown, high plasticity, moist condition, stiff to very stiff consistency.	NATURAL SOIL Environment sample at 0.5 m
	1.7 – 2.0	SHALE; red-brown, highly weathered, low strength. Ironstone observed from 1.9 m.	BEDROCK
	2.0	Excavation terminated at 2.0 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP08 (295280 mE, 6252493 mN)	0 – 0.1	CLAY; dark brown, low plasticity, moist condition, soft to firm consistency, grass and roots observed.	TOPSOIL
	0.1 – 2.8	CLAY trace gravel; red-brown, medium to high plasticity, sob-rounded to sub-angular gravel up to 5 mm, moist condition, stiff to very stiff consistency, roots observed. Becomes brown-yellow-grey at 1.4 m. Becomes grey at 1.7 m.	NATURAL SOIL
	2.8 – 3.0	SHALE; brown-grey, extremely weathered, very low strength.	BEDROCK
	3.0	Excavation terminated at 3.0 m.	Target Depth

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP09 (295438 mE, 6252526 mN)	0 – 0.15	CLAY trace gravel; dark brown, low plasticity, sub-angular to angular gravel up to 10 mm, moist condition, soft consistency, grass, roots and worms observed.	TOPSOIL
	0.15 – 1.2	CLAY trace gravel; red, grey and yellow-brown, high plasticity, sub-angular to angular gravel up to 10 mm, moist condition, firm to stiff consistency.	NATURAL SOIL Environment sample at 0.5 m
	1.2 – 1.3	SHALE; brown-grey, highly weathered, low to medium strength.	BEDROCK
	1.3	Excavation terminated at 1.3 m.	Practical Refusal

Test Pit ID	Approximate Depth (m)	Material Encountered	Notes
TP10 (295532 mE, 6252657 mN	0 – 0.2	CLAY trace gravel; dark brown, low plasticity, sub-angular to angular gravel up to 10 mm, moist condition, soft consistency, grass, roots and worms observed.	TOPSOIL
	0.2 – 1.2	CLAY trace gravel; red, grey and yellow-brown, high plasticity, sub-angular to angular gravel up to 10 mm, moist condition, firm to stiff consistency.	NATURAL SOIL CBR at 0.5 m
	1.2 – 1.6	SHALE; grey, extremely weathered, low strength. Becomes highly weathered, low to medium strength at 1.5 m.	BEDROCK
	1.6	Excavation terminated at 1.6 m.	Practical Refusal

Appendix B
Test Pit Photos



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884-928 Mamre Road
Kemps Creek, NSW
GEOTECHNICAL INVESTIGATION
TP01

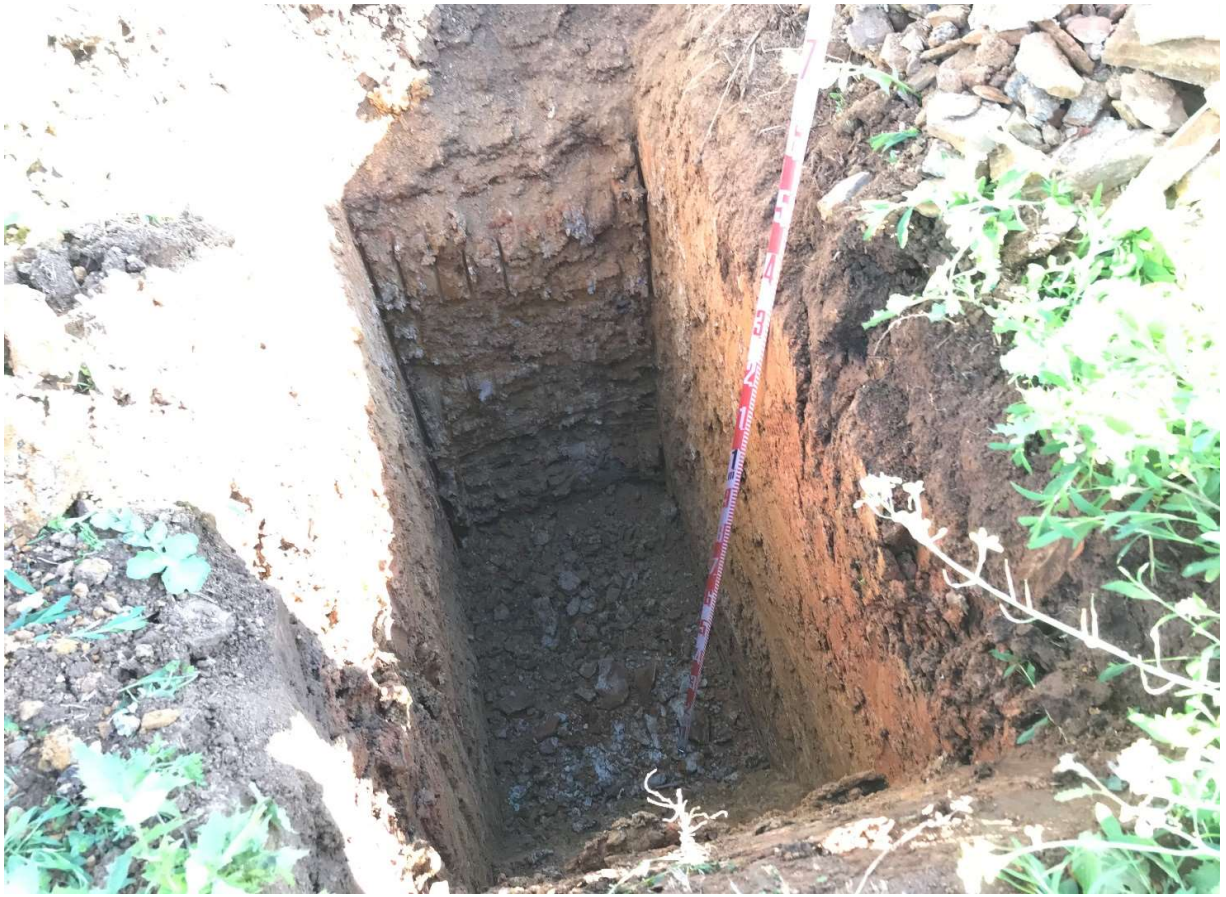
PSM3939-004L	Appendix B

Altis Property Partners
884-928 Mamre Road
Kemps Creek, NSW
GEOTECHNICAL INVESTIGATION
TP02

PSM3939-004L	Appendix B

Altis Property Partners
884-928 Mamre Road
Kemps Creek, NSW
GEOTECHNICAL INVESTIGATION
TP03

PSM3939-004L	Appendix B



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GEOTECHNICAL INVESTIGATION

TP07

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GEOTECHNICAL INVESTIGATION
TP08

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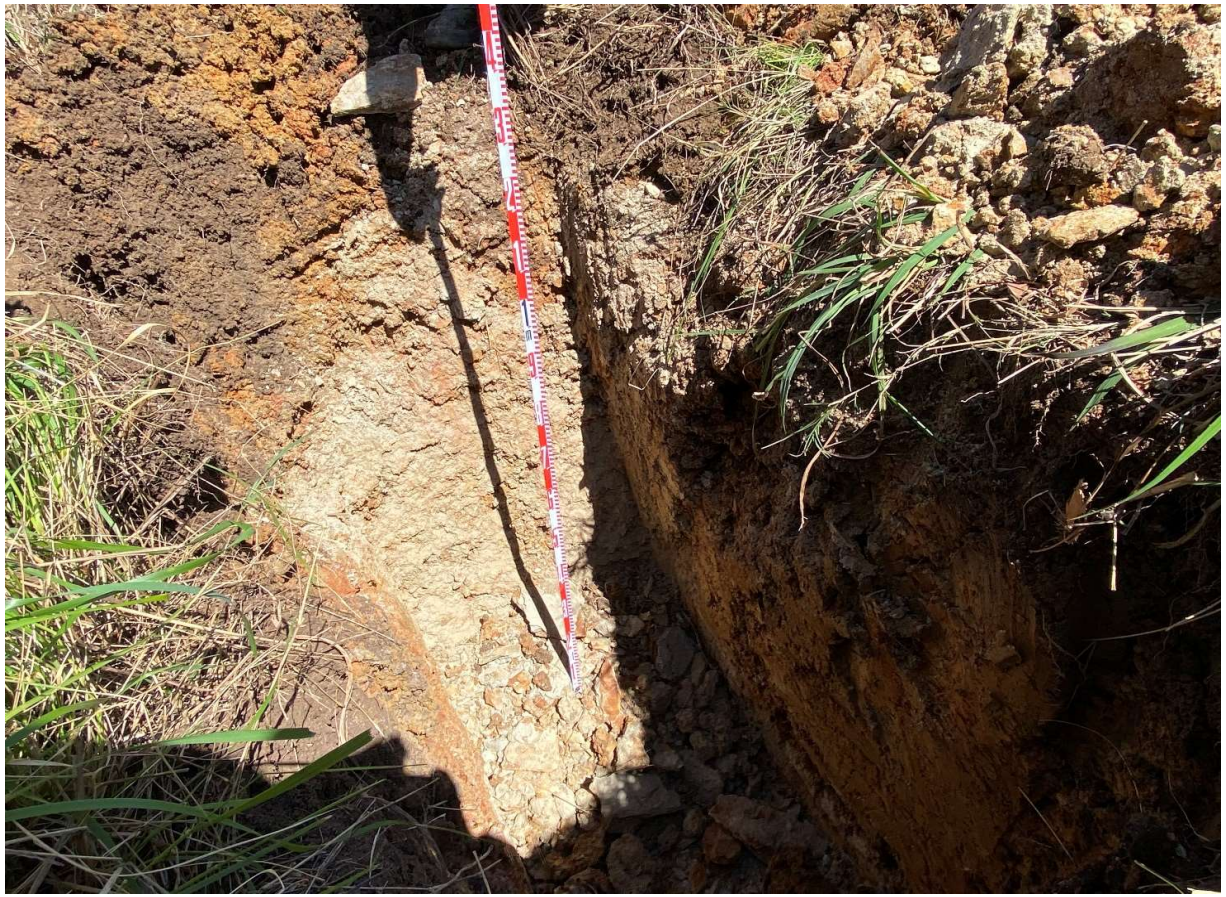

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Kemps Creek, NSW
GEOTECHNICAL INVESTIGATION
TP09

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884-928 Mamre Road

Kemps Creek, NSW

GEOTECHNICAL INVESTIGATION

TP10

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Appendix C
CBR Test Results

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES

ABN 43 002 145 173

FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client:	Pells Sullivan Meynink	**Ref No:**	L4501E
PSM Job No.: PSM3939		**Report:**	1
Location:	884-904 Mamre Road, Kemps Creek, NSW	**Report Date:**	1/10/2020
		Page 1 of 1	

TESTPIT NUMBER	TP 1	TP 6	TP 10
DEPTH (m)	0.50 - 1.00	0.5	0.5
Surcharge (kg)	4.5	4.5	4.5
Maximum Dry Density (t/m^3)	1.70 STD	1.60 STD	1.72 STD
Optimum Moisture Content (%)	20.5	22.2	19.5
Moulded Dry Density (t/m^3)	1.66	1.58	1.65
Sample Density Ratio (%)	98	99	96
Sample Moisture Ratio (%)	98	96	109
Moisture Contents			
Insitu (%)	25.0	29.1	26.5
Moulded (%)	20.1	21.4	21.2
After soaking and			
After Test, Top 30mm(%)	35.5	35.8	33.0
Remaining Depth (%)	23.0	26.7	22.7
Material Retained on 19mm Sieve (%)	0	0	0
Swell (%)	4.5	4.5	4.5
C.B.R. value: @2.5mm penetration	1.5	1.0	2.0

NOTES:
- Sampled and supplied by client. Samples tested as received.
- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods: AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 22/09/2020.
- All samples dried back prior to testing as too wet.

NATA

NATA Accredited Laboratory Number:1327

01/10/2020

Authorised Signature / Date
(D. Treweek)

Appendix D
Analytical Test Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2033538**	Page	: 1 of 3
Client	: **PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MATIAS BRAGA	Contact	: Customer Services ES
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 884-928 Mamre Road, Kemps Creek	Date Samples Received	: 23-Sep-2020 12:30
Order number	: ----	Date Analysis Commenced	: 25-Sep-2020
C-O-C number	: ----	Issue Date	: 30-Sep-2020 15:03
Sampler	: Omid Ghaffaripour		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 5		
No. of samples analysed	: 5		

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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 Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED045G: LOR raised for Chloride on sample 4 due to sample matrix.
- 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+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP02-1.0m	TP04-0.5m	TP05-0.5m	TP07-0.5m	TP09-0.5m
			Client sampling date / time	22-Sep-2020 08:00	22-Sep-2020 08:45	22-Sep-2020 09:10	22-Sep-2020 10:15	22-Sep-2020 11:00
Compound	CAS Number	LOR	Unit	ES2033538-001	ES2033538-002	ES2033538-003	ES2033538-004	ES2033538-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.3	5.4	5.5	6.0	5.8
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	712	168	288	60	60
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	13.1	21.9	15.8	22.2	18.9
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	1400	5950	3470	16700	16700
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	2.3	0.9	1.2	3.4
Exchangeable Magnesium	----	0.1	meq/100g	----	14.1	12.4	13.1	8.1
Exchangeable Potassium	----	0.1	meq/100g	----	0.3	0.2	0.2	0.1
Exchangeable Sodium	----	0.1	meq/100g	----	3.3	4.3	3.4	1.5
Cation Exchange Capacity	----	0.1	meq/100g	----	20.1	17.9	17.9	13.1
Exchangeable Sodium Percent	----	0.1	%	----	16.6	24.1	19.0	11.5
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	<0.1	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	4.1	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	<0.1	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	1.9	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	6.2	----	----	----	----
Exchangeable Sodium Percent	----	0.1	%	31.0	----	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	150	120	140	20	30
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	1340	130	310	<100	40

Appendix E
PSM3939-005L (IGDA)

G3 56 Delhi Road
North Ryde NSW 2113
P +61-2 9812 5000
F +61-2 9812 5001
E mailbox@psm.com.au
www.psm.com.au

Our Ref: PSM3939-005L REV3

15 July 2021

Project Strategy
c/- Altis Property Partners
PO Box 271
SUTHERLAND NSW 1499
amurr@projectstrategy.com.au

Attention: Anthony Murr

Dear Anthony

RE: 884-928 MAMRE ROAD, KEMPS CREEK
INTERIM GEOTECHNICAL DESIGN ADVICE

1. Introduction

This letter provides the interim geotechnical design advice for the proposed warehouse development on Lot 1 and subdivision works at 884-928 Mamre Road, Kemps Creek. The work was undertaken in accordance with PSM proposal (PSM3939-002L) dated 31 August 2020. Figure 1 presents the locality plan.

2. Bulk Earthworks

We assume the proposed development will comprise standard lightweight warehouse facilities.

The design intent is for the bulk earthworks on site to be completed in accordance with a PSM Specification – PSM3939-006S REV0. The Specification sets out clearly the roles and responsibilities of the earthworks contractor and its Geotechnical Inspection and Testing Authority (GITA). The Specification will only be varied with the consent of PSM to ensure that this interim design advice is able to be confirmed at the completion of the earthworks.

The Specification allows for a broad range of fill to be incorporated into the earthworks. The Specification requires close inspection, and frequent testing to provide a high level of confidence that the completed work complies with the Specification.

We have based our assessment of moduli on numerous plate load tests (PLTs) completed on VENM/ENM fills by PSM. Fill placed in accordance with such a specification is referred to herein as ENGINEERED FILL. The criteria for and selection of acceptable material is set out in Clause 2.3 of the Specification.

If the structural or civil engineer requires engineering properties different to those provided in Section 3 then the Specification can be modified such that these properties will be obtained in the final earthworks. This allows the additional cost of the earthworks to be balanced against any economies achieved in other parts of the works.

3. Geotechnical Advice for the Proposed Development

3.1 General

The design advice provided in the following sections has been prepared on the following basis:

- The subsurface conditions are as those encountered in the test pits reported in PSM3939-004L dated 9 October 2020
- The earthworks are to be completed in accordance with the PSM bulk earthworks specification PSM3939-006S REV0
- The proposed new facility will comprise typical light warehouse facilities.

If any of the above is not applicable, PSM should be requested to confirm that the design advice below is still valid.

We note that desiccation and/or wetting up of the pad surface is possible should it be exposed to the elements for an extended period of time, particularly at completion of the bulk earthworks prior to the builder taking responsibility for the pad. To reduce the likelihood of this and preserve the pad condition we recommend the following should be considered following completion of the bulk earthworks:

- Placement of a sacrificial layer comprising road base or other equivalent material
- Grade the pad surface to reduce the extent and severity of standing water during and after weather events
- Minimise the time between the completion of earthworks and the builder commencing construction of the warehouse roof
- Limit vehicular and plant access until a roof has been installed.

Alternately, the builder may have to undertake some surficial remediation if the pad is to comply with the requirements of this IGDA (i.e. comply with the PSM Specification) at the time of construction. It is PSM's opinion that it should be the builder's responsibility to maintain the condition of the pad after the handover date and accept the risk that comes with modifying excavation levels and weather. There should be a strict transfer of the risk. We recommend that building tenderers be required to indicate how they intend to manage this risk.

3.2 Site Classification

While the proposed development is out of scope of AS2870-2011 "Residential slabs and footings", we assess that, upon removal of the uncontrolled fill and for fill placed in accordance with the Specification, the characteristic surface movement, ys, would be in the range 40 mm to 60 mm and thus would classify the site as Class H1. The civil and structural engineers should consider likely heave / settlement due to the effect of climatic factors in their designs.

We recommend that all structures and services be detailed such that they preclude any local wetting up or drying out of the subgrade after initial equilibrium is reached following construction of the slab and that the subgrade be within specification at the time of construction of the slab. We note that normal mounding or sagging away from the perimeter of covered areas will still occur and perimeters, or open joints, will still respond to environmental changes.

For effectively sealed areas away from the perimeter, the design should allow for the following:

- Differential mound movement, y_m = 20 mm. We note that this is not the total heave or settlement but the estimated local heave or settlement due to fill variability
- Tilts of up to approximately 1 in 300.

Mounds at perimeters or penetrations of slabs open to the environment can be taken to be as per AS2870-2011 for ys = 55 mm.

3.3 Foundations

3.3.1 Shallow Foundations

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 1

We note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly. As the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements can be estimated using the elastic parameters provided in Table 1. When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load shall also be assessed.

Foundation conditions at the proposed shallow pad footings locations should be inspected by a suitably qualified geotechnical engineer prior to the pouring of concrete.

Table 1 – Engineering Parameters of Inferred Geotechnical Units

Inferred Unit	Bulk Unit Weight (kN/m^3)	Soil Effective Strength Parameters		Ultimate Bearing Pressure under Vertical Centric Loading[2] (kPa)	Allowable Bearing Pressure under Vertical Centric Loading[3] (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Parameters	
		c' (kPa)	*Φ'* (deg)				Young's Modulus (MPa)	Poisson's Ratio
ENGINEERED FILL, NATURAL SOIL	18	0	30	400[1]	150[1]	N.A.	10	0.3
BEDROCK	22	N.A.	N.A.	3000[2]	700[3]	50	100	0.25

Note: 1. Minimum plan dimension of 1.0 m and a minimum embedment depth of 0.5 m.
2. Ultimate bearing pressure for bedrock assumes a settlement of approximately 5% of the least footing dimension for footings in rock.
3. Allowable bearing pressure assumes a settlement of approximately 1% of the least footing dimension for footings in rock.

3.3.2 Piled Foundations

Piled foundation should be founded within the bedrock unit.

Piles should be designed in accordance with the requirements in AS 2159 (2009), *Piling – Design and Installation.* The parameters provided in Table 1 may be adopted in the design of piles founded in the BEDROCK units.

The foundation designer should note the following with regards to the pile design:

- The ABP needs to be confirmed by a geotechnical engineer during a pile inspection
- Under permanent load, the contribution of side adhesion for soils including soil units should be ignored
- Pile settlement needs to be checked using the recommended elastic parameters in Table 1

The bearing capacities provided are contingent on piles or footings being vertically and centrally loaded. Further advice should be sought if the footings are not vertically centrically loaded. Should higher bearing capacities be required in Table 1, further advice should be sought from PSM.

With regards to the pile design we recommend that:

- A geotechnical strength reduction factor, Φ_g = 0.60 (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) between 2.5 and 3.0. This should be reviewed to suit the specific design and appropriate pile testing proposed by the structural designers in accord with the requirements of AS2159
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc
- If a geotechnical strength reduction factor, Φ_g = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

Foundation conditions at the proposed pile locations should be inspected by a suitably qualified geotechnical engineer prior to pouring concrete to confirm this advice.

3.4 Temporary and Permanent Batters

The batter slope angles shown in Table 2 are recommended for the design of batters up to 3 m height and above the groundwater table: subject to the following recommendations:

1. All batters shall be protected from erosion.
2. Permanent batters shall be drained.
3. Temporary batters shall not be left unsupported for more than 1 month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events.
4. Where loads are imposed or structures/services are located within one batter height of the crest of the batter, further advice should be sought.

Table 2 – Batter Slope Angles

Unit	Temporary	Permanent
ENGINEERED FILL, NATURAL SOIL	2H : 1V	2.5H : 1V
BEDROCK	1H : 1V	1.5H : 1V

If the conditions above cannot be met, further advice should be sought.

Steeper batters may be possible subject to further advice, likely including inspection during construction.

3.5 Excavation Support

Permanent cuts in the ENGINEERED FILL, RESIDUAL SOIL and BEDROCK unit's steeper than the recommended permanent batter slopes in Table 2 will need to be supported by some form of retaining structure.

Note that design of retention systems may be based on either K_a or K_o earth pressures. Design using active earth pressures provides the minimum lateral earth pressure that must be supported to avoid failure and requires a wall that can rotate or translate to allow the pressures to reduce to these values (vertical and lateral movements up to 2% of height may occur, typical movements will be much less).

Where the design is based on K_o pressures, construction should be carefully controlled to avoid unwanted effects. It should be noted that designing for K_o pressures does not, of itself, ensure that movement does not occur. Movements are controlled by the construction method, especially sequence.

The design of these structure should be based on the:

- Proposed wall geometry
- Effective soil strength parameters in Table 1
- 10 kPa lateral pressure for vertical cuts in BEDROCK. This is to allow for blocks and rock wedges formed due to adverse defects that may exist within the unit
- Surcharge loads behind the retention

- Water pressure. The designer shall consider the information regarding groundwater in this report and the drainage features included in the design of the retention system.

Both surface and sub-surface drainage needs to be designed and constructed properly to prevent pore water pressures from building up behind the retaining walls or appropriate water pressures must be included in the design.

3.6 Pavements

Results of CBR testing indicated a soaked CBR value of 1.0 to 2.0% (Ref. PSM3939-004L).

We advise that a CBR of 1.5% can be adopted for subgrade and fill formed in bulk earthworks constructed in accordance with the Specification. Higher values may be provided on completion of testing on the finished bulk earthworks or if, on request, the Specification is varied to obtain such higher values on fill.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised.

3.7 Slab

The design of slabs on ground on the ENGINEERED FILL can be based on a subgrade with a long-term Young's Modulus of 10 MPa. The short-term Young's modulus can be taken to be 15 MPa.

We note that the environmental effects (e.g. drying or wetting up of the finished surface) affecting the land prior to development should be taken into account by the various designers of the proposed development.

We note that the final bulk earthworks subgrade will require proof rolling and plate load testing to confirm the properties provided and may require some boxing out and refilling, etc.

We understand that the structural engineer should be able to design efficient slabs. If assessed deformation and settlement is an issue, our advice can be further refined if required.

The structural designer or builder may wish to employ a surface layer of road base / crushed sandstone / concrete for trafficability or structural purposes. This is not required to achieve the properties provided in this design advice.

4. Conclusion

If at any time, the conditions encountered vary from those described in PSM3939-004L dated 9 October 2020, further advice should be sought.

If you have any queries, please do not hesitate to contact the undersigned.

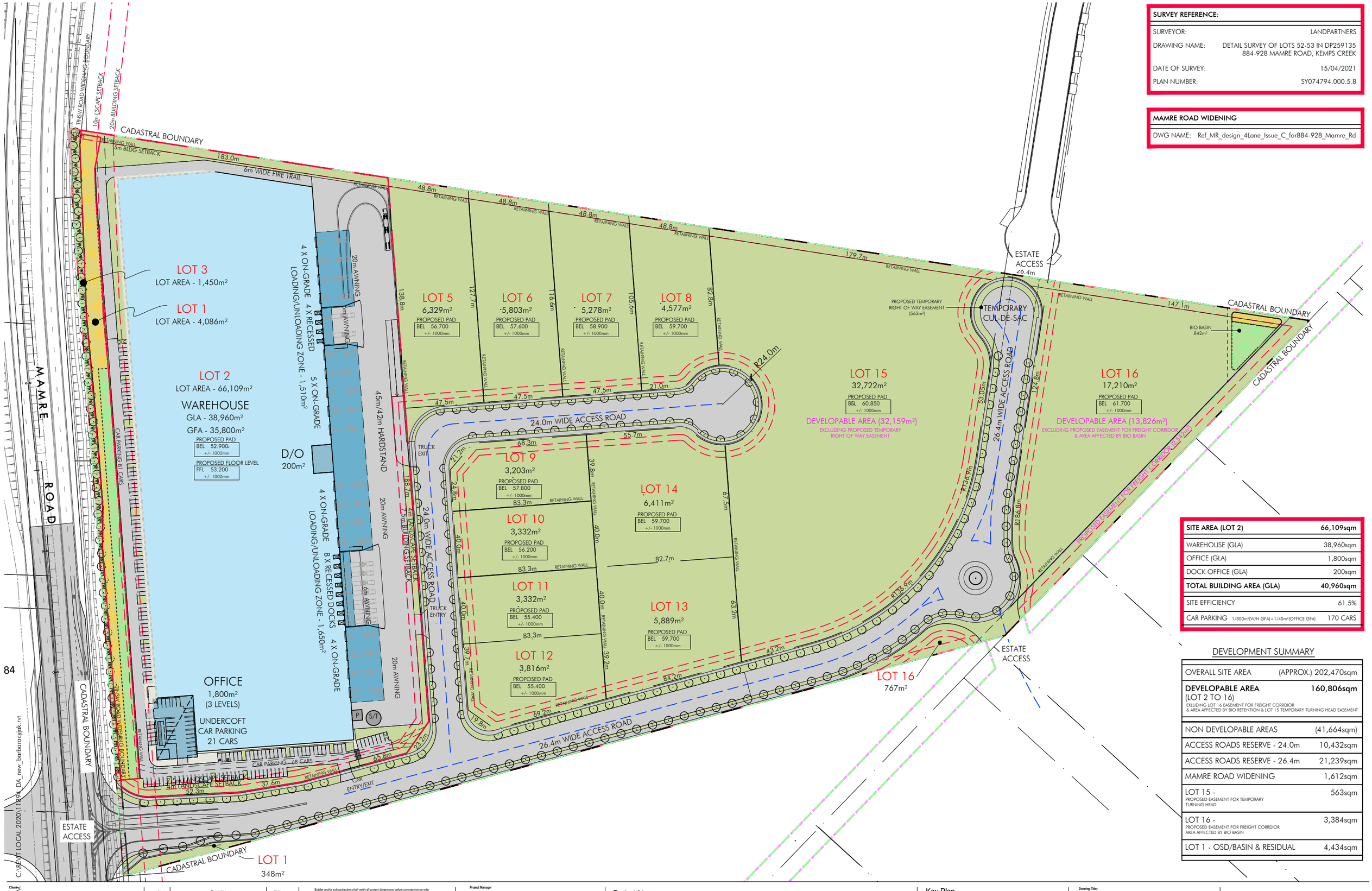
For and on behalf of
PELLS SULLIVAN MEYNINK

BRYAN TAM
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Encl:

Figure 1 – Locality Plan



SURVEY REFERENCE:

SURVEYOR:	LANDPARTNERS
DRAWING NAME:	DETAIL SURVEY OF LOTS 52-53 IN DP259135 884-928 MAMRE ROAD, KEMPS CREEK
DATE OF SURVEY:	15/04/2021
PLAN NUMBER:	SY074794.000.5.8

MAMRE ROAD WIDENING

DWG NAME: Ref_MR_design_4Lane_Issue_C_for884-928_Mamre_Rd

SITE AREA (LOT 2)	**66,109sqm**
WAREHOUSE (GLA)	38,960sqm
OFFICE (GLA)	1,800sqm
DOCK OFFICE (GLA)	200sqm
TOTAL BUILDING AREA (GLA)	**40,960sqm**
SITE EFFICIENCY	61.5%
CAR PARKING 1/300m²(W/H GFA)+1/40m²(OFFICE GFA)	170 CARS

DEVELOPMENT SUMMARY

OVERALL SITE AREA	(APPROX.) 202,470sqm
DEVELOPABLE AREA (LOT 2 TO 16) EXLUDING LOT 16 EASEMENT FOR FREIGHT CORRDIOR & AREA AFFECTED BY BIO RETENTION & LOT 15 TEMPORARY TURNING HEAD EASEMENT	**160,806sqm**
NON DEVELOPABLE AREAS	(41,664sqm)
ACCESS ROADS RESERVE - 24.0m	10,432sqm
ACCESS ROADS RESERVE - 26.4m	21,239sqm
MAMRE ROAD WIDENING	1,612sqm
LOT 15 - PROPOSED EASEMENT FOR TEMPORARY TURNING HEAD	563sqm
LOT 16 - PROPOSED EASEMENT FOR FREIGHT CORRDIOR AREA AFFECTED BY BIO BASIN	3,384sqm
LOT 1 - OSD/BASIN & RESIDUAL	4,434sqm

Client

ALTIS PROPERTY PARTNERS

8/09/2021 3:20:16 PM

Issue	Description	Date
P8	DRAFT - ISSUE FOR APPROVAL	13.07.2021
P7	DRAFT - ISSUE FOR APPROVAL	09.07.2021
P6	DRAFT - ISSUE FOR APPROVAL	02.07.2021
P5	DRAFT - ISSUE FOR APPROVAL	30.06.2021
P4	DRAFT - MAMRE ROAD AND SOUTHERN BDY UPDATED	11.06.2021
P3	DRAFT	08.06.2021
P2	DRAFT	14.05.2021
P1	DRAFT - CONTEXT SUBMISSION	14.04.2021

ISSUE FOR
S4.55

Project Manager

ProjectStrategy

Project Name

Project Address

884-928 Mamre Road, Kemps Creek, NSW

Key Plan

0 2000 5000

Drawing Title:
Masterplan / Benching Plan

Author:	Checker:	Sheet Size:	Scale:
MA	MA	A1	1:1000

Drawing Number: **11894_DA004**

Issue: **P8**

nettleton tribe

nettleton tribe partnership pty ltd ABN 58 161 683 122

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Appendix F
PSM3939-006S (Bulk Earthworks Specification)

Altis Property Partners

884-928 Mamre Road, Kemps Creek

Bulk Earthworks Specification - Filling, Cutting and Testing

PSM3939-006S 9 October 2020

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1. Scope 3

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1. Scope

This specification details the requirements for the bulk earthworks to be undertaken at 884-928 Mamre Road, Kemps Creek, NSW. The area where this specification is applicable is shown in Figure 1. This includes areas where material is filled to bulk earthworks level (BEL) within the site.

Fill placed in accordance with this specification is denoted as Engineered Fill.

This specification does not address any environmental, contamination or erosion issues with respect to the fill material.

There is a HOLD POINT on placing fill in Section 2.4 of this specification.

2. Filling Works

2.1 Subgrade Preparation

The condition of the subgrade should be assessed immediately prior to the commencement of filling.

All Engineered Fill is to be placed on one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Engineered compacted fill placed in accordance with this or other approved specifications for which the Geotechnical Inspection and Testing Authority (GITA) has a Level 1 certificate certifying compliance with that approved specification AND of at least stiff consistency.
4. Other materials as approved by PSM (including Existing Fill).

Sediment within existing dams/ponds will be required to be removed for the subgrade to meet the above requirement.

Proof rolling shall only be undertaken under the direction of PSM. PSM may also direct a bridging layer of Engineered Fill be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 95% and 102%. Any such layer shall be a Lot under Clause 5.3.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be moisture conditioned and compacted to be in accordance with Clauses 2.5 and 2.6 of this specification.

Engineered Fill shall be placed only on subgrade approved by the GITA as being in accordance with this specification.

2.2 Base Geometry and Permanent Batters

The slope of any buried batter shall be less than 2H:1V unless otherwise directed by PSM.

The contractor shall remove or flatten any geometrical obstructions (e.g. protrusions or holes) such that subsequent Engineered Fill can be placed to achieve the requirements of this specification.

Engineered Fill shall be placed only on areas where the base geometry has been approved by the GITA.

Permanent batters in fill shall be built by overfilling then cut back to the final slopes as shown in the bulk earthworks drawings, e.g. 2H:1V, or other method as approved by PSM.

2.3 Material

2.3.1 Imported Fill

Imported Engineered Fill is to conform to one of the following definitions:

1. "Virgin excavated natural material" (**VENM**) as defined by the Protection of the Environment Operations Act 1997 No 156, Schedule 1, on Page 209:

   "Virgin excavated natural material (e.g. clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

a. has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphide ores or soils, or.

b. consists of excavated natural materials that meet such criteria as may be approved by the EPA".

2. "Excavated natural material" (**ENM**) as defined under Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014:

"Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

a. been excavated from the ground, and

b. contains at least 98% (by weight) natural material, and

c. does not meet the definition of Virgin Excavated Natural Material in the Act.

Excavated Natural Material does not include material that has been located in a hotspot; that has been processed; or that contains asbestos, Acid Sulphate Soils (ASS), Potential Acid Sulphate soils (PASS) or sulfidic ores."

2.3.2 Site Won Material

Site won material shall comprise material won from excavations on site. They need to satisfy Clause 2.3.3.

2.3.3 All Fill

The Engineered Fill shall be approved by the GITA as suitable for use in a structural fill.

Engineered Fill shall not comprise unsuitable material as defined by Clause 4.3 of AS3798-2007 "Guidelines on earthworks for commercial and residential developments" as:

a. "organic soils, such as many topsoils, severely root-affected subsoils and peat.

b. materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture.

c. materials containing substances which can be dissolved or leached out in the presence of moisture (e.g.: gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g.: some shales and sandstones), unless these matters are specifically addressed in the design.

d. silts, or materials that have the deleterious engineering properties of silt.

e. other materials with properties that are unsuitable for the forming of structural fill; and.

f. fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill."

The GITA shall assess that the proportion of deleterious material in each Lot is not greater than 1% by weight. Deleterious material is defined by Table 3015.3 of the RTA QA Specification 3051 (Edition 5 June 1998) as:

"Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter".

If the GITA is not able to visually assess the above criterion, the GITA shall arrange appropriate testing.

All Engineered Fill particles shall be able to be incorporated within a single layer. Further, less than 30% of particles shall be retained on the 37.5 mm sieve.

Engineered Fill shall be able to be tested in accordance with the Standard Compaction method (AS1289.5.4.1) or Hilf test method (AS1289.5.7.1). These methods require less than 20% retained on the 37.5 mm sieve. Where between 20% and 30% of particles are retained on the 37.5 mm sieve the above test methods shall still be adopted and test reports annotated appropriately.

These requirements should be met by the material after placement and compaction.

Only material approved by the GITA shall be placed as Engineered Fill.

2.4 Fill Zonation

Table 1 - HOLD POINT

Process Held	Placing of Fill
Submission detail	The Contractor / GITA submit to PSM a Weekly Certificate as defined in Clause 6.2.1 of this specification for the earthworks completed to the previous Saturday no later than 5 pm of the subsequent Wednesday.
Release of Hold Point	PSM to confirm receipt of Weekly Certificate and recommend release of Hold Point if initial assessment of the Weekly Certificate indicates it complies with requirements of this specification. The contract superintendent should then release the Hold Point if it considers appropriate.

2.5 Compaction

Engineered Fill shall be placed and compacted to a Dry or Hilf Density Ratios (Standard Compaction) of between 98% and 102%.

The insitu density shall be measured over the full depth of each layer placed.

2.6 Moisture Control

The placement moisture variation or Hilf moisture variation shall be controlled to be between 2% dry of optimum and 2% wet of optimum.

Placement moisture content of the Engineered Fill shall be measured.

3. Cutting

3.1 Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Existing fill and other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be excavated and filled to the BEL in accordance with this specification.

4. Survey

4.1 Filling Areas

The survey requirements are as follows:

1. Any approved subgrade shall be surveyed prior to first filling such that subgrade levels are established to within ± 0.1 m. The area subject to approval shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
2. The Lot boundaries shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
3. The location of the field density tests shall be assessed and shown on the Lot boundary plan drawing to an accuracy of at least +/-5 m in plan.

4. The elevation of the field density tests shall be surveyed to an accuracy of +/-0.05 m.

The plan drawing shall show at the boundaries of the site and other identifiable site features, so as to allow the location of the lots and the test to be recoverable.

4.2 Cutting Areas

Any approved subgrade for cut areas shall be surveyed such that subgrade levels are established to within ± 0.1 m.

5. Inspection and Testing

5.1 Role of the GITA

The Geotechnical Inspection and Testing Authority (GITA) shall be contracted to document and certify that the works undertaken by the contractor has been completed in accordance with the relevant design and specifications.

5.2 Level 1 Control

The GITA shall adopt Level 1 responsibility as described in Section 8.2 of AS 3798-2007 "Guidelines on earthworks for commercial and residential developments":

"The primary objective of Level 1 Inspection and Testing is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work. The GITA is responsible for ensuring that the inspection and testing are sufficient for this purpose.

The geotechnical inspection and testing authority need to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:

- Completion of removal of topsoil
- Placing of imported or cut material
- Compaction and adding/removal of moisture
- Trenching and backfilling
- Test rolling
- Testing.

The superintendent should agree a suitable inspection and testing plan prior to commencement of the works.

On completion of the earthworks, the GITA will usually be required to provide a report setting out the inspections, sampling and testing it has carried out, and the locations and results thereof. Unless very unusual conditions apply, the GITA should also be able to express an opinion that the works (as far as it has been able to determine) comply with the requirements of the specification and drawings."

For this particular contract, Level 1 responsibility includes:

1. Lot testing as per Clause 5.3 of this specification.
2. A frequency of compaction testing not less than that specified in Clause 5.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 6 of this specification.
4. The GITA undertaking adequate inspections and testing to comply with the above requirements and to be able to certify the fill in the terms required by Clause 6 of this specification.

5.3 Lot Testing

This specification requires lot testing to be undertaken.

A Lot is defined as a single layer of Engineered Fill consisting of uniform material which has undergone similar treatment.

Lot testing comprises the following:

1. A Lot shall be identified by the Contractor or the GITA with a Lot Number and presented for testing.
2. A Lot shall be deemed to be in accordance with the specification if all the tests undertaken within the Lot are in accordance with the specification, i.e. "a none to fail basis".
3. If any one test undertaken within a Lot fails, the whole of the Lot shall be reworked and retested.

Any portion of the placed Engineered Fill must be part of a single lot and all Lots will require approval by the GITA.

5.4 Testing Frequency (Compaction Testing)

The frequency of compaction testing for each lot shall not be less than the greater of:

1. For lot less than 50 m^3
   a. 1 test per lot.
2. For lot between 50 m^3 and 100 m^3
   a. 2 tests per lot.
3. For lot greater than 100 m^3
   a. 1 test per 500 m^3 of material placed.
   b. 3 tests per lot.

A laboratory moisture content test shall be undertaken for each field density test.

5.5 Proof Rolling and Plate Load Testing

Proof rolling, together with minor boxing out and refilling, of the upper surface of the bulk earthworks will be undertaken as directed by PSM. The plant to be adopted depends upon the design loads adopted by the structural engineers for each section of the site. Any remediation of soft spots identified during proof rolling shall be undertaken in accordance with this Specification (Cl 2.5 and 2.6).

Plate load testing shall be undertaken at the direction of PSM at the following stages:

1. At final bulk earthworks level (BEL). Expected test frequency is approximately a day of testing for each building pad.

The contractor is to make a suitable reaction (e.g. 20 tonne excavator) available for the tests.

5.6 Inspection and Testing

The GITA shall at least undertake the following tasks:

Cut areas

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 3.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements of Clause 3.1 of this specification. If the cut subgrade has been approved by PSM, the GITA will be required to reference the approval in its weekly report.
2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.

Fill areas

3. For fill areas, identify the subgrade as one of the four (4) subgrade types listed in Clause 2.1 of this specification and assess that the subgrade condition of any area prior to placement of fill material is in accordance with the subgrade preparation requirements of Clause 2.1 of this specification. For the following subgrade types, GITA needs to include / refer to PSM approval in its weekly report:
   a. Existing fill and other materials as approved by PSM.
4. Assess that the base geometry of any area prior to placement of fill material is in accordance with the base geometry requirements of Clause 2.2 of this specification.

5. For each Lot, identify the material as either Site Won or Imported fill as defined in Clause 2.3 of this specification and assess that the material placed is in accordance with the fill material requirements of Clause 2.3 of this Specification.
6. Assess the proportion of deleterious material is in accordance with the requirements of Clause 2.3.3 of this Specification.
7. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 2.4 of this specification.
8. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 5.3 of this specification.
9. Ensure that the survey requirements in Clause 5 of this specification have been completed.
10. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
11. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 5.3 and 5.4 of this specification.
12. Assess that the compaction of each Lot is in accordance with the requirements of Clause 2.5 of this specification. The GITA shall select a depth of insitu density tests that allows the density of the full layer to be assessed.
13. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 2.6 of this specification.
14. Conduct material property testing in accordance with the material testing requirements in this specification.

6. Reporting and Certification

6.1 Reporting

The GITA shall produce at least the following reports:

1. *VENM / ENM Validation Reports*. Such a report shall transmit the VENM or ENM validation certificates for the fill imported to site.
2. *Subgrade Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments undertaken for tasks 1 and task 3 of Clause 5.6 including reporting the subgrade type
   – Document the subgrade survey that has been undertaken
   – Approve or reject the subgrade condition and base geometry for filling, based on tasks 3 and 4 of Clause 5.6
   – Approve or reject the subgrade condition for cut areas based on task 1.
3. *Lot Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments, testing and survey undertaken for tasks 3 to 14 of Clause 5.6
   – Report material identification undertaken for task 5 of Clause 5.6
   – Report the assessed proportion of deleterious material for task 6 of Clause 5.6
   – Report the results of testing undertaken for task 11 of Clause 5.6
   – Approve or reject lots based on tasks 12 and 13 of Clause 5.6.
4. Material Testing Reports. Such a report shall:
   – Report the results of material property testing undertaken for task 14 of Clause 5.6.
5. *Daily Reports* (a sample is attached). Such a report shall be completed daily and shall:
   – Document time spent on site by the GITA personnel
   – List subgrade assessments and approvals undertaken each day with reference to relevant Subgrade Approval Report(s)
   – List Lots presented, accepted and approved or rejected each day, with reference to relevant Lot Approval Report(s)

- List survey undertaken each day as for task 9 of Clause 5.6 and not already documented in the Subgrade or Lot Approval Reports
- Document other relevant activities undertaken on site that day (site instructions, breakdowns, compaction equipment used, etc.).

6.2 Certification

6.2.1 Weekly Certificates

The GITA shall produce a Weekly Certificate for any week in which earthworks are undertaken in accordance with this specification. The Weekly Certificate will cover all works from the previous Weekly Certificate until the end of work on a Saturday.

The Weekly Certificate shall transmit the following:

- Copy or reference to the complete specification document(s)
- Subgrade Approval Reports
- Lot Approval Reports
- Material property testing reports
- Daily Reports
- Survey of subgrade geometry prior to filling or in cut areas
- Plan survey drawing showing lot boundaries and location of density tests
- Survey documenting filling undertaken to date and showing location of testing
- Provide an Excel spreadsheet presenting the results of the week's acceptance testing completed by the GITA.

And certify that:

"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM3939-006S Rev 0 dated 9 October 2020)."

6.2.2 Interim or Final Filling Certificate

At the completion of the bulk earthworks, or as requested by the Client, the GITA shall provide an Interim or Final Filling Certificate which shall:

1. Transmit a reference list of the Weekly Certificates.
2. Provide an Excel spreadsheet presenting the results of all the acceptance testing completed by the GITA.
3. Certify that *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM3939-006S Rev 0 dated 9 October 2020)."*

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Appendix A
Figure 1

294700 294800 294900 295000 295100 295200 295300 295400 295500 295600 295700 295800

6252900 6252800 6252700 6252600 6252500 6252400 6252300 6252200

TP01 TP02 TP03 TP04 TP05 TP06 TP07 TP08 TP09 TP10

Legend

- Apprxoimate Site Boundary
- Test Pit Locations

Notes:
1. Image obtained from Nearmap of the site conditions on 3 August 2020.

N

Scale 1:3,000

0 50 100 150 m

Scale (m)

P S M

Created By: M.B.	Revision: 0
Date: 23 Sep 2020	Paper Size: A3

Altis Property Partners
884-928 Mamre Road
Kemps Creek, NSW

GEOTECHNICAL INVESTIGATION
LOCALITY PLAN

PSM3939-006S | Figure 1

Appendix B
Subgrade Approval Report

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

SUBGRADE APPROVAL REPORT

Client:	Contractor:
Job number:	Report number:
Project:	Technician:

Subgrade areas assessed:

Area ID	Date	Approximate extent	Subgrade description	Geometry summary	Specification reference	Compliance (Pass/Fail)	Survey reference	Approved (Yes/No)

COMMENTS:

Signed: Date:

Appendix C
Lot Approval Report

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

LOT APPROVAL REPORT

Client:	Report number:
Job number:	Report date:
Project:	Technician:
Contractor:	Test methods:

LOT ID:			**Sheet**	**of**
Retest (Yes/No)			Original test report number:	
Specification reference				
Location:				
Lot boundary survey reference/location:				
Materials description:	*(MATERIAL TYPE, colour, minor components, maximum particle size)*			
Material identification:	*(Identify the material as defined in Clause 2.3.1, Clause 2.3.2 or Clause 2.3.3 of the Specification)*			
Deleterious material assessment:	*(Report proportion of deleterious material)*			
Layer thickness:				
Accepted as Lot: (Yes/No)			Date:	
Approximate volume (m3)			Number of tests required:	

Test ID No.				
Test soil description				
Date tested:				
Grid reference				
Surveyed test locations (RL,E,N)				
Test depth (mm)				
Max size (mm)				
% Oversize material (wet)				
Field wet density (t/m^3)				
Field moisture content (%)				
PWCD (t/m^3)				
Compactive effort				
Moisture variation (%)				
HILF density ratio (%)				
TEST (Pass/Fail)				

LOT APPROVAL	(Pass/Fail)	Signed:	Date:

Appendix D
Daily Report

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

DAILY REPORT

Client:	Report number:
Job number:	Report date:
Project:	
Location:	Level of testing: Level 1
Contractor	Technician:
Time on site:	
Time off site:	

1. Subgrade Approval

Areas ID	Subgrade Approval Report No:	Comments

2. Lot Approval

Lot ID	Lot Approval Report No:	Comments

3. Survey

Type of survey	Survey undertaken by:	Reference

4. Instructions received on site

5. Instructions given on site

COMMENTS:

Signed: Date:

Appendix E
Certification Letter (Sample Only)

Our Ref:

Date:

Addressed to: Earthwork Contractor

Attention: Earthwork Contractor Representative

Dear

RE: SAMPLE INTERIM (OR FINAL) FILLING CERTIFICATE
INDUSTRIAL DEVELOPMENT, BULK EARTHWORKS
CERTIFICATION OF EARTHWORKS
BETWEEN [DATE OF COMMENCEMENT] AND [DATE OF COMPLETION]

In the period between [date start] and [date finish] the contractor has undertaken earthworks in areas XXX and XXX.

During the above period:

- The GITA has prepared the following Subgrade Approval Reports:

1. Subgrade Approval Report No 1
2. ……

- The GITA has prepared the following Lot Approval Reports:

1. Lot Approval Report No 1
2. ……

- The GITA has prepared the following Daily Reports:

1. Daily Report No 1……
2. ……

- The following subgrade survey was undertaken:

1. Subgrade Survey reference……
2. ……

- The following weekly survey was undertaken:

1. Weekly survey of week ending …….reference……..
2. ……

Copies of all the above documents are attached.

The GITA certifies that all the earthworks undertaken in the above stated period are documented in the above reports and have been undertaken in accordance with the Specifications (ref. PSMXXXX-XXXS, dated XXX) a copy of which is attached, with the exception of:

1. List outstanding issues (not approved subgrade, lots, unsuitable material, failed tests etc.)
2. ……..

Signed

GITA