Geotechnical Investigation Report

Project

Proposed Yiribana Logistics Estate West
771 – 797 Mamre Road, Kemps Creek NSW 2178

Prepared for

The GPT Group

Date

12 December 2022

Report No

15955-GR-1-1

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Contents

Appendices

1 INTRODUCTION

This report presents the findings of a geotechnical investigation carried out by Alliance Geotechnical Pty Ltd (Alliance) for The GPT Group (the Client) for the proposed Yiribana Logistics Estate – West at 771 – 797 Mamre Road, Kemps Creek NSW 2178. The geotechnical investigation was undertaken in accordance with Alliance's fee proposal Estimate No. 7493, dated 11 October 2022.

The objectives of this Geotechnical Investigation Report were to address the subsurface conditions encountered and provide comments and recommendations regarding:

- Existing site geotechnical and groundwater conditions.
- Aggressivity classification of soil on buried concrete and steel structures.
- Soil Salinity Potential and Acid Sulfate Soil impacts.
- Retaining structure design parameters.
- Footings and foundation system recommendations.
- Subgrade preparation and earthworks.
- Pavement design parameters for the proposed road and carpark.

The investigation comprised the drilling of nine boreholes, dynamic cone penetrometer testing on or adjacent to the borehole locations, and sampling of site soils for laboratory testing followed by engineering analysis and reporting. Details of the field investigation are presented in this report, together with comments and recommendations relating to field and construction practice.

2 PROPOSED WORKS

To assist with the geotechnical investigation, Alliance was provided with the following documents:

- Geotechnical brief and site location plan provided by the client.
- Architectural Plans by SBA Architects, Job No. 21246, Dated 09/12/2022.
- Civil Works Plan by Costin Roe Consulting, Drawing No. CO14429.00-DA40, Issue C, Dated 23/11/2022.

Based on the provided documents and information provided by the client, it is understood that a geotechnical investigation is required to provide information for the detailed design of the proposed Stage 1 development of the Yiribana Logistics Estate – West and subsequent Development Application (DA). Alliance understands that the proposed development at the site comprises the following:

- Construction of two warehouse structures: Warehouse 1 (South) with a total floor area of 10,207 sqm. and Warehouse 2 (North) with a total floor area 13,836 sqm.
- Two-storey office buildings adjacent to each warehouse.
- Site-wide bulk earthworks and construction of retaining walls.
- Construction of an internal road network and car parking.

3 SITE DESCRIPTION & REGIONAL GEOLOGY

3.1 Site Description

The site is located on the eastern portion of Lots 23 and 24 in DP 258414 in the suburb of Kemps Creek within the City of Penrith local government area. The site is accessible through Mamre Road and is surrounded by proposed industrial development lots to the north and south. The site location relative to the surrounding features is shown in Figure 1 below. At the time of investigation, the site had a lush grass vegetative cover with scattered trees and shrubs across the vicinity. Local ponding was noted at the north-western portion of the site within footprint of Warehouse 2.

Based on the site observations prior to drilling and available elevation data from Google Earth, the site is situated on an undulating terrain with site elevations ranging approximately between 37m and 41m above local mean sea level (LMSL).

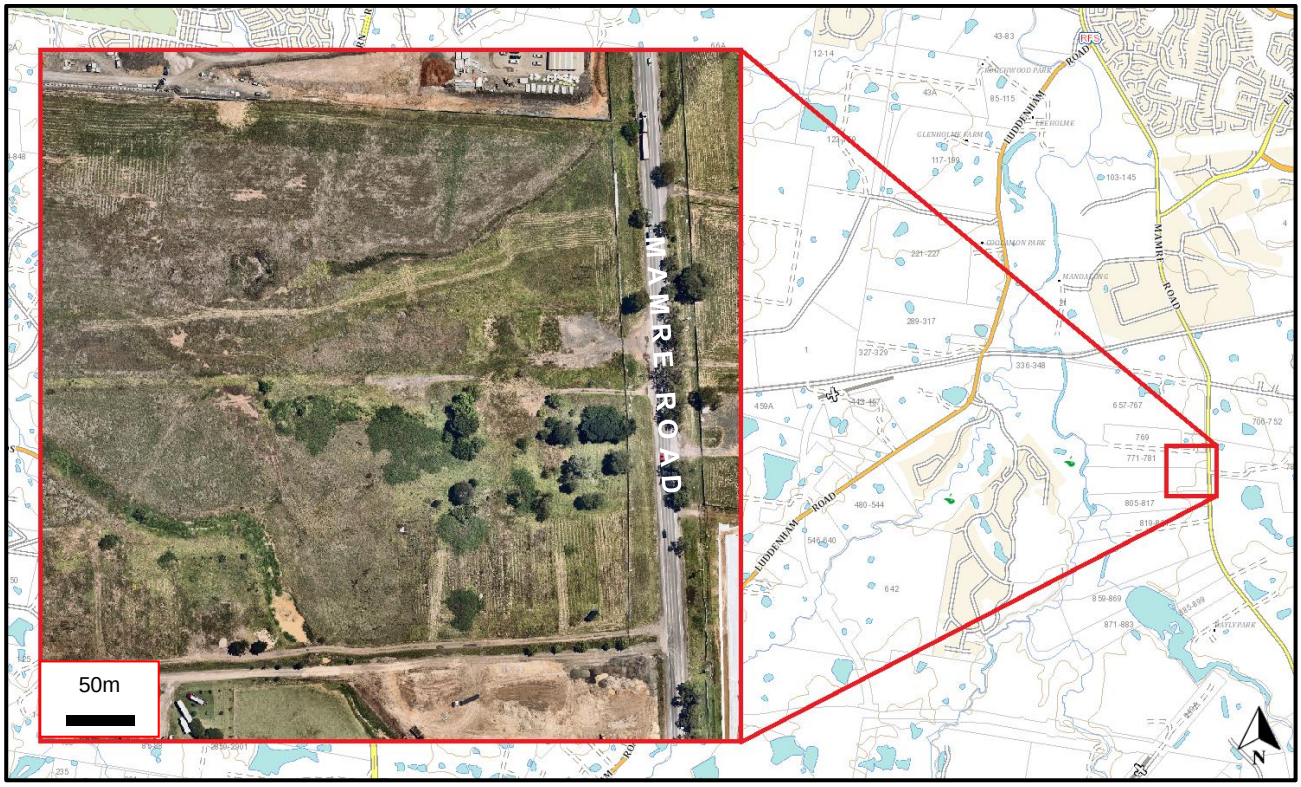

Figure 1 - The Site Location & Aerial Image (extracted from MinView)

3.2 Regional Geology

The New South Wales Seamless Geology dataset, version 2.1 [Digital Dataset] published by the Geological Survey of New South Wales indicates that the site is underlain mostly by Bringelly Shale which may contain *shale, carbonaceous claystone, laminite, lithic sandstone, and rare coal.*

Based on the results of the investigation, the site soils encountered were mostly residual clays overlain by minor pockets of alluvial clays.

An ephemeral minor tributary of South Creek was identified at the southwestern end of the site.

The site overlaying NSW Seamless Geology map with 10m contours are presented in Figure 2 below.

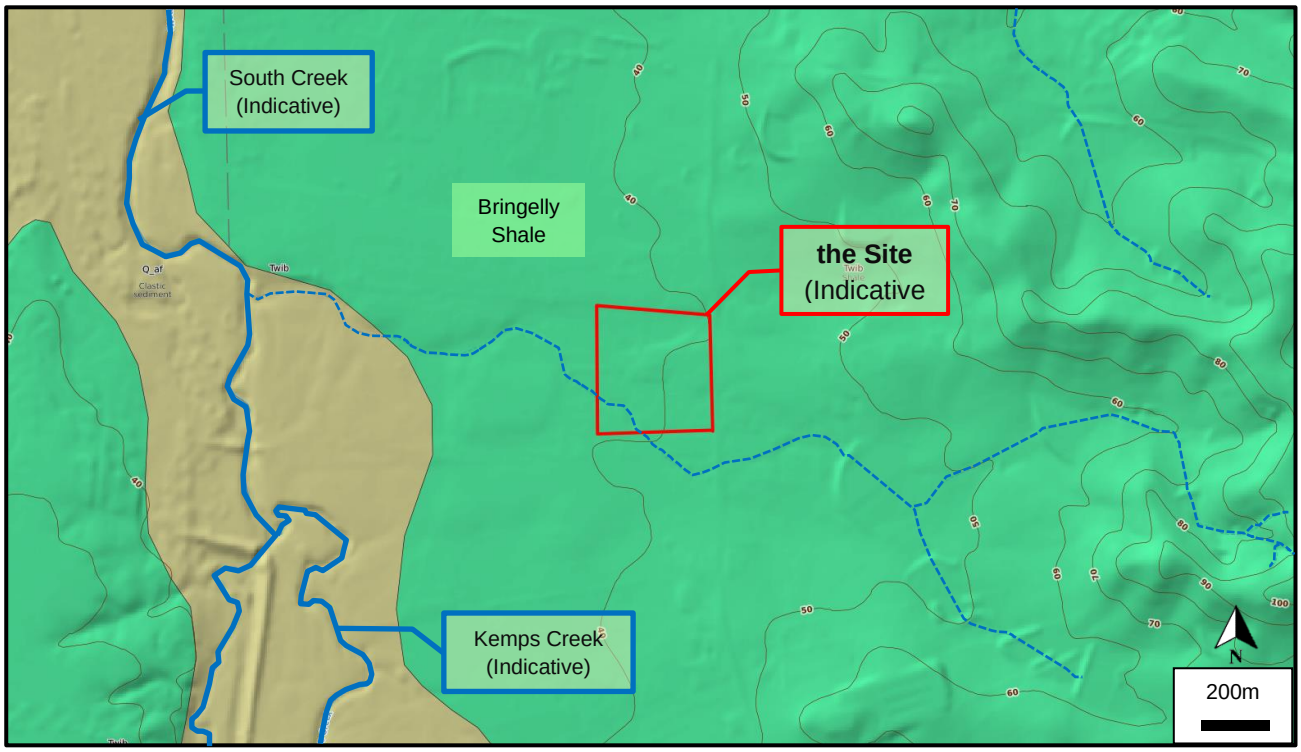

Figure 2 - The Site Location with NSW Seamless Geology and 10m Contours

3.3 Soil Salinity Potential

The site overlaying the Salinity Potential Map of Western Sydney is presented in Figure 3 below.

The areas of high salinity potential near the site typically follow the trend of water bodies present within the locality. This association is due to the high accumulation of dissolved salts in water in these areas which potentially influence the soils within the vicinity.

Sampling for indicative soil salinity was conducted in the borehole locations. A summary of the analytical results is presented in Table 6 in Section 5.2.

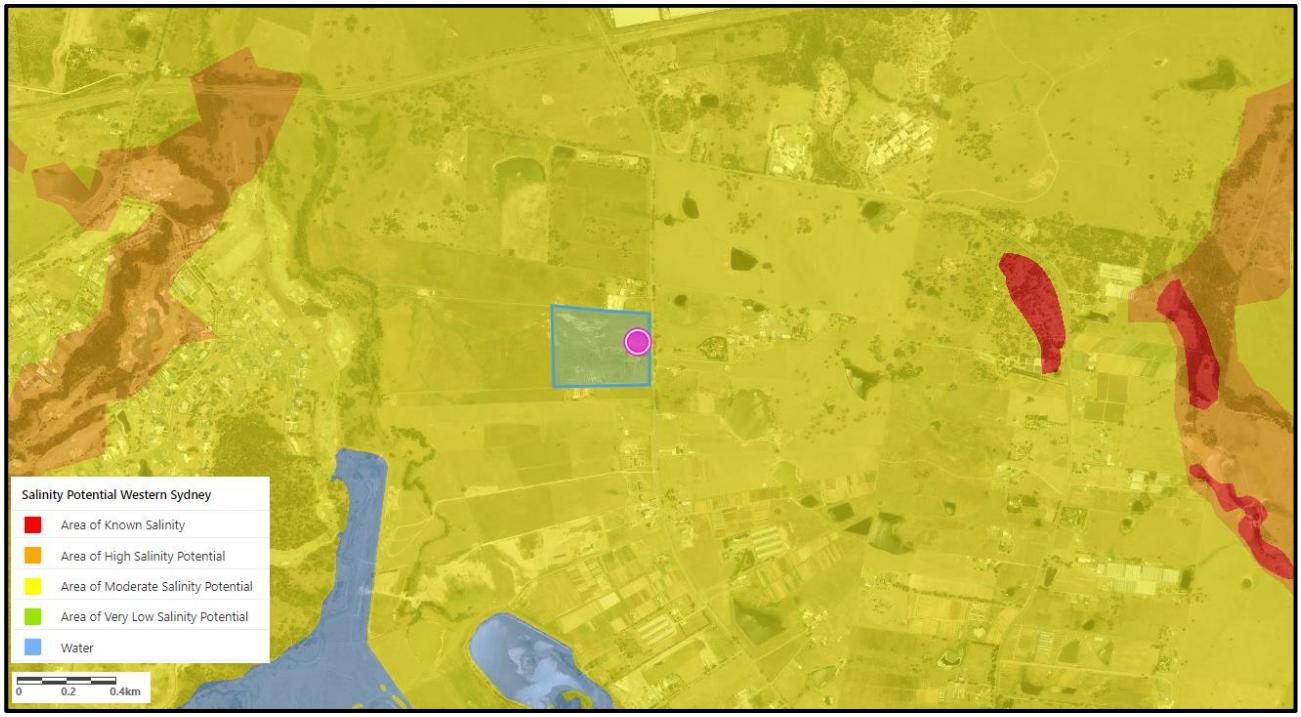

Figure 3 - Site Location with Soil Salinity Potential Map of Western Sydney

4 FIELDWORK

The geotechnical investigation was undertaken as per the brief provided by the client.

4.1 Methods

The geotechnical investigation was undertaken by Alliance between 4 and 11 November 2022. Alliance completed the drilling of nine boreholes and Dynamic Cone Penetrometer (DCP) testing aligned to the geotechnical scope. The borehole locations were cleared of buried services by an accredited service locator prior to drilling.

Initial borehole locations were provided by Alliance and were adjusted on-site to locations considered reasonably representative of the subsurface conditions of the proposed borehole locations. Only DCP testing was conducted on the initial location of borehole BH02 due to local ponding and soft boggy ground and a supplementary borehole BH02A was drilled at the nearest accessible location from BH02.

The boreholes were drilled using Alliance's ute-mounted auger drilling rig. The boreholes were advanced in the overburden soils using 110mm diameter solid flight augers fitted with a tungsten carbide (TC)-bit down to the 5.0m target depth or prior refusal on inferred bedrock.

Standard Penetrometer Tests (SPT) were conducted at 1.5m intervals commencing from 1.5m below ground level (bgl). Dynamic Cone Penetrometer (DCP) tests were undertaken for all boreholes down to 5.0m bgl or prior refusal adjacent to each borehole to determine the near-surface soil consistency.

The encountered soil profiles were documented by a geotechnical engineer from Alliance generally in accordance with AS 1726 - 2017 Geotechnical Site Investigation. The approximate borehole locations are indicated on drawing 15955-GR-1-1-A in Appendix B.

At completion, the boreholes were backfilled with drilling spoil and generally made flush with the surrounding surface.

4.2 Borehole Details

A summary of the geotechnical site investigation at each borehole location and approximate borehole coordinates are presented in Table 1 below.

Table 1 - Summary of approximate borehole locations and termination depths

ID	Easting (m GDA2020 MGA Zone 56)	Northing (m GDA2020 MGA Zone 56)	Termination Depth
			m bgl
BH01	294601	6253638	5.0
BH02	294451	6253642	1.48
BH02A	294543	6253606	5.0
BH03	294450	6253560	5.0
BH04	294604	6253561	5.0
BH05	294545	6253535	5.0
BH06	294553	6253411	6.0
BH07	294616	6253415	5.0
BH08	294627	6253479	1.5
BH09	294417	6253575	1.5

The coordinates provided above are approximate borehole locations and should be used as a reference only and a registered surveyor must be engaged if detailed survey is required for design purposes.

4.3 Subsurface Conditions

Summarised descriptions of the encountered subsurface geotechnical units are provided in Table 2. Reference to the individual borehole log sheets should be made for a full description of the subsurface conditions encountered at each borehole.

Table 2 - Summary of Subsurface Profile (north)

Ground Profile	Consistency	**BH01** (m)	**BH02A** (m)	**BH03** (m)	**BH04** (m)	**BH09** (m)
Topsoil/Fill **Gravelly CLAY**	-	0.0 – 0.7	0.0 – 0.8	0.0 – 0.6	0.0 – 0.01	0.0 – 0.2
Alluvium **CLAY/Silty SAND**	Firm to Very Stiff/ Medium Dense	0.7 – 2.1	0.8 – 2.4	-	0.01 -0.6	0.2 – 1.3
Residual **CLAY/Gravelly CLAY/ Sandy CLAY**	Stiff to Very Stiff	2.1 – 5.0	2.4 – 5.0	0.6 – 5.0	0.6 – 5.0	1.3 – 1.5

Table 3- Summary of Subsurface Profile (south)

Ground Profile	Consistency	**BH05** (m)	**BH06**(m)	**BH07** (m)	**BH08** (m)
Topsoil/Fill **Gravelly CLAY**	-	0.0 – 0.6	0.0 – 0.3	0.0 – 0.3	0.0 – 0.2
Alluvium **Silty CLAY**	Soft to Stiff	0.6 – 1.0	0.3 – 1.8	0.3 – 2.0	0.2 – 0.5
Residual **CLAY/ Gravelly CLAY/ Sandy CLAY**	Firm to Very Stiff	1.0 – 5.0	1.8 – 5.0	2.0 – 5.0	0.5 – 1.5

The approximate borehole locations are indicated on the Geotechnical Investigation Plan (Drawing 15955-GR-1-1-A) in Appendix B.

The borehole logs along with the DCP test report are provided in Appendix C. Reference to the individual borehole log sheets attached in Appendix C should be made for a full description of the subsurface conditions encountered at each borehole location.

These results should be read in conjunction with the attached Explanatory Notes which explain the terms, abbreviations, and symbols used, together with the interpretation and limitation of the logging procedure.

4.4 Groundwater

Groundwater seepage was encountered during drilling across the site at depth shown in Tab. It is not known whether the encountered groundwater levels are indicative of perched groundwater or the groundwater table.

Borehole	Groundwater depth
BH01	Groundwater as seepage at 4.5m
BH02A	Groundwater as seepage at 4.0m
BH04	Groundwater as seepage at 2.2m
BH05	Groundwater as seepage at 2.0m
BH06	Groundwater as seepage at 2.8m
BH07	Groundwater as seepage at 3.0m

Groundwater seepage at the site can be dependent on and fluctuate based on seasonal and climatic conditions or relative water levels prevalent in the non-perennial minor tributary of South Creek approximately at the southwestern end of the site. It should be noted that groundwater seepage condition may vary across the site and its vicinity.

5 LABORATORY TESTING

Laboratory tests were carried out on selected soil samples collected from the boreholes during the site investigation. The following tests were carried out on selected soil samples in Alliance's NATA-accredited soil laboratory and a subcontracted NATA-accredited environmental laboratory:

- Soil Aggressivity
- Soil Salinity
- California Bearing Ratio

The laboratory tests certificates are provided in Appendix D.

5.1 Soil Aggressivity

Selected soil samples were tested from the boreholes for soil aggressivity. The tests were performed on the soil samples to aid with the durability design of concrete and steel. The results and exposure classifications are presented in Table 4 below:

Table 4 - Summary of Soil Aggressivity Tests

Test	Unit	BH01 1.0m	BH02A 2.0m	BH03 1.0m	BH04 2.0m	BH05 1.0m	BH06 2.0m	BH07 1.0m
Chloride	$mg.kg^{-1}$	< 10	670	1700	25	< 10	660	56
Conductivity (1)	$uS.cm^{-1}$	21	380	890	46	97	400	93
pH (1)	pH Units	7.8	7.7	7.1	8.0	6.6	7.3	6.1
Resistivity	Ohm.cm	48,000	2,700	1,100	22,000	10,000	2,500	11,000
Sulfate (SO_4)	$mg.kg^{-1}$	38	92	190	54	250	75	170
Moisture	%	14	16	15	13	19	15	15
Exposure Classification (2)	Concrete	Non-aggressive	Non-aggressive	Non-aggressive	Non-aggressive	Non-aggressive	Non-aggressive	Non-aggressive
	Steel	Non-aggressive	Non-aggressive	Mild	Non-aggressive	Non-aggressive	Non-aggressive	Non-aggressive

(1): Tests were carried out on a 1:5 aqueous extract at 25°C as recorded.
(2): Assessed in accordance with AS 2159 – 2009, Table 6.4.2 (C) and Table 6.5.2 (C)

5.2 Soil Salinity Testing

Selected soil samples were collected from the boreholes for soil salinity testing. Results of analytical testing of the soils at the boreholes were compared to the following guideline values derived from *Department of Land Water Conservation (DLWC) NSW, 2002: Site Investigations for urban salinity).* The adopted criteria based on the DWLC guidelines are listed in Table 5 below.

Table 5 - DWLC Salinity test guidelines criteria

Soil Salinity Class	EC_e (Ds/m)
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

A multiplication factor has been used for calculation of the EC_e based on the material types in *Table 6.1* of *Department of Land Water Conservation NSW, 2002: Site Investigations for urban salinity.*

Table 6 - Soil Salinity Test Results

Sample Source	Moisture (%)	$EC_{1.5}$ (uS/cm)	pH	Material	Multiplier	ECe (dS/m)	Salinity Class
BH01 0.5m	14	17	7.7	Gravelly CLAY	14	0.24	Non-Saline
BH01 1.0m	14	21	7.8	CLAY	8.5	0.18	Non-Saline
BH01 1.5m	16	25	7.6	CLAY	8.5	0.21	Non-Saline
BH01 2.5m	18	200	7.3	CLAY	8.5	1.70	Non-Saline
BH02A 0.5m	18	68	7.5	Clayey GRAVEL	17	1.16	Non-Saline
BH02A 1.5m	16	180	7.3	CLAY	8.5	1.53	Non-Saline
BH02A 2.0m	16	380	7.7	CLAY	8.5	3.23	Slightly Saline
BH02A 2.5m	16	260	7.9	CLAY	8.5	2.21	Slightly Saline
BH03 0.5m	19	430	5.8	CLAY	8.5	3.66	Slightly Saline
BH03 1.0m	15	890	7.1	CLAY	8.5	7.57	Moderately Saline
BH03 1.5m	18	500	6.9	CLAY	8.5	4.25	Moderately Saline
BH03 2.5m	14	350	7.3	CLAY	8.5	2.98	Slightly Saline
BH04 0.5m	20	48	7.0	Silty SAND	17	0.82	Non-Saline
BH04 1.5m	17	18	7.5	Sandy CLAY	14	0.25	Non-Saline
BH04 2.0m	13	46	8.0	Sandy CLAY	14	0.64	Non-Saline
BH04 2.5m	15	15	8.3	Sandy CLAY	14	0.21	Non-Saline
BH05 0.5m	17	72	7.4	Silty CLAY	9	0.65	Non-Saline

BH05 1.0m	19	97	6.6	CLAY	8.5	0.82	Non-Saline
BH05 1.5m	15	57	6.3	CLAY	8.5	0.48	Non-Saline
BH05 2.5m	14	37	7.3	CLAY	8.5	0.31	Non-Saline
BH06 0.5m	19	110	7.2	Silty CLAY	9	0.99	Non-Saline
BH06 1.5m	18	280	7.2	CLAY	8.5	2.38	Slightly Saline
BH06 2.0m	15	400	7.3	CLAY	8.5	3.40	Slightly Saline
BH06 2.5m	15	260	7.4	CLAY	8.5	2.21	Slightly Saline
BH07 0.5m	17	27	6.5	CLAY	8.5	0.23	Non-Saline
BH07 1.0m	15	93	6.1	CLAY	8.5	0.79	Non-Saline
BH07 1.5m	16	130	6.1	CLAY	8.5	1.11	Non-Saline
BH07 2.5m	15	210	6.6	Silty CLAY	9	1.89	Non-Saline

Based on the summary of analytical results presented in Table 6 and the application of an appropriate conversion factor, two of the samples were moderately saline, seven were slightly saline, and the rest were non-saline of the samples.

5.3 California Bearing Ratio

Two bulk samples were collected from the boreholes for CBR testing. The CBR test specimens were compacted to approximately 100% of Standard Maximum Dry Density at Optimum Moisture Content (AS 1289 5.1.1 and 2.1.1) and thereafter, the CBR test specimens were soaked for four days prior to testing.

The CBR values are shown in Table 7 below.

Table 7 - California Bearing Ratio Test Results

Borehole	Depth (m)	Material Description	FMC (%)	OMC (%)	MDD (t/m^3)	CBR (%)	Swell (%)
BH08	0.2 – 0.7	CLAY	16.7	16.5	1.87	4.0	0.5
BH09	0.2 – 0.7	Sandy CLAY	17.3	18.0	1.77	3.5	2.0

6 COMMENTS & RECOMMENDATIONS

6.1 Acid Sulfate Soil Risk

A review of eSPADE 2.2 published by NSW Department of Planning and Environment indicated that the site is located in an area with no mapped acid sulfate soil potential.

Further assessment for acid sulfate soils is considered unwarranted.

6.2 Retaining Wall Design Parameters

Based on the review of civil works plan provided, retaining walls are required at the site along the overland flow channel at the northern boundary, around the channel extent of the drainage corridor at the southwest, and along the southern boundary. It is recommended that earth retaining structures should be designed in accordance with AS 4678 – 2002: Earth Retaining Structures based on the recommendations of the preliminary geotechnical design parameters set out in Table 8 below.

Table 8 - Retaining Structures Design Parameters

Description	c' (kPa)	ϕ' (deg)	γ (kN/m³)	K_a	K_0	K_p	E (MPa)	ϑ
Existing Clayey Fill	2	24	16	0.39	0.50	2.56	8	0.3
Alluvium/Residual: CLAY, firm to stiff	2	25	17	0.42	0.59	2.37	10	0.3
Residual: CLAY, stiff to very stiff	5	26	18	0.39	0.56	2.56	25	0.3

Legends:
c': Effective cohesion
ϕ': Effective friction angle
K_0: At rest earth pressure coefficient
K_a: Active earth pressure coefficient
K_p: Passive earth pressure coefficient
γ: Unit weight
E: Elasticity Modulus
θ: Poisson's ratio

Retaining walls should be designed for free draining granular backfill and appropriate surface and subsoil drains to either divert or intercept groundwater flow which otherwise could provide surcharging on the walls and additional pressures.

6.3 Temporary Retention and Batter Slopes

The minor site preparation excavation works for the proposed development is anticipated to locally encounter topsoil/fill and alluvial/residual clay. The feasibility of using unsupported slope depends on the footing level of the adjoining structures which should be assessed by a structural designer. Given the distance of the proposed development to the adjacent structures, temporary batters are considered feasible for the anticipated excavation works. The recommended maximum temporary batter slopes are presented in Table 9.

Batter slopes should be extended below the 'zone of influence' of any adjacent structure, road, or services. i.e., a 45° line drawn downward from the foundation level of any adjacent structures.

Table 9 - Maximum Dry Batter Slopes

Description	Maximum Temporary Dry Batter Slopes H:V
Uncontrolled Fill	2.5:1
Alluvium/Residual: CLAY, firm to stiff	1.5:1
Residual: CLAY, stiff to very stiff	1:1

6.4 Footings and Foundation System Recommendations

6.4.1 Shallow Foundation

The existing uncontrolled fill material is not considered to be a suitable foundation stratum. It is recommended footings should be founded on alluvial/residual stiff clayey soils. Design parameters for shallow footing design in residual clayey soils are presented in Table 10.

Table 10 - Preliminary Geotechnical Design Parameters for Shallow Foundations

Description	Minimum Founding Depth (m)	Allowable Bearing Pressure (kPa)
Alluvium/Residual **CLAY, stiff**	1.0	150 (1)(2)
Residual **CLAY, very stiff**	2.0	300 (2)
(1) Based on a 1.0m square pad footing. (2) Separate settlement assessment should be undertaken to ensure that the footing settlements are within the tolerable range.		

6.5 Site Preparation and Earthworks

It is understood from the provided architectural plans that the ground floor level of the proposed warehouses and office buildings will be at RL 40.0 across the site. It is also understood that there will be retaining walls at the northern, southern, and southwestern areas of the site up to a maximum height of 1.5m. From the available elevation data, it is expected that the site will require approximately 3.0m of fill to be placed and compacted on areas or lower elevation in order to raise the ground surface levels to the required design levels.

Over the low areas of the site that will require filling to be placed in order to raise the ground surface to the required level, any vegetation, topsoils, and poorly compacted or unsuitable surficial filling should be stripped and removed to expose the underlying natural stiff and very stiff clays that underlie the site. The exposed subgrade surface should then be proof rolled with a non-vibrating roller of at least 10 tonnes deadweight capacity. The rolling should be accompanied by visual inspection to allow detection and treatment of any weak, compressible, or spongy zones. This will be of particular importance in the area where local ponding was observed.

The results of the fieldwork indicate that the natural clays on site could be utilised as filing material in situations where a significant raising of the ground surface level is required but it is likely that much of the fill materials will need to be imported. Any imported filling proposed for the building footprint and pavements should consist of material with little to no plasticity such as igneous rocks. All filling material should be placed in layers not exceeding 250 mm maximum loose thickness and the material moisture conditioned to within 2% of standard optimum by the addition or removal of water, as appropriate. Each layer should be compacted by rolling to a density ratio not less than 95% (±1%) standard maximum density, increasing to 98% (±1%) standard maximum over the final two layers.

Over-compaction should be avoided due to the potential for ground surface heave, which may cause ground slabs to crack and distortion in paving while under compaction will lead to excessive settlement. It is recommended that a programme of density testing be implemented to ensure that the required level of compaction is being achieved in accordance with AS1289 to minimum Level 2 standard, but Level 1 is recommended.

The long-term serviceability of slabs on ground and pavements for this development will depend on the control of moisture content of the subgrade. Given that filling of up to 3.0 metres thick is expected, it is of great importance to maintain moisture levels within 2% standard optimum at the required level of compaction. I1f the deep subgrade is allowed to dry out, shrinkage settlement will occur over time, reducing the available support to ground slabs and pavements resulting in their possible future failure. Alternatively, if the subgrade is placed too dry and water permeates the subgrade via natural seepage or backflow through excavates service trenches, substantial swelling may occur also resulting in the failure of ground slabs and pavements.

It is recommended that for the development at this site, service trenches are backfilled with clay-based filling and, using hand equipment, compacted to 95% standard. Using clay-based filling instead of sand will reduce the risk of any water back flowing along the service trenches and penetrating below the ground slabs, causing the subgrade to heave and potentially damage ground slabs.

Methods of maintaining moisture content may include the use of plastic membranes or gravel layers over the surface of the exposed subgrade or lime blending within the upper subgrade layers. Maintaining correct moisture content within the subgrade will be assisted if there are minimal delays in construction of ground slabs and pavements after completion of earthworks. Interception and relief of subsoil seepage in all areas of significant cut is essential if subsequent softening of the subgrade below ground slabs and pavements is to be avoided.

Further advice should be sought where filling is required to support major structures.

It is recommended that site preparation works are to be undertaken in accordance with AS 37898 – 2007 Guidelines on earthworks for commercial and residential developments.

If the structures and pavement are to be constructed over the fill material, the fill should be an engineering fill as per AS 3798-2007. If fill will not support any structural load or pavement, the fill could be placed as per the general fill specifications provided in AS 3798-2007.

Any imported fill material should not contain vegetation, organic matter or high plasticity clayey soils and particles greater than 75mm. The Plasticity Index of imported fill should be limited to 30%. Granular fill is preferred for filling. The maximum particle size for any placed fill should not exceed 75mm.

It is recommended that all compaction control testing in area that will support structures and pavements be undertaken under appropriate supervision by an approved Geotechnical Inspection and Testing Authority (GITA). All earthworks and geotechnical Level 2 sampling and testing is to be carried out under the guide of AS3789 – Guidelines on earthworks for commercial and residential developments. Any waste soils being

removed from the site must be classified in accordance with current regulatory authority requirements to enable appropriate reuse or disposal to an appropriately licensed landfill facility.

6.6 Pavement Design Parameters

Based on the subsurface profile encountered at the site during the site investigation, laboratory test results, and the recommendations from AGPT02-17 with regards to high plasticity clay material in poor drainage conditions, a design CBR value of 3.5% has been determined adequate for the site. The pavement design parameters for preliminary pavement design are presented in Table 11.

Table 11 - Pavement design parameters

Parameter	Value
Design CBR	3.5%
Elasticity Modulus	30MPa
Subgrade Reaction (k)	27kPa/mm
Poisson's Ratio (n)	0.30

7 LIMITATIONS

Alliance has prepared this report for the site located at 771-797 Mamre Road, Kemps Creek NSW 2178 in accordance with Alliance's fee proposal and Terms of Engagement. This geotechnical report has been prepared for The GPT Group for this project and for the purposes outlined in this report. This report cannot be relied upon for other projects, other parties on this site or any other site. The comments and recommendations provided in this report are based on the assumption that the geotechnical recommendations contained in this report will be fully complied with during the design and construction of the proposed site development.

The borehole investigation and dynamic cone penetrometer results provided in this report are indicative of the subsurface conditions at the site only at the specific sampling and testing locations, and to the depths excavated at the time of the investigation. Subsurface conditions can change significantly due to geological and human processes. Where variations in conditions are encountered further geotechnical advice should be sought from Alliance.

8 REFERENCES

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AS 2159 – 2009: Piling – Design and Installation.

AS 4678 – 2002: Earth Retaining Structures.

AS3789-2007: Guidelines on earthworks for commercial and residential developments.

Site Investigations for Urban Salinity, Department of Land and Water Conservation 2002.

State of NSW and Department Planning, Industry and Environment 2022.

APPENDIX A – Site Photograph

Photo 1 - General view of the northern portion of the Site, looking west

Photo 2 - Borehole BH01 drilling rig setup

APPENDIX B – Geotechnical Investigation Plan (Drawing 15955-GR-1-1-A)

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Site Plan Scale 1:1,200 on A3

Client Name:	The GPT Group	0 40 Metres	Figure Number:	15955-GR-1-1-A
Project Name:	Proposed Yiribana Logistics Estate - West		Figure Date:	07/12/2022
Project Location	771 - 797 Mamre Road, Kemps Creek NSW 2178		Report Number:	15955-GR-1-1

APPENDIX C – Explanatory Notes, Borehole Logs & DCP Test Report

alliance

Explanatory Notes
Drill & Excavation Logs

General

Information obtained from site investigations is recorded on log sheets. Soils and very low strength rock are commonly drilled using a combination of solid-flight augers with a Tungsten-Carbide (TC) bit. Descriptions of these materials presented on the “Borehole Log” are based on a combination of regular sampling and in-situ testing. Rock coring techniques commences once material is encountered that cannot be penetrated using a combination of solid-flight augers and Tungsten-carbide bit. The "Cored Borehole Log" presents data from drilling where a core barrel has been used to recover material - commonly rock.

The "Excavation – Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits or trenches.

The heading of the log sheets contains information on Project Identification, Hole or Test Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The scale is presented in the depth column as metres below ground level.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is included in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures, and geological unit. Material description and classifications are based on Australian Standard Geotechnical Site Investigations: AS 1726 - 2017 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

Drilling

Drilling, Casing and Excavating

Drilling methods deployed are abbreviated as follows

Abbreviation	Method
AS	Auger Screwing
ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
BH	Backhoe
E	Excavator
HA	Hand Auger
HQ	HQ core barrel (~63.5 mm diameter core) *
HMLC	HMLC core barrel (~63.5 mm diameter core) *
NMLC	NMLC core barrel (~51.9 mm diameter core) *
NQ	NQ core barrel (~47.6 mm diameter core) *
RR	Rock Roller
WB	Wash-bore drilling

* Core diameters are approximate and vary due to the strength of material being drilled.

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage. It is introduced to assist with the drill process, in particular, when core drilling. The introduction of drill fluid/water does not allow for accurate identification of water seepages.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

Abbreviation	Description
VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.


Standing water level measured in completed borehole


Level taken during or immediately after drilling


Groundwater inflow water level

Samples/Tests

Samples collected and testing undertaken are abbreviated as follows

Abbreviation	Test
ES	Environmental Sample
DS	Disturbed Sample
BS	Bulk Sample
U50	Undisturbed (50 mm diameter)
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test
HB	Hammer Bouncing

Excavation Logs

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added. Photos are recommended.

Material Description – Soil

Material Description - In accordance with AS 1726-2017

Classification Symbol - In accordance with the Unified Classification System (AS 1726-2017).

Abbreviation	Typical Name
GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
SM	Silty sand, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity. *
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts. *
Pt	Peat and other highly organic soils. *

* Additional details may be provided in accordance with the Von Post classification system (1922).

Organic Soils – Identification using laboratory testing:

Material	Organic Content - % of dry mass
Inorganic	<2
Organic Soil	<2 ≤ 25
Peat	> 25

Organic Soils – Descriptive terms for the degree of decomposition of peat:

Term	Decomposition	Remains	Squeeze
Fibrous	Little or none	Clearly recognizable	Only water No solid
Pseudo-fibrous	Moderate	Mixture of fibrous and amorphous	Turbid water < 50% solids
Amorphous	Full	Not recognizable	Paste > 50% solids

Particle Characteristics – Definitions are as follows:

Fraction	Component (& subdivision)		Size (mm)
Oversize	**Boulders**		> 200
	Cobbles		> 63 ≤ 200
Coarse grained soils	**Gravel**	Coarse	> 19 ≤ 63
		Medium	> 6.7 ≤ 19
		Fine	> 2.36 ≤ 6.7
	Sand	Coarse	> 0.6 ≤ 2.36
		Medium	> 0.2 ≤ 0.6
		Fine	> 0.075 ≤ 0.21
Fine grained soils	**Silt**		0.002 ≤ 0.075
	Clay		< 0.002

Secondary and minor soil components

In coarse grained soils – The proportions of secondary and minor components are generally estimated from a visual and tactile assessment of the soils. Descriptions for secondary and minor soil components in coarse grained soils are as follows.

Designation of components	Percentage fines	Terminology (as applicable)	Percentage accessory coarse fraction	Terminology (as applicable)
Minor	≤ 5	Trace clay / silt	≤ 5	Trace sand / gravel
	> 5 ≤12	With clay / silt	> 5 ≤12	With sand / gravel
Secondary	> 12	Silty or clayey	> 30	Sandy or gravelly

Descriptions for secondary and minor soil components in fine grained soils are as follows.

Designation of components	Percentage coarse grained soils	Terminology (as applicable)
Minor	≤ 5	Trace sand / gravel / silt / clay
	> 5 ≤12	With sand / gravel / silt / clay
Secondary	> 30	Sandy / gravelly / silty / clayey

Plasticity Terms - Definitions for fine grained soils are as follows:

Descriptive Term	Range of Liquid Limit for silt	Range of Liquid Limit for clay
Low Plasticity	≤ 50	≤ 35
Medium Plasticity	N/A	> 35 ≤50
High Plasticity	> 50	> 50

Particle Characteristics

Particle shape and angularity are estimated from a visual assessment of coarse-grained soil particle characteristics. Terminology used includes the following:

Particle shape – spherical, platy, elongated,

Particle angularity – angular, sub-angular, sub-rounded, rounded.

Moisture Condition – Abbreviations are as follows:

D	Dry, looks and feels dry.
M	Moist, No free water on remoulding.
W	Wet, free water on remoulding.

Moisture content of fine-grained soils is based on judgement of the soils moisture content relative to the plastic and liquid limit as follows:

MC < PL	Moist, dry of plastic limit.
MC ≈ PL	Moist, near plastic limit.
MC > PL	Moist, wet of plastic limit.
MC ≈ LL	Wet, near liquid limit.
MC > LL	Wet of liquid limit.

Consistency - of cohesive soils in accordance with AS 1726-2017, Table 11 are abbreviated as follows:

Consistency Term	Abbreviation	Indicative Undrained Shear Strength Range (kPa)
Very Soft	**VS**	< 12
Soft	**S**	12 ≤ 25
Firm	**F**	25 ≤ 50
Stiff	**St**	50 ≤ 100
Very Stiff	**VSt**	100 ≤ 200
Hard	**H**	≥ 200
Friable	**Fr**	-

Density Index (%) of granular soils is estimated or is based on SPT results. Abbreviations are as follows:

Description	Abbreviation	Relative Density	SPT N
Very Loose	**VL**	< 15%	0 - 4
Loose	**L**	15 - 35%	4 - 10
Medium Dense	**MD**	35 - 65%	10 - 30
Dense	**D**	65 - 85%	30 - 50
Very Dense	**VD**	> 85%	> 50

Structures – Fissuring and other defects are described in accordance with AS 1726-2017 using the terminology for rock defects

Origin – Where practicable an assessment is provided of the probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, residual soil.

MATERIAL DESCRIPTION - ROCK

Material Description – In accordance with AS 1726-2017

Rock Naming – Where possible conventional geological names are used within the logs. Engineering properties cannot be inferred directly from the rock names in the table, but the use of a particular name provides an indicative range of characteristics to the reader. Lithological identification of rock is provided to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock.

Grain Size – Grain size is done in accordance with AS1726-2017 as follows:

For sedimentary rock:

Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mmto 0.6mm
Fine grained	Mainly 0.06mm to 0.2mm

For igneous and metamorphic rock:

Coarse grained	Mainly greater than 2 mm
Medium grained	Mainly 0.6mm to 2mm
Fine grained	Mainly less than 2mm

Colour - Rock colour is described in the moist condition.

Texture and Fabric

Frequently used terms:

Sedimentary Rock	Metamorphic Rock	Igneous
Bedded	Banded	Amorphous
Cross-bedded	Cleaved	Crystalline
Folded	Folded	Flow banded
Graded	Foliated	Folded
Interbedded	Gneissose	Lineated
Laminated	Lineated	Massive
Massive	Schistose	Porphyritic

Bedding and fabric:

Description	Spacing
Very Thickly Bedded	> 2m
Thickly Bedded	0.6m to 2m
Medium Bedded	0.2m to 0.6m
Thinly Bedded	60mm to 200mm
Very Thinly Bedded	20mm to 60mm
Thickly Laminated	6mm to 20mm
Thinly Laminated	< 6mm

Degree of development:

Massive	No layering or fabric. Rock is homogeneous.
Indistinct	Layering or fabric just visible, There is little effect on strength properties.
Distinct	Layering or fabric obvious. The rock may break more easily parallel to the fabric.

Features, inclusions, and minor components - Features, inclusions and minor components within the rock material shall be described where those features could be significant such as gas bubbles, mineral veins, carbonaceous material, salts, swelling minerals, mineral inclusions, ironstone or carbonate bands, cross-stratification, or minerals the readily oxidise upon atmospheric exposure.

Moisture content - Where possible descriptions are made by the feel and appearance of the rock using one according to following terms:

Dry	Looks and feels dry.
Moist	Feels cool, darkened in colour, but no water is visible on the surface.
Wet	Feels cool, darkened in colour, water film or droplets visible on the surface.

The moisture content of rock cored with water may not be representative of its in-situ condition.

Durability – Descriptions of the materials durability such as tendency to develop cracks, break into smaller pieces or disintegrate upon exposure to air or in contact with water are provided where observed.

Rock Material Strength – The strength of the rock material is based on uniaxial compressive strength (UCS). The following terms are used:

Term / Abbreviation		Description	UCS (MPa)	Point Load Strength Index (MPa)
Very Low	**VL**	Crumbles under firm blow with sharp end of pick, can be peeled with a knife; too hard to cut a triaxial by hand; 30mm pieces can be broken by hand.	0.6 – 2	0.03 – 0.1
Low	**L**	Easily scored with a knifed; indentations 1-3mm show with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	2 – 6	0.1 – 0.3
Medium	**M**	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.	6 – 20	0.3 – 1
High	**H**	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.	20 – 60	1 – 3
Very High	**VH**	Hand specimen breaks with pick after more than one blow; rock rings under hammer.	60 – 200	3 – 10
Extremely High	**EH**	Specimen requires many blows with geological pick to break into intact materials; rock rings under hammer.	> 200	> 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical logs as follows:

D	Diametral Point Load Test
A	Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown. Point Load Strength Index test results are presented as $I_{s\,(50)}$ values in MPa.

Weathering – Weathering classification assists in identification but does not imply engineering properties. Descriptions are as follows:

Term / Abbreviation		Description
Residual Soil	**RS**	Material has soil properties. Mass structure and material texture and fabric of original rock not visible, but the soil has not been significantly transported.
Extremely Weathered	**EW**	Material has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	**HW**	Material is completely discoloured, significant decrease in strength from fresh rock.
Moderately Weathered	**MW**	Material is `completely discoloured, little or no change of strength from fresh rock.
Slightly Weathered	**SW**	Partly stained or discoloured, little or no change to strength from fresh rock.
Fresh	**FR**	No signs of mineral decomposition or colour change.

Alteration – Physical and chemical changes of the rock material due to geological processes by fluids at depth at pressures and temperatures above atmospheric conditions. Unlike weathering, alteration shows no relationship to topography and may occur at any depth. When altered materials are recognized, the following terms are used:

Term / Abbreviation				Description
Extremely Altered		**XA**		Material has soil properties. Structure, texture, and fabric of original rock are still visible. The rock name is replaced with the name of the parent material, e.g., Extremely Altered basalt. Soil descriptive terms are used.
Highly Altered	**Distinctly altered**	**HA**	**DA**	The whole of the rock material is discoloured. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be higher or lower due to loss of minerals or precipitation of secondary minerals in pores.
Moderately Altered	**Distinctly altered**	**MA**	**DA**	The whole of the rock material is discoloured. Little or no change of strength from fresh rock. The term 'Distinctly Altered' is used where it is not practicable to distinguish between 'Highly Altered' and 'Moderately Altered'. Distinctly Altered is defined as follows: - The rock may be highly discoloured; - Porosity may be higher due to mineral loss; or may be lower due to precipitation of secondary minerals in pores; and - Some change of rock strength.
Slightly Altered		**S**		Rock is slightly discoloured. Little or no change of strength from fresh rock.

Alteration is only described in the context of the project where it has relevance to the civil and structural design.

Defect Descriptions

General and Detailed Descriptions – Defect descriptions are provided to suit project requirements. Generalized descriptions are used for some projects where it is unnecessary to describe each individual defect in a rock mass, or where multiple similar defects are present which are too numerous to log individually. The part of the rock mass to which this applies is delineated.

Detailed descriptions are given of defects judged to be particularly significant in the context of the project. For example, crushed seams in an apparently unstable slope. As a minimum, general descriptions outlining the number of defect sets within the rock mass and their broad characteristics are provided where it is possible to do so.

Defect Type – Defect abbreviations are as follows:

BP	Bedding parting	**SSM**	Sheared seam	**DB**	Drilling break
JT	Joint	**CS**	Crushed seam	**HB**	Handling break
SS	Shear surface	**SM**	Infilled seam		
SZ	Sheared zone	**EWS**	Extremely weathered seam		

Sheared surfaces, sheared zones, sheared seams, and crushed seams are generally faults in geological terms.

Defect Orientation

For oriented core: The dip and dip direction are recorded as a two-digit and three-digit number separated by a slash, are collected e.g., 50°/240° and there is not core loss that could obscure core orientation. If alternative measurements are made, such as dip and strike or dip direction relative to magnetic north this shall be documented.

For non-oriented core: The dip is recorded as a two-digit number, e.g., 10°. In vertical boreholes the dip is generally measured relative to the horizontal plan. If the borehole is inclined the dip is generally measured from the core axis.

Surface Roughness – Defect surface roughness is described as follows:

VR	**Very rough**	Many large surface irregularities with amplitude generally more than 1 mm.
RO	**Rough**	Many small surface irregularities with amplitude generally less than 1 mm.
SO	**Smooth**	Smooth to touch. Few or no surface irregularities.
PO	**Polished**	Shiny smooth surface
SK	**Slickensided**	Grooved or striated surface, usually polished.

Surface Shape – Defect surface roughness is described as follows:

PL	**Planar**	The defect does not vary in orientation.
CU	**Curved**	The defect has a gradual change in orientation
UN	**Undulating**	The defect has a wavy surface.
ST	**Stepped**	The defect has one or more well defined steps
IR	**Irregular**	The defect has many sharp changes of orientation

Defect Infilling – Common abbreviation as follows:

Ca	Calcite	**Fe**	Iron Oxide	**Qz**	Quartz
Cy	Clay	**MS**	Secondary mineral	**X**	Carbonaceous

Defect Coatings and Seam Composition - Coatings are described using the following terms:

CN	**Clean**	No visible coating.
SN	**Stained**	No visible coating but surfaces are discoloured.
VN	**Veneered**	A visible coating of soil or mineral, too thin to measure; may ne patchy.
CO	**Coating**	A visible coating up to 1 mm thick. Soil in-fill greater than 1 mm shall be described using defect terms (e.g., infilled seam). Defects greater than 1 mm aperture containing rock material great described as a vein.

Defect Spacing, Length, Openness and Thickness – Described directly in millimetres and metres. In general descriptions, half order of magnitude categories is used, e.g. joint spacing typically 100 mm to 300 mm, sheared zones 1m to 3m thick.

Depending on project requirements and the scale of observation, spacing may be described as the mean spacing within a set of defects, or as the spacing between all defects within the rock mass. Where spacing is measured within a specific set of defects, measurements shall be made perpendicular to the defect set.

Where significant, the nature of the defect end condition is recorded in the context of the scale of the exposure.

Block Shape – Where it is considered significant, block shape should be described using terms given in Table 23, AS 1725:2017.

Stratigraphic Unit – Geological maps related to the project are used for the designation of lithological formation name and, where possible geological unit name, e.g., Bringelly Shale, Potts Hill Sandstone Member.

Core Loss – Core loss occurs when material is lost during the drilling process It is shown at the bottom of the run unless otherwise indicated where core loss is known.

Total Core Recovery – The percentage of rock recovered excluding core loss per core run.

Defect Spacing – The spacing of successive defects or the mean spacing for relatively broken core.

Fracture Index – Which is the number defects per metre of core.

Rock Quality Designation (RQD) – The percentage of sound core pieces of 100mm or greater per core run and is calculated using Deere et al. (1989) method.

Rock Classification System – For design purpose, Sydney Rock Mass Classification System (Pells et al. 1998, 2019) is adopted.

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BH No: BH01
Sheet: 1 of 1
Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 11/11/2022
Finished: 11/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 | **Hole Location** 294601E, 6253638N | **Driller:** CC | **Logged:** IG
RL Surface: 40m | **Contractor:** Alliance | **Bearing:** --- | **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	TOPSOIL: Gravelly CLAY, low platicity, brown, with rootlets.	2 4 9 18		MC < PL	-	TOPSOIL
							FILL: Gravelly CLAY, low plasticity, brown, fine to medium subrounded igneous gravel	9 5 5 3 3		MC < PL	-	FILL
						CI-CH	CLAY, medium to high plasticity, brown mottled orange to red orange. trace medium subrounded gravel.	7 9 10 19 21 25		MC >= PL	F - St	ALLUVIUM
			39	1								
									SPT 3, 4, 5 N=9			
			38	2					PP=175kPa			
						CI-CH	CLAY, medium to high plasticity, grey mottled orange and brown.			MC <= PL	St - VSt	RESIDUAL
											VSt	
			37	3					SPT 2, 6, 10 N=16			
									PP=275kPa			
						CI	Gravelly CLAY, medium plasticity, grey mottled orange, fine subangular ironstone gravel.			MC < PL		
			36	4								
	Seepage @ 4.5m								SPT 4, 7, 9 N=16			
			35	5								
							Target depth reached. Borehole BH01 terminated at 5m					
			34	6								
			33	7								
			32	8								

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BH No: BH02A
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Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 11/11/2022
Finished: 11/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 | **Hole Location** 294543E, 6253606N | **Driller:** CC | **Logged:** IG
RL Surface: 38m | **Contractor:** Alliance | **Bearing:** --- | **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	TOPSOIL: Gravelly CLAY, medium plasticity, brown, with rootlets.	2 4 9 18		MC ~ PL	-	TOPSOIL
						-	FILL: Gravelly CLAY, medium plasticity, brown, fine to medium subrounded igneous gravel.	4 1 1 2 2			-	FILL
						-	FILL: Clayey GRAVEL, medium to coarse, brown with black, poorly compacted.			MC ~ PL M	-	FILL
			37	1		CH	CLAY, high plasticity, brown with grey mottled orange, trace medium subrounded igneous gravel.	6 11		MC ~ PL	St - VSt	ALLUVIUM
						CH	CLAY, high plasticity, brown orange with dark grey, trace fine to medium subrounded igneous gravel.	20 25		MC ~ PL		
			36	2					SPT 3, 4, 4 N=8 PP=225kPa			
						CH	CLAY, high plasticity, grey with mottled orange, trace fine to medium subangular ironstone gravel.			MC ~ PL	VSt	RESIDUAL
			35	3					SPT 3, 7, 10 N=17 PP=325kPa			
	Seepage @ 4.0m		34	4								
						CL	Gravelly CLAY, high plasticity, pale grey mottled orange brown, fine to medium subangular ironstone gravel.		SPT 6, 7, 9 N=16			
			33	5			Target depth reached. Borehole BH02A terminated at 5m					
			32	6								
			31	7								
			30	8								

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BH No: BH03
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Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 4/11/2022
Finished: 4/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294450E, 6253560N **Driller:** CC **Logged:** IG
RL Surface: 37m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	Not Encountered					-	FILL: Gravelly CLAY, medium plasticity, dark brown, trace fine grained sand.	3 3 4 5		MC ~ PL	-	FILL
						CH	CLAY, high plasticity, brown with dark grey.	9 14 19 25		MC ~ PL	St - VSt	RESIDUAL
			36	1		CH	CLAY, high plasticity, grey mottled yellow brown, with fine to medium subangular ironstone gravel.			MC ~ PL	VSt	
			35	2					SPT 4, 7, 8 N=15 PP=375kPa			
			34	3						MC > PL		
						CI	Sandy CLAY, medium plasticity, pale grey mottled yellow orange, fine grained sand.		SPT 3, 4, 6 N=10 PP=175kPa		St	
			33	4								
							At 4.5m: with fine to medium subangular ironstone gravel.		SPT 5, 6, 9 N=15		VSt	
			32	5								
							Target depth reached. Borehole BH03 terminated at 5m					
			31	6								
			30	7								
			29	8								

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BH No: BH04
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Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 4/11/2022
Finished: 4/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294604E, 6253561N **Driller:** CC **Logged:** IG
RL Surface: 41m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	TOPSOIL: Sandy CLAY, medium plasticity, dark brown, trace fine gravel, rootlets present.	2 4 9 18		MC ~ PL	-	TOPSOIL
						-	FILL: Silty SAND, fine grained, pale brown, with fine to medium gravel, trace clay.	9 7 3		M	-	FILL
			40	1		CI-CH	Sandy CLAY, medium to high plasticity, orange brown mottled grey, fine grained sand, with fine to medium subangular ironstone gravel.	4 6 9 16 25		MC ~ PL	St	RESIDUAL
			39	2					SPT 5, 4, 6 N=10			
	Seepage @ 2.2m									MC < PL		
			38	3								
									SPT 3, 5, 5 N=10			
			37	4		CI	CLAY, medium plasticity, pale grey mottled yellow brown, trace fine subangular ironstone gravel.			MC ~ PL		
			36	5					SPT 5, 7, 7 N=14			
							Target depth reached. Borehole BH04 terminated at 5m					
			35	6								
			34	7								
			33	8								

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Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 4/11/2022
Finished: 4/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294545E, 6253535N **Driller:** CC **Logged:** IG
RL Surface: 39m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	FILL: Gravelly CLAY, medium plasticity, dark grey with brown, with medium grained sand, moderately compacted.	7 5 5 4		MC ~ PL	-	FILL hydrocarbon contamination noted.
						CL-CI	Silty CLAY, low to medium plasticity, grey to brown mottled grey, with fine grained sand, trace fine subangular ironstone gravel.	2 3 5		MC >= PL	S - F	ALLUVIUM
			38	1		CI-CH	CLAY, medium to high plasticity, brown, with fine to medium grained sand, trace fine to medium gravel.	11 20 25		MC ~ PL	St - VSt	RESIDUAL
	Seepage @ 2.0m		37	2					SPT 4, 5, 6 N=11 PP=275kPa			
						CI	CLAY, medium plasticity, grey mottled orange, trace fine gravel.			MC ~ PL		
			36	3		CI	Gravelly CLAY, medium plasticity, yellow brown mottled grey and black, fine subangular ironstone gravel, with medium to coarse grained sand.		SPT 5, 6, 9 N=15 PP=225kPa		VSt	
			35	4								
						CH	Sandy CLAY, high plasticity, pale grey mottled yellow brown, fine to medium grained sand.		SPT 4, 5, 7 N=12	MC > PL	St	
			34	5								
							Target depth reached. Borehole BH05 terminated at 5m					
			33	6								
			32	7								
			31	8								

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BH No: BH06
Sheet: 1 of 1
Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 11/11/2022
Finished: 11/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294553E, 6253411N **Driller:** CC **Logged:** IG
RL Surface: 39m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	TOPSOIL: Sandy CLAY, low plasticity, brown, trace fine to medium gravel, with rootlets.	2 4 9 18		MC ~ PL	-	TOPSOIL
						CI-CH	Silty CLAY, medium to high plasticity, yellow brown.			MC ~ PL	F - St	ALLUVIUM
			38	1								
						CI-CH	CLAY, medium to high plasticity, pale grey mottled orange brown and black, with fine to medium subangular ironstone gravel.			MC > PL		
									SPT 3, 2, 5 N=7			
			37	2					PP=190kPa		St - VSt	RESIDUAL
	Seepage @ 2.8m					CI	Gravelly CLAY, medium plasticity, brown with black, fine to medium subangular ironstone gravel, trace sand.			MC ~ PL		
			36	3					SPT 4, 3, 6 N=9			
						CH	Sandy CLAY, high plasticity, grey with red and brown.		PP=200kPa	MC > PL		
			35	4					PP=375kPa			
						CH	CLAY, high plasticity, pale grey mottled red brown and yellow brown, with fine to medium subangular ironstone gravel.			MC ~ PL	VSt	
									SPT 6, 11, 15 N=26			
			34	5								
			33	6								
							Target depth reached. Borehole BH06 terminated at 6m					
			32	7								
			31	8								

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BH No: BH07
Sheet: 1 of 1
Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 11/11/2022
Finished: 11/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294616E, 6253415N **Driller:** CC **Logged:** IG
RL Surface: 40m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	TOPSOIL: Gravelly CLAY, high plasticity, brown, with rootlets.	2 1 3		MC > PL	-	TOPSOIL
						CI	CLAY, medium plasticity, brown mottled red orange.	3 5 6 7 8 12 19 25		MC ~ PL	St	ALLUVIUM
			39	1								
			38	2		CI-CH	Silty CLAY, medium to high plasticity, plae grey mottled yellow orange, with fine to medium subangular ironstone gravel.		SPT 4, 5, 6 N=11 PP=125kPa	MC >= PL	F	RESIDUAL
	Seepage @ 3.0m ▼		37	3					SPT 3, 3, 6 N=9 PP=75kPa		F - St	
			36	4		CH	CLAY, high plasticity, grey with orange.			MC > PL		
			35	5		CH	Sandy CLAY, high plsticity, orange brown mottled grey, fine grained sand, with fine subangular ironstone gravel.		SPT 4, 6, 8 N=14		St	
							Target depth reached. Borehole BH07 terminated at 5m					
			34	6								
			33	7								
			32	8								

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BH No: BH08
Sheet: 1 of 1
Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 7/11/2022
Finished: 7/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 | **Hole Location** 294627E, 6253479N | **Driller:** CC | **Logged:** IG
RL Surface: 41m | **Contractor:** Alliance | **Bearing:** --- | **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	Not Encountered		41	0		CI	Sandy CLAY, medium plasticity, brown, trace fine gravel, with rootlets.	1 4 4		MC < PL	-	TOPSOIL
						CI	CLAY, medium plasticity, brown with grey, with fine grained sand, trace subrounded gravel.	4 6 6		MC ~ PL	St	ALLUVIUM
			40	1		CI	CLAY, medium plasticity, grey mottled brown, with fine grained sand, trace fine to medium subangular ironstone gravel.	6 7 7 6 8 11		MC ~ PL	St - VSt	RESIDUAL
							Target depth reached. Borehole BH08 terminated at 1.5m	18 25				
			39	2								
			38	3								
			37	4								
			36	5								
			35	6								
			34	7								
			33	8								

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BH No: BH09
Sheet: 1 of 1
Job No: 15955

Borehole Log

Client: The GPT Group
Project: Proposed Yiribana Logistics Estate - West
Location: 771-797 Mamre Road, Kemps Creek

Started: 11/11/2022
Finished: 11/11/2022
Borehole Size: 110 mm

Rig Type: TDLR690 **Hole Location** 294417E, 6253575N **Driller:** CC **Logged:** IG
RL Surface: 37m **Contractor:** Alliance **Bearing:** --- **Checked:** MAG

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	Not Encountered					-	TOPSOIL: Gravelly CLAY, medium plasticity, brown, fine subrounded igneous gravel, with fine grained sand, with rootlets.	4 8		MC < PL	-	TOPSOIL
						CI	Sandy CLAY, medium plasticity, brown with grey, with fine to medium gravel.	4 3 3 3 4 5 6		MC < PL	St	ALLUVIUM
			36	1		CH	CLAY, high plasticity, grey mottled orange, trace medium to coarse gravel.	8 4		MC ~ PL	VSt	RESIDUAL
							Target depth reached. Borehole BH09 terminated at 1.5m	18				
			35	2								
			34	3								
			33	4								
			32	5								
			31	6								
			30	7								
			29	8								

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Dynamic Cone Penetrometer (DCP) Test Report

Client	The GPT Group	**Report Number**	15955-GR-1-1
Project Name	Proposed Yiribana Logistics Estate West	**Project Number**	15955
Project Location	771-797 Mamre Road, Kemps Creek NSW	**Date Tested**	04-11/11/2022
Test Method	AS 1289.6.3.2		

Test Number	**BH01**	**BH02**	**BH02A**	**BH03**	**BH04**
Test Locations	Refer to drawing 15955-GR-1-1-A				
Depth (m)					
0.00 – 0.15	9	7	2	3	2
0.15 – 0.30	5	3	4	3	9
0.30 – 0.45	5	4	1	4	7
0.45 – 0.60	3	6	1	5	3
0.60 – 0.75	3	9	2	9	4
0.75 – 0.90	7	13	2	14	6
0.90 – 1.05	9	14	6	19	9
1.05 – 1.20	10	21	11	25/150mm	16
1.20 – 1.35	19	24	20		25/135mm
1.35 – 1.50	21	25/160mm	25/150mm		
1.50 – 1.65	25/130mm				
1.65 – 1.80					
1.80 – 1.95					
1.95 – 2.10					
2.10 – 2.25					
2.25 – 2.40					
2.40 – 2.55					
2.55 – 2.70					
2.70 – 2.85					
2.85 – 3.00					

Notes: This test report is intended to be read in conjunction with the geotechnical report by Alliance Geotechnical (ref: 15955-GR-1-1). HB indicates hammer bounce.

Dynamic Cone Penetrometer (DCP) Test Report

Client	The GPT Group	**Report Number**	15955-GR-1-1
Project Name	Proposed Yiribana Logistics Estate West	**Project Number**	15955
Project Location	771-797 Mamre Road, Kemps Creek NSW	**Date Tested**	04-11/11/2022
Test Method	AS 1289.6.3.2		

Test Number	**BH05**	**BH06**	**BH07**	**BH08**	**BH09**
Test Locations	Refer to drawing 15955-GR-1-1-A				
Depth (m)					
0.00 – 0.15	7	1	2	1	4
0.15 – 0.30	5	2	1	4	8
0.30 – 0.45	5	3	3	4	4
0.45 – 0.60	4	3	3	6	3
0.60 – 0.75	2	6	5	6	3
0.75 – 0.90	3	4	6	7	3
0.90 – 1.05	5	6	7	7	4
1.05 – 1.20	11	10	8	6	5
1.20 – 1.35	20	15	12	8	6
1.35 – 1.50	25	21	19	11	8
1.50 – 1.65		29	25	18	4
1.65 – 1.80				25/140mm	18
1.80 – 1.95					
1.95 – 2.10					
2.10 – 2.25					
2.25 – 2.40					
2.40 – 2.55					
2.55 – 2.70					
2.70 – 2.85					
2.85 – 3.00					

Notes: This test report is intended to be read in conjunction with the geotechnical report by Alliance Geotechnical (ref: 15955-GR-1-1). HB indicates hammer bounce.

APPENDIX D – Laboratory Test Certificates

Material Test Report

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Email: brett@allgeo.com.au

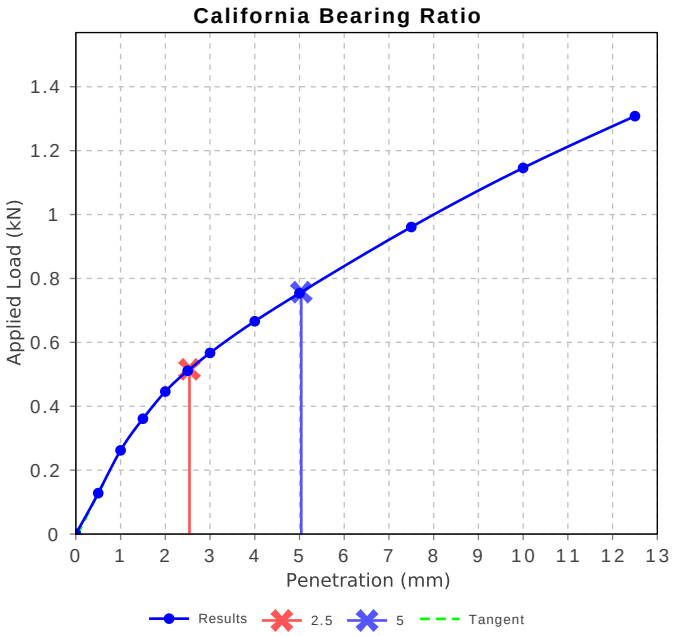
Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **15955-1**
Issue Number: 1
Date Issued: 29/11/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Roni Marquez
Project Number: 15955
Project Name: Yiribana Estate West
Project Location: 771-797 Mamre Road, Kemps Creek
Contractor: GPT Group
Work Request: 22118
Sample Number: 22-22118A
Date Sampled: 11/07/2022
Dates Tested: 15/11/2022 - 28/11/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between dates 07/11/2022 and 08/11/2022
Sample Location: **BH08, Depth: 0.2-0.7m**
Material: CLAY, medium plasticity, brown with grey, with fine grained sand, with fine gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Tactile		
Maximum Dry Density (t/m^3)	1.87		
Optimum Moisture Content (%)	16.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.86		
Field Moisture Content (%)	16.7		
Moisture Content at Placement (%)	16.2		
Moisture Content Top 30mm (%)	19.2		
Moisture Content Rest of Sample (%)	16.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48.2		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	N/A		
Oversize Material (%)	0.0		



Material Test Report

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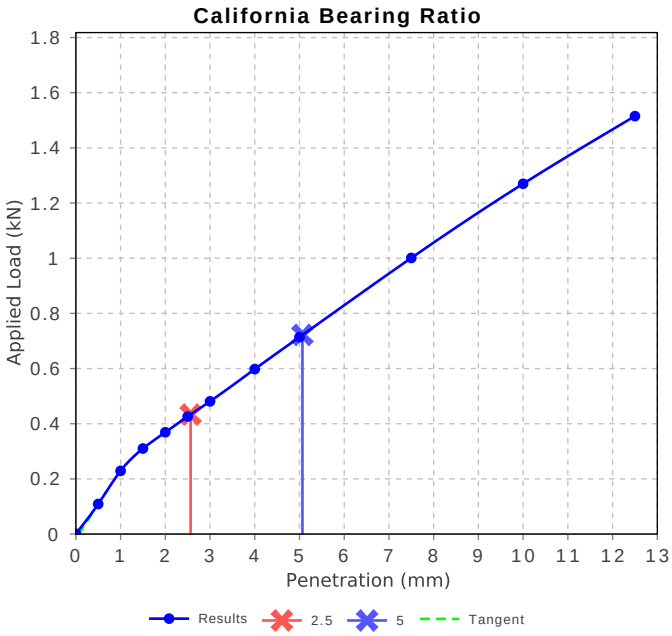
NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **15955-1**
Issue Number: 1
Date Issued: 29/11/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Roni Marquez
Project Number: 15955
Project Name: Yiribana Estate West
Project Location: 771-797 Mamre Road, Kemps Creek
Contractor: GPT Group
Work Request: 22118
Sample Number: 22-22118B
Date Sampled: 11/07/2022
Dates Tested: 15/11/2022 - 28/11/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between dates 07/11/2022 and 08/11/2022
Sample Location: **BH09, Depth: 0.2-0.7m**
Material: Sandy CLAY, medium plasticity, brown with grey, with fine to medium gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**3.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Tactile		
Maximum Dry Density (t/m^3)	1.77		
Optimum Moisture Content (%)	18.0		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	101.5		
Dry Density after Soaking (t/m^3)	1.73		
Field Moisture Content (%)	17.3		
Moisture Content at Placement (%)	18.1		
Moisture Content Top 30mm (%)	22.3		
Moisture Content Rest of Sample (%)	18.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	49.6		
Swell (%)	2.0		
Oversize Material (mm)	19		
Oversize Material Included	N/A		
Oversize Material (%)	0.0		



Alliance Geotechnical
10 Welder Road
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Attention: **Roni Marquez**

Report **942845-S**
Project name PROPOSED WAREHOUSE
Project ID 15955
Received Date Nov 18, 2022

Client Sample ID			**BH01-0.5m**	**BH01-1.0m**	**BH01-1.5m**	**BH01-2.5m**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S22-No0048020**	**S22-No0048021**	**S22-No0048022**	**S22-No0048023**
Date Sampled			**Nov 11, 2022**	**Nov 11, 2022**	**Nov 11, 2022**	**Nov 11, 2022**
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	17	21	25	200
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.7	7.8	7.6	7.3
% Moisture	1	%	14	14	16	18
Chloride	10	mg/kg	-	< 10	-	-
Resistivity*	0.5	ohm.m	-	480	-	-
Sulphate (as SO4)	10	mg/kg	-	38	-	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	8.1	8.3	8.1	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	5.8	6.1	7.7	-
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	-

Client Sample ID			**BH02-0.5m**	**BH02-1.0m**	**BH02-1.5m**	**BH02-2.0m**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S22-No0048024**	**S22-No0048025**	**S22-No0048026**	**S22-No0048027**
Date Sampled			**Nov 11, 2022**	**Nov 11, 2022**	**Nov 11, 2022**	**Nov 11, 2022**
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	68	-	180	380
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.5	-	7.3	7.7
% Moisture	1	%	18	-	16	16
Chloride	10	mg/kg	-	-	-	670
Resistivity*	0.5	ohm.m	-	-	-	27
Sulphate (as SO4)	10	mg/kg	-	-	-	92
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.7	7.7	7.3	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	7.3	5.8	5.9	-
Reaction Ratings*[S05]	0	-	4.0	4.0	3.0	-

Client Sample ID			BH02-2.5m	BH03-0.5m	BH03-1.0m	BH03-1.5m
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S22-No0048028	S22-No0048029	S22-No0048030	S22-No0048031
Date Sampled			Nov 11, 2022	Nov 04, 2022	Nov 04, 2022	Nov 04, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	260	430	890	500
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.9	5.8	7.1	6.9
% Moisture	1	%	16	19	15	18
Chloride	10	mg/kg	-	-	1700	-
Resistivity*	0.5	ohm.m	-	-	11	-
Sulphate (as SO4)	10	mg/kg	-	-	190	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	5.9	7.1	7.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	4.0	6.5	7.3
Reaction Ratings*[S05]	0	-	-	3.0	4.0	4.0

Client Sample ID			BH03-2.5m	BH04-0.5m	BH04-1.0m	BH04-1.5m
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S22-No0048032	S22-No0048033	S22-No0048034	S22-No0048035
Date Sampled			Nov 04, 2022	Nov 04, 2022	Nov 04, 2022	Nov 04, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	350	48	-	18
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.3	7.0	-	7.5
% Moisture	1	%	14	20	-	17
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	7.3	7.5	7.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	5.0	7.3	7.9
Reaction Ratings*[S05]	0	-	-	4.0	4.0	4.0

Client Sample ID			BH04-2.0m	BH04-2.5m	BH05-0.5m	BH50-1.0m
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S22-No0048036	S22-No0048037	S22-No0048038	S22-No0048039
Date Sampled			Nov 04, 2022	Nov 04, 2022	Nov 04, 2022	Nov 04, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	46	15	72	97
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	8.0	8.3	7.4	6.6
% Moisture	1	%	13	15	17	19
Chloride	10	mg/kg	25	-	-	< 10
Resistivity*	0.5	ohm.m	220	-	-	100
Sulphate (as SO4)	10	mg/kg	54	-	-	250
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	-	7.4	6.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	-	6.4	4.7
Reaction Ratings*[S05]	0	-	-	-	4.0	2.0

Client Sample ID			BH05-1.5m	BH05-2.5m	BH06-0.5m	BH06-1.0m
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S22-No0048040	S22-No0048041	S22-No0048042	S22-No0048043
Date Sampled			Nov 04, 2022	Nov 04, 2022	Nov 11, 2022	Nov 11, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	57	37	110	-
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	6.3	7.3	7.2	-
% Moisture	1	%	15	14	19	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.1	-	7.2	7.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.9	-	5.3	6.5
Reaction Ratings*[S05]	0	-	2.0	-	4.0	4.0

Client Sample ID			BH06-1.5m	BH06-2.0m	BH06-2.5m	BH07-0.5m
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S22-No0048044	S22-No0048045	S22-No0048046	S22-No0048047
Date Sampled			Nov 11, 2022	Nov 11, 2022	Nov 11, 2022	Nov 11, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	280	400	260	27
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	7.2	7.3	7.4	6.5
% Moisture	1	%	17	15	15	17
Chloride	10	mg/kg	-	660	-	-
Resistivity*	0.5	ohm.m	-	25	-	-
Sulphate (as SO4)	10	mg/kg	-	75	-	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.2	-	-	6.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	7.9	-	-	4.9
Reaction Ratings*[S05]	0	-	4.0	-	-	4.0

Client Sample ID			BH07-1.0m	BH07-1.5m	BH07-2.5m
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			S22-No0048048	S22-No0048049	S22-No0048050
Date Sampled			Nov 11, 2022	Nov 11, 2022	Nov 11, 2022
Test/Reference	LOR	Unit			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	93	130	210
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	6.1	6.1	6.6
% Moisture	1	%	15	16	15
Chloride	10	mg/kg	56	-	-
Resistivity*	0.5	ohm.m	110	-	-
Sulphate (as SO4)	10	mg/kg	170	-	-
Acid Sulfate Soils Field pH Test					
pH-F (Field pH test)*	0.1	pH Units	5.9	6.0	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.8	6.7	-
Reaction Ratings*[S05]	0	-	2.0	4.0	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Sydney	Nov 24, 2022	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25 °C as rec.)	Sydney	Nov 24, 2022	7 Days
- Method: LTM-GEN-7090 pH by ISE			
Chloride	Sydney	Nov 24, 2022	28 Days
- Method: LTM-INO-4270 Anions by Ion Chromatography			
Sulphate (as SO4)	Sydney	Nov 24, 2022	28 Days
- Method: In-house method LTM-INO-4270 Sulphate by Ion Chromatograph			
% Moisture	Sydney	Nov 21, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Acid Sulfate Soils Field pH Test	Sydney	Nov 24, 2022	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			

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Company Name: Alliance Geotechnical
Address: 10 Welder Road
Seven Hills
NSW 2147

Project Name: PROPOSED WAREHOUSE
Project ID: 15955

Order No.:
Report #: 942845
Phone: 1800 288 188
Fax: 02 9675 1888

Received: Nov 18, 2022 9:44 PM
Due: Nov 24, 2022
Priority: 3 Day
Contact Name: Roni Marquez

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Salinity (determined from EC)*	Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	BH01-0.5m	Nov 11, 2022		Soil	S22-No0048020		X	X		X
2	BH01-1.0m	Nov 11, 2022		Soil	S22-No0048021			X	X	X
3	BH01-1.5m	Nov 11, 2022		Soil	S22-No0048022		X	X		X
4	BH01-2.5m	Nov 11, 2022		Soil	S22-No0048023		X			X
5	BH02-0.5m	Nov 11, 2022		Soil	S22-No0048024		X	X		X
6	BH02-1.0m	Nov 11, 2022		Soil	S22-No0048025			X		
7	BH02-1.5m	Nov 11, 2022		Soil	S22-No0048026		X	X		X
8	BH02-2.0m	Nov 11, 2022		Soil	S22-No0048027				X	X
9	BH02-2.5m	Nov 11, 2022		Soil	S22-No0048028		X			X
10	BH03-0.5m	Nov 04, 2022		Soil	S22-No0048029		X	X		X
11	BH03-1.0m	Nov 04, 2022		Soil	S22-No0048030			X	X	X
12	BH03-1.5m	Nov 04, 2022		Soil	S22-No0048031		X	X		X
13	BH03-2.5m	Nov 04, 2022		Soil	S22-No0048032		X			X

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Sample Detail						HOLD	Salinity (determined from EC)*	Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X
14	BH04-0.5m	Nov 04, 2022		Soil	S22-No0048033		X	X		X
15	BH04-1.0m	Nov 04, 2022		Soil	S22-No0048034			X		
16	BH04-1.5m	Nov 04, 2022		Soil	S22-No0048035		X	X		X
17	BH04-2.0m	Nov 04, 2022		Soil	S22-No0048036				X	X
18	BH04-2.5m	Nov 04, 2022		Soil	S22-No0048037		X			X
19	BH05-0.5m	Nov 04, 2022		Soil	S22-No0048038		X	X		X
20	BH50-1.0m	Nov 04, 2022		Soil	S22-No0048039			X	X	X
21	BH05-1.5m	Nov 04, 2022		Soil	S22-No0048040		X	X		X
22	BH05-2.5m	Nov 04, 2022		Soil	S22-No0048041		X			X
23	BH06-0.5m	Nov 11, 2022		Soil	S22-No0048042		X	X		X
24	BH06-1.0m	Nov 11, 2022		Soil	S22-No0048043			X		
25	BH06-1.5m	Nov 11, 2022		Soil	S22-No0048044		X	X		X
26	BH06-2.0m	Nov 11, 2022		Soil	S22-No0048045				X	X
27	BH06-2.5m	Nov 11, 2022		Soil	S22-No0048046		X			X
28	BH07-0.5m	Nov 11, 2022		Soil	S22-No0048047		X	X		X
29	BH07-1.0m	Nov 11, 2022		Soil	S22-No0048048			X	X	X

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Sample Detail						HOLD	Salinity (determined from EC)*	Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X
30	BH07-1.5m	Nov 11, 2022		Soil	S22-No0048049		X	X		X
31	BH07-2.5m	Nov 11, 2022		Soil	S22-No0048050		X			X
32	BH05-2m	Nov 04, 2022		Soil	S22-No0048070	X				
33	BH03_0-0.3m	Nov 04, 2022		Soil	S22-No0048116	X				
34	BH05_0.6-0.8m	Nov 04, 2022		Soil	S22-No0048117	X				
Test Counts						3	21	21	7	28

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Conductivity (1:5 aqueous extract at 25 °C as rec.)	uS/cm	< 10			10	Pass	
Chloride	mg/kg	< 10			10	Pass	
Sulphate (as SO4)	mg/kg	< 10			10	Pass	
LCS - % Recovery							
Conductivity (1:5 aqueous extract at 25 °C as rec.)	%	76			70-130	Pass	
Chloride	%	92			70-130	Pass	
Resistivity*	%	76			70-130	Pass	
Sulphate (as SO4)	%	115			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chloride	S22-No0048021	CP	%	116			70-130	Pass	
Sulphate (as SO4)	S22-No0048021	CP	%	121			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
pH (1:5 Aqueous extract at 25 °C as rec.)	S22-No0048020	CP	pH Units	7.7	7.9	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S22-No0048021	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Sulphate (as SO4)	S22-No0048021	CP	mg/kg	38	34	11	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S22-No0048024	CP	pH Units	7.7	7.7	pass	20%	Pass	
pH-FOX (Field pH Peroxide test)*	S22-No0048024	CP	pH Units	7.3	7.3	pass	0%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S22-No0048030	CP	%	15	16	4.2	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
pH (1:5 Aqueous extract at 25 °C as rec.)	S22-No0048035	CP	pH Units	7.5	7.5	<1	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S22-No0048039	CP	pH Units	6.2	6.1	pass	20%	Pass	
pH-FOX (Field pH Peroxide test)*	S22-No0048039	CP	pH Units	4.7	4.7	pass	0%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	S22-No0048048	CP	uS/cm	93	85	8.9	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	S22-No0048048	CP	pH Units	6.1	5.9	<1	30%	Pass	
Resistivity*	S22-No0048048	CP	ohm.m	110	120	8.9	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	S22-No0048050	CP	uS/cm	210	270	24	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	S22-No0048050	CP	pH Units	6.6	6.7	<1	30%	Pass	
Resistivity*	S22-No0048050	CP	ohm.m	47	37	24	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Andrew Black	Analytical Services Manager
Roopesh Rangarajan	Senior Analyst-Inorganic

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.