



MEMORANDUM

TO: Charter Hall Holdings Pty Ltd c/o Tactical Group Pty Ltd
FROM: Gareth Evans (Senior Principal Geotechnical Engineer)
SUBJECT: **Compass 2 Warehouse & Distribution Centre – Geotechnical Assessment compliance with Condition 12 of SEARs**
OUR REF: PS127384-GE-SYD-GEO-MEM-6331 Rev2
DATE: **8 February 2022**

WSP Australia Pty Ltd (WSP) was engaged by Charter Hall Holdings Pty Limited (Charter Hall) care of Tactical Group Pty Limited (Tactical) for the provision of selected environmental, geotechnical and waste consulting services. The overall engagement is associated with the proposed warehouse and distribution centre development (named ‘Project Compass 2’) at the property legally described as Lot 1 in Deposited Plan (DP) 1274322, or Lot 1 Eastern Creek Drive, Eastern Creek NSW (the site). Tactical has been appointed by Charter Hall to the role of project superintendent for the proposed development.

Charter Hall has acquired the site and in order to progress the project, Charter Hall needs to gain approval from the Development Consent Authority (DCA). As the proposed development is considered a State Significant Development (SSD), the development consent application process is subject to the NSW Government Planning Secretary’s Environmental Assessment Requirements (SEARs), which requires an Environmental Impact Statement (EIS) to be prepared. The overall EIS comprises numerous disciplines, reports and plans – this report is one of the required components.

This memo relates to satisfying the ‘Geotechnical Assessment’ requirement outlined in Key issue #12 of the SEARs for the subject development.

WSP has issued two previous geotechnical reports for Charter Hall for the proposed redevelopment of this site: a desktop study report; and a preliminary geotechnical interpretive report (GIR), which included an intrusive borehole investigation (WSP 2021, *Eastern Creek Geotechnical Investigation – Geotechnical Interpretive Report*, ref. PS122611-GEO-REP-002 Rev2, dated 06/09/2021). The preliminary GIR report is provided as Attachment A, and it includes the findings of the desktop study as Section 2.

The layout and features of the current and final development plan, presented in Qanstruct drawing ref. TP-03, Revision B, dated 3/02/2022, has not changed materially from the preliminary layout on which the geotechnical investigation and advice provided in the WSP 2021 GIR was prepared.

It is noted that Condition 12 of the SEARs set out in the table below does not identify any specific key geotechnical issues, however, notes *Geotechnical Assessment* as a requirement. The provision of the preliminary GIR to the development consent authority in support of the

Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
www.wsp.com

WSP acknowledges that every project we work on takes place on First Peoples lands. We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.



SEARs development application is considered appropriate for the purpose of satisfying the SEARs.

The specific and relevant SEAR that has been addressed with this memo and the preliminary GIR (provided in Attachment A) is detailed in Table 1.

Table 1. Relevant SEARs compliance table

Key issue no. & description	Issue & assessment requirements	How it is addressed	Section of this report
Issue 12. Geotechnical Assessment	Geotechnical Assessment	This memo and the attached preliminary GIR are appropriate to satisfy the requirement of a 'Geotechnical Assessment' related to the SEARs	This memo and the entire GIR (Attachment A)

Regards,

Gareth Evans
Senior Principal Geotechnical Engineer
WSP Australia Pty Ltd

Matthew Miklos
Senior Environmental Scientist
WSP Australia Pty Ltd



Attachment A – Preliminary Geotechnical Interpretive Report
(GIR) (WSP, 2021)

CHARTER HALL PTY. LTD.

SEPTEMBER 2021

EASTERN CREEK GEOTECHNICAL INVESTIGATION GEOTECHNICAL INTERPRETIVE REPORT

wsp



Question today Imagine tomorrow Create for the future

Eastern Creek Geotechnical Investigation Geotechnical Interpretive Report

Charter Hall Pty. Ltd.

WSP

Level 27, 680 George Street

Sydney NSW 2000

GPO Box 5394



Sydney NSW 2001

Tel: +61 2 9272 5100

Fax: +61 2 9272 5101

wsp.com

REV	DATE	DETAILS
1	03/12/2020	Draft Preliminary Geotechnical Report
2	06/09/2021	Final Geotechnical Interpretive Report

	NAME	DATE	SIGNATURE
Prepared by:	Casey Janssen	06/09/2021	
Reviewed by:	Gareth Evans	06/09/2021	
Approved by:	Gareth Evans	06/09/2021	

This document may contain confidential and legally privileged information, neither of which are intended to be waived, and must be used only for its intended purpose. Any unauthorised copying, dissemination or use in any form or by any means other than by the addressee, is strictly prohibited. If you have received this document in error or by any means other than as authorised addressee, please notify us immediately and we will arrange for its return to us.



TABLE OF CONTENTS

	EXECUTIVE SUMMARY	III
1	INTRODUCTION	1
1.1	PROJECT BACKGROUND	1
1.2	SCOPE OF WORKS.....	1
1.3	AVAILABLE INFORMATION.....	2
2	DESKTOP STUDY	3
3	METHODOLOGY	4
3.1	PRELIMINARIES.....	4
3.2	BOREHOLES.....	4
3.3	LABORATORY TESTING	5
4	INVESTIGATION RESULTS.....	6
4.1	SUBSURFACE CONDITIONS	6
4.1.1	FILL.....	6
4.1.2	NATURAL MATERIAL.....	6
4.1.3	GROUNDWATER.....	7
5	GEOTECHNICAL TEST RESULTS.....	8
5.1	LABORATORY TESTING	8
5.1.1	GEOTECHNICAL TEST RESULTS	8
5.1.2	CHEMICAL TEST RESULTS.....	9
6	GEOTECHNICAL ASSESSMENT.....	10
6.1	GENERALISED SUBSURFACE PROFILE.....	10
6.2	GEOTECHNICAL DESIGN PARAMETERS.....	10
6.3	SITE CLASSIFICATION	10
6.4	DURABILITY ASSESSMENT	11
6.5	EARTHQUAKE SITE CLASSIFICATION.....	11
7	DISCUSSION & RECOMMENDATIONS	12
7.1	EARTHWORKS.....	12
7.1.1	EXCAVATIONS	12
7.1.2	TEMPORARY BATTERS AND BENCHING	12
7.2	FOUNDATIONS.....	13



7.3	PAVEMENT.....	13
8	CONCLUSIONS.....	14
9	REFERENCES.....	15
10	LIMITATIONS.....	16

LIST OF TABLES

TABLE 3.1	SUMMARY OF BOREHOLES.....	4
TABLE 4.1	EXTENT OF FILL ENCOUNTERED ON SITE.....	6
TABLE 4.2	DEPTH TO NATURAL MATERIAL.....	7
TABLE 5.1	MOISTURE CONTENT TEST RESULTS.....	8
TABLE 5.2	ATTERBERG LIMITS TEST RESULTS.....	8
TABLE 5.3	CHEMICAL LABORATORY TEST RESULTS.....	9
TABLE 6.1	GENERALISED SUBSURFACE PROFILE.....	10
TABLE 6.2	GEOTECHNICAL DESIGN PARAMETERS.....	10
TABLE 7.1	SAFE BATTER SLOPES.....	12

LIST OF APPENDICES

FIGURES

APPENDIX A DESKTOP STUDY

APPENDIX B BOREHOLE LOGS AND EXPLANATORY NOTES

APPENDIX C LABORATORY TEST CERTIFICATES

EXECUTIVE SUMMARY

WSP Australia Pty Limited (WSP) carried out a preliminary geotechnical investigation at Lot 1 DP1243178 Eastern Creek Drive, Eastern Creek for Charter Hall. The primary purpose of the investigation being to inform its due diligence assessment and to identify likely geotechnical conditions and potential constraints that would apply to a proposed warehouse development.

No geotechnical show stoppers were identified at this site that would constrain future development of the proposed warehouse facility, although design measures and ground treatments necessary to accommodate the site conditions will have a cost implication for the development, specifically with respect to pavement subgrade treatments, potential replacement of fill used to form the construction platform currently underway on site, or provision of suitable imported capping material beneath the warehouse slab. Building foundations may have to be deeper to reach natural soils or rock.

These engineering measures would be typical for similar developments in the immediate locale of the site, where natural ground levels have also been increased to form a construction platform.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

WSP was engaged by Charter Hall Pty. Limited to undertake a geotechnical investigation at Lot 1 DP1243178 Eastern Creek Drive, Eastern Creek (the Site) as part of its due diligence assessment with the aim of purchasing the site. The geotechnical investigation is tailored to provide a high-level understanding of the existing ground conditions and to identify potential constraints that should be considered in the development of the site. The report will provide indicative advice as to possible geotechnical solutions for the proposed warehouse foundations and surrounding pavement. Further investigation is likely to be required once the final site levels have been determined and the design of the warehouse progressed further.

This preliminary geotechnical report describes:

- Findings from the geotechnical investigation including extent of fill encountered on site and groundwater conditions (where applicable).
- Borehole and laboratory testing information (including logs and test certificates) determining soil characteristics.
- Discussion and preliminary advice related to geotechnical constraints, anticipated earthworks requirements and design of pavements and foundations.

This investigation was carried out in accordance with the email fee proposal (Barnett/Walters) dated 3 November 2020.

1.2 SCOPE OF WORKS

The scope of works for this investigation and analysis are as follows:

- Review of relevant, available information.
- Five (5) x boreholes drilled to 5 m below ground level (mBGL) or auger refusal, whichever comes first, with Standard Penetration Tests (SPTs) at nominal 1 m centres.
- Logging and sampling of retrieved material by an experienced geotechnical engineer in accordance with AS 1726-2017 *Geotechnical site investigations*.
- Laboratory testing on selected samples in accordance with AS 1289 *Methods of testing soils for engineering purposes*.
- Production of a preliminary geotechnical report addressing the following aspects:
 - Composition of subsurface soil profile including depth and strength profile of fill.
 - Soil characteristics across the site.
 - Determination of soil aggressivity to construction materials.
 - Provisional Site Classification.

1.3 AVAILABLE INFORMATION

The following documents were made available to assist the investigation and the development of this report:

- Calibre Group, *Proposed Subdivision of Lot 4002 in DP 1243178*, Ref: 18-001145-DA Rev 2 dated 15 June 2020.
- JK Williams, *Contour Plan – Detail Survey*, Ref: 6556 Rev B dated 28 October 2020.
- Watch this Space Design, *Indicative Development Masterplan – Proposed Masterplan*, Ref: CH 1EDC SK01(A) dated 7 October 2020.

2 DESKTOP STUDY

Refer to Appendix A for the Phase 1 Geotechnical Desktop Study of the Eastern Creek site (ref: PS122611-GEO-REP-001 Rev00 dated 13 November 2020).

3 METHODOLOGY

3.1 PRELIMINARIES

The following activities were undertaken by WSP prior to commencement of the intrusive field investigation:

- Preparation of a health, environmental, and safety plan (HESP), which included hazard and risk assessments with associated control measures and safe work method statements (SWMSs).
- Service plans were obtained from Dial Before You Dig (DBYD), and a desktop audit of services near the investigation locations was undertaken. A ground penetration permit (GPP) was completed for each location prior to excavation. Test pit locations were cleared for services using a cable avoidance tool (CAT) and/or ground penetrating radar (GPR) where applicable.

3.2 BOREHOLES

In order to assess the subsurface conditions at the site, the geotechnical investigation comprised drilling of five boreholes with a track-mounted Geoprobe 6712 DT drill rig utilising solid auger drilling techniques. All equipment was owned and operated by Stratacore Pty. Limited. Boreholes were offset from proposed test pit locations (investigation undertaken by the environmental team) and positioned to target one or both of the proposed warehouse slab or hardstand pavement areas. Identification of these target locations was provided in the site desktop study (provided in Appendix A) ref: PS122611-GEO-REP-001 Rev00 dated 13 November 2020. Boreholes were backfilled with the recovered spoil and nominally compacted to existing state on completion of logging, sampling and testing.

A summary of borehole information including termination depths, approximate coordinates and investigation purpose is presented in Table 3.1.

Table 3.1 Summary of boreholes

BOREHOLE ID	EASTING* (m)	NORTHING* (m)	TERMINATION DEPTH (mBGL)	TERMINATION REMARK	TARGET AREA
BH01	299997	6257106	5.00	Target Depth	Warehouse slab
BH02	300035	6257030	5.00	Target Depth	Warehouse slab
BH03	300000	6256976	5.00	Target Depth	Hardstand pavement
BH04	299899	6256996	5.00	Target Depth	Warehouse slab & hardstand pavement
BH05	299906	6257115	2.65	Practical Refusal	Hardstand pavement

*Coordinates acquired from handheld GPS accurate to approximately ± 5 m

Pocket (or Hand) Penetrometer (PP) tests were undertaken where competent cohesive soils were encountered. SPTs were undertaken at nominal 1 m intervals to assist with informing strength of the subsurface material.

Borehole drilling was supervised by a qualified geotechnical engineer from WSP who logged recovered samples in general accordance with AS 1726-2017 *Geotechnical site investigations*. The borehole logs are presented in Appendix B along with explanatory notes.

3.3 LABORATORY TESTING

A selection of samples collected on site were sent to Resource Laboratories Pty. Ltd., a NATA-accredited soil testing facility, to perform the tests outlined below:

- Four (4) x Moisture Content tests as per AS 1289 2.1.1.
- Four (4) x Atterberg Limits tests (including linear shrinkage) as per AS 1289 3.1.1, 3.1.2 and 3.2.1.
- Four (4) x Soil Aggressivity test suites (including pH, SO₄ and Cl).

Results from the above laboratory testing are provided in Section 5.1 of this report.

4 INVESTIGATION RESULTS

4.1 SUBSURFACE CONDITIONS

Engineering borehole logs are presented in Appendix B together with explanatory notes describing terms and symbols. The logs provide descriptions of the soil conditions encountered during the investigation. The ground conditions underlying the site generally comprised consistent strata, broadly summarised in the following sections.

4.1.1 FILL

Fill thicknesses encountered across the site ranged from 0.3 m (in borehole BH01) to 2.5 m (in borehole BH02). Based on site observations cut material from elsewhere on site is being used to fill the southern portion of the lot associated with this investigation to form a platform for future construction. Filling to date suggests an average fill depth of 0.5 m and maximum fill depth of approximately 2.9 m could be encountered at the southern portion of the site. Investigation findings are generally consistent with this; however, it is assumed that further filling is required to form the final construction platform. At the time of writing, the filling specification was not known.

Table 4.1 summarises the extent of fill found at each borehole location.

Table 4.1 Extent of fill encountered on site

BOREHOLE ID	DEPTH OF FILL
	DEPTH (mBGL)
BH01	0.3
BH02	2.5
BH03	0.6
BH04	0.5
BH05	1.0

Fill material was generally described as reworked natural material (cut from elsewhere on site) and typically comprised cohesive medium to high plasticity sandy clay with gravel and some roots observed.

4.1.2 NATURAL MATERIAL

Natural material was encountered in each test pit, starting from 0.3 mBGL (in borehole BH01) to 2.5 mBGL (in borehole BH02). The natural material typically comprised stiff to very stiff, medium and medium to high plasticity, sandy or silty clay, which was inferred to be alluvial soil. Residual soil (derived from weathered rock) transitioning into extremely weathered rock (inferred as Bringelly Shale) was encountered in all boreholes from, on average, approximately 2.5 mBGL, however, in borehole BH02, weathered rock was encountered at 4.6 mBGL due to the deeper fill profile.

Table 4.2 summarises depths to alluvial and residual soil and inferred weathered rock material found at the borehole locations.

Table 4.2 Depth to natural material

BOREHOLE ID	DEPTH TO ALLUVIAL SOIL	DEPTH TO RESIDUAL SOIL	DEPTH TO INFERRED WEATHERED ROCK
	DEPTH (mBGL)	DEPTH (mBGL)	DEPTH (mBGL)
BH01	0.3	1.5	1.9
BH02	2.5	4.0	4.6
BH03	0.6	2.0	2.8
BH04	0.5	2.5	3.2
BH05	NE	1.0	1.95

NE = Not Encountered

4.1.3 GROUNDWATER

Groundwater was not encountered in any boreholes during the fieldwork. Possible perched water was encountered in borehole BH02 at 2.5 mBGL (fill/alluvium boundary), however, further drilling did not yield any additional evidence of a water table at this location. It should be noted that groundwater levels are subject to seasonal and climatic variations and there had been periods of heavy rainfall in the weeks leading up to the fieldwork. Borehole BH02 was located at a low point of the site, hence, surface run off may have accumulated at this location.

5 GEOTECHNICAL TEST RESULTS

Laboratory test results are tabulated in the following sections. Laboratory test certificates will also be provided in Appendix C.

5.1 LABORATORY TESTING

5.1.1 GEOTECHNICAL TEST RESULTS

Geotechnical laboratory test results will be provided in Table 5.1 and Table 5.2.

Table 5.1 Moisture content test results

BOREHOLE ID	SAMPLE DEPTH (mBGL)	MATERIAL	MOISTURE CONTENT, MC (%)
BH01	1.50-1.95	Silty CLAY, brown/pale grey/yellow-brown	13.1
BH02	2.50-2.95	Silty CLAY, grey/red	20.1
BH03	1.50-1.95	Silty CLAY, pale yellow-brown/red	18.4
BH04	2.50-2.95	Silty CLAY, yellow-brown/pale grey/red	19.2

Table 5.2 Atterberg Limits test results

BOREHOLE ID	SAMPLE DEPTH (mBGL)	MATERIAL	USCS SYMBOL	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	LINEAR SHRINKAGE (%)
BH01	1.50-1.95	Silty CLAY, brown/pale grey/yellow-brown	CI	41	18	23	10.5
BH02	2.50-2.95	Silty CLAY, grey/red	CI-CH	40	13	27	13.0
BH03	1.50-1.95	Silty CLAY, pale yellow-brown/red	CH	54	14	40	15.5
BH04	2.50-2.95	Silty CLAY, yellow-brown/pale grey/red	CI-CH	48	14	34	14.0

USCS = Unified Soil Classification System

5.1.2 CHEMICAL TEST RESULTS

Soil chemical laboratory test results will be provided in Table 5.3.

Table 5.3 Chemical laboratory test results

BOREHOLE ID	SAMPLE DEPTH (mBGL)	pH	SULPHATE (SO₄²⁻) (mg/kg)	CHLORIDE (mg/kg)
BH01	1.50-1.95	5.8	160	180
BH02	1.50-1.95	7.3	70	370
BH04	2.50-2.95	7.8	140	910
BH05	1.50-1.95	5.5	140	130

6 GEOTECHNICAL ASSESSMENT

6.1 GENERALISED SUBSURFACE PROFILE

A generalised subsurface ground profile for the site is presented in Table 6.1. Geotechnical parameters have been assigned as shown in Section 6.2.

Table 6.1 Generalised subsurface profile

DEPTH FROM (mBGL)	DEPTH TO (mBGL)	MATERIAL	CLASSIFICATION
0.0	1.0*	Reworked material	FILL
1.0	2.0	Sandy CLAY/Clayey SAND	ALLUVIAL SOIL
2.0	2.5	Silty CLAY	RESIDUAL SOIL
2.5**	-	SILTSTONE	WEATHERED ROCK

*FILL was encountered to 2.5 mBGL in borehole BH02

**WEATHERED ROCK was encountered at 1.9 mBGL in borehole BH01 and 1.95 mBGL in BH05

6.2 GEOTECHNICAL DESIGN PARAMETERS

Based on the intrusive investigation, local experience with similar materials and engineering judgement, preliminary geotechnical design parameters have been assigned to the materials encountered and provided in Table 6.2.

Table 6.2 Geotechnical design parameters

MATERIAL	UNIT WEIGHT, γ (kN/m ³)	EFFECTIVE COHESION, C' (kPa)	ANGLE OF FRICTION, ϕ (°)
Reworked material	18	2	26
Sandy CLAY; stiff	20	10	28
Clayey SAND; inferred medium dense	19	1	32
Silty CLAY; very stiff	21	15	28
Extremely Weathered SILTSTONE; hard	24	350	33

6.3 SITE CLASSIFICATION

Site Classification is determined with reference to AS2870:2011 – Residential Slabs and Footings and is predominantly due to soil reactivity.

Based on the laboratory test results the soils on site are identified as being moderate to high plasticity. Reference to the standard indicates the site would be classified as Class M - Moderately reactive clay site. This means the ground may experience moderate ground movement from moisture changes.

However, as the site levels are being raised using locally won fill material and the final depth and specification is unknown, the site is likely to classify as Class P. This classification can be revised subject to engineering assessment of the final fill platform and of the proposed structure. Design of foundations for a Class P site require special engineering consideration by geotechnical and structural engineering practitioners.

6.4 DURABILITY ASSESSMENT

An assessment of chemical test results was undertaken to provide a durability assessment in accordance with AS 2159 – 2009 *Piling – Design and installation*.

An exposure classification has also been assessed in accordance with AS 3600 – 2009 *Concrete structures*.

Based on the chemical laboratory test results presented in Section 5.1.2, an exposure classification for concrete of “non-aggressive” is recommended in accordance with AS 2159-2009. An exposure classification of “non-aggressive” is also recommended for steel.

In accordance with AS 3600-2009, an exposure classification of B1 is recommended for buried concrete.

6.5 EARTHQUAKE SITE CLASSIFICATION

AS/NZS 1170-2007 Part 4 *Earthquake actions in Australia* requires designers to consider the effects of earthquakes. The design is influenced by a hazard factor (based on the probability of an earthquake occurring) and the classification of the site (based on the subsoil strength and thickness).

The hazard factor (Z) for this site should be taken as 0.09 as per Table 3.2 of AS/NZS 1170.4, which is the nominated value for the region encompassing the site. The hazard factor quoted in the standard is based on a 1 in 500-year probability of exceedance.

The site sub-soil classification recommended for this site is C_e (Shallow soil site) as per Section 4 of AS/NZS 1170.4.

7 DISCUSSION & RECOMMENDATIONS

7.1 EARTHWORKS

7.1.1 EXCAVATIONS

All excavation work should be carried out in accordance with the Safe Work Australia publication, **Excavation Work Code of Practice, October 2018** and NSW Government publication **Code of Practice Construction Work, August 2019**.

Based on the materials encountered in the boreholes, excavations will likely encounter fill (generally sandy clays) overlying sandy and silty clay, stiff to very stiff natural material, and then typically siltstone/shale rock-strength material.

No issues are foreseen removing the fill, soils and inferred very low strength shale within the site. These materials are expected to be able to be removed using conventional earth moving equipment such as excavators and backhoes with toothed buckets and this was confirmed by observations on site during the fieldwork.

7.1.2 TEMPORARY BATTERS AND BENCHING

For temporary and short-term excavations (up to 3 days), batter slopes should be excavated as per criteria provided in Table 7.1. Care should be taken to avoid surcharge loading adjacent to the excavation, including excavated spoil and plant and equipment (refer to the Excavation Work Code of Practice).

If groundwater inflows are encountered, a sump should be formed at the base of the excavation and the water pumped out.

Table 7.1 Safe batter slopes

MATERIAL	MAXIMUM SAFE BATTER SLOPE (SHORT-TERM, H:V)
FILL	1.5:1
Firm/Stiff CLAY (Alluvium)	1:1
Very Stiff/Hard CLAY (Residual Soil)	0.75:1
Weathered rock	0.5:1

A 0.5 m wide bench should be incorporated at maximum 1.5 m of excavation.

If the site boundary prevents application of the above recommended safe batter slopes, consideration should be given to:

- Use of a 1:1 batter slope incorporating a minimum 0.5 m wide bench at a depth of 1.0 m and every 1.5 m of excavation thereafter.
- Retaining structures, if required would typically include concrete soldier piles or post and panel walls with timber/ steel/ concrete walers, or sheet piles to support temporary excavations.

All excavations (deeper than 1.5 m) should be observed by a geotechnical engineer or engineering geologist, who shall assess safe batter angles appropriate for the conditions encountered. Where access is required for a worker, the need (or otherwise) for support of the temporary excavation should be assessed on-site by a geotechnical engineer or engineering geologist.

Supports could include retaining structures (shoring) and/or use of trench shields to protect workers within the excavation.

If a period of heavy rainfall occurs during construction, the stability of the excavation should also be reassessed prior to recommencement of work. If the exposed soils have softened significantly due to an increase in moisture content, then temporary shoring or other approaches may be required to support excavations. Protective plastic sheeting can be used to protect the batters if heavy rainfall is predicted before the excavation is backfilled or the clay surface smoothed using the excavator bucket to reduce infiltration and softening of the soils.

7.2 FOUNDATIONS

Foundation options will depend on the structural loading and the ability of the structure to accommodate some movement. For example, steel framed warehouse type buildings can typically accommodate greater movement compared with a concrete framed and or brick walled structures.

Options to be considered include:

- Pad footings - founded on the stiff to very stiff alluvial or residual soils, where bearing pressures of over 150kPa can be expected with settlements of around 1% of the footing width.
 - Pile footings - extending in to the weathered shale bedrock where bearing pressures over 1MPa are required and settlements of 1% of the footing dimension.
 - Stiffened raft slab – where differential settlements need to be minimised and structural and or operational loads need to be spread. Where this option is used a capping layer of imported granular fill should be placed beneath the slab to provide an even bearing surface over the reworked clay platform. The depth of this capping layer needs to be assessed by the geotechnical/ structural engineer once the building design and loads are known with more certainty. Typically, a thickness of 300 mm – 500 mm of granular fill would be required beneath the slab.
 - Combination of individual footings and slab on ground – This option would consist of using pad footings as discussed above with a floating concrete slab. The slab would need to be constructed above a capping layer of granular imported material as described for the stiffened raft slab.
-

7.3 PAVEMENT

We understand a pavement is required for the car parking and freight drop off/pick up areas. Consideration will need to be given during design to the difference in loading requirements between the two pavement areas including type of vehicles, frequency of movement and design life, speed limits.

Based on the investigation results, a preliminary design CBR value of 1% is recommended for pavement design across the site, assuming the clay subgrade is the final surface layer. This value is consistent with a poor-quality subgrade requiring deeper layers of imported sub base and base materials. It is recommended that the subgrade is inspected by a geotechnical engineer and proof rolled to identify any soft spots prior to the placement of any pavement material. There may be a requirement to excavate soft material or uncontrolled fill and replace with an imported granular engineered fill at some locations.

The laboratory tests have indicated that the reactive clay present at the site has a linear shrinkage (LS) value of between 10.5% and 15.5%. Typically, material with a LS value greater than 7% would require special consideration beneath pavements to prevent loss of bearing capacity resulting in rutting and surface cracking. This could include treatment of the clay subgrade using lime stabilisation or use of deeper sub base.

Particular attention should be given to site drainage to avoid accumulation or ponding of water as this will compromise the bearing capacity of the pavement if it penetrates cracks leading to further damage.

8 CONCLUSIONS

It is important to note that there are no geotechnical show stoppers identified at this site that would constrain future development of the proposed warehouse facility, although design measures and ground treatments necessary to accommodate the site conditions will have a cost implication.

The investigation has confirmed that special engineered solutions as discussed in this report will be required to address the reactive clay soils which are prone to movement (shrink and swell) under seasonal changes in moisture content.

At this stage the final platform level of the site is unknown as is the specification for how the platform has been engineered. The platform specification will need to be understood by the geotechnical and structural engineers for the development in order to make an assessment of its bearing capacity and potential for settlement under load. Further work may be required to excavate and recompact this platform if it is not constructed to a satisfactory standard including replacement of some of the material with imported granular material or provision of a capping layer as discussed in this report.

Building footings should not be founded in the fill but rather taken down to natural soils or rock.

9 REFERENCES

The following references were used in the development of this factual report:

- Australian Standard, AS/NZS 1170 – 2007 Part 4 *Earthquake actions in Australia*.
- Australian Standard, AS 1289 *Methods of testing soils for engineering purposes*.
- Australian Standard, AS 1726 – 2017 *Geotechnical site investigations*.
- Australian Standard, AS 2159 – 2009 *Piling – Design and installation*.
- Australian Standard, AS 2870 – 2011 *Residential slabs and footings*.
- Australian Standard, AS 3600 – 2009 *Concrete structures*.
- Calibre Group, *Proposed Subdivision of Lot 4002 in DP 1243178*, Ref: 18-001145-DA Rev 2 dated 15 June 2020.
- Clark, N.R., and Jones, D.C., (Eds), 1991. Penrith 1:100,000 Geological Sheet 9030. New South Wales Geological Survey, Sydney.
- JK Williams, *Contour Plan – Detail Survey*, Ref: 6556 Rev B dated 28 October 2020.
- Safework Australia, *Excavation Work – Code of Practice*, dated October 2018.
- Safework NSW, *Code of Practice – Construction Work*, dated August 2019.
- Watch this Space Design, *Indicative Development Masterplan – Proposed Masterplan*, Ref: CH 1EDC SK01(A) dated 7 October 2020.

10 LIMITATIONS

SCOPE OF SERVICES

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances, the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

GEOTECHNICAL INVESTIGATION

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his/her representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

THIS GEOTECHNICAL REPORT IS BASED ON PROJECT-SPECIFIC FACTORS

This geotechnical engineering report is based on a subsurface investigation, which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained, this geotechnical engineering report cannot be used:

- When the nature of any proposed development is changed.
- When the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

THE LIMITATIONS OF SITE INVESTIGATION

When assessing a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however, this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regards to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation and cannot always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

AVOID MISINTERPRETATION

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

BORE/PROFILE LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to 'Guidelines for the Provision of Geotechnical Information in Construction Contracts' published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

GEOTECHNICAL INVOLVEMENT DURING CONSTRUCTION

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason, geotechnical consultancy should be retained through the construction stage to identify variations if they are exposed, and to conduct additional tests, which may be required and to deal quickly with geotechnical problems if they arise.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

WSP will not be liable to update or revise the report to consider any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

FIGURES

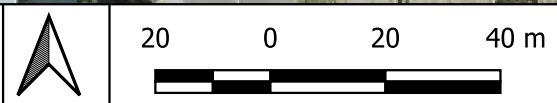




Legend

- Site boundary
- Test pit location (WSP 2021a environmental investigation)
- ◆ Borehole location (WSP 2021b geotechnical investigation)

Data source: © Metropmap 2021



© WSP Australia Pty Ltd ("WSP") Copyright in the drawings, information and data recorded ("the information") is the property of WSP. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by WSP. WSP makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information. NCSI Certified Quality System to ISO 9001. © APPROVED FOR AND ON BEHALF OF WSP Australia Pty Ltd.

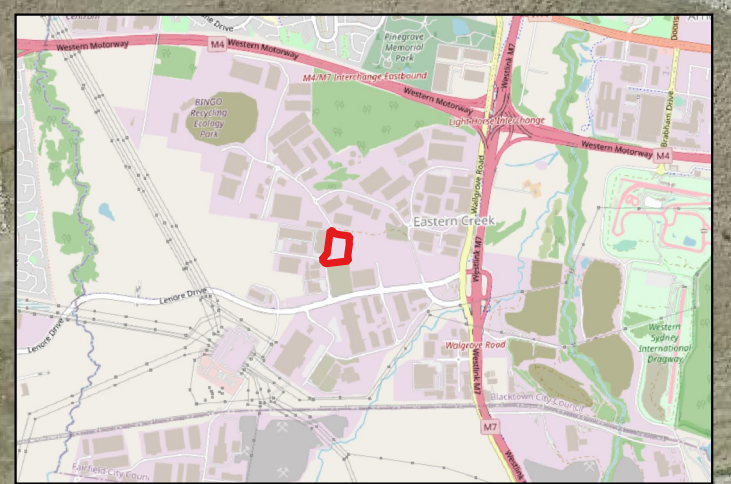


Figure 1.
Investigation Locations
Lot 1 Eastern Creek Drive, Eastern Creek NSW

APPENDIX A

DESKTOP STUDY





1 INTRODUCTION

WSP has been engaged by Charter Hall Pty. Ltd. to develop a geotechnical desktop study to support and inform decisions associated with a future development proposed for the currently empty property on Eastern Creek Drive, Eastern Creek NSW 2766.

In accordance with the scope provided to Charter Hall in the fee proposal email (Barnett/Walters) dated 3 November 2020, this desktop study will address the following objectives:

- Provide an indication of anticipated geotechnical conditions at the site utilising publicly available information such as geological maps and databases
- Identify potential geotechnical risks and hazards, which may be encountered at the site
- Provide preliminary advice and recommendations regarding anticipated allowable bearing pressures and soil characteristics at the site to assist with informing future foundation design
- Provide a preliminary scope of works for an intrusive geotechnical investigation to assist with confirming findings from the desktop study

2 DESKTOP STUDY

2.1 SITE LOCATION

The site is located at Eastern Creek Drive, Eastern Creek NSW 2766 (legally defined as Lot 4002 DP1243178), in the Blacktown Local Government area, approximately 40 km west of Sydney CBD. Figure 2.1 depicts where the site is with respect to metropolitan Sydney.

The site comprising approximately 25,500 square metres is shown in Figure 2.2, and covers the area shaded yellow. Medium-scale industrial estate makes up a majority of the local surrounds (to the north and west of the property). Areas directly adjacent to the property are also empty; earmarked for future industrial development. At the time of undertaking this desktop study and based on photographs from a recent site visit by WSP, it appears that earthworks have been undertaken to de-vegetate the site and grade the ground surface to a moderately flat level.

Historically, a water detention basin or drainage catchment was situated in the middle of the site (shown in Figure 2.2) with access tracks running north-south.

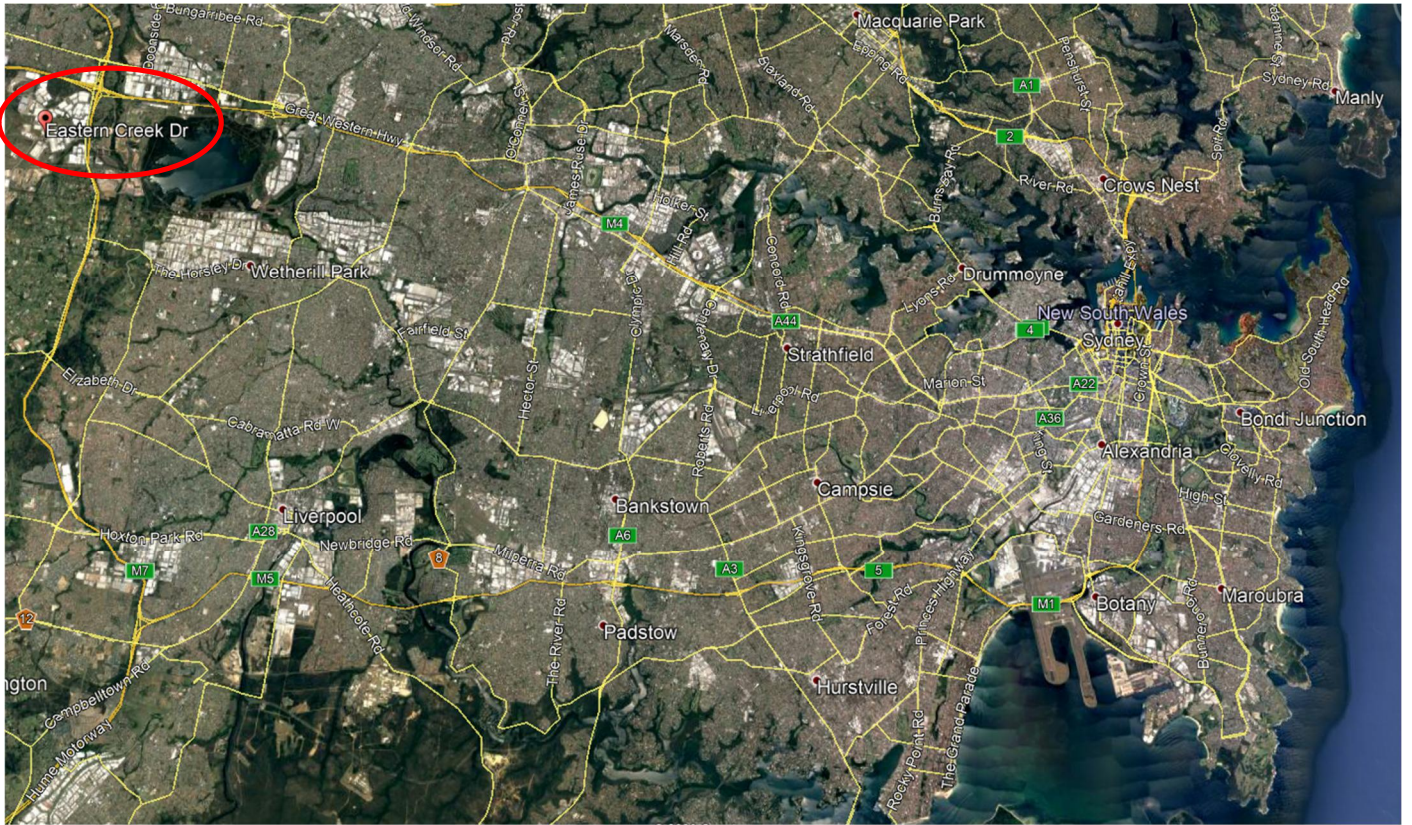


Figure 2.1 Large-scale map of site location with respect to Sydney CBD (Google Earth, 2020)



Figure 2.2 Site Location and local surrounds (SIX Maps, 2020)

2.2 REGIONAL GEOLOGY

Review of the 1:100,000 Penrith Geological map (NSW Department of Minerals and Energy, 1991), for the Eastern Creek area indicates the site is likely to be underlain by Middle Triassic period Bringelly Shale of the Wianamatta Group. The geological formation is described as follows:

- Rwb: Shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff

A nearby boundary between fluvial material (denoted as Qal) and the Bringelly Shale (denoted Rwb) is observed on the map. An extract from the geological map is shown in Figure 2.3; the approximate location of the site is denoted with a placemark.

Consolidating the above information, a preliminary natural subsurface profile, which may be encountered at the site is as follows:

- Minor fluvial material such as fine-grained sand, silt and clay
- Bringelly Shale formations at depth

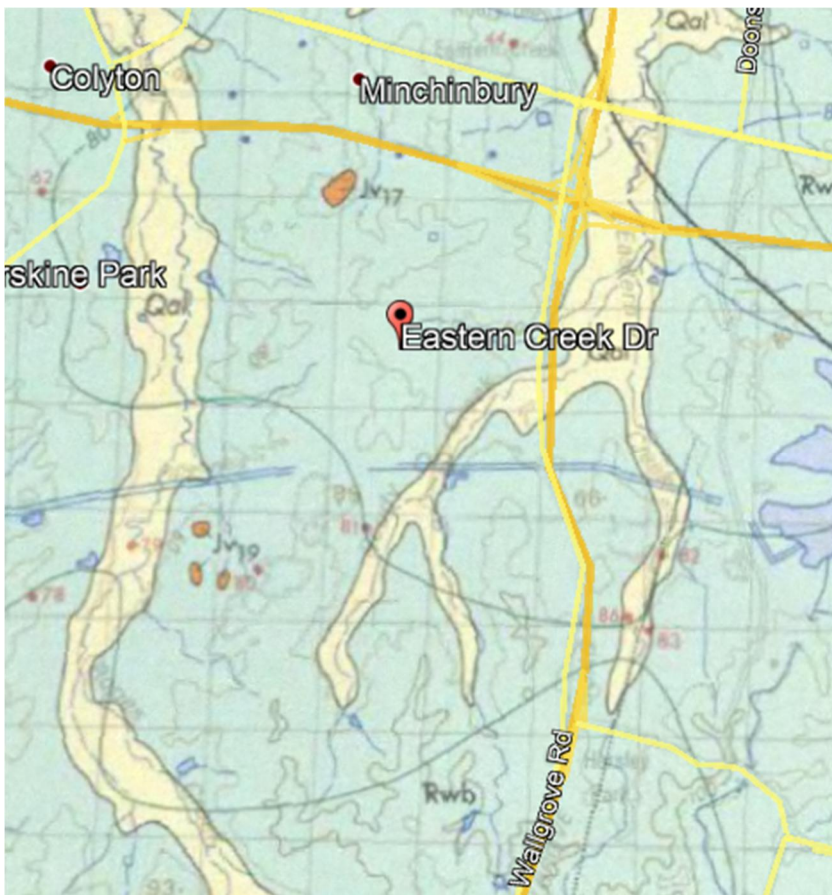


Figure 2.3 Geology in the Eastern Creek area (Penrith 1:100,000 Geological Map, 1991)

2.3 GROUNDWATER

Review of the Australian Bureau of Meteorology Groundwater Exploration Database [accessed 12 November 2020], including historical bores in the vicinity of the site, indicates that groundwater has previously been encountered at shallow depth, about 1.5 m below ground level. A number of relevant bores shown in the database did not report a groundwater strike during the investigation, however, it should be noted that groundwater levels are subject to seasonal and climatic variations depending on the time of year in which the associated test locations were investigated. Based on the majority of bores reviewed and the location of site with respect to local watercourses, it is likely that groundwater would be encountered at varying depths being deeper around



the edges of the site (4-5 m) and relatively shallow around the central low lying area where the depth is expected to be <1.5 m below ground level in general.

Perched water may also be encountered within granular material above cohesive soil layers; more likely directly following periods of heavy rainfall.

2.4 ACID SULPHATE SOILS (ASS)

Upon review of the CSIRO's Australian Soil Resource Information System (ASRIS) [accessed 12 November 2020], it is unlikely that ASS will be encountered at the site. ASRIS notes a confidence level of 4, corresponding to an "extremely low probability of occurrence".

However, it is possible that there may be some areas where ASS could exist across site, particularly in areas of shallow groundwater (if encountered). It is recommended that the presence of ASS is further assessed as part of an environmental investigation.

3 GEOTECHNICAL RISKS & HAZARDS

It is important to note that the geotechnical risks identified below do not preclude development or impose onerous restrictions. These risks can be addressed by well understood engineering design methodologies.

Risks can vary depending on the proposed development. For example, buildings founded at the surface that require minimal excavation have different risks compared with a building with basement excavation.

Some risks to be considered include:

- Potentially shallow groundwater table, which could affect excavations that extend below.
- Moderately deep clay profile which may be slightly to moderately expansive and subject to volumetric changes with fluctuation in moisture content.
- Though not strictly a geotechnical risk, as the site is within a natural low lying area and appears to have been used as a local water detention basin, the risk of flooding should be investigated.

Many of these potential risks could be mitigated or reduced by undertaking an intrusive geotechnical investigation with collection of soil samples and laboratory testing.

4 ADVICE & RECOMMENDATIONS

The following sections outline preliminary advice relating to expected geotechnical conditions.

4.1 SITE CLASSIFICATION

Site classification is carried out in accordance with Australian Standard AS2870: "Residential Slabs and Footings" and is based on laboratory testing of soil samples. Preliminary advice based on the geology and expected soil types discussed in Section 2.2 and on review of recent site photographs, indicates the surface soils on site consist of sandy and silty loams and sandy clays. The loam is likely to be less expansive compared with the predominantly clayey soils and would likely classify as Class 'A' (little or no movement due to moisture content changes) or 'S' (slight ground movements due to moisture content changes). The clayey soils could be moderately reactive and could experience moderate movements due to moisture changes. It would be important to delineate areas that comprise expansive soils so that appropriate foundation systems and precautions can be designed.

4.2 EXCAVATION

Ease of excavation will depend on the depth of the soil profile. Areas of soil will be readily excavated using conventional earthmoving equipment such as hydraulic excavators with bucket attachments. Deeper excavations that encounter rock will require rock hammer attachments for small localised excavations. Large excavations could be advanced using dozers with ripping tines. Due to the size of the site and lack of residential properties, noise and vibrations caused by excavating in rock are unlikely to be of concern.



Off-site disposal of waste spoil will typically require classification in accordance with the current Waste Classification Guidelines (NSW, EPA).

4.3 EXCAVATION SUPPORT

Vertical excavations in the surface sandy and clayey soils are not expected to be self-supporting. Temporary batters of 1V:2H are likely to be acceptable for excavations less than about 3m deep. Where batters cannot be accommodated due to space restrictions, shoring support will be required. This would likely take the form of concrete soldier piles spaced at 1.5m to 3m centres with reinforced shotcrete panels between and extended to below the base of the excavation. Intrusive borehole investigations would be required to assess the design of shoring with greater certainty.

4.4 FOUNDATIONS

The type of foundation system used will depend on the building structure and ground conditions. For example, warehouse type developments constructed using steel frames can typically accommodate greater settlement than more rigid concrete framed or brick buildings. It is noted that buildings on adjoining sites have been constructed on a fill platform. This is likely required to raise the surface above the probable maximum flood (PMF) level. It is not possible to provide accurate advice on allowable bearing pressures without carrying out a detailed intrusive borehole investigation and having an understanding of whether the site levels are to be raised to form a platform. As a general guide the following options could be considered for this site:

- Shallow spread, pad or strip footings – could potentially be founded in the surface natural soils where bearing pressures are less than about 150 kPa, or if rock is found within about 3 m depth, the footing could be extended to this horizon where significantly higher bearing pressures could be accommodated.
- Slab on ground – could potentially be founded on the ground or platform fill once compacted to provide a consistent bearing surface. Typically, bearing pressures would be limited to less than 100 kPa but could be higher depending on the ground conditions and with treatment by compaction.
- Piles – if heavier loads need supporting or if buildings are sensitive to settlement, piles may be required to transfer loads to the underlying rock.

4.5 ROAD PAVEMENT

Pavement or road construction would require compaction of the in-situ soils prior to constructing the pavement layers. Pavement design typically requires identification of the California Bearing Ratio (CBR) of the soil, an understanding of the engineering characteristics after compaction and the anticipated traffic loading. CBR value and compaction characteristics are determined by laboratory testing. However, based on experience with similar soils, the soil material on this site is likely to provide a CBR value of 1-3.

4.6 INTRUSIVE GEOTECHNICAL INVESTIGATION

This section outlines the recommended scope of works for a preliminary intrusive geotechnical investigation at the site. Reasons for recommending this investigation include:

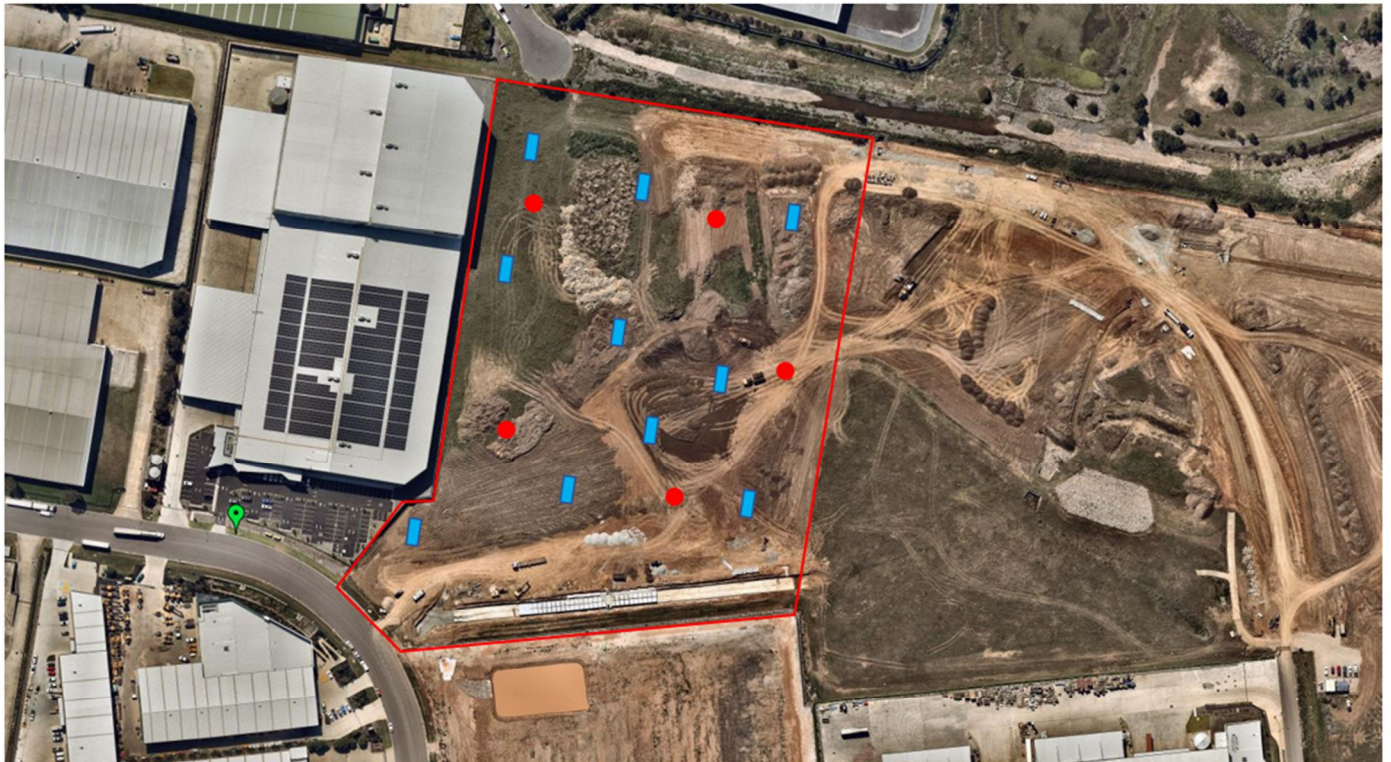
- To confirm ground conditions as discussed in this desktop study
- To gain a more comprehensive understanding of the characteristics of the soil and rock conditions across the site using both in-situ and laboratory testing

For initial assessment, the following minimum scope of works is recommended:

- Drilling of five (5) boreholes, approximately located as shown in Figure 4.1, drilled to around 5 m below ground level or until practical refusal, whichever comes first. This would provide broad confirmation of the ground profile and possible water table level.
- Standard Penetrometer Tests (SPTs) undertaken within each of the boreholes at approximately 1 m intervals (where appropriate) to assist with determination of soil strength characteristics to inform foundation design

- Soil samples taken for laboratory testing to confirm soil type and shrink/swell classification to inform foundation design and settlement predictions
- Production of a geotechnical interpretive report outlining results of the investigation, provision of relevant design parameters and recommendations on foundation design, batter slopes, site classification, fill placement (if required) and construction issues.

More detailed building-specific intrusive investigations are recommended once the development plans are known with more certainty.



- Proposed test pit location (Environmental investigation)
- Proposed borehole location (Geotechnical investigation)

Figure 4.1 Proposed borehole and test pit locations

5 REFERENCES

The following sources were used during the development of this desktop study:

- Asris.csiro.au. (2020). [online] Available at: <http://www.asris.csiro.au/mapping/viewer.htm> [Accessed 12 November 2020].
- Bom.gov.au. (2020). Groundwater Explorer. [online] Available at: <http://www.bom.gov.au/weave/explorer.html?max=true> [Accessed 12 November 2020].
- Clark, N.R., and Jones, D.C., (Eds), 1991, PENRITH 1:100,000 Geological Sheet 9030, New South Wales Geological Survey, Sydney.
- Maps.six.nsw.gov.au (2020). SIX Maps. [online] Available at: <https://maps.six.nsw.gov.au/> [Accessed 10 November 2020].
- Standards Australia 2017, Geotechnical site investigations, AS 1726:2017 [2 May 2017].

APPENDIX B

BOREHOLE LOGS AND EXPLANATORY NOTES



Explanatory Notes - Engineering Logs

Engineering logs have been prepared in accordance with AS1726:2017 "Geotechnical Site Investigations" and as defined below.





DRILLING/EXCAVATION METHODS

Symbol	Term
AS	Auger Screwing
EX	Excavation
HA	Hand Auger
NMLC/HMLC	Diamond Core –triple tube
NQ/HQ/PQ	Diamond Core – wireline
PC	Percussion
PCB	Poly Carbonised Diamond Bit
PT	Push Tube
RAB	Rotary Air Blast
RC	Reverse Circulation
S	Sonic drill
VB	Vibrocoring
WB	Washbore with blade
WR	Washbore with roller (tricone)

SUPPORT

C	Casing
M	Drill mud
Nil	No support

WATER

	Partial water loss		Water inflow
	Complete water loss		
	Water level at date shown		

NFGWO No Free Groundwater Observed
The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

NFGWE No Free Groundwater Encountered
The borehole/test pit was dry soon after excavation. Inflow may have been observed had the borehole/test pit been left open for a longer period.

FIELD TEST (Soil borehole and test pit logs)

DM	Dilatometer test
HB	Hammer bounce
OT	Other test (eg. plate load test)
PE	Permeability test
PM	Pressuremeter test
PP	Pocket penetrometer
SPT	Standard penetration test
SV	Shear vane test

SAMPLE (Soil borehole and test pit logs)

B	Bulk disturbed sample
D	Disturbed sample
PT	Push tube
SPT	SPT sample
U50	Undisturbed sample in 50mm diameter tube
U75	Undisturbed sample in 75mm diameter tube

GRAPHIC LOG – see later

TOTAL CORE RECOVERY (Rock logs only)

$$\text{TCR (\%)} = \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

ROCK QUALITY DESIGNATION (Rock logs only)

$$\text{RQD (\%)} = \frac{\sum \text{Length of sound core pieces} > 100\text{mm}}{\text{Length of core run}} \times 100$$

GROUP SYMBOL (Soil borehole and test pit logs)

Soils are classified to reflect their primary and significant secondary component/characteristic using the classification symbols described in AS1726-2017, summarised as follows.

Symbol	Major division	Typical names
GW, GP	GRAVEL	Gravel & gravel-sand mixtures, little/no fines
GM		Gravel-silt & gravel-sand-silt mixtures
GC		Gravel-clay & gravel-sand-clay mixtures
SW, SP	SAND	Sand & gravel-sand mixtures, little/no fines
SM		Sand-silt mixtures
SC		Sand-clay mixtures
ML	SILT & CLAY (low & medium plasticity)	Inorganic silt/clayey fine sand or silt
CL, CI		Inorganic clay, gravelly clay, sandy clay
OL		Organic silt
MH	SILT & CLAY (high plasticity)	Inorganic silt
CH		Inorganic clay, high plasticity
OH		Organic clay, med-high plasticity, organic silt
Pt	Highly organic soil	Peat, highly organic soil

FIELD DESCRIPTION

Soil and rock materials described to AS1726-2017. The description of percentage of cobbles and boulders in a soil may be limited by sample size.

MOISTURE CONDITION

Coarse grained soils and rocks

Dry (D), Moist (M) or Wet (W).

Estimated based on appearance and feel.

Cohesive soils

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, wet of liquid limit

Estimated based on judgement

COHESIVE SOILS - CONSISTENCY

The consistency of a cohesive soil is assessed by tactile means or field measurement of undrained shear strength.

A Hand Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils (kPa) as follows:

Strength	Symbol	Indicative undrained shear strength (kPa)	Hand Penetrometer Reading (kPa)
Very Soft	VS	≤ 12	< 25
Soft	S	>12 and ≤ 25	25 to 50
Firm	F	> 25 and ≤ 50	50 to 100
Stiff	St	>50 and ≤ 100	100 to 200
Very Stiff	VSt	> 100 and ≤ 200	200 to 400
Hard	H	>200	> 400
Friable	Fr	-	-

COHESIONLESS SOILS - RELATIVE DENSITY

Relative density terms are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm is recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows /0.3 m)	DCP (blows /100mm)
Very Loose	VL	0 to 15	0 to 4	0 to 1
Loose	L	15 to 35	4 to 10	1 to 2
Medium Dense	MD	35 to 65	10 to 30	2 to 5
Dense	D	65 to 85	30 to 50	5 to 10
Very Dense	VD	>85	>50	>10

SOIL STRUCTURE

Soil structure is described to AS 1726-2017 if visible and present.

SOIL / ROCK ORIGIN

The geological origin of the soil or rock is presented as an interpretation of the geological and geomorphological setting. Origin cannot be deduced on the basis of material appearance and properties alone and is therefore limited by the availability of supporting geological information

ROCK MATERIAL WEATHERING

Rock weathering is described mainly using the following abbreviations and definitions used in AS1726.

Term	Symbol	Definition
Residual soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition of individual minerals or colour changes.

If differentiation between highly and moderately weathered rock is not practicable, then Distinctly Weathered (DW) is used as defined in AS1726:2017.

INFERRED ROCK STRENGTH

Rock strength is inferred based on field assessment, Point Load Index or Uniaxial Compressive Strength as follows:

Term	Symbol	UCS (MPa)	Point Load Index IS ₍₅₀₎ (MPa)
Very Low	VL	0.6 to 2	0.03 to 0.1
Low	L	2 to 6	0.1 to 0.3
Medium	M	6 to 20	0.3 to 1
High	H	20 to 60	1 to 3
Very High	VH	60 to 200	3 to 10
Extremely High	EH	>200	>10

- Diametral Point Load Index test
 - Axial Point Load Index test
 - ◆ Uniaxial Compressive Strength test
- strength test data is indicated on a dual PL/UCS column due to space constraints only. No correlation between the two values is to be inferred

DEFECT SPACING/BEDDING SPACING (Rock)

Measured at right angles to defects of same set or bedding.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm 6 to 20 mm	Thinly Laminated Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION (Rock)

Symbol	Term	Symbol	Term
Bg	Bedding	DB	Drill Break
Pt	Parting	Se	Seam
Cn	Contact	SZ	Sheared Zone
Bd	Boundary	CZ	Crushed Zone
Jt	Joint	F	Fault
Fo	Foliation	Vn	Vein
C	Cleavage		

DEFECT ORIENTATION (Rock)

Dip measured relative to the horizontal plane in vertical boreholes and relative to core axis in inclined boreholes.

DEFECT ROUGHNESS AND SHAPE (Rock)

Roughness	Description	Roughness	Description
Sm	Smooth	Po	Polished
Ro	Rough	Sl	Slickensided
VRO	Very Rough		
Shape	Description	Shape	Description
PI	Planar	Cu	Curved
Un	Undulating	Vu	Vuggy
Ir	Irregular	St	Stepped

COATING OR INFILLING (Rock)

Abbreviation	Description	Abbreviation	Description
Cln	Clean	Co	Coal
Cg	Coating	Cr	Crushed rock
In	infill	Fe	Limonite/ironstone
Sn	Stain	Fl	Feldspar
Vr	Veneer	Gp	Gypsum
Ca	Calcite	Mn	Manganese
Ch	Chlorite	Py	Pyrite
Cl	Clay	Qz	Quartz

Graphic Symbols — Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicate mixed materials such as clayey sand.

SOIL SYMBOLS

Main components



CLAY



SILT



SAND



GRAVEL



BOULDERS / COBBLES



TOPSOIL



PEAT

Minor components



CLAYEY



SILTY



SANDY



GRAVELLY

OTHER MATERIAL SYMBOLS



FILL



BITUMEN



CONCRETE

ROCK SYMBOLS

Sedimentary Rocks



SANDSTONE



SILTSTONE



CLAYSTONE, MUDSTONE



SHALE



COAL



LIMESTONE



CONGLOMERATE

Igneous rocks



GRANITE



BASALT



UNDIFFERENTIATED IGNEOUS

Metamorphic rocks



SLATE, PHYLLITE, SCHIST



GNEISS

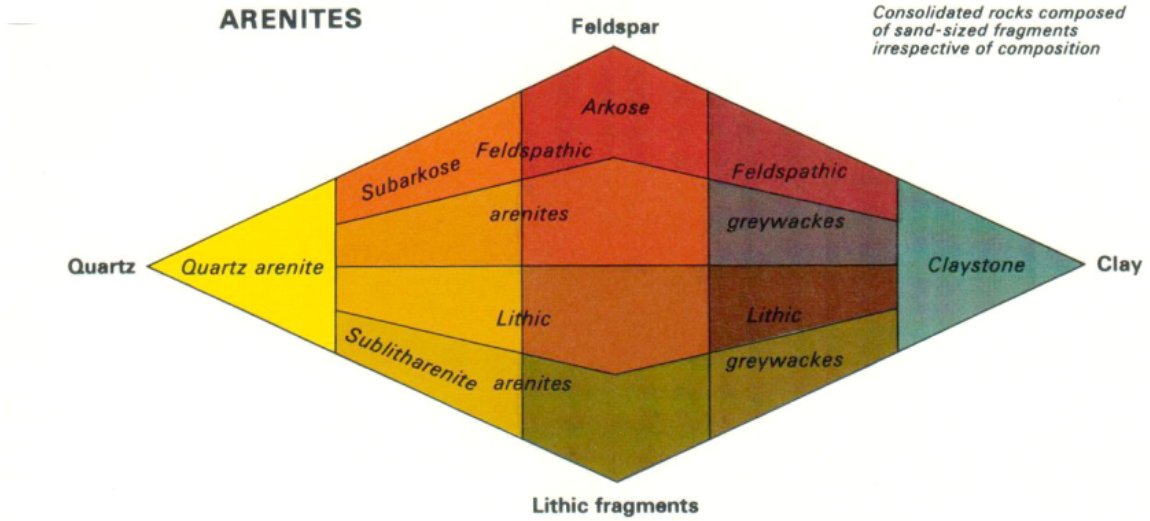


QUARTZITE

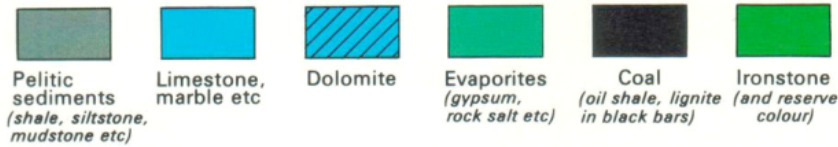
Colour Scheme — Soils and Rocks

The soil and rock colour schemes presented on the logs and fences have been derived from those below. The rock colour scheme is taken from Geoscience Australia's predecessor, the Bureau of Mineral Resources (BMR).

SEDIMENTARY ROCKS



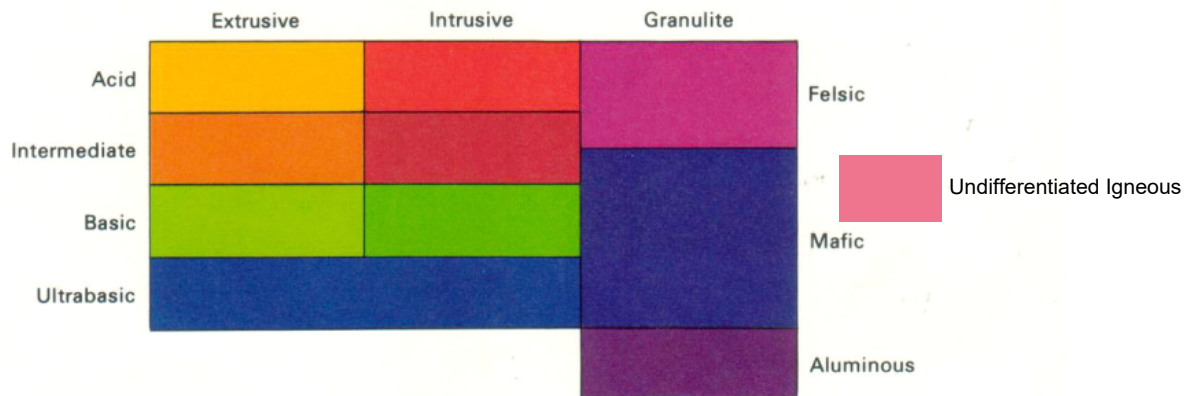
OTHER SEDIMENTARY ROCKS



METAMORPHIC ROCKS



IGNEOUS AND HIGH GRADE METAMORPHIC ROCKS



SOIL COLOUR SCHEME





BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BH01

SHEET : 1 OF 1

Client:	Charter Hall	Date Commenced:	18/11/20
Project:	Eastern Creek GI	Date Completed:	18/11/20
Borehole Location:	See site plan	Recorded By:	CTJ
Project Number:	PS122611	Log Checked By:	GE

Drill Model/Mounting:	Geoprobe 6712DT/ Track	Hole Angle:	-90°	Surface RL:	
Borehole Diameter:	110 mm	Bearing:	---	Co-ords:	E 299997 N 6257106 MGA94 56

Borehole Information						Field Material Description							
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	Nil	NFWGE				ES							
				0.30		ES			FILL: Silty Sandy CLAY; low plasticity, grey-brown, fine to coarse grained sand, with fine to coarse grained angular to sub-angular gravel	<PL			FILL
				1.00	SPT 4, 4, 9 N=13	DS		CI-CH	Sandy CLAY; medium to high plasticity, brown, orange-brown, fine to coarse grained sand, trace fine to coarse grained sub-angular gravel 0.5 m: decrease in sand content, no gravel 0.8 m: becoming grey mottled red-brown	<PL - ~PL		300 280 350 400 450 350	ALLUVIAL SOIL
				1.50	SPT 7, 13, 26 N=39	DS		CI	Silty CLAY; medium plasticity, pale orange-brown, grey, with fine to coarse grained sand	<PL		450	RESIDUAL SOIL
				2.00		ES		CI	SILTSTONE: extremely weathered, very low strength Recovered as Silty CLAY; medium plasticity, orange-brown, yellow-brown, red staining, trace fine to coarse grained sand, trace siltstone pieces	<PL		500	WEATHERED ROCK 1.95 m: Increase in drilling resistance
				3.00	SPT 29 HB N=R	DS			2.5 m: pale grey-brown, with red-orange staining			450	2.5 m: Poor SPT sample recovery 2.8-5.0 m: Consistency based on recovered material and drilling resistance
				4.00		ES			3.8 m: with siltstone pieces				3.5 m: SPT not undertaken due to hard material
				5.00		ES			4.5 m: becoming grey, dark grey				4.5 m: SPT not undertaken due to hard material
				5.00					END OF BOREHOLE AT 5.00 m Target depth				

WSP Australia Pty Ltd. V00 10.02.00.04 WSP_LIB_7.9.5.GLB_Log WSP NON-CORED LOG PS122611 EASTERN CREEK GI.GPJ <<DrawingFile>> 03/09/2021 16:16 Developed by Datigel Pty Ltd

This borehole log should be read in conjunction with WSP's accompanying explanatory notes.



BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BH02

SHEET : 1 OF 1

Client:	Charter Hall	Date Commenced:	18/11/20
Project:	Eastern Creek GI	Date Completed:	18/11/20
Borehole Location:	See site plan	Recorded By:	CTJ
Project Number:	PS122611	Log Checked By:	GE

Drill Model/Mounting:	Geoprobe 6712DT/ Track	Hole Angle:	-90°	Surface RL:	
Borehole Diameter:	110 mm	Bearing:	---	Co-ords:	E 300035 N 6257030 MGA94 56

Borehole Information					Field Material Description								
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	Nil												
				0.50	SPT 2, 2, 3 N=5	ES		CI-CH	FILL: Sandy CLAY; medium to high plasticity, dark brown, fine to coarse grained sand, with fine to coarse grained angular to sub-angular gravel, rootlets	~PL		200	
				1.00		ES		CI-CH	FILL: Sandy CLAY; medium to high plasticity, dark brown, orange-brown, fine to coarse grained sand, with fine to coarse grained, angular to sub-rounded gravel, trace roots	~PL		190	
				1.60	SPT 1, 2, 3 N=5	DS		CI-CH	FILL: Silty Sandy CLAY; medium to high plasticity, dark black, green-grey, fine to coarse grained sand, trace fine to coarse grained, sub-angular gravel, rootlets, organic material	~PL		100	
				2.00		ES						200	
				2.50	SPT 6, 5, 6 N=11	DS		CI-CH	Sandy Silty CLAY; medium to high plasticity, grey, orange-brown, brown, fine to coarse grained sand, trace fine to coarse grained, sub-angular gravel	~PL		320	2.5 m: Possible water strike. Water rose to surface at completion of drilling
				3.00		ES		CH	Sandy CLAY; high plasticity, orange-brown mottled grey, fine to coarse grained sand	>PL		410	ALLUVIAL SOIL
				3.50	SPT 2, 4, 4 N=8	DS		SC	Clayey Silty SAND; fine to medium grained, grey, orange-brown, high plasticity clay fines	W		300	
				4.00		ES		CH	Silty CLAY; high plasticity, orange-brown, grey, trace fine to coarse grained sand	>PL		470	RESIDUAL SOIL
				4.60	SPT 25/100mm HB N=R	DS		CI-CH	SILTSTONE; extremely weathered, very low strength Recovered as Silty CLAY; medium to high plasticity, pale grey-brown	~PL		150	4.5 m: Poor SPT sample recovery
				5.00		ES			END OF BOREHOLE AT 5.00 m Target depth			150	WEATHERED ROCK

WSP Australia Pty Ltd. V00 10.02.00.04 WSP_LIB_7.9.5.GLB_Log_WSP_NON-CORED LOG PS122611 EASTERN CREEK GI.GPJ <<DrawingFile>> 03/09/2021 16:16 Developed by Dageel Pty Ltd

This borehole log should be read in conjunction with WSP's accompanying explanatory notes.



BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BH03

SHEET : 1 OF 1

Client: Charter Hall	Date Commenced: 18/11/20
Project: Eastern Creek GI	Date Completed: 18/11/20
Borehole Location: See site plan	Recorded By: CTJ
Project Number: PS122611	Log Checked By: GE

Drill Model/Mounting: Geoprobe 6712DT/ Track	Hole Angle: -90°	Surface RL:
Borehole Diameter: 110 mm	Bearing: ---	Co-ords: E 300000 N 6256976 MGA94 56

Borehole Information				Field Material Description							
METHOD	SUPPORT	WATER	DEPTH (m)	FIELD TEST	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	Nil	NFWGE									
			0.60	SPT 3, 3, 6 N=9		CI	FILL: Sandy CLAY; medium plasticity, dark brown, orange-brown, grey, fine to coarse grained sand, with fine to coarse grained, sub-angular gravel, roots	<PL			FILL
			1.00			CI	Silty Sandy CLAY; medium plasticity, grey, red, red-brown, fine to coarse grained sand, trace fine to coarse grained, angular to sub-angular gravel	<PL		240 360	ALLUVIAL SOIL
			1.50	SPT 4, 5, 8 N=13		CI	Sandy CLAY, medium plasticity, red, red-brown, fine to coarse grained sand	<PL			
			2.00			SM	Silty Clayey SAND; fine to coarse grained, pale white, grey, red-brown streaks, low to medium plasticity fines, trace fine to coarse grained, sub-angular gravel	D - M		310 310 420	RESIDUAL SOIL
			2.80	SPT 6, 14, 25/100mm HB N=R		CI	Silty CLAY; medium plasticity, red-brown, with fine to coarse grained sand	<PL		550 400	
			3.00			CI	SILTSTONE; extremely weathered, very low strength Recovered as Silty CLAY; medium plasticity, grey-brown, red-brown, with fine to coarse grained sand	<PL		>600	WEATHERED ROCK
			3.50								3.0-5.0 m: Consistency based on recovered material and drilling resistance
			4.50								3.5 m: No SPT undertaken due to hard material
			5.00								4.5 m: No SPT undertaken due to hard material
			5.00				END OF BOREHOLE AT 5.00 m Target depth				

WSP Australia Pty Ltd. V00 10.02.00.04 WSP_LIB_7.9.5.GLB_Log_WSP_NON-CORED LOG PS122611 EASTERN CREEK GI.GPJ <<DrawingFile>> 03/09/2021 16:16 Developed by Datigel Pty Ltd

This borehole log should be read in conjunction with WSP's accompanying explanatory notes.



BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BH04

SHEET : 1 OF 1

Client:	Charter Hall	Date Commenced:	18/11/20
Project:	Eastern Creek GI	Date Completed:	18/11/20
Borehole Location:	See site plan	Recorded By:	CTJ
Project Number:	PS122611	Log Checked By:	GE

Drill Model/Mounting:	Geoprobe 6712DT/ Track	Hole Angle:	-90°	Surface RL:	
Borehole Diameter:	110 mm	Bearing:	---	Co-ords:	E 299899 N 6256996 MGA94 56

Borehole Information				Field Material Description									
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	Nil	NFWGE				ES		CL					
			0.10			ES		CI	TOPSOIL: Sandy CLAY; low plasticity, dark brown, black, fine to coarse grained sand, rootlets	<PL			TOPSOIL Grass at surface
						ES		CI	FILL: Sandy CLAY; medium plasticity, dark brown, fine to coarse grained sand, trace fine to coarse grained, sub-angular gravel, trace rootlets	<PL			FILL
			0.50		SPT 3, 4, 5 N=9	DS		CI	Sandy CLAY; medium plasticity, orange-brown, brown, fine to coarse grained sand, trace fine to coarse grained, sub-angular gravel	<PL		300	ALLUVIAL SOIL
				1		ES						290	
						ES						310	
					SPT 4, 5, 6 N=11	DS						410	
			2.00	2		ES		CI-CH	1.9 m: no gravel CLAY; medium to high plasticity, with fine to coarse grained sand	<PL - ~PL		250	
						ES						500	
			2.50		SPT 4, 6, 9 N=15	DS		CI-CH	Silty Sandy CLAY; medium to high plasticity, dark orange-brown mottled grey, fine to coarse grained sand, trace siltstone pieces	<PL		230	RESIDUAL SOIL
						ES			2.8 m: increase in sand content			400	
						ES						380	
			3.20		SPT 23/70mm HB N=R	DS		CI	SILTSTONE; extremely weathered, very low strength Recovered as Silty CLAY; medium plasticity, pale grey, brown, with fine to coarse grained sand, with siltstone pieces	<PL			WEATHERED ROCK
						ES							3.6-5.0 m: Consistency based on recovered material and drilling resistance
						ES			4.0 m: becoming pale orange-brown, brown				
						ES			4.4 m: increase in clay content				4.5 m: No SPT undertaken due to hard material
						ES							
				5		ES			END OF BOREHOLE AT 5.00 m Target depth				

This borehole log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 10.02.00.04 WSP_LIB_7.9.5.GLB_Log_WSP_NON-CORED LOG PS122611 EASTERN CREEK GI.GPJ <<DrawingFile>> 03/09/2021 16:16 Developed by Dageel Pty Ltd



BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BH05

SHEET : 1 OF 1

Client:	Charter Hall	Date Commenced:	18/11/20
Project:	Eastern Creek GI	Date Completed:	18/11/20
Borehole Location:	See site plan	Recorded By:	CTJ
Project Number:	PS122611	Log Checked By:	GE

Drill Model/Mounting:	Geoprobe 6712DT/ Track	Hole Angle:	-90°	Surface RL:	
Borehole Diameter:	110 mm	Bearing:	---	Co-ords:	E 299906 N 6257115 MGA94 56

Borehole Information				Field Material Description									
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
										VS	FB	VL	
										W	LL	PL	
										ST	MD		
										YS	TD		
										H	VD		
AS	Nil	NFWGE	0.10			ES		CL	TOPSOIL: Sandy CLAY; low plasticity, dark brown, black, fine to coarse grained sand, rootlets	<PL			TOPSOIL
						ES		CL	FILL: Sandy CLAY; low to medium plasticity, dark brown, orange-brown, fine to coarse grained sand, trace fine to coarse grained, sub-angular gravel	<PL			FILL
					SPT 3, 4, 6 N=10	DS		CL				380	
						DS		CL				400	
						DS		CL				350	
			1.00	1		ES		CI	Silty CLAY; medium plasticity, grey, orange-brown, with fine to coarse grained sand, trace black inclusions	<PL			RESIDUAL SOIL
					SPT 4, 14, 27 N=41	DS		CI	1.7 m: increase in sand content			400	
						ES		CI				410	
			1.95	2		ES		CI	SILTSTONE; extremely weathered, very low strength Recovered as Silty CLAY; medium plasticity, pale grey-brown, trace fine to coarse grained sand, with siltstone pieces	<PL			WEATHERED ROCK
					SPT 31 HB N=R	DS		CI				>600	1.95 m: Very high drilling resistance
						DS		CI					2.5 m: Poor SPT sample recovery (no sample taken)
									END OF BOREHOLE AT 2.65 m Practical Refusal				

WSP Australia Pty Ltd. V00 10.02.00.04 WSP_LIB_7.9.5.GLB_Log WSP NON-CORED LOG PS122611 EASTERN CREEK GI.GPJ <<DrawingFile>> 03/09/2021 16:16 Developed by Datigel Pty Ltd

This borehole log should be read in conjunction with WSP's accompanying explanatory notes.

APPENDIX C

LABORATORY TEST CERTIFICATES



Test Report

Customer: WSP Australia Pty Limited

Job number: 20-0097

Project: Eastern Creek GI - PS122611

Report number: 1

Location: Eastern Creek

Page: 1 of 1

Moisture Content

Sampling method: Tested as received

Test method(s): AS 1289.1.1, 2.1.1

	Results			
Laboratory sample no.	23075	23077	23078	23079
Customer sample no.	BH01 1.50-1.95m	BH02 2.50-2.95m	BH03 1.50-1.95m	BH04 2.50-2.95m
Date sampled	18/11/2020	18/11/2020	18/11/2020	18/11/2020
Material description	silty CLAY, brown/pale grey/ yellow-brown	silty CLAY, grey/red	silty CLAY, pale grey/yellow- brown/red	silty CLAY, yellow-brown/ pale grey/red
Moisture content (%)	13.1	20.1	18.4	19.2

Laboratory sample no.				
Customer sample no.				
Date sampled				
Material description				
Moisture content (%)				

Approved Signatory:  C. Greely

Date: 02/12/2020



ACCREDITED FOR
**TECHNICAL
 COMPETENCE**

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

Test Report

Customer: WSP Australia Pty Limited
Project: Eastern Creek GI - PS122611
Location: Eastern Creek

Job number: 20-0097
Report number: 2
Page: 1 of 1

Soil Index Properties

Sampling method: Tested as received

Test method(s): AS 1289.1.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1, .3.4.1

	Results				
Laboratory sample no.	23075	23077	23078	23079	
Customer sample no.	BH01 1.50-1.95m	BH02 2.50-2.95m	BH03 1.50-1.95m	BH04 2.50-2.95m	
Date sampled	18/11/2020	18/11/2020	18/11/2020	18/11/2020	
Material description	silty CLAY, brown/pale grey/ yellow-brown	silty CLAY, grey/red	silty CLAY, pale grey/yellow- brown/red	silty CLAY, yellow-brown/ pale grey/red	
Liquid limit (%)	41	40	54	48	
Plastic limit (%)	18	13	14	14	
Plasticity index (%)	23	27	40	34	
Linear shrinkage (%)	10.5	13.0	15.5	14.0	
Cracking / Curling / Crumbling	-	-	-	-	
Sample history	Air dried	Air dried	Air dried	Air dried	
Preparation	Dry sieved	Dry sieved	Dry sieved	Dry sieved	

Approved Signatory:  C. Greely

Date: 02/12/2020



ACCREDITED FOR
**TECHNICAL
 COMPETENCE**

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

CERTIFICATE OF ANALYSIS

Work Order : ES2041623 Client : RESOURCE LABORATORIES Contact : CHRIS GREELY Address : 1 BODEN ROAD SEVEN HILLS 2147 Telephone : ---- Project : PS122611 - Eastern Creek GI Order number : 20-0364 C-O-C number : ---- Sampler : ---- Site : Eastern Creek Quote number : EN/222 No. of samples received : 4 No. of samples analysed : 4	Page : 1 of 2 Laboratory : Environmental Division Sydney Contact : Angus Harding Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 Telephone : +61 2 8784 8555 Date Samples Received : 24-Nov-2020 13:44 Date Analysis Commenced : 25-Nov-2020 Issue Date : 30-Nov-2020 11:14
--	--



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	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.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				23075	23076	23079	23080	----
				BH01, 1.50-1.95m	BH02, 1.50-1.95m	BH04, 2.50-2.95m	BH05, 1.50-1.95m	----
Sampling date / time				18-Nov-2020 00:00	18-Nov-2020 00:00	18-Nov-2020 00:00	18-Nov-2020 00:00	----
Compound	CAS Number	LOR	Unit	ES2041623-001	ES2041623-002	ES2041623-003	ES2041623-004	-----
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.8	7.3	7.8	5.5	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	10.9	17.6	15.8	12.6	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	160	70	140	140	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	180	370	910	130	----