idealgeotech
a division of idealcorp

Report on

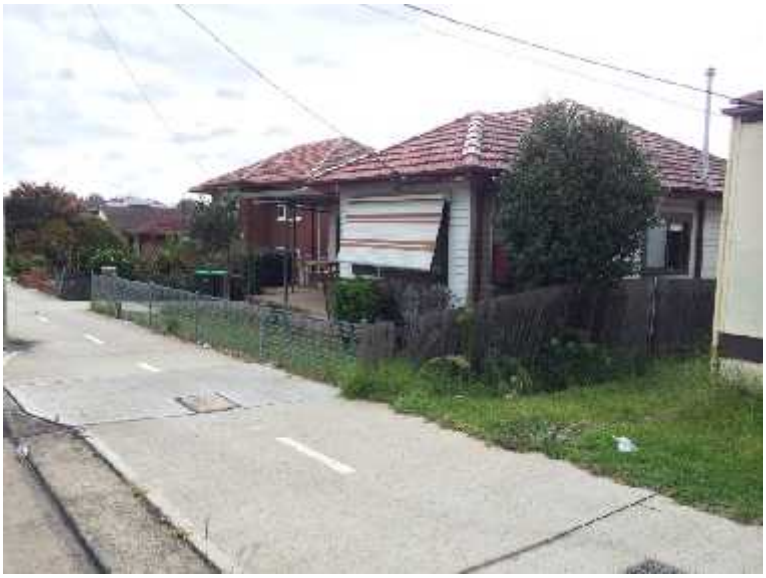
Geotechnical Assessment

Prepared for: SGCH

Address: 88-92 Elizabeth Drive, Liverpool

Job No: 26192

Date: March 2017



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1.0 INTRODUCTION

Ideal Geotech has prepared this report to discuss the results of the geotechnical investigation undertaken for the proposed residential development at 88-92 Elizabeth Drive, Liverpool.

The proposed development indicated by the client comprises construction of a multi storey residential development.

2.0 SITE DETAILS

The following information, presented in Table 1, describes the site.

Table 1: Summary of Site Details

Site Address	88-92 Elizabeth Drive, Liverpool
Client	Saint George Community Housing
Council Area	Liverpool City Council

2.1 Geology

Reference to the Penrith 1:100,000 geological map (Geological series sheet 9030) indicates that the site is underlain by Bringelly Shale of the Wianamatta Group consisting of shale, claystone, laminite, lithic sandstone and rare coal along with soils derived from the weathering of these rocks.

2.2 Site Description

The subject site is rectangular in shape and approximately 2,350m² in area and covers three residential blocks, 88-92 Elizabeth Drive, Liverpool. The site is bound by Elizabeth Drive to the north and neighbouring residential properties on all other sides.

The site is currently occupied by three houses and associated garages and granny flats at 88 and 90 Elizabeth Drive. The site is located on slightly sloping terrain with gradients of approximately 1-2º falling towards the east. Vegetation consists of grass cover and some small to large trees.

3.0 GEOTECHNICAL INVESTIGATION

Fieldwork was undertaken on 14 March 2017 and included drilling four boreholes (BH1 and BH3-BH5) using a 4WD Mitsubishi Triton Ute mounted drill rig using solid flight spiral augers to a maximum depth of 4.2m at the locations shown on Figure 1, attached in Appendix A. The Boreholes were supplemented with Dynamic Cone Penetrometer (DCP) testing for the measurement of soil strength properties.

Borehole logs and field observations are presented in Appendix B.

3.1 Soil Profiles

A general summary of the subsurface conditions encountered across the site is presented in Table 2 below.

Table 2: Summary of Subsurface Conditions

Borehole	Depth of fill (m)	Depth to rock (m)	Practical refusal (m)	Summary of sub-surface profiles
BH1	0.4	2.0	3.5	FILL-Silty Sandy CLAY / Silty CLAY / XW SHALE
BH3	0.3	2.7	3.8	FILL-Silty Sandy CLAY / Silty CLAY / XW SHALE
BH4	0.2	2.4	4.2	FILL-Silty Sandy CLAY / Silty CLAY / XW SHALE
BH5	0.2	2.2	4.0	FILL-Silty Sandy CLAY / Silty CLAY / XW SHALE

XW Extremely Weathered

Groundwater was not encountered in any of the boreholes at the time of investigation. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions.

4.0 RECOMMENDATIONS

4.1 Site Classification

This site is classified as **Class M** in accordance with AS2870 – 2011:

As defined in AS 2870-2011, Table 2.1 and section 2.2.3, this site will be classified as **Class M, Moderately Reactive** based on geology and natural soil profile as encountered on this limited scope investigation. The site is estimated to have a Characteristic Surface Movement (ys) in the range between **20mm** and **40mm**.

It must be emphasized that the soil movement (heave) mentioned and recommendations referred to in this report are based solely on the soil profile observed at the time of the investigation for this report, without taking into account any abnormal moisture conditions that might be created thereafter. With abnormal moisture conditions, distresses will occur and may result in non-acceptable probabilities of serviceability and safety of the building during its design life. If these distresses are not acceptable to the builder, owner or other relevant parties then further fieldwork and revised footing recommendations must be carried out.

This type of investigation (as per our commission) is not designed or capable of locating all soil conditions. Therefore, it is recommended that the builder engage the service of this company (Ideal Geotech) to confirm the soil profile and "Site Classification" at footing excavation stage if required.

4.2 Footings - Allowable Bearing Capacity

All footings should be founded below any uncontrolled fill or deleterious materials. All footings for the same structure should be founded on strata of similar stiffness and reactivity to minimise the risk of differential movements.

All footing excavations should be inspected prior to installation of structural steel by Ideal Geotech or a suitably experienced engineer or geotechnical consultant to confirm that the founding conditions are as described in this report. All loose material should be cleared from the footing excavations before concrete is poured.

4.2.1 High Level Footings

High-level footing alternatives could be expected to comprise slabs-on-ground with edge beams or pad footings for the support of concentrated loads. Such footings designed in accordance with engineering principles and founded in stiff or better clays (below uncontrolled fill or other deleterious material) may be proportioned on an allowable bearing capacity of 150kPa and founded in the extremely weathered shale may be proportioned on an allowable bearing capacity of 400kPa. The founding conditions should be assessed by a geotechnical consultant or experienced engineer to confirm suitable conditions.

4.2.2 Piered Footings

Piered footings are considered as an alternative to deep edge beams or high level footings. Piered footings, founded in the extremely weathered shale could be proportioned on an end bearing pressure of 400kPa.

The potential for volume change in the subsurface profile should be considered by the designer as the piered footing may move with the soil and undergo differential settlement or heaving.

4.3 Batter Slopes

We understand that excavation will be required during the construction phase. Excavations or trenches in the stiff or better clay could be expected to stand vertical in the short-term. Where personnel are to enter excavations, options for short-term excavations include benching or battering back of excavations to 1H:1V.

Unsupported permanent excavations (where not supporting existing structures) in the in situ material batters should be sloped back at gradients not steeper than 2H:1V subject to inspection of the strata exposed in the faces by a geotechnical professional.

Un-retained excavations should not extend below the "zone of influence" of adjacent structures. That is, a line drawn 45° down from the foundation level of adjacent structures or features (including paths, fences, stairs etc). If excavations are to extend below this line, proposed excavations are to be retained prior to excavation.

4.4 Excavation

Excavations up to the depths noted on the borehole logs should be readily achievable with conventional earthmoving equipment such as backhoes and excavators with bucket attachment

We would recommend that the method and size of proposed excavation equipment are advised and inspected prior to excavation.

5.0 LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all ground conditions, which can vary even over short distances. The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If excavations reveal ground conditions significantly different from those shown in our findings, Ideal Geotech must be

consulted.

The scope and the period of Ideal Geotech services are described in the report and are subject to restrictions and limitations. Ideal Geotech did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ideal Geotech in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ideal Geotech for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

6.0 REFERENCES

- *Geological Series Sheet 9030, Map of the Penrith region, scale 1:100,000*

For and on behalf of
Ideal Geotech

Murali Pamu
Geotechnical Engineer

For and on behalf of
Ideal Geotech

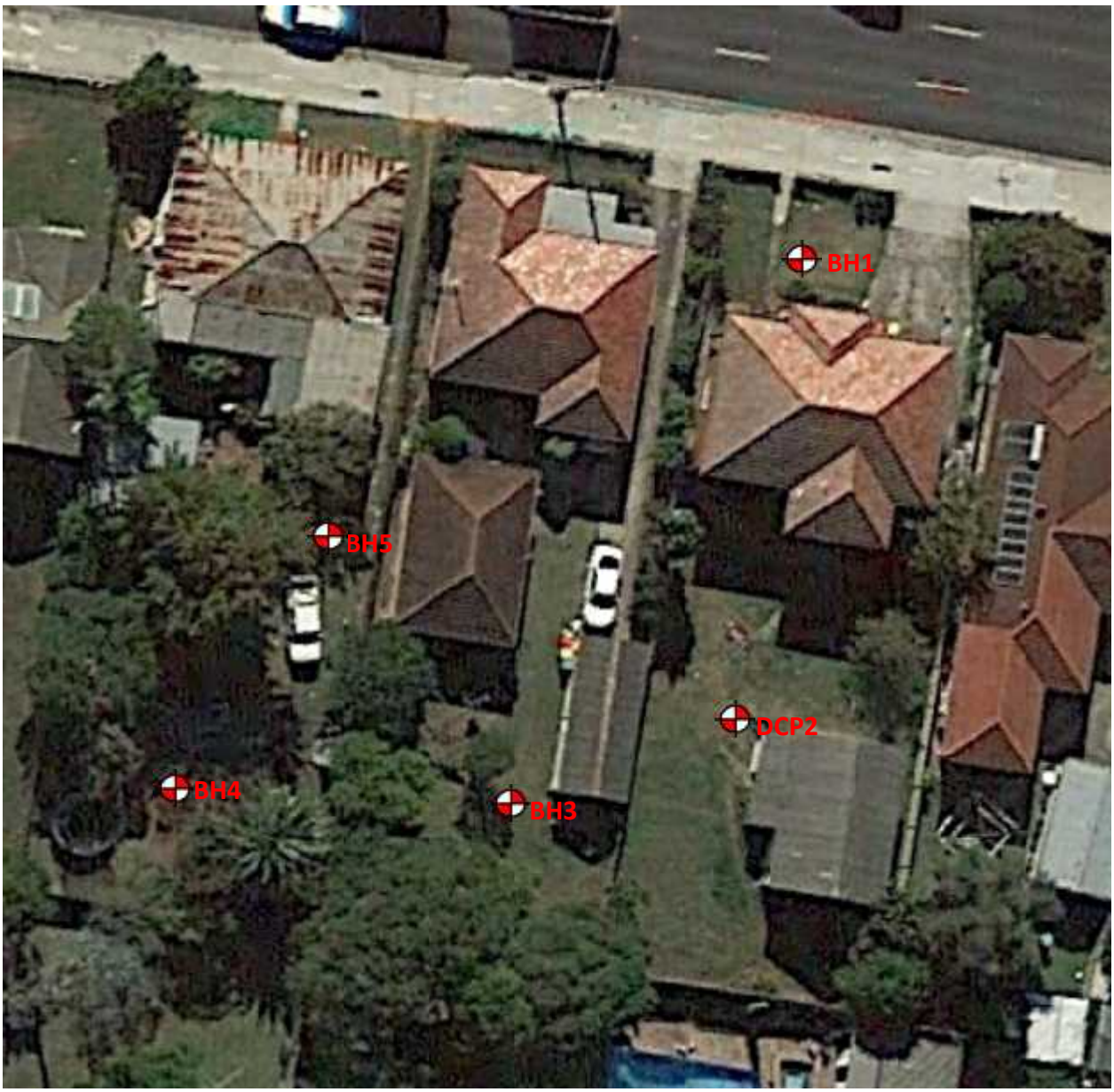
Dane Dwyer
Geotechnical Engineer

APPENDIX A

FIGURES

Figure 1 – Borehole and DCP Location Plan

88-92 Elizabeth Drive, Liverpool



APPENDIX B

BOREHOLE LOGS

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5.0 FIELD RECORD OF TEST BORING AND/OR IN SITU TESTING

Fill | Natural Soil | FOUNDING

Bore Hole 1

Depth (m)	PP	Soil Profile
0.0		FILL SILTY SANDY CLAY, CI brown, moist
	0.7	
0.5		NATURAL SILTY CLAY, CH
	3.0	orange-brown mottled grey, moist,
		very stiff, trace fine grained sand
	3.1	
1.0		
	5.2	hard
1.5	5.0	
	5.2	
2.0		
	6.0+	XW SHALE
		pale brown
2.5		
3.0		
3.5		
		End Bore 3.5m due to practical refusal on shale
4.0		
4.5		
5.0		
5.5		
6.0		

Depth (m)	DCP 2	Soil Profile
0.0	1	
	1	
	1	
	2	
0.5	2	
	6	
	7	
	9	
	13	
1.0	19	
	22	
	22	
	28	
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		

Bore Hole 3

Depth (m)	PP	Soil Profile
0.0		FILL SILTY SANDY CLAY, CI brown, moist
	1.6	
0.5		NATURAL SILTY CLAY, CH
	2.7	orange-brown mottled grey,
		moist, very stiff
	2.9	
1.0		
	2.4	
1.5	2.5	
	2.4	
2.0		
	3.2	
	4.5	hard
2.5		
	5.1	
		XW SHALE
		pale brown
3.0	6.0+	
3.5		
		End Bore 3.8m due to practical refusal on shale
4.0		
4.5		
5.0		
5.5		
6.0		

Notes: DCP = Dynamic Cone Penetrometer blow counts (blows/100mm). P.P = Pocket Penetrometer (Undrained Shear Strength Cu) PSP = Perth Sand Penetrometer (blows/100mm) UTP = Unable to penetrate.

TABLE 5.1 **For SAND correlation between Density Index & Penetrometer results**

DENSITY Term	Density Index (%)	Approx DCP Blow Count (blows/100mm)
Very Loose	< 15	< 1
Loose	15 to ≤35	1 to ≤3
Medium Dense	35 to ≤65	3 to ≤9
Dense	65 to ≤85	9 to ≤15
Very Dense	> 85	> 15

TABLE 5.2 **For SILTS & CLAY correlation between Cu & Penetrometer results**

CONSISTENCY Term	Undrained Shear Strength (kPa)	Approx DCP Blow Count (blows/100mm)	PP Idial indicator)
Very Soft	0 - 12	< 1	0 to ≤ 0.2
Soft	12 to ≤25	1 to ≤ 2	0.2 to ≤0.5
Firm	25 to ≤50	2 to ≤3	0.5 to ≤1
Stiff	50 to ≤100	3 to ≤5	1 to ≤2
Very Stiff	100 to ≤200	5 to ≤8	2 to ≤4
Hard	> 200	> 8	>4

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5.0 FIELD RECORD OF TEST BORING AND/OR IN SITU TESTING

Fill | Natural Soil | FOUNDING

Bore Hole 4

Depth (m)	PP	Soil Profile
0.0		FILL SILTY SANDY CLAY, CI brown, moist
	1.5	NATURAL SILTY CLAY, CH orange-brown mottled grey, moist, stiff
0.5		
	1.6	
	2.9	very stiff
1.0		
	3.4	
1.5	2.7	
	5.7	hard
2.0		
	6.0	
	6	
2.5		XW SHALE pale brown
	6.0+	
3.0		
3.5		
4.0		
		End Bore 4.2m due to practical refusal on shale
4.5		
5.0		
5.5		
6.0		

Bore Hole 5

Depth (m)	PP	Soil Profile
0.0		FILL SILTY SANDY CLAY, CI brown, moist
	1.6	NATURAL SILTY CLAY, CH orange-brown mottled grey, moist, stiff
0.5		
	1.6	
	3.2	very stiff
1.0		
	3.2	
1.5	3.0	
	5.6	hard
2.0		
	6.0	
		XW SHALE pale brown
	6.0+	
2.5		
3.0		
3.5		
4.0		
		End Bore 4.0m due to practical refusal on shale
4.5		
5.0		
5.5		
6.0		

Depth (m) | PP | Soil Profile

Depth (m)	PP	Soil Profile
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		

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Very Stiff	100 to ≤200	5 to ≤8	2 to ≤4
Hard	> 200	> 8	>4