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11th March, 2011

Gehad Elgalada
107a Lancaster Avenue
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Our Reference **AW24407**

Site Address

No 1-5

The Crescent

Yagoona

Commission

Geotechnical Investigation

1. Construction Proposal

1.1. The proposed development is the construction of a six(6) storey residential unit block with basement carparking, which effectively creates a seven(7) storey structure.

1.2. We have sighted certain plans by "Mackenzie Architects", which outline this construction proposal.

2. Site Description

2.1. The site is on the northern side of the street, and its north-eastern boundary is separated from the Railcorp property by a walkway.

2.2. The Railcorp rail lines are between about 4 and 5metres below this subject property.

2.3. The subject property is currently occupied by residential dwellings which restricted access for our testing.

2.4. Vegetation consists of grasses and trees and slopes towards the north at about 2°.

3. About Your Report

3.1. This geotechnical report is generally in accordance with the guidelines in AS 2870-1996. We have also appended a copy of the following paper, which illustrates the relationship between landscaping/garden maintenance and structural footings.

CSIRO "Foundation Maintenance and Footing Performance: A Homeowner's Guide" Sheet BTF 18, 2003

3.2. The statements presented in this report, including attached appendices, are intended to advise you of what should be your realistic expectations of this report and to present you with recommendations as to how to minimise risks associated with ground works for this project.

3.3. These appendices and other cautioning sections are not intended to reduce our level of responsibility but rather to ensure that all parties who may rely on this report are aware of their responsibilities each assumes in so doing.

3.4. As geotechnical consultants on this project, our responsibilities are restricted to determining the parameters of the strata encountered (within the limitations of our commission and budget) so that the design engineer can design suitable footings.

3.5. As an additional service, we have offered advice in this report to the design engineer on the most suitable type of footing for this site, but it is possible that the engineer will have his own method of support for this structure.

3.6. AS 2870-1996 contains a system of classifying soils based on the ability of the soils to change in soil moisture. These classes are (Class "E" being most severe);

CLASS "A"	CLASS "S"	CLASS "M"	CLASS "H"	CLASS "E"

3.7. AS 2870-1996 also has another Class ("P") for problem sites which include both filled sites and sites with soft and collapsing soils. It should be noted that the more severe the soil conditions, the heavier and in general, the more expensive the footing system will be.

4. Testing Programme

4.1. Access to the site was limited.

4.1.1. Two(2) test sites were excavated with our 4WD mounted drill rig.

4.1.2. Two(2) test sites were excavated with a hand auger and augmented by a 9kg Dynamic Cone Penetrometer.

NOTE: These test sites were not surveyed, therefore their locations on the attached site sketch should be treated as approximate.

4.2. Numerous disturbed samples were collected and hand classified.

4.3. One (1) tube sample was retrieved and returned to the laboratory and tested for its Shrink/Swell (Iss) Parameters.

4.4. A pocket penetrometer (PP) was used to determine the undrained shear strength (qa) which was then converted to an undrained cohesion (ca) which in turn was used in Skempton's Theorem (1954) to determine the allowable bearing pressures.

5. Findings

5.1. The strata encountered is recorded on the attached Log Section.

5.2. On the relevant 1:250,000 geological map, this site plots within the Liverpool subgroup which is a Triassic aged sub-group consisting of mainly near horizontal bedded sandstones and shales, locally known as the Bringelly Shale.

5.3. No water table was encountered during our testing programme.

5.4. When considering the water table, the following must be remembered.

5.4.1. The above does not exclude the possibility that during or just after rains, that water seepage can occur into excavations particularly where a permeable layer of strata overlies a less permeable layer.

5.5. The sample tested in the laboratory for its shrink/swell (Iss) index (TS No 1, 700-1000mm) was found to have a value of 2.3%.

5.6. Rock was encountered at the following depths;

TS No.	XW-Rock	DW-Rock	Refusal on SW-Rock
1	3400-4400mm	4400-5600mm	5600mm
2	2300-4300mm	4300-6000mm+	NE*

*6000mm was the limit of our testing within this commission.

5.7. The two(2) hand auger holes (TS No's 3 & 4) reached their limit of 1500mm still in soil.

5.8. The Dynamic Cone Penetrometer tests established adjacent to the hand auger holes refused at the following depths;

TS No.	Depth
1	1800mm
2	2600mm

5.8.1. We believe that this Penetrometer refused was on the "Ironstone Gravels" reported in TS No 1 and 2, just above the XW-Rock.

6. Conclusions and Recommendations

6.1. Although this development is not under the scope of AS2870-1996, most consultants find it useful to relate the soil reactivity to AS2870, and on this basis using a Hs = 1800mm, and a pF of 1.2, we have derived a ys in the range of 30-40mm.

6.2. Because high bearing strata is input for this project access at the time of our testing, if the SW-Rock is to be relied upon, it would be prudent to commission a further two(2) 4WD mounted drill rig holes down to the SW-Rock after the site has been cleared before other works commence.

6.3. For the proposed basement excavation, under temporary conditions we recommend the following safe angles;

Top 500mm	45°
Soil	60°
XW-Rock	70-90°
DW-Rock	80-90°

6.4. Prior to any excavations taking place, it would be prudent to carry out a dilapidation survey on the nearby structures. This is a service this company does not offer, and these surveys are best done by Architects or building inspection service companies.

6.5. The following parameters are also applicable

Strata	∅	Ko	Ka	Kp
Soil	23°	0.61	0.44	2.28

6.6. The following ultimate bearing pressure are available;

Strata	q_u	Comment
Natural Stiff Clay	750kPa	500mm or deeper into the stiff clay strata
XW-Rock	1800kPa	500mm or deeper into the XW-Rock
DW-Rock	3000kPa	500mm or deeper into the DW-Rock
SW-Rock	4500kPa	500mm or deeper into the SW-Rock

6.7. If adhesion is to be relied upon, we offer the following Ultimate Values;

Depth	Adhesion
0-1000mm	Zero
1000-2000mm	30kPa
2000-4000mm	75kPa
4000mm+	150kPa

6.8. Where features including (but not limited to) paths, landscaping, fencing, etc are supported on soil, but abut the part of the structure supported at depth, an unquantifiable potential exists for these features to move as a response to the shrink/swell potential of the soil, which may exceed the predicted ys value, because of nearby trees and because the main structure will be supported at depth on the rock.

6.8.1. These junctions need to be carefully detailed and constructed, so as these movements will not result in unsightly damage.

6.9. Based on our onsite testing, we do not believe that there will be a need to excavate hard rock, therefore the potential for excavations with ground vibrations is avoided.

6.10. In our judgement the construction proposal presented to us, does not have the potential to adversely influence the nearby rail corridor or any infrastructure in it, providing that normal construction procedures are undertaken.

Auswide Geotechnical

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7. Report Limitations

7.1. The contents of this report are based on the expertise and experience of the author, representing the company. Our commission didn't extend to assessing instability due to previous existing or proposed sub-surface mining, slope stability or earthquakes, nor did it extend to testing to comply with the relevant Contaminated Land Act.

7.2. The opinions and recommendations made in this report are based on the assumption that the test results are representative of the true site conditions. Even under optimum circumstances, actual conditions may differ from those reported to exist. Economic and time constraints necessarily limit the practical extent of any investigation. We therefore cannot accept responsibility for conditions encountered on this site, outside the areas tested, which are different to those reported. Where the attached soil profiles are similar to each other, then we would expect little variation across the site, so if widely different soils are encountered then a further inspection of the site and/or further testing may be required. If the attached soil profiles are different across the site, then variations will be encountered during footing excavations. In these cases, the design engineer/client must make a decision whether to extend the geotechnical budget to do more testing or to cope with the variations during footing excavations. Regardless of the option chosen the final inspection before placement of concrete is critical and the person certifying this inspection should be competent in identification of strata.

7.3. This report may only be reproduced in full, if any doubt exists to the number of pages in this report we should be contacted. The original copies of this report are signed in blue ink.

8. Rock Classification

7.3.2. ROCK WEATHERING CLASSIFICATION[1]

Term	Symbol	Definition
Residual soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has 'soil' properties, ie it either disintegrates or can be remoulded, in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

1. From Table A9 of Australian Standard 1726-1993, by permission.

7.3.3. ROCK STRENGTH CLASSES[1]

Term	Letter symbol	Point load index (MPa) $I_s(50)$	Field guide to strength
Extremely low	EL	≤ 0.03	Easily remoulded by hand to a material with soil properties.
Very low	VL	> 0.03 ≤ 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1 ≤ 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3 ≤ 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1 ≤ 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very high	VH	>3 ≤ 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely high	EH	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Note that although relationships between Unconfined Compression Strength (UCS) and Point Load Index (PLI) exist, they do vary with rock types and the degree of weathering. A ratio of UCS/PLI of 24 has been used, but much lower ratios (as low as ten) can occur.

1. From Table A8 of Australian Standard 1726-1993, by permission.

9. References

9.1. The following papers, reports or books have been consulted in preparing this report:

- AS 2870-1996 "Residential Slabs & Footings" by Standards Australia
- AS2870-1996 Supplement 1-1996 "Residential Slabs and Footings-Construction-Commentary, (Supplement to AS2870-1996).
- AS 3798-1996 "Guidelines on Earthworks for Commercial and Residential Developments" by Standards Australia.
- Paul Walsh & Don Cameron "The Design of Residential Slabs and Footings" Standards Australia 1997
- M.F. Atkinson "Structural Foundations Manual for Low-Rise Buildings" 1993

We believe these are the most up to date publications available. Should other publications not listed are brought to our attention, then we reserve the right to modify this report if they contain information, which conflicts with this report.

Log Sections;

TEST SITE 1				TEST SITE 2			
Location:	refer to site sketch			Location:	refer to site sketch		
depth	description	fill	PP	depth	description	fill	dcp
100mm	SILT			100mm	SILT		
200mm	(grey/brown-grey)			200mm	(grey/brown-grey)		
300mm	dry & dense			300mm	dry & dense		
400mm	GRAVELLY CLAY			400mm			
500mm	(red/orange-orange/grey/red)		600	500mm	GRAVELLY CLAY		
600mm	moist & very stiff			600mm	(red/orange-orange/grey/red)		
700mm				700mm	moist & very stiff		
800mm				800mm			
900mm				900mm			
1000mm			450	1000mm			
1100mm				1100mm			
1200mm				1200mm			
1300mm				1300mm			
1400mm				1400mm			
1500mm			400	1500mm			
1600mm				1600mm			
1700mm				1700mm			
1800mm				1800mm			
1900mm				1900mm			
2000mm			500	2000mm			
2100mm	-ironstone gravels			2100mm	-ironstone gravels		
2200mm				2200mm			
2300mm				2300mm			
2400mm				2400mm	XW ROCK		
2500mm				2500mm	(grey-dark grey)		
2600mm				2600mm	Sl moist/dry & mod strong		
2700mm				2700mm			
2800mm				2800mm			
2900mm				2900mm			
3000mm			600	3000mm			
3100mm				3100mm			
3200mm				3200mm			
3300mm				3300mm			
3400mm				3400mm			
3500mm	XW ROCK			3500mm			
3600mm	(grey-dark grey)			3600mm			
3700mm	Sl moist/dry & mod strong			3700mm			
3800mm				3800mm			
3900mm				3900mm			
4000mm				4000mm			
4100mm				4100mm			
4200mm				4200mm			
4300mm				4300mm			
4400mm				4400mm	DW ROCK		
4500mm	DW ROCK			4500mm	(grey-grey/brown)		
4600mm	(grey-grey/brown)			4600mm	dry & strong		
4700mm	dry & strong			4700mm			
4800mm				4800mm			
4900mm				4900mm			
5000mm				5000mm			
5100mm				5100mm			
5200mm				5200mm			
5300mm				5300mm			
5400mm				5400mm			
5500mm				5500mm			
5600mm				5600mm			
5700mm	UTP P/A – sw rock			5700mm			
5800mm				5800mm			
5900mm				5900mm			
6000mm				6000mm			
					END P/A		

Log Sections

TEST SITE 3				TEST SITE 4			
Location:	refer to site sketch			Location:	refer to site sketch		
depth	description	fill	dcp	depth	description	fill	dcp
100mm	SILT		3	100mm	FILL-gravelly silt		3
200mm	(grey/brown-grey)		6	200mm	dry & uncontrolled		3
300mm	dry & dense		5	300mm	SILT		6
400mm			8	400mm	(grey/brown-grey)		10
500mm	GRAVELLY CLAY		11	500mm	dry & dense		10
600mm	(red/orange-orange/grey/red)		10	600mm	GRAVELLY CLAY		9
700mm	moist & very stiff		9	700mm	(red/orange-orange/grey/red)		9
800mm			12	800mm	moist & very stiff		8
900mm			10	900mm			8
1000mm			5	1000mm			7
1100mm			4	1100mm			9
1200mm			2	1200mm			10
1300mm			3	1300mm			7
1400mm			3	1400mm			8
1500mm			7	1500mm			5
1600mm	END H/A – limit of testing		8	1600mm	END H/A – limit of testing		5
1700mm			7	1700mm			5
1800mm			16	1800mm			5
1900mm			24+	1900mm			11
2000mm				2000mm			9
2100mm				2100mm			9
2200mm				2200mm			7
2300mm				2300mm			7
2400mm				2400mm			14
2500mm				2500mm			16
2600mm				2600mm			26
2700mm				2700mm			30+
2800mm				2800mm			
2900mm				2900mm			
3000mm				3000mm			
3100mm				3100mm			
3200mm				3200mm			
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4000mm				4000mm			
4100mm				4100mm			
4200mm				4200mm			
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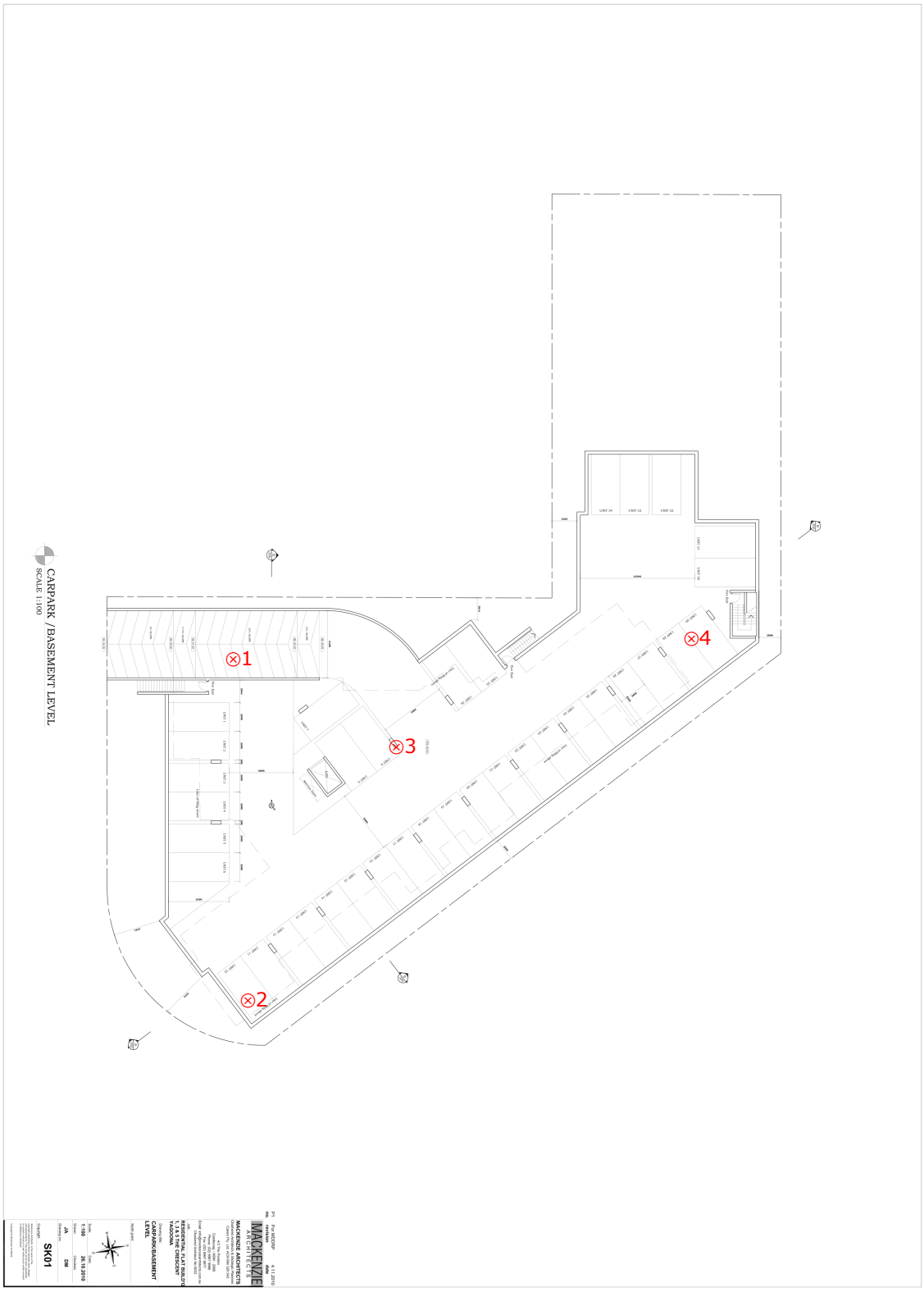
5900mm				5900mm			
6000mm				6000mm			

Site Sketch (Not to scale)

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