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Geotechnics / Environment / Groundwater

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Report on
Preliminary Geotechnical Assessment

100 Edinburgh Road, Castlecrag

Prepared for
Greencliff Castlecrag Pty Ltd

Project 86417.00
June 2018

Douglas Partners
Geotechnics / Environment / Groundwater

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author	PC Hartcliff	6 June 2018
Reviewer	pp KS	6 June 2018

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Report on Preliminary Geotechnical Assessment
100 Edinburgh Road, Castlecrag

1. Introduction

This report presents the results of a preliminary geotechnical assessment (desktop study) undertaken for a proposed Mixed-Use development at 100 Edinburgh Road, Castlecrag. The investigation was commissioned in an email dated 23 May 2018 by Mr Marcus Chang of Greencliff Castlecrag Pty Ltd (GC) and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal SYD180408 dated 30 April 2018.

The construction of a 'Mixed-Use' building with a three level basement is proposed. Geotechnical assessment was carried out to provide information on the subsurface conditions for the planning and Development Application (DA) purposes.

The assessment comprised a site inspection and a review of existing data on the site and the general area from published information and nearby geotechnical investigations carried out by DP.

A survey plan of the site produced by Frank M Mason and Co (Drawing No. 33216-02, dated 23.02.2017) was provided by GC for use in the assessment.

2. Site Description

The site (known as Lot 11, DP 611594) is near rectangular in shape and covers an area of approximately 4,460 m^2. It has street frontages of about 95 m along Edinburgh Road to the north, and about 57 m along Eastern Valley Way to the west. The southern boundary is about 95 m long and is bounded by residential houses and the eastern boundary is about 38 m long and is bounded by a commercial building.

The site is currently occupied by a shopping centre known as 'The Quadrangle' which includes an amalgamation of shops and restaurants as well as an 'IGA' supermarket. The shopping centre is open plan and comprises a single storey building which is level with Edinburgh Road. A vehicle access ramp is located along the eastern boundary and provides access to single level basement carpark below the shops. A pedestrian access ramp within the central part of the building provides access for pedestrians between the basement and the shops.

The natural ground surface falls to the south. Based on a review of the survey drawing provided, the reduced level along Edinburg Road is approximately RL 86.2 m AHD and at the base of the site is about 80.0 m AHD, corresponding to a drop of about 6.2 m from north to south over a distance of some 57 m.

The existing basement floor level slopes gently from the north-east corner to the south-east corner resulting in variable clearance throughout the carpark. Along the northern side of the basement and below the ramp to the east of the site is a vertical sandstone excavation (refer to Appendix B – Site

Plan and Figure 1 below). The exposed rock face is between about 0.5 m and 1.6 m high and comprises low and medium strength, moderately weathered strength sandstone that comprises some horizontal bedding planes and distinct cross beds that generally dip towards the east at about 35°.

Figure 1: View of the sandstone rock face exposed along the northern basement wall

3. Geology

Reference to the Sydney 1:100000 Geological Series Sheet indicates that the site is underlain by Hawkesbury Sandstone Formation rocks of Triassic Age. Hawkesbury Sandstone typically comprises medium to coarse grained quartz sandstone, shale, carbonaceous claystone, laminate (thinly interbedded siltstone and fine grained sandstone) and fine to medium grained lithic sandstone.

An extract from the geological map is shown in Figure 2.

Figure 2: Extract of the Sydney 1:100000 Geological Series Sheet

The Acid Sulphate Soil Risk Plan indicates that the site is located in an area not considered at risk of no known acid sulphate soil risk. An extract from the Acid Sulphate Risk Plan is given in Figure 3.

Figure 3: Extract of Acid Sulphate Soils Risk Plan

4. Geotechnical Model

Based on the site walk-over inspection, a typical subsurface profile for the site is expected to comprise surface pavements, shallow filling and residual soils to varying depths overlying sandstone bedrock. Sandstone bedrock will likely be present at shallow depth below the pavement towards the northern

part of the site, however, based on the 2 m high retaining wall located close to the southern boundary, the top of rock is likely to be greater than 2 m below existing surface levels within this part of the site.

The strength of the sandstone bedrock generally tends to be low strength near the rock surface but increases in strength (to medium strength and greater strength) with depth.

Based on our experience it is anticipated that the sub-soil profile could contain some sandstone floaters. The floaters could vary in size from boulders (> 200 mm in diameter) to single detached blocks in excess of 1 m or more in diameter. Generally any sandstone floaters present on site would be expected to be located just above the level of bedrock. Further, the surface of the sandstone bedrock is expected to comprise some ledges that step down the slope to the south.

5. Comments

5.1 Proposed Development

It is understood that the proposed development will comprise the demolition of the existing building and the construction of a 'Mixed-Use' building. Preliminary design information indicates that the new building will include three basement levels extending close to the existing site boundaries.

5.2 Hydrogeological Conditions and Site Drainage

It is anticipated that during and following periods of wet weather there will be ongoing seepage both along the top of rock and also along any jointing, bedding planes or other structures in the rock which are intersected by the excavation. Surface run-off should be readily controlled by perimeter drains to direct seepage around the excavations and building structures to the stormwater system.

Appropriate allowance must be incorporated into the design and construction to reduce the possible effect of moisture and ensure the amenity of all below-ground areas and excavation. Further, the design and construction of drainage measures should allow for future inspection, maintenance and cleaning of drainage lines.

Due to the elevated location, the sloping topography of the area and shallow depth to bedrock, it is considered that the permanent, regional groundwater table will be below the proposed lower basement level and that the proposed development will have no significant influence on the existing surface and groundwater flow system, both in the site and the surrounding area.

Further, it is anticipated that the anticipated minor seepage along the top of rock, as well as from joints and bedding planes within the rock can be intercepted and redirected by the installation of drainage behind the proposed lower floor level walls.

5.3 Excavation

It is expected that the excavation required for the basement will encounter pavements, shallow granular filling underlain by low and medium strength sandstone bedrock possibly higher strength at

depth. The pavement will require removal using hydraulic plant and the underlying filling and any soil together with low strength sandstone bedrock should be readily removed using conventional hydraulically operated earthmoving equipment with bucket/auger attachments. Excavation of medium strength or stronger sandstone bedrock will require rock saws, rotary mill heads or hydraulic rock breaking equipment.

5.4 Excavation Support

Where space permits, the use of temporary batters in filling and shallow soils will be possible and it is recommended that temporary batters be cut no steeper than 1:1 (H:V) with the top of the batter offset at least 0.5 m from any site boundary and protected from all surface water runoff. The crest of the batters must not be surcharged.

Where there is insufficient room to batter the soils at a safe angle, it will be necessary to provide shoring support for the filling and soils above the bedrock. It is recommended that retaining structures be engineer designed assuming a lateral earth pressure coefficient (Ka) of 0.4 (for level backfill) and a unit weight of 20 kN/m^3.

Allowance should be made for sloping ground behind/above any walls, potential surcharge loads or water pressures acting on the walls. Drainage measures such as free draining backfill and discharge points through the walls should be incorporated in the wall design and the walls must be founded on stable bedrock.

Low to medium strength and stronger sandstone, will generally stand vertically unsupported, unless unfavourably oriented jointing is present. It will be necessary for a geotechnical engineer to undertake regular inspections during excavation to determine if, and where, localised rock support measures are required.

5.5 Vibration Induced by Excavation Plant

Where sandstone bedrock is encountered it is recommended that the rock be removed using multiple rock saw cuts and splitting methods rather than continuous use of a hydraulic rock breaking attachment, to reduce the level of excavation generated vibration.

From current information, it is considered likely that the residences on the adjacent sites can withstand vibration levels higher than those required to maintain the comfort of the occupants. A human comfort criterion is therefore suggested and the peak particle velocity in any direction (PPVi), is proposed as the control parameter. It is recommended that a Provisional Allowed Vibration Limit of 8.0 mm/sec PPVi be set during normal working hours, measured at foundation level of the potentially affected buildings. Vibration trials are recommended prior to the commencement of rock excavation to determine vibration levels and the possible need for vibration monitoring during excavation.

It is also recommended that a dilapidation survey of the adjacent residences be carried out to document their existing condition and any damage present before the commencement of site preparation, demolition and excavation works so that any claim can be appropriately addressed.

5.6 Disposal of Excavated Materials

All excavated materials will need to be disposed of in accordance with current Department of Environment, Climate Change and Water (DECCW) regulations. Under the DECCW Waste Classification Guidelines (2014) a waste/fill receiving site must be satisfied that materials received meet the environmental criteria for proposed land use. This includes filling and virgin excavated natural materials (VENM), such as may be removed from this site. Accordingly, environmental testing will need to be carried out to classify spoil prior to disposal. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirements of the receiving site.

It should be noted that some receiving sites, such as those operated by Councils or other bodies might have their own special environmental criteria to be met before admitting any materials.

5.7 Foundations

For a three level basement with bulk excavation to about 9 m depth, shallow strip or pad footings founded in the rock exposed at the basement should be suitable. Preliminary design could be based on footings bearing on medium strength sandstone with an allowable end bearing pressure of 3.5 MPa.

The excavation of funding conditions must be verified by appropriate intrusive geotechnical investigation and testing.

6. Construction Considerations

The following geotechnical, contamination and hydrogeological items will be required prior to and during construction:

- geotechnical investigation for detailed design purposes;
- pre-construction dilapidation surveys of adjacent residences and structures;
- pre-construction waste classification of materials to be removed from site;
- installation of seepage/stormwater erosion protection measures prior to commencement of bulk excavation;
- plant vibration trials will be required with reduction in plant size if exceedance of the nominated appropriate PPV occurs; and
- excavation of footings with inspection by a geotechnical engineer and confirmation of allowable bearing pressures.

7. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for 100 Edinburgh Road, Castlecrag in accordance with DP's proposal SYD86417.00 dated 30 April 2018 and acceptance received from Greencliff Castlecrag P/L dated 23 May 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Greencliff Castlecrag P/L for this project only and for the purposes as described in the report. It should not be used for other projects or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions observed on site. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences.

DP's advice is based upon the conditions observed during the site walkover and other investigations on different sites. Actual ground conditions across the site may be different to those encountered on nearby sites. The advice may also be limited by project constraints.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

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Appendix A

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

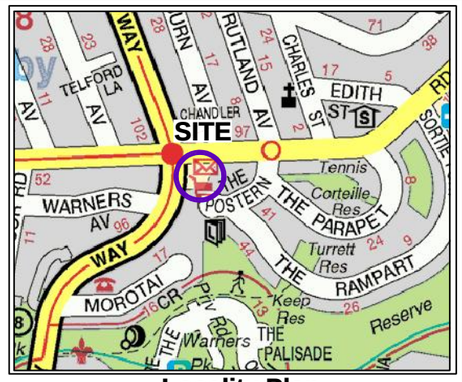
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Drawing 1 – Site Plan



Locality Plan

NOTE:
1: Base drawing from Frank M Mason & Co Pty Ltd (Dwg 33216-022, dated 23.2.2017

0 5 10 15 20 30 40 50m

1:500 @ A3

LEGEND

- Sandstone bedrock
- 1 Photo number with direction of view

Douglas Partners Geotechnics | Environment | Groundwater	CLIENT: Greencliff Castlecrag Pty Ltd	TITLE: **Site Plan** **Proposed Mixed-Use Development** **100 Edinburgh Road, CASTLECRAG**	PROJECT No: 86417.00
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 1
	SCALE: 1;500 @ A3 / DATE: 31.5.2018		REVISION: 0