



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Desktop Study

Riley Street Colonnade Outdoor Seating
Riley Street, Penrith

Prepared for
Scentre Group Ltd

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Integrated Practical Solutions



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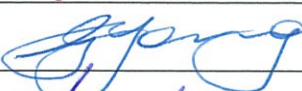
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Desktop Study

Riley Street Colonnade Outdoor Seating

Riley Street, Penrith

1. Introduction

This report presents the results of a desktop study undertaken for the colonnade outdoor seating at Riley Street, Penrith. The investigation was commissioned in an email dated 31 March 2016 by Ms Lee Ng of Scentre Group Ltd and was undertaken in accordance with Douglas Partners' proposal SYD160355 dated 17 March 2016.

It is understood that the development will involve widening of the Riley Street footpath, removal of some trees, demolition of existing light poles, new light poles, new awnings over footpath and new trees, planter boxes and seating.

The report is based on a review of a number of existing geotechnical investigations carried out by DP in the area and DP's experience of the ground conditions in the area. Comments relating to typical design and construction practice are provided in the report.

2. Site Description

The site of the works is located on the north-western corner of the intersection of Riley and Henry Streets, Penrith outside the existing Westfield shopping centre. The site is currently a relatively level, paved open area with street landscaping which includes planter boxes, trees, poles and barricades. There are also some outdoor dining areas associated with adjacent cafes.

It is understood that the Westfield shopping centre in the area of the proposed colonnade has been constructed on grade and there is no basement in the vicinity.

3. Geology

Reference to the Penrith 1:100 000 Geological Sheets indicates that the site is underlain by the fluvial materials of the Cranebrook Formation of the Quaternary Period which typically comprises sands, clays, silts and gravels.

The NSW Acid Sulphate Risk Map prepared by The Department of Infrastructure Planning and Natural Resources indicates that the site is not located within an area of potential risk for acid sulphate soils.

4. Previous Investigations

Douglas Partners has carried out a number of investigations for the existing buildings and pavements on the site. At the time, the development was known as Penrith Plaza. There are four tests in the general area whose locations are shown on Drawing No. 1 in Appendix B.

In summary, the tests had the subsurface profile given in Table 1.

Table 1: Summary of Previous Testing

Layer	Depth to Top of Stratum			
	CPT 35	Bore/CPT 36	CPT 37	Bore 41
Surface	RL 27.2	RL 27.3 m	RL 27.0 m	RL 27.2
Filling	0	0	0	
Very Stiff to hard sandy clay	-	1.0	0.3	0
Medium Dense to dense clayey sand	1.0	3.8		3.5
Gravel	5.0	5.5		5.5
End of test	5.2	9.5	4.6	7.0
Groundwater		6.1		6.0

The above tests were carried out in 1989 or 1990. Except where the area has been disturbed (e.g. the installation of services) by more recent activities, the existing subsurface profile is expected to be similar to that given in Table 1 and could be summarised as follows:

- Pavement
- Filling – clayey filling varying in thickness up to about 1 m depth. There would also be backfill above underground services, overlying;
- Clayey sand, sandy clay – interbedded medium dense and dense clayey sands and very stiff to hard sandy clays, overlying;
- Gravel – large cobble size river gravel at about 5 m to 5.5 m depth.

Groundwater levels have been found to vary over time. In March 1990, the water was at about RL 23 which was some 2 m higher than in October 1989.

5. Proposed Redevelopment

It is understood that the development will involve widening of the Riley Street footpath, removal of some trees, demolition of existing light poles, new light poles, new awnings over footpath and new trees, planter boxes and seating.

6. Comments

6.1 Site Classification

Due to the presence of filling on the site, the site classification in terms of AS 2870 would be Class P.

6.2 Excavation and Support

Excavations up to about 5 m could involve the removal of filling, clay and sand. The filling, clay and sand should be readily excavated using conventional earthmoving equipment. If the excavation is relatively deep, groundwater could be expected.

Sketches provided with the project brief show planter boxes up to about 600 mm depth. For such shallow excavations, the consequences of the sides of an excavation collapsing are considered to be in significant and nor a safety issue. However, a batter of 1H:1V is suggested for the sides of the excavation, assuming that there are no loads at the top of the batter.

There is the practical consideration for backfilling behind the planter boxes. The excavation should be enlarged to that a small compacter, e.g. whacker packer, can successfully compact the backfilling behind the walls of the planter boxes. Any backfilling should be compacted to at least 95 % density ratio compared to Standard compaction. A non-cohesive backfill is suggested.

It is suggested that any retaining walls are designed based on a triangular pressure distribution using an active pressure coefficient of 0.3 and a bulk density of 20 kN/m³.

6.3 Foundations

Loads have not been provided for the different structures on the site. The founding conditions are expected to vary across the site, depending on the structure and the location. Filling of varying thicknesses, mainly for levelling purposes, overlying stiff to hard clay or medium dense clayey sand at relatively shallow depth is expected on the site. There are also a number of underground services in the area which would have been constructed in trenches and backfilled, often with granular material.

It is assumed that for any significant structure, it will be founded on the natural ground under the superficial layer of filling. For structures located over services, it is expected that the services are moved or the loads transferred around the services onto natural ground.

For shallow pad or strip footings founded on the natural sandy clays or clayey sands at depths of the order of 0.75 m to 1 m, an allowable bearing pressure of 200 kPa would be appropriate.

Alternatively, bored piles taken to the gravels at about 5.0 m depth could be adopted using an allowable bearing pressure of 1 000 kPa. If bored piles are used, temporary casing may be required to keep the hole open until the concrete is poured.

For uplift loads, the weight of the shallow footing should be utilised. An allowable skin friction of 20 kPa could be adopted for piles in tension.

All footing excavations should be inspected by a geotechnical engineer to confirm the design parameters have been achieved.

7. Pavements

Douglas Partners has carried out a number of pavement investigations around the Penrith Plaza shopping centre. In situ CBR as well as laboratory CBR tests have been undertaken with CBR results varying from 1.5% to about 30%. For pavement design, it has been suggested that a CBR of 3% be adopted for the natural soils in the general area.

It is, however, noted that the pavement extension could be located over underground services, in which case the subgrade material will be trench backfilling. The pavement design in these areas will depend on the quality of the backfill which will only be obvious when the area is exposed. A common treatment for a pavement over services is to remove some of the backfill, place a geofabric over the exposed surface and fill and compact with select material in layers. Filling under pavements should be compacted to 100 % density ratio relative to Standard compaction. The size of the equipment used to compact the filling should be appropriate so as not to damage the underlying services.

8. Limitations

Douglas Partners (DP) has prepared this report for this project at Riley Street, Penrith in accordance with DP's proposal dated 17 March 2016 and acceptance received from Scentre Group dated 29 March 2016. The work was carried out under Scentre Group Consultant Service Contract for Project C57490. This report is provided for the exclusive use of 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 on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

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. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

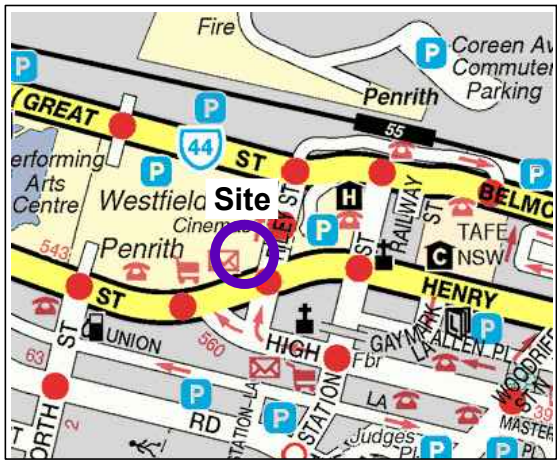
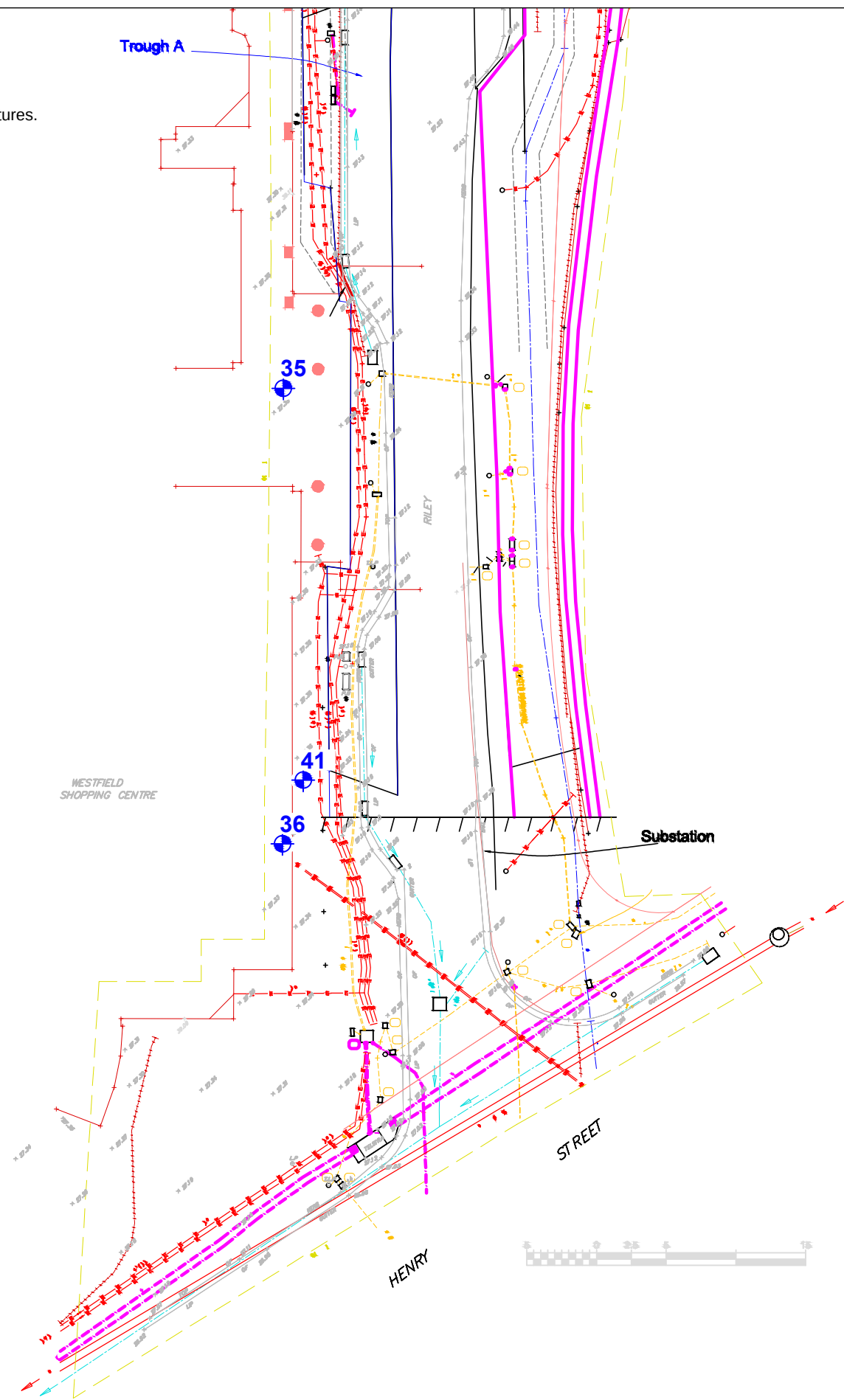
Site Inspection

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 No. 1 – Site Plan Showing Test Locations

- NOTE:
- 1: Base drawing from Utility Pty Ltd (Dwg 201015, dated 6.11.2015)
 - 2: Test locations are approximate only and are shown with reference to existing features.



Locality Plan

LEGEND

◆ Test location

 Douglas Partners Geotechnics Environment Groundwater	CLIENT: Scentre Group		TITLE: Site Plan Showing Test Locations Riley Street Colonade Outdoor Seating Riley Street, PENRITH		PROJECT No: 85437.00
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