



# **Douglas Partners**

*Geotechnics | Environment | Groundwater*

Report on  
Preliminary Geotechnical Investigation

Proposed Residential Development  
Block 29 Section 36, Mawson

Prepared for  
Land Development Agency

Project 88379.00  
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Integrated Practical Solutions



## Document History

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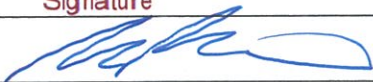

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
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## **Report on Preliminary Geotechnical Investigation**

### **Proposed Residential Development**

### **Block 29 Section 36, Mawson**

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## **1. Introduction**

This report presents the results of a preliminary geotechnical investigation undertaken for a proposed residential development at Block 29 Section 36, Mawson. The investigation was commissioned in an email dated 25 May 2017 by Adrian Arul of Land Development Agency and was undertaken in accordance with Douglas Partners' proposal CAN170259 dated 25 October 2016.

It is understood that Block 29 Section 36, Mawson will be subject to future redevelopment is expected to be a series of single or double storey units, built at or near grade with no basements. Further details of the development were unknown at the time of this report.

Site investigation was carried out to provide broad information on subsurface conditions with preliminary comments given on site classification, site preparation measures, excavation conditions, the performance of suitable foundation systems, likely bearing pressures and pavement design parameters.

The investigation comprised test pit excavation with in-situ testing and sampling of the subsurface strata, followed by laboratory testing, engineering evaluation and analysis. Details of the work undertaken are given in the report.

This report must be read in conjunction with the attached notes *About This Report* which are included in Appendix A.

## **2. Site Description**

The site is known as Block 29 Section 36 in Mawson and is near-rectangular in shape. It comprises an area of about 7,910 m<sup>2</sup> with maximum north/south and east/west dimensions of approximately of 165 m and 60 m north respectively. The site is currently undeveloped and mainly grassed with small to mature trees scattered across the area with various dacite rock boulders or outcrops across the site (see Figure 1).

At the time of the investigation, various small fill stockpiles with concrete, bricks and other building materials and localised areas of asphalt patches were observed on the site surface (see Figure 2).

The site is bounded by Mawson Drive to the north, Shackleton Circuit to the south and residential urban development to the east and west. Currently the site is not securely fenced and can be accessed from both Mawson Drive and Shackleton Circuit (refer Drawing 1, Appendix B).

The site is generally slightly to moderately sloping towards the north from RL 638 m relative to the Australian Height Datum (AHD) to RL 648 m AHD.





**Figure 1: Looking south across the site from the centre of the site (Pit 7).**



**Figure 2: Looking west at a stockpile comprising building materials (Pit 10)**

### 3. Regional Geology

Reference to the Canberra 1:100 000 Geological Series Sheet (Ref 1) indicates that the site is underlain by rock units of the Deakin Volcanics of Silurian age. The Deakin Volcanics typically comprise rhyodacitic ignimbrite with minor volcanoclastic and argillaceous sedimentary rocks.

The subsurface investigations have confirmed the presence of dacite underlying the site.

### 4. Field Work Methods

The field investigation comprised eleven test pits (Pits 1 – 11) excavated to depths ranging from 1.1 – 2.1 m using a Kubota KX057-4 mini excavator fitted with a 450 mm wide bucket working under the direction of a geotechnical engineer. Pits 10 and 11 were excavated into existing stockpiles. Disturbed and bulk samples of the soils encountered in the test pits were collected for laboratory testing and to assist in strata identification. Dynamic cone penetrometer tests (AS1289 6.3.2) were also undertaken to provide an indication of the in-situ strength profile of the site soils at each test location. The approximate location of the test pits are shown on Drawing 1 included in Appendix B with the AHD surface levels shown on the logs interpolated from the survey information provided on the ACT Government website (ACTMapi).

### 5. Field Work Results

Details of the subsurface conditions encountered are given in the test pit logs included in Appendix C which must be read in conjunction with the included explanatory notes that define classification methods and terms used to describe the soils and rocks. In summary, the test pits encountered slightly variable subsurface conditions underlying the site with the principal succession of strata broadly summarised as follows:

- **TOPSOIL:** generally comprising dry to moist sandy silt, silty sand varying amounts of gravel dacite cobbles and boulders to depths of 0.1 – 0.2 m in Pits 1 – 9.
- **FILLING (Stockpiled):** generally comprising, dry to moist silty sand, sandy silty and gravelly sandy silt in Pits 10 and 11 to depths of 0.7 m and 0.8 m respectively. Concrete, clay bricks and black plastic were also encountered in one or both the pits.
- **SILTY SAND SANDY SILT:** medium dense, dry to moist, silty sand and sandy silt with varying amounts of gravel and dacite cobbles and boulders encountered to depths 0.3 – 0.5 m. Pits 10 and 11 were terminated at the limit of investigation depth of 1.1 m.
- **SANDY CLAY:** very stiff to hard, dry to moist sandy clay with varying amounts of dacite cobbles and boulders in Pits 1 – 9 to depths of 0.5 – 1.1 m.
- **WEATHERED ROCK:** variably extremely low to high strength, extremely to moderately weathered dacite below depths of 0.5 – 1.1 m in Pits 1 – 9. Very high to extremely high, slightly weathered to fresh fractured inclusion / boulder was encountered in Pit 4. Pits 1 and 2 were terminated at the limit of investigation depth of 2.1 m and Pits 3 – 9 at slow progress depths of 1.2 – 1.9 m.



No free groundwater was observed during excavation of the test pits. The pits were backfilled immediately following excavation precluding longer term monitoring of groundwater levels. Groundwater conditions rarely remain constant and can change seasonally due to variations in rainfall, temperature and soil permeability. For these reasons, it is noted that the moisture condition of the site soils (in particular the near-surface silty and sandy soils) can vary considerably from the time of the investigation compared to at the time of construction.

## 6. Laboratory Testing

Two samples collected from the test pits were tested in the laboratory for measurement of either California bearing ratio (CBR), compaction properties, plasticity properties or particle size distribution. The detailed laboratory test report sheets are given in Appendix D with the results summarised in Tables 1 and 2.

**Table 1: Summary of CBR Testing**

Test Location	Depth (m)	FMC (%)	OMC (%)	MDD (t/m <sup>3</sup> )	CBR (%)	Swell (%)	Field Description
5	0.6 – 0.8	12.0	14.0	1.84	2.0	2.5	Sandy Clay
8	0.7 – 0.9	6.8	9.5	2.03	30	0.5	Dacite

Where:

FMC = Field Moisture Content  
 OMC = Optimum Moisture Content

MDD = Maximum dry density (modified)  
 CBR = California bearing ratio (soaked)

**Table 2: Summary of Plasticity Testing and Particle Size Distribution**

Test Location	Depth (m)	FMC (%)	PL (%)	LL (%)	LS (%)	%Passing 2.36 mm Sieve	%Passing 0.075 mm Sieve	Field Description
2	0.8 – 1.0	17.7	27	55	13.0	94	56	Sandy Clay
6	0.3 – 0.5	14.6	25	55	14.0	99	55	Sandy Clay

Where:

FMC = Field Moisture Content  
 LS = Linear Shrinkage

PL = Plastic Limit  
 LL = Liquid Limit

The CBR testing was carried out on samples compacted to about 95% modified maximum dry density at close to optimum moisture content. The samples were soaked for four days under surcharge loading of 4.5 kg.

The results indicate the CBR samples tested were 2 - 3 percentage points dry of Modified optimum values.

The plasticity and particle size distribution test results indicate that the clay soils tested were of high plasticity and comprised a portion of sand.

## 7. Comments

### 7.1 General

The following comments are based on the results of limited subsurface investigation and Douglas Partners (DP) experience with similar projects. Whilst development details for the block have yet to be fully determined, it is likely that a series of single or double storey units, built at or near grade with no basements. As such excavation depths of no more than 1 m are considered likely.

### 7.2 Site Classification

Based on the presence of uncontrolled filling (stockpiles) on the site at the time of the investigation, the overall site is classified as Class P (problem site) in accordance with the requirements of AS 2870 – 2011 *'Residential Slabs and Footings'* (Ref 2). The main requirement for Class P sites is for design to be undertaken by a structural engineer using sound engineering principles.

It is noted that the classification is appropriate for the undeveloped site and is independent of the proposed site preparation measures and construction. If the stockpiled filling was to be removed from site, the underlying natural soil profile across the site would be classified as ranging from Class S (slightly reactive) to low range Class M (moderately reactive). This classification would be dependent on the depth of highly reactive clay soils across the site.

In addition, reference to Clause 3.1.1 of AS 2870 – 2011 indicates that the foundation details given in AS 2870 are not applicable to buildings longer than 30 m.

### 7.3 Earthworks and Site Preparation

#### 7.3.1 Stripping

Site preparation for the construction of pavement areas and structures should include the removal of uncontrolled filling, roots, topsoils, vegetation and other deleterious materials such as organic matter and/or tree affected soils from the proposed construction areas. Based on the results of the current investigation, an average topsoil stripping depth of 0.1 – 0.2 m is expected. Uncontrolled filling was limited to mainly isolated stockpiles (i.e. Pits 10 and 11 to 0.7 m and 0.8 m respectively) from surface dumping. It is noted however that stripping depths could be greater, if in places should localised deeper topsoils or unsuitable materials/filling be encountered, if inclement weather precedes construction or if the contractor adopts inappropriate stripping methods.

It is noted that the site is underlain by silty / sandy soils (beneath the topsoils) to the depth of sandy clay (0.3 -0.5 m) below existing surface level. This material could prove difficult to handle and compact if moisture affected and will require careful control (moisture). Allowance must be made for at least partial removal of the silty / sandy soils however it is recommended that prior to stripping of this material inspection be undertaken by a suitably qualified geotechnical engineer to assess the depth of removal. Where possible this material would be designated to remain in-situ, however if considered unsuitable would be required to be removed.



### 7.3.2 Site Trafficability

Following periods of wet weather, the natural surface across the site may be boggy and effectively untrafficable to all but tracked construction vehicles.

Some measures that can be undertaken to reduce the impact of wet weather on the earthworks construction include:

- retain grass cover wherever possible;
- provide cut surfaces with an slight but even cross-gradient to assist surface drainage;
- “seal” exposed fill surfaces at the end of each work day by running over with a smooth-wheeled roller;
- armour temporary access roads with rockfill; and
- form swale drains at upslope locations to help intercept surface and near-surface seepage water and to redirect it into existing drainage gullies or dams, or to sediment retention ponds.

### 7.3.3 Excavation Conditions

Removal of the filling, topsoil, natural soils and bedrock up to low strength (i.e. to the slow progress depths of 1.2 – 1.9 m) should be readily achievable using conventional earthmoving plant with slower production within cemented soils and weathered rock and use of a ripper. Below the slow progress depths, and where the very high to extremely high strength inclusion was encountered in Pit 4, large excavators fitted with rock hammers, single tyne ripper and toothed buckets would be required at slow production rates. The ease of removal of very high strength inclusions would depend on the size of the inclusions. Should excavation depths be deeper than the depths of investigation, additional geotechnical assessment would be required in order to provide comment. Tenderers for bulk excavation will need to make their own assessment of the excavatability based on the results of the test pitting and their own experience.

No free groundwater or groundwater seepage was observed during excavation of the test pits. However, taking into account the possibility of a basement excavation as part of the future development, groundwater seepages cannot be ruled out within excavations. It is noted that the extent and volume of groundwater inflow into excavations would be dependent on prior weather conditions. Groundwater seepages should be anticipated to increase following rainfall.

### 7.3.4 Excavation Support

The soils exposed in cut would have only limited capacity to stand vertically without support over extended periods of time.

Where space permits the natural soils should be battered at 1:1 (H:V) for temporary excavations and 2.5:1 (H:V) for permanent battering. Where excavation is proposed right up to the property boundary, or where battering of the excavation is not possible, there will be a need for retaining structures to prevent lateral movement of the retained soils in order to reduce the risk of potential damage to neighbouring land, structures, footpaths and/or services. Feasible options would include either anchor piles with close shuttering or sprayed concrete infill panels or contiguous piling.

In areas where cantilevered retaining structures are proposed, it is suggested that earth pressures on retaining walls due to the retained soils be based on a triangular pressure distribution calculated as follows:

$$h_z = \gamma k_a z$$

where,

$h_z$	=	horizontal pressure at depth $z$
$\gamma$	=	unit weight of retained soil
	=	20 kN/m <sup>3</sup> (soil and extremely weathered rock)
	=	22 kN/m <sup>3</sup> (very low or greater strength rock)
$k_a$	=	0.3 (active earth pressure coefficient)

Drainage behind all retaining walls should be provided or, alternatively, full hydrostatic pressure allowed for in design. In the event that hydrostatic pressures are allowed, densities of the retained soils can be reduced to the buoyant values.

Where applicable, superimposed surcharge loads due to adjacent roadways, inclined surfaces etc. should also be accommodated in the design of such structures.

An “at rest” pressure coefficient ( $k_o$ ) of 0.5 would be appropriate where support must be provided to adjacent boundaries and where movement-intolerant services are present within the adjacent footpaths.

### 7.3.5 Reuse of Onsite Material

The surface stockpiles containing building debris and any other deleterious material (such as soft or significantly root affected soils) would not be suitable for reuse within future building or pavement areas and should be disposed offsite to a licenced landfill facility.

The topsoil and silty sandy soils are also not considered to be soil suitable for engineering applications. The underlying silty / sandy soils could be difficult to handle and compact, and are prone to loss of strength upon saturation. Careful moisture control to maintain optimum moisture content for compaction would be required to produce compacted fill suitable to support structures such as pavements and buildings.

It must be noted that at the time of the investigation, the underlying clay soils were of high plasticity and dry of Modified optimum moisture values. Prior to re-use, the soils will need to be moistened and preferably blended with a low plasticity imported material or the underlying extremely low to low strength dacite rock to reduce the potential adverse shrink / swell affects. The imported material should be inspected by a geotechnical engineer for its suitability.

As excavation proceeds into low or greater strength rock, it would be expected that cobble and boulder sized rock pieces would be removed, which would need to be crushed to a general maximum particle size of 75 mm prior to use within filling areas. Some rock particles, say up to 150 mm would be considered acceptable however only in a small percentage of the overall filling volume, say 5 – 10%.

The excavated bedrock could potentially be re-used as select grade filling in pavement areas, however it is recommended it be tested to determine if it meets the minimum requirements for select quality material.

Prior to reuse or disposal of material excavated from site, a waste classification assessment should be undertaken in accordance with current ACT EPA guidelines.

### **7.3.6 Filling Selection, Placement and Compaction**

In order to achieve Class S or M site classifications in areas of filling, it will be necessary for any medium and/or high plasticity clays to be avoided in structural areas. Generally low plasticity clays (i.e.  $LL < 35\%$ ) and blended soils comprising a mixture of clay, silt, sand and gravel would be considered appropriate to achieve Class S or M conditions. The depth of filling will also need to be considered in predicting likely classification; generally the deeper the filling, the greater the likelihood of H1 (highly reactive) classification or higher. All sources of imported filling should be assessed by a geotechnical engineer as to its suitability to conform to a filled Class S or M profile.

Prior to filling, the stripped surfaces must be inspected and/or test rolled in the presence of a geotechnical engineer. Any areas exhibiting significant deflections under test rolling must be appropriately treated at the direction of the geotechnical engineer.

All controlled filling should be placed in horizontal layers of maximum 250 mm loose thickness. The material should be placed in accordance with the ACT Government Standard Specification for Urban Infrastructure Works – Earthworks. Moisture content should be within the range  $\pm 2\%$  of modified optimum.

All constructed fill batters should be constructed no steeper than 2.5:1 (horizontal:vertical), protected against erosion by vegetating the exposed surface and construction of toe and spoon drains as a means of controlling surface water flows on the batters.

All controlled filling should be compacted to a minimum 95% Modified maximum dry density (MMDD), (ACT Government Standard Specification for Urban Infrastructure Works – Earthworks) to accommodate pavements and commercial type land use.

To validate the filling quality, field inspections and in-situ testing of future earthworks must be undertaken in order to satisfy the requirements for Level 1 controlled filling AS 3798 – 2007 (Ref 3).

## **7.4 Site Drainage**

It is recommended that subsurface and surface drainage be installed early in the works programme and maintained at the site to minimise groundwater and overland flows. All collected stormwater, groundwater and roof runoff should be discharged into the stormwater disposal system.

## **7.5 Foundations**

Following site preparation as outlined in Section 7.3 and subject to building design, foundation options for the future buildings/structures could include pad and strip footings or bored piers supported on either future controlled filling, natural soils or weathered rock. Suggested allowable base bearing pressures are as follows:

- Controlled filling (95% MMDD): 150 kPa
- Very stiff to hard natural sandy clay soils 150 kPa
- Extremely low to very low strength bedrock 500 kPa
- Low to medium strength bedrock 2,000 kPa

All footings must be founded within a uniform bearing stratum and should be inspected by a suitably qualified engineer prior to placement of reinforcing and pouring of concrete to verify design assumptions.

Settlements of footings will be dependent on the applied load and the sizing of the footing and at this stage cannot be determined. Confirmation of suitable footing systems and expected settlements can be undertaken once building design is suitably advanced.

Design of footings must be taken into consideration the influence of any adjacent service trenches, retaining walls or submerged structures.

## 7.6 Pavement Design Considerations

The CBR result is given in Table 1 and the test report sheet is provided in Appendix D.

Based on the results of the field investigation and previous experience in the Mawson area, Table 3 gives suggested design CBR values for the various likely subgrade conditions.

**Table 3 – Design CBR Values**

Subgrade Material	Design CBR (%)
Controlled Filling	3*
Natural Clayey Soils	2
Weathered Bedrock	7 (in-situ)
	4 (recompacted)

Note (\*) – To be determined based on soil type, subject to change.

Subgrade conditions should be reviewed during further detailed investigations for the future development and also during construction. The reviews should be carried out by a suitably qualified engineer and would involve additional CBR testing to confirm the design assumptions regarding subgrade strength. Subgrade replacement will be required where soaked CBR values of less than 2% are obtained.

All earthworks should be undertaken under close supervision and consultation with the geotechnical consultant in order to avoid any unnecessary over excavation.

The standard of construction, the selection of materials and quality of workmanship for the roads should satisfy the requirements of the latest edition of the ACT Standard Specification for Urban Infrastructure Works.



Surface and subsoil drainage should be installed and maintained to protect the pavement and subgrade. Subsoil drains should be located at a minimum of 0.5 m depth below the subgrade level.

## 8. Further Investigation

Further investigation of the site will be required following conceptual design to confirm the subsurface conditions encountered and to provide more detailed and specific advice on excavation conditions, support requirements, foundations options and pavement design parameters.

## 9. References

1. Geology of Canberra 1:100 000 Geological Series Sheet 8727, Bureau of Mineral Resources, (1992).
2. Australian Standard AS2870-2011, 'Residential Slabs and Footings', April 2011, Standards Australia
3. Australian Standard AS 3798 – 2007 *Guidelines on Earthworks for Commercial and Residential Developments*.

## 10. Limitations

Douglas Partners (DP) has prepared this report for this project at Block 29 Section 36 Mawson in accordance with DP's proposal dated 25 October 2016 and acceptance received from Adrian Arul dated 25 May 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of the Land Development Agency for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site 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.

DP's advice is based upon the conditions encountered during this investigation. 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 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 components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

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**Douglas Partners Pty Ltd**

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## Appendix A

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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.

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## **Appendix B**

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Drawing 1 – Test Location Plan





**LEGEND**

- Approximate Site Boundary
- 640 Contours from ACTMAPi (captured May 2004)
- # 1 Approximate Test Pit Locations



NOTE: Base drawing from ACTMAPi.com.au (dated 26 March to 1 April, 2016)

<div><b>Douglas Partners</b> Geotechnics   Environment   Groundwater</div>		CLIENT: Land Development Agency		TITLE: <b>Test Location Plan</b>		<div></div>
OFFICE: Canberra		DRAWN BY: SDG		<b>Proposed Residential Development</b> <b>Block 29 Section 39, Mawson</b>		
SCALE: As shown		DATE: 30.06.2017				
		PROJECT NO: 88379.00		DRAWING NO: 1		
		REVISION: 0				

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## Appendix C

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Explanatory Notes  
Test Pit Logs (Pits 1 – 11)





## Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

## Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

## Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

## Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

## Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

## Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

## Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:  
4,6,7  
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:  
15, 30/40 mm

# *Sampling Methods*

The results of the SPT tests can be related empirically to the engineering properties of the soils.

## **Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests**

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.



## Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

## Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

## Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

## Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 - 5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

# *Soil Descriptions*

## **Soil Origin**

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.





### Rock Strength

Rock strength is defined by the Point Load Strength Index ( $Is_{(50)}$ ) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

\* Assumes a ratio of 20:1 for UCS to  $Is_{(50)}$ . It should be noted that the UCS to  $Is_{(50)}$  ratio varies significantly for different rock types and specific ratios should be determined for each site.

### Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

### Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

# Rock Descriptions

## Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

## Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

# Symbols & Abbreviations

## Douglas Partners



### Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

### Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

### Water

▷	Water seep
▽	Water level

### Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U <sub>50</sub>	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

### Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

### Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

### Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

### Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

### Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

### Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

### Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

### Other

fg	fragmented
bnd	band
qtz	quartz

# Symbols & Abbreviations

## Graphic Symbols for Soil and Rock

### General



Asphalt



Road base



Concrete



Filling

### Soils



Topsoil



Peat



Clay



Silty clay



Sandy clay



Gravelly clay



Shaly clay



Silt



Clayey silt



Sandy silt



Sand



Clayey sand



Silty sand



Gravel



Sandy gravel



Cobbles, boulders



Talus

### Sedimentary Rocks



Boulder conglomerate



Conglomerate



Conglomeratic sandstone



Sandstone



Siltstone



Laminite



Mudstone, claystone, shale



Coal



Limestone

### Metamorphic Rocks



Slate, phyllite, schist



Gneiss



Quartzite

### Igneous Rocks



Granite



Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 640.0 m AHD **PIT No:** 1  
**EASTING:** 208858 **PROJECT No:** 88379.00  
**NORTHING:** 594864 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
640		TOPSOIL-dry to moist, dark brown sandy silt with rootlets		E	0.1							
	0.15	SILTY SAND-medium dense, moist to dry, brown silty sand, fine to medium grained, some rootlets, roots and cobbles		E	0.2							
	0.3	SANDY CLAY-very stiff to hard, dry to moist, red brown, high plasticity sandy clay with roots		E	0.5							
				D	0.6							
	0.9	DACITE-very low strength, extremely weathered to highly weathered, yellow fractured, orange and brown fine to coarse grained dacite		E	1.0							
639	1	-from 1.5m, low strength, highly weathered		D	1.6							
		-from 1.9m, medium strength, moderately weathered										
638	2											
	2.1	Pit discontinued at 2.1m -limit of investigation										

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 639.7 m AHD **PIT No:** 2  
**EASTING:** 208898 **PROJECT No:** 88379.00  
**NORTHING:** 594870 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
639	0.15	TOPSOIL-dry to moist, dark brown sandy silt with rootlets, cobbles and boulders ~0.5m in width		E	0.1							
		SILTY SAND-medium dense, moist to dry, brown, fine to medium grained silty sand with some rootlets, roots, cobbles and dacite boulder inclusions 0.5m in size		E	0.2							
	0.45	SANDY CLAY-very stiff to hard, dry to moist, red brown, high plasticity sandy clay with roots		E	0.5							
					0.8							
	1			B	1.0							
638	1.1	DACITE-very low strength, extremely weathered highly fractured, yellow orange and brown, fine to coarse grained dacite,		D	1.2							
		-from 1.7m, medium strength, moderately weathered										
	2	-from 2.0m, high strength, moderately weathered										
	2.1	Pit discontinued at 2.1m -limit of investigation										

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket

**LOGGED:** SDG

**SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 642.7 m AHD **PIT No:** 3  
**EASTING:** 208879 **PROJECT No:** 88379.00  
**NORTHING:** 594840 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
642		TOPSOIL-dry to moist, dark brown silty sand with some rootlets		E	0.1							
	0.15	SILTY SAND-medium dense, moist to dry, brown, fine to medium grained silty sand, some rootlets, roots and cobbles		E	0.2							
	0.4	SANDY CLAY-very stiff to hard, dry to moist, red brown, high plasticity sandy clay with roots										
	0.5	DACITE-extremely low to very low strength, extremely to highly weathered, yellow brown, fine to coarse grained, highly fractured to fractured dacite		E	0.55							
		-0.8m, boulder sized inclusion, high strength, moderately to slightly weathered										
	1			E	1.0							
641				D	1.2							
		-from 1.4m, low strength, moderately weathered										
		-from 1.6m, medium to high strength, moderately weathered										
		-from 1.7m, high strength										
	1.85	Pit discontinued at 1.85m -slow progress		D	1.8							
2												

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**






☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 642.8 m AHD **PIT No:** 4  
**EASTING:** 208910 **PROJECT No:** 88379.00  
**NORTHING:** 594834 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
		TOPSOIL-dry to moist, dark brown sandy silt with rootlets		E	0.1							
	0.15	SILTY SAND-loose silty sand, dry to moist, brown, fine to medium grained silty sand with cobbles and boulders (dacite)		E	0.2							
	0.3	SANDY CLAY-very stiff, dry to moist, red brown, medium plasticity sandy clay with some cobbles and boulders										
	0.6	DACITE-low strength, highly weathered, fractured, yellow brown, fine to coarse grained dacite		D E	0.5							
642												
1		-from 1.1m, very high to extremely high strength, slightly weathered to fresh, fractured dacite inclusion (most likely a boulder, excavated around it to 1.5m)										
	1.5	Pit discontinued at 1.5m -slow progress										
641												
2												

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 645.8 m AHD **PIT No:** 5  
**EASTING:** 208899 **PROJECT No:** 88379.00  
**NORTHING:** 594793 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
645	0.15	TOPSOIL-dry to moist, dark brown silty sand with gravel and rootlets		E	0.1							
		SANDY SILT-stiff to very stiff, dry to moist, light brown, low plasticity sandy silt with some gravel and cobbles		E	0.2							
	0.4	SANDY CLAY-very stiff to hard, dry to moist, red brown, medium plasticity sandy clay with some cobbles and boulders		E	0.5							
					0.6							
				B								
	0.9	DACITE-very low strength, extremely weathered, highly fractured, yellow brown, fine to coarse grained, dacite			0.8							
				E	1.0							
				D	1.2							
	1.5	-from 1.2m medium strength, medium weathered										
		-from 1.4m, medium to high strength, moderately to slightly weathered										
644	Pit discontinued at 1.5m -slow progress											

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**



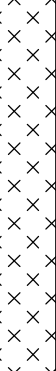
☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 645.2 m AHD **PIT No:** 6  
**EASTING:** 208929 **PROJECT No:** 88379.00  
**NORTHING:** 594797 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
645	0.1	TOPSOIL-dry to moist, dark brown silty sand with cobbles and dacite boulders and rootlets		E	0.1							
	0.2	SILTY SAND-medium dense, dry to moist, brown, fine to medium grained silty sand, rootlets, cobbles and dacite boulders		E	0.2							
	0.3	SANDY CLAY-very stiff, dry to moist, red brown, medium to high plasticity sandy clay			0.3							
	0.4			B D	0.4							
	0.5			E	0.5							
644	0.6	DACITE-very low strength, extremely to highly weathered, highly fractured, yellow brown fine to coarse grained dacite										
		-from 0.9m, low strength, highly weathered		D	0.9							
				E	1.0							
643		-from 1.3m, high strength, moderately weathered										
	1.5	Pit discontinued at 1.5m -slow progress										

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 648.0 m AHD **PIT No:** 7  
**EASTING:** 208913 **PROJECT No:** 88379.00  
**NORTHING:** 594773 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
648		TOPSOIL-dry to moist, dark brown silty sand with abundant rootlets		E	0.1							
	0.15	SANDY SILT-stiff, dry to moist, light brown, low plasticity sandy silt with some rootlets and cobbles and boulders (dacite colluvium)		E	0.2							
	0.3	SANDY CLAY-very stiff, dry to moist, red brown, high plasticity sandy clay with some silt		D E	0.5							
	0.6	DACITE-low strength, highly weathered, yellow brown, highly fractured, fine to coarse grained dacite										
647	1	-from 1.0m, medium strength, moderately weathered, orange grey and brown		E D	1.0 1.1							
	1.2	Pit discontinued at 1.2m -slow progress										
646	2											

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** DCP refusal on dacite cobbles and boulders

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 646.8 m AHD **PIT No:** 8  
**EASTING:** 208938 **PROJECT No:** 88379.00  
**NORTHING:** 594774 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
		TOPSOIL-dry to moist, dark brown silty sand with rootlets		E	0.1							
	0.15	SANDY SILT-stiff to very stiff, dry to moist, brown, low plasticity sand silt with cobbles (possible filling)		E	0.2							
	0.4	SANDY CLAY-very stiff, dry to moist, red brown, high plasticity sandy clay		E	0.5							
	0.6	DACITE-very low strength, extremely weathered, yellow brown dacite, fine to coarse grained, highly fractured			0.7							
		-from 0.7m, low strength, highly weathered		B								
					0.9							
646												
	1											
		-from 1.1m, medium strength, moderately weathered										
	1.4	Pit discontinued at 1.4m -slow progress										
645												
	2											

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 648.2 m AHD **PIT No:** 9  
**EASTING:** 208931 **PROJECT No:** 88379.00  
**NORTHING:** 594751 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
648		TOPSOIL-dry to moist, light brown silty sand with rootlets										
	0.15	SILTY SAND-medium dense, dry to moist, light brown, fine to medium grained silty sand		E	0.2							
	0.3	SANDY CLAY-very stiff, dry to moist, red brown, high plasticity sandy clay		E	0.5							
	0.7	DACITE-very low strength, extremely weathered, yellow brown dacite, highly fractured, fine to coarse grained dacite										
647		-from 0.9m, low strength, highly weathered		E	1.0							
		-from 1.2m, medium to high strength, moderately weathered										
646	1.5	Pit discontinued at 1.5m -slow progress										

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

☐ Sand Penetrometer AS1289.6.3.3  
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 647.4 m AHD **PIT No:** 10  
**EASTING:** 208900 **PROJECT No:** 88379.00  
**NORTHING:** 594787 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
647		FILLING-generally comprising dry to moist,brown silty sand/sandy silt with some cobbles and boulders -from 0.1m, concrete block, 0.4m wide		E	0.2							
				E	0.5							
	0.7	SANDY SILT/SILTY SAND-stiff to very stiff, medium dense, dry to moist, brown and light brown, low plasticity, fine to medium grained, sandy silt/silty sand										
	1			E	1.0							
	1.1	Pit discontinued at 1.1m -limit of investigation										
646												
	2											
645												

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Excavated into an existing stockpile



☐ Sand Penetrometer AS1289.6.3.3  
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
IE	Environmental sample	≡	Water level	V	Shear vane (kPa)

# TEST PIT LOG

**CLIENT:** Land Development Agency  
**PROJECT:** Proposed Residential Development  
**LOCATION:** Block 29 Section 36, Mawson

**SURFACE LEVEL:** 644.0 m AHD **PIT No:** 11  
**EASTING:** 208874 **PROJECT No:** 88379.00  
**NORTHING:** 594832 **DATE:** 7/6/2017  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
644		FILLING-generally comprising dry to moist, brown gravelly silty sand with concrete, brick and black plastic pieces		E	0.2							
				E	0.5							
	0.8	SANDY SILT-stiff to very stiff, dry to moist, light brown, low plasticity sandy silt		E	1.0							
643	1											
	1.1	Pit discontinued at 1.1m -limit of investigation										
642	2											

**RIG:** Kubota KX057-4 (5.7 tonne) mini-excavator fitted with 450mm bucket **LOGGED:** SDG **SURVEY DATUM:** ACT Coordinates

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Excavated into an existing stockpile

☐ Sand Penetrometer AS1289.6.3.3  
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

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## **Appendix D**

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Results of Laboratory Testing (5 sheets)



# J & A GEOTECH TESTING PTY LTD

Unit 2/25 Dacre Street Mitchell ACT 2911

Certificate No **245373 & 245375**

## Test Certificate – California Bearing Ratio – CBR

Client	<b>DOUGLAS &amp; PARTNERS</b>	Job No	<b>1933</b>
Principal		Date Tested	<b>19.6.17</b>
Project	<b>88379.00</b>	Tested By	<b>D.J</b>
Location	<b>Mawson ACT</b>	Date Checked	<b>20.6.17</b>
<b>Test Procedures</b>		Checked By	<b>J.S</b>
<input checked="" type="checkbox"/> AS 1289 6.1.1 <input checked="" type="checkbox"/> AS 1289 2.1.1 <input type="checkbox"/> AS 1289 2.1.4 <input type="checkbox"/> AS 1289 5.1.1 <input checked="" type="checkbox"/> AS 1289 5.2.1 <input type="checkbox"/> RMS T102 <input type="checkbox"/> RMS T111 <input type="checkbox"/> RMS T112 <input type="checkbox"/> RMS T117 <input type="checkbox"/> RMS 130 <input type="checkbox"/> RMS T120 <input type="checkbox"/> RMS T132 <input type="checkbox"/> RMS T180			

Sample Location		Pit 5	Pit 8	-	-
Level at Test Taken	BFL	0.6m-0.8m	0.7m-0.9m	-	-
Remoulding Parameters		95%MMDD@OMC	95%MMDD@OMC	-	-
Compactive Effort		Modified	Modified	-	-
Maximum Particle Size	mm	19.0   37.5	19.0   37.5	19.0   37.5	19.0   37.5
Percentage Oversize of Material	%	0.0   0.0	0.0   0.0	0.0   0.0	-   -
Oversize Material included in Sample		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Maximum Dry Density	t/m <sup>3</sup>	1.84	2.03	-	-
Optimum Moisture Content	%	14.0	9.5	-	-
Dry Density Before Soak	t/m <sup>3</sup>	1.75	1.93	-	-
Dry Density After Soak	t/m <sup>3</sup>	1.70	1.92	-	-
Dry Density Ratio Before Soak	%	95.0	95.0	-	-
Dry Density Ratio After Soak	%	92.5	94.5	-	-
Moisture Ratio Before Soak	%	100.0	100.0	-	-
Moisture Content Before Soak	%	13.8	9.7	-	-
<b>Soaking</b>					
Period of Soak days		4	4	-	-
Surcharge kg		9.0	9.0	-	-
Swell%		2.5	0.5	-	-
<b>Penetration Test</b>					
Sample Moisture Content	%	12.0	6.8	-	-
Top 30 mm	%	26.4	16.4	-	-
Whole Sample	%	18.2	12.7	-	-
<b>CBR Value</b>		<b>2.0</b>	<b>30</b>	-	-
Penetration at Which CBR Determined mm		5.0	2.5	-	-
<b>Material Classification: Sampled by client received on 9.6.17</b>		<b>Sandy Clay</b>	<b>Dacite</b>	-	-



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NATA Accredited Laboratory  
Number: 19979

R-CBR Oct 2016

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The results of the tests, calibrations and/or measurements  
included in this document are traceable to Australian/national  
standards.

20.6.17  
Manager/Date  
Justin Smith



# J & A GEOTECH TESTING PTY LTD

Unit 2/25 Dacre Street Mitchell ACT 2911

Particle Size Distribution / Atterberg Limits

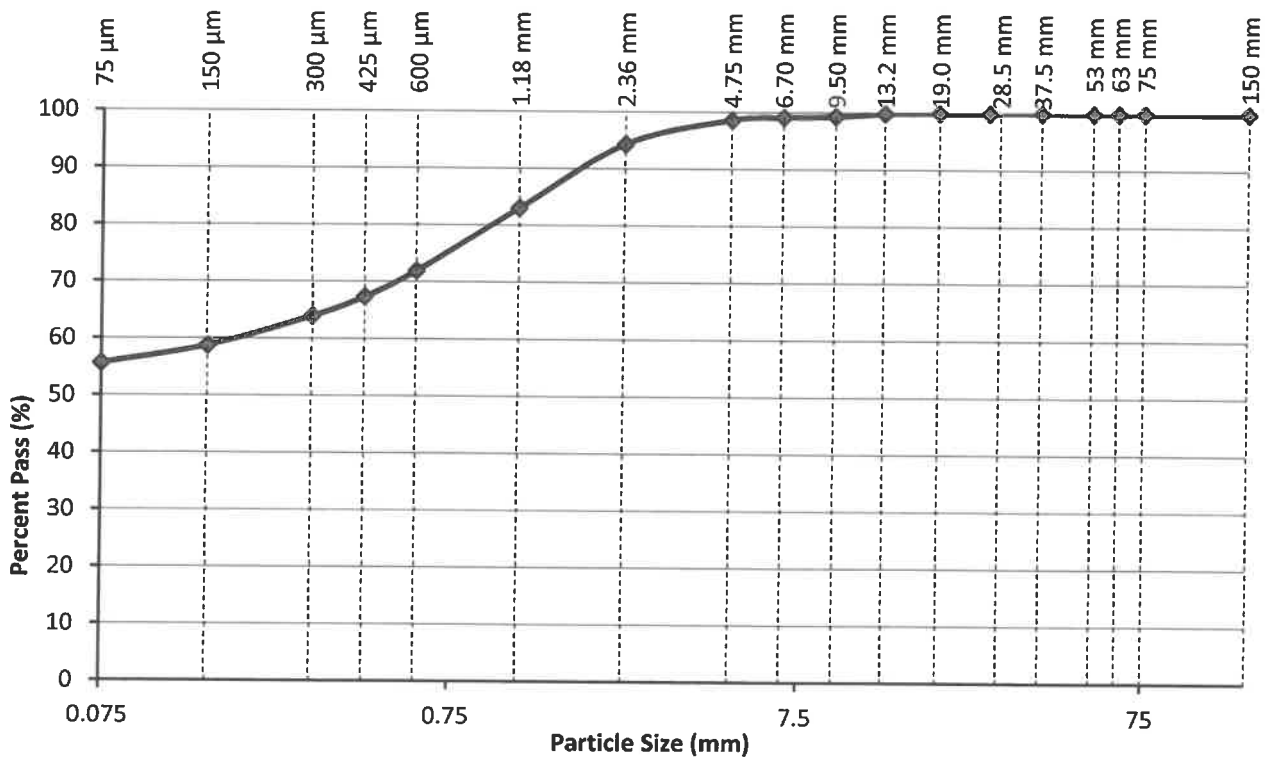
Job No

1933

Sample No

245372

Client			Douglas & Partners												Date Prepared			13.6.17	
Principal															Prepared By			D.J	
Project			88379												Date Tested			19.6.17	
Location			Mawson ACT												Tested By			D.J	
Sample Identification			Pit 2 0.8m-1.0m												Date Checked			20.6.17	
Test Procedures			[ ] AS 1289 3.1.1 [•] AS 1289 3.1.2 [•] AS 1289 3.2.1												Checked By			J.S	
			[•] AS 1289 3.3.1 [•] AS 1289 3.4.1 [ ] AS 1141.11.1 w																
			[•] AS 1289 3.6.1 [ ] Wet Prep [•] Dry Prep PI [ ] AS 1289 4.3.1																
			[ ] RMS T108 [ ] RMS T109 [ ] RMS T113 [ ] RMS T201 washed [ ] AS 1141.33																
AS Sieve Size	150 mm	75 mm	63 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 µm	425 µm	300 µm	150 µm	75 µm	
Percent Passing	100	100	100	100	100	100	100	100	99	99	99	94	83	72	67	64	59	56	



0.002			0.06			2			60		
clay	silt			sand			gravel			cobbles	
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

AS 1289

Atterberg Limits	Liquid Limit	%	57	Plastic Limit	%	27
	Linear Shrinkage	%	13.0	Plasticity Index	%	30
Other Tests	Clay and Fine Silt	%	-	pH		-

Comments: Sampled by client, received on 7.6.17



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20.6.17  
Justin Smith  
Manager





# J & A GEOTECH TESTING PTY LTD

Unit 2/25 Dacre Street Mitchell ACT 2911

Particle Size Distribution / Atterberg Limits

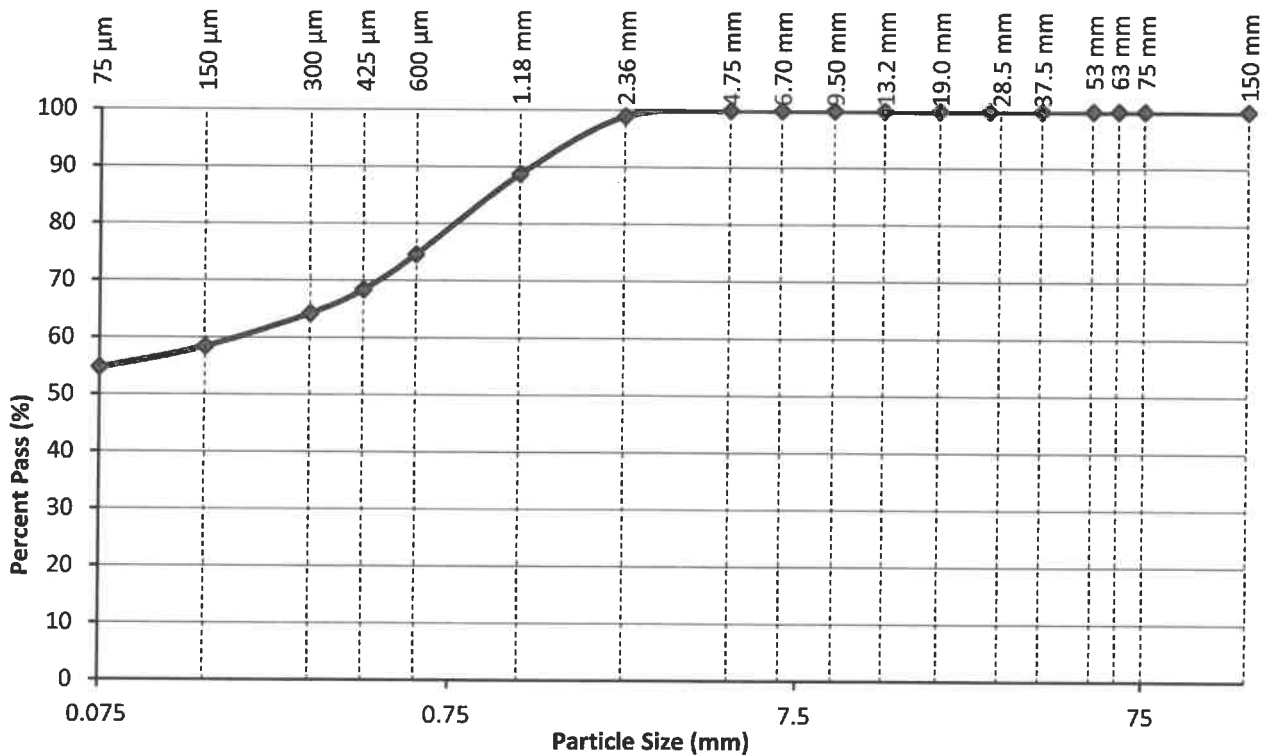
Job No

1933

Sample No

245374

Client			Douglas & Partners												Date Prepared			13.6.17	
Principal															Prepared By			D.J	
Project			88379												Date Tested			19.6.17	
Location			Mawson ACT												Tested By			D.J	
Sample Identification			Pit 6 0.3m-0.5m												Date Checked			20.6.17	
Test Procedures			[ ] AS 1289 3.1.1 [•] AS 1289 3.1.2 [•] AS 1289 3.2.1												Checked By			J.S	
			[•] AS 1289 3.3.1 [•] AS 1289 3.4.1 [ ] AS 1141.11.1 w																
			[•] AS 1289 3.6.1 [ ] Wet Prep [•] Dry Prep PI [ ] AS 1289 4.3.1																
			[ ] RMS T108 [ ] RMS T109 [ ] RMS T113 [ ] RMS T201 washed [ ] AS 1141.33																
AS Sieve Size	150 mm	75 mm	63 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 µm	425 µm	300 µm	150 µm	75 µm	
Percent Passing	100	100	100	100	100	100	100	100	100	100	100	99	89	75	68	64	58	55	



0.002			0.06			2			60		
clay			silt			sand			gravel		
			fine	medium	coarse	fine	medium	coarse	fine	medium	coarse

AS 1289

<b>Atterberg Limits</b>	<b>Liquid Limit</b>	%	55	<b>Plastic Limit</b>	%	25
	<b>Linear Shrinkage</b>	%	14.0	<b>Plasticity Index</b>	%	30
<b>Other Tests</b>	<b>Clay and Fine Silt</b>	%	-	<b>pH</b>		-

Comments: Sampled by client, received on 7.6.17



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20.6.17  
Justin Smith  
Manager



# J & A GEOTECH TESTING PTY LTD

Unit 2/25 Dacre Street Mitchell ACT 2911

Certificate No 245372

## Test Certificate - Moisture Content, Particle Size Distribution, Atterberg Limits, Linear Shrinkage, pH Value & Clay & Fine Silt

Client	DOUGLAS & PARTNERS	Job No	1933
Principal		Date Tested	19.06.17
Project	88379.00	Tested By	D.J
Location	Mawson ACT	Date Checked	20.06.17
Test Procedures		Checked By	J.S
<input type="checkbox"/> AS 1141.11.1 Washed <input checked="" type="checkbox"/> AS 1289 2.1.1 <input type="checkbox"/> AS 1289 3.1.1 <input type="checkbox"/> AS 1289 3.1.2 <input type="checkbox"/> AS 1289 3.2.1 <input type="checkbox"/> AS 1289 3.3.1 <input type="checkbox"/> AS 1289 3.4.1 <input type="checkbox"/> AS 1289 3.6.1 <input type="checkbox"/> AS 1141 .33 <input type="checkbox"/> AS 1289 4.3.1 <input type="checkbox"/> RMS T108 <input type="checkbox"/> RMS T109 <input type="checkbox"/> RMS T113 <input type="checkbox"/> RMS T120 <input type="checkbox"/> RMS T180 <input type="checkbox"/> RMS T106 <input type="checkbox"/> RMS T107			

Gradation			
AS Sieve Size	Percent Finer Than AS Sieve	Specification Limits	
		From	To
75.0 mm			
53.0 mm			
37.5 mm			
26.5 mm			
19.0 mm			
13.2 mm			
9.5 mm			
6.7 mm			
4.75 mm			
2.36 mm			
1.18 mm			
0.600 mm			
425 µm			
300 µm			
150 µm			
75 µm			
13.5 µm			
Comments:			

Natural Moisture Content, Atterberg Limits and Linear Shrinkage <input type="checkbox"/> Wet Prep <input type="checkbox"/> Dry Prep		
Liquid Limit	%	-
Plastic Limit	%	-
Plasticity Index	%	-
Linear Shrinkage	%	-
Natural Moisture Content	%	17.7

Sample Description/Material Source
Sampled by Client Received on 07.06.17
Pit 2 0.8m-1.0m

pH Value -	pH
Clay & Fine Silt Settling Method	%



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30.06.17  
Laboratory Manager/Date  
Scott Miller



# J & A GEOTECH TESTING PTY LTD

Certificate No **245374**

Unit 2/25 Dacre Street Mitchell ACT 2911

## Test Certificate – Moisture Content, Particle Size Distribution, Atterberg Limits, Linear Shrinkage, pH Value & Clay & Fine Silt

Client	<b>DOUGLAS &amp; PARTNERS</b>	Job No	<b>1933</b>
Principal		Date Tested	<b>19.06.17</b>
Project	<b>88379.00</b>	Tested By	<b>D.J</b>
Location	<b>Mawson ACT</b>	Date Checked	<b>20.06.17</b>
<b>Test Procedures</b>		Checked By	<b>J.S</b>
<input type="checkbox"/> AS 1141.11.1 Washed <input checked="" type="checkbox"/> AS 1289 2.1.1 <input type="checkbox"/> AS 1289 3.1.1 <input type="checkbox"/> AS 1289 3.1.2 <input type="checkbox"/> AS 1289 3.2.1 <input type="checkbox"/> AS 1289 3.3.1 <input type="checkbox"/> AS 1289 3.4.1 <input type="checkbox"/> AS 1289 3.6.1 <input type="checkbox"/> AS 1141 .33 <input type="checkbox"/> AS 1289 4.3.1			
<input type="checkbox"/> RMS T108 <input type="checkbox"/> RMS T109 <input type="checkbox"/> RMS T113 <input type="checkbox"/> RMS T120 <input type="checkbox"/> RMS T180 <input type="checkbox"/> RMS T106 <input type="checkbox"/> RMS T107			

### Gradation

AS Sieve Size	Percent Finer Than AS Sieve	Specification Limits	
		From	To
75.0 mm			
53.0 mm			
37.5 mm			
26.5 mm			
19.0 mm			
13.2 mm			
9.5 mm			
6.7 mm			
4.75 mm			
2.36 mm			
1.18 mm			
0.600 mm			
425 µm			
300 µm			
150 µm			
75 µm			
13.5 µm			

Comments:

### Natural Moisture Content, Atterberg Limits and Linear Shrinkage ☐ Wet Prep ☐ Dry Prep

Liquid Limit	%	-
Plastic Limit	%	-
Plasticity Index	%	-
Linear Shrinkage	%	-
Natural Moisture Content	%	14.6

### Sample Description/Material Source

Sampled by Client Received on 07.06.17

Pit 6 0.3m-0.5m

pH Value - pH

Clay &amp; Fine Silt Settling Method %



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Number: 19979

R-SCT Oct 2016

30.06.17  
Laboratory Manager/Date  
Scott Miller

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