



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Geotechnical Investigation

Proposed Industrial Development
Block 11 Section 21, Hume

Prepared for
Flexible Australia

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Integrated Practical Solutions





Douglas Partners

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Report on Geotechnical Investigation

Proposed Industrial Development

Block 11 Section 21, Hume

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed industrial development at Block 11 Section 21, Hume. The investigation was commissioned in an email dated 18 April 2018 by Robert Thompson of Flexible Australia and was undertaken in accordance with Douglas Partners' proposal CAN180051 dated 13 March 2018.

It is understood that the development of the site will include the construction of a light industrial development and associated pavement areas.

The geotechnical investigation was undertaken to provide comment on the following:

- the subsurface conditions underlying the site;
- an appropriate site classification in accordance with the requirements of AS2870;
- recommendations on site preparation and earthworks;
- an appropriate foundation system for the proposed development, including an assessment of allowable bearing pressures; and
- suitable parameters for the design of new pavements.

The investigation included the excavation of nine test pits and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

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

2. Background Information

Controlled filling was placed over most of the site in mid-2016 up to a general depth of 0.1 – 0.6 m with deeper filling (up to about 1.2 m) placed along the south eastern parts of the site to marry in with the Tralee Street formation adjacent. An existing groundwater spring was identified on the site however was not filled as part of that controlled filling operations. It must be noted that some of the controlled filling downslope of the spring may have become water softened as a result of rising groundwater flows from the spring. It is also noted that previous uncontrolled filling located on the site was not fully removed; the extent of uncontrolled filling removed was limited to that required to facilitate the placement and compaction of the controlled filling. It is expected that uncontrolled filling still remains along the Tralee Street boundary and a portion of the Couranga Street boundary.

In late 2016 to early 2017, a subsoil drainage network was installed around each of the 3 blocks known as Blocks 9 – 11 Section 21 to attempt to intercept lateral groundwater flows entering each of the blocks in the upper 2 – 2.5 m depth range.

3. Site Description and Regional Geology

The site which is known as Block 11 Section 21, Hume is a near-rectangular shaped area of about 25,000 m². It is located on the western corner of Couranga Crescent and Tralee Street.

Existing site levels fall in the north to north west direction at grades of 1 in 20 to 1 in 30 (vertical in horizontal) across the block area however slightly steepen to 1 in 10 to 1 in 15 within the easement next to Tralee Street.

The site is bounded by existing roads to the north east and south east vacant land to the south-west and vacant Block 10 Section 21 to the north-west.

At the time of the investigation, the site was mostly lightly grassed with some small stockpiles of soil and building rubble near the corner of Couranga Crescent and Tralee Street.

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. The Deakin Volcanics typically comprise dacitic ignimbrite with minor volcanoclastic and argillaceous sedimentary rocks. From previous experience, the Hume area is generally underlain by thick alluvial, deposits comprising sand, silt, clay and gravel which are cemented in parts.

4. Field Work Methods

The field investigation comprised the excavation of 18 test pits (Pits 301 – 318) to depths ranging from 1.3 – 3.0 m using a Kobelco SK45 SRX mini-excavator fitted with a 450 mm wide bucket working under the direction of a Geotechnical Engineer. Disturbed and bulk samples of the soils encountered in the test pits were collected for laboratory testing and to assist in strata identification. The approximate test locations are shown on Drawing 1 (Appendix B) with the AHD surface levels and coordinates shown on the logs interpolated from the provided survey information from the client. The test pits were located on site using a hand held GPS which is accurate only to about 3 – 5 m.

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 variable subsurface conditions underlying the site with the principal succession of strata broadly summarised as follows:

TOPSOIL/TOPSOIL FILLING: mixture of silt, sand and gravel with rootlets to depths of 0.1 – 0.2 m,

FILLING (UNCONTROLLED): sandy silty clay with some cobbles and boulders in Pits 307 – 310 to depths of 0.7 – 2.8 m,

FILLING (CONTROLLED): well compacted gravelly silty clay with some cobbles and sand to depths of 0.4 – 1.2 m in Pits 301 – 306 and 311 – 318,

SILTY SAND & SANDY CLAY: interbedded loose to dense (cemented in parts), dry to wet silty sand with some gravelly lenses and stiff to hard, moist to dry sandy clay to the limit of investigation of 1.3 – 3.0 m.

Groundwater seepages were noted in Pits 301, 303, 304, 310 below depths of 1.6 – 2.2 m. No free groundwater was observed during excavation of the remaining test pits. It is noted, however, that 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 may vary considerably from the time of the investigation compared to at the time of construction.

6. Laboratory Testing

Four (4) samples of the soil recovered from the test pits were tested in the laboratory for measurement of either Atterberg limits and linear shrinkage or California bearing ratio (CBR) and maximum dry density. The detailed laboratory test report sheets are included in Appendix D with the results summarised in Table 1. The CBR testing was carried out on a sample compacted to about 95% modified maximum dry density at close to Modified optimum moisture content. The sample was soaked for four days under surcharge loading of 4.5 kg.

Table 1: Results of Laboratory Testing

Pit No	Depth (m)	LL (%)	PI (%)	LS (%)	FMC (%)	OMC (%)	MDD (t/m ³)	CBR (%)	Swell (%)	Material
302	1.8	37	23	10.0	12.9					Sandy Clay
311	1.3	NP	NP	NP	5.1					Silty Sand
312	0.3-0.5				9.3	12.5	1.95	8	0.0	Filling – Silty Gravelly Clay
316	0.4-0.6				3.5	7.5	1.92	12	1.5	Silty Sand

where LL = Liquid limit
 PI = Plasticity index
 LS = Linear shrinkage
 FMC = Field moisture content
 OMC = Optimum moisture content (mod)
 MDD = Maximum dry density (mod)
 CBR = California bearing ratio
 NP = Non Plastic

The plasticity test result indicate that the soil tested is of medium plasticity and would be susceptible to shrinkage and swelling movements with changes in soil moisture content. The compaction test results indicate that the samples tested were dry of the Modified optimum value.

7. Proposed Development

It is understood that the development of the site will include the construction of a light industrial development and associated pavement areas. Development details were not provided at the time of reporting, however as advised by the client some excavation would be required along the Tralee Street side boundary to facilitate the construction of a retaining wall (maybe 0.7 – 1.5 m in height) with the remainder of the site either filled or formed near current grade. Some isolated excavations may be required.

8. Comments

8.1 Geotechnical Constraints

Following the placement and compaction of controlled filling across the majority of the block and the installation of the subsoil drainage lines, the perceived geotechnical constraints which could impact on the development and the control measures are discussed as follows:

- **Uncontrolled filling:** Limited areas across the site contain uncontrolled filling which would be unsuitable to support structures or pavements. The filling appears to be a result of the adjacent road embankment construction and as such is limited to mainly the Tralee Street boundary and some of the Couranga Street boundary. The uncontrolled filling could be stripped to expose suitable natural soils and/or replaced with controlled filling, depending on development levels. It is considered to be a minor impediment to development and readily remediated.
- **Groundwater spring:** The presence of the groundwater spring in the rear part of the block is a localised limitation and will need to be controlled to enable development around that area to proceed. Controlling measures are expected to be relatively simple using a drainage blanket and outlet drain to one of the already installed subsoil drainage lines. Water softened materials would need to be removed as part of remediation works. It is recommended that the layout of any proposed development take into consideration the location of the groundwater spring and potential subsurface drainage line. The layout of the development should also take into consideration the recommended earthworks for the site which is further detailed below.
- **Deeper groundwater seepages:** Based on the installation of subsoil drains around the perimeter of the block and the effectiveness of similar drains on the adjacent stage of Hume West, it is expected that the majority of groundwater seepages would remain below a depth of about 2 m. The impact of any deep groundwater seepages (ie: greater than 2 m depth) will be dependent on the sensibility of future development design. It is strongly recommended that the existing controlled filling be utilised as a base to support additional controlled filling to create a near-level construction platform to raise the site rather than excavate closer to potential seepage zones. The installation of drainage measures for the groundwater spring and raising of the site in additional controlled filling is likely to enable raft or waffle type footings to be constructed on the prepared foundation.

8.2 Site Classification

Site classification in accordance with AS2870 - 2011 provides guidance on the patterns and magnitude of moisture related seasonal ground movements that must be considered in design. The subsurface conditions underlying the site at the time of the investigation indicate that due to the presence of uncontrolled filling greater than 0.4 m depth in parts of the site (ie: adjacent to the existing road formations), overall it is classified as Class P in accordance with the requirements of AS 2870 – 2011 ‘Residential Slabs and Footings’ (Ref 2).

It is further noted, that parts of the site encountered groundwater seepages during the field investigation, which would also warrant a Class P site classification in those areas due to adverse groundwater conditions. These areas were isolated to the area around the existing groundwater spring (Pits 301, 303 and 304) and Pit 310 in the north eastern corner of the site. As detailed above in Section 8.1 (deeper groundwater seepages), provided site levels are maintained or raised such that there is at least 1.5 m cover of soil above these seepages, it would be considered that the seepages in most cases would have minimal to no impact on future development. With the exception of the groundwater spring, the majority of the groundwater seepages have preferred subsurface flow paths and provided they are not cut off or interrupted, it would be unlikely for these seepages to rise upwards.

The main requirement for Class P sites is for design to be undertaken by a structural engineer using sound engineering principles.

Notwithstanding the above P classification, the majority of the site would be equivalent to Class M (moderately reactive) conditions.

It is noted that the classification is appropriate for the areas investigated in its present condition and is independent of the proposed site preparation measures and construction and any remedial works including removing uncontrolled filling and/or groundwater control measures. In addition, the foundation details given in AS 2870 are not applicable to buildings longer than 30 m, and those exceeding the specified construction type/size.

8.3 Earthworks and Site Preparation

8.3.1 Site Trafficability

Following periods of wet weather, the soil 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 a 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 or diversion mounds 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.

8.3.2 Stripping

Site preparation for the construction of pavement areas and structures should include the removal of uncontrolled filling, roots, topsoils, vegetation, moisture affected soils and other deleterious materials such as organic matter and/or tree affected soils from the proposed construction areas.

Based on the results of the investigation, the depth of surficial topsoil was generally 0.1 – 0.2 m. Undocumented filling was encountered in Pits 307 – 310 to depths of 2.8 m. Unless density testing records or fill certification is produced, the filling must be considered uncontrolled and must be removed if structures are proposed either on or adjacent (within 3 – 4 m) of the uncontrolled filling edge. It is cautioned though that full removal of the filling may encounter groundwater seepages and induce additional problems. Careful development layout or an acceptance of movement risk for footings founding on or near the uncontrolled filling could also be considered.

Deeper excavations will be necessary where localised thicker topsoils or unsuitable materials, including uncontrolled filling and root affected soils, are encountered, if inclement weather precedes construction or if the contractor adopts inappropriate stripping methods.

Sandy/silty soils were encountered at all test locations. These soils are sensitive to changes in moisture content and can prove difficult to handle and as such, allowance should be made for at least partial removal (say 0.3 m following stripping) of these soils. The extent of removal of silty soils underlying the site to be stripped would largely be dependent on the weather conditions at the time of stripping and the intended land use.

It is recommended that prior to any stripping of this material, inspection be undertaken by a suitably qualified geotechnical engineer in the presence of the earthworks contractor and Superintendent to assess the extent of removal required.

8.3.3 Excavation Conditions

Removal of the filling, topsoil and natural uncemented soils should be readily achievable using conventional earthmoving plant. Excavation of the cemented sands would require large excavators fitted with toothed buckets, single tyne rippers and possibly rock hammers would be required potentially at low production rates. Should excavation depths be deeper than the depths of investigation, additional geotechnical assessment would be required in order to provide comment.

Whilst seepages were limited to the existing groundwater spring and the north eastern corner of the site, previous experience in the area suggests that it would be likely that groundwater would be present in excavations should they be deeper than 1.5 – 2.0 m. The extent and seepage rate would depend on prior weather conditions and the depth of excavation.

8.3.4 Excavation Support

The filling and natural soils exposed in cut would have only limited capacity to stand vertically without support over extended periods of time. Table 2 below provides recommended maximum slopes for temporary and permanent cut batters, of no more than 2 m height on the basis no adverse groundwater is encountered. If adverse groundwater is encountered, flatter batter angles or stabilisation would be required.

Table 2: Recommended Maximum Batter Slopes in Cut

Strata	Temporary Batters (H:V)	Permanent Batters (H:V)
Existing Fill	2:1	3:1
Loose Soil	2:1	3.5:1
Dense/Very Stiff Soil	1:1	3:1

All constructed cut batters should be 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.

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.

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
γ	=	unit weight of retained soil
	=	20 kN/m ³
k_a	=	active earth pressure coefficient
	=	0.3 for compacted filling
	=	0.4 for uncontrolled filling

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 appropriately 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.

8.3.5 Reuse of Onsite Material

The topsoil and the underlying upper sandy/silty soil layers are not considered to be soil suitable for engineering applications. The sandy/silty soil can be difficult to handle and compact, and is prone to loss of strength upon saturation. Blending of the non-organic sandy/silty soils with the site clayey soils or imported low plasticity material may produce a suitable material for inclusion in controlled filling. Alternatively, the silty sand soil could be placed in non-structural applications. It is noted that it is

technically feasible to reuse silty sand soils though extreme care with moisture control will be required including extensive drainage measures and trial earthworks pads to determine the most appropriate equipment and moisture levels.

The existing filling could be reused as controlled filling but must be culled of any unsuitable fractions such as topsoil pockets, organic material, debris etc. prior to reuse, and allowance must be made for the additional cost and time of these activities.

Pending prior weather conditions, the soils may be required to be moisture conditioned (i.e.: dried or moistened).

8.3.6 Filling Selection, Placement and Compaction

It is recommended that any high plasticity clays be avoided in structural areas or else placed at a depth of 1.5 m below foundation level. Generally low to medium plasticity clays (i.e. LL<50%) and blended soils comprising a mixture of clay, silt, sand and gravel would be considered appropriate for controlled filling. All sources of imported filling should be assessed by a geotechnical engineer as to its suitability for controlled filling.

Prior to filling, the stripped surfaces must be inspected and 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. The use of a geofabric separation layer and/or a bridging layer cannot be discounted and would be influenced by prior weather conditions.

All controlled filling should be placed in near-horizontal layers of maximum 250 mm loose thickness and compacted to a minimum 95% modified maximum dry density, (ACT Government Standard Specification for Urban Infrastructure Works – Earthworks) to accommodate pavements and commercial type land use. Due to the potential for adverse groundwater conditions at the site, it is recommended that non-vibratory compaction be used to minimise the risk of pumping groundwater to the surface. Moisture content should be within the range $\pm 2\%$ of modified optimum.

All constructed fill batters should be constructed no steeper than 3:1 (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.

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).

8.4 Site Drainage

As discussed in Section 8.1 above, drainage measures will be required in the area of and around the existing groundwater spring and possibly in the area of Pit 310.

Additional subsurface drainage measures may also be required in other parts of the site though cannot be determined until the time of construction. If the site development excludes any site excavations in the areas of buildings and pavements, the extent of additional drainage measures would be expected

to be minimal. The placement of controlled filling would further decrease the chance that additional drains would be needed.

Surface drainage and control of stormwater captured from roofs and pavement areas will be essential to protect the pavement gravels, subgrade and foundation soils from inundation and potential softening.

8.5 Foundations

Following site preparation as outlined in Section 8.3 and subject to earthworks options and building design, foundation options for the future buildings/structures could include pad and strip footings or bored piers supported on either future controlled filling or natural soils. Suggested allowable base bearing pressures are as follows:

- Stiff / medium dense natural soils 100 kPa
- Very stiff to hard/dense natural soils 150 kPa
- Controlled filling: 150 kPa
- Cemented sandy soils 300 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 steel 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 undertaken by a structural engineer taking into consideration the influence of any adjacent service trenches, retaining walls or submerged structures.

8.6 Pavement Design Parameters

Based on the results of laboratory testing and previous experience in the area, it is recommended that for clay soils exposed at subgrade level, a CBR of 2% be adopted and for sandy soils, a CBR of 5% be adopted. It is noted that the design of pavements with a silty sand soil subgrade will be governed by constructability and not CBR value (ie: deformations under load). Replacement with stabilised road base and/or rock bridging layers will be required in areas where the design CBR or suitable subgrade performance under a roller test cannot be obtained.

CBR testing should be undertaken to confirm the design assumptions regarding subgrade strength.

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 in addition to the overall site drainage. Subsoil drains should be located at a minimum of 0.5 m depth below the subgrade level.

9. Design Review & Further Investigation

It is strongly recommended that DP review the proposed civil design for the project to assess whether the geotechnical constraints for the site have been appropriately addressed. Depending on the outcome of that review, additional investigations may be required.

10. References

1. Geology of Canberra 1:100 000 Geological Series Sheet 8727, Bureau of Mineral Resources, (1992).
2. Australian Standard AS 2870 – 2011 *Residential Slabs and Footings*.
3. Australian Standard AS 3798 – 2007 *Guidelines on Earthworks for Commercial and Residential Developments*.

11. Limitations

Douglas Partners (DP) has prepared this report for this project at Block 11 Section 21, Hume in accordance with DP's proposal dated 13 March 2018 and acceptance received from Flexible Australia dated 18 April 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Flexible Australia 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.

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.

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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 1

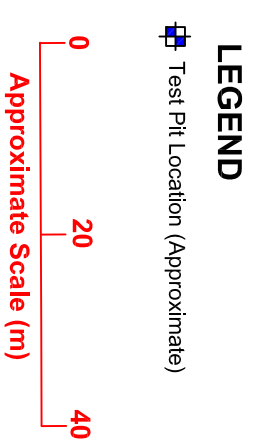
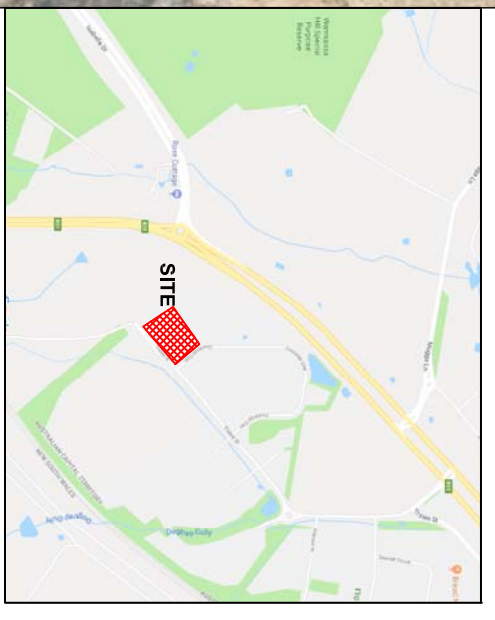
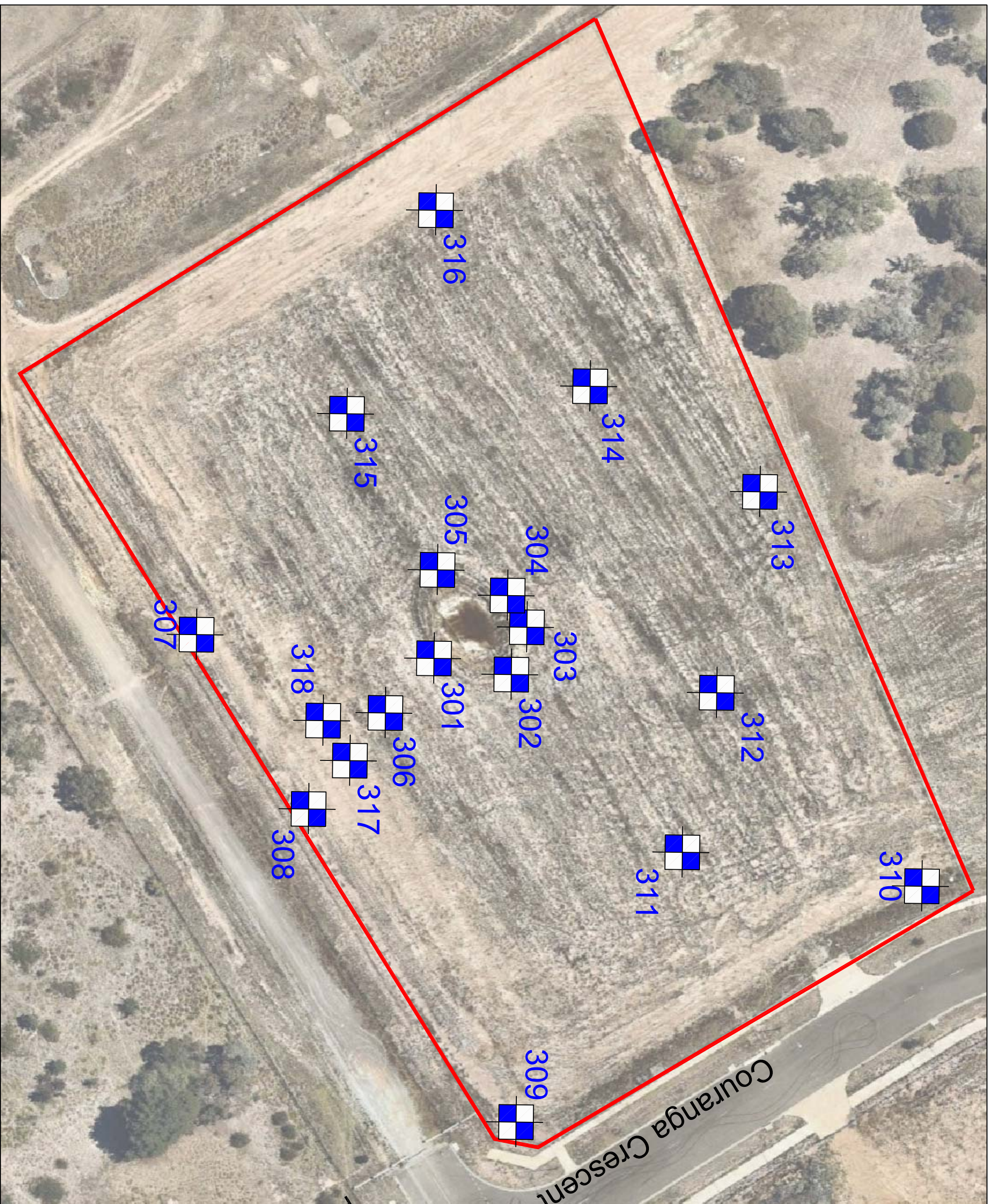


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Geotechnics | Environment | Groundwater

CLIENT: Flexible Australia	DRAWN BY: APH
OFFICE: Canberra	DATE: 30.04.2018
SCALE: As Shown	

TITLE: Test Location Plan Proposed Industrial Development Block 11 Section 21, Hume
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PROJECT No: 94028.00
DRAWING No: 1
REVISION: 0



Note: Base drawing taken from NeatMaps

Appendix C

Explanatory Notes
Results of Field Work (Pits 301 – 318)



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 ₅₀	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


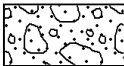
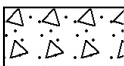

Other

fg	fragmented
bnd	band
qtz	quartz






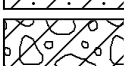


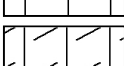
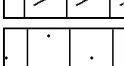

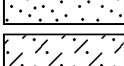
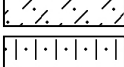
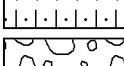
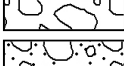
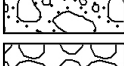

Symbols & Abbreviations

Graphic Symbols for Soil and Rock




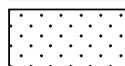
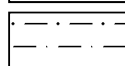
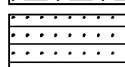
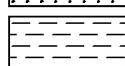

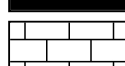
General

	Asphalt
	Road base
	Concrete
	Filling

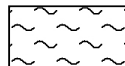
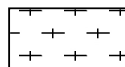
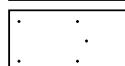
Soils

	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

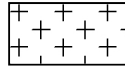

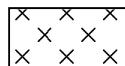
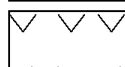

Sedimentary Rocks

	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 641 AHD
EASTING: 212607.65
NORTHING: 59005.12

PIT No: 301
PROJECT No: 94028.00
DATE: 27/4/2018
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		
641	0.2	TOPSOIL FILLING-dry to moist, light brown grey gravelly sandy silt with rootlets												
	0.7	FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity gravelly silty clay with cobbles and some sand		D	0.4									
	1.0	SILTY SAND-medium dense to dense, dry to moist, fine to medium grained silty sand		D	1.0									
	1.6	-from 1.5m, loose to medium dense, moist to wet SANDY CLAY-very stiff, moist to dry, brown grey, low plasticity, fine to medium grained sandy clay		D	1.7		pp = 200							
	2.0	-from 2.0m, hard, dry to moist												
638	3.0	Pit discontinued at 3.0m -limit of investigation												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: light seepage at 1.6m

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W _s	Water seep
E	Environmental sample	W _l	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 640.4 AHD
EASTING: 212611
NORTHING: 590071

PIT No: 302
PROJECT No: 94028.00
DATE: 27/4/2018
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	
640 639 638 637	0.12	TOPSOIL FILLING-dry to moist, light brown grey gravelly silty sand with rootlets FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity gravelly silty clay with cobbles											
	1.0	SILTY SAND-dense, dry to moist, light grey/light brown, fine to medium grained silty sand (cemented)		D	1.3								
	1.7	SANDY CLAY-hard, dry to moist, brown grey orange, medium plasticity sandy clay		D	1.8		pp >400						
	2.3	SILTY SAND-dense, dry to moist, light brown grey, fine to medium grained silty sand (cemented)		D	2.4								
	2.5	Pit discontinued at 2.5m -slow progress											
	3												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 640.3 AHD
EASTING: 212601
NORTHING: 590074

PIT No: 303
PROJECT No: 94028.00
DATE: 27/4/2018
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	0.15	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand with rootlets											
		FILLING-generally comprising well compacted, dry to moist, orange brown gravelly silty clay with cobbles											
	0.7	SILTY SAND-dense, dry to moist, light grey/light brown, fine to medium grained silty sand (cemented)											
639	1.1	SANDY SILTY CLAY-very stiff, moist to dry, light grey/light brown, medium plasticity silty sandy clay		D	1.3		pp = 200-220						
	1.5	SILTY SAND-medium dense, light brown grey, fine to medium grained silty sand											
	2	-from 2.0m, loose, moist to wet											
638		-from 2.3m, medium dense to dense, dry to moist		D	2.2								
	3.0	Pit discontinued at 3.0m -limit of investigation											
637													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: light seepage at 2.1m

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 640.3 AHD
EASTING: 212594
NORTHING: 590071

PIT No: 304
PROJECT No: 94028.00
DATE: 27/4/2018
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	0.2	TOPSOIL FILLING-dry to moist, light brown grey gravelly silty sand with rootlets											
		FILLING-generally comprising well compacted, brown orange grey, medium plasticity gravelly silty clay with some cobbles and sand											
	0.8	SILTY SAND-medium dense, moist to dry, light brown/light grey, fine to medium grained silty sand with some gravel		D	0.9								
639		-from 1.6m, moist											
	2	-from 2.0m, loose, moist to wet		D	2.1								
638		-from 2.5m, medium dense to dense, dry to moist											
	2.9	Pit discontinued at 2.4m -limit of investigation											
637	3												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: light seepage at 2.2m

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 640.8 AHD
EASTING: 212588
NORTHING: 590056

PIT No: 305
PROJECT No: 94028.00
DATE: 27/4/2018
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	
	0.15	TOPSOIL FILLING-dry to moist, light brown grey gravelly silty sand with rootlets											
		FILLING-generally comprising well compacted dry to moist, orange brown, medium plasticity gravelly silty clay with some sand		D	0.3								
640	0.8	SILTY SAND-medium dense to dense, dry to moist, light grey, fine to medium grained silty sand											
1		-from 1.2m, loose to medium dense, moist with some subangular rounded gravel		D	1.5								
639	2.3	SANDY CLAY-very stiff, moist to dry, orange brown grey, medium plasticity sand clay with some gravel		D	2.4		pp = 350						
2	2.7	SILTY SAND-medium dense to dense, dry to moist, light grey, fine to coarse grained silty sand											
638	3.0	Pit discontinued at 3.0m -limit of investigation											
637													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W _s	Water seep
EE	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 641.4 AHD
EASTING: 212619
NORTHING: 590044

PIT No: 306
PROJECT No: 94028.00
DATE: 27/4/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 40mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
641	0.1	TOPSOIL FILLING-dry to moist, light brown grey gravelly sandy silt with rootlets											
		FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity gravelly silty clay with some sand		D	0.3								
	0.6	SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		D	0.7								
640		-from 1.2m, dense, dry to moist, light brown orange (cemented)											
	1.7	Pit discontinued at 1.7m -slow progress/refusal		D	1.6								
639	2												
638	3												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 643.2 AHD
EASTING: 212603
NORTHING: 590003

PIT No: 307
PROJECT No: 94028.00
DATE: 27/4/2018
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		
643	0.1	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand with rootlets												
	0.3	FILLING-generally comprising well compacted, dry to moist, light brown/brown, medium plasticity gravelly sandy clay with some cobbles												
642		FILLING-very stiff to hard, dry to moist, orange brown, medium plasticity sandy silty clay with some gravel and cobbles		B	0.4									
					0.6									
	1	-from 0.7m, orange brown		D	1.0									
				D	1.5		pp = 350-400							
641	2	-from 2.0m, stiff, moist			2.1		pp = 100							
					2.5		pp = 150-200							
	2.8													
640	3.0	SILTY SAND - medium dense, moist to dry, light brown grey, fine to medium grained silty sand												
		Pit discontinued at 3.0m -limit of investigation												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 642.6 AHD
EASTING: 212637
NORTHING: 590030

PIT No: 308
PROJECT No: 94028.00
DATE: 27/4/2018
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	
	0.2	TOPSOIL FILLING-dry to moist, light brown grey sandy gravelly silt with rootlets											
642		FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity sandy silty clay with some gravel and cobbles		D	0.5								
1		-from 1.1m, very stiff, moist to dry		D	1.3		pp = 250						
641													
1.9		SILTY GRAVELLY SAND-dense, dry to moist, light grey/light brown, fine to medium grained silty gravelly sand (cemented)		D	2.2								
2													
2.4		Pit discontinued at 2.4m -refusal											
640													
3													
639													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 637.9 AHD
EASTING: 212645
NORTHING: 590166

PIT No: 310
PROJECT No: 94028.00
DATE: 27/4/2018
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	
	0.15	TOPSOIL FILLING-dry to moist, light brown grey sandy gravelly silt with rootlets											
		FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity sandy silty clay with some gravel and cobbles		D	0.4								
	0.7	SILTY SAND-medium dense to dense, dry to moist, light grey/light brown, fine to medium grained silty sand											
637	1												
		-from 1.4m, loose to medium dense, moist											
		-from 1.6m, loose, moist to wet											
		-from 1.8m, medium dense to dense		D	1.7								
636	2												
	2.0	Pit discontinued at 2.0m -slow progress											
635	3												
634													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: light seepage at 1.6m

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 639.4 AHD
EASTING: 212644
NORTHING: 590121

PIT No: 311
PROJECT No: 94028.00
DATE: 27/4/2018
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	0.2	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand											
		FILLING-generally comprising well compacted, dry to moist, orange brown, medium plasticity silty gravelly clay with some cobbles		D	0.4								
638	1.2	SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		D	1.3								
		-from 2.0m, brown/light brown orange		D	2.6								
636	2.9	Pit discontinued at 2.9m -limit of investigation											

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 639.1 AHD
EASTING: 212613
NORTHING: 590122

PIT No: 312
PROJECT No: 94028.00
DATE: 27/4/2018
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	0.1	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand												
		FILLING-generally comprising well compacted, dry to moist, orange brown, silty gravelly clay with some cobbles		B	0.3									
					0.5									
638	1.2	GRAVELLY SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained gravelly silty sand with some traces of clay		D	1.4									
		-from 2.0m moist to dry, light orange brown												
637	2													
636	3.0	Pit discontinued at 3.0m -limit of investigation												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 638.5 AHD
EASTING: 212572
NORTHING: 590124

PIT No: 313
PROJECT No: 94028.00
DATE: 27/4/2018
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	
638	0.2	TOPSOIL FILLING-dry to moist, light brown grey gravelly sandy silt with rootlets											
		FILLING-generally comprising well compacted, dry to moist, brown orange, medium plasticity silty gravelly clay with some cobbles											
	0.8	SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		D	1.0								
637		-from 1.2m, light orange brown, cemented		D	1.5								
	1.6	Pit discontinued at 1.6m -refusal											
636	2												
	3												
635													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2




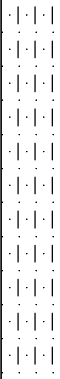


SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial 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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 639.3 AHD
EASTING: 212549
NORTHING: 590088

PIT No: 314
PROJECT No: 94028.00
DATE: 27/4/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
639	0.2	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand											
	0.5	FILLING-generally comprising well compacted, dry to moist, orange brown, gravelly silty clay with some sand and cobbles		D	0.3								
	0.5	GRAVELLY SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		D	0.7								
638	1	-from 1.0m, moist to dry, light brown											
	2	-from 2.0m, dense, dry to moist (cemented)											
637	2.2	Pit discontinued at 2.2m -refusal											
636	3												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 641.1 AHD
EASTING: 212588
NORTHING: 590034

PIT No: 315
PROJECT No: 94028.00
DATE: 27/4/2018
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	
641	0.2	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand											
		FILLING-generally comprising dry to moist, orange brown, silty gravelly clay with some cobbles		D	0.56								
	0.7	SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		D	0.8								
640	1	-from 1.1m, dense, dry to moist, cemented											
	1.3	Pit discontinued at 1.3m -refusal											
	2												
639													
	3												
638													

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 639.8 AHD
EASTING: 212511
NORTHING: 590055

PIT No: 316
PROJECT No: 94028.00
DATE: 27/4/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 60mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.1	TOPSOIL FILLING-dry to moist, light brown grey silty gravelly sand												
	0.4	FILLING-generally comprising dry to moist, orange brown, medium plasticity gravelly silty clay with some cobbles												
	0.4	SILTY SAND-medium dense, dry to moist, light grey, fine to medium grained silty sand		B	0.4									
	0.6				0.6									
639	1													
638	2	-from 1.8m, dense, dry to moist, light brown/light grey, cemented		D	2.0									
	2.4	Pit discontinued at 2.4m -refusal												
637	3													
636														

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
EE	Environmental sample	≡	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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 641.8 AHD
EASTING: 212626
NORTHING: 590035

PIT No: 317
PROJECT No: 94028.00
DATE: 27/4/2018
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		
	0.2	TOPSOIL FILLING-dry to moist, light brown grey gravelly sandy silt												
	0.6	FILLING-generally comprising dry to moist, orange brown, medium plasticity gravelly silty clay with some cobbles												
641	1.0	SILTY SAND-medium dense, moist to dry, light grey, fine to medium grained silty sand												
	1.6	-from 1.2m, dense, dry to moist, light brown/light grey, lightly cemented with some gravels												
640	2.0	Pit discontinued at 1.6m -slow progress												
639	3.0													
638														

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2



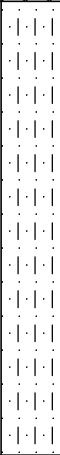
SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial 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: Flexible Australia
PROJECT: Proposed Industrial Development
LOCATION: Block 11 Section 21, Hume

SURFACE LEVEL: 641.9 AHD
EASTING: 212621
NORTHING: 590031

PIT No: 318
PROJECT No: 94028.00
DATE: 27/4/2018
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	
641	0.15	TOPSOIL FILLING-dry to moist, light brown grey gravelly sandy silt											
		FILLING-generally comprising dry to moist, orange brown, medium plasticity gravelly silty clay with some cobbles											
	0.6	SILTY SAND-medium dense, moist to dry, light grey, fine to medium grained silty sand											
		-from 1.5m, dense, dry to moist, light brown/light grey, lightly cemented with some gravels											
640	1.8	Pit discontinued at 1.8m -slow progress											
639	2												
638	3												

RIG: Kobelco SK45SRX 5 tonne excavator, 450mm bucket

LOGGED: APH

SURVEY DATUM: MGA94

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 _s	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	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)

Appendix D

Results of Laboratory Testing (5 pages)

Material Test Report

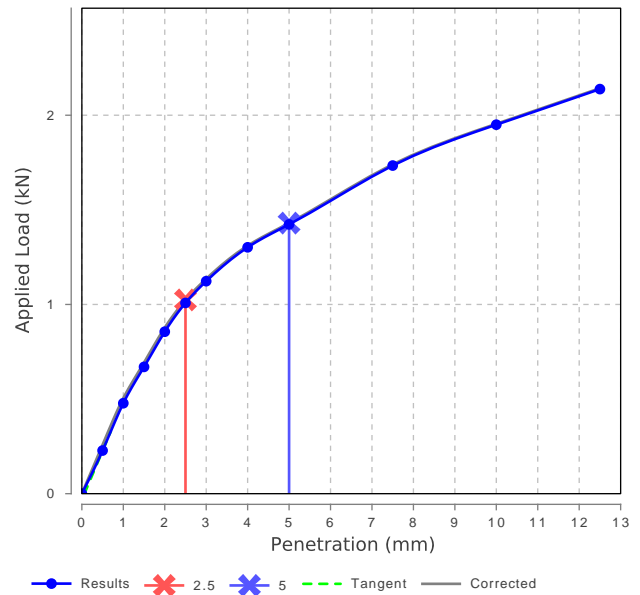


Approved Signatory: Tom Gordon
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: 94028.00-1
Issue Number: 1
Date Issued: 14/05/2018
Client: Flexible Australia
P.O. Box 575, Fyshwick ACT 2609
Contact: Bob Thompson
Project Number: 94028.00
Project Name: Proposed Industrial Development
Project Location: Block 11 Section 21, Hume
Work Request: 1106
Sample Number: 18-1106A
Date Sampled: 27/04/2018
Sampling Method: Sampled by Engineering Department
Sample Location: Pit 312 (0.3 - 0.5m)
Material: Filling - Silty Gravelly Clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	8		
Method of Compactive Effort	Modified		
Method used to Determine MDD	AS 1289 5.2.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.95		
Optimum Moisture Content (%)	12.5		
Laboratory Density Ratio (%)	94.5		
Laboratory Moisture Ratio (%)	101.0		
Dry Density after Soaking (t/m ³)	1.84		
Field Moisture Content (%)	9.3		
Moisture Content at Placement (%)	12.4		
Moisture Content Top 30mm (%)	17.2		
Moisture Content Rest of Sample (%)	15.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48.0		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.5		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		9.3	

California Bearing Ratio



Material Test Report

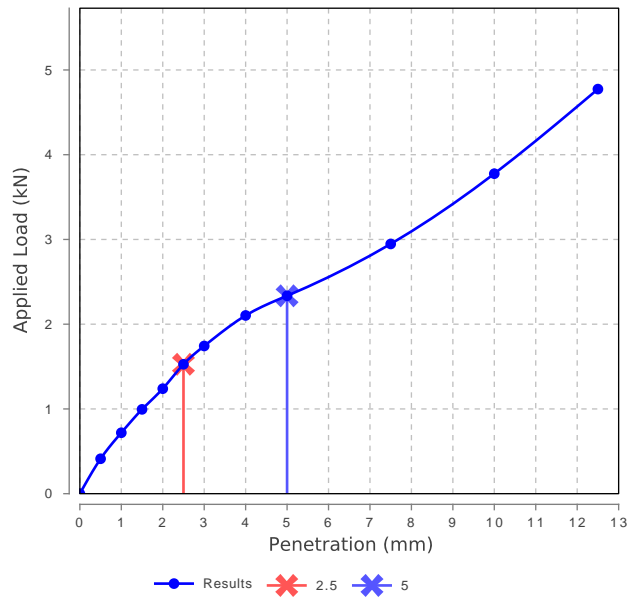


Approved Signatory: Tom Gordon
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: 94028.00-1
Issue Number: 1
Date Issued: 14/05/2018
Client: Flexible Australia
P.O. Box 575, Fyshwick ACT 2609
Contact: Bob Thompson
Project Number: 94028.00
Project Name: Proposed Industrial Development
Project Location: Block 11 Section 21, Hume
Work Request: 1106
Sample Number: 18-1106B
Date Sampled: 27/04/2018
Sampling Method: Sampled by Engineering Department
Sample Location: Pit 316 (0.4 - 0.6m)
Material: Silty Sand

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	12		
Method of Compactive Effort	Modified		
Method used to Determine MDD	AS 1289 5.2.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.92		
Optimum Moisture Content (%)	7.5		
Laboratory Density Ratio (%)	95.0		
Laboratory Moisture Ratio (%)	101.5		
Dry Density after Soaking (t/m ³)	1.78		
Field Moisture Content (%)	3.5		
Moisture Content at Placement (%)	7.7		
Moisture Content Top 30mm (%)	12.9		
Moisture Content Rest of Sample (%)	11.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48.0		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	3.7		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		3.5	

California Bearing Ratio



Material Test Report



Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd

Goulburn Laboratory

1 Farquhar Street Goulburn NSW 2580

Phone: 02 4822 8395

Email: tom.gordon@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Tom Gordon
Laboratory Manager

NATA Accredited Laboratory Number: 828

Report Number: 94028.00-1
Issue Number: 1
Date Issued: 14/05/2018
Client: Flexible Australia
 P.O. Box 575, Fyshwick ACT 2609
Contact: Bob Thompson
Project Number: 94028.00
Project Name: Proposed Industrial Development
Project Location: Block 11 Section 21, Hume
Work Request: 1106
Sample Number: 18-1106C
Date Sampled: 27/04/2018
Sampling Method: Sampled by Engineering Department
Sample Location: Pit 302 (1.8m)
Material: Sandy Clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	37		
Plastic Limit (%)	14		
Plasticity Index (%)	23		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	10.0		
Cracking Crumbling Curling	Curling		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		12.9	

Material Test Report



Geotechnics | Environment | Groundwater

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Approved Signatory: Tom Gordon
Laboratory Manager

NATA Accredited Laboratory Number: 828

Report Number: 94028.00-1
Issue Number: 1
Date Issued: 14/05/2018
Client: Flexible Australia
P.O. Box 575, Fyshwick ACT 2609
Contact: Bob Thompson
Project Number: 94028.00
Project Name: Proposed Industrial Development
Project Location: Block 11 Section 21, Hume
Work Request: 1106
Sample Number: 18-1106D
Date Sampled: 27/04/2018
Sampling Method: Sampled by Engineering Department
Sample Location: Pit 311 (1.3m)
Material: Silty Sand

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	Not Obtainable		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	Non Plastic		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)			
Cracking Crumbling Curling	None		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		5.1	

Material Test Report



Geotechnics | Environment | Groundwater

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1 Farquhar Street Goulburn NSW 2580

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Accredited for compliance with ISO/IEC 17025 - Testing



A blue ink signature of Tom Gordon.

Approved Signatory: Tom Gordon

Laboratory Manager

NATA Accredited Laboratory Number: 828

Report Number: 94028.00-1
Issue Number: 1
Date Issued: 14/05/2018
Client: Flexible Australia
P.O. Box 575, Fyshwick ACT 2609
Contact: Bob Thompson
Project Number: 94028.00
Project Name: Proposed Industrial Development
Project Location: Block 11 Section 21, Hume
Work Request: 1106
Date Sampled: 27/04/2018
Sampling Method: Sampled by Engineering Department

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content	Material
18-1106A	Pit 312 (0.3 - 0.5m)	9.3 %	Filling - Silty Gravelly Clay
18-1106B	Pit 316 (0.4 - 0.6m)	3.5 %	Silty Sand
18-1106C	Pit 302 (1.8m)	12.9 %	Sandy Clay
18-1106D	Pit 311 (1.3m)	5.1 %	Silty Sand