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Geotechnics / Environment / Groundwater

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Report on
Preliminary Geotechnical Investigation and Preliminary Salinity Assessment

Proposed Commercial/Industrial Subdivision
144 - 228 Aldington Road, Kemps Creek

Prepared for
Stockland Commercial Property Pty Ltd

Project 92364.01
September 2019

Douglas Partners
Geotechnics / Environment / Groundwater

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

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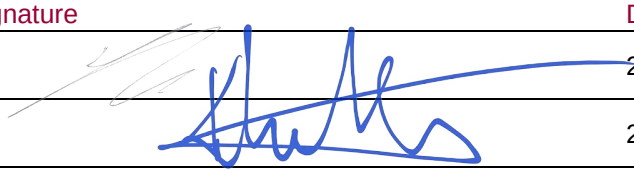
Author		25 September 2019
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Report on Preliminary Geotechnical Investigation and Preliminary Salinity Assessment

Proposed Commercial/Industrial Subdivision

144 - 228 Aldington Road, Kemps Creek

1. Introduction

This report presents the results of a preliminary geotechnical investigation and preliminary salinity assessment undertaken for a proposed commercial/industrial subdivision at 144 - 228 Aldington Road, Kemps Creek. The investigation was commissioned by Mr Marcus Donnelly of Stockland Commercial Property Pty Ltd and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal MAC190214 dated 23 July 2019.

It is understood that the purchase of the site for a commercial/industrial subdivision is proposed and investigation was undertaken to provide information on subsurface conditions for due diligence purposes and conceptual design.

The investigation comprised a site walkover inspection, test pit excavation, borehole drilling and in-situ testing followed by laboratory testing of selected samples. Details of the field and laboratory work are given in the report, together with comments relating to design and construction practice.

The work was undertaken concurrently with a 'due-diligence' contamination assessment which is reported separately (Project 92364.00.R.001.Rev0).

2. Site Description and Regional Geology

The site, which includes Lots 20 - 23 in DP 25560 and Lots 30 and 31 in DP 258949, is an approximate trapezoidal shape with maximum plan dimensions of some 970 m and 710 m and an area of about 61 ha. It is bounded to the west by Aldington Road and on the remaining sides by rural properties similar to the subject site. Surface levels generally fall from a low ridge which runs diagonally across the site in a north west to south east direction towards Aldington Road and the north eastern corner at grades of approximately 1 in 30 to 1 in 65. The overall difference in level is estimated to be approximately 27 m from the highest parts of the site near the north west and south east corners at about RL 86 m relative to the Australian Height Datum (AHD) to the lowest near the south west corner at RL 59 m AHD.

At the time of the investigation, six residences were located on site, which were either fronting Aldington Road or located towards the middle or back of each lot (ie: near the eastern boundary of the site). Several greenhouses (mostly concentrated in the middle part of the site) and detached rural structures and farm dams were also present. The remainder of the site comprised rural land being used for grazing and agistment. Various features observed during the assessment are shown on the colour photoplates in Appendix A.

Reference to the 1:100 000 Penrith Geological Series Sheet indicates that the site is underlain by Bringelly Shale (Rwb) of the Wianamatta Group of Triassic age (refer Figure 1, following page). The Bringelly Shale typically comprises shale, siltstone, claystone and laminite with coal bands, all of which weather to form clays of medium to high plasticity. The mapping indicates the in the north eastern corner of the site the residual soils are overlain by Quaternary alluvium (Qa).

The results of the investigation were generally consistent with the geological mapping with shale encountered in seven of the 21 test locations.

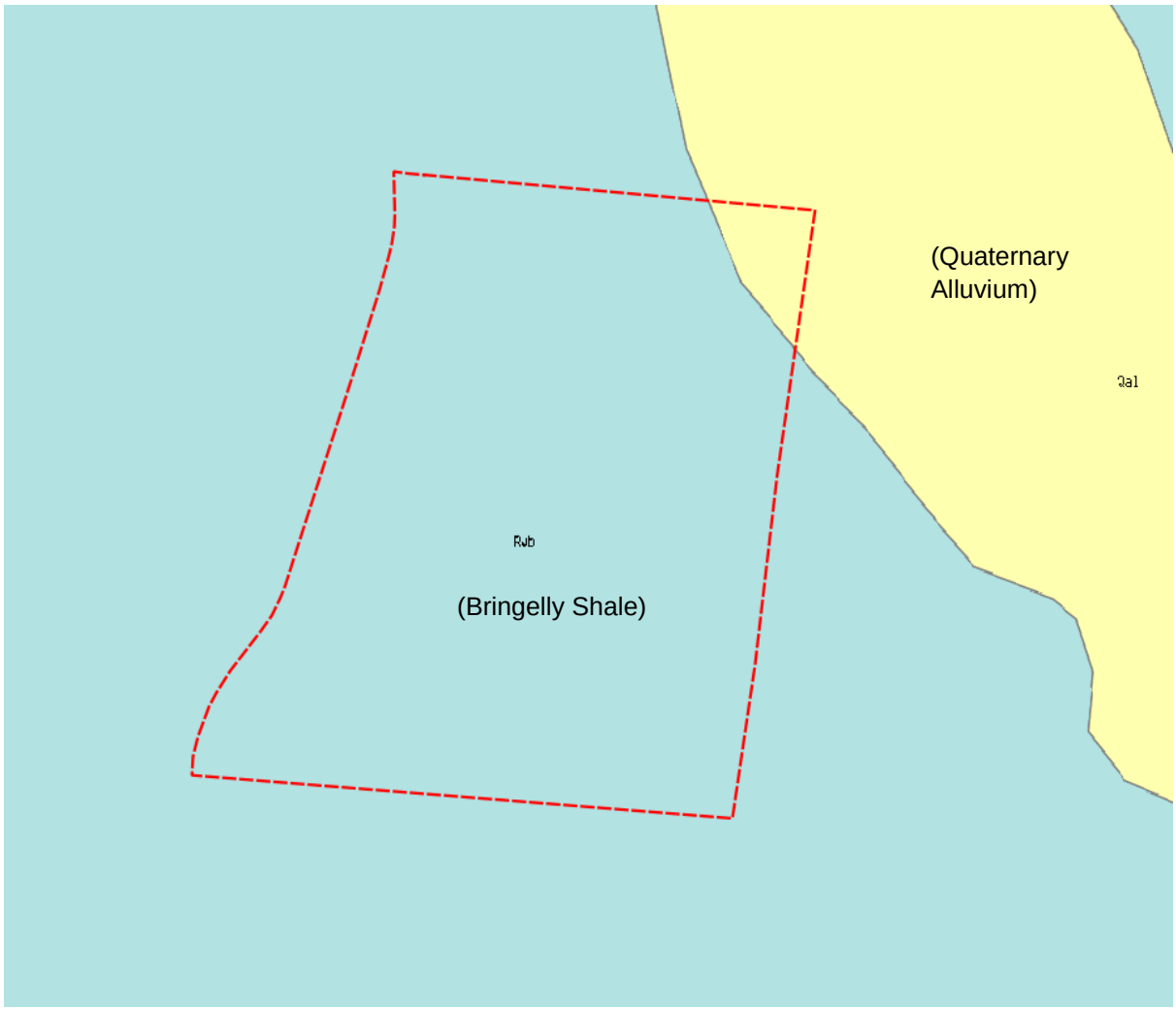

Figure 1: Geology Mapping

Reference to the Map of Salinity Potential in Western Sydney (refer Figure 2, following page) infers known salinity and high salinity potential around the primary creek line /dam in the north east corner of the site and moderate salinity potential for the remainder of the site. It is noted that the mapping is based on soil type, surface level and general groundwater considerations and, as such is approximate only.

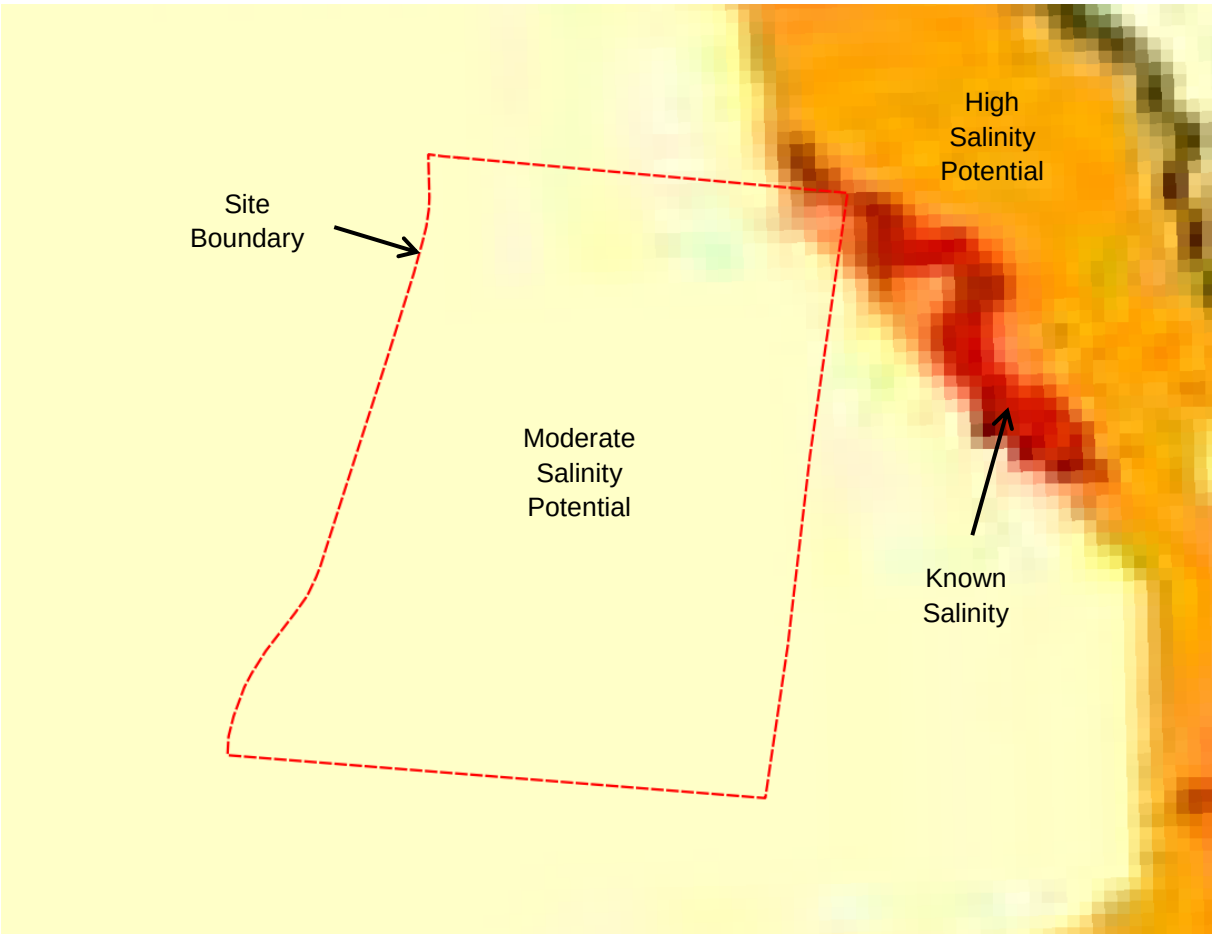

Figure 2: Salinity Mapping

3. Field Work

3.1 Methods

The field work comprised:

- a site walkover inspection by an engineering geologist;
- the excavation of 19 test pits (Pits 1 – 6, 8 – 18 and 26). Pits preliminarily numbered 20 to 25 were not excavated;
- the drilling of two boreholes (Bores 7 and 19).

The test pits were excavated to depths of up to 3 m using a John Deere 315SE backhoe fitted with a 400 mm wide bucket. Dynamic cone penetrometer (DCP) tests were undertaken to depths of up to 1.2 m adjacent to the test pit locations to assess the penetration resistance of the near-surface soils. The test pits were logged on site by a geotechnical engineer who collected disturbed and 'undisturbed' (in 50 mm diameter thin-walled steel tubes) to assist in strata identification and for laboratory testing. Following logging, testing and sampling, all test pits were backfilled and the ground surface reinstated to its previous level.

The boreholes were drilled with a truck mounted drilling rig to depths of 8.7 m and 8.4 m. The boreholes were advanced through the overburden soils with 150 mm solid flight augers to refusal of the TC-bit at depths of 3.3 m and 2.4 m and were continued into the rock using NMLC (50 mm diameter) diamond coring equipment to the termination depths. Standard penetration tests (SPT) were carried out at regular depth intervals to assist in strata identification and for possible laboratory testing. Details of the SPT procedure are given on the accompanying notes in Appendix A, with the penetration 'N' values shown on the borehole logs.

The test pit and borehole locations were nominated by DP and located on site prior to the investigation. The approximate test pit and borehole locations are shown on Drawing 1 in Appendix A. The surface levels to Australian Height Datum (AHD) and coordinates to Map Grid of Australia (MGA) were obtained using a differential GPS unit for which an accuracy of ± 20 mm is typical.

3.2 Results

3.2.1 Site Inspection

Specific geotechnical observations at various Map Reference Points (MRP) within the site are included in Appendix A, the locations of which are shown on Drawing 2 and summarised below:

- The site was occupied by a number of detached dwellings, outbuildings, and sheds. Significant portions of the site were actively farmed using greenhouses and windrowed plots. Uncontrolled filling had been placed to depths of up to 1.5 m to create roughly level allotments for the greenhouses. Both the greenhouse and outdoor plots had additional topsoil placed over them. (Photos 3 and 7).
- Eight farm dams ranging in surface area from approximately 550 m^2 to 5400 m^2 were present on the site (Photos 4, 5, 8 and 9). The dam embankments typically ranged in height from 0.5 m up to 3 m with batter slopes in the range 1V:2H to 1V:3H. The southern most and largest dam on site had embankments up to 4.5 m with batter slopes of 40° (approximately 0.8V:1H).
- A larger farm dam (approximately 2 ha) was located outside the site along the northeast corner boundary of the site (MRP 2 and Photo 8).
- The site generally comprised low hills with gentle slopes typically up to 8°. Local slopes dipping to the northwest at angles up to 12° were encountered in the southeast corner of site (MRP 17 and Photo 10).
- Two relatively small portions of the site were observed to be affected by water logging (MRPs 6 and 12 and Photo 9). The water logging and heavy vegetation at MRP 12 appeared be due to a low lying area while the isolated water logging at MRP 6 appeared to be due to runoff from the above greenhouse irrigation.
- Fill mounds and stockpiles comprising clay, gravel and cobbles were scattered across the site. Fill in places had been levelled and in others was heaped (MRP 10 and Photos 3 and 11).
- No signs of salt efflorescence or scalding were noted during the field investigation.

3.2.2 Test Pits and Boreholes

The test pit and borehole logs are included in Appendix B and should be read in conjunction with the accompanying standard notes that define classification methods and descriptive terms.

Relatively uniform conditions were encountered underlying the site with the general succession of strata broadly summarised as follows:

TOPSOIL FILL: silty clay and clayey silt topsoil fill to depths of 0.1 – 0.3 m in Pits 1 – 6, 8 – 15, 17, 18 and 26 and Bore 7;

FILL: silty clay with some anthropogenics to depths of 0.3 – 1.4 m in Pits 8 – 10, 16 – 19, and 26 and Bore 19;

RESIDUAL SOIL: variably stiff to hard clay and silty clay to depths of 0.6 – 3.3 m in Pits 1, 3 – 7, 9, 11 – 15, 19 and 26 and Bores 7 and 9, and to the termination depths in Pits 2, 8, 10, 16 – 18; and

BEDROCK: very low strength sandstone or shale at first contact at depths of 0.6 – 2.6 m and continuing to the termination depths of 3 m in Pits 1, 4, 5, 11, 13 and 14. Pits 3, 6 and 12 were terminated at bucket refusal on low strength shale at depths of 2.5 m, 2.1 m and 2.6 m respectively. The recovered core from Bore 7 comprised variably very low to low strength siltstone to 5.3 m followed by a band of low strength sandstone to 6.0 m and then low strength siltstone, which becomes medium strength below 8.3 m, to the termination depth of 8.7 m. In Bore 19, low strength siltstone was intersected at 2.4 m and then variably very low to medium strength sandstone from 5.1 m and continuing to the termination depth of 8.4 m.

No free groundwater was observed in the pits for the short time that they were left open. No groundwater was intersected in Bores 7 and 19 whilst auger drilling. The use of water as a drilling fluid precluded groundwater observations whilst core drilling. It is also noted that the pits and boreholes were immediately backfilled following excavation which precluded longer term monitoring of groundwater levels. Groundwater levels are affected by factors such as soil permeability and weather conditions, and can therefore vary with time.

4. Laboratory Testing

Selected samples were tested in the laboratory for measurement of field moisture content, Shrink-swell index, Atterberg limits and linear shrinkage. The detailed results are given in the report sheets in Appendix B, with the results summarised in Table 1 (following page).

Table 1: Results of Atterberg Limits and Shrink-swell Testing

Location	Depth (m)	Material	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Shrink-Swell Index, Iss (%)
2	0.5	Silty Clay	21.1	48	16	32	15.0	-
3	0.5	Silty Clay	14.6	-	-	-	-	1.8
9	1.25	Silty Clay	14.0	-	-	-	-	1.6
11	0.85	Silty Clay	20.9	-	-	-	-	1.3
15	0.5	Silty Clay	19.1	49	20	29	14.5	-

The results of the plasticity testing indicate the samples tested are of medium plasticity and will be susceptible to changes in volume with variations in soil moisture content.

California bearing ratio (CBR) testing was carried out on four clay samples following compaction to approximately 100% dry density ratio relative to Standard maximum dry density at near standard optimum moisture content. The samples were soaked for four days under a surcharge loading of 4.5 kg. The detailed results are given in the report sheets and are summarised in Table 2.

Table 2: Results of CBR Testing

Location	Depth (m)	Material	Field Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m^3)	Swell (%)	CBR (%)
4	1.5	Silty Clay	27.2	23.5	1.58	2.5	2.0
6	0.5	Silty Clay	17.5	21.0	1.64	3.0	3.0
11	0.5	Silty Clay	24.5	23.5	1.58	1.5	4.5
14	1.0	Silty Clay	28.3	26.5	1.55	2.0	3.0

The results of the compaction and CBR tests indicate that the soil moisture content is variable and ranges from 3.7% wet to 3.5 dry of the optimum moisture content for Standard Maximum dry density.

The detailed laboratory test report sheets and a summary table presenting the results of laboratory tests, calculated salinity ECe and salinity classification inferred from ECe values using the method of Richards are given in Appendix B.

The summary table presents aggressivities and salinities for each pit location, based on minimum pH, minimum electrical resistivity and maximum ECe values within the investigated depth zone.

Table 3: Results of Laboratory Testing - Chemical

Parameter		Units	Number of Tests	Range of Results
pH		pH units	50	4.7 – 9.2
Chlorides		(mg/kg)	12	>10 – 2400
Sulphates		(mg/kg)	12	>10 – 370
Aggressivity [AS 2159, Ref 7]	to Concrete	-	50	non-aggressive – mildly aggressive
	to Steel	-	50	non-aggressive – moderately aggressive
Exchangeable Sodium (Na)		(meq/100g)	5	>1
CEC (cation exchange capacity)		(meq/100g)	5	3 – 14
Sodicity [Na/CEC]		(ESP%)	5	-
Sodicity Class		[after DLWC]	5	-
Emerson Class		-	2	2 and 3
EC1:5 [Lab.]		(µS/cm)	50	57 – 1500
Resistivity		Ω.cm	50	-
ECe [M x EC1:5] [1]		(dS/m)	50	0.3 – 9
Salinity Class [after Richards, Ref 10]		-	50	Non-Saline – Very Saline

Notes: 1 M is soil textural factor

Test results showing the aggressivity assessed by pH, resistivity, sulphate concentrations, and chloride concentration criteria (of AS 2159) at the test pit locations, together with the aggressivity class ranges are given in Appendix B. The absence of free groundwater in the test pits or the inferred very low permeability of the sampled clay-rich soils indicate that soils at all test pits are in Condition “B” as defined by AS 2159.

The results indicate that of the 50 samples tested for aggressivity:

- 14 samples were mildly aggressive to concrete and 30 were non aggressive to concrete; and
- One sample was moderately aggressive to steel, 11 were mildly aggressive to steel and 38 were non-aggressive to steel.

Test results showing the salinity classifications based on the electrical conductivity (ECe) and the methods of Richards are given in Appendix B.

The results indicate that of the 50 samples tested for salinity:

- 14 samples were non-saline;
- 25 samples were slightly saline;

- 10 samples were moderately saline; and
- 1 sample was very saline.

Emerson Class test results of 2 and 3 indicate that the soil samples tested were prone to dispersion when exposed to free water.

5. Proposed Development

It is understood that the purchase the site for commercial and light industrial development purposes is being considered. Whilst preliminary concept plans were not available at the time of the investigation, it is likely that the development will include warehouse structures and hardstand areas constructed on near-level building platforms. Construction of the platforms may require cut to fill earthworks in the order of 5 – 10 m in depth and the filling of farm dams.

Although concept design is yet to be undertaken, similar developments have required geotechnical advice regarding earthworks, foundations, retaining walls and pavements.

6. Comments

6.1 Subsurface Conditions

Based on the results of the investigation, the inferred subsurface geotechnical model underlying the site comprises:

- Topsoil/topsoil filling to depths of 0.1 – 0.3 m;
- Fill to depths of up to 1.4 m over parts of the site, but deeper in localised areas such as dam walls;
- Residual clay, typically of stiff to hard consistency, to depths in the range 0.6 – 3.3 m;
- Shale bedrock initially very low strength becoming low to medium strength below a depth of 3.3 m in Bore 7 and 5.2 m in Bore 19.

No free groundwater was observed in any of the test pits during excavation or boreholes during augering.

6.2 Site Classification

The size, type and extent of the likely commercial/industrial development suggests that AS 2870:2011 Residential Slabs and Footings is not appropriate for the design of footings for this site. Notwithstanding this, the presence of uncontrolled filling to depths greater than 0.4 m will result in classification of the lots as Class P when assessed in accordance with the Standard. It may be feasible to reclassify the lots if all the uncontrolled fill is removed and replaced as controlled fill. Such re-working may result in M (moderate) to H2 (highly reactive).

6.3 Site Preparation and Earthworks

To prepare the site for the proposed commercial/industrial lots and pavements it should be feasible to carry out conventional earthworks in accordance with the requirements of AS 3798:2007 Guidelines on Earthworks for Commercial and Residential Developments. Earthworks quality control inspections and testing should be carried out to a Level 1 standard where fill is required to support structural loads. It may be feasible to carry out Level 2 sampling and testing for fill beneath pavements, hardstands and other non-structural applications.

All fill material imported to site would require approval from geotechnical and environmental consultants.

If the site soils are reused, some moisture conditioning (wetting or drying) may be required for the earthworks and pavement subgrade construction.

6.4 Excavations

Soil and weathered rock up to low strength should be readily removed for bulk excavation using conventional earthmoving equipment. Where encountered, low strength to medium strength rock, or higher strength, will require heavy ripping plant, rock hammers, saws or road headers.

Detailed excavations in rock for footings, services etc, will probably require saw cutting to control overbreak.

Excavations in soil and weathered rock should include provision for temporary support using batters, benching or shoring.

6.5 Desilting of Ponds

The existing farm dams will need to be drained and filled to design level. It should be feasible to drain the ponds, reuse the existing filling in the dam walls (subject to environmental protocols and selective removal of deleterious portions) and recondition any saturated soil from the base of the dams for reuse either for landscaping or structural fill.

Any discharge or disposal of the pond water should be in accordance with Penrith City Council requirements.

6.6 Footings

The results of the investigation suggest that the site is suitable for the design of conventional pad or strip footings or deeper piled footings. Further investigation would be required to determine appropriate design parameters, however for relatively lightly loaded structures, say with column loads up to about 400 kN, it should be feasible for footings to be proportioned based on an allowable base bearing pressure in uniform stiff clay (or higher strength clay) and controlled filling of 150 kPa.

For settlement sensitive structures or where higher load capacity is required, footings could found in the underlying very low strength shale with allowable base bearing pressure of 500 kPa.

6.7 Batter Slopes and Retaining Walls

Temporary slopes up to about 4 m in height through clay, controlled fill and weathered rock should be feasible at batter of 1(H):1(V). Permanent batters up to 4 m in height slopes no steeper than 2(H):1(V) would be required to achieve an appropriate factor of safety. Erosion protection would be required for all exposed slopes and any permanent batters which require maintenance may need to be flattened to 4(H):1(V)

6.8 Pavement Subgrade

Based on the results of laboratory testing and previous experience in the area, it is expected that most of the clay subgrades will generally comprise clays with CBR values in the range of 2 – 4.5%. A CBR value of 7% could be adopted for preliminary design of pavements on rock subgrades.

All pavement subgrades should be investigated prior to detailed design and verified during earthworks construction.

Where the pavement subgrade has a CBR of less than 3% then improvement can be made by either excavating and replacement or by lime stabilisation of the in-situ materials.

6.9 Seismic Site Factor

The site stratigraphy comprises minor filling and topsoil underlain by stiff to hard clay with a variable depth to rock, in some areas greater than 3 m within the footprint of the proposed structure. Therefore, the site sub-soil class when assessed in accordance with AS 1170.4:2007 is Class C (shallow soil site). It is noted that the sub-soil class can be affected by site works and should be verified during the detailed design process and it may be that some of the development site become Class B_e (rock site).

6.10 Site Maintenance and Drainage

Surface drainage should be installed and maintained at the site. All collected stormwater, groundwater and roof runoff from lots should be discharged into the stormwater disposal system. Similarly, effluent flows should be directed to the sewerage system.

7. Summary

A preliminary geotechnical investigation has been undertaken for 'due-diligence' purposes as part of the client's consideration prior to purchase of the property. The investigation comprised a site inspection, excavation of test pits and the drilling of boreholes followed by laboratory testing of selected samples, engineering analysis and reporting.

The principal geotechnical items that need to be considered are as follows:

- The site is underlain by predominantly shale that typically increases in strength with depth;
- Excavation within the shale of low to medium strength (or higher strength), will need for heaving ripping, hammering and sawing;
- The presence (in parts) of uncontrolled filling, some area of initially wet near-surface soils and farm dams;
- Existing structures and services that will require demolition and removal prior to site re-development.
- Further (project-specific) investigations will be required if the purchase of the property proceeds and conceptual planning and design progresses further to detail design.

Based on the results of the investigation, the site is considered geotechnically suitable for a commercial or industrial development, with comments given in the report with respect to site preparation measures, likely reactivity site classifications, retaining wall design parameters and footing design parameters

8. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 144-228 Aldington Road, Kemps Creek in accordance with DP's proposal MAC190214 dated 23 July 2019 and acceptance received from Mr Marcus Donnelly of Stockland Commercial Property Pty Ltd dated 24 July 2019. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Stockland Commercial Property Pty Ltd for this project only and for the purposes as described in the report. It should not be used for other projects or purposes 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 subsurface 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. Subsurface 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 time or budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attachments 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 subsurface 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
Results of Field Work
Drawings 1 and 2
Photoplates

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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

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.

Symbols & Abbreviations

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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

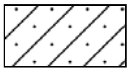
Soils


Topsoil

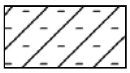

Peat


Clay

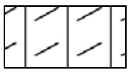

Silty clay

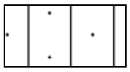

Sandy clay

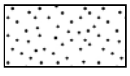

Gravelly clay

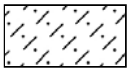

Shaly clay

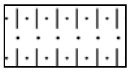

Silt


Clayey silt


Sandy silt

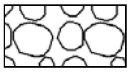

Sand

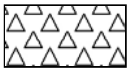

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

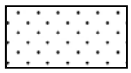

Talus

Sedimentary Rocks

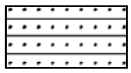

Boulder conglomerate

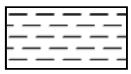

Conglomerate


Conglomeratic sandstone

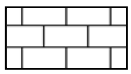

Sandstone


Siltstone


Laminite

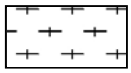

Mudstone, claystone, shale

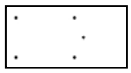

Coal


Limestone

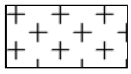
Metamorphic Rocks

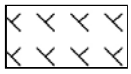

Slate, phyllite, schist

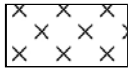

Gneiss

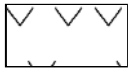

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Soil Descriptions

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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, 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 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx 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 $Is_{(50)}$

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 loner 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:

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

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

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 79.7 mAHD
EASTING: 296452
NORTHING: 6253052

PIT No: 1
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
79.7	0.2	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, pale brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CI: medium plasticity, red-brown, w~PL, stiff		D	0.5				
79	1	- becoming grey with extremely weathered shale bands below 0.7m		D	1.0				
		- with iron indurated bands below 1.3m		D	1.5				
78	1.9								
	2	SANDSTONE: fine grained, grey and brown, very low strength, highly weathered		D	2.0				
				D	2.5				
77	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
76	4								
75	5								
74	6								
73	7								
72	8								
71	9								
70									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 66.3 mAHD
EASTING: 296761
NORTHING: 6253027

PIT No: 2
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.2	FILL/TOPSOIL: Clayey SILT MH: high plasticity, pale brown, trace rootlets, w<PL		E	0.1				
		Silty CLAY CH: medium plasticity, brown and red, trace ironstone gravel, w<PL, stiff		D	0.5				
	1			D	1.0				
65		- becoming brown, w~PL below 1.3m		D	1.5		pp = 300		
	2			D	2.0		pp = 250-300		
64		- with a grey band of extremely weathered shale below 2.4m		D	2.5				
	3	3.0		D	3.0				
63		Pit discontinued at 3.0m - limit of investigation							
	4								
62									
	5								
61									
	6								
60									
	7								
59									
	8								
58									
	9								
57									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 75.3 mAHD
EASTING: 296450
NORTHING: 6252861

PIT No: 3
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
75	0.3	FILL/TOPSOIL: Clayey SILT MH, high plasticity, red and brown, trace ironstone gravel, w<PL, stiff		D	0.1				
		Silty CLAY CH: medium to high plasticity, red and brown, trace ironstone gravel, w<PL, stiff		D	0.5				
				U_{50}	0.85				
		- becoming red below 0.8m		D	1.0				
74		- band of extremely weathered shale below 1.1m							
		- becoming brown, with sand below 1.4m		D	1.5				
	1.9	SANDSTONE: white, very low strength, highly weathered		D	2.0				
73	2.5	Pit discontinued at 2.5m - refusal on low strength sandstone		D	2.5				
72									
71									
70									
69									
68									
67									
66									

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 70.8 mAHD
EASTING: 296566
NORTHING: 6252795

PIT No: 4
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
70	0.2	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CI: medium plasticity, brown, with ironstone gravel, w~>PL, stiff		D	0.5				
69	1	- becoming brown and mottled grey, with iron indurated bands below 0.9m		D	1.0				
				D/B	1.5		pp = 300-400		
68	2			D	2.0		pp = 300-400		
	2.6	- bands of extremely weathered shale below 2.4m		D	2.5		pp = 400-500		
		SANDSTONE: fine grained, white and red, very low strength, highly weathered, with bands of extremely weathered shale							
67	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
66	4								
65	5								
64	6								
63	7								
62	8								
61	9								

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 73.7 mAHD
EASTING: 296819
NORTHING: 6252776

PIT No: 5
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
73	0.2	FILL/TOPSOIL: Clayey SILT MH, high plasticity, brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CH: high plasticity, brown-red, trace ironstone gravel, w<PL, very stiff		D	0.5				
	0.9	SANDSTONE: fine grained, brown, very low strength, highly weathered		D	1.0				
72				D	1.5				
				D	2.0				
		- interbedded with dark grey shale below 2.4m		D	2.5				
71	3.0	Pit discontinued at 3.0m		D	3.0				
		- limit of investigation							
70									
69									
68									
67									
66									
65									
64									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 70.5 mAHD
EASTING: 296307
NORTHING: 6252715

PIT No: 6
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
70	0.2	FILL/TOPSOIL: Clayey SILT MH, high plasticity, brown, with rootlets, w<PL		D/E	0.1				
		Silty CLAY CI: medium plasticity, red, w<PL, very stiff - becoming hard below 0.3m		D/B	0.5				
69	1	- becoming brown below 0.8m		D	1.0				
		- becoming dark grey-brown below 1.4m		D	1.5		pp = 300-400		
	1.9	SHALE: brown, very low strength, highly weathered		D	2.0				
68	2.1	Pit discontinued at 2.1m - refusal on low strength shale		D	2.1				

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 74.3 mAHD
EASTING: 296479
NORTHING: 6252656
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
74	0.1	FILL/TOPSOIL: Clayey SILT, brown, with rootlets										
		Silty CLAY CH: high plasticity, red brown, w<PL, very stiff, residual							S			7,12,19 N = 31
73	1	- becoming grey, with iron indurated bands, extremely weathered shale, hard below 1.3m										
72	2											
	2.63	CLAY CI: medium plasticity, grey mottled red, trace gravel and cobbles, w<PL										
71	3											
	3.33	SILTSTONE: fine grained, brown, low strength, highly weathered										PL(A) = 0.21
	4	- becoming extremely weathered between 3.96m to 5.0m						3.8m: J, 40°, pl, ro, fe, he 3.88m: B, pl, ro, fe, he 4.2m: sm, pl, clay 200mm thick	C	100	87	PL(A) = 0.17
70	5							4.79m: sm, pl, clay 90mm thick				
69	5.26	SANDSTONE: fine grained, brown, low strength, distinctly weathered						5.2m: J, 15°, pl, ro, fe, he 5.3m: J, 35°, pl, ro, fe, he				PL(A) = 0.67
	6							5.37m: B, pl, ro, clay 5.73m: B, pl, ro, clay 5.97m: B, pl, ro, clay 6.04m: Cs, pl, ro, fe 60mm thick 6.35m: Cs, pl, ro, fe 40mm thick 6.55m: B, pl, sm, clay, he				
68	6.0	SILTSTONE - fine grained, brown, low strength, highly weathered										
	7	- becoming dark grey, distinctly weathered below 6.53m						6.84m: B, pl, ro, clay	C	100	30	PL(A) = 0.13
67	8											
66		- becoming medium strength, moderately weathered below 8.26m										PL(A) = 0.4
	8.67	Bore discontinued at 8.67m - limit of investigation										
65	9											

RIG: Scout 1/DT100 **DRILLER:** Groundtest **LOGGED:** FH **CASING:**

TYPE OF BORING: 150mm diameter Solid flight auger (TC-bit) to 1.5m, wash boring to 5.26m, NMLC coring to 8.67m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. w = moisture content; PL = plastic limit

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_x	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)

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DOUGLAS PARTNERS PTY LTD

STOCKLAND COMMERCIAL PROPERTY PTY LTD
PROPOSED COMMERCIAL/INDUSTRIAL SUBDIVISION, KEMPS CREEK

BORE: 7 DEPTH: 2.63 – 8.67 m PROJECT: 92364.00 JULY 2019

End of Bore at 8.67 m

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 73.6 mAHD
EASTING: 296795
NORTHING: 6252613

PIT No: 8
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
73	0.1	FILL/TOPSOIL: Organic SILT OH, dark brown, trace rootlets, w<PL		E	0.1				
		FILL/Silty CLAY CH: high plasticity, pale brown, with textiles, pieces of broken plastic pipe and wooden stake, w<PL		E	0.5				
	0.9								
	1	Silty CLAY CH: high plasticity, red-brown, trace ironstone gravel, w<PL		D	1.1				
	1.2	Pit discontinued at 1.2m - limit of investigation							
72	2								
71	3								
70	4								
69	5								
68	6								
67	7								
66	8								
65	9								
64									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 73.4 mAHD
EASTING: 296820
NORTHING: 6252578

PIT No: 9
PROJECT No: 92364.00
DATE: 30/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
73	0.3	FILL/Clayey GRAVEL GL: grey-white, dry, typically loosely placed		D/E	0.1				
	0.6	FILL/Silty CLAY CI: medium plasticity, brown, with rootlets, trace metallic wires and ceramic tile, w<PL (uncontrolled fill)		D/E	0.5				
72	1	Silty CLAY CI: medium plasticity, brown-red, trace gravel, w<PL		D U_{50}	0.9 1.0 1.25				
				D	1.5				
	2.0	- brown and grey bands of extremely weathered shale below 1.8m		D	2.0				
71	2.5	SANDSTONE: fine grained, brown, very low strength, highly weathered		D	2.5				
		Pit discontinued at 2.5m - limit of investigation							
70	3								
69	4								
68	5								
67	6								
66	7								
65	8								
64	9								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 77.6 mAHD
EASTING: 296526
NORTHING: 6252611

PIT No: 10
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
77	0.2	FILL/TOPSOIL: Silty CLAY CH, high plasticity, pale brown, with rootlets, w<PL		E	0.1				
		FILL/Silty CLAY CH: high plasticity, brown, trace siltstone gravel, w<PL		E	0.5				
	0.7	Silty CLAY CH: high plasticity, red and grey, w<PL							
	1			D	1.0				
	1.2	- bands of extremely weathered shale below 1.1m							
76		Pit discontinued at 1.2m - limit of investigation							
75	2								
74	3								
73	4								
72	5								
71	6								
70	7								
69	8								
68	9								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 68.9 mAHD
EASTING: 296235
NORTHING: 6252516

PIT No: 11
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
68	0.2	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CH: high plasticity, red-brown, trace gravel, w>PL, stiff		D/B	0.5				
				U_{50}	0.6				
					0.85				
67	1	- becoming grey and brown, hard below 0.9m		D	1.0				
		- becoming grey and red, sandstone gravel below 1.4m		D	1.5		pp = 300-400		
66	2			D	2.0		pp = 400-500		
	2.4	SANDSTONE: fine grained, red and grey, very low strength, highly weathered		D	2.5				
65	3	Pit discontinued at 3.0m - limit of investigation		D	3.0				
64	4								
63	5								
62	6								
61	7								
60	8								
59	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 69.1 mAHD
EASTING: 296549
NORTHING: 6252533

PIT No: 12
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
69	0.15	FILL/TOPSOIL: Clayey SILT MH, high plasticity, brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CI: medium plasticity, red-brown, trace ironstone gravel, w<PL, hard		D	0.5				
68	1			D	1.0				
		- becoming brown mottled grey below 1.1m							
		- with bands of extremely weathered shale below 1.4m		D	1.5		pp = 400-500		
67	1.9	SHALE: dark grey, very low strength, highly weathered, with bands of fine grained, brown sandstone gravel							
	2			D	2.5				
	2.6	Pit discontinued at 2.6m - refusal on low strength shale							
66	3								
65	4								
64	5								
63	6								
62	7								
61	8								
60	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 71.9 mAHD
EASTING: 296691
NORTHING: 6252472

PIT No: 13
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
71	0.15	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, brown, with rootlets, w<PL		D	0.1				
		Silty CLAY CH: high plasticity, red-brown, trace ironstone gravel, w<PL, stiff		D	0.5				
	1	- with bands of brown and grey extremely weathered shale below 0.8m		D	1.0				
70				D	1.5				
	2			D	2.0				
	2.3	SHALE: brown and grey, very low strength, highly weathered		D	2.5				
69	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
68	4								
67	5								
66	6								
65	7								
64	8								
63	9								
62									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 60.1 mAHD
EASTING: 296231
NORTHING: 6252333

PIT No: 14
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
60	0.3	FILL/TOPSOIL: Clayey SILT MH, high plasticity, brown, with rootlets, w<PL		D/E	0.1				
		Silty CLAY CH: high plasticity, red-brown, trace gravel, w<PL, hard		D	0.4				
				U_{50}	0.5 – 0.65				
59	1	- becoming red mottled grey, w~PL below 0.9m		D/B	1.0				
				D	1.5				
58	2	- with band of brown and grey extremely weathered shale below 1.9m		D	2.0				
	2.3	SHALE: brown, very low strength, highly weathered, with bands of low strength, highly weathered		D	2.5				
57	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
56	4								
55	5								
54	6								
53	7								
52	8								
51	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 77.6 mAHD
EASTING: 296689
NORTHING: 6252284

PIT No: 15
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
77	0.2	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, brown, with rootlets, w<PL		D/E	0.1				
	0.6	Silty CLAY CI: medium plasticity, brown, with gravel, w<PL, hard		D	0.5				
76	1	SANDSTONE: pale brown, very low strength, highly weathered, with bands of low strength, highly weathered		D	1.0				
				D	1.5				
	2			D	2.0				
75	2.1	Pit discontinued at 2.1m - limit of investigation							
74	3								
73	4								
72	5								
71	6								
70	7								
69	8								
68	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 79.5 mAHD
EASTING: 296809
NORTHING: 6252397

PIT No: 16
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
79	0.6	FILL/ROADBASE: black roadbase gravel		E	0.2				
		Silty CLAY CH: high plasticity, red mottled grey, trace gravel, w<PL		D	0.7				
78	1.0	Pit discontinued at 1.0m - limit of investigation							
77									
76									
75									
74									
73									
72									
71									
70									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20; 1 to 9

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 64.5 mAHD
EASTING: 296441
NORTHING: 6252409

PIT No: 17
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
64	0.2	FILL/TOPSOIL: Silty CLAY CH, high plasticity, brown, with rootlets, w<PL		E	0.1				
		FILL/Silty CLAY CI: medium plasticity, pale brown, with gravel, w<PL		E	0.5				
	0.9								
63	1	Silty CLAY CI: medium plasticity, brown, trace gravel, w<PL		D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							
62	2								
61	3								
60	4								
59	5								
58	6								
57	7								
56	8								
55	9								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 71.4 mAHD
EASTING: 296862
NORTHING: 6252693

PIT No: 18
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
71	0.1	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, pale brown, with rootlets, w<PL		E	0.1				
		FILL/Silty CLAY CI: medium plasticity, brown, trace sandstone gravel, w<PL		E	0.5				
70	1.1	Silty CLAY CH: high plasticity, red, trace ironstone gravel, w<PL		D	1.2				
	1.6	Pit discontinued at 1.6m - limit of investigation							
69									
68									
67									
66									
65									
64									
63									
62									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 80.7 mAHD
EASTING: 296839
NORTHING: 6252374
DIP/AZIMUTH: 90°/--

BORE No: 19
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
80	0.25	FILL/Silty Sandy GRAVEL: dark brown and grey, trace root fibres, w<PL							D			
		CLAY CI: medium plasticity, red brown, trace fine sand and gravel, w<PL, hard							D			pp = 500
1		- becoming very stiff below 0.8m							D			pp = 300-350
		- becoming grey mottled red orange below 1.0m							S			6,12,16 N = 28
79												
2												
	2.36	SILTSTONE: fine grained, brown, low strength, highly weathered							S			25/60mm,-,- refusal
78								2.69m: B, pl, ro, clay				
3												PL(A) = 0.51
		- with interbedded fine grained sandstone below 3.09m						3.26m: B, pl, ro, clay				
								3.46m: B, pl, ro, clay				
77									C	100	100	
4								3.91m: B, pl, ro, clay				
								4.19m: B, pl, ro, clay				
		- becoming grey, moderately weathered below 4.32m										PL(A) = 0.2
76								4.69m: J, 40°, pl, ro, fe, he				
5	5.08	SANDSTONE: fine grained, pale brown, medium strength, moderately weathered						5.13m: J, 80°, pl, ro, fe, he				PL(A) = 2.66
		- with interbedded siltstone bands between 5.18m to 7.0m						5.19m: B, pl, ro, clay				
75								5.85m: B, pl, ro, clay				
6												PL(A) = 1.35
								6.8m: B, pl, ro, clay	C	100	60	
74												
7		- becoming grey below 7.0m										PL(A) = 3.96
								7.54m: B, pl, ro, clay				
73												
8												
	8.37	Bore discontinued at 8.37m										PL(A) = 0.33
72		- limit of investigation										
9												
71												

RIG: Scout 1 **DRILLER:** Groundtest **LOGGED:** FH **CASING:**

TYPE OF BORING: Solid flight auger (TC-bit) to 1.0m, rotary to 2.3m, NMLC coring to 8.37m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. 50% water loss at approximately 7.1m; w = moisture content; PL = plastic limit

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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

DOUGLAS PARTNERS PTY LTD

STOCKLAND COMMERCIAL PROPERTY PTY LTD
PROPOSED COMMERCIAL/INDUSTRIAL SUBDIVISION, KEMPS CREEK

BORE: 19 DEPTH: 2.36 – 8.37 m PROJECT: 92364.00 JULY 2019

End of Bore at 8.37 m

TEST PIT LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commerical/Industrial Subdivision
LOCATION: 144 - 228 Aldington Road, Kemps Creek

SURFACE LEVEL: 67.9 mAHD
EASTING: 296516
NORTHING: 6252385

PIT No: 26
PROJECT No: 92364.00
DATE: 31/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
67	0.15	FILL/TOPSOIL: Silty CLAY CI, medium plasticity, brown, with rootlets, w<PL		E	0.1				
		FILL/Silty CLAY CI: medium plasticity, brown, with shale and siltstone gravel, w<PL		E	0.5				
66	1.4	SHALE: brown and grey, extremely weathered, with band of grey, very low strength, highly weathered		D	1.5				
	2.0	Pit discontinued at 2.0m - limit of investigation		D	2.0				

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: ABB

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

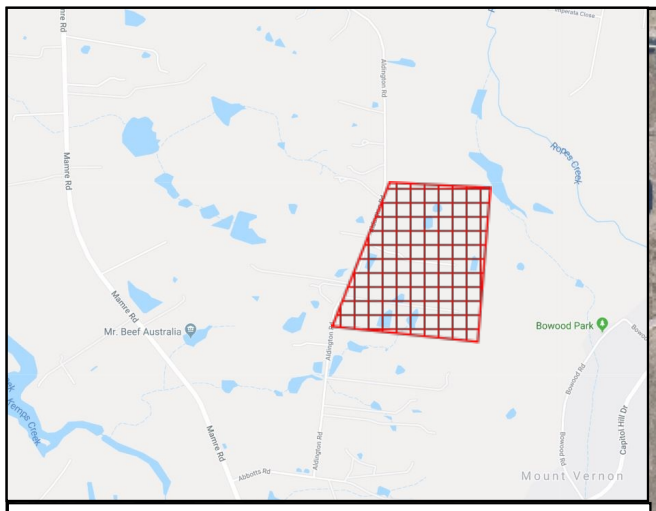
REMARKS: w = moisture content; PL = plastic limit

☐ 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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater



Site Locality

Legend

Boundary

Test Pit Locations

Borehole Locations

0 60 120 180 240 m

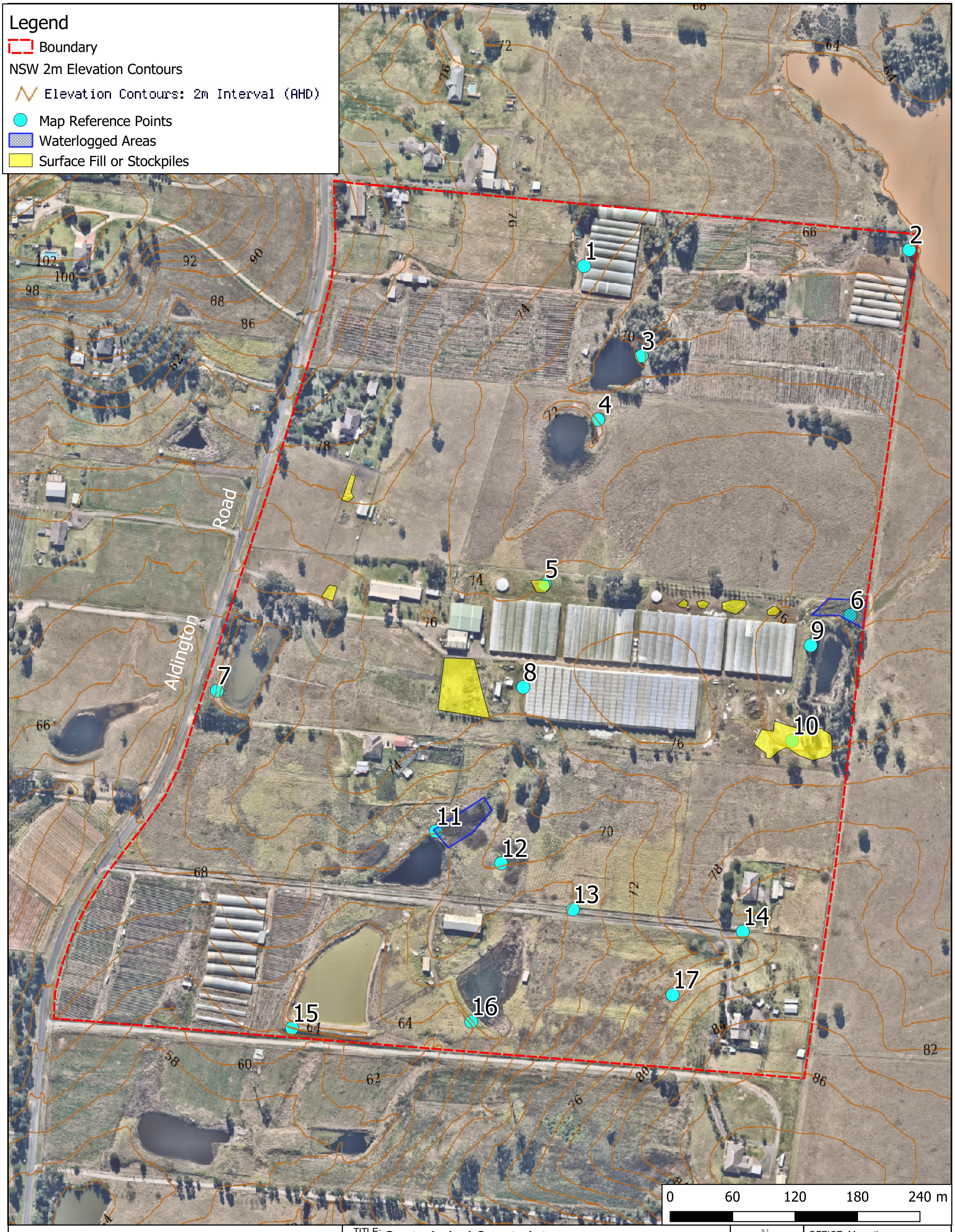
Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: **Test Pit and Borehole Location Plan**
Proposed Commercial/Industrial Development
144 - 228 Aldington Road, Kemps Creek

N
MGA

OFFICE: Macarthur
DRAWN BY: ECR
DATE: 8.09.2019

CLIENT: Stockland Commercial Property
PROJ. #: 92364.01
DRAWING No: 1
REVISION: 0
SCALE: As Shown



Douglas Partners Geotechnics / Environment / Groundwater	TITLE: **Geotechnical Constraints** **Proposed Commercial/Industrial Development** **144 - 228 Aldington Road, Kemps Creek**	N MGA	OFFICE: Macarthur DRAWN BY: ECR DATE: 8.09.2019
CLIENT: Stockland Commercial Property	PROJ. #: 92364.01	DRAWING No: 1	REVISION: 0 / SCALE: As Shown

Photograph 1 - View from central portion of the site looking northwest (typical landscape)

Photograph 2 - View looking west from southern properties

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92364.00
	Proposed Commercial/Industrial Subdivision	PLATE No: 1
	144 - 228 Aldington Road, Kemps Creek	REV: 0
	CLIENT: Stockland Commercial Property	DATE: Aug-19

Photograph 3 - Typical topsoil and vegetation stockpile (farm spoil)

Photograph 4 - Typical farm dam

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs Proposed Commercial/Industrial Subdivision 144 - 228 Aldington Road, Kemps Creek	PROJECT: 92364.00 PLATE No: 2 REV: 0
	CLIENT: Stockland Commercial Property	DATE: Aug-19

Photograph 5 - View from dam embankment looking north to low lying area

Photograph 6 - View looking east along southern boundary of site

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92364.00
	Proposed Commercial/Industrial Subdivision	PLATE No: 3
	144 - 228 Aldington Road, Kemps Creek	REV: 0
	CLIENT: Stockland Commercial Property	DATE: Aug-19

Photograph 7 - Typical fill placed for greenhouse construction

Photograph 8 - View looking north at northwestern site boundary. Note dam to right is outside of site boundary.

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs Proposed Commercial/Industrial Subdivision 144 - 228 Aldington Road, Kemps Creek CLIENT: Stockland Commercial Property	PROJECT: 92364.00 PLATE No: 4 REV: 0 DATE: Aug-19

Photograph 9 - View of heavily vegetated dam in southern portion of site

Photograph 10 - Area of relatively higher relief at southern portion of site

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92364.00
	Proposed Commercial/Industrial Subdivision	PLATE No: 5
	144 - 228 Aldington Road, Kemps Creek	REV: 0
	CLIENT: Stockland Commercial Property	DATE: Aug-19

Photograph 11 - Clay, sandstone and shale fill spread across site

Photograph 12 - Dam embankment along Aldington Road

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92364.00
	Proposed Commercial/Industrial Subdivision	PLATE No: 5
	144 - 228 Aldington Road, Kemps Creek	REV: 0
	CLIENT: Stockland Commercial Property	DATE: Aug-19

Appendix B

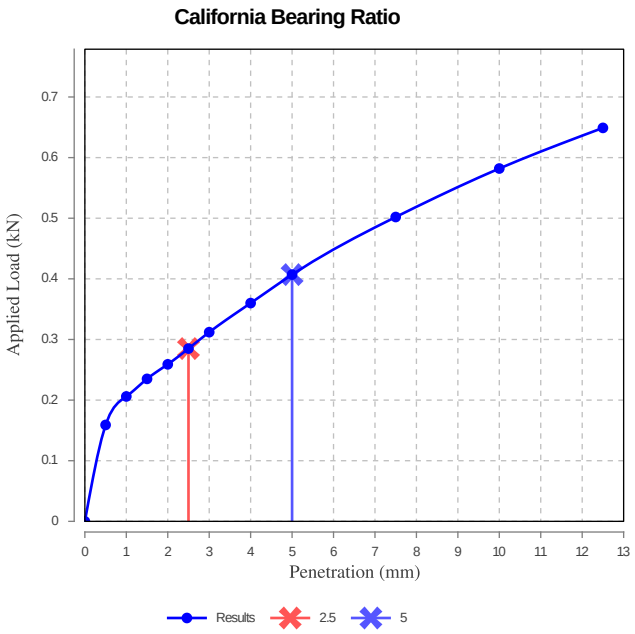
Results of Laboratory Testing
Summary of Salinity and Aggressivity Results

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: tim.white@douglaspartners.com.au

Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071A
Date Sampled: 30/07/2019
Dates Tested: 02/08/2019 - 13/08/2019
Sample Location: **4 (1.5m)**
Material: SILTY CLAY - brown mottled grey silty clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**2.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.58		
Optimum Moisture Content (%)	23.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.55		
Field Moisture Content (%)	27.2		
Moisture Content at Placement (%)	23.4		
Moisture Content Top 30mm (%)			
Moisture Content Rest of Sample (%)			
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	0		
Swell (%)	2.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

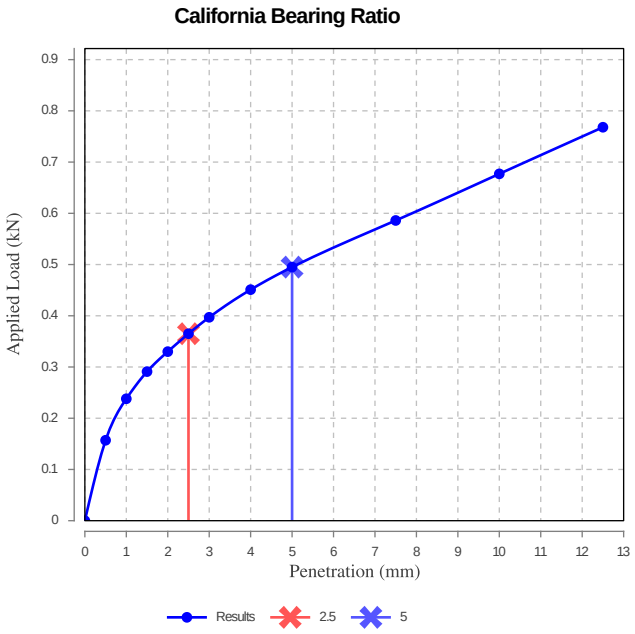


Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: tim.white@douglaspartners.com.au

Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071B
Date Sampled: 30/07/2019
Dates Tested: 02/08/2019 - 13/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **6 (0.5m)**
Material: SILTY CLAY - red silty clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**3.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.64		
Optimum Moisture Content (%)	21.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.59		
Field Moisture Content (%)	17.5		
Moisture Content at Placement (%)	21.2		
Moisture Content Top 30mm (%)			
Moisture Content Rest of Sample (%)			
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48		
Swell (%)	3.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

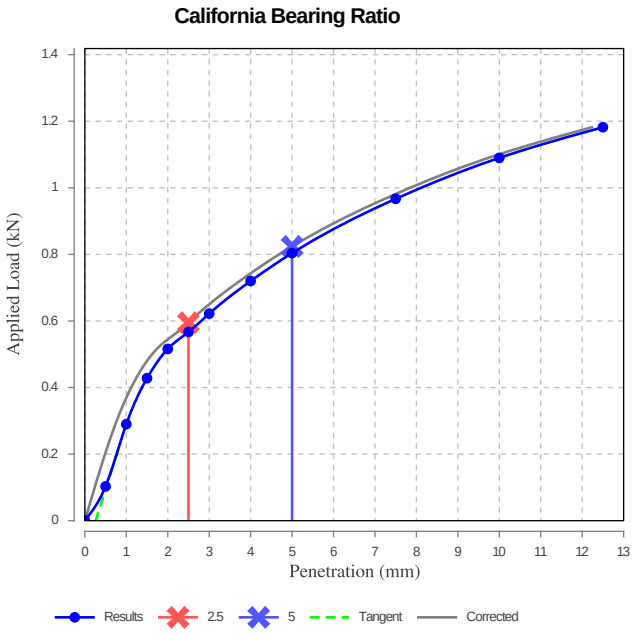


Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: tim.white@douglaspartners.com.au

Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071C
Date Sampled: 30/07/2019
Dates Tested: 02/08/2019 - 13/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **11 (0.5m)**
Material: SILTY CLAY - red-brown silty clay with gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.58		
Optimum Moisture Content (%)	23.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.57		
Field Moisture Content (%)	24.5		
Moisture Content at Placement (%)	23.6		
Moisture Content Top 30mm (%)			
Moisture Content Rest of Sample (%)			
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

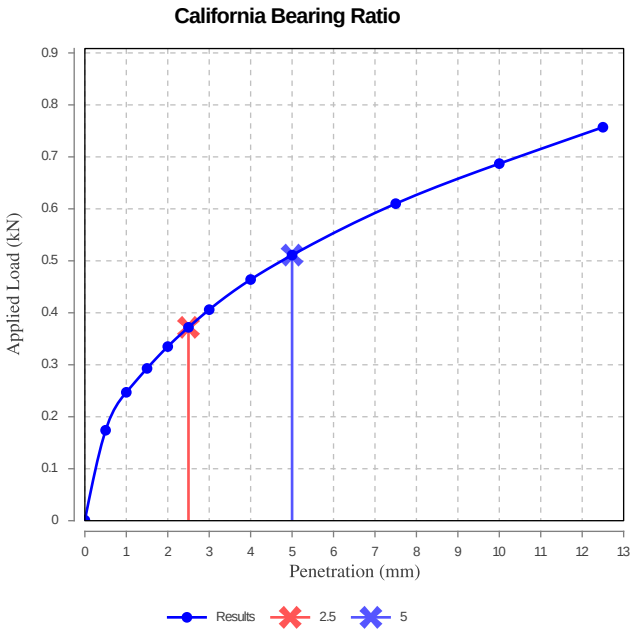


Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: tim.white@douglaspartners.com.au

Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071D
Date Sampled: 30/07/2019
Dates Tested: 02/08/2019 - 13/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **14 (1.0m)**
Material: SILTY CLAY - red mottled grey silty clay

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**3.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.55		
Optimum Moisture Content (%)	26.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.52		
Field Moisture Content (%)	28.3		
Moisture Content at Placement (%)	26.6		
Moisture Content Top 30mm (%)			
Moisture Content Rest of Sample (%)			
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48		
Swell (%)	2.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071H
Date Sampled: 31/07/2019
Dates Tested: 02/08/2019 - 06/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **4 (1.0m)**
Material: SILTY CLAY - brown-red mottled grey silty clay

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	20		

Material Test Report

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Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071I
Date Sampled: 31/07/2019
Dates Tested: 02/08/2019 - 07/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **11 (0.5m)**
Material: SILTY CLAY - red-brown silty clay

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	As sbove		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	20		

Material Test Report

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Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071J
Date Sampled: 31/07/2019
Dates Tested: 02/08/2019 - 08/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Remarks: Field moisture content = 21.1%
Sample Location: **2 (0.5m)**
Material: SILTY CLAY - brown and red silty clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	48		
Plastic Limit (%)	16		
Plasticity Index (%)	**32**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	15.0		
Cracking Crumbling Curling	Curling		

Material Test Report

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Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Sample Number: 19-1071K
Date Sampled: 31/07/2019
Dates Tested: 02/08/2019 - 08/08/2019
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Remarks: Field moisture content = 19.1%
Sample Location: **15 (0.5m)**
Material: SILTY CLAY - brown silty clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	49		
Plastic Limit (%)	20		
Plasticity Index (%)	**29**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	14.5		
Cracking Crumbling Curling	Curling		

Material Test Report

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Report Number: **PREVIEW**
Issue Number:
Date Issued:
Client: Stockland Commercial Property
Level 25, 133 Castlereagh Street, Sydney NSW 2000
Contact: Marcus Donnelly
Project Number: 92364.00
Project Name: Proposed Commerical/Industrial Subdivision
Project Location: 144 - 228 Aldington Road, Kemps Creek
Work Request: 1071
Dates Tested: 02/08/2019 - 05/08/2019

Shrink Swell Index AS 1289 7.1.1 & 2.1.1			
Sample Number	19-1071E	19-1071F	19-1071G
Sampling Method	AS1289 1.2.1 6.4	AS1289 1.2.1 6.4	AS1289 1.2.1 6.4
Date Sampled	31/07/2019	31/07/2019	31/07/2019
Date Tested	05/08/2019	05/08/2019	05/08/2019
Material Source	U50 push tube	U50 push tube	U50 push tube
Sample Location	3 (0.5 - 0.85m)	9 (0.9 - 1.25m)	11 (0.6 - 0.85m)
Inert Material Estimate (%)	0	0	0
Pocket Penetrometer before (kPa)	550	>600	>600
Pocket Penetrometer after (kPa)	250	450	200
Shrinkage Moisture Content (%)	14.1	14.4	20.7
Shrinkage (%)	**2.3**	**2.3**	**2.2**
Swell Moisture Content Before (%)	14.6	14.0	20.9
Swell Moisture Content After (%)	18.6	18.8	25.0
Swell (%)	**1.7**	**1.2**	**0.4**
Shrink Swell Index Iss (%)	**1.8**	**1.6**	**1.3**
Visual Description	SILTY CLAY - red and brown silty clay	SILTY CLAY - red-brown silty clay	SILTY CLAY - red-brown silty clay
Cracking	Slightly Cracked	Moderately Cracked	Moderately Cracked
Crumbling	No	No	No
Remarks	**	**	**

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.
NATA Accreditation does not cover the performance of pocket penetrometer readings.

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ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 222972

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Cindy Murphy
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92364.00, Kemps Creek**
Number of Samples	50 SOIL
Date samples received	01/08/2019
Date completed instructions received	01/08/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	08/08/2019
Date of Issue	06/08/2019

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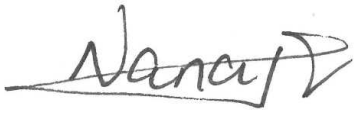
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		222972-1	222972-2	222972-3	222972-4	222972-5
Your Reference	UNITS	TP2	TP2	TP2	TP2	TP2
Depth		0.5	1.0	1.5	2.0	2.5
Date Sampled		30/07/2019	30/07/2019	30/07/2019	30/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	5.4	5.5	5.4	5.3	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	1,500	640	660	740	790
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	670	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	100	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		222972-6	222972-7	222972-8	222972-9	222972-10
Your Reference	UNITS	TP2	TP4	TP4	TP4	TP4
Depth		3.0	0.5	1.0	1.5	2.0
Date Sampled		30/07/2019	30/07/2019	30/07/2019	30/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	6.0	4.8	4.7	5.2	5.9
Electrical Conductivity 1:5 soil:water	µS/cm	1,000	380	500	340	250
Chloride, Cl 1:5 soil:water	mg/kg	2,400	[NA]	[NA]	210	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	370	[NA]	[NA]	190	[NA]

Misc Inorg - Soil						
Our Reference		222972-11	222972-12	222972-13	222972-14	222972-15
Your Reference	UNITS	TP4	TP5	TP5	TP5	TP5
Depth		3.0	0.5	1.0	1.5	2.0
Date Sampled		30/07/2019	30/07/2019	30/07/2019	30/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	6.0	5.8	5.8	5.8	6.1
Electrical Conductivity 1:5 soil:water	µS/cm	300	110	250	470	470
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	470	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	160	[NA]

Misc Inorg - Soil						
Our Reference		222972-16	222972-17	222972-18	222972-19	222972-20
Your Reference	UNITS	TP5	TP5	TP6	TP6	TP6
Depth		2.5	3.0	0.5	1.0	1.5
Date Sampled		30/07/2019	30/07/2019	30/07/2019	30/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	6.5	6.8	6.6	7.1	6.5
Electrical Conductivity 1:5 soil:water	µS/cm	480	400	66	320	510
Chloride, Cl 1:5 soil:water	mg/kg	620	[NA]	50	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	190	[NA]	21	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		222972-21	222972-22	222972-23	222972-24	222972-25
Your Reference	UNITS	TP6	TP9	TP9	TP9	TP9
Depth		2.0	0.5	1.0	1.5	2.0
Date Sampled		30/07/2019	30/07/2019	30/07/2019	30/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	7.5	8.4	5.7	5.7	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	360	320	99	250	350

Misc Inorg - Soil						
Our Reference		222972-26	222972-27	222972-28	222972-29	222972-30
Your Reference	UNITS	TP9	TP9	TP11	TP11	TP11
Depth		2.5	3.0	0.5	1.0	1.5
Date Sampled		30/07/2019	30/07/2019	31/07/2019	31/07/2019	31/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	6.2	6.4	5.7	5.2	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	400	410	81	390	400
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	350	43	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	180	96	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		222972-31	222972-32	222972-33	222972-34	222972-35
Your Reference	UNITS	TP11	TP11	TP11	TP13	TP13
Depth		2.0	2.5	3.0	0.5	1.0
Date Sampled		31/07/2019	31/07/2019	31/07/2019	31/07/2019	31/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	5.4	5.2	5.4	5.7	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	300	420	380	100	280
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	45	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	92	[NA]

Misc Inorg - Soil						
Our Reference		222972-36	222972-37	222972-38	222972-39	222972-40
Your Reference	UNITS	TP13	TP13	TP13	TP13	TP14
Depth		1.5	2.0	2.5	3.0	0.5
Date Sampled		31/07/2019	31/07/2019	31/07/2019	31/07/2019	31/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	5.6	5.8	6.1	6.1	6.7
Electrical Conductivity 1:5 soil:water	µS/cm	350	340	320	300	470
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	340	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	130	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		222972-41	222972-42	222972-43	222972-44	222972-45
Your Reference	UNITS	TP14	TP14	TP14	TP14	TP14
Depth		1.0	1.5	2.0	2.5	3.0
Date Sampled		31/07/2019	31/07/2019	31/07/2019	31/07/2019	31/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	5.3	5.9	7.7	8.7	7.4
Electrical Conductivity 1:5 soil:water	µS/cm	1,000	1,000	640	730	640
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	760	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	140	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		222972-46	222972-47	222972-48	222972-49	222972-50
Your Reference	UNITS	TP15	TP15	TP15	TP15	TP4
Depth		0.5	1.0	1.5	2.0	2.5
Date Sampled		31/07/2019	31/07/2019	31/07/2019	31/07/2019	30/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
pH 1:5 soil:water	pH Units	6.3	8.1	8.6	9.2	6.3
Electrical Conductivity 1:5 soil:water	µS/cm	57	96	69	100	210
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	20	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	10	[NA]

ESP/CEC						
Our Reference		222972-1	222972-8	222972-18	222972-28	222972-40
Your Reference	UNITS	TP2	TP4	TP6	TP11	TP14
Depth		0.5	1.0	0.5	0.5	0.5
Date Sampled		30/07/2019	30/07/2019	30/07/2019	31/07/2019	31/07/2019
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Date analysed	-	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Exchangeable Ca	meq/100g	<0.1	0.9	4.6	1.5	3.4
Exchangeable K	meq/100g	<0.1	0.4	0.1	<0.1	0.7
Exchangeable Mg	meq/100g	2.1	10	7.2	5.0	8.1
Exchangeable Na	meq/100g	0.91	0.69	1.1	0.66	1.5
Cation Exchange Capacity	meq/100g	3.1	12	13	7.2	14
ESP	%	29	6	8	9	11

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			05/08/2019	2	05/08/2019	05/08/2019		05/08/2019	[NT]
Date analysed	-			05/08/2019	2	05/08/2019	05/08/2019		05/08/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	5.5	5.5	0	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	640	560	13	103	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	670	630	6	95	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	100	92	8	100	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	05/08/2019	05/08/2019		[NT]	[NT]
Date analysed	-			[NT]	11	05/08/2019	05/08/2019		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	11	6.0	6.0	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	11	300	320	6	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	34	45	44	2	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	34	92	91	1	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	05/08/2019	05/08/2019		[NT]	[NT]
Date analysed	-			[NT]	21	05/08/2019	05/08/2019		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	21	7.5	7.5	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	21	360	340	6	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	34	05/08/2019	05/08/2019		[NT]	[NT]
Date analysed	-			[NT]	34	05/08/2019	05/08/2019		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	34	5.7	5.7	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	34	100	110	10	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	44	05/08/2019	05/08/2019		[NT]	[NT]
Date analysed	-			[NT]	44	05/08/2019	05/08/2019		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	44	8.7	8.7	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	44	730	770	5	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			05/08/2019	1	05/08/2019	05/08/2019		05/08/2019	[NT]
Date analysed	-			05/08/2019	1	05/08/2019	05/08/2019		05/08/2019	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	1	<0.1	<0.1	0	112	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	1	<0.1	<0.1	0	111	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	1	2.1	2.4	13	113	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	1	0.91	0.97	6	123	[NT]
ESP	%	1	Metals-009	[NT]	1	29	28	4	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	KEMPS CREEK, Proposed Commercial/Industrial Subdivision			**To:**	Envirolab Services
Project No:	92364.00	**Sampler:**	Adad Barkho		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Rod Gray/Cindy Murphy	**Mob. Phone:**	0437396499	**Attn:**	Tania Notaras
Email:	adad.barkho@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity					
TP2/0.5	1	30/07/19	S	P	X	X			X					
TP2/1.0	2	30/07/19	S	P	X	X	X	X						
TP2/1.5	3	30/07/19	S	P	X	X								
TP2/2.0	4	30/07/19	S	P	X	X								
TP2/2.5	5	30/07/19	S	P	X	X								
TP2/3.0	6	30/07/19	S	P	X	X	X	X						
TP4/0.5	7	30/07/19	S	P	X	X								
TP4/1.0	8	30/07/19	S	P	X	X			X					
TP4/1.5	9	30/07/19	S	P	X	X	X	X						
TP4/2.0	10	30/07/19	S	P	X	X								
TP4/2.5	50 TNR	30/07/19	S	P	X	X								
TP4/3.0	11	30/07/19	S	P	X	X								
TP5/0.5	12	30/07/19	S	P	X	X								

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 222972

Date Received: 01/08/19
Time Received: 16.27
Received by: STB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address:** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	Adad Barkho	**Transported to laboratory by:**	
Signed:	**Date & Time:** 1:30pm 1/08/2019	**Received by:** ECS Syd. S.Bolton STB	

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	KEMPS CREEK, Proposed Commercial/Industrial Subdivision			**To:**	Envirolab Services
Project No:	92364.00	**Sampler:**	Adad Barkho		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Rod Gray/Cindy Murphy	**Mob. Phone:**	0437396499	**Attn:**	Tania Notaras
Email:	adad.barkho@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity					
TP5/1.0	13	30/07/19	S	P	X	X								
TP5/1.5	14	30/07/19	S	P	X	X	X	X						
TP5/2.0	15	30/07/19	S	P	X	X								
TP5/2.5	16	30/07/19	S	P	X	X	X	X						
TP5/3.0	17	30/07/19	S	P	X	X								
TP6/0.5	18	30/07/19	S	P	X	X	X	X	X					
TP6/1.0	19	30/07/19	S	P	X	X								
TP6/1.5	20	30/07/19	S	P	X	X								
TP6/2.0	21	30/07/19	S	P	X	X								
TP9/0.5	22	30/07/19	S	P	X	X								
TP9/1.0	23	30/07/19	S	P	X	X								
TP9/1.5	24	30/07/19	S	P	X	X								
TP9/2.0	25	30/07/19	S	P	X	X								

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address:** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	Adad Barkho	**Transported to laboratory by:**	
Signed:	**Date & Time:** 1:30 pm 1/08/2019	**Received by:** S. Bolton	

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	KEMPS CREEK, Proposed Commercial/Industrial Subdivision			**To:**	Envirolab Services
Project No:	92364.00	**Sampler:**	Adad Barkho		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Rod Gray/Cindy Murphy	**Mob. Phone:**	0437396499	**Attn:**	Tania Notaras
Email:	adad.barkho@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity					
TP9/2.5	26	30/07/19	S	P	X	X								
TP9/3.0	27	30/07/19	S	P	X	X	X	X						
TP11/0.5	28	31/07/19	S	P	X	X	X	X	X					
TP11/1.0	29	31/07/19	S	P	X	X								
TP11/1.5	30	31/07/19	S	P	X	X								
TP11/2.0	31	31/07/19	S	P	X	X								
TP11/2.5	32	31/07/19	S	P	X	X								
TP11/3.0	33	31/07/19	S	P	X	X								
TP13/0.5	34	31/07/19	S	P	X	X	X	X						
TP13/1.0	35	31/07/19	S	P	X	X								
TP13/1.5	36	31/07/19	S	P	X	X								
TP13/2.0	37	31/07/19	S	P	X	X	X	X						
TP13/2.5	38	31/07/19	S	P	X	X								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address:** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Adad Barkho		**Transported to laboratory by:**		
Signed:		**Date & Time:** 1:30pm 1/08/2019	**Received by:**	S-Bolton	

Douglas Partners
Geotechnics / Environment / Groundwater

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Project Name:	KEMPS CREEK, Proposed Commercial/Industrial Subdivision			**To:**	Envirolab Services
Project No:	92364.00	**Sampler:**	Adad Barkho		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Rod Gray/Cindy Murphy	**Mob. Phone:**	0437396499	**Attn:**	Tania Notaras
Email:	adad.barkho@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity					
TP13/3.0	39	31/07/19	S	P	X	X								
TP14/0.5	40	31/07/19	S	P	X	X			X					
TP14/1.0	41	31/07/19	S	P	X	X								
TP14/1.5	42	31/07/19	S	P	X	X								
TP14/2.0	43	31/07/19	S	P	X	X	X	X						
TP14/2.5	44	31/07/19	S	P	X	X								
TP14/3.0	45	31/07/19	S	P	X	X								
TP15/0.5	46	31/07/19	S	P	X	X								
TP15/1.0	47	31/07/19	S	P	X	X								
TP15/1.5	48	31/07/19	S	P	X	X								
TP15/2.0	49	31/07/19	S	P	X	X	X	X						
Count					50	50	12	12	5					

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Adad Barkho		**Transported to laboratory by:**		
Signed:		**Date & Time:** 1:30pm 1/08/2019	**Received by:** S. Bolton		

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Cindy Murphy

Sample Login Details

Your reference	92364.00, Kemps Creek
Envirolab Reference	222972
Date Sample Received	01/08/2019
Date Instructions Received	01/08/2019
Date Results Expected to be Reported	08/08/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	50 SOIL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	20.1
Cooling Method	None
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	Misc Inorg - Soil	ESP/CEC
TP2-0.5	✓	✓
TP2-1.0	✓	
TP2-1.5	✓	
TP2-2.0	✓	
TP2-2.5	✓	
TP2-3.0	✓	
TP4-0.5	✓	
TP4-1.0	✓	✓
TP4-1.5	✓	
TP4-2.0	✓	
TP4-3.0	✓	
TP5-0.5	✓	
TP5-1.0	✓	
TP5-1.5	✓	
TP5-2.0	✓	
TP5-2.5	✓	
TP5-3.0	✓	
TP6-0.5	✓	✓
TP6-1.0	✓	
TP6-1.5	✓	
TP6-2.0	✓	
TP9-0.5	✓	
TP9-1.0	✓	
TP9-1.5	✓	
TP9-2.0	✓	
TP9-2.5	✓	
TP9-3.0	✓	
TP11-0.5	✓	✓
TP11-1.0	✓	
TP11-1.5	✓	
TP11-2.0	✓	
TP11-2.5	✓	

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Sample ID	Misc Inorg - Soil	ESP/CEC
TP11-3.0	✓	
TP13-0.5	✓	
TP13-1.0	✓	
TP13-1.5	✓	
TP13-2.0	✓	
TP13-2.5	✓	
TP13-3.0	✓	
TP14-0.5	✓	✓
TP14-1.0	✓	
TP14-1.5	✓	
TP14-2.0	✓	
TP14-2.5	✓	
TP14-3.0	✓	
TP15-0.5	✓	
TP15-1.0	✓	
TP15-1.5	✓	
TP15-2.0	✓	
TP4-2.5	✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Test Bore or Pit	Test Location			Sample Depth	pH	Chloride Concentration	Sulphate Concentration	Resistivity	Soil Condition	Sample Aggressivity Class				
	East	North	RL					By inversion of EC1:5		Aggr. to Concrete - from sample pH	Aggr. to Concrete - from Sulphate conc.	Aggr. to Steel - from sample pH	Aggr. to Steel - from Chloride conc.	Aggr. to Steel - from sample Resistivity
	(m MGA56)	(m MGA56)	(m AHD)	(m bgl)	(pH units)	(mg/kg)	(mg/kg)	Ω.cm	[AS2159-2009]	[AS2159-2009]				
2	296760.2	6253025.3	66.3	0.5	5.4			667	B	Mild		Non-Aggressive		Moderate
				1.0	5.5	670	100	1563	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
				1.5	5.4			1515	B	Mild		Non-Aggressive		Mild
				2.0	5.3			1351	B	Mild		Non-Aggressive		Mild
				2.5	5.7			1266	B	Non-Aggressive		Non-Aggressive		Mild
.	.	.	.	3.0	6.0	2400	370	1000	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
4	296449.7	6252861.4	75.3	0.5	4.8			2632	B	Mild		Non-Aggressive		Non-Aggressive
				1.0	4.7			2000	B	Mild		Non-Aggressive		Non-Aggressive
				1.5	5.2	210	190	2941	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				2.0	5.9			4000	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				2.5	6.3			4762	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
.	.	.	.	3.0	6.0			3333	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
5	296820.1	6252777.5	73.7	0.5	5.8			9091	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.0	5.8			4000	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.5	5.8	470	160	2128	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				2.0	6.1			2128	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				2.5	6.5	620	190	2083	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
.	.	.	.	3.0	6.8			2500	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
6	296306.7	6252716.2	70.7	0.5	6.6	50	21	15152	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				1.0	7.1			3125	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.5	6.5			1961	B	Non-Aggressive		Non-Aggressive		Mild
.	.	.	.	2.0	7.5			2778	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
9	296479.0	6252655.7	74.3	0.5	8.4			3125	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.0	5.7			10101	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.5	5.7			4000	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				2.0	5.7			2857	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				2.5	6.2			2500	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
.	.	.	.	3.0	6.4	350	180	2439	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
11	296795.2	6252612.9	73.7	0.5	5.7	43	96	12346	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				1.0	5.2			2564	B	Mild		Non-Aggressive		Non-Aggressive
				1.5	5.3			2500	B	Mild		Non-Aggressive		Non-Aggressive
				2.0	5.4			3333	B	Mild		Non-Aggressive		Non-Aggressive
				2.5	5.2			2381	B	Mild		Non-Aggressive		Non-Aggressive
.	.	.	.	3.0	5.4			2632	B	Mild		Non-Aggressive		Non-Aggressive
13	296817.2	6252578.7	73.4	0.5	5.7	45	92	10000	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				1.0	5.5			3571	B	Mild		Non-Aggressive		Non-Aggressive
				1.5	5.6			2857	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				2.0	5.8	340	130	2941	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
				2.5	6.1			3125	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
.	.	.	.	3.0	6.1			3333	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
14	296526.9	6252611.8	74.2	0.5	6.7			2128	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.0	5.3			1000	B	Mild		Non-Aggressive		Mild
				1.5	5.9			1000	B	Non-Aggressive		Non-Aggressive		Mild
				2.0	7.7	760	140	1563	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
				2.5	8.7			1370	B	Non-Aggressive		Non-Aggressive		Mild
.	.	.	.	3.0	7.4			1563	B	Non-Aggressive		Non-Aggressive		Mild
15	296234.7	6252515.7	68.9	0.5	6.3			17544	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.0	8.1			10417	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
				1.5	8.6			14493	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
.	.	.	.	2.0	9.2	20	10	10000	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive

Test Bore or Pit	Test Location			Sample Depth	Exchangeable Sodium (Na) Concentration	Cation Exchange Capacity	Sodicity	Sodicity Class	Emerson Crumb Class Number	Dispersion?	Soil Texture Group	Textural Factor (M)	$EC_{1:5}$	EC_e	Sample Salinity Class
	East	North	RL				[Na/CEC]			(from Emerson Class)	(for detailed soil logs see Report Appendix)		[Lab.]	[M x $EC_{1:5}$]	(Based on sample ECe)
	(m MGA56)	(m MGA56)	(m AHD)	(m bgl)	(meq/100g)	(meq/100g)	(%)	[after DLWC]		[AS1289.3.8.1]	[after DLWC]	[after DLWC]	(microS/cm)	(deciS/m)	[Richards 1954]
2	296760.2	6253025.3	66.3	0.5		3					Heavy clay	6	1500	9.0	Very Saline
				1.0	1						Light clay	9	640	5.4	Moderately Saline
				1.5							Medium clay	7	660	4.6	Moderately Saline
				2.0							Heavy clay	6	740	4.4	Moderately Saline
				2.5							Medium clay	7	790	5.5	Moderately Saline
.	.	.	.	3.0							Medium clay	7	1000	7.0	Moderately Saline
4	296449.7	6252861.4	75.3	0.5							Heavy clay	6	380	2.3	Slightly Saline
				1.0		12			2	Some	Medium clay	7	500	3.5	Slightly Saline
				1.5							Medium clay	7	340	2.4	Slightly Saline
				2.0							Heavy clay	6	250	1.5	Non-Saline
				2.5	1						Heavy clay	6	210	1.3	Non-Saline
.	.	.	.	3.0							Medium clay	7	300	2.1	Slightly Saline
5	296820.1	6252777.5	73.7	0.5							Medium clay	7	110	0.8	Non-Saline
				1.0							Light medium clay	8	250	2.0	Slightly Saline
				1.5	1						Medium clay	7	470	3.3	Slightly Saline
				2.0							Light clay	9	470	4.0	Slightly Saline
				2.5							Medium clay	7	480	3.4	Slightly Saline
.	.	.	.	3.0							Medium clay	7	400	2.8	Slightly Saline
6	296306.7	6252716.2	70.7	0.5		13					Light medium clay	8	66	0.5	Non-Saline
				1.0							Medium clay	7	320	2.2	Slightly Saline
				1.5							Medium clay	7	510	3.6	Slightly Saline
.	.	.	.	2.0							Medium clay	7	360	2.5	Slightly Saline
9	296479.0	6252655.7	74.3	0.5							Heavy clay	6	320	1.9	Non-Saline
				1.0							Light medium clay	8	99	0.8	Non-Saline
				1.5							Medium clay	7	250	1.8	Non-Saline
				2.0							Light medium clay	8	350	2.8	Slightly Saline
				2.5	1						Medium clay	7	400	2.8	Slightly Saline
.	.	.	.	3.0							Medium clay	7	410	2.9	Slightly Saline
11	296795.2	6252612.9	73.7	0.5		7			3	Dispersive	Heavy clay	6	81	0.5	Non-Saline
				1.0							Medium clay	7	390	2.7	Slightly Saline
				1.5							Heavy clay	6	400	2.4	Slightly Saline
				2.0							Medium clay	7	300	2.1	Slightly Saline
				2.5							Medium clay	7	420	2.9	Slightly Saline
.	.	.	.	3.0							Medium clay	7	380	2.7	Slightly Saline
13	296817.2	6252578.7	73.4	0.5							Medium clay	7	100	0.7	Non-Saline
				1.0							Heavy clay	6	280	1.7	Non-Saline
				1.5							Heavy clay	6	350	2.1	Slightly Saline
				2.0							Heavy clay	6	340	2.0	Slightly Saline
				2.5	1						Medium clay	7	320	2.2	Slightly Saline
.	.	.	.	3.0							Medium clay	7	300	2.1	Slightly Saline
14	296526.9	6252611.8	74.2	0.5		14					Heavy clay	6	470	2.8	Slightly Saline
				1.0							Heavy clay	6	1000	6.0	Moderately Saline
				1.5							Medium clay	7	1000	7.0	Moderately Saline
				2.0							Medium clay	7	640	4.5	Moderately Saline
				2.5							Medium clay	7	730	5.1	Moderately Saline
.	.	.	.	3.0							Medium clay	7	640	4.5	Moderately Saline
15	296234.7	6252515.7	68.9	0.5							Heavy clay	6	57	0.3	Non-Saline
				1.0							Heavy clay	6	96	0.6	Non-Saline
				1.5							Medium clay	7	69	0.5	Non-Saline
.	.	.	.	2.0							Medium clay	7	100	0.7	Non-Saline