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Report on
Preliminary Geotechnical and Salinity Assessment

Proposed Rezoning
Sub Precinct 5, South Creek West, NSW

Prepared for
Boyuan Bringelly Pty Ltd

Project 92225.02
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Preliminary Geotechnical and Salinity Assessment
Proposed Rezoning
Sub Precinct 5, South Creek West, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) has been commissioned by Boyuan Bringelly Pty Ltd to undertake a Preliminary Geotechnical and Soil Salinity Assessment at Sub Precinct 5, South Creek West, NSW located at 670 The Northern Road, Cobbitty (the site). The subject site is shown on Drawing 1, Appendix B.

A geotechnical assessment of Lot 45 in Deposited Plan 1104369, Lot 500 in DP1231858, Lot 2 and Lot 4 in DP1216380 and Lot 102 in DP1217062 was undertaken by DP with the results presented in report 92225.02.R.001.Rev2, dated 17 June 2022. It is noted that the conclusions of this preliminary geotechnical and salinity assessment were based on a previous Indicative Layout Plan (ILP) which considered the entirety of Sub Precinct 5. The current ILP incorporates only Lots 2 and 4 in DP1216380, Lots 1 and 4 in DP1273487, and Lot 500 in DP1231858, as depicted in Drawing 1. This DP June 2022 report has been revised following removal from the rezoning application and the ILP of Lot 45 in DP1104369.

The conclusions of this report remain relevant to the initial assessment, providing a holistic assessment of the precinct within the current ILP, to inform future development on the subject site. It is intended this report will be updated to address any comments received following public notification.

DP understands this report is required to support rezoning of the site. To assist the rezoning process, DP has undertaken a high-level geotechnical assessment of the site to determine its suitability for urban development. The geotechnical investigation addresses the geotechnical surface and subsurface conditions, slope instability risk potential, soil erosion risks, soil salinity and development constraints from a geotechnical perspective.

Details of the work undertaken and the results obtained are presented in this report, together with comments relating to land capability, engineering design and construction practice. Comments are also provided on the need for further geotechnical investigations which are considered to be required following progression of the project to the Development Application stage.

In conjunction with this report, DP also completed a preliminary environmental site investigation for contamination, as well as a groundwater assessment. The results of these studies are presented in separate reports, entitled:

- *Report on Preliminary Site Investigation (Contamination), Proposed Rezoning, 621 - 705 The Northern Road, Cobbitty,* Project 92225.04.R.001.Rev0; and
- *Report on Groundwater Investigation, Proposed Rezoning, 621-705 The Northern Road, Cobbitty,* Project 92225.04.R.002.Rev0.

2. Background

DP has previously prepared the following reports for the areas surrounding the site, and within the southern portion of the proposed development area:

- DP *Report on Land Capability and Contamination Assessment, Oran Park Precinct, Oran Park and Cobbitty, Project 40740* dated February 2007 (DP, 2007); and
- DP *Salinity Review, 621 - 705 The Northern Road, Bringelly, NSW, Project 92225.00.R.002.Rev1* dated 4 December 2017 (DP, 2017).

The salinity review (DP, 2017) largely involved the review of salinity data from the land capability and contamination assessment report (DP, 2007) in relation to the current site boundary. DP (2007) incorporated a small portion within the southern site area (refer Drawing 1, Appendix B). A review of the DP (2007) report indicates that the site area which overlaps with the present study contains soils which were identified generally as *non-saline* to *moderately saline*.

Based on the review of DP (2007), DP (2017) concluded that the soils located within the site could potentially range from *non-saline* to *very saline*, *non-aggressive* to *moderately aggressive* to concrete and steel and would be *sodic* to *highly sodic*. These constraints were noted as naturally occurring features of the local landscape and were not considered significant impediments to proposed development at the site, provided appropriate remediation or management techniques are implemented. DP (2017) recommended that a detailed salinity investigation and management plan be undertaken, in advance of any development applications or bulk earthworks occurring at the site.

3. Scope of Works

The geotechnical assessment was based on the following scope of work:

- A review of published soils and geological information;
- A site walkover of the BHL land by a senior environmental / geotechnical engineer to map areas of potential site instability, erosion risks and other potential geotechnical constraints;
- Excavation of 14 test pits (TP101 – 113 and TP115) within the site. DP notes that at the time of field work in 2020 the lot boundary extended further to the south, with five test pits positioned in this area (TP114 and TP116-119). As these locations are outside the current site boundary, discussion of these areas is not included in this report;
- Recovery of disturbed samples of soil and rock excavated from the test pits, to assist with strata identification and possible laboratory testing;
- Laboratory testing of selected samples for the assessment of a range of geotechnical properties; and
- Preparation of a report, outlining the scope of works undertaken, together with field work results and recommendations relating to design and construction practice.

4. Site Description

The site, incorporating Lots 2 and 4 in DP1216380, Lot 4 in DP1273487, and Lot 500 in DP1231858, is an irregular, roughly 'L'-shaped site, with maximum plan dimensions 1270 m long (approximately parallel to The Northern Road) by 1770 m wide (approximately east-west), and a combined area of about 169 hectares. The street address for the northern limit of the site is currently 670 The Northern Road, Cobbitty. The site is bounded to the north, south and west by rural residential and agricultural land, and to the east by The Northern Road.

Overall, the site generally slopes down towards the north, with elevations ranging between RL120 m-RL145 m along the southern site boundary (falling towards the west), RL96 m-RL120 m along the eastern site boundary (falling from south to north), and to about RL84 m near the northern limit of the site (i.e. the lowest point along the northern boundary of Lot 2 in DP1216380). Hillside slopes are present within each of the lots, although the slopes within Lot 2 in DP1216380 are generally shallow and relatively rounded.

At the time of the field work for the assessment, the site was mostly covered with grass and a scattering of tall trees, although sloping areas of the site were covered with tall and/or dense vegetation (including olive trees). Several dams are scattered across the site, being generally clustered in the north-eastern quadrant of Lot 500, and the eastern and western portions of Lot 4 in DP1216380 and Lot 4 in DP1273487. A location plan showing the positions of the current and previous test pits, and the 'Zone 2' and 'Zone 3' boundaries presented in our previous report (DP, 2022) are shown on Drawing 5 in Appendix B.

5. Regional Topography, Geology and Hydrogeology

5.1 Topography

The topography across most of the site is gently undulating, and appears to be controlled by an irregular ridge line which is present within the southern portion of the site. A series of incised gullies have formed, creating an ephemeral dendritic drainage system that flows into the farm dams.

As previously noted, site elevations fall from a topographical high-point of about RL145 m (relative to the Australian Height Datum (AHD)) adjacent to the south-eastern ridgeline and southern site boundary of Lot 4 in DP1273487, to a topographical low-point of approximately RL84 m adjacent to the northern boundary of Lot 2 in DP1216380. The ridgeline comprises steep upper slopes up to 30 degrees, with lower slopes of up to about 15 degrees. Most of the site's undulating terrain comprises slopes ranging between 0 – 10 degrees.

Construction of an access road and retaining walls was in progress along the south-eastern ridgeline, within two Lots adjoining Lot 4 in DP1273487 (including Lots 1-2 in DP1273487). It is understood that this work is part of a water storage reservoir project by Sydney Water.

5.2 Soil Landscape

Reference to the Penrith 1:100 000 Soils Landscape Sheet (Bannerman & Hazelton, 2011) indicates that that the following soil landscapes are present at the site (also refer to Figure 3 on the following page):

- Luddenham erosional landscape (mapping unit 'lu'): associated with the steeper areas of the site, including the Lots subject to slope instability;
- Blacktown residual landscape (mapping unit 'bt'): generally associated with the flatter areas of the site; and
- South Creek alluvial landscape (mapping unit sc): associated with a small sub-area of the site near the northern site boundary.

The Luddenham erosional soil landscape is characterised by undulating to rolling low hills on Wianamatta Group shales, with slope grades usually 5 - 20% and local relief of 50 - 80 m. Soils within this landscape are typically described as moderately reactive with a high erosion hazard. On crests and upper slopes (which is consistent with the observed topographic features within the southern and western portions of this site), these soils are typically described as dark brown or red podzolic soils, shallow to moderately deep (<1.0 m thick). On lower slopes and within drainage lines, these soils are typically described as yellow podzolic soils, moderately deep (<1.5 m thick).

The Blacktown residual soil landscape is characterised by gently undulating rises on Wianamatta Group shales, with slopes usually <5% and local relief to 30 m. Soils within this landscape are typically described as moderately reactive with low fertility, poor soil drainage and highly plastic subsoil. On crests, upper slopes and well drained areas, these soils are typically described as red and brown, shallow to moderately deep podzolic soils (<1.0 m thick). Elsewhere, on lower slopes and in areas of poor drainage, these soils are typically described as yellow, deep podzolic soils and soloths (1.5 - 3.0 m thick: which is consistent with the observed topographic features within the northern portions of this site).

The South Creek alluvial soil landscape is characterised by floodplains, valley flats and drainage depressions within channels across the Cumberland Plain, and are usually relatively flat with incised channels. Soils are often very deep and layered, overlying bedrock or relict residual soils (red and yellow podzolic soils). Soils within this landscape are typically described as being subject to erosion (hazard) and frequent flooding.

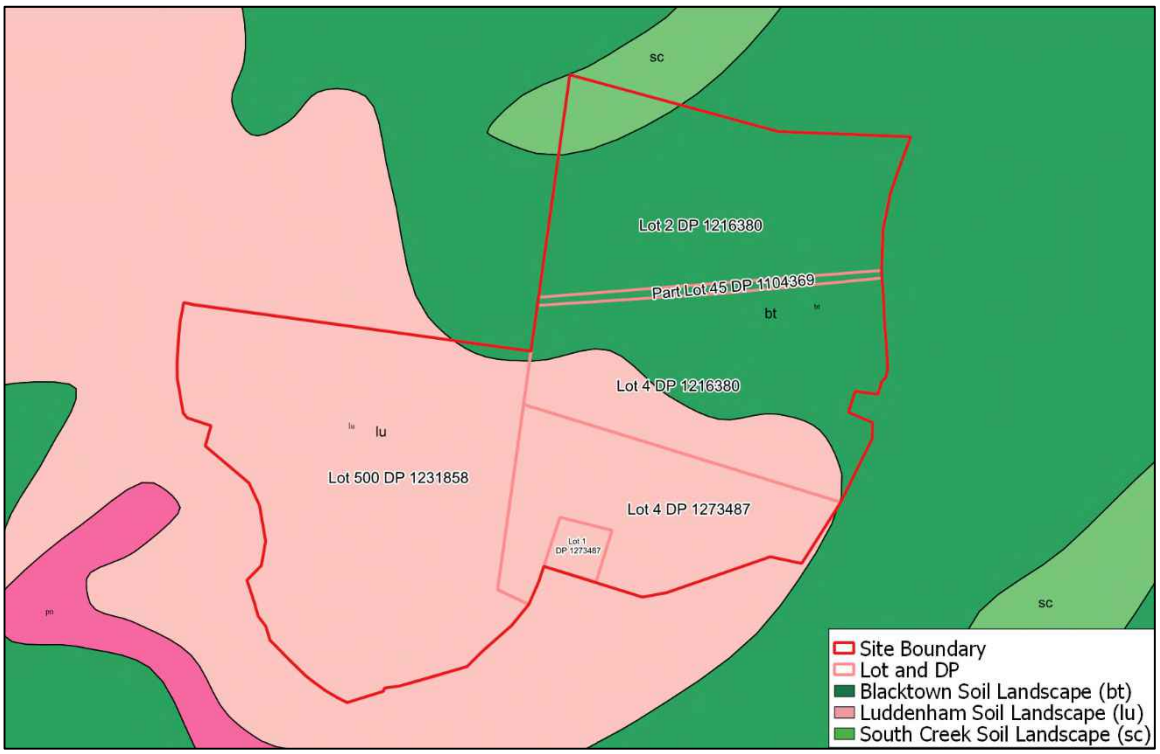

Figure 1 Penrith 1:100 000 Soils Landscape Sheet, with the site boundary for the revised ILP.

5.3 Site Geology

Reference to the Penrith 1:100 000 Geological Sheet (Herbert & Smith, 1991) indicates that the site is underlain by both Bringelly Shale (mapping unit Twib) of the Wianamatta Group of Triassic age and Fluvial Sediments (mapping unit Q_af) of Quaternary age. The Bringelly Shale formation typically comprises shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff. The Fluvial Sediments formation typically comprises fine-grained sand, silt and clay. Un-named sandstone members within the Bringelly Shale are present within the southern parts of the site, forming elongated ridgelines.

The NSW Seamless geology dataset (Colquhoun, et al., 2019) indicates that a broad, north-west striking synclinal fold structure is present within the western part of the site, with another synclinal fold structure present about 5 km to the north-east. This data indicates that Lot 4 in DP1273487 is on the eastern limb of the syncline, that most of Lot 500 in DP1231858 is on the western limb of the syncline, and that an anticline (or a series of more than one smaller anticlines) is likely to be present within the eastern part of the site. Therefore, bedding within the rock on the western side of the ridgeline is likely to be dipping towards the south-west, and bedding within the rock on the eastern side of the ridgeline could be dipping towards the north-east.

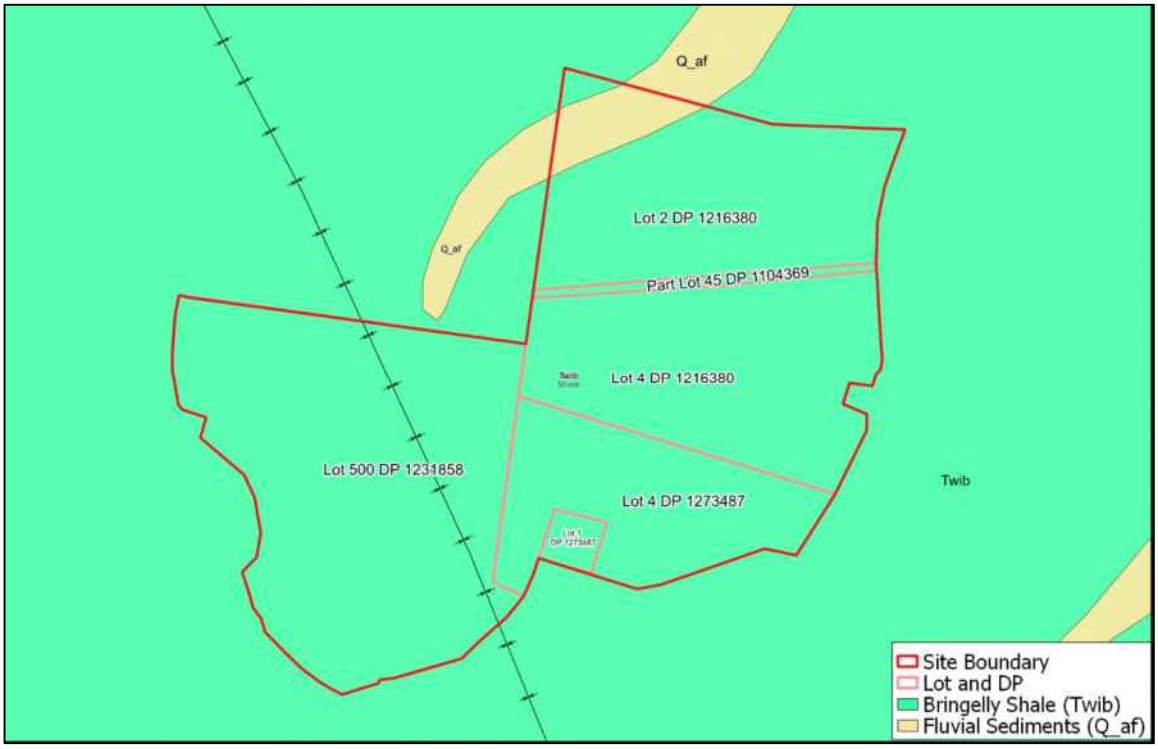

Figure 2 Penrith 1:100,000 Geological Sheet, with the site boundary for the revised ILP.

5.4 Hydrogeology

Ephemeral water courses traverse through the site in a general northerly direction, with farm dams present at a few locations within the ephemeral watercourses. Surface water is anticipated to flow towards the north along these ephemeral watercourses, towards Lowes Creek (about 2 km to the north).

A search of the publicly available registered groundwater bore database indicated that registered groundwater bores are not present within 1 km of the site.

Based on the regional surface topography and the inferred flow direction of the watercourses, the anticipated flow direction of groundwater beneath the site is northward towards Lowes Creek.

Given the presence of Bringelly Shale, groundwater within the rock beneath the site is anticipated to be brackish to saline, with the rock mass permeability likely to be dominated by flow through fractures / defects within the rock, and resultant low yields in groundwater wells (typically < 1 L/s). Accordingly, it is considered there would be no significant potential beneficial uses for groundwater which could be extracted from the underlying rock.

5.5 Soil Salinity

Western Sydney soil salinity mapping (NSW Department of Infrastructure, Planning and Natural Resources, 2002) shows that the site is considered to be predominantly in an area of moderate salinity potential, with an area of high salinity potential running through the centre of the site along the ephemeral

creek line. Approximate salinity potential boundaries, as shown on the salinity potential map, are shown on Drawing 2, in Appendix B.

The mapping is based on soil type, surface level and general groundwater considerations but is not generally 'ground-truthed', hence actual soil salinity needs to be assessed to confirm the potential salinity mapping.

6. Field Work Methodology

A site walkover was undertaken on 28 January 2020 by a senior DP geotechnical / environmental engineer to identify areas of potentially instability, areas that could be affected by salinity and/or erosion. Following the walkover, an investigation strategy was proposed to undertake a preliminary geotechnical assessment of the subsurface conditions.

Surface and subsurface investigations included:

- Excavation of 14 test pits across the site;
- Dynamic cone penetrometer (DCP) tests adjacent to the test pit locations, to assist in the assessment of near-surface in-situ soil strength; and
- Recovery of disturbed and undisturbed soil samples from the test pits for geotechnical, contamination and soil salinity laboratory testing.

The test pits were excavated by a John Deere 315SE backhoe using a 450 mm wide toothed bucket. The field work was undertaken between 28 and 31 January 2020. The test pit excavations were undertaken to a maximum depth of 3 m or shallower refusal on weathered rock. The test pit excavations were reinstated by backfilling the excavated soils in layers and tamped with the excavator bucket.

Geotechnical and salinity sampling from the test pits included the recovery of disturbed samples, 'bulk' 20 kg samples, and 'undisturbed' 50 mm diameter steel tube samples to assist with the visual classification and logging.

The coordinates of the test pits locations were recorded using a differential GPS receiver and a hand-held GPS unit. Horizontal positioning was referenced to the Map Grid of Australia 1994 (MGA94), Zone 56 datum. Vertical positioning was referenced to reduced levels (RL) relative to the Australian Height Datum (AHD).

7. Field Work Results

7.1 Site Observations

The following observations were made from the site walkover undertaken in 2020:

- Several farm dams are present within the site, one of which had been subject to piping failure of the soil embankment. The dam embankments comprise fill materials which are likely to have been locally sourced. It is noted that given the observed damage and absence of spillways, it is likely that the farm dams have not been structurally designed or constructed under engineering control;

- Lot 2 in DP1216380 was gently undulating with slopes generally not steeper than 5 degrees, except around the dam embankments and within creek lines;
- Lot 4 in DP1216380 was also gently undulating, though slope angles ranged up to 15 degrees in the central portions of the lot;
- Lot 500 in DP1231858 was also gently undulating, with slope angles ranging up to 10 degrees, except within creek and drainage lines. It is noted that beyond the southern and western boundaries the ground surface graded steeply upward, with measured slope angles of more than 25 degrees. The eastern portion of Lot 500 included slopes measured to be up to about 15 degrees, associated with a spur coming from the main ridge located on Lot 4 in DP1273487; and
- Lot 4 in DP1273487 is positioned at the termination of a south-west to north-east trending ridgeline, associated with steep slopes measured to be in excess of 25 degrees. The steepest slopes observed were on the slopes facing north-west and south-east. The ridgeline was heavily vegetated with 'African Olive', which made inspection of surface features difficult.

7.2 Subsurface Conditions

The test pit logs are included in Appendix D, together with notes defining classification methods and descriptive terms. A total of 14 test pits were carried out within the proposed development area.

The test pits encountered generally uniform conditions underlying the site, consistent with the available regional mapping. The succession of strata at the site is broadly summarised as follows:

- FILL – Fill materials were observed to 0.8 m depth in test pit TP108, including silty clay with trace gravel and anthropogenic inclusions (including brick fragments, roof tiles, metal and concrete);
- TOPSOIL – Topsoil was observed within all test pits to depths of up to 0.4 m (except test pit TP108), and comprised grey/brown silty clay with trace ironstone gravel and sand;
- SILTY CLAY – variably stiff to hard, grey, brown, yellow and red silty clay residual soils of medium to high plasticity, with trace sandstone gravels and sands observed at depth. Silty clay residual soils were observed within each of the test pits below depths of 0.9 m to a maximum depth of 4.5 m. Silty clay was observed grading into extremely weathered rock with increasing depth and prior to encountering weathered bedrock.
- BEDROCK:
  - SILTSTONE – pale brown and grey siltstone (with orange-brown iron staining), very low to low strength and moderately to slightly weathered. Clay seams were observed in test pit TP110 to the maximum depth of investigation, and within test pit TP112 between depths of 1.4 - 2.1 m. A band of grey, iron-stained, low strength, highly weathered shale (siltstone) was observed in test pit TP106 between depths of 1.9 - 2.8 m (i.e. between layers and seams of extremely weathered rock); and
  - SANDSTONE – brown to grey, low strength to medium strength, moderately weathered, fine grained sandstone was observed in test pits TP101, TP103, TP105, TP107 to TP109, TP113 and TP115, to the maximum depth of investigation (or refusal to the backhoe bucket).

Free groundwater was not observed in any of the test pits during excavation, and for the short time that the pits were open. It is noted that the test pits were immediately backfilled following excavation, logging and sampling which precluded long-term groundwater observations. It is also noted that groundwater levels are transient and are affected by preceding climatic conditions, soil/rock permeability and downslope drainage conditions, and therefore groundwater levels can vary over time. A separate

investigation of groundwater, including the installation of monitoring wells has been undertaken separately (refer to Project 92225.04.R.002.Rev0).

8. Laboratory Testing

8.1 Geotechnical

Selected samples of soil and weathered rock were collected from the test pits during the field investigation and submitted to DP's NATA-accredited laboratory for testing. Test results are summarised in Tables 1 and 2, and the test reports included in Appendix E. For completeness, the test results for samples obtained from test pits TP114 and test pits TP116 to TP119 (which are outside of the current development boundary) are included and summarised in this report for completeness.

Table 1: Laboratory Test Results (Geotechnical)

Test Pit ID	Depth (m)	FMC	PL (%)	LL (%)	PI (%)	Linear shrinkage (%)	I_{ss} (%/ΔpF)	ECN	Swell (%)	Material
TP101	0.5-0.9	-	-	-	-	-	2.7	-	7.3	Silty Clay
TP101	1.5	-	-	-	-	-	-	2	-	Silty Clay
TP102	0.5	-	-	-	-	-	-	2	-	Silty Clay
TP103	0.5	-	-	-	-	-	-	-	-	Silty Clay
TP103	1.5	7.4	17	35	18	9.0	-	-	-	Sandstone
TP104	0.5	-	-	-	-	-	-	6	-	Silty Clay
TP105	0.5	-	-	-	-	-	-	6	-	Silty Clay
TP106	0.5	-	-	-	-	-	-	2	-	Silty Clay
TP107	0.5	16.2	21	74	53	11.5	-	3	-	Silty Clay
TP108	0.5-0.9	17.7	19	39	20	9.0	-	5	-	Silty Clay
TP109	0.5	-	-	-	-	-	-	2	-	Silty Clay
TP110	1.5	11.6	19	67	48	13.5	-	2	-	Silty Clay
TP111	1.5	-	-	-	-	-	-	2	-	Silty Clay
TP112	0.5-0.9	-	-	-	-	-	3.0	-	7.2	Silty Clay
TP112	1.5	-	-	-	-	-	-	2	-	Silty Clay
TP113	1.5	-	-	-	-	-	-	2	-	Silty Clay
TP115	0.5	-	-	-	-	-	-	3	-	Silty Clay
TP115	1.5	11.6	17	50	33	13.5	-	-	-	Silty Clay

Where: MC = Field Moisture Content; I_{SS} = Shrink-swell Index; ECN = Emerson Class Number; LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index

The laboratory test results indicate that the residual clay soils are of medium to high plasticity and moderate reactivity, which are both considered to be typical for the region. The Emerson Class Number (ECN) for a soil relates to the potential for the soil to slake and disperse. Emerson Class Numbers which are 'higher' correspond to soils with a lower tendency to disperse: test results of 5 and 6 indicate

a tendency for the soil to slake with a low susceptibility to dispersion whereas test results of 2 and 3 indicate a tendency for the soil to slake with some dispersion (possibly more when re-moulded).

The laboratory test results confirm the consistent clayey nature of the soils at the site, and indicate that soil classifications correspond to inorganic clays of medium to high plasticity (CH).

Table 2: Results of California Bearing Ratio Tests (4-day soak)

Test Pit ID	Sample Depth (m)	OMC (%)	MDD (t/m^3)	CBR (%)	Material
TP102	1.0	13.0	2.00	1.7	Silty clay with gravel
TP105	0.5	14.5	1.81	13	Silty clay with gravel
TP111	1.0	13.5	1.94	2.0	Silty clay with gravel

Where: OMC = Optimum Moisture Content MDD = Maximum Dry Density
CBR = California bearing ratio (4-day soak)

The California bearing ratio (CBR) test result from test pit TP105 (13%, 4-day soak) is greater than the typical expected range, which is considered to be due to the silt and gravel content within a predominantly medium to high plasticity clay matrix. Whilst the result is an accurate determination of a small, remoulded laboratory sample, it is considered that it overstates the in-situ subgrade strength. As such, downgrading will need to be undertaken for pavement thickness design purposes.

8.2 Salinity

Soil salinity is typically assessed with respect to electrical conductivity of a 1:5 soil:water extract ($EC_{1:5}$). This value can be converted to ECe (electrical conductivity of a saturated extract) by multiplication with a factor dependent on soil texture, ranging between 6 for heavy clay soils to 17 for sand soils. Soil salinity can be classified on the basis of ECe (Hazelton & Murphy, 1992). The salinity classes and their implications on agriculture are summarised in Table 3.

Table 3: Soil Salinity Classification

Soil Salinity Class	ECe (dS/m)	Implication
Non Saline	<2	Salinity effects mostly negligible
Slightly Saline	2 – 4	Yields of sensitive crops affected
Moderately Saline	4 – 8	Yields of many crops affected
Very Saline	8 – 16	Only tolerant crops yield satisfactorily
Highly Saline	>16	Only a few very tolerant crops yield satisfactorily

Following the field investigation, 41 soil samples were submitted to NATA-accredited laboratories to carry out tests for soil salinity. Testing was generally undertaken in accordance with the guidelines presented in the *Site Investigations for Urban Salinity* booklet, as published in 2002 by the Department of Land and Water Conservation. The chemical tests completed on soil samples included determination of pH, electrical conductivity (1:5), sulphate and chloride concentration, and soil texture classification. Detailed test reports are presented in Appendix E. A summary of the test results is presented in Table 4.

Table 4: Laboratory Test Results (Salinity)

Test Pit ID	Depth (m)	EC1:5 (µS/m)	Texture Class	ECe (dS/m)	pHw (1:5)	Aggr. to Concrete (from sample pH)	Aggr. to Steel (from sample resistivity)	Salinity Comments
TP101	0.5	136.4	7.0	1.0	7.5	Non-Aggressive	Non-Aggressive	Non-Saline
TP101	1.5	548	8.0	4.4	6.8	Non-Aggressive	Mild	Moderately Saline
TP101	2.5	316	7.0	2.2	6.9	Non-Aggressive	Non-Aggressive	Slightly Saline
TP102	0.5	130	7.0	0.9	7.2	Non-Aggressive	Non-Aggressive	Non-Saline
TP102	1.5	498	7.0	3.5	6.5	Non-Aggressive	Non-Aggressive	Slightly Saline
TP102	2.5	669	8.0	5.4	6.3	Non-Aggressive	Mild	Moderately Saline
TP103	0.5	56.9	7.0	0.4	7.3	Non-Aggressive	Non-Aggressive	Non-Saline
TP103	1.5	510	9.0	4.6	6.3	Non-Aggressive	Mild	Moderately Saline
TP104	0.5	34.6	9.0	0.3	7.4	Non-Aggressive	Non-Aggressive	Non-Saline
TP104	1.5	304	8.0	2.4	6.4	Non-Aggressive	Non-Aggressive	Slightly Saline
TP104	2.5	614	8.0	4.9	5.8	Non-Aggressive	Mild	Moderately Saline
TP105	0.5	65.6	9.0	0.6	6.9	Non-Aggressive	Non-Aggressive	Non-Saline
TP105	1.5	104.9	8.0	0.8	6.6	Non-Aggressive	Non-Aggressive	Non-Saline
TP105	2.5	97.4	7.0	0.7	6.6	Non-Aggressive	Non-Aggressive	Non-Saline
TP106	0.5	79.4	8.5	0.7	6.7	Non-Aggressive	Non-Aggressive	Non-Saline
TP106	1.5	772	8.0	6.2	7.1	Non-Aggressive	Mild	Moderately Saline
TP106	2.5	387	7.0	2.7	7.3	Non-Aggressive	Non-Aggressive	Slightly Saline
TP107	0.5	80.7	7.0	0.6	7.6	Non-Aggressive	Non-Aggressive	Non-Saline
TP107	1.5	629	8.0	5.0	6.6	Non-Aggressive	Mild	Moderately Saline

Test Pit ID	Depth (m)	EC1:5 (µS/m)	Texture Class	ECe (dS/m)	pHw (1:5)	Aggr. to Concrete (from sample pH)	Aggr. to Steel (from sample resistivity)	Salinity Comments
TP107	2.5	407	7.0	2.8	6.8	Non-Aggressive	Non-Aggressive	Slightly Saline
TP108	0.5	123.9	8.5	1.1	7.1	Non-Aggressive	Non-Aggressive	Non-Saline
TP108	1.5	123.2	8.0	1.0	7.1	Non-Aggressive	Non-Aggressive	Non-Saline
TP108	2.5	267	8.5	2.3	6.7	Non-Aggressive	Non-Aggressive	Slightly Saline
TP109	0.5	1084	8.0	8.7	5.8	Non-Aggressive	Moderate	Very Saline
TP109	1.5	823	7.0	5.8	6.0	Non-Aggressive	Mild	Moderately Saline
TP109	2.5	679	7.0	4.8	6.1	Non-Aggressive	Mild	Moderately Saline
TP110	0.5	270	7.0	1.9	6.5	Non-Aggressive	Non-Aggressive	Non-Saline
TP110	1.5	488	7.0	3.4	6.2	Non-Aggressive	Non-Aggressive	Slightly Saline
TP110	2.5	565	7.0	4.0	6.1	Non-Aggressive	Mild	Slightly Saline
TP111	0.5	27.5	7.0	0.2	7.4	Non-Aggressive	Non-Aggressive	Non-Saline
TP111	1.5	384	7.0	2.7	6.9	Non-Aggressive	Non-Aggressive	Slightly Saline
TP111	2.5	813	7.0	5.7	6.6	Non-Aggressive	Mild	Moderately Saline
TP112	0.5	290	8.0	2.3	7.0	Non-Aggressive	Non-Aggressive	Slightly Saline
TP112	1.5	413	7.0	2.9	6.7	Non-Aggressive	Non-Aggressive	Slightly Saline
TP112	2.5	643	8.0	5.1	6.6	Non-Aggressive	Mild	Moderately Saline
TP113	0.5	102.2	8.5	0.9	7.3	Non-Aggressive	Non-Aggressive	Non-Saline
TP113	1.5	745	9.0	6.7	6.4	Non-Aggressive	Mild	Moderately Saline
TP113	2.5	651	10.0	6.5	6.4	Non-Aggressive	Mild	Moderately Saline

Test Pit ID	Depth (m)	EC1:5 (µS/m)	Texture Class	ECe (dS/m)	pHw (1:5)	Aggr. to Concrete (from sample pH)	Aggr. to Steel (from sample resistivity)	Salinity Comments
TP115	0.5	62.9	7.0	0.4	7.4	Non-Aggressive	Non-Aggressive	Non-Saline
TP115	1.5	454	7.0	3.2	6.4	Non-Aggressive	Non-Aggressive	Slightly Saline
TP115	2.5	391	8.0	3.1	6.4	Non-Aggressive	Non-Aggressive	Slightly Saline

Where $EC_{1:5}$ = Electrical Conductivity
EC_e = Electrical Conductivity corrected for soil texture
pHw = pH in water

Based on the limited extent of testing undertaken, the results indicate that for the accessible areas of the site and for tests completed within the upper 2.5 m of the soil profile, the soil conditions were:

- *non-saline* to *moderately-saline* (with one sample recording *very-saline*);
- classified as *non-aggressive* to concrete; and
- classified as *non-aggressive to mildly aggressive* to buried steel (with one sample classified as *moderately aggressive* to buried steel).

9. Comments

9.1 Slope Stability

Portions of the site are affected by slope instability. The various areas of the site have been divided into three zones ('Zone 1' to 'Zone 3'), dependent upon the inferred potential of these areas to be affected by slope instability. These delineated zones of potential constraints to development are:

- Zone 1: No constraint, or only minor constraints;
- Zone 2: Intermediate constraint; and
- Zone 3: Major constraint.

The inferred boundaries of these zones are given on Drawing 5. Descriptions of each of the zones and preliminary comments on the likely constraints to development for each zone are outlined below.

Zone 1: No Constraint or Minor Constraint

The land in this zone comprises gently-graded slopes which are incised by a few minor drainage gullies. Other than soil slumping from low-height gully sides, which has probably been triggered by soil erosion and with the volume of movement-affected materials probably no more than a few cubic metres, there does not appear to be a significant risk of soil slope / gully instability. It is considered that potential instability of these low-height slopes (along drainage lines) would impose only a minor constraint to development, which could be addressed by good engineering practices during the construction phase of the project.

Apart from the low-height drainage gully slopes, the other relatively flat areas of 'Zone 1' (which includes most of the site) are considered not to pose a constraint to development with respect to slope instability.

Zone 2: Intermediate Constraint

The lower and mid-slopes below the ridgelines on the southern part of the site comprise thick soil profiles of the Blacktown (residual) and Luddenham (erosional) soil landscapes, which have been documented as being prone to slope instability (slumping and soil creep) when triggered by erosion or groundwater seepage, particularly on steep slopes underlain by shale. The low permeability, poorly draining clayey soils can lose strength due to saturation induced by periods of high rainfall or where natural drainage has been disturbed by development. The slopes below the ridgelines could be affected by 'run-out' of landslides from steeper terrain above.

It is considered that potential soil creep or shallow slump instability is likely to impose minor to moderate development constraints which can be addressed by good engineering practices for hillside development (including site-specific investigation and engineering of structures), while areas of run-out from landslides further upslope may be a major constraint to development.

Zone 3: Major Constraint

The upper slopes of the highest sections of the ridgelines within the southern part of the site are considered to be affected by deep-seated hillslope instability. Numerous historical landslides have been mapped within the upper hillside slopes adjacent to ridgelines. Although many of these historical landslides are external to the site boundary, portions of the site could be affected by run-out of a significant landslide event.

The potential for instability (or re-activation of previous instability) is a major constraint to development within these areas, and it may be difficult to provide cost-effective engineering solutions for proposed development in these areas. Construction of buildings should be avoided without completion of specific geotechnical investigations, probably in conjunction with the installation of slope stabilisation measures and the implementation of other engineering recommendations.

Further specific investigation will be required prior to or in conjunction with the planning process for development within Zones 2 and 3, to more accurately delineate the zones subject to development constraints, assess the risk of instability, and provide engineering recommendations. It is noted that additional investigations for this purpose are currently in preparation.

9.2 Erosion Potential

No obvious signs of significant active soil erosion were identified at the site during the site walkover inspection. The Emerson Class Number laboratory test results were generally in the range 2 to 3, which indicates the presence of dispersive soils on site that would be susceptible to erosion if subjected to overland flows.

Given the potential for erosion of the site soils, development should avoid creation of landforms which concentrate overland stormwater or other drainage flows. As this is not always possible, the following measures could be adopted to reduce the risk of soil erosion:

- Placement of 'select' fill materials within overland flow paths (i.e. non–dispersive, or less erodible), placed under controlled conditions;

- Provision of a temporary surface cover within overland flow paths (e.g. biodegradable matting, pegged in place), during gully floor re-vegetation;
- Placement of a lining within drainage channels, over lengths of channel where there is a rapid change in grade;
- Discharge of collected water flows through a piped stormwater network, where appropriate; and
- Re-establishment of an appropriate vegetated zone within areas of disturbed soil, to protect the ground surface over the long-term.

It is considered that the erosion hazard within the areas proposed for urban development would be within usually accepted limits, and can be managed by good engineering and land management practices.

9.3 Preliminary Soil Salinity and Aggressivity Assessment

The laboratory testing conducted indicates that the subsurface materials within the site are *non-saline to very saline,* and would be classified as *non-aggressive* to concrete and *non-aggressive to moderately-aggressive* to buried steel (AS 2159, 2009).

Based on the test results, the 'worst case' resistivity values for each test pit were interpolated to define approximate extents for each aggressivity classification (to buried steel) within the accessible portion of the site, as represented by colour zones on Drawing 3 (Appendix B). Based on the reported ECe values from test pits, 'worst case' values were interpolated and contoured to define approximate extents for each salinity classification (within accessible portions of the site), as represented by colour zones on Drawing 4.

Potential constraints to development due to soil salinity can be addressed using good engineering practices typical for the region. Further salinity assessment to inform a salinity management plan will be required prior to Development application for individual development stages.

9.4 Site Preparation and Earthworks

9.4.1 Topsoil

Topsoil is relatively shallow across the site, typically to depths of up to 0.4 m below the existing ground surface level. It is expected that topsoil thickness will be locally deeper in some parts of the site. Minimisation of topsoil stripping should be relatively easily managed during bulk earthworks, and is unlikely to result in generation of significant excess material. Stripping operations should be undertaken under the guidance of a geotechnical engineer, to assist with delineation of the extent and depth of topsoil to be removed prior to bulk earthworks, and to minimise unnecessary over-excavation.

9.4.2 Rock

Depth to the top of weathered rock within widely-spaced test pits was observed to be quite variable, typically ranging between 1.5 m to more than 3 m depth below the existing ground surface. Deeper soil profiles with deeper weathering profiles were encountered within some portions of the site, however, these areas could not be clearly delineated in the present study due to the limited number of test locations. Generally, it is expected that cut-to-fill earthworks in these areas could be undertaken using

conventional earthmoving equipment, possibly in conjunction with light to medium ripping with bulldozers (e.g. D6 – D9 bulldozers, or equivalent) in areas where deeper excavation is proposed that will likely encounter weathered bedrock.

It is anticipated for some areas of the site that ripping of weathered bedrock may generate 'oversize' particles of rock, which may need to be further processed on-site (such as using pneumatic hammers or crushing plant) before they can be re-used in filling operations. Rock 'oversize' generated from Wianamatta Shale rocks is generally not suitable to be used to construct retaining walls due to its propensity to degrade and weather over time. Further investigation of the variation in rock depth and rippability (rock quality) should be undertaken in areas of the site where excavation is proposed, when bulk earthworks plans are available.

9.4.3 Site Preparation

Site preparations within portions of the site where construction of structures and pavements are proposed should include the removal of topsoils and other deleterious materials (as determined by a geotechnical engineer).

Following completion of stripping, areas of the site where surface levels are to be raised by placement of fill materials should be test rolled in the presence of a geotechnical engineer or senior soils technician, to confirm that there are no 'soft spots' within the exposed surface. Any areas exhibiting significant deflections during test rolling should be rectified by excavation of the weak material and replacement with low plasticity fill material, placed in near-horizontal layers of (loose) thickness not greater than 250 mm. Each layer should be compacted to a minimum dry density ratio of 98% relative to Standard compaction (but not greater than 102%), with the 'as placed' moisture contents maintained within 2% of standard optimum moisture content. For pavement areas, the subgrade surface should be compacted to achieve a minimum dry density ratio of 100% relative to Standard compaction, with the placement moisture contents maintained within 2% of standard optimum moisture content.

To validate site classifications, field inspections and in situ testing of future earthworks should be undertaken to satisfy the requirements of Level 1 geotechnical inspection and testing, as defined in Australian Standard AS 3798 (AS 3798, 2007). It should be noted that Level 1 inspection and testing requires full-time geotechnical presence during all aspects of the earthworks program.

Batters required for pavement construction should be formed no steeper than 3H:1V in the residual clays and any engineered fill material. All batters should be protected against erosion with toe and spoon drains, constructed to minimise surface water flows down the slope batters.

If embankments are proposed for use as water quality control ponds, then the results of testing completed to date indicates that the site soils may be suitable for re-use as embankment materials, subject to further testing of sodicity and erosion potential. Preliminary design of detention basins (i.e. short term storage only) could be dimensioned with maximum batter slopes of 4H:1V, with allowance made to incorporate erosion control measures (such as topsoiling and turfing) if soils are used which have Emerson Class Number test results of less than 4. Subject to design permeability requirements, the use of liners for both the embankments and within parts of the reservoir area may also be necessary.

Site observations indicate that silty topsoils and silty clay residual soils are present, which could be adversely affected by inclement weather. Whilst these soils are typically of a stiff to very stiff consistency when dry, they can rapidly lose strength during rainfall and subsequent partial saturation, resulting in difficult trafficability conditions. To minimise the potential for soil saturation within work areas, surface

drainage should be installed prior to commencement of bulk excavations, to re-direct surface flows away from work areas. Haul routes should be selected to minimise trafficking of stripped areas.

Conventional sediment and erosion control measures should be implemented during the construction phase, with exposed surfaces to be covered with topsoil and re-vegetated as soon as practicable following the completion of earthworks.

10. Further Investigation

The results of the previous land capability assessment and the current preliminary geotechnical and salinity assessment indicate that development of the site is geotechnically feasible. Further investigation will be required as the project progresses to Development Application. Any proposed future development within portions of the site delineated as either 'Zone 2' or 'Zone 3' will require additional investigation and geotechnical consultation. A geotechnical consultant with experience in slope instability and geotechnical remedial works must be engaged during the concept planning for the works to ensure that the geotechnical constraints on development are addressed. As noted in Section 9.1, areas of the site delineated as 'Zone 3' are considered to have major constraints to development, and it may be difficult to provide cost-effective engineering solutions for proposed development in these areas. As such, development in these areas should be considered to be high risk.

Additional work will also be required during the project's construction phase. Specific investigation would typically be undertaken at the appropriate development application or construction certificate stage and would include (but not necessarily be limited to):

- Review of bulk earthworks plans, together with a rock depth and rippability assessment (if considered necessary);
- Additional testing of site soils for erosion and dispersion, to assist with the detailed design of future water retention structures or drainage areas, and confirmation of the potential for site soils to be used to line water retention structures.
- Detailed geotechnical investigations on a stage-by-stage basis, to determine pavement thickness designs and lot classifications, and to address stage-specific issues such as deep excavations, construction of pavements, and construction of dwellings/structures on steeper landforms and/or slope crests;
- Salinity investigations on a stage-by-stage basis, prior to submission of a Development Application; and
- Completion of geotechnical inspections and earthworks monitoring during construction.

11. References

AS 2159 (2009). *Piling - Design and Installation.* Standards Australia.

AS 3798 (2007). *Guidelines on Earthworks for Commercial and Residential Developments.* Standards Australia.

Bannerman, S. M., & Hazelton, P. A. (2011). *Soil Landscapes of the Penrith 1:100,000 Sheet report.* Office of Environment and Heritage, Sydney.

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DP (2017). *Salinity Review, 621 - 705 The Northern Road, Bringelly, NSW.* Macarthur: Douglas Partners Pty Ltd, Report 92225.00.R.002.Rev1.

Hazelton, P. A., & Murphy, B. W. (1992). *What do all the numbers mean? A Guide for the Interpretation of Soil Test Results.* Department of Conservation and Land Management, Sydney.

Herbert, C., & Smith, V. (1991). *Penrith 1:100,000 Geology Sheet, 1st edition.* Geological Survey of New South Wales, Sydney.

NSW Department of Infrastructure, Planning and Natural Resources (2002). *Map of Salinity Potential in Western Sydney.*

Richards, L. A. (1954). *Diagnosis of Saline and Alkaline Soils.* Washington D.C: US Department of Agriculture.

12. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 621 - 705 The Northern Road, Cobbitty in accordance with DP's proposal MAC180379.P.001.Rev1. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Boyuan Bringelly Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the 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 assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in

design' assessment is outside the current scope of this report and requires additional project data and assessment.

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

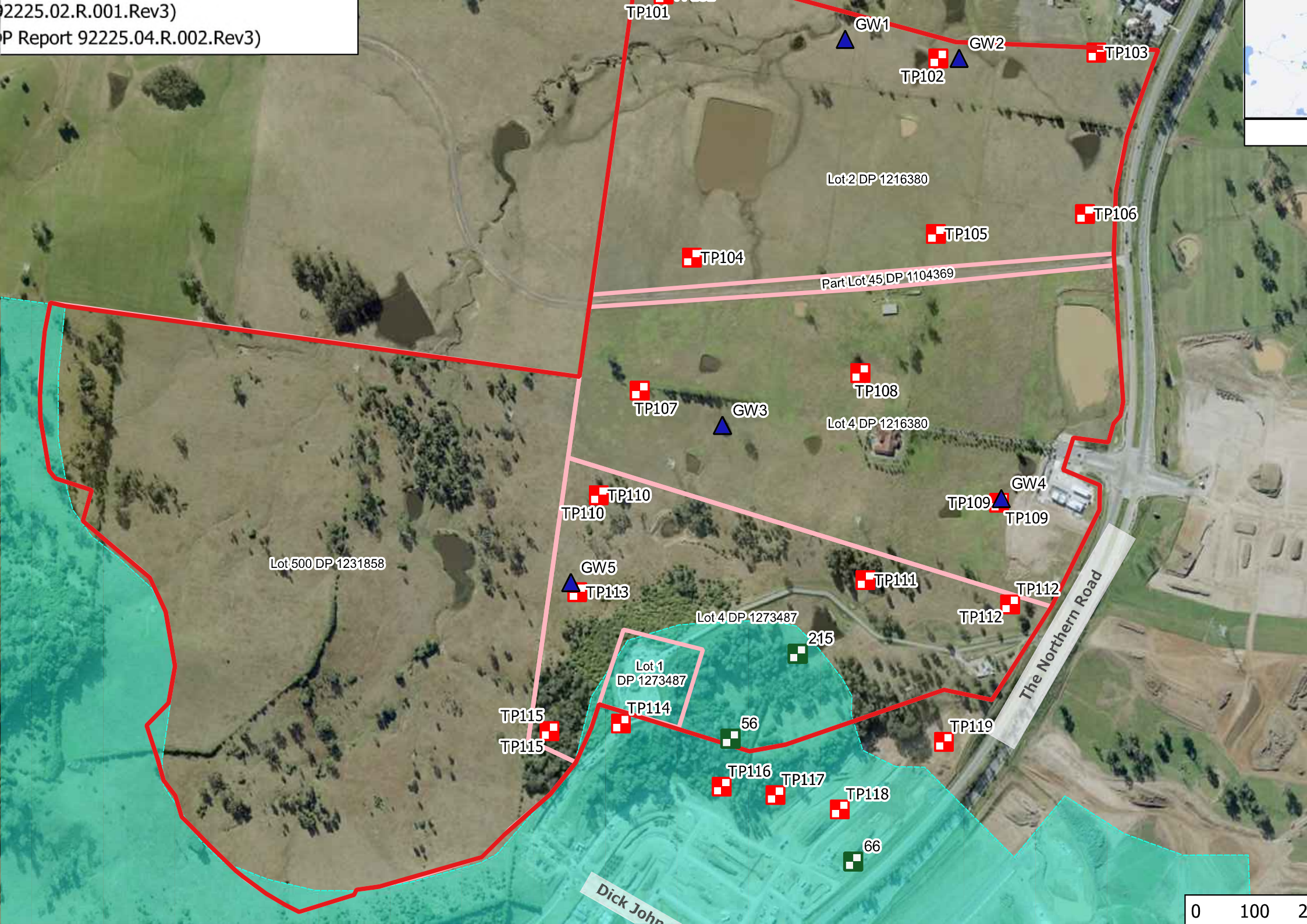
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

Site Inspection

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

Appendix B

Drawings 1 to 5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TP104
Part Lot 45 DP 1104369
TP108
TP107
GW3
Lot 4 DP 1216380
GW4
TP109
TP109
TP110
TP110
Lot 500 DP 1231858
GW5
TP113
TP111
TP112
TP112
Lot 4 DP 1273487
215
Lot 1
DP 1273487
TP114
TP115
TP115
56
TP119
The Northern Road
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TP117
TP118
66
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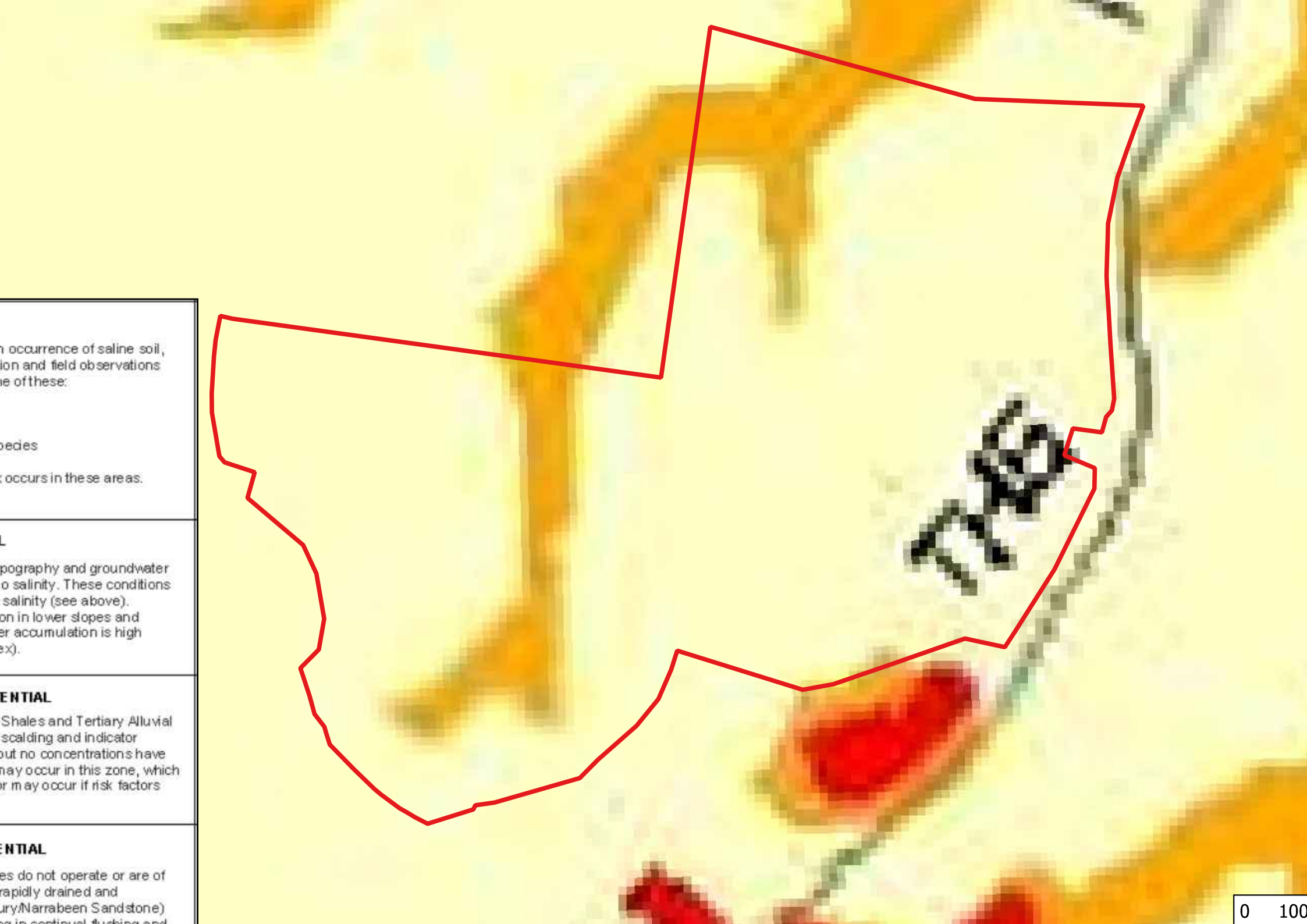
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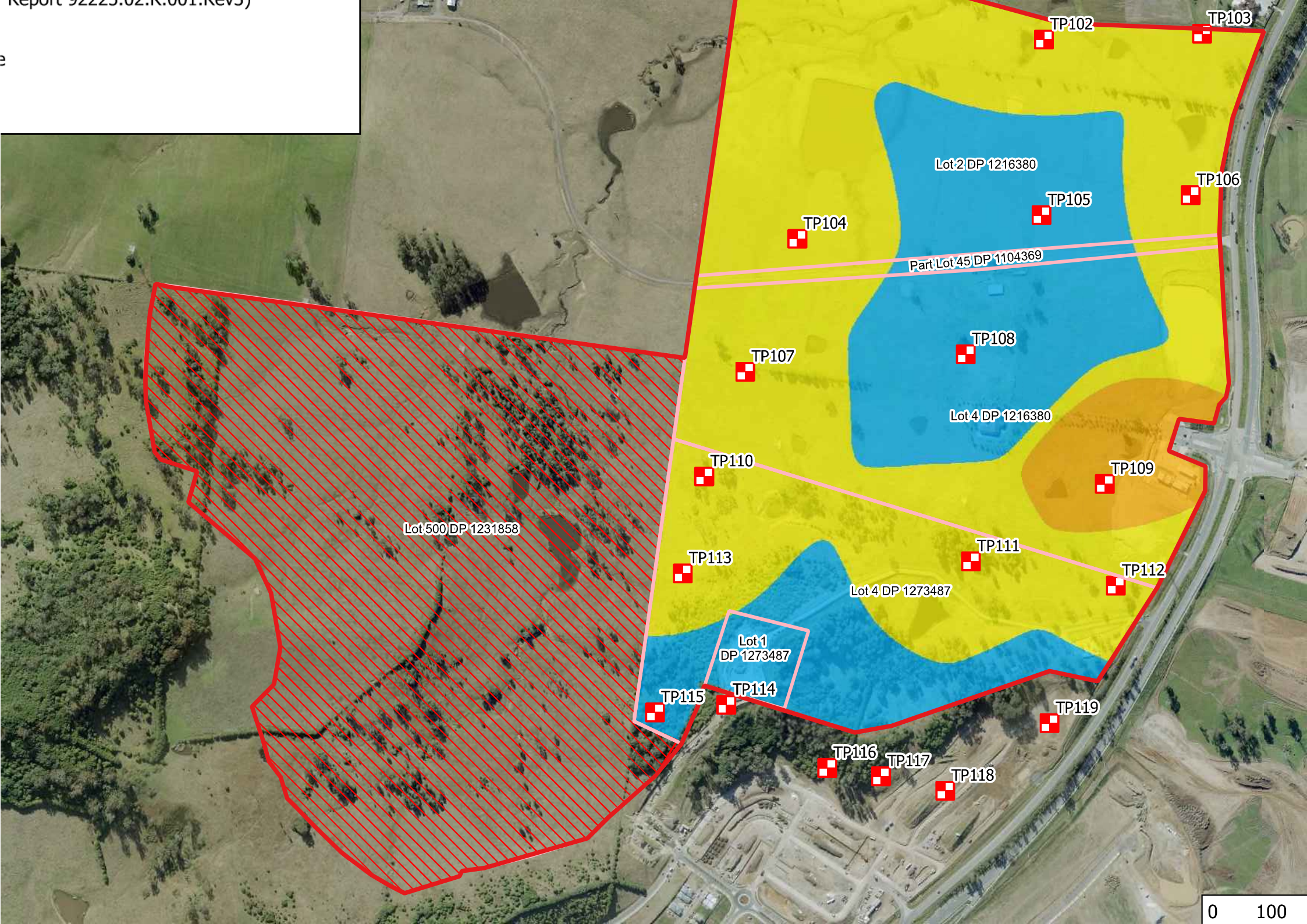
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TP102
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TP108
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Lot 4 DP 1216380
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Lot 500 DP 1231858
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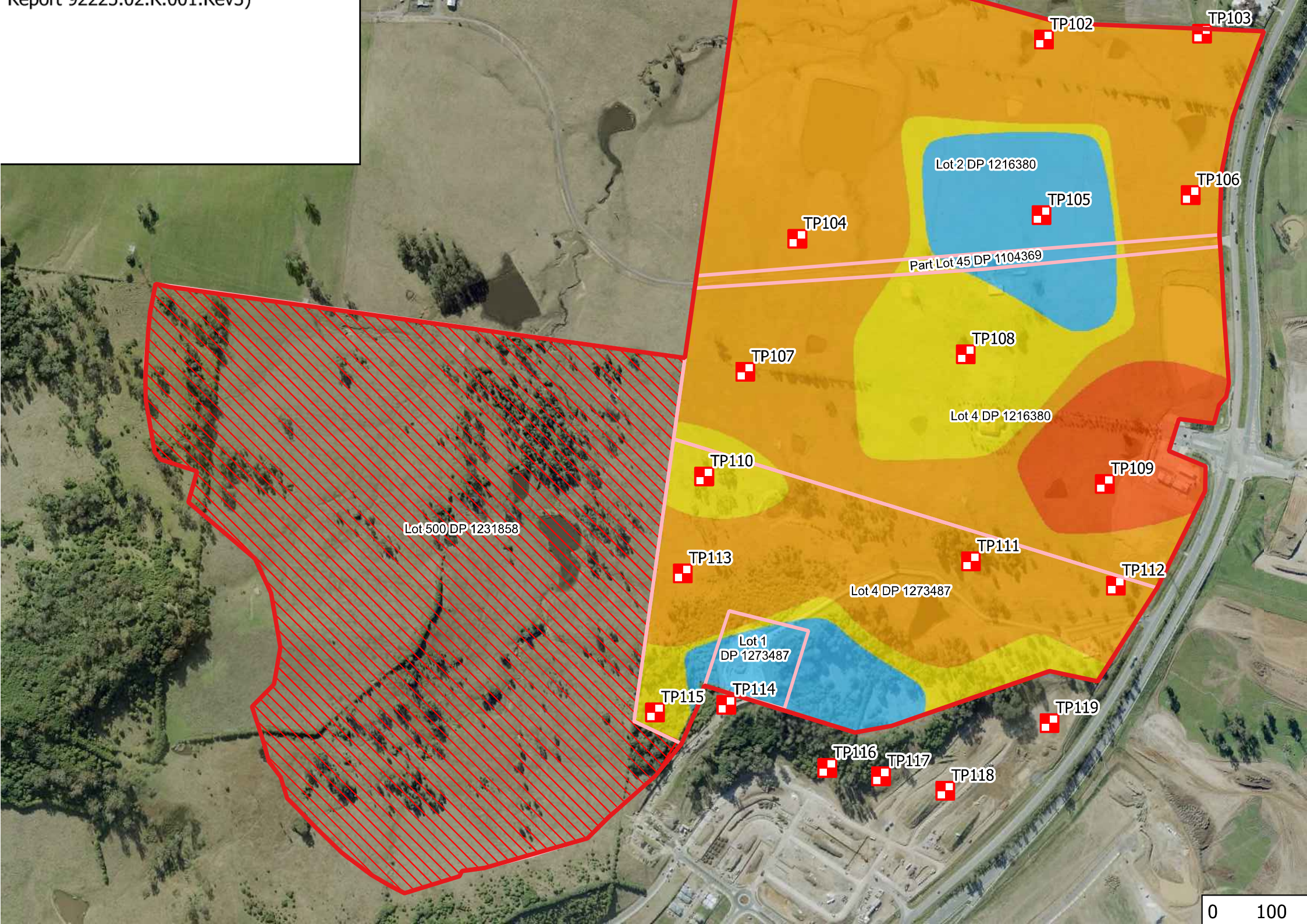

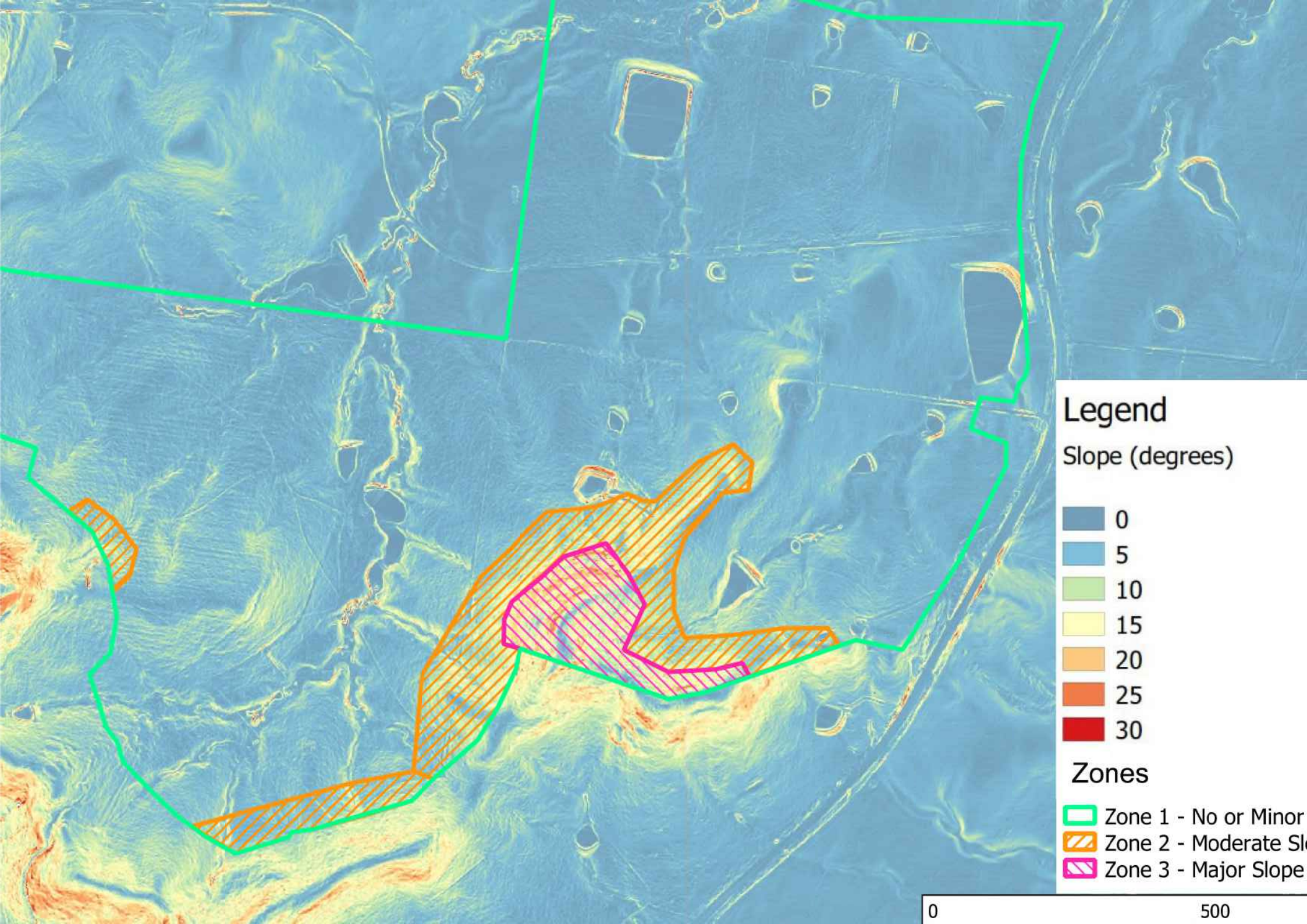
Legend
Slope (degrees)
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5
10
15
20
25
30
Zones
Zone 1 - No or Minor
Zone 2 - Moderate Sl
Zone 3 - Major Slope
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500

Appendix C

Site Photographs

Photo 1 - General Site Photograph

Photo 2 - General Site Photograph

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92225.04
	Preliminary Site Investigation	PLATE No: 1
	621 - 705 The Northern Road, Cobbitty	REV: 0
	CLIENT: Boyuan Bringelly Pty Ltd	DATE: Aug-20

Photo 3 - General Site Photograph

Photo 4 - Observed Fly Tipping

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92225.04
	Preliminary Site Investigation	PLATE No: 2
	621 - 705 The Northern Road, Cobbitty	REV: 0
	CLIENT: Boyuan Bringelly Pty Ltd	DATE: Aug-20

Photo 5 - Potential ACM Pipe

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs Preliminary Site Investigation 621 - 705 The Northern Road, Cobbitty CLIENT: Boyuan Bringelly Pty Ltd	PROJECT: 92225.04 PLATE No: 3 REV: 0 DATE: Aug-20

Appendix D

Test Pit Logs

Sampling Methods

Douglas Partners

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.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. 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	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

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

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with ‘Mix of Soil and Cobbles/Boulders’ with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

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
Friable	Fr	-

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	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

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;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w <PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w >PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈LL' (i.e. near the liquid limit).
- 'Wet' or 'w >LL' (i.e. wet of the liquid limit).

Rock Strength

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

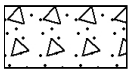
Symbols & Abbreviations

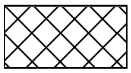
Graphic Symbols for Soil and Rock

General


Asphalt


Road base

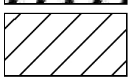

Concrete


Filling

Soils


Topsoil

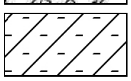

Peat


Clay


Silty clay

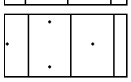

Sandy clay

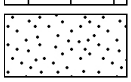

Gravelly clay

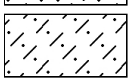

Shaly clay

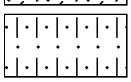

Silt


Clayey silt

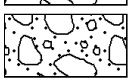

Sandy silt

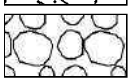

Sand

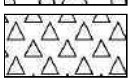

Clayey sand


Silty sand

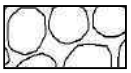

Gravel

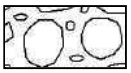

Sandy gravel


Cobbles, boulders

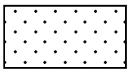

Talus

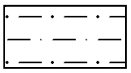
Sedimentary Rocks

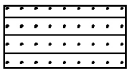

Boulder conglomerate

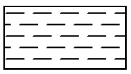

Conglomerate


Conglomeratic sandstone

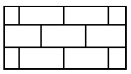

Sandstone


Siltstone

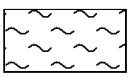

Laminite

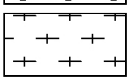

Mudstone, claystone, shale

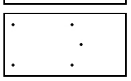

Coal


Limestone

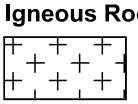
Metamorphic Rocks

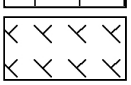

Slate, phyllite, schist

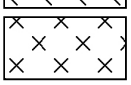

Gneiss

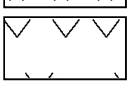

Quartzite

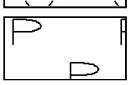
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 90 mAHD
EASTING: 289823
NORTHING: 6237792

PIT No: 101
PROJECT No: 92225.02
DATE: 3/2/2020
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)
90	0.4	TOPSOIL/Silty CLAY CI: brow, trace gravel and sand, rootlets in top 0.1m, w<PL							
89	1	Silty CLAY CI: grey, brown, yellow and red mottled, trace gravel and sand, w<PL, hard		Dx2	0.5				
				U_{50}	0.9		pp ≥400		
				D	1.0				
	1.4								
88	2	Silty CLAY CI: grey and red brown, trace sandstone gravel, w<PL, hard - becoming grey below 1.7m		Dx2	1.5		pp ≥400		
				D	2.0		pp = 300		
	2.2	SANDSTONE: brown, with iron staining, low to medium strength, highly to moderately weathered		D	2.5				
	2.6	Pit discontinued at 2.6m - refusal on low to medium strength sandstone							
87	3								
86	4								
85	5								
84	6								
83	7								
82	8								
81	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 88 mAHD
EASTING: 290291
NORTHING: 6237683

PIT No: 102
PROJECT No: 92225.02
DATE: 3/2/2020
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)
88	0.4	TOPSOIL/Silty CLAY CI: brown, trace gravel, rootlets in top 0.05m, w<PL							
		Silty CLAY CI: red brown, trace ironstone gravel, w<PL, hard		D	0.5		pp >400		
87	1			D/B	1.0		pp >400		
				D	1.5		pp >400		
	1.8								
86	2	Silty CLAY CI: grey and red brown mottled, trace sandstone gravel, w<PL, very stiff		D	2.0		pp = 300		
				D	2.5		pp = 300		
85	3	3.0		D	3.0				
		Pit discontinued at 3.0m - limit of investigation							
84	4								
83	5								
82	6								
81	7								
80	8								
79	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 95 mAHD
EASTING: 290561
NORTHING: 6237693

PIT No: 103
PROJECT No: 92225.02
DATE: 3/2/2020
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)
95	0.3	TOPSOIL/Silty CLAY CI: brown, trace rootlets in top 0.1m, w<PL							
		Silty CLAY CI: red brown and grey mottled, trace gravel and sand, w<PL, hard		Dx2	0.5				
94	1			D	1.0				
	1.2	SANDSTONE: fine grained, grey, low strength, moderately weathered		Dx2	1.5				
		- becoming brown, low to medium strength, moderately weathered							
93	2 2.0	Pit discontinued at 2.0m		D	2.0				
		- refusal on low to medium strength sandstone							
92	3								
91	4								
90	5								
89	6								
88	7								
87	8								
86	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 94 mAHD
EASTING: 289871
NORTHING: 6237343

PIT No: 104
PROJECT No: 92225.02
DATE: 3/2/2020
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)
94	0.2	TOPSOIL/Silty CLAY CI: with rootlets in top 0.1m, w<PL							
	0.6	Silty CLAY CI: brown, trace gravel and sand, w<PL, hard		Dx2	0.5		pp >400		
93	1	Silty CLAY CI: red brown and grey mottled, trace gravel and sand, w<PL, hard		D	1.0				
				Dx2	1.5				
		- becoming more grey with depth below 1.7m							
92	2			D	2.0				
				Dx2	2.5		pp >400		
		- becoming extremely weathered below 2.8m							
91	3	3.0 Pit discontinued at 3.0m		D	3.0				
		- limit of investigation							
90	4								
89	5								
88	6								
87	7								
86	8								
85	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 97 mAHD
EASTING: 290287
NORTHING: 6237383

PIT No: 105
PROJECT No: 92225.02
DATE: 3/2/2020
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)
97	0.2	TOPSOIL/Silty CLAY CI: brown, with rootlets in top 0.1m, w<PL							
	0.5	Silty CLAY CI: brown, trace gravel and sand, w<PL, hard		Dx2/B	0.35 0.5		pp ≥400		
96	1	Silty CLAY CI: red brown, trace gravel and sand, w<PL, hard		D	1.0				
				Dx2	1.5		pp ≥400		
95	2			D	2.0				
	2.2	SANDSTONE: fine grained, pale grey and brown, with iron staining, low strength, highly to moderately weathered							
	2.5	Pit discontinued at 2.5m - refusal on low to medium strength sandstone		Dx2	2.5				
94	3								
93	4								
92	5								
91	6								
90	7								
89	8								
88	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 95 mAHD
EASTING: 290542
NORTHING: 6237417

PIT No: 106
PROJECT No: 92225.02
DATE: 3/2/2020
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)
95	0.15	TOPSOIL/Silty CLAY CI: brown, trace gravel and sand, with rootlets in top 0.05m, w<PL, hard							
		Silty CLAY CI: brown and red brown, trace gravel and sand, w<PL, hard		Dx2	0.5		pp >400		
94	1			D	1.0				
		- becoming red grey mottled below 1.2m		Dx2	1.5				
		- becoming grey, red, yellow mottled below 1.6m							
93	1.9	SHALE: mid grey, with iron staining, low strength, highly to moderately weathered, Bringelly Shale		D	2.0				
	2			Dx2	2.5				
		- becoming extremely weathered below 2.8m							
92	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
91	4								
90	5								
89	6								
88	7								
87	8								
86	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 102 mAHD
EASTING: 289782
NORTHING: 6237116

PIT No: 107
PROJECT No: 92225.02
DATE: 3/2/2020
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)
102	0.2	TOPSOIL/Silty CLAY CI: trace rootlets in top 0.05m, w<PL							
		Silty CLAY CI: red brown and grey mottled, becoming more grey with depth, trace ironstone and sandstone bands, w<PL		Dx2	0.5				
101	1			D	1.0				
				Dx2	1.5				
100	2			D	2.0				
	2.1	SANDSTONE: fine grained, grey, becoming more brown with depth, with iron staining, low strength, highly to moderately weathered		Dx2	2.5				
99	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
98	4								
97	5								
96	6								
95	7								
94	8								
93	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 105 mAHD
EASTING: 290158
NORTHING: 6237146

PIT No: 108
PROJECT No: 92225.02
DATE: 3/2/2020
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)
105	0.8	FILL/Silty CLAY CI: with rootlets in top 0.1m, trace gravel and anthropogenics comprising brick fragments, roof tiles, pipe, metal, concrete, w<PL		Dx2	0.5		pp >400		
				U_{50}	0.9				
104	1	Silty CLAY CI: medium plasticity, red brown, trace gravel, with sandstone bands, w<PL, hard		D	1.0				
				Dx2	1.5		pp >400		
103	2			D	2.0				
	2.4	SANDSTONE: fine grained, brown and grey, with iron staining, very low to low strength, highly to moderately weathered		Dx2	2.5				
102	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97	8								
96	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 104 mAHD
EASTING: 290395
NORTHING: 6236925

PIT No: 109
PROJECT No: 92225.02
DATE: 3/2/2020
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)
104	0.3	TOPSOIL/Silty CLAY CI: trace rootlets in top 0.15m, w<PL							
		Silty CLAY CI: brown, trace gravel, w<PL, hard		Dx2	0.5		pp >400		
		- becoming red brown, very stiff below 0.6m		D	1.0				
103	1			Dx2	1.5				
					1.8		pp = 350		
		- becoming red brown grey mottled below 1.8m		D	2.0				
102	2								
	2.1	SANDSTONE: fine grained, grey and brown, with iron staining, low strength, highly to moderately weathered		Dx2	2.5				
		- becoming extremely weathered with depth							
101	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
100	4								
99	5								
98	6								
97	7								
96	8								
95	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 105 mAHD
EASTING: 289712
NORTHING: 6236938

PIT No: 110
PROJECT No: 92225.02
DATE: 4/2/2020
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)
105	0.05	TOPSOIL/Silty CLAY CI: brown, trace rootlets, w<PL							
	0.3	Silty CLAY CI: brown, w<PL, hard							
104	1	Silty CLAY CI: medium to high plasticity, red brown and grey, yellow mottled, with ironstone gravel, w<PL, hard, residual			1.0		pp ≥400		
	1.4	Silty CLAY CH: high plasticity, pale grey, with iron staining (red and yellow), with very low to low strength siltstone bands, (extremely weathered siltstone, residual)							
103	2								
	2.1	SILTSTONE: pale brown and grey, with iron staining, with clay seams, very low to low strength, moderately to slightly weathered - no clay seams below 2.7m							
102	3								
	3.0	Pit discontinued at 3.0m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97	8								
96	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 113 mAHD
EASTING: 290167
NORTHING: 6236793

PIT No: 111
PROJECT No: 92225.02
DATE: 4/2/2020
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)
113	0.1	TOPSOIL/Silty CLAY CI: trace rootlets, w<PL							
	0.4	Silty CLAY CI: brown, trace gravel, w<PL, hard							
		Silty CLAY CI: medium to high plasticity, orange brown, trace ironstone and siltstone gravel, hard		Dx2	0.5				
112	1			D/B	1.0				
				Dx2	1.5				
111	2	- becoming grey and orange/red mottled, with siltstone (possible sandstone) bands (possible extremely weathered siltstone)		D	2.0				
				Dx2	2.5				
110	3	3.0 Pit discontinued at 3.0m - limit of investigation		D	3.0				
109	4								
108	5								
107	6								
106	7								
105	8								
104	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 111 mAHD
EASTING: 290414
NORTHING: 6236752

PIT No: 112
PROJECT No: 92225.02
DATE: 4/2/2020
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)
111	0.05	TOPSOIL/Silty CLAY CI: trace rootlets, w<PL							
	0.3	Silty CLAY CI: w<PL, hard							
	0.6	Silty CLAY CI; medium to high plasticity, brown, w<PL, hard, residual		Dx2	0.5				
				U_{50}					
110	1	Silty CLAY CH: high plasticity, red brown and grey mottled, becoming grey with depth, w<PL, hard		D	0.9 1.0				
	1.4	SILTSTONE: pale grey and brown, with iron staining, with clay seams, low strength, highly weathered		Dx2	1.5				
109	2	-becoming extremely weathered below 2.1m		D	2.0				
				Dx2	2.5				
108	3			D	3.0				
	3.0	Pit discontinued at 3.0m -limit of investigation							
107	4								
106	5								
105	6								
104	7								
103	8								
102	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 114 mAHD
EASTING: 289676
NORTHING: 6236773

PIT No: 113
PROJECT No: 92225.02
DATE: 4/2/2020
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)
114	0.05	TOPSOIL/Silty CLAY CI: brown, trace rootlets, w<PL							
	0.2	Silty CLAY CI: brown, w<PL, hard							
		Silty CLAY CI: medium to high plasticity, orange brown, w<PL, hard		Dx2	0.5				
113	1	- becoming orange brown and grey mottled, trace ironstone gravel below 0.7m		D	1.0				
				Dx2	1.5				
	1.6	Silty CLAY CI: medium to high plasticity, pale brown and grey, with iron staining, with siltstone (possible sandstone) bands, w<PL, very low strength, highly to slightly weathered		D	2.0				
112	2	- becoming more grey, banding decreasing, hard below 2.4m		Dx2	2.5				
		- banding increasing below 2.8m							
111	3	3.0 Pit discontinued at 3.0m		D	3.0				
		- limit of investigation							
110	4								
109	5								
108	6								
107	7								
106	8								
105	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 148 mAHD
EASTING: 289750
NORTHING: 6236549

PIT No: 114
PROJECT No: 92225.02
DATE: 4/2/2020
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)
148	0.6	Silty CLAY CI: red brown, w<PL, hard, residual		D	0.5				
147	0.9	SANDSTONE: fine to medium grained, low to medium strength, highly to slightly weathered, horizontally bedded, Bringelly Shale		D	0.9				
	1	Pit discontinued at 0.9m - refusal on medium strength sandstone							
146	2								
145	3								
144	4								
143	5								
142	6								
141	7								
140	8								
139	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 119 mAHD
EASTING: 289628
NORTHING: 6236536

PIT No: 115
PROJECT No: 92225.02
DATE: 4/2/2020
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)
119	0.05	TOPSOIL/Silty CLAY CI: trace ironstone gravel and rootlets, w<PL							
	0.4	Silty CLAY CI: trace ironstone gravel, w<PL, hard		Dx2	0.5				
		Silty CLAY CI: brown, trace ironstone gravel, w<PL, hard, residual							
118	1.0	- becoming orange brown and dark grey mottled		D	1.0				
		Silty CLAY CH: high plasticity, brown and grey mottled, trace ironstone and sandstone bands, w<PL, hard, residual		Dx2	1.5				
117	1.9	SANDSTONE: fine grained, pale brown, iron staining, with ironstone gravel, low strength, highly to slightly weathered, Bringelly Shale		D	2.0				
				Dx2	2.5				
116	3.0	Pit discontinued at 3.0m - limit of investigation		D	3.0				
115	4								
114	5								
113	6								
112	7								
111	8								
110	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 131 mAHD
EASTING: 289922
NORTHING: 6236441

PIT No: 116
PROJECT No: 92225.02
DATE: 4/2/2020
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)
131	0.15	TOPSOIL/Silty CLAY CI: brown, trace gravel, with rootlets, w<PL, stiff							
	0.6	Silty CLAY CI: medium to high plasticity, orange brown, slightly mottled, with angular siltstone gravel (colluvium), w<PL, stiff		Dx2/B	0.5				
130	1	SILTSTONE: pale brown and grey, with clay seams, very low to low strength, highly to slightly weathered		D	1.0				
		- with clay seams, becoming low strength below 1.0m		Dx2	1.5				
129	2			D	2.0				
				Dx2	2.5				
	2.8	- becoming low to medium strength at 2.6m							
128	3	Pit discontinued at 2.8m - limit of investigation		D	3.0				
127	4								
126	5								
125	6								
124	7								
123	8								
122	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 125 mAHD
EASTING: 290014
NORTHING: 6236427

PIT No: 117
PROJECT No: 92225.02
DATE: 4/2/2020
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)
125	0.1	TOPSOIL/Silty CLAY CI: brown, fissured, with rootlets, trace gravel (colluvium), w<PL							
	0.6	Silty CLAY CI: brown, fissured, trace SR ironstone and SA siltstone gravel (colluvium), w<PL			0.5				
124	1.0	Silty CLAY CI: orange brown, fissured, trace ironstone gravel, w<PL, residual		U_{50} D	0.7 0.9				
		Silty CLAY CI: medium to high plasticity,orange brown and grey mottled, trace SR siltstone gravel, w<PL, residual		D	1.1				
		- very low to medium strength band below 1.5m		Dx2	1.5				
	1.7	Clayey SILT ML: pale grey and orange mottled, friable,							
123	2.0	with very low to low strength siltstone seams, w<PL (extremely weathered siltstone)		D	2.0				
		SILTSTONE: pale orange and brown, with iron staining, low to medium strength, moderately to slightly weathered, Bringelly Shale		Dx2	2.5				
	2.8	- becoming medium strength below 2.7m							
122	3	Pit discontinued at 2.8m							
		- limit of investigation							
121	4								
120	5								
119	6								
118	7								
117	8								
116	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 117 mAHD
EASTING: 290123
NORTHING: 6236402

PIT No: 118
PROJECT No: 92225.02
DATE: 4/2/2020
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)
117	0.2	TOPSOIL/Silty CLAY CI: brown, with rootlets to 0.1m, trace gravel, w<PL, residual							
		Silty CLAY CI: red brown and grey mottled, trace gravel, w<PL, very stiff to hard, residual		Dx2	0.5				
116	0.9	SILTSTONE: pale grey and red brown, with clay seams, very low to low strength, moderately to slightly weathered, Bringelly Shale		D	1.0				
				Dx2	1.5				
115		- becoming low to medium strength, no clay seams below 2.0n		D	2.0				
				Dx2	2.5				
114	3.0	Pit discontinued at 3.0m - limit of investigation		D	3.0				
113									
112									
111									
110									
109									
108									

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 113 mAHD
EASTING: 290301
NORTHING: 6236517

PIT No: 119
PROJECT No: 92225.02
DATE: 4/2/2020
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)
113	0.15	TOPSOIL/Silty CLAY CI: brown, fissured, with rootlets, w<PL, stiff							
		Silty CLAY CI: medium to high plasticity, orange brown and grey mottled, fissured, trace ironstone and siltstone gravel, w<PL, stiff, residual		Dx2	0.5				
112	1	- becoming hard below 0.6m		D	1.0				
		- becoming grey and orange brown mottled, extremely weathered siltstone below 1.2m		Dx2	1.5				
	1.6	SILTSTONE: pale grey and brown, with yellow and red iron staining, low to medium strength, moderately to slightly weathered, Bringelly Shale		D	2.0				
111	2								
	2.1	Pit discontinued at 2.1m - refusal on low to medium strength siltstone							
110	3								
109	4								
108	5								
107	6								
106	7								
105	8								
104	9								

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

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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

Appendix E

Laboratory Reports, Chain-of-Custody and
Sample Receipt documentation

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

CERTIFICATE OF ANALYSIS 236141

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Erin Leslie
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92225.03, Cobbitty, SWP, Prelim Salinity Assess**
Number of Samples	20 Soil
Date samples received	06/02/2020
Date completed instructions received	06/02/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	13/02/2020
Date of Issue	13/02/2020

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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

[redacted]

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		236141-1	236141-2	236141-3	236141-4	236141-5
Your Reference	UNITS	TP101	TP101	TP103	TP103	TP109
Depth		0.5	1.5	0.5	1.5	0.5
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Chloride, Cl 1:5 soil:water	mg/kg	51	670	63	300	1,300
Sulphate, SO4 1:5 soil:water	mg/kg	20	230	47	160	130

Misc Inorg - Soil						
Our Reference		236141-6	236141-7	236141-8	236141-9	236141-10
Your Reference	UNITS	TP109	TP109	TP111	TP111	TP112
Depth		1.5	2.5	1.5	2.5	0.5
Date Sampled		03/02/2020	03/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Chloride, Cl 1:5 soil:water	mg/kg	1,200	740	400	1,200	310
Sulphate, SO4 1:5 soil:water	mg/kg	82	74	99	250	180

Misc Inorg - Soil						
Our Reference		236141-11	236141-12	236141-13	236141-14	236141-15
Your Reference	UNITS	TP112	TP112	TP113	TP113	TP113
Depth		1.5	2.5	0.5	1.5	2.5
Date Sampled		04/02/2020	04/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Chloride, Cl 1:5 soil:water	mg/kg	520	750	48	890	910
Sulphate, SO4 1:5 soil:water	mg/kg	140	200	10	330	300

Misc Inorg - Soil						
Our Reference		236141-16	236141-17	236141-18	236141-19	236141-20
Your Reference	UNITS	TP115	TP115	TP115	TP119	TP119
Depth		0.5	1.5	2.5	0.5	1.5
Date Sampled		04/02/2020	04/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Chloride, Cl 1:5 soil:water	mg/kg	40	520	450	36	290
Sulphate, SO4 1:5 soil:water	mg/kg	<10	21	22	10	160

ESP/CEC						
Our Reference		236141-1	236141-2	236141-3	236141-4	236141-5
Your Reference	UNITS	TP101	TP101	TP103	TP103	TP109
Depth		0.5	1.5	0.5	1.5	0.5
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Exchangeable Ca	meq/100g	4.3	1.0	1.1	0.1	1.4
Exchangeable K	meq/100g	0.2	0.1	<0.1	0.1	0.6
Exchangeable Mg	meq/100g	6.4	7.4	7.7	7.1	8.2
Exchangeable Na	meq/100g	0.80	2.0	1.1	2.6	1.2
Cation Exchange Capacity	meq/100g	12	11	9.9	9.9	11
ESP	%	7	19	11	26	10

ESP/CEC						
Our Reference		236141-6	236141-7	236141-8	236141-9	236141-10
Your Reference	UNITS	TP109	TP109	TP111	TP111	TP112
Depth		1.5	2.5	1.5	2.5	0.5
Date Sampled		03/02/2020	03/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Exchangeable Ca	meq/100g	<0.1	0.2	0.8	0.1	0.4
Exchangeable K	meq/100g	<0.1	<0.1	<0.1	<0.1	0.1
Exchangeable Mg	meq/100g	8.2	16	9.2	9.8	7.2
Exchangeable Na	meq/100g	2.9	8.3	5.6	8.0	1.4
Cation Exchange Capacity	meq/100g	11	24	16	18	9.2
ESP	%	26	34	36	45	15

ESP/CEC						
Our Reference		236141-11	236141-12	236141-13	236141-14	236141-15
Your Reference	UNITS	TP112	TP112	TP113	TP113	TP113
Depth		1.5	2.5	0.5	1.5	2.5
Date Sampled		04/02/2020	04/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Exchangeable Ca	meq/100g	<0.1	<0.1	7.4	3.3	0.6
Exchangeable K	meq/100g	<0.1	0.1	0.1	<0.1	0.2
Exchangeable Mg	meq/100g	6.1	11	9.5	10	10
Exchangeable Na	meq/100g	2.2	4.9	1.3	4.0	3.8
Cation Exchange Capacity	meq/100g	8.5	16	18	17	15
ESP	%	26	30	7	23	25

ESP/CEC						
Our Reference		236141-16	236141-17	236141-18	236141-19	236141-20
Your Reference	UNITS	TP115	TP115	TP115	TP119	TP119
Depth		0.5	1.5	2.5	0.5	1.5
Date Sampled		04/02/2020	04/02/2020	04/02/2020	04/02/2020	04/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Date analysed	-	10/02/2020	10/02/2020	10/02/2020	10/02/2020	10/02/2020
Exchangeable Ca	meq/100g	10	7.5	3.6	6.5	0.7
Exchangeable K	meq/100g	0.4	0.1	<0.1	0.2	0.2
Exchangeable Mg	meq/100g	7.9	16	14	13	13
Exchangeable Na	meq/100g	0.67	3.8	3.5	1.6	3.2
Cation Exchange Capacity	meq/100g	19	27	21	21	17
ESP	%	3	14	16	7	19

Method ID	Methodology Summary
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	236141-3
Date prepared	-			10/02/2020	1	10/02/2020	10/02/2020		10/02/2020	10/02/2020
Date analysed	-			10/02/2020	1	10/02/2020	10/02/2020		10/02/2020	10/02/2020
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	51	71	33	96	75
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	20	24	18	99	102

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	16	10/02/2020	10/02/2020		[NT]	[NT]
Date analysed	-			[NT]	16	10/02/2020	10/02/2020		[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	16	40	34	16	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	16	<10	<10	0	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			10/02/2020	1	10/02/2020	10/02/2020		10/02/2020	[NT]
Date analysed	-			10/02/2020	1	10/02/2020	10/02/2020		10/02/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	1	4.3	4.4	2	109	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	1	0.2	0.2	0	104	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	1	6.4	6.0	6	103	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	1	0.80	0.70	13	102	[NT]
ESP	%	1	Metals-009	[NT]	1	7	6	15	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	10/02/2020	10/02/2020		[NT]	[NT]
Date analysed	-			[NT]	11	10/02/2020	10/02/2020		[NT]	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	[NT]	11	6.1	5.7	7	[NT]	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	[NT]	11	2.2	2.1	5	[NT]	[NT]
ESP	%	1	Metals-009	[NT]	11	26	27	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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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 (not SPOCAS); 60-140% for organics/SPOCAS (+/-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.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Samples received in good order: 22.6

[redacted]glas Partners
[redacted]otechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	92225.03	**Suburb:**	South Creek West, Cobbit	**To:**	Envirolab
Project Name:	COBBITTY, SWP, Prelim Salinity Asses	**Order Number**			12 Ashley St, Chatswood NSW 2067
Project Manager:	Chris Kline	**Sampler:**	E Leslie	**Attn:**	Tania Notaras
Emails:	Erin.Leslie@douglaspartners.com.au			**Phone:**	(02) 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	tnotaras@envirolabservices.com.au
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Chlorides & sulphites	Analytes: CEC & SEP	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Notes/preservation
TP101/0.5	1	02/03/20	S	G	X	X								
TP101/1.5	2	02/03/20	S	G	X	X								
TP103/0.5	3	02/03/20	S	G	X	X								
TP103/1.5	4	02/03/20	S	G	X	X								
TP109/0.5	5	02/03/20	S	G	X	X								
TP109/1.5	6	02/03/20	S	G	X	X								
TP109/2.5	7	02/03/20	S	G	X	X								
TP111/1.5	8	02/04/20	S	G	X	X								
TP111/2.5	9	02/04/20	S	G	X	X								
TP112/0.5	10	02/04/20	S	G	X	X								
TP112/1.5	11	02/04/20	S	G	X	X								
TP112/2.5	12	02/04/20	S	G	X	X								
TP113/0.5	13	02/04/20	S	G	X	X								
TP113/1.5	14	02/04/20	S	G	X	X								
TP113/2.5	15	02/04/20	S	G	X	X								
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

Envirolab Services
12 Ashley St
Chatswood NSW 2067
ph: (02) 9910 6200
ENVIROLAB
Job No: 236141
Date Received: 6/2/20
Time Received: 1352
Received by: SD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No: 236141

Metals to Analyse: 8HM unless specified here:

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address:** **Phone:** **Fax:**

Signed: **Received by:** Jason Day EIS SYD **Date & Time:** 6/2/20 1352

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	92225.03	**Suburb:**	South Creek West, Cobbit	**To:**	Envirolab
Project Name:	COBBITTY, SWP, Prelim Salinity Asses	**Order Number**			12 Ashley St, Chatswood NSW 2067
Project Manager:	Chris Kline	**Sampler:**	E Leslie	**Attn:**	Tania Notaras
Emails:	Erin.Leslie@douglaspartners.com.au			**Phone:**	(02) 9910 6200
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	tnotaras@envirolabservices.com.au
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)		

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Chlorides & sulphites	Analytes: CEC & SEP	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Notes/preservation
TP115/0.5	16	02/04/20	S	G	X	X								
TP115/1.5	17	02/04/20	S	G	X	X								
TP115/2.5	18	02/04/20	S	G	X	X								
TP119/0.5	19	02/04/20	S	G	X	X								
TP119/1.5	20	02/04/20	S	G	X	X								
PQL (S) mg/kg												**ANZECC PQLs req'd for all water analytes** ☐		

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No: 236141

Total number of samples in container: | **Relinquished by:** | **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd | **Address:** | **Phone:** | **Fax:**

Signed: | **Received by:** Jason Day GCS SYD 3PM | **Date & Time:** 6/2/20 1382

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	Erin Leslie

Sample Login Details

Your reference	92225.03, Cobbitty, SWP, Prelim Salinity Assess
Envirolab Reference	236141
Date Sample Received	06/02/2020
Date Instructions Received	06/02/2020
Date Results Expected to be Reported	13/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	20 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	22.6
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:

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 ID	Misc Inorg - Soil	ESP/CEC
TP101-0.5	✓	✓
TP101-1.5	✓	✓
TP103-0.5	✓	✓
TP103-1.5	✓	✓
TP109-0.5	✓	✓
TP109-1.5	✓	✓
TP109-2.5	✓	✓
TP111-1.5	✓	✓
TP111-2.5	✓	✓
TP112-0.5	✓	✓
TP112-1.5	✓	✓
TP112-2.5	✓	✓
TP113-0.5	✓	✓
TP113-1.5	✓	✓
TP113-2.5	✓	✓
TP115-0.5	✓	✓
TP115-1.5	✓	✓
TP115-2.5	✓	✓
TP119-0.5	✓	✓
TP119-1.5	✓	✓

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.

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: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198A
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 05/03/2020
Sample Location: **TP101 (1.5m)**
Material: Silty CLAY : grey and red brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	23		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
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Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198B
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 05/03/2020
Sample Location: **TP102 (0.5m)**
Material: Silty CLAY: red brown 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 water		
Temperature of Water (°C)	23		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
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Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198C
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 11/03/2020
Sample Location: **TP103 (0.5 m)**
Material: Silty CLAY - brown silty clay

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	22		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
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NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198D
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 06/03/2020
Sample Location: **TP103 (1.5m)**
Material: SANDSTONE- fine grained, grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	35		
Plastic Limit (%)	17		
Plasticity Index (%)	**18**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	9.0		
Cracking Crumbling Curling	None		

Material Test Report

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Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198E
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP104 (0.5m)**
Material: Silty CLAY : red brown and grey mottled

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	23		

Material Test Report

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Douglas Partners Pty Ltd
Macarthur Laboratory
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Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198F
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP105 (0.5m)**
Material: Silty CLAY: red brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	23		

Material Test Report

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Macarthur Laboratory
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Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198G
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP106 (0.5m)**
Material: Silty CLAY : brown and red brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	23		

Material Test Report

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Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
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Email: meregal.henakaa@douglaspartners.com.au

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[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198H
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 06/03/2020
Sample Location: **TP107 (0.5m)**
Material: Silty CLAY : red brown and grey mottled 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 (%)	74		
Plastic Limit (%)	21		
Plasticity Index (%)	**53**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	11.5		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	23		

Material Test Report

Douglas Partners
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Macarthur Laboratory
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Fax: (02) 4646 1886
Email: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198J
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP109 (0.5m)**
Material: Silty CLAY: brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	22		

Material Test Report

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Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198K
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 09/03/2020
Sample Location: **TP110 (1.5m)**
Material: Silty CLAY: pale gre silty clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	67		
Plastic Limit (%)	19		
Plasticity Index (%)	**48**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	13.5		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	22		

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: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198L
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP111 (1.5m)**
Material: Silty CLAY : orange brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	22		

Material Test Report

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Approved Signatory: Meragal Henaka Arachchi
clean lab

NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198M
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP112 (1.5m)**
Material: Silty CLAY red brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	22		

Material Test Report

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Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198N
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP113 (1.5m)**
Material: Silty CLAY : orange brown

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	22		

Material Test Report

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Report Number: **92225.02-1**
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Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198O
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP115 (0.5m)**

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (°C)	23		

Material Test Report

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Report Number: **92225.02-1**
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Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198P
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sample Location: **TP115 (1.5m)**
Material: Silty CLAY : brown and grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	50		
Plastic Limit (%)	17		
Plasticity Index (%)	**33**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	13.5		
Cracking Crumbling Curling	None		

Material Test Report

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Report Number: **92225.02-1**
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Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198R
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 09/03/2020
Sample Location: **TP108 (0.5 - 0.9m)**
Material: FILL/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 (%)	39		
Plastic Limit (%)	19		
Plasticity Index (%)	**20**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	9.0		
Cracking Crumbling Curling	None		

Material Test Report

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Report Number: **92225.02-1**
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Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198T
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 09/03/2020
Sample Location: **TP117 (0.5 - 0.9m)**
Material: Silty CLAY : orange 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 (%)	75		
Plastic Limit (%)	22		
Plasticity Index (%)	**53**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	14.0		
Cracking Crumbling Curling	Curling		

Material Test Report

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Report Number:	**92225.02-1**
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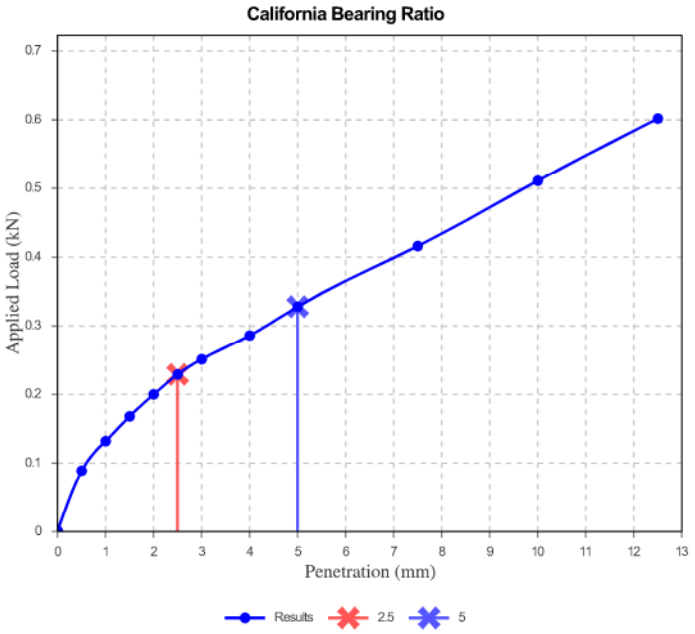
Date Issued:	11/03/2020
Client:	Cyan Stone Bringelly (Aus) Pty Ltd Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact:	Adam Carmody
Project Number:	92225.02
Project Name:	Proposed Rezoning
Project Location:	621 - 705 The Northern Road, Cobbitty
Work Request:	2198
Sample Number:	MA-2198U
Date Sampled:	05/02/2020
Dates Tested:	28/02/2020 - 10/03/2020
Sample Location:	**TP102 (1.0m)**
Material:	Silty Clay - hard red-brown trace gravels (including ironstone) and sands

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**1.5**		
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)	2.00		
Optimum Moisture Content (%)	13.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	12.9		
Moisture Content Top 30mm (%)	14.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

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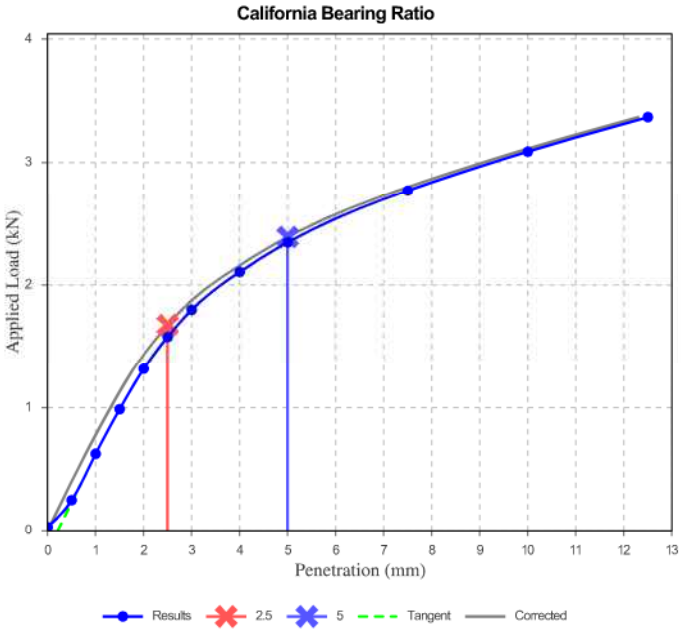
NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198V
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 10/03/2020
Sample Location: **TP105 (0.5m)**
Material: silty CLAY - hard red-brown with trace gravels and sands

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**13**		
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)	1.81		
Optimum Moisture Content (%)	14.5		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	14.7		
Moisture Content Top 30mm (%)	22.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

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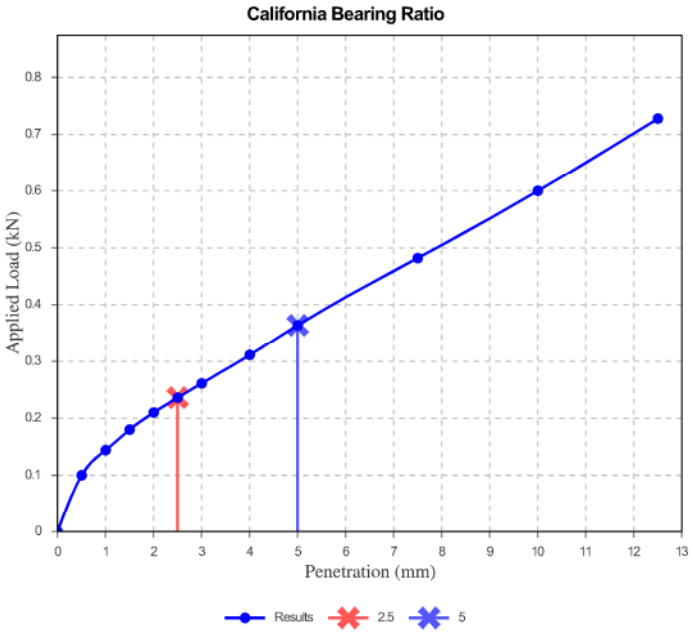
NATA Accredited Laboratory Number: 828

Report Number:	**92225.02-1**
Issue Number:	1
Date Issued:	11/03/2020
Client:	Cyan Stone Bringelly (Aus) Pty Ltd Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact:	Adam Carmody
Project Number:	92225.02
Project Name:	Proposed Rezoning
Project Location:	621 - 705 The Northern Road, Cobbitty
Work Request:	2198
Sample Number:	MA-2198W
Date Sampled:	05/02/2020
Dates Tested:	28/02/2020 - 10/03/2020
Sample Location:	**TP111 (1.0m)**
Material:	silty CLAY - Orange-brown with trace gravels (ironstone and siltstone)

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	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)	1.94		
Optimum Moisture Content (%)	13.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	13.3		
Moisture Content Top 30mm (%)	21.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

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WORLD RECOGNISED ACCREDITATION

Approved Signatory: Meragal Henaka Arachchi
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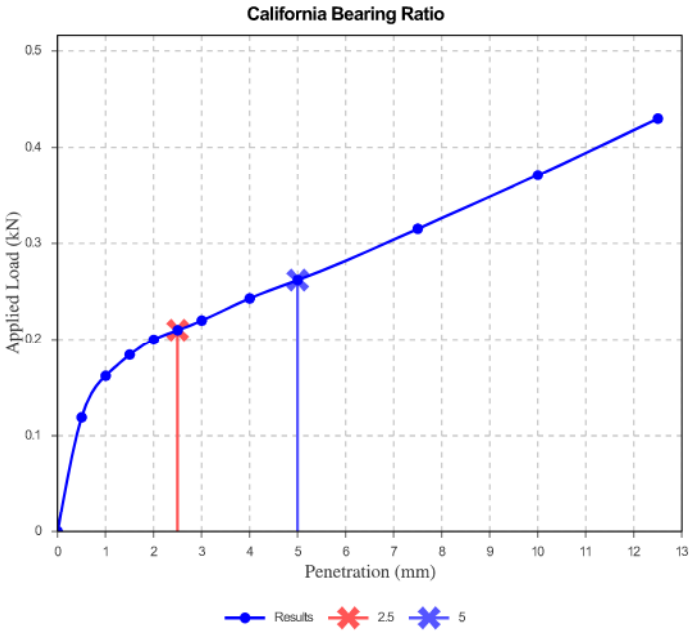
NATA Accredited Laboratory Number: 828

Report Number: **92225.02-1**
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198X
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 10/03/2020
Sample Location: **TP116 (0.5m)**
Material: silty CLAY - Orange-bown (slight mottle) with angular gravels (siltstone). Coluvium.

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**1.5**		
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)	1.80		
Optimum Moisture Content (%)	15.5		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	100.5		
Moisture Content at Placement (%)	15.8		
Moisture Content Top 30mm (%)	28.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

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Report Number: **92225.02-1**
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Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Sample Number: MA-2198BZ
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **TP108 (0.5 m)**
Material: FILL/Silty CLAY

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	22		

Material Test Report

Report Number: 92225.02-1
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Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 28/02/2020

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Determination of EC of Soil (In-House) DP MAC2

Sample Number	Location	Depth (m)	Material	EC Value (µS/cm)
MA-2198Y	TP101	0.5	Soil	136.40
MA-2198Z	TP101	1.5	Soil	548.00
MA-2198AA	TP101	2.5	Soil	316.00
MA-2198AB	TP102	0.5	Soil	130.00
MA-2198AC	TP102	1.5	Soil	498.00
MA-2198AD	TP102	2.5	Soil	669.00
MA-2198AE	TP103	0.5	Soil	56.90
MA-2198AF	TP103	1.5	Soil	510.00
MA-2198AG	TP104	0.5	Soil	34.60
MA-2198AH	TP104	1.5	Soil	304.00
MA-2198AI	TP104	2.5	Soil	614.00
MA-2198AJ	TP105	0.5	Soil	65.60
MA-2198AK	TP105	1.5	Soil	104.90
MA-2198AL	TP105	2.5	Soil	97.40
MA-2198AM	TP106	0.5	Soil	79.40
MA-2198AN	TP106	1.5	Soil	772.00
MA-2198AO	TP106	2.5	Soil	387.00
MA-2198AP	TP107	0.5	Soil	80.70
MA-2198AQ	TP107	1.5	Soil	629.00
MA-2198AR	TP107	2.5	Soil	407.00
MA-2198AS	TP108	0.5	Soil	123.90
MA-2198AT	TP108	1.5	Soil	123.20
MA-2198AU	TP108	2.5	Soil	267.00
MA-2198AV	TP109	0.5	Soil	1084.00
MA-2198AW	TP109	1.5	Soil	823.00
MA-2198AX	TP109	2.5	Soil	679.00
MA-2198AY	TP110	0.5	Soil	270.00
MA-2198AZ	TP110	1.5	Soil	488.00
MA-2198BA	TP110	2.5	Soil	565.00
MA-2198BB	TP111	0.5	Soil	27.50
MA-2198BC	TP111	1.5	Soil	384.00
MA-2198BD	TP111	2.5	Soil	813.00
MA-2198BE	TP112	0.5	Soil	290.00
MA-2198BF	TP112	1.5	Soil	413.00
MA-2198BG	TP112	2.5	Soil	643.00

Sample Number	Location	Depth (m)	Material	EC Value (µS/cm)
MA-2198BH	TP113	0.5	Soil	102.20
MA-2198BI	TP113	1.5	Soil	745.00
MA-2198BJ	TP113	2.5	Soil	651.00
MA-2198BK	TP114	0.5	Soil	33.80
MA-2198BL	TP115	0.5	Soil	62.90
MA-2198BM	TP115	1.5	Soil	454.00
MA-2198BN	TP115	2.5	Soil	391.00
MA-2198BO	TP116	0.5	Soil	23.80
MA-2198BP	TP116	1.5	Soil	131.80
MA-2198BQ	TP116	2.5	Soil	101.20
MA-2198BR	TP117	0.5	Soil	64.30
MA-2198BS	TP117	1.5	Soil	243.00
MA-2198BT	TP117	2.5	Soil	245.00
MA-2198BU	TP118	0.5	Soil	153.60
MA-2198BV	TP118	1.5	Soil	327.00
MA-2198BW	TP118	2.5	Soil	360.00
MA-2198BX	TP119	0.5	Soil	87.60
MA-2198BY	TP119	1.5	Soil	267.00

Material Test Report

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Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 03/03/2020

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NATA Accredited Laboratory Number: 828

Determination of pH of Soil (In-House) DP MAC1

Sample Number	Location	Depth (m)	Material	pH Value
MA-2198Y	TP101	0.5	Soil	7.5
MA-2198Z	TP101	1.5	Soil	6.8
MA-2198AA	TP101	2.5	Soil	6.9
MA-2198AB	TP102	0.5	Soil	7.2
MA-2198AC	TP102	1.5	Soil	6.5
MA-2198AD	TP102	2.5	Soil	6.3
MA-2198AE	TP103	0.5	Soil	7.3
MA-2198AF	TP103	1.5	Soil	6.3
MA-2198AG	TP104	0.5	Soil	7.4
MA-2198AH	TP104	1.5	Soil	6.4
MA-2198AI	TP104	2.5	Soil	5.8
MA-2198AJ	TP105	0.5	Soil	6.9
MA-2198AK	TP105	1.5	Soil	6.6
MA-2198AL	TP105	2.5	Soil	6.6
MA-2198AM	TP106	0.5	Soil	6.7
MA-2198AN	TP106	1.5	Soil	7.1
MA-2198AO	TP106	2.5	Soil	7.3
MA-2198AP	TP107	0.5	Soil	7.6
MA-2198AQ	TP107	1.5	Soil	6.6
MA-2198AR	TP107	2.5	Soil	6.8
MA-2198AS	TP108	0.5	Soil	7.1
MA-2198AT	TP108	1.5	Soil	7.1
MA-2198AU	TP108	2.5	Soil	6.7
MA-2198AV	TP109	0.5	Soil	5.8
MA-2198AW	TP109	1.5	Soil	6.0
MA-2198AX	TP109	2.5	Soil	6.1
MA-2198AY	TP110	0.5	Soil	6.5
MA-2198AZ	TP110	1.5	Soil	6.2
MA-2198BA	TP110	2.5	Soil	6.1
MA-2198BB	TP111	0.5	Soil	7.4
MA-2198BC	TP111	1.5	Soil	6.9
MA-2198BD	TP111	2.5	Soil	6.6
MA-2198BE	TP112	0.5	Soil	7.0
MA-2198BF	TP112	1.5	Soil	6.7
MA-2198BG	TP112	2.5	Soil	6.6

Sample Number	Location	Depth (m)	Material	pH Value
MA-2198BH	TP113	0.5	Soil	7.3
MA-2198BI	TP113	1.5	Soil	6.4
MA-2198BJ	TP113	2.5	Soil	6.4
MA-2198BK	TP114	0.5	Soil	7.8
MA-2198BL	TP115	0.5	Soil	7.4
MA-2198BM	TP115	1.5	Soil	6.4
MA-2198BN	TP115	2.5	Soil	6.4
MA-2198BO	TP116	0.5	Soil	7.7
MA-2198BP	TP116	1.5	Soil	6.9
MA-2198BQ	TP116	2.5	Soil	7.1
MA-2198BR	TP117	0.5	Soil	7.2
MA-2198BS	TP117	1.5	Soil	6.6
MA-2198BT	TP117	2.5	Soil	6.7
MA-2198BU	TP118	0.5	Soil	6.9
MA-2198BV	TP118	1.5	Soil	6.9
MA-2198BW	TP118	2.5	Soil	6.8
MA-2198BX	TP119	0.5	Soil	7.3
MA-2198BY	TP119	1.5	Soil	6.7

Material Test Report

Report Number: 92225.02-1
Issue Number: 1
Date Issued: 11/03/2020
Client: Cyan Stone Bringelly (Aus) Pty Ltd
Level 16, 5 Martin Place, SYDNEY NSW 2000
Contact: Adam Carmody
Project Number: 92225.02
Project Name: Proposed Rezoning
Project Location: 621 - 705 The Northern Road, Cobbitty
Work Request: 2198
Date Sampled: 05/02/2020
Dates Tested: 28/02/2020 - 28/02/2020

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
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Accredited for compliance with ISO/IEC 17025 - Testing

[redacted]

Approved Signatory: Meragal Henaka Arachchi
clean lab
NATA Accredited Laboratory Number: 828

Moisture Content AS 1289 2.1.1

Sample Number	Sample Location	Moisture Content (%)	Material
MA-2198D	TP103 (1.5m)	7.4 %	SANDSTONE- fine grained, grey
MA-2198H	TP107 (0.5m)	16.2 %	Silty CLAY : red brown and grey mottled silty clay
MA-2198K	TP110 (1.5m)	17.7 %	Silty CLAY: pale gre silty clay
MA-2198P	TP115 (1.5m)	11.6 %	Silty CLAY : brown and grey
MA-2198R	TP108 (0.5 - 0.9m)	9.7 %	FILL/Silty CLAY
MA-2198T	TP117 (0.5 - 0.9m)	15.7 %	Silty CLAY : orange brown silty clay

Material Test Report

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Dates Tested: 28/02/2020 - 28/02/2020

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	MA-2198Q	MA-2198S			
Date Sampled	05/02/2020	05/02/2020			
Date Tested	28/02/2020	28/02/2020			
Material Source	**	**			
Sample Location	TP101 (0.5 - 0.9m)	TP112 (0.5 - 0.9m)			
Inert Material Estimate (%)	1	0.5			
Pocket Penetrometer before (kPa)	600	600			
Pocket Penetrometer after (kPa)	270	300			
Shrinkage Moisture Content (%)	12.0	13.4			
Shrinkage (%)	**1.3**	**1.8**			
Swell Moisture Content Before (%)	12.2	13.3			
Swell Moisture Content After (%)	21.4	20.7			
Swell (%)	**7.3**	**7.2**			
Shrink Swell Index Iss (%)	**2.7**	**3.0**			
Visual Description	Silty CLAY:grey, brown, yellow and red mottled silty clay	**			
Cracking	SC	MC			
Crumbling	No	**			
Remarks	**	**			

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.
Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.
NATA Accreditation does not cover the performance of pocket penetrometer readings.