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SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

HAYMARKET PRECINCT, DARLING HARBOUR, SYDNEY NSW
ACID SULFATE SOIL ASSESSMENT AND PRELIMINARY MANAGEMENT PLAN

Prepared for:

Lend Lease Development
30 The Bond
30 Hickson Road
Millers Point NSW 2000

Report Date: 11 March 2013
Project Ref: ENAURHOD04498AA

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11 March 2013

Lend Lease Development
30 The Bond
30 Hickson Road
Millers Point NSW 2000

Attention: Warwick Bowyer

Dear Warwick

RE: Haymarket Precinct, Darling Harbour, Sydney NSW
Acid Sulfate Soils Assessment and Preliminary Management Plan

Coffey is pleased to submit our Acid Sulfate Soil Assessment and Preliminary Management Plan for the Haymarket Precinct.

This work was carried out in general accordance with our proposal dated 13th February 2013 (ref: ENAURHOD04498AA-P03 Rev.1).

Coffey understands that "The Haymarket" development is to include a mix of land uses including commercial office, residential including student accommodation, retail and public open space. Residential podium and tower forms (up to 40 storeys) are proposed. Generally, car parking is proposed to be above grade within the podium. New infrastructure services (including diversions and augmentations) will be provided to service new developments. In addition, it is likely that additional excavation works associated with remediation and archaeological works will also be required.

Coffey has assessed the Lend Lease proposed development scheme in the context of the potential to encounter acid sulfate soils on the site and have concluded that where such soils are encountered through the undertaking of the proposed development works, that they can be adequately managed utilising industry standard design and construction techniques and practices to prevent unacceptable environmental impacts and render the site is suitable for its intended use.

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Please contact the undersigned should you have any queries regarding this report

For and on behalf of Coffey Environments Australia Pty Ltd

Emma Coleman
Associate Environmental Scientist

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CONTENTS

CONTENTS

LIST OF ATTACHMENTS

Important Information about your Coffey Environmental Report

Figures

Appendices

ABBREVIATIONS

AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate Soils
ASSMAC	Acid Sulfate Soils Management Advisory Committee
ASSMP	Acid Sulfate Soils Management Plan
bgs	below ground surface
BH	Borehole
DLWC	Department of Land and Water Conservation (NSW)
EC	Electrical conductivity
H_2O_2	Hydrogen peroxide
HHERA	Human Health and Environmental Risk Assessment
ha	Hectare
ID	Identification
LLD	Lend Lease Development
NATA	National Association of Testing Authorities
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NSW EPA	Environment Protection Authority of NSW
NSW DECCW	Department of Environment, Climate Change and Water of NSW
NV	Neutralising value
PASS	Potential Acid Sulfate Soils
SCR	Chromium reducible sulfur

ABBREVIATIONS

SEC	Sydney Entertainment Centre
SICEEP	Sydney International Convention, Exhibition and Entertainment Precinct
SWL	Standing Water Level

1 INTRODUCTION

1.1 Background

Darling Harbour Live (formerly known as 'Destination Sydney'- a consortium comprising AEG Ogden, Lend Lease, Capella Capital and Spotless) was announced by the NSW Government in December 2012 as the preferred proponent to transform Darling Harbour and create the new Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP).

The SICEEP Site has been divided into three distinct redevelopment areas (from north to south) – Bayside, Darling Central and The Haymarket. The Application Site area relates to The Haymarket as shown in Figure 1.1 below.

Figure 1.1: Overview illustrating the location of The Haymarket relative to other areas within SICEEP

This report supports a State Significant Development Application (SSD 12_5752) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the Environmental Planning and

Assessment Act 1979 (EP&A Act) for the establishment of building envelopes and design parameters for a new neighbourhood and a community hub within The Haymarket.

Separate development applications will be lodged for other components of the SICEEP Project. Such areas of the SICEEP are beyond the scope of this report.

1.2 Brief

To support the Application, Coffey Environments Australia Pty Ltd (Coffey) was commissioned by LLD to prepare an acid sulfate soil (ASS) assessment and preliminary management plan (ASSMP).

This ASSMP has been prepared using available data from previous investigations by Coffey, which are described in Section 1.4 below.

The ASSMP has been prepared for the planning assessment phase of the proposed development. At this stage, the ASSMP is based on the conceptual drawings provided by LLD. The conceptual drawings show that the proposed development will include:

- Multi-storey buildings founded on bored piles extending to bedrock;
- Car parking, which may extend about 1.5m below ground surface;
- Lift bases, pile caps and stair bases;
- General trenches and excavations for the purpose of infrastructure and services;
- Excavations that may be required as part of remediation and/or archaeological works;
- Excavation and retention systems;
- Extensive dewatering involving the lowering of the water table for extended periods (months) is not anticipated during construction however, dewatering for shorter periods for the localised excavation of lift pits, pile caps, infrastructure services and associated with archaeological works may be required

This ASSMP presents a frame work for the approach and methodology of ASS management at the site during the construction phase to be followed by the contactor and its subcontractors. It provides a basis for specifications for ASS management in the understanding that a site specific ASSMP will be prepared for construction. The ASSMP will be updated and re-submitted with each subsequent Stage 2 DA (where relevant).

It is envisaged that this ASSMP may require review and updating once detailed design has been undertaken.

1.3 Objectives

The objective of the ASSMP is to assess the potential to encounter ASS and reduce the potential environmental impacts associated with the disturbance of ASS within the area of the proposed works. The ASSMP is prepared in general accordance with the Acid Sulfate Soils Assessment Guidelines (Ahern et al, 1998a) and the Acid Sulfate Soils Management Guidelines (Ahern et al, 1998b) in the Acid Sulfate Soil Manual, published by the Acid Sulfate Soils Management Advisory Committee (ASSMAC). Reference has also been made to the Queensland ASS Technical Manual Soil Management Guidelines (Dear et al 2002) and the ASS Laboratory Test Methods (QASSIT 2004).

1.4 Previous Reports

Coffey has prepared several geotechnical and environmental reports for the site. The information contained in these has been collated and summarised in reports:

- Coffey Environments (2013) Site Investigation: Factual Report, Haymarket Precinct, Darling Harbour, Sydney NSW, ref: ENAURHOD04498AA-R01 (Coffey 2013a);
- Coffey Geotechnics (2013) Geotechnical Assessment, SICEEP, Haymarket Precinct – Stage 1, ref: GEOTLCOV24303AG-AB (Coffey 2013b).

The site conditions, geology and hydrogeology information included in Section 2 in this ASSMP has been reproduced from these reports.

The previous ASS sampling and analysis data was only summarised in the Coffey (2013a) report. Therefore ASS data included in Section 3.2 has been obtained from the report Contamination Investigation, Sydney International Convention and Entertainment Centre, ref: GEOTLCOV24303AA-Phase 2 report (Coffey, 2011a).

1.5 Project Description

The conceptual drawings and information provided by LLD show that the proposed development will include:

- Multi-storey buildings (up to 40 levels) founded on bored piles extending to bedrock at depths between 6.7m and 23.5m below ground surface (bgs);
- Car parking, which may extend to about 1.5m bgs;
- Lift bases, pile caps and stair bases;
- General trenches and excavations for the purpose of infrastructure and services;
- Excavations that may be required as part of remediation and/or archaeological works;
- Excavation and retention systems;
- Extensive dewatering involving the lowering of the water table for extended periods (months) is not anticipated during construction.

2 PHYSICAL SETTING

2.1 Site Description

The site is located within Darling Harbour and adjacent to Sydney's Central Business District and comprises the Sydney Entertainment Centre (SEC), associated car park and surrounding public realm. The location of the site and study boundaries is shown in Figure 1.

The site occupies an area of approximately 4ha and is bound by Pier Street to the north, Hay Street to the south, a light rail corridor to the west and Harbour Street to the east. In general, the topography of the site is relatively level. The site layout is provided in Figure 2.

The current location of Cockle Bay, Darling Harbour is about 530m to the north of the site. Based on historical records (Macquarie's Map dated 1822), the site historically would have been within Cockle Bay and its tributaries.

2.2 Soils and Geology

The site is founded over what was originally known as Cockle Bay based on Macquarie's Map of 1822. The former bay and its tributaries extended almost 1km inland from the southern boundary of the current Cockle Bay, Darling Harbour. The present shoreline has been formed progressively by infilling since the 1820's. The fill deposits are underlain by estuarine and alluvial deposits, and slope wash, which are underlain by residual soil and Hawkesbury Sandstone bedrock of the Triassic Geological Age.

After reclamation in the 1820's, several factory buildings and roadways were developed progressively within the site. In the 1930's, most of the site was demolished to allow construction of a council depot. In 1949, the site was redeveloped into City Markets No.4. Subsequently in the 1980's, the City Market structures were demolished and the site was redeveloped with a multi-storey car park and the Sydney Entertainment Centre. Further details on historical land use of the site can be found in the Environmental Desk Study report, ref: GEOTLCOV24303AA-AC dated 13 July 2011.

A paleochannel is orientated in a north to south direction has been identified on the site. The paleochannel has been in-filled with various materials, including slope wash, estuarine deposits, and man-made fill.

An igneous dyke known as "The Great Sydney Dyke" intrudes the Hawkesbury Sandstone in a northwest to southeast direction towards the southern boundary of the site.

Further information on the geotechnical units and subsurface profile is provided in Section 2.4.

2.3 Hydrogeology

Recent ground investigations (Coffey, January 2013) recorded groundwater inflows at depths of 2.4m bgs to 3.0m bgs which coincided predominantly with the fill and upper alluvial deposits. Coffey (August 2011) report that groundwater flows in a northerly direction towards Cockle Bay, Darling Harbour.

Standing groundwater levels were recorded in one monitoring well (MW120), located in the north-eastern portion of the site, using a data logger to assess the influence on tidal fluctuations (Coffey, January 2013). Groundwater levels measured over a five day period ranged between 0.751mAHD

(1.959m bgs) and 0.788mAHD (1.922m bgs), which suggests that tidal fluctuations have negligible influence on groundwater levels within the site.

2.4 General Subsurface Profile

The general subsurface profile comprises fill underlain by alluvial/estuarine sediments, which have been deposited predominantly in a south-north direction consistent with the shape of the bay, with increasing thickness to the north. Beneath these alluvial/estuarine deposits, variable thicknesses of residual soils were encountered, underlain by weathered sandstone bedrock.

Borehole logs, from June 2011 and April to May 2012 drilling programs, reporting observed soil stratigraphy at each borehole location are provided in Appendix A. In general, borehole logs prepared during the investigation broadly correlate with the published geological records.

From the available borehole information, we have broadly inferred the subsurface profiles into geotechnical units for the purpose of this report, as summarised in Table 2.1.

Table 2.1 – Inferred Generalised Geotechnical Units

Unit	Material Description
1	Fill – comprising heterogeneous mixtures of sand, sandy gravel, clay and sandy clay/silt with cobbles and occasional boulder sized rock fragments. Concrete and Asphalt materials were encountered at shallow depths at most of the borehole locations. The density/consistency of the fill is variable, and may range from loose to dense or very soft to stiff. Due to its variability and likely non-uniform placement procedure, it would be classified as “uncontrolled fill”.
2	Alluvium and Estuarine Deposits – comprising clayey sands and clays with occasional shell layers and organic matters. These materials range from very loose to medium dense or very soft to very stiff in consistency. The Estuarine layers would generally be expected to comprise grey to dark grey, very soft to firm clays/silts and very loose to loose dark grey sands and silty sands. Deeper alluvium comprises stiff to very stiff orange brown and grey clays and dense sands and clayey sands.
3	Residual Soil – derived from weathering of the underlying sandstone rock, and generally comprising dense clayey sand or sandy clay having stiff consistency, pale grey to dark grey, orange and red brown. In many places, however, this unit is relatively thin or absent due to the geological erosion process.
4	Bedrock – comprising Hawkesbury Sandstone ranging from extremely weathered to fresh with low to medium strength shale bands (up to 1.2m thick).
5A	Extremely Weathered Dolerite (Clay) – comprising high plasticity clay derived from completely weathered dyke material. This unit is found within the dyke shown to significant depths as recorded in the past investigations.

Unit	Material Description
5B	Highly weathered to fresh Dolerite found within the dyke shown in Figure 2 from observations made during previous investigations.

Three cross sections have been drawn through the site and are presented as Figures 3 to Figure 5.

Table 2.2 presents a summary of the depths of occurrence and thickness of each geotechnical unit observed at the site based on the findings of previous investigations by Coffey.

Table 2.2 – Depth of Occurrence and Thickness of Geotechnical Units

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Elevation at Top of Unit (mAHD)
1	Fill	0	0.4 to 4.5	2.4 to 3.8
2	Alluvium/Estuarine	0.4 to 6.5	1.5 to 14.5 (Where proven)	1.2 to -1.5
3	Residual Soil	4.6 to 9.8	0.4 to 4.2	-1.8 to -11.7
4	Sandstone	6.7 to 23.5	Not Proven	-3.2 to -20.8

2.5 Acid Sulfate Soil Occurrence

The DLWC (1997) 1:25,000 scale ASS risk map shows the site as disturbed terrain, which they describe as *"Disturbed terrain may include filled areas, which often occur during reclamation of low lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. Soil investigations are required to assess these areas for acid sulphate soil potential."*

A review of the acid sulfate soil (ASS) risk map, presented on the Australian Soil Resource Information System (ASRIS) website (http://www.asris.csiro.au/indec_ie.html#), indicated a low probability for the presence of ASS beneath the site.

The ASRIS map indicated that there was a high probability of ASS in sediments in Darling Harbour and Sydney Harbour. There is evidence that the site and surrounding area has been reclaimed using harbour sediments, possibly along with other sources of fill material. Therefore it is possible that the some of the fill material at the site could contain ASS.

3 COASTAL ACID SULFATE SOILS

3.1 Background

Coastal ASS are commonly found in low lying coastal floodplains, estuaries, rivers and creeks. They are naturally occurring sediments rich in iron sulfides that form sulfuric acid when exposed to oxygen. Coastal ASS can include **potential** ASS (PASS) and **actual** ASS (AASS).

PASS are soils which contain iron sulfides or sulfidic material. In their undisturbed state, PASS may exhibit a pH of 4 or greater, and may be slightly alkaline. When exposed to air, the sulfides in PASS oxidise and can release significant quantities of acid. Following oxidation, the pH of these soils may fall considerably below pH 3.5.

AASS are highly acidic soils resulting from the oxidation of iron sulfides or sulfidic material present in the soil profile. AASS are formed through the disturbance of PASS, which may be a result of either natural disturbances (i.e. regional fall in groundwater levels which exposes PASS to oxygen) or human disturbances (i.e. excavating PASS, dewatering and/or dredging). AASS are typically characterised by pale yellow mottles, coating of soils with jarosite and pH of 4 or less.

3.2 Existing Laboratory Results

3.2.1 Action Levels

In order to assess the significance of the ASS potential, the laboratory results were compared to action levels in the ASSMAC (1998) Acid Sulfate Soil Manual.

The ASSMAC (1998) action levels are based on oxidisable sulfur concentrations for three differing soil textures. There are separate action levels depending on the amount of soil disturbed as a result of the proposed works. For this project it has been assumed that more than 1,000 tonnes of ASS will be disturbed. The applicable action levels are indicated in Table 3.1.

TABLE 3.1 - ASSMAC (1998) ACTION LEVELS

TEXTURE CATEGORY	APPROXIMATE CLAY CONTENT (%)	ACTION LEVEL Net Acidity (S_{CR}) (%)	ACTION LEVEL Net acidity moles/tonne
Coarse	<5%	0.03	18
Medium	5 to 40%	0.03	18
Fine	>40%	0.03	18

3.2.2 Comparison of Existing ASS Laboratory Results to Action Levels

The existing laboratory results collected by Coffey (2011) are summarised in Table 3.2.

Eighteen (18) soil samples were collected and tested using the ASS Field Screening Procedure. Subsequently, five samples were subjected to testing using the Chromium Reducible sulfur method (S_{CR}).

The testing was performed by SGS Australia Pty Ltd (SGS) a NATA-accredited laboratory in Alexandria, NSW. The results were compared to the ASSMAC (1998) Action Criteria assuming greater than 1000 tonnes of material will be disturbed during construction.

TABLE 3.2 – SUMMARY OF ASS LABORATORY RESULTS

LOCATION	MATERIAL DESCRIPTION	SCREENING TEST RESULT		S_{CR} (%)	NET ACIDITY (mol H+ / tonne)	ANC (% CaCO3)	LIMING RATE (kg / tonne)
		pH_F	pH_{FOX}				
BH5 8.5	Alluvium, sandy clay, low to medium plasticity, pale grey, medium sand, some silt, stiff	8.3	2.3	<0.005	<5	NA	NA
BH5 14.5	Estuarine, silty clay, low plasticity, dark brown, black, with some organic material (wood), very light, stiff	6.2	6.9	-	-	-	-
BH6 2.5	Fill, sand, coarse grained, grey-brown, trace silt and rubber	7.6	5.1	-	-	-	-
BH6 6.0	Alluvium, clayey sand, coarse grained, pale grey, medium plasticity clay, loose to medium dense	7.2	5.9	-	-	-	-
BH6 9.5	Slopewash, clay, high plasticity, red-brown , pale grey, grey, trace coarse sand, very stiff to hard	5.8	5.1	<0.005	12	NA	NA
BH10 3.0	Fill, Clay, medium to high plasticity, red, brown, pale grey, orange mottled, with some fine grained gravel	6.8	6.5	-	-	-	-
BH10 8.0	Alluvium, Clay, high plasticity, red-brown-grey, some coarse sand, very stiff	6.7	4.9	-	-	-	-
BH12 3.0	Estuarine, Silty Clay, high plasticity, dark grey, some bands of medium sand, and some shells, soft-firm	6.2	4.2	-	-	-	-
BH12 4.5	Estuarine, Silty Clay, high plasticity, grey, some bands of medium sand, and some shells, soft-firm	7.9	2.7	0.028	16	NA	NA
BH13 2.0	Fill, Gravelly Sand, fine to medium grained, brown, fine to coarse grained gravel	8.1	8.3	-	-	-	-
BH13 4.0	Estuarine, silty clay, high plasticity, dark grey, soft	-	-	0.92	460	0.8	43
BH13 5.5	Slopewash, sandy clay, low plasticity, pale grey mottled	8.3	3.4	-	-	-	-

LOCATION	MATERIAL DESCRIPTION	SCREENING TEST RESULT		S_{CR} (%)	NET ACIDITY (mol H+ / tonne)	ANC (% CaCO3)	LIMING RATE (kg / tonne)
		pH_F	pH_{FOX}				
	orange-brown, fine to medium sand, with some fine to medium ironstone gravel, stiff to very stiff						
BH14 2.5	Estuarine, silty clay, high plasticity, dark grey to grey, trace of medium sand, very soft	10.7	8.0	0.013	6.7	NA	NA
BH14 5.5	Estuarine, silty clay/clayey sand, clay is high plasticity and dark grey, sand is medium to coarse and dark grey, soft/loose	8.1	6.8	-	-	-	-
BH15 4-4.1	Slopewash, clay, high plasticity, pale grey, trace fine sand, stiff	8.4	6.9	-	-	-	-
BH15 7.5-7.6	Residual, clayey sand, coarse grained, red, trace ironstone gravels, medium dense	7.2	6.9	-	-	-	-
BH17 8-8.1	Alluvium, clay, high plasticity, pale grey mottled red-brown, trace sand, stiff to very stiff	7.5	3.7	-	-	-	-

The results of the field screening tests showed:

- No samples showed soil in water with a pH less than 4. Soil in water showing pH below 4 can be an indication of AASS;
- Three samples showed soil in hydrogen peroxide solution with a pH below 3; R17-BH5 8.5m (alluvium), and R17-BH12 4.5m (estuarine). Soil in hydrogen peroxide solution showing pH below 3 can be an indication of PASS.

The chromium reducible sulfur (S_{CR}) suite tests showed:

- Sample R17-BH13 4.0 (estuarine) recorded 0.92% S_{CR} and a net acidity of 460 mol H+/tonne. This indicates PASS is present in this soil;
- Sample R17-BH12 4.5 (estuarine) recorded 0.028% S_{CR} and a net acidity of 16 mol H+/tonne. This indicates PASS is present in this soil;
- The remaining three samples tested showed <0.005% S_{CR}, which indicates the soils were not ASS.

The results of the testing carried out to date indicated that the estuarine soils across the site are likely to be ASS. One sample indicated the soil was AASS, and another sample indicated the soil was PASS.

The field screening results indicated that in one location, R17-BH5 8.5m, in the alluvium may be PASS. However, the S_{CR} testing suggests that this was a false positive.

3.3 Summary of ASS Risk

The following summary of ASS risk is based on the current level of knowledge regarding the soil profiles, and the development of a site specific ground model including bored piles to bedrock.

3.3.1 Unit 1 Fill Material

The composition of the fill material is variable across the site. Historical information suggests that some of the fill materials may comprise dredged sediments from the former Cockle Bay. It is unclear when these sediments were placed as fill and there is a risk that these dredged sediments may be ASS. Three samples of fill material were screened using the ASS field screening test, and the results indicated that the fill in those locations were not ASS.

The risk of encountering ASS within the fill is related to the time the sediments were placed and hence the length of time that oxidation could have occurred and the height of groundwater in the fill which would tend to slow down the oxidation process.

It is considered likely that pockets of fill material may be encountered which have some stored acidity and will need to managed as ASS.

Given the uncertainties associated with the placement and occurrence of dredged sediments the fill material will require check testing during excavation (refer to Sections 4.5 and 4.6), and if the laboratory results indicate that stored acidity is present, then they will require management in accordance with this ASSMP.

3.3.2 Unit 2 Alluvium and Estuarine Deposits

The alluvium and estuarine deposits have been deposited predominantly in a south-north direction consistent with the former shape of the bay and occurrence of paleochannels, with increasing thickness to the north. The estuarine soils generally comprise very soft to firm clays and very loose to loose sand, grey to dark grey in colour. Estuarine soils are often characterised by organic and/or sulfurous odours. The alluvium generally comprises firm to very stiff clay and dense sand, grey and brown, often with red or orange mottling.

Estuarine soils have a high probability of being ASS and the limited laboratory analysis to date generally supports this. The logs indicate that the estuarine deposits are not consistent over the site, and that estuarine soils are not shown on all logs. It would be expected that estuarine soils would exist within former tidal creeks (prior to infilling) and as a thin layer over older alluvium.

3.3.3 Unit 3 Residual Soils, Unit 4 Weathered Sandstone and Unit 5 Weathered Dolerite

Residual soils weathered from Hawkesbury Sandstone, and weathered sandstone and dolerite are not coastal ASS, and therefore do not require management under this ASSMP.

3.3.4 Summary

Based on the review of the available soils and geological information plus the laboratory results, the risk of ASS is considered to be highest in the estuarine soils present in Unit 2. There is a low probability of encountering ASS within Unit 1 fill materials and possibly some Unit 2 alluvium if it has interbedded estuarine deposits.

Therefore, it is considered that Unit 1 and Unit 2 soils will require management in accordance with this ASSMP if excavated or disturbed.

Localised dewatering may be required, and prolonged dewatering has the potential to expose ASS to oxidation and produce acidic water, and procedures will be required to manage these risks.

The probability of ASS being encountered during the various construction activities is outlined in Table 3.3 below.

Table 3.3 – Probability of Encountering ASS

Construction Activity	Probability of Encountering ASS
Boring pile foundations	High probability of encountering ASS. Piles will extend into estuarine soils. There is also a low to moderate probability of encountering pockets of fill which are ASS.
Car park excavation to 1.5m bgs	Across most of the site fill material extends beyond 1.5m bgs. There is a low to moderate probability of encountering pockets of fill which are ASS. Where the car park excavation extends beyond the depth of fill, there is a high probability of encountering ASS.

Construction Activity	Probability of Encountering ASS
Excavation of pile caps, lift bases and stair bases. These are anticipated to be shallow, and extend no deeper than 2m bgs	Across most of the site, fill material extends beyond 2m bgs. There is a low to moderate probability of encountering pockets of fill which are ASS where excavation extends no deeper than 2m bgs. Where the pile cap and lift/stair base excavations extend beyond the depth of fill, there is a high probability of encountering ASS.
Trenches and excavations for infrastructure and services.	Across most of the site, fill material extends beyond 1.5m bgs. There is a low to moderate probability of encountering pockets of fill which are ASS where trenches and excavation extends no deeper than 2m bgs. Where the infrastructure/services excavations extend beyond the depth of fill, there is a high probability of encountering ASS. Should directional drilling/under-boring be proposed for installation of services, these would likely encounter ASS.
Excavations for remediation and/or archaeological purposes.	The depth of proposed remediation/archaeological excavations is not known. There is a low to moderate probability of encountering pockets of fill which are ASS where excavations for remediation and archaeological purposes extend no deeper than 2m bgs. Where the remediation/archaelogical excavations extend beyond the depth of fill, there is a high probability of encountering ASS.
Excavation/retention systems.	The depth of proposed excavation/retention systems is not known. There is a low to moderate probability of encountering pockets of fill which are ASS where excavation/retention systems extend no deeper than 2m bgs. Where excavation/retention systems extend beyond the depth of fill, there is a high probability of encountering ASS.

It is anticipated that material which has been excavated, may be managed in the following ways:

- Disposed to landfill - this material will require treatment and management. Guidance on the management and treatment of excavated soils is provided in Sections 4.8 below;
- Re-used on site after long-term stockpiling - this material will require treatment and management. Guidance on the management and treatment of excavated soils is provided in Sections 4.8 below;

- Re-used on site, under the water table, after short to medium term stockpiling – there is a reduced need to treat these soils as they will not be exposed for long time periods, and will be returned to below the water table. Guidance on the management of these soils is provided in Section 4.9 below.

4 MANAGEMENT PLAN AND PROCEDURES FOR ACID SULFATE SOILS

4.1 General

The monitoring and management of ASS will be the responsibility of the Contractor who will prepare a site-specific ASSMP based on the actual construction scenario and using the framework provided by this general ASSMP. The site-specific ASSMP will require review and approval by Department of Planning and Infrastructure as part of the overall project approval and subsequent Development Applications (where relevant).

Sampling undertaken for previous assessment does not conform with the NSW (1998) ASS Manual where it is recommended that samples are collected and field screened at 0.5m intervals (vertically), and selected samples tested in the laboratory for further assessment (S_{CR}). Future sampling and analysis may be carried out by the Contractor to improve confidence on the location of ASS and liming rates. The results, including amended liming rates (if applicable) can be incorporated into the site-specific ASSMP.

The following general management procedures are considered applicable for the following activities:

- Spoil generated from bored piles extending to bedrock at depths between 6.7m and 23.5m below ground surface (bgs);
- Excavations for construction of basement car parks, which may extend about 1.5m bgs;
- Excavations for lift bases, pile caps and stair bases;
- General trenches and excavations for the purpose of infrastructure and services;
- Excavations that may be required as part of remediation and/or archaeological works;
- Excavation and retention systems; and,
- Localised dewatering of the above excavations.

Extensive dewatering involving the lowering of the water table for extended periods (months) is not anticipated during construction, therefore detailed management measures for dewatering has not been provided.

The general management procedures are:

i. Appointment of an appropriately qualified person to manage the ASS issues during the earthwork activities;

ii. Undertake regular monitoring (screening) of excavated Unit 1 (fill), and Unit 2 (alluvium and estuarine) soils to assess the potential presence of ASS during excavation activities;

iii. Undertake regular surface water and groundwater monitoring during localised dewatering to assess if the surface water or groundwater has been impacted by oxidation of ASS;

iv. Manage the materials that are assessed to potentially be ASS through temporary stockpiling and treatment with lime to neutralise sulphuric acid produced via oxidation.

v. Assess options for water that requires disposal.

These procedures are further discussed in the following sections.

In the event that extensive dewatering involving the lowering of the water table for extended periods (months) is required, detailed management measures for dewatering will need to be assessed.

4.2 Preparation of a Site-Specific ASSMP

The Contractor will be responsible for preparation of a site-specific ASSMP based on the actual construction scenario.

The site-specific ASSMP will need to use the framework provided in this general ASSMP, including information on:

- The results of the additional sampling and analysis (as per Section 4.4), if carried out;
- Training, roles and responsibilities;
- Management of excavated soils;
- Treatment and monitoring of acid sulfate soils, including liming rates;
- Management of temporary stockpiles;
- Management of dewatering water, including liming rates;
- Options for re-use and/or disposal of soils;
- Options for disposal of water;
- Monitoring and reporting requirements.

4.3 Training, Roles and Responsibilities

The earthworks contractor will appoint an appropriately trained person who is responsible for managing the ASS issues during the earthwork activities.

This person should be familiar with:

- Council and other relevant statutory requirements;
- Recognition of ASS materials;
- ASS testing and treatment procedures;
- Onsite management of ASS materials, including implementing management procedures.

The classification of ASS materials during construction should be carried out by personnel trained in the identification of ASS and be based on visual classification and the field screening test. If required, a suitably qualified Environmental Consultant could be engaged to assist or train the Contractor in the identification of ASS.

4.4 Additional Assessment

The 1998 ASS Manual states that for sites greater than 4 hectares, samples should be collected from a minimum of 2 sampling locations per hectare, with soil samples collected at 0.5m intervals at each

location. Samples should be collected to a depth of 1m below the proposed depth of disturbance. For this site, this would require a minimum of eight locations.

Samples were collected from eight locations, with between one to three samples collected and analysed at each location. Additional sampling and analysis would therefore be required to satisfy these guidelines. The additional sampling and analysis can be undertaken by the Contractor, to improve confidence on the location of ASS and liming rates, with the results and liming rates incorporated into a site-specific ASSMP to be prepared by the Contractor.

4.5 Visual Classification

The preliminary visual checking of potential ASS will be based on material type, colour and consistency. Dark grey and black, very soft to soft, occasionally firm clays and sandy clays and dark grey to grey, very loose to loose clayey sands and sands will be classified as suspected acid sulfate soils.

The site soils comprise fill materials, overlying alluvial and estuarine soils. There is a potential for the fill material to contain pockets of dredged sediments, which may be ASS. The alluvial soils are generally unlikely to be ASS and would comprise stiffer clays and denser sands, and are brown, grey and mottled orange in colour.

4.6 Field Test Classification and pH Monitoring

A field screening test using hydrogen peroxide (H_2O_2) will be performed regularly on the excavated soils. The peroxide screening test will be undertaken based on Appendix I of the ASSMAC (1998) Acid Sulfate Soils Manual (Ahern et al, 1998a). Soils that record a pH of below 4, following oxidation with H_2O_2 , will be managed as ASS.

Based on the results of pH monitoring, visual assessment and field screening, selected soils samples (at a minimum rate of 10% of screened samples) will be sent for laboratory analysis using the chromium reducible suite (Scr) method to confirm the peroxide screening test results to confirm the required liming rate.

4.7 Management of Excavated Soil During Construction

Table 4.1 below summarises the required management/treatment of soils for the various construction activities, and frequency of check testing and validation sampling, and the field and laboratory analysis required. More detailed information on how to carry out the recommended treatment, and the requirements of sampling and analysis are provided in Sections 4.8 and 4.9.

The probability of ASS being encountered during the various construction activities is outlined in Table 3.3 in Section 3.3.4.

It is anticipated that generally material which has been excavated, will not be returned to the excavation. The possible exceptions to this are soils excavated from infrastructure/services trenches, and remediation/archaeological excavations. The material excavated for remediation/archaeological purposes is not expected to be returned to the excavation within a short to medium time frame, and therefore will require treatment similarly to other excavated soils.

The soils excavated from the infrastructure/services trenches may be able to be returned to below the water table within the trench within a short timeframe, reducing the need to treat these soils.

Table 4.1 – Management/Treatment of ASS for Various Construction Activities

Construction Activity	Treatment/Management Method^	Check Testing Frequency and Analysis	Validation Sampling and Analysis
Boring pile foundations	It is considered impractical to attempt to separate the soil cuttings that could contain ASS, from the soil cuttings that are non-ASS. It is also considered that the non-ASS cuttings could act as a sufficient buffer to neutralise the ASS present, provided the ratio of ASS to non ASS is greater than 3:1. As a precaution samples of the soil cuttings should be tested to assess if there is a need for additional neutralisation by liming. If liming is required, the procedures in Section 4.8 should be carried out.	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR} test to check the liming rate.	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.
Car park excavations.	The soils will need to be placed in the treatment area. Check testing is required to assess if the soil is ASS, and confirm liming rates. Depending on the results of check testing, the soil will be treated with lime as per the procedures in Section 4.8.	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR} test to check the liming rate.	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.
Excavation of pile caps, lift bases and stair bases.	The soils will need to be placed in the treatment area. Check testing is required to assess if the soil is ASS, and confirm liming rates. Depending on the results of check testing, the soil will be treated with lime as per the procedures in Section 4.8.	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR} test to check the liming rate.	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.
Trenches and excavations for infrastructure and services.	Depending on the method of installation, two management/treatment options are possible. ***Soils from excavation of trenches:*** The soils will need to be placed in the treatment area. Check testing is required to assess if the soil is ASS, and confirm liming rates. Depending on the results of check testing, the soil will be treated with lime as per the procedures in Section 4.8. ***Soils from directional drilling / under-boring:*** Based on experience with similar under-boring work the drilling technique will most likely include wash boring using a bentonite slurry and casing to keep the hole from collapsing. It is considered impractical to attempt to separate the soil cuttings that could contain ASS, from the bentonite slurry. It is also considered that the bentonite slurry would act as a sufficient buffer to neutralise ASS. As a precaution samples of the slurry should be tested to assess if there is a need for additional neutralisation by liming.	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR} test to check the liming rate.	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.
Excavations for remediation and/or archaeological purposes.	The soils will need to be placed in the treatment area. Check testing is required to assess if the soil is ASS, and confirm liming rates. Human health precautions may need to be implemented to protect construction workers in accordance with any approved human health and	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR}	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.

Construction Activity	Treatment/Management Method^	Check Testing Frequency and Analysis	Validation Sampling and Analysis
	environmental risk assessment (HHERA). Depending on the results of check testing, the soil will be treated with lime as per the procedures in Section 4.8.	test to check the liming rate.	
Excavation/retention systems.	The soils will need to be placed in the treatment area. Check testing is required to assess if the soil is ASS, and confirm liming rates. Depending on the results of check testing, the soil will be treated with lime as per the procedures in Section 4.8.	One sample per 250m^3 to be analysed using the field screening test. If the field screening tests indicate cuttings are ASS, then 10% of samples should be tested using the S_{CR} test to check the liming rate.	If liming is carried out, validation sampling will be required. This would comprise one sample per 250m^3 to be analysed using the field screening test.
Notes: *^The treatment/management method outlined in this table may be amended if further assessment is carried out. The further assessment may confirm if the soils proposed to be excavated are ASS or non-ASS, and the liming rate. This would reduce the need for check testing.*			

4.8 Treatment of ASS

4.8.1 Treatment Pad and Liming Methodology

Excavated soils will be placed in a specially prepared treatment pad for treatment via application of lime to the soil. The type and amount of lime to be applied should be such that a neutralising value (NV) of 100 can be achieved. The NV should be identified prior to mixing. NV relates to the purity of the lime and an NV of 100 is required to ensure that the lime is effective in neutralising the potential acid. Fine powdered agricultural lime ($CaCO_3$) generally has an NV of 90% to 100% whilst other manufactured forms of lime can have an NV as low as 80%. Where NV is below 100, the factor of safety, hence the amount of lime will have to be adjusted accordingly.

The design of the treatment pad should be in general accordance with Figure 4, page 24, of Dear et al (2002) presented in Appendix C. The following procedures (or other equivalent) should be undertaken for the treatment pad and liming:

- The treatment pad should be located at least 40m from a permanent waterway or creek and, if possible, placed in a topographically high area to avoid inundation following heavy rain. The area should be appropriately bunded and provision made to collect run-off water.
- Spreading of the soil in thin (<200mm) layers on impervious pads within the boundary of the site works. Consideration should be given to providing a suitable foundation for the treatment area that can support the weight of the mixing machinery;
- A guard layer of neutralising agents should be provided at the base of the pad prior to the addition of ASS; and
- Addition of lime by hand or light weight truck followed by mixing, using light weight rotovators or similar tools. The amount of lime to be added has been assessed from the existing laboratory results. The preliminary lime rate, based on the current laboratory data, is 43kg/tonne by dry weight which includes a factor of safety of 1.5 to account for incomplete mixing and NV of 100 (agricultural lime). This preliminary liming rate is based on the laboratory results of five samples at various depths from five locations. Once additional assessment has been carried out, the liming rate can be reviewed;
- The amount of lime to be kept on site for emergencies will be assessed by the Contractor.

4.8.2 Lime Register and pH

In order to demonstrate that appropriate quantities of lime have been used, a lime register shall be maintained by the Contractor. The register shall list the amount of lime delivered to the site, verified by delivery dockets, and where the lime has been used. The lime usage shall quantify areas limed and soil volumes treated, liming rates and quantities of lime used. The amount of lime to be kept on-site for emergencies will be assessed by the Contractor.

Observations of the limed material will be made by an experienced ASS consultant who will also assess the lime register. Monitoring of pH will be carried out at least weekly prior to re-use of the material.

Readings of pH at or above background, in conjunction with the lime register and observations of mixing, can be used as verifiable performance indicators.

4.8.3 Validation of Treated ASS

In order to demonstrate that the treatment of the ASS has been effective sampling and analysis of the soil will be required. The sampling and analysis will comprise:

- Collection of samples at the following frequencies:
  - one sample per 250m^3 for volumes up to 5,000m^3;
  - one sample per 500m^3 for volumes up to 10,000m^3;
  - one sample per 1,000m^3 for volumes greater than 10,000m^3;
- Field screening of the samples as per Appendix I of the ASSMAC (1998) ASS Manual;
- Analysis of at least 10% of samples using the chromium reducible sulfur (S_{CR}) test by a NATA accredited laboratory;

Where the results indicate that the treatment has not been effective, further liming will be required.

Once successfully limed and validated this material could be used on site as general fill provided it is placed above the water table. Alternatively the limed material can be disposed off site to landfill once appropriately classified.

If the material is proposed to be disposed to landfill, sampling and analysis of the soil for contaminants of concern may be required. The soil can then be classified in accordance with the NSW DECCW (2009) Waste Classification Guidelines (or other guidelines that may supercede NSW DECCW (2009) at the time of construction).

If the material is proposed to be re-used on site, sampling and analysis of the soil for contaminants of concern may be required. The results of the testing should be compared to the commercial/industrial land use criteria in NEPM (1999) (or other guidelines that may supercede NEPM (1999) at the time of construction).

It is assumed further information on the re-use and disposal of soil from a contamination perspective will be provided in a remedial action plan or construction environment management plan.

4.9 Spoil to be Returned to Below Groundwater Level

The excavated soil from trenches for infrastructure/services may be able to be returned to at or below the groundwater level within a short to medium timeframe, where such soil also meets the on-site reuse criteria established by any approved HHERA or RAP. Where this is possible, it is not proposed to treat the excavated material but to excavate, temporarily stockpile and monitor this material for pH. The excavated material can then be used to backfill the trench to at or below the groundwater level where practicable and acceptable to the relevant utility provider. The decision to reuse material in such a manner will be to Lend Lease's discretion.

4.9.1 Temporary Stockpiling

The types of material that are likely to be encountered during trenching for services are expected to range from clays (fine textured) to sands (coarse textured). Reference must be made to Table 4 of

Dear et al (2002), presented in Appendix C, for appropriate timeframes for short to medium term stockpiling depending on the actual material types encountered. The site specific ASSMP is to detail how stockpiling will be minimised by preparing a detailed earthworks strategy that documents:

- The timing and volumes of soil to be stockpiled and returned to the trench;
- Temporary stockpile locations;
- Measures to prevent potential impacts relating to the oxidation of ASS on surface water and groundwater.

Medium term stockpiling timeframes should conform to Table 5 of Dear et al (2002) (Appendix C). Where stockpiling exceeds these limits or pH monitoring indicates that oxidation is occurring, these soils will be removed to the specially prepared liming pad and treated as per Section 4.8.

The following management plan should be followed where ASS is placed in a medium term stockpile area:

- Soils will be stockpiled at least 40m from stormwater drains or creeks and if possible placed in a topographically high area to avoid inundation following heavy rain. The soil stockpiles will be bunded, and placed on strong impermeable plastic sheeting, and provision made for collection of surface runoff and appropriate sediment, erosion and dust controls;
- The stockpiles will be kept moist to help slow the oxidation process;
- A supply of fine grained agricultural lime (with a neutralisation factor of at least 97%) will be kept on site during construction work. The amount of lime to be kept on site will be sufficient to provide emergency liming of existing stockpiles on site (see Section 5).
- The stockpiles will also be observed for obvious signs of oxidation, such as jarosite staining;
- Monitoring of the stockpiles and associated run-off water will be carried out for the duration of the work by personnel trained in the identification of ASS. The monitoring will include:
    - **Soil**
    - The stockpiles will be observed for obvious signs of oxidation, such as jarosite staining;
    - Soil samples will be collected from stockpiles at a frequency of one per 250m^3 and tested in the field for pH;
    - If the pH results indicate acidification is occurring (i.e. pH is below 4) then the soil will need to managed and treated as per Section 4.8. The soil can then be re-used on site or disposed to landfill as per Section 4.8.3.
    - **Water**
    - If surface run-off water is collected, then a water sample must be tested in the field for pH;
    - If the pH results indicate the water is acidic (i.e. pH is below 4), then the procedures in Section 4.11 should be implemented.

4.9.2 Backfilling of Trench

Material in the temporary stockpiles will be placed back within the trench within four days of excavation provided there is no evidence of oxidation. This material will be placed below the groundwater level.

4.10 Management of ASS During Directional Drilling/Under-Boring

Directional drilling or under-boring may be used for installation of some underground infrastructure or services. Based on experience with similar underboring work the drilling technique will most likely include wash boring using a bentonite slurry and casing to keep the hole from collapsing.

The slurry material is usually directed to a sump during drilling and recycled as the borehole advances. At the completion of drilling, the slurry waste should be classified and disposed of to a licensed landfill. It is considered impractical to attempt to separate the soil cuttings that could contain ASS, from the bentonite slurry. It is also considered that the bentonite slurry would act as a sufficient buffer should the slurry dry out. As a precaution a sample of the slurry should be tested to assess if there is a need for additional neutralisation.

4.11 Dewatering During Construction

Localised dewatering may be required in excavations for pile caps and lift/stair bases, and possibly in remediation/archaeological excavations. Dewatering has the potential to expose ASS to oxidation. Water levels on the site ranged from about 2.0m to 3.0m bgs.

Localised dewatering during excavations is considered to represent a low risk of ASS oxidation for the following reasons:

- Prolonged drawdown is not expected due to the localised nature of the dewatering (i.e. small excavation areas only). If draw-down is likely, then further consideration of the impacts this will have will be required in the site specific ASSMP;
- Excavations would most likely be carried out progressively in small areas. The length of time for dewatering within each area should be measured in days/weeks and is not considered to be sufficient time for significant oxidation to occur;

It should be noted that actual construction details are not known at this stage and may vary from that assumed above. Dewatering and mitigation strategies will be provided by the Contractor in line with the broad framework outlined in this general ASSMP. Prolonged lowering of the groundwater table (months) would enhance oxidation of the potential ASS in the area and eventually cause harm once the groundwater returned to pre-construction levels. As a precaution groundwater and surface water monitoring is recommended and outlined in the following sections.

Should acidification of water occur, the following general procedures should be followed:

- Water is to be placed in an acid-resistant holding tank or pond, and samples collected to assess the pH, electrical conductivity, chloride sulfate ions, and heavy metals;
- Lime will be added to the water at a rate assessed from the results of the testing;
- Following treatment with lime, the water will be sampled and tested again for pH, electrical conductivity, chloride sulfate ions and heavy metals;
- The results of the water testing must be compared to the results of baseline monitoring of receiving bodies (i.e. Darling Harbour). If the water results are similar to the results of the baseline monitoring of the receiving body, then the water will be considered suitable for disposal to the receiving body, or to stormwater drains that discharge into the receiving body. Permission from the relevant regulatory authority (i.e. NSW Office of Water or Council) must be obtained before disposal;

- If the water is not suitable for disposal in the environment, the water must either be treated to become suitable for disposal to the environment (i.e. use of a pH dosing equipment), or be removed and disposed by a licensed liquid waste contractor;
- It is assumed that the detailed remediation action plan for construction environment management plan would provide information on the management, treatment and disposal of water from a contamination perspective.

4.12 Groundwater and Surface Water Monitoring

A groundwater and surface water monitoring system will be required to confirm that impacts from potential oxidation of ASS are being appropriately managed.

Nearby drains and groundwater monitoring wells should be monitored for pH and electrical conductivity. The frequency of testing should be assessed based on the construction timetable and the length of time each areas of excavation remains open.

Baseline data should be collected from existing drains and groundwater wells prior to the commencement of excavations. Baseline data should include laboratory analysis of samples for pH, electrical conductivity, chloride sulfate ions, and heavy metals.

4.13 Monitoring Testing and Reporting

Monitoring testing and reporting of soil and groundwater will be carried out in accordance with best practice industry standards. Monitoring and testing of surface water will be carried out in accordance with the relevant sections of the National Water Quality Management Strategy. In particular the following guidelines will be referenced and used where appropriate:

- ASS Manual prepared by the ASS Management Advisory Committee (1998);
- National Environment Protection Measure (1999);
- NSW DECCW Waste Classification Guidelines (2009);
- Australian and New Zealand Guidelines for the Protection of Fresh and Marine Waters (2000); and
- Australian Guidelines for Water Quality Monitoring and Protection (2000).

4.13.1 Soil Monitoring Programme

The following soil monitoring programme should be carried out during excavation and pile boring:

- Visual assessment and pH monitoring of stockpiled material (minimum one field test per 250m^3);
- Visual assessment and pH monitoring of temporary stockpiles for signs of oxidation of ASS (minimum one field test per 250m^3);
- Visual assessment of backfilling operations (if soil is re-used on site) to assess that ASS is placed appropriately within the excavations/trenches;
- Laboratory analysis of selected soil samples for Scr and comparison to ASS Action Criteria;
- Laboratory analysis of soil for contaminants of concern, and comparison to the appropriate landuse criteria in NEPM (1999) and/or the NSW DECCW (2009) Waste Classification Guidelines. Further

information on the re-use and disposal of soil from a contamination perspective will be provided in the remedial action plan or construction environment management plan;

- Reporting of the results of pH monitoring, visual assessment and laboratory results.

4.13.2 Water Quality Monitoring Programme

The following water monitoring programme should be carried out during dewatering activities:

- Baseline sampling of surface water bodies where water will be discharged to, either directly or indirectly (i.e. via stormwater). Samples should be collected in accordance with the guidelines noted above;
- Laboratory analysis of baseline samples for pH, electrical conductivity (EC), chloride sulfate and heavy metals, and other potential contaminants of concern as discussed in the detailed detailed remediation action plan;
- Monitoring of groundwater and surface water during dewatering activities including field parameters EC, temperature, redox and pH;
- Reporting of the baseline results prior to dewatering commencing;
- Reporting of the monitoring of field parameters in groundwater and surface water. A comparison of monitoring results to thresholds and/or baseline data will be made. Should results exceed the threshold and/or baseline data, then the contingency procedures in Section 5 should be implemented. Other factors to be included in reporting are the areas of excavation affected, volume of stockpiled material and length of time dewatering is carried out.

5 CONTINGENCY PLAN

A contingency plan is outlined in Table 5.1, listing potential events relating to ASS that may arise during construction and actions that will be undertaken if unexpected conditions occur.

TABLE 5.1 - CONTINGENCY PLAN

Unexpected Condition	Action
ASS encountered where not expected.	Emergency liming of soil to be carried out. Where emergency liming is required and additional laboratory testing results are not readily available, the liming of ASS may be carried out at a rate of about 20kg lime per tonne of soils. The emergency liming rate is a temporary measure to lower the immediate risk to the environment and may not be sufficient for complete neutralisation.
Severity of ASS encountered is higher than expected (i.e. potential to generate more acid).	Carry out chromium reducible sulphur testing of the soil, using a NATA accredited laboratory, to confirm liming rate. Additional liming of soil is to be carried out (as per Section 4.8.1), and validation testing (as per Section 4.8.3) conducted to check liming has effectively neutralised acid.
Accumulated water from dewatering is observed to be acidified (i.e. pH <4).	Emergency liming of water is to be carried out. Where emergency liming of water is required either from dewatering or run-off from stockpiles, and laboratory testing results are not available, liming of acidic water may be carried out at a rate such that residual lime is present and the pH of the water is not less than 6. The emergency liming rate is a temporary measure to lower the immediate risk to the environment and may not be sufficient for complete neutralisation.
Validation samples fail criteria.	Carry out additional liming of soil.
Identification of unexpected contaminated materials or archaeological finds during excavations.	Refer to construction environment management plan, or remedial action plan (for contamination). An environmental consultant or archaeologist may be required to assess the material and provide management measures.
Other	Other unexpected events which may affect the outcome of the investigation would be notified to the client, and other relevant parties. At that time potential actions to address the unexpected event will be assessed and presented.

6 CONCLUSION

Coffey understands that “The Haymarket” development is to include a mix of land uses including commercial office, residential including student accommodation, retail and public open space. Residential podium and tower forms (up to 40 storeys) are proposed. Generally, car parking is proposed to be above grade within the podium. New infrastructure services (including diversions and augmentations) will be provided to service new developments. In addition, it is likely that additional excavation works associated with remediation and archaeological works will also be required.

Coffey has assessed the Lend Lease proposed development scheme in the context of the potential to encounter acid sulfate soils on the site and have concluded that where such soils are encountered through the undertaking of the proposed development works, that they can be adequately managed utilising industry standard design and construction techniques and practices to prevent unacceptable environmental impacts and render the site suitable for its intended use.

7 LIMITATIONS

This ASSMP is prepared based on the current level of understanding of the site and the proposed development. It should be reviewed and updated progressively as detailed design is known, and work is completed. It is assumed that a site specific ASSMP will be developed by the successful contractor using management procedures of this ASSMP as a framework. This ASSMP will be superceded once a site specific ASSMP has been prepared and approved.

The findings contained in this report are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of this site at all points.

This plan has been prepared based on preliminary information regarding acid sulfate soils at the site based on borehole information, and limited laboratory testing The actual subsurface conditions encountered during the project could differ from that relied on for this report.

This plan does not address geotechnical or contamination issues.

8 REFERENCES

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coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Important information about Coffey Environmental Report

Uncertainties as to what lies below the ground on potentially contaminated sites can lead to remediation costs blow outs, reduction in the value of the land and to delays in the redevelopment of land. These uncertainties are an inherent part of dealing with land contamination. The following notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report has been written for a specific purpose

Your report has been developed on the basis of a specific purpose as understood by Coffey and applies only to the site or area investigated. For example, the purpose of your report may be:

- To assess the environmental effects of an on-going operation.
- To provide due diligence on behalf of a property vendor.
- To provide due diligence on behalf of a property purchaser.
- To provide information related to redevelopment of the site due to a proposed change in use, for example, industrial use to a residential use.
- To assess the existing baseline environmental, and sometimes geological and hydrological conditions or constraints of a site prior to an activity which may alter the sites environmental, geological or hydrological condition.

For each purpose, a specific approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible, quantify risks that both recognised and unrecognised contamination pose to the proposed activity. Such risks may be both financial (for example, clean up costs or limitations to the site use) and physical (for example, potential health risks to users of the site or the general public).

Scope of Investigations

The work was conducted, and the report has been prepared, in response to specific instructions from the client to whom this report is addressed, within practical time and budgetary constraints, and in reliance on certain data and information made available to Coffey. The analyses, evaluations, opinions and conclusions presented in this report are based on those instructions, requirements, data or information, and they could change if such instructions etc. are in fact inaccurate or incomplete.

Subsurface conditions can change Interpretation of factual data

Subsurface conditions are created by natural processes and the activity of man and may change with time. For example, groundwater levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project and/or on the property.

Interpretation of factual data

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from indirect field measurements and sometimes other reports on the site are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of Coffey through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other problems encountered on site.

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Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered with redevelopment or on-going use of the site. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. In particular, a due diligence report for a property vendor may not be suitable for satisfying the needs of a purchaser. Your report should not be applied for any purpose other than that originally specified at the time the report was issued.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other professionals who are affected by the report. Have Coffey explain the report implications to professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), field testing and laboratory evaluation of field samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Contact Coffey for additional assistance

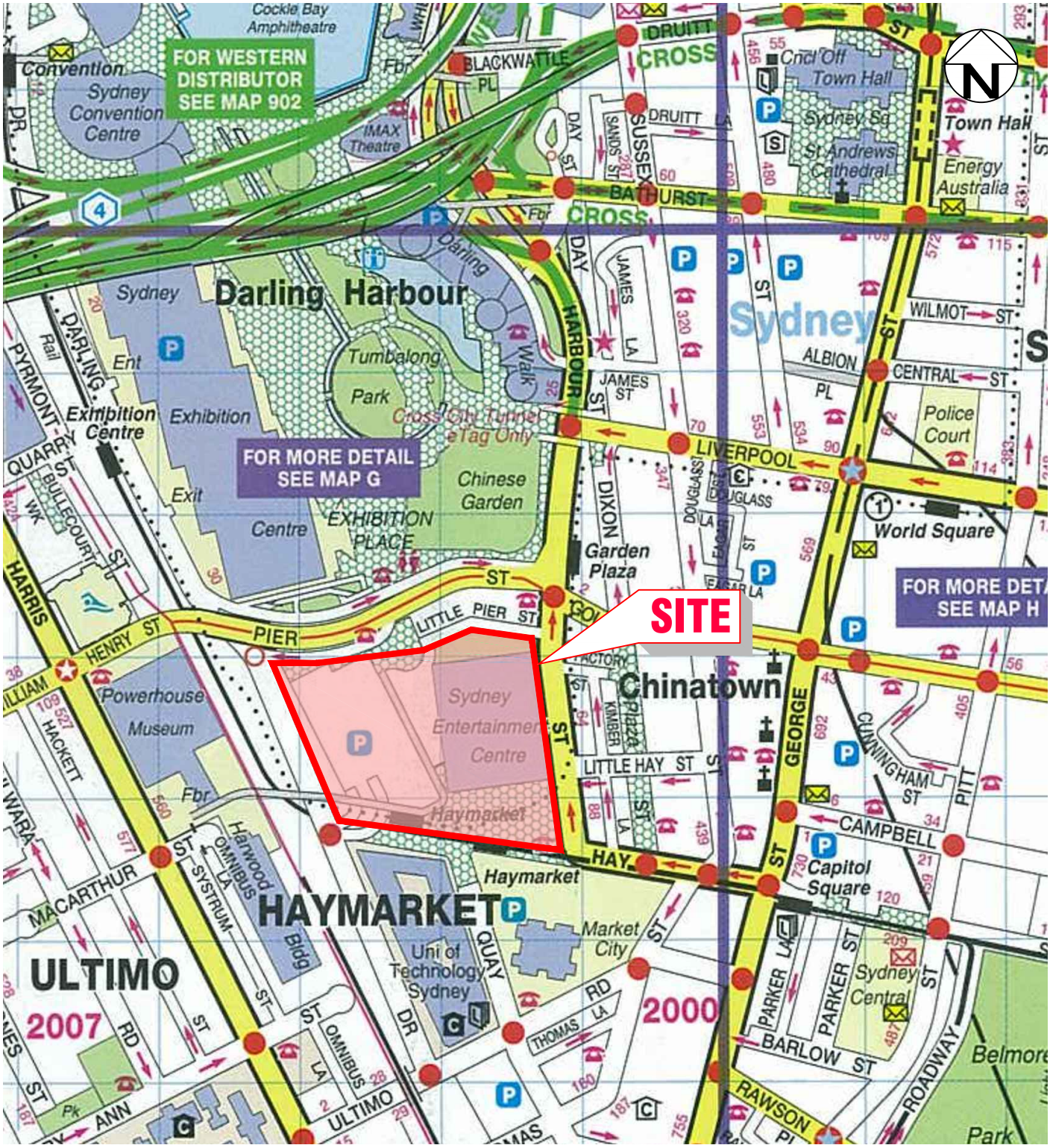
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to land development and land use. It is common that not all approaches will be necessarily dealt with in your environmental site assessment report due to concepts proposed at that time. As a project progresses through planning and design toward construction and/or maintenance, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Environmental reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

Figures

Acid Sulfate Soil Assessment and Preliminary Management Plan
Haymarket Precinct, Darling Harbour, Sydney NSW



SOURCE: UBD STREET DIRECTORY GREGORYS
SYDNEY, NEW SOUTH WALES
47TH EDITION, 2012, MAP 20

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Scale (metres) 1:5000

drawn	EC / AW
approved	-
date	22 / 02 / 13
scale	AS SHOWN
original size	A4

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client:	LEND LEASE DEVELOPMENTS PTY LTD
project:	ACID SULFATE SOIL MANAGEMENT PLAN HAYMARKET PRECINCT, DARLING HARBOUR, NSW
title:	SITE LOCALITY PLAN
project no:	ENAURHOD04498AA-R03
figure no:	FIGURE 1

PLOT DATE: 22/02/2013 8:52:54 AM DWG FILE: F:\ENVIPROJECTS\ENAURHOD\ENAURHOD04\GOVINDI\ENAURHOD04400-04499\ENAURHOD04498\AA\FIGURES\ENAURHOD04498AA-R03.DWG

R9-WB30a
R13-T12
R13-T10
R5-2
R18-NBH21
R8-A24
R8-B9
PIER
STREET
C
B
A
R11-23
R11-34
R11-26
R11-30
R11-20
R11-29
R11-33
R11-19
R11-18
R11-22
R11-25
R11-28
R11-32
R11-17
R11-21
R3-11
R11-24
R11-27
R11-31
R11-16
R19-CBH6
R18-NBH24
R3-10
R4-22
R3-12
R4-21
R4-18
R4-23
R8-B8
R9-WB33
R4-20
R4-17
R4-24
R4-19
EB1
R19-CBH7
R19-CBH7A
R4-16
R20-BH124
R19-CBH5A
R19-CBH5
R4-13
R4-14
R17-BH1
R19-CBH8
R20-BH120
R4-15
R3-9
R8-B23
R8-A4
R8-B7
R17-BH2
R18-NBH26
EB2
R20-BH123
R2-6
R17-BH3
R3-8
R18-NBH25
R20-BH121
EB3
R3-7
R20-BH122
R17-BH4
R8-B6
R9-WB37
R8-B24
R2-4
R9-WB39
R8-A3
R8-B5
R8-B25
R10-43
R10-42
R16-P52
R16-P53
R19-CBH9
R19-CBH10
R20-BH118
R2-1
R17-BH5
R18-NBH29
R2-3
R18-NBH23
R17-BH12
R19-CBH11
R17-BH10
R17-BH6
R17-BH7
R20-BH128
BR20-H129
R17-BH14
R18-NBH27
R17-BH8
R20-BH125
R17-BH9
R18-NBH30
R20-BH127
R17-BH15
R17-BH16
R20-BH126
R17-BH13
R2-5
R2-2
R20-BH119
R17-BH11
R17-BH17
R9-HY45
B'
C'

LEGEND

- PREVIOUS BOREHOLE LOCATION
- SITE BOUNDARY
- APPROXIMATE LOCATION OF THE GREAT SYDNEY DKYE
- GEOTECHNICAL SECTION

revision	description	drawn	approved	date

N

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Scale (metres) 1:1000

drawn	EC / AW
approved	-
date	26 / 02 / 13
scale	AS SHOWN
original size	A3

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client: LEND LEASE DEVELOPMENTS PTY LTD

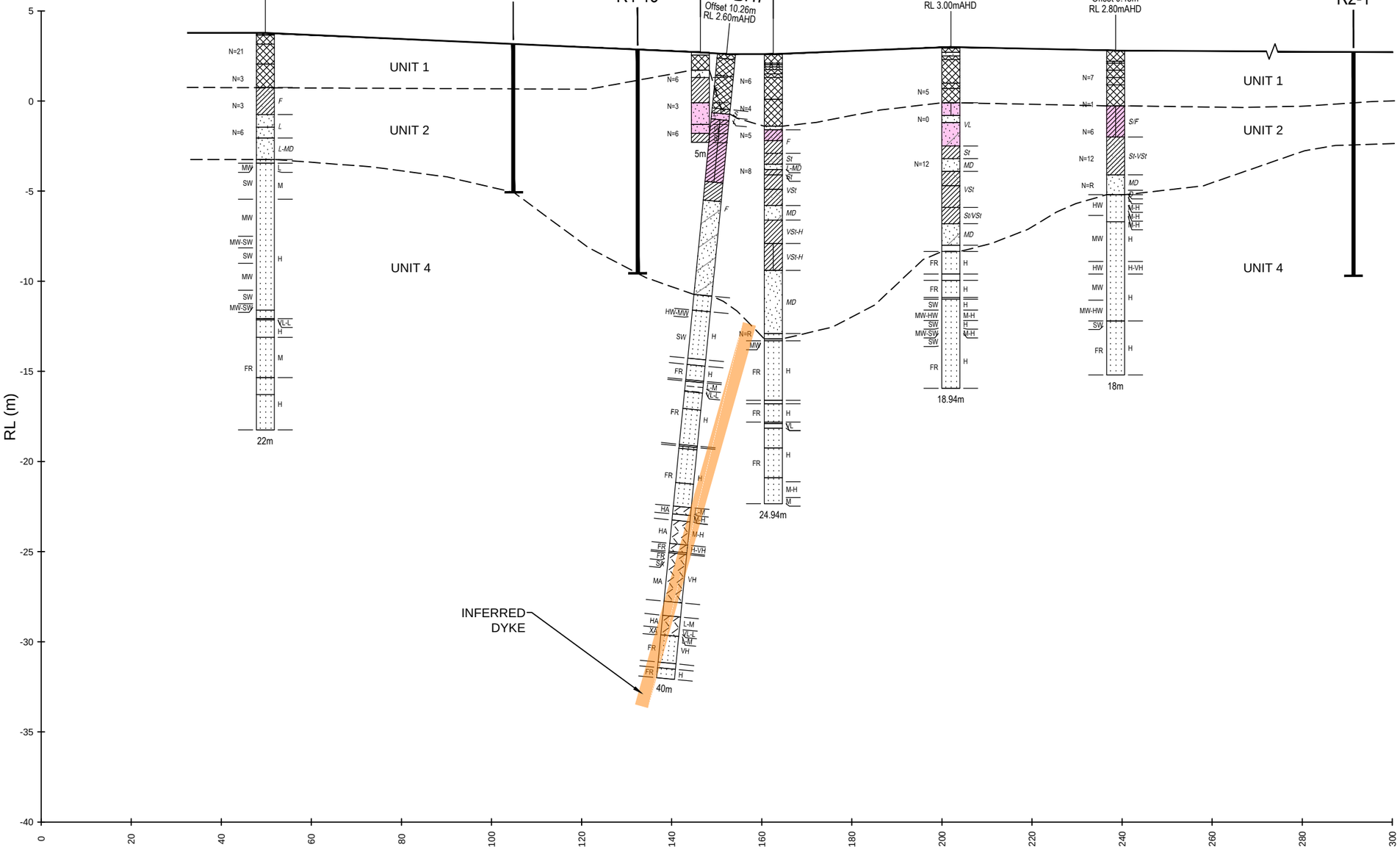
project: ACID SULFATE SOIL MANAGEMENT PLAN
HAYMARKET PRECINCT, DARLING HARBOUR, NSW

title: PROPOSED DEVELOPMENT LAYOUT AND PREVIOUS BOREHOLE LOCATIONS

project no: ENAURHOD04498AA-R03

figure no: FIGURE 2

PLOT DATE: 26/02/2013 4:35:26 PM DWG FILE: F:\ENVPROJECTS\ENAURHOD\ENAURHOD04400-04499\ENAURHOD04498 BOVIS LAND LEASE HAYMARKET\ENAURHOD04498AA\FIGURES\ASSMP FIGURES\ENAURHOD04498AA-R03.DWG



SECTION A-A'

LEGEND

- FILL
- CLAYEY SAND
- SANDSTONE
- SHALE
- CLAY
- SANDY CLAY
- SAND
- SILTY CLAY
- SILTY SAND
- DOLERITE
- OCCURRENCE OF ACID SULFATE SOILS
- IV — ROCK CLASSIFICATION (PELLS ET AL, 1998)
- DX — WEATHERING (SEE EXPLANATION SHEETS)
- WATER LEVEL
- N*=17 — STANDARD PENETRATION TEST RESULT
- UNIT 1 — FILL
- UNIT 2 — ALLUVIUM / ESTUARINE
- UNIT 3 — ALLUVIUM SOIL
- UNIT 4 — SANDSTONE

revision	description	drawn	approved	date

Scale (metres) 1:1000

drawn	EC / AW
approved	-
date	22 / 02 / 13
scale	AS SHOWN
original size	A3

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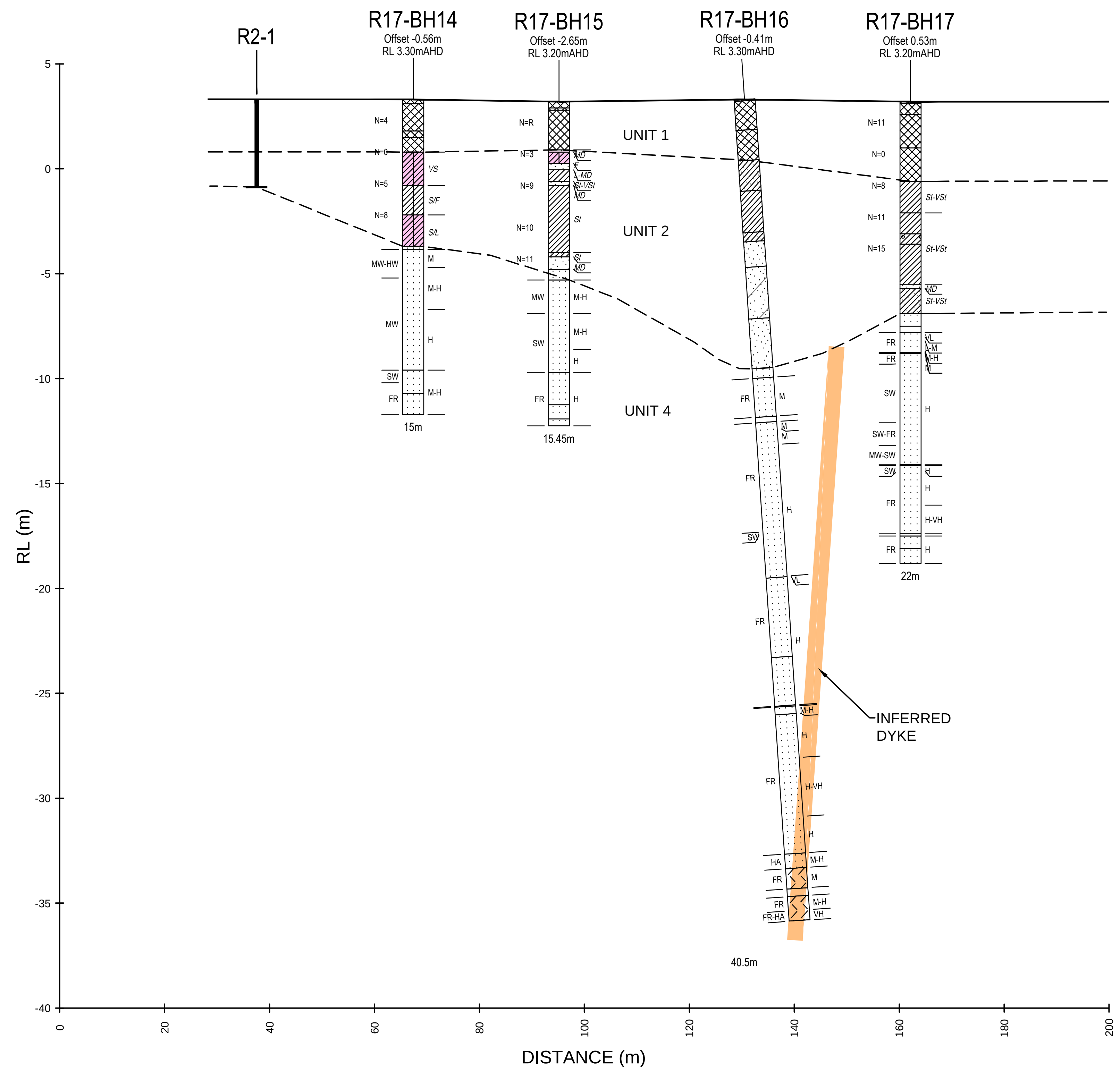
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

client: LEND LEASE DEVELOPMENTS PTY LTD

project: ACID SULFATE SOIL MANAGEMENT PLAN
HAYMARKET PRECINCT, DARLING HARBOUR, NSW

title: SECTION A-A'
OCCURRENCE OF ACID SULFATE INFERRED SOILS

project no: ENAURHOD04498AA-R03 | figure no: FIGURE 3



SECTION B-B'

LEGEND

- FILL
- CLAYEY SAND
- SANDSTONE
- SHALE
- CLAY
- SANDY CLAY
- SAND
- SILTY CLAY
- SILTY SAND
- DOLERITE
- OCCURRENCE OF ACID SULFATE SOILS
- IV — ROCK CLASSIFICATION (PELLS ET AL, 1998)
- DX — WEATHERING (SEE EXPLANATION SHEETS)
- WATER LEVEL
- N*=17 — STANDARD PENETRATION TEST RESULT
- UNIT 1 — FILL
- UNIT 2 — ALLUVIUM / ESTUARINE
- UNIT 3 — ALLUVIUM SOIL
- UNIT 4 — SANDSTONE

revision	description	drawn	approved	date

Scale (metres) 1:1000

drawn	EC / AW
approved	-
date	22 / 02 / 13
scale	AS SHOWN
original size	A3

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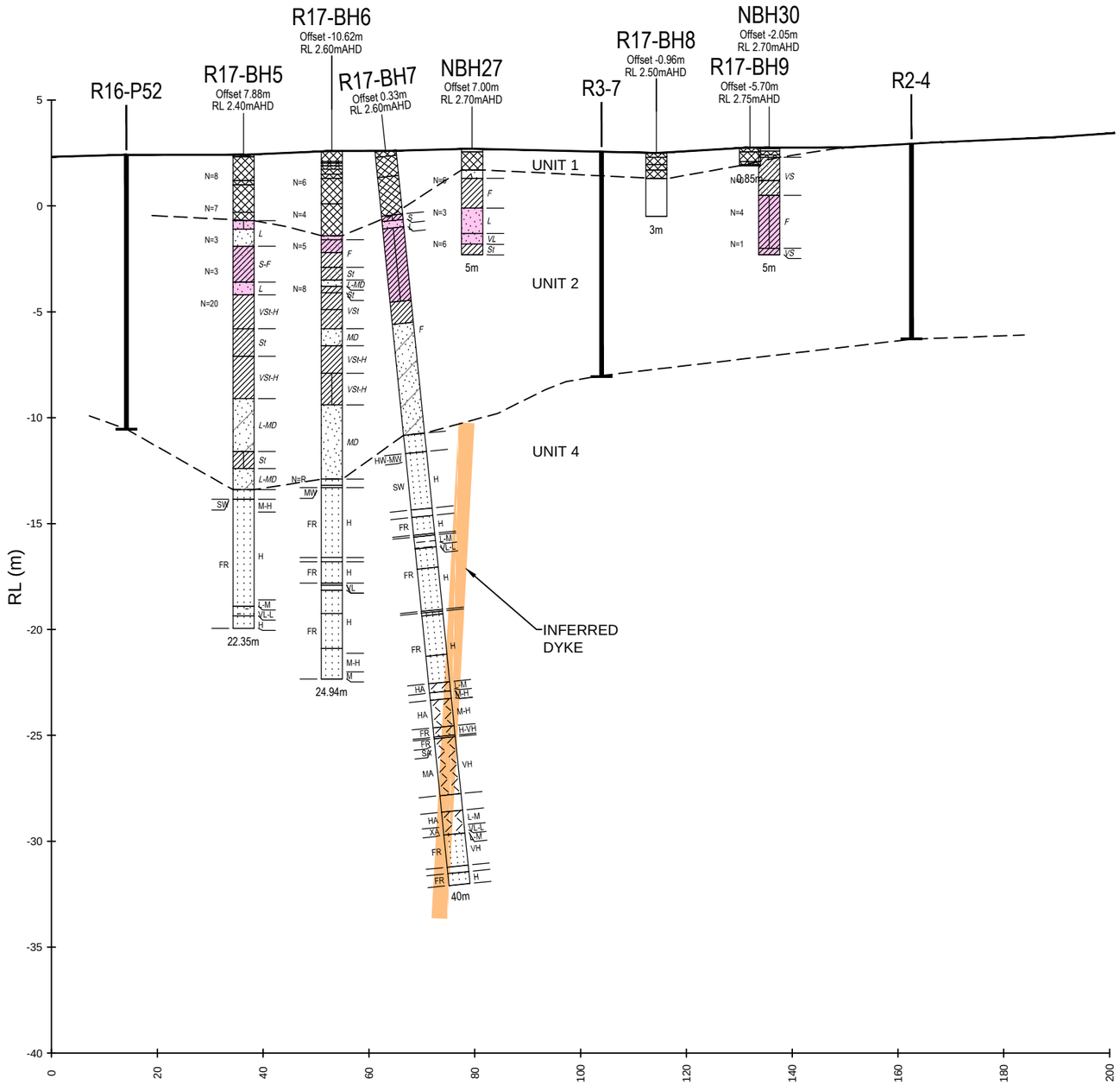
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

client: LEND LEASE DEVELOPMENTS PTY LTD
project: ACID SULFATE SOIL MANAGEMENT PLAN HAYMARKET PRECINCT, DARLING HARBOUR, NSW
title: SECTION B-B' OCCURRENCE OF ACID SULFATE INFERRED SOILS
project no: ENAURHOD04498AA-R03
figure no: FIGURE 4

PLOT DATE: 22/02/2013 9:31:41 AM



SECTION C-C'

LEGEND

- FILL
- CLAYEY SAND
- SANDSTONE
- SHALE
- CLAY
- SANDY CLAY
- SAND
- SILTY CLAY
- SILTY SAND
- DOLERITE
- OCCURRENCE OF ACID SULFATE SOILS
- IV — ROCK CLASSIFICATION (PELLS ET AL, 1998)
- DX — WEATHERING (SEE EXPLANATION SHEETS)
- WATER LEVEL
- N*=17 — STANDARD PENETRATION TEST RESULT
- UNIT 1 FILL
- UNIT 2 ALLUVIUM / ESTUARINE
- UNIT 3 ALLUVIUM SOIL
- UNIT 4 SANDSTONE

revision	description	drawn	approved	date

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drawn	EC / AW
approved	-
date	22 / 02 / 13
scale	AS SHOWN
original size	A3

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SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

client: LEND LEASE DEVELOPMENTS PTY LTD

project: ACID SULFATE SOIL MANAGEMENT PLAN
HAYMARKET PRECINCT, DARLING HARBOUR, NSW

title: SECTION C-C'
OCCURRENCE OF ACID SULFATE INFERRED SOILS

project no: ENAURHOD04498AA-R03 | figure no: FIGURE 5

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Appendix A
Borehole Logs

Acid Sulfate Soil Assessment and Preliminary Management Plan
Haymarket Precinct, Darling Harbour, Sydney NSW

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Engineering Log - Borehole

Borehole No. **NBH1**

Sheet 1 of 3

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***19.4.2012***

Principal:

Date completed: ***19.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 Ute | Easting: 333372 | slope: -90° | R.L. Surface: 2.85

hole diameter: 100 mm | Northing 6250503 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
NDD		C	None Observed	E					**FILL: Red Brick** (0.08m)	M			PAVEMENT
				E	2	1			**FILL: Clayey SAND:** Fine to medium grained, pale brown, trace fine gravel				FILL No Odour, PID = 14.8ppm
									FILL: Sandy GRAVEL: Fine to coarse grained, dark brown, with some cobbles, trace of clay, tree Root (<80mm) and brick fragments				No Odour, PID = 16.1ppm
TC				SPT 5,9,6/30 N*=R	1	2		SC	**Clayey SAND:** Fine to medium grained, pale brown, mottled red-brown and pale grey		VD		RESIDUAL SOIL No Odour, Dup 3, PID = 3.9ppm
RR					0	3			**SANDSTONE:** Medium to coarse grained, yellow brown, with some quartz grains, hightly weathered, low to medium strength.				BEDROCK
					-1	4			Borehole NBH1 continued as cored hole				
					-2	5							
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

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Engineering Log - Borehole

Borehole No. **NBH10**

Sheet 1 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***1.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADDT		C							**CONCRETE:** (0.11m) with 10mm reinforcement				CONCRETE SLAB
				E	5	1			**FILL: GRAVEL:** Medium to coarse grained, subangular, dark grey, with some fine to medium grained sand	M			FILL No Odour, PID = 0.4ppm
				E	4	2			**FILL: Gravelly SAND:** Fine to medium grained, pale grey, mottled pale yellow, pale brown, medium to coarse grained, subangular sandstone gravel, with some cobbles and boulders 1.5m - With some low plasticity clay				No Odour, PID = 1.1ppm
			►	E	3	3			**FILL: Gravelly Sandy CLAY:** Low plasticity, dark brown, mottled dark grey, fine to medium grained, subangular sandstone gravel, trace of boulders	<Wp >Wp			No odour, PID = 0.6ppm
				E	2	4			**FILL: Gravelly CLAY:** Low plasticity, pale grey, fine to medium grained, subangular gravel				No Odour, PID = 0.7ppm
RR			◄	E	1 0 -1 -2	5 6 7 8			**FILL: Sandy CLAY:** Low plasticity, pale brown, mottled orange-brown, fine grained sand				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

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Engineering Log - Borehole

Borehole No. **NBH10**

Sheet 2 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***1.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
RR		C								>Wp			
CB			◄		-3	9			**Clayey SAND:** Medium to coarse grained, pale grey, mottled dark grey, trace fine grained, subangular sandstone gravel	W	L-MD		ALLUVIUM No Odour, PID = 0.5ppm
					-4	10							
					-5	11							
					-6	12							
					-7	13							
					-8	14							
					-9	15			**SANDSTONE:** Medium to coarse grained, pale grey, off-white, moderately weathered grading to slightly weathered, low to medium strength.	>Wp			BEDROCK
					-10	16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
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consistency/density index

VS	very soft
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VSt	very stiff
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VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH10**

Sheet 3 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***1.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
CB					-11	17			**SANDSTONE:** Medium to coarse grained, pale grey, off-white, moderately weathered grading to slightly weathered, low to medium strength. *(continued)*	>Wp			
					-12	18							
					-13	19							
					-14	20							
					-15	21							
					-16	22							
					-17	23							
					-18	24							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH10**

Sheet 4 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***1.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
CB					-19	25			**SANDSTONE:** Medium to coarse grained, pale grey, off-white, moderately weathered grading to slightly weathered, low to medium strength. *(continued)*	>Wp			
					-20	26							
					-21	27							
					-22	28							
					-23	29							
					-24	30			**SANDSTONE:** Fine to medium grained, pale grey, fresh, medium to high strength.				
					-25	31			Borehole NBH10 continued as cored hole				
					-26	32							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH11***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***23.4.2012***
Principal:	
Date completed:	***23.4.2012***
Project:	***SICEEP***
Logged by:	***ACM***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT DT		N	None Observed	E	5	1			**FILL: CONCRETE** (0.15m) with 10mm reinforcement	D M			CONCRETE SLAB
									FILL: Sandy GRAVEL: Medium to coarse grained, subangular, pale grey, mottled orange-brown, fine to medium grained sand				FILL
				E	4	2			**FILL: Clayey GRAVEL:** Fine to coarse grained, subangular sandstone, pale brown, low plasicity clay, trace fine to medium grained sand				No Odour, Dup 6 + Dup 6a, PID = 1.6ppm
													No Odour, PID = 1.6ppm
					3	3			**SANDSTONE:** Fine to medium grained, orange-brown to pale grey, highly weathered, low to medium strength				BEDROCK
					2	4			Borehole NBH11 terminated at 3.2m				
					1	5							
					0	6							
					-1	7							
					-2	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No.	***NBH12***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***23.4.2012***
Principal:	
Date completed:	***23.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333563 | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing 6250232 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		N	None Observed	E					**FILL: Red Brick** (0.08m)	M			PAVEMENT
					5				**FILL: Sandy GRAVEL:** Dark grey, fine to medium grained, subangular, fine to medium grained sand				FILL
				E					**FILL: Gravelly SAND:** Fine to medium grained, yellow-brown, mottled pale grey, fine to medium grained, subangular sandstone gravel				No Odour, PID = 1.8ppm
ADT						1							
					4				**FILL: Gravelly Sandy CLAY:** High plasticity, pale grey, mottled pale brown, fine to medium grained sand, fine to medium grained sandstone gravel				
				SPT 7,3,14 N*=17		2							No Odour, PID = 0.6ppm
					3				**FILL: Sandy CLAY:** High plasticity, dark brown, mottled orange-brown, medium grained sand				
				E		3							No Odour, PID = 1.5ppm
					2								
						4							
					1								
				SPT 3,3,2 N*=5		5							No Odour, PID = 0.4ppm
									Borehole NBH12 terminated at 4.95m				
					0	6							
					-1	7							
					-2	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH13***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***1.5.2012***
Principal:	
Date completed:	***1.5.2012***
Project:	***SICEEP***
Logged by:	***ACM***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XP60 Ute | Easting: | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA									**FILL: Red Brick** (0.08m)	D			PAVEMENT
NDB				E					**FILL: SAND:** Medium to coarse grained, pale brown	M			FILL
				E	5	1			**Gravelly SAND** Fine to medium, dark brown, fine to coarse grained, subangular sandstone gravel, with some silt 0.7m - With some sandstone cobbles/boulders				No Odour, Dup 19 + Dup 19a, PID = 2.2ppm
ADT				E	4	2							No Odour, PID = 6.2ppm
			▼		3	3			**FILL: Clayey SAND:** Fine to medium, pale grey, mottled pale brown, with some fine to coarse grained, subangular sandstone gravel	W			
				SPT 1,0,2 N*=2	2	4			**FILL: Sandy GRAVEL:** Medium to coarse grained, subangular, pale grey, fine to coarse grained sand				No Odour, PID = 4.1ppm
				SPT 8,9,10 N*=19	1	5							No Odour, PID = 3.8ppm
					0	6			Borehole NBH13 terminated at 5m				
					-1	7							
					-2	8							

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH14***
Sheet	1 of 4
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***26.4.2012***
Principal:	
Date completed:	***26.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting:	Ausrock 3000 Truck	Easting:	333583	slope:	-90°	R.L. Surface:	5.4
hole diameter:	100 mm	Northing	6250177	bearing:	N/A	datum:	AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		C			5				**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: Gravelly SAND: Medium grained, dark grey, fine to medium grained, subangular sandstone gravel, trace clay	M			FILL
ADT						1			0.8m - With some sandstone cobbles/boulders, becoming fine grained, pale grey, mottled yellow, pale brown				
					4								
				SPT 10,12,12 N*=24		2			**FILL: Clayey SAND:** Fine to medium grained, dark grey, with some medium to coarse grained, subangular gravel				No Odour
					3								
				SPT 4,4,2 N*=6		3							No Odour
					2				**CONCRETE:** (0.4m)	D			CONCRETE SLAB
						4			**FILL: Gravelly SAND:** Fine to medium grained, dark grey, medium to coarse grained, subangular gravel, trace clay	M			FILL
					1				4.5m - Becoming dark grey, mottled pale grey, brown, with a trace of red brick fragments				No Odour
			►			5				W			
					0								
				SPT 8,7,5 N*=12		6			**FILL: Gravelly CLAY:** Low plasticity, pale grey, mottled dark grey, medium to coarse grained, subangular sandstone gravel	>Wp			No Odour
				SPT 4,1,4 N*=5	-1								
						7							
					-2								
				SPT 6,13,10 N*=23		8			**FILL: Clayey Sandy GRAVEL:** Fine to coarse grained, subangular sandstone and shale, pale grey, fine grained sand	W			No Odour

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**NBH14**
Sheet	2 of 4
Project No:	**GEOTLCOV24303AC**
Client:	**Infrastructure NSW**
Date started:	**26.4.2012**
Principal:	
Date completed:	**26.4.2012**
Project:	**SICEEP**
Logged by:	**JW**
Borehole Location:	**See Figure 1**
Checked by:	**DS**

drill model and mounting: Ausrock 3000 Truck | Easting: 333583 | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing 6250177 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		C			-3	9			**FILL: Clayey Sandy GRAVEL:** Fine to coarse grained, subangular sandstone and shale, pale grey, fine grained sand *(continued)*	W			
				SPT 11,5,7 N*=12	-4	10			**FILL: Clayey SAND:** Fine to medium grained, pale grey, mottled dark grey, with some fine to medium grained sandstone gravel	M-W			No Odour
				SPT 6,9,6 N*=15	-5	11							No Odour
					-6	12			**FILL: GRAVEL:** Fine to medium grained, subangular, pale grey, mottled pale brown, mainly sandstone with shale				
					-7	13							
					-8				13.3m - With mixture of concrete, brick and sandstone gravel **FILL: Clayey GRAVEL:** Dark grey, medium to coarse grained, subangular				
					-9	14							
RR				SPT 3,8,12 N*=20				CH	**CLAY:** High plasticity, drak grey-black, trace fine grained sand	>Wp	St	×	ALLUVIUM
					-10	15			**Clayey SAND:** Fine grained, dark grey	W	MD		RESIDUAL SOIL No Odour
						16							

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH14**

Sheet 3 of 4

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***26.4.2012***

Principal:

Date completed: ***26.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333583 | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing 6250177 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
RR					-11	17			**Clayey SAND:** Fine grained, dark grey *(continued)*	W	MD		
				SPT 29,10/120,1 N*=R	-12				**SANDSTONE:** Fine to medium grained, yellow-brown, highly weathered, low to medium strength				BEDROCK SPT hammer bouncing
					-13	18							
					-14	19			Borehole NBH14 continued as cored hole				
					-15	20							
					-16	21							
					-17	22							
					-18	23							
						24							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No.	***NBH15***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***27.4.2012***
Principal:	
Date completed:	***27.4.2012***
Project:	***SICEEP***
Logged by:	***ACM***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XP60 Ute | Easting: | slope: -90° | R.L. Surface: 3.4

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA				E	3	1			**FILL: Red Brick** (0.08m)	D			PAVEMENT
SS			▼	E					**FILL: SAND:** Medium to coarse grained, pale brown	W			FILL
									FILL: Clayey GRAVEL: Medium to coarse grained, subangular sandstone, pale brown with some fine to medium grained sand	>Wp			No Odour, Dup 15 + Dup 15a, PID = 11.6ppm
					2	2			**FILL: Gravelly CLAY:** Medium plasticity, pale brown, fine to medium grained, subangular sandstone gravel				
				E					**FILL: Silty CLAY:** Medium plasiticy, red-brown, with some fragments of concrete towards base				No Odour, PID = 2.0ppm
					1	3			Borehole NBH15 terminated at 2.1m				Concrete Obstruction Encountered at 2.1m - Suspected Service
					0	4							
					-1	5							
					-2	6							
					-3	7							
					-4	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH16***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***23.4.2012***
Principal:	
Date completed:	***23.4.2012***
Project:	***SICEEP***
Logged by:	***ACM***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.79

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
DT / HA / ADT		N							**CONCRETE:** (0.2m)	D			FILL
									FILL: GRAVEL: Fine to medium grained, subangular to angular, pale brown sandstone	M			
				E	5	1			**FILL: Silty Clayey SAND:** Medium to coarse grained, pale brown, mottled pale grey/dark grey, with some fine to medium grained, subangular sandstone gravel				No Odour, Dup 8 + Dup 8a, PID = 12.1ppm
				E	4	2		CH	**CLAY:** Medium to high plasticity, pale orange, mottled red-brown, pale brown	<Wp	S-F		ALLUVIUM No Odour, PID = 11.0ppm
			▼	E	3	3		SC	**Clayey SAND:** Medium to coarse grained, pale brown, with some dark grey/black mottling, trace of fine rootlets and fine to medium grained angular ironstone gravel	>Wp	L		RESIDUAL SOIL No Odour, PID = 1.4ppm
				E	2	4							
				E	1	5			**SANDSTONE:** Medium to coarse grained, orange-brown, highly to extremely weathered, low strength				No Odour, PID = 1.1ppm BEDROCK
					0	6			Borehole NBH16 terminated at 5.1m				
					-1	7							
					-2	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH17**

Sheet 1 of 4

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***27.4.2012***

Principal:

Date completed: ***27.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333635 | slope: -90° | R.L. Surface: 2.4

hole diameter: 100 mm | Northing 6250073 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		C			2	1			**FILL: Red Brick** (0.08m)	M			PAVEMENT
									FILL: SAND: Fine grained, pale grey, with some fine to medium grained, subangular sandstone gravel				FILL
				E									
ADT									0.6m - Becoming yellow brown, mottled dark grey				No Odour, Dup 14, PID = 43.7ppm
					1	2							
									1.3m - With some high plasticity clay				
HA									**FILL: SAND:** Fine grained, pale yellow, mottled pale brown				
									1.8m - With some high plasticity clay and a trace of medium grained, subangular gravel				
ADT				E	0	3							No Odour, PID = 11.3ppm
			▶							W			
				SPT 2,1,0 N*=1	-1	4		CL	**CLAY:** Low plasticity, drak grey/black	M-W	VS-S		ALLUVIUM
													Organic Odour, PID = 8.0ppm
					-2	5							
				SPT 0,0,2 N*=2									No Odour, PID = 7.9ppm
					-3	6			5.8m - With some organic fibres				
RR				SPT 13,4,4 N*=8	-4				6m - With trace of fine grained sandstone gravel				
						7		CH	**CLAY:** High plasticity, pale grey, mottled dark grey, orange-brown		F-St		
				SPT 2,2,3 N*=5	-5								No Odour, PID = 9.8ppm
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH17***
Sheet	2 of 4
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***27.4.2012***
Principal:	
Date completed:	***27.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333635 | slope: -90° | R.L. Surface: 2.4

hole diameter: 100 mm | Northing 6250073 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
RR					-6	9		CH	**CLAY:** High plasticity, pale grey, mottled dark grey, with some shell fragments	M-W	St	x x	
				SPT 8,11,12 N*=23	-7	10		CH	**CLAY:** High plasticity, pale grey, mottled orange-brown, trace of ironstone gravel and staining		VSt	x x	RESIDUAL SOIL
				SPT 6,7,9 N*=16	-8	11			11.5m - Becoming dark grey, mottled yellow-brown		St	x x x x	
				SPT 13,7,15 N*=22	-9	12							
					-10	13							
					-11	14			**SANDSTONE:** Medium to coarse grained, pale grey, extremely weathered, very low strength				BEDROCK
					-12	15							
					-13	16			Borehole NBH17 continued as cored hole				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH18**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***24.4.2012***

Principal:

Date completed: ***24.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333676 | slope: -90° | R.L. Surface: 2.9

hole diameter: 100 mm | Northing 6250079 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA									**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: Sandy GRAVEL: Fine to medium grained, subangular, dark grey, medium to coarse grained sand	M			FILL
				E									
ADT					2	1			**FILL: Gravelly SAND:** Medium grained, pale grey, mottled yellow-brown, fine to medium grained, subangular sandstone gravel, trace clay				No Odour, PID = 140ppm
				SPT 3,2,2 N*=4	1	2			**FILL: CLAY:** High plasticity, dark grey, mottled off-white, orange-brown, with some fine to coarse grained gravel	<Wp			No Odour, PID = 186ppm
					0	3							
				SPT 1,1,3 N*=4				CH	**Sandy CLAY:** High plasticity, dark grey, mottled yellow-brown, fine grained sand, trace of fine grained gravel		St	X X	No Odour, PID = 0ppm ALLUVIUM
			►		-1	4		SP	**Clayey SAND:** Fine grained, dark grey/black	W	L		
				E									No odour, PID = 70.3ppm
					-2	5			Borehole NBH18 terminated at 4.5m				
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH19**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***24.4.2012***

Principal:

Date completed: ***24.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.79

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT DT		N	None Observed	E	5	1			**CONCRETE:** (0.15m) with 10mm reinforcement				CONCRETE SLAB
									FILL: GRAVEL: Medium to coarse grained, subangular, pale brown, mottled pale grey	M	S		FILL
									FILL: Silty SAND: fine to coarse grained, pale brown, with some fine to medium grained, subangular sandstone gravel				No Odour, Dup 10 + Dup 10a, PID = 9.1ppm
				E					**SANDSTONE:** Fine to medium grained, pale brown, highly weathered, low strength				BEDROCK ~~No Odour, PID = 9.6ppm~~
					4	2			Borehole NBH19 terminated at 1.4m				
					3	3							
					2	4							
					1	5							
					0	6							
					-1	7							
					-2	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH2**

Sheet 1 of 3

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***1.5.2012***

Principal:

Date completed: ***1.5.2012***

Project: ***SICEEP***

Logged by: ***DB***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 6x6 Ute | Easting: | slope: -90° | R.L. Surface: 2.82

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C							**FILL: Asphaltic Concrete** (0.4m)	D			PAVEMENT
				E	2	1			**FILL: Gravelly SAND:** Medium to coarse grained, pale brown, mottled pale grey, fine to coarse, subangular gravel.	M			ROADBASE
HA									**FILL: Sandy GRAVEL:** Fine to coarse grained, subangular, pale grey, mottled orange-brown sandstone and shale, fine to medium grained sand with some sandstone cobbles <100mm.				No Odour, Dup 20 + Dup 20a, PID = 3.0ppm
								SP			L		Geofrabric Layer at 0.95m
				E	1	2			**FILL: Gravelly SAND:** Fine to medium grained, yellow-brown, mottled red-brown and pale grey.				ALLUVIUM
									SAND: Fine to medium grained, orange-brown, trace of shell fragments.				No Odour, PID = 1.8ppm
				D									
			▶		0	3				W			
ADT				E									No Odour, PID = 1.8ppm
				D									
					-1	4							
				SPT R,_,_ N*=R	-2	5			**SANDSTONE:** Fine to medium grained, orange brown, highly weathered, medium strength.				BEDROCK
									Borehole NBH2 continued as cored hole				No Odour, PID = 2.7ppm
					-3	6							SPT rods bouncing at 4.50m
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH20**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***24.4.2012***

Principal:

Date completed: ***24.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 2.81

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		N		E					**FILL: Red Brick** (0.08m)	D			PAVEMENT
				E					**FILL: SAND:** Fine to medium grained, pale brown	M			FILL No Odour, PID = 5.91ppm
ADT					2	1			**FILL: Gravelly SAND:** Medium to coarse grained, dark grey, mottled pale brown, fine to medium grained, subangular sandstone gravel, with some clay				No Odour, Dup 11, PID = 1.3ppm
									FILL: SAND: Medium to coarse grained, pale grey, cement stabilized				
									FILL: Gravelly SAND: Medium to coarse grained, dark grey, mottled pale brown, fine to medium grained, subangular sandstone gravel, with some clay				
				SPT 2,2,2 N*=4	1	2			**FILL: Clayey SAND:** Medium to coarse grained, pale brown, with some black mottling, with some fine grained sandstone gravel				No Odour, PID =1.8ppm
										W			
					0	3		CH	**CLAY:** Medium to high plasticity, pale grey	>Wp	F		ALLUVIUM
				SPT 1,2,2 N*=4				SC	**Clayey SAND:** Medium to coarse grained, dark grey, mottled black, low plasticity clay	W	VL		Organic Odour, PID = 0.8ppm
					-1	4							
				SPT 1,0,0 N*=0	-2	5							No Odour, PID = 0.8ppm
									Borehole NBH20 terminated at 5m				
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil

C casing

penetration 1 2 3 4

no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**NBH21**
Sheet	1 of 1
Project No:	**GEOTLCOV24303AC**
Client:	***Infrastructure NSW***
Date started:	***27.4.2012***
Principal:	
Date completed:	***27.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333580 | slope: -90° | R.L. Surface: 4.2

hole diameter: 100 mm | Northing 6249998 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		N	None Observed		4	1			**CONCRETE:** (0.4m)				CONCRETE SLAB
				E					**FILL: Gravelly SAND:** Fine to medium grained, yellow-brown	M			FILL No Odour, PID = 48.3ppm
					3				1m - With some medium plasticity clay, trace of brick fragments and fine to coarse grained, subangular gravel				
				SPT 3,4,5 N*=9		2			**FILL: CLAY:** High plasticity, dark grey, mottled dark brown, trace medium grained, subangular sandstone gravel				No Odour, PID = 12.5ppm
					2								
						3		CH	**CLAY:** High plasticity, dark grey	>Wp	VS-S		ALLUVIUM
				SPT 0,1,1 N*=2	1							XXX	No Odour, PID = 7.0ppm
									Borehole NBH21 terminated at 3.45m				
					0	4							
						5							
					-1								
						6							
					-2								
						7							
					-3								
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH22***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client: ***Infrastructure NSW***	Date started: ***24.4.2012***
Principal:	Date completed: ***24.4.2012***
Project: ***SICEEP***	Logged by: ***JW***
Borehole Location: ***See Figure 1***	Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333636 | slope: -90° | R.L. Surface: 2.4

hole diameter: 100 mm | Northing 6250067 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA					2	1			**ASPHALT:** (0.1m) **CONCRETE:** (0.3m)	D			PAVEMENT CONCRETE SLAB
				E					**FILL: SAND:** Fine to medium grained, yellow-brown, mottled pale brown	M			FILL No Odour, PID = 29ppm
ADT				E	1				1.3m - With some dark grey high plasticity clay, and a trace of organic material				No Odour, PID = 60.2ppm
				SPT 2,4,4 N*=8		2			**FILL: CLAY:** High plasticity, dark grey, mottled dark brown, trace fine grained sand	<Wp			No Odour, PID = 6.5ppm
			►		0					>Wp			
				SPT 4,2,1 N*=3	-1	3		CH	**CLAY:** High plasticity, dark grey, mottled black		VS-S		ALLUVIUM Organic Odour, PID = 4.9ppm
				E	-2	4							No Odour, PID = 7.1ppm
									Borehole NBH22 terminated at 4.5m				
					-3	5							
						6							
					-4								
						7							
					-5								
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH23***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***17.4.2012***
Principal:	
Date completed:	***24.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting:	XP60 Ute		Easting:	333727	slope:	-90°	R.L. Surface: 2.7
hole diameter:	100 mm		Northing	6249937	bearing:	N/A	datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
DT		N							**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Coarse grained, pale brown, mottled yellow-brown, with some shell fragments	M			FILL
				E						D			CONCRETE SLAB
HA					2				**FILL: Concrete:** (0.25m)	M			FILL
						1			**FILL: Sandy GRAVEL:** Fine grained, subangular, dark grey, fine to medium grained sand				No Odour, PID = 0.4ppm
									FILL: Clayey SAND: Fine grained, pale brown, mottled red-brown				
ADT									**FILL: CLAY:** High plasticity, dark grey, mottled orange-brown, pale grey, trace fine grainedsand, and medium grained, subangular sandstone gravel	<Wp			
				SPT 3,2,4 N*=6	1	2							No Odour, PID = 0.8ppm
					0			CL	**Sandy CLAY:** Low plasticity, drak grey, mottled black, fine grained sand	>Wp	VS	× ×	ALLUVIUM
				SPT 1,0,1 N*=1		3							No Odour, PID = 0.3ppm
					-1	4			Borehole NBH23 terminated at 3.45m				
					-2	5							
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH24***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***24.4.2012***
Principal:	
Date completed:	***24.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333604 | slope: -90° | R.L. Surface: 3.9

hole diameter: 100 mm | Northing 6249930 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
HA		N		E					**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Fine to medium grained, pale brown, trace fine to medium grained, subangular sandstone gravel	M			FILL
				E						<Wp			No Odour, PID = 1.9ppm
					3	1			**FILL: Gravelly Sandy CLAY:** Low plasticity, dark grey, mottled dark brown, fine to medium grained sand and fine to medium grained, subangular gravel				
ADT			▶						**FILL: CLAY:** High plasticity, pale grey, mottled orange-brown, dark grey, trace fine grained sand	>Wp			
									FILL: Gravelly CLAY: Low plasticity, dark grey, mottled red-brown, medium to coarse grained, subangular gravel				
				SPT 5/20,_,_ N*=R	2	2			**FILL: Clayey GRAVEL:** Fine to medium grained, subangular, dark grey, mottled black, low plasticity clay, with some medium to coarse grained sandstone gravel	W			No Odour, PID = 6.9ppm
								CL	**CLAY:** Low plasticity, dark grey, mottled black, trace of organics	>Wp	VS		ALLUVIUM
					1	3						XX	
				SPT 0,0,1 N*=1				CL	**Sandy CLAY:** Low plasticity, dark grey, mottled black, fine grained sand, with some shell fragments			XX	Organic Odour, PID = 18.2ppm
									Borehole NBH24 terminated at 3.45m				
					0	4							
					-1	5							
					-2	6							
					-3	7							
					-4	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**NBH25**
Sheet	1 of 1
Project No:	**GEOTLCOV24303AC**
Client:	***Infrastructure NSW***
Date started:	***18.4.2012***
Principal:	
Date completed:	***18.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XP60 Ute | Easting: 323628 | slope: -90° | R.L. Surface: 3.3

hole diameter: 100 mm | Northing 6249852 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
DT					3				**CONCRETE:** (0.4m) with 10mm reinforcement	D			CONCRETE SLAB
HA				E E					**FILL: Sandy CLAY:** Low plasticity, pale brown, fine grained sand, trace fine to medium grained, subangular gravel	<Wp			FILL No Odour, Dup 2 + Dup 2a, PID = 8.3ppm
ADT						1			**FILL: Clayey SAND:** Fine grained, dark grey, with some fine to medium grained, subangular sandstone gravel	M			
				SPT 12/120,_,_,_ N*=R	2	2							No Odour, PID = 5.9ppm
					1				2m - Becoming dark grey, mottled red-brown				
				SPT 4,2,10/80 N*=R	0	3			**FILL: Gravelly Sandy CLAY:** High plasticity, dark grey, fine to medium grained, angular gravel, fine to medium grained sand	<Wp			No Odour, PID = 1.2ppm
					-1	4							
				SPT 11,13,7 N*=20		5		CH	**Sandy CLAY:** High plasticity, dark grey/grey, fine grained sand		F-St		No Odour, PID = 4.5ppm ALLUVIUM
			▶		-2					>Wp			
				SPT 2,2,3 N*=5	-3	6							No Odour, PID = 1.0ppm
					-4	7					St		
				SPT 4,7,11 N*=18		8			7.5m - Becoming dark grey/grey, mottled yellow-brown				No Odour, PID = 1.0ppm

Borehole NBH25 terminated at 7.95m

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH26**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***24.4.2012***

Principal:

Date completed: ***24.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 3.3

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N	None Observed	E	3				**ASPHALT:** (0.3m)				PAVEMENT
									FILL: Silty GRAVEL: Fine to medium grained, subangular, pale grey, mottled pale brown, with some fine to medium grained sand and red brick fragments	M			FILL No Odour, PID = 2.7ppm
									SANDSTONE: Fine to medium grained, pale grey to orange-brown, highly weathered, low to medium strength				BEDROCK
					2	1			Borehole NBH26 terminated at 0.8m				
					1	2							
					0	3							
					-1	4							
					-2	5							
					-3	6							
					-4	7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH27**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***27.4.2012***

Principal:

Date completed: ***27.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 Truck | Easting: | slope: -90° | R.L. Surface: 2.65

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT									**ASPHALT:** (0.15m)	D			PAVEMENT
				E					**FILL: Gravelly SAND:** Fine grained, dark brown, mottled dark grey, fine to medium grained, subangular to angular gravel	M			FILL
				E	2	1							No Odour
									CONCRETE: (0.4m)	D			CONCRETE
				SPT 2,2,4 N*=6	1	2		CH	**CLAY:** Medium plasticity, pale brown, mottled orange-brown, red-brown	<Wp	F		ALLUVIUM
					0								No Odour, PID = 2.1ppm
			▼	SPT 2,1,2 N*=3	-1	3		SP	**SAND:** Coarse grained, dark grey, mottled black, with some fine grained, subangular gravel	M	L		No odour, PID = 2.8ppm
						4				W			
								SC	**Clayey SAND:** Fine to medium grained, dark grey, mottled black, with some organics		VL		Organic Odour
				SPT 3,3,3 N*=6	-2	5		CH	**CLAY:** Medium to high plasticity, pale brown, mottled dark grey	>Wp	St		No Odour, PID = 0.4ppm
					-3	6			Borehole NBH27 terminated at 5m				
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH28***
Sheet	1 of 4
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***20.4.2012***
Principal:	
Date completed:	***23.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting:	Ausrock 3000 Truck	Easting:	333703	slope:	-90°	R.L. Surface:	2.3
hole diameter:	100 mm	Northing	6250005	bearing:	N/A	datum:	AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		C		E	2				**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Medium grained, pale brown	M			FILL No Odour, PID = 0.9ppm
				E					**FILL: Clayey Gravelly SAND:** Fine to medium grained, dark grey, fine to medium grained, subangular gravel				No Odour, PID = 0.5ppm
ADT						1			**FILL: Clayey SAND:** Fine to medium grained, pale brown, with some sandstone cobbles (<100mm)				
					1			SP	**SAND:** Fine to medium grained, pale brown, trace clay				ALLUVIUM
				SPT 4,3,4 N*=7				CH	**CLAY:** High plasticity, dark grey, mottle pale grey, orange-brown	<Wp	F-St	×	No Odour, PID = 0.8ppm
					0	2						×	
RR			▶	SPT 2,3,3 N*=6	-1	3		CH	**CLAY:** High plasticity, black, trace fine grained sand	>Wp	S-F	×	No Odour, PID = 0.8ppm
								CH	**Sandy CLAY:** High plasticity, dark grey, mottled dark brown, fine grained sand			×	
				SPT 1,2,1 N*=3	-2	4		SP	**Clayey SAND:** Fine grained, dark grey, trace medium grained, subangular sandstone gravel	M-W	VL		No Odour, PID = 0.9ppm
					-3	5			5.5m - With some shell fragments				
				SPT 0,1,1 N*=2	-4	6		CL	**CLAY:** Low plasticity, dark grey, with some shell fragments	<Wp	VS	×	5.8m - SPT Rod sunk under weight of hammer (250mm) No Odour, PID = 0.7ppm
						7						×	
				SPT 0,12,15 N*=27	-5			CH	**Silty CLAY:** High plasticity, pale grey, mottled red-orange, yellow-brown	>Wp	St-VSt	×	RESIDUAL SOIL No Odour, PID = 1.8ppm
						8						×	
												×	

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH28**
Sheet 2 of 4
Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***
Date started: ***20.4.2012***
Principal:
Date completed: ***23.4.2012***
Project: ***SICEEP***
Logged by: ***JW***
Borehole Location: ***See Figure 1***
Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333703 | slope: -90° | R.L. Surface: 2.3
hole diameter: 100 mm | Northing 6250005 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
RR		C			-6	9		CH	**Silty CLAY:** High plasticity, pale grey, mottled red-orange, yellow-brown *(continued)*	>Wp	St-VSt		
				SPT 7,10,15 N*=25	-7						VSt	× ×	No Odour, PID = 1.4ppm
						10		CH	**CLAY:** High plasticity, dark grey, trace shell fragments				
				SPT 12,19,22 N*=41	-8							× ×	No Odour, PID = 1.2ppm
			11.3m - Complete Water Loss		-9	11							
					-10	12							
					-11	13		SC	**Clayey SAND:** Fine to medium grained, dark grey, mottled orange-brown, high plasticity clay	M-W	MD		
				SPT 5,8,12 N*=20	-12	14							
						15			**SANDSTONE:** Medium grained, yellow-brown, red-brown, moderately weathered, low to medium strength				BEDROCK
					-13				Borehole NBH28 continued as cored hole				
						16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support
M mud N nil
C casing

penetration
1 2 3 4 — no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***NBH29***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***17.4.2012***
Principal:	
Date completed:	***17.4.2012***
Project:	***SICEEP***
Logged by:	***JW***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting:	XP60 Ute	Easting:	333735	slope:	-90°	R.L. Surface:	3
hole diameter:	100 mm	Northing	6249927	bearing:	N/A	datum:	AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		N	None Observed						**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Coarse grained, yellow-brown, with some shell fragments and quartz grains	M			FILL
				E									No Odour, PID = 1.7ppm
ADT DT									**FILL: Sandy GRAVEL:** Medium to coarse grained, angular, dark grey, fine to coarse grained sand	D			CONCRETE SLAB
									Concrete: (0.2m) with 10mm reinforcement	M			FILL
				E	2	1			**FILL: Clayey SAND:** Fine grained, dark grey, low plasticity clay				Stong Hydrocarbon Odour, PID = 75.3ppm
				SPT 2,2,4 N*=6					**FILL: CLAY:** High plasticity, pale grey, mottled orange-brown with some iron oxide staining	<Wp			
				E	1	2			2m - Becoming dark grey.				No Odour, PID = 35.2ppm
					0	3		CH	**CLAY:** High plasticity, pale grey, mottled orange-brown		F-St		ALLUVIUM
				SPT 1,2,1 N*=3									
				E									No Odour, PID = 3.4ppm
					-1	4							
				SPT 3,4,6 N*=10									
					-2	5			Borehole NBH29 terminated at 4.95m				
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH3**

Sheet 1 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***4.5.2012***

Principal:

Date completed: ***4.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Mobile Drill B80 Truck | Easting: 333487 | slope: -90° | R.L. Surface: 3.5

hole diameter: 100 mm | Northing 6250411 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADV / ADT		C		E					**FILL: Red Brick** (0.08m)	M			PAVEMENT
				E, Dup 2	3				**FILL: SAND:** Fine to medium grained, brown/dark brown, trace of fine to medium, sub angular gravel				FILL
						1			0.5m - With trace of clay.				
				SPT 14,6,4 N*=10	2				**FILL: Gravelly Clayey SAND:** Fine to medium grained, pale grey, mottled pale brown, dark brown, fine to medium grained, subangular sandstone gravel				
			▶			2				W			
					1				**FILL: Clayey GRAVEL:** Fine to coarse grained, grey, mottled orange-brown, dark brown, trace fine grained sand				
				SPT 3,3,3 N*=6	0	3							
						4			4m - With some fine grained sand				
				SPT 7,13,6 N*=19	-1								
						5			**FILL: Gravelly CLAY:** Low plasticity, grey to dark grey, fine to medium grained, subangular gravel				
					-2								
						6			6m - With some medium grained sand				
				SPT 4,7,4 N*=11	-3								
						7							
					-4								
				SPT 4,5,7 N*=12		8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH3**

Sheet 2 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***4.5.2012***

Principal:

Date completed: ***4.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Mobile Drill B80 Truck | Easting: 333487 | slope: -90° | R.L. Surface: 3.5

hole diameter: 100 mm | Northing 6250411 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		C			-5	9			**FILL: Gravelly CLAY:** Low plasticity, grey to dark grey, fine to medium grained, subangular gravel *(continued)*	W			
								CH	**CLAY:** High plasticity, brown, mottled pale grey, orange-brown, trace fine gravel and medium sand	>Wp	F		ALLUVIUM
				Bs	-6	10							
					-7						F-St		
				SPT 4,9,6 N*=15		11							
					-8	12							
					-9	13							
								CH	**CLAY:** High plasticity, red brown, mottled orange-brown and grey	>Wp	St-VSt		
				SPT 7,12,16 N*=28	-10	14							
					-11								
						15		CH	**Sandy CLAY:** High plasticity, dark grey, fine grained sand	<Wp	St		
					-12	16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH3**

Sheet 3 of 5

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***4.5.2012***

Principal:

Date completed: ***4.5.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Mobile Drill B80 Truck | Easting: 333487 | slope: -90° | R.L. Surface: 3.5

hole diameter: 100 mm | Northing 6250411 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT								CH	**Sandy CLAY:** High plasticity, dark grey, fine grained sand *(continued)*	<Wp	St		
RR				SPT 2,4,6 N*=10	-13	17					F-St	x x x	
					-14	18							
					-15	19							
				SPT 3,6,12 N*=18	-16	20		SC	**Clayey SAND:** Fine to medium grained, dark grey, mottled black	M	MD	x x x	
					-17	21							
					-18	22			**SANDSTONE:** Fine grained, orange brown - pale grey, highly weathered, low to medium strength				BEDROCK
					-19	23			Borehole NBH3 continued as cored hole				
					-20	24							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

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Engineering Log - Borehole

Borehole No. **NBH30**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***27.4.2012***

Principal:

Date completed: ***27.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 Truck | Easting: | slope: -90° | R.L. Surface: 2.75

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		N		E					**ASPHALTIC CONCRETE:** (0.1m)	D			PAVEMENT
									FILL: Clayey GRAVEL: Medium to coarse grained, subangular to angular sandstone, pale brown,	M			FILL
										D			No Odour, PID = 0.3ppm
				E	2	1		CL	medium plasticity clay fines	<Wp	VS		ALLUVIUM
									FILL: SAND: Fine to medium grained, pale grey, mottled pale brown, cement stablized				No Odour, Dup 12 + Dup 12a
									Sandy CLAY: Medium to low plasticity, pale brown, mottled orange-brown, fine to medium grained sand				
ADT				SPT 1,0,0 N*=0	1	2		CH	**Sandy CLAY:** Medium to high plasticity, pale brown, mottled red-brown, medium to coarse grained sand				No Odour, PID = 0.9ppm
					0	3		CH	**Silty CLAY:** Medium plasticity, dark grey, mottled black		F		
			▼	SPT 1,3,1 N*=4	-1	4				>Wp			No Odour, PID = 1.7ppm
				SPT 0,0,1 N*=1	-2	5		CH	**CLAY:** Medium plasticity, pale grey		VS		No Odour, PID = 1.8ppm
									Borehole NBH30 terminated at 5m				
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH4**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***30.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 Truck | Easting: | slope: -90° | R.L. Surface: 2.97

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N		E					**FILL: Red Brick** (0.08m)	D			PAVEMENT
				E					**FILL: SAND:** Fine to medium grained, pale brown	M			FILL
					2	1			**FILL: Sandy GRAVEL:** Medium to coarse grained, subangular, pale brown, fine to medium grained sand, with some sandstone cobbles <100mm, trace clay				No Odour, PID = 49.2ppm
				SPT 3,3,12 N*=15	1	2							No Odour, PID = 4.0ppm
					0	3		SC	**Sandy CLAY:** Low plasticity, pale brown, mottled red-brown, fine to medium grained sand, with some black organic stained layers and plant fibres	<Wp	F-S		ALLUVIUM
				SPT 2,3,3 N*=6						>Wp			No Odour, PID = 3.7ppm
					-1	4							
				SPT 2,2,1 N*=3	-2	5							No Odour, PID = 1.4ppm
					-3	6		SC	**Sandy CLAY:** Low plasticity, dark grey, mottled pale brown, medium grained sand, with some shell fragments				No Odour
				SPT 1,1,2 N*=3									
					-4	7							
				SPT 1,3,3 N*=6	-5	8		CH	**CLAY:** Medium to high plasticity, pale grey, mottled red-brown.		F		

Borehole NBH4 terminated at 8m

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No.	***NBH5***
Sheet	1 of 1
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***1.5.2012***
Principal:	
Date completed:	***1.5.2012***
Project:	***SICEEP***
Logged by:	***ACM***
Borehole Location:	***See Figure 1***
Checked by:	***DS***

drill model and mounting: XP60 Truck | Easting: | slope: -90° | R.L. Surface: 3.0

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
DT		N							**CONCRETE:** (0.05m)	D			CONCRETE SLAB
NDDT				E					**FILL: Gravelly SAND:** Fine to medium grained, dark grey, fine to medium grained, subangular sandstone gravel.	M			FILL No Odour, PID = 0.3ppm
				E					**FILL: Sandy GRAVEL** Medium to coarse grained, subangular, orange-brown, mottled red-brown, fine to coarse grained sand, with some clay.				No Odour, PID = 0.4ppm
					2	1			**FILL: CLAY:** Low to medium plasticity, red-brown.	<Wp			
ADT				SPT 5,6,7 N*=13	1	2			**FILL: Sandy GRAVEL:** Medium to coarse grained, subangular sandstone, pale brown, fine to coarse grained sand, trace of clay.	M			No Odour, PID = 0.3ppm
			▼		0	3		SC	**Clayey SAND:** Medium to coarse grained, dark grey, low plasticity clay fines, with some shell fragments.	W	MD		ALLUVIUM
				SPT 3,4,7 N*=11	-1	4					VD		No Odour, PID = 0.1ppm
				SPT R,_,_ N*=R	-2	5							No Odour, PID = 1.3ppm
									Borehole NBH5 terminated at 5m				
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH6**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***30.4.2012***

Project: ***SICEEP***

Logged by: ***ACM***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XP60 Truck | Easting: | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT HA		N		E	5	1			**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Medium to coarse grained, pale brown	M			FILL
				E					**FILL: Clayey SAND:** Fine to medium grained, pale brown, with some fine to coarse grained, subangular sandstone gravel				No Odour, PID = 6.8ppm
					4				**FILL: Gravelly SAND:** Medium to coarse grained, pale brown, mottled pale grey, red-brown, fine to coarse grained, subangular sandstone, trace of clay fines and silt				
				SPT 7,17,9 N*=26		2			**FILL: Clayey GRAVEL:** Fine to medium grained, subangular, pale brown, mottled off-white				No Odour, PID = 6.1ppm
					3								
				SPT 9,7,3 N*=10	2	3							No Odour, PID = 6.1ppm
						4							
					1								No Odour, PID = 4.0ppm
			▼	SPT 3,0,1 N*=1		5		SC	**Clayey SAND:** Fine to medium grained, dark brown, mottled dark grey, black	W	VL		ALLUVIUM
					0								
						6			Borehole NBH6 terminated at 6m				
					-1	7							
					-2								
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No. **NBH7**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***23.4.2012***

Principal:

Date completed: ***23.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Ausrock 3000 Truck | Easting: 333529 | slope: -90° | R.L. Surface: 5.4

hole diameter: 100 mm | Northing 6250304 | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
HA		N	None Observed	E					**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: SAND: Fine to medium grained, pale brown	M			FILL
				E	5				**FILL: Gravelly SAND:** Fine to medium grained, yellow-brown, mottled pale grey, with some fine to medium grained, subangular sandstone gravel, trace of clay				No Odour, PID = 0.7ppm
ADT						1			**FILL: Sandy GRAVEL:** Fine to medium grained, subangular sandstone, dark grey, coarse grained sand	<Wp			
					4				**FILL: Sandy CLAY:** Low plasticity, dark grey, fine to medium grained sand, with some fine to medium grained, subangular gravel				
				SPT 4,4,2 N*=6		2							No Odour, PID = 2.3ppm
					3								
				E		3							No Odour, PID = 1.9ppm
					2				**FILL: CLAY:** High plasticity, dark brown, mottled dark grey, trace fine grained, subangular sandstone gravel and fine grained sand				
									FILL: CONCRETE	D			Suspected Service Encountered
									Borehole NBH7 terminated at 3.6m				
					1	4							
					0	5							
					-1	6							
					-2	7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

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Engineering Log - Borehole

Borehole No.	***NBH8***
Sheet	1 of 3
Project No:	***GEOTLCOV24303AC***
Client: ***Infrastructure NSW***	Date started: ***27.4.2012***
Principal:	Date completed: ***27.4.2012***
Project: ***SICEEP***	Logged by: ***DB***
Borehole Location: ***See Figure 1***	Checked by: ***DS***

drill model and mounting: Mobile Drill Truck | Easting: | slope: -90° | R.L. Surface: 3.4

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		C		E	3	1			**FILL: Red Brick** (0.08m)	D			PAVEMENT
									FILL: Gravelly SAND: Fine to coarse grained, dark brown, mottled red-brown, dark grey, fine to medium grained, angular gravel.	M			FILL
				E									Slight Odour, PID = 1.4ppm
					2				**FILL: Sandy Gravelly CLAY:** Low plasticity, dark brown, mottled pale grey, orange-brown, fine to medium grained sand, fine to coarse grained, subangular to angular gravel.	<Wp			
ADT				SPT 3,4,5 N*=9		2							Slight Odour, PID = 31.5ppm
					1				**FILL: Silty Clayey SAND:** Fine to medium grained, dark brown, with some fine to coarse grained, angular to subangular gravel and slag.	M			
			▶			3				W			
				SPT 2,1,5 N*=6	0								No Odour, PID =16.1ppm
						4			**FILL: Sandy Gravelly CLAY:** Low plasticity, dark brown, mottled pale grey, red-brown, orange-brown, fine to medium grained sand, fine to coarse grained, subangular sandstone/blue metal gravel, with some cobbles (<100mm).	>Wp			
					-1								No Odour, PID =6.8ppm
				SPT 3,2,12 N*=14		5							
					-2				**FILL: Gravelly SAND:** Fine to medium grained, pale grey, mottled orange-brown, dark brown, fine to coarse grained, subangular sandstone and blue metal slag gravel, trace clay.	W			
						6							No Odour, PID =5.3ppm
				SPT 3,1,2 N*=3	-3								
						7							
					-4			SP	**SAND:** Medium, dark brown to dark grey, abundant shell fragments.	W	VL		ALLUVIUM
				SPT 1,1,0 N*=1		8							No Odour, PID =4.5ppm

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

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Engineering Log - Borehole

Borehole No. **NBH8**

Sheet 2 of 3

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***27.4.2012***

Principal:

Date completed: ***27.4.2012***

Project: ***SICEEP***

Logged by: ***DB***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: Mobile Drill Truck | Easting: | slope: -90° | R.L. Surface: 3.4

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		C			-5	9		SP	**SAND:** Medium, dark brown to dark grey, abundant shell fragments. *(continued)*	W	VL		
				SPT 1,1,0 N*=1	-6			SC	**Sandy CLAY:** Low to medium plasticity, orange-brown, mottled red-brown, fine to medium grained sand, trace of fine to medium grained, subrounded to subangular ironstone/sandstone gravel.	>Wp	VS	×	
					-7	10			**SANDSTONE:** Fine to medium grained, orange-brown, highly weathered, low to medium strength.				BEDROCK
					-8	11			Borehole NBH8 continued as cored hole				
					-9	12							
					-10	13							
					-11	14							
					-12	15							
						16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. **NBH9**

Sheet 1 of 1

Project No: **GEOTLCOV24303AC**

Client: ***Infrastructure NSW***

Date started: ***30.4.2012***

Principal:

Date completed: ***30.4.2012***

Project: ***SICEEP***

Logged by: ***JW***

Borehole Location: ***See Figure 1***

Checked by: ***DS***

drill model and mounting: XC Drill Track | Easting: | slope: -90° | R.L. Surface: 5.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT DT		N							**CONCRETE:** (0.21m) with 10mm reinforcement	D			CONCRETE SLAB
									FILL: GRAVEL: Medium to coarse grained, subangular, dark grey, with some fine to medium grained sand, trace of clay				FILL
									SANDSTONE: Fine to medium grained, pale grey, pale yellow brown, moderately weathered, low to medium strength.				BEDROCK
					5	1			Borehole NBH9 terminated at 0.33m				
					4	2							
					3	3							
					2	4							
					1	5							
					0	6							
					-1	7							
					-2	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH1***

Sheet 1 of 3

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***7.6.2011***

Principal:

Date completed: ***7.6.2011***

Project: ***SICEEP***

Logged by: ***LJG***

Borehole Location: ***Darling Drive, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Hydrapower Scout Truck | Easting: | slope: -90° | R.L. Surface: 3.75

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		C							**FILL: BRICK PAVERS:** 0.08m. **FILL: SAND:** Medium grained, brown, with some roots, 0.02m. **FILL: CONCRETE:** Grey, 0.50m.	D			PAVEMENT
				SPT 7,11,10 N*=21	3 2	1 2			**FILL: SAND:** Coarse grained, red, brown, grey, trace of clay and fine to medium sandstone and brick gravel.	D			FILL
ADV				SPT 1,1,2 N*=3	1 0	3 4			**FILL: Clayey SAND:** Coarse grained, brown, low plasticity clay, with some medium grained sand, trace of shells, fibers and fine grained rounded sandstone and brick gravel.				
			▶	SPT 3,2,1 N*=3				CL	**Sandy CLAY:** Low to medium plasticity clay, dark brown, coarse grained sand, with some shells.	M	F		POSSIBLY FILL?
									4.00m Band of red partially cemented sand and ironstone gravel.	W			
					-1	5		SC	**Clayey SAND:** Medium to coarse grained, brown, red, orange mottled, low to medium plasticity clay, with some shells.		L		ESTUARINE/ALLUVIUM
								SW	**SAND:** Medium to coarse grained, brown, grey, red, with some clay and shells.				
				SPT 1,2,4 N*=6	-2	6		SP	**SAND:** Coarse grained, pale grey to grey, trace of clay.		L-MD		RESIDUAL SOIL
					-3	7							
				SPT 8/70mm N*=R					**SANDSTONE:** Extremely weathered, coarse grained, grey, red, brown, estimated to be low strength, remoulds to a sand.				WEATHERED BEDROCK
					-4	8			Borehole R17-BH1 continued as cored hole				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH10***

Sheet 1 of 4

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***1.6.2011***

Principal:

Date completed: ***10.6.2011***

Project: ***SICEEP***

Logged by: ***LJG***

Borehole Location: ***Little Pier Street, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Ausroc 4000 Truck | Easting: | slope: -90° | R.L. Surface: 3

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C							**BRICK PAVERS:**	D			PAVEMENT
									FILL: Gravelly SAND: Medium to coarse grained, brown, fine to medium grained, angular gravel.				
									CONCRETE: Grey, 200mm	D			FILL
									FILL: Clayey SAND: Coarse grained, brown				
					2	1			**FILL: Sandy CLAY:** Medium plasticity, red-brown/pale grey.				
				SPT 8/90mm N*=R					1.09m - with some asphalt gravel.				1.09m - Strong odour
					1	2				M			
									FILL: Silty CLAY: Low to medium plasticity, grey, brown, trace of sand.	D			
									FILL: CLAY: Medium to high plasticity, red, brown, pale grey, orange mottled, with some fine grained gravel				
				SPT 3,2,3 N*=5	0	3		SM	**Silty SAND:** Medium to coarse grained, black, with some shells, trace of fine grained gravel.	W	VL		ALLUVIUM
					-1	4		SC	**Clayey SAND:** Coarse grained, brown, medium to high plasticity clay.				
				SPT 1,0,0 N*=0				SC	**Clayey SAND:** Coarse grained, black, low plasticity clay, with some shells, trace of silt.				
					-2	5							
WB								CH	**CLAY:** High plasticity, red brown, grey with some sand.		St		
					-3	6							
								SC	**Clayey SAND:** Fine grained, pale grey, low plasticity clay.		MD		
				SPT 4,5,7 N*=12	-4	7		CL-CH	**Sandy CLAY:** Medium to high plasticity, pale grey, yellow brown.		VSt	×	
								CH	**CLAY:** High plasticity, red brown, grey, with some coarse sand.			×	
					-5	8							

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH10***

Sheet 2 of 4

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***1.6.2011***

Principal:

Date completed: ***10.6.2011***

Project: ***SICEEP***

Logged by: ***LJG***

Borehole Location: ***Little Pier Street, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Ausroc 4000 Truck | Easting: | slope: -90° | R.L. Surface: 3

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
WB				SPT 6,7,9 N*=16				CH	**CLAY:** High plasticity, red brown, grey, with some coarse sand. *(continued)*	W	VSt	x x x	
					-6	9		CH	**CLAY:** High plasticity, red, brown, dark grey, orange mottled, trace of ironstone gravel and fine sand.		St/VSt		
				SPT 5,5,7 N*=12								x	
					-7	10		SC	**Clayey SAND:** Coarse grained, grey, low to medium clay.		MD		RESIDUAL SOIL
					-8	11							
									Borehole R17-BH10 continued as cored hole				
					-9	12							
					-10	13							
					-11	14							
					-12	15							
					-13	16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***R17-BH11***
Sheet	1 of 3
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***1.6.2011***
Principal:	
Date completed:	***1.6.2011***
Project:	***SICEEP***
Logged by:	***RH***
Borehole Location:	***Sydney Entertainment Centre, Haymarket, NSW***
Checked by:	***SS***

drill model and mounting:	Ausroc 4000 Truck	Easting:	slope:	-90°	R.L. Surface: 2.9
hole diameter:	100 mm	Northing	bearing:	N/A	datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADV		C		D					**FILL: SAND:** Medium to coarse grained, pale brown, with some quartz and shell fragments.	M			FILL
				D	2	1			**FILL: SAND:** Fine to coarse grained, dark brown, black, with some fine to medium lithic gravels and sandstone.				
									FILL: SANDSTONE BOULDER: Pale yellow and white				0.70m distinct bitumen odour 0.80m SPT1 moved from 1.0m to 1.50m due to sandstone boulder.
				SPT 13,5,3 N*=8	1	2			**FILL: SAND:** Fine to coarse grained, dark brown, black, with some fine to medium lithic and sandstone gravel. 1.40m colour becoming brown				
								CL	**Silty CLAY:** Low plasticity, pale grey mottled red.	W	F		ALLUVIUM
					0	3		SC	**Clayey SAND:** Fine to medium grained, dark grey, clay rich and sand rich layers throughout		MD		
				U_{50}									3.00m distinct organic odour
					-1	4		CH	**CLAY:** High plasticity, dark grey, brown.		S-F		
				SPT 3,4,10 N*=14	-2	5		CL	**Silty CLAY:** Low plasticity, pale grey mottled red and orange iron stained, with some red clay pockets throughout.		VSt		RESIDUAL SOIL
					-3	6			5.70m increased iron staining				
				SPT 7,8,9 N*=17	-4	7							
				SPT 3,5,30/120mm N*=R	-5	8			**SANDSTONE:** Extremely weathered, medium grained, pale grey, white, estimated to be very low strength.				WEATHERED BEDROCK

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH11***

Sheet 2 of 3

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***1.6.2011***

Principal:

Date completed: ***1.6.2011***

Project: ***SICEEP***

Logged by: ***RH***

Borehole Location: ***Sydney Entertainment Centre, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Ausroc 4000 Truck | Easting: | slope: -90° | R.L. Surface: 2.9

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
									Borehole R17-BH11 continued as cored hole				
					-6	9							
					-7	10							
					-8	11							
					-9	12							
					-10	13							
					-11	14							
					-12	15							
					-13	16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***R17-BH12***
Sheet	1 of 3
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***10.6.2011***
Principal:	
Date completed:	***10.6.2011***
Project:	***SICEEP***
Logged by:	***RC***
Borehole Location:	***Sydney Entertainment Centre, Haymarket, NSW***
Checked by:	***SS***

drill model and mounting: Hydrapower Scout Truck | Easting: | slope: -90° | R.L. Surface: 2.8

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		C							**FILL: Clayey SAND:** Fine to medium grained, brown, trace of gravel and rootlets.	D			TOPSOIL/FILL
					2	1			**FILL: CONCRETE:** Pale grey, 100mm **FILL: Sandy GRAVEL:** Medium to coarse, grey to dark grey.				FILL (Pavement?)
									FILL: Silty SAND: Fine to medium grained, dark grey to black, with some clay and fine rounded gravel.	M			FILL slight odour
				SPT 4,4,3 N*=7	1	2			**FILL:** Very low strength shale remoulding as brown silty clay.	<Wp			
									FILL: Silty CLAY: High plasticity, red-brown mottled orange-brown, with some sand.	>Wp			
			▼		0	3			2.7m - With some fine to medium subangular ironstone gravel. 3.4m - Band with some sand and shells (50mm).				
ADV				SPT 0,0,1 N*=1				CH	**Silty CLAY:** High plasticity, dark grey, with some bands of medium grained sand and some shells. 3.4m - Band with some sand and shells.		S/F		3.0m - SPT rods sunk 400mm under hammer weight ALLUVIUM
				U_{50}	-1	4			3.95m - With some fibres. 4.2m - Becoming grey.				
				SPT 2,2,4 N*=6	-2	5		CH	4.7m - Becoming mottled red. **Sandy CLAY:** High plasticity, pale grey mottled red and orange-brown, medium grained sand, trace of silt.		St-VSt		
			5.5m at 11am on 10/6/2011		-3	6							
				SPT 2,4,8 N*=12	-4	7		SP	**SAND:** Medium grained, pale grey mottled brown, trace of clay.	W	MD		RESIDUAL SOIL
				SPT 3,11,30/60mm N*=R	-5	8			7.75m - Becoming yellow and red.		D		WEATHERED BEDROCK

Borehole R17-BH12 continued as cored hole

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH13***

Sheet 1 of 3

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***9.6.2011***

Principal:

Date completed: ***9.6.2011***

Project: ***SICEEP***

Logged by: ***RC***

Borehole Location: ***Sydney Entertainment Centre, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Hydrapower Scout Truck | Easting: | slope: -90° | R.L. Surface: 3.15

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa (100 200 300 400)	structure and additional observations
ADT					3				**FILL:** Rectangular, red-brown concrete pavers (50mm) overlying medium grained pale brown sand (50mm)	D			PAVEMENT
									FILL: Sandy GRAVEL: Medium to coarse grained, grey, fine to medium grained gravel.				FILL
ADV						1			**FILL: Gravelly SAND:** Fine to medium grained, brown, fine to coarse angular to subrounded gravel.				
				SPT 10,8,2 N*=10	2					M			
									FILL: SAND: Medium grained, pale brown.	W			
						2			1.8m - With some brown gravel.				
			▼		1			CH	**Silty CLAY:** High plasticity, dark grey.	>Wp	S		ALLUVIUM
			4m at 12pm on 9/6/2011	SPT 1,1,1 N*=2		3							3m - With sulfuric odour
				U_{50}	0								
						4					F/St		
				SPT 3,6,6 N*=12	-1								
						5		CL	**Sandy CLAY:** Low plasticity, pale grey mottled, orange-brown, fine to medium grained sand with some fine to medium grained subangular ironstone gravel.		St-VSt		
					-2								
				SPT 5,4,4 N*=8		6							
					-3				6.5m - Becoming red.				
						7			6.8m - One rootlet.				
				SPT 6,6,7 N*=13	-4								
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***R17-BH13***
Sheet	2 of 3
Project No:	***GEOTLCOV24303AC***
Client: ***Infrastructure NSW***	Date started: ***9.6.2011***
Principal:	Date completed: ***9.6.2011***
Project: ***SICEEP***	Logged by: ***RC***
Borehole Location: ***Sydney Entertainment Centre, Haymarket, NSW***	Checked by: ***SS***

drill model and mounting: Hydrapower Scout Truck | Easting: | slope: -90° | R.L. Surface: 3.15

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADV					-5	9		CL	**Sandy CLAY:** Low plasticity, pale grey mottled, orange-brown, fine to medium grained sand with some fine to medium grained subangular ironstone gravel. *(continued)*	>Wp	St-VSt		
				SPT 4,5,3 N*=8	-6	10		SP	**SAND:** Medium to coarse grained, dark grey to grey, with some high plasticity clay.	W	L-MD		RESIDUAL SOIL?
													WEATHERED ROCK
NMLC				SPT R,30/140,R N*=R	-7				Borehole R17-BH13 continued as cored hole				SPT hammer bouncing
					-8	11							
					-9	12							
					-10	13							
					-11	14							
					-12	15							
						16							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH14***

Sheet 1 of 2

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***17.6.2011***

Principal:

Date completed: ***17.6.2011***

Project: ***SICEEP***

Logged by: ***RC***

Borehole Location: ***Harbour Street, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Hydrapower Scout Truck | Easting: | slope: -90° | R.L. Surface: 3.3

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C			3	1			**FILL: ASPHALT:** Dark grey, medium to coarse grained gravel, overlying medium to coarse grained, pale brown. Sandy GRAVEL.	D			PAVEMENT
									Gravelly SAND: Fine to medium grained, brown, dark brown, fine to coarse gravel, with some dioritic cobbles (70mm), trace of silt.				FILL
				SPT 3,2,2 N*=4	2								
						2			**FILL: CONCRETE:** Pale grey				
					1				**FILL: Gravelly SAND:**	M			
			►	SPT 1,0,0 N*=0	0	3		CH	**Silty CLAY:** High plasticity, dark grey, grey, trace of medium grained sand.	>Wp	VS	×	ALLUVIUM
									3.5m - With some bands of sand.				
				SPT 2,3,2 N*=5	-1	4		CH	**Silty CLAY:** High plasticity, red mottled pale grey.		S/F	× × ×	
					-2	5							
				SPT 3,3,5 N*=8	-3	6		CH/SC	**BANDS OF Silty CLAY/Clayey SAND:** Dark grey and high plasticity clay. Sand is medium to coarse grained, dark grey sand.	>Wp/W	S/L		
						7							
				SPT R,20/90 N*=R	-4				**SANDSTONE:** Medium to coarse grained, pale grey to white, remoulds to a sand.				WEATHERED BEDROCK
									Borehole R17-BH14 continued as cored hole				
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH15***

Sheet 1 of 3

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***21.6.2011***

Principal:

Date completed: ***21.6.2011***

Project: ***SICEEP***

Logged by: ***LJG***

Borehole Location: ***Harbour Street, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Ausroc 4000 Truck | Easting: | slope: -90° | R.L. Surface: 3.2

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		C			3				**FILL: BITUMEN:** Dark grey, 300mm				FILL
									FILL: CONCRETE: Grey, 100.m				
									FILL: Gravelly SAND: Medium to coarse grained, dark grey, brown, fine grained brick, sandstone and aggregate gravel, trace of clay.	D M			
						1			0.5m - Fine to medium grained gravel, with some clay.				
				SPT 8/160mm N*=R	2								1m - SPT refused on gravel
						2			1.50m - With some clay and coarse sandstone gravel, trace of cobbles.				
					1			SC	**Clayey SAND:** Medium to coarse grained, black,	W	MD		ALLUVIUM
				SPT 3,1,2 N*=3				CL	dark grey, high plasticity clay, trace of organic material.	M-W	F		
									Silty CLAY: Low plasticity, dark brown, dark grey, with some organic material and some shells.				
			►		0	3		SC	**Clayey SAND:** Coarse grained, dark grey, brown, trace of shells.	W	L-MD		
								CH	**CLAY:** High plasticity, pale grey mottled red brown, trace of sand.		St-VSt		
									3.5m - With some interbedded sand layers.				
						4		SC	**Clayey SAND:** Coarse grained, dark grey, dark brown, low plasticity clay, trace of shells.		MD		
				SPT 3,4,5 N*=9	-1			CH	**CLAY:** High plasticity, pale grey, trace of fine sand.		St		
						5							
					-2				5.20m - Pale grey, pale brown mottled.	M			
						6			5.80m - Pale grey, red, brown mottled, trace of fine to coarse sand and fine ironstone.				
				SPT 2,4,6 N*=10	-3								
						7							
					-4			CL	**Sandy CLAY:** Low to medium plasticity, pale brown mottled red, coarse sand.		St		
								SC	**Clayey SAND:** Coarse grained, red, trace of fine ironstone gravel and burrows.	M	MD		RESIDUAL SOIL
				SPT 7,5,6 N*=11		8			7.8m - Pale brown, mottled black and red, trace of				

BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix	
e.g.	ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole No. ***R17-BH15***

Sheet 2 of 3

Project No: ***GEOTLCOV24303AC***

Client: ***Infrastructure NSW***

Date started: ***21.6.2011***

Principal:

Date completed: ***21.6.2011***

Project: ***SICEEP***

Logged by: ***LJG***

Borehole Location: ***Harbour Street, Haymarket, NSW***

Checked by: ***SS***

drill model and mounting: Ausroc 4000 Truck | Easting: | slope: -90° | R.L. Surface: 3.2

hole diameter: 100 mm | Northing | bearing: N/A | datum: AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		C			-5				burrows.				WEATHERED BEDROCK
									SANDSTONE: Extremely weathered, coarse grained, pale brown, pale grey, estimated to be very low strength, remoulds to a sand.				
									Borehole R17-BH15 continued as cored hole				TC Bit refusal at 8.50m
					-6	9							
					-7	10							
					-8	11							
					-9	12							
					-10	13							
					-11	14							
					-12	15							
						16							

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BOREHOLE GINTGEOTLCOV24303AC_COMBINED WITH AA GINT.GPJ COFFEY.GDT 5.15.12

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	***R17-BH16***
Sheet	1 of 6
Project No:	***GEOTLCOV24303AC***
Client:	***Infrastructure NSW***
Date started:	***20.6.2011***
Principal:	
Date completed:	***21.6.2011***
Project:	***SICEEP***
Logged by:	***LJG***
Borehole Location:	***Harbour Street, Haymarket, NSW***
Checked by:	***SS***

drill model and mounting:	Hydrapower Scout Truck	Easting:		slope:	-75°	R.L. Surface:	3.30
hole diameter:	100 mm	Northing		bearing:	177.5°	datum:	AHD

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
PH		C			3	1			**BRICK PAVERS:** 0.06m **FILL: Gravelly SAND:** Fine to coarse, brown, dark brown, fine to rounded gravel with some clay and trace of medium to coarse gravel, roots, glass, metal piping, concrete, bricks.	D			FILL
AD					2	2			**FILL: SAND:** Medium to coarse grained, brown, with some clay and fine gravel.	M			
WB			►		1	3				W			
					0	4		CL/SC	**Sandy CLAY/Clayey SAND:** Low plasticity clay, medium to coarse grained sand, grey, brown, with some organic material.				ALLUVIUM
					-1	5		CH	**CLAY:** High plasticity, red, brown, grey, trace of sand.				
				U_{50}	-2	6							
					-3	7		CH	**Sandy CLAY:** High plasticity, grey, coarse sand.				
					-4	8		SP	**SAND:** Coarse grained, grey, brown, trace of clay.				

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C casing

penetration

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10/1/98 water level on date shown
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