Appendix 4 – Site Investigations (Contamination) Report

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Limited Detailed Site Investigation

26 Kissing Point Road and 266 Victoria Road
Parramatta Planning Proposal
Parramatta, NSW

Prepared for
Elton Consulting Group Pty Ltd

Project 85556.00
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Douglas Partners
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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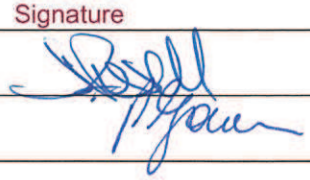
Author		16 November 2016
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Executive Summary

Douglas Partners Pty Ltd (DP) has prepared this Limited Detailed Site Investigation (Limited DSI) for contamination at 26 Kissing Point Road and 266 Victoria Road, Parramatta (hereon in, referred to collectively as the 'site'). The report was commissioned on 22 June 2016 by Elton Consulting Group Pty Ltd (Elton) on behalf of Property NSW.

The purpose of the Limited DSI is to support a planning proposal to amend the Parramatta Local Environmental Plan (PLEP) 2011 to allow rezoning of the site to create a new mixed use precinct.

The objective of this Limited DSI is to fill data gaps identified during previous investigations in relation to site contamination issues, within the parameters of the engagement, and to document the site characterisation methods utilised to assess potential site contamination. The findings of this Limited DSI will establish whether further investigation and/or site remediation is required in the context of the proposed development.

The site comprises two adjoining land parcels, the Ageing, Disability and Home Care (ADHC) facility at 266 Victoria Road, North Parramatta and the former Macquarie Boys High School (MBHS) at 26 Kissing Point Road. Immediately prior to commencement of the fieldwork, the MBHS portion of the site was subject to extensive damage by a fire, and as such was not accessible for investigation. All of the intrusive investigation work described herein was conducted at the ADHC.

The Limited DSI included sampling from 40 boreholes / test pits, drilling and installation of two groundwater wells, analysis of selected samples for various contaminants of potential concern and assessment of the results with respect to the proposed land use.

The current investigation, which comprised intrusive investigation in the ADHC portion of the site (noting the MBHS portion was inaccessible at the time of investigation) (refer to Figure 5, below for areas) found the following:

- Confirmed the presence of filling over the ADHC portion of the site, generally to depths of between 0.03 m and 0.6 m below ground level;
- Confirmed the presence of relatively deeper filling (compared to the general site filling levels) in one location in the Western Fill Area (encountered to a depth of 4.4 m in BH14);
- Confirmed the presence of relatively deeper filling (compared to the general site filling levels) in the Eastern Fill Area (encountered to a maximum depth >6.1 m in BH13);
- Identified a fragment of asbestos cement in one location in the Eastern Fill Area, with a low asbestos concentration in soil (below the laboratory reporting limit) also identified by the laboratory at this location (BH12). Inclusions of building debris was observed in other test locations, and can be associated with asbestos contamination;
- Identified benzo(a)pyrene in filling above the ecological-based investigation levels at two locations (BH11 and TP10). Statistical analysis indicated that these concentrations are not statistically significant for the entire filling dataset, however given the proposed mixed use the actual locations and potential impacts should be considered when detailed development plans are confirmed; and

- Recorded concentration of potential groundwater contaminants in one location (BH14) (note other well locations either not accessible for well installation or were dry at the time of sampling). All results were within the adopted GIL with the exception of zinc. Zinc was above the adopted ecological-based investigation level, however is within background levels often recorded in urban Sydney areas. As such the detected zinc concentrations are not considered to be of concern.

Based on the findings of the current investigation it is considered that the site can be made suitable for the proposed mixed use (including residential) development subject to the following:

- Additional investigations at the MBHS site with reference to the sampling and analysis quality plan (SAQP) (DP, 2016). The proposed scope may need to be modified depending on the site contamination impacts which may have been caused by the fire (e.g. asbestos, PFAS); and
- Development of a suitable remediation action plan (RAP) that covers, *inter alia*, the decommissioning and management of any contamination associated with the boiler house, maintenance areas and other site structures, management of any contamination associated with the high pressure pipeline, remediation of asbestos contamination and any other contamination identified during the additional investigation and management of filling identified at the site.

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Limited Detailed Site Investigation
26 Kissing Point Road and 266 Victoria Road Parramatta Planning Proposal
Parramatta, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) has prepared this Limited Detailed Site Investigation (Limited DSI) for contamination at 26 Kissing Point Road and 266 Victoria Road, Parramatta (hereon in, referred to collectively as the 'site'). The report was commissioned on 22 June 2016 by Elton Consulting Group Pty Ltd (Elton) on behalf of Property NSW.

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The objective of this Limited DSI is to fill data gaps identified during previous investigations in relation to site contamination issues, within the parameters of the engagement, and to document the site characterisation methods utilised to assess potential site contamination. The findings of this Limited DSI will establish whether further investigation and/or site remediation is required in the context of the proposed development.

A site plan is shown on Drawing 1, Appendix A.

The scope of work for the Limited DSI was based on a sampling and analysis quality plan (SAQP) (DP, 2016) which is included in Appendix B.

2. Project Background

The new precinct will provide a high density residential development with a diverse range of housing and retail and commercial development with the opportunity for research and education related employment in close proximity to existing and planned public transport nodes. The proposal will allow for the provision of up to 3,000 dwellings and approximately 40,000 m^2 of retail and commercial floor space.

The proposal will also allow for community facilities, a significant public open space network and a new public domain to meet the needs of the new community.

Comprising two adjoining land parcels, the Ageing, Disability and Home Care (ADHC) facility at 266 Victoria Road, North Parramatta and the former Macquarie Boys High School (MBHS) at 26 Kissing Point Road, the Site encompasses approximately 19.4 ha in the City of Parramatta local government area (LGA). The MBHS was closed by the Department of Education in 2008 and the Site has been vacant since that time. The ADHC facility is still in operation, however, the site will be vacated by mid-2017.

Property NSW on behalf of Family and Community Services (FACS) and Department of Education (DE) have been charged with responsibility of divesting the site.

The site is located north of Rydalmere train station, on the north eastern corner of James Ruse Drive and Victoria Road intersection, bounded to the north by Kissing Point Road and Vineyard Creek. The site is a 5 to 10 minute walk from Rydalmere train station, with the potential for improvements in connectivity to further enhance accessibility. The University of Western Sydney's North Parramatta and Parramatta campuses lie to the west and south of the site offering the potential for synergies between education, research and employment.

The divestment and redevelopment of the site offers opportunities to:

- Provide a significant urban infill opportunity within the City of Parramatta LGA aligning with the broader Government objectives and the Sydney Metropolitan strategy to increase and accelerate housing supply
- Optimise the site's strategic location relative to the proposed Western Sydney Light Rail network in terms of increasing density along public transport corridors; and
- Support FACS and DE's commitment to recycling of capital investment in new and expanded facilities to meet the needs of the community.

In line with the above and to provide certainty of housing supply to the market, job creation and development of underutilised assets, Property NSW has developed a concept plan to guide the redevelopment of the site. The concept plan seeks to satisfy the NSW Government's priorities for the precinct:

- Create a sustainable community with access to employment and education opportunities, community facilities and a high quality of life;
- Improve connectivity between the site and its surrounds in terms of transport, pedestrian and cycling networks and the open space network;
- Create a high quality public domain that is legible and activates the precinct;
- Enhance the riparian corridor along the boundary of the Site with the potential to deliver the missing link in the Vineyard Creek Corridor and to support the development of Sydney's Green Grid; and
- To realise the vision for the site articulated in the concept plan, an amendment to the PLEP 2011 to allow for the redevelopment of surplus land in Parramatta to create a new mixed use precinct.

3. Scope of Works

The proposed scope of works for the Limited DSI was outlined in the SAQP (DP, 2016). The actual scope implemented was as follows:

- Review previous reports;
- Prepare the SAQP that details the proposed fieldwork;
- Drilling / excavating of 40 boreholes / test pits to a depth of 0.5 m into natural soils (or prior refusal) to a maximum depth of 3 m. Test locations were placed in a generally grid-based pattern

modified based on site accessibility and to target areas of potential concern. A total of 64 boreholes / test pits had been proposed however 24 of the locations were not accessible at the time of fieldwork, as discussed below;

- Extend four boreholes to depths intersecting the water table (to a maximum depth of 6 m, or prior refusal) for soil sampling and groundwater monitoring well installation;
- Collection of soil samples at regular intervals based on field observations, including from the near surface, from near the water table (if encountered) and upon any signs of obvious contamination such as odours or staining. Soil samples will be collected from the auger spiral for drilled boreholes. Soil samples from test pits will be collected from freshly exposed walls of the test pits;
- Surveying of boreholes and test pits using a differential global positioning system (dGPS);
- Screening of all samples collected with a photoionisation detector (PID) to assess the likely presence or absence of volatile organic compounds (VOC);
- Analysis of 56 selected primary soil samples (plus QC samples) for the following common contaminants at a NATA accredited laboratory:
  - eight priority metals (arsenic, cadmium, chromium, copper lead, mercury, nickel, zinc);
  - total recoverable hydrocarbons (TRH);
  - benzene, toluene, ethylbenzene, xylenes (BTEX);
  - polycyclic aromatic hydrocarbons (PAH);
  - organochlorine pesticides (OCP);
  - organophosphate pesticides (OPP);
  - polychlorinated biphenyls (PCB);
  - total phenols;
  - asbestos (presence / absence);
  - pH, cation exchange capacity (CEC) (required for determination of site specific environmental investigation levels);
- Installation of two groundwater monitoring wells [note 2 additional wells were proposed in the SAQP but were not accessible at the time of fieldwork, as discussed below]. The wells were constructed using class 18 uPVC screw threaded screened and blank sections. A gravel filter pack was placed to approximately 0.5 m above the screened section of the well followed by a hydrated bentonite seal. The well was then backfilled using cement / bentonite grout to surface and finished with a lockable steel well monument or gatic cover;
- Developing the wells immediately following installation;
- Collection of groundwater samples from each monitoring well. The physical parameters of pH, conductivity, dissolved oxygen and oxidation / reduction potential were measured and recorded whilst sampling;
- Submitting one groundwater sample (plus QC sample) to a National Association of Testing Authorities (NATA) accredited laboratory for analysis of the following contaminants:
  - eight priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
  - TRH;
  - BTEX;
  - PAH;

  - o total phenols;
  - o OCP, OPP and PCB;
  - o nutrients (nitrate, nitrite, ammonia and total phosphorous); and
- Field sampling and laboratory analysis in compliance with standard environmental protocols, including a QA/QC plan consisting of replicate sampling (intra and inter-laboratory replicate samples), trip spikes, trip blanks, appropriate Chain of Custody procedures and in–house laboratory QA/QC testing; and
- Preparation of this Limited DSI report with reference to NSW Environment Protection Authority (EPA) endorsed guidelines.

Modification of Scope Due to Access Constraints

Immediately prior to commencement of the fieldwork, the MBHS portion of the site was subject to extensive damage by a fire. The MBHS portion of the site was consequently not accessible as the damage was being assessed by insurers and clean-up of the affected area was required. The extent of clean-up required is not known to DP, however, is understood to involve clean-up of asbestos contamination.

As a result of the access restriction, the implemented scope of the fieldwork component of this investigation was limited to that proposed on the ADHC portion of the site only. It is understood the access to the MBHS portion of the site will be granted in due course, and this report will need to be updated accordingly.

4. Site Identification and Description

The site covers an approximate area of 19.4 ha and is located within the LGA of Parramatta in the County Cumberland and Parish of Field of Mars. The site comprises two street addresses and three Lots as follows:

- 266 Victoria Road, Parramatta – the current Ageing, Disability and Home Care Facility;
  - o Lot 1 in Deposited Plan (D.P.) 836958 and Lot 1 in D.P. 247855, current zoning SP2 (Educational Establishment);
- 26 Kissing Point Road, Parramatta – the former Macquarie Boys High School;
  - o Lot 1 in D.P. 128413, current zoning R2 Low Density Residential.

Lot 1 in D.P. 836958 and Lot 1 in D.P. 247855 currently consists of approximately 30 single storey structures dating from the late 1960's, providing accommodation, support and service facilities. The buildings were mostly constructed from about 1968 and were originally built as a hospital complex (Resolve, 2005). The buildings include a boiler house, maintenance yard and maintenance shed.

Lot 1 in D.P. 128413 (former MBHS) currently consists of the former school buildings and associated courtyard and pathways. The south-western portion of the Lot contains a sports oval and former animal enclosure. The eastern portion of the Lot contains a bus turning bay, creek (Vineyard Creek)

and vegetated area. At the commencement of this project, the MBHS site was subject to extensive damage by a fire.

A high pressure liquid petroleum products pipeline (the 'high pressure pipeline' or 'oil pipeline') and associated easement, located to the west of Vineyard Creek, transects the site from north to south.

Key site features are shown on Drawing 1, Attachment 1 of DP (2016) in Appendix B. The drawing is reproduced in Figure 1, below.

Figure 1: Site features

5. Summary of Previous Investigations

The following investigations are known to have previously been undertaken at the site:

- Resolve Environmental Management (Resolve) *Rydalmere Centre Rydalmere – Stage 1 Environmental Site Assessment*, dated 19 June 2006 (Resolve, 2006);
- EP Risk Management (EP) *Preliminary Contamination Assessment, 26 Kissing Point Road Parramatta*, dated 9 October 2012 (EP, 2012); and
- SMEC Testing Services Pty Ltd (SMEC Testing) *Geotechnical Investigation of 26 Kissing Point Road, Parramatta*, dated September 2012 (SMEC Testing, 2012).

Extracts of the previous reports are reproduced in Appendix C.

5.1 Resolve (2006)

Resolve (2006) was a desktop investigation and did not include any soil or groundwater sampling to confirm the contamination status of soil and/or groundwater beneath the site. The investigation was limited to 266 Victoria Road, Parramatta.

The key findings of Resolve (2006) are summarised as follows:

- Conclusions:
  - The property is presently utilised as a hospital and centre for rehabilitation of the mentally disabled;
  - The majority of the buildings were mostly constructed from about 1968 and was initially built as a hospital complex;
  - Prior to the current configuration the hospital appeared to comprise a more agriculture layout with grazing areas and cultivated land;
  - Areas of the site have been filled or re-contoured through development of the facility to the current configuration;
  - A coal fired boiler was used at the site for heating. It is understood that residual ashes may have been used for filling across the site;
  - The historical aerial photographs suggest that filling is most likely along the eastern boundary with Vineyard Creek and the central western boundary;
  - With the exception of the boiler house, ash was not observed at the ground surface during the site inspection;
  - The use of ash and unknown fill may have introduced contaminants to the soil profile particularly on the eastern and western boundaries of the site;
  - Asbestos building materials are likely to be present in some of the building elements and are understood to be the subject of a separate hazardous building assessment;
- Recommendations:
  - A Hazardous Building Material Survey is conducted at the facility including a ground surface survey;
  - The boiler house and waste material should be fully decommissioned and removed from the site;

- As part of the site management groundwater wells should be installed on the eastern boundary to confirm the soil profile and the groundwater quality leaving the site; and
- Any major construction or earthworks program should make suitable documented allowance for the management of unexpected soil types such as ash fill.

5.2 EP (2012)

EP (2012) was a desktop investigation with limited soil sampling (the soil sampling was actually undertaken by SMEC Testing, 2012). The 'site' investigated was 26 Kissing Point Road, Parramatta. Fieldwork by SMEC Testing (2012) involved the drilling and sampling from 10 boreholes located on an area of suspected fill (i.e. the eastern portion of the site comprising the sports oval).

The key findings of EP (2012) are summarised as follows:

- Conclusions and recommendations:
  - The potentially contaminating activities that have occurred at the site include:
    - Rural land use that may have involved the application of pesticides and herbicides;
    - Extensive filling of the site during development that may have been imported from and off-site source;
    - Operation of an underground high pressure fuel line;
- SMEC Testing (2012) undertook a geotechnical investigation of the southern portion of the site containing the sports oval and collected 25 primary soil samples which were selectively tested for TRH, BTEX, PAH, Phenols, PCBs, heavy metals and asbestos. The sports oval was considered to have the most potential for contamination due to the presence of the high pressure pipeline and significant fill up to depths of 7.6 m below ground surface (bgs);
- A review of the analytical soil results collected by SMEC Testing (2012) indicated that all analytes tested were either below the limits of reporting of the laboratory or the adopted criteria;
- Preliminary testing of soils in the portion of the site with the greatest potential for contamination did not detect any contaminants above the adopted criteria. Investigations were not undertaken in the northern and eastern portions of the Site containing the access road and the bus drop off area. However the risk of contamination to these areas was considered to be less than the area investigated. Groundwater was not investigated as it was not intersected during the investigation;
- Based on the review of the site inspection, historical information and the SMEC Testing (2012) Geotechnical Investigation results, the site is considered to present a low risk of soil and groundwater contamination at the time of the assessment; and
- It should be noted, however that the high pressure pipeline presents an on-going future risk of contamination at the site. In order to mitigate future risk of an environmental liability from leakage of the pipeline, it would be prudent to install groundwater monitoring wells adjacent and down gradient to the pipeline easement to enable collection of baseline data. This could be undertaken after acquisition and prior to construction of the proposed development.

5.3 SMEC Testing (2012)

SMEC Testing (2012) involved the drilling and sampling from 10 boreholes located on an area of suspected fill (i.e. the eastern portion of the site comprising the sports oval). The investigation identified uncontrolled fill to depths of greater than 7 m at the site. The full depth of the fill could not be penetrated at BH2 and BH3 due to obstructions in the fill.

A review of the borehole logs indicates the general absence of anthropogenic material (e.g. building and demolition rubble).

The test locations and depth of fill are shown on Drawing 2, Attachment 1 of DP (2016) in Appendix B. The drawing is reproduced (in part) in Figure 2, below.

Figure 2: Previous test locations (SMEC Testing, 2012) and depth of fill on the MBHS oval

6. Regional Topography, Geology, Acid Sulfate Soil Risk and Hydrogeology

The regional topography, shown with 2 m surface level contours based on data supplied by the NSW Department of Lands in April 2009, is shown on Drawing 3. The contours show levels at the site sloping either in a generally southerly direction towards Parramatta River or in a generally easterly direction towards Vineyard Creek. The contours indicate that the site has been levelled to the current land profile, and that the slope becomes steeper closer to Vineyard Creek. Surface water is expected to flow into Vineyard Creek (which discharges into the Parramatta River) or overland into the Parramatta River.

Figure 3: Regional Topography (2 m contour intervals, AHD) (approximate site area outlined shown in red)

Based on a review of the NSW Department of Mineral Resources, Geological Series Sheet 9130, the site is underlain by:

- Hawkesbury Sandstone (denoted Rh) of Triassic age generally comprising a lithology of medium to coarse grained quartz sandstone with very minor shale and laminite lenses – north-eastern and eastern portion of the site;
- Ashfield Shale (denoted Rwa) of Triassic age of the Wianamatta Group generally comprising a lithology of black to dark-grey shale and laminate – western portion of the site;
- Alluvial and estuarine sediment (denoted Qha) of Quaternary age generally comprising a lithology of silty to peaty quartz sand, silt, and clay with ferruginous and humic cementation in places and common shell layers – southern portion of the site.

The regional geological mapping is shown in Figure 4, below.

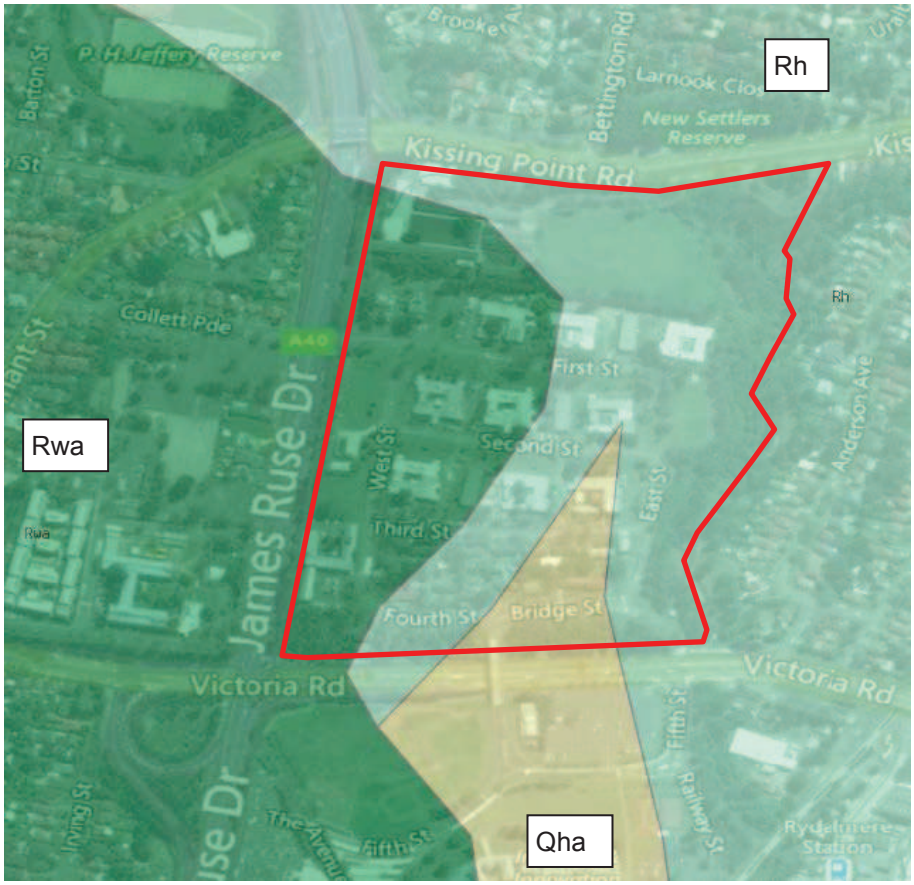

Figure 4: Regional Geology (approximate site area outlined shown in red)

An Acid Sulphate Soils Planning Map has been produced Department Natural Resources (DNR). The information from these maps is summarised on the iPlan planning portal. According to the iPlan website the site is not located in an ASS risk area (Resolve, 2005).

A search of registered groundwater bores within a 2 km radius of the site was undertaken with the Department Natural Resources (DNR) and was included in Resolve (2005). The search indicated that up to 27 bores are located within 2 km of the site. DNR provided drillers logs that recorded the nearby bores were developed to depths of between 1.1 m and 406 m. The listed use of the bores included irrigation, industrial and environmental monitoring.

Regional groundwater is expected to flow to the south consistent with the direction of flow of Vineyard Creek. There may also be localised flow to the east which discharge to the creek.

7. Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors (linkages). The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages. The potential sources of contamination and contaminants of concern within the site have been identified and summarised in the Table 1, below.

Table 1: Potential Contamination Sources and Contaminants of Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Concern (see notes)
1. Filling	Filling activity has occurred at the site, primarily at the northern and eastern peripheries associated with the sports oval and the high pressure pipeline easement. The fill is from an unknown source and may be contaminated.	Metals, TRH, BTEX, PAH, OCP, OPP, PCB, asbestos, nutrients (nitrate, nitrite and phosphorous)
2. Current/ Former site activities	A coal fired boiler house, possible use of ash residues from the boiler house for filling, maintenance yard/ shed. Hospitals also used to often have on –site incinerators, and though this has not been identified at the site, the former presence of an incinerator cannot be discounted. Prior to commercial operations the site was used for agricultural purposes. Potential contamination during this period could have occurred with the use of pesticides. The recent fire at MBHS may also be a source of contamination to the site.	PAH, TPH, BTEX, phenols, OCP, OPP, metals and, if used to help extinguish the fire, PFAS
3. High pressure pipeline	A buried high pressure pipeline runs through the site with a north-south orientation. Leakage may have occurred from the pipeline.	TRH, BTEX, PAH and lead
4. Hazardous building materials	Former/ current buildings within the site may have contained hazardous building materials (e.g. bonded ACM). This is particularly relevant to the fire affected MBHS portion of the site.	Asbestos, lead, PCB

Notes to Table 1:
TRH – Total recoverable hydrocarbons including light, mid and heavy fractions
BTEX – Monocyclic aromatic hydrocarbons – benzene, toluene, ethylbenzene and xylenes
PAH – Polycyclic aromatic hydrocarbons
OCP – Organochlorine pesticides
OPP – Organophosphorus pesticides
PCB – Polychlorinated Biphenyls
ACM – Asbestos containing material
PFAS – per- and poly- fluoroalkyl substances

The potential contamination sources (S) on the site are therefore:

- S1 –Filling;
- S2 – Current/ former site activities, including agriculture and hospital usage;
- S3 – High pressure pipeline; and
- S4 – Hazardous building materials.

The following potential human receptors (R) have been identified:

- R1 – Current site users.
- R2 – Construction workers (during site redevelopment).
- R3 – Future site users (including occupants) following construction of the proposed residential development.

The following potential ecological receptors (ER) have been identified:

- ER1 – Local ecology (upper 2.0 m of the proposed final landform).
- ER2 – Vineyard Creek located within the eastern boundary of the site.

Potentially complete exposure pathways (P) for contamination to impact on the identified receptors include the following:

Primarily relevant to human receptors:

- P1 – Ingestion and dermal contact.
- P2 – Inhalation of dust and/or vapours.

Primarily relevant to ecological receptors:

- P3 – Direct contact with local ecology (upper 2.0 m of the proposed final landform).
- P4 – Surface water run-off.
- P5 – Leaching of contaminants from soil / fill and vertical migration to groundwater.
- P6 – Lateral migration of contaminants in groundwater which provides base flow to Vineyard Creek/ Parramatta River.

A ‘source–pathway–receptor’ approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible pathways between the above sources (S1, S2, S3 and S4) and receptors (R1-R4, ER1-ER2) are provided in the table below.

Table 2: Conceptual Site Model

Source	Transport Pathway	Receptor	Risk Management Action Recommended
S1: Filling Metals, TRH, BTEX, VOC, PAH, OCP, OPP, PCB, asbestos, nutrients (nitrate, nitrite and phosphorous) **S2. Current/ former site activities** PAH, TPH, BTEX, phenols, OCP, OPP, metals, PFAS **S3. High pressure pipeline** TRH, BTEX, PAH and lead **S4. Hazardous building materials** Asbestos, lead, PCB	P1: Ingestion and dermal contact	R1: Current site users R2: Construction workers R3: Future site users ER1: Local ecology	An intrusive investigation is recommended to assess possible contamination including chemical testing of the soils and groundwater. If the site soils and/or groundwater are contaminated at unacceptable levels, mitigation / remediation measures will need to be implemented to manage the risk to the identified receptors.
	P2: Inhalation of dust and/or vapours	R1: Current site users R2: Construction workers R3: Future site users ER1: Local ecology	
	P3: Direct contact	ER1: Local ecology	
	P4: Surface water run-off	ER2: Water bodies (Vineyard Creek/ Parramatta River) (freshwater)	
	P6: Lateral migration of groundwater providing base flow to water bodies		
	P5: Leaching of contaminants and vertical migration into groundwater	R6: Groundwater (discharging to freshwater)	

8. Data Quality Objectives

The Limited DSI has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in 2013) (NEPC, 2013). The DQO process is outlined in the SAQP (DP, 2016) included in Appendix B.

9. Rationale and Methodology

Table A of NSW EPA (1995) *Sampling Design Guidelines* recommends a minimum of 213 sampling points for a site of 19.4 ha for site characterisation based on the detection of circular hot spots using a systemic grid sampling pattern. Given that the project is currently at concept plan stage, 30% of the recommended density is considered appropriate and additional investigation(s) may be undertaken as necessary when the project is at a more advanced planning stage.

Four groundwater monitoring wells were proposed at the locations shown on Drawing 3, Attachment 1 of DP (2016) in Appendix B, due to access restrictions only two wells were constructed (refer to Drawing 1, Appendix A).

Reference should be made to the SAQP in Appendix B for further details regarding the rationale and methodology associated with the Limited DSI. As discussed in Section 3, the sample numbers were reduced on the basis of physical access constraints.

The actual test locations are shown on Drawing 1, Appendix A.

10. Site Assessment Criteria

NEPC (2013) was adopted for evaluation of the soil and groundwater analysis results. Application of these guidelines is summarised below.

10.1 Soils

10.1.1 Health Investigation Levels

The health-based investigation levels (HILs) described in the NEPC (2013) are scientifically based, generic assessment criteria designed to be used in the first stage of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use settings, as follows:

- HIL-A Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools and primary schools.
- HIL-B Residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats.
- HIL-C Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths.
- HIL-D Commercial/industrial such as shops, offices, factories and industrial sites.

10.1.2 Health Screening Levels

The HSLs presented in the NEPC (2013) were developed to be protective of human health by determining the reasonable maximum concentration from site sources for a range of situations commonly encountered on contaminated sites. The HSLs apply to the same land use settings as for the HILs, although the values for residential A and B are combined, and include additional consideration of soil texture and depth to source to determine the appropriate soil, groundwater and soil vapour criteria for the exposure scenario.

The HSLs are summarised as follows:

- HSL-A-B, HSL-C, HSL-D:
- Soil depth 0 m to <1 m; 1 m to <2 m; 2 m to <4 m and 4 m +:
- Soil type:
- Sand (sand, sandy clay, sandy clay loam, sandy loam, loamy sand, loam, sandy silt and silty sand);
- Silt (silt, silty clay and silty clay loam); and
- Clay (clay, clay loam and silt loam).

10.1.3 Aesthetics, Ecological Investigation Levels and Ecological Screening Levels

Neither NEPC (2013) or CRC CARE (2011)[1] provide numeric aesthetic guidelines, however, NEPC (2013) states that site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

Ecological investigation levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL,

The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al *Trace element concentrations in soils from rural and urban areas of Australia*, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy, 1995) or Hamon et al, *Geochemical indices allow estimation of heavy metal background concentrations in soils*, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. An *Interactive (Excel)*

[1] Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) *Technical Report no. 10 Health screening levels for petroleum hydrocarbons in soil and groundwater* (2011)

Calculation Spreadsheet may be used for calculating site-specific EIL for these contaminants, and has been provided in the ASC NEPM Toolbox.

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL.

ESL have been derived in NEPC (2013) for petroleum fractions $C_6 – C_{10}$ (F1); $>C_{10}-C_{16}$ (F2); $>C_{16}-C_{34}$ (F3); $>C_{34}-C_{40}$ (F4) as well as BTEX and benzo(a)pyrene. Site specific data and assumptions are used to determine the applicable ESL.

10.1.4 Adopted Site Assessment Criteria for Soil

The following have been adopted as the soil SAC on the basis of the likely future land uses under the proposed rezoning:

- HIL-B;
- Vapour Intrusion: HSL-A-B, clay, depth of 0 – 1 m (scope to modify the criteria for samples collected from a depth of >1 m);
- EILs and ESLs;
- Management Limits.

The following rationale was applied in the selection of these SAC:

- Residential with minimal access to soil standards (HIL-B and HSL-A-B for) were adopted as they are most applicable criteria for the current and proposed land use; and
- For HSLs, clay was selected as the soil type based on logged field conditions. Depth was conservatively assumed as 0 – 1 m with scope to modify the criteria for samples collected from a depth of >1 m, as appropriate. Criteria for hydrocarbon 'management limits' and direct contact are also available, however, these are far higher concentrations that the adopted HSL and will only be considered where significantly elevated concentrations of hydrocarbons are detected in soil.

NEPC (2013) provides SAC for asbestos in soil however; presence or absence of asbestos in soil has been adopted as an initial screening criterion.

The adopted EIL were derived from the *Interactive (Excel) Calculation Spreadsheet*. The following assumptions have been used to determine the EILs:

- A protection level of 80% for urban residential areas and public open space has been adopted;
- The EILs will apply to the top 2.0 m of the soil profile which corresponds to the root zone and habitation zone of many species;
- Given the likely source of soil contaminants (i.e. historical site use/fill) the contamination is considered as "aged" (>2 years);
- ABCs have been derived using the *Interactive (Excel) Calculation Spreadsheet* using input parameters of NSW for the State in which the site is located, and high for traffic volumes; and

- Average pH of 6.13 and CEC of 7.4 $cmol_c/kg$ values based on three samples from across the site within the upper 2.0 m and a conservatively assumed clay content of 10%.

The adopted ESLs were derived based on the following assumptions:

- Depth of ESL application – upper 2 m of the soil profile (the top 2 m depth below ground level corresponds to the root zone and habitation zone of many species);
- Land use of residential and open space.
- Soil texture coarse as site soils include sand both in natural soils and filling, and is the most conservative medium for soil ESLs.

The adopted SAC are shown in the summary of soil results, Table E1, Appendix E.

10.2 Groundwater

10.2.1 Groundwater Investigation Levels

The adopted Groundwater Investigation Levels (GILs) are based on:

- NEPC (2013)*National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in 2013);
- ANZECC (2000), *National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality*; and
- NHMRC (2016), *National water quality management strategy, Australian drinking water guidelines 6, 2011* (v3.2 updated 2016) (the ADWG).

Application of these guidelines is summarised below.

10.2.2 Human Health

Health Screening Levels (HSLs)
For the assessment of petroleum hydrocarbon contamination, the HSLs presented in the NEPC (2013) and CRC CARE (2011) are applicable for assessing vapour intrusion risks from contaminated groundwater. The HSLs are based on five specific land uses/receptors; three soil types and three depth ranges for groundwater summarised as follows:

- HSL-A-B, HSL-C, HSL-D:
- Groundwater depth 2 m to <4 m; 4 m to <8 m; 8 m +:
- Soil type:
- Sand (sand, sandy clay, sandy clay loam, sandy loam, loamy sand, loam, sandy silt and silty sand);
- Silt (silt, silty clay and silty clay loam); and
- Clay (clay, clay loam and silt loam).

Drinking Water Quality Guidelines
For the assessment of drinking water, the NEPC (2013) refer to the use of the ADWG. These guidelines have been developed for health and aesthetic quality levels for supplying good quality drinking water. The ADWG do not present guideline values for TRH in drinking water.

10.2.3 Protection of Aquatic Ecosystems

ANZECC (2000) provides 'trigger' values for chemicals within the water, which represent the best current estimates of the concentration of chemicals that should have no significant adverse effects on the aquatic ecosystem. ANZECC (2000) indicates that an exceedance of a trigger value does not necessarily imply that there is an inherent risk, rather that further assessment and monitoring may be required prior to implementing appropriate management actions. It is noted that:

- According to ANZECC (2000), low reliability trigger values are interim levels only because "low reliability trigger values were derived, in the absence of a data set of sufficient quantity, using larger assessment factors to account for greater uncertainty", and, "low reliability values should not be used as default guidelines";
- NEPC (2013) has not adopted the low reliability trigger levels as GILs; and
- Whilst ANZECC (2000) provide an interim, low reliability trigger level of 7 µg/L for crude oil in water, there is no trigger level for TRH. Current laboratory reporting limits cannot quantify TRH to this concentration and as a consequence, no ecological assessment criteria were adopted for TRH.

10.2.4 Adopted Groundwater Investigation Levels

The following have been adopted as the GIL:

- Vapour intrusion: HSL-A/B, 2 m to <4 m, clay; and
- Freshwater ecosystems (slightly to moderately disturbed systems) as derived from ANZECC (2000).

The following rationale was applied in the selection of the GIL:

- HSL-A/B was adopted for human health as they are most applicable to the site;
- Clay was selected as the soil type and depth to groundwater as 2 m to <4 m based on field observations;
- Freshwater GILs were selected as DP considers that groundwater at the site is likely to initially discharge to Vineyard Creek intersecting the site, considered to be a freshwater environment; and
- It is considered that groundwater at the site is unlikely to be extracted and used for drinking purposes however; the ADWG are included for reference purposes.

The adopted GIL are shown in the summary of soil results, Table E3, Appendix E.

11. Fieldwork

11.1 Drilling, Test Pitting and Soil Sampling

An experienced DP Environmental Scientist conducted the fieldwork. A Scout drilling rig utilising solid flight augers was used for the drilling. Soil samples were retrieved from the auger flights. Test pits were excavated using a backhoe. The surface level at each test location was surveyed using a dGPS.

Samples were generally collected at nominal depth intervals of 1.0 m and based on observed changes in strata, PID response and upon obvious sign of contamination such as strong hydrocarbon odour or staining / discolouration.

Environmental sampling was performed according to standard operating procedures outlined in the DP *Field Procedures Manual*. All sampling data was recorded on DP chain of custody sheets. The general sampling and sample management procedures comprised:

- Collection of samples from the auger flights or backhoe bucket into laboratory-prepared glass jars with Teflon lined lids by hand, capping immediately and ensuring headspace within the sample jar is minimised;
- Collection of a replicate sample in a zip-lock bag for PID screening;
- A new disposable nitrile glove was worn by the field scientist / engineer for each sample collected thereby precluding potential cross-contamination;
- Collection of 10% replicate samples for QC purposes;
- Labelling of sample containers with individual and unique identification details, including project number, sample location and sample depth (where applicable); and
- Placement of the sample jars into a cooled, insulated and sealed container for transport to the laboratory.

The headspace in the zip-lock bag sample was allowed to equilibrate and was screened using the PID. The PID had a 10.6eV lamp and was calibrated with isobutylene gas at 100 ppm and with fresh air prior to commencement of each successive day's field work.

11.2 Drilling and Installation of Groundwater Monitoring Wells

Wells were constructed using class 18 uPVC machine slotted screen and blank sections. The joints were screw threaded in order to prevent the use of glues, which may contaminate the well. The screened section of each well was backfilled with a washed sand filter pack to approximately 0.5 m above the screened interval. Confirmation of the filter pack was achieved by probing. Each well was completed with a hydrated bentonite plug generally 0.5 m thick and concrete at the surface with a steel lockable monument.

Each groundwater monitoring well was developed following installation by removing a minimum of three well volumes, or until dry. The purpose of well development was to remove as far as practicable sediment introduced via drilling and to facilitate connection of the well to the local groundwater regime.

Monitoring well locations are shown on Drawing 1, Appendix A.

11.3 Groundwater Sampling

Groundwater sampling was performed according to standard operating procedures outlined in the DP *Field Procedures Manual*. Groundwater samples were collected using a peristaltic pump. The sampling method is described as follows:

- Measure the static water level using an electronic interface probe and record the thickness of any light non-aqueous phase liquid (LNAPL) (if encountered);
- Lower the pump tubing into the well and taped off at a level estimated to be 1m below the top of the water column provided it was within screened section of the monitoring well;
- Set the pump at the lowest rate possible that could produce laminar flow out of the bore and measure the drawdown with the interface probe to confirm minimal drawdown;
- Physical parameters (pH, temperature, dissolved oxygen, electrical conductivity and redox) were measured continuously by passing the purged water through a flow cell; and
- Following stabilisation of the field parameters the appropriate laboratory prepared sample bottles were filled.

The pump was decontaminated between bores by rinsing in a diluted Decon-90 solution and then rinsing in demineralised water.

The following sample handling and transport were employed:

- Laboratory prepared sample bottles were labelled with individual and unique identification, including project number and sample number;
- Samples were placed in insulated coolers and maintained at a temperature of approximately 4^0C until transported to the analytical laboratory;
- Chain of custody documentation was maintained at all times and countersigned by the receiving laboratories on transfer of samples; and
- NATA accredited laboratories were engaged to complete the analyses.

12. Results

12.1 Sub-Surface Conditions

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

The subsurface conditions are broadly summarised as follows:

- TOPSOIL FILLING – encountered in most location to depths of between 0.03 and 0.3 m, but generally less than 0.05 m. Observed to generally comprise dark brown silty and/ or sandy clays or clayey sand;
- GRAVEL / ASPHALT FILLING – asphalt pavement underlain by basecourse was observed in one location (BH15) to a combined depth of 0.25 m, and crushed gravel filling was observed at the surface in two locations (BH11 and BH12) to up to 0.04 m depth;

- FILLING – encountered in most locations to depths of between 0.03 m and greater than 6.1 m (refusal in filling at 6.1 m in BH13). This filling was generally observed to comprise red, brown, orange and grey sandy and/ or silty clay, clayey sand and/ or crushed sandstone (with sandstone observed up to boulder size in the filling);

  One fragment of potential asbestos containing material (ACM) was observed in drill cuttings whilst drilling at BH12/0.1-0.2. The fragment was tested and confirmed to contain asbestos;

  Inclusions of building debris (such as metal, brick, asphalt, concrete) were observed in BH12, BH13, TP6, TP9, TP18, TP21 and TP35;
- SILTY CLAY / SANDY CLAY / SHALY CLAY – grey, red, orange and yellow sandy clay, silty clay and/ or shaly clay were observed beneath the filling in most locations, with the silty and shaly clay generally only observed in areas of observed/ mapped shale bedrock;
- SHALE – light grey and/ or red-grey shale was observed in 11 of the test locations from depths of between 0.1 m and 4.4 m. The areas where shale was encountered were generally consistent with the areas of mapped Ashfield Shale (refer to Section 6);
- SANDSTONE – white, light grey, orange, red, pink and/ or purple sandstone with some clay banding was observed in seven of the test locations from depths of between 0.05 m and 2.5 m. The areas where shale was encountered were generally consistent with the areas of mapped Hawkesbury Sandstone (refer to Section 6).

No free groundwater was observed whilst drilling or test pitting. It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

12.2 Field Screening Results for Soil

Replicate soil samples collected in zip-lock plastic bags were allowed to equilibrate under ambient temperatures before screening for total photoionisable compounds (i.e. VOC) using a calibrated PID. Results of sample screening are shown on borehole logs presented in Appendix D. The PID readings were all generally low (i.e. <5 ppm). The screening results suggest the general absence of gross VOC contamination.

12.3 Groundwater Levels

Groundwater wells were surveyed using a differential Global Positioning System (dGPS). Groundwater levels were gauged on 26 August 2016 using an electronic oil/water interface meter prior to sampling the wells. The measured water levels are shown in the following table.

Table 3: Summary of Groundwater Level Measurements

Well ID	Ground Level * m (AHD)	SWL m (bgl)	SWL m (AHD)
BH11	20.5	Well Dry	Well Dry
BH14	25.0	7.80	17.20

Notes to Table 3:
*Surveyed by dGPS and top of casing measured from ground level
AHD – Australian Height Datum
SWL – standing water level; and bgl – below ground level

BH11 which terminated at a depth 12 m bgl was dry. Regional groundwater is expected to flow to the south consistent with the direction of flow of Vineyard Creek. There is also expected to be localised flows to the east which discharge to the creek. Additional groundwater wells would be required in order to confirm these assumptions.

Field parameters were measured whilst sampling. The field parameters are summarised in the following table.

Table 4: Summary of Field Parameters (Groundwater and Surface Water)

Well / Sample ID	Temp. (°C)	DO (mg/L)	EC (µS/cm)	pH	Redox (mV)
BH11	Well Dry				
BH14	19.3	35.1	3396	5.06	97.1

The electrical conductivity data indicates that the groundwater is relatively saline.

No phase separated hydrocarbons were observed whilst sampling.

12.4 Analytical Laboratory Results

Summary results tables including analytical results and relevant assessment criteria are appended as follows:

- Appendix E – Table E1 Summary Results for Soil;
- Appendix E – Table E2 Waste Classification Results; and
- Appendix E – Table E2 Summary Results for Groundwater.

Laboratory reports with associated chain of custody documentation are presented in Appendix F.

12.5 Data Quality Assurance and Quality Control

Field and laboratory quality assurance and quality control (QA/QC) procedures formed an integral part of the assessment. The QA/QC procedures and results are presented in Appendix G. Overall, the standard operating procedures (SOPs) were complied with in the field, and the field and laboratory QC samples were generally within the acceptance criteria. On this basis, it is considered that an acceptable level of field and laboratory precision and consistency was achieved and that the laboratory data sets are reliable, accurate and useable for this assessment.

13. Discussion of Results

13.1 Soil Results

13.1.1 Site Usage

All the soil samples recorded concentrations that were below the adopted SAC with the following exceptions:

- Sample BH12/0.1-0.2: chrysotile, amosite and crocidolite asbestos identified in matted material at a concentration below the laboratory reporting limit (0.1g/kg);
- Sample BH11/0.4-0.5 which recorded a concentration of benzo(a)pyrene of 0.71 mg/kg, compared to the ESL of 0.7 mg/kg; and
- Sample TP10/0.1-0.2 which recorded a concentration of benzo(a)pyrene of 1.4 mg/kg, compared to the ESL of 0.7 mg/kg.

Statistical analysis of the dataset for benzo(a)pyrene on the filling samples recorded a standard deviation of 0.331 and recommended a 95% UCL of 0.363 mg/kg[2]. This indicates that the detected exceedances of the ESL are not statistically significant. The results are provided in Appendix E.

13.1.2 Leachability Results and Preliminary Waste Classification

Toxicity characteristic leaching procedure (TCLP) testing was undertaken on selected 'worst case' soil samples which recorded elevated concentrations of metals or PAH in order to provide a preliminary waste classification. Based on the total concentrations and the TCLP data, the preliminary classification of the fill which does not contain asbestos is general solid waste (non putrescible) in accordance with the NSW EPA (2014) *Waste Classification Guidelines* (EPA, 2014). Further testing at an appropriate frequency based on the volume(s) of fill that need to be classified would be required in order to confirm the preliminary classification.

Any filling containing asbestos would be classified as Special Waste-Asbestos in addition to the classification for its chemical contaminant results. The presence of asbestos has been confirmed in BH12.

[2] Calculated using US EPA ProUCL Version 5.1, with non-detects, 95% KM (Chebyshev) UCL

The waste classification data and threshold levels from EPA (2014) are shown on Table E2, Appendix E.

13.2 Groundwater Results

All results for the groundwater sample were below the adopted GIL with the following exceptions:

- Zinc, detected at a concentration of 120 µg/L in both samples BH14 and its replicate sample, compared to the ecological-based GIL of 42 µg/L.

14. Conclusions

14.1 General

The current investigation, which comprised intrusive investigation in the ADHC portion of the site (noting the MBHS portion was inaccessible at the time of investigation) (refer to Figure 5, below for areas) found the following:

- Confirmed the presence of filling over the ADHC portion of the site, generally to depths of between 0.03 m and 0.6 m below ground level;
- Confirmed the presence of relatively deeper filling (compared to the general site filling levels) in one location in the Western Fill Area (encountered to a depth of 4.4 m in BH14);
- Confirmed the presence of relatively deeper filling (compared to the general site filling levels) in the Eastern Fill Area (encountered to a maximum depth >6.1 m in BH13);
- Identified a fragment of asbestos cement in one location in the Eastern Fill Area, with a low asbestos concentration in soil (below the laboratory reporting limit) also identified by the laboratory at this location (BH12). Inclusions of building debris was observed in other test locations, and can be associated with asbestos contamination;
- Identified benzo(a)pyrene in filling above the ecological-based investigation levels at two locations (BH11 and TP10). Statistical analysis indicated that these concentrations are not statistically significant for the entire filling dataset, however given the proposed mixed use the actual locations and potential impacts should be considered when detailed development plans are confirmed; and
- Recorded concentration of potential groundwater contaminants in one location (BH14) (note other well locations either not accessible for well installation or were dry at the time of sampling). All results were within the adopted GIL with the exception of zinc. Zinc was above the adopted ecological-based investigation level, however is within background levels often recorded in urban Sydney areas. As such the detected zinc concentrations are not considered to be of concern.

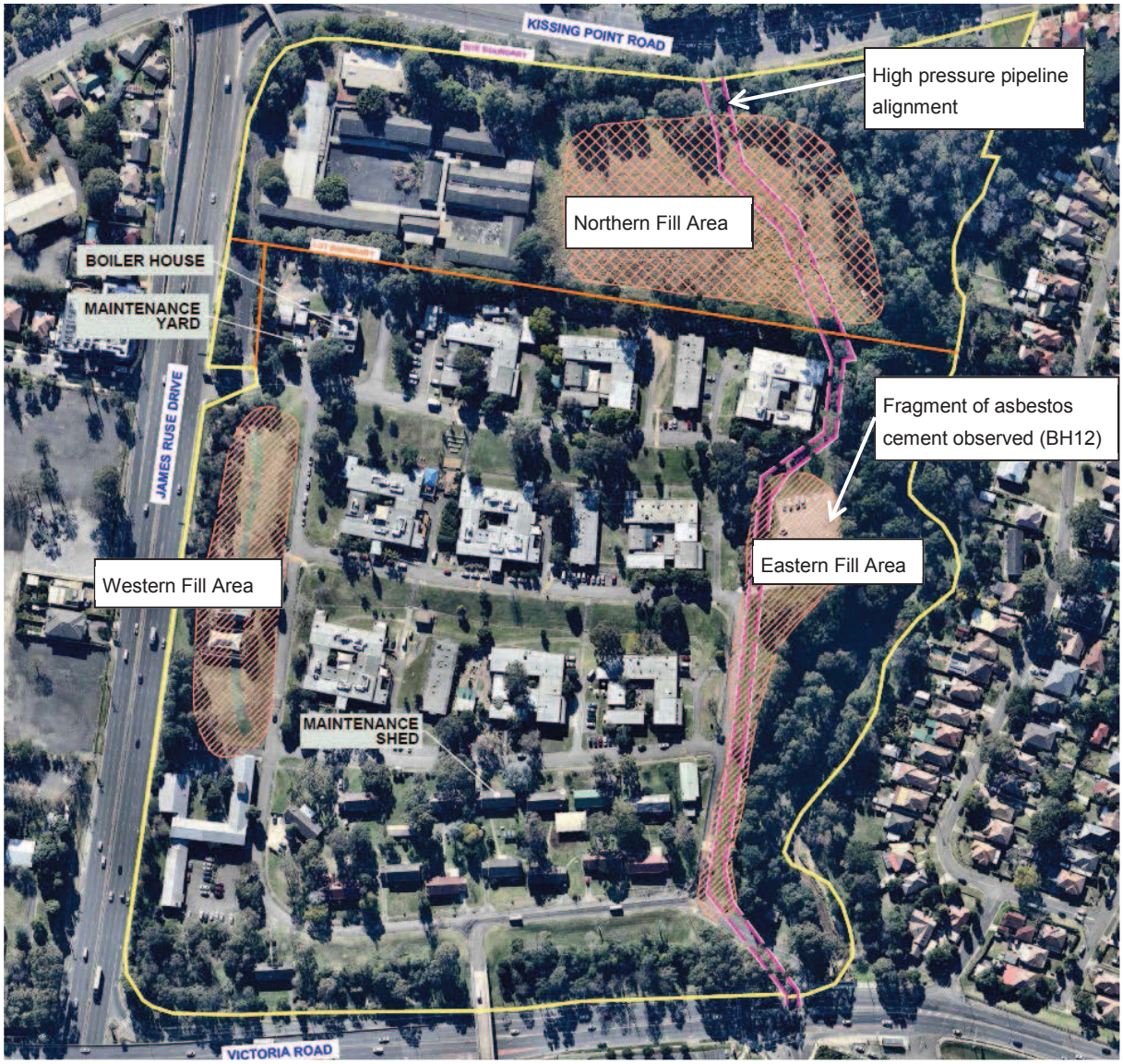

Figure 5: Summary of Fill Area

14.2 Suitability of the Site for the Proposed Development

Based on the findings of the current investigation it is considered that the site can be made suitable for the proposed mixed use (including residential) development subject to the following:

- Additional investigations at the MBHS site with reference to the SAQP. The proposed scope may need to be modified depending on the site contamination impacts which may have been caused by the fire (e.g. asbestos, PFAS);
- Development of a suitable remediation action plan (RAP) that covers, *inter alia*, the decommissioning and management of any contamination associated with the boiler house, maintenance areas and other site structures, management of any contamination associated with the high pressure pipeline, remediation of asbestos contamination and any other contamination identified during the additional investigation and management of filling identified at the site.

14.3 Geotechnical Considerations

Reference should be made to SMEC Testing (2012) in relation to the geotechnical requirements for the deep fill area of the site (i.e. the oval at the MBHS site).

15. References

- Australian and New Zealand Environment and Conservation Council (ANZECC) / Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000) (ANZECC, 2000)
- Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) *Technical Report no. 10 Health screening levels for petroleum hydrocarbons in soil and groundwater* (2011) (CRC CARE, 2011)
- EP Risk Management (2012) Preliminary Contamination Assessment, 26 Kissing Point Road Parramatta (EP, 2012)
- National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013) (NEPC, 2013)
- National Health and Medical Research Council and National Resource Management Ministerial Council (NHMRC/NRMMC) *National Water Quality Management Strategy Australian Drinking Water Guidelines* 6 2011, (V3.2 updated February 2016) (ADWG)
- NSW Department of Environment and Conservation (DEC) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme 2nd edition* (2006) (DEC, 2006)
- NSW Environmental Protection Authority (EPA) *Contaminated Sites: Sampling Design Guidelines* (1995) (EPA, 1995)
- NSW Office of Environment and Heritage (OEH) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (reprinted 2011) (OEH, 2011)
- Resolve Environmental Management (2006) Rydalmere Centre Rydalmere – Stage 1 Environmental Site Assessment (Resolve, 2006)
- SMEC Testing Services Pty Ltd (2012) Geotechnical Investigation of 26 Kissing Point Road, Parramatta (SMEC Testing, 2012)

16. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report (or services) for this project at Parramatta in accordance with DP's proposal SYD160600 dated 30 May 2016 and acceptance received from Liz Densley of Elton Consulting Group Pty Ltd on behalf of Property NSW dated on 22 June 2016. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Property NSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP

for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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

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

Asbestos has been identified at one location in filling materials. Building demolition materials, such as concrete, brick, were, however, observed in other locations in previous below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the site being inaccessible and not available for inspection/sampling. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

Douglas Partners Pty Ltd

Appendix A

About This Report

Drawing

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

NOTE:
1: Base image from Nearmap.com
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

- Pipeline easement (approximate)
- Approximate borehole location (SMEC, 2012)
- Test pit location
- Borehole location
- Groundwater monitoring well location

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Elton Consulting Group Pty Ltd		TITLE: **Test Locations**	PROJECT No: 85556.00
OFFICE: Sydney	DRAWN BY: PSCH	**Limited Detailed Site Investigation**	DRAWING No: 1
SCALE: 1:2500 @ A3	DATE: 1.9.2016	**266 Victoria Road and 26 Kissing Point Road, PARRAMATTA**	REVISION: 0

Appendix B

DP (2016) Sampling and Analysis Quality Plan

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Appendix B to Limited Detailed Site Investigation

Sampling and Analysis Quality Plan

26 Kissing Point Road and 266 Victoria Road
Parramatta Planning Proposal
Parramatta, NSW

Prepared for
Elton Consulting Group Pty Ltd

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Douglas Partners
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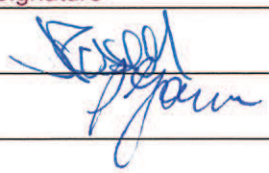
Author		5 August 2016
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26 Kissing Point Road and 266 Victoria Road Parramatta Planning Proposal
Parramatta, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) has prepared this Sampling and Analysis Quality Plan (SAQP) for a proposed limited Detailed Site Investigation (Limited DSI) for contamination to be carried out at 26 Kissing Point Road and 266 Victoria Road, Parramatta (hereon in, referred to collectively as the 'site'). The report was commissioned on 22 June 2016 by Liz Densley of Elton Consulting Group Pty Ltd (Elton) on behalf of Property NSW and was undertaken with reference to DP's proposal SYD160600 dated 30 May 2016.

The Limited DSI will be used to support a planning proposal to amend the Parramatta Local Environmental Plan (PLEP) 2011 to allow for the redevelopment of surplus land in Parramatta to create a new mixed use precinct.

The objective of this SAQP is to identify existing data gaps in relation to site contamination issues and to document the proposed Limited DSI scope and associated site characterisation methods.

2. Project Background

The new precinct will provide a high density residential development with a diverse range of housing and retail and commercial development with the opportunity for research and education related employment in close proximity to existing and planned public transport nodes. The proposal will allow for the provision of up to 3000 dwellings and approximately 40,000 m^2 of retail and commercial floor space.

The proposal will also allow for community facilities, a significant public open space network and a new public domain to meet the needs of the new community.

Comprising two adjoining land parcels, the Ageing, Disability and Home Care (ADHC) facility at 266 Victoria Road, North Parramatta and the former Macquarie Boys High School (MBHS) at 26 Kissing Point Road, the site encompasses approximately 19.4ha in the City of Parramatta LGA. The MBHS was closed by the Department of Education in 2008 and the Site has been vacant since that time. The ADHC facility is still in operation, however, the site will be vacated by mid-2017.

Property NSW on behalf of Family and Community Services (FACS) and Department of Education (DE) have been charged with responsibility of divesting the site.

The site is located north of Rydalmere train station, on the north eastern corner of James Ruse Drive and Victoria Road intersection, bounded to the north by Kissing Point Road and Vineyard Creek. The site is a 5 to 10 minute walk from Rydalmere train station, with the potential for improvements in

connectivity to further enhance accessibility. The University of Western Sydney's North Parramatta and Parramatta campuses lie to the west and south of the site offering the potential for synergies between education, research and employment.

The divestment and redevelopment of the site offers opportunities to:

- Provide a significant urban infill opportunity within the City of Parramatta LGA aligning with the broader Government objectives and the Sydney Metropolitan strategy to increase and accelerate housing supply
- Optimise the site's strategic location relative to the proposed Western Sydney Light Rail network in terms of increasing density along public transport corridors; and
- Support FACS and DE's commitment to recycling of capital investment in new and expanded facilities to meet the needs of the community.

In line with the above and to provide certainty of housing supply to the market, job creation and development of underutilised assets, Property NSW has developed a concept plan to guide the redevelopment of the site. The concept plan seeks to satisfy the NSW Government's priorities for the precinct:

- Create a sustainable community with access to employment and education opportunities, community facilities and a high quality of life;
- Improve connectivity between the site and its surrounds in terms of transport, pedestrian and cycling networks and the open space network;
- Create a high quality public domain that is legible and activates the precinct;
- Enhance the riparian corridor along the boundary of the Site with the potential to deliver the missing link in the Vineyard Creek Corridor and to support the development of Sydney's Green Grid; and
- To realise the vision for the site articulated in the concept plan, an amendment to the PLEP 2011 to allow for the redevelopment of surplus land in Parramatta to create a new mixed use precinct.

3. Site Identification and Description

The site covers an approximate area of 19.4 ha and is located within the local government area (LGA) of Parramatta in the County Cumberland and Parish of Field of Mars. The site comprises two street addresses and three Lots as follows:

- 266 Victoria Road, Parramatta – the current Ageing, Disability and Home Care Facility;
  - Lot 1 in DP 836958 and Lot 1 in DP 247855, current zoning SP2 (Educational Establishment);
- 26 Kissing Point Road, Parramatta – the former Macquarie Boys High School;
  - Lot 1 in DP 128413, current zoning R2 Low Density Residential.

Lot 1 in DP 836958 and Lot 1 in DP 247855 currently consists of approximately 30 single storey structures dating from the late 1960s, providing accommodation, support and service facilities. The

buildings were mostly constructed from about 1968 and were originally built as a hospital complex (Resolve, 2005). The buildings include a boiler house, maintenance yard and maintenance shed.

Lot 1 in DP 128413 (former MBHS) currently consists of the former school buildings and associated courtyard and pathways. The south-western portion of the Lot contains a sports oval and former animal enclosure. The eastern portion of the Lot contains a bus turning bay, creek (Vineyard Creek) and vegetated area. At the commencement of this project, the MBHS site was subject to extensive damage by fire.

An oil pipeline and associated easement, located to the west of Vineyard Creek, transects the site from north to south.

Key site features are shown on Drawing 1, Attachment 1.

4. Summary of Previous Investigations

The following investigations are known to have previously been undertaken at the site:

- Resolve Environmental Management (Resolve) *Rydalmere Centre Rydalmere – Stage 1 Environmental Site Assessment*, dated 19 June 2006 (Resolve, 2006);
- EP Risk Management (EP) *Preliminary Contamination Assessment, 26 Kissing Point Road Parramatta*, dated 9 October 2012 (EP, 2012); and
- SMEC Testing Services Pty Ltd (SMEC Testing) Geotechnical Investigation of 26 Kissing Point Road, Parramatta, dated September 2012 (SMEC Testing, 2012).

4.1 Resolve (2006)

Resolve (2006) was a desktop investigation and did not include any soil or groundwater sampling to confirm the contamination status of soil and/or groundwater beneath the site. The 'site' investigated was 266 Victoria Road, Parramatta.

The key findings of Resolve (2012) are summarised as follows:

- Conclusions:
  - The property is presently utilised as a hospital and centre for rehabilitation of the mentally disabled;
  - The majority of the buildings were mostly constructed from about 1968 and was initially built as a hospital complex;
  - Prior to the current configuration the hospital appeared to comprise a more agriculture layout with grazing areas and cultivated land;
  - Areas of the site have been filled or re-contoured through development of the facility to the current configuration;
  - A coal fired boiler was used at the site for heating. It is understood that residual ashes may have been used for filling across the site;

- The historical aerial photographs suggest that filling is most likely along the eastern boundary with Vineyard Creek and the central western boundary;
- With the exception of the boiler house, ash was not observed at the ground surface during the site inspection;
- The use of ash and unknown fill may have introduced contaminants to the soil profile particularly on the eastern and western boundaries of the site;
- Asbestos building materials are likely to be present in some of the building elements and are understood to be the subject of a separate hazardous building assessment;

- Recommendations:
  - A Hazardous Building Material Survey is conducted at the facility including a ground surface survey;
  - The boiler house and waste material should be fully decommissioned and removed from the site;
  - As part of the site management groundwater wells should be installed on the eastern boundary to confirm the soil profile and the groundwater quality leaving the site; and
  - Any major construction or earthworks program should make suitable documented allowance for the management of unexpected soil types such as ash fill.

4.2 EP (2012)

EP (2012) was a desktop investigation with limited soil sampling (the soil sampling was actually undertaken by SMEC Testing). The 'site' investigated was 26 Kissing Point Road, Parramatta. Fieldwork by SMEC Testing involved the drilling and sampling from 10 boreholes located on an area of suspected fill (i.e. the eastern portion of the site comprising the sports oval).

The key findings of EP (2012) are summarised as follows:

- Conclusions and recommendations:
  - The potentially contaminating activities that have occurred at the site include:
    - Rural land use that may have involved the application of pesticides and herbicides;
    - Extensive filling of the site during development that may have been imported from and off-site source;
    - Operation of an underground high pressure fuel line;
- SMEC Testing undertook a geotechnical investigation of the southern portion of the site containing the sports oval and collected 25 primary soil samples which were selectively tested for TRH, BTEX, PAH, Phenols, PCBs, heavy metals and asbestos. The sports oval was considered to have the most potential for contamination due to the presence of the oil pipeline and significant fill up to depths of 7.6 mbgs;
- A review of the analytical soil results collected by SMEC Testing indicated that all analytes tested were either below the limits of reporting of the laboratory or the adopted criteria;
- Preliminary testing of soils in the portion of the site with the greatest potential for contamination did not detect any contaminants above the adopted criteria. Investigations were not undertaken in the northern and eastern portions of the site containing the access road and the bus drop off

area. However the risk of contamination to these areas was considered to be less than the area investigated. Groundwater was not investigated as it was not intersected during the investigation;

- Based on the review of the site inspection, historical information and the SMEC Testing (2012) Geotechnical Investigation results, the site is considered to present a low risk of soil and groundwater contamination at the time of the assessment; and
- It should be noted, however that the oil pipeline presents an on-going future risk of contamination at the site. In order to mitigate future risk of an environmental liability from leakage of the pipeline, it would be prudent to install groundwater monitoring wells adjacent and down gradient to the pipeline easement to enable collection of baseline data. This could be undertaken after acquisition and prior to construction of the proposed development.

4.3 SMEC Testing (2012)

SMEC Testing (2012) involved the drilling and sampling from 10 boreholes located on an area of suspected fill (i.e. the eastern portion of the site comprising the sports oval). The investigation identified uncontrolled fill to depths of greater than 7 m at the site. The full depth of the fill could not be penetrated at BH2 and BH3 due to obstructions in the fill.

A review of the borehole logs indicates the general absence of anthropogenic material (e.g. building and demolition rubble).

The test locations and depth of fill are shown on Drawing 2, Attachment 1.

5. Regional Geology, Acid Sulfate Soil Risk and Hydrogeology

Based on a review of the NSW Department of Mineral Resources, Geological Series Sheet 9130, the site is underlain by:

- Hawkesbury Sandstone (denoted Rh) of Triassic age generally comprising a lithology of medium to coarse grained quartz sandstone with very minor shale and laminite lenses – north-eastern and eastern portion of the site;
- Ashfield Shale (denoted Rwa) of Triassic age of the Wianamatta Group generally comprising a lithology of black to dark-grey shale and laminate – western portion of the site;
- Alluvial and estuarine sediment (denoted Qha) of Quaternary age generally comprising a lithology of silty to peaty quartz sand, silt, and clay with ferruginous and humic cementation in places and common shell layers – southern portion of the site.

The regional geological mapping is shown in Figure 1, below.

Figure 1: Regional Geology

An Acid Sulphate Soils Planning Map has been produced Department Natural Resources (DNR). The information from these maps is summarised on the iPlan planning portal. According to the iPlan website the site is not located in an ASS risk area (Resolve, 2005).

A search of registered groundwater bores within a 2 km radius of the site was undertaken with the Department Natural Resources (DNR) and was included in Resolve (2005). The search indicated that up to 27 bores are located within 2 km of the site. DNR provided drillers logs that recorded the nearby bores were developed to depths of between 1.1 m and 406 m. The listed use of the bores included irrigation, industrial and environmental monitoring.

6. Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors (linkages). The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages.

The potential sources of contamination and contaminants of concern within the site have been identified and summarised in Table 1, below.

Table 1: Potential Contamination Sources and Contaminants of Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Concern
1. Filling	Filling activity has occurred at the site, primarily at the northern and eastern peripheries associated with the sports oval and the oil pipeline easement. The fill is from an unknown source and may be contaminated.	Metals, TRH, BTEX, PAH, OCP, OPP, PCB, asbestos, nutrients (nitrate, nitrite and phosphorous)
2. Current/ Former site activities	A coal fired boiler house, possible use of ash residues from the boiler house for filling, maintenance yard/ shed. Hospitals also used to often have on –site incinerators, and though this has not been identified at the site, the former presence of an incinerator cannot be discounted. Prior to commercial operations the site was used for agricultural purposes. Potential contamination during this period could have occurred with the use of pesticides. The recent fire at MBHS may also be a source of contamination to the site.	PAH, TPH, BTEX, phenols, OCP, OPP, metals and, if used to help extinguish the fire, PFAS
3. Oil pipeline	A buried oil pipeline runs through the site with a north-south orientation. Leakage may have occurred from the pipeline.	TRH, BTEX, PAH and lead
4. Hazardous building materials	Former/ current buildings within the site may have contained hazardous building materials (e.g. bonded ACM). This is particularly relevant to the fire affected MBHS portion of the site.	Asbestos, lead, PCB

Notes to Table 3:
TRH – Total recoverable hydrocarbons including light, mid and heavy fractions
BTEX – Monocyclic aromatic hydrocarbons – benzene, toluene, ethylbenzene and xylenes
PAHs – Polycyclic aromatic hydrocarbons
OCPs – Organochlorine pesticides
OPPs – Organophosphorus pesticides
PCBs – Polychlorinated Biphenyls
PFAS – per- and poly- fluoroalkyl substances

The potential contamination sources (S) on the site are therefore:

- S1 – Large scale filling;
- S2 – Past agricultural activities which may have used pesticides or herbicides;
- S3 – Current site activities which may contribute to contaminants entering the soil; and
- S4 – Buildings that could have been constructed using asbestos, or other hazardous building materials.

The following potential human receptors (R) have been identified:

- R1 – Current site users.
- R2 – Construction workers (during site redevelopment).
- R3 – Future site users (including occupants) following construction of the proposed residential development.

The following potential ecological receptors (ER) have been identified:

- ER1 – Local ecology (upper 2.0 m of the proposed final landform).
- ER2 – Vineyard Creek located within the eastern boundary of the site.

Potentially complete exposure pathways (P) for contamination to impact on the identified receptors include the following:

Primarily relevant to human receptors:

- P1 – Ingestion and dermal contact.
- P2 – Inhalation of dust and/or vapours.

Primarily relevant to ecological receptors:

- P3 – Direct contact with local ecology (upper 2.0 m of the proposed final landform).
- P4 – Surface water run-off.
- P5 – Leaching of contaminants from soil / fill and vertical migration to groundwater.
- P6 – Lateral migration of contaminants in groundwater which provides base flow to Vineyard Creek.

A ‘source–pathway–receptor’ approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible pathways between the above sources (S1, S2, S3 and S4) and receptors (R1-R4, ER1-ER2) are provided in the table below.

Table 2: Conceptual Site Model

Source	Transport Pathway	Receptor	Risk Management Action Recommended
S1: Filling Metals, TRH, BTEX, VOC, PAH, OCP, OPP, PCB, asbestos, nutrients (nitrate, nitrite and phosphorous) **S2. Current/ former site activities** PAH, TPH, BTEX, phenols, OCP, OPP, metals, PFAS **S3. Oil pipeline** TRH, BTEX, PAH and lead **S4. Hazardous building materials** Asbestos, lead and PCB	P1: Ingestion and dermal contact	R1: Current site users R2: Construction workers R3: Future site users ER1: Local ecology	An intrusive investigation is recommended to assess possible contamination including chemical testing of the soils and groundwater. If the site soils and/or groundwater are contaminated at unacceptable levels, mitigation / remediation measures will need to be implemented to manage the risk to the identified receptors.
	P2: Inhalation of dust and/or vapours	R1: Current site users R2: Construction workers R3: Future site users ER1: Local ecology	
	P3: Direct contact	ER1: Local ecology	
	P4: Surface water run-off	ER2: Water bodies (Vineyard Creek/ Parramatta River) (freshwater)	
	P6: Lateral migration of groundwater providing base flow to water bodies		
	P5: Leaching of contaminants and vertical migration into groundwater	R6: Groundwater (discharging to freshwater)	

7. Data Quality Objectives

7.1 Introduction

The Limited DSI has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of NEPC (2013). The DQO process is outlined as follows:

7.1.1 State the Problem

The proposed development involves high density residential apartments and commercial space. Previous investigations have identified potential sources of soil contamination, groundwater contamination associated with the sites history. The “problem” to be addressed is that the extent and nature of potential contamination on site is not fully understood; it is unclear whether the site is suitable for the proposed redevelopment and if contamination poses a risk to human health or the environment during and after the redevelopment works. The objective of the investigation is therefore to characterise the nature and extent of contamination at the site and make recommendations for

further targeted investigations and remediation to render the site suitable for the proposed redevelopment works.

The project is also located close to sensitive environmental receptors such as the Vineyard Creek.

DP's proposed project team includes a Principal, Project Manager (Associate), field engineers / scientists and drilling subcontractor. The decision makers are the DP Principal, Project Manager (Associate).

7.1.2 Identify the Decision / Goal of the Study

Based on the site history including large scale filling, primarily on the MBHS site, it is considered that the contaminants of concern are various organic and inorganic compounds (refer to the CSM in Section 6) for soil and groundwater. As such, the analysis will focus on those contaminants relevant to the identified media.

The analytical data for soil will be compared to relevant site assessment criteria (SAC) including HIL, HSL, EIL and ESL for residential land use land use as per Tables 1A and 1B in Schedule B1, National Environmental Protection (Assessment of Site Contamination) Measure, 1999, updated 2013 (NEPC, 2013). The analytical data for groundwater will be compared to GIL relevant to the particular receptors including HSL (petroleum hydrocarbons) and freshwater aquatic ecosystems with Vineyard Creek being the nearest receiving water body as per Table 1C in Schedule B1, NEPC (2013).

The suitability of the site for the proposed residential development will be based on a comparison of the analytical results for all contaminants of concern to the adopted SAC and, if necessary, compared to the 95% UCL of the mean concentrations (relevant to soil contamination under certain circumstances).

The following specific decisions will be made, as appropriate:

- What is the conceptual site model (i.e. sources, receptors, migration pathways, exposure)?
- Do the existing fill materials and/or natural soils pose a potential risk to identified receptors?
- Does the existing groundwater beneath the site pose a potential risk to identified receptors?
- Is the data sufficient to make a decision regarding the abovementioned risks, the compatibility of the site for the proposed development or are additional investigations required?
- Does contamination at the site, if encountered, trigger the Duty to Report requirements under the *Contaminated Land Management Act* 1997 (NSW)?
- Are there any off-site migration issues that need to be considered?
- Is the data sufficient to enable the preparation of a Remediation Action Plan (RAP) and/or Environmental Management Plan (EMP) should the data suggest these are required?

7.1.3 Identify Inputs to the Decision

Inputs into the decisions are as follows:

- Collection and review of site history information including information regarding previous and current activities undertaken on the site and the surrounding areas;

- Review of previous investigations undertaken as summarised in Section 4;
- Regional geology, topography, ASS risk mapping and hydrogeology;
- Soil and groundwater samples will be collected at a combination of targeted and grid-based sampling patterns and analysed for the relevant contaminants of concern;
- The lithology of the site as described in the bore logs;
- If site conditions suggest additional contaminants of concern e.g. if the condition of subsurface material encountered whilst drilling encounter particular odours, further analysis may be undertaken;
- Field and laboratory QA/QC data to assess the suitability of the environmental data for the assessment;
- All analysis undertaken at a NATA accredited laboratory; and
- The results will be compared with the SAC and GIL criteria discussed in Section 7.1.2.

7.1.4 Define the Study Boundaries

The study boundary is as shown on Drawing 1, Attachment 1.

7.1.5 Develop an Analytical Approach (or Decision Rule)

The information obtained during the assessment will be used to characterise the site in terms of contamination issues and risk to human health and/or the environment. The decision rules used in characterising the site will be as follows:

- Laboratory test results for fill/soil will be assessed individually or statistically, if considered appropriate, to determine the 95% UCL of the mean concentration for each analyte or analyte group (of like materials);
- Laboratory test results for targeted locations (and identified 'hot spots') will be assessed individually;
- The adopted SAC and GIL will be from EPA endorsed guidelines;
- Where such criteria are not available, other recognised national or international standards will be used;
- The contaminant concentrations in fill/soil should meet the following criteria, or further investigation or remedial action is required if:
    - The concentration of the contaminant is more than 2.5 times the SAC. Any location more than 2.5 times the adopted site criteria is classified as a 'hotspot', requiring further assessment / management; and
    - The calculated 95% UCL for a relevant area and discrete impacted fill/soil stratum (excluding any 'hotspot' concentrations) exceeds the adopted SAC;
    - The standard deviation of the results is greater than 50% of the SAC;
- The groundwater will not be considered significantly impacted by a particular contaminant if there is no notable or significant increase in background concentrations and/or there are no analyte concentrations in the groundwater samples significantly exceeding the adopted GIL; and

- Further investigation, remediation and/or management will be recommended if the site is found to be contaminated or containing contamination 'hot spots' or significantly impacted groundwater.

Field and laboratory test results will considered useable for the assessment after evaluation against the following data quality indicators (DQIs):

- Precision – a measure of variability or reproducibility of data;
- Accuracy – a measure of closeness of the data to the 'true' value;
- Representativeness – the confidence (qualitative) of data representativeness of media present on site;
- Completeness – a measure of the amount of usable data from a data collection activity; and
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event.

7.1.6 Specify Limits on the Decision Error

Considering that the future site use/development will involve residential land use, decision errors for the respective contaminants of concern for fill/soil are:

1. Deciding that the site's fill/soil exceeds the SAC when they truly do not; and
2. Deciding that the site's fill/soils are within the SAC when they are truly not.

Considering that the assessment of groundwater is intended to determine if the site is impacting negatively on groundwater quality, the decision errors for the contaminants of concern are:

3. Deciding that the groundwater quality exceeds the GIL when it truly does not; and
4. Deciding that the groundwater quality is within the GIL when it truly is not.

Decision errors for the proposed assessment will be minimised and measured by the following:

- Compare new data with available previous investigations to determine the possible range of the parameters of interest;
- The sampling regime will target key strata identified to account for site variability;
- Sample collection and handling techniques will be with reference to DP's Field Procedures Manual;
- Samples will be prepared and analysed by a NATA accredited laboratory with the acceptance limits for laboratory QA/QC parameters based on the laboratory reported acceptance limits and those stated in NEPC (2013);
- The analyte selection is based on the available site history, past site activities, site features and the findings of the previous investigations. The potential for contaminants other than those proposed to be analysed is currently considered to be low;
- The SAC and GIL will be adopted from established and EPA endorsed guidelines where available. The SAC and GIL have risk probabilities already incorporated;
- A significance level of 0.05 will be adopted for data with statistical analysis of 95% UCL of average concentrations; and

- Only NATA accredited laboratories using NATA endorsed methods will be used to perform laboratory analysis. Where NATA endorsed methods are not used, the reasons will be stated. The effect of using non-NATA methods (if relevant) on the decision making process will be explained.

7.1.7 Optimise the Design for Obtaining Data

Sampling design and procedures that will be implemented to optimise data collection for achieving the DQOs included the following:

- Only NATA accredited laboratories using NATA endorsed methods are used to perform laboratory analysis whenever possible;
- Grid based soil sampling (within access constraints) will generally be used to provide representative coverage of the site;
- Where possible, targeted samples will be incorporated into the grid based sampling;
- To optimise the selection of soil samples for chemical analysis, all samples collected will be screened using a calibrated photoionization detector (PID) allowing for site assessment and sample selection. In addition, additional soil samples will be collected but kept 'on hold' pending details of initial analysis and will be analysed if further delineation is required;
- Adequately experienced environmental scientists/engineers will be chosen to conduct field work and sample analysis interpretation; and
- This SAQP has been prepared.

8. Rationale and Methodology

Table A of NSW EPA (1995) *Sampling Design Guidelines* recommends a minimum of 213 sampling points for a site of 19.4 ha for site characterisation based on the detection of circular hot spots using a systemic grid sampling pattern. Given that the project is currently at concept plan stage, 30% of the recommended density is considered appropriate and additional investigation(s) may be undertaken as necessary when the project is at a more advanced planning stage.

Groundwater monitoring wells are usually placed at the hydraulic down-gradient of potential point sources and hydraulic up-gradient of the general site boundary in order to evaluate the potential for groundwater contamination at the site.

8.1 Scope of Works

The scope of works for the Limited DSI covering the further characterisation of soil and groundwater comprises the following:

- Review previous reports;
- Prepare this SAQP that details the proposed fieldwork;

- Drilling / excavating of 64 (grid-based, where possible due to access constraints) boreholes / test pits to a depth of 0.5 m into natural soils (or prior refusal) to a maximum depth of 3.0 m;
- Extend four boreholes to depths intersecting the water table (to a maximum depth of 6.0 m, or prior refusal) for soil sampling and groundwater monitoring well installation;
- Collection of soil samples at regular intervals based on field observations, including from the near surface, from near the water table (if encountered) and upon any signs of obvious contamination such as odours or staining. Soil samples will be collected from the auger spiral for drilled boreholes. Soil samples from test pits will be collected from freshly exposed walls of the test pits;
- Surveying of boreholes and test pits using a differential GPS;
- Screening of all samples collected with a PID to assess the likely presence or absence of VOC;
- Submitting up to 96 selected soil samples (plus 10% QC samples, i.e. 16 QC samples) for analysis of a combination of the following common contaminants at a NATA accredited laboratory:
  - eight priority metals (arsenic, cadmium, chromium, copper lead, mercury, nickel, zinc);
  - TRH;
  - BTEX;
  - PAH;
  - OCP, OPP;
  - PCB;
  - total phenols;
  - asbestos (presence / absence);
  - pH, cation exchange capacity (required for determination of site specific environmental investigation levels);
- Installation of four groundwater monitoring wells. The wells would be constructed using class 18 uPVC screw threaded screened and blank sections. A gravel filter pack would be placed to approximately 0.5 m above the screened section of the well followed by a hydrated bentonite seal. The well would then be backfilled using cement / bentonite grout to surface and finished with a lockable steel well monument or gatic cover;
- Developing the wells immediately following installation;
- Collection of groundwater samples from each monitoring well. The physical parameters of pH, conductivity, dissolved oxygen and oxidation / reduction potential will be measured and recorded whilst sampling;
- Submitting four groundwater samples (plus 10% QC samples, i.e. one QC sample) to a NATA accredited laboratory for analysis of the following contaminants:
  - eight priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
  - TRH;
  - BTEX;
  - PAH;
  - total phenols;
  - OCP, OPP and PCB;
  - nutrients (nitrate, nitrite, ammonia and total phosphorous); and

- Field sampling and laboratory analysis in compliance with standard environmental protocols, including a QA/QC plan consisting of 10% replicate sampling (intra and inter-laboratory replicate samples), trip spikes, trip blanks, appropriate Chain of Custody procedures and in–house laboratory QA/QC testing.

The proposed test locations are shown on Drawing 3, Attachment 1.

9. Site Assessment Criteria

The proposed use for the site after development is residential. The analytical results from the laboratory testing will be assessed (as a Tier 1 assessment) against the investigation and screening levels in the following guidelines as relevant to the media sampled:

- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (Schedule B1);
- ANZECC (2000), National water quality management strategy. *Australian and New Zealand guidelines for fresh and marine water quality*; and
- NHMRC (2013), National water quality management strategy, *Australian drinking water guidelines*.

10. Assessment and Reporting

The results of the investigation will be assessed with reference to EPA endorsed guidelines. This will include assessment of field and laboratory results to determine the presence of unacceptable risks from contamination being present, or potentially being present at the site. Laboratory results will be assessed individually, and/or statistically where appropriate.

The results will be reported with reference to the OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

11. Concluding Statement

It is considered that the implementation of this SAQP will provide sufficient data to meet the project objectives and provide data that supports the development of a preferred remediation strategy (if required) that meets NSW EPA guidelines.

12. References

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

EPA (1995) Sampling Design Guidelines

EP Risk Management (2012) Preliminary Contamination Assessment, 26 Kissing Point Road Parramatta

DEC (2006) Guidelines for the NSW Site Auditor Scheme

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 amended 2013

NHMRC (2011) Australian Drinking Water Guidelines

Office of Environment and Heritage (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites

Resolve Environmental Management (2006) Rydalmere Centre Rydalmere – Stage 1 Environmental Site Assessment

SMEC Testing Services Pty Ltd (2012) Geotechnical Investigation of 26 Kissing Point Road, Parramatta

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Parramatta, NSW in accordance with DP's proposal dated 30 May 2016 and acceptance received from Elton Consulting Group Pty Ltd. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Elton Consulting Group Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

Douglas Partners Pty Ltd

Attachment 1

About This Report

Drawings 1 to 3

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

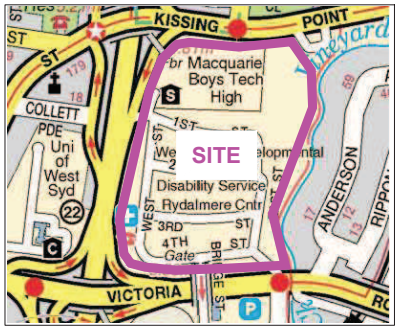
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

Information for Contractual Purposes

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

Site Inspection

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



Locality Plan

NOTE:
1: Base image from Nearmap.com
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

Pipeline easement

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Elton Consulting Group Pty Ltd	TITLE: **Site Features** Sampling and Analysis Quality Plan 266 Victoria Road and 26 Kissing Point Road, PARRAMATA	PROJECT No: 85556.00
	OFFICE: Sydney DRAWN BY: PSCH		DRAWING No: 1
	SCALE: 1:2500 @ A3 DATE: 21.7.2016		REVISION: 0

NOTE:
1: Base image from Nearmap.com
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

- Pipeline easement
- ▲ Approximate borehole location (SMEC, 2012)
- 1.8m Depth of fill

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Elton Consulting Group Pty Ltd	TITLE: **Previous Test Locations** Sampling and Analysis Quality Plan 266 Victoria Road and 26 Kissing Point Road, PARRAMATA	PROJECT No: 85556.00
	OFFICE: Sydney DRAWN BY: PSCH		DRAWING No: 2
	SCALE: 1:2500 @ A3 DATE: 21.7.2016		REVISION: 0

NOTE:
1: Base image from Nearmap.com
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

- Pipeline easement
- Approximate borehole location (SMEC, 2012)
- Proposed test pit location
- Proposed borehole location
- Proposed groundwater monitoring well location

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Elton Consulting Group Pty Ltd		TITLE: **Proposed Test Locations** Samling and Analysis Quality Plan 266 Victoria Road and 26 Kissing Point Road, PARRAMATA
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:2500 @ A3	DATE: 21.7.2016	

N

PROJECT No:	85556.00
DRAWING No:	3
REVISION:	0

Appendix C

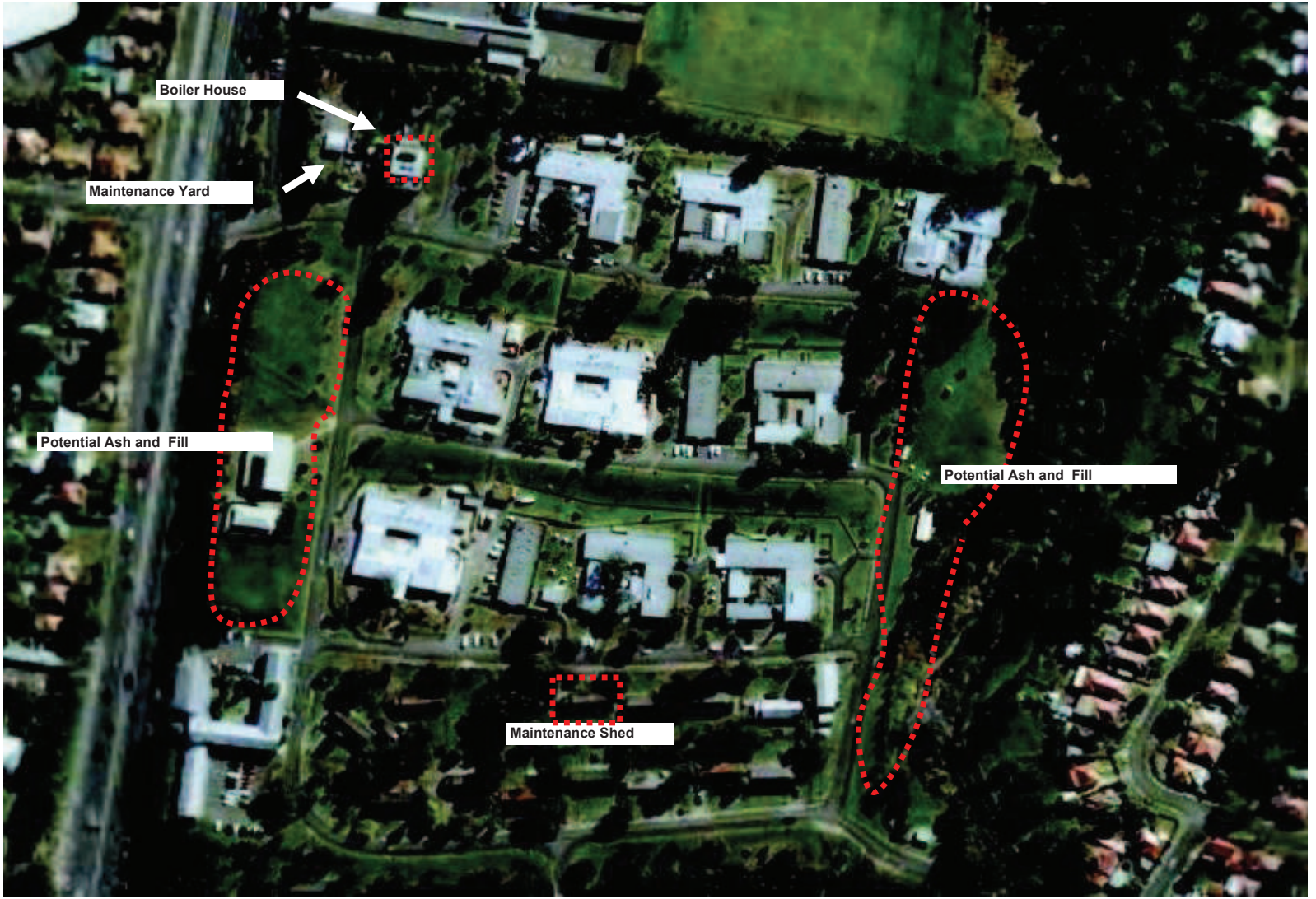
Extracts from Previous Reports

Department of Ageing, Disability and Home Care

Rydalmere Centre Rydalmere - Stage 1 Environmental Site Assessment

- ESA Report
- 19/06/2006

Resolve Environmental Management
ABN 74 108 348 554
56 Alexander Street
Alexandria, NSW
Australia 2015
Tel: +61 2 9519 5835
Fax: +61 2 9519 5835



Notes:
1)

resolve environmental management

CLIENT:	Department of Ageing, Disability and Home Care	REVISION:	A	DESIGNED:	bjm	TITLE:	Phase 1 ESA Site Layout and Observations
PROJECT:	Rydalmere Centre	SCALE:	NTS	DRAWN:	bjm		
		DWG NO:		CHECKED:			
		DATE:	25-Jun-06	STATUS:	Final	FIGURE:	11

A4

Preliminary Contamination Assessment

26 Kissing Point Road, Parramatta, NSW

Prepared for:
Landcom

Prepared by:
EP Risk Management Pty Ltd

Date:
9 October 2012

Project Number:
EP0026

Preliminary Contamination Assessment
26 Kissing Point Road, Parramatta, NSW

Figure 1 – Site Location

Job No: EP0026
Date: 25 September 2012
Drawing No: EP0026_Fig1_25sep12

0 100 200 400

Co-ordinate system: MGA 56
Drawn by: PS Checked by: PH
Scale of regional map not shown

Approximate boundary
Approximate location

288 High Street, Maitland, NSW, 2320
t: 02 4015 7979 f: 02 4934 6766
w: www.eprm.com.au ABN: 81 147 147 591

288 High Street, Maitland, NSW, 2320
t: 02 4015 7979 f: 02 4934 6766
w: www.eprm.com.au ABN: 81 147 147 591

Preliminary Contamination Assessment
26 Kissing Point Road, Parramatta, NSW

Figure 2 – Site Layout

Job No: EP0026
Date: 25 September 2012
Drawing No: EP0026_Fig2_25sep12

0 30 60 120m

Co-ordinate system: MGA 56
Drawn by: PS **Checked by:** PH
Approximate scale as shown

Approximate boundary

288 High Street, Maitland, NSW, 2320
t: 02 4015 7979 f: 02 4934 6766
w: www.eprm.com.au ABN: 81 147 147 591

Preliminary Contamination Assessment
26 Kissing Point Road, Parramatta, NSW

Figure 3 – Potential Fill Areas

Job No: EP0026
Date: 25 September 2012
Drawing No: EP0026_Fig3_25sep12

0 30 60 120m

Co-ordinate system: MGA 56
Drawn by: PS **Checked by:** PH
Approximate scale as shown

Potential Fill Areas

Tables

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

Field ID	S1	S3	S6	S8	S11	S16	S17	S18	S20
Sampled Date-Time	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12

ANALYTE	Units	LOR	NEPM 1999 EIL	NEPM 1999 HIL A	NEPM 1999 HIL D	NEPM 1999 HIL E	NEPM 1999 HIL F	NSW EPA 1994 Service Station								
Asbestos																
Asbestos ID									No						No		
BTEX																
Benzene	mg/kg	0.2						1		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5						50		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5						130		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2								<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	mg/kg	0.5						25		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons (TPH)																
C6 - C9 Fraction	mg/kg	10						65		<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg	50								<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg	100								<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg	100								<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50						1,000		<50	<50	<50	<50	<50	<50	<50	<50
Total Recoverable Hydrocarbons - NEPM 2010 Draft																
C6 - C10 Fraction	mg/kg	10								<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10								<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg	50								<50	<50	<50	<50	<50	<50	<50	<50
>C16 - C34 Fraction	mg/kg	100								<100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	mg/kg	100								<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50								<50	<50	<50	<50	<50	<50	<50	<50
Metals																
Arsenic	mg/kg	5	20	100	400	200	500			8	<5	<5	8	<5	13	<5	6
Cadmium	mg/kg	1	3	20	80	40	100			<1	<1	<1	<1	<1	<1	<1	<1
Chromium[1]	mg/kg	2	400	120,000	480,000	200,000	500,000			16	20	19	13	16	16	22	38
Copper	mg/kg	5	100	1000	4000	2,000	5000			5	23	16	5	16	21	21	10
Lead	mg/kg	5	600	300	1200	600	1,500	300		26	75	105	13	70	199	48	12
Mercury	mg/kg	0.1	1	15	60	30	75			<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	2	60	600	2400	600	3000			<2	21	5	<2	6	8	16	22
Zinc	mg/kg	5	200	7000	28000	14,000	35000			34	88	130	9	65	103	22	14
Organochlorine Pesticides																
alpha-BHC	mg/kg	0.05							<0.05							<0.05
Hexachlorobenzene (HCB)	mg/kg	0.05							<0.05							<0.05
beta-BHC	mg/kg	0.05							<0.05							<0.05
gamma-BHC	mg/kg	0.05							<0.05							<0.05
delta-BHC	mg/kg	0.05							<0.05							<0.05
Heptachlor	mg/kg	0.05		10	40	20	50		<0.05							<0.05
Aldrin	mg/kg	0.05							<0.05							<0.05
Heptachlor epoxide	mg/kg	0.05							<0.05							<0.05
Total Chlordane (sum)	mg/kg	0.05		50	200	100	250		<0.05							<0.05
trans-Chlordane	mg/kg	0.05							<0.05							<0.05
alpha-Endosulfan	mg/kg	0.05							<0.05							<0.05
cis-Chlordane	mg/kg	0.05							<0.05							<0.05
Dieldrin	mg/kg	0.05							<0.05							<0.05

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

	Field ID	S1	S3	S6	S8	S11	S16	S17	S18	S20
	Sampled Date-Time	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12
4.4`-DDE	mg/kg	0.05							<0.05								<0.05
Endrin	mg/kg	0.05							<0.05								<0.05
beta-Endosulfan	mg/kg	0.05							<0.05								<0.05
4.4`-DDD	mg/kg	0.05							<0.05								<0.05
Endrin aldehyde	mg/kg	0.05							<0.05								<0.05
Endosulfan sulfate	mg/kg	0.05							<0.05								<0.05
4.4`-DDT	mg/kg	0.2							<0.2								<0.2
Endrin ketone	mg/kg	0.05							<0.05								<0.05
Methoxychlor	mg/kg	0.2							<0.2								<0.2
Sum of Aldrin + Dieldrin	mg/kg	0.05		10	40	20	50		<0.05								<0.05
Sum of DDD + DDE + DDT	mg/kg	0.05		200	800	400	1000		<0.05								<0.05
Organophosphorus Pesticides (OP)																	
Dichlorvos	mg/kg	0.05							<0.05								<0.05
Demeton-S-methyl	mg/kg	0.05							<0.05								<0.05
Monocrotophos	mg/kg	0.2							<0.2								<0.2
Dimethoate	mg/kg	0.05							<0.05								<0.05
Diazinon	mg/kg	0.05							<0.05								<0.05
Chlorpyrifos-methyl	mg/kg	0.05							<0.05								<0.05
Parathion-methyl	mg/kg	0.2							<0.2								<0.2
Malathion	mg/kg	0.05							<0.05								<0.05
Fenthion	mg/kg	0.05							<0.05								<0.05
Chlorpyrifos	mg/kg	0.05							<0.05								<0.05
Parathion	mg/kg	0.2							<0.2								<0.2
Pirimphos-ethyl	mg/kg	0.05							<0.05								<0.05
Bromophos-ethyl	mg/kg	0.05							<0.05								<0.05
Fenamiphos	mg/kg	0.05							<0.05								<0.05
Prothiofos	mg/kg	0.05							<0.05								<0.05
Ethion	mg/kg	0.05							<0.05								<0.05
Carbophenothion	mg/kg	0.05							<0.05								<0.05
Azinphos Methyl	mg/kg	0.05							<0.05								<0.05
PAH																	
Naphthalene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	mg/kg	0.5		1	4	2	5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5		20	80	40	100	20		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (WHO)	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenolics																	
Phenol	mg/kg	0.5		8,500	34,000	17,000	42,500			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

									Field ID	S1	S3	S6	S8	S11	S16	S17	S18	S20
									Sampled Date-Time	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12
2-Methylphenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	mg/kg	1								<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-Methylphenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.5-Trichlorophenol	mg/kg	0.5								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	mg/kg	2								<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Polychlorinated Biphenyls																		
PCBs (Sum of total)	mg/kg	0.1		10	40	20	50			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

Field ID	S21		S22		S23	S24	S25	S26	S27	S29	S32
Sampled Date-Time	14-Sep-12		14-Sep-12		14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	17-Sep-12

ANALYTE	Units	LOR	NEPM 1999 EIL	NEPM 1999 HIL A	NEPM 1999 HIL D	NEPM 1999 HIL E	NEPM 1999 HIL F	NSW EPA 1994 Service Station		RPD		RPD						
Asbestos																		
Asbestos ID																		No
BTEX																		
Benzene	mg/kg	0.2						1	<0.2	-	<0.5	-	<0.2		<0.2	<0.2	<0.2	<0.2	
Toluene	mg/kg	0.5						50	<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Ethylbenzene	mg/kg	0.5						130	<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
meta- & para-Xylene	mg/kg	0.5							<0.5	-	<1	-	<0.5		<0.5	<0.5	<0.5	<0.5	
ortho-Xylene	mg/kg	0.5							<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Sum of BTEX	mg/kg	0.2							<0.2	-	<1.5	-	<0.2		<0.2	<0.2	<0.2	<0.2	
Total Xylenes	mg/kg	0.5						25	<0.5	-	<1.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Total Petroleum Hydrocarbons (TPH)																		
C6 - C9 Fraction	mg/kg	10						65	<10	-	<10	-	<10		<10	<10	<10	<10	
C10 - C14 Fraction	mg/kg	50							<50	-	<50	-	<50		<50	<50	<50	<50	
C15 - C28 Fraction	mg/kg	100							<100	-	<100	-	<100		<100	<100	<100	<100	
C29 - C36 Fraction	mg/kg	100							<100	-	<100	-	<100		<100	<100	<100	<100	
C10 - C36 Fraction (sum)	mg/kg	50						1,000	<50	-	<100	-	<50		<50	<50	<50	<50	
Total Recoverable Hydrocarbons - NEPM 2010 Draft																		
C6 - C10 Fraction	mg/kg	10							<10	-	<20	-	<10		<10	<10	<10	<10	
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10							<10	-	<20	-	<10		<10	<10	<10	<10	
>C10 - C16 Fraction	mg/kg	50							<50	-	<50	-	<50		<50	<50	<50	<50	
>C16 - C34 Fraction	mg/kg	100							<100	-	<100	-	<100		<100	<100	<100	<100	
>C34 - C40 Fraction	mg/kg	100							<100	-	<100	-	<100		<100	<100	<100	<100	
>C10 - C40 Fraction (sum)	mg/kg	50							<50	-	-	-	<50		<50	<50	<50	<50	
Metals																		
Arsenic	mg/kg	5	20	100	400	200	500		6	0%	6.7	3%	9		9	<5	6	<5	
Cadmium	mg/kg	1	3	20	80	40	100		<1	-	<0.1	-	<1		<1	<1	<1	<1	
Chromium[1]	mg/kg	2	400	120,000	480,000	200,000	500,000		26	9%	23	12%	25		29	6	29	14	
Copper	mg/kg	5	100	1000	4000	2,000	5000		7	9%	5.9	13%	<5		<5	<5	8	<5	
Lead	mg/kg	5	600	300	1200	600	1,500	300	13	2%	9.3	6%	11		32	7	20	7	
Mercury	mg/kg	0.1	1	15	60	30	75		<0.1	-	<0.05	-	<0.1		<0.1	<0.1	<0.1	<0.1	
Nickel	mg/kg	2	60	600	2400	600	3000		14	11%	13	13%	<2		<2	<2	14	<2	
Zinc	mg/kg	5	200	7000	28000	14,000	35000		14	11%	7.7	15%	<5		<5	<5	27	<5	
Organochlorine Pesticides																		
alpha-BHC	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
Hexachlorobenzene (HCB)	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
beta-BHC	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
gamma-BHC	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
delta-BHC	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
Heptachlor	mg/kg	0.05		10	40	20	50		<0.05	-	<0.05	-		<0.05					<0.05
Aldrin	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
Heptachlor epoxide	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
Total Chlordane (sum)	mg/kg	0.05		50	200	100	250		<0.05	-	-	-		<0.05					<0.05
trans-Chlordane	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
alpha-Endosulfan	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
cis-Chlordane	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05
Dieldrin	mg/kg	0.05							<0.05	-	<0.05	-		<0.05					<0.05

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

									Field ID	S21		S22		S23	S24	S25	S26	S27	S29	S32
									Sampled Date-Time	14-Sep-12		14-Sep-12		14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	17-Sep-12
4.4`-DDE	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
Endrin	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
beta-Endosulfan	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
4.4`-DDD	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
Endrin aldehyde	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
Endosulfan sulfate	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
4.4`-DDT	mg/kg	0.2								<0.2	-	<0.05	-		<0.2					<0.2
Endrin ketone	mg/kg	0.05								<0.05	-	<0.05	-		<0.05					<0.05
Methoxychlor	mg/kg	0.2								<0.2	-	<0.05	-		<0.2					<0.2
Sum of Aldrin + Dieldrin	mg/kg	0.05		10	40	20	50			<0.05	-	<0.1	-		<0.05					<0.05
Sum of DDD + DDE + DDT	mg/kg	0.05		200	800	400	1000			<0.05	-	<0.15	-		<0.05					<0.05
Organophosphorus Pesticides (OP)																				
Dichlorvos	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Demeton-S-methyl	mg/kg	0.05								<0.05	-	<1	-		<0.05					<0.05
Monocrotophos	mg/kg	0.2								<0.2	-	<10	-		<0.2					<0.2
Dimethoate	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Diazinon	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Chlorpyrifos-methyl	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Parathion-methyl	mg/kg	0.2								<0.2	-	<0.5	-		<0.2					<0.2
Malathion	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Fenthion	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Chlorpyrifos	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Parathion	mg/kg	0.2								<0.2	-	<0.5	-		<0.2					<0.2
Pirimphos-ethyl	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Bromophos-ethyl	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Fenamiphos	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Prothiofos	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Ethion	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Carbophenothion	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
Azinphos Methyl	mg/kg	0.05								<0.05	-	<0.5	-		<0.05					<0.05
PAH																				
Naphthalene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Acenaphthylene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Acenaphthene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Fluorene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Phenanthrene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Anthracene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Fluoranthene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Pyrene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benz(a)anthracene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Chrysene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benzo(b)fluoranthene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benzo(k)fluoranthene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benzo(a)pyrene	mg/kg	0.5		1	4	2	5			<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Indeno(1.2.3.cd)pyrene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Dibenz(a.h)anthracene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benzo(g.h.i)perylene	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5		20	80	40	100	20		<0.5	-	<1	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Benzo(a)pyrene TEQ (WHO)	mg/kg	0.5								<0.5	-	-	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Phenolics																				
Phenol	mg/kg	0.5		8,500	34,000	17,000	42,500			<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2-Chlorophenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

									Field ID	S21		S22		S23	S24	S25	S26	S27	S29	S32
									Sampled Date-Time	14-Sep-12		14-Sep-12		14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	14-Sep-12	17-Sep-12
2-Methylphenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
3- & 4-Methylphenol	mg/kg	1								<1.0	-	<1	-	<1.0		<1.0	<1.0	<1.0	<1.0	
2-Nitrophenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2.4-Dimethylphenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2.4-Dichlorophenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2.6-Dichlorophenol	mg/kg	0.5								<0.5	-	-	-	<0.5		<0.5	<0.5	<0.5	<0.5	
4-Chloro-3-Methylphenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2.4.6-Trichlorophenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
2.4.5-Trichlorophenol	mg/kg	0.5								<0.5	-	<0.5	-	<0.5		<0.5	<0.5	<0.5	<0.5	
Pentachlorophenol	mg/kg	2								<2.0	-	<1	-	<2.0		<2.0	<2.0	<2.0	<2.0	
Polychlorinated Biphenyls																				
PCBs (Sum of total)	mg/kg	0.1		10	40	20	50			<0.10	-	<0.5	-	<0.10		<0.10	<0.10	<0.10	<0.10	

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

Field ID	S33	S34	S35	S36	S37	S38	S39
Sampled Date-Time	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12

ANALYTE	Units	LOR	NEPM 1999 EIL	NEPM 1999 HIL A	NEPM 1999 HIL D	NEPM 1999 HIL E	NEPM 1999 HIL F	NSW EPA 1994 Service Station							
Asbestos															
Asbestos ID															No
BTEX															
Benzene	mg/kg	0.2						1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5						50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5						130	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2							<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	mg/kg	0.5						25	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons (TPH)															
C6 - C9 Fraction	mg/kg	10						65	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg	50							<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg	100							<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg	100							<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50						1,000	<50	<50	<50	<50	<50	<50	<50
Total Recoverable Hydrocarbons - NEPM 2010 Draft															
C6 - C10 Fraction	mg/kg	10							<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10							<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg	50							<50	<50	<50	<50	<50	<50	<50
>C16 - C34 Fraction	mg/kg	100							<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	mg/kg	100							<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50							<50	<50	<50	<50	<50	<50	<50
Metals															
Arsenic	mg/kg	5	20	100	400	200	500		9	7	<5	9	6	9	<5
Cadmium	mg/kg	1	3	20	80	40	100		<1	<1	<1	<1	<1	<1	<1
Chromium[1]	mg/kg	2	400	120,000	480,000	200,000	500,000		22	26	61	15	84	10	3
Copper	mg/kg	5	100	1000	4000	2,000	5000		<5	<5	14	<5	7	<5	<5
Lead	mg/kg	5	600	300	1200	600	1,500	300	15	17	13	17	13	15	9
Mercury	mg/kg	0.1	1	15	60	30	75		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	2	60	600	2400	600	3000		10	4	44	3	14	<2	<2
Zinc	mg/kg	5	200	7000	28000	14,000	35000		5	16	30	<5	17	<5	<5
Organochlorine Pesticides															
alpha-BHC	mg/kg	0.05													
Hexachlorobenzene (HCB)	mg/kg	0.05													
beta-BHC	mg/kg	0.05													
gamma-BHC	mg/kg	0.05													
delta-BHC	mg/kg	0.05													
Heptachlor	mg/kg	0.05		10	40	20	50								
Aldrin	mg/kg	0.05													
Heptachlor epoxide	mg/kg	0.05													
Total Chlordane (sum)	mg/kg	0.05		50	200	100	250								
trans-Chlordane	mg/kg	0.05													
alpha-Endosulfan	mg/kg	0.05													
cis-Chlordane	mg/kg	0.05													
Dieldrin	mg/kg	0.05													

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

								Field ID	S33	S34	S35	S36	S37	S38	S39
								Sampled Date-Time	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12
4.4`-DDE	mg/kg	0.05													
Endrin	mg/kg	0.05													
beta-Endosulfan	mg/kg	0.05													
4.4`-DDD	mg/kg	0.05													
Endrin aldehyde	mg/kg	0.05													
Endosulfan sulfate	mg/kg	0.05													
4.4`-DDT	mg/kg	0.2													
Endrin ketone	mg/kg	0.05													
Methoxychlor	mg/kg	0.2													
Sum of Aldrin + Dieldrin	mg/kg	0.05		10	40	20	50								
Sum of DDD + DDE + DDT	mg/kg	0.05		200	800	400	1000								
Organophosphorus Pesticides (OP)															
Dichlorvos	mg/kg	0.05													
Demeton-S-methyl	mg/kg	0.05													
Monocrotophos	mg/kg	0.2													
Dimethoate	mg/kg	0.05													
Diazinon	mg/kg	0.05													
Chlorpyrifos-methyl	mg/kg	0.05													
Parathion-methyl	mg/kg	0.2													
Malathion	mg/kg	0.05													
Fenthion	mg/kg	0.05													
Chlorpyrifos	mg/kg	0.05													
Parathion	mg/kg	0.2													
Pirimphos-ethyl	mg/kg	0.05													
Bromophos-ethyl	mg/kg	0.05													
Fenamiphos	mg/kg	0.05													
Prothiofos	mg/kg	0.05													
Ethion	mg/kg	0.05													
Carbophenothion	mg/kg	0.05													
Azinphos Methyl	mg/kg	0.05													
PAH															
Naphthalene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	mg/kg	0.5		1	4	2	5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5		20	80	40	100	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (WHO)	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenolics															
Phenol	mg/kg	0.5		8,500	34,000	17,000	42,500		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table A1. Analytical Summary - Soils

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

								Field ID	S33	S34	S35	S36	S37	S38	S39
								Sampled Date-Time	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12
2-Methylphenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	mg/kg	1							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-Methylphenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.5-Trichlorophenol	mg/kg	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	mg/kg	2							<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Polychlorinated Biphenyls															
PCBs (Sum of total)	mg/kg	0.1		10	40	20	50		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

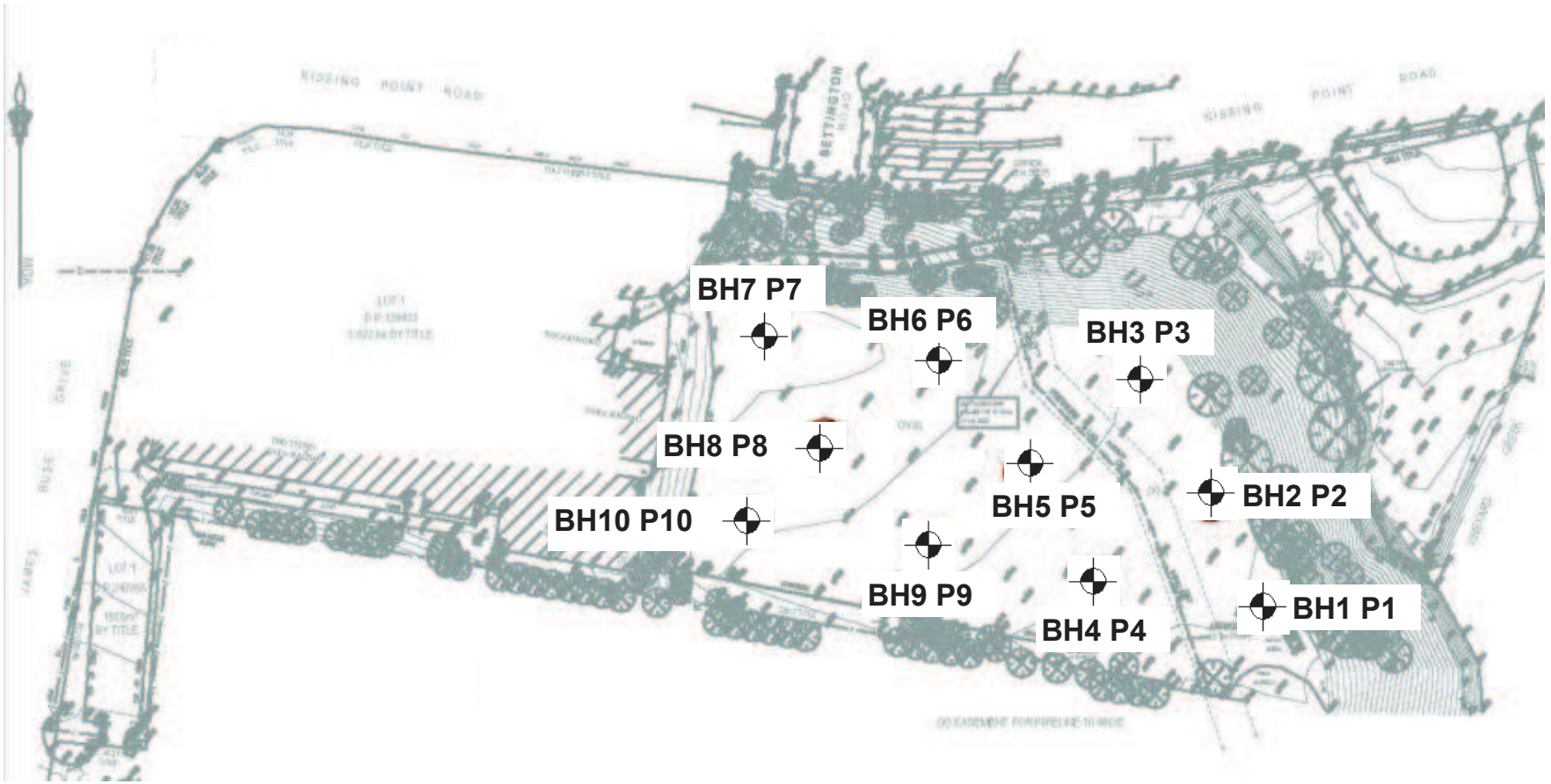
Table 2. Analytical Summary - Water

PROJECT: EP0026 Parramatta

Laboratory Report No: ES1223064

	Field ID	RB1	RB2	TRIP BLANK
	Sampled Date-Time	14-Sep-12	17-Sep-12	14-Sep-12

ANALYTE	Units	LOR			
BTEXN					
Benzene	µg/L	1			<1
Toluene	µg/L	2			<2
Ethylbenzene	µg/L	2			<2
meta- & para-Xylene	µg/L	2			<2
ortho-Xylene	µg/L	2			<2
Total Xylenes	µg/L	2			<2
Sum of BTEX	µg/L	1			<1
Naphthalene	µg/L	5			<5
TPH					
TPH C6 - C9	µg/L	20			<20
Total Recoverable Hydrocarbons - NEPM 2010 Draft					
C6 - C10 Fraction	µg/L	20			<20
C6 - C10 Fraction minus BTEX	µg/L	20			<20
Metals					
Arsenic	mg/L	0.001	<0.001	<0.001	
Cadmium	mg/L	0.0001	<0.0001	<0.0001	
Chromium	mg/L	0.001	<0.001	<0.001	
Copper	mg/L	0.001	0.001	<0.001	
Mercury	mg/L	0.0001	<0.0001	<0.0001	
Nickel	mg/L	0.001	<0.001	<0.001	
Zinc	mg/L	0.005	<0.005	<0.005	



SMEC TESTING SERVICES Pty. Ltd.	Scale: Unknown	Date: September 2012
Client: MEINHARDT INFRASTRUCTURE AND ENVIRONMENT PTY LTD		
GEOTECHNICAL INVESTIGATION 26 KISSING POINT ROAD, PARRAMATTA BOREHOLE & PENETROMETER LOCATIONS		Project No. 18774/2094C Drawing No: 12/1360

NOTES RELATING TO GEOTECHNICAL REPORTS

Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

When copies of reports are made, they should be reproduced in full.

Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC Testing Services Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, SMEC Testing Services Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC Testing Services Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

Supply of Geotechnical Information or Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.

APPENDIX A

BOREHOLE LOGS & EXPLANATION SHEETS

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client:	Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.: BH 2**
Project:	26 Kissing Point Road, Parramatta	Date : 14 September 2012	Sheet 1 of 1
Location:	Refer to Drawing No. 12/1360	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S9 @ 0.3 m		SILTY CLAY: light brown, low plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN FIRM AND VERY STIFF	D
	S10 @ 1.0 m	1.0	SILTY CLAY: light grey with orange brown, medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN FIRM AND VERY STIFF	D
	S11 S12, S13 @ 2.0 m	2.0	SILTY SANDY CLAY: mottled orange brown, light grey and red brown, fine grained sand medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN FIRM AND VERY STIFF	D-M M
	S14 @ 3.0 m	3.0				
	S15 @ 4.0 m	4.0	SILTY CLAY: orange brown with occasional dark grey, medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN FIRM AND VERY STIFF	M
	S16 @ 5.0 m	5.0				
			AUGER REFUSAL AT 5.2 M IN FILL			

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.: BH 3**	
Project: 26 Kissing Point Road, Parramatta	Date : 14 September 2012	Sheet 1 of 1	
Location: Refer to Drawing No. 12/1360	Logged: JK		

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S17 @ 0.3 m		SILTY SANDY CLAY: light brown, fine grainede sand, low plasticity FILL	CL	GENERALLY STIFF	D
			SILTY CLAY: orange brown with light grey, medium plasticity FILL	CL	GENERALLY STIFF	M
	S18 @ 1.0 m	1.0	SANDY GRAVEL: dark grey with light grey, fine to medium grained FILL	GW	GENERALLY STIFF	D
			AUGER REFUSAL AT 1.5 M IN FILL (unable to penetrate despite attempting at several locations)			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client:	Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.: BH 4**
Project:	26 Kissing Point Road, Parramatta	Date : 14 September 2012	Sheet 1 of 1
Location:	Refer to Drawing No. 12/1360	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S19 @ 0.3 m		SILTY CLAY: dark brown with orange brown, medium plasticity, occasional gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	M
	S20 S21, S22 @ 1.0 m	1.0	SILTY SANDY CLAY: orange brown with dark brown and light grey, medium plastiicty, fine grained sand, trace of gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	M
	S23 @ 2.0 m	2.0	SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	D
		3.0	AUGER REFUSAL AT 2.7 M ON WEATHERED SANDSTONE			
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment		Project No.: 18774/2094C	**BOREHOLE NO.: BH 5**
Project: 26 Kissing Point Road, Parramatta		Date : 14 September 2012	
Location: Refer to Drawing No. 12/1360		Logged: JK	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S24 @ 0.3 m		SILTY CLAY: dark brown with orange brown, low plasticity, trace of fine sand, occasional gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	M
	S25 @ 1.0 m	1.0	SILTY CLAY: orange brown with dark brown and dark grey, medium plasticity, trace of fine sand occasional gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	M
			SILTY CLAY: orange brown with light grey, medium plasticity, trace of fine sand	CL	VERY STIFF	M
	S26 @ 2.0 m	2.0	SILTY SANDY CLAY: red brown with light grey, fine to medium grained sand, low plasticity C W SANDSTONE	CL	HARD	M-D
			SANDSTONE: light grey with red brown, fine to medium grained		EXTREMELY LOW STRENGTH	D
		3.0	AUGER REFUSAL AT 2.8 M ON WEATHERED SANDSTONE			
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment
Project: 26 Kissing Point Road, Parramatta
Location: Refer to Drawing No. 12/1360

Project No.: 18774/2094C
Date : 14 September 2012
Logged: JK

BOREHOLE NO.: BH 1

Sheet 1 of 2

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S1 @ 0.3 M		SILTY CLAY: light brown, low plasticity, trace of fine sand, occasional gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M-D
	S2 @ 1.0 m	1.0	SILTY CLAY: light grey with dark grey, trace of fine sand, low plasticity, occasional gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	D
	S3 @ 2.0 m	2.0	SILTY CLAY: mottled orange brown, light grey yellow brown and light brown, medium plasticity trace of fine sand, trace of gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M
	S4 @ 3.0 m	3.0	SILTY CLAY: dark grey, medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M
	S5 @ 4.0 m	4.0	SILTY CLAY: orange brown with light grey, medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M
	S6 @ 5.0 m	5.0	SILTY CLAY: dark brown/grey, medium plasticity, trace of gravel FILL	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M
	S7 @ 6.0 m		SILTY CLAY: dark grey, medium plasticity, trace of gravel (ceramic pieces) FILL	CL	VARIABLE BETWEEN SOFT & VERY STIFF	M

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment		Project No.: 18774/2094C	**BOREHOLE NO.: BH 6**
Project: 26 Kissing Point Road, Parramatta		Date : 14 September 2012	
Location: Refer to Drawing No. 12/1360		Logged: JK	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S27 @ 0.3 m		SILTY SANDY CLAY: dark brown with orange brown, fine to medium grained sand, low plasticity, trace of gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	D
	S28 @ 1.0 m	1.0	SILTY SANDY CLAY: orange brown with light grey and yellow brown, fine grained sand, medium plasticity, trace of gravel FILL	CL	VARIABLE STIFF AND VERY STIFF	M-D
	S29 S30, S31 @ 2.0 m	2.0	SILTY SANDY CLAY: dark grey/brown, fine grained sand, low plasticity, occasional gravel OLD TOPSOIL	CL	FIRM	M
			SILTY CLAY: orange brown with light grey, medium plasticity, trace of fine grained sand	CL	FIRM TO STIFF	M
			SANDSTONE: light grey, fine to medium plasticity		EXTREMELY LOW STRENGTH	D
		3.0	AUGER REFUSAL AT 2.8 M ON WEATHERED SANDSTONE			
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment		Project No.: 18774/2094C	**BOREHOLE NO.: BH 1**
Project: 26 Kissing Point Road, Parramatta		Date : 14 September 2012	Sheet 2 of 2
Location: Refer to Drawing No. 12/1360		Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: orange grey, medium plasticity, trace of gravel (ceramic pieces)	CL	VARIABLE BETWEEN SOFT AND VERY STIFF	M-VM
			FILL			
	S8 @ 7.0 m	7.0				
			SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	D
			AUGER REFUSAL AT 7.8 M ON WEATHERED SANDSTONE			
		8.0				
		9.0				
		10.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment
Project: 26 Kissing Point Road, Parramatta
Location: Refer to Drawing No. 12/1360

Project No.: 18774/2094C
Date : 17 September 2012
Logged: JK

BOREHOLE NO.: BH 7

Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S32 @ 0.3 m		SILTY SANDY CLAY: dark brown, fine to medium grained sand FILL	CL	VARIABLE FIRM TO STIFF AND VERY STIFF	D-M
	S33 @ 1.0 m	1.0	SILTY SANDY CLAY: orange brown with ref brown and light grey, fine to medium grained sand, occasional gravel FILL	CL	VERYABLE FIRM TO STIFF AND VERY STIFF	M-D
			SILTY CLAY: orange brown with light grey, medium plasticity	CL	VERY STIFF	M
	S34 @ 2.0 m	2.0	SILTY SANDY CLAY: light grey, fine to medium grained, low plasticity C W SANDSTONE	CL	HARD	M-D
			SANDSTONE: light grey, fine to medium grained		EXTREMELY LOW STRENGTH	D
			AUGER REFUSAL AT 2.5 M			
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.: BH 8**	
Project: 26 Kissing Point Road, Parramatta	Date : 17 September 2012	Sheet 1 of 1	
Location: Refer to Drawing No. 12/1360	Logged: JK		

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S35 @0.3 m		SILTY SANDY CLAY: light brown with occasional orange brown, fine to medium grained sand, low plasticity, occasional gravel FILL	CL	GENERALLY VERY STIFF	M-D
	S36 @ 1.0 m	1.0	SILTY CLAY: light grey with occasional orange brown, low plasticity, trace of fine sand C W SANDSTONE	CL	HARD	M-D
			SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	D
			AUGER REFUSAL AT 1.6 M ON WEATHERED SANDSTONE			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.: BH 9**	
Project: 26 Kissing Point Road, Parramatta	Date : 17 September 2012	Sheet 1 of 1	
Location: Refer to Drawing No. 12/1360	Logged: JK		

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S37 @ 0.3 m		SILTY SANDY CLAY: dark brown with orange brown and occasional light grey, fine to medium grained sand, low plasticity FILL	CL	GENERALLY STIFF	M-D
	S38 @ 1.0 m	1.0	SILTY CLAY: light grey with red brown and orange brown, low plasticity, trace of fine grained sand C W SANDSTONE	CL	HARD	M-D
			SANDSTONE: light grey with red brown and orange brown, fine to medium grained		EXTREMELY LOW STRENGTH	D
		2.0	AUGER REFUSAL AT 1.7 M ON WEATHERED SANDSTONE			
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Meinhardt Infrastructure and Environment	Project No.: 18774/2094C	**BOREHOLE NO.:**	**BH 10**
Project: 26 Kissing Point Road, Parramatta	Date : 17 September 2012	Sheet 1 of 1	
Location: Refer to Drawing No. 12/1360	Logged: JK		

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S39 @ 0.3 m		SILTY SANDY CLAY: dark brown with orange brown, fine to medium grained sand, low plasticity, trace of gravel FILL	CL	GENERALLY STIFF	M-D
		1.0	SANDSTONE: light grey with red brown, fine to medium gravel, clay seams		EXTREMELY LOW STRENGTH	D D
			AUGER REFUSAL AT 1.0 M ON WEATHERED SANDSTONE			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dynamic Cone Penetrometer Test Report

Project: 26 KISSING POINT ROAD, PARRAMATTA
Client: Meinhardt Infrastructure & Environment Pty Ltd
Address: Level 4, 66 Clarence Street, Sydney
Test Method: AS 1289.6.3.2

Project No.: 18774/2094C
Report No.: 12/1360
Report Date: 21/09/2012

Site No.	P1	P2	P3	P4		P1	P2	P3	P4
Location	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360					
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	4	5	8	2	3.00 - 3.15	6			
0.15 - 0.30	3	6	5	3	3.15 - 3.30	7			
0.30 - 0.45	2	4	6	4	3.30 - 3.45	6			
0.45 - 0.60	5	4	8	4	3.45 - 3.60	7			
0.60 - 0.75	22	10	10	6	3.60 - 3.75	2			
0.75 - 0.90	R	22	13	7	3.75 - 3.90	10			
0.90 - 1.05	*	R	22	8	3.90 - 4.05	12			
1.05 - 1.20	*	*	Refusal	10	4.05 - 4.20	14			
1.20 - 1.35	*	*		9	4.20 - 4.35	22			
1.35 - 1.50	*	*		19	4.35 - 4.50	R			
1.50 - 1.65	*	*		22	4.50 - 4.65	*			
1.65 - 1.80	*	4		Refusal	4.65 - 4.80	*			
1.80 - 1.95	*	4			4.80 - 4.95	*			
1.95 - 2.10	*	3			4.95 - 5.10	*			
2.10 - 2.25	3	5			5.10 - 5.25	*			
2.25 - 2.40	4	7			5.25 - 5.40	*			
2.40 - 2.55	6	8			5.40 - 5.55	*			
2.55 - 2.70	2	18			5.55 - 5.70	2			
2.70 - 2.85	3	22			5.70 - 5.85	1			
2.85 - 3.00	9	Refusal			5.85 - 6.00	2			

Remarks: * = Pre-drilled hole prior to testing

Approved Signatory.....
Laurie Ihnatiw - Manager

Technician: JK

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Project No.: 18774/2094C
Report No.: 12/1360
Report Date: 21/09/2012

Site No.	P1								
Location	Refer to Drawing No. 12/1360								
Starting Level	Surface Level								
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
6.00 - 6.15	3								
6.15 - 6.30	4								
6.30 - 6.45	22								
6.45 - 6.60	Refusal								
6.60 - 6.75									
6.75 - 6.90									
6.90 - 7.05									

Remarks: * = Pre-drilled hole prior to testing

Approved Signatory.....
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Dynamic Cone Penetrometer Test Report

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Client: Meinhardt Infrastructure & Environment Pty Ltd
Address: Level 4, 66 Clarence Street, Sydney
Test Method: AS 1289.6.3.2

Project No.: 18774/2094C
Report No.: 12/1360
Report Date: 21/09/2012

Site No.	P5	P6	P7	P8					
Location	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360					
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	4	3	3	4	3.00 - 3.15				
0.15 - 0.30	6	4	3	7	3.15 - 3.30				
0.30 - 0.45	8	4	4	8	3.30 - 3.45				
0.45 - 0.60	8	5	5	10	3.45 - 3.60				
0.60 - 0.75	10	7	7	14	3.60 - 3.75				
0.75 - 0.90	12	8	8	22	3.75 - 3.90				
0.90 - 1.05	22	22	10	Refusal	3.90 - 4.05				
1.05 - 1.20	Refusal	Refusal	9		4.05 - 4.20				
1.20 - 1.35			19		4.20 - 4.35				
1.35 - 1.50			22		4.35 - 4.50				
1.50 - 1.65			Refusal		4.50 - 4.65				
1.65 - 1.80					4.65 - 4.80				
1.80 - 1.95					4.80 - 4.95				
1.95 - 2.10					4.95 - 5.10				
2.10 - 2.25					5.10 - 5.25				
2.25 - 2.40					5.25 - 5.40				
2.40 - 2.55					5.40 - 5.55				
2.55 - 2.70					5.55 - 5.70				
2.70 - 2.85					5.70 - 5.85				
2.85 - 3.00					5.85 - 6.00				

Remarks: * = Pre-drilled hole prior to testing

Approved Signatory.....
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Dynamic Cone Penetrometer Test Report

Project: 26 KISSING POINT ROAD, PARRAMATTA
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Test Method: AS 1289.6.3.2

Project No.: 18774/2094C
Report No.: 12/1360
Report Date: 21/09/2012

Site No.	P9	P10							
Location	Refer to Drawing No. 12/1360	Refer to Drawing No. 12/1360							
Starting Level	Surface Level	Surface Level							
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	3	3			3.00 - 3.15				
0.15 - 0.30	4	5			3.15 - 3.30				
0.30 - 0.45	6	10			3.30 - 3.45				
0.45 - 0.60	9	22			3.45 - 3.60				
0.60 - 0.75	9	Refusal			3.60 - 3.75				
0.75 - 0.90	8				3.75 - 3.90				
0.90 - 1.05	10				3.90 - 4.05				
1.05 - 1.20	22				4.05 - 4.20				
1.20 - 1.35	Refusal				4.20 - 4.35				
1.35 - 1.50					4.35 - 4.50				
1.50 - 1.65					4.50 - 4.65				
1.65 - 1.80					4.65 - 4.80				
1.80 - 1.95					4.80 - 4.95				
1.95 - 2.10					4.95 - 5.10				
2.10 - 2.25					5.10 - 5.25				
2.25 - 2.40					5.25 - 5.40				
2.40 - 2.55					5.40 - 5.55				
2.55 - 2.70					5.55 - 5.70				
2.70 - 2.85					5.70 - 5.85				
2.85 - 3.00					5.85 - 6.00				

Remarks: * = Pre-drilled hole prior to testing

Approved Signatory.....
Laurie Ihnatiw - Manager

Technician: JK

E1. CLASSIFICATION OF SOILS

E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by SMEC in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour

Soil condition

- moisture condition
- consistency or density index

Soil structure

- structure (zoning, defects, cementing)

Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

E1.2 Soil Composition

(a) Soil Name and Classification Symbol

The USC system is summarized in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 μm).

- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 μm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 μm
Silt (2)		2 μm to 60 μm
Sand	Fine Medium Coarse	60 μm to 200 μm 200 μm to 600 μm 600 μm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms “some” and “trace” as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - low to medium plasticity	H

(b) Grading

"Well graded" Good representation of all particle sizes from the largest to the smallest.

"Poorly graded" One or more intermediate sizes poorly represented

"Gap graded" One or more intermediate sizes absent

"Uniformly graded" Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

Angularity may be expressed as "rounded", "sub-rounded", "sub-angular" or "angular".

Particle **form** can be "equidimensional", "flat" or elongate".

Surface texture can be "glassy", "smooth", "rough", pitted" or striated".

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black White Grey Red
Brown Orange Yellow Green
Blue

These may be modified as necessary by "light" or "dark". Borderline colours may be described as a combination of two colours, eg. red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

*E1.3 **S**oil Condition*

(a) Moisture

Soil moisture condition is described as "dry", "moist" or "wet".

The moisture categories are defined as:
Dry (D) - Little or no moisture evident. Soils are running.
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 – 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 – 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 – 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 – 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ($q_u = 2\ c_u$).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE q_c (MPa)	DENSITY INDEX (%)
Very Loose	0 – 3	0 - 2	0 - 15
Loose	3 – 8	2 - 5	15 - 35
Medium Dense	8 – 25	5 - 15	35 - 65
Dense	25 – 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

E1.4 Soil Structure

(a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample
Lens - discontinuous with lenticular shape
Pocket - irregular inclusion
Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

(b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

"Residual Soil" - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

"Colluvium" - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

"Landslide Debris" - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

"Alluvium" - Material which has been transported essentially by water. Usually associated with former stream activity.

"Fill" - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicted by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes "O" or "H" depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an "organic material" by classification.

Coal and lignite should be described as such and not simply as organic matter.

Appendix D

Borehole and Test Pit Logs

Notes and Descriptive Terms

Sampling Methods

Douglas Partners

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

Douglas Partners

Description and Classification Methods

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

Soil Types

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

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

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

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

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base

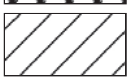

Concrete

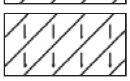

Filling

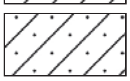
Soils

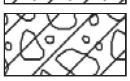

Topsoil

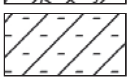

Peat

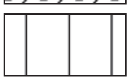

Clay


Silty clay

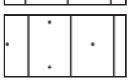

Sandy clay

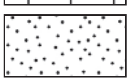

Gravelly clay

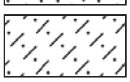

Shaly clay

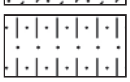

Silt


Clayey silt


Sandy silt

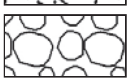

Sand


Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

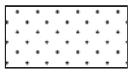

Talus

Sedimentary Rocks

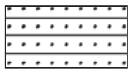

Boulder conglomerate

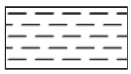

Conglomerate


Conglomeratic sandstone

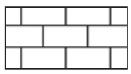

Sandstone


Siltstone

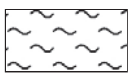

Laminite

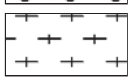

Mudstone, claystone, shale

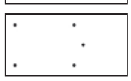

Coal


Limestone

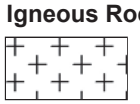
Metamorphic Rocks


Slate, phyllite, schist

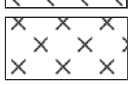

Gneiss

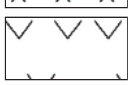

Quartzite

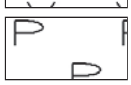
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.5 AHD
EASTING: 317466
NORTHING: 6257508
DIP/AZIMUTH: 90°/--

BORE No: BH11
PROJECT No: 85556.00
DATE: 9/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
20.5	0.04	FILLING - crushed gravel filling		A	0.1		PID<5		Gatic cover Concrete plug 0.0-0.1m 50mm Class 18 PVC casing 0.0-3.0m
				A	0.2				
		FILLING - red-brown clay filling with some basalt gravel, humid		A	0.4		PID<5		
20	0.7				0.5				
	0.9	FILLING - red sandy clay filling with a trace of sandstone		A	1.0		PID<5		
19.5	1	SANDSTONE - white sandstone			1.1				Sand 0.1-2.0m
				A	2.0		PID<5		Bentonite plug 2.0-2.5m
19	2				2.1				
				A	2.9		PID<5		
18.5	3				3.0				
				A	3.9		PID<5		
18	4				4.0				
17.5	5								Gravel/sand backfill 2.5-12.0m
17	6								
16.5	7								
16	8								50mm Class 18 Machine-Slotted PVC Screen 3.0-12.0m
15.5	9								
15	10								
14.5	11								
14	12	12.0 Bore discontinued at 12.0m - auger refusal							End cap
13.5	13								
13	14								

RIG: Scout **DRILLER:** LC **LOGGED:** MH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 4.0m; Washbore to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.8 AHD
EASTING: 317465
NORTHING: 6257540
DIP/AZIMUTH: 90°/--

BORE No: BH12
PROJECT No: 85556.00
DATE: 9/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
20	0.02	FILLING - coarse crushed gravel filling		A	0.1 0.2		PID<5		
		FILLING - brown sandy clay filling with some fine to medium gravel and large metal fragments (5-8cm) and asbestos fragment (2cm x 2cm)		A*	0.4 0.5		PID<5		
19	1	- orange-brown below 0.9m		A	0.9 1.0		PID<5		
	2			A	1.9 2.0		PID<5		
18	2.5	SANDSTONE - red sandstone with some red-orange clay bands		A	2.9 3.0		PID<5		
17	4			A	3.9 4.0		PID<5		
16	4.5	Bore discontinued at 4.5m - target depth reached							
15	5								
14	6								
13	7								
12	8								
11	9								
10	10								
9	11								
8	12								
7	13								
6	14								

RIG: Scout **DRILLER:** LC **LOGGED:** CB **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1-090816 taken at 0.4m to 0.4m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 18.1 AHD
EASTING: 317429
NORTHING: 6257461
DIP/AZIMUTH: 90°/--

BORE No: BH13
PROJECT No: 85556.00
DATE: 9/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
18	0.03	FILLING - dark brown sandy clay filling with some fine igneous gravel and grass at surface		A	0.1		PID<5		
	0.3				0.2				
	0.6	FILLING - brown and orange sandy clay with some fine to medium igneous gravel and a trace of silt		A*	0.4		PID<5		
17	1				0.5				1
		FILLING - orange-brown sandy clay filling with fine to medium igneous gravel, fine brick fragments and metal fragments		A	0.9		PID<5		
					1.0				
16	2	FILLING - red-orange sandstone filling with some clay and igneous gravel		A	1.9		PID<5		2
		- fine asphalt fragments at 1.9m to 2.1m			2.0				
15	3			A	2.9		PID<5		3
					3.0				
		- no clay/gravel from 3.5m							
14	4	- sandstone boulder at 3.9m to 4.2m		A	3.9		PID<5		4
					4.0				
13	5			A	4.9		PID<5		5
					5.0				
12	6			A	5.9		PID<5		6
	6.1	Bore discontinued at 6.1m			6.0				
		- target depth reached							
11	7								7
10	8								8
9	9								9
8	10								10
7	11								11
6	12								12
5	13								13
4	14								14

RIG: Scout **DRILLER:** LC **LOGGED:** CB/MH **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD2-080916 taken at 0.4m to 0.5m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 25.0 AHD
EASTING: 317153
NORTHING: 6257576
DIP/AZIMUTH: 90°/--

BORE No: BH14
PROJECT No: 85556.00
DATE: 10/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
25	0.03	FILLING - dark brown sandy clay filling with some fine igneous gravel and roots (topsoil), grass at surface		A	0.1		PID<5		Gatic cover
	0.3				0.2				Concrete plug 0.0-0.1m
		FILLING - orange-brown sandy clay filling with some fine igneous gravel		A*	0.4		PID<5		50mm Class 18 PVC casing 0.0-1.0m
24	1				0.5				Bentonite plug 0.1-0.5m
		FILLING - orange-red clay filling with some ironstone gravel		A	0.9		PID<5		
		- red and light grey below 0.7m			1.0				
23	2	- white sandstone fragments (1-2cm) at 1.8m		A	1.9		PID<5		
		- sandstone boulder from 2.1m to 2.3m			2.0				
		- sandstone boulder from 2.6m to 2.8m							
22	3			A	2.9		PID<5		Gravel/sand backfill 0.5-10.0m
	3.7				3.0				
		FILLING - grey sandy clay filling with some fine igneous gravel and orange sandstone fragments		A	3.9		PID<5		
21	4				4.0				
	4.4	SHALE - light grey shale							
20	5			A	4.9		PID<5		
					5.0				
19	6								50mm Class 18 Machine-Slotted PVC Screen 1.0-10.0m
18	7								
17	8								
16	9								
15	10								End cap
	10.5	Bore discontinued at 10.5m - target depth reached							
14	11								
13	12								
12	13								
11	14								

RIG: Scout **DRILLER:** LC **LOGGED:** CB **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1-100816 taken at 0.4m to 0.5m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 26.1 AHD
EASTING: 317185
NORTHING: 6257635
DIP/AZIMUTH: 90°/--

BORE No: BH15
PROJECT No: 85556.00
DATE: 10/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
26	0.02	ASPHALT		A	0.1		PID<5		
	0.05				0.2				
	0.25	FILLING - grey gravelly sand (roadbase)		A*	0.4		PID<5		
	0.7				0.5				
25	1	FILLING - grey-brown clayey sand filling with some fine to medium igneous gravel		A	0.9		PID<5		1
					1.0				
		SHALY CLAY - light grey-red and yellow mottled shaly clay							
24	2	SHALE - light grey highly weathered shale							2
	2.0	- red-grey below 1.6m							
		Bore discontinued at 2.0m - target depth reached							
23	3								3
22	4								4
21	5								5
20	6								6
19	7								7
18	8								8
17	9								9
16	10								10
15	11								11
14	12								12
13	13								13
12	14								14

RIG: Scout **DRILLER:** LC **LOGGED:** CB **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD2-100916 taken at 0.4m to 0.4m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 19.8 AHD
EASTING: 317455
NORTHING: 6257491

PIT No: TP1
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown clayey sand with some roots (topsoil), grass at surface							
		FILLING - dark brown sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.3	FILLING - orange and red sandy clay filling with fine to medium igneous gravel and sandstone fragments							
				D*	0.4		PID<5		
					0.5				
19	0.8	SANDSTONE - pink and white sandstone							
				D	0.9		PID<5		
	1				1.0				1
	1.1	Pit discontinued at 1.1m - refusal on sandstone							
18									

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1-110816 taken at 0.4m to 0.5m

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 18.1 AHD
EASTING: 317397
NORTHING: 6257482

PIT No: TP2
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
18	0.02	FILLING - dark brown clayey sand filling with some roots (topsoil), grass at surface							
		FILLING - dark brown silty clay with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.3	FILLING - orange sandy clay with some fine to medium igneous gravel and sandstone fragments							
				D*	0.4		PID<5		
					0.5				
	0.6	SANDSTONE - orange sandstone with some clay							
					0.9		PID<5		
	1			D	1.0				1
17	1.1	Pit discontinued at 1.1m - refusal on sandstone							

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD2-110816 taken at 0.4m to 0.5m

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 19.4 AHD
EASTING: 317342
NORTHING: 6257485

PIT No: TP3
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
19	0.07	FILLING - dark brown clayey sand filling with some fine igneous gravel and roots (topsoil), grass at surface							
		FILLING - brown silty clay filling with fine igneous gravel		D	0.1		PID<5		
	0.25				0.2				
		SANDY CLAY - orange and red sandy clay with some ironstone gravel and shale fragments							
				D	0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
18	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.1 AHD
EASTING: 317306
NORTHING: 6257498

PIT No: TP4
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
20	0.03	FILLING - dark brown clayey sand filling with some fine igneous gravel and roots (topsoil), grass at surface							
		FILLING - brown silty clay filling with some fine igneous gravel		D	0.1		PID<5		
	0.25	SHALY CLAY - light grey shaly clay			0.2				
				D	0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
19	1								1

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.7 AHD
EASTING: 317621
NORTHING: 6257492

PIT No: TP5
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.03	FILLING - dark brown clayey sand filling with some fine igneous gravel and roots (topsoil), grass at surface							
		FILLING - brown silty clay filling with some fine igneous gravel		D	0.1		PID<5		
	0.2	SHALY CLAY - light grey shaly clay			0.2				
				D	0.4		PID<5		
					0.5				
20	0.7	Pit discontinued at 0.7m - target depth reached							
	1								1
19									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.6 AHD
EASTING: 317232
NORTHING: 6257497

PIT No: TP6
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown clayey sand filling with some roots (topsoil), grass at surface							
		FILLING - brown silty clay filling with some fine igneous gravel and brick fragments (5-15cm)		D	0.1		PID<5		
					0.2				
				D	0.4		PID<5		
					0.5				
20	0.6	SHALY CLAY - light grey shaly clay							
	1			D	0.9		PID<5		1
					1.0				
	1.1	Pit discontinued at 1.1m - target depth reached							
19									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 20.1 AHD
EASTING: 317201
NORTHING: 6257598

PIT No: TP7
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
20	0.02	FILLING - dark brown sandy clay filling with some roots, grass at surface		D	0.03		PID<5		
	0.1	FILLING - brown silty clay filling with some fine igneous gravel		D	0.1		PID<5		
		SHALE - light grey shale			0.2				
	0.3	Pit discontinued at 0.3m - refusal on shale							
19	1								1

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 25.0 AHD
EASTING: 317215
NORTHING: 6257588

PIT No: TP8
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
25	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							5 10 15 20
		FILLING - brown silty clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
	0.2	SHALY CLAY - light grey shaly clay			0.2				
				D	0.4		PID<5		
					0.5				
	0.7	Pit discontinued at 0.7m - target depth reached							
24	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 24.3 AHD
EASTING: 317251
NORTHING: 6257579

PIT No: TP9
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
24	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							5 10 15 20
		FILLING - brown and orange silty sandy clay with some fine igneous gravel and brick fragments (8-10cm)		D	0.1		PID<5		
					0.2				
	0.4	SHALY CLAY - light grey shaly clay		D	0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
23	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 23.7 AHD
EASTING: 317284
NORTHING: 6257571

PIT No: TP10
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown sandy silty clay filling with some roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with some fine igneous gravel		D	0.1		PID<5		
					0.2				
	0.3	SHALY CLAY - light grey shaly clay		D	0.3		PID<5		
	0.4	SHALE - light grey shale			0.4				
	0.45	Pit discontinued at 0.45m - refusal on shale							
23	1								1
22									

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 22.3 AHD
EASTING: 317375
NORTHING: 6257563

PIT No: TP11
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
22	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
				D	0.4		PID<5		
	0.5	SANDY CLAY - orange sandy clay with some ironstone gravel and sandstone fragments			0.5				
				D	0.9		PID<5		
21	1.0	Pit discontinued at 1.0m - target depth reached			1.0				

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 26.2 AHD
EASTING: 317215
NORTHING: 6257613

PIT No: TP12
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
26	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown silty clay filling with some fine igneous gravel		D	0.1		PID<5		
	0.2	SHALY CLAY - light grey shaly clay		D	0.2		PID<5		
	0.31	Pit discontinued at 0.31m - refusal on shale fragments			0.3				
	1								1
25									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 27.8 AHD
EASTING: 3317219
NORTHING: 6257632

PIT No: TP13
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
27	0.03	FILLING - dark brown silty sandy clay filling with roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.3	SHALY CLAY - red-orange and light grey shaly clay							
				D	0.4		PID<5		
					0.5				
	0.7	Pit discontinued at 0.7m - target depth reached							
26	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 28.8 AHD
EASTING: 317189
NORTHING: 6257646

PIT No: TP14
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown sandy silty clay filling with some roots (topsoil), grass at surface							
		FILLING - brown shaly clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
				D	0.4		PID<5		
					0.5				
	0.6	SHALY CLAY - orange and light yellow sandy shaly clay							
28				D	0.9		PID<5		
	1				1.0				1
	1.1	Pit discontinued at 1.1m - target depth reached							
27									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 30.4 AHD
EASTING: 317181
NORTHING: 6257660

PIT No: TP15
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
30	0.03	FILLING - dark brown sandy clay filling with some roots and fine igneous gravel (topsoil), grass at surface							5 10 15 20
		FILLING - dark grey gravelly sand roadbase gravel							
	0.15	FILLING - brown silty sandy clay filling with some fine igneous gravel		D	0.2		PID<5		
	0.3	SANDY CLAY - orange and yellow sandy clay with some shale fragments		D	0.3				
					0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
29	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 14.2 AHD
EASTING: 3317176
NORTHING: 6257392

PIT No: TP16
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
14	0.03	FILLING - dark brown silty sandy clay filling with roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with fine igneous gravel		D	0.1		PID<5		
					0.2				
	0.25	SANDY CLAY - orange sandy clay		D	0.25		PID<5		
	0.3	SHALY CLAY - light grey shaly clay			0.3				
				D	0.4		PID<5		
					0.5				
	0.7	Pit discontinued at 0.7m - target depth reached							
	1								1
13									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 13.6 AHD
EASTING: 317173
NORTHING: 6257393

PIT No: TP17
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.03	FILLING - dark brown silty sandy clay filling with some roots, grass at surface							
		SHALY CLAY - orange and light grey shaly clay		D	0.3		PID<5		
	0.5	Pit discontinued at 0.5m - target depth reached			0.5				
13	1								1
12									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 11.7 AHD
EASTING: 317187
NORTHING: 6257294

PIT No: TP18
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
11	0.03	FILLING - dark brown silty sandy clay filling with roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with some fine to medium igneous gravel and asphalt fragments		D	0.1		PID<5		
					0.2				
	0.3	SANDY CLAY - orange sandy clay with some sandstone fragments							
				D	0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
10	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 11.5 AHD
EASTING: 317217
NORTHING: 6257299

PIT No: TP19
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown silty sandy clay filling with some roots and fine to medium igneous gravel, grass at surface							
		SANDY CLAY - orange sandy clay with some sandstone		D	0.3		PID<5		
					0.4				
11	0.5	Pit discontinued at 0.5m - target depth reached							
	1								1
10									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 11.3 AHD
EASTING: 317249
NORTHING: 6257730

PIT No: TP20
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
11	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown silty sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.25	SANDY CLAY - orange sandy clay with sandstone fragments (6-8cm)							
				D	0.4		PID<5		
					0.5				
	0.55	Pit discontinued at 0.55m - refusal on large sandstone fragments							
10	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 13.3 AHD
EASTING: 317282
NORTHING: 6257332

PIT No: TP21
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
13	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with fine to medium igneous gravel and asphalt fragments		D	0.1		PID<5		
	0.2	SANDY CLAY - orange sandy clay with some sandstone fragments			0.2				
				D	0.4		PID<5		
					0.5				
	0.7	Pit discontinued at 0.7m - target depth reached							
12	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 10.4 AHD
EASTING: 317323
NORTHING: 6257309

PIT No: TP22
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
10	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							5 10 15 20
		FILLING - brown sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.25	SANDY CLAY - orange sandy clay with some sandstone fragments (2-3cm)							
				D	0.4		PID<5		
					0.5				
	0.7	Pit discontinued at 0.7m - target depth reached							
9	1								1

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD3-110816 taken at 0.1m to 0.2m

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 9.5 AHD
EASTING: 317365
NORTHING: 6257311

PIT No: TP23
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface		D	0.03 0.05		PID<5		
	0.07	SANDSTONE - orange and purple sandstone							
		Pit discontinued at 0.07m - refusal on sandstone							

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 9.9 AHD
EASTING: 317394
NORTHING: 6257305

PIT No: TP24
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some fine to medium igneous gravel, roots and sandstone fragments		D*	0.1		PID<5		
					0.2				
	0.3	SANDY CLAY - orange sandy clay with some sandstone fragments							
				D	0.4		PID<5		
					0.5				
	0.8	Pit discontinued at 0.8m - target depth reached							
9	1								1
8									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD4-110816 taken at 0.1m to 0.2m

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

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 16.9 AHD
EASTING: 317403
NORTHING: 6257452

PIT No: TP25
PROJECT No: 85556.00
DATE: 11/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.05	FILLING - dark brown silty sandy clay filling with some roots, grass at surface							
		SANDSTONE - orange and light grey sandstone		D	0.05 0.1		PID<5		
	0.15	Pit discontinued at 0.15m - refusal on sandstone							
16	1								1
15									

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 17.0 AHD
EASTING: 317244
NORTHING: 6257419

PIT No: TP26
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
17	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some fine to medium gravel and sandstone fragments (2-10cm)		D*	0.1		PID<5		
	0.2	SANDY CLAY - orange sandy clay with some cobble sized sandstone fragments (20cm)		D	0.2		PID<5		
	0.4				0.3				
	0.41	SANDSTONE - red and grey sandstone Pit discontinued at 0.41m - refusal on sandstone			0.4				
16	1								1

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1-120816 taken at 0.1m to 0.2m

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 18.1 AHD
EASTING: 317131
NORTHING: 6257433

PIT No: TP27
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
18	0.0	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface		D	0.1		PID<5		
	0.2	SILTY CLAY - orange silty clay with some shale fragments (5-10cm)		D	0.4		PID<5		
					0.5				
	0.7	SHALE - light grey shale		D	0.9		PID<5		
17	1				1.0				1
	1.2	Pit discontinued at 1.2m - refusal on shale							

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 18.6 AHD
EASTING: 317132
NORTHING: 6257445

PIT No: TP28
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown silty sandy clay filling with some roots, grass at surface							
		FILLING - brown sandy clay filling with some fine to medium igneous gravel		D*	0.1		PID<5		
					0.2				
	0.3	SANDY CLAY - orange sandy clay with some shale fragments							
				D	0.4		PID<5		
					0.5				
18									
	0.7	SHALY CLAY - light grey and red shaly clay							
					0.9		PID<5		
				D					
	1				1.0				1
	1.3	Pit discontinued at 1.3m - target depth reached							
17									

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD2-120816 taken at 0.1m to 0.2m

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 19.5 AHD
EASTING: 317147
NORTHING: 6257445

PIT No: TP29
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some silt and fine igneous gravel		D	0.1		PID<5		
	0.3				0.2				
		SILTY CLAY - orange silty clay with some silt and shale fragments		D	0.4		PID<5		
19	0.5				0.5				
		SHALY CLAY - light grey shaly clay		D	0.9		PID<5		
	1.0				1.0				1
		SHALE - light grey medium strength shale							
	1.3								
18		Pit discontinued at 1.3m - target depth reached							

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 18.6 AHD
EASTING: 317146
NORTHING: 6257430

PIT No: TP30
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		SANDY CLAY - stiff, orange sandy clay with some shale fragments		D	0.1		PID<5		
					0.2				
				D	0.4		PID<5		
					0.5				
18	0.7	SHALY CLAY - light grey and red shaly clay							
				D	0.9		PID<5		
	1				1.0				1
	1.1	SHALE - light grey shale							
	1.3	Pit discontinued at 1.3m - target depth reached							
17									

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 23.1 AHD
EASTING: 317156
NORTHING: 6257530

PIT No: TP31
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
23	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some fine to medium igneous gravel		D	0.1		PID<5		
					0.2				
	0.25	SILTY CLAY - orange silty clay with some silt and some shale fragments (5-6cm), moist							
				D	0.4		PID<5		
					0.5				
	0.7	SHALY CLAY - light grey and red shaly clay							
				D	0.9		PID<5		
1					1.0				1
	1.05	SHALE - light grey shale							
22	1.1	Pit discontinued at 1.1m - target depth reached							

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 23.4 AHD
EASTING: 317155
NORTHING: 6257541

PIT No: TP32
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
23	0.03	FILLING - dark brown silty sandy clay filling with some roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some fine to medium gravel		D	0.1		PID<5		
					0.2				
	0.25	SILTY CLAY - orange silty clay with some silt and shale fragments (5-6cm)							
				D	0.4		PID<5		
	0.5	SHALY CLAY - light grey and red shaly clay			0.5				
				D	0.9		PID<5		
22	1.0	SHALE - light grey shale			1.0				1
	1.05	Pit discontinued at 1.05m - target depth reached							

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Elton Consultants
PROJECT: Parramatta Planning Proposal
LOCATION: 266 Victoria Road, Parramatta

SURFACE LEVEL: 24.2 AHD
EASTING: 317159
NORTHING: 6257551

PIT No: TP33
PROJECT No: 85556.00
DATE: 12/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
24	0.03	FILLING - dark brown silty sandy clay filling with roots (topsoil), grass at surface							
		FILLING - brown sandy clay filling with some fine to medium igneous gravel		D*	0.1		PID<5		
	0.2	SILTY CLAY - orange silty clay with some silt and shale fragments (6-8cm)							
				D	0.4		PID<5		
					0.5				
	0.8	SHALY CLAY - light grey and red shaly clay							
				D	0.9		PID<5		
	1				1.0				1
23	1.2	Pit discontinued at 1.2m - target depth reached							

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

RIG: John Deere 350SE backhoe - 500mm wide bucket

LOGGED: CB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD3-120816 taken at 0.1m to 0.2m

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

SAMPLING & IN SITU TESTING LEGEND

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

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