Waterbrook Lifestyle Resort
C/- Marchese Partners Engineering

Detailed Site Investigation:
Proposed Seniors Living Development,
Bayview Golf Course
Cabbage Tree Road, Bayview, NSW

P1706099JR01V02
November 2017

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

Limitations Statement

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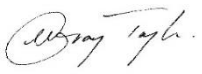
Andrew Mesthos	Gray Taylor Andrew Norris	Gray Taylor	

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Overview

1.1 Introduction

This report prepared by Martens and Associates (MA) documents the findings of a Detailed Site Investigation (DSI) to address potential land contamination at a proposed seniors living development at Cabbage Tree Road, Bayview, NSW. The investigation area ('the site') is part of the northern section of Lot 1 DP662920. The site boundaries are shown in Figure 1, Attachment A.

A preliminary site investigation (PSI) was previously completed by MA (2014) and should be read in conjunction with this report. Findings are summarised in Section 3 of this report.

1.2 Objectives

The objective of this report is to assess potential sources of site contamination identified in the PSI (2014), where access is available, and determine site suitability for the proposed development. In addition, the works were undertaken in conjunction with a geotechnical investigation (MA, 2017) for the same proposed development.

1.3 Project Scope

Scope of works included:

- Review of PSI (MA, 2014) and prepare sampling methodology.
- Intrusive soil investigation and soil sampling program where access is available, targeting areas of environmental concern (AECs) outlined in PSI (MA, 2014).
- Laboratory analyses of selected samples for identified contaminants of potential concern (COPC) and assessment against site acceptance criteria (SAC).
- Preparation of a report in general accordance with the relevant sections of ASC NEPM (1999, amended 2013), NSW OEH (2011) and DEC (2006).

1.4 Reference Guidelines

This assessment is prepared in general accordance with the following guidelines:

- ASC NEPC (1999, amended 2013) National Environmental Protection Measure, (NEPM 1999, amended 2013).
- NSW DEC (2006) 2nd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme.
- NSW OEH (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.

1.5 Abbreviations

ABC – Ambient background concentration

ACM – Asbestos containing material

AEC – Area of environmental concern

AF – Asbestos fines

ASC NEPM – Assessment of site contamination (National Environmental Protection Measure)

BGL – Below ground level

BTEXN – Benzene, toluene, ethyl benzene, xylene, naphthalene

CEC – Cation exchange capacity

COPC – Contaminants of potential concern

CSM – Conceptual site model

DEC – NSW Department of Environment and Conservation

DP – Deposited Plan

DQI – Data quality indicators

DQO – Data quality objective

DSI – Detailed site investigation

EIL – Ecological investigation levels

EPA – NSW Environmental Protection Authority

EQL – Estimated quantitation limit

ESL – Ecological screening levels

FA – Friable asbestos

GSW – General solid waste

HM – Heavy metals

LGA – Local government area

MA – Martens and Associates Pty Ltd

mbgl – Metres below ground level

NATA – National Association of Testing Authorities

NBC – Northern Beaches Council

OCP – Organochloride pesticides

OEH – NSW Office of Environment and Heritage

OPP – Organophosphate pesticides

PACM – Potential asbestos containing material

PAH – Polycyclic aromatic hydrocarbons

PCB – Polychlorinated biphenyl

PSI – Preliminary site investigation

RPD – Relative percentage difference – difference between two values divided by the average

SAC – Site acceptance criteria

SAQP – Sampling analytical and quality plan

SOP – Standard operating procedure

TCLP – Toxicity characteristic leaching procedure

TRH – Total recoverable hydrocarbons

UCL – Upper confidence limit

UST – Underground storage tank

VHC – Volatile halogenated compounds

VOC – Volatile organic compounds

2 Site Background Information

2.1 Site Location and Existing Land Use

General site information is summarised in Table 1 and site location shown in Figure 1, Attachment A.

Table 1: General site information.

Item	Description / Detail
Site address, lot/DP, and approximate area	Part of Lot 1 DP 662920 (north of Cabbage Tree Road Only) at Bayview Golf Club, Cabbage Tree Road, Bayview, NSW – approximately 1.99 ha.
Local Government Area (LGA)	Northern Beaches Council (NBC) (formerly Pittwater Council)
Current land use	The lot is currently zoned RE2 – Private Recreation. The site is currently used for private recreation (golf).
Proposed land use	Senior's living development
Site description	Site is currently used as part of the Bayview Golf Course. The site is developed and vegetated for golf course purposes. It is bordered by Cabbage Tree Road to the south and residential properties and native bushland to the north, east and west.
Surrounding land uses	Residential and native bushland to the north, east and west. Bayview Golf Course to the south and southwest.
Topography	Slopes at 10 – 15% to the south west. Site elevation varies from 4 mAHD in the south west to 38 mAHD in the site's north east.
Expected geology	The Sydney 1:100,000 Geological Sheet 9130 (NSW Dept. of Mineral Resources, 1983) identifies the site as being underlain by Newport Formation, comprised of the Narrabeen Group with interbedded laminate, shale and quartz, to lithic – quartz sandstone with clay pellet sandstone south of Hawkesbury River. The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Erina erosional landscape, consisting primarily of undulating to rolling rises and low hills on fine-grained sandstones and claystones of the Narrabeen Group. Soils are moderately deep to deep yellow to red podzolic soils on sandstone and shales. The mid to southern part of the site is identified as having Deep Creek fluvial soil landscapes, with level to gently undulating alluvial floodplain. Soils are deep podzols on well drained terraces.
Environmental Receptors	The investigation site generally drains toward an unnamed creek crossing the west and south western part of the site, eventually draining 50 m south to da, reservoirs on the Bayview Golf Course and Cahill Creek. Cahill Creek drains into Pittwater (1 km east).
Sensitive receptors	Neighbouring residential occupants. Future golfers playing adjacent to the site. Site workers during future construction works. Future residents and visitors.

2.2 Hydrogeology

Review of NSW Department of Primary Industries Water's (DPIW) database indicated eight groundwater bores within 500 m of the site (Table 2). Groundwater bore locations are shown in Figure 2 (Attachment A).

Table 2: Available hydrogeological information

Groundwater Bore Identification	Distance / Orientation From Site	Depth To Groundwater (mBGL)	Intended Use	Water Bearing Zone Substrate
GW014463	55 m south	ND [1]	Recreation (Groundwater)	ND [1]
GW111610	180 m south east	1.2	Recreation (Groundwater)	Silty sand black fill
GW106813	315 m east	11.4	Domestic	Sandstone
GW108934	315 m east	88.5	Domestic	ND [1]
GW108920	70 m north east	13.0	Domestic	ND [1]
GW108778	445 m north west	90.0	Domestic	Siltstone
GW105256	285 m west	18.0	Domestic	Sandstone
GW106327	440 m west	49.5	Domestic stock	Sandstone

Notes

[1] ND – No data available.

Current groundwater bores in the vicinity are used for recreation (groundwater) and domestic purposes.

Groundwater inflow was encountered only during drilling of BH101 at 5.0 mBGL (RL 0.8 mAHD). This borehole is located on the lower slopes of the site (near Cabbage Tree Road) underlain by alluvial sediments (silty clay) to about 0.0 mAHD. Groundwater inflow was not encountered during drilling of other boreholes, which were drilled into the residual soil unit (except for BH314), up to 8.5 mBGL or observed below this depth due to the introduction of drilling fluids during rock coring.

Groundwater wells (MW02, MW03 and MW05) were installed to depths of 12.0 m, 13.4 m and 15.0 m with slotted screen lengths of 6.0 m, 10.4 m and 9 m, respectively. Summary of groundwater level readings within monitoring wells, undertaken on September and October 2017, are provided in Table 3.

Table 3: Summary of groundwater levels at MW02, MW03 and MW05 (September and October 2017).

Date	Groundwater Level (mBGL)		
	MW02	MW03	MW05
21.09.17 (following installation) [1]	10.44	10.7	8.11
20.10.17	11.86	12.62	13.69

Notes:

[1] Readings are likely to have been influenced by inflow of drilling fluids introduced during rock coring.

We note that monitoring and recorded levels are within a dry period (i.e. no substantial rain in the last 3 months) and therefore these levels are considered not to be representative of the average or peak groundwater levels. Actual levels are likely to be 1 – 2 m greater than what was recorded on 21.10.17. To get a better understanding and more accurate assessment of groundwater levels / impacts through the site, groundwater level monitoring would need to be extended to cover 2 - 3 substantial at a minimum (i.e. greater than 10 mm of rain within 24 / 48 hrs).

Based on DPIW search results and field investigations we expect deep excavations, particularly in lower portions of the site, will intercept the permanent groundwater table. Groundwater level data loggers have been installed in monitoring wells and results of further monitoring will be provided in a letter after completion of readings to assess permanent water levels, where encountered.

3 Previous Site Investigation

A summary of key PSI (MA, 2014) findings is outlined in Table 4.

Table 4: Summary of previous site investigations.

Investigation Details	Investigation Task and Finding
Scope of works	o Research and review of available site information including EPA records, Council records and historic aerial photography. o Site walkover inspection. o Preparation of a PSI in general accordance with ASC NEPM (1999, amended 2013).
Current and historical site records key findings	o Available Council records show development applications for construction of a new club house and alterations and additions to an existing maintenance facility. Both of which are located outside the area of investigation. o A review of historic aerial photography showed private recreational land use since at least 1947. o No notices for the site were listed under the Contaminated Land Management Act (1997) or the Environmentally Hazardous Chemicals Act (1985). Three notices for eight sites were listed for the surrounding area in association with a Caltex Service Station at 79 Barrenjoey Road, Mona Vale, however due to distance (1.4 km – 1.7 km) from the site, none of the listed OEH sites are expected to have impacted the subject site.
Site walkover key findings	A walkover inspection (21 May 2014) provided the following observations: o Site vegetation comprised of vegetated corridors that run generally north to south adjacent to fairways. Vegetated zones also exist along the southern boundary adjacent to Cabbage Tree Road, and around the wetland, pond and creek areas. o Concrete and gravel pathways meander throughout the site. o An embankment along the southern boundary of the development area consists of fill from unknown source. o No evidence of contamination such as stockpiles, soil staining or odours. o Site infrastructure associated with the golf course design.

4 Conceptual Site Model

4.1 Areas of Environmental Concern

Our assessment of site AECs and COPCs (Table 5) is made on the basis of available site history, aerial photography interpretation and site walkovers. AEC locations are shown in Figure 3, Attachment B.

Table 5: Areas of environmental concern and contaminants of potential concern.

AEC [1]	Potential for Contamination	COPC	Contamination Likelihood
AEC A – Golf course areas	Pesticides, herbicides and heavy metals may be present due to historical use as a golf course.	TRH, BTEXN, PAH, OCP / OPP, phenyl acid, triazine and HM	Medium
AEC B – Fill embankment	Fill from unknown sources.	TRH, BTEXN, PAH, HM and asbestos	Medium - high

Notes

[1] Locations identified on AEC map in Figure 3, Attachment B.

4.2 Sensitive Receptors and Exposure Pathways

Table 6 provides a summary of identified sensitive receptors and potential exposure pathways connecting receptors to identified AECs and COPCs outlined in Table 4.

Table 6: Summary of receptors and potential pathways.

Receptor	Pathway
Human Receptors: o Future site residents and visitors. o Site workers during future construction works. o Neighbouring residential occupants. o Future golfers playing adjacent to the site.	o Dermal contact. o Oral ingestion of potentially contaminated soil. o Inhalation of airborne contaminants. o Migration of pollutants via site surface.
Environmental Receptors o Unnamed creek that eventually drains into Pittwater via Cahill Creek. o Existing site flora and fauna.	o Migration of contaminated runoff. o Direct contact with site flora and fauna.

5 Sampling, Analytical and Quality Plan (SAQP)

A SAQP has been developed to ensure that data collected for this DSI is representative and provides a robust basis for site assessment decisions. Preparation of the SAQP has been completed in general accordance with ASC NEPM (1999, amended 2013) methodology and includes:

- Data quality objectives.
- Sampling methodologies and procedures.
- Field screening methods.
- Sample handling, preservation and storage procedures.
- Analytical QA/QC.

5.1 Data Quality Objectives (DQO)

Data quality objectives (DQO) have been prepared as statements specifying qualitative and quantitative data required to support project decisions. DQO have been prepared in general accordance with NSW DEC (2006) guidelines and are presented in Table 7.

Table 7: Data quality objectives for the assessment of soil investigations.

Step 1 **Stating the Problem**	The proposed development will ultimately be used for low density residential purposes and will therefore be required to meet the most conservative land use criteria being residential land use with access to soil. This DSI is required to assess risk posed by potentially contaminated soil to onsite and offsite sensitive receptors.
Step 2 **Identifying the Decision(s)**	Historical investigations have identified AECs which may be the source of contamination including former golf course areas and fill material. To assess the suitability of the site for future residential use, decisions are to be made based on the following questions: o Is site soil quality suitable for the intended residential land use? o Has previous or current site use impacted the quality of site soils posing a human health risk during intended future land use including construction phase? o Do site soils require remediation or management to prior to onsite residential land use?
Step 3 **Identification of Inputs to the Decision**	The inputs to the assessment of site soil quality will include: o Soil sampling at nominated locations (where access is available) across the site. o Laboratory analytical results for relevant COPC. o Assessment of analytical results against site suitable human health and ecological risk criteria.
Step 4 **Study Boundary Definitions**	Study boundaries are as follows: o Lateral – Lateral boundary of the assessment is defined by the site boundary as indicated in Attachment A. o Vertical – Vertical boundary will be governed by the maximum depth reached during subsurface investigations. o Temporal – At this stage of investigation, only one round of sampling has been undertaken.
Step 5 **Development of Decision Rules**	The decision rule for this investigation area as follows: If the concentration of contaminants in the soil data exceeds the adopted assessment criteria; an assessment of the need to further investigate, remediate and or manage the onsite impacts in relation to the proposed development will be undertaken.
Step 6 **Specification of Limits on Decision Errors**	Guidance found in ASC NEPM (1999 amended 2013) Schedule B2 regarding 95% upper confidence limit (UCL) states that the 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than or equal to this value. Therefore a decision can be made based on a probability that 95% of the data collected will satisfy the site acceptance criteria. A limit on decision error will be 5% that a conclusive statement may be incorrect.
Step 7 **Optimisation of Sampling Design**	Proposed sampling locations shall provide even coverage across identified AEC on the site (with consideration to the existing golf course constraints). Sampling shall attempt to ensure that critical locations are assessed, sampled, and analysed for appropriate contaminants of concern. Soil sampling locations were set using a combined judgemental and grid pattern across the site (access permitting).

5.2 Data Quality Indicators (DQI)

In accordance with NSW DEC (2006), the investigation data set has been compared with Data Quality Indicators (DQI) outlined in Table 8 to ensure that collected data meets the project needs and that DQOs have been meet.

Table 8: Data Quality Indicators.

Assessment Measure (DQI)	Comment
Precision – A measure of the variability (or reproducibility) of data.	Precision is assessed by reviewing blind field duplicated sample set through the calculation of relative percent difference (RPD). Data precision is deemed acceptable where RPDs are less than 30%. Exceedance of this range is still considered acceptable where: o Results are less than 10 times the laboratory EQL. o Heterogeneous materials are sampled.
Accuracy – A measure of the closeness of reported data to the "true value".	Data accuracy is assessed by: o Method blanks. o Field spikes and blanks. o Laboratory control samples. o Matrix spikes.
Representativeness – The confidence that data are representative of each media present on the site.	To ensure data representativeness the following field and laboratory procedures are followed: o Ensure that the design and implementation of the sampling program has been completed in accordance with MA standard operating procedures (SOP). o Blank samples shall be used during field sampling to ensure no cross contamination or laboratory artefacts. o Ensure that all laboratory hold times are meet and that sample handling and transport is completed in accordance with MA SOP.
Completeness – A measure of the amount of usable data from a data collection activity.	To ensure data set completeness, the following is required: o Confirmation that all sampling methodology was completed in general accordance with MA SOP. o COC and receipt forms. o Results from all laboratory QA/QC samples (Lab blanks, matrix spikes, lab duplicates). o NATA accreditation stamp on all laboratory reports.
Comparability - The confidence that data may be considered to be equivalent for each sampling and analytical event.	Data comparability is maintained by ensuring that: o All site sampling events are undertaken following methodologies outlined in MA SOP and published guidelines. o NATA accredited laboratory methodologies shall be followed on all laboratory testing.

5.3 Investigation and Sampling Methodology and Quality Assurance / Quality Control

Site investigation and soil sampling methodology (Table 9) was completed to meet the project DQOs.

Table 9: Investigation and sampling methodology.

Activity	Detail / Comments
Fieldworks	Subsurface investigations were completed on 20 September 2017, and involved the excavation of boreholes and the collection of surface samples.
Soil sampling	Soil sampling was completed by the supervising MA environmental engineer. Each sample was placed into a laboratory-supplied, acid-rinsed 250mL glass jar, labelled with a unique identification number and no headspace to limit volatile loss. A clean pair of disposable gloves was used when handling each sample.
Sample compositing	Four triple composite and two double composite samples were collected across the golf course areas.
QA / QC sampling	Duplicate samples were collected at a rate of approximately 1 in 10 samples for intra-laboratory analysis. 3 soil duplicate samples were collected during investigations. Blank and trip spike samples were used during sampling.
Sample handling and transportation	Sample collection, storage and transport were conducted according to MA SOP. Collected samples were placed immediately into an ice chilled cooler-box. Samples were dispatched to NATA-accredited laboratories under chain of custody documentation within holding times.
Decontamination of sampling equipment	Sampling auger and spade were washed between sampling locations (where required) with potable water to limit potential for cross contamination.

A review of QA/QC procedure has been completed and is presented in the data validation report (Attachment E). The report concludes that data is suitable for the purposes of the assessment.

5.4 Investigation Program

An overview of the soil investigation and soil sampling program is provided in Table 10. Soil sampling methodology is outlined in detail in Section 5.3. A detailed soil sampling plan is provided in Figure 4, Attachment B.

Table 10: Investigation Program

Investigation dates	20 September, 2017
Number of sampling points and coverage	7 borehole samples across the fill embankment. 21 surface samples collected from the golf course fairways.
Investigation method	4WD – ute mounted drill rig, hand auger and spade.

5.5 Laboratory Analytical Suite

Laboratory analysis was carried out by Envirolab Pty Ltd a NATA accredited laboratory. Laboratory analytical documentation is presented in Attachment C. Soil laboratory analysis is summarised in Table 11.

Table 11: Summary of primary soil laboratory analyses.

COC	Number of Primary Samples Analysed
pH	3
CEC	3
PCB	7
BTEXN	7
TRH	7
PAH	7
Herbicides (Phenoxy Acid and Triazine)	21
OPP	28
OCP	28
Heavy metals[1]	28

Notes:
[1] Heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc.

6 Site Assessment Criteria

6.1 Overview

The site assessment criteria (SAC) adopted for this DSI have been derived from the following source:

- ASC NEPM (1999, amended 2013) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM).

Guideline values for individual contaminants analysed for this assessment are presented in laboratory tables in Attachment D.

Table 12 summarises the applicability of the SAC adopted for this investigation.

Table 12: Summary of SAC.

Media	Adopted Guidelines	Applicability
Soil	ASC NEPM (1999, amended 2013) Soil HILs, EILs, HSLs, ESLs and TPH Management Limits	Health Investigation Levels (HILs) HIL A – residential land use with access to soil Ecological Investigation Levels (EIL) Site EILs have been calculated using methodology outlined in ASC NEPM (1999, amended 2013). Cation exchange capacity (CEC) and pH physiochemical properties results were averaged for EIL calculations. Ambient background concentrations (ABC) have been taken from Olszowy et al. (1995) for aged contamination in low traffic areas in NSW. Ecological Screening Levels (ESLs) ESLs for coarse grained soils in urban residential and open spaces (ASC NEPM 1999, amended 2013) have been adopted based on site lithology and as a conservative measure. Health Screening Levels (HSL) HSLs A – residential land use for sand (ASC NEPM 1999, amended 2013) have been adopted based on site lithology and as a conservative measure. Management Limits TPH management levels for coarse grained material have been selected based on site lithology and as a conservative measure. Asbestos Due to the preliminary nature of this assessment, the presence / absence of all forms of asbestos has been adopted as SAC.

7 Results

7.1 Field Observations

7.1.1 Natural Lithology

A summary of typical natural lithology observations is presented in Table 13. Detailed borehole logs are presented in Attachment F.

Table 13: Summary of natural soils.

Lithology [1]	Depth Range (mBGL) [2]
Top Soil: Silt, sandy silt and silty sand, pale to dark brown	0.0 – 0.7
Alluvium: Sandy clay and clay, dark brown and pale grey / red (BH314)	1.5 – 2.5
Residual: Clay, sandy clay, silty clay and sandy silt, pale yellow to brown, orange, red and grey	0.15 – 3.7
Weathered Rock: Sandstone with claystone and siltstone bands, pale pink to red, brown and grey	0.6 +

Notes:
[1] See borehole / test pit logs for detailed material description.
[2] Indicative depth range. Material depth may vary across the site depending on site and local geological conditions.

7.1.2 Fill Observations

Fill was encountered in limited sections across the golf course to approximately 0.3 mBGL. The fill is likely site won reworked native soil (clay, sandy clay, silty clay and sandy silt, pale yellow to brown, orange, red and grey).

Fill emplaced within the embankment along the northern border of Cabbage Tree Road was encountered to 1.5 mBGL and in previous MA (2014) site investigation to 5.0 m. The fill is likely site won reworked native soil surface (silt, silty to sandy clays, clay and silty to clayey sand, brown, red and grey in colour). The fill within BH314 is most likely associated with fill placed for pavement levelling and construction.

No anthropogenic inclusions, soil staining or hydrocarbon odours were detected within the fill during investigations. Detailed borehole logs are provided in Attachment F.

7.1.3 Asbestos in Material

Asbestos was not identified during PSI or DSI investigations.

7.2 Laboratory Analytical Results

The following sections summarise the results of soil laboratory analysis for samples taken (Table 14). Detailed tabulated results showing individual sample concentrations compared to adopted SAC values are available in Attachment D. Laboratory analytical documentation is available in Attachment C.

Table 14: Summary of soil laboratory results.

Analyte	Results Compared to SAC
Heavy Metals	HILs All results below SAC. EILs All results below SAC.
TPH/BTEXN	HILs All results below SAC. EILs All results below SAC.
OCP/OPP	HILs All results below SAC. EILs All results below SAC.
PCB	HILs All results below SAC. EILs All results below SAC.
PAH	HILs All results below SAC. EILs All results below SAC.
Asbestos	All results below SAC.

8 Discussions

Laboratory results (Envirolab report 176282) indicate all soil contaminant concentrations are below the adopted SAC.

9 Conclusions and Recommendations

Laboratory results indicated all contaminant concentrations below the adopted SAC for the proposed seniors living development, Bayview Golf Course, Cabbage Tree Road. No other potential contamination was observed as part of this assessment. We consider that the area for the proposed seniors living development within the northern section of Lot 1 DP 662920, Bayview Golf Course is suitable for the proposed development.

Prior to any soil material being removed from site, a formal waste classification assessment is required in accordance with NSW EPA Waste Classification Guidelines (2014).

10 Limitation Statement

This DSI was undertaken generally in accordance with current industry standards.

It is important to note that no land contamination study can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of potential contamination or all past potentially contaminating land-uses. This is particularly the case where significant past site earthworks have occurred. Therefore, this report should not be read as a guarantee that only contamination identified shall be found on the site. Should material be exposed in future which appears to be contaminated, additional testing may be required to determine the implications for the site.

Martens & Associates Pty Ltd has undertaken this assessment for the purposes of assessing potential site contamination. No reliance on this report should be made for any other investigation or proposal. Martens & Associates accepts no responsibility, and provides no guarantee regarding the characteristics of areas of the site not specifically studied in this investigation.

11 References

ASC NEPM (1999, amended 2013) National Environmental Protection Measure, (site contamination measure)

Martens & Associates (2014) *Stage 1 Environmental Site Assessment: Proposed Seniors Living Development, Bayview Golf Course, Cabbage Tree Road, Bayview, NSW* (P1404179JR02V01)

Martens & Associates (2017) *Geotechnical and Acid Sulfate Soils Assessment: Proposed Seniors Living Development, Cabbage Tree Road, Bayview, NSW* (P1706099JR02V01)

Nearmaps (2007)

NSW Department of Environment & Heritage (eSPADE, NSW soil and land information), www.environment.nsw.gov.au

NSW Department of Mineral Resources, (1983) *Sydney 1:100,000 Geological Sheet 9130*

NSW DPI Water groundwater database, accessed September, 2017, http://allwaterdata.water.nsw.gov.au/water.stm

NSW EPA (1995) *Sampling Design Guidelines*

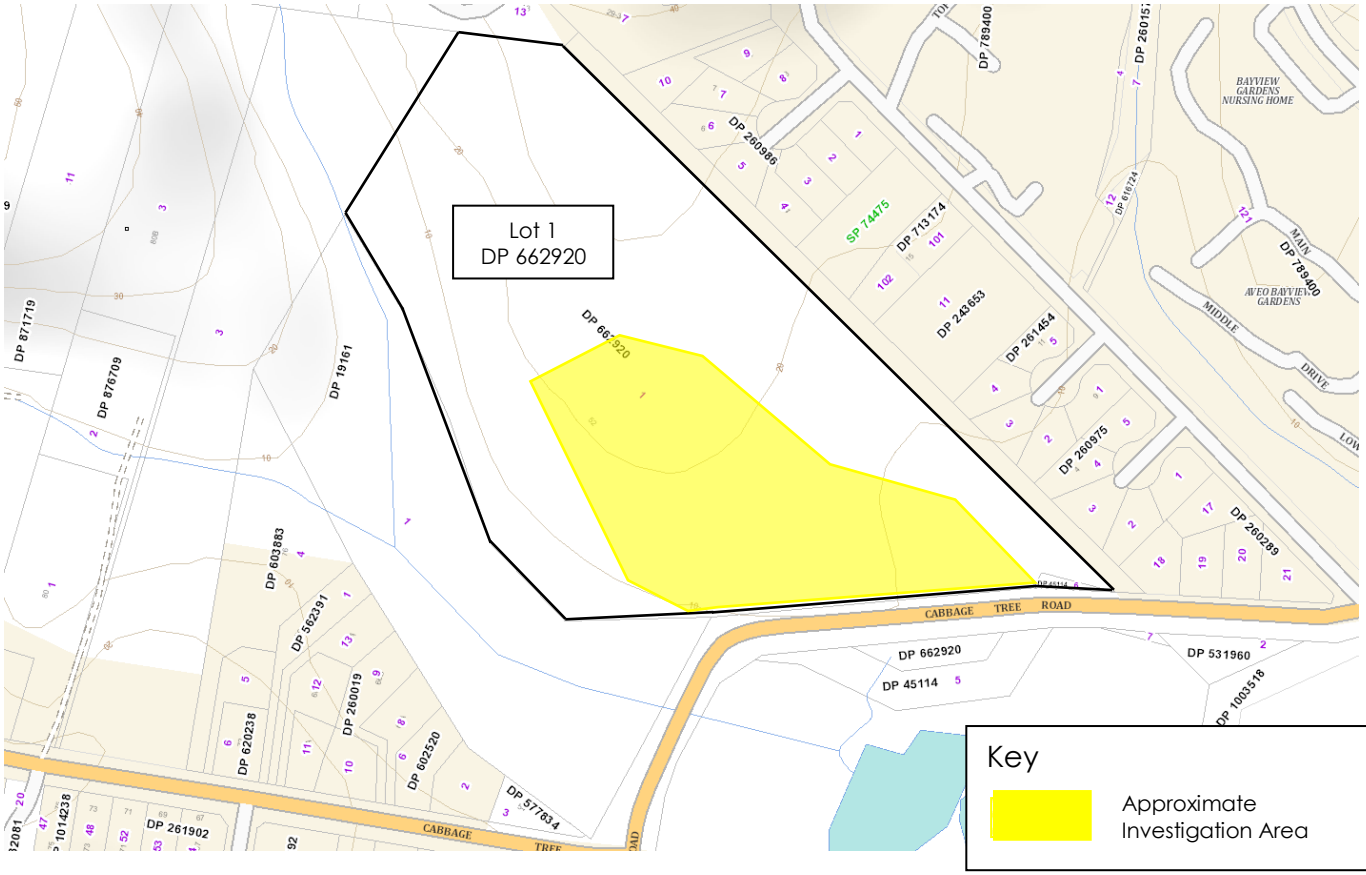
NSW Land and Property Information (LPI) - Aerial photographs (1947, 1956, 1982, 2005)

NSW OEH (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites

NSW SIX – Spatial Information Exchange – Land & Property Information https://six.nsw.gov.au/wps/portal/

Pittwater Council (now Northern Beaches Council) – DA/BA/CC records (2014)

12 Attachment A – Figures 1 and 2



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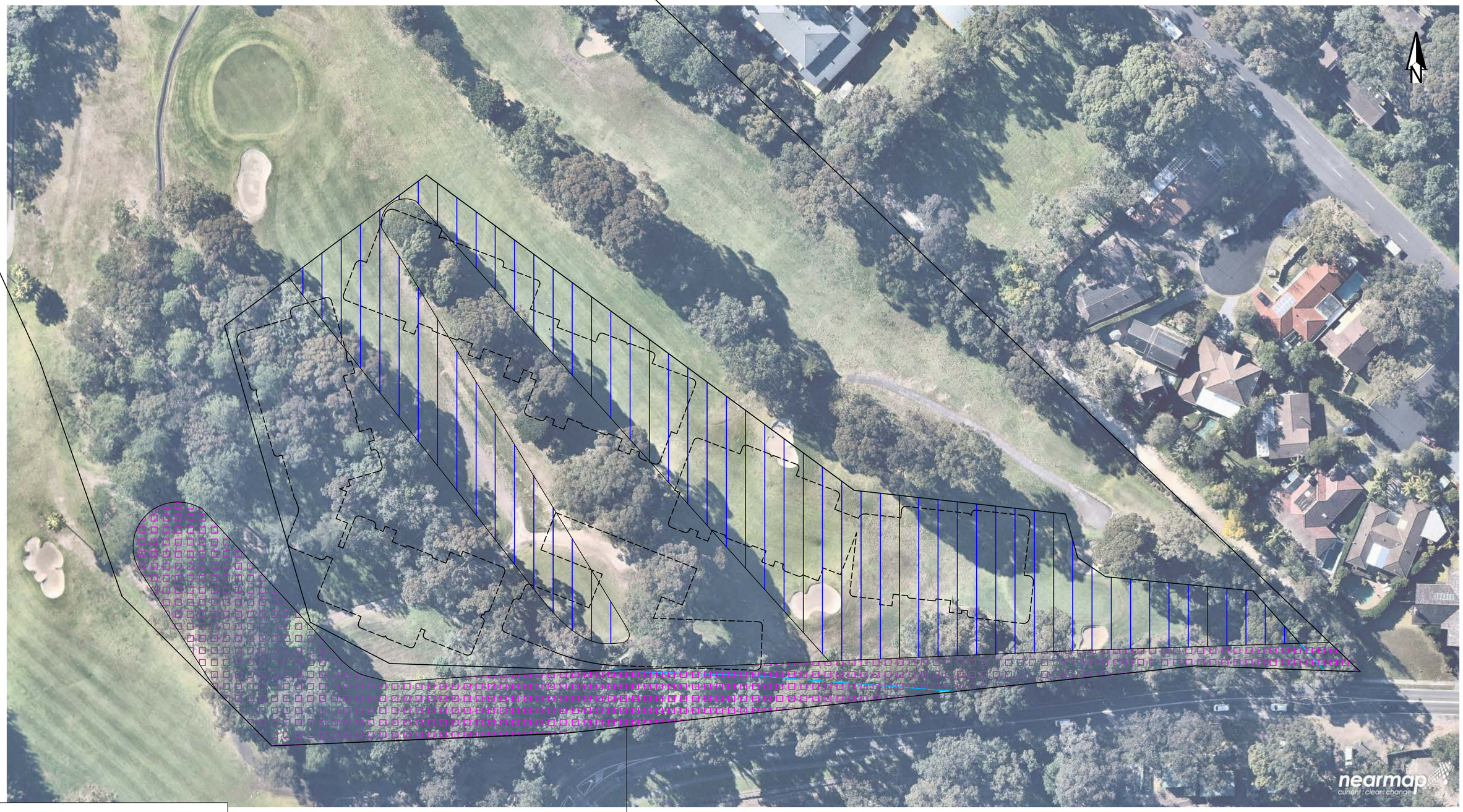
Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	AM	**Site Location** **Bayview Golf Course, NSW** **Source: NSW SIX Viewer, 2017 (bottom)**	Drawing No: FIGURE 1
Approved:	GT		
Date:	29.09.2017		
Scale:	Not to Scale		Job No: P1706099JR01V02

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	AM	**Groundwater Bore Locations Cabbage Tree Road, Bayview, NSW Source: Department of Primary Industries Office of Water 2017**	Drawing No: FIGURE 2
Approved:	GT		
Date:	29.09.2017		
Scale:	Not to Scale		Job No: P1706099JR01V02

13 Attachment B – AEC and Testing Locations



SITE BOUNDARY

KEY

AEC A- GOLF COURSE (FAIRWAYS)

AEC B - FILL EMBANKMENT

BUILDING OUTLINE

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	23/10/2017	KW	AM	GT	

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

DISCLAIMER & COPYRIGHT

This plan must not be used for construction unless signed as approved by principal certifying authority.

All measurements in millimetres unless otherwise specified.

CLIENT
WATERBROOK LIFESTYLE RESORT

PROJECT NAME/PLANSET TITLE
ENGINEERING WORKS
GEOTECHNICAL & ENVIRONMENTAL INVESTIGATION
CABBAGE TREE ROAD, BAYVIEW, NSW

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

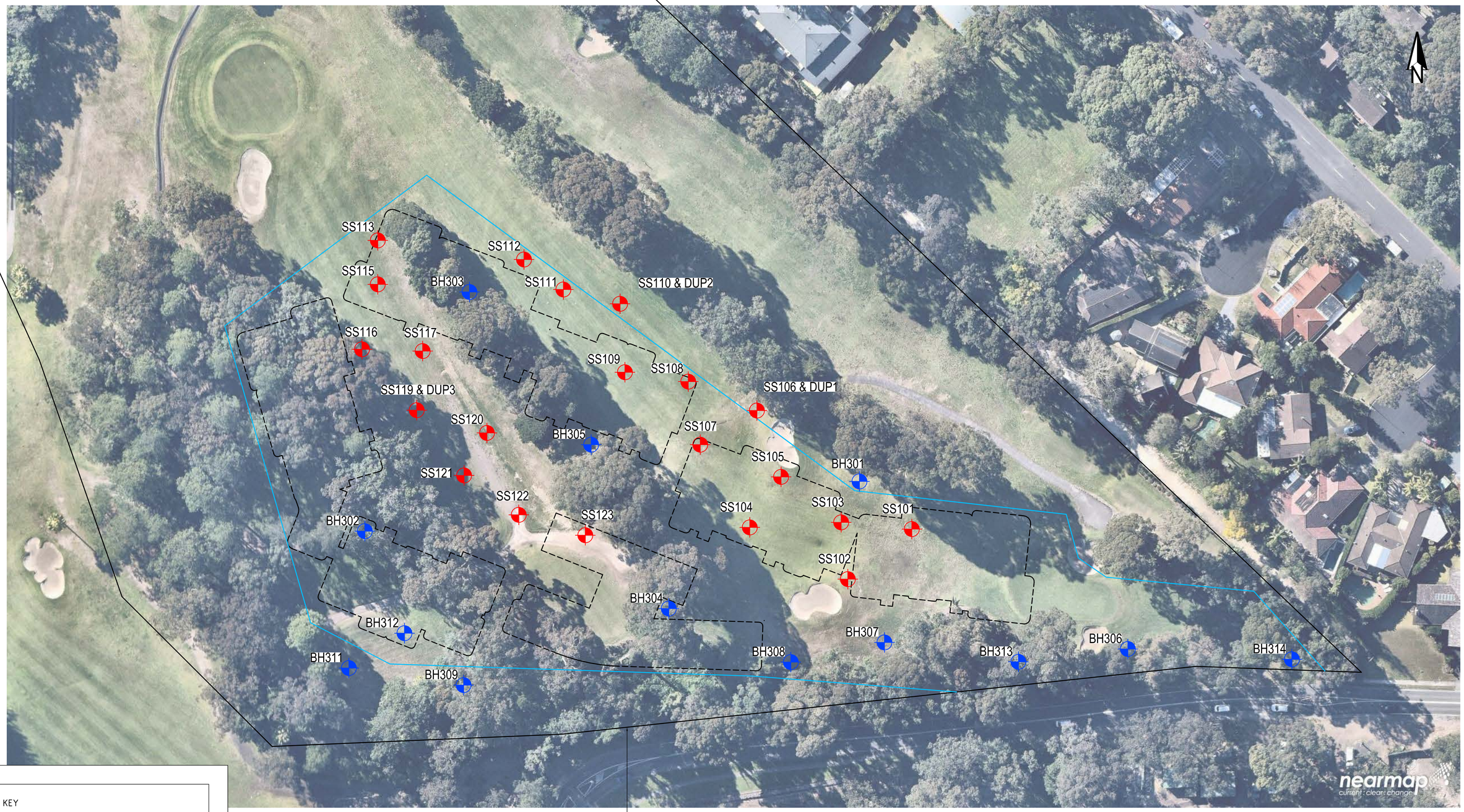
DRAWING TITLE
FIGURE 3: INVESTIGATION LOCATIONS & AEC MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706099	PS01	R01	PS01-J110	A

DRAWING ID: P1706099-PS01-R01-J110

PRINTED: --- USER: KWONG

A1 / A3 LANDSCAPE (A1LC_v02.0.01)



KEY

- SURFACE SAMPLE
- BOREHOLE
- DEVELOPMENT ENVELOPE
- AREA OF INVESTIGATION
- BUILDING OUTLINE

SITE BOUNDARY

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	23/10/2017	KW	AM	GT	

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT
WATERBROOK LIFESTYLE RESORT

PROJECT NAME/PLANSET TITLE
ENGINEERING WORKS
GEOTECHNICAL & ENVIRONMENTAL INVESTIGATION
CABBAGE TREE ROAD, BAYVIEW, NSW

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
SITE TESTING
FIGURE 4: INVESTIGATION LOCATIONS

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706099	PS01	R01	PS01-J100	A

PRINTED: ---- - USER: KWANG
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1706099-PS01-R01-J100

14 Attachment C – Laboratory Analytical Certificates

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

CERTIFICATE OF ANALYSIS 176282

Client Details

Client	Martens & Associates Pty Ltd
Attention	Andrew Mesthos, Gray Taylor
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P1706099 - Contamination Investigation at Cabbage**
Number of Samples	63 soil
Date samples received	22/09/2017
Date completed instructions received	21/09/2017

Analysis Details

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

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

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

Report Details

Date results requested by	29/09/2017
Date of Issue	29/09/2017

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Report Comments

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 176282-31 for Pb. Therefore a triplicate result has been issued as laboratory sample number 176282-64.

Acid Herbicides & Triazine Herbicides analysed by MPL Laboratories. Report No.201085.

Results Approved By
Dragana Tomas, Senior Chemist
Jacinta Hurst, Laboratory Manager, Sydney
Ken Nguyen, Senior Chemist
Long Pham, Team Leader, Metals
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Chemist

Authorised By

David Springer, General Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	99	118	123	96	91

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		176282-49	176282-51	176282-55	176282-56
Your Reference	UNITS	6099 / BH314	6099 / BH314	6099 / TS	6099 / TB
Composite Reference		--	--	--	--
Depth		0.2	0.8	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017
TRH C_6 - C_9	mg/kg	<25	<25	[NA]	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	[NA]	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	[NA]	[NA]
Benzene	mg/kg	<0.2	<0.2	86%	<0.2
Toluene	mg/kg	<0.5	<0.5	86%	<0.5
Ethylbenzene	mg/kg	<1	<1	89%	<1
m+p-xylene	mg/kg	<2	<2	89%	<2
o-Xylene	mg/kg	<1	<1	88%	<1
Total +ve Xylenes	mg/kg	<1	<1	[NT]	<1
naphthalene	mg/kg	<1	<1	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	%	123	102	88	84

svTRH (C10-C40) in Soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	82	88	85	83	81

svTRH (C10-C40) in Soil			
Our Reference		176282-49	176282-51
Your Reference	UNITS	6099 / BH314	6099 / BH314
Composite Reference		--	--
Depth		0.2	0.8
Date Sampled		21/09/2017	21/09/2017
Type of sample		soil	soil
Date extracted	-	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	82	80

PAHs in Soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	82	84	86	85	84

PAHs in Soil			
Our Reference		176282-49	176282-51
Your Reference	UNITS	6099 / BH314	6099 / BH314
Composite Reference		--	--
Depth		0.2	0.8
Date Sampled		21/09/2017	21/09/2017
Type of sample		soil	soil
Date extracted	-	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Total +ve PAH's	mg/kg	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	84	84

Organochlorine Pesticides in soil						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	81	88	77	83	70

Organochlorine Pesticides in soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	79	81	88	93	86

Organochlorine Pesticides in soil						
Our Reference		176282-49	176282-51	176282-58	176282-59	176282-60
Your Reference	UNITS	6099 / BH314	6099 / BH314	Composite 1	Composite 2	Composite 3
Composite Reference		--	--	1+2+3	4+5+6	7+8+9
Depth		0.2	0.8	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	0.4	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	0.5	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	0.4	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	72	74	85	81	82

Organochlorine Pesticides in soil				
Our Reference		176282-61	176282-62	176282-63
Your Reference	UNITS	Composite 4	Composite 5	Composite 6
Composite Reference		10+11	12+13	14+15+16
Depth		--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017
HCB	mg/kg	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	76	77	80

Organophosphorus Pesticides						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	81	88	77	83	70

Organophosphorus Pesticides						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	79	81	88	93	86

Organophosphorus Pesticides						
Our Reference		176282-49	176282-51	176282-58	176282-59	176282-60
Your Reference	UNITS	6099 / BH314	6099 / BH314	Composite 1	Composite 2	Composite 3
Composite Reference		--	--	1+2+3	4+5+6	7+8+9
Depth		0.2	0.8	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	72	74	85	81	82

Organophosphorus Pesticides				
Our Reference		176282-61	176282-62	176282-63
Your Reference	UNITS	Composite 4	Composite 5	Composite 6
Composite Reference		10+11	12+13	14+15+16
Depth		--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	76	77	80

PCBs in Soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	79	81	88	93	86

PCBs in Soil			
Our Reference		176282-49	176282-51
Your Reference	UNITS	6099 / BH314	6099 / BH314
Composite Reference		--	--
Depth		0.2	0.8
Date Sampled		21/09/2017	21/09/2017
Type of sample		soil	soil
Date extracted	-	26/09/2017	26/09/2017
Date analysed	-	28/09/2017	28/09/2017
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	72	74

Acid Extractable metals in soil						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	6	5	6	7	2
Copper	mg/kg	6	4	4	3	2
Lead	mg/kg	7	9	9	9	2
Mercury	mg/kg	0.2	<0.1	1.1	0.2	<0.1
Nickel	mg/kg	4	2	2	2	2
Zinc	mg/kg	35	21	19	12	4

Acid Extractable metals in soil						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Arsenic	mg/kg	6	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	17	14	9	12	16
Copper	mg/kg	10	1	4	<1	1
Lead	mg/kg	12	8	12	5	9
Mercury	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Nickel	mg/kg	10	<1	2	1	<1
Zinc	mg/kg	19	9	63	2	3

Acid Extractable metals in soil						
Our Reference		176282-49	176282-51	176282-52	176282-53	176282-58
Your Reference	UNITS	6099 / BH314	6099 / BH314	6099 / DUP1	6099 / DUP2	Composite 1
Composite Reference		--	--	--	--	1+2+3
Depth		0.2	0.8	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Arsenic	mg/kg	<4	<4	<4	<4	4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	14	3	7	6	6
Copper	mg/kg	11	<1	7	4	5
Lead	mg/kg	10	3	10	10	9
Mercury	mg/kg	<0.1	<0.1	0.2	<0.1	1.4
Nickel	mg/kg	14	<1	5	2	2
Zinc	mg/kg	27	<1	43	19	38

Acid Extractable metals in soil						
Our Reference		176282-59	176282-60	176282-61	176282-62	176282-63
Your Reference	UNITS	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6
Composite Reference		4+5+6	7+8+9	10+11	12+13	14+15+16
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	6	5	8	5	6
Copper	mg/kg	7	2	4	3	5
Lead	mg/kg	9	9	12	8	6
Mercury	mg/kg	3.2	<0.1	2.2	0.1	<0.1
Nickel	mg/kg	3	2	3	2	3
Zinc	mg/kg	40	13	19	13	16

Acid Extractable metals in soil		
Our Reference		176282-64
Your Reference	UNITS	6099 / BH306 - [TRIPLICATE]
Composite Reference		--
Depth		0.2
Date Sampled		21/09/2017
Type of sample		soil
Date prepared	-	26/09/2017
Date analysed	-	26/09/2017
Arsenic	mg/kg	8
Cadmium	mg/kg	<0.4
Chromium	mg/kg	16
Copper	mg/kg	10
Lead	mg/kg	13
Mercury	mg/kg	<0.1
Nickel	mg/kg	13
Zinc	mg/kg	22

Misc Inorg - Soil				
Our Reference		176282-17	176282-19	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 112	6099 / ss / 120
Composite Reference		--	--	--
Depth		--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil
Date prepared	-	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017
pH 1:5 soil:$CaCl_2$	pH Units	4.7	5.1	5.7

CEC				
Our Reference		176282-17	176282-19	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 112	6099 / ss / 120
Composite Reference		--	--	--
Depth		--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil
Date prepared	-	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017
Exchangeable Ca	meq/100g	2.4	10	1.1
Exchangeable K	meq/100g	0.2	0.8	<0.1
Exchangeable Mg	meq/100g	0.82	4.5	0.12
Exchangeable Na	meq/100g	<0.1	0.12	<0.1
Cation Exchange Capacity	meq/100g	3.5	16	1.2

Triazine Herbicides in Soil						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Ametryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Atrazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Cyanazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexazinone	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Prometryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Simazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Terbutryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Propazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Irgarol	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Metribuzine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Terbutylazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	106	108	110	104	100

Triazine Herbicides in Soil						
Our Reference		176282-58	176282-59	176282-60	176282-61	176282-62
Your Reference	UNITS	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5
Composite Reference		1+2+3	4+5+6	7+8+9	10+11	12+13
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Ametryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Atrazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Cyanazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexazinone	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Prometryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Simazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Terbutryn	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Propazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Irgarol	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Metribuzine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Terbutylazine	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	104	104	110	108	106

Triazine Herbicides in Soil		
Our Reference		176282-63
Your Reference	UNITS	Composite 6
Composite Reference		14+15+16
Depth		--
Date Sampled		21/09/2017
Type of sample		soil
Date extracted	-	27/09/2017
Date analysed	-	28/09/2017
Ametryn	mg/kg	<0.5
Atrazine	mg/kg	<0.5
Cyanazine	mg/kg	<0.5
Hexazinone	mg/kg	<0.5
Prometryn	mg/kg	<0.5
Simazine	mg/kg	<0.5
Terbutryn	mg/kg	<0.5
Propazine	mg/kg	<0.5
Irgarol	mg/kg	<0.5
Metribuzine	mg/kg	<0.5
Terbutylazine	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	106

Phenoxy Acid Herbicides in Soil						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Clopyralid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3,5-Dichlorobenzoic acid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
o-chlorophenoxy acetic acid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-CPA	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dicamba	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPP	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPA	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dichlorprop	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoxynil	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Triclopyr	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-TP	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-T	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPB	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dinoseb	mg/kg	<1	<1	<1	<1	<1
2,4-DB	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ioxynil	mg/kg	<1	<1	<1	<1	<1
Picloram	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
DCPA (Chlorthal) Diacid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acifluorfen	mg/kg	<2	<2	<2	<2	<2
2,4,6-T	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-D	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate 2.4- DCPA	%	110	110	110	110	110

Phenoxy Acid Herbicides in Soil						
Our Reference		176282-58	176282-59	176282-60	176282-61	176282-62
Your Reference	UNITS	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5
Composite Reference		1+2+3	4+5+6	7+8+9	10+11	12+13
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Date analysed	-	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Clopyralid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3,5-Dichlorobenzoic acid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
o-chlorophenoxy acetic acid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-CPA	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dicamba	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPP	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPA	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dichlorprop	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoxynil	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Triclopyr	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-TP	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-T	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
MCPB	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dinoseb	mg/kg	<1	<1	<1	<1	<1
2,4-DB	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ioxynil	mg/kg	<1	<1	<1	<1	<1
Picloram	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
DCPA (Chlorthal) Diacid	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acifluorfen	mg/kg	<2	<2	<2	<2	<2
2,4,6-T	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-D	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate 2.4- DCPA	%	110	110	110	110	110

Phenoxy Acid Herbicides in Soil		
Our Reference		176282-63
Your Reference	UNITS	Composite 6
Composite Reference		14+15+16
Depth		--
Date Sampled		21/09/2017
Type of sample		soil
Date extracted	-	27/09/2017
Date analysed	-	28/09/2017
Clopyralid	mg/kg	<0.5
3,5-Dichlorobenzoic acid	mg/kg	<0.5
o-chlorophenoxy acetic acid	mg/kg	<0.5
4-CPA	mg/kg	<0.5
Dicamba	mg/kg	<0.5
MCPP	mg/kg	<0.5
MCPA	mg/kg	<0.5
Dichlorprop	mg/kg	<0.5
2,4-D	mg/kg	<0.5
Bromoxynil	mg/kg	<0.5
Triclopyr	mg/kg	<0.5
2,4,5-TP	mg/kg	<0.5
2,4,5-T	mg/kg	<0.5
MCPB	mg/kg	<0.5
Dinoseb	mg/kg	<1
2,4-DB	mg/kg	<0.5
Ioxynil	mg/kg	<1
Picloram	mg/kg	<0.5
DCPA (Chlorthal) Diacid	mg/kg	<0.5
Acifluorfen	mg/kg	<2
2,4,6-T	mg/kg	<0.5
2,6-D	mg/kg	<0.5
Surrogate 2.4- DCPA	%	110

Moisture						
Our Reference		176282-17	176282-18	176282-19	176282-20	176282-21
Your Reference	UNITS	6099 / ss / 106	6099 / ss / 110	6099 / ss / 112	6099 / ss / 119	6099 / ss / 120
Composite Reference		--	--	--	--	--
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Moisture	%	16	28	12	7.0	0.4

Moisture						
Our Reference		176282-31	176282-37	176282-38	176282-43	176282-45
Your Reference	UNITS	6099 / BH306	6099 / BH308	6099 / BH309	6099 / BH311	6099 / BH312
Composite Reference		--	--	--	--	--
Depth		0.2	0.2	0.1	0.5	0.8
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Moisture	%	19	9.6	8.1	7.7	17

Moisture						
Our Reference		176282-49	176282-51	176282-52	176282-53	176282-58
Your Reference	UNITS	6099 / BH314	6099 / BH314	6099 / DUP1	6099 / DUP2	Composite 1
Composite Reference		--	--	--	--	1+2+3
Depth		0.2	0.8	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Moisture	%	10	12	18	23	10

Moisture						
Our Reference		176282-59	176282-60	176282-61	176282-62	176282-63
Your Reference	UNITS	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6
Composite Reference		4+5+6	7+8+9	10+11	12+13	14+15+16
Depth		--	--	--	--	--
Date Sampled		21/09/2017	21/09/2017	21/09/2017	21/09/2017	21/09/2017
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	26/09/2017	26/09/2017	26/09/2017	26/09/2017	26/09/2017
Date analysed	-	27/09/2017	27/09/2017	27/09/2017	27/09/2017	27/09/2017
Moisture	%	27	14	41	14	14

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-061	Analysed by Envirolab Melbourne
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.

Method ID	Methodology Summary
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			27/09/2017	31	27/09/2017	27/09/2017		27/09/2017	27/09/2017
TRH C_6 - C_9	mg/kg	25	Org-016	<25	31	<25	<25	0	91	90
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	31	<25	<25	0	91	90
Benzene	mg/kg	0.2	Org-016	<0.2	31	<0.2	<0.2	0	89	86
Toluene	mg/kg	0.5	Org-016	<0.5	31	<0.5	<0.5	0	90	98
Ethylbenzene	mg/kg	1	Org-016	<1	31	<1	<1	0	92	85
m+p-xylene	mg/kg	2	Org-016	<2	31	<2	<2	0	91	90
o-Xylene	mg/kg	1	Org-016	<1	31	<1	<1	0	92	93
naphthalene	mg/kg	1	Org-014	<1	31	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	94	31	99	118	18	96	121

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	31	<50	<50	0	109	104
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	31	<100	<100	0	105	99
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	31	<100	<100	0	106	84
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	31	<50	<50	0	109	104
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	31	<100	<100	0	105	99
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	31	<100	<100	0	106	84
Surrogate o-Terphenyl	%		Org-003	86	31	82	82	0	96	88

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Naphthalene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	96	94
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	112	109
Phenanthrene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	103	99
Anthracene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	96	93
Pyrene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	101	97
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	113	108
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	31	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	31	<0.05	<0.05	0	121	111
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	89	31	82	84	2	112	109

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			28/09/2017	31	28/09/2017	28/09/2017		28/09/2017	28/09/2017
HCB	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	87	87
gamma-BHC	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	87	83
Heptachlor	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	82	81
delta-BHC	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	79	79
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	78	77
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	86	86
Dieldrin	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	93	93
Endrin	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	81	80
pp-DDD	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	94	93
Endosulfan II	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	77	77
Methoxychlor	mg/kg	0.1	Org-005	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	92	31	79	84	6	90	92

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	51	26/09/2017	26/09/2017		[NT]	[NT]
Date analysed	-			[NT]	51	28/09/2017	28/09/2017		[NT]	[NT]
HCB	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-005	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	[NT]	51	74	82	10	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			28/09/2017	31	28/09/2017	28/09/2017		28/09/2017	28/09/2017
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	82	73
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	77	79
Dimethoate	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	88	94
Fenitrothion	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	100	108
Malathion	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	87	84
Parathion	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	109	101
Ronnel	mg/kg	0.1	Org-008	<0.1	31	<0.1	<0.1	0	95	81
Surrogate TCMX	%		Org-008	92	31	79	84	6	85	72

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	51	26/09/2017	26/09/2017		[NT]	[NT]
Date analysed	-			[NT]	51	28/09/2017	28/09/2017		[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-008	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-008	[NT]	51	74	82	10	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date extracted	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			28/09/2017	31	28/09/2017	28/09/2017		28/09/2017	28/09/2017
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	102	103
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	31	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	92	31	79	84	6	85	72

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	51	26/09/2017	26/09/2017		[NT]	[NT]
Date analysed	-			[NT]	51	28/09/2017	28/09/2017		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	[NT]	51	74	82	10	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	176282-37
Date prepared	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Date analysed	-			26/09/2017	31	26/09/2017	26/09/2017		26/09/2017	26/09/2017
Arsenic	mg/kg	4	Metals-020	<4	31	6	8	29	113	98
Cadmium	mg/kg	0.4	Metals-020	<0.4	31	<0.4	<0.4	0	109	103
Chromium	mg/kg	1	Metals-020	<1	31	17	23	30	111	101
Copper	mg/kg	1	Metals-020	<1	31	10	12	18	114	109
Lead	mg/kg	1	Metals-020	<1	31	12	21	55	107	98
Mercury	mg/kg	0.1	Metals-021	<0.1	31	<0.1	<0.1	0	102	107
Nickel	mg/kg	1	Metals-020	<1	31	10	10	0	106	100
Zinc	mg/kg	1	Metals-020	<1	31	19	25	27	108	100

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	51	26/09/2017	26/09/2017		[NT]	[NT]
Date analysed	-			[NT]	51	26/09/2017	26/09/2017		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	51	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	51	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	51	3	3	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	51	<1	<1	0	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	51	3	3	0	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	51	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	51	<1	<1	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	51	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			27/09/2017	[NT]	[NT]	[NT]	[NT]	27/09/2017	[NT]
Date analysed	-			27/09/2017	[NT]	[NT]	[NT]	[NT]	27/09/2017	[NT]
pH 1:5 soil:$CaCl_2$	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			27/09/2017	[NT]	[NT]	[NT]	[NT]	27/09/2017	[NT]
Date analysed	-			27/09/2017	[NT]	[NT]	[NT]	[NT]	27/09/2017	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: Triazine Herbicides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	176282-20
Date extracted	-			27/09/2017	18	27/09/2017	27/09/2017		27/09/2017	27/09/2017
Date analysed	-			28/09/2017	18	28/09/2017	28/09/2017		28/09/2017	28/09/2017
Ametryn	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Atrazine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	89	95
Cyanazine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Hexazinone	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Prometryn	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	88	97
Simazine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Terbutryn	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Propazine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	91	96
Irgarol	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Metribuzine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Terbutylazine	mg/kg	0.5	Org-012	<0.5	18	<0.5	<0.5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-061	110	18	108	106	2	98	98

QUALITY CONTROL: Triazine Herbicides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	63	27/09/2017	27/09/2017		[NT]	[NT]
Date analysed	-			[NT]	63	28/09/2017	28/09/2017		[NT]	[NT]
Ametryn	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Atrazine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Cyanazine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Hexazinone	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Prometryn	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Simazine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Terbutryn	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Propazine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Irgarol	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Metribuzine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Terbutylazine	mg/kg	0.5	Org-012	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-061	[NT]	63	106	108	2	[NT]	[NT]

QUALITY CONTROL: Phenoxy Acid Herbicides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	176282-59
Date extracted	-			27/09/2017	58	27/09/2017	27/09/2017		27/09/2017	27/09/2017
Date analysed	-			28/09/2017	58	28/09/2017	28/09/2017		28/09/2017	28/09/2017
Clopyralid	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
3,5-Dichlorobenzoic acid	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
o-chlorophenoxy acetic acid	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
4-CPA	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Dicamba	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	98	102
MCPP	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	101	121
MCPA	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	100	113
Dichlorprop	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
2,4-D	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	94	105
Bromoxynil	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Triclopyr	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
2,4,5-TP	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
2,4,5-T	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	94	102
MCPB	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Dinoseb	mg/kg	1	Ext-054	<1	58	<1	<1	0	[NT]	[NT]
2,4-DB	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Ioxynil	mg/kg	1	Ext-054	<1	58	<1	<1	0	[NT]	[NT]
Picloram	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
DCPA (Chlorthal) Diacid	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Acifluorfen	mg/kg	2	Ext-054	<2	58	<2	<2	0	[NT]	[NT]
2,4,6-T	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
2,6-D	mg/kg	0.5	Ext-054	<0.5	58	<0.5	<0.5	0	[NT]	[NT]
Surrogate 2.4- DCPA	%		Ext-054	100	58	110	110	0	108	114

QUALITY CONTROL: Phenoxy Acid Herbicides in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	63	27/09/2017	27/09/2017		[NT]	[NT]
Date analysed	-			[NT]	63	28/09/2017	28/09/2017		[NT]	[NT]
Clopyralid	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
3,5-Dichlorobenzoic acid	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
o-chlorophenoxy acetic acid	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
4-CPA	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Dicamba	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
MCPP	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
MCPA	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Dichlorprop	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
2,4-D	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Bromoxynil	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Triclopyr	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
2,4,5-TP	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
2,4,5-T	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
MCPB	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Dinoseb	mg/kg	1	Ext-054	[NT]	63	<1	<1	0	[NT]	[NT]
2,4-DB	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Ioxynil	mg/kg	1	Ext-054	[NT]	63	<1	<1	0	[NT]	[NT]
Picloram	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
DCPA (Chlorthal) Diacid	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Acifluorfen	mg/kg	2	Ext-054	[NT]	63	<2	<2	0	[NT]	[NT]
2,4,6-T	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
2,6-D	mg/kg	0.5	Ext-054	[NT]	63	<0.5	<0.5	0	[NT]	[NT]
Surrogate 2.4- DCPA	%		Ext-054	[NT]	63	110	110	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

15 Attachment D – Laboratory Summary Tables

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	BTEX							PAH/Phenols																TPH									
	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Carcinogenic PAHs (as B(a)P TPE)	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Picloram	Pyrene	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29-C36	C10 - C40 (Sum of total)	C6-C10
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.2	1	0.5	2	1	1	25	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.5	0.1	50	100	100	50	25	50	100	100	50	25
NEPM 2013 Table 1A(1) HILs Res A Soil																	3						4500										
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																	
0-1m	0.5	55	160			40	45														3						110						
1-2m	0.5	NL	220			60	70														NL						240						
2-4m	0.5	NL	310			95	110														NL						440						
>4m	0.5	NL	540			170	200														NL						NL						
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																																	
0-2m	50	70	85			105	180					0.7													300	2800	120						
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																								1000	2500	10000							700

Field_ID	LocCode	Sample_Depth_Range	Sampled_Date-Time	Matrix_Description																															
6099 / BH306	6099 / BH306	0.2	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH308	6099 / BH308	0.2	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH309	6099 / BH309	0.1	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH311	6099 / BH311	0.5	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH312	6099 / BH312	0.8	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH314	6099 / BH314	0.2	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / BH314	6099 / BH314	0.8	21/09/2017		<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6099 / ss / 106	6099 / ss / 106		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
6099 / ss / 110	6099 / ss / 110		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
6099 / ss / 112	6099 / ss / 112		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
6099 / ss / 119	6099 / ss / 119		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
6099 / ss / 120	6099 / ss / 120		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 1	Composite 1		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 2	Composite 2		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 3	Composite 3		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 4	Composite 4		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 5	Composite 5		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-
Composite 6	Composite 6		21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-

Statistical Summary

Number of Results	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	11	7	7	7	7	7	7	7	7	7	7	7
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.1	0.5	0.25	1	0.5	0.5	13	0.05	0.05	0.05	0.05	0.025	0.05	0.05	0.05	0.086	0.05	0.05	0.05	0.05	0.05	0.25	0.05	25	50	50	25	13	25	50	50	25	13
Median Concentration	0.1	0.5	0.25	1	0.5	0.5	12.5	0.05	0.05	0.05	0.05	0.025	0.05	0.05	0.05	0.086	0.05	0.05	0.05	0.05	0.05	0.25	0.05	25	50	50	25	12.5	25	50	50	25	12.5
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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				Herbicides																											Pesticides	Polychlorinated Biphenyls								
				2,4,5-Trichlorophenoxy Acetic Acid	2,4,5-TP (Silvex)	Hedonal	2,4-dichlorophenoxybutanoic acid	2,4-Dichlorprop	2,4,6-Trichlorophenoxy-acetic acid	2-Chlorophenoxyacetic acid	4-Chlorophenoxy acetic acid	Ametryn	Acifluorfen	Atrazine	Bromoxynil	Clopyralid	Cyanazine	Dicamba	Dinoseb	Hexazinone	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid	Mecoprop	Prometryn	Propazine	Simazine	Terbutryn	Triclopyr	Parathion	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Sum of total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Res A Soil				600		900								320							600	600	600															1
Field_ID	**LocCode**	**Sample_Depth_Range**	**Sampled_Date-Time**	**Matrix_Description**																																			
6099 / BH306	6099 / BH306	0.2	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH308	6099 / BH308	0.2	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH309	6099 / BH309	0.1	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH311	6099 / BH311	0.5	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH312	6099 / BH312	0.8	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH314	6099 / BH314	0.2	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH314	6099 / BH314	0.8	21/09/2017		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 106	6099 / ss / 106		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
6099 / ss / 110	6099 / ss / 110		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
6099 / ss / 112	6099 / ss / 112		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
6099 / ss / 119	6099 / ss / 119		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
6099 / ss / 120	6099 / ss / 120		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 1	Composite 1		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 2	Composite 2		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 3	Composite 3		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 4	Composite 4		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 5	Composite 5		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Composite 6	Composite 6		21/09/2017		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-
Statistical Summary																																						
Number of Results				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	18	7	7	7	7	7	7	7	7
Number of Detects				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Minimum Detect				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Maximum Detect				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	0.25	0.25	0.25	0.25	0.25	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Median Concentration				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	0.25	0.25	0.25	0.25	0.25	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Standard Deviation				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

					Lead	Metals						
					Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					1	4	0.4	1	1	0.1	1	1
NEPM 2013 Table 1A(1) HILs Res A Soil					300	100	20		6000	40	400	7400
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil												
Site Specific EIL					1100	100			120		75	270
Field_ID	**LocCode**	**Sample_Depth_Range**	**Sampled_Date-Time**	**Matrix_Description**								
6099 / BH306	6099 / BH306	0.2	21/09/2017		12	6	<0.4	17	10	<0.1	10	19
6099 / BH306TRIP	6099 / BH306TRIP	0.2	21/09/2017		13	8	<0.4	16	10	<0.1	13	22
6099 / BH308	6099 / BH308	0.2	21/09/2017		8	<4	<0.4	14	1	<0.1	<1	9
6099 / BH309	6099 / BH309	0.1	21/09/2017		12	<4	<0.4	9	4	0.2	2	63
6099 / BH311	6099 / BH311	0.5	21/09/2017		5	<4	<0.4	12	<1	<0.1	1	2
6099 / BH312	6099 / BH312	0.8	21/09/2017		9	<4	<0.4	16	1	<0.1	<1	3
6099 / BH314	6099 / BH314	0.2	21/09/2017		10	<4	<0.4	14	11	<0.1	14	27
6099 / BH314	6099 / BH314	0.8	21/09/2017		3	<4	<0.4	3	<1	<0.1	<1	<1
6099 / ss / 106	6099 / ss / 106		21/09/2017		7	<4	<0.4	6	6	0.2	4	35
6099 / ss / 110	6099 / ss / 110		21/09/2017		9	<4	<0.4	5	4	<0.1	2	21
6099 / ss / 112	6099 / ss / 112		21/09/2017		9	<4	<0.4	6	4	1.1	2	19
6099 / ss / 119	6099 / ss / 119		21/09/2017		9	<4	<0.4	7	3	0.2	2	12
6099 / ss / 120	6099 / ss / 120		21/09/2017		2	<4	<0.4	2	2	<0.1	2	4
Composite 1	Composite 1		21/09/2017		9	4	<0.4	6	5	1.4	2	38
Composite 2	Composite 2		21/09/2017		9	<4	<0.4	6	7	3.2	3	40
Composite 3	Composite 3		21/09/2017		9	<4	<0.4	5	2	<0.1	2	13
Composite 4	Composite 4		21/09/2017		12	<4	<0.4	8	4	2.2	3	19
Composite 5	Composite 5		21/09/2017		8	<4	<0.4	5	3	0.1	2	13
Composite 6	Composite 6		21/09/2017		6	<4	<0.4	6	5	<0.1	3	16
Statistical Summary												
Number of Results					19	19	19	19	19	19	19	19
Number of Detects					19	3	0	19	17	8	16	18
Minimum Concentration					2	<4	<0.4	2	<1	<0.1	<1	<1
Minimum Detect					2	4	ND	2	1	0.1	1	2
Maximum Concentration					13	8	<0.4	17	11	3.2	14	63
Maximum Detect					13	8	ND	17	11	3.2	14	63
Average Concentration					8.5	2.6	0.2	8.6	4.4	0.48	3.6	20
Median Concentration					9	2	0.2	6	4	0.05	2	19
Standard Deviation					2.9	1.6	0	4.7	3.2	0.88	4	16
Number of Guideline Exceedances					0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0

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					Organochlorine Pesticides																					Organophosphorous Pesticides														
					4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Azinophos methyl	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Ronnel
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Res A Soil														240					10			6		300			160											
Field_ID	**LocCode**	**Sample_Depth_Range**	**Sampled_Date-Time**	**Matrix_Description**																																			
6099 / BH306	6099 / BH306	0.2	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH308	6099 / BH308	0.2	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH309	6099 / BH309	0.1	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH311	6099 / BH311	0.5	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH312	6099 / BH312	0.8	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH314	6099 / BH314	0.2	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / BH314	6099 / BH314	0.8	21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 106	6099 / ss / 106		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 110	6099 / ss / 110		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 112	6099 / ss / 112		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 119	6099 / ss / 119		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6099 / ss / 120	6099 / ss / 120		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 1	Composite 1		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 2	Composite 2		21/09/2017		<0.1	<0.1	<0.1	<0.1	0.5	0.4	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 3	Composite 3		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 4	Composite 4		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 5	Composite 5		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Composite 6	Composite 6		21/09/2017		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Statistical Summary																																						
Number of Results					18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Number of Detects					0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Minimum Detect					ND	ND	ND	ND	0.5	0.4	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration					<0.1	<0.1	<0.1	<0.1	0.5	0.4	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Maximum Detect					ND	ND	ND	ND	0.5	0.4	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration					0.05	0.05	0.05	0.05	0.075	0.069	0.05	0.05	0.05	0.05	0.069	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Median Concentration					0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Standard Deviation					0	0	0	0	0.11	0.082	0	0	0	0	0.082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

16 Attachment E – Data Validation Report

DATA VALIDATION REPORT: Proposed Seniors Living Development, Bayview Golf Course

1. Sample Handling

	Yes	No (Comments below)
a. Were sample holding times met?	✓	
b. Were samples in proper custody between the field and reaching the laboratory?	✓	
c. Were the samples properly and adequately preserved?	✓	
d. Were the samples received by the laboratory in good condition?	✓	

COMMENTS

Sample handling is:

- ✓ **Satisfactory**
- **Partially Satisfactory**
- **Unsatisfactory**

2. Precision / Accuracy Statement

	Yes	No (Comments below)
a. Was a NATA registered laboratory used?	✓	
b. Did the laboratory perform the requested tests?	✓	
c. Were laboratory methods adopted NATA endorsed?	✓	
d. Were appropriate test procedures followed?	✓	
e. Were reporting limits satisfactory?	✓	
f. Was the NATA Seal on the reports?	✓	
g. Were reports signed by an authorised person?	✓	

COMMENTS

Precision / Accuracy of the Laboratory Report:	✓	**Satisfactory**
		Partially Satisfactory
		Unsatisfactory

3. Field Quality Assurance / Quality Control (QA/QC)

	Media	Number
a. Number of Primary Samples analysed *(does not include duplicates)*	Soil:	18
	Water:	-
	Material	-
b. Number of days of sampling	1	

c. Number and Type of QA/QC Samples analysed	Soil	Water
Intra-Laboratory Field Duplicates	2	
Inter-Laboratory Field triplicates	-	
Trip Blanks	1	
Field Rinsate	-	
Other (Field Blanks, Spikes, etc.)	1	

Comments

1 x Trip Spike

18 Primary samples analysed that include 6 composites (four triple composites and two double composites).

DATA VALIDATION REPORT: Proposed Seniors Living Development, Bayview Golf Course

Field Duplicates

	Yes	No (Comments below)
Adequate Numbers of intra-laboratory field duplicates analysed?	✓	
Adequate Numbers of inter-laboratory field duplicates analysed?	-	-
Were field duplicate RPDs within Control Limits?		
i. Organics	N/A	
ii. Metals / Inorganics	✓	
iii. Nutrients	N/A	

COMMENTS

DATA VALIDATION REPORT: Proposed Seniors Living Development, Bayview Golf Course

Summary of Quality Assurance / Quality Control (QA/QC)

QA/QC Type	Satisfactory	Partially Satisfactory	Unsatisfactory
Sample handling	✓		
Precision / Accuracy of the Laboratory Report	✓		
Field QA / QC	✓		
Laboratory Internal QA / QC	✓		

Data Usability

1. Data directly usable ✓
2. Data usable with the following corrections/modifications *(see comment below)*
3. Data not usable.

COMMENTS

DATA VALIDATION REPORT: Proposed Seniors Living Development, Bayview Golf Course

Field Duplicates (soil)

SDG	ENVIROLAB 2017-09-22T00:00:00	ENVIROLAB 2017-09-22T00:00:00	**RPD**	ENVIROLAB 2017-09-22T00:00:00	ENVIROLAB 2017-09-22T00:00:00	**RPD**
Field ID	6099 / ss / 106	6099 / DUP1		6099 / ss / 110	6099 / DUP2	
Sampled Date/Time	21/09/2017	21/09/2017		21/09/2017	21/09/2017	

Method_Type	**ChemName**	**Units**	**EQL**						
Moisture	Moisture	%	0.1	16.0	18.0	12	28.0	23.0	20
8 metals in soil	Lead	mg/kg	1	7.0	10.0	35	9.0	10.0	11
	Arsenic	mg/kg	4	<4.0	<4.0	0	<4.0	<4.0	0
	Cadmium	mg/kg	0.4	<0.4	<0.4	0	<0.4	<0.4	0
	Chromium (III+VI)	mg/kg	1	6.0	7.0	15	5.0	6.0	18
	Copper	mg/kg	1	6.0	7.0	15	4.0	4.0	0
	Mercury	mg/kg	0.1	0.2	0.2	0	<0.1	<0.1	0
	Nickel	mg/kg	1	4.0	5.0	22	2.0	2.0	0
	Zinc	mg/kg	1	35.0	43.0	21	21.0	19.0	10

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL)

17 Attachment F – Detailed Borehole Logs

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH301**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	15 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	NORTHING		ASPECT	East	SLOPE 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L-M	Not Encountered	0	15.00	6099/BH301/0.2/S/1 D 0.20 m			ML	TOPSOIL: Sandy SILT, low liquid limit, dark brown.		St - VSt	TOPSOIL
				0.70								
				14.30				CL	Sandy CLAY, low plasticity, pale orange/brown.			RESIDUAL SOIL
			1	*1.10*	6099/BH301/0.9/S/1 D 0.90 m							
				13.90				CL	Silty CLAY, low plasticity, pale yellow, with sand.		VSt and H	
				1.60						D		
AD/T	M		2	13.40					SANDSTONE, medium grained, pale yellow, trace claystone bands, inferred extremely low and very low strength, distinctly weathered.			WEATHERED ROCK 1.60: V-bit refusal.
				2.50	6099/BH301/2.4/R/1 D 2.40 m							
				12.50					Pale pink/white.			
			3	*3.00*					Hole Terminated at 3.00 m			
			4									
			5									
			6									
			7									
			8									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH302**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	AM	CHECKED	RE	Sheet 1 OF 3
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.7 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 12.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
	L			***0.15***				ML	TOPSOIL: SILT, low liquid limit, brown, with fine grained sand.	D		TOPSOIL
				19.55	P6099/302/0.1/S/1 D 0.10 m			CL	Silty CLAY, low plasticity, dark brown and red, with subangular sandstone gravels (<7mm).		F and St	RESIDUAL SOIL
AD/V					P6099/302/0.3/S/1 D 0.30 m							
	L-M									M		
					P6099/302/0.8/S/1 D 0.80 m						VSt	
			1		P6099/302/0.9/S/1 D 0.90 m							
				1.20								
				18.50					SANDSTONE, fine grained, light grey/red/brown/orange, with bands of claystone/siltstone, inferred extremely low and very low strength, distinctly weathered.			WEATHERED ROCK 1.20: V-bit refusal.
AD/T	M	Not Observed	2									
				2.80								
			3						Continued as Cored Borehole			
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF BH303**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 3
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	24.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 13.40 m depth	NORTHING		ASPECT	SE	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				24.50				ML	TOPSOIL: SILT, low liquid limit, pale brown.			TOPSOIL
AD/V	L-M	Not Observed		*0.30* 24.20	P6099/303/0.2/S/1 D 0.20 m			CL	Silty CLAY, low plasticity, brown.	D	St - VSt	RESIDUAL SOIL
				0.70 23.80	P6099/303/0.5/S/1 D 0.50 m							
AD/T	M		1		P6099/303/0.8/R/1 D 0.80 m				SANDSTONE, medium to coarse grained, pale orange/yellow/brown, inferred extremely low and very low strength, with medium strength ironstone bands, distinctly weathered.			WEATHERED ROCK 0.70: V-bit refusal.
	H				P6099/303/1.5/R/1 D 1.50 m							
			2	*2.62*								
									Continued as Cored Borehole			
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH304**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	16.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 8.50 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				16.50								
AD/V				*0.30* 16.20	P6099/304/0.2/S/1 D 0.20 m			ML	FILL: Sandy SILT, low liquid limit, dark brown, with organic material.		St - VSt	FILL
	L			*0.60* 15.90	P6099/304/0.5/S/1 D 0.50 m			ML	TOPSOIL: SILT, low liquid limit, dark red/dark brown, trace subangular sandstone gravels.			TOPSOIL
			1	*1.10* 15.40	P6099/304/1.0/S/1 D 1.00 m			SC	Clayey SAND, dark orange/brown, trace iron staining.	D	D	RESIDUAL SOIL
	M				P6099/304/1.5/R/1 D 1.50 m				SANDSTONE, fine to medium grained, red/grey/white, inferred extremely low to very low strength, distinctly weathered.			WEATHERED ROCK 1.10: V-bit refusal.
			2		P6099/304/1.9/R/1 D 1.90 m							
			3	*3.00* 13.50					With claystone/siltstone bands.			
AD/T	L-M	Not Encountered	4									
			5									
			6									
			7									
			8									
				8.50					Hole Terminated at 8.50 m			

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF BH305**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	AM	CHECKED	RE	Sheet 1 OF 3
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 15.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Observed		19.90 ***0.20***	P6099/305/0.1/S/1 D 0.10 m			ML	TOPSOIL: SILT, low liquid limit, brown, trace of fine grained sand, with subangular sandstone gravels.		St	TOPSOIL
				19.70	P6099/305/0.3/S/1 D 0.30 m			SM	TOPSOIL: Silty SAND, fine grained, brown/orange/red, with clay and trace of subangular sandstone gravels.		D	
	L-M			***0.60***								
AD/T	M		1 2	19.30 ***2.80***	P6099/305/0.7/R/1 D 0.70 m				SANDSTONE, fine grained, orange/red/grey, with claystone and siltstone bands, inferred extremely low and very low strength, distinctly weathered.	D		WEATHERED ROCK 0.60: V-bit refusal.
			3 4 5 6 7 8						Continued as Cored Borehole			

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort	COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH306**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment	LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW	GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT	4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	7 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 2.80 m depth	NORTHING		ASPECT	Northeast	SLOPE 5-10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		6.95 *0.25* 6.75	6099/BH306/0.2/S/1 D 0.20 m 6099/BH306/0.3/S/1 D 0.30 m 6099/BH306/0.3-0.6/CBR CBR 0.30 m			SM CI CH	FILL: Silty SAND, fine to medium grained, brown. FILL: Sandy CLAY, medium plasticity, orange/brown. CLAY, high plasticity, pale brown/white.		MD St and VSt	FILL RESIDUAL SOIL
			1	*1.00* *1.10* 5.90	6099/BH306/1.0/S/1 D 1.00 m			CH	Mottled red/grey. CLAY, high plasticity, pale brown/grey.	M	St - VSt	
	L-M				6099/BH306/1.5/S/1 D 1.50 m							
			2	*2.00* 5.00	6099/BH306/2.2/S/1 D 2.20 m			CL-CI	Silty CLAY, low to medium plasticity, red/brown, trace subangular gravels.		H	
				2.80	P6099/BH306/2.7/S/1 D 2.70 m				Hole Terminated at 2.80 m			
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH307**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	8.8 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.10 m depth	NORTHING		ASPECT	South	SLOPE 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				8.80				SM	TOPSOIL: Silty SAND, brown, fine grained.		MD	TOPSOIL
				0.20								
AD/V	M	Not Encountered		8.60	6099/BH307/0.25/S/1 D 0.25 m			SC	Clayey SAND, medium grained, pale yellow/grey.	D	D - VD	RESIDUAL SOIL
	H		1	*1.10*								
									Hole Terminated at 1.10 m			1.10: V-bit refusal on inferred very low strength sandstone.
			2									
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH308**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	11.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.50 m depth	NORTHING		ASPECT	Southeast	SLOPE 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0	11.90	6099/BH308/0.2/S/1 D 0.20 m			SM	FILL: Silty SAND, fine grained, brown, sub angular gravels.		D	FILL
	H			*0.75*								
AD/T	VH		1	11.15				SC	FILL: Clayey SAND, fine to medium grained, red/brown, with sandstone gravels.			0.75: V-bit refusal on inferred sandstone boulder within soil profile.
				1.20								
	H			10.70					SANDSTONE, medium to coarse grained, orange/brown, white, inferred extremely low and very low strength, with medium strength bands, distinctly weathered.	D		WEATHERED ROCK
	M		2	*2.50*								
									Hole Terminated at 2.50 m			
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH309**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	DO	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		Hand Auger	EASTING		RL SURFACE	15.1 m	DATUM AHD
EXCAVATION DIMENSIONS		⌀75 mm x 0.50 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	L-M	Not Encountered		15.10	P6099/309/0.1/S/1 D 0.10 m			ML	TOPSOIL: SILT, low liquid limit, brown, with fine gravels.	D	St - VSt	TOPSOIL
				0.35	P6099/309/0.3/S/1 D 0.30 m							
	H			*0.50*	P6099/309/0.4/S/1 D 0.40 m			CL	Silty CLAY, low plasticity, brown/red, with sandstone gravels.			RESIDUAL SOIL
									Hole Terminated at 0.50 m			0.50: Hand auger refusal on sandstone bands within soil profile.

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH311**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	DO	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		Hand Auger	EASTING		RL SURFACE	11.1 m	DATUM AHD
EXCAVATION DIMENSIONS		⌀75 mm x 0.80 m depth	NORTHING		ASPECT	South	SLOPE 10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	M-H	Not Encountered		11.10	P6099/311/0.1/D/1 D 0.10 m			ML	FILL: SILT, low liquid limit, brown, with organic materials, trace of fine grained sand.	D - M	VSt - H	FILL
				0.40 10.70	P6099/311/0.3/S/1 D 0.30 m			ML	TOPSOIL: SILT, low liquid limit, brown, trace of clay, with fine to medium gravels.			TOPSOIL
				0.65 *0.80*	P6099/311/0.5/S/1 D 0.50 m			CL	CLAY, low plasticity, brown/red, with fine to medium grained gravels, trace of fine grained sand.			RESIDUAL SOIL
			1						Hole Terminated at 0.80 m			0.80: Hand auger refusal due high resistance.
			2									
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH312**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	17.2 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.70 m depth	NORTHING		ASPECT	South	SLOPE 5-10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered		17.20				SM	FILL: Silty SAND, dark brown, fine grained, trace shells and clay.	D	MD	FILL
				0.30 16.90	6099/BH312/0.2/S/1 D 0.20 m			CI	FILL: Silty CLAY, medium plasticity, dark brown, trace red staining.			
	L		1		6099/BH312/0.8/S/1 D 0.80 m						St	
				1.20 16.00				CI	CLAY, medium plasticity, pale orange/brown.			RESIDUAL SOIL
				1.65 15.55	6099/BH312/1.4/S/1 D 1.40 m			SC	Clayey SAND, fine to medium grained, pale red/brown.	M		
	M		2								D - VD	
			3	*3.00* 14.20	6099/BH312/3.0/S/1 D 3.00 m				with clay bands.			
				3.70					Hole Terminated at 3.70 m			
			4									
			5									
			6									
			7									
			8									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

martens
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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort	COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH313**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment	LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW	GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT	4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	7 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 4.50 m depth	NORTHING		ASPECT	Southeast	SLOPE 9%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T		Not Encountered		7.00				SM	TOPSOIL: Silty SAND, fine grained, brown.		MD	TOPSOIL
				0.30	6099/BH313/0.2/S/1 D 0.20 m							
				6.70	6099/BH313/0.5/S/1 D 0.50 m			SC	Clayey SAND, fine to medium grained, orange/brown, with subangular sandstone gravels.		D and VD	RESIDUAL SOIL
	M		1	*1.10*								
	H			5.90					SANDSTONE, fine to medium grained, red/brown, inferred extremely low and very low strength, with medium strength bands, distinctly weathered.	D		WEATHERED ROCK
			2									
			3									
			4	*4.50*								
									Hole Terminated at 4.50 m			
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF BH314**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	3.2 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.50 m depth	NORTHING		ASPECT	East	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	H	Not Encountered		3.20				SM	FILL: Silty SAND, fine grained, brown, trace fine to medium subangular igneous gravel, trace clay.			FILL
					6099/BH314/0.2/S/1 D 0.20 m							
				0.40								
				2.80	6099/BH314/0.3-0.6/CBR CBR 0.30 m			SP	FILL: SAND, brown, fine grained, trace subangular gravels.	D	D	
				0.60								
				2.60	6099/BH314/0.5/S/1 D 0.50 m			SP	FILL: SAND, fine grained, dark brown, with clay, trace fine to medium subangular gravels.			
					6099/BH314/0.8/S/1 D 0.80 m							
			1	*1.00*				SC	FILL: Clayey SAND, fine grained, dark brown.		MD	
	L			2.20								
				1.50								
				1.70				CI	Sandy CLAY, medium plasticity, dark brown.	M	St	ALLUVIUM
			2		6099/BH314/2.0/S/1 D 2.00 m							
				2.30								
				0.90				CH	CLAY high plasticity, pale grey/red, with sand.			
				2.50	6099/BH314/2.4/S/1 D 2.40 m							
									Hole Terminated at 2.50 m			
			3									
			4									
			5									
			6									
			7									
			8									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF MW02**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	AM	CHECKED	RE	Sheet 1 OF 2
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.7 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 12.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
	L			*0.15* 19.55	P6099/302/0.1/S/1 D 0.10 m			ML	TOPSOIL: SILT, low liquid limit, brown, with fine grained sand.	D		MW02
AD/V	L-M				P6099/302/0.3/S/1 D 0.30 m			CL	Silty CLAY, low plasticity, dark brown and red, with subangular sandstone gravels (<7mm).	M	F and St	
			1		P6099/302/0.8/S/1 D 0.80 m						VSt	
				1.20 18.50	P6099/302/0.9/S/1 D 0.90 m				SANDSTONE, fine grained, light grey/red/brown/orange, with bands of claystone/siltstone, inferred extremely low and very low strength, distinctly weathered.			Bentonite
AD/T	M		2									
				2.80 16.90					SANDSTONE, fine grained, bedding 0-10°, light grey and red-brown with some yellow-brown, with bands of claystone/siltstone (<300mm).			
			3									
			4									Casing
			5									
				5.80 13.90								
NMLC	L-M		6						SANDSTONE, fine grained, bedding 5-10°, yellow-brown and red-brown with some pale grey and grey, with bands of claystone/siltstone (<300mm).			
			7									Sand
			8									Screen

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort	COMMENCED	20/09/2017	COMPLETED	20/09/2017	**REF MW02**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment	LOGGED	AM	CHECKED	RE	Sheet 2 OF 2
SITE	Bayview Golf Course, Bayview, NSW	GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT	4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.7 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 12.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
NMLC	L-M	21/09/17	10						SANDSTONE, fine grained, bedding 5-10°, yellow-brown and red-brown with some pale grey and grey, with bands of claystone/siltstone (<300mm).			MW02
			11	*11.70*								
				8.00					SANDSTONE, fine grained, bedding ±10°, grey and red-brown, with bands of claystone/siltstone (<300mm).			
			12	*12.00*					Hole Terminated at 12.00 m (Target depth reached)			
			13									
			14									
			15									
			16									
			17									

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF MW03**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 1 OF 2
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	24.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 13.40 m depth	NORTHING		ASPECT	SE	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
				24.50								MW03
AD/V	L-M			*0.30* 24.20	P6099/303/0.2/S/1 D 0.20 m			ML	TOPSOIL: SILT, low liquid limit, pale brown.			
					P6099/303/0.5/S/1 D 0.50 m			CL	Silty CLAY, low plasticity, brown.	D	St - VSt	
				0.70 23.80								
AD/T	M		1		P6099/303/0.8/R/1 D 0.80 m				SANDSTONE, medium to coarse grained, pale orange/yellow/brown, inferred extremely low and very low strength, with medium strength ironstone bands, distinctly weathered.			Bentonite
	H		2		P6099/303/1.5/R/1 D 1.50 m							
				2.62 21.88								
NMLC			3						SANDSTONE, fine grained, bedding 0-5°, yellow-brown with some pale grey-brown and red-brown, with claystone and siltstone bands (<700mm).			Casing
			4	*4.40* 20.10					Pale grey and dark red-brown.			
			5									
			6									
			7	*7.50* 17.00					SANDSTONE, fine grained, bedding 5-10°, red-brown and yellow-brown, with claystone and siltstone bands (<700mm).			
			8									Sand

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CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF MW03**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	MV	CHECKED	RE	Sheet 2 OF 2
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	24.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 13.40 m depth	NORTHING		ASPECT	SE	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW03 Static Water Level
NMLC		21/09/17	10						SANDSTONE, fine grained, bedding 5-10°, red-brown and yellow-brown, with claystone and siltstone bands (<700mm).			Screen
			11	11.70								
				12.80					SANDSTONE, fine grained, pale grey and pale red-brown with yellow-brown, with claystone and siltstone bands (<700mm).			
			12									
			13	13.40					Hole Terminated at 13.40 m (Target depth reached)			
			14									
			15									
			16									
			17									

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CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF MW05**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	AM	CHECKED	RE	Sheet 1 OF 2
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 15.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
AD/V	L			19.90 *0.20* 19.70	P6099/305/0.1/S/1 D 0.10 m P6099/305/0.3/S/1 D 0.30 m			ML SM	TOPSOIL: SILT, low liquid limit, brown, trace of fine grained sand, with subangular sandstone gravels. TOPSOIL: Silty SAND, fine grained, brown/orange/red, with clay and trace of subangular sandstone gravels.		St D	MW05
	L-M			*0.60* 19.30	P6099/305/0.7/R/1 D 0.70 m				SANDSTONE, fine grained, orange/red/grey, with claystone and siltstone bands, inferred extremely low and very low strength, distinctly weathered.			
AD/T	M		1							D		Bentonite
			2	*2.80* 17.10					SANDSTONE, fine grained, red/brown/light grey, bedding 0-10°, with claystone and siltstone bands (<400mm).			
			3									
			4									
			5									Casing
			6									
NMLC			7	*6.94* 12.96					NO CORE			
				7.30 12.60					CLAYSTONE and SILTSTONE, bedding 5-10°, red/light grey/yellow-brown.			
		21/09/17	8									
				8.90 11.00								

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Engineering Log - BOREHOLE

CLIENT	Waterbrook Lifestyle Resort		COMMENCED	21/09/2017	COMPLETED	21/09/2017	**REF MW05**
PROJECT	Geotechnical and Acid Sulfate Soils Assessment		LOGGED	AM	CHECKED	RE	Sheet 2 OF 2
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Narrabeen Group	VEGETATION	Grass	PROJECT NO. P1706099
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	19.9 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 15.00 m depth	NORTHING		ASPECT	South	SLOPE 2-5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW05 Static Water Level
NMLC			10	10.30 / 9.60					NO CORE			Sand
			11						CLAYSTONE and SILTSTONE, light red/light grey/yellow-brown.			Screen
				11.80 / 8.10					NO CORE			
			12	12.00 / 7.90					CLAYSTONE and SILTSTONE, red with light grey and yellow-brown.			
				12.50 / 7.40					NO CORE			
			13									
				13.45 / 6.45					CLAYSTONE and SILTSTONE, red with light grey and yellow-brown.			
			14									
			15	15.00					Hole Terminated at 15.00 m (Target depth reached)			
			16									
			17									

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Engineering Log - BOREHOLE

18 Attachment G – Notes About this Report

Information

Important Information About Your Report (1 of 2)

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

Engineering reports are based on information that may be gained from limited subsurface site testing and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend 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.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings *etc* are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.

- The actions of contractors responding to commercial pressures.

- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

  The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

If these conditions occur, Martens will be pleased to assist with investigation or providing advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

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

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Soil Data

Explanation of Terms (1 of 3)

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are typically based on Australian Standard 1726 and the Unified Soil Classification System (USCS) – refer Soil Data Explanation of Terms (2 of 3). In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

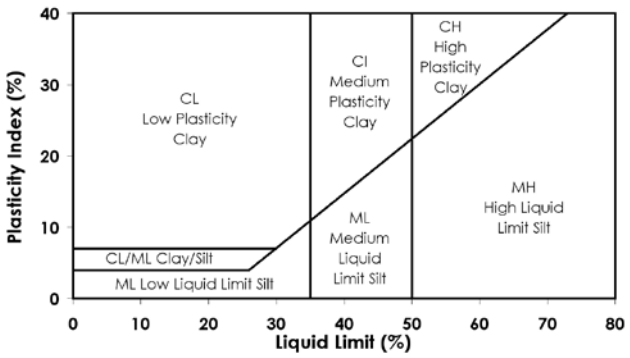
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy CLAY). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision	Size (mm)
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	20 to 63
	Medium	6 to 20
	Fine	2.36 to 6
SAND	Coarse	0.6 to 2.36
	Medium	0.2 to 0.6
	Fine	0.075 to 0.2
SILT		0.002 to 0.075
CLAY		< 0.002

Plasticity Properties

Plasticity properties of cohesive soils can be assessed in the field by tactile properties or by laboratory procedures.



Moisture Condition

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and damp and is darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.

Term	C_u (kPa)	Approx. SPT "N"	Field Guide
Very Soft	<12	2	A finger can be pushed well into the soil with little effort. Sample extrudes between fingers when squeezed in fist.
Soft	12 - 25	2 – 4	A finger can be pushed into the soil to about 25mm depth. Easily moulded in fingers.
Firm	25 - 50	4 – 8	The soil can be indented about 5mm with the thumb, but not penetrated. Can be moulded by strong pressure in the figures.
Stiff	50 - 100	8 – 15	The surface of the soil can be indented with the thumb, but not penetrated. Cannot be moulded by fingers.
Very Stiff	100 - 200	15 – 30	The surface of the soil can be marked, but not indented with thumb pressure. Difficult to cut with a knife. Thumbnail can readily indent.
Hard	> 200	> 30	The surface of the soil can be marked only with the thumbnail. Brittle. Tends to break into fragments.
Friable	-	-	Crumbles or powders when scraped by thumbnail.

Density of Granular Soils

Non-cohesive soils are classified on the basis of relative density, generally from standard penetration test (SPT) or Dutch cone penetrometer test (CPT) results as below:

Relative Density	%	SPT 'N' Value* (blows/300mm)	CPT Cone Value (q_c MPa)
Very loose	< 15	< 5	< 2
Loose	15 - 35	5 - 10	2 - 5
Medium dense	35 - 65	10 - 30	5 - 15
Dense	65 - 85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

* Values may be subject to corrections for overburden pressures and equipment type.

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Term	Assessment	Proportion of Minor component In:
Trace of	Presence just detectable by feel or eye. Soil properties little or no different to general properties of primary component.	Coarse grained soils: < 5 % Fine grained soils: < 15 %
With some	Presence easily detectable by feel or eye. Soil properties little different to general properties of primary component.	Coarse grained soils: 5 – 12 % Fine grained soils: 15 – 30 %

Soil Data

Explanation of Terms (2 of 3)

martens consulting engineers

Symbols for Soils and Other

SOILS


COBBLES/BOULDERS


GRAVEL (GP OR GW)


SILTY GRAVEL (GM)


CLAYEY GRAVEL (GC)


SAND (SP OR SW)


SILTY SAND (SM)


CLAYEY SAND (SC)


SILT (ML OR MH)


ORGANIC SILT (OH)


CLAY (CL, CI OR CH)


SILTY CLAY


SANDY CLAY


PEAT


TOPSOIL

OTHER


FILL


TALUS


ASPHALT


CONCRETE

Unified Soil Classification Scheme (USCS)

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)					USCS	Primary Name
COARSE GRAINED SOILS More than 50 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm.	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Gravel
				Predominantly one size or a range of sizes with more intermediate sizes missing	GP	Gravel
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	Silty Gravel
				Plastic fines (for identification procedures see CL below)	GC	Clayey Gravel
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of intermediate sizes missing.	SW	Sand
				Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Sand
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	SM	Silty Sand
				Plastic fines (for identification procedures see CL below)	SC	Clayey Sand

FINE GRAINED SOILS More than 50 % of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
	None to Low	Quick to Slow	None	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	ML	Silt
	Medium to High	None	Medium	Inorganic clays of low to medium plasticity [1], gravely clays, sandy clays, silty clays, lean clays	CL [2]	Clay
	Low to Medium	Slow to Very Slow	Low	Organic slits and organic silty clays of low plasticity	OL	Organic Silt
	Low to Medium	Slow to Very Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	Silt
	High	None	High	Inorganic clays of high plasticity, fat clays	CH	Clay
	Medium to High	None	Low to Medium	Organic clays of medium to high plasticity	OH	Organic Silt
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	Peat

Notes:

1. Low Plasticity – Liquid Limit W_L < 35 % Medium Plasticity – Liquid limit W_L 35 to 60 % High Plasticity - Liquid limit W_L > 60 %.
2. CI may be adopted for clay of medium plasticity to distinguish from clay of low plasticity.

Soil Data

Explanation of Terms (3 of 3)

Soil Agricultural Classification Scheme

In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL$^-$	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

Rock Data

Explanation of Terms (1 of 2)

Symbols for Rock

SEDIMENTARY ROCK


BRECCIA


CONGLOMERATE


CONGLOMERATIC SANDSTONE


SANDSTONE/QUARTZITE


SILTSTONE


MUDSTONE/CLAYSTONE


SHALE


COAL


LIMESTONE


LITHIC TUFF

IGNEOUS ROCK


GRANITE


DOLERITE/BASALT

METAMORPHIC ROCK


SLATE, PHYLLITE, SCHIST


GNEISS


METASANDSTONE


METASILTSTONE


METAMUDSTONE

Definitions

Descriptive terms used for Rock by Martens are based on AS1726 and encompass rock substance, defects and mass.

Rock Substance In geotechnical engineering terms, rock substance is any naturally occurring aggregate of minerals and organic matter which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Rock substance is effectively homogeneous and may be isotropic or anisotropic.

Rock Defect Discontinuity or break in the continuity of a substance or substances.

Rock Mass Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

Degree of Weathering

Rock weathering is defined as the degree of decline in rock structure and grain property and can be determined in the field.

Term	Symbol	Definition
Residual soil[1]	Rs	Soil derived from the weathering of rock. The mass structure and substance fabric are no longer evident. There is a large change in volume but the soil has not been significantly transported.
Extremely weathered[1]	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly weathered[2]	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decrease compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable.
Moderately weathered[2]	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	FR	Rock substance unaffected by weathering

Notes:
1 The term "Distinctly Weathered" (DW) may be used to cover the range of substance weathering between EW and SW.
2 Rs and EW material is described using soil descriptive terms.

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the loading. The test procedure is described by the International Society of Rock Mechanics.

Term	Is (50) MPa	Field Guide	Symbol
Very low	>0.03 ≤0.1	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VL
Low	>0.1 ≤0.3	A piece of core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	L
Medium	>0.3 ≤1.0	A piece of core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	M
High	>1 ≤3	A piece of core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife.	H
Very high	>3 ≤10	A piece of core 150mm long x 50mm diameter may be broken readily with hand held hammer. Cannot be scratched with pen knife.	VH
Extremely high	>10	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	EH

Rock Data

Explanation of Terms (2 of 2)

Degree of Fracturing

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude fractures such as drilling breaks (DB) or handling breaks (HB).

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments.
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300 mm to 1000 mm, with occasional longer sections and sections of 100 mm to 300 mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\%$$

SCR = Solid Core Recovery

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\%$$

RQD = Rock Quality Designation

$$= \frac{\sum \text{Axial lengths of core} > 100\text{ mm long}}{\text{Length of core run}} \times 100\%$$

Rock Strength Tests

▼ Point load strength Index (Is50) - axial test (MPa)

▶ Point load strength Index (Is50) - diametral test (MPa)

● Unconfined compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)

BP	Bedding plane parting
FL	Foliation
CL	Cleavage
JT	Joint
FC	Fracture
SZ/SS	Sheared zone/ seam (Fault)
CZ/CS	Crushed zone/ seam
DZ/DS	Decomposed zone/ seam
FZ	Fractured Zone
IS	Infilled seam
VN	Vein
CO	Contact
HB	Handling break
DB	Drilling break

Planarity

Pl	Planar
Cu	Curved
Un	Undulating
St	Stepped
Ir	Irregular
Dis	Discontinuous

Thickness

Zone	> 100 mm
Seam	> 2 mm < 100 mm
Plane	< 2 mm

Roughness

Pol	Polished
Sl	Slickensided
Sm	Smooth
Ro	Rough
VR	Very rough

Coating or Filling

Cn	Clean
Sn	Stain
Ct	Coating
Vnr	Veneer
Fe	Iron Oxide
X	Carbonaceous
Qz	Quartzite
MU	Unidentified mineral

Inclination

Inclination of defect is measured from perpendicular to and down the core axis.
Direction of defect is measured clockwise (looking down core) from magnetic north.

Test, Drill and Excavation Methods

Explanation of Terms (1 of 3)

Sampling

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

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

Undisturbed samples may be taken by pushing a thin-walled sampling tube, e.g. U_{50} (50 mm internal diameter thin walled tube), into soils and withdrawing a soil sample 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. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling / Excavation Methods

The following is a brief summary of drilling and excavation methods currently adopted by the Company and some comments on their use and application.

Hand Excavation - in some situations, excavation using hand tools, such as mattock and spade, may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger, generally 75-100 mm in diameter, into the ground. The penetration depth is usually limited to the length of the auger pole; however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils and, if it is safe to descend into the pit, collection of bulk disturbed samples. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of 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 sampling.

Continuous Sample Drilling (Push Tube) - the hole is advanced by pushing a 50 - 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength *etc.* is only marginally affected.

Continuous Spiral Flight Augers - the hole 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 in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water 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 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel of usually 50 mm internal diameter. Provided full core recovery is achieved (not always possible in very weak or fractured rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

In-situ Testing and Interpretation

Cone Penetrometer Testing (CPT)

Cone penetrometer testing (sometimes referred to as Dutch Cone) described in this report has been carried out using an electrical friction cone penetrometer.

The test is described in AS 1289.6.5.1-1999 (R2013). In the test, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system.

Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the push rod centre to an amplifier and recorder unit mounted on the control truck. As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

(i) Cone resistance (q_c) - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa.

(ii) Sleeve friction (q_f) - the frictional force of the sleeve divided by the surface area, expressed in kPa.

(iii) Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0 - 5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0 - 50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1 % - 2 % are commonly encountered in sands and very soft clays rising to 4 % - 10 % in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (MPa)} = (0.4 \text{ to } 0.6)\ N \text{ (blows/300 mm)}$$

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to } 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes *etc.* This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Standard Penetration Testing (SPT)

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample.

The test procedure is described in AS 1289.6.3.1-2004. 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 penetration depth increments and the 'N' value is taken as the number of blows for the last two 150 mm depth increments (300 mm total penetration). 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:

(i) Where full 450 mm penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows:

as 4, 6, 7
N = 13

(ii) Where the test is discontinued, short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm

as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

Dynamic Cone (Hand) Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer (PSP) - a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm. The test, described in AS 1289.6.3.3-1997 (R2013), was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

Cone penetrometer (DCP) - sometimes known as the Scala Penetrometer, a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm. The test, described in AS 1289.6.3.2-1997 (R2013), was developed initially for pavement sub-grade investigations, with correlations of the test results with California Bearing Ratio published by various Road Authorities.

Pocket Penetrometers

The pocket (hand) penetrometer (PP) is typically a light weight spring hand operated device with a stainless steel loading piston, used to estimate unconfined compressive strength, q_u, (UCS in kPa) of a fine grained soil in field conditions. In use, the free end of the piston is pressed into the soil at a uniform penetration rate until a line, engraved near the piston tip, reaches the soil surface level. The reading is taken from a gradation scale, which is attached to the piston via a built-in spring mechanism and calibrated to kilograms per square centimetre (kPa) UCS. The UCS measurements are used to evaluate consistency of the soil in the field moisture condition. The results may be used to assess the undrained shear strength, C_u, of fine grained soil using the approximate relationship:

$$q_u = 2 \times C_u.$$

It should be noted that accuracy of the results may be influenced by condition variations at selected test surfaces. Also, the readings obtained from the PP test are based on a small area of penetration and could give misleading results. They should not replace laboratory test results. The use of the results from this test is typically limited to an assessment of consistency of the soil in the field and not used directly for design of foundations.

Test Pit / Borehole Logs

Test pit / borehole log(s) presented herein are an engineering and / or geological interpretation of the subsurface conditions. Their reliability will depend to some extent on frequency of sampling and methods of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / 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 test pit / borehole logs 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 test pits / boreholes, the frequency of sampling and the possibility of other than 'straight line' variation between the test pits / boreholes.

Laboratory Testing

Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all during the time it 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 prior weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations 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.

Test, Drill and Excavation Methods

Explanation of Terms (3 of 3)

DRILLING / EXCAVATION METHOD

HA	Hand Auger	RD	Rotary Blade or Drag Bit	NQ	Diamond Core - 47 mm
AD/V	Auger Drilling with V-bit	RT	Rotary Tricone bit	NMLC	Diamond Core – 51.9 mm
AD/T	Auger Drilling with TC-Bit	RAB	Rotary Air Blast	HQ	Diamond Core – 63.5 mm
AS	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core – 63.5 mm
HSA	Hollow Stem Auger	CT	Cable Tool Rig	DT	Diatube Coring
S	Excavated by Hand Spade	PT	Push Tube	NDD	Non-destructive digging
BH	Tractor Mounted Backhoe	PC	Percussion	PQ	Diamond Core - 83 mm
JET	Jetting	E	Tracked Hydraulic Excavator	X	Existing Excavation

SUPPORT

Nil	No support	S	Shotcrete	RB	Rock Bolt
C	Casing	Sh	Shoring	SN	Soil Nail
WB	Wash bore with Blade or Bailer	WR	Wash bore with Roller	T	Timbering

WATER

▽ Water level at date shown ◁ Partial water loss

▷ Water inflow ◀ Complete water loss

GROUNDWATER NOT OBSERVED (NO)	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED (NX)	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

PENETRATION / EXCAVATION RESISTANCE

L	Low resistance: Rapid penetration possible with little effort from the equipment used.
M	Medium resistance: Excavation possible at an acceptable rate with moderate effort from the equipment used.
H	High resistance: Further penetration possible at slow rate & requires significant effort equipment.
R	Refusal/ Practical Refusal. No further progress possible without risk of damage/ unacceptable wear to digging implement / machine.

These assessments are subjective and dependent on many factors, including equipment power, weight, condition of excavation or drilling tools, and operator experience.

SAMPLING

D	Small disturbed sample	W	Water Sample	C	Core sample
B	Bulk disturbed sample	G	Gas Sample	CONC	Concrete Core

U63 Thin walled tube sample - number indicates nominal undisturbed sample diameter in millimetres

TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11	4,7,11 = Blows per 150mm.
N=18	'N' = Recorded blows per 300mm penetration following 150mm seating
DCP	Dynamic Cone Penetration test to AS1289.6.3.2-1997. 'n' = Recorded blows per 150mm penetration

Notes:

RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB 30/80mm	Hammer double bouncing on anvil after 80 mm penetration
N=18	Where practical refusal occurs, report blows and penetration for that interval

CPT	Static cone penetration test
CPTu	CPT with pore pressure (u) measurement
PP	Pocket penetrometer test expressed as instrument reading (kPa)
FP	Field permeability test over section noted
VS	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PM	Pressuremeter test over section noted
PID	Photoionisation Detector reading in ppm
WPT	Water pressure tests

SOIL DESCRIPTION

Density		Consistency		Moisture	
VL	Very loose	VS	Very soft	D	Dry
L	Loose	S	Soft	M	Moist
MD	Medium dense	F	Firm	W	Wet
D	Dense	St	Stiff	Wp	Plastic limit
VD	Very dense	VSt	Very stiff	Wl	Liquid limit
		H	Hard		

ROCK DESCRIPTION

Strength		Weathering	
VL	Very low	EW	Extremely weathered
L	Low	HW	Highly weathered
M	Medium	MW	Moderately weathered
H	High	SW	Slightly weathered
VH	Very high	FR	Fresh
EH	Extremely high		