Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Supplementary Geotechnical Investigation

Proposed Residential Development
Site 68, Sydney Olympic Park

Prepared for
Ecove Group Pty Ltd

Project 73942
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NCS INTERNATIONAL CERTIFIED QUALITY MANAGEMENT SYSTEM

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

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Report on Supplementary Geotechnical Investigation
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1. Introduction

This report presents the results of a supplementary geotechnical investigation undertaken for a proposed residential development at Site 68 on the corner of Australia Avenue and Bennelong Parkway, Sydney Olympic Park. The work was commissioned by Ecove Group Pty Ltd, developers of the site.

The project involves the construction of a multi-storey residential unit building on the site of a stormwater detention basin. A large concrete tank will be constructed (by others) to the north of the site to replace the detention basin. The new building will be constructed to the south of the tank and will include several basement levels, one or two of which will be below the level of Bennelong Parkway. A new pedestrian bridge will also be constructed to replace an existing bridge across Bennelong Parkway that links Bicentennial Park with the Sydney Olympic Park precinct.

Supplementary geotechnical investigation was undertaken to provide additional information on the subsurface conditions on the site and included the drilling of five cored boreholes and one augered borehole, laboratory testing and engineering analysis. Details of the field work and comments relevant to design and construction are given in this report. This report supersedes the *Report on Geotechnical Investigation Rev0* dated 22 July 2014 prepared by Douglas Partners (also for Project 73942).

It is noted that the Sydney Olympic Park Authority uses a separate height datum (Australian Height Datum + 100.078 m), although for the purposes of this report AHD has been used.

2. Site Description and Geology

The site is an irregular shaped lot with maximum dimensions of approximately 170 m by 70 m. It is bounded by a commercial premise to the north, Bennelong Parkway to the east and south, and the Sydney Olympic Park rail loop to the west. The rail loop is elevated above the site and is supported by retaining walls. The site is currently used as a stormwater detention basin which is confined by earth embankments.

The surface at the top of the embankments varies from about RL 8 m to RL 13 m AHD which is some 4 m to 8 m above the levels of Bennelong Parkway.

The *Sydney 1:100 000 Geological Series Sheet* shows that the site is close to a boundary between man-placed filling over alluvial and estuarine sediments, and Ashfield Shale. Ashfield Shale typically comprises black to dark grey shale and laminite, and weathers to form clayey soils of high plasticity.

The *Prospect/Parramatta River 1:25 000 Acid Sulfate Soil Risk Map* shows no known occurrence of acid sulphate soils on the site.

3. Field Work Methods

3.1 Previous Investigation

Five cored boreholes (BH1 to BH4 and BH6) were drilled to depths of 12.7 m to 14.7 m using a truck-mounted DT100 drilling rig. They were commenced using solid flight augers then continued using rotary wash-boring equipment inside top casing, where required. Standard penetration tests were undertaken within the overburden at regular depth intervals. Soon after rock was encountered, the bores were advanced using NMLC-sized diamond core drilling equipment to obtain 50 mm diameter continuous samples of the rock for identification and strength testing purposes.

Borehole BH5 was drilled to a depth of 2.5 m at which point auger refusal occurred on what was inferred to be a large steel plate. The rig was moved three times in an attempt to penetrate beyond the level of the obstruction without success. Restrictions on blocking pedestrian access prevented additional attempts at this location.

A groundwater monitoring well was installed in BH2 at the completion of drilling.

The locations of the boreholes are shown on Drawing 1 in Appendix B. The ground surface levels at the bores were measured to AHD using differential global positioning system (dGPS).

3.2 Current Investigation

Five cored boreholes (BH101 to BH103, BH105 and BH106) were drilled to depths of 6.0 m to 12.1 m using a truck-mounted DT100 drilling rig. They were commenced using solid flight augers then continued using rotary wash-boring equipment inside top casing, where required. Standard penetration tests were undertaken within the overburden at regular depth intervals. Soon after rock was encountered, the bores were advanced using NMLC-sized diamond core drilling equipment to obtain 50 mm diameter continuous samples of the rock for identification and strength testing purposes.

Borehole BH104 was drilled to a depth of 0.7 m at which point an underground conduit was encountered. Restrictions on blocking pedestrian access and space limitations prevented additional drilling at this location.

A groundwater monitoring well was installed in BH105 and BH106 at the completion of drilling.

The locations of the boreholes are also shown on Drawing 1 in Appendix B. The ground surface levels at the bores were measured to AHD using an automatic level, relative to known benchmarks on the site.

4. Field Work Results

The subsurface conditions encountered in the boreholes are presented in the borehole logs in Appendix C (current investigation) and Appendix D (previous investigation). Notes defining descriptive terms and classification methods are included in Appendix A. The boreholes encountered:

- FILLING – concrete, asphalt, roadbase, topsoil, pavers and woodchips to depths of 0.1 m to 0.3 m. Clayey, sandy and gravelly filling with brick, metal, wood, charcoal, glass, rubber, wire, concrete, plastic, coal, slag and asbestos sheeting to depths of 0.3 m to 9.4 m. A hydrocarbon odour was detected in BH2 and BH4;
- RESIDUAL SOIL – firm to hard clay, silty clay and shaly clay with some ironstone gravel and bands to depths of 2.5 m to 11.0 m; and
- BEDROCK – shale bedrock which was initially extremely low strength and extremely weathered, grading to low, medium and medium to high strength rock to the base of the bores at 12.0 m to 14.7 m depth. Very high strength sideritic bands were encountered in BH2 and BH3.

Several zones of core loss are shown on the borehole logs. It is likely that the core loss was due to the presence of weaker, friable zones within the rock profile.

Tables 1A and 1B summarise the levels at which different materials were encountered in the boreholes. The rock has been classified in accordance with a system developed by Pells, Douglas et al in the 1970s and updated by Pells et al (1998) which classifies rock strata depending on strength, fracturing and defects. Class V rock is typically very low strength, highly weathered and highly fractured rock whereas Class I rock is typically high strength, fresh and unbroken rock.

Table 1A: Summary of Material Strata Levels and Rock Classifications

Stratum	RL of Top of Stratum (m, AHD)					
	BH1	BH2	BH3	BH4	BH5	BH6
Ground Surface/ Filling	8.5	8.6	9.5	10.2	12.8	8.8
Residual Soil	5.2	3.1	4.2	4.5	NE	-0.6
Class V/IV Shale	1.6	1.6	2.2	2.9	NE	-2.2
Class III Shale	-1.0	NE	-0.7	1.0	NE	-2.6
Class II Shale	-1.5	-0.1	-1.7	0.6	NE	-3.2
Base of Borehole	-4.2	-4.4	-4.2	-2.8	9.4	-5.9

Notes: Rock classification in accordance with Pells et al (1998); NE = not encountered

Table 1B: Summary of Material Strata Levels and Rock Classifications

Stratum	RL of Top of Stratum (m, AHD)					
	BH101	BH102	BH103	BH104	BH105	BH106
Ground Surface/ Filling	13.9	9.6	9.1	3.3	3.6	3.8
Residual Soil	9.9	NE	6.6	NE	2.6	3.5
Class V/IV Shale	7.4	7.3	5.8	NE	-0.2	1.3
Class III Shale	3.7	5.3	NE	NE	-2.0	NE
Class II Shale	3.1	3.7	2.8	NE	NE	-1.2
Base of Borehole	1.9	-2.4	-3.0	2.6	-2.4	-2.2

Notes: Rock classification in accordance with Pells et al (1998); NE = not encountered

Seepage was observed at a depth of 4.0 m (RL 6.2 m AHD) in BH4 and 1.5 m (RL 2.1 m AHD) in BH105 during augering. Free groundwater was not observed during augering in the other bores and the use of drilling fluid prevented groundwater observations during rotary wash-boring and coring.

Table 2 summarises the groundwater observations made in the monitoring wells installed on the site.

Table 2: Summary of Groundwater Observations in Monitoring Wells (RL, m AHD)

Date	BH2	BH105	BH106
28 May 2014	5.2	NM	NM
9 Sep 2014	3.0	2.4	3.2

Notes: NM = not measured

5. Laboratory Testing

5.1 Rock Samples

Fifty-three samples selected from the better quality rock core were tested for axial point load strength index (Is_{50}). The results ranged between 0.1 MPa and 2.5 MPa which correspond to very low to low strength and high strength rock, respectively. A sideritic band at a depth of 11.6 m in BH3 exhibited an axial point load strength index of 4.5 MPa which is very high strength.

5.2 Soil Samples

Nine soil samples were sent to a NATA accredited analytical laboratory and were analysed for a range of potential organic and inorganic contaminants to provide preliminary information for waste classification purposes. The results of the analysis are summarised in Tables 3 to 6. The detailed results are included in Appendix E.

Table 3: Analytical Results for Selected Organic Compounds in Soil (mg/kg)

Sample/ Depth (m)	Benzene	Toluene	Ethyl-benzene	Xylene	TRH $_{C6-C9}$	TRH $_{C10-C36}$
BH1/1-1.45	<0.2	<0.5	<1	<3	<25	<250
BH1/2.5-2.95	<0.2	<0.5	<1	<3	<25	<250
BH2/1.7	<0.2	<0.5	<1	<3	<25	<250
BH2/4.0	<0.2	<0.5	<1	<3	<25	1170
BH2/5.5	<0.2	<0.5	<1	<3	<25	3240
BH4/1.9	<0.2	<0.5	<1	<3	<25	290
BH4/5.0	<0.2	<0.5	<1	<3	<25	1030
BH5/5.5	<0.2	<0.5	<1	<3	<25	960
BH5/2.5	<0.2	<0.5	<1	<3	<25	330

Notes: TRH = total recoverable hydrocarbons

Table 4: Analytical Results for Selected Organic Compounds in Soil (mg/kg)

Sample/ Depth (m)	Total PAH	Benzo(a) pyrene	OCP	PCB	Phenol
BH1/1-1.45	NIL(+)VE	<0.05	NIL(+)VE	NIL(+)VE	<5
BH1/2.5-2.95	NIL(+)VE	<0.05	NIL(+)VE	NIL(+)VE	<5
BH2/1.7	5.4	0.45	NIL(+)VE	NIL(+)VE	<5
BH2/4.0	11	0.69	NIL(+)VE	NIL(+)VE	<5
BH2/5.5	6.4	0.41	NIL(+)VE	NIL(+)VE	<5
BH4/1.9	5.3	0.39	NIL(+)VE	NIL(+)VE	<5
BH4/5.0	3.4	0.25	NIL(+)VE	NIL(+)VE	<5
BH5/5.5	4.0	0.30	NIL(+)VE	NIL(+)VE	<5
BH5/2.5	5.3	0.39	NIL(+)VE	NIL(+)VE	14

Notes: PAH = polycyclic aromatic hydrocarbons; OCP = organochlorine pesticides; PCB = polychlorinated biphenyls

Table 5: Analytical Results for Selected Heavy Metals in Soil (mg/kg)

Sample/ Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BH1/1-1.45	5	<0.4	12	17	16	<0.1	2	8
BH1/2.5-2.95	7	<0.4	13	19	16	<0.1	1	7
BH2/1.7	30	6.4	30	270	220	0.2	27	310
BH2/4.0	20	4.9	36	700	360	0.3	29	450
BH2/5.5	20	3	37	470	240	0.2	34	370
BH4/1.9	20	2	15	160	180	0.1	16	560
BH4/5.0	30	0.8	21	160	190	0.3	13	210
BH5/5.5	40	1	25	200	190	0.3	15	280
BH5/2.5	20	2	46	710	510	0.4	48	700

Table 6: Analytical Results for the Toxicity Characteristics Leaching Procedure

Sample/Depth (m)	Sample pH (pH units)	Lead (mg/L)
BH2/1.7	8.1	0.3
BH2/4.0	8.6	5.9
BH2/5.5	8.9	0.5
BH4/1.9	8.5	0.2
BH4/5.0	8.7	0.5
BH5/5.5	8.8	0.4
BH5/2.5	8.4	0.3

In addition to the results outlined above, the nine samples were also tested for asbestos. Chrysotile asbestos was detected in the sample from BH2/5.5 m but respirable fibres were not detected. Asbestos was not detected in the other soil samples.

One piece of fibre cement sheeting recovered from a depth of 2.0 m in BH5 was also analysed. The sample contained Chrysotile asbestos.

6. Geotechnical Model

A geotechnical model for the site is presented in Sections A-A and B-B on Drawings 2 and 3 in Appendix B. A summary of the geotechnical model is provided in Table 7.

Table 7: Summary of Geotechnical Model

Geological Unit	Description
Unit A	Filling
Unit B	Residual clayey soils
Unit C	Class V and IV shale bedrock of extremely low and very low strength with stronger bands (up to medium strength)
Unit D	Class III shale bedrock generally of low to medium strength
Unit E	Class II shale bedrock generally of medium and medium to high strength
Groundwater	Measured at between RL 2.4 m and 3.2 m AHD during the current field work programme

7. Proposed Development

The project involves the construction of a multi-storey residential unit building on the site of a stormwater detention basin. A large concrete tank will be constructed (by others) to the north of the site to replace the detention basin. The new building will be constructed to the south of the tank and will include several basement levels, one or two of which will be below the level of Bennelong Parkway. The lowest proposed basement level will be at approximately RL 0 m AHD. A new pedestrian bridge will also be constructed to replace an existing bridge across Bennelong Parkway that links Bicentennial Park with the Sydney Olympic Park precinct.

The geotechnical issues considered relevant to the proposed development include excavation, excavation support, groundwater and foundations. Comments on the potential impacts on the adjacent railway corridor, seismicity and waste classification are also provided.

8. Comments

8.1 Excavation

Excavation for the basement will be required within filling, residual soils and shale bedrock of varying strength. The majority of the rock is likely to be extremely low to low strength with some stronger bands throughout. Excavation in these materials should be able to be undertaken using hydraulic excavators with bucket attachments, with some light ripping of the stronger bands required.

Excavation in the lowest portion of the basement and detailed excavation for footings, tanks, lift pits etc. may be required within low to medium strength, medium strength and medium to high strength shale which will require heavy ripping, rock hammers and/or rock saws.

The use of rock hammers will emit vibrations which have the potential to damage nearby structures and cause discomfort to the occupants of nearby buildings. The closest structure is the retaining wall that supports the railway line. It is recommended that vibrations be limited to a peak component particle velocity (PPVi) of 15 mm/s at the retaining wall. This vibration level should ensure that the vibrations in nearby buildings are also within tolerable levels.

A vibration monitoring trial and possibly continuous monitoring during excavation works may be required to ensure appropriate excavation techniques and equipment are being employed for the works.

8.2 Excavation Support

8.2.1 General

It is assumed that the existing embankment will be removed from the site and therefore batters and or shoring support will be required to support Bennelong Parkway, the railway corridor and the area to the north of the proposed basement which will presumably contain the proposed concrete stormwater tank.

Vertical excavations in filling, soil and weathered rock are not expected to be self-supporting for any extended period of time. Temporary batters of 1(H):1(V) could be used to support the sides of the excavation to a depth of up to 3 m, although will only be practical where space permits. Benches will need to be incorporated into deeper cuts. Shoring support will be required from the ground surface down to the bulk excavation level along the sides of the excavation where batters cannot be provided.

Soldier piles with infill reinforced shotcrete panels are commonly used to support excavations in residual clays and shales. The soldier piles would generally be spaced at about 2 m to 2.5 m centres and should be founded at least two pile diameters below the lowest excavation level (both bulk and detailed) adjacent to the pile location. Shotcreting will be needed over the full excavation depth and should be undertaken in approximately 2.5 m drops as excavation proceeds in order to reduce the risk of local slippages. Temporary ground anchors or internal propping/bracing will be required to prevent excessive lateral deformation. It is noted that anchors are generally not permitted beneath RailCorp property.

8.2.2 Earth Pressures

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of Class III rock. Table 8 outlines material and strength parameters that could be used for the preliminary design of excavation support structures.

Table 8: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Ultimate Passive Earth Pressure (kPa)
Filling	20	0.4	0.6	-
Residual Clays	20	0.3	0.5	-
Class V/IV Shale	22	0.2[1]	0.3[1]	750[2]
Class III Shale	23	0[1]	0[1]	3,000[2]
Class II Shale	23	0[1]	0[1]	6,000[2]

Notes: [1] Unless unfavourably jointed; [2] Only below bulk/detailed excavation level and where jointing is favourable

The design of temporary and permanent support will need to consider the possibility that 45° joints in the shale bedrock will daylight near the base of the excavation leading to large wedges of rock requiring support by the temporary and permanent retaining structures. Sufficient anchoring of the shoring wall should be undertaken to prevent movements along 45° joints, even though there is a low probability that a joint would run the full length and height of the excavation. It is suggested that preliminary design be carried out such that the support system has a factor of safety of 1.1 against the ultimate sliding force along the most unfavourable 45° joint.

The support system would typically comprise anchors spaced over the rock face. These anchors should have their bond lengths behind the projected 45° line from the bulk excavation level and should provide sufficient force to resist the movement of a wedge of rock projected at 45° from just below the anchor to the ground surface. The frictional resistance of the wedge along the joint may be calculated assuming an angle of friction of 20°. Regular rock-face inspections will be required during excavation to determine whether the assumed factor of safety is adequate. Additional anchors may be required to increase the factor of safety if large wedges are observed during excavation.

Rock sockets below the bulk excavation level for the purpose of passive restraint should have a minimum length of two pile diameters below the lowest level of any nearby excavation (including any detailed excavations).

The lateral earth pressure distribution for cantilevered walls and walls supported by a single row of anchors/props could be assumed to be triangular. The lateral pressure distribution on a multi-anchored or braced wall is complex and for preliminary design purposes a uniform distribution with depth (i.e. rectangular) could be assumed. It is recommended that a sophisticated software package such as WALLAP, FLAC or PLAXIS be used to analyse the shoring system to refine the preliminary design prior to the commencement of construction.

Lateral pressures due to surcharge loads from the railway corridor, adjacent buildings, sloping ground surfaces, the existing road corridors, and construction machinery should be included where relevant. Hydrostatic pressure acting on the shoring walls should also be included in the design where adequate drainage is not provided behind the full height of the walls.

8.2.3 Ground Anchors

Where necessary, the use of declined tie-back (ground) anchors is suggested for the lateral restraint of the perimeter piled walls. Such ground anchors should be declined below the horizontal to allow anchorage into the stronger bedrock materials at depth. The design of temporary ground anchors for the support of pile wall systems may be carried out using the allowable average bond stresses at the grout-rock interface given in Table 9.

Table 9: Allowable Bond Stresses for Anchor Design

Material Description	Allowable Bond Stress (kPa)
Class V/IV Shale	100
Class III Shale	250
Class II Shale	500

Ground anchors should be designed to have a free length equal to their height above the base of the excavation and have a minimum 3 m bond length. After installation they should be proof loaded to 125% of the design working load and locked-off at no higher than 60% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep.

The parameters given in Table 9 assume that the anchor holes are clean and adequately flushed, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing.

In normal circumstances the building will restrain the basement excavation over the long term and therefore ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed at this site.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that will extend beyond the perimeter of the site. As previously mentioned, anchors are generally not permitted beneath RailCorp property. Care should be taken to avoid damaging buried services, pipes and subsurface structures during anchor installation.

8.3 Potential Impacts on Railway Corridor

The RailCorp corridor is close to the western side of the proposed basement excavation and will need to be supported by shoring in the short term and the finished structure in the long term. Previous experience with RailCorp would suggest that contiguous piles will be required adjacent to the railway corridor and that the piles will need to be propped or braced to limit deflections. Foundation details for the existing retaining wall will be required to design the shoring system.

It is considered that the proposed excavation and construction works can be designed and undertaken in such a way that will not have a detrimental impact on the railway corridor or the tracks and associated infrastructure within it. Detailed modelling of the excavation will probably be required by RailCorp to estimate deflections of the shoring wall and the infrastructure behind it as part of the approvals process.

8.4 Groundwater

Groundwater was most recently observed in the monitoring wells between RL 2.4 m and RL 3.2 m AHD which is some 2 m to 3 m above the proposed lowest basement level. The natural groundwater flow direction is likely to be to the east and north-east towards Powells Creek. Bicentennial Park is a former landfill and therefore leachate production may be an issue. However, the Bennelong Parkway road alignment is unlikely to be underlain by landfill and therefore a relatively wide buffer exists between the former landfill and the proposed basement. The leachate would also be expected to flow towards Powells Creek unless natural or artificial barriers exist that alter the flow direction.

Groundwater quality testing is currently being undertaken to assess future disposal requirements. It is likely that only minor seepage will occur into the basement through joints and defects in the rock and therefore a drained basement should be suitable. If excessive flow rates or contaminated groundwater are issues then tanking may be required. Confirmation of this will be made prior to the commencement of the detailed design phase of the project.

This advice is also provided on the basis that the proposed concrete stormwater detention tank is watertight and will not allow water to seep into the basement. If this is not the case then a tanked basement may be required. Regardless of how the basement is constructed, pumps will probably be required to remove seepage from the basement and from pile excavations during construction.

8.5 Foundations

8.5.1 Spread Footings

The proposed bulk excavation works are expected to expose Class III or Class II shale bedrock at or close to the proposed foundation level of the majority of the building. Spread footings (i.e. pad or strip footings) within the excavation should be suitable for supporting the proposed building loads and could be designed on the basis of an allowable bearing pressure of 3500 kPa in the Class III and Class II materials.

Settlement of a spread footing is dependent on the loads applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the parameters provided in this report should be less than 5 mm to 10 mm upon application of the design load. Differential settlements between footings may be in the order of 50% of the value of total settlement.

All spread footings should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material.

8.5.2 Piles

Piles will be required to support the proposed bridge over Bennelong Parkway. Bored piles should be suitable for the site but may need to incorporate temporary lining within the filling materials to prevent collapse. Bored piles used for shoring support for the basement excavation could also be used to support structural loads provided that they are founded below the bulk excavation level. Piles could also be used to support structural loads outside the basement area, if required.

Bored piles could be proportioned on the basis of the design parameters provided in Table 10.

Table 10: Design Parameters for Bored Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion[1] (kPa)	Allowable Lateral Bearing Pressure[2] (kPa)
Class V/IV Shale	750	50	750
Class III and Class II Shale	3500	300	3500

Notes: [1]Provided adequate socket roughness is achieved; [2]Only in the case of a full pile socket

Settlement of a pile is dependent on the loads applied to the pile and the foundation conditions in the socket zone and below the pile toe. The total settlement of a bored pile designed using the parameters provided in this report should be less than a few millimetres upon application of the design load.

All bored piles should be inspected by an experienced geotechnical professional during construction to check the adequacy of the foundation material and to check the socket cleanliness and roughness.

8.6 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class would be Class C_e.

8.7 Waste Classification Advice

All materials requiring removal from the site will need to be classified in accordance with *Waste Classification Guidelines* (Department of Environment, Climate Change and Water NSW, 2009). The laboratory testing undertaken during this investigation can be used to provide a preliminary indication of the classification of the materials requiring disposal.

The waste classification guidelines include the following six-step process for waste classification:

- Establish if the waste is 'special waste'
- Establish if the waste is 'liquid waste'

- Establish if the waste is 'pre-classified' by the EPA
- Establish if the waste possesses hazardous characteristics
- Determine the contaminant concentrations of the waste
- Establish if the waste is putrescible

Visual inspection and the laboratory analysis indicated that asbestos was present in the soil samples obtained from two boreholes (BH2 and BH5). Filling containing asbestos is classified as 'Special Waste – Asbestos' and needs to be handled and disposed of accordingly. Consideration of the contaminant concentrations in the samples also needs to be made to determine an appropriate landfill facility for disposal.

The samples analysed were not in liquid form and therefore could not be described as liquid waste.

The EPA has pre-classified glass, plastic, rubber, bricks, concrete, building and demolition waste, and asphalt waste as General Solid Waste (non-putrescible). Although these materials were encountered within the boreholes, the samples were typically soil and therefore analysis of the contaminant concentrations is still required as part of the classification process.

The samples analysed did not possess any obvious hazardous characteristics and could not be described as hazardous waste prior to chemical analysis. All samples analysed were assessed on a visual and tactile basis as being incapable of significant biological transformation and are therefore considered to be non-putrescible.

The total concentrations in the samples of filling tested were compared to the threshold criteria provided in the guidelines. The samples from BH2, BH4 and BH5 had elevated concentrations of lead and which fall into the Restricted Solid Waste or Hazardous Waste category without leachability analysis. Leachability testing was subsequently undertaken on these samples using the Toxicity Characteristics Leaching Procedure (TCLP).

On the basis of the total and leachable concentrations of lead, the sample from 4.0 m depth in BH2 would be classified as Restricted Solid Waste. The remaining samples can be classified as General Solid Waste (non-putrescible). All soil that contains asbestos would also be classified as Special Waste – Asbestos. These materials will require disposal at an appropriately licenced landfill facility.

The natural soils and rock below the filling may be able to be described as virgin excavated natural material (VENM) upon excavation, providing they are not cross-contaminated during excavation works. VENM can usually be transported to a site for use as filling rather than requiring disposal at landfill.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a project at Site 68, Sydney Olympic Park in accordance with instructions received from Ecove Group Pty Ltd. The report is provided for the use of Ecove Group Pty Ltd for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party.

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

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

Douglas Partners Pty Ltd

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

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Description and Classification Methods

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

Soil Types

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

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

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

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

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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

Rock Strength

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

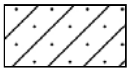
Soils


Topsoil

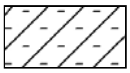

Peat


Clay

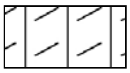

Silty clay

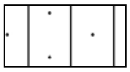

Sandy clay

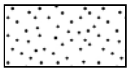

Gravelly clay

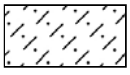

Shaly clay

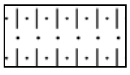

Silt


Clayey silt


Sandy silt

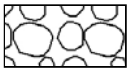

Sand

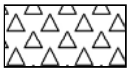

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

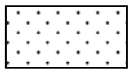

Talus

Sedimentary Rocks

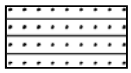

Boulder conglomerate

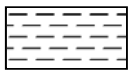

Conglomerate


Conglomeratic sandstone

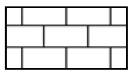

Sandstone


Siltstone


Laminite

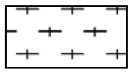

Mudstone, claystone, shale

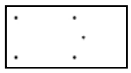

Coal


Limestone

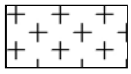
Metamorphic Rocks

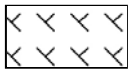

Slate, phyllite, schist

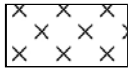

Gneiss

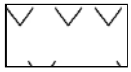

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote

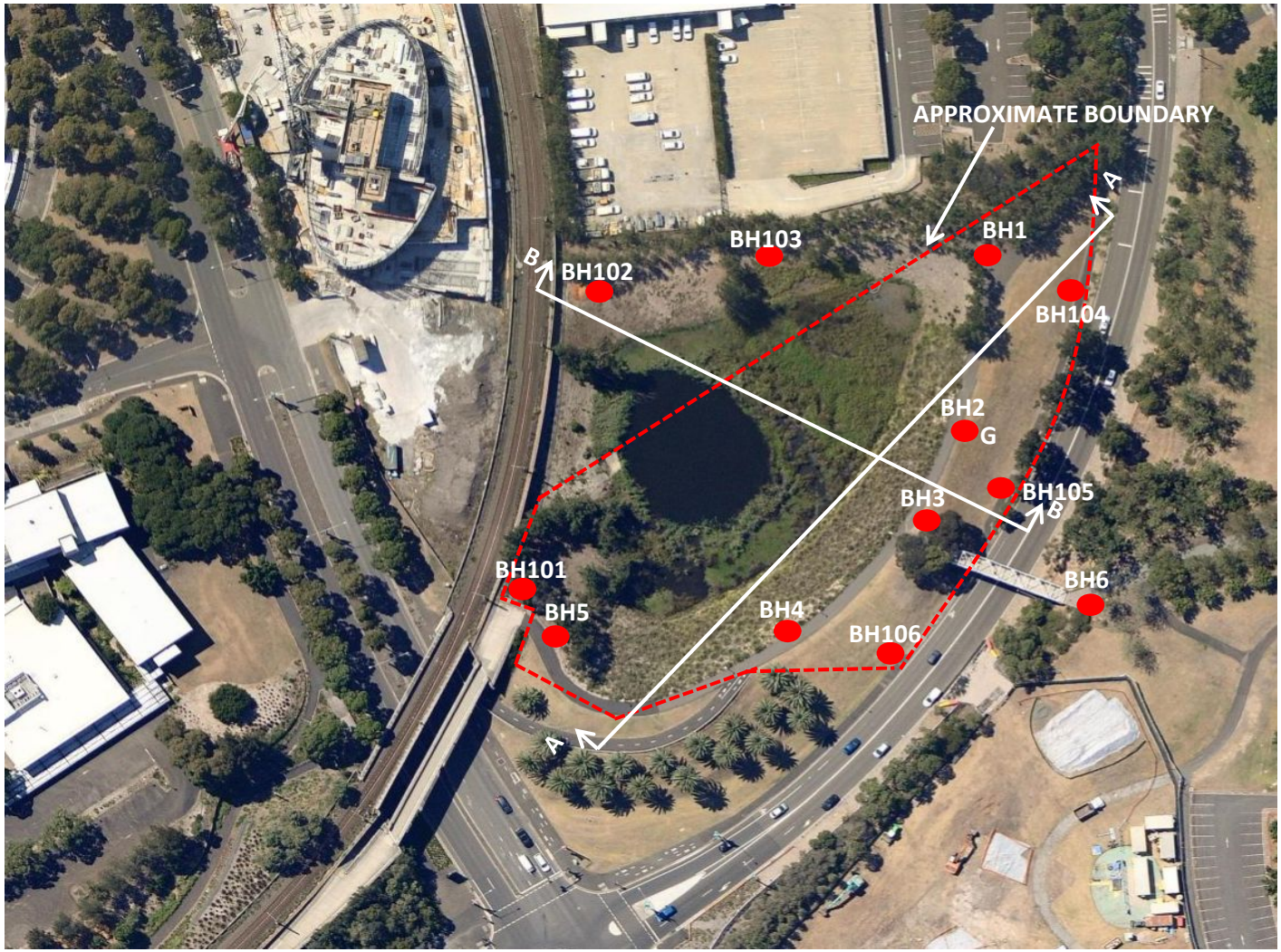

Tuff, breccia


Porphyry

Appendix B

Drawings

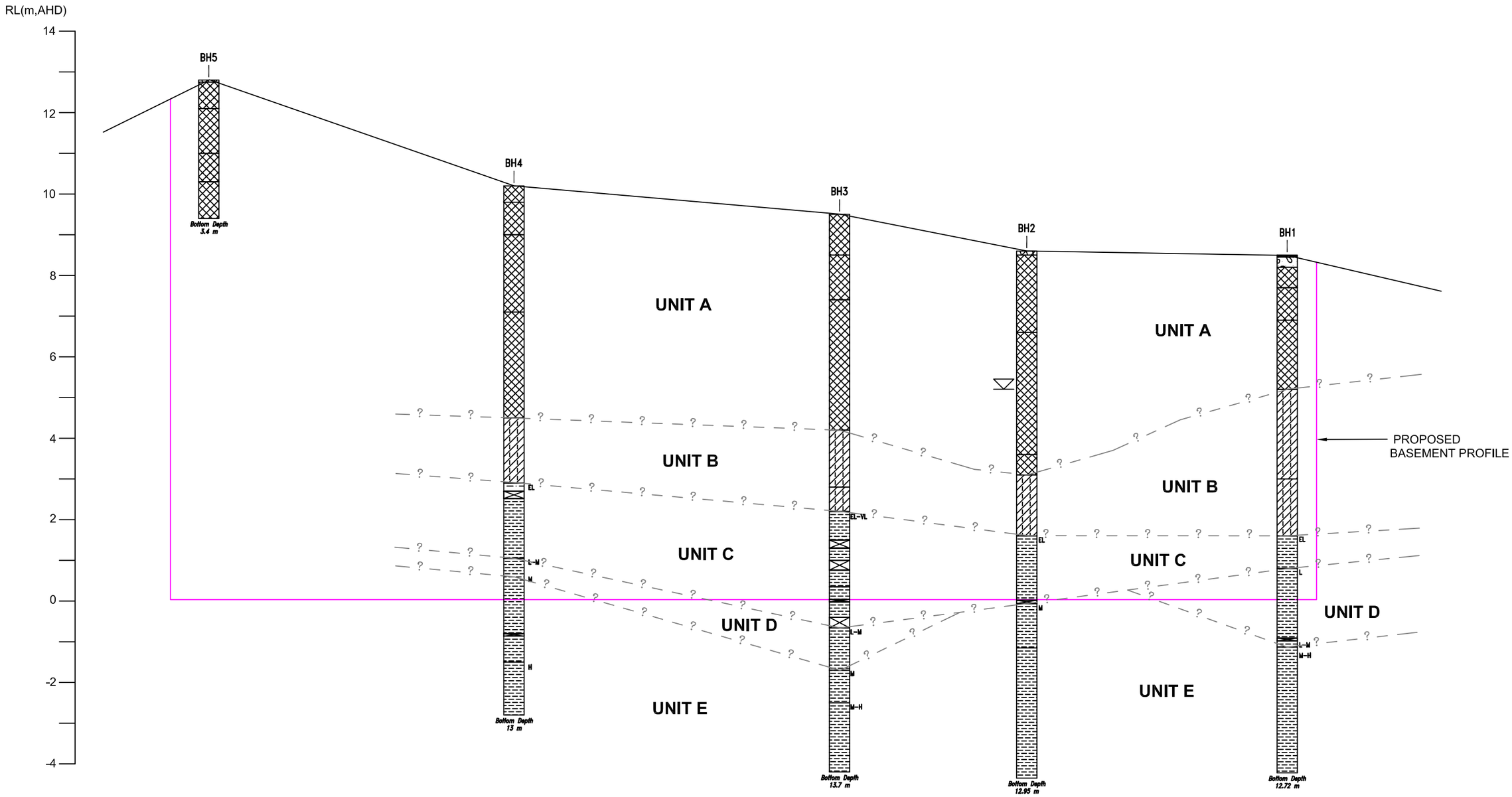
N



Location of Borehole

G Groundwater monitoring well

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Ecove Group Pty Ltd	**Locations of Boreholes**	PROJECT No: 73942
	OFFICE: Sydney	**Site 68 Geotechnical Investigation**	DWG No: 1
	DATE: 9 Sep 2014	**Sydney Olympic Park**	REVISION: A



0 1 2 3 4 5 7.5 10m

VERTICAL 1:100 @ A3

0 5 10 15 20 30 40 50m

HORIZONTAL 1:500 @ A3

LEGEND

- Core Loss
- Asphalt
- Filling
- Roadbase
- Shale
- Siltstone
- Silty Clay
- Groundwater

EL Extremely low strength
VL Very low strength
L Low strength
M Medium strength
H High strength

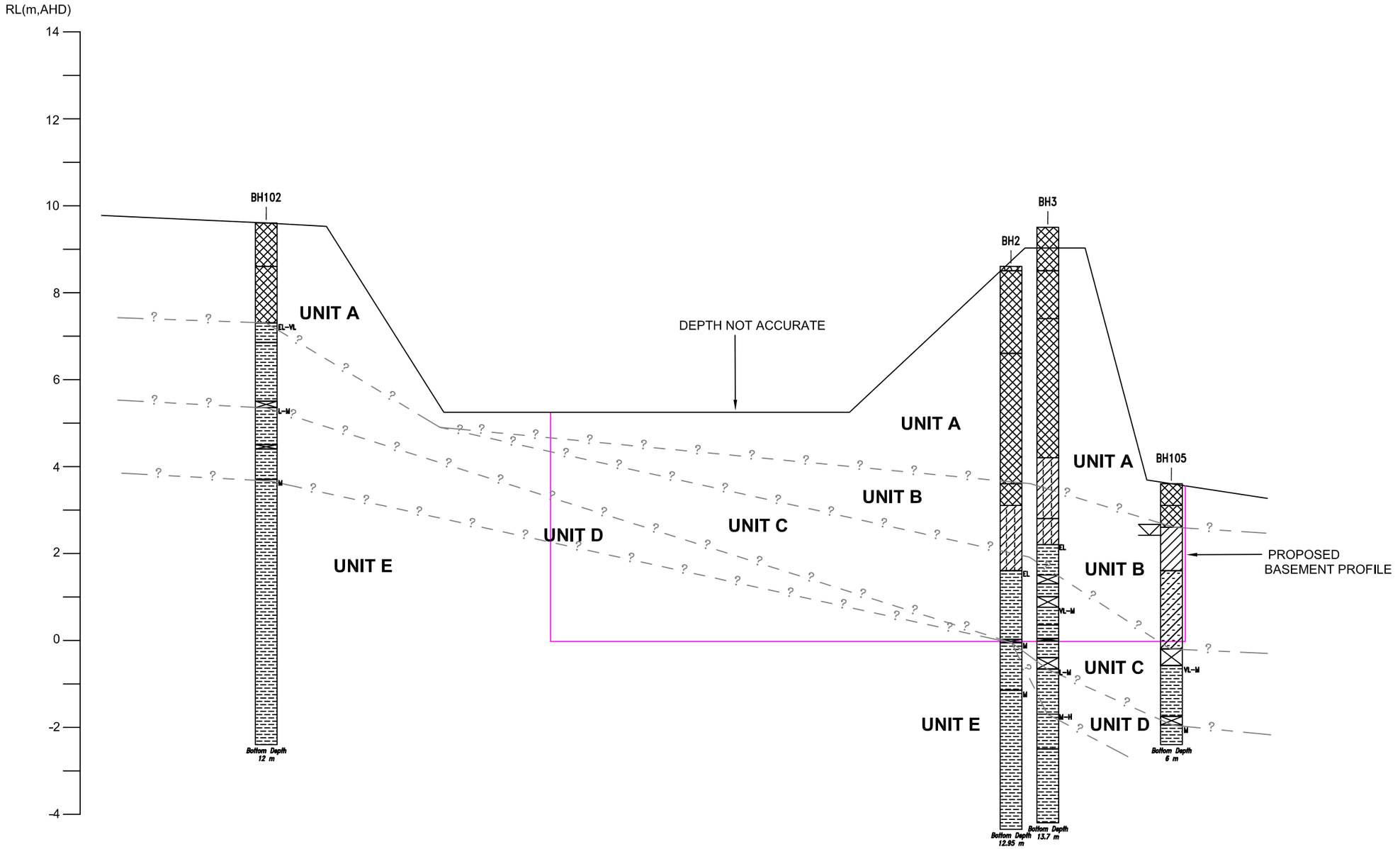
UNIT A Filling
UNIT B Residual clays
UNIT C Class V/IV Shale
UNIT D Class III Shale
UNIT E Class II Shale

— ? — — Inferred strata boundary

Strata boundaries are inferred. Depths accurate only at test locations

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Ecove Group Pty Ltd		TITLE: **Geotechnical Section A-A**	PROJECT No: 73942
OFFICE: Sydney	DRAWN BY: PSCH	**Site 68 Geotechnical Investigation**	DRAWING No: 2
SCALE: As shown	DATE: 6.06.2014	**Sydney Olympic Park**	REVISION: 0



0 1 2 3 4 5 7.5 10m

VERTICAL 1:100 @ A3

0 5 10 15 20 30 40 50m

HORIZONTAL 1:500 @ A3

LEGEND

Core Loss
Asphalt
Filling
Roadbase
Shale
Siltstone
Silty Clay
Groundwater

EL Extremely low strength
VL Very low strength
L Low strength
M Medium strength
H High strength

UNIT A Filling
UNIT B Residual clays
UNIT C Class V/IV Shale
UNIT D Class III Shale
UNIT E Class II Shale

— ? — — Inferred strata boundary

Strata boundaries are inferred. Depths accurate only at test locations

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CLIENT: Ecove Group Pty Ltd		TITLE: **Geotechnical Section B-B**	PROJECT No: 73942
OFFICE: Sydney	DRAWN BY: PSCH	**Site 68 Geotechnical Investigation**	DRAWING No: 3
SCALE: As shown	DATE: 9.09.2014	**Sydney Olympic Park**	REVISION: 0

Appendix C

Results of Current Field Work

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 13.9 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 73942
DATE: 4/9/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
13	0.13	CONCRETE							A			
		FILLING - grey-brown, gravelly (roadbase) clayey sand filling, medium to coarse, angular, moist							A			
	0.9	FILLING - variably compacted, grey-brown, clayey sand filling with some crushed sandstone gravel, moist							A S			4,4,5 N = 9
12	2.0	FILLING - light grey-brown, crushed sandstone filling with a trace of slag							S			6,8,8 N = 16
11	4.0	CLAY - stiff, light brown clay with some ironstone gravel, moist							S			9,5,6 N = 11
10	5.5	SILTY CLAY - stiff, light grey and red-brown, silty clay with ironstone bands						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			2,4,6 N = 10
9	6.5	SHALE - extremely low strength, light grey-brown shale										
8	6.9	SHALE - medium strength, highly weathered, highly fractured, red-brown shale						7m: B5°, cly, 20mm 7.07m: CORE LOSS: 230mm	C	55	0	PL(A) = 0.9
7	7.3	SHALE - low to medium strength, extremely to highly weathered, highly fractured, brown-grey shale						7.37m: J90°, un, ro 7.53m: B0°, cly, 20mm 7.62m: J90°, un, ro 7.94m: B5°, cly, fe 8m: B0°, cly, 10mm, fe 8.05m: B0°, cly, 10mm, fe 8.06m: J90°, un, ro, fe 8.11m: B0°, fe, cly, 40mm 8.17m: B0°, cly, 30mm	C	72	0	
6	8.36	SHALE - low to medium strength, moderately weathered, fractured, brown-grey shale						8.2m: J90°, pl, ro, fe 8.25m: B5°, 30mm, fe 8.35m: J90°, pl, ro, fe 8.45m: J90°, un, ro 8.52m: CORE LOSS: 480mm 9.05m: J90°, cu, ro, fe	C	81	0	PL(A) = 0.4
5	9.0											
4												

RIG: DT100 **DRILLER:** SM **LOGGED:** IW **CASING:** HW to 4.0m

TYPE OF BORING: Diatube to 0.13m; Solid flight auger to 4.0m; Rotary to 6.9m; NMLC-Coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 13.9 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 73942
DATE: 4/9/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3	10.22	SHALE - low to medium strength, moderately weathered, fractured, brown-grey shale *(continued)*						9.15m: J30°, pl, ro, fe 9.23m: B0°, cly, 30mm, fe 9.26m: J70°, cu, ro, fe 9.34m: B6°, fe, cly, 10mm 9.46m: J80°, pl, sm 9.84m: CORE LOSS: 380mm 10.56m: J90°, un, ro, fe 10.7m: J70°, st, ro, fe 10.72m: J70°, pl, ro, fe 11m: J50°, pl, sm	C	91	66	PL(A) = 0.9 PL(A) = 0.7
2	10.8	SHALE - medium strength, fresh, slightly fractured, grey shale										
1	12.0	Bore discontinued at 12.0m										
0												
-1												
-2												
-3												
-4												
-5												
-6												

RIG: DT100 **DRILLER:** SM **LOGGED:** IW **CASING:** HW to 4.0m

TYPE OF BORING: Diatube to 0.13m; Solid flight auger to 4.0m; Rotary to 6.9m; NMLC-Coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 73942
DATE: 2/9/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		FILLING - grey-brown, clayey sand and crushed sandstone gravel filling, moist							A			
									A			
	1.0	FILLING - grey to grey-brown, silty/sandy clay filling with some crushed shale fragments, moist							A			
									S			
								Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
	2.3	SHALE - extremely low strength, light grey-brown shale							S			12,25/80mm refusal
	2.75	SHALE - extremely low then extremely low to very low strength, extremely to highly weathered, slightly fractured, light grey-brown, shale with some medium strength bands						2.75-3.73m: B's 0°- 5°, fe, cly	C	100	0	PL(A) = 0.4
								3.81m: J40°, pl, ro, cly				
	4.25	SHALE - low to medium strength, highly to moderately then moderately weathered, fragmented to fractured, grey-brown shale						4.1m: CORE LOSS: 150mm 4.25-4.4m: fg, cly 4.4-4.63m: fg, fe, cly 4.63-4.73m: J70°, un, ro, fe 4.9m: J40°, pl, ro, fe				PL(A) = 0.5
	5.2							5.1m: CORE LOSS: 100mm 5.2-5.9m: B's 0°- 5°, fe, cly co, 2-5mm 5.25-5.27m: Cz, cly	C	92	15	PL(A) = 0.7
	5.9	SHALE - medium strength, slightly weathered then fresh, slightly fractured and unbroken, grey shale						5.9-6.25m: B0°, cly co				PL(A) = 0.9
								6.4m: J35°, pl, sm, cly 6.41-6.46m: Sz 6.46m: J45°, pl, ro, cly				
												PL(A) = 0.5
								7.9m: J45°, pl, sm, cln &P J80°, pl, ro, cln 8.12m: B0°, cly, 3mm 8.21m: J30°, pl, sm, cln 8.25-8.38m: J90°, he	C	100	94	PL(A) = 0.4 PL(A) = 2.5
								8.87m: J60° & 80°, st, ro, cln 9.15m: J75°, pl, ro, ci				
									C	100	100	PL(A) = 0.7

RIG: DT100 **DRILLER:** SM **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 2.75m; NMLC-Coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Water loss from approximately 8.4m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 73942
DATE: 2/9/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1	11	SHALE - medium strength, slightly weathered then fresh, slightly fractured and unbroken, grey shale *(continued)*							C	100	100	PL(A) = 0.7
-2	12							11.4 & 11.5m: B0°, cly, ca	C			PL(A) = 0.8
	12.0	Bore discontinued at 12.0m										
-3	13											
-4	14											
-5	15											
-6	16											
-7	17											
-8	18											
-9	19											
-10												

RIG: DT100 **DRILLER:** SM **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 2.75m; NMLC-Coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Water loss from approximately 8.4m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 73942
DATE: 1/9/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9	0.2	FILLING - brown sand and crushed sandstone filling, humid							A			
		FILLING - variably compacted, grey then brown, clay and crushed shale filling, damp							A			
8	1								A			
									S			3,4,5 N = 9
7	2											
	2.5	SILTY CLAY - very stiff, brown, silty clay with a trace of ironstone gravel, damp						Note: Unless otherwise stated, all defects are bedding planes dipping 0°- 10°	S			5,10,14 N = 24
6	3											
	3.3								S			25/10mm refusal
	3.4	SHALE - extremely low strength, light grey-brown shale							C	100	0	
		SHALE - medium strength with extremely low to very low strength clay bands, highly to extremely weathered, highly fractured, brown shale										PL(A) = 0.3
5	4							4.06m: J80°, un, ro, cly, fe 4.17m: JJ40°, he, cly 4.34m: B0°, cly, fe, 30mm 4.52m: B0°, cly, fe, 30mm	C	94	9	
4	5							4.52m: B0°, cly, 10mm 4.59m: J40°, pl, ro, fe 4.63m: B0°, cly, 20mm 4.93m: CORE LOSS: 70mm 5.05m: B0°, cly, 5mm 5.09m: B0°, cly, 10mm 5.2m: B0°, cly, 10mm	C	96	0	PL(A) = 0.7
	5.75											
3	6											
	6.26 6.27	SHALE - medium strength, moderately weathered, highly fractured, grey-brown shale						5.25m: B0°, cly, fe, 10mm 5.3m: B0°, cly, fe, 20mm 5.44m: B0°, cly, fe, 10mm 5.69m: CORE LOSS: 60mm 6.1m: CORE LOSS: 160mm 6.23m: B0°, cly, fe, 10mm 6.55m: J50°, pl, ro 6.63m: J50°, pl, ro 7.59m: J80°, st, ro	C	93	22	PL(A) = 0.3 PL(A) = 0.3
2	7											
	7.98	SHALE - medium strength, fresh, slightly fractured, grey shale										PL(A) = 0.3
1	8							8.66m: J90°, pl, ro	C	100	97	PL(A) = 0.6
0	9							9.67m: J60°, un, ro 9.97m: J30°, pl, ro				

RIG: DT100 **DRILLER:** SM **LOGGED:** IW **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 3.4m; NMLC-Coring to 12.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 73942
DATE: 1/9/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1	11	SHALE - medium strength, fresh, slightly fractured, grey shale *(continued)*						10.2m: B0°, cly, fe, 10mm 10.64m: J70°, pl, ro 10.72m: J20°, pl, ro	C	100	97	PL(A) = 0.4 PL(A) = 1
-2									C	100	100	
-3	12											
	12.1	Bore discontinued at 12.1m										
-4	13											
-5	14											
-6	15											
-7	16											
-8	17											
-9	18											
-10	19											

RIG: DT100 **DRILLER:** SM **LOGGED:** IW **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 3.4m; NMLC-Coring to 12.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 3.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 73942
DATE: 3/9/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	ASPHALT										
	0.25	ROADBASE GRAVEL										
		FILLING - sand filling										
	0.7	Bore discontinued at 0.7m - refusal on buried services										

RIG: DT100 **DRILLER:** SM **LOGGED:** SI **CASING:**

TYPE OF BORING: Solid flight auger to 0.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 3.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 73942
DATE: 3/9/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3	0.0	FILLING - grey, sandy clay filling with some roadbase gravel and a trace of grass roots, moist							A			
2	0.5	FILLING - apparently very poorly compacted, grey, sandy gravelly clay filling, wet							A			
1	1.0	CLAY - stiff, light grey-brown clay with a trace of silt, moist to wet				▼			A			
0	2.0	SHALY CLAY - very stiff, light brown to red-brown, shaly clay with ironstone bands						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			2,4,7 N = 11
-1	3.8								S			8,10,11 N = 21
-2	4.18	SHALE - low to medium and medium strength, highly to moderately and slightly weathered, fragmented to fractured, grey-brown shale with some very low to low strength bands						3.8m: CORE LOSS: 380mm 4.18-4.45m: fg 4.45-4.52m: cly 4.55-4.95m: B's 0°- 5°, fe, cly 4.95-5.14m: fg 5.2m: J35°, pl, ro, cly 5.21-5.3m: Cz, cly 5.35m: CORE LOSS: 200mm 5.6m: J30°, un, ro, cln	C	75	0	PL(A) = 0.3
-3	5.55								C	69	26	PL(A) = 0.4
-4	6.0	Bore discontinued at 6.0m										

RIG: DT100 **DRILLER:** SM **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 3.8m; NMLC-Coring to 6.0m

WATER OBSERVATIONS: Free groundwater observed at 1.5m whilst augering

REMARKS: Standpipe installed to 6.0m (screen 3.0-6.0m; gravel 3.0-6.0m; bentonite 2.5-3.0m; backfill to ground level with gatic lid)

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 3.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 73942
DATE: 3/9/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.3	TOPSOIL - grey-brown, silty clay topsoil with some fine sand and gravel and a trace of grass roots, moist							A			
		CLAY - stiff to very stiff, light grey and red-brown clay, slightly silty, moist							A			
	1.5	SHALY CLAY - very stiff, light grey, shaly clay with ironstone bands							A			
									S			4,7,8 N = 15
	2.5	SHALE - extremely low strength, light grey-brown shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			7,13,20 N = 33
	3.2	SHALE - very low to low and low strength, highly to moderately weathered, highly fractured to fractured, grey-brown shale with medium strength band						3.2m: B0°, cly 3.25-3.38m: B (x5) 0°-10°, cly co 3.5-3.63m: J's 35°- 40°, pl, ro, cly 3.77m: J60°, un, ro, cly 4m: CORE LOSS: 170mm 4.17-4.32m: B0°, cly 4.32m: J55°, un, ro, cly 4.45m: J40°, pl, ro, cly 4.5-4.6m: B's 0°, cly co, 1-5mm 4.6m: J45°, pl, sm, cln 4.7-4.95m: B's 0°, fe, cly 5.15-5.3m: J80°, pl, ro, cln	C	100	0	PL(A) = 0.2
	4.17								C	87	20	
	4.97	SHALE - medium strength, fresh, slightly fractured, grey shale							C	100	60	PL(A) = 0.4
	6.0	Bore discontinued at 6.0m							C	100	100	PL(A) = 0.7

RIG: DT100 **DRILLER:** SM **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 3.0m; NMLC-Coring to 6.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 6.0m (screen 3.0-6.0m; gravel 3.0-6.0m; bentonite 2.5-3.0m; backfill to ground level with gatic lid)

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

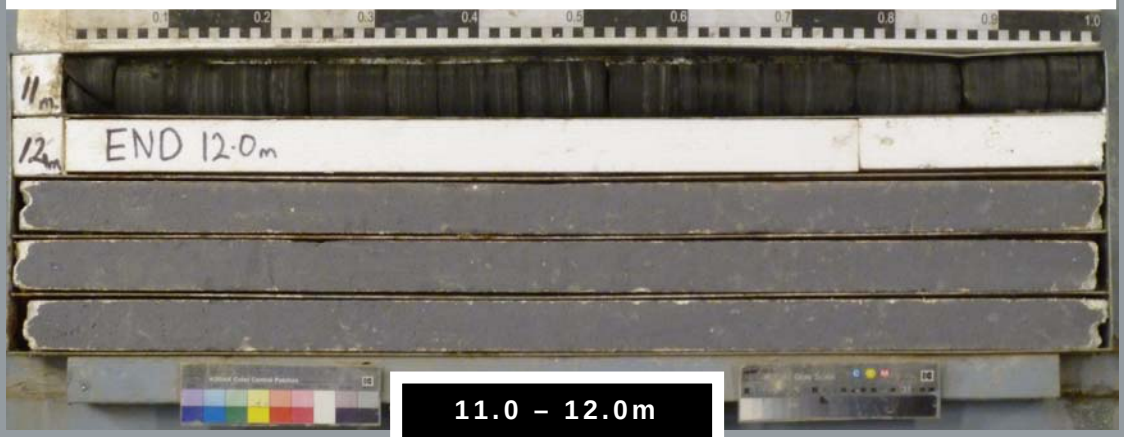
BORE 101 PROJECT 73942 SEPT 2014

6.9 – 10.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 101 PROJECT 73942 SEPT 2014

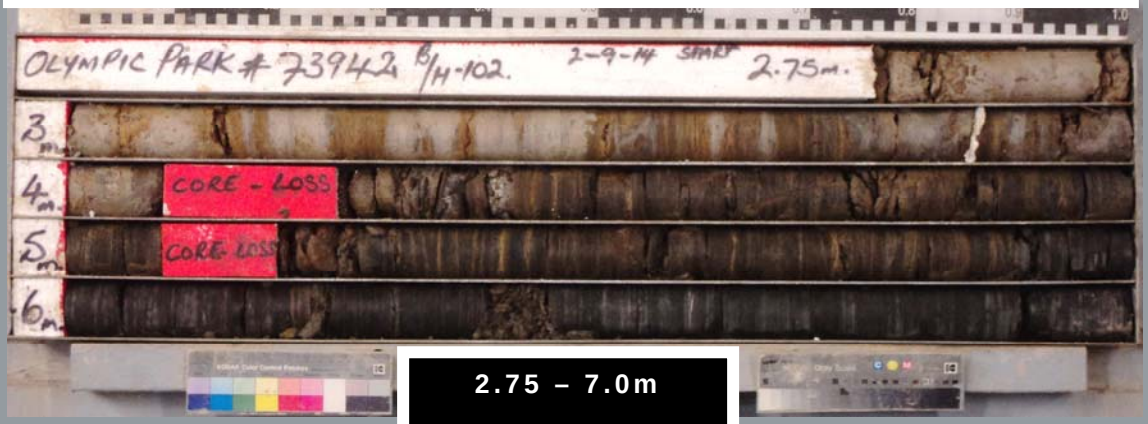


11.0 – 12.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 102 PROJECT 73942 SEP 2014

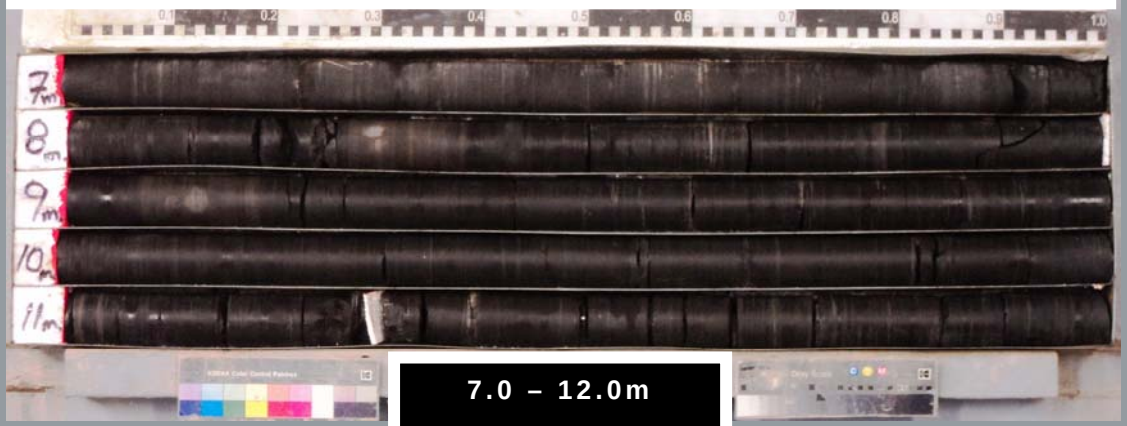


2.75 – 7.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 102 PROJECT 73942 SEP 2014

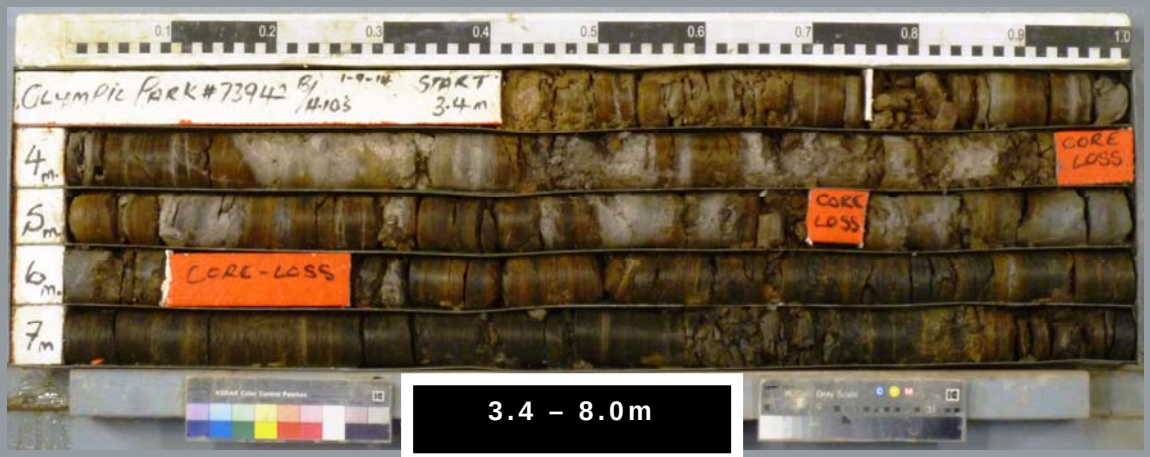


7.0 – 12.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 103 PROJECT 73942 SEPT 2014

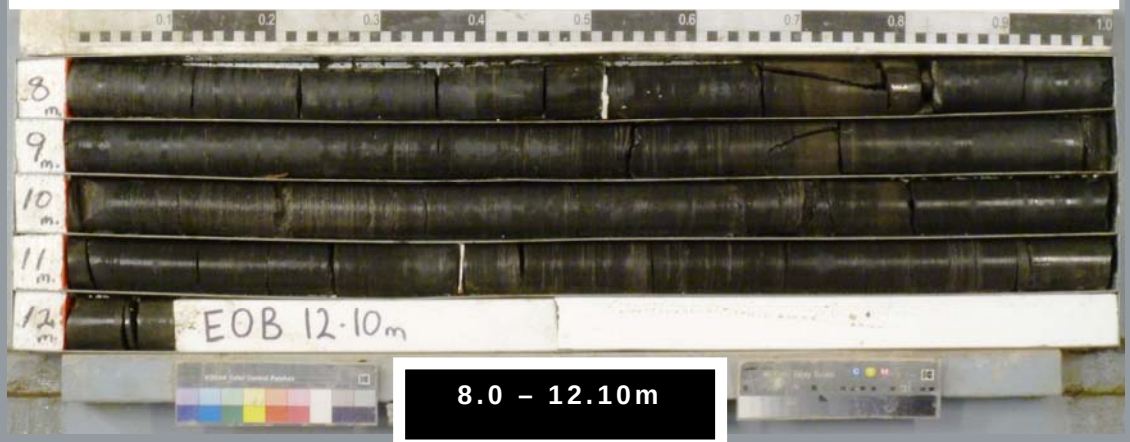


3.4 – 8.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 103 PROJECT 73942 SEPT 2014



8.0 – 12.10m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 105 PROJECT 73942 SEP 2014

3.8 – 6.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 106 PROJECT 73942 SEP 2014

3.0 – 6.0m

Appendix D

Results of Previous Field Work

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 73942
DATE: 5/5/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	ASPHALT							A			
	0.3	ROADBASE GRAVEL							A			
		FILLING - orange-brown, silty clay filling, humid										
	0.8	FILLING - apparently moderately compacted, light grey and orange-brown, silty clay filling with some ironstone gravel, moist							A			7,8,9 N = 17
									E/S			
	1.6	FILLING - apparently moderately compacted, orange-brown, clay filling with some ironstone gravel and ripped shale fragments, moist							E/S			3,9,10 N = 19
	3.3	SILTY CLAY - firm to stiff, orange-brown and red-brown, silty clay, moist							S			4,5,3 N = 8
	5.5	SILTY CLAY - hard, light grey and orange-brown, silty clay with some ironstone bands, moist							S			12,16,25 N = 41
	6.9	SHALE - extremely low strength, grey shale						Note: Unless otherwise stated, all defects are bedding planes dipping 0°- 10°	S			25/100mm refusal
	7.7	SHALE - low strength, moderately and highly weathered, fractured and fragmented, grey and brown shale						7.74m: B0°, cly, 8mm 7.8m: B0°, cly, 3mm 7.82m: J60°, pl, st, fe 7.96m: B0°, cly, 2mm, fe 8.0-8.03m: fg 8.04-8.28m: B (x4) 0°, fe 8.21m: J70°, pl, he, fe 8.29m: J50°, pl, sm, cly vn 8.36m: J50°, pl, he, fe 8.39-8.5m: B (x4) 5°-10°, fe 8.54m: J80°, pl, he, fe 8.59-8.76m: B (x4) 0°-5°, cly vn, fe 8.8m: J60°, pl, he, fe	C	100	0	PL(A) = 0.1
		9.28-9.34m: extremely low strength, extremely weathered band							C	90	11	PL(A) = 0.1
	9.41											
	9.48	SHALE - low then medium strength, moderately weathered, highly fractured, grey and brown shale							C	100	96	PL(A) = 0.5
	9.63											

RIG: DT100 **DRILLER:** SS **LOGGED:** JH **CASING:** HW to 2.5m; HQ to 7.0m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 7.7m; NMLC-Coring to 12.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 80% water loss in filling, 20% water loss from 8.1m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 73942
DATE: 5/5/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-2	11	9.62-9.63m: extremely low strength, extremely weathered band SHALE - medium then medium to high and high strength, fresh, slightly fractured then unbroken, light grey and grey shale with approximately 10% fine grained sandstone laminations *(continued)*						8.83m: B5°, cly vn, fe 8.85m: J40°, pl, sm, fe 8.91-9.14m: B (x5), fe 9.23-9.28m: fg 9.28-9.34m: Ds 9.34-9.41m: fg 9.41m: CORE LOSS: 70mm 9.48-9.62m: fg 9.62m: B0°, cly, 10mm 9.9m: J50°, un, sm, cln				PL(A) = 1
-3	12	11.64-11.71m: fractured						11.64-11.71m: B0°, cly vn	C	100	96	PL(A) = 1.1
-4	12.72	Bore discontinued at 12.72m - target depth reached										PL(A) = 1
-5	13											
-6	14											
-7	15											
-8	16											
-9	17											
-10	18											
-11	19											

RIG: DT100 **DRILLER:** SS **LOGGED:** JH **CASING:** HW to 2.5m; HQ to 7.0m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 7.7m; NMLC-Coring to 12.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 80% water loss in filling, 20% water loss from 8.1m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 73942
DATE: 7/5/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - brown silt topsoil, humid							A			
		FILLING - poorly compacted, dark brown, silty clay filling with some gravel and traces of brick, metal, wood and charcoal, damp							A			
									A			
									S			1,2,2 N = 4
									E			
	2.0	FILLING - variably compacted, dark brown, clay filling with basalt gravel and traces of glass, rubber tyres, ripped sandstone gravel, wood, steel and charcoal, damp							S			10,18,12 N = 30
									E			
									S			2,3,4 N = 7
	5.0	FILLING - dark grey, gravelly clay filling with traces of grease, wire and steel, wet										
	5.5	- faint hydrocarbon odour							E			
		SILTY CLAY - very stiff, red-brown mottled light grey, silty clay with some ironstone gravel, damp						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			4,9,11 N = 20
	7.0	SHALE - extremely low strength, extremely weathered, light grey-brown shale with a trace of ironstone							S			25/100mm refusal
								7.4m: B0°, fe, cly	C	100	0	
									C	90	0	
	8.66	SHALE - medium strength, slightly weathered, fragmented to fractured, grey-brown shale with a trace of fine sandstone laminations						8.58m: CORE LOSS: 80mm 8.66-8.87m: B (x5) 0°, fe 8.87-8.97m: fg, fe 9.0-9.48m: Ds, fe	C	100	20	PL(A) = 0.5
								9.55-9.65m: B (x3) 0°, fe, cly 9.75m: B0°, cly				PL(A) = 0.6
	9.75	SHALE - see next page										

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.1m; NMLC-Coring to 12.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 12.9m (Screen 6.95-12.95m; Gravel 4.0-12.95m; Bentonite 1.0-4.0m; Backfill to Ground Level with Gatic Cover)

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 73942
DATE: 7/5/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-2	11	SHALE - medium strength, fresh, unbroken, grey shale with approximately 15% fine grained sandstone laminations *(continued)*										PL(A) = 0.9
-3	12	11.9-12.0m: very high strength siderite band						11.93m: J90°, un, ro, cln	C	100	100	PL(A) = 0.7
-4	13	12.95 Bore discontinued at 12.95m										PL(A) = 0.7
-5	14											
-6	15											
-7	16											
-8	17											
-9	18											
-10	19											
-11												

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.1m; NMLC-Coring to 12.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 12.9m (Screen 6.95-12.95m; Gravel 4.0-12.95m; Bentonite 1.0-4.0m; Backfill to Ground Level with Gatic Cover)

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 73942
DATE: 6/5/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		FILLING - brown, clayey silt filling with gravel and traces of concrete, plastic and metal, humid							A			
									A			
	1.0	FILLING - apparently moderately compacted, dark brown, sandy and gravelly clay filling with traces of plastic, concrete and brick, damp							A S			6,10,9 N = 19
	2.1	FILLING - brown, sandy basaltic gravel filling with traces of coal and glass, damp							A			
	5.3	SILTY CLAY - apparently very stiff, red-brown and light grey, silty clay, moist										
	6.7	SILTY CLAY - apparently very stiff, red-brown and light grey, silty clay with some ironstone gravel layers, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			5,12,25/130mm refusal
	7.3	SHALE - extremely low strength, grey and brown shale										
	8.0	SHALE - extremely low to very low strength, extremely to highly weathered, light grey-brown to grey, shale some low to medium strength ironstone bands						8m: CORE LOSS: 200mm 8.3-8.4m: Ds 8.4-8.5m: fg, fe 8.5m: CORE LOSS: 240mm 8.74-8.92m: Ds 8.92m: B10°, cly 9.05-9.15m: Ds 9.21m: B0°, fe 9.41m: B0°, fe, cly 9.46m: CORE LOSS: 60mm 9.6m: J30°, pl, ro, fe	C	73	16	PL(A) = 0.3 PL(A) = 0.4
	8.74											
	9.15	SHALE - medium and low to medium strength, slightly weathered, fragmented to fractured, grey-brown shale with a trace of fine sandstone laminations										
	9.52											

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 8.0m; NMLC-Coring to 13.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 100% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 9.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 73942
DATE: 6/5/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1	10.16	SHALE - medium and low to medium strength, slightly weathered, fragmented to fractured, grey-brown shale with a trace of fine sandstone laminations *(continued)*						9.63m: J70°, un, ro, cly 9.73m: J70°, un, ro, fe 9.85-9.88m: Ds 9.9m: CORE LOSS: 260mm 10.16-10.75m: fg, fe				
	11	9.15-10.0m: some very low strength bands						10.75-11.0m: J85°, he, fe	C	84	27	PL(A) = 0.3
-2	11.2	SHALE - medium strength, fresh stained, fractured, grey shale with approximately 10% fine sandstone laminations						11.08m: B5°, fe & J45°, pl, ro, fe 11.25-11.37m: J80°, un, ro, cln				PL(A) = 0.5
	12	11.6m: very high strength siderite band						11.47m: J30°, pl, sm, fe, Cz, 10mm				PL(A) = 4.5
-3	12.0	SHALE - medium to high then medium strength, fresh, slightly fractured and unbroken, grey shale with approximately 15% fine grained sandstone laminations						11.65 & 11.75m: J70°-80°, un, ro, fe 11.8m: J45°, pl, ro, fe 11.92m: J30°, pl, ro, fe 12.28m: B0°, fe				PL(A) = 1
	13								C	100	82	
-4								13.39-13.5m: J90° & 45°, st, ro, cln 13.53m: J30°, pl, sm, cln				PL(A) = 0.5
	13.7	Bore discontinued at 13.7m										
	14											
-5												
	15											
-6												
	16											
-7												
	17											
-8												
	18											
-9												
	19											
-10												

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 8.0m; NMLC-Coring to 13.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 100% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 10.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 73942
DATE: 8/5/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10	0.4	FILLING - brown, sandy gravel filling, humid							A			
		FILLING - generally loose, grey-brown, silty sand filling with gravel, damp							A			
9	1.2	FILLING - dark grey, silty clay filling with sand and traces of brick and gravel, damp							A			
									S			6,4,5 N = 9
		- slight hydrocarbon odour from approximately 2.0m							E			
8	3.1	FILLING - dark grey, clay filling with traces of glass, brick, gravel and wood, moist, slight hydrocarbon odour							S			4,3,3 N = 6
		- wet from approximately 4.0m				▷			S			1,2,3 N = 5
7	5.7	SILTY CLAY - stiff, red-brown and grey then orange-brown and light grey, silty clay, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	E			
									S			3,3,6 N = 9
6	7.3	SILTSTONE - extremely low strength, light grey and orange-brown, siltstone with some ironstone gravel bands							S			8,13,23 N = 36
	7.5 7.68							7.5m: CORE LOSS: 180mm 7.68-8.05m: Ds				
5		SHALE - extremely low strength, extremely weathered, slightly fractured, light grey-brown, shale with some ironstone bands						8.05-8.7m: B (x5) fe, cly	C	89	0	
	9.15	SHALE - low to medium then medium strength, slightly weathered, fragmented to fractured and slightly fractured, grey-brown shale with some fine sandstone laminations						8.9m: B5°, fe 9.2-9.36m: fg, fe 9.41m: B5°, fe 9.54m: J25°, pl, ro, fe 9.6m: B0°, fe, cly, 5mm 9.7-10.2m: fg, fe	C	100	40	PL(A) = 0.3

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.5m; NMLC-Coring to 13.0m

WATER OBSERVATIONS: Seepage from approximately 4.0m

REMARKS: 100% water loss at 10.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 10.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 73942
DATE: 8/5/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
0	11	SHALE - low to medium then medium strength, slightly weathered, fragmented to fractured and slightly fractured, grey-brown shale with some fine sandstone laminations *(continued)*						10.26m: J30°, pl, sm, fe 10.32m: J70°, cu, ro, fe 10.6-10.9m: B (x3) 0°-5°, fe 11m: CORE LOSS: 60mm 11.2m: J35°, pl, ro, fe 11.36m: J30°, pl, sm, fe 11.4m: J85°, pl, ro, fe 11.45-11.7m: B (x5) 0°, fe	C	100	40	PL(A) = 0.4
-1	11.06											
	11.7	SHALE - medium to high strength, fresh, unbroken, grey shale with approximately 10% fine sandstone laminations							C	96	67	PL(A) = 1
-2	12											
-3	13	13.0 Bore discontinued at 13.0m										
-4	14											
-5	15											
-6	16											
-7	17											
-8	18											
-9	19											

RIG: DT100 **DRILLER:** SS **LOGGED:** JH/SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.5m; NMLC-Coring to 13.0m

WATER OBSERVATIONS: Seepage from approximately 4.0m

REMARKS: 100% water loss at 10.1m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 12.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 73942
DATE: 9/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
12.75	0.05	WOOD CHIPS (garden mulch)		A	0.1				
		FILLING - grey and brown, silty clay filling with gravel and some sand, damp		A	0.5				
12.1	0.7	FILLING - dark grey, sandy gravel filling with some clay							
	1	0.95-1.0m: wood		A	1.0				1
				S	1.45		10,6,10 N = 16		
		1.5m: traces of asbestos (fibro board)							
11	1.8	FILLING - loose, gravel filling with traces of sand, wire, slag and charcoal		A	2.0				2
	2	2.0m: traces of asbestos (fibro board)							
		2.4-2.5m: steel wire		E	2.5				
10.3	2.5	FILLING - dark grey, clayey sand filling with slag, wire, charcoal, ripped sandstone gravel and steel		S	2.85		4,9,10/50mm refusal Bouncing		
	3								3
9.4	3.4	Bore discontinued at 3.4m - auger refusal on steel							
	4								4
	5								5
	6								6
	7								7
	8								8
	9								9

RIG: DT100 **DRILLER:** SS **LOGGED:** JH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 3.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Water added to hole from 1.5m due to asbestos hazard

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 73942
DATE: 9/5/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.08	PAVERS							A			
		FILLING - roadbase gravel filling										
	0.5	FILLING - light grey-brown to red-brown, sandy clay and crushed shale filling, damp							A			
	1.1	FILLING - variably compacted, light brown to red-brown, clayey sand and crushed sandstone filling, damp							A			
									S			2,5,8 N = 13
									S			6,15,12 N = 27
	3.5	FILLING - variably compacted, brown, sandy clay filling, moist							S			13,16,12 N = 28
									S			2,6,13 N = 19
	6.1	FILLING - moderately compacted, light grey-brown, coarse sand and quartz gravel filling							S			8,12,13 N = 25
	7.1	FILLING - dark grey and red-brown, gravelly clay filling, moist							S			4,8,5 N = 13
	9.4	CLAY - very stiff, light brown clay with ironstone gravel, moist										

RIG: DT100 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 7.0m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 11.4m; NMLC-Coring to 14.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ecove Group Pty Ltd
PROJECT: Site 68 Geotechnical Investigation
LOCATION: Sydney Olympic Park

SURFACE LEVEL: 8.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 73942
DATE: 9/5/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-2	11 11.0	CLAY - very stiff, light brown clay with ironstone gravel, moist *(continued)*						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			5,10,13 N = 23
		SHALE - very low to low strength, grey-brown shale										
-3	11.4 12	SHALE - medium and low to medium strength, slightly weathered, fragmented to fractured, grey-brown shale						11.4-11.5m: fg, fe 11.5-11.52m: Ds 11.6m: J30°, pl, ro, fe 11.62-11.7m: fg, fe 11.8m: J45° &P 85°, st, ro, fe 11.85-11.98m: B (x3) 0°, cly 12.21m: J45°, pl, sm, cln 12.35m: J35°, pl, sm, cln 12.45-12.53m: fg, fe, cly 12.65m: J30°, pl, sm, cln 12.7 & 12.8m: B0°, cly	C	100	40	PL(A) = 0.3 PL(A) = 0.4
-4	12.8 13	SHALE - medium strength, fresh, unbroken, grey shale							C	100	100	PL(A) = 0.5 PL(A) = 0.8
-5	14											
-6	14.7 15	Bore discontinued at 14.7m										PL(A) = 0.8
-7	16											
-8	17											
-9	18											
-10	19											
-11												

RIG: DT100 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 7.0m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 11.4m; NMLC-Coring to 14.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

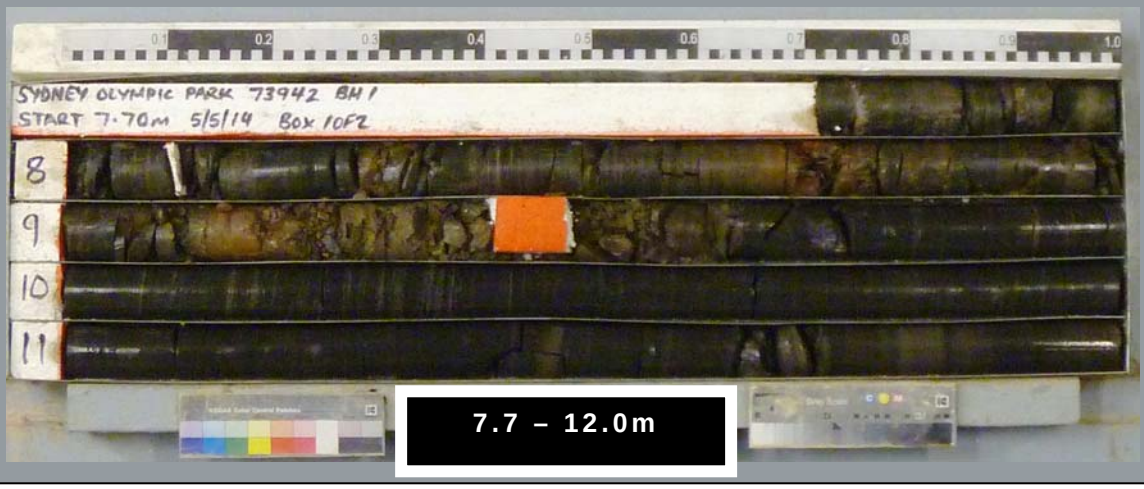
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample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

Douglas Partners
Geotechnics / Environment / Groundwater

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 73942 MAY 2014

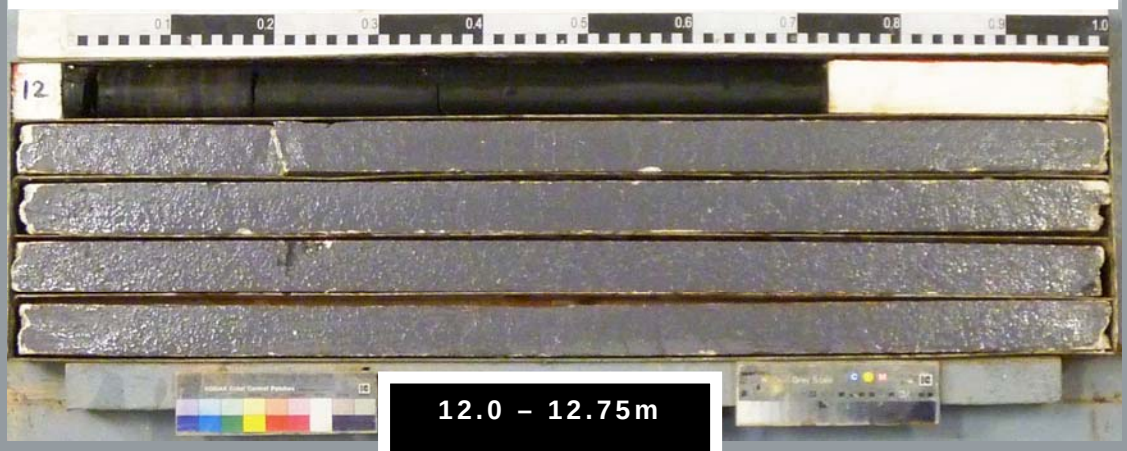


7.7 – 12.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 73942 MAY 2014



12.0 – 12.75m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

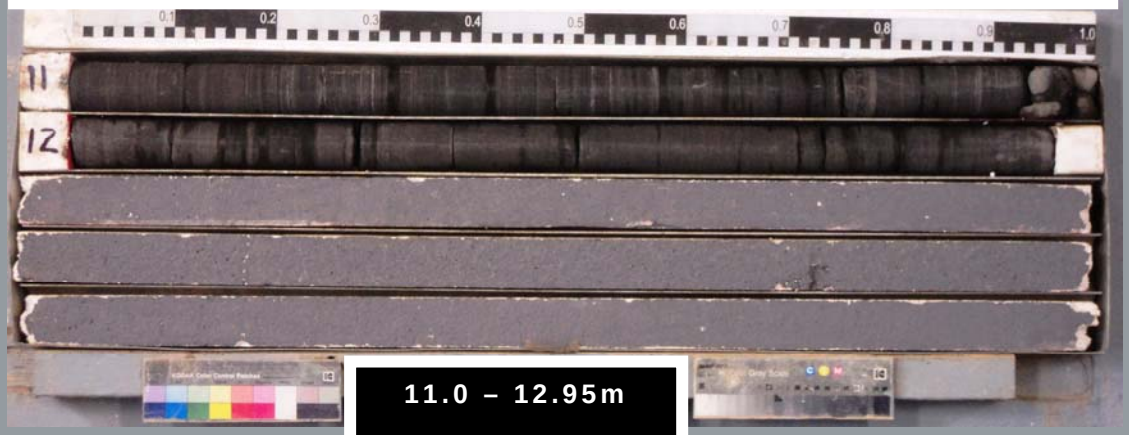
BORE 2 PROJECT 73942 MAY 2014

7.1 – 11.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 73942 MAY 2014



11.0 – 12.95m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

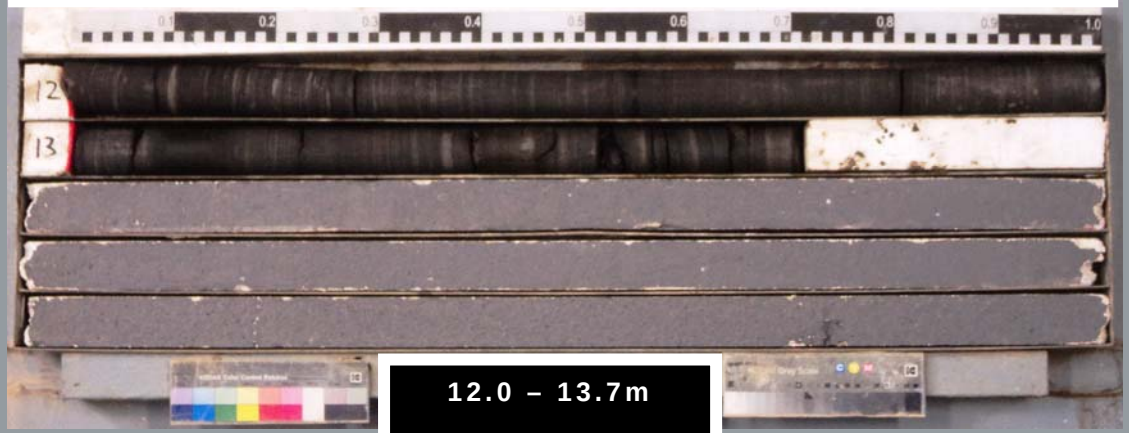
BORE 3 PROJECT 73942 MAY 2014

8.0 – 12.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 3 PROJECT 73942 MAY 2014



12.0 – 13.7m

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SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

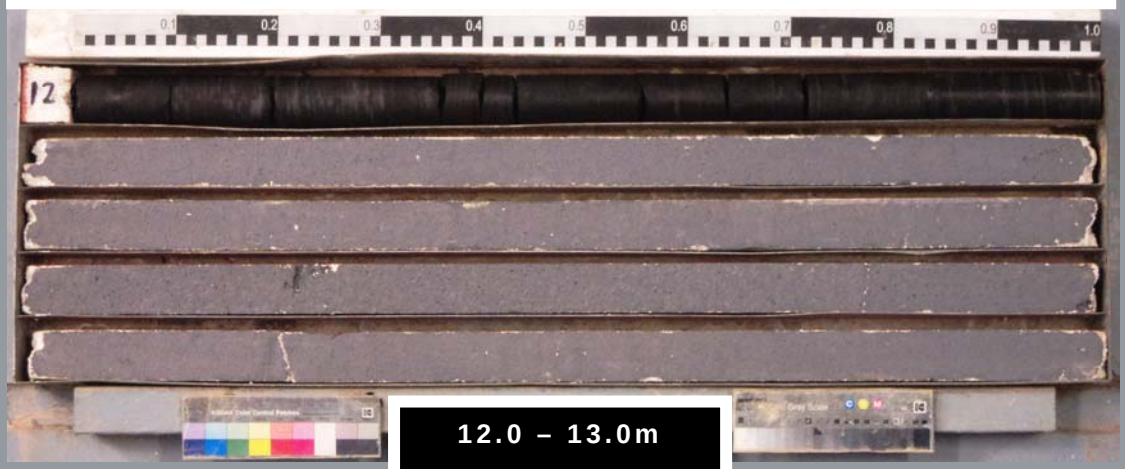
BORE 4 PROJECT 73942 MAY 2014

7.5 – 12.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 4 PROJECT 73942 MAY 2014



12.0 – 13.0m

DOUGLAS PARTNERS PTY LTD

SITE 68 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 6 PROJECT 73942 MAY 2014

11.4 – 14.7m

Appendix E

Laboratory Test Results

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

CERTIFICATE OF ANALYSIS 109741

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Peter Oitmaa

Sample log in details:

Your Reference:	**73942, Sydney Olympic Park**
No. of samples:	9 soils, 1 material
Date samples received / completed instructions received	14/05/14 / 14/05/14

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	21/05/14 / 21/05/14
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	17/05/2014	17/05/2014	17/05/2014	17/05/2014	17/05/2014
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25	<25	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25	<25	<25
vTPHC$_6$ - 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
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	99	100	96	99	98

vTRH(C6-C10)/BTEXN in Soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	17/05/2014	17/05/2014	17/05/2014	17/05/2014
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25	<25
vTPHC$_6$ - C$_{10}$ less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	100	96	102	94

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100	<100	590	940
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100	<100	580	2,300
TRH>C$_{10}$-C$_{16}$	mg/kg	<50	<50	<50	52	65
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50	52	65
TRH>C$_{16}$-C$_{34}$	mg/kg	<100	<100	<100	990	2,700
TRH>C$_{34}$-C$_{40}$	mg/kg	<100	<100	<100	370	1,500
Surrogate o-Terphenyl	%	80	75	85	97	105

svTRH (C10-C40) in Soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	100	420	390	140
TRHC$_{29}$ - C$_{36}$	mg/kg	190	610	570	190
TRH>C$_{10}$-C$_{16}$	mg/kg	<50	<50	<50	<50
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH>C$_{16}$-C$_{34}$	mg/kg	240	850	810	280
TRH>C$_{34}$-C$_{40}$	mg/kg	110	510	460	110
Surrogate o-Terphenyl	%	91	95	91	83

PAHs in Soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Naphthalene	mg/kg	<0.1	<0.1	<0.1	0.2	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	0.3	0.2
Phenanthrene	mg/kg	<0.1	<0.1	0.5	1.8	1.1
Anthracene	mg/kg	<0.1	<0.1	0.1	0.4	0.2
Fluoranthene	mg/kg	<0.1	<0.1	0.9	2.0	1.0
Pyrene	mg/kg	<0.1	<0.1	0.9	2.0	1.0
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.5	0.9	0.5
Chrysene	mg/kg	<0.1	<0.1	0.5	0.9	0.6
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	0.8	1.3	0.8
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.45	0.69	0.41
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.3	0.3	0.2
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	0.3	0.4	0.3
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	1.0	1.0	1.0
Total +ve PAH's	mg/kg	NIL (+)VE	NIL (+)VE	5.4	11	6.4
Surrogate p-Terphenyl-d14	%	104	104	100	96	96

PAHs in Soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Naphthalene	mg/kg	0.2	0.1	0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.7	0.4	0.5	0.7
Anthracene	mg/kg	0.1	0.1	0.1	0.2
Fluoranthene	mg/kg	0.9	0.6	0.7	1.0
Pyrene	mg/kg	0.8	0.5	0.7	1.0
Benzo(a)anthracene	mg/kg	0.4	0.3	0.3	0.5
Chrysene	mg/kg	0.5	0.3	0.4	0.4
Benzo(b+k)fluoranthene	mg/kg	0.8	0.5	0.6	0.7
Benzo(a)pyrene	mg/kg	0.39	0.25	0.30	0.39
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2	0.2	0.2	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.2	0.2	0.2	0.2
Benzo(a)pyrene TEQ NEPM B1	mg/kg	1.0	<0.5	<0.5	1.0
Total +ve PAH's	mg/kg	5.3	3.4	4.0	5.3
Surrogate p-Terphenyl-d14	%	102	98	104	101

Organochlorine Pesticides in soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014	16/05/2014
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
Surrogate TCMX	%	88	97	87	83	89

Organochlorine Pesticides in soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	91	87	82	86

Organophosphorus Pesticides						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Diazinon	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
Chlorpyriphos-methyl	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
Chlorpyriphos	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
Bromophos-ethyl	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
Surrogate TCMX	%	88	97	87	83	89

Organophosphorus Pesticides					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	91	87	82	86

PCBs in Soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.2	<0.1
Surrogate TCLMX	%	88	97	87	99	89

PCBs in Soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Arochlor 1016	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1221	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1232	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1242	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1248	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1254	mg/kg	<0.2	<0.2	<0.1	<0.2
Arochlor 1260	mg/kg	<0.2	<0.2	<0.1	<0.2
Surrogate TCLMX	%	103	100	82	94

Total Phenolics in Soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Total Phenolics in Soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	14

Acid Extractable metals in soil						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Arsenic	mg/kg	5	7	30	20	20
Cadmium	mg/kg	<0.4	<0.4	6.4	4.9	3
Chromium	mg/kg	12	13	30	36	37
Copper	mg/kg	17	19	270	700	470
Lead	mg/kg	16	16	220	360	240
Mercury	mg/kg	<0.1	<0.1	0.2	0.3	0.2
Nickel	mg/kg	2	1	27	29	34
Zinc	mg/kg	8	7	310	450	370

Acid Extractable metals in soil					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Arsenic	mg/kg	20	30	40	20
Cadmium	mg/kg	2	0.8	1	2
Chromium	mg/kg	15	21	25	46
Copper	mg/kg	160	160	200	710
Lead	mg/kg	180	190	190	510
Mercury	mg/kg	0.1	0.3	0.3	0.4
Nickel	mg/kg	16	13	15	48
Zinc	mg/kg	560	210	280	700

Moisture						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Moisture	%	17	17	15	17	17

Moisture					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	15/05/2014	15/05/2014	15/05/2014	15/05/2014
Date analysed	-	16/05/2014	16/05/2014	16/05/2014	16/05/2014
Moisture	%	10	18	18	25

Asbestos ID - soils						
Our Reference:	UNITS	109741-1	109741-2	109741-3	109741-4	109741-5
Your Reference	----------	BH1	BH1	BH2	BH2	BH2
Depth	----------	1-1.45	2.5-2.95	1.7	4.0	5.5
Date Sampled		02/05/2014	02/05/2014	07/05/2014	07/05/2014	07/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	21/05/2014	21/05/2014	21/05/2014	21/05/2014	21/05/2014
Sample mass tested	g	Approx 35g	Approx 35g	34.80g	Approx 30g	34.85g
Sample Description	-	Brown coarse-grained soil	Brown coarse-grained soil	Dark brown coarse-grained soil	Dark brown coarse-grained soil	Dark brown coarse-grained soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	Chrysotile asbestos detected
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Asbestos ID - soils					
Our Reference:	UNITS	109741-6	109741-7	109741-8	109741-9
Your Reference	----------	BH4	BH4	BH4	BH5
Depth	----------	1.9	5.0	5.5	2.5
Date Sampled		08/05/2014	08/05/2014	08/05/2014	09/05/2014
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	21/05/2014	21/05/2014	21/05/2014	21/05/2014
Sample mass tested	g	Approx 35g	Approx 35g	Approx 35g	30.25g
Sample Description	-	Dark brown coarse-grained soil	Dark brown coarse-grained soil	Dark brown coarse-grained soil	Dark brown coarse-grained soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Asbestos ID - materials		
Our Reference:	UNITS	109741-10
Your Reference	----------	BH5
Depth	----------	2.0
Date Sampled		09/05/2014
Type of sample		material
Date analysed	-	16/05/2014
Mass / Dimension of Sample	-	45x30x4mm
Sample Description	-	Grey compressed fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected

Method ID	Methodology Summary
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-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
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-012 subset	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.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-5	15/05/2014
Date analysed	-			17/05/2014	[NT]	[NT]	LCS-5	17/05/2014
TRHC$_6$ - C$_9$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-5	111%
TRHC$_6$ - C$_{10}$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-5	111%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-5	108%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-5	114%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-5	111%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-5	110%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-5	113%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	107	[NT]	[NT]	LCS-5	108%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-4	15/05/2014
Date analysed	-			15/05/2014	[NT]	[NT]	LCS-4	15/05/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	95%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	103%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	104%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	95%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	103%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	104%
Surrogate o-Terphenyl	%		Org-003	81	[NT]	[NT]	LCS-4	88%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-4	15/05/2014
Date analysed	-			16/05/2014	[NT]	[NT]	LCS-4	16/05/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	94%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	99%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	92%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	90%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	92%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	85%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-4	95%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	96	[NT]	[NT]	LCS-4	99%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-5	15/05/2014
Date analysed	-			16/05/2014	[NT]	[NT]	LCS-5	16/05/2014
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	86%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	92%
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	90%
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	89%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	93%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	92%
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	92%
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	91%
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	110%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-5	93%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-005	92	[NT]	[NT]	LCS-5	89%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-5	15/05/2014
Date analysed	-			16/05/2014	[NT]	[NT]	LCS-5	16/05/2014
Diazinon	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Dimethoate	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Ronnel	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-5	106%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-5	83%
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-5	93%
Surrogate TCMX	%		Org-008	92	[NT]	[NT]	LCS-5	105%
QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	[NT]	[NT]	LCS-5	15/05/2014
Date analysed	-			16/05/2014	[NT]	[NT]	LCS-5	16/05/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	LCS-5	116%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	92	[NT]	[NT]	LCS-5	101%
QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			15/05/2014	109741-1	15/05/2014 || 15/05/2014	LCS-1	15/05/2014
Date analysed	-			15/05/2014	109741-1	15/05/2014 || 15/05/2014	LCS-1	15/05/2014
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	109741-1	<5 || <5	LCS-1	101%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			15/05/2014	[NT]	[NT]	LCS-6	15/05/2014
Date analysed	-			15/05/2014	[NT]	[NT]	LCS-6	15/05/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-6	92%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-6	99%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	97%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	97%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	95%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-6	89%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	98%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-6	96%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

QUALITY CONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]

QUALITY CONTROL Asbestos ID - materials	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]

QUALITY CONTROL Total Phenolics in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	109741-2	15/05/2014
Date analysed	-	[NT]	[NT]	109741-2	15/05/2014
Total Phenolics (as Phenol)	mg/kg	[NT]	[NT]	109741-2	102%

Report Comments:

PCB's in soil:PQL has been raised due to interference from analytes(other than those being tested) in the sample/s.

Asbestos-ID in soil: A portion of each of the supplied samples were sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire samples. Envirolab recommends supplying 40-50g of sample in its own container.

Sample 109741-3; Chrysotile asbestos identified embedded in several fragments of fibre cement (total weight 0.0044g). It is estimated that the fibre cement contains up to 60% asbestos fibres by weight. This calculates to 0.0026g of asbestos fibres, which in 34.80g of soil is 0.08g/kg (i.e. < reporting limit for the method of 0.1g/kg).

Sample 109741-5; Loose fibre bundles of chrysotile asbestos identified within the sample (total weight 0.0042g). This is 90% asbestos fibres by weight, which in 34.85g of soil is 0.11g/kg (i.e. > reporting limit for the method of 0.1g/kg).

Sample 109741-9; Chrysotile asbestos identified embedded in several fragments of fibre cement (total weight 0.1677g). It is estimated that the fibre cement contains up to 1% asbestos fibres by weight. This calculates to 0.0017g of asbestos fibres, which in 30.25g of soil is 0.06g/kg (i.e. < reporting limit for the method of 0.1g/kg).

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

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.

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 and 10-140% for SVOC 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.

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

SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Peter Oitmaa

Sample log in details:

Your reference:	**73942, Sydney Olympic Park**
Envirolab Reference:	**109741**
Date received:	14/05/14
Date results expected to be reported:	**21/05/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	9 soils, 1 material
Turnaround time requested:	Standard
Temperature on receipt (°C)	11.8
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

Douglas Partners
Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY

Project Name: Sydney Olympic Park
Project No: 73942 Sampler: JH
Project Mgr: Peter Oitmaa Mob. Phone: 0412 574 518
Email: peter.oitmaa@douglaspartners.com.au
Date Required: Std Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2067
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes: 8 Heavy Metal	TRH BTEX	PAH	OCP OPP	PCB	Phenol	Asbestos		Notes
BH1	1-1.45	1	2/5	S	Jar									
BH1	2.5-2.95	2	"											
BH2	1.7	3	7/5											
BH2	4.0	4	"											
BH2	~~4.5~~ 5.5	5	"											
BH4	1.9	6	8/5											
BH4	5.0	7	"											
BH4	5.5	8	"											
BH5	2.5	9	9/5											
BH5	2.0	10	"	Material	Bag							✓		

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 109741
Date Received: 14/5/14
Time Received: 11:00
Received by: JH
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No.
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114 Phone: (02) 9809 0666 Fax: (02) 9809 4095

Relinquished by: P. Oitmaa	Signed:	Date & Time: 14/5 0930	Received By:	Date & Time: 14/5/14 1100
Relinquished by:	Signed:	Date & Time:	Received By:	Date & Time:

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

CERTIFICATE OF ANALYSIS 109741-A

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Peter Oitmaa

Sample log in details:

Your Reference:	**73942, Sydney Olympic Park**
No. of samples:	Additional testing on soils
Date samples received / completed instructions received	14/05/14 / 23/05/14

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	30/05/14 / 27/05/14
Date of Preliminary Report:	Not Issued

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

Metals in TCLP USEPA1311						
Our Reference:	UNITS	109741-A-3	109741-A-4	109741-A-5	109741-A-6	109741-A-7
Your Reference	----------	BH2	BH2	BH2	BH4	BH4
Depth	----------	1.7	4.0	5.5	1.9	5.0
Date Sampled		07/05/2014	07/05/2014	07/05/2014	08/05/2014	08/05/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Date analysed	-	26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
pH of soil for fluid# determ.	pH units	8.1	8.6	8.9	8.5	8.7
pH of soil for fluid # determ. (acid)	pH units	1.7	1.4	1.4	1.2	1.3
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.6	4.6	4.7	4.8	4.7
Lead in TCLP	mg/L	0.3	5.9	0.5	0.2	0.5

Metals in TCLP USEPA1311			
Our Reference:	UNITS	109741-A-8	109741-A-9
Your Reference	----------	BH4	BH5
Depth	----------	5.5	2.5
Date Sampled		08/05/2014	09/05/2014
Type of sample		Soil	Soil
Date extracted	-	26/05/2014	26/05/2014
Date analysed	-	26/05/2014	26/05/2014
pH of soil for fluid# determ.	pH units	8.8	8.4
pH of soil for fluid # determ. (acid)	pH units	1.9	0.8
Extraction fluid used	-	1	1
pH of final Leachate	pH units	4.8	4.9
Lead in TCLP	mg/L	0.4	0.3

Method ID	Methodology Summary
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311 and in house method INORG-004.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL Metals in TCLP USEPA1311	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/05/2014	109741-A-3	26/05/2014 || 26/05/2014	LCS-W1	26/05/2014
Date analysed	-			26/05/2014	109741-A-3	26/05/2014 || 26/05/2014	LCS-W1	26/05/2014
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	109741-A-3	0.3 || 0.3 || RPD: 0	LCS-W1	85%

QUALITY CONTROL Metals in TCLP USEPA1311	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	109741-A-4	26/05/2014
Date analysed	-	[NT]	[NT]	109741-A-4	26/05/2014
Lead in TCLP	mg/L	[NT]	[NT]	109741-A-4	81%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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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.

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 and 10-140% for SVOC 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.

Aileen Hie

From: Peter Oitmaa [Peter.Oitmaa@douglaspartners.com.au]
Sent: Friday, 23 May 2014 1:44 PM
To: Aileen Hie
Subject: RE: Results for registration '109741 - 73942, Sydney Olympic Park'

Hi Aileen,

Can you please arrange TCLP testing as follows:

Lead: ELS sample no.s 109741-3, 4, 5, 6, 7, 8, 9.

Order attached.

109741 A
std T/A
due 30/5

Regards,

Peter Oitmaa | Senior Associate
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
96 Hermitage Road West Ryde NSW 2114 | PO Box 472 West Ryde NSW 1685
P: 02 9809 0666 | F: 02 9809 4095 | M: 0412 574 518 | E: Peter.Oitmaa@douglaspartners.com.au

-----Original Message-----
From: Results [mailto:Results@envirolab.com.au]
Sent: Wednesday, 21 May 2014 4:07 PM
To: Peter Oitmaa; Rob Dobinson
Subject: Results for registration '109741 - 73942, Sydney Olympic Park'

Please refer to attached for:
a copy of the Certificate of Analysis
a copy of the COC
an excel file containing the results

Please note that a hard copy will not be posted.

Enquiries should be made directly to:
Jacinta Hurst on jhurst@envirolabservices.com.au or David Springer on dspringer@envirolabservices.com.au
or
Tania Notaras on tnotaras@envirolabservices.com.au

Regards

Envirolab Services
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
www.envirolabservices.com.au

Regards,