



Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Additional Geotechnical Investigation

Kellyville Stage 3
Memorial Drive, Kellyville

Prepared for
Impact Group

Project 71123.07
July 2017

Integrated Practical Solutions



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

Signature	Date
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Report on Additional Geotechnical Investigation

Kellyville Stage 3

Memorial Drive, Kellyville

1. Introduction

This report details the results of an additional geotechnical investigation undertaken for Kellyville Retirement Village, Stage 3 at 34 – 36 Memorial Avenue, Kellyville. The work was commissioned by Impact Group, project managers, on behalf of Baptist Community Services – NSW & ACT and was undertaken in accordance with Douglas Partners' proposal SYD170658 dated 2 June 2017.

The project involves the construction of residential unit buildings, known as Clusters 2, 3 and 4, with several storeys above ground and a basement under each cluster. Column loads of up to 5,000 kN are envisaged in the larger buildings.

Douglas Partners has previously carried out a preliminary investigation on the site in 2009. Since the initial investigation was carried out, the proposed development has been updated and the currently proposed depths of the basements are lower than the depths of most of the bores from the previous investigation. Hence, some additional bores were drilled at accessible locations to supplement information on the expected subsurface conditions on the site, and laboratory testing and engineering analysis undertaken. Details of the field work and comments relevant to design and construction are given in this report.

2. Site Description

The development site is 34 – 36 Memorial Avenue, Kellyville and is part of the Baptist Aged Care facility. The ground surface slopes gently down to the west with an overall fall of about 9 m across the site at grades in the order of 4% to 5%.

At the time of the initial investigation, the site of Clusters 2 to 4 was open grassed areas with medium to large trees scattered on the remainder of the site. Since September 2009, residential units have been constructed at the southern and northern ends of the site.

3. Regional Geology

The *Penrith 1:100 000 Geological Series Sheet* shows that the site is underlain by Ashfield Shale which generally comprises black to dark grey shale and laminite. Ashfield Shale weathers to form clay soils of medium to high plasticity. The *1:100 000 Salinity Potential in Western Sydney* sheet shows the site in a zone of moderate salinity potential.

4. Field Work Methods

The current field work included four boreholes, Bores 301 to 304 as shown on Drawing No. 1 in Appendix B. Previous bores are also shown on Drawing 1. The current bores were drilled to depths of 8 m to 10 m using a track-mounted drilling rig. The bores were commenced with solid flight augers to drill through the overburden soils and standard penetration tests (SPTs) were undertaken to aid in strength interpretation. Once weathered rock was encountered, the bores were cased and advanced using NMLC sized diamond core drilling equipment to obtain 50 mm diameter samples of the rock for identification and strength testing purposes.

The ground surface levels at the bores were interpolated from the original survey plan of the site.

5. Field Work Results

The subsurface conditions encountered in the bores drilled during the current and previous investigations are presented in the borehole logs in Appendix C. Notes defining descriptive terms and classification methods are also included.

The bores encountered:

- **Filling** – silty clay and shale fragments to depths of 0.2 m to 0.7 m.
- **Residual Soil** – silty clay to depths of 0.9 m to 1.8 m. The residual soil was generally stiff or very stiff silty clay.
- **Weathered Rock** – the cored bores generally encountered weathered shale and laminate bedrock. The rock was typically extremely low to very low strength to depths of 2.7 m to 4.3 m, generally becoming low, medium and/or high strength to the base of the bores at 8 m to 10 m depth. Some very high strength bands were also encountered.

Table 1 below summarise the levels at which different materials were encountered in the bores. The rock has been classified in accordance with Pells et al (1998) which classifies rock depending on strength, fracturing and defects within the profile. Class V rock is typically weathered, very low strength, fractured rock while Class I is typically fresh, high strength, unbroken rock.

Table 1: Summary of Material Strata Levels and Rock Classifications

Bore	RL of Top of Stratum (AHD)					
	Ground Surface	Filling	Stiff Clay	Class V/IV ¹ Shale	Class III ¹ Shale	Base of Borehole
Cluster 2	Basement Level at RL 55.2 – RL 57.2 m					
304	58.5	58.5	57.9	57.1	53.5	49.9
1	59.5	59.5	59.3	58.0	56.9	53.8
5	59.0	59.0	58.8	57.7	57.0	53.3
8	59.0	59.0	58.8	58.0	56.7	54.0
Cluster 3	Basement Level at RL 54.2 m					
302	60.8	60.8	60.1	59.0	55.7	50.8
303	61.2	61.2	60.9	60.4	58.6	51.3
2	61.2	61.2	60.9	60.0	59.7	57.1
6	60.7	60.7	60.5	59.2	58.7	55.7
9	60.2	60.2	60.0	58.7	57.2	54.7
10	61.7	61.7	61.5	60.3	59.2	56.3
12	61.7	61.7	61.5	60.4	58.9	56.9
101	60.0	60.0	59.6	57.7		57.6
Cluster 4	Basement Level at RL 59.7 m					
301	64.0	64.0	63.8	62.9	60.9	56.3
7	63.0	63.0	62.8	61.7	61.1	58.1
11	64.1	64.1	63.9	62.8	61.4	59.1
14	63.9	63.9	61.6	62.3	61.6	58.7

Note: 1 Refer to Pells et al (1998) for rock class descriptions

The core samples exhibited many joints dipping in the 40° to 60° range (and steeper) which is fairly typical of Ashfield Shale. Several joints were assessed as being smooth-sided and numerous were clay-filled. There were some minor zones of core loss evident in several of the cores bores which are likely to be due to weaker, friable or fragmented bands in the rock strata.

Free groundwater was not observed during augering, and the use of drilling fluid prevented further groundwater observations during coring.

6. Laboratory Testing

6.1 Rock Samples

Seventy three selected samples of the rock core were tested for axial point load strength index (IS_{50}) from the current and previous investigation. The results generally ranged from 0.1 MPa to 1.7 MPa which corresponds to low strength and high strength rock respectively. There was one result of 4.1 MPa in Bore 304 outside the typical range of results which indicates very high strength rock.

7. Inferred Geotechnical Model

The site appears to be underlain by filling, residual soil and shale and laminate bedrock. The filling is generally silty clay and shale fragments, probably from basement excavation for the adjacent buildings. The residual soil comprised clayey soils formed from weathering of the underlying parent rock. The strength of the soils was generally stiff to very stiff. Previous testing of the soils from the site indicates that the soils swell upon saturation and are highly reactive to changes in moisture content.

Bedrock was encountered below depths of 0.9 m to 2.3 m across the site. The rock was initially extremely weathered and of extremely low to very low strength to depths of 1.5 m to 5.1 m. The rock then became low, medium and high strength to the base of the bores at 4.2 m to 10.0 m depth (ignoring Bore 101 which was not cored). Some very high strength bands were also observed in the core samples.

Many moderately dipping (40-65°) and steeper joints were evident in the core samples which are typical within the shale units in the Sydney basin. Unconfined compressive rock strengths in excess of 60 MPa for some very high strength bands were inferred from the point load strength index testing.

Groundwater was not encountered in the boreholes during augering and the use of drilling fluid during coring prevented observations at depth. The regional groundwater table is expected to be well below the bedrock surface.

8. Comments

8.1 Proposed Development

The Stage 3 project involves the construction of residential unit buildings known as Clusters 2 to 4, with several storeys above ground and basement level(s) under each cluster. Cluster 2 is located on the adjacent Free Settlers Drive on the lower western side of the site and has one basement level at RL 55.2 m. Cluster 3 is located in the middle of the site and has a common basement with Cluster 2 as well as another basement level at RL 54.2 m. Cluster 4 is located adjacent to Rutherford Avenue on the eastern side of the site and has one basement level at RL 59.7 m.

Drawing and sketches of the Stage 3 indicate up to approximately 3 m to 8 m of excavation. Column loads of up to 5,000 kN are envisaged.

8.2 Excavation

Excavation for the basements is expected to be required in filling, residual soil and rock of varying strength, possibly up to very high strength. Excavation in filling, soil and extremely low to very low strength rock should be readily achievable using conventional earthmoving equipment such as a hydraulic excavator with bucket attachment.

Excavation in low strength and stronger rock will require the use of heavy ripping equipment such as a Caterpillar D8 dozer or larger, hydraulic rock hammers, milling heads and/or rock saws. Potential

excavation contractors should be made aware that bands of very high strength rock with an estimated unconfined compressive strength in excess of 60 MPa were encountered on the site.

The use of rock hammers will cause vibration which, if not controlled, could possibly result in damage to nearby structures and disturbance to occupants. It is suggested that vibrations be provisionally limited to a peak particle velocity (PPV) of 8 mm/s at the foundation level of the buildings to protect the architectural features of the building and to reduce discomfort for the occupants. A site specific vibration monitoring trial may be required to determine vibration attenuation once excavation plant and methods have been finalised. The contractor will have to select his equipment carefully so that the equipment used on site to remove the laminite does not exceed the vibrations limits.

8.3 Excavation Support

8.3.1 General

Vertical excavations in filling, soil and weathered rock are not expected to be self-supporting for any extended period of time. Temporary batters may be feasible on the site where space permits. A maximum temporary batter slope of 1(H):1(V) is recommended for cuts up to approximately 3 m in height in the clay soils and weathered rock encountered on the site. A maximum temporary batter slope of 1.5(H):1(V) is recommended for cuts up to 5 m in height in the same materials.

Maximum permanent, vegetated batter slopes of 3(H):1(V) are suggested for the residual soils encountered on the site, to allow the maintenance of grass or other slope coverage

Shoring support will be required in areas where batters are considered impractical such as adjacent to existing roads. Soldier piles with infill reinforced shotcrete panels are commonly used to support excavations in Ashfield Shale. The soldier piles would generally be spaced at about 2 m to 2.5 m centres and should be founded at least 1 m below bulk excavation level for anchored walls (but more for cantilevered walls). Shotcreting will be needed to the full excavation depth and should be undertaken in about 2 m to 3 m drops as excavation proceeds in order to reduce the risk of local slippages. Temporary ground anchors may be required to prevent excessive lateral deformation of soldier pile walls and to ensure stability and limit pile bending moments for larger height walls.

8.3.2 Earth pressures

Excavations braced either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of Class III rock. Additional loads from rock wedges may also be applied to the wall and may need to be considered in the design or remotely supported by rock bolts.

Suitable design parameters for shoring systems are shown in Table 2. Allowance for hydrostatic pressures, sloping ground surfaces and surcharge loads should also be made where applicable.

Table 2: Design Earth Pressures and Bulk Unit Weights

Material	Temporary Active (K_a)	Permanent Active (K_a)	Ultimate Passive Pressure (kPa)	Bulk Unit Weight (kN/m³)
Filling/ Residual Soil	0.3	0.4	N/A	20
Class V / IV Rock	0.2	0.25	1,000	22
Class III Rock	0	0	3,000	23

Passive pressure can be used to provide lateral support for piles installed below the bulk excavation level. Table 2 outlines maximum ultimate passive earth pressure values for piles founded in various materials.

The depth equal to at least one pile diameter below the base of the excavation should be ignored in passive earth pressure calculations. The rock will need to be regularly inspected by an experienced geotechnical professional to check for unfavourable jointing. The presence of unfavourable joints may result in additional bolts or anchors needing to be installed to provide lateral support at the toe of the piles.

A triangular lateral earth pressure distribution could be used to design cantilevered retaining walls and walls with a single row of support. Inspections of the rock during excavation may also indicate additional support is required on some parts of the site.

8.3.3 Ground Anchors

Where necessary, the use of inclined 'tie-back' (ground) anchors is suggested for the lateral restraint of the perimeter piled wall system. Such ground anchors should be inclined below the horizontal to allow anchorage into the stronger bedrock materials at depth. The design of temporary ground anchors for the support of piled wall systems may be carried out using the allowable average bond stresses at the grout-rock interface given in Table 3.

Table 3: Bond Stresses for Anchor Design

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

Ground anchors should be designed to have a free length equal to their height above the base of the excavation and 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 effects or other causes.

The parameters given above 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 generally 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 (e.g. road owner) prior to installing anchors that will extend beyond the perimeter of the site. In addition, care should be taken to avoid damaging buried services and pipes during anchor installation.

8.4 Groundwater

Groundwater was not observed during augering and is likely to be well below the bedrock surface. However, seepage will occur through and along strata boundaries on the site. The subsurface conditions encountered in the bores are such that seepage can probably be controlled using sub-floor drainage and collection systems in the basements. Pumps will be required to periodically remove stored water if gravity drainage systems cannot be provided.

A pump may also be needed to remove seepage from footing and/or bored pile excavations prior to the placement of concrete.

8.5 Foundations

The foundation conditions will vary depending on the final basement levels. The basement excavations are expected to expose mainly Class III or better shale over most of the bulk excavation level for the Clusters with possibly some localised areas of Class IV/V shale. It is recommended that all footings are founded on rock. Spread footings (i.e. pad or strip footings) could be designed using the parameters provided in Table 4.

Table 4: Design Parameters for Spread Footings in Heavily Loaded Structures

Material	Maximum Allowable Bearing Pressure (kPa)
Class IV / V Shale	700
Class III or better Shale	3,000

Where Class IV/V shale is exposed at bulk excavation level, Class III rock or better is generally expected close to the excavated surface. It may be more economical to excavate to Class III rock with higher bearing pressures to achieve smaller footings.

Footings founded in bedrock and designed using the parameters provided in this report would be expected to settle no greater than 0.5% to 1% of the footing width at working load. Differential settlements between footings founded in similar strata are expected to be less than 50% of the value of total settlement.

It would be prudent to pour a blinding layer in the base of the footings to protect the foundation material unless the footings can be poured on the same day they are excavated.

All shallow footings should be inspected prior to concrete placement by an experienced geotechnical professional.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Memorial Drive, Kellyville in accordance with DP's proposal dated 2 June 2017 and acceptance received from Impact Group on behalf of Baptist Community Services dated 14 June 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

This report must be read in conjunction with all of the attached 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 stated in this report.

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

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

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. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

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

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

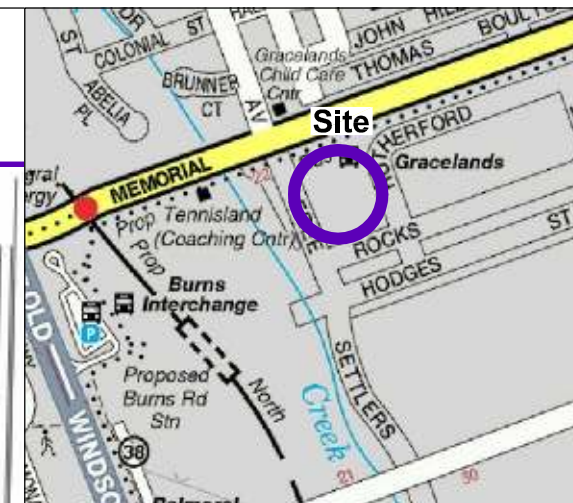
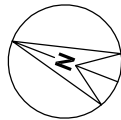
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

Site Inspection

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

Appendix B

Drawing



Location Plan

Legend

- 301 Borehole Location 2017
- Borehole Location (Sept. 2009)
- Borehole Location (June 2014)

Appendix C

Field Work Results

BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 59.5 AHD
EASTING: 309396
NORTHING: 6267036
DIP/AZIMUTH: 90°/-

BORE No: 1
PROJECT No: 71123
DATE: 30 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding J - Joint		Type	Core Rec %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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59	0.25	TOPSOIL - grey brown silty clay topsoil, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															</

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.3m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 5.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials: *RWD*

Date: *3-9-09*



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 Geotechnics • Environment • Groundwater

BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 61.2 AHD
EASTING: 309433
NORTHING: 6267062
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 71123
DATE: 20 Apr 09
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 0.01 0.05 0.10 0.50 1.00	Fracture Spacing (m)	Discontinuities B - Bedding J - Joint S - Shear D - Drill Break	Sampling & In Situ Testing			
									Type	Core Rec %	RQD %	Test Results & Comments
61	0.35	FILLING - grey brown, clay filling with some brick fragments, tiles and timber										
	0.5	CLAY - light brown clay, moist										
		CLAY - very stiff, red brown clay, moist										
60	1.2	SHALE/SILTSTONE - extremely low to very low strength, light grey brown shale/siltstone							S			9,13,25 N = 38
59	1.5	SILTSTONE - medium strength, moderately weathered, fragmented to fractured, brown siltstone with some extremely low strength bands										
58	2											
57	3											
56	3.4	SILTSTONE - high strength, moderately weathered then fresh, fractured to slightly fractured, grey brown siltstone							C	92	31	PL(A) = 0.5MPa PL(A) = 0.8MPa
55	4											
54	4.15	Bore discontinued at 4.15m										PL(A) = 1.5MPa
53	5											
52	6											
	7											
	8											
	9											

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.5m; NMLC-Coring to 4.15m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

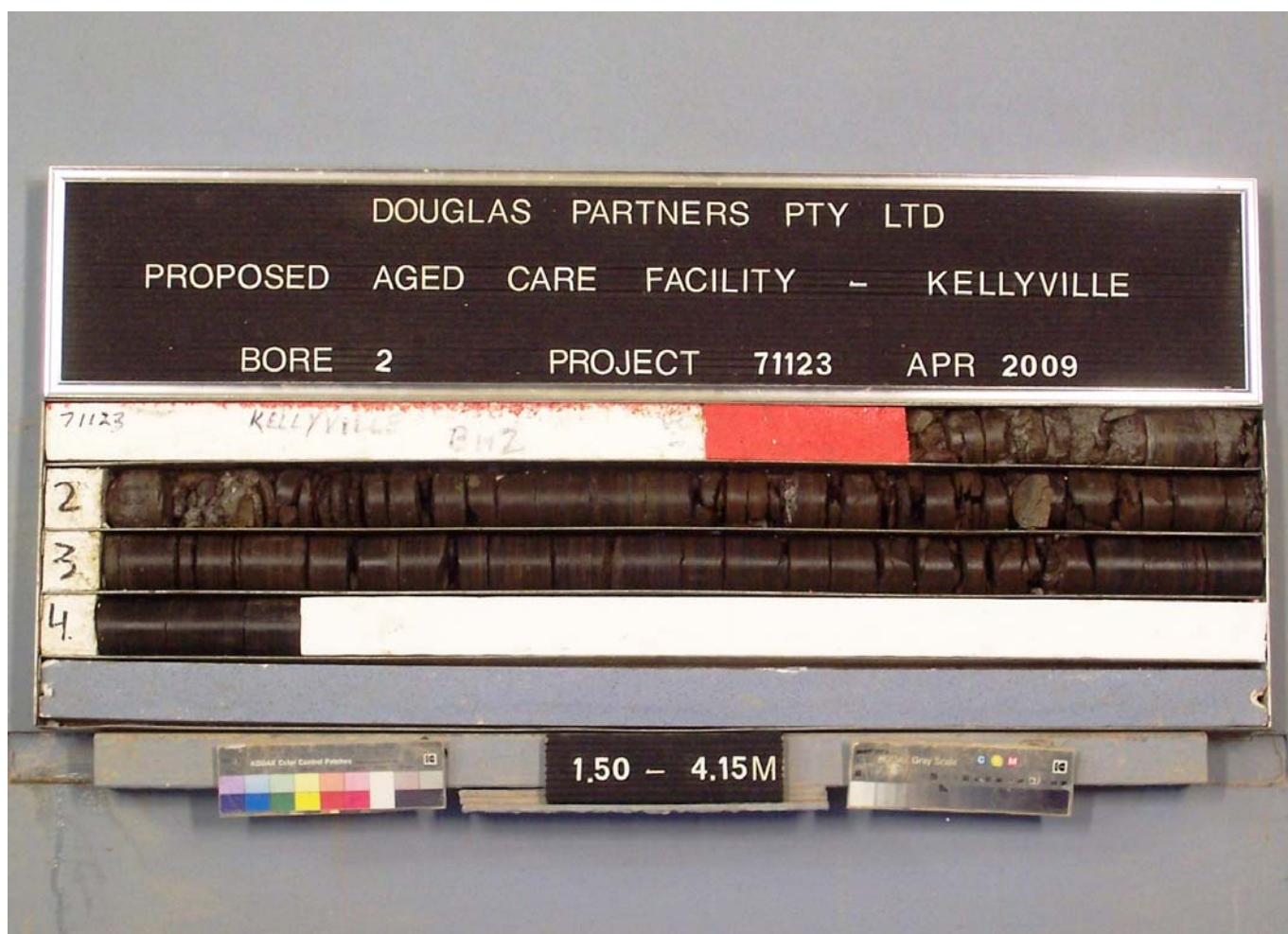
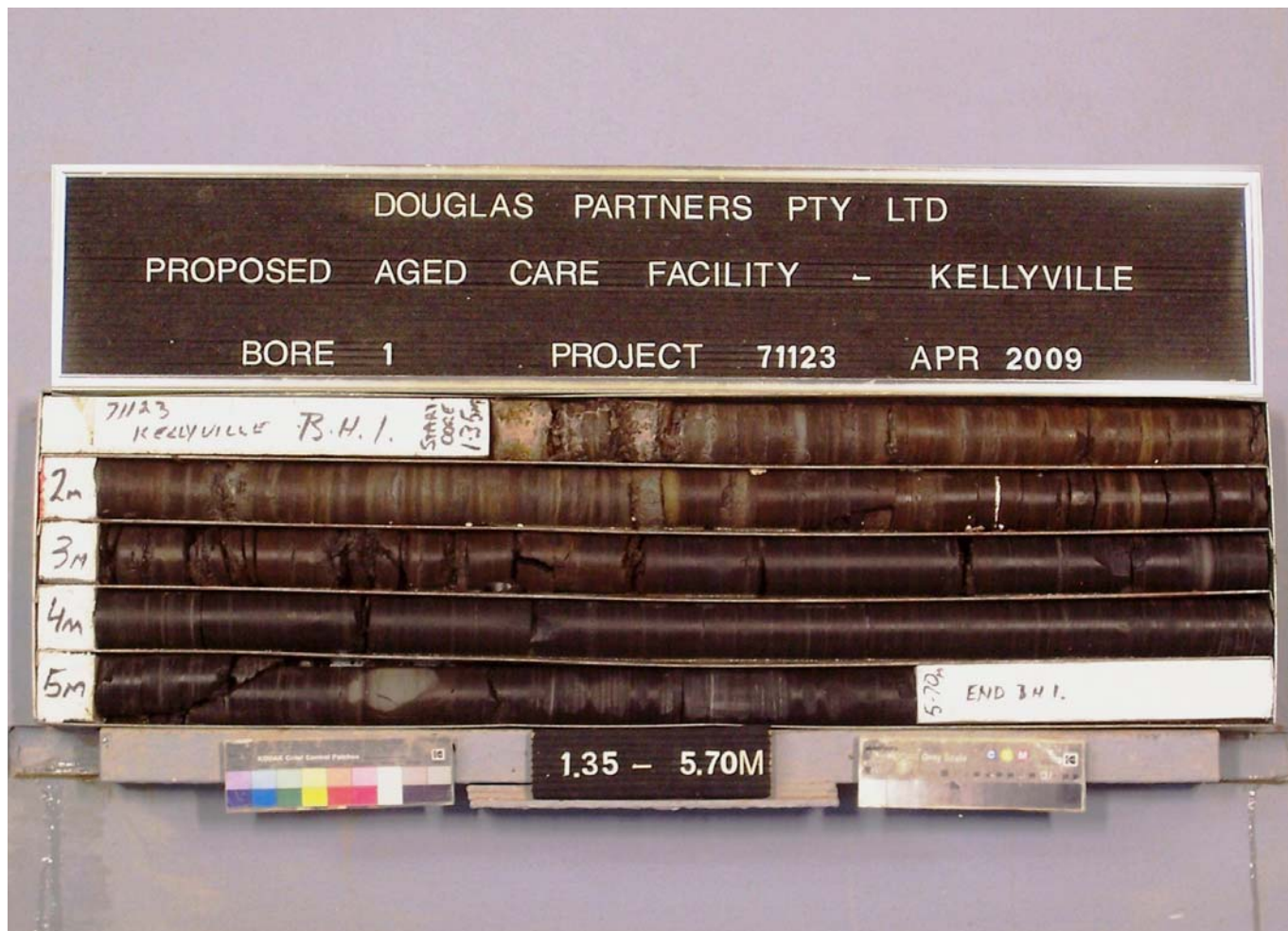
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Initials *PLD*

Date *3-9-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 59.0 AHD
EASTING: 309399
NORTHING: 6267002
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 71123
DATE: 22 Apr 09
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 0.01 0.05 0.10 0.50 1.00	Fracture Spacing (m)	Discontinuities B - Bedding J - Joint S - Shear D - Drill Break	Sampling & In Situ Testing				Test Results & Comments
									Type	Core Rec %	RQD %		
58	0.2	TOPSOIL - grey brown, silty clay topsoil, moist											
	0.5	CLAY - stiff, red brown clay, moist											
		CLAY - very stiff, brown clay with ironstone gravel, moist											
58	1												
	1.35	SHALE - extremely low strength, extremely weathered, brown shale with ironstone bands											
57	2												
	2.49	SHALE/SILTSTONE - low to medium strength, moderately weathered, fragmented to fractured, grey brown shale/siltstone with some extremely low strength bands											
56	2.7												
	3.58	SILTSTONE - medium strength, moderately weathered, fractured, grey brown siltstone											
55	4												
	4.5	SILTSTONE - high strength, fresh, slightly fractured, dark grey siltstone											
54	5												
	5.7	Bore discontinued at 5.7m											
53	6												
52	7												
51	8												
50	9												

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.3m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 5.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		■	Water level

CHECKED

Initials: *RLD*

Date: *3-9-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 60.7 AHD
EASTING: 309436
NORTHING: 6267029
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 71123
DATE: 21 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities				Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	S - Shear	D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
60	0.25	FILLING - silty clay filling, with some roadbase gravel																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.3m

TYPE OF BORING: Solid flight auger to 0.8m; Rotary to 1.5m; NMLC-Coring to 5.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

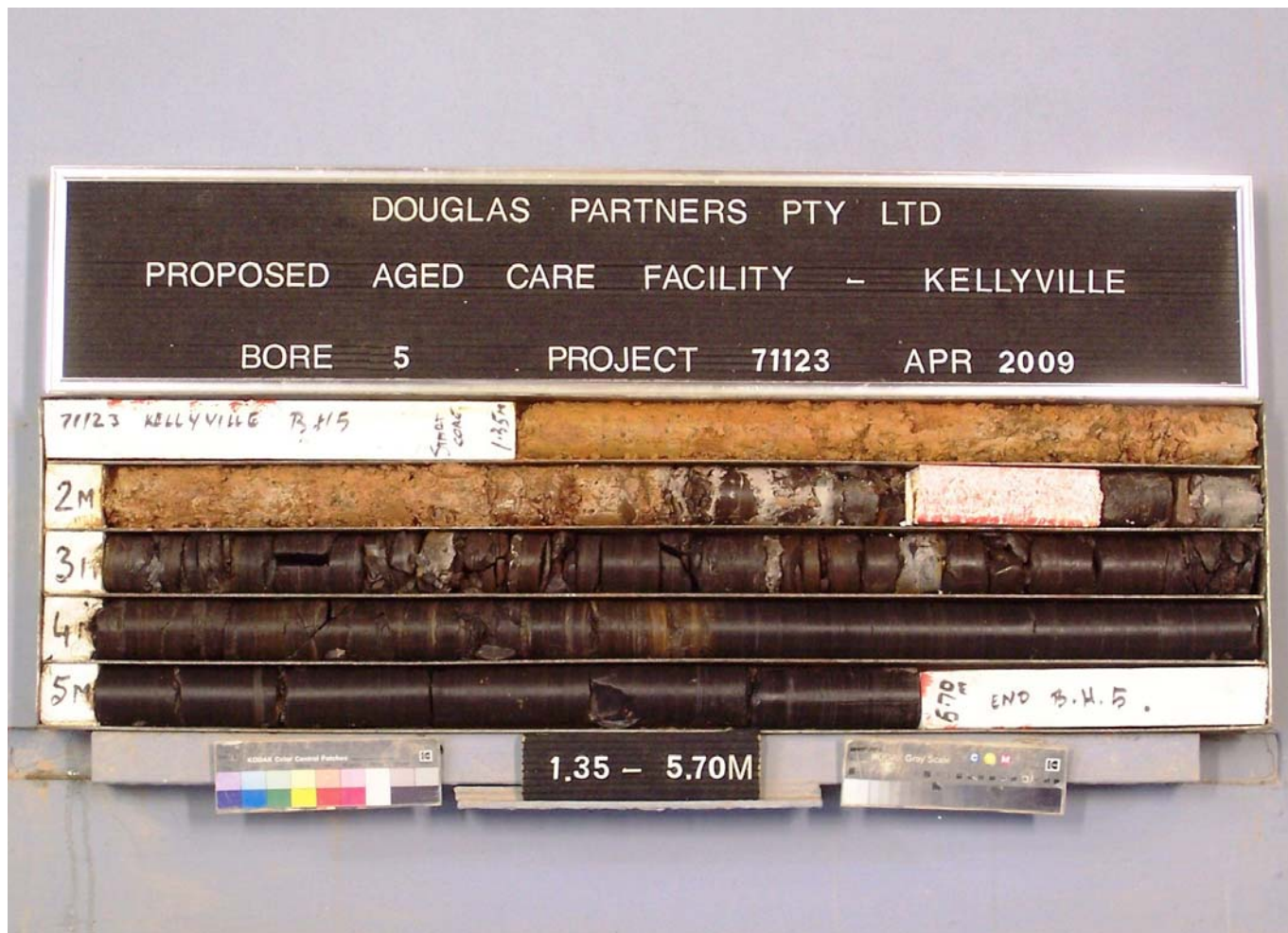
REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		■	Water level

CHECKED	
Initials:	RLO
Date:	3.9.09



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 63.0 AHD
EASTING: 309489
NORTHING: 6267049
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 71123
DATE: 27 Apr 09
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 D - Drill Break		Sampling & In Situ Testing				Test Results & Comments
										Type	Core Rec %	RQD %		
63	0.2	TOPSOIL - grey brown silty clay topsoil, moist												
		CLAY - red brown clay, moist												
62	0.7	SHALY CLAY - very stiff, light grey brown, shaly clay with ironstone bands												
61	1.35	SHALE - extremely low to very low strength, extremely to moderately weathered, light grey brown shale with low to medium strength bands												
60	1.9	SILTSTONE - low to medium then medium strength, highly to moderately weathered, fractured to slightly fractured, brown siltstone												
59	3.6	SILTSTONE - high strength, slightly weathered then fresh, slightly fractured, grey siltstone												
58	4.9	Bore discontinued at 4.9m												

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 4.9m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		▽	Water level

CHECKED
Initials: <i>RWD</i>
Date: <i>3-9-09</i>



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 59.0 AHD
EASTING: 309406
NORTHING: 6266976
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 71123
DATE: 22 Apr 09
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 D - Drill Break		Sampling & In Situ Testing			
										Type	Core Rec %	RQD %	Test Results & Comments
58	0.2	TOPSOIL - grey silty clay topsoil with some grass roots, moist											
	0.5	CLAY - red brown clay, moist											
		CLAY - stiff, mottled red, light grey clay											
58	1.0	SHALE - extremely low strength, light grey shale with ironstone bands								S			3,6.9 N = 15
	1.4	SHALE - extremely low then very low strength, extremely and highly weathered, light grey to grey shale with some medium strength ironstone bands											
57	2									C	100	15	
	2.32	SILTSTONE - medium strength, slightly weathered, fractured to slightly fractured, grey brown siltstone with extremely low strength bands											PL(A) = 0.6MPa
56	3												PL(A) = 0.4MPa
	3.4	SILTSTONE - medium and medium to high strength, slightly weathered, fractured to slightly fractured, grey brown siltstone with very low to low strength bands								C	100	68	PL(A) = 1MPa
55	4												
	4.27	SILTSTONE - high strength, fresh, slightly fractured, grey shale											PL(A) = 1.1MPa
54	5.0	Bore discontinued at 5.0m											
53	6												
52	7												
51	8												
50	9												

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.4m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.4m; NMLC-Coring to 5.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

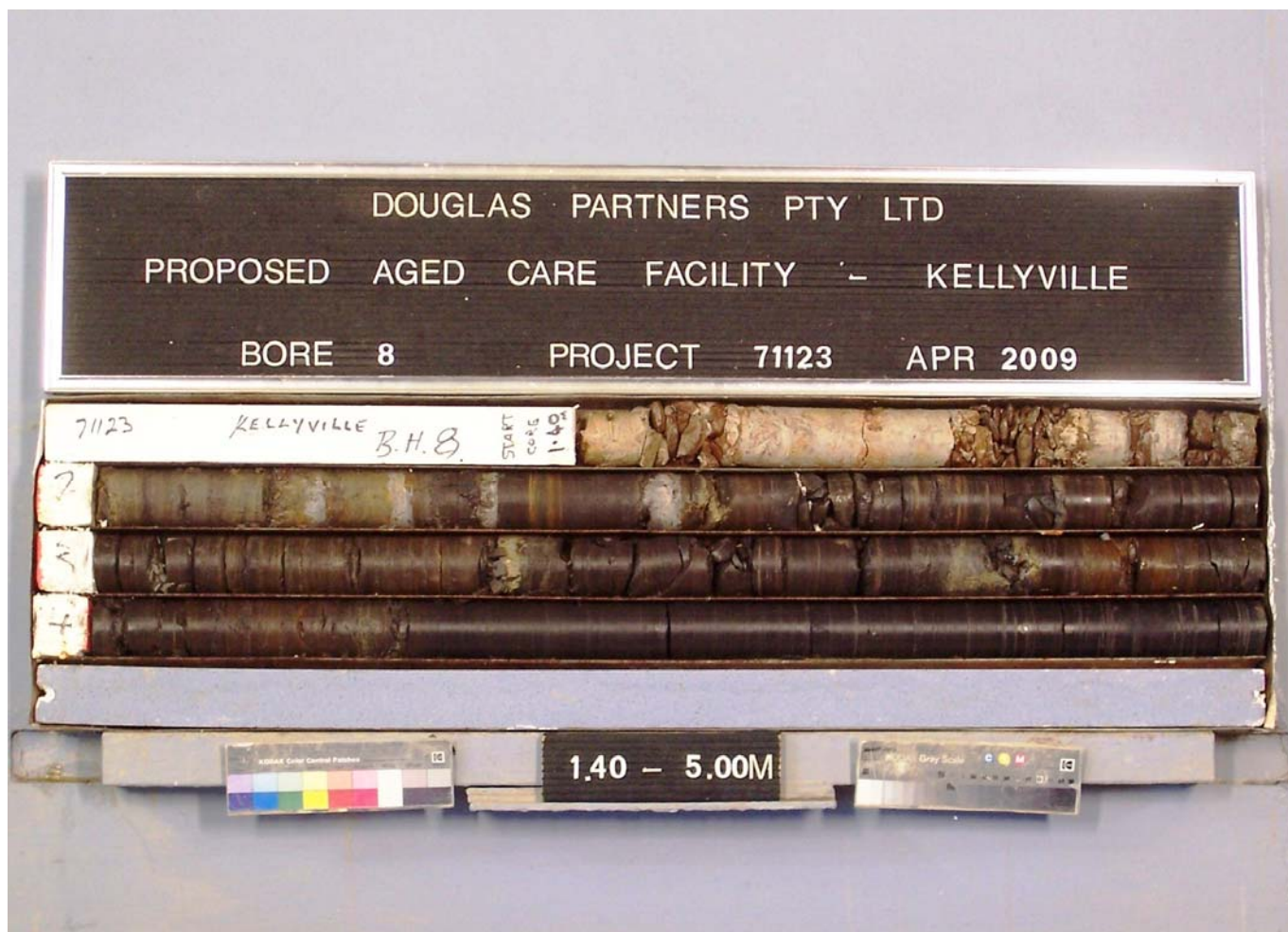
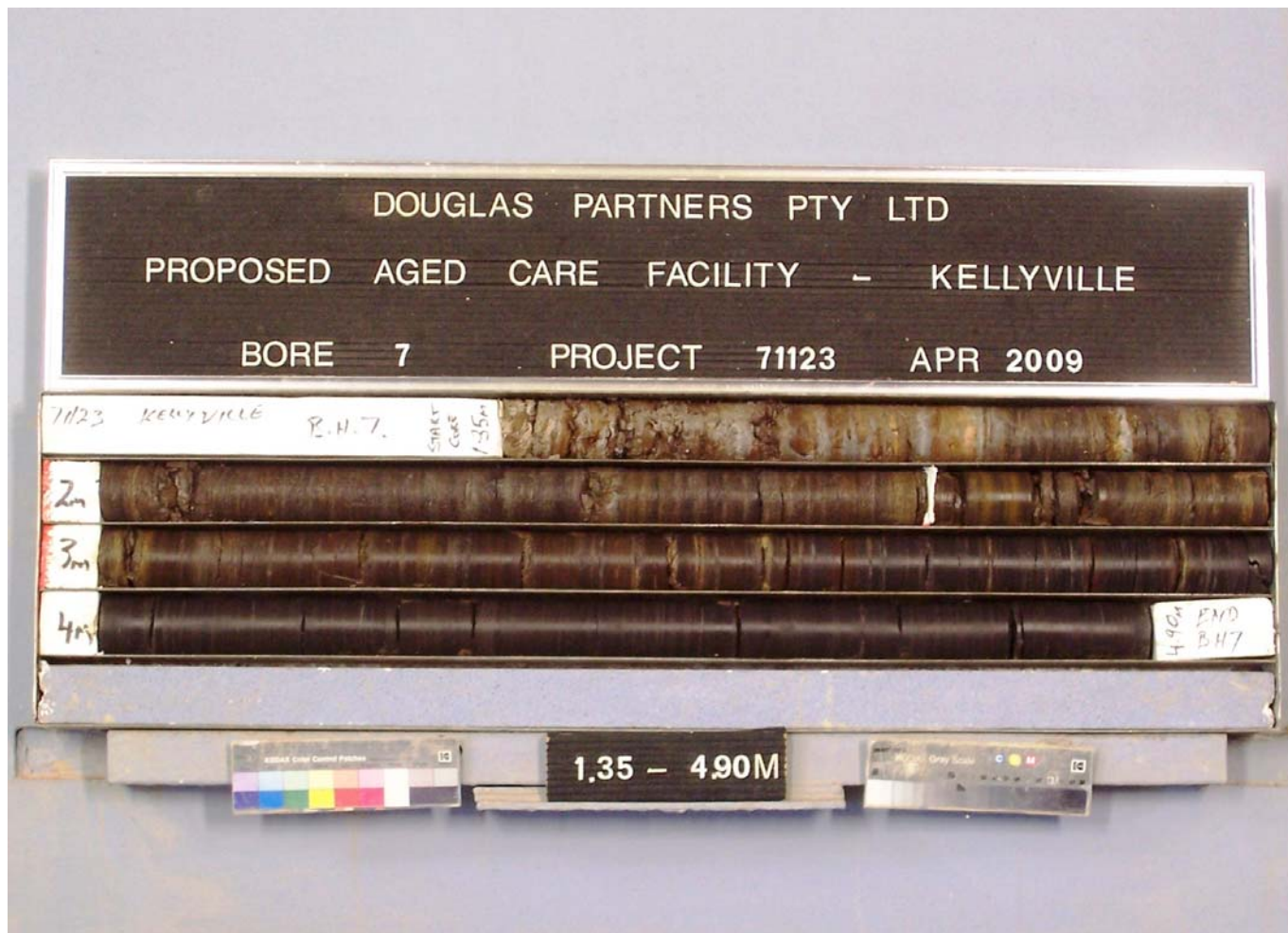
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Initials: *RLD*

Date: *3.9.09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 60.2 AHD
EASTING: 309435
NORTHING: 6266988
DIP/AZIMUTH: 90°/-

BORE No: 9
PROJECT No: 71123
DATE: 22-22 Apr 09
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 0.01 0.05 0.10 0.50 1.00	Fracture Spacing (m)	Discontinuities B - Bedding J - Joint S - Shear D - Drill Break	Sampling & In Situ Testing			
									Type	Core Rec %	RQD %	Test Results & Comments
60	0.2	TOPSOIL - grey clay topsoil with grass roots, moist										
		CLAY - red brown clay, moist										
	0.8	CLAY - stiff, mottled red brown light grey clay, moist										
59	1.1	SHALY CLAY - very stiff, light grey brown, shaly clay, moist							S			3,7,15 N = 22
	1.5	SHALE - extremely low strength, extremely to highly weathered, light grey brown shale with some medium strength bands							C	100	0	
58	2											
	2.73											
57	3	SHALE/SILTSTONE - medium strength, moderately and slightly weathered, fractured to slightly fractured, grey brown shale/siltstone with some extremely and very low strength bands							C	97	52	PL(A) = 0.7MPa
	3.04											
56	4											
	4.3m	fractured rock										PL(A) = 0.6MPa
55	5											
	5.45	Bore discontinued at 5.45m										PL(A) = 0.5MPa
54	6											
	7											
53	8											
	9											
52												
51												

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.5m; NMLC-Coring to 5.45m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED

Initials: *RLD*

Date: *3-9-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 61.7 AHD
EASTING: 309465
NORTHING: 6267008
DIP/AZIMUTH: 90°/-

BORE No: 10
PROJECT No: 71123
DATE: 27 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
								Type	Core Rec %	RQD %	Test Results & Comments
	0.2	TOPSOIL - grey brown silty clay topsoil									
	0.6	SILTY CLAY - light grey brown to red brown, silty clay, humid					Note: Unless otherwise stated, rock is fractured along rough, planar bedding planes or joints dipping 0° - 10°				
	1.4	SHALY CLAY - very stiff, light grey brown, shaly clay with some ironstone bands, moist						S			4.7, 11 N = 18
	2.41	SHALE - extremely low and extremely low to very low strength, extremely to highly weathered, light grey brown shale with ironstone bands						C	100	0	pp = 220kPa pp > 500kPa
	2.48	SHALE/SILTSTONE - medium then low to medium strength, moderately weathered, fragmented to fractured, brown shale/siltstone with extremely low strength bands					2.41m: CORE LOSS: 70mm 2.48-2.61m: fragmented rock, ironstained, occasional clay smear 2.61m: B0°, 30mm clay band 2.75m: B0°, 10mm clay band 2.8m: J75° 2.88m: B0°, 15mm clay 2.91m: J75° 3.06m: B0°, 5mm clay 3.14m: J30° 3.16m: J55°, ironstained 3.25m: B0°, 20mm clay 3.35m: J85° 3.4m: J45°, ironstained 3.45m: J45° 3.92m: B0°, ironstained 3.96m: J85° 4.08-4.15m: B (x2) 0°, clay 4.15m: J40° 4.22-4.90m: B (numerous) 0°, clay smear 4.46-4.85m: B (numerous) 0°, clay smear 5.06m: B0°, ironstained	C	98	34	PL(A) = 0.6MPa PL(A) = 0.9MPa
	3.85	SILTSTONE - medium strength, moderately weathered, fractured to slightly fractured, brown siltstone with some extremely low and very low strength bands									PL(A) = 0.8MPa PL(A) = 0.9MPa
	4.9	SILTSTONE - high strength, fresh, slightly fractured, dark grey siltstone									PL(A) = 1.1MPa
	5.4	Bore discontinued at 5.4m									
	6										
	7										
	8										
	9										
	10										

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.25m

TYPE OF BORING: Solid flight auger to 0.85m; Rotary to 1.4m; NMLC-Coring to 5.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		■	Water level

CHECKED

Initials: *RLD*

Date: *3-9-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 64.1 AHD
EASTING: 309512
NORTHING: 6267033
DIP/AZIMUTH: 90°/-

BORE No: 11
PROJECT No: 71123
DATE: 27-28 Apr 09
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 0.01 0.05 0.10 0.50 1.00	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
								B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec %	RQD %	Test Results & Comments
64	0.2	TOPSOIL - grey brown silty clay topsoil, moist											
	0.5	CLAY - stiff, red brown clay, moist											
		CLAY - stiff, mottled orange brown light grey clay, moist											
63	1.1	SHALY CLAY - stiff, grey brown shaly clay with ironstone bands								S			4,7,7 N = 14
62	1.35	SHALE - extremely low strength, extremely to highly weathered, light grey brown shale with medium strength ironstone bands											
	1.78	SHALE/SILTSTONE - very low to low strength, highly to moderately weathered, fractured, grey brown shale/siltstone with some medium and extremely low strength bands											
	2.7	SILTSTONE - high strength, moderately then moderately to slightly weathered, highly fractured to slightly fractured, grey brown siltstone with some very low/extremely low strength bands											
61	3.85	SILTSTONE - high strength, fresh, slightly fractured, grey siltstone											
60	5.0	Bore discontinued at 5.0m											
59													
58													
57													
56													
55													

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 5.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		■	Water level

CHECKED

Initials: *RW*

Date: *3-9-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 61.7 AHD
EASTING: 309467
NORTHING: 6266983
DIP/AZIMUTH: 90°/-

BORE No: 12
PROJECT No: 71123
DATE: 27 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Fracture Spacing (m)	Water	Discontinuities	Sampling & In Situ Testing			
									Type	Core Rec %	RQD %	Test Results & Comments
	0.2	TOPSOIL - grey brown silty clay topsoil										
	0.5	SILTY CLAY - light grey brown silty clay, humid										
	1	SHALY CLAY - very stiff, light grey brown, shaly clay with some ironstone bands						Note: Unless otherwise stated, rock is fractured along rough, planar bedding planes or joints dipping at 0°- 10°	S			7, 10, 10 N = 20
	1.35	SHALE - extremely low strength, extremely to highly weathered, light grey brown shale with some medium strength ironstone bands							C	100	0	pp = 320kPa
	1.85							1.85m: CORE LOSS: 100mm				
	2.22	SILTSTONE - very low to low strength, highly to moderately weathered, highly fractured to fractured, grey brown siltstone with some medium strength bands						2.25-3.37m: B (numerous) 0°, 1-10mm clay band				PL(A) = 0.4MPa
	2.8	SILTSTONE - medium strength, moderately weathered, highly fractured to fractured, brown siltstone										PL(A) = 0.7MPa
	3								C	97	49	PL(A) = 1.2MPa
	3.35	SILTSTONE - high strength, fresh, slightly fractured and unbroken, grey siltstone										PL(A) = 1.2MPa
	4											
	4.85	Bore discontinued at 4.85m										
	5											
	6											
	7											
	8											
	9											

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 4.85m

WATER OBSERVATIONS: No free groundwater observed whilst augering

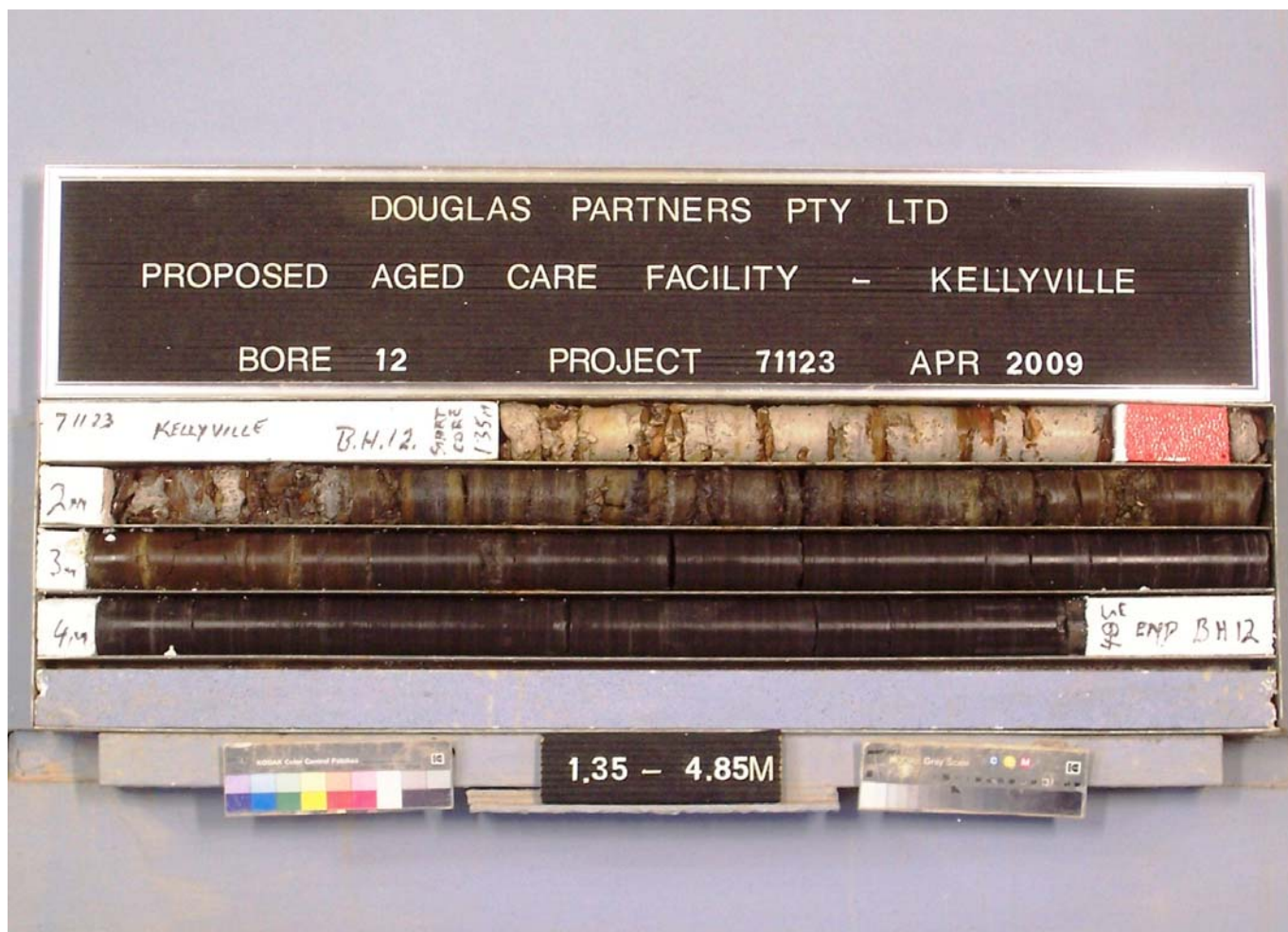
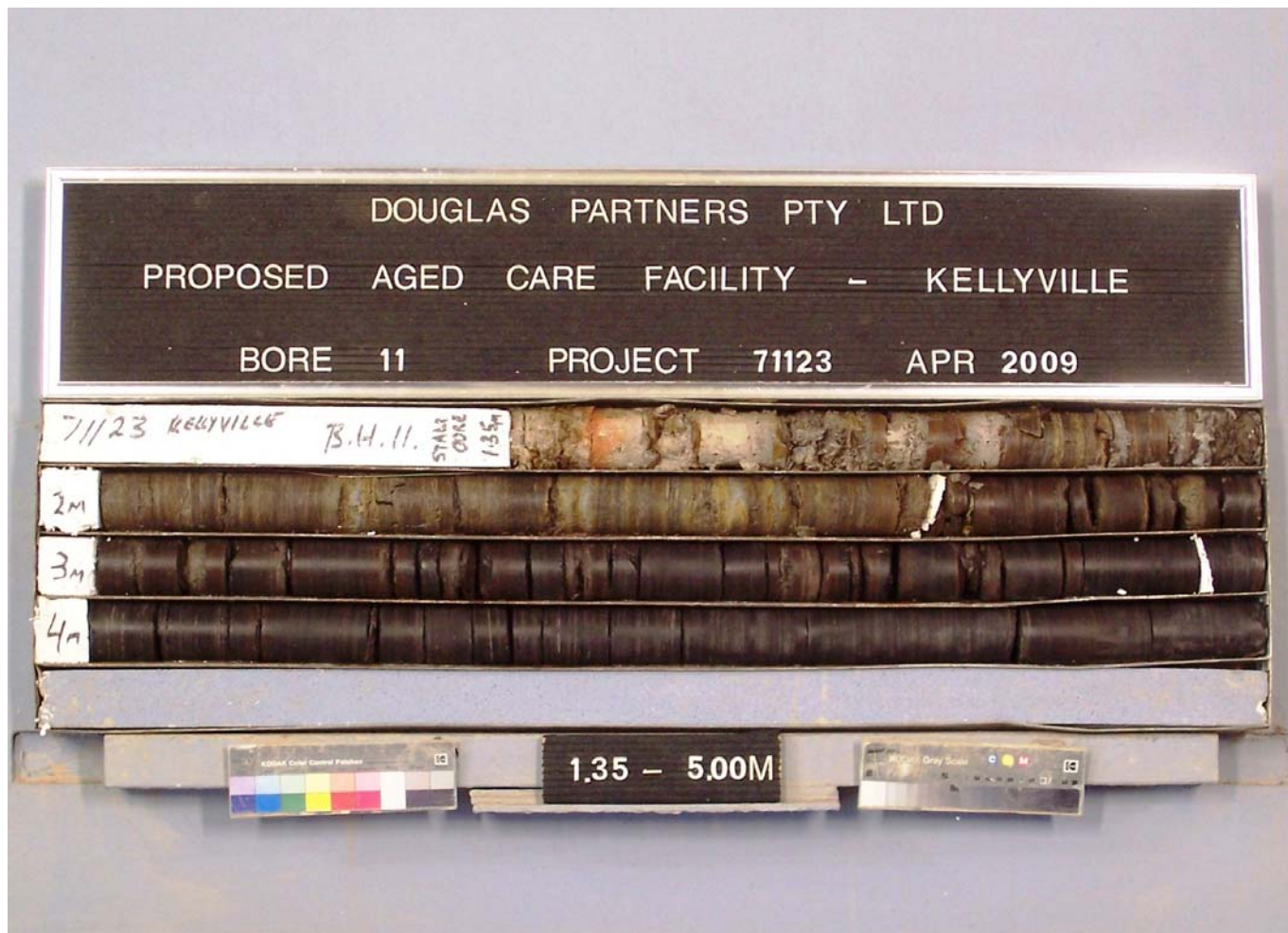
REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED
Initials: <i>RWD</i>
Date: <i>3-9-09</i>



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 60.1 AHD
EASTING: 309447
NORTHING: 6266929
DIP/AZIMUTH: 90°/-

BORE No: 13
PROJECT No: 71123
DATE: 23 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
								B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec %	RQD %	Test Results & Comments
80	0.15	TOPSOIL - grey brown silty clay topsoil											
		CLAY - red brown clay with ironstone gravel, moist											
59	1.05	CLAY - very stiff, orange brown clay with ironstone gravel, moist								S			7,8,14 N = 22
58	1.4	SHALE - extremely low and very low strength, extremely to highly weathered, light grey and brown shale with some medium strength ironstone bands								C	100	0	
57	2.6	SHALE/SILTSTONE - medium then medium to high strength, moderately to slightly weathered, fragmented to fractured, grey brown shale/siltstone											PL(A) = 0.7MPa
56	4.0	SILTSTONE - high then medium strength, fresh, slightly fractured, grey siltstone								C	100	55	PL(A) = 1.1MPa
55	4.75-4.85m	very high strength band											PL(A) = 3.8MPa
54	5.6	Bore discontinued at 5.6m											PL(A) = 0.8MPa
53	6												
52	7												
51	8												
	9												

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.3m

TYPE OF BORING: Solid flight auger to 0.95m; Rotary to 1.4m; NMLC-Coring to 5.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials: *RW*

Date: *39-09*



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 63.6 AHD
EASTING: 309519
NORTHING: 6266982
DIP/AZIMUTH: 90°/-

BORE No: 14
PROJECT No: 71123
DATE: 28 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
								B - Bedding J - Joint S - Shear D - Drill Break	Type	Core Rec %	RQD %	Test Results & Comments
63	0.2	TOPSOIL - grey brown silty clay topsoil, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping at 0° - 10°				
	0.45	CLAY - dark brown clay, moist										
	0.75	CLAY - very stiff, light grey brown clay, moist										
1	1.3	SHALY CLAY - very stiff, light grey brown, shaly clay with ironstone bands							S			7,8,10 N = 18
2	2.0	SHALE - extremely low strength, extremely to highly weathered, light grey and brown shale with some low to medium strength bands										
3	2.6	SILTSTONE - low to medium strength, highly to moderately weathered, fragmented to fractured, brown siltstone with medium and high strength bands						1.93m: J40° 2.0-2.50m: fractured rock	C	100	19	PL(A) = 0.4MPa
	2.63-2.85m	slightly fractured, high strength band						2.42m: B0°, 20mm clay 2.63-2.65m: B0°, clay				PL(A) = 1.5MPa
3.3	3.3	SILTSTONE - high strength, slightly weathered to fresh stained then fresh, fractured to slightly fractured, grey brown to dark grey siltstone						2.85m: J85°, ironstained 3.05m: J40°, ironstained 3.1m: J35°, ironstained 3.16m: J85°, ironstained				PL(A) = 1.1MPa
4	3.65m							3.65m: J25°, ironstained 3.75m: J75°, ironstained	C	100	47	PL(A) = 1.1MPa
4.95	4.95	Bore discontinued at 4.95m						4.18m: J45°, ironstained				

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.25m

TYPE OF BORING: Solid flight auger to 0.85m; Rotary to 1.3m; NMLC-Coring to 4.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

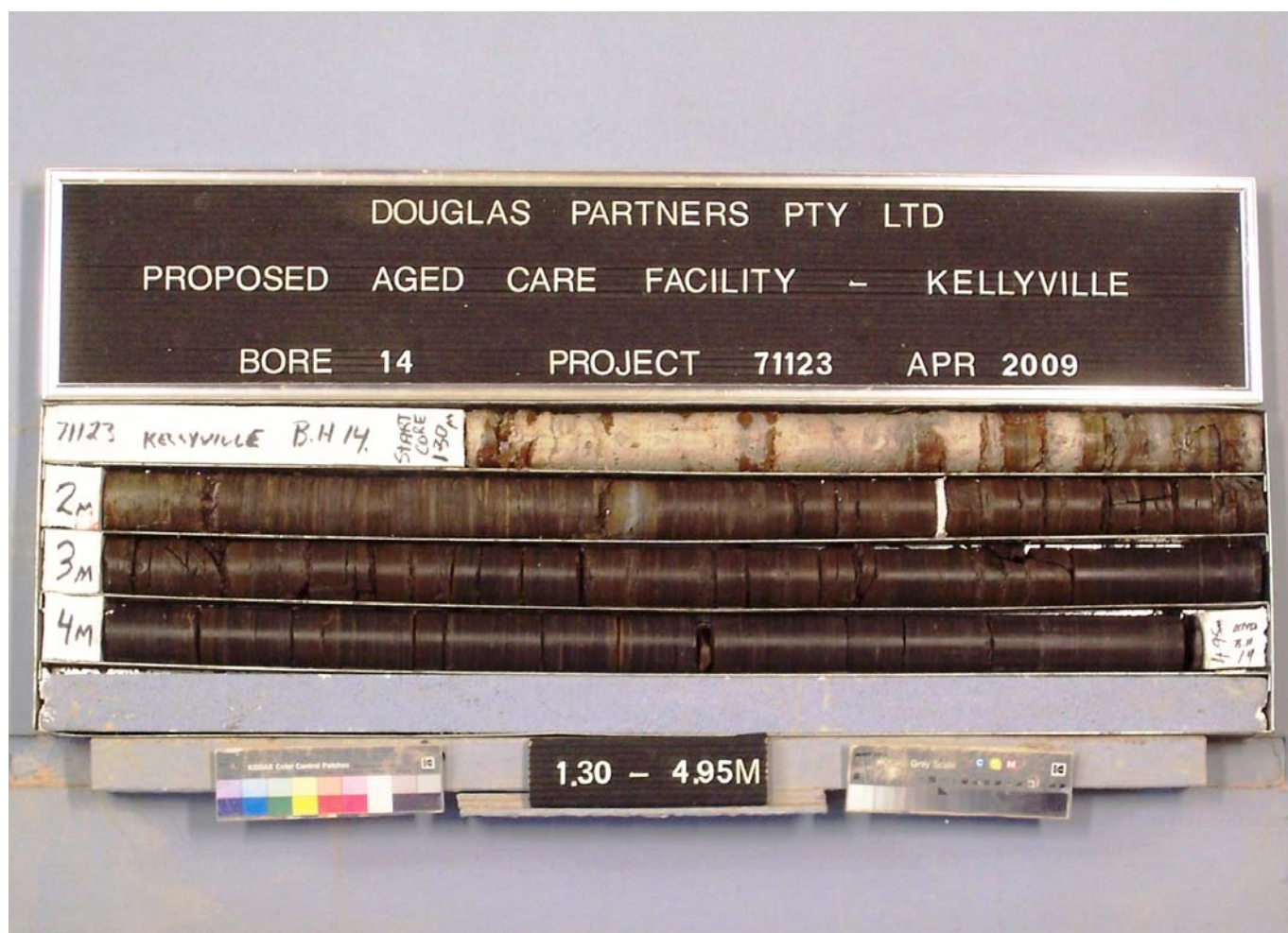
CHECKED

Initials: *RW*

Date: 3-9-09



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 58.7 AHD
EASTING: 309431
NORTHING: 6266904
DIP/AZIMUTH: 90°/-

BORE No: 15
PROJECT No: 71123
DATE: 23 Apr 09
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 0.01 0.05 0.10 0.50 1.00	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
								B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec %	RQD %	Test Results & Comments
58	0.2	TOPSOIL - grey brown silty clay topsoil, moist											
		CLAY - stiff, red brown clay, moist											
58	0.7	CLAY - stiff, light grey brown clay, moist											
1	1.35	SHALE - extremely low then extremely low to very low strength, extremely to highly weathered, light grey brown shale with ironstone bands								S			3,6.8 N = 14
57	2	SHALE - very low to low strength, highly to moderately weathered, grey shale								C	100	0	pp = 330kPa
56	2.26	SHALE - very low to low strength, highly to moderately weathered, grey shale											PL(A) = 0.4MPa
56	2.7	SILTSTONE - medium strength, moderately to slightly weathered, fractured to slightly fractured, grey brown siltstone											PL(A) = 0.4MPa
55	3	3.52-4.18m: highly fractured rock								C	100	53	PL(A) = 0.6MPa
54	4.18	SILTSTONE - very high then medium strength, fresh, slightly fractured, grey siltstone											PL(A) = 0.6MPa
54	5.0	Bore discontinued at 5.0m											
53	6												
52	7												
51	8												
50	9												
49													

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.3m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 5.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		■	Water level

CHECKED

Initials: *RW*

Date: 3.9.09



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BOREHOLE LOG

CLIENT: Baptist Community Services - NSW & ACT
PROJECT: BCS Kellyville Project
LOCATION: 34-36 Memorial Avenue, Kellyville

SURFACE LEVEL: 59.8 AHD
EASTING: 309483
NORTHING: 6266913
DIP/AZIMUTH: 90°/-

BORE No: 16
PROJECT No: 71123
DATE: 29-30 Apr 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Water	Fracture Spacing (m)	Discontinuities				Sampling & In Situ Testing			
			EW	HW	MW	SW	FS				B - Bedding	J - Joint	S - Shear	D - Drill Break	Type	Core Rec %	RQD %	Test Results & Comments
	0.3	TOPSOIL - grey brown silty clay topsoil, moist																
		CLAY - stiff, red brown clay, moist																
59	0.95	SHALY CLAY - stiff, grey brown shaly clay with ironstone bands													S			3, 4, 7 N = 11
1	1.35	SHALE - extremely low strength, extremely to highly weathered, light grey brown shale																pp = 140kPa
2	2.35	SHALE/SILTSTONE - medium and medium to high strength, moderately weathered, fragmented to fractured, grey brown shale/siltstone														100	0	pp = 150kPa PL(A) = 1MPa
3	3.54	SHALE - medium to high strength, fresh stained then fresh, slightly fractured, dark grey shale																PL(A) = 1.3MPa
4																		PL(A) = 1MPa
5																		PL(A) = 1MPa
5.7		Bore discontinued at 5.7m																
6																		
7																		
8																		
9																		
50																		

RIG: Scout 2

DRILLER: J Simon

LOGGED: SI

CASING: NW to 1.35m

TYPE OF BORING: Solid flight auger to 0.9m; Rotary to 1.35m; NMLC-Coring to 5.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep Water level

CHECKED	
Initials	RLB
Date	3-9-09



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BOREHOLE LOG

CLIENT: Impact Group
PROJECT: Kellyville Stage 3
LOCATION: Memorial Drive, Kellyville

SURFACE LEVEL: 64.0 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 301
PROJECT No: 71123.07
DATE: 27/6/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	FR	Ex Low	Very Low	Low	Medium	High	Ex High			Type	Core Rec. %	RQD %	Test Results & Comments
64	0.2	FILLING - grey-brown silty clay filling with some shale fragments, moist															A			
	0.7	CLAY - apparently stiff, red-brown clay, moist															A			
	1.1	CLAY - very stiff, light grey-brown clay, slightly silty, moist															A			
	1.45	SHALE - extremely low strength, light grey-brown shale															S			4.8,10 N = 18
	1.53	SHALE - extremely low then very low strength, extremely to highly weathered, fractured, grey-brown shale with some low strength bands																		
	2																C	97	0	
	3																			
	3.15	SHALE/LAMINITE - medium then high strength, moderately weathered then fresh, slightly fractured then unbroken, grey-brown then grey shale or laminite with approximately 15-20% fine sandstone laminations																		PL(A) = 0.75
	4																C	100	84	PL(A) = 0.99
	5																			PL(A) = 1.03
	6																			PL(A) = 1.13
	7																C	100	100	PL(A) = 1.05
	7.75	Bore discontinued at 7.75m																		
	8																			
	9																			

RIG: ECO 305

DRILLER: LC

LOGGED: SI

CASING: HW to 1.1m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.45m; NMLC-Coring to 7.75m

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	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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BORE: 301

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123-07
BH ID: 301
Depth: 1.45 - 6.00m
Core Box No.: 1-2



1.45 - 6.00m

BORE: 301

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123-07
BH ID: 301
Depth: 6.00 - 7.75m
Core Box No.: 2-2



6.0 - 7.75m

BOREHOLE LOG

CLIENT: Impact Group
PROJECT: Kellyville Stage 3
LOCATION: Memorial Drive, Kellyville

SURFACE LEVEL: 60.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/-

BORE No: 302
PROJECT No: 71123.07
DATE: 26/6/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing								
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
60 1 59 2 58 3 57 4 56 5 55 6 54 7 53 8 52 9 51 10.0	0.7	FILLING - grey silty clay and shale fragments filling, damp																									5,8,9 N = 17	
		SILTY CLAY - very stiff, red-brown silty clay with at trace of ironstone gravel, damp to moist																				A						
	1.8	LAMINITE - extremely low to very low strength, grey-brown laminite																				A						
																						S						
	3.0	LAMINITE - extremely low to very low strength, extremely to highly weathered, fractured, grey-brown laminite																									16,25,25/130mm refusal	
4.25	LAMINITE - low to medium strength, highly to moderately weathered, slightly fractured, grey-brown laminite																									PL(A) = 0.39		
5.1	LAMINITE - medium to high then medium strength, slightly weathered then fresh slightly fractured and unbroken, grey-brown to grey laminite with approximately 20% fine sandstone laminations																									PL(A) = 1.5		
6.1																										PL(A) = 0.89		
7.45																										PL(A) = 0.65		
7.87																												
8.42																										PL(A) = 0.97		
9.5																										PL(A) = 0.88		
9.72																												

Bore discontinued at 10.0m

RIG: ECO 305 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 2.6m
TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 3.0m; NMLC-Coring to 10.0m
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	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	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BORE: 302

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 302
Depth: 3.00 - 7.00
Core Box No.: 1 of 2



3.0 - 7.0m

BORE: 302

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 302
Depth: 7.00 - 10.00m
Core Box No.: 2 - 2



7.0 - 10.0m

BOREHOLE LOG

CLIENT: Impact Group
PROJECT: Kellyville Stage 3
LOCATION: Memorial Drive, Kellyville

SURFACE LEVEL: 61.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 303
PROJECT No: 71123.07
DATE: 27/6/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type
61	0.35	FILLING - light grey-brown shale fragments filling, damp																				A			13,19,17 N = 36
		CLAY - very stiff, red-brown clay, damp																				A			
1	0.85	SHALE - extremely low strength, light grey shale																				A			
60																						S			
1.5		SHALE - extremely low strength, extremely to highly weathered, fractured, light grey-brown shale																							PL(A) = 0.48 PL(A) = 0.8 PL(A) = 0.86 PL(A) = 1.27 PL(A) = 0.72 PL(A) = 0.74 PL(A) = 1.31 PL(A) = 0.79
2																						C	100	10	
59	2.65	LAMINITE - medium then medium to high strength, slightly weathered then fresh, slightly fractured then unbroken, grey-brown then grey laminite with approximately 20% fine sandstone laminations																							
3																									
58																									
4																									
57																						C	100	82	
5																									
56																									
6																									
55																									
7																									
54																						C	100	100	
8																									
53																									
9																									
52																						C	100	100	
9.95																									

RIG: ECO 305

DRILLER: LC

LOGGED: SI

CASING: HW to 1.1m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.5m; NMLC-Coring to 9.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BORE: 303

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 303
Depth: 1.50 - 6.00 m
Core Box No.: 1 - 2



1.5 - 6.0m

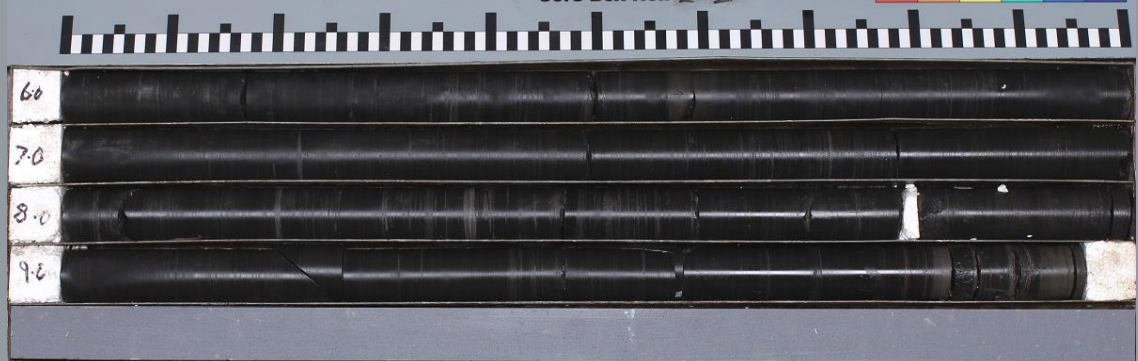
BORE: 303

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 303
Depth: 6.00 - 9.97 m
Core Box No.: 2 - 2



6.0 - 9.95m

BOREHOLE LOG

CLIENT: Impact Group
PROJECT: Kellyville Stage 3
LOCATION: Memorial Drive, Kellyville

SURFACE LEVEL: 58.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/-

BORE No: 304
PROJECT No: 71123.07
DATE: 26/6/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
58	0.6	FILLING - grey to grey-brown silty clay and shale fragments filling, damp																A			4.5,10 N = 15
1		CLAY - stiff, red-brown clay, moist																A			
57	1.4	SHALE - extremely low strength, light grey shale																S			
2	2.0	LAMINITE - very low strength, light grey-brown laminite																			
56	2.8	LAMINITE - very low strength, highly weathered, fragmented to fractured, grey-brown laminite																S			22,25/100mm refusal
3		LAMINITE - very low strength, highly weathered, fragmented to fractured, grey-brown laminite																			PL(A) = 0.13
55																					
4																					
54	4.3	LAMINITE - low to medium strength, highly to moderately weathered, fractured, grey-brown laminite																C	100	52	
5	5.0	SHALE - medium then medium to high strength, fresh, slightly fractured, grey shale with some fine sandstone laminations																			PL(A) = 0.55
53																					PL(A) = 0.56
6		5.75m: becoming very high strength siderite band																			PL(A) = 4.14
52																					PL(A) = 0.95
7																		C	100	100	PL(A) = 0.99
51																					PL(A) = 0.99
8																					PL(A) = 1.27
50	8.6	Bore discontinued at 8.6m																			
9																					
49																					

RIG: ECO 305

DRILLER: LC

LOGGED: SI

CASING: HW to 2.6m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 2.8m; NMLC-Coring to 8.6m

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	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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BORE: 304

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 304
Depth: 2.80 - 7.00
Core Box No.: 1002



Kellyville 71123.07 BH# 304 26/6/17 2.8m



2.8 – 7.0m

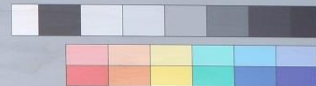
BORE: 304

PROJECT: KELLYVILLE

JUNE 2017



Project No: 71123.07
BH ID: 304
Depth: 7.00 - 8.60m
Core Box No.: 212



7.0 – 8.60m