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BOREHOLE RECORD SHEET

Location Number: BH 321

Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 20/02/2012

Easting: 502207 Northing: 6956858 RL: 9.95 m
Logger: SO/CB Operator: SO Machine: Scout 2

Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
0.10		Surface grass/Topsoil						
		FILL Clayey SAND (SC) Dense, fine to medium grained, brown orange, medium plasticity fines, moist.						SPT 12, 15, 12 N=27
2.70		NATURAL SANDSTONE (DW) Weak, brown orange, fine to medium grained.						SPT 30/30mm N=R
3.10		SANDSTONE, fine to medium grained, light grey, with some orange and red mottling, massively bedded, closely spaced to moderately widely spaced fractures, with trace organic veins and with a gravel band from 4.67m to 4.77m.	DW - SW					3.53 m; J, **20°,** P, R, O, C 3.76m, Is50 = 0.74 MPa 3.73 m; DI, **5°,** P, R, O, Z 3.85m, Is50 = 1.14 MPa 3.81 m; C, **2°,** P, R, C, C
4.77		SANDSTONE, fine to medium grained, light grey, massively bedded, moderately widely spaced fractures, with trace organic lenses and limonite staining of fractures and trace fine to medium size gravel inclusions.	SW - FR			100	80	4.23 m; J, **5°,** U, R, O, X 4.52 m; J, **7°,** P, R, O, X 4.63 m; J, **10°,** P, R, O, X 4.67 m; Z, **5°,** P, R, O, L 5.57 m; J, **5°,** P, R, O, L 6.31 m; J, **2°,** P, R, O, L 6.67 m; J, **3°,** S, R, O, L 6.83m, Is50 = 0.61 MPa 6.9m, Is50 = 0.48 MPa
8.22		SANDSTONE, fine to medium grained, light grey, massively bedded, widely spaced fractures, trace organic lenses and trace fine to medium size gravel inclusions.	DW FR			100	100	9.15m, Is50 = 0.79 MPa 9.25m, Is50 = 0.88 MPa
10.0								

Comments:
1) Groundwater not observed. 2) Monitoring well installed to 34.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C

Depth (m) | Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break | Dip (deg) | Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating | Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough | Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain | Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

Weathering Grades
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

SOIL SURVEYS 00 LIBRARY 2012-05.GLB Log SOIL SURVEY BOREHOLE LOG 111-12936 NEW.GPJ <<DrawingFile>> 21/05/2012 14:33 8.30.002 Developed by Datgel

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BOREHOLE RECORD SHEET

Location Number: BH 321
Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 20/02/2012

Easting: 502207 Northing: 6956858 RL: 9.95 m
Logger: SO/CB Operator: SO Machine: Scout 2

Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
11.0		SANDSTONE, fine to medium grained, light grey, massively bedded, widely spaced fractures, trace organic lenses and trace fine to medium size gravel inclusions. *(continued)*	FR			100	100	10.39 m; DI, **5°,** U, V, O, Z 10.51 m; DI, **5°,** S, R, O, Z 10.67 m; DI, **5°,** P, R, O, Z
12.0								11.78 m; DI, **2°,** S, R, O, X
12.00		SANDSTONE, fine to medium grained, light grey, massively bedded, widely spaced fractures, trace organic lenses, with some fine to medium size gravel, trace of coal stringers, with a 50mm thick coal band at 15.55m						12.08 m; J, **10°,** S, S, O, C
13.0						100	94	12.57 m; J, **10°,** U, R, O, W 12.73 m; J, **30°,** S, S, O, Z 12.88 m; J, **5°,** P, R, O, X
14.0								13.42 m; DI, **5°,** P, R, O, Z 14.15m, Is50 = 1.2 MPa
15.0								14.25 m; DI, **5°,** S, R, O, Z 14.36m, Is50 = 0.91 MPa
16.0			SW - FR			100	36	14.91 m; DI, **15°,** U, R, O, W
16.26		Interbedded SILTSTONE and MUDSTONE, fine grained, alternating, light brown and dark grey, cryptocrystalline, medium bedded, fragmented to closely spaced fractures, with some 20mm-100mm thick coal bands.				100	0	
17.0								
18.0						100	12	18.35m, Is50 = MPa 18.5m, Is50 = 0.37 MPa 18.72 m; J, **60°,** S, R, O, Z
19.0								19.18 m; J, **70°,** T, R, O, W
19.38								
20.0						100	56	

Drilling Method: TC, WB, RR, NMLC, Casing

Comments:
1) Groundwater not observed. 2) Monitoring well installed to 34.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C

Depth (m) | Type | Dip (deg) | Planarity | Roughness | Aperature | Infill

Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break
Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating
Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough
Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain
Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

Weathering Grades
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

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BOREHOLE RECORD SHEET

Location Number: BH 321
Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 20/02/2012

Easting: 502207 Northing: 6956858 RL: 9.95 m
Logger: SO/CB Operator: SO Machine: Scout 2

Depth	Description	Weathering	Rec (%)	RQD	Samples and Remarks
21.0	MUDSTONE, fine grained, brown, cryptocrystalline, moderately widely spaced fractures, with some bands of fine grained, sandstone, with 30mm thick coal bands at 21.79m and 22.45m, and 100mm coal band at 23.25m. *(continued)*	SW - FR	100	56	
22.0			100	61	20.98m, Is50 = MPa
23.0					
24.0					21.00-26.60 m; DI, **6°,** P, R, O, Z
25.0			100	77	24.8m, Is50 = 0.04 MPa
26.0					25.75m, Is50 = MPa
26.60	SILTSTONE, fine grained, grey, laminated, moderately widely spaced fractures, with fine to medium size gravel band from 27.0m to 27.26m.	FR			26.73 m; J, **75°,** P, R, O, Z
27.0					27.21 m; J, **50°,** S, R, O, Q 27.32 m; J, **5°,** P, R, O, X
28.0			100	84	27.83 m; J, **10°,** P, R, O, Z
29.0					28.77m, Is50 = 0.21 MPa 28.83m, Is50 = 0.39 MPa
29.00	SANDSTONE, fine to medium grained, grey, massively bedded, moderately widely spaced fractures, with some fine to medium size gravel.				29.40 m; J, **80°,** P, R, O, Z
30.0			100	86	

Drilling Method: TC, WB, RR, NMLC, Casing

Strength Estimated: RS, XW, DW, SW, MS, S, VS, ES

Defect Spacing: 20, 60, 200, 600

Comments:
1) Groundwater not observed. 2) Monitoring well installed to 34.5m on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F,60°,P,R,O,C

Depth (m) | Type | Dip (deg) | Planarity | Roughness | Aperature | Infill

Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break

Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating

Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough

Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain

Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

Weathering Grades
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
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Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

Samples
U50
SPT
Disturbed Sample

Approved:
Date:

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BOREHOLE RECORD SHEET

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Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 20/02/2012

Easting: 502207 Northing: 6956858 RL: 9.95 m
Logger: SO/CB Operator: SO Machine: Scout 2

Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
30.54		SANDSTONE, fine to medium grained, grey, massively bedded, moderately widely spaced fractures, with some fine to medium size gravel. *(continued)*	FR					
		SILTSTONE, fine grained, alternating grey and dark grey, laminated, with closely to moderately widely spaced fractures, with trace of coal stringers, with some fine grained interbedded sandstone from 30.75m.	SW - FR			100	86	30.96 m; J, **10°,** P, R, O, Coal 32.23m, Is50 = MPa 32.20 m; DI, **5°,** P, R, O, Z 32.28 m; DI, **5°,** P, R, O, Z
						100	71	33.60 m; J, **80°,** P, R, O, Z 34.13 m; J, **35°,** P, R, O, Z 34.38m, Is50 = MPa 34.62m, Is50 = 0.28 MPa
						100	93	37.37 m; J, **30°,** S, R, O, Z
40.00						177	77	

Comments:
1) Groundwater not observed. 2) Monitoring well installed to 34.5m on completion.

BOREHOLE BH 321 TERMINATED AT 40.00m

Water First Noted Water Steady Level

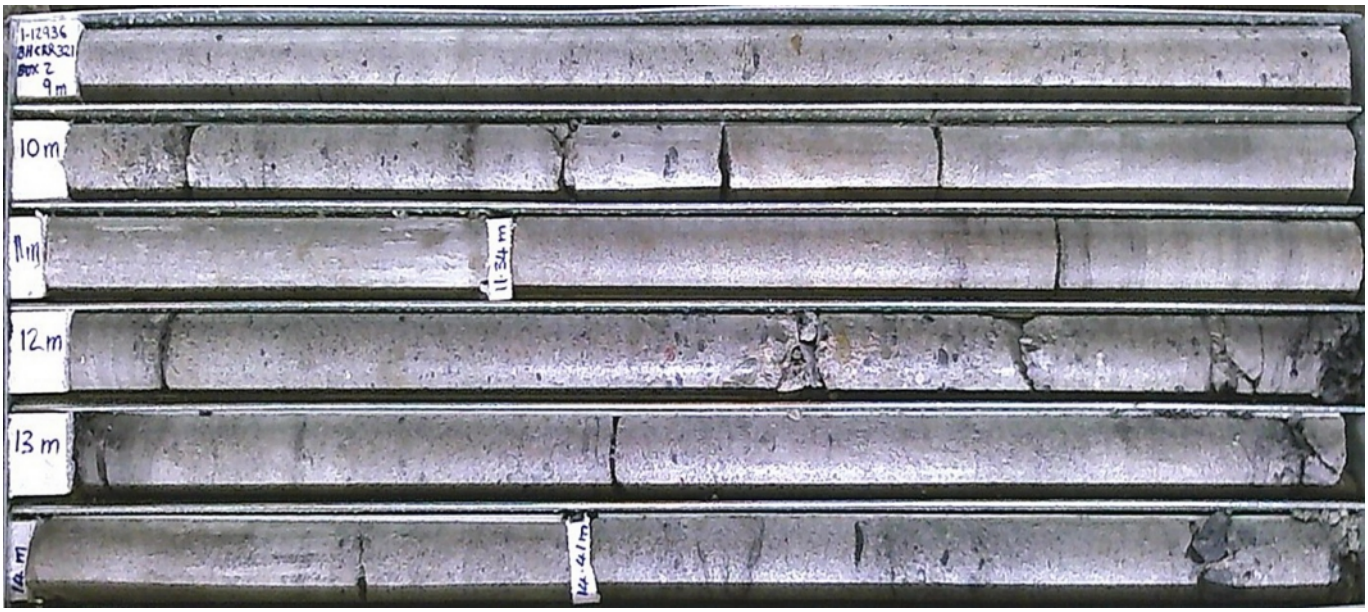
Drilling Method: TC, WB, RR, NMLC, Casing

Weathering Grades: RS - Residual Soil; XW - Extremely weathered; DW - Distinctly weathered; SW - Slightly weathered; FR - Fresh

Rock Strength: VW - Very weak; W - Weak; MS - Medium strong; S - Strong; VS - Very strong; ES - Extremely strong

Samples: U50; SPT; Disturbed Sample

Approved:
Date:



SOIL SURVEYS

TITLE

AECOM
Brisbane
Cross River Rail
Core Photo - BH 321

DRAWN	DT	DATE	26/04/2012
CHECKED	CB	DATE	26/04/2012
SCALE	Not To Scale		A4
PROJECT No	110-12936	FIGURE No	1/2

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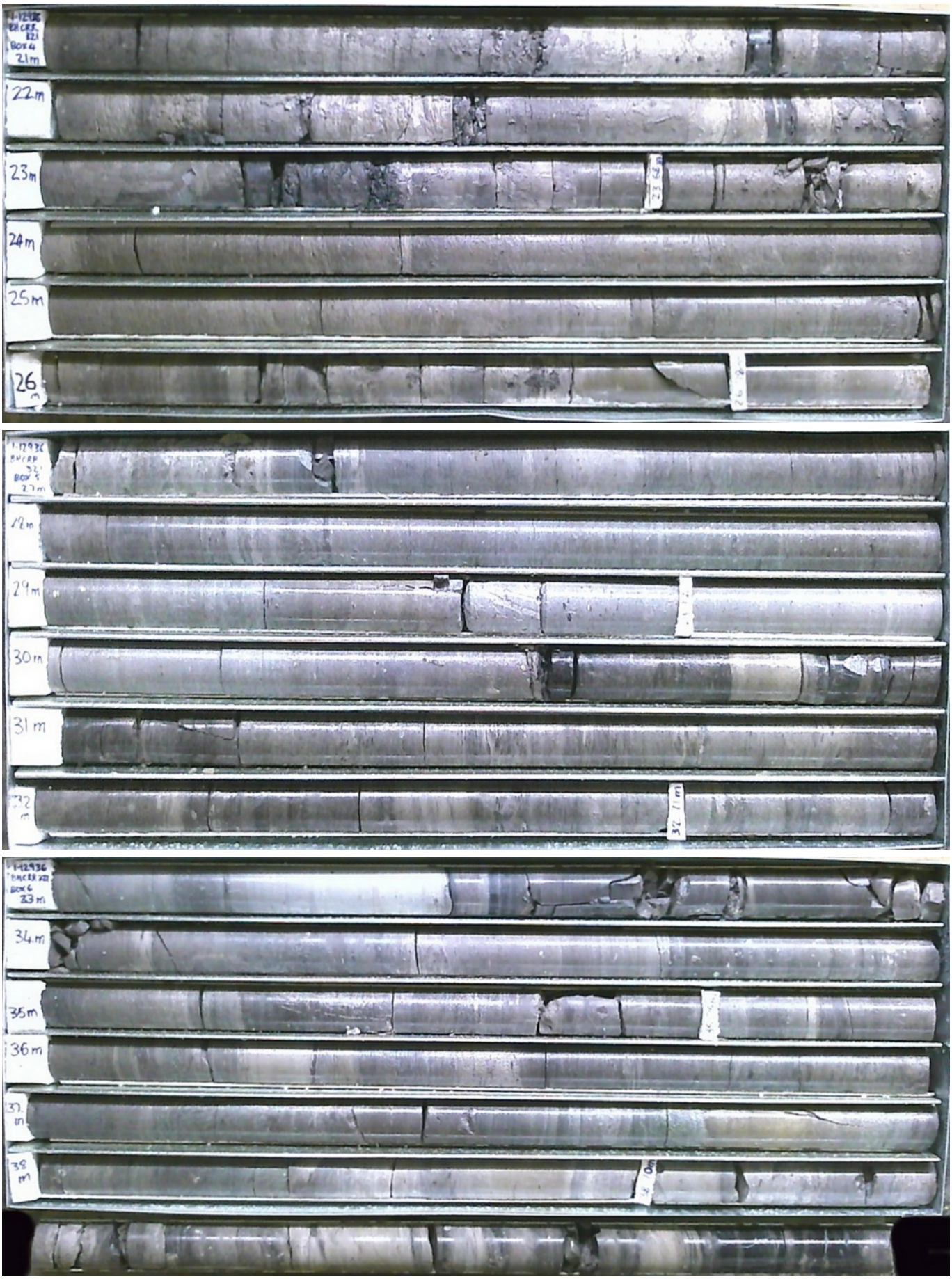

SOIL SURVEYS

TITLE

AECOM
Brisbane
Cross River Rail
Core Photo - BH 321

DRAWN	DT	DATE	26/04/2012
CHECKED	CB	DATE	26/04/2012
SCALE	Not To Scale		A4
PROJECT No	110-12936	FIGURE No	2/2

SOIL_SURVEYS_00 LIBRARY.GLB GrfcTbl DG PHOTO CORE PHOTO 4 PER PAGE 111-12936 NEW.GPJ <<DrawingFile>> 26/04/2012 14:47 8.2.866 Developed by Datgel

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 321
Test No.: 1
Date: 21/02/2012

Packer type: Double
Packer pressure: 2500kPa
Gauge pressures measured in: kPa
Tested by: CS

Vertical depth to:

Top of test section (m):	36.00
Base of test section (m):	37.50
Centre of test section(m):	36.75
Base of casing (m):	35.00
Ground water (m)	NR

Depth of centre of test section (m)	36.75
Length of test section (m):	1.50

Gauge Height above ground level	0.00
Hole Diameter in test section (mm	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2406.6	2408.6	2409.8	2411.8	Flow (l/min)
100	Water Take	0.00	2.00	1.20	2.00	0.347
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2414.0	2418.5	2423.0	2426.7	Flow (l/min)
200	Water Take	0.00	4.50	4.50	3.70	0.847
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2428.0	2434.6	2439.0	2442.6	1733.800
300	Water Take	0.00	6.60	4.40	3.60	0.973
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2443.0	2445.7	2448.8	2452.0	Flow (l/min)
200	Water Take	0.00	2.70	3.10	3.20	0.600
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2451.6	2453.0	2454.5	2455.8	Flow (l/min)
100	Water Take	0.00	1.40	1.50	1.30	0.280

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.347	100.00	10.220	0.000	0.000	46.970	0.503	4.81E-08
2nd	0.847	200.00	20.440	0.000	0.000	57.190	1.008	9.64E-08
3rd	0.973	300.00	30.660	0.000	0.000	67.410	0.983	9.41E-08
4th	0.600	200.00	20.440	0.000	0.000	57.190	0.714	6.83E-08
5th	0.280	100.00	10.220	0.000	0.000	46.970	0.406	3.88E-08

*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

SOIL SURVEYS ENGINEERING

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 321
Test No.: 2
Date: 21/02/2012

Packer type: Double
Packer pressure: 2500kPa
Gauge pressures measured in: kPa
Tested by: CS

Vertical depth to:

Top of test section (m):	25.00
Base of test section (m):	26.50
Centre of test section(m):	25.75
Base of casing (m):	24.00
Ground water (m)	NR

Depth of centre of test section (m)	25.75
Length of test section (m):	1.50

Gauge Height above ground level	0.00
Hole Diameter in test section (mm	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2473.5	2474.0	2474.2	2475.0	Flow (l/min)
100	Water Take	0.00	0.50	0.20	0.80	0.100
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2476.6	2477.6	2478.6	2478.8	Flow (l/min)
200	Water Take	0.00	1.00	1.00	0.20	0.147
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2480.0	2480.9	2481.6	2481.8	1733.800
400	Water Take	0.00	0.90	0.70	0.20	0.120
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	2482.6	2490.0	2547.0	2623.0	Flow (l/min)
600	Water Take	0.00	7.40	57.00	76.00	9.360
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading					Flow (l/min)
	Water Take	0.00	0.00	0.00	0.00	0.000

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)* Basic	Friction Loss (m)* In extra rods	Total Head (m)	Lugeon Value	Perm. (m/s)
1st	0.100	100.00	10.220	0.000	0.000	35.970	0.189	1.81E-08
2nd	0.147	200.00	20.440	0.000	0.000	46.190	0.216	2.07E-08
3rd	0.120	400.00	40.880	0.000	0.000	66.630	0.123	1.17E-08
4th	9.360	600.00	61.320	0.000	0.000	87.070	7.321	7.00E-07
5th	0.000	0.00	0.000	0.000	0.000	25.750	0.000	0.00E+00

*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

Note - leakage through pressure head at end period 4 - test ended

SOIL SURVEYS ENGINEERING