Soil Surveys Engineering Pty. Limited
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BOREHOLE RECORD SHEET

Location Number: BH 323

Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 09/02/2012

Easting: 502490 Northing: 6957511 RL: 7.36 m
Logger: SO/DT Operator: SO Machine: Scout 2

Drilling Method (TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
	0.30		BITUMEN						
	0.40		FILL Clayey Sandy GRAVEL (GP) Dense, fine sized, grey and orange, fine to coarse grained sand, low plasticity fines, moist.						
	1.0		CLAY (CH) Stiff, high plasticity, brown and grey, moist.						U50 PP=170
	2.0								
	3.0								SPT 3, 4, 4 N=8
	4.0								
	5.0								U50 PP=260
	6.0								U50 PP=330
	7.0								
	8.0								SPT 3, 3, 6 N=9
	9.0								U50 PP=560
	10.0								

Strength: RS VW W MS S VS ES
Defect Spacing: 20 60 200 600

Comments:
1) Groundwater not observed. 2) Borehole grouted 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 14:34 8.30.002 Developed by Datgel

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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: 09/02/2012

Easting: 502490 Northing: 6957511 RL: 7.36 m
Logger: SO/DT Operator: SO Machine: Scout 2

Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
10.30								
		Sandy CLAY (CH) Medium dense to dense, high plasticity, brown grey and yellow, fine to medium grained sand, moist.						SPT 4, 7, 8 N=15
11.70								
		Clayey Sandy GRAVEL (GP) Very dense, fine to medium size, brown yellow and purple grey, fine to coarse grained sand, low to medium plasticity fines, moist.						SPT 16, 30/140mm N=R
13.00								
		Clayey Sandy GRAVEL (GP) Medium dense, fine to medium size, brown yellow and purple grey, fine to coarse grained sand, low to medium plasticity fines, with bands of gravelly sandy clay, moist.						SPT 5, 6, 9 N=15
								SPT 7, 4, 19 N=23
16.50								SPT 30/120mm N=R
		Clayey Sandy GRAVEL (GP) Very dense, fine to medium size, brown yellow and purple grey, fine to coarse grained sand, low to medium plasticity fines, moist.						
17.30								
		SANDSTONE, medium grained, pale grey stained orange brown, granular, very thinly bedded to thinly bedded, closely spaced fractures.	SW			100	60	17.49 m; J, **35°,** P, R, O, Z 17.60 m; DI, **5°,** P, S, O, Z 17.70 m; J, **65°,** P, R, O, Z 17.87 m; DI, **9°,** S, R, O, Z 18.01 m; J, **38°,** P, R, O, L 18.13 m; DI, **5°,** P, R, O, Z 18.29 m; DI, **2°,** P, R, O, Z
18.31								
		Interlaminated MUDSTONE and SILTSTONE, fine grained, alternating dark grey and light grey, thinly laminated, extremely closely spaced to moderately widely spaced fractures. Trace of fine sandstone laminae.	SW - FR FR			98	43	18.77 m; J, **50°,** P, R, O, Z 18.33-20.81 m; B, **0 - 3°,** P, S, O, Z
20.0								

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

Comments:
1) Groundwater not observed. 2) Borehole grouted 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:

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BOREHOLE RECORD SHEET

Location Number: BH 323

Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 09/02/2012

Easting: 502490 Northing: 6957511 RL: 7.36 m
Logger: SO/DT Operator: SO Machine: Scout 2

Depth	Description	Weathering	Rec (%)	RQD	Samples and Remarks
21.0	Interlaminated MUDSTONE and SILTSTONE, fine grained, alternating dark grey and light grey, thinly laminated, extremely closely spaced to moderately widely spaced fractures. Trace of fine sandstone laminae. *(continued)*	FR	98	43	
22.0			100	69	21.25 m; B, **55°**, P, S, O, Z 21.50 m; B, **79°**, P, S, O, Z 21.53 m; DI, **1°**, P, S, O, Z 21.67 m; DI, **1°**, P, S, O, Z 21.80 m; DI, **1°**, P, S, O, Z 21.95 m; B, **8°**, P, S, O, Z 22.06 m; DI, **2°**, P, S, O, Z 22.15 m; J, **19°**, S, R, O, W 22.22 m; B, **21°**, P, S, O, Z 22.27 m; B, **22°**, P, S, O, Z 22.36 m; J, **82°**, U, R, O, Z 22.51 m; B, **13°**, P, S, O, Z
22.17	Interlaminated SILTSTONE and SANDSTONE, fine grained, pale grey banded dark grey, granular, thinly laminated to laminated, closely spaced fractures.				
22.67					
23.0	Interlaminated MUDSTONE and SILTSTONE, fine grained, alternating dark grey and light grey, thinly laminated, very closely spaced to moderately widely spaced fractures. Trace of fine sandstone laminae.				
24.0			99	57	22.80-26.07 m; B, **0 - 5°**, P, S, O, Z
25.0					
25.63	Interlaminated SILTSTONE and SANDSTONE, fine grained, pale grey banded dark grey, granular, thinly laminated to laminated, closely spaced fractures.				
26.0					
26.16	CONGLOMERATE, coarse grained, pale grey speckled grey and dark grey, granular, closely spaced to moderately widely spaced fractures. Clast are fine to medium gravel size of tuff, sandstone, phyllite, siltstone and quartzite. Trace thinly bedded, medium grained sandstone bands. Clast supported.				
27.0			100	100	
28.0					
29.0			100	95	26.66-31.89 m; DI, **1 - 11°**, S, R, O, Z
30.0					

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

Strength Estimated: RS, VW, W, MS, S, VS, ES

Defect Spacing: 20, 60, 200, 600

Comments:
1) Groundwater not observed. 2) Borehole grouted 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 323

Project Number: 110-12936
Project Name: Cross River Rail
Location: Brisbane
Client: AECOM
Date: 09/02/2012

Easting: 502490 Northing: 6957511 RL: 7.36 m
Logger: SO/DT Operator: SO Machine: Scout 2

Depth	Graphic	Description	Weathering	Strength (Estimated)	Defect Spacing	Rec (%)	RQD	Samples and Remarks
31.0		CONGLOMERATE, coarse grained, pale grey speckled grey and dark grey, granular, closely spaced to moderately widely spaced fractures. Clast are fine to medium gravel size of tuff, sandstone, phyllite, siltstone and quartzite. Trace thinly bedded, medium grained sandstone bands. Clast supported. *(continued)*	FR			100	95	
31.83								
32.0		CONGLOMERATE, coarse grained, pale grey speckled grey and dark grey, granular, closely spaced fractures. Clasts are medium gravel to cobble sized of chert, siltstone, quartzite, sandstone and tuff, clast supported by sandy matrix.						32.20 m; DI, **40°,** P, S, O, Z 32.30 m; DI, **55°,** U, R, O, Z 32.34 m; DI, **60°,** S, R, O, Z 32.41 m; DI, **20°,** P, S, O, Z 32.60 m; DI, **35°,** U, S, O, Z 32.70 m; DI, **15°,** O, Z
33.0								
34.0						100	77	33.45 m; DI, **50°,** P, R, O, Z 33.74 m; J, **40°,** P, R, O, Z
34.08								
35.0		CONGLOMERATE, coarse grained, pale grey speckled grey and dark grey, granular, closely spaced to moderately widely spaced fractures. Clast are fine to medium gravel size of tuff, sandstone, phyllite, siltstone and quartzite. Trace thinly bedded medium grained sandstone bands. Clast supported.						32.87-35.00 m; DI, **5 - 11°,** S, R, O, Z
35.00		BOREHOLE BH 323 TERMINATED AT 35.00 m						
36.0								
37.0								
38.0								
39.0								
40.0								

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

Comments:
1) Groundwater not observed. 2) Borehole grouted 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

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Samples
U50
SPT
Disturbed Sample

Approved:
Date:

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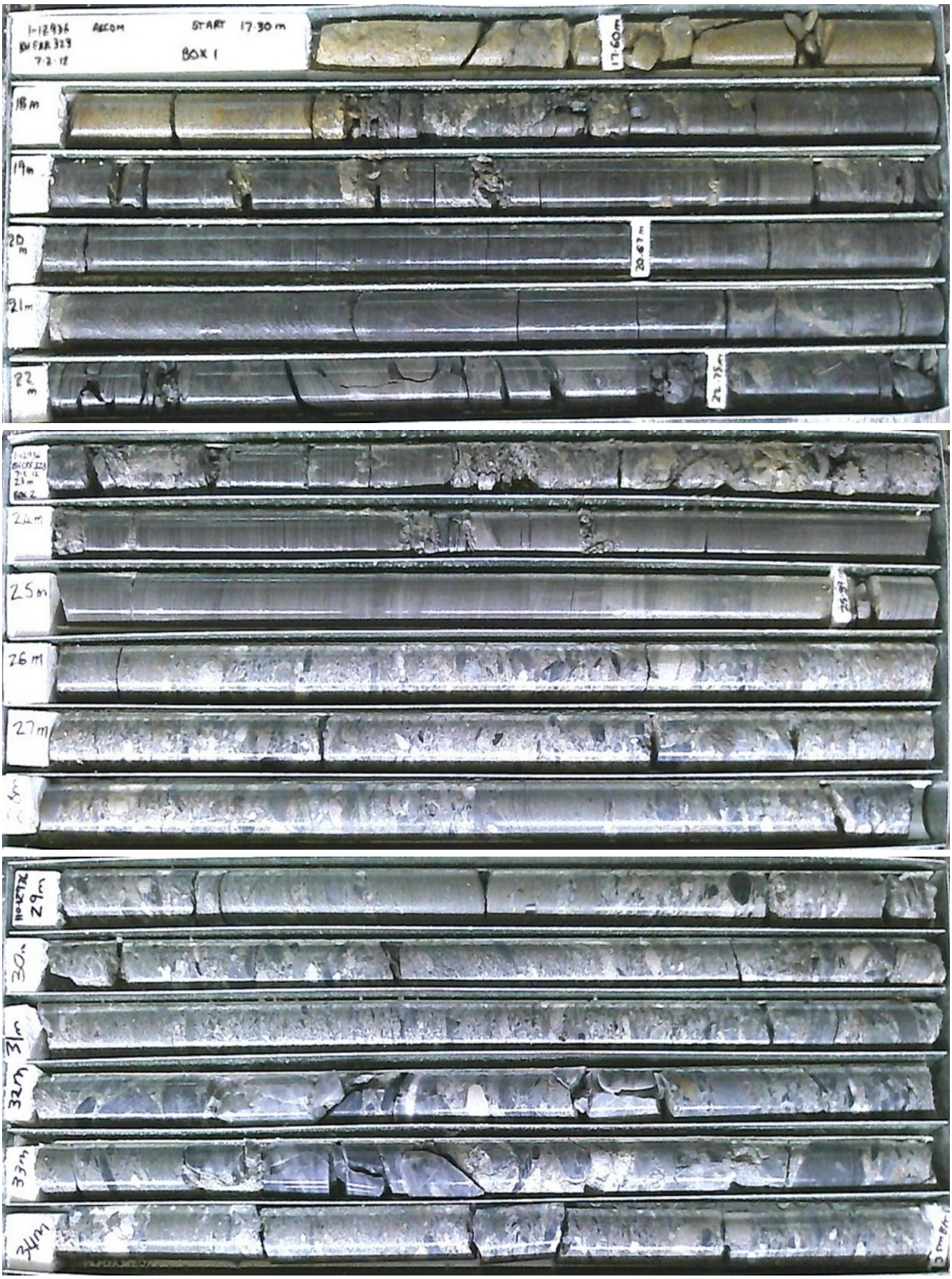

SOIL SURVEYS

TITLE: AECOM Brisbane Cross River Rail Core Photo - BH 323	DRAWN: DT	DATE: 26/04/2012	
	CHECKED: CB	DATE: 26/04/2012	
	SCALE: Not To Scale		A4
	PROJECT No: 110-12936	FIGURE No: 1/1	

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IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 323
Test No.: 1
Date: 9/02/2012

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

Vertical depth to:

Top of test section (m):	30.00
Base of test section (m):	31.50
Centre of test section(m):	30.75
Base of casing (m):	29.00
Ground water (m)	NR

Depth of centre of test section (m)	30.75
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	1922.0	1922.0	1922.0	1922.0	Flow (l/min)
100	Water Take	0.00	0.00	0.00	0.00	0.000
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1922.8	1922.9	1923.1	1923.5	Flow (l/min)
200	Water Take	0.00	0.10	0.20	0.40	0.047
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1923.5	1923.5	1923.7	1923.9	1733.800
300	Water Take	0.00	0.00	0.20	0.20	0.027
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1923.5	1923.5	1923.5	1923.5	Flow (l/min)
200	Water Take	0.00	0.00	0.00	0.00	0.000
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading					Flow (l/min)
100	Water Take	0.00	0.00	0.00	0.00	0.000

Period	Flow (q)	Gauge Press	Gauge Press	Friction Loss (m)*		Total Head	Lugeon	Perm.
	(l/min)	(kPa)	(m of water)	Basic	In extra rods	(m)	Value	(m/s)
1st	0.000	100.00	10.220	0.000	0.000	40.970	0.000	0.00E+00
2nd	0.047	200.00	20.440	0.000	0.000	51.190	0.062	5.94E-09
3rd	0.027	300.00	30.660	0.000	0.000	61.410	0.030	2.83E-09
4th	0.000	200.00	20.440	0.000	0.000	51.190	0.000	0.00E+00
5th	0.000	100.00	10.220	0.000	0.000	40.970	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 - zero flow period 4 - test ended

SOIL SURVEYS ENGINEERING

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: CRR
PROJECT No.: 110-12936
BH No.: 323
Test No.: 2
Date: 9/02/2012

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

Vertical depth to:

Top of test section (m):	21.00
Base of test section (m):	22.50
Centre of test section(m):	21.75
Base of casing (m):	20.00
Ground water (m)	NR

Depth of centre of test section (m)	21.75
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	1931.0	1931.6	1933.4	1935.3	Flow (l/min)
100	Water Take	0.00	0.60	1.80	1.90	0.287
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1936.5	1938.0	1940.0	1941.6	Flow (l/min)
200	Water Take	0.00	1.50	2.00	1.60	0.340
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1942.6	1946.8	1948.0	1949.9	1733.800
300	Water Take	0.00	4.20	1.20	1.90	0.487
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1948.2	1948.8	1949.1	1949.6	Flow (l/min)
200	Water Take	0.00	0.60	0.30	0.50	0.093
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure	Flow reading	1948.2	1948.2	1948.3	1948.3	Flow (l/min)
100	Water Take	0.00	0.00	0.10	0.00	0.007

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	0.287	100.00	10.220	0.000	0.000	31.970	0.611	5.84E-08
2nd	0.340	200.00	20.440	0.000	0.000	42.190	0.549	5.25E-08
3rd	0.487	300.00	30.660	0.000	0.000	52.410	0.632	6.05E-08
4th	0.093	200.00	20.440	0.000	0.000	42.190	0.151	1.44E-08
5th	0.007	100.00	10.220	0.000	0.000	31.970	0.014	1.36E-09

*Where friction loss is assumed to be negligible.
N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

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