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Soil Surveys Engineering Pty. Limited

Specialist in Applied Geotechnics

Milton: ph +61 7 3369 6000 brisbane@soilsurveys.com.au
Gold Coast: ph +61 7 5500 0465 goldcoast@soilsurveys.com.au
Northern Rivers: ph +61 7 5523 4577 northernrivers@soilsurveys.com.au
Mackay: ph +61 7 4942 2907 mackay@soilsurveys.com.au

BOREHOLE RECORD SHEET

Location Number: BH 336

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 08/03/2012

Page: 1 OF 4

Easting: 503111 Northing: 6959305 RL: 21.14 m
Logger: JI/CB Operator: Phil Machine: MC450

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	Casing									
				0.15		BITUMEN						
				0.30		FILL Sandy GRAVEL (GP) Dense, fine to coarse size, grey, medium to coarse grained sand, moist.						
				1.0		FILL Sandy CLAY (CH) Stiff, high plasticity, orange brown and mottled grey, some fine to coarse size gravel, moist.						
				1.90		NATURAL Sandy CLAY (CH) Very stiff, high plasticity, light grey and brown, fine to coarse grained sand, trace of fine size gravel.						
				2.30		TUFF (DW) Very weak, light grey, with clay bands.						
				3.0								
				3.00		TUFF, fine to medium grained, pale grey mottled orange, porphyritic, massively bedded, closely spaced fractures, with limonite infill.	SW			100	38	3.19 m; J, 30°, U, R, O, C 3.21 m; J, 65°, S, R, O, W
				4.0								3.77 m; J, 20°, S, R, O, W 3.88 m; J, 70°, S, R, O, L
				4.60		TUFF, fine to medium grained, pale grey mottled orange and red, porphyritic, massively bedded, closely spaced fractures, with limonite infill.	DW			100	26	4.13 m; J, 40°, S, R, O, L 4.18 m; J, 30°, U, R, O, W
				5.15		TUFF, fine to medium grained, light grey, with red and orange mottles, porphyritic, massively bedded, closely spaced fractures, with limonite infill.	SW			100	86	4.60 m; J, 80°, S, R, O, L
				6.0								5.55m, Is50 = 0.74 MPa 5.73 m; V, 30°, C, L
				6.23m								6.23m, Is50 = 1.47 MPa
				6.44 m								6.44 m; Z, 10°, R, O, W 6.51 m; J, 85°, S, R, O, C
				7.0		TUFF, fine to medium grained, light grey, porphyritic, massively bedded, closely spaced fractures, with limonite infill.	DW			100	54	8.43m, Is50 = 0.32 MPa 8.36 m; DI, 5°, S, R, O, Z 8.49 m; DI, 15°, S, R, O, C
				7.00			SW - FR					8.92 m; J, 50°, P, S, O, C 9.09 m; C, 30°, S, S, O, C
				8.0								9.35 m; C, 10°, S, S, O, C
				9.0								9.73 m; C, 50°, P, S, O, C
				10.0								

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 20.5m on completion.

Defects - 1.54m : F, 60° P, R, O, C											
Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Wells	Planarity	Roughness	Aperture	Wells	Planarity
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay	D - Discontinuous	P - Polished	F - Filled	P - Iron Oxide	K - Calcite
	C - Clay seam		P - Planar	R - Rough	N - Clean	K - Calcite	H - Schistosity	S - Subplanar	S - Smooth	O - Open	L - Limonite
	J - Joint		T - Stepped	V - Very rough	S - Stain	S - Secondary mineral	R - Fracture	U - Undulating	U - Undulating	U - Undulating	U - Undulating
	L - Cleavage						S - Shear zone				
	T - Contact						V - Vein				
	Z - Decomposed Zone										
	DI - Drilling induced break										

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 336

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 08/03/2012

Easting: 503111 Northing: 6959305 RL: 21.14 m

Logger: JI/CB Operator: Phil Machine: MC450

Page: 2 OF 4

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NALC									
				11.0	x x x	TUFF, fine to medium grained, light grey, porphyritic, massively bedded, closely spaced fractures, with limonite infill. (continued)	SW - FR			100	70	
				11.30	x x x					100	100	
				12.0	x x x	TUFF, fine to medium grained, light yellow brown, porphyritic, massively bedded, with closely to moderately widely spaced fractures, with limonite infill.				100	60	11.5m, Is50 = 1.01 MPa 11.43 m; J, 35°, S, V, O, Z 11.72 m; V, 80°, C, S
				12.60	x x x							
				13.0	x x x	TUFF, fine to medium grained, light yellow brown with red grains, porphyritic, massively bedded, with closely to moderately widely spaced fractures, with limonite infill.						12.91m, Is50 = 1.27 MPa 13.07m, Is50 = 0.77 MPa
				14.0	x x x					100	72	13.30 m; J, 50°, S, R, O, L 13.54 m; J, 80°, P, R, O, W
				15.0	x x x							
				15.60	x x x					100	50	15.12 m; C, 50°, S, S, O, C
				16.0	x x x	TUFF, fine to medium grained, light yellow brown, porphyritic, massively bedded, with closely to moderately widely spaced fractures. Fractures infilled with secondary yellow mineral. Trace dark grey bands, and with some black mottling at 20.93m and 21.29m.						15.64 m; J, 75°, S, S, O, C 15.76 m; J, 60°, P, R, O, S 15.86 m; J, 50°, P, R, O, S 16.20 m; J, 80°, U, R, O, Z
				17.0	x x x							17.15m, Is50 = 1.46 MPa 17.24 m; J, 70°, S, R, O, W
				18.0	x x x					100	51	17.77 m; J, 80°, U, R, O, Z 18.20 m; J, 60°, S, R, O, Z
				19.0	x x x							19.10 m; J, 85°, S, R, O, W 19.4m, Is50 = 1.28 MPa
				20.0	x x x					100	63	

Comments:

- Groundwater not observed. 2) ATV survey carried out.
- Monitoring well installed to 20.5m on completion.

Defects - 1.54m : F, 60°, P, R, O, C

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

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 336

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 08/03/2012

Page: 3 OF 4

Easting: 503111 Northing: 6959305 RL: 21.14 m
Logger: JI/CB Operator: Phil Machine: MC450

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NWLC									
				21.0	x x x	TUFF, fine to medium grained, light yellow brown, porphyritic, massively bedded, with closely to moderately widely spaced fractures. Fractures infilled with secondary yellow mineral. Trace dark grey bands, and with some black mottling at 20.93m and 21.29m. (continued)	SW - FR			100	63	20.27 m; J, 80°, U, S, O, S
				21.66	x x x					100	67	21.28 m; J, 50°, P, R, O, W 21.60 m; J, 70°, S, S, O, C
				22.0	x x x	TUFF, fine to medium grained, light grey, porphyritic, massively bedded, moderately widely spaced fractures.						
				23.0	x x x							22.46 m; J, 65°, S, R, O, Z 22.77 m; DI, 5°, U, R, O, Z 23.1m, Is50 = 0.8 MPa
				24.0	x x x					100	70	24.60 m; J, 85°, U, R, O, Z
				25.0	x x x		FR					25.06m, Is50 = 1.65 MPa 25.12 m; J, 80°, P, S, O, C
				26.0	x x x	TUFF, fine to medium grained, pale light grey, porphyritic, massively bedded, widely spaced fractures.						25.9m, Is50 = 1.19 MPa 25.83 m; J, 55°, P, R, O, Z
				27.0	x x x					100	89	26.41 m; J, 40°, P, R, O, Z 26.78 m; J, 15°, C, R, O, X 26.90 m; V, 15°, C, U 26.91 m; J, 85°, S, R, O, Z
				28.0	x x x							27.70 m; J, 20°, P, R, O, Z 27.95m, Is50 = 3.46 MPa
				29.0	x x x					100	75	28.93m, Is50 = 0.71 MPa 29.10 m; J, 85°, P, R, O, Z 29.43 m; J, 30°, S, R, O, Z
				30.0	x x x							29.85 m; J, 60°, S, R, O, Z

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 20.5m on completion.

Defects - 1.54m : F, 60°, P, R, O, C											
Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Width	Frequency	Continuity	Polished	Filled	Notes
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay					
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	P - Iron Oxide					
	F - Foliation		P - Planar	R - Rough	N - Clean	K - Calcite					
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite					
	J - Joint		T - Stepped	V - Very rough	S - Stain	Q - Quartz					
	L - Cleavage		U - Undulating			S - Secondary mineral					
	R - Fracture					U - Unidentified mineral					
	S - Shear zone					W - Weathered rock					
	T - Contact					X - Carbonaceous					
	V - Vein					Z - Clean					
	Z - Decomposed zone										
	DI - Drilling induced break										

Weathering Grades	
RS - Residual Soil	
XW - Extremely weathered	
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FR - Fresh	
Rock Strength	
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Samples	
U50	
SPT	
Disturbed Sample	

Approved:
Date:



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BOREHOLE RECORD SHEET

Location Number: BH 336

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 08/03/2012

Page: 4 OF 4

Easting: 503111 Northing: 6959305 RL: 21.14 m
Logger: JI/CB Operator: Phil Machine: MC450

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	Casing									
				31.0	x x	TUFF, fine to medium grained, pale light grey, porphyritic, massively bedded, widely spaced fractures. (continued)	FR			100	75	30.44 m; J, 70°, S, R, O, Q
				32.0	x x					100	76	31.42 m; J, 70°, S, R, O, Z
				32.00		BOREHOLE BH 336 TERMINATED AT 32.00 m						31.93m, Is50 = 1.93 MPa
				33.0								
				34.0								
				35.0								
				36.0								
				37.0								
				38.0								
				39.0								
				40.0								

Comments:
1) Groundwater not observed. 2) ATV survey carried out.
3) Monitoring well installed to 20.5m on completion.

Defects - 1.54m : F, 60° P, R, O, C									
Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Width	Fill	Notes	
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed		C - Clay		
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled		F - Iron Oxide		
	F - Foliation		P - Planar	R - Rough	N - Clean		K - Calcite		
	H - Schistosity		S - Subplanar	S - Smooth	O - Open		L - Limonite		
	J - Joint		T - Stepped	V - Very rough	S - Stain		Q - Quartz		
	L - Cleavage		U - Undulating				S - Secondary mineral		
	R - Fracture						U - Unidentified mineral		
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	Z - Decomposed zone								
	DI - Drilling induced break								

Weathering Grades	
RS - Residual Soil	
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Rock Strength	
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W - Weak	
MS - Medium strong	
S - Strong	
VS - Very strong	
ES - Extremely strong	

Samples	
U50	
SPT	
Disturbed Sample	

Approved:
Date:



TITLE

AECOM
Brisbane
Cross River Rail
Core Photo - BH 336

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

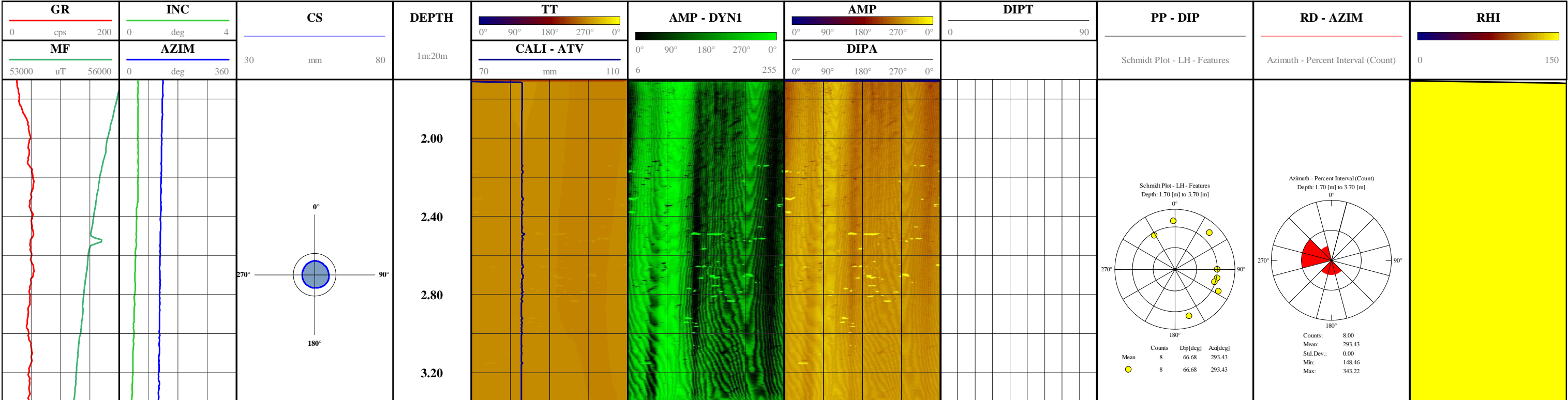


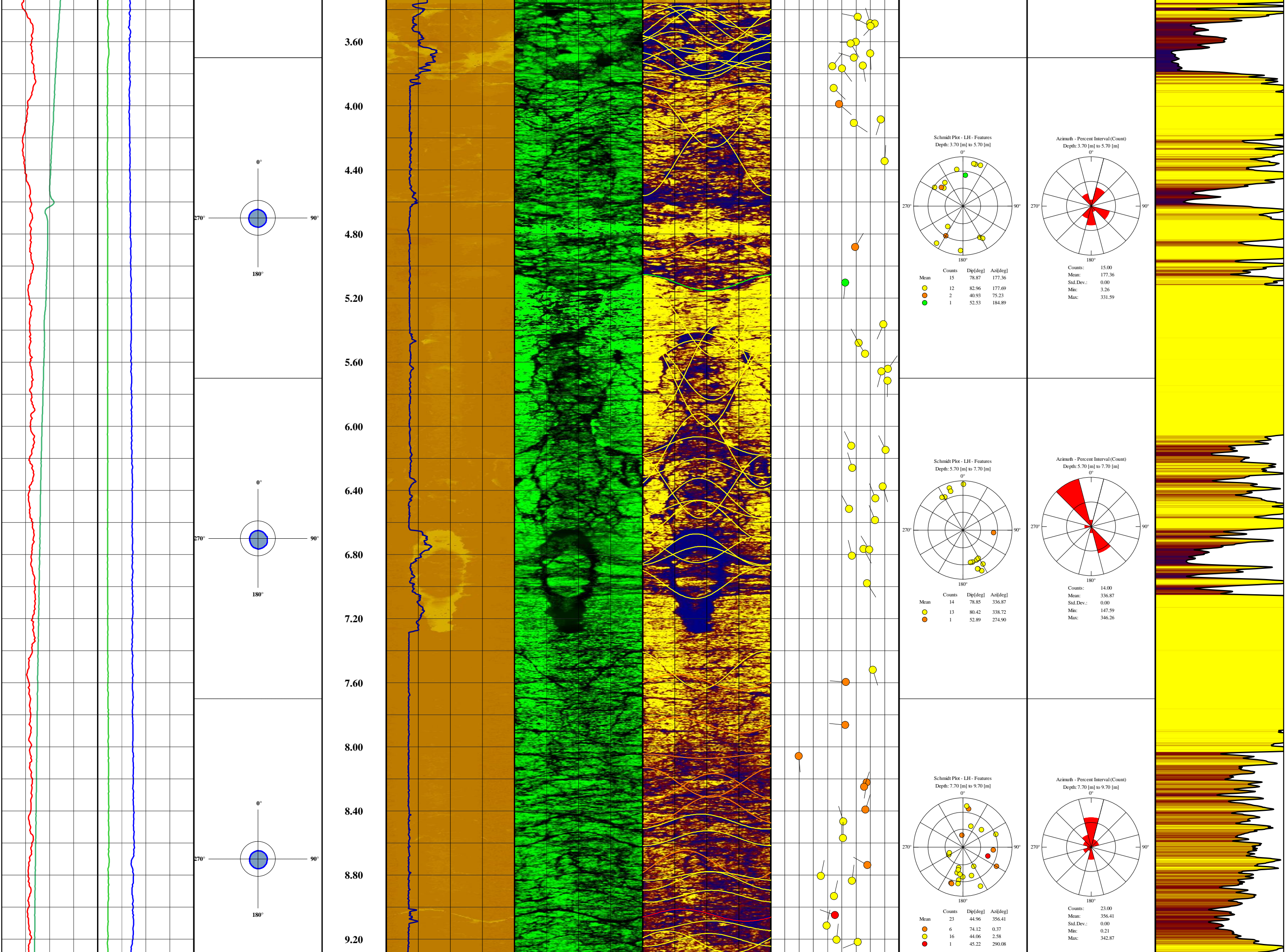
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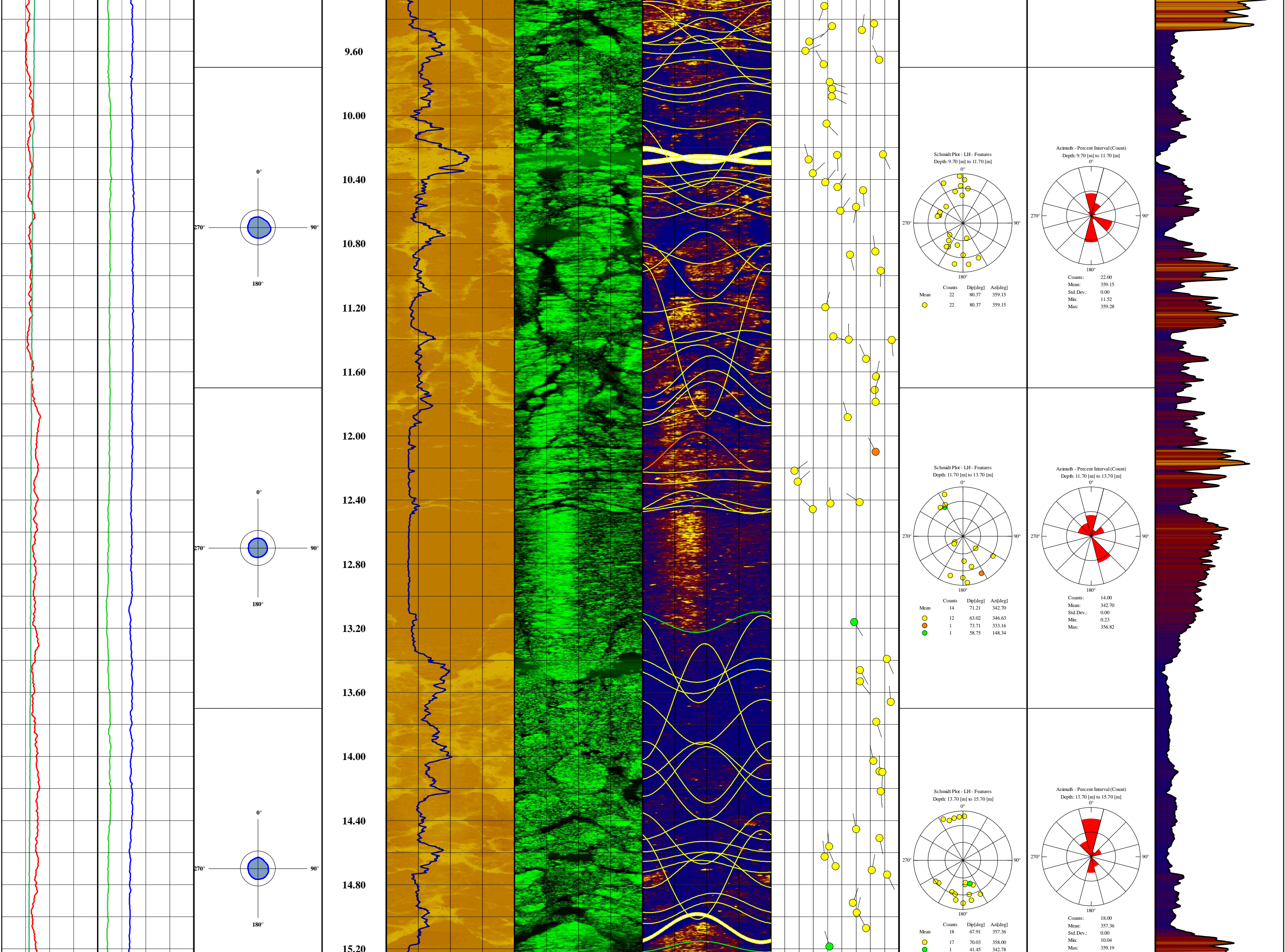
AECOM
Brisbane
Cross River Rail
Core Photo - BH 336

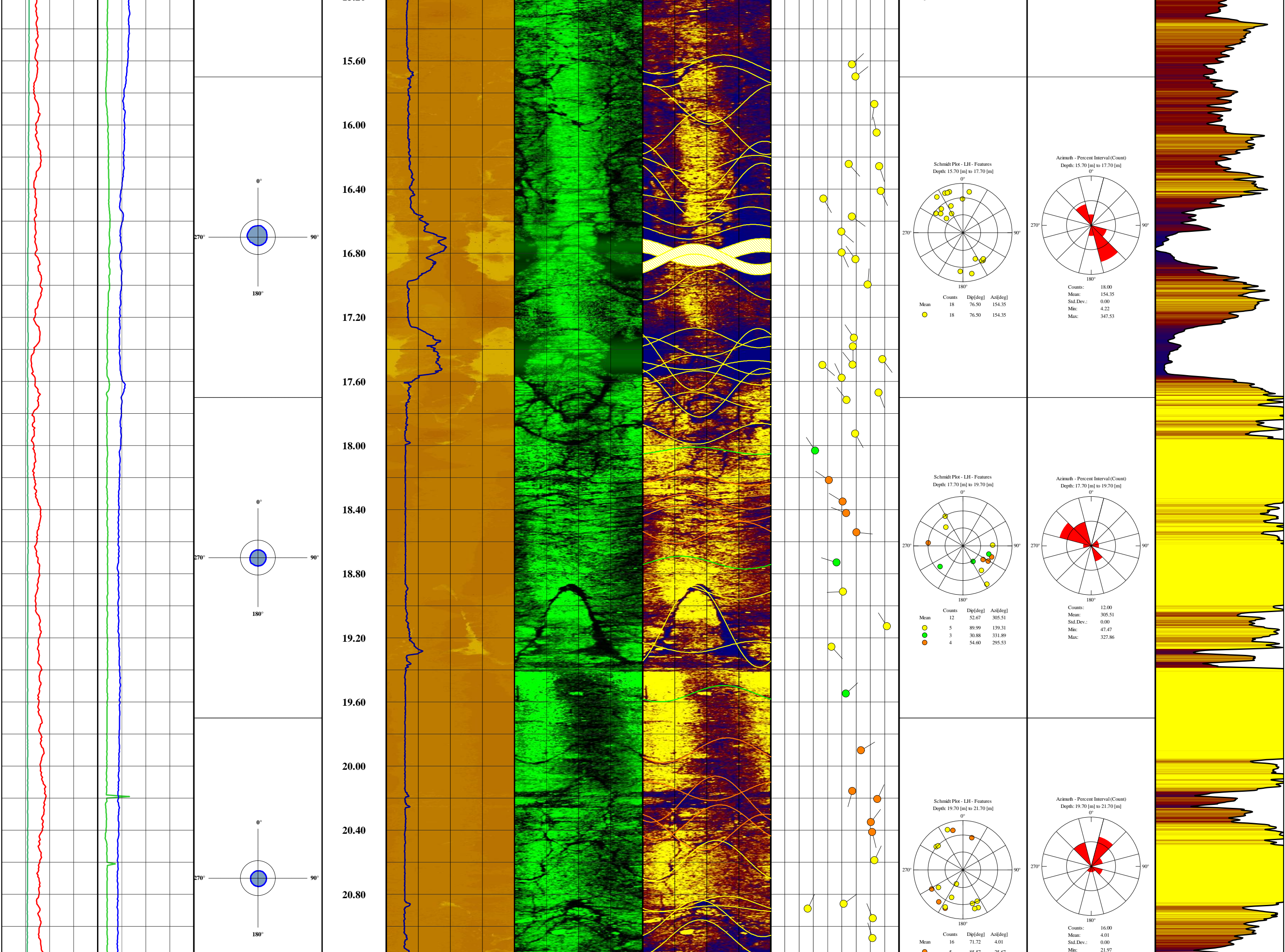
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CHECKED	CB	DATE	26/04/2012
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PROJECT No	110-12936	FIGURE No	2/2

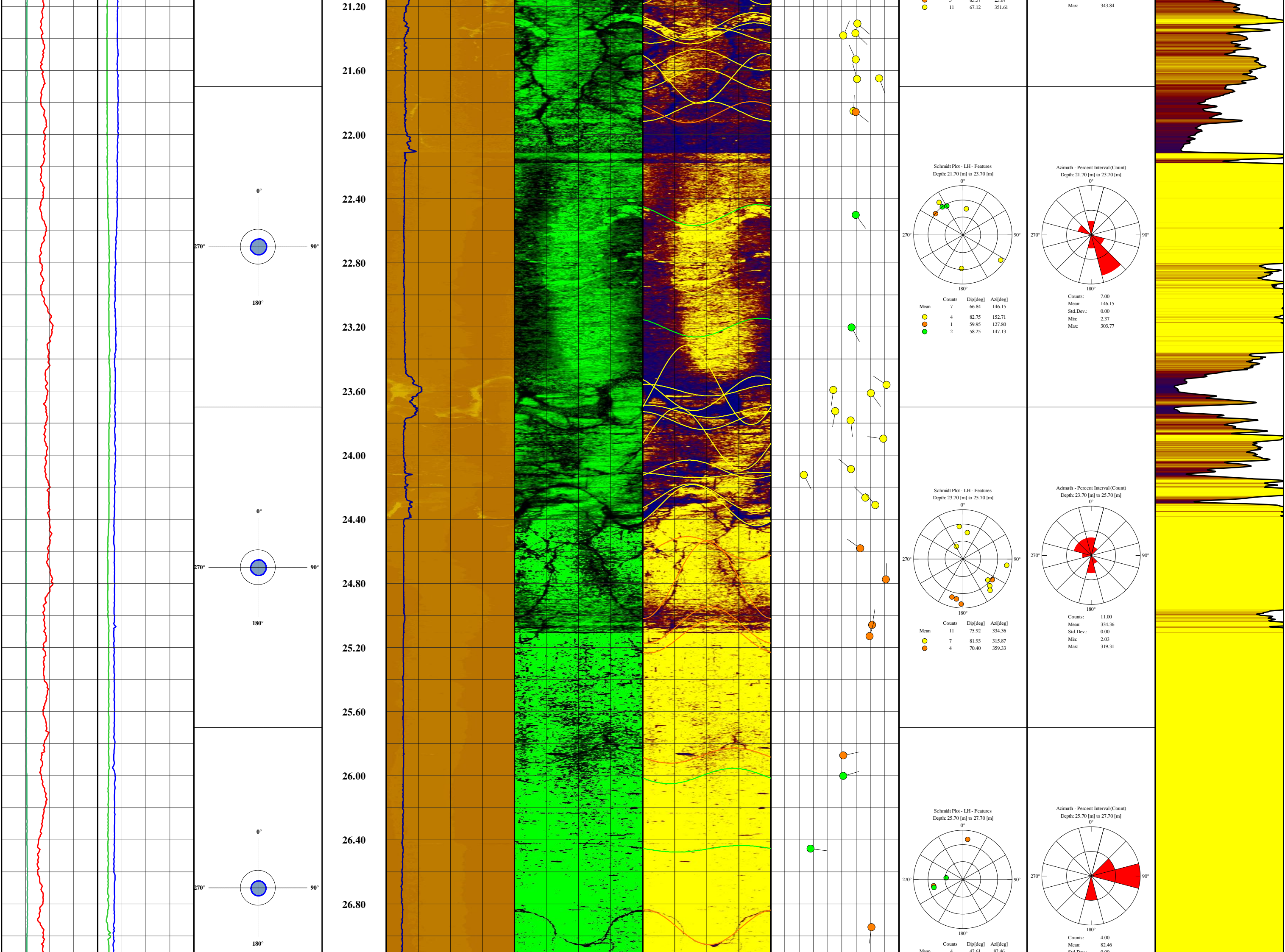
		<div>COMPOSITE LOG</div> <div>BOREHOLE TELEVIEWER LOGS AND STRUCTURES</div>				 <div>INTERPRETATION SERVICES</div>	
<div>Hole NameCRR336</div> <div>FieldBrisbane City</div> <div>Log Date9th Mar,2012</div> <div>LocationQLD</div>		<div>Drill Depth32m</div> <div>Bit Size76mm</div> <div>Casing TypePVC</div> <div>Casing DepthN/A</div>		<div>Grid NameN/A</div> <div>Collar EastingN/A</div> <div>Collar NorthingN/A</div> <div>Reduced LevelN/A</div>		<div>Logging UnitSV031</div> <div>EngineerJ.Mackay</div> <div>Client RepresentJulian Irons</div> <div>Service TypeTeleviewer</div>	
TELEVIEWER LOGS		STRUCTURAL LOGS		TADPOLES		COMMENTS	
<div>MFMag Field</div> <div>GRGamma</div> <div>INCTool Inclination (0 = Vertical Down)</div> <div>AZIMTool Azimuth</div> <div>TTTravel Time Image</div> <div>AMPAmplitude Image</div> <div>AMP - DYN1Amplitude Image Dynamic 1</div>		<div>DIPAStructures Apparent (Sinusoid Presentation)</div> <div>DIPTStructures True (Tadpole Presentation)</div> <div>PP - DIPolar Projection Dip (Schmidt)</div> <div>RD - AZIMRose Diagram - Azimuth</div> <div>CSCross Section</div>		<div> Open Fracture</div> <div> Partially Open Fracture</div> <div> Closed Fracture</div> <div> Foliation/Banding/Bedding</div>		<div>Image data is presented oriented to True North.</div> <div>Magnetic Declination = 10.97 deg</div> <div>Cross Sections are plotted at 2m intervals: White : Tool Position, Light Blue : Nominal Hole Size and Blue : Actual Hole Size</div>	
PROCESSED LOGS							
<div>CALI - ATVCalliper Average from ATV</div> <div>RHIRock Hardness Index</div>							
<div>IMPORTANT NOTE</div> <div>The following interpretations are opinions based upon inferences from borehole logs, Surtron Technologies (Australia) Pty Ltd cannot and does not guarantee the correctness or accuracy of any interpretations. Therefore Surtron Technologies (Australia) Pty Ltd shall not be liable or responsible for any loss, damage, cost or expense incurred or sustained by anyone resulting from any interpretations.</div>							











IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: **CRR**
PROJECT No.: **110-12936**

BH No.: **336**
Test No.: **1**
Date: **9/03/2012**

Packer type: Double
Packer pressure: 2000kPa
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 100	Flow reading	6486.0	6487.1	6488.8	6491.5	Flow (l/min)
	Water Take	0.00	1.10	1.70	2.70	0.367
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	6496.0	6498.0	6501.2	6503.5	Flow (l/min)
	Water Take	0.00	2.00	3.20	2.30	0.500
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	6504.1	6504.5	6504.6	6505.5	Flow (l/min)
	Water Take	0.00	0.40	0.10	0.90	0.093
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	6504.5	6504.5	6504.5	6504.5	Flow (l/min)
	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)
	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)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.367	100.00	10.220	0.000	0.000	35.970	0.694	6.64E-08
2nd	0.500	200.00	20.440	0.000	0.000	46.190	0.737	7.05E-08
3rd	0.093	300.00	30.660	0.000	0.000	56.410	0.113	1.08E-08
4th	0.000	200.00	20.440	0.000	0.000	46.190	0.000	0.00E+00
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 - zero flow in period 4 - test ended

IN-SITU PACKER PERMEABILITY TEST RESULT

PROJECT: **CRR**
PROJECT No.: **110-12936**

BH No.: **336**
Test No.: **2**
Date: **9/03/2012**

Packer type: Double
Packer pressure: 2000kPa
Gauge pressures measured in: kPa
Tested by: CS

Vertical depth to:

Top of test section (m):	19.00
Base of test section (m):	20.50
Centre of test section(m):	19.75
Base of casing (m):	18.00
Ground water (m)	NR

Depth of centre of test section (m)	19.75
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 100	Flow reading	6530.5	6531.8	6532.5	6532.7	Flow (l/min)
	Water Take	0.00	1.30	0.70	0.20	0.147
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	6536.4	6536.8	6537.1	6537.8	Flow (l/min)
	Water Take	0.00	0.40	0.30	0.70	0.093
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	6539.1	6539.5	6539.9	6540.3	Flow (l/min)
	Water Take	0.00	0.40	0.40	0.40	0.080
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	6538.5	6538.5	6538.5	6538.5	Flow (l/min)
	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)
	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)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.147	100.00	10.220	0.000	0.000	29.970	0.333	3.19E-08
2nd	0.093	200.00	20.440	0.000	0.000	40.190	0.158	1.51E-08
3rd	0.080	300.00	30.660	0.000	0.000	50.410	0.108	1.03E-08
4th	0.000	200.00	20.440	0.000	0.000	40.190	0.000	0.00E+00
5th	0.000	0.00	0.000	0.000	0.000	19.750	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 - zero flow in period 4 - test ended