

APPENDIX 'A'

SITE PHOTOS



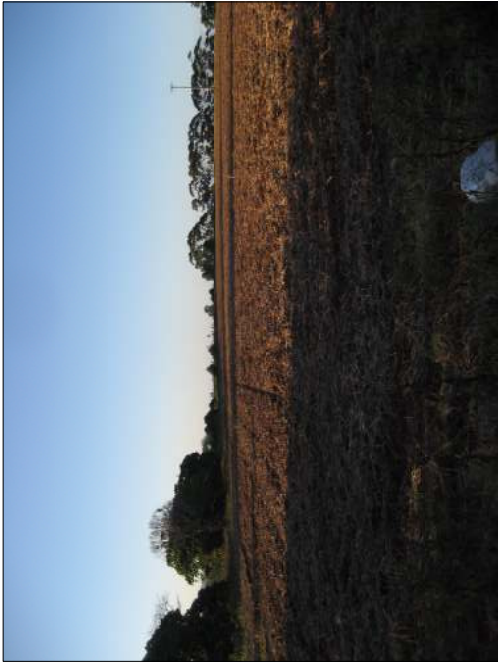


Plate 1 - Slightly elevated flat terrain at location of proposed hospital (Area 1).



Plate 2 - Looking southwards at slightly elevated flat terrain also at location of proposed hospital (Area 1).

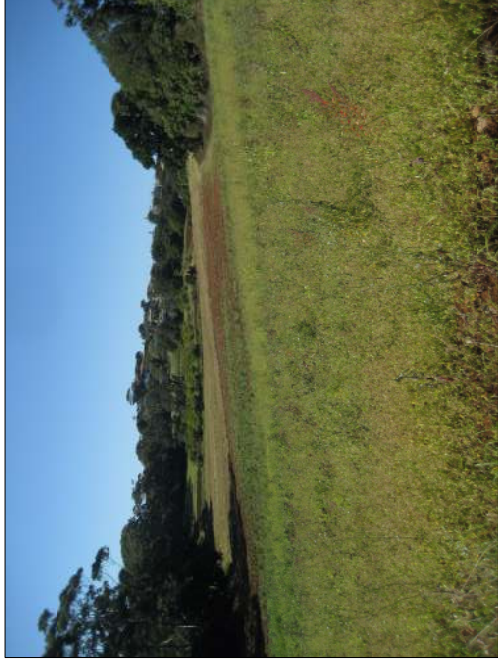


Plate 3 - Mild sloping terrain downslope of proposed car parking area to the north east. Detention basins are proposed in this terrain.



Plate 4 - Mild sloping terrain downslope to the north of the proposed hospital.



Plate 5 - Mild sloping terrain downslope to the west. Proposed hospital to slightly encroach into this area.

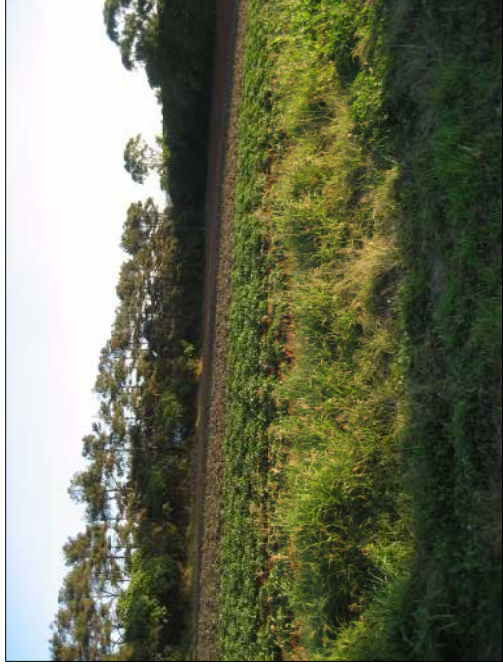


Plate 6 - Mild sloping terrain in the far western portion of the site at the location of the proposed south western car parking area (Area 4)

APPENDIX 'B'

BOREHOLE LOGS





Morrison Geotechnic Pty Ltd

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Engineering Log - Borehole

Borehole No.: **BH1**

Page: 1 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
Northing: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 1.60 Date: 01/08/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		23.0	0.4	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, moist.		M	St		0.1 0.3	U50 PP	PP: 400kPa 150-200kPa
						CH	Silty CLAY: As above but very stiff and cobbles.		M	VSt				
						CI	Silty CLAY: Very stiff, medium plasticity, red brown with some orange brown mottling, moist.		M	VSt				
				Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown mottled dark grey.	XW		VLS				
						BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS				
Washbore		22.0	1.2								1	SPT	8,17,25, N=42	
		1.4												
			1.6											
			2.0				1.60m: COMMENCE NMLC CORING							
			21.0											
			3.0											
			20.0											
			4.0											
			19.0											
			5.0											
			18.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
Northing: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 17.40 Date: 01/08/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			Defect Spacing (mm)	Defect Description	
									ELS VLS LS MS HS VHS EHS	IS ⁽⁵⁰⁾ MPa	RQD %	30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			23.0											
			22.5											
			22.0											
			21.5				Commence NMLC Coring at 1.60m							
			21.0	Bedrock	▽ ▲	BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey, moderately fractured.	SW-Fr			7.84		J10° Pl/Ro,St,O S25° 30mm cly & VLS J15° Pl/Ro,St,O	
			20.5		▽ ▲	BAS	BASALT: As above but medium strength, distinctly weathered, dark grey mottled orange brown.	DW					J5° Pl/Sm,St,O J70° Un/Ro,Vr,O	
			20.0		▽ ▲	BAS	BASALT: As above but medium strength to high strength.	DW					J10° Un/Ro,St,O J30° Pl/Sm,St,O S35° 15mm VLS J40° Pl/Sm,St,O J10° Pl/Sm,Cn,O	
			19.5		▽ ▲	BAS	BASALT: As above but medium strength.	DW			0.98		J15° Un/Sm,St,O 600mm HFZ VN10° Plagioclase	
			19.0		▽ ▲								S5° 10mm J5° Un/Ro,St,O J45° Un/Sm,St,C	
			18.5		▽ ▲								170mm Partically BZ	
			18.0		▽ ▲	BAS	BASALT: As above but high strength and distinctly weathered to slightly weathered.	DW-SW			6.01		J45° Stp/Ro,St,O S10° 10mm J5° Un/Ro,St,O J15° Pl/Ro,St,O	
			17.5		▽ ▲								J20° Pl/Sm,Cn,C VN5° Plagioclase J5° Un/Pl,Vr,C	
			17.0		▽ ▲									
			16.5		▽ ▲									

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
		Moisture		EHS Extremely high	
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555510.00 Drilling Rig: Hydrapower Scout
Northings: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 17.40 Date: 01/08/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring			17.0		▽ ▲	BAS	BASALT: As above but very high strength and slightly weathered.	SW				10.8	38%	J10° Un/Ro,Cn,O J25° Pl/Sm,Cn,O
			6.56.4		▽ ▲	BAS	BASALT: As above but high strength, distinctly weathered to slightly weathered, with some medium strength and very high strength zones	DW-SW						S10° 10mm VLS J90° Pl/Sm,Vr,O
			7.0		▽ ▲									J5° Pl/Sm,Vr,O
			7.1		▽ ▲	BAS	BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered	AW-SW				9.4		J15° Pl/Sm,St,O J50° Pl/Sm,Vr,O J35° Pl/Sm,Vr,O J15° Un/Ro,Ct,O
			7.2		▽ ▲	BAS	BASALT: As above but very high strength and slightly weathered.	SW						J10° Pl/Sm,Cn,O
			7.57.4		▽ ▲	BAS	BASALT: As above but low strength and extremely weathered.	XW						S20° 30mm VLS -2650mm HFZ
			15.5		▽ ▲								7%	
			8.0		▽ ▲									
			15.0		▽ ▲									
			8.5		▽ ▲									
			14.5		▽ ▲									
			9.0		▽ ▲									
			14.0		▽ ▲									
			9.5		▽ ▲									
		13.5		▽ ▲										
		10.0		▽ ▲										
		10.05		▽ ▲								0.63		
		13.0			▨	Cl	Silty CLAY: Very stiff, medium plasticity, dark grey mottled orange brown, extremely weathered basalt layers throughout, moist.						0%	
		10.5												
		12.5												
		11.0												
		12.0												
		11.5												
		11.6												
		12.0					CORE LOSS							

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH1**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555510.00 Drilling Rig: Hydrapower Scout
Northing: 6873397.00 Driller: Redlands Drilling
RL: 23.20 Logged By: L. Bexley
Total Depth: 17.40 Date: 01/08/2018

Drilling Information				Material Description						Rock Mass Defects																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet						
▶ Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◀ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH1
BOREHOLE DEPTH: 1.6m TO 17.4m





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Engineering Log - Borehole

Borehole No.: **BH2**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40 Drilling Rig: Hydrapower Scout
Northing: 6873454.10 Driller: Redlands Drilling
RL: 24.10 Logged By: L. Bexley
Total Depth: 3.10 Date: 01/08/2018

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
100mm Auger with T.C Bit			24.0	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	St		0.15	U50	PP: 300kPa	
		0.4	CH			Silty CLAY: As above but very stiff and with some cobbles.		M	VSt		1				SPT
		1.0													
		1.5	CH			Silty CLAY: Very stiff, high plasticity, red brown, moist.		M	VSt						
		2.0													
Washbore			22.0			CI	Silty CLAY: As above but medium plasticity, red brown mottled orange brown and grey.		M	VSt		2.5	SPT	6,11,18, N=29	
		2.8													
		3.0	Bedrock			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled dark grey.	XW		VLS					
3.10m: COMMENCE NMLC CORING															
			20.0												
			19.0												
			6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40

Drilling Rig: Hydrapower Scout

Northing: 6873454.10

Driller: Redlands Drilling

RL: 24.10

Logged By: L. Bexley

Total Depth: 9.80

Date: 01/08/2018

Drilling Information				Material Description										Rock Mass Defects								
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength					IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description					
									ETS	VLS	LS	MS	HS	VHS	EHS		30	100	300	1000	3000	type, inclination,planarity, roughness, coating, thickness
				Commence NMLC Coring at 3.10m																		
NMLC Coring				Bedrock	▽ ▲	BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey, slightly fractured.	SW-Fr						9.14	81%		~S5° 60mm cly & VLS ~S15° 70mm cly & VLS ~J5° Pl/Ro,Vn,O ~J20° Stp/Ro,St,O ~J5° Pl/Sm,Cn,C ~S5° 25mm VLS ~J5° Pl/Sm,Cn,O					
					▽ ▲									10.2			~J5° Un/Ro,Cn,O ~S10° 30mm VLS					
					▽ ▲									12.5	64%		~J20° Un/Ro,Vr,O ~J5° Pl/Sm,Cn,O ~S15° 40mm VLS					
					▽ ▲												~J40° Pl/Sm,Ct,O ~J5° Pl/Sm,Ct,O 10mm cly & VLS ~S30° 60mm VLS & cly					

Comments:

Authorised by:

Date:

Water		Weathering		Consistency		Density		Rock Strength		Defects	
 Water level on date shown	RS	Residual	VS	Very soft	VL	Very loose	ELS	Extremely	Refer to Defect Description Sheet		
		soil	S	Soft	L	Loose		low			
 Water inflow	XW	Extremely	F	Firm	MD	Medium	VLS	Very low			
		weathered	St	Stiff		dense	LS	Low			
 Water outflow	DW	Distinctly	VSt	Very stiff	D	Dense	MS	Medium			
		weathered	H	Hard	VD	Verv dense	HS	High			
	SW	Slightly	Moisture				VHS	Very high			
	weathered	EHS					Extremely				
	FR	Fresh	D Dry M Moist W Wet					high			



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Engineering Log - Cored Borehole

Borehole No.: **BH2**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555532.40
Northing: 6873454.10
RL: 24.10
Total Depth: 9.80
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 01/08/2018

Drilling Information				Material Description							Rock Mass Defects							
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description			
									ELS	VLS	LS	MS	HS	VHS	EHS			type, inclination, planarity, roughness, coating, thickness
NMLC Coring		18.0	6.5 6.7 7.06.9 7.25 7.5 7.65 8.07.9 8.5 8.7 9.0 9.35 9.8			BAS	BASALT:	SW-Fr					11.6	64%		-S15° 15mm VLS -J15° Pl/Sm, Vr, O -S20° 40mm VLS -J30° Pl/Sm, Cn, O		
	Very high strength, slightly weathered to fresh, dark grey, slightly fractured.																	
	BASALT: As above but medium strength, distinctly weathered, highly fractured.																	
	BASALT: As above but very high strength and slightly weathered to fresh.																	
	BASALT: As above but medium strength, distinctly weathered, orange brown, highly fractured.																	
	BASALT: As above but very high strength and slightly weathered.																	
	BASALT: As above but medium strength, distinctly weathered, orange brown and grey.																	
	BASALT: As above but very high strength and slightly weathered to fresh.																	
	BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered.																	
	BASALT: As above but very high strength and slightly weathered to fresh.																	
	BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered.																	
															</			

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH2
BOREHOLE DEPTH: 3.1m TO 9.8m





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Engineering Log - Borehole

Borehole No.: **BH3**

Page: 1 of 2

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555581.40

Drilling Rig: Hydrapower Scout

Northing: 6873502.40

Driller: Redlands Drilling

RL: 25.30

Logged By: L. Bexley

Total Depth: 7.95

Date: 31/07/2018

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
100mm Auger with T.C Bit			25.0	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	St		0.2 –	PP	150kPa	
						CH	Silty CLAY: As above but with some cobbles.		M	St					
			0.6	Residual		CH	Silty CLAY: As above but very stiff.		M	VSt		1	SPT	4,8,7, N=15: PP=300-350kPa	
			1.0												
			1.5			CH	Silty CLAY: Stiff, high plasticity, red brown trace of grey mottling, trace of extremely weathered basalt gravel, moist.		M	St		1.5	D		
			2.0												
			2.3	Bedrock									2.5	SPT	3,3,7, N=10: PP=150-200kPa
			3.0			CH	Silty CLAY: As above but very stiff.		M	VSt					
			2.9												
			2.2												
			3.6			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled dark grey.	XW		VLS		4	SPT	18,19,30/130mm, N*=54	
			4.0												
21.0	4.5	BAS	BASALT: As above but low strength.			XW		LS							
Washbore with Rock Roller			4.7			BAS	BASALT: As above but medium strength, distinctly weathered, dark grey mottled orange brown.	DW		MS					
			5.0			4.9	BAS	BASALT: As above but low strength and extremely weathered.	XW		LS	5.5	SPT	30/100mm, N*=90	
			20.0												
			6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	MS Medium	S Vane shear value kPa
		H Hard	VD Very dense	HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH3**

Page: 2 of 2

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555581.40 Drilling Rig: Hydrapower Scout
Northing: 6873502.40 Driller: Redlands Drilling
RL: 25.30 Logged By: L. Bexley
Total Depth: 7.95 Date: 31/07/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Washbore with Rock Roller			19.0			BAS	BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered.	XW-DW		LS-MS				
			6.8			BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS		7 } - SPT	30/140mm, N*=64	
			7.0			BAS	BASALT: As above but low strength and extremely weathered.	XW		LS				
		18.0	7.3			BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS				
			7.8			BAS	BASALT: As above but high strength and slightly weathered.	SW		HS				
			8.05			BAS	7.95m: BOREHOLE TERMINATED							
			17.0											
			9.0											
			16.0											
			10.0											
			15.0											
			11.0											
			14.0											
			12.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH4**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555582.40 Drilling Rig: Hydrapower Scout
Northings: 6873458.60 Driller: Redlands Drilling
RL: 26.70 Logged By: L. Bexley
Total Depth: 0.90 Date: 31/07/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit				Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	St		0.1	PP U50	150kPa PP: 290kPa
		26.0	0.5	Bedrock Residual		CH	Silty CLAY: As above but very stiff and with some cobbles.		M	VSt		0.5		
			0.8			BAS	BASALT: Medium strength, distinctly weathered, dark grey stained orange brown.	DW		MS		0.6	PP D	300kPa
			1.0											
0.90m: COMMENCE NMLC CORING														
			25.0											
			2.0											
			24.0											
			3.0											
			23.0											
			4.0											
			22.0											
			5.0											
			21.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH4**

Page: 2 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555582.40
Northing: 6873458.60
RL: 26.70
Total Depth: 10.10

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 31/07/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	Defect Spacing (mm)	Defect Description		
								ELS VLS LS MS HS VHS EHS			30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness		
NMLC Coring			26.5				Commence NMLC Coring at 0.90m							
			0.5											
			26.0											
			25.5	1.0	Bedrock	△	BAS	BASALT: Very high strength, slightly weathered, dark grey stained orange brown, moderately to highly fractured.	SW	8.22		J10° Un/Ro, Vr, O 10mm cly J10° Pl/Sm, Vr, O S10° 10mm cly S5° 15mm cly J5° Pl/Sm, Cn, O S40° 30mm cly S15° 30mm cly J20° Pl/Sm, Ct, O J15° Pl/Sm, Vr, O 10mm cly J15° Stp/Sm, St, O 100mm HFZ		
			25.0	1.5	△						17%	-260mm HFZ		
			24.5	2.0	△							-100mm BZ -400mm HFZ		
			24.0	2.5	△		BAS	BASALT: As above but medium strength and distinctly weathered.	DW				-120mm BZ	
			23.5	3.0	△		BAS	BASALT: As above but very high strength and slightly weathered.	SW	8.14		J50° Un/Sm, St, O J15° Pl/Sm, Cn, O J20° Pl/Sm, Cn, O -110mm HFZ J30° Stp/Sm, Vr, O J40° Pl/Sm, Cn, O 30mm HFZ J5° Pl/Sm, St, O -180mm BZ 30mm CZ 30mm CZ -S15° with VLS & cly J5° Pl/Sm, Ct, O S15° with 25mm VLS S15° with 25mm VLS J5° Pl/Sm, Cn, O J5° Pl/Sm, Cn, O S20° with VLS S5° with VLS		
			23.0	3.5	△						23%	-S10° 20mm J5° Pl/Sm, St, O J5° Pl/Sm, St, O J15° Un/Ro, St, O		
			22.5	4.0	△							-S15° with 30mm VLS & cly J40° Pl/Sm, St, O J15° Pl/Sm, Vr, O 20mm BZ -50mm		
			22.0	4.5	△							J10° Pl/Ro, Cn, O		
			21.5	5.0	△						65%			
			21.0	5.5	△									
				6.0	△									

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH4**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555582.40 Drilling Rig: Hydrapower Scout
Northings: 6873458.60 Driller: Redlands Drilling
RL: 26.70 Logged By: L. Bexley
Total Depth: 10.10 Date: 31/07/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			20.5			BAS	BASALT: As above but very high strength and slightly weathered.	SW					J10° Pl/Ro,Cn,O 40mm BZ J30° Pl/Sm,St,O J5° Un/Ro,Cn,O S5° with 15mm VLS S15° 25mm VLS S20° 50mm VLS J5° Pl/Ro,Cn,O J10° Pl/Sm,Vr,O VLS & cly J5° Pl/Sm,Vr,O with VLS & cly J5° Pl/Sm,Vr,O J5° Pl/Sm,Vr,O S15° with VLS J5° Pl/Ro,Cn,O 50mm BZ S10° 30mm S15° 20mm J20° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O S25° 25mm VLS J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O S10° 50mm VLS J5° Pl/Sm,Cn,O J10° Pl/Sm,Vr,O 10mm VLS S5° 30mm VLS J5° Pl/Sm,St,O S15° 20mm VLS J15° Un/Ro,St,O J70° Un/Ro,St,O
			6.5							11.8	65%		
			7.0							12.0			
			7.5								73%		
			8.0							11.7			
			8.5							14.0			
			9.0								72%		
			9.5							10.2			
			10.0										
			10.1										
			10.5				10.10m: BOREHOLE TERMINATED						
			11.0							6.01			
			11.5										
			12.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH4
BOREHOLE DEPTH: 3.1m TO 10.1m





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Engineering Log - Borehole

Borehole No.: **BH5**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555622.80 Drilling Rig: Hydrapower Scout
Northings: 6873483.70 Driller: Redlands Drilling
RL: 26.80 Logged By: L. Bexley
Total Depth: 1.30 Date: 30/07/2018

Drilling Information				Material Description						Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Was	100mm Auger with T.C Bit		26.0		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	St					
			1.0		CH	Silty CLAY: Very stiff, high plasticity, red brown, some cobbles, moist.		M	VSt					
			1.1		CI	Silty CLAY: As above but hard and medium plasticity.		M	H					
			1.3		BAS	BASALT: Low strength, extremely weathered, orange brown mottled dark grey.	XW		LS					
1.30m: COMMENCE NMLC CORING														
		25.0	2.0											
		24.0	3.0											
		23.0	4.0											
		22.0	5.0											
		21.0	6.0											

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.		
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa		
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		D Dry M Moist W Wet		EHS Extremely high			



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Engineering Log - Cored Borehole

Borehole No.: **BH5**

Page: 2 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555622.80
Northing: 6873483.70
RL: 26.80
Total Depth: 6.95

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 30/07/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS			30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring			26.5										
			0.5										
			26.0										
			1.0										
			25.5				Commence NMLC Coring at 1.30m						
			1.5	Bedrock	V A	BAS	BASALT: Very high strength, slightly weathered, dark grey with some orange brown staining.	SW		8.11	48%	J15° Pl/Sm,Cn,O	
			25.0	1.7	V A	BAS	BASALT: As above but medium strength, distinctly weathered, highly fractured.	DW				J40° Pl/Sm,St,O 40mm CZ with cly & VLS J60° Pl/Sm,Vr,C 130mm BZ	
			2.0	1.95	V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW				J40° Pl/Sm,Vr,O J45° Pl/Sm,Vr,O 140mm HFZ	
			24.5	2.3	V A	BAS	BASALT: As above but medium strength and distinctly weathered	DW				250mm BZ	
			2.5	2.52	V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW				J10° Pl/Ro,Vr,O with VLS & cly 200mm HFZ	
			24.0	3.0	V A							J45° Stp/Ro,Vr,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O 50mm BZ	
			23.5	3.5	V A	BAS	BASALT: As above but very low strength and extremely weathered.	XW				J5° Pl/Ro,Vr,O 160mm CZ with VLS	
			23.0	3.57	V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW				100mm BZ	
			22.5	4.0	V A							40mm CZ with VLS 50mm BZ	
			22.0	4.5	V A							S10° 20mm J45° Pl/Sm,Cn,O J10° Pl/Sm,Vr,O J20° Pl/Sm,Vr,O S45° 30mm J50° Stp/Ro,Cn,O S10° 20mm	
			21.5	5.0	V A	BAS	BASALT: As above but medium strength and distinctly weathered	DW				200mm HFZ	
			21.0	5.5	V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW				80mm CZ J5° Pl/Sm,Cn,O J35° Pl/Ro,Ct,O 170mm HFZ	
				6.0	V A							J5° Pl/Sm,Ct,O J25° Pl/Sm,Ct,O J40° Un/Ro,Cn,O S10° with VLS J15° Pl/Sm,Cn,O	

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
		Moisture		EHS Extremely high	
		D Dry M Moist W Wet			

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555622.80

Drilling Rig: Hydrapower Scout

Northing: 6873483.70

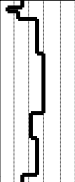
Driller: Redlands Drilling

RL: 26.80

Logged By: L. Bexley

Total Depth: 6.95

Date: 30/07/2018

Drilling Information				Material Description								Rock Mass Defects										
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength				IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description						
									ETS	VLS	LS	MS	HS	VHS	EHS		30	100	300	1000	3000	type, inclination,planarity, roughness, coating, thickness
NMLC Coring			20.5 6.5 20.0 7.0 6.95		V A V V A V A V V A V V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW								9.46	65%		J40° Pl/Sm,Cn,C J10° Pl/Sm,Cn,C J10° Pl/Sm,Cn,O J5° Pl/Ro,St,O S20° -10mm BZ			
			19.5 7.5 19.0 8.0 18.5 8.5 18.0 9.0 17.5 9.5 17.0 10.0 16.5 10.5 16.0 11.0 15.5 11.5 15.0 12.0				6.95m: BOREHOLE TERMINATED															

Comments:

Authorised by:

Date:

Water		Weathering		Consistency		Density		Rock Strength		Defects		
 Water level on date shown	RS	Residual	VS	Very soft	VL	Very loose	ELS	Extremely	Refer to Defect Description Sheet			
		soil	S	Soft	L	Loose		low				
 Water inflow	XW	Extremely weathered	F	Firm	MD	Medium dense	VLS	Very low				
			St	Stiff			LS	Low				
 Water outflow	DW	Distinctly weathered	VSt	Very stiff	D	Dense	MS	Medium				
			H	Hard	VD	Verv dense	HS	High				
	SW	Slightly weathered	Moisture					VHS				Very high
			D Dry M Moist W Wet					EHS				Extremely high
	FR	Fresh										

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH5
BOREHOLE DEPTH: 1.3m TO 6.9m





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Engineering Log - Borehole

Borehole No.: **BH6**

Page: 1 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555579.90

Drilling Rig: Hydrapower Scout

Northing: 6873410.10

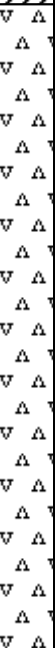
Driller: Redlands Drilling

RL: 27.00

Logged By: L. Bexley

Total Depth: 8.00

Date: 30/07/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		27.0	0.2	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, moist.		M	St				
						CH	Silty CLAY: As above but with some cobbles.		M	St		0.5 –	PP	150kPa
		26.0	1.0	Residual		CH	Silty CLAY: Stiff, high plasticity, red brown, some fine to coarse sized gravel, moist.		M	St		1	SPT	2,2,2, N=4: PP=150-200kPa
		25.0	1.8			CI	Silty CLAY: As above but hard, medium plasticity, red brown mottled grey and some extremely weathered basalt lenses.		M	H		2.5		
Washbore with Rock Roller			2.7	Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown mottled dark grey.	XW		VLS			SPT	7,21,15, N=36
		24.0	3.0									4	SPT	23,30/120mm, N*=75
		23.0	4.0									5.5		
		22.0	5.0										SPT	22,22,26, N=48
	21.0	6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH6**

Page: 2 of 4

Job Number: GE18/144

Easting: 555579.90 **Drilling Rig:** Hydrapower Scout
Northing: 6873410.10 **Driller:** Redlands Drilling
RL: 27.00 **Logged By:** L. Bexley
Total Depth: 8.00 **Date:** 30/07/2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Washbore with Rock Roller		24.0		Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown .mottled dark grey	XW		VLS		7	SPT	30/75mm, N*=120
		20.0	6.5			BAS	BASALT: As above but low strength and dark grey mottled orange .brown	XW		LS				
			7.0											
			7.2		BAS	BASALT: .As above but medium strength and distinctly weathered	DW		MS					
			19.0	8.0										
							8.00m: COMMENCE NMLC CORING							
		18.0	9.0											
		17.0	10.0											
		16.0	11.0											
		15.0	12.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	MS Medium	S Vane shear value kPa
		H Hard	VD Very dense	HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH6**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555579.90
Northings: 6873410.10
RL: 27.00
Total Depth: 14.50

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 30/07/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description	
		21.0							ELS VLS LS MS HS VHS EHS			30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring		20.5	6.5											
		20.0	7.0											
		19.5	7.5											
		19.0	8.0				Commence NMLC Coring at 8.00m							
		18.5	8.1	Bedrock		BAS BAS	BASALT: High strength, slightly weathered, dark grey with some orange brown staining, highly fractured.	SW SW						HFZ 100mm J35° St/Ro, St, O J15° Stp/Ro, St, O J50° Un/Sm, Vr, O J25° Pl/Sm, Cn, O HFZ 120mm S40° J5° Un/Ro, Cn, O BZ 110mm CZ 100mm J50° Pl/Sm, Vr, O
		18.0	8.5				BASALT: As above but very high strength.				7.21			CZ 70mm S30° HFZ 100mm S5° J5° Pl/Sm, Cn, O S10° 50mm
		17.5	9.0								10.9			J5° Pl/Sm, Cn, O J25° Pl/Sm, St, O J15° Stp/Ro, Vr, O
		17.0	9.5											CZ with VLS 230mm
		16.5	10.0											J10° Pl/Sm, Ct, O Cly 15mm J10° Pl/Sm, Ct, O Cly 20mm
		16.0	10.3											
		15.5	10.5											
		15.0	11.0											
		11.3												
		11.5												
		11.7												
		12.0												
						</								

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
		Moisture		EHS Extremely high	
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH6**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555579.90 Drilling Rig: Hydrapower Scout
Northing: 6873410.10 Driller: Redlands Drilling
RL: 27.00 Logged By: L. Bexley
Total Depth: 14.50 Date: 30/07/2018

Drilling Information				Material Description							Rock Mass Defects						
Drill Method	Water	RL (m)	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength					IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description type, inclination, planarity, roughness, coating, thickness
								ELS	VLS	LS	MS	HS	VHS				
NMLC Coring			12.3			BAS	BASALT: As above but very low strength, with some highly fractured zones and crushed zones.	XW								~J70° Un/Ro, St, O ~J10° Stp/Ro, St, C ~J40° Stp/Ro, St, O ~CZ 50mm with Cly & VLS ~CZ 70mm with Cly & VLS CZ throughout ranging between 10mm & 30mm ~J5° Pl/Sm, Cn, O ~CZ 30mm with Cly & VLS ~J5° Pl/Sm, Cn, O ~J15° Pl/Sm, Cn, O ~HFZ 100mm ~J30° Pl/Sm, Cn, O ~CZ 90mm	
			14.5	12.5		BAS	BASALT: As above but low strength.	XW									
			14.0	13.0													
			13.5	13.5													
			13.7	14.0		BAS	BASALT: As above but low strength to medium strength and extremely to distinctly weathered.	XW-DW									
			13.0				BASALT: As above but high strength and slightly weathered.	XW									
			14.25	14.25		BAS	BASALT: As above but very low strength and extremely weathered.	SW									
			14.33	14.33		BAS		SW									
			14.32	14.32		BAS		XW									
			12.5	14.5		BAS	BASALT: High strength and slightly weathered.	SW									
14.50m: BOREHOLE TERMINATED																	
			12.0	15.0													
			11.5	15.5													
			11.0	16.0													
			10.5	16.5													
			10.0	17.0													
			9.5	17.5													
			9.0	18.0													

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
				EHS Extremely high	
		Moisture D Dry M Moist W Wet			

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH6
BOREHOLE DEPTH: 8.0m TO 14.5m





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Engineering Log - Borehole

Borehole No.: **BH7**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555540.70 Drilling Rig: Hydrapower Scout
 Northing: 6873361.10 Driller: Redlands Drilling
 RL: 25.40 Logged By: L. Bexley
 Total Depth: 2.00 Date: 02/08/2018

Drilling Information				Material Description				Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results
T.C. Rig Wa shore with Rock		25.0	0.7	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, moist.		M	St	0.1 } 0.3 } - BP - 150kPa 1 } - SPT - 6,10,12, N=22
			1.0	Residual		CH	Silty CLAY: Very stiff, high plasticity, red brown, fine to medium sized gravel, some cobbles, moist.		M	VSt	
			1.05			CL	Silty CLAY: As above but hard, low plasticity and grey mottled orange brown.		M	H	
			1.5	Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS	
			2.0			BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS	
2.00m: COMMENCE NMLC CORING											
			23.0								
			3.0								
			22.0								
			4.0								
			21.0								
			5.0								
			20.0								
			6.0								

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.		
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa		
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		D Dry M Moist W Wet		EHS Extremely high			



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70
Northing: 6873361.10
RL: 25.40
Total Depth: 19.05
Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 02/08/2018

Drilling Information				Material Description						Rock Mass Defects						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description type, inclination, planarity, roughness, coating, thickness	
								ELS VLS LS MS HS VHS EHS								
NMLC Coring			25.0				Commence NMLC Coring at 2.00m									
			24.5													
			24.0													
			23.5													
			23.0	Bedrock	V A	BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey, moderately fractured.	SW-Fr			6.51			J5° Pl/Sm,Cn,O J10° Pl/Sm,St,O S15° 30mm S30° 30mm S45° 20mm VLS S20° 15mm J15° Pl/Sm,St,O CZ 100mm cly & VLS BZ 150mm		
			22.5		V A	BAS BAS	BASALT: As above but very low strength and extremely weathered.	XW						HFZ 450mm		
			22.0		V A		BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered.	XW-DW						BZ 70mm		
			21.5		V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW			2.56			J25° Stp/Ro,Cn,O J25° Un/Ro,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Vr,O S5° 60mm		
			21.0		V A	BAS	BASALT: As above but low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some very high strength and slightly weathered zones.	XW-DW						J30° Pl/Ro,Cn,O J30° Pl/Sm,Vr,O J15° Pl/Sm,St,O J15° Pl/Sm,St,O J20° Pl/Sm,St,O BZ 340mm		
			20.5		V A											
		20.0		V A												
		19.5		V A												

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	VSt Very stiff	VD Very dense	HS High							
		H Hard		VHS Very high							
		Moisture		EHS Extremely high							
		D Dry M Moist W Wet									



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70

Drilling Rig: Hydrapower Scout

Northing: 6873361.10

Driller: Redlands Drilling

RL: 25.40

Logged By: L. Bexley

Total Depth: 19.05

Date: 02/08/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			Defect Spacing (mm)	Defect Description
				</									

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70

Drilling Rig: Hydrapower Scout

Northing: 6873361.10

Driller: Redlands Drilling

RL: 25.40

Logged By: L. Bexley

Total Depth: 19.05

Date: 02/08/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring													
			13.0			BAS	BASALT: As above but low strength and extremely weathered.	XW					
			12.5										
			13.0										
			12.0										
			13.5										
			13.6			BAS	BASALT: As above but very low strength, with some clay seams.	XW					
			11.5										
			14.0										
			11.0										
			14.5										
			10.5										
			15.0										
			10.0			BAS	BASALT: As above but very high strength, fresh, dark grey vesicular, lenses of feldspar.	Fr					
			15.4										
			9.5										J20° Stp/Ro,Cn,O
			16.0										J5° Pl/Ro,Cn,O
			9.0										J5° Un/Ro,Cn,O
			16.5										J20° Pl/Sm,Cn,O
			8.5										J45° Pl/Sm,Cn,O
			17.0										
			8.0										
			17.5										
			7.5										
			18.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH7**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555540.70

Drilling Rig: Hydrapower Scout

Northing: 6873361.10

Driller: Redlands Drilling

RL: 25.40

Logged By: L. Bexley

Total Depth: 19.05

Date: 02/08/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			7.0 18.5			BAS	BASALT: As above but very high strength, fresh, dark grey vesicular, lenses of feldspar.	Fr		10.9	100%		
			6.5 19.0							4.9			J30° Pl/Sm,Cn,O
			10.05				19.05m: BOREHOLE TERMINATED						
			6.0 19.5										
			5.5 20.0										
			5.0 20.5										
			4.5 21.0										
			4.0 21.5										
			3.5 22.0										
			3.0 22.5										
			2.5 23.0										
			2.0 23.5										
			1.5 24.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH7
BOREHOLE DEPTH: 2.0m TO 19.05m





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Engineering Log - Borehole

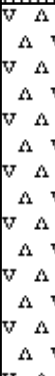
Borehole No.: **BH8**

Page: 1 of 1

Job Number: GE18/144

Easting: 555637.00 Drilling Rig: Jeyhco Digga
Northing: 6873523.00 Driller: Morrison Geotechnic
RL: 20.20 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit		20.0	0.1	Residual Slopewash		CI CH	Sandy CLAY: Stiff, medium plasticity, red brown, fine to medium grained sand, moist		M	St		0.1	BS	Bulk Sample
							Silty CLAY: Hard, high plasticity, red brown mottled grey, some fine to medium sized gravel, moist		M	H				
		19.0	1.1	Rock		BAS	BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments	XW		VLS				
		18.0	2.0											
		3.0												
		17.0					3.00m: BOREHOLE TERMINATED							
		16.0	4.0											
		15.0	5.0											
		6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH9**

Page: 1 of 1

Job Number: GE18/144

Easting: 555699.00
Northing: 6873542.00
RL: 17.70
Total Depth: 1.30

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

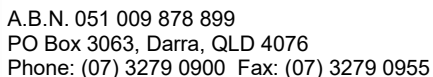
Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit			0.15	Slope wash		CI	Sandy CLAY: Stiff, medium plasticity, red brown, fine to medium grained sand, moist		M	St				
			0.5	Residual		CH	Silty CLAY: Hard, high plasticity, red brown mottled grey, some fine to medium sized gravel, moist		M	H				
	17.0		1.0	Rock		BAS	BASALT: Very low strength, extremely weathered, brown mottled grey, some medium strength fragments	XW		VLS				
			1.2			BAS	BASALT: As above but low strength	XW		LS				
			1.3				1.30m: MAXIMUM TC REFUSAL							
			16.0											
			2.0											
			15.0											
			3.0											
			14.0											
			4.0											
			13.0											
			5.0											
			12.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	L Low	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium High	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



Page: 1 of 1

Location: Cudgen Road, Kingscliff

Easting:	555711.00
Northing:	6873497.70
RL:	25.10
Total Depth:	3.00

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Comments:										Authorised by:	
										Date:	
Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
▼	Water level	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	U50	Undisturbed 50mm diam tube.
—	on date shown			S	Soft	L	Loose			D	Disturbed sample.
		XW	Extremely weathered	F	Firm	MD	Medium dense	VLS	Very low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
►	Water inflow	DW	Distinctly weathered	St	Stiff			LS	Low		
				VSt	Very stiff	D	Dense	MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.
				H	Hard	VD	Very dense	HS	High	S	Vane shear value kPa
◄	Water outflow	SW	Slightly weathered					VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
								EHS	Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		FR	Fresh	Moisture							
				D	Dry	M	Moist	W	Wet		



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Engineering Log - Borehole

Borehole No.: **BH11**

Page: 1 of 1

Job Number: GE18/144

Easting: 555681.90
Northing: 6873421.00
RL: 26.70
Total Depth: 2.60

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit			0.1	Slopewash		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H	2			
				Residual		CH	Silty CLAY: Stiff, high plasticity, red brown, moist		M	St	3			
		26.0									8			
			0.8			CH	Silty CLAY: As above but brown, some fine to medium sized gravel		M	St	15			
			1.0											
		25.0		Rock		BAS	BASALT: Very low strength, extremely weathered, brown mottled grey, some medium strength fragments	XW		VLS				
			1.5											
			2.0											
			2.5	Rock		BAS	BASALT: As above but low strength	XW		LS				
		24.0		2.6				2.60m: MAXIMUM TC REFUSAL						
			3.0											
		23.0												
			4.0											
		22.0												
			5.0											
		21.0												
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	L Low	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH12**

Page: 1 of 1

Job Number: GE18/144

Easting: 555644.00 Drilling Rig: Jeyhco Digga
Northing: 6873396.00 Driller: Morrison Geotechnic
RL: 26.50 Logged By: C. Lam
Total Depth: 1.50 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result			
100mm Solid Flight Auger with TC Bit		26.0	0.1	Slopewash Residual		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist Silty CLAY: Very stiff, high plasticity, red brown, trace fine to medium sized gravel, moist BASALT: Low strength, extremely weathered, grey, with medium strength fragments		M	H	2	0.5	U50	PP=350kPa			
			CH			3											
						3											
						2											
						3											
						3											
						3											
						3											
						6											
						5											
				7													
				15													
			25.0	1.3	Rock		BAS	XW		LS							
			1.50m: MAXIMUM TC REFUSAL														
						2.0											
						24.0											
			3.0														
			23.0														
			4.0														
			22.0														
			5.0														
			21.0														
			6.0														

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium high	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH13**

Page: 1 of 1

Job Number: GE18/144

Easting: 555580.70
Northing: 6873319.60
RL: 26.50
Total Depth: 1.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples									
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result						
100mm Solid Flight Auger with TC Bit		26.0	0.1	Slopewash		CH	Sandy CLAY: Hard, high plasticity, brown, fine to medium grained sand, with organics, moist		M	H	11									
			CH			6														
											10									
											4									
											5									
			0.7	Residual		CH	Silty CLAY: Hard, high plasticity, red brown, some fine to coarse sized gravel, moist		M	St - Vst	6									
											5									
											4									
											3									
											8									
			1.0						Silty CLAY: As above but stiff to very stiff		M				St - Vst	15				
																4				
																3				
																8				
																15				
			1.3	Rock			BASALT: Low strength, extremely weathered, grey, with medium strength fragments	XW		LS										
						BAS														
			25.0																	
			1.5	1.50m: MAXIMUM TC REFUSAL																
			2.0																	
			24.0																	
			3.0																	
			23.0																	
			4.0																	
			22.0																	
			5.0																	
			21.0																	
			6.0																	

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
— Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
◄ Water outflow	SW Slightly weathered	St Stiff	LS Low	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	HS High	S Vane shear value kPa
		H Hard	VD Very dense	VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH14**

Page: 1 of 1

Job Number: GE18/144

Easting: 555523.40 Drilling Rig: Jeyhco Digga
Northing: 6873320.10 Driller: Morrison Geotechnic
RL: 24.80 Logged By: C. Lam
Total Depth: 0.90 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
10mm Solid Flight Auger with TC Bit			0.15	Slope wash		CH	Sandy CLAY: Stiff, high plasticity, red brown, fine to medium grained sand, with organics, moist		M	St	2			
				Residual		CH	Silty CLAY: Very stiff, high plasticity, red brown, trace fine to medium sized gravel, moist		M	VSt	3			
			0.6				BASALT: Very low strength, extremely weathered, brown				2			
											3			
											4			
			0.8	Rock		BAS	BASALT: As above but low strength	XW		VLS	11			
						BAS					15			
								XW		LS				
		24.0	1.0				0.90m: MAXIMUM T.C. REFUSAL							
			23.0											
			2.0											
			22.0											
			3.0											
			21.0											
			4.0											
			20.0											
			5.0											
			19.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH15**

Page: 1 of 1

Job Number: GE18/144

Easting: 555453.90 Drilling Rig: Jeyhco Digga
Northing: 6873347.90 Driller: Morrison Geotechnic
RL: 18.20 Logged By: C. Lam
Total Depth: 0.80 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit		18.0	0.1			CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H				
			CH			Silty CLAY: Very stiff, high plasticity, red brown, some fine to medium sized gravel, moist		M	VSt					
						BASALT: Very low strength, extremely weathered, grey brown, some low to mediums strength fragments			VLS					
			0.6			BAS		XW		LS				
			0.7			BAS		XW		LS				
			0.8				0.80m: MAXIMUM T.C REFUSAL	XW						
			1.0											
			17.0											
			2.0											
			16.0											
			3.0											
			15.0											
			4.0											
			14.0											
			5.0											
			13.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	L Loose	MD Medium dense	VLS Very low	D Disturbed sample.
► Water outflow	DW Distinctly weathered	St Stiff	LS Low	MS Medium	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	VSt Very stiff	D Dense	HS High	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	H Hard	VD Very dense	VHS Very high	S Vane shear value kPa
				EHS Extremely high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture			From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH16**

Page: 1 of 1

Job Number: GE18/144

Easting: 555464.00 Drilling Rig: Jeyhco Digga
Northing: 6873295.00 Driller: Morrison Geotechnic
RL: 20.80 Logged By: C. Lam
Total Depth: 0.80 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
100mm Solid Flight Auger with TC Bit			0.1	Superficial Residual		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H					
						CH	Silty CLAY: Very stiff, high plasticity, red brown, some fine to coarse sized gravel, moist		M	VSt					
			0.6	Rock		BAS	BASALT: Very low strength, extremely weathered, grey brown, some low to medium strength fragments								
			0.7			BAS	BASALT: As above but low strength	XW		VLS					
			0.8			BAS		XW		LS					
		20.0	1.0				0.80m: MAXIMUM T.C. REFUSAL								
			19.0												
			2.0												
			18.0												
			3.0												
			17.0												
			4.0												
			16.0												
			5.0												
			15.0												
			6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH17**

Page: 1 of 1

Job Number: GE18/144

Easting: 555407.00
Northing: 6873296.10
RL: 14.70
Total Depth: 3.00

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

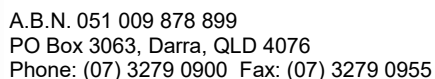
Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit			0.1	Residual Slopewash		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H		0.3	BS	Bulk Sample
			14.0		CH	M		VSt						
			1.0											
			13.0											
			2.0											
			12.0											
			3.0											
3.00m: BOREHOLE TERMINATED														
			11.0											
			4.0											
			10.0											
			5.0											
			9.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



Page: 1 of 1

Location: Cudgen Road, Kingscliff

Easting:	555482.30
Northing:	6873253.70
RL:	23.40
Total Depth:	3.00

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Comments:										Authorised by: Date:	
Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
▼ —	Water level on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	U50	Undisturbed 50mm diam tube.
►	Water inflow	XW	Extremely weathered	S	Soft	L	Loose	VLS	Very low	D	Disturbed sample.
►	Water outflow	DW	Distinctly weathered	F	Firm	MD	Medium dense	LS	Low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
►		SW	Slightly weathered	St	Stiff			MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.
				VSt	Very stiff	D	Dense	HS	High	S	Vane shear value kPa
				H	Hard	VD	Very dense	VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		FR	Fresh					EHS	Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				Moisture							
				D	Dry	M	Moist	W	Wet		



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Engineering Log - Borehole

Borehole No.: **BH19**

Page: 1 of 1

Job Number: GE18/144

Easting: 555396.00 Drilling Rig: Jeyhco Digga
Northing: 6873218.00 Driller: Morrison Geotechnic
RL: 17.10 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with TC Bit		17.0	0.1	Residual Slopewash		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist Silty CLAY: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist		M	H	2	0.5	U50	PP=350kPa
						CH			M	VSt	6			
										4				
										4				
										6				
										5				
										10				
										6				
										10				
										15				
		16.0	1.1	CH	Silty CLAY: As above but brown and some fine to medium sized gravel		M	VSt						
			1.5	CH	Silty CLAY: As above but brown mottled grey		M	VSt						
		15.0	2.0											
			2.5	Rock		BAS	BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments	XW		VLS				
		3.0												
	14.0		3.00m: BOREHOLE TERMINATED											
		4.0												
	13.0													
		5.0												
	12.0													
		6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH20**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555434.90

Drilling Rig: Jeyhco Digga

Northing: 6873158.70

Driller: Morrison Geotechnic

RL: 21.10

Logged By: C. Lam

Total Depth: 2.60

Date: 08.03.2018

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
100mm Solid Flight Auger with TC Bit		21.0	0.1	Slopewash		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H	2				
				Residual		CH	Silty CLAY: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist		M	VSt	3				
			0.5			CH	Silty CLAY: As above but with fine to coarse sized gravel and some cobbles				3				
											3				
			1.0			CH	Silty CLAY: As above but brown		M	VSt	3				
											15				
			1.3	Rock		BAS	BASALT: Very low strength, extremely weathered, brown mottled grey, some low to medium strength fragments	XW		VLS					
			2.0												
			2.5				BASALT: As above but low strength								
			2.6						XW		LS				
			3.0			2.60m: MAXIMUM T.C. REFUSAL									
		18.0	4.0												
		17.0	5.0												
		16.0	6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	L Low	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH21**

Page: 1 of 1

Job Number: GE18/144

Eastings: 555387.00 Drilling Rig: Jeyhco Digga
Northings: 6873134.00 Driller: Morrison Geotechnic
RL: 17.70 Logged By: C. Lam
Total Depth: 3.00 Date: 08.03.2018

Client: Wood & Grieve Engineers
Project: Geotechnical Invest - Tweed Valley Hospital
Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
100mm Solid Flight Auger with TC Bit			0.1	Slopewash		CH	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H	2	1 –	PP	270kPa	
						CH		M	VSt	2					
										3					
										4					
										4					
			0.6	Residual		CH	Silty CLAY: Very stiff, high plasticity, red brown, some fine to medium sized gravel, moist		M	VSt	15				
			1.0												
			16.0												
			2.0												
			15.0												
			3.0												
	3.00m: BOREHOLE TERMINATED														
			14.0												
		4.0													
		13.0													
		5.0													
		12.0													
		6.0													

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	U50 Undisturbed 50mm diam tube. D Disturbed sample. SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. PP Hand penetrometer estimate of unconfined compressive strength, kPa. S Vane shear value kPa DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		Moisture D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH22**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555738.00
Northing: 6873607.00
RL: 6.30
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
10mm Solid Flight Auger with TCB Bit		6.0	0.05	Slope wash		CH	Sandy CLAY: Stiff, high plasticity, red brown, fine to medium grained sand, trace of fine to medium sized gravel, moist		M	St		0.3 –	PP	450kPa
			0.5	Residual		CH	Silty CLAY: Hard, high plasticity, red brown, moist		M	H				
			0.5				0.50m: BOREHOLE TERMINATED FOR PERMEABILITY TEST							
			1.0											
			5.0											
			2.0											
			4.0											
			3.0											
			3.0											
			4.0											
			2.0											
			5.0											
			1.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH23**

Page: 1 of 1

Job Number: GE18/144

Easting: 555796.00
Northing: 6873615.00
RL: 7.20
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with		7.0	0.05	Slo pew		CH CH	Silty CLAY: Stiff, high plasticity, red brown, trace of fine to medium sand, with organics, moist		M M	St H		0.2 -	PP	450kPa
							Silty CLAY: Hard, high plasticity, red brown, moist							
			0.5	Residual			0.50m: BOREHOLE TERMINATED FOR PERMEABILITY TEST							
			1.0											
			6.0											
			2.0											
			5.0											
			3.0											
			4.0											
			3.0											
			5.0											
			2.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH24**

Page: 1 of 1

Job Number: GE18/144

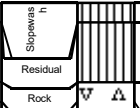
Easting: 555467.40
Northing: 6873402.50
RL: 18.30
Total Depth: 0.50

Drilling Rig: Jeyhco Digga
Driller: Morrison Geotechnic
Logged By: C. Lam
Date: 08.03.2018

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

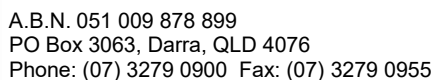
Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Solid Flight Auger with T.C. Bit		18.0	0.1			CH CH BAS	Sandy CLAY: Hard, high plasticity, red brown, fine to medium grained sand, moist		M	H				
							M		VSt					
0.50m: MAXIMUM T.C. REFUSAL														
			1.0											
			17.0											
			2.0											
			16.0											
			3.0											
			15.0											
			4.0											
			14.0											
			5.0											
			13.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



Page: 1 of 5

Location: Cudgen Road, Kingscliff

Easting:	555600.30
Northing:	6873495.60
RL:	25.80
Total Depth:	1.55

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

Comments:										Authorised by:	
										Date:	
Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
	Water level	RS	Residual	VS	Very soft	VL	Very loose	ELS	Extremely	U50	Undisturbed 50mm diam tube.
	on date shown		soil	S	Soft	L	Loose		low	D	Disturbed sample.
		XW	Extremely	F	Firm	MD	Medium	VLS	Very low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler
			weathered	St	Stiff		dense	LS	Low		300mm with a 63.6kg hammer falling 762mm.
	Water inflow	DW	Distinctly	VSt	Very stiff	D	Dense	MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.
			weathered	H	Hard	VD	Very dense	HS	High	S	Vane shear value kPa
		SW	Slightly					VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg
	Water outflow		weathered					EHS	Extremely		taper cone fitted to rods of smaller section.
		FR	Fresh	Moisture					high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				D	Dry	M	Moist	W	Wet		



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555600.30
Northing: 6873495.60
RL: 25.80
Total Depth: 21.30

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring							Commence NMLC Coring at 1.55m								
			25.5												
			25.0												
			24.5												
			24.0	Bedrock	V A	BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey with some orange brown staining, moderately fractured.	SW-Fr			8.66				S5° 50mm some VLS -BZ 50mm J10° Pl/Sm,Cn,O J5° Un/Sm,Cn,O S15° 40mm S15° 10mm J60° Pl/Sm,St,O -BZ 30mm
			23.5		V A	BAS	BASALT: As above but high strength and distinctly weathered to slightly weathered.	DW-							S10° 20mm
			23.0		V A	BAS	BASALT: As above but very high strength and slightly weathered.	SW			9.38				S15° 10mm S30° 50mm HFZ 180mm
			22.5		V A										J15° Pl/Sm,St,O J50° Un/Ro, Vr,O J5° Pl/Sm,St,O
			22.0		V A						9.8				-BZ 130mm
			21.5		V A	BAS	BASALT: As above but low strength, extremely weathered, grey mottled orange brown.	XW					0%		
			21.0				CORE LOSS								
			20.5		V A	BAS	BASALT: Very low strength, extremely weathered, grey mottled orange brown, numerous broken zones.	XW					0%		
			20.0		V A										
			6.0		V A										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
				VHS Very high	
				EHS Extremely high	
Moisture D Dry M Moist W Wet					

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30

Drilling Rig: Hydrapower Scout

Northing: 6873495.60

Driller: Redlands Drilling

RL: 25.80

Logged By: L. Bexley

Total Depth: 21.30

Date: 03/08/2018

[illegible]

Comments:					Authorised by: Date:				
Water	Weathering		Consistency		Density		Rock Strength		Defects
 Water level on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	Refer to Defect Description Sheet
 Water inflow	XW	Extremely weathered	S	Soft	L	Loose	VLS	Very low	
 Water outflow	DW	Distinctly weathered	F	Firm	MD	Medium dense	LS	Low	
	SW	Slightly weathered	St	Stiff	D	Dense	MS	Medium	
	FR	Fresh	H	Hard	VD	Verv dense	HS	High	
			Moisture					VHS	Very high
			D Dry	M Moist	W Wet			EHS	Extremely high



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555600.30
Northing: 6873495.60
RL: 25.80
Total Depth: 21.30

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 03/08/2018

Drilling Information				Material Description							Rock Mass Defects							
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description			
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness				
NMLC Coring																		
			13.5			BAS	BASALT: As above but low strength, extremely weathered, numerous broken zones.	XW					25%					
			12.5															
			13.0															
			13.0															
			12.5															
			13.3			BAS	BASALT: As above but medium strength and distinctly weathered.	DW							J15° Un/Ro,Cn,O J15° Un/Ro,Cn,O S30° 20mm VLS			
			13.5															
			13.55			BAS	BASALT: As above but low strength to medium strength and extremely weathered to distinctly weathered.	XW-DW							BZ 550mm			
			12.0															
			14.0															
			11.5								0.17				J50° Pl/Sm,Ct,C			
			14.5												J25° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O			
			14.55			BAS	BASALT: As above but low strength and extremely weathered.	XW					0%					
			11.0															
			15.0															
			10.5															
			15.5															
			15.55			BAS	BASALT: As above but very low strength.	XW										
			10.0															
			16.0															
			9.5															
			16.5															
			16.55			BAS	BASALT: As above but low strength.	< W							J5° Pl/Ro,Cn,O J15° Pl/Sm,Cn,O BZ 80mm			
			9.0			BAS	BASALT: As above but very high strength, slightly weathered to fresh, vesicular dark grey.	SW-Fr					40%					
			17.0												J10° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O			
			8.5															
			17.54			BAS	BASALT: As above but very low strength and extremely weathered.	< W										
			17.55				CORE LOSS				7.81							
			18.0															

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH25**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotechnical Invest - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555600.30

Drilling Rig: Hydrapower Scout

Northing: 6873495.60

Driller: Redlands Drilling

RL: 25.80

Logged By: L. Bexley

Total Depth: 21.30

Date: 03/08/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description	
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring		7.5	18.15			BAS	CORE LOSS							
			18.5				BASALT: Very high strength, slightly weathered, vesicular dark grey.	SW			1.37	57%	J10° Pl/Ro,Cn,O J15° Pl/Ro,Cn,O	
		7.0	19.0										J15° Pl/Sm,St,O J5° Un/Ro,Cn,O	
		6.5	19.2				CORE LOSS						-BZ	
		6.0	19.6			BAS	BASALT: Very high strength, slightly weathered to fresh, vesicular dark grey.	SW-Fr			7.87			
			20.0			BAS	BASALT: As above but low strength and extremely weathered.	XW					-BZ 205mm	
		5.5	20.05			BAS	BASALT: As above but very high strength and slightly weathered.	SW				32%	J30° Stp/Ro,Ct,O S20° 70mm VLS & cly S10° 100mm VLS & cly	
		5.0	20.5										S20° 100mm VLS & cly	
			21.0										HFZ 300mm	
		4.5	21.3								6.42		J25° Pl/Sm,Cn,O J25° Pl/Sm,Cn,O	
		4.0	21.5				21.30m: BOREHOLE TERMINATED							
			22.0											
		3.5	22.5											
			23.0											
		2.5	23.5							6.01				
			24.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION
- TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH25
BOREHOLE DEPTH: 1.55m TO 21.3m





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Engineering Log - Borehole

Borehole No.: **BH26**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555422.00

Drilling Rig: Jehyco Digga

Northing: 6873815.00

Driller: Morrison Geotechnic

RL: 19.69

Logged By: C. Lam

Total Depth: 2.10

Date: 09/11/2018

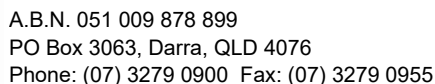
Drilling Information				Material Description							Test Samples								
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result					
100mm Auger with T.C Bit			0.1	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	1	0.5	U50	PP=350-400kPa					
						CH		Silty CLAY: As above but very stiff and no organics.		M	VSt				5				
											7								
											9								
											10								
		19.0		Residual		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	9								
																9			
																8			
																9			
																11			
			1.0									8							
												7							
												9							
			1.3			CI	Silty CLAY: As above but grey brown.		M	VSt-H	7								
												6							
												10							
			1.6			CI	Silty CLAY: As above but with some fine to medium gravel.		M	VSt-H									
				Bedrock			BASALT: Very low strength, extremely weathered, orange brown mottled grey.												
			2.0			BAS	BASALT: As above but low strength.	XW		VLS									
					BAS	XW			LS										
2.10m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL																			
			17.0																
			3.0																
			16.0																
			4.0																
			15.0																
			5.0																
			14.0																
			6.0																

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



Page: 1 of 1

Location: Cudgen Road, Kingscliff

Easting:	555469.00	Drilling Rig:	Jehyco Digga
Northing:	6873204.00	Driller:	Morrison Geotechnical
RL:	23.08	Logged By:	C. Lam
Total Depth:	1.50	Date:	09/11/2018

Comments:										Authorised by: Date:	
Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
 Water level  on date shown		RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.					
		XW Extremely weathered	S Soft	L Loose	D Low	D Disturbed sample.					
 Water inflow		DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.					
		SW Slightly weathered	St Stiff	LS Low	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.					
 Water outflow		FR Fresh	VSt Very stiff	D Dense	HS High	S Vane shear value kPa					
			H Hard	VD Very dense	VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.					
			Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes					
			D Dry	M Moist	W Wet						



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Engineering Log - Borehole

Borehole No.: **BH28**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555425.00

Drilling Rig: Jehyco Digga

Northing: 6873258.00

Driller: Morrison Geotechnic

RL: 17.88

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			0.1	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	6	0.5	U50	PP>=400kPa
			CH			10								
						11								
						9								
						13								
			0.5	Residual		CI	Silty CLAY: Hard, medium plasticity, red brown, moist.		M	H	15			
1.0														
2.0														
2.1														
15.0														
3.0														

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH29**

Page: 1 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555435.00 Drilling Rig: Hydrapower Scout
Northing: 6873319.40 Driller: Redlands Drilling
RL: 16.18 Logged By: C. Lam
Total Depth: 16.80 Date: 16/11/2018

Drilling Information				Material Description							Test Samples								
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result					
100mm Auger with T.C Bit			16.0	Residual Slopewash		CH	Silty CLAY: Firm, high plasticity, red brown, trace of fine to medium sized gravel, moist.		M	F									
		0.3	CI			Silty CLAY: Very stiff to hard, medium plasticity, red brown, with some fine to medium sized gravel, moist		M	VSt-H										
		0.8	CI			Silty CLAY: .As above but hard and no gravel		M	H										
		1.0	CI			Silty CLAY: .As above but brown		M	H										
		1.4	CI			Gravelly CLAY: Hard, medium plasticity, grey mottled dark grey and orange brown, fine to medium sized gravel, extremely weathered basalt fragments, moist		M	H										
	Wash Bore - Rock Roller			2.0															
				14.0															
				3.0															
				13.0															
				3.8			CI	Silty CLAY: Very stiff, medium plasticity, brown mottled grey and orange brown, trace of fine sized gravel, moist		M					VSt				
			4.0																
			12.0																
			5.0																
			11.0																
			6.0																

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH29**

Page: 2 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555435.00 Drilling Rig: Hydrapower Scout
Northing: 6873319.40 Driller: Redlands Drilling
RL: 16.18 Logged By: C. Lam
Total Depth: 16.80 Date: 16/11/2018

Drilling Information				Material Description							Test Samples						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result			
Wash Bore - Rock Roller			10.0		CI	Silty CLAY: Very stiff, medium plasticity, brown mottled grey and orange brown, trace of fine sized gravel, moist.			M	VSt		6	PP - 250kPa SPT - 6,9,12, N=21				
			6.2		CI							Silty CLAY: As above but orange brown mottled grey.			M	VSt	6.1
			7.0												7	PP - 380kPa SPT - 3,4,6, N=10	
			9.0												7.2		
			8.0													PP - 150kPa SPT - 1,3,3, N=6	
			8.0		CI	Silty CLAY: As above but stiff, grey mottled orange brown.	M	St	8.5 8.6								
			9.0													PP - 150kPa SPT - 3,3,3, N=6	
			7.0												10 10.1		
			10.0													SPT - 1,3,3, N=6	
			11.0												11.5		
12.0																	

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
 Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
 Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
 Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH29**

Page: 3 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555435.00

Drilling Rig: Hydrapower Scout

Northing: 6873319.40

Driller: Redlands Drilling

RL: 16.18

Logged By: C. Lam

Total Depth: 16.80

Date: 16/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		4.0				CI	Silty CLAY: As above but stiff, grey mottled orange brown.		M	St				
			13.0											
		3.0	13.2			CI	Silty CLAY: As above but brown mottled dark grey, with some very low strength, extremely weathered basalt rock layering.		M	St		13	SPT	5,10,18, N=28
			14.0											
		2.0	14.5			CI	Silty CLAY: As above but dark grey mottled orange and brown, with some fine sized gravel.		M	St		14.5	SPT	3,6,7, N=13
			15.0											
		1.0												
			16.0									16	SPT	4,7,19, N=26
		0.0										16.5	PP	180kPa
			16.6											
		16.8												
			16.6	Rock		BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown	DW		MS				
			17.0				16.80m: COMMENCE NMLC CORING							
		-1.0												
			18.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	U50 Undisturbed 50mm diam tube. D Disturbed sample. SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. PP Hand penetrometer estimate of unconfined compressive strength, kPa. S Vane shear value kPa DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes



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Engineering Log - Cored Borehole

Borehole No.: **BH29**

Page: 4 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555435.00 Drilling Rig: Hydrapower Scout
Northings: 6873319.40 Driller: Redlands Drilling
RL: 16.18 Logged By: C. Lam
Total Depth: 25.00 Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS						30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring		4.0													
			12.5												
		3.5													
			13.0												
		3.0													
			13.5												
		2.5													
			14.0												
		2.0													
			14.5												
		1.5													
			15.0												
		1.0													
			15.5												
		0.5													
			16.0												
		0.0													
			16.5												
		-0.5						Commence NMLC Coring at 16.8m							
			17.0	Bedrock	V A	BAS		BASALT: Very high strength, slightly weathered to fresh, grey, slightly fractured.	SW-Fr		15.29		90%		J10° Un/Ro,Cn,O J10° Un/Ro,Cn,O J20° Pl/Ro,Cn,O
		-1.0			V A										J5° Un/Ro,Cn,O J10° Un/Ro,Cn,O J40° Un/Ro,Vr,O J20° Un/Ro,Cn,O J40° Un/Ro,Cn,O J5° Un/Ro,St,O
			17.5		V A										
		-1.5			V A										
			17.8		V A										
			18.0		V A	BAS		BASALT: As above but medium strength, distinctlv weathered.	DW						

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH29**

Page: 5 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: GeotechInvestigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555435.00

Drilling Rig: Hydrapower Scout

Northing: 6873319.40

Driller: Redlands Drilling

RL: 16.18

Logged By: C. Lam

Total Depth: 25.00

Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			-2.0		△ △	BAS	BASALT: As above but medium strength, distinctly weathered	DW				0.48			J40° Un/Ro,Cn,O
			18.3 18.5		△ △	BAS	BASALT: Very high strength, slightly weathered to fresh, grey	SW-Fr					90%		J35° Un/Ro,Cn,O J5° Pl/Ro,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J5° Un/Ro,Cn,O J45° Un/Ro,Cn,O J5° Pl/Ro,Cn,O J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O J40° Un/Ro,Cn,O J10° Un/Ro,Cn,O
			-2.5		△ △										
			19.0		△ △							7.70			
			-3.0		△ △										
			19.5		△ △							5.11			
			-3.5		△ △										
			20.0		△ △										
			-4.0		△ △										
			20.34 20.5		△ △	BAS	BASALT: Medium strength, distinctly weathered, grey, slightly fractured.	DW				0.98	87%		J5° Un/Ro,Cn,O J10° Pl/Ro,Cn,O J10° Un/Ro,Vr,O J5° Pl/Ro,Cn,O J10° Un/Ro,Cn,O J5° Un/Ro,Cn,O
			-4.5		△ △										
			21.0		△ △										
			-5.0		△ △							0.39			
			21.5		△ △										
			-5.5		△ △										
			22.0		△ △										
			-6.0		△ △										
			22.5		△ △										
			-6.5		△ △										
			23.0		△ △										
			-7.0		△ △							0.31	92%		J5° Un/Ro,Cn,O J15° Un/Ro,Cn,O J5° Un/Ro,Vr,O SZ 20mm, MS & clay
			23.5		△ △										
			-7.5		△ △										
			24.0		△ △										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555435.00

Drilling Rig: Hydrapower Scout

Northing: 6873319.40

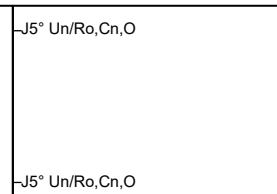
Driller: Redlands Drilling

RL: 16.18

Logged By: C. Lam

Total Depth: 25.00

Date: 16/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
		-8.0	24.5		BAS	BASALT: Medium strength, distinctly weathered, aqua grey, slightly fractured.	DW				92%				
		-8.5													
		-9.0	25.0										J5° Un/Ro, Cn, O		
		-9.5	25.00m: BOREHOLE TERMINATED												
		-10.0													
		-10.5													
		-11.0													
		-11.5													
		-12.0													
		-12.5													
		-13.0													
		-13.5													
		-14.0													
		-14.5													
		-15.0													
		-15.5													
		-16.0													
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		-19.0													
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		-26.0													
		-26.5													
		-27.0													
		-27.5													
		-28.0													
		-28.5													
		-29.0													
		-29.5													
		-30.0													

Comments:				Authorised by: Date:		
Water  Water level  on date shown  Water inflow  Water outflow	Weathering RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	Consistency VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Defects Refer to Attached Defect Description Sheet	

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD

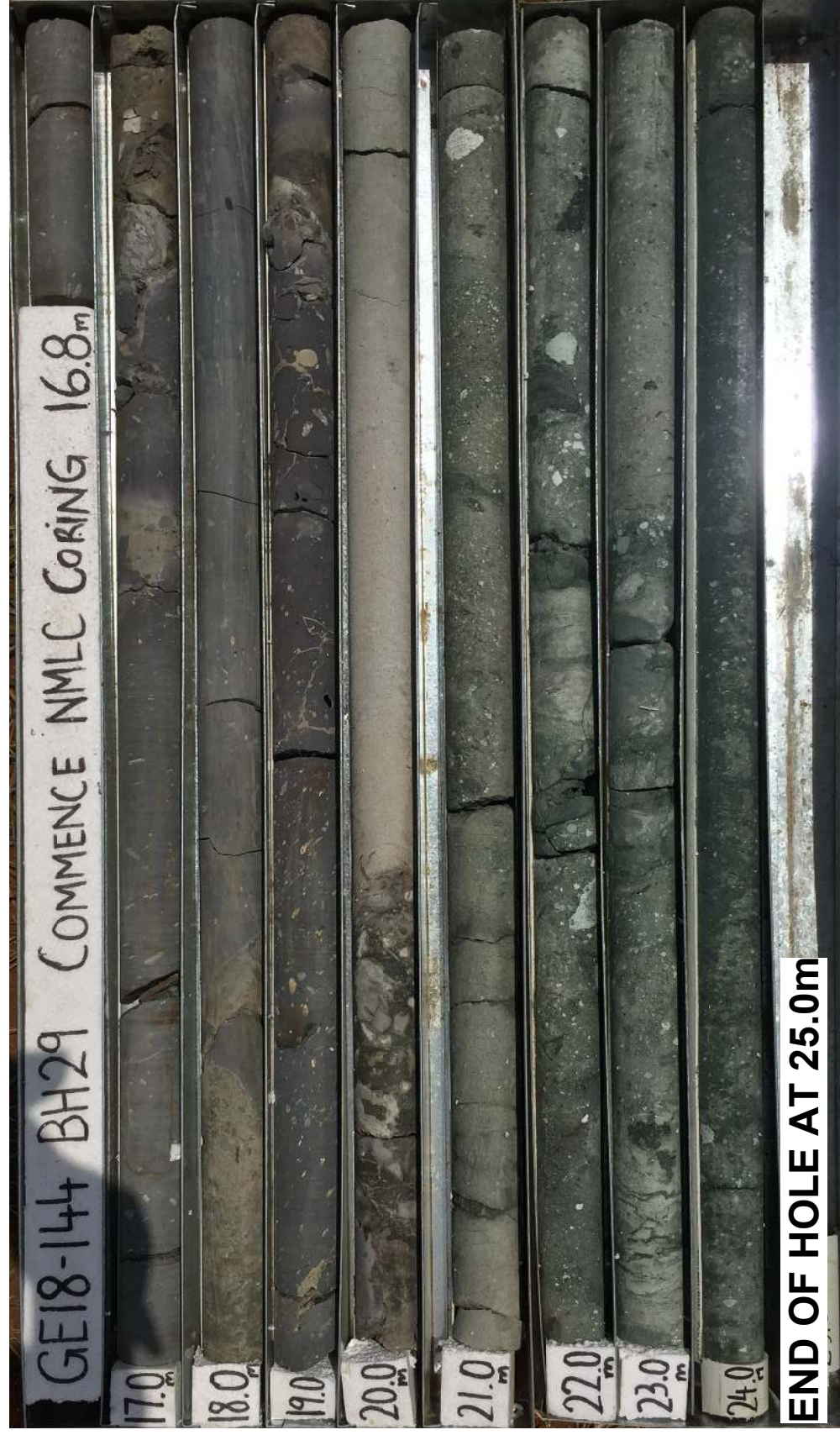
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL

LOCATION: CUDGEN ROAD, KINGSCLIFF

JOB NUMBER: GE18/144

BOREHOLE NUMBER: BH29

BOREHOLE DEPTH: 16.8m TO 25.0m





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Engineering Log - Borehole

Borehole No.: **BH30**

Page: 1 of 1

Job Number: GE18/144

Eastings: 555405.00 Drilling Rig: Jehyco Digga
Northings: 6873364.00 Driller: Morrison Geotechnic
RL: 11.48 Logged By: C. Lam
Total Depth: 3.00 Date: 09/11/2018

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples												
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result									
100mm Auger with T.C Bit			0.1	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	1												
			CH			Silty CLAY: As above but very stiff and no organics.					M				VSt	4							
			0.4	Residual		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	5												
			8																				
			9																				
			7																				
			5																				
			8																				
			7																				
			8																				
			9																				
			6																				
			7																				
			8																				
			8																				
			7																				
8																							
9																							
2.0																							
2.4																							
3.0																							
3.00m: BOREHOLE TERMINATED																							
8.0																							
4.0																							
7.0																							
5.0																							
6.0																							
6.0																							

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	D Disturbed sample.		
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa		
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		D Dry M Moist W Wet					



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Engineering Log - Borehole

Borehole No.: **BH31**

Page: 1 of 1

Job Number: GE18/144

Eastings: 555411.00 Drilling Rig: Jehyco Digga
 Northings: 6873417.00 Driller: Morrison Geotechnic
 RL: 9.34 Logged By: C. Lam
 Total Depth: 3.00 Date: 09/11/2018

Client: Wood & Grieve Engineers
 Project: Geotech Investigation - Tweed Valley Hospital
 Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			0.1	Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	4			
			9.0			CH			M	VSt	7			
			0.5				Silty CLAY: As above but very stiff and no organics.				7			
											8			
											9			
			1.0	Residual		Cl	Silty CLAY: Very stiff to hard, medium plasticity, red brown, moist.		M	VSt-H	9			
											8			
											9			
											10			
											11			
											10			
											9			
											12			
											10			
											12			
										15				
			2.0											
			7.0											
			2.4			Cl	Silty CLAY: As above but grey brown.		M	VSt-H				
			3.0											
			3.00m: BOREHOLE TERMINATED											
			6.0											
			4.0											
			5.0											
			5.0											
			4.0											
			6.0											

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
▼ Water level on date shown	RS Residual	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
► Water inflow	S Soft	L Loose	MD Medium dense	VLS Very low	D Disturbed sample.		
◄ Water outflow	XW Extremely weathered	F Firm	VD Very dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	DW Distinctly weathered	St Stiff		MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	SW Slightly weathered	VSt Very stiff		HS High	S Vane shear value kPa		
	FR Fresh	H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		D Dry M Moist W Wet					



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Engineering Log - Borehole

Borehole No.: **BH32**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555422.00 Drilling Rig: Jehyco Digga
Northing: 6873498.00 Driller: Morrison Geotechnic
RL: 9.19 Logged By: C. Lam
Total Depth: 3.00 Date: 09/11/2018

Drilling Information				Material Description							Test Samples						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result			
100mm Auger with T.C Bit		9.0	0.1	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown mottled grey, with organics, trace of fine to medium sized gravel , moist		M	St	2						
			CH			Silty CLAY: .As above but very stiff and no organics					M				VSt	4	
																7	
			0.4	CI	Silty CLAY: .Very stiff to hard, medium plasticity, red brown, moist			M	VSt-H	9							
				11													
				10													
			1.0			10											
						9											
						11											
						10											
						12											
						10											
						9											
						11											
						8											
			9														
			10														
		1.7			CI	Silty CLAY: .As above but hard		M	H								
2.0																	
2.5			CI	Silty CLAY: .As above but brown and very stiff		M	VSt										
3.0																	
		6.0				3.00m: BOREHOLE TERMINATED											
		4.0															
		5.0															
		5.0															
		4.0															
		6.0															

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555466.00

Drilling Rig: Jehyco Digga

Northing: 6873545.00

Driller: Morrison Geotechnic

RL: 10.09

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

[illegible]**Comments:**

Authorised by:

Date:

Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
 Water level  on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	U50	Undisturbed 50mm diam tube.	
			S	Soft	L	Loose			D	Disturbed sample.	
 Water inflow	XW	Extremely weathered	F	Firm	MD	Medium dense	VLS	Very low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.	
			St	Stiff			LS	Low			
 Water outflow	DW	Distinctly weathered	VSt	Very stiff	D	Dense	MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.	
			H	Hard	VD	Very dense	HS	High	S	Vane shear value kPa	
	SW	Slightly weathered	Moisture D Dry M Moist W Wet				VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.	
	FR	Fresh					EHS	Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes	



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Engineering Log - Borehole

Borehole No.: **BH34**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555541.00

Drilling Rig: Jehyco Digga

Northing: 6873570.00

Driller: Morrison Geotechnic

RL: 10.79

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

Drilling Information				Material Description				Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results
100mm Auger with T.C Bit			0.1	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, trace of fine to medium sized gravel, with organics, moist.		M	St	4
						CH			M	VSt	9
			0.4	Residual		CI	Silty CLAY: As above but very stiff and no organics		M	VSt-H	5
							Silty CLAY: Very stiff to hard, medium plasticity, red brown, trace of fine to medium sized gravel moist				4
											4
											7
											8
											9
											8
			1.0			CI	Silty CLAY: As above but no gravel		M	VSt-H	
			1.6			CI	Silty CLAY: As above but hard		M	H	
			2.0			CI	Silty CLAY: As above but red brown mottled grey		M	H	
			3.0								
			3.00m				3.00m: BOREHOLE TERMINATED				
			4.0								
			5.0								
			6.0								

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
▶ Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◀ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH35**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555628.00

Drilling Rig: Jehyco Digga

Northing: 6873575.00

Driller: Morrison Geotechnic

RL: 9.85

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			0.1	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, trace of fine to medium sized gravel, with organics, moist		M	St	5			
						CH			M	VSt	8			
			0.4	Residual		CI	Silty CLAY: As above but very stiff, trace of fine to coarse sized gravel and no organics. Silty CLAY: Very stiff to hard, medium plasticity, red brown, trace of fine to coarse sized gravel, moist.		M	VSt-H	7			
								9						
								7						
								9						
								8						
								9						
								9						
								9						
			1.0			CI	Silty CLAY: As above but no gravel.		M	VSt-H	9			
						3.00m: BOREHOLE TERMINATED								

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	HS High	S Vane shear value kPa
		H Hard	VD Very dense	VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH36**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555699.00

Drilling Rig: Jehyco Digga

Northing: 6873581.00

Driller: Morrison Geotechnic

RL: 10.23

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

Drilling Information				Material Description							Test Samples						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result			
100mm Auger with T.C Bit		10.0	0.1	Slope wash		CH	Silty CLAY: .Stiff, high plasticity, red brown, with organics, moist		M	St	3						
			CH			Silty CLAY: .As above but very stiff and no organics					VSt				3		
			Residual		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown, with fine to medium sized gravel, moist.	M	VSt-H	11								
					8												
					6												
					5												
					9												
					5												
					4												
					4												
					4												
					5												
					6												
					5												
					8												
					15												
					1.0					CI	Silty CLAY: .As above but hard and no gravel				M	H	5
					6												
					5												
			5														
			6														
			2.0		CI	Silty CLAY: As above but orange brown.	M	H	5								
			8														
			15														
			2.1		CI	Silty CLAY: As above but brown	M	H	5								
2.5	CI	Silty CLAY: .As above but brown	M						H	5							
3.0	3.00m: BOREHOLE TERMINATED																
		7.0															
		6.0															
		5.0															
		5.0															
		6.0															

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH37**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555837.00

Drilling Rig: Jehyco Digga

Northing: 6873578.00

Driller: Morrison Geotechnic

RL: 13.60

Logged By: C. Lam

Total Depth: 4.50

Date: 09/11/2018

Drilling Information				Material Description							Test Samples					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result		
100mm Auger with T.C Bit			0.1	Residual		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	3	0.2 –	PP	150kPa		
						CH		M	VSt	4						
			0.4							3	0.4 –				PP	300kPa
										3						
										5						
										4						
			1.0								6					
											6					
											8					
											8					
			1.3			CI	Silty CLAY: As above but hard		M	H	6					
											8					
			1.6			CI	Silty CLAY: As above but brown.		M	H	8					
											9					
			2.0								9					
											9					
			2.1			CI	Silty CLAY: .As above but dark grey		M	H	9					
			2.5										2.5 –	PP	100kPa	
						CI	Silty CLAY: As above but stiff and grey brown.		M	St						
			3.0													
			3.3													
			3.5			CI	Silty CLAY: .As above but very stiff		M	VSt						
			4.0			CI	Silty CLAY: As above but stiff.		M	St						
		4.5														
		5.0														
		8.0														
		6.0														
4.50m: BOREHOLE TERMINATED																

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH38**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555888.00

Drilling Rig: Jehyco Digga

Northing: 6873558.00

Driller: Morrison Geotechnic

RL: 19.29

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			19.0	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	10			
		0.3	CH				M	VSt	7					
				Residual		CI	Silty CLAY: As above but very stiff and no organics.		M	H	5			
												7		
												9		
												6		
												7		
			1.0									15		
			1			CI	Silty CLAY: As above but with some fine to medium gravel.		M	H				
			2.0											
		17.0												
		3.0												
		2												
			16.0				3.00m: BOREHOLE TERMINATED							
			4.0											
			15.0											
			5.0											
			14.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555775.00

Drilling Rig: Jehyco Digga

Northing: 6873551.00

Driller: Morrison Geotechnic

RL: 18.86

Logged By: C. Lam

Total Depth: 3.00

Date: 09/11/2018

[illegible]**Comments:**

Authorised by:

Date:

Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
 Water level  on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	U50	Undisturbed 50mm diam tube.	
			S	Soft	L	Loose			D	Disturbed sample.	
 Water inflow	XW	Extremely weathered	F	Firm	MD	Medium dense	VLS	Very low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.	
			St	Stiff			LS	Low			
 Water outflow	DW	Distinctly weathered	VSt	Very stiff	D	Dense	MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.	
			H	Hard	VD	Very dense	HS	High	S	Vane shear value kPa	
	SW	Slightly weathered	Moisture D Dry M Moist W Wet				VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.	
	FR	Fresh					EHS	Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes	



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Engineering Log - Borehole

Borehole No.: **BH40**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555783.00

Drilling Rig: Jehyco Digga

Northing: 6873508.00

Driller: Morrison Geotechnic

RL: 23.01

Logged By: C. Lam

Total Depth: 1.10

Date: 09/11/2018

Drilling Information				Material Description					Test Samples					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with		23.0	0.1	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.		M	St	10			
			CH			Silty CLAY: As above but very stiff to hard, with some fine to medium sized gravel, no organics and some cobbles.		M	VSt-H	7				
			0.4	Residual		CI	Silty CLAY: Hard, medium plasticity, red brown, with some fine to medium sized gravel, some cobbles, moist.		M	H	15			
			0.8			Bedrock		BAS	BASALT: Very low strength, extremely weathered, red brown and grey.	XW				
			1.0	BAS	BASALT: As above but low strength.			XW		LS				
			1.1											
			22.0				1.10m: BOREHOLE TERMINATED AT MAXIMUM TC REFUSAL							
			21.0											
			20.0											
			19.0											
			18.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH41**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555662.00
 Northings: 6873513.00
 RL: 22.59
 Total Depth: 3.00

Drilling Rig: Jehyco Digga
 Driller: Morrison Geotechnic
 Logged By: C. Lam
 Date: 09/11/2018

Drilling Information				Material Description				Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results
100mm Auger with T.C Bit			0.1	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravels, with organics, moist.		M	St	1
			0.2	Residual		CH			M	VSt	15
						CI	Silty CLAY: As above but very stiff and no organics.		M	VSt-H	20/50
							Silty CLAY: Very stiff to hard, medium plasticity, red brown, with some fine to coarse sized gravel, moist.				
			22.0								
			1.0								
			21.0								
			2.0								
			2.4								
			20.0	Bedrock		BAS	BASALT: Very low strength, extremely weathered, grey.	XW		VLS	
			3.0								
3.00m: BOREHOLE TERMINATED											
			19.0								
			4.0								
			18.0								
			5.0								
			17.0								
			6.0								

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	HS High	S Vane shear value kPa
		H Hard	VD Very dense	VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH42**

Page: 1 of 1

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555666.00

Drilling Rig: Jehyco Digga

Northing: 6873465.00

Driller: Morrison Geotechnic

RL: 29.93

Logged By: C. Lam

Total Depth: 1.40

Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		29.0	0.1	Residual		CH	Silty CLAY: Stiff, high plasticity, red brown, with organics, moist.	XW	M	St	5			
			CH			Silty CLAY: As above but very stiff and no organics.	VSt				8			
			0.3			Silty CLAY: Very stiff, medium plasticity, red brown, moist.	VSt				3			
			0.6			BASALT: Very low strength, extremely weathered, grey.	VLS				4			
			1.0				VLS				4			
			1.3				VLS				4			
			1.4				VLS				5			
							VLS				15			
	</													

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	HS High	S Vane shear value kPa
		H Hard	VD Very dense	VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Borehole

Borehole No.: **BH43**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555522.10 Drilling Rig: Hydrapower Scout
Northings: 6873345.90 Driller: Redlands Drilling
RL: 24.67 Logged By: L. Bexley
Total Depth: 1.50 Date: 05/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit				Slopewash		CH	Silty CLAY: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	VSt				
			0.3	Residual		CH	Silty CLAY: As above but with some cobbles.		M	VSt		0.4 –	PP	>600kPa
		0.5			CI	Silty CLAY: Hard, medium plasticity, red brown, with some cobbles, moist		M	H		1 }	SPT	17,10/20mm, bouncing on cobble	
		24.0	1.0	Bedrock		BAS	BASALT: Medium strength, distinctly weathered, dark grey.	DW		MS				
			1.2											
			1.5				1.50m: COMMENCE NMLC CORING							
			23.0											
			2.0											
			22.0											
			3.0											
			21.0											
			4.0											
			20.0											
			5.0											
			19.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	S Soft	L Loose	MD Medium dense	VLS Very low	D Disturbed sample.
◄ Water outflow	XW Extremely weathered	F Firm	MS Medium	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	DW Distinctly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	SW Slightly weathered	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
	FR Fresh	H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH43**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555522.10

Drilling Rig: Hydrapower Scout

Northing: 6873345.90

Driller: Redlands Drilling

RL: 24.67

Logged By: L. Bexley

Total Depth: 20.40

Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description	
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring		24.5	0.5											
		24.0	1.0											
		23.5	1.5											
		23.0	2.0	Bedrock		BAS	Commence NMLC Coring at 1.5m	SW-Fr		10.67	44%		-BZ 30mm	
		22.5	2.5				BASALT: Very high strength, slightly weathered to fresh, dark grey, slightly fractured.						-SZ 10° 10mm, some VLS	
		22.0	3.0										-J10° Pl/Ro,Vr,O	
		21.5	3.5										-J5° Pl/Ro,Vr,O	
		21.0	4.0										-S5° 40mm, VLS & cly	
		20.5	4.5										-J20° Pl/Sm,St,C	
		20.0	5.0										-J35° Un/Sm,Cn,O	
	19.5	5.3										-J15° Un/Sm,St,C		
	19.0	5.5											-J25° Un/Sm,Cn,O	
													-BZ 80mm	
													-J90° Un/Ro,Cn,O	
													-J5° Pl/Sm,St,O	
													-J50° Un/Ro,Cn,O	
													-SZ 5° 10mm, VLS & cly	
													-J5° Pl/Ro,Vr,O	
													-SZ 5° 15mm, VLS	
													-J10° Un/Ro,Cn,O	
													-J5° Pl/Sm,Cn,O	
													-SZ 5° 20mm, VLS & cly	
													-J10° Un/Ro,Vn,O	
													-J5° Un/Ro,St,O	
													-SZ 5° 10mm, VLS	
													-SZ 5° 10mm, VLS & cly	
													-J2° Un/Ro,Cn,O	
													-BZ 280mm (moderately fractured)	
													-SZ 15° 20mm, VLS	
													-J5° Un/Ro,Cn,O	
													-SZ 10° 15mm, VLS & clay	
													-J5° Un/Ro,Vr,O	
													-J30° Un/Ro,St,O	
													-SZ 20° 120mm, MS	
													-J20° Un/Ro,St,O	
													-J5° Pl/Ro,St,O	
													-J5° Pl/Ro,Vr,O	
													-J90° Un/Ro,Vr,O	
													-J20° Pl/Ro,St,O	
													-SZ 20° 40mm, MS	
													-SZ 5° 60mm, MS & clay	
													-SZ 40° 20mm, MS & clay	

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	VSt Very stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH43**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555522.10

Drilling Rig: Hydrapower Scout

Northing: 6873345.90

Driller: Redlands Drilling

RL: 24.67

Logged By: L. Bexley

Total Depth: 20.40

Date: 05/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS (50) MPa	Defect Spacing (mm)	Defect Description	
									ELS VLS LS MS HS VHS EHS		30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			18.5			BAS	BASALT: As above but very high strength, slightly weathered to fresh.	SW-Fr					
			6.3			BAS	BASALT: As above but low strength, extremely weathered.	XW				J10° Pl/Sm,Vr,O -BZ 350mm (highly fractured)	
			18.0										
			6.5							0.46			
			6.85			BAS	BASALT: As above but very high strength, slightly weathered to fresh.	SW-Fr				J30° Pl/Un,Ro,Vr,O J45° Pl/Ro,Cn,O J10° Pl/Sm,Cn,O	
			7.0			BAS	BASALT: As above but medium strength, distinctly weathered.	DW				SZ 10° 40mm, MS & clay -SZ 10° 70mm, MS & clay	
			17.5									J10° Pl/Ro,Cn,O	
			7.05			BAS	BASALT: As above but very high strength, slightly weathered to fresh.	SW-Fr				J5° Un/Sm,Cn,O J30° Un/Ro,Vr,O	
			7.35			BAS	BASALT: As above but medium strength, distinctly weathered.	DW				-SZ 30° 80mm, MS & clay -SZ 10° 30mm, MS & clay J10° Un/Ro,St,O -SZ 5° 60mm, MS & clay	
			17.0									-Core Loss 110mm J45° Pl/Sm,St,O J15° Un/Ro,St,O J5° Un/Ro,St,O -SZ 15° 10mm, LS & clay J10° Pl/Ro,Vr,O J5° Un/Ro,St,O J5° Pl/Ro,Vr,O -SZ 5° 130mm, VLS & clay	
			7.8			BAS	BASALT: As above but medium strength, distinctly weathered.	DW				-SZ 10° 70mm, VLS & clay	
			8.0			BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey.	SW-Fr				J10° Un/Ro,Vr,O J5° Pl/Ro,Cn,O J5° Pl/Ro,St,O -LS	
			16.5										
			8.25										
			8.35			BAS	CORE LOSS BASALT: Very high strength, slightly weathered to fresh, dark grey.	SW-Fr					
			16.0										
			8.9			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW					
			9.0			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.73			
			15.5										
			9.5										
			15.0										
		9.77			BAS	BASALT: Low strength, extremely weathered, orange brown mottled grey.	XW						
		14.5											
		10.0											
		10.35			BAS	BASALT: As above but very low strength.	XW						
		14.0											
		11.0											
		13.5											
		11.2											
		11.5					CORE LOSS						
		13.0											
		12.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	JT Joint PT Parting SM Seam PL Planar CV Curved IR Irregular RO Rough SO Smooth SL Slickensided



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Engineering Log - Cored Borehole

Borehole No.: **BH43**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555522.10 Drilling Rig: Hydrapower Scout
Northing: 6873345.90 Driller: Redlands Drilling
RL: 24.67 Logged By: L. Bexley
Total Depth: 20.40 Date: 05/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS						30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring			12.5			BAS	CORE LOSS BASALT: Very low strength, extremely weathered, grey mottled orange brown, with some clay layering.	XW							
			12.1												
			12.5												
			12.0												
			13.0												
			11.5												
			13.5												
			11.0												
			14.0												
			10.5												
			14.5												
			10.0												
			15.0			BAS	BASALT: Very high strength, distinctly weathered to fresh, grey.	DW-Fr							
			9.5								5.80				J20° Un/Ro,St,O
			15.5												
			9.0												
			16.0												
			8.5									100%			J10° Un/Sm,Cn,O
			16.5								8.61				J15° Un/Ro,Cn,O
			8.0												
			17.0												
			7.5												
			17.5												
			7.0									100%			
			18.0												

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH43**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555522.10 Drilling Rig: Hydrapower Scout
Northing: 6873345.90 Driller: Redlands Drilling
RL: 24.67 Logged By: L. Bexley
Total Depth: 20.40 Date: 05/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring		6.5 18.5 6.0 19.0 5.5 19.5 5.0 20.0 4.5		V	Δ	BAS	BASALT: Very high strength, distinctly weathered to fresh, grey.	DW-Fr		9.20	100%		
		20.34					20.40m: BOREHOLE TERMINATED						
		4.0 21.0 3.5 21.5 3.0 22.0 2.5 22.5 2.0 23.0 1.5 23.5 1.0 24.0											

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH43
BOREHOLE DEPTH: 1.5m TO 20.4m





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Engineering Log - Borehole

Borehole No.: **BH44**

Page: 1 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555502.00

Drilling Rig: Hydrapower Scout

Northing: 6873282.20

Driller: Redlands Drilling

RL: 23.96

Logged By: C. Lam

Total Depth: 1.15

Date: 21/11/2018

Drilling Information				Material Description						Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with				Slope		CH	Silty CLAY: Very stiff, high plasticity, red brown, trace of fine to medium sized gravel, moist.		M	VSt				
			0.3	Residual		CI	Silty CLAY: Very stiff, medium to high plasticity, red brown, with some fine to medium sized gravel, with some cobbles, moist.		M	VSt				
		23.0	1.0	Bedrock		BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown.	DW		MS		1	SPT	-20/145mm, N*=42
			1.15	1.15m: COMMENCE NMLC CORING										
			22.0	2.0										
			21.0	3.0										
			20.0	4.0										
			19.0	5.0										
			18.0	6.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH44**

Page: 2 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555502.00

Drilling Rig: Hydrapower Scout

Northing: 6873282.20

Driller: Redlands Drilling

RL: 23.96

Logged By: C. Lam

Total Depth: 8.30

Date: 21/11/2018

Drilling Information				Material Description							Rock Mass Defects					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description	
									ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness		
NMLC Coring		23.5	0.5													
		23.0	1.0				Commence NMLC Coring at 1.15m									
		22.5	1.5	Bedrock		BAS	BASALT: Very high strength, slightly weathered to fresh, grey with some orange staining.	SW-Fr			9.89				J5° Pl/Sm,Cn,O SZ 10° 20mm, MS SZ 5° 40mm, MS	
		22.0	2.0													
		2.05														
		2.2				BAS	BASALT: Medium strength, distinctly weathered, grey and orange brown.	DW							SZ 5° 30mm, MS & clay J5° Pl/Ro,Ct,O J5° Pl/Ro,Ct,O J5° Pl/Ro,Ct,O	
		21.5	2.5			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr							J5° Pl/Sm,St,O SZ 10° 20mm, VLS J10° Pl/Sm,St,O	
		21.0	3.0								10.74				J5° Pl/Ro,Ct,O, 5mm VLS J5° Pl/Sm,Ct,C, CA 4mm J50° Pl/Sm,Cn,O	
		20.5	3.5													J5° Pl/Sm,St,O J10° Pl/Sm,St,O
		20.0	4.0													J5° Un/Sm,St,O J5° Pl/Sm,Vr,O
		19.5	4.5													J15° Un/Ro,St,O J5° Pl/Ro,Cn,O
		19.0	5.0													J5° Pl/Sm,St,O J5° Pl/Ro,Cn,O
		18.5	5.5													J15° Pl/Sm,Vr,O J10° St/Sm,St,O J15° Pl/Sm,St,O
		18.0	6.0													J5° Pl/Sm,St,O J20° Pl/Sm,Vr,O

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH44**

Page: 3 of 3

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555502.00

Drilling Rig: Hydrapower Scout

Northing: 6873282.20

Driller: Redlands Drilling

RL: 23.96

Logged By: C. Lam

Total Depth: 8.30

Date: 21/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			17.5 6.5			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			100%		J55° Pl/Sm,Cn,O J5° Pl/Sm,Vr,O J20° Pl/Sm,Cn,O J5° Pl/Sm,St,O J5° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O J5° Un/Ro,Cn,O J35° Pl/Sm,St,O J40° Pl/Sm,St,O SZ 5° 15mm, MS J5° Un/Sm,Cn,O J10° Un/Sm,Cn,O J5° Pl/Sm,St,O J5° Un/Sm,St,O J5° Pl/Sm,St,O J10° Pl/Sm,Vr,O J20° Pl/Sm,St,O J5° Pl/Sm,St,O
			17.0 7.0							10.64	67%		
			16.5 7.5										
			16.0 8.0							11.09			
			8.3										
			15.5 8.5				8.30m: BOREHOLE TERMINATED						
			15.0 9.0										
			14.5 9.5										
			14.0 10.0										
			13.5 10.5										
			13.0 11.0										
			12.5 11.5										
			12.0 12.0										

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH44
BOREHOLE DEPTH: 1.15m TO 8.3m





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Engineering Log - Borehole

Borehole No.: **BH45**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.20
Northing: 6873391.30
RL: 26.45
Total Depth: 1.45

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 09/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			26.0	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St				
			0.25	Residual		CI	Silty CLAY: Very stiff, medium plasticity, red brown, with some fine to medium sized gravel, moist.		M	VSt				
		0.6	CI			Silty CLAY: As above but with some cobbles.		M	VSt					
		1.0	Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown, mottled grey.	XW		VLS		1	SPT	6,15,25, N=40	
		1.3												
	25.0	1.45	1.45m: COMMENCE NMLC CORING											
			2.0											
			24.0											
			3.0											
			23.0											
			4.0											
			22.0											
			5.0											
			21.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH45**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.20

Drilling Rig: Hydrapower Scout

Northing: 6873391.30

Driller: Redlands Drilling

RL: 26.45

Logged By: L. Bexley

Total Depth: 20.25

Date: 09/11/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS (50) MPa	Defect Spacing (mm)	Defect Description		
								ELS VLS LS MS HS VHS EHS			30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness		
NMLC Coring			26.0											
			25.5											
			25.0				Commence NMLC Coring at 1.45m							
			24.5	Bedrock		BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey with some orange brown staining, slightly fractured, with some extremely weathered to moderately zones	SW-Fr		8.97		-BZ 30mm -BZ 25mm -J30° Pl/Sm,Vr,O -J40° St/Sm,St,O -SZ 15° 10mm, some LS -SZ 25° MS -SZ 20° 15mm, MS -J60° Pl/Sm,St,O -J60° Pl/Ro,Vr,O -BZ 80mm -J20° Pl/Sm,St,O -J15° Pl/Sm,Cn,O -J5° Un/Ro,Cn,O -J60° Pl/Sm,Vr,O -SZ 10° 10mm, VLS -SZ 10° 20mm, VLS -SZ 5° 30mm, VLS -J10° Pl/Sm,Vr,O -J15° Pl/Sm,Cn,O -SZ 10° 20mm, VLS -J25° Pl/Sm,St,O -SZ 10° 50mm, VLS -SZ 10° 80mm, VLS & cly -SZ 15° 70mm, VLS -J55° Pl/Sm,St,O -J10° Un/Ro,St,O -J15° Un/Ro,St,O -SZ 10° 40mm, VLS -SZ 10° 70mm, VLS & cly -SZ 25° 25mm, VLS -J5° Pl/Sm,St,O -J20° Un/Ro,St,O -SZ 10° 10mm, VLS -SZ 5° 30mm, VLS -SZ 5° 15mm, VLS & cly -SZ 5° 30mm, VLS -BZ 50mm -J5° Pl/Sm,St,O -J5° Un/Ro,St,O -SZ 5° 10mm, VLS -SZ 25° 10mm, VLS -SZ 15° 60mm, VLS & cly -SZ 35° 40mm, VLS -SZ 5° 25mm, MS -SZ 5° 40mm, LS-MS -SZ 170mm, MS -J5° Un/Ro,Cn,O		
			24.0											
			23.5											
			23.0											
			22.5											
			22.0											
			21.5											
		21.0	5.5			BAS	BASALT: Medium strength to high strength, distinctly weathered, orange brown, mottled grey highly fractured	DW		11.62				
		20.5	5.8			BAS	BASALT: Very high strength, slightly weathered to fresh. grey, slightly fractured.	SW-Fr		0.85				

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	JT Joint
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	PT Parting
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SM Seam
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PL Planar
	FR Fresh	VSt Very stiff	VD Very dense	HS High	CV Curved
		H Hard		VHS Very high	IR Irregular
				EHS Extremely high	RO Rough
					SO Smooth
					SL Slickensided



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Engineering Log - Cored Borehole

Borehole No.: **BH45**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555564.20 Drilling Rig: Hydrapower Scout
Northing: 6873391.30 Driller: Redlands Drilling
RL: 26.45 Logged By: L. Bexley
Total Depth: 20.25 Date: 09/11/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description	
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			6.25			BAS	BASALT: Very high strength, slightly weathered to fresh, grey, slightly fractured.	SW-Fr		11.81			-SZ 15° 25mm, VLS -J20° Pl/Sm,Cn,O -J15° Pl/Sm,Cn,O -SZ 5° 90mm, VLS & cly -HFZ 450mm, LS-MS	
	20.0		6.5			BAS	BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, with some extremely weathered zones, with some slightly weathered zones, highly fractured	XW-DW			38%			
	19.5		6.85			BAS	BASALT: Very high strength, slightly weathered to fresh, orange brown mottled grey, slightly to moderately fractured, with some extremely weathered zones.	SW-Fr		10.30			-SZ 40° 60mm, VLS -SZ 30° 80mm, VLS -J20° St/Sm,Cn,O -J5° Pl/Sm,Ct,O, VLS -SZ 30° 30mm, VLS & cly	
	19.0		7.5										-SZ 5° 10mm, VLS -SZ 5° 10mm, VLS -SZ 20° 80mm, VLS -HFZ 10mm	
	18.5		8.0										-SZ 15° 30mm, VLS -BZ 50mm	
	18.0		8.5				BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some extremely weathered zones	XW-DW		9.31	23%		-SZ 10° 120mm, VLS	
	17.5		8.6			BAS							-J40° Pl/Sm,Cn,O -HFZ 180mm	
			8.9			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		10.84			-SZ 5° 10mm, VLS -BZ & SZ 500mm	
	17.0		9.0			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey, highly fractured.	XW		0.15				
			9.15											
			9.5											
			9.65			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr					-J25° Pl/Sm,Cn,O -J10° Pl/Sm,Cn,O	
	16.5		9.85			BAS	BASALT: Very low strength, extremely weathered, orange brown mottle grey, highly fractured, sheared zones throughout.	XW		0.15				
	16.0		10.0											
			10.5											
			10.8			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr				10%		-J5° Pl/Sm,Cn,O -J15° Pl/Sm,Cn,O -J50° Pl/Sm,Cn,O
	15.5		10.95			BAS	BASALT: Low strength, extremely weathered, orange brown mottled grey, highly fractured and sheared.	XW						
			11.0											
			11.5				BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		0.14				-J50° Un/Ro,St,O
			11.65			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey, with some clay lenses	SW-Fr						-J15° Pl/Sm,St,O
	14.5		11.75			BAS		XW						
			11.95			BAS		XW						

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH45**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.20

Drilling Rig: Hydrapower Scout

Northing: 6873391.30

Driller: Redlands Drilling

RL: 26.45

Logged By: L. Bexley

Total Depth: 20.25

Date: 09/11/2018

Drilling Information				Material Description						Rock Mass Defects					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			12.3	V	Δ	BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr						J5° Un/Sm,Cn,O SZ 15° 100mm, VLS & cly	
			12.5	V	Δ	BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey, with some clay lenses, with some highly fractured zones	XW				10%			
			13.0	V	Δ						0.13				
			13.5	V	Δ										
			14.0	V	Δ										
			14.5	V	Δ							44%			
			15.0	V	Δ						0.24				
			15.25	V	Δ	BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown, mottled grey, vesicular.	DW						BZ 150mm	
			15.5	V	Δ	BAS	BASALT: Very high strength, fresh, grey, feldspar lenses, vesicular.	Fr			2.44			J5° Un/Ro,Cn,O J15° Pl/Sm,Cn,O	
			16.0	V	Δ										
			16.5	V	Δ						8.47				
			17.0	V	Δ						3.24	100%		J5° Pl/Sm,Cn,O	
			17.5	V	Δ									J45° Pl/Ro,Cn,O	
			18.0	V	Δ						9.61				

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH45**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.20

Drilling Rig: Hydrapower Scout

Northing: 6873391.30

Driller: Redlands Drilling

RL: 26.45

Logged By: L. Bexley

Total Depth: 20.25

Date: 09/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			8.0 18.5			BAS	BASALT: Very high strength, fresh, grey, feldspar lenses, vesicular	Fr		9.36	100%		
			7.5 19.0										
			7.0 19.5										
			6.5 20.0										
			20.25							6.02			
			6.0 20.5				20.25m: BOREHOLE TERMINATED						
			5.5 21.0										
			5.0 21.5										
			4.5 22.0										
			4.0 22.5										
			3.5 23.0										
			3.0 23.5										
			2.5 24.0										

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH45
BOREHOLE DEPTH: 1.45m TO 20.25m



Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555491.70

Drilling Rig: Hydrapower Scout

Northing: 6873374.60

Driller: Redlands Drilling

RL: 22.42

Logged By: C. Lam

Total Depth: 2.00

Date: 06/11/2018

[illegible]**Comments:**

Authorised by:

Date:

Water		Weathering		Consistency		Density		Rock Strength		Tests & Results		
 Water level on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	U50	Undisturbed 50mm diam tube.		
	XW	Extremely weathered	S	Soft	L	Loose	VLS	Very low	D	Disturbed sample.		
 Water inflow	DW	Distinctly weathered	St	Stiff	MD	Medium dense	LS	Low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
			VSt	Very stiff	D	Dense	MS	Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.		
 Water outflow			H	Hard	VD	Very dense	HS	High	S	Vane shear value kPa		
	SW	Slightly weathered	Moisture					VHS	Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.	
	FR	Fresh	D Dry	M Moist	W Wet			EHS	Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes	



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Engineering Log - Cored Borehole

Borehole No.: **BH46**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555491.70

Drilling Rig: Hydrapower Scout

Northings: 6873374.60

Driller: Redlands Drilling

RL: 22.42

Logged By: C. Lam

Total Depth: 17.40

Date: 06/11/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description	
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			22.0											
			21.5											
			21.0											
			20.5											
			20.0	Bedrock	△	BAS	Commence NMLC Coring at 2.0m	SW-Fr		7.87	36%		-BZ 100mm, highly fractured -J5° Pl/Sm,Cn,O -SZ 30° 50mm, MS & cly -J90° Un/Ro,Ct,O	
			19.5											
			19.0											
			18.5											
			18.0		△	BAS	BASALT: Medium strength, distinctly weathered to slightly weathered, orange brown mottled grey.	Un-SW		11.44	20%		-SZ 10° 100mm, MS & cly -J10° Pl/Sm,Cn,O -J45° Un/Ro,Vr,O -BZ 120mm, highly fractured -J10° Un/Ro,Cn,O -J5° Un/Ro,Vr,O -J15° Un/Ro,Vr,O -J5° Pl/Ro,St,O -J5° Pl/Ro,Vr,O -J5° Pl/Ro,St,O -J5° Un/Ro,Vr,O -J5° Un/Ro,Vr,O -J5° Un/Ro,St,O -J10° Pl/Ro,St,O -J10° Un/Ro,St,O -SZ 10° 20mm, MS & cly	
			17.5		△	BAS	BASALT: Very high strength, slightly weathered to .fresh, grey	SW-Fr						
			17.0		△	BAS	BASALT: Medium strength, distinctly weathered to slightly weathered, brown mottled orange brown and grey	DW-SW						
			16.5		△	BAS	BASALT: Very high strength, slightly weathered to .fresh, grey	SW-Fr						

Comments:						Authorised by:					
						Date:					
Water		Weathering		Consistency		Density		Rock Strength		Defects	
▼ Water level on date shown		RS Residual soil		VS Very soft		VL Very loose		ELS Extremely low		Refer to Attached Defect Description Sheet	
▶ Water inflow		XW Extremely weathered		S Soft		L Loose		VLS Very low			
◀ Water outflow		DW Distinctly weathered		F Firm		MD Medium		LS Low			
		SW Slightly weathered		St Stiff		D Dense		MS Medium			
		FR Fresh		H Hard		VD Very dense		HS High			
				Moisture				VHS Very high			
				D Dry M Moist W Wet				EHS Extremely high			



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Engineering Log - Cored Borehole

Borehole No.: **BH46**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555491.70

Drilling Rig: Hydrapower Scout

Northing: 6873374.60

Driller: Redlands Drilling

RL: 22.42

Logged By: C. Lam

Total Depth: 17.40

Date: 06/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			6			BAS	BASALT: Medium strength, distinctly weathered brown mottled orange brown	DW					20%	J45° Un/Ro,Vr,O J15° Un/Ro,St,O J10° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O J30° Un/Ro,Cn,O J10° Un/Ro,Cn,O J45° Un/Ro,Cn,O J5° Pl/Sm,Cn,O J10° Vr/Sm,Cn,O	
			6.5												
			6.8			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			8.03			J5° Pl/Sm,Cn,O	
			7.0												
			7.1			BAS	BASALT: Medium strength, distinctly weathered, brown mottled orange and grey.	DW						J10° Pl/Sm,Cn,O	
			7.5												
			7.45			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			5.49	45%		J5° Un/Sm,Cn,O	
			7.6			BAS	BASALT: Medium strength, distinctly weathered, brown mottled orange and grey.	DW						J10° Un/Ro,Cn,O J10° Vr/Ro,Cn,O J45° Un/Ro,Cn,O	
			7.84			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr						SZ 10° 30mm, MS & clay	
			8.0												
			8.5												
			9.0			BAS	BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey.	XW-DW			8.76			SZ 5° 100mm, MS J5° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J5° Pl/Ro,St,O	
			9.5												
			9.55			BAS	BASALT: As above but very low strength and extremely weathered.	XW				16%		SZ 25° 20mm, MS J45° Pl/Sm,St,O J45° Pl/Sm,St,O HFZ 550mm, LS-MS	
			9.75											BZ/SZ 200mm	
		10.0					CORE LOSS								
		10.5													
		11.0				CL	Silty CLAY/BASALT (XW): Hard, low plasticity, grey mottled orange brown, moist.					33%			
		11.5													
		12.0													

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH46**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555491.70

Drilling Rig: Hydrapower Scout

Northings: 6873374.60

Driller: Redlands Drilling

RL: 22.42

Logged By: C. Lam

Total Depth: 17.40

Date: 06/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			12.0			BAS	BASALT: Very low strength, extremely weathered, dark grey mottled orange brown.	XW			33%		
			12.5			BAS	BASALT: Very high strength, slightly weathered, dark grey, vesicular.	SW					
			9.5							7.35			J10° Pl/Sm,Cn,O
			9.0										J5° St/Sm,Cn,O
			8.5										J35° Un/Ro,Cn,O
			8.0										
			7.5								99%		
			7.0							6.43			J20° Un/Ro,Cn,O
			6.5										
			6.0										
			5.5										
			5.0							11.78			J30° Un/Ro,Cn,O
			17.40				17.40m: BOREHOLE TERMINATED						
			4.5										
			18.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Borehole

Borehole No.: **BH47**

Page: 1 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555446.90 Drilling Rig: Hydrapower Scout
Northing: 6873412.00 Driller: Redlands Drilling
RL: 14.37 Logged By: L. Bexley
Total Depth: 8.20 Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with			14.0	Slopewash		CH	Silty CLAY: Very stiff, high plasticity, red brown and orange brown, with some fine to medium sized gravel, trace of organics, moist.		M	VSt				
		0.4	Residual		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown mottled grey, with some fine to medium sized gravel, moist.		M	VSt-H					
		1.0												
		1.4		CI	Silty CLAY: As above but with some extremely weathered basalt layers.		M	VSt-H						
		2.0												
Wash Bore - Rock Roller			12.0											
		3.0												
		11.0												
		3.7		CI	Silty CLAY: As above but hard, pale grey mottled orange brown and no extremely weathered basalt layers.		M	H						
		4.0												
		10.0												
		5.0												
		5.1		CI	Silty CLAY: As above but dark grey mottled orange brown and red brown.		M	H						
		9.0												
		6.0												

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.		
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa		
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		D Dry M Moist W Wet		EHS Extremely high			



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Engineering Log - Borehole

Borehole No.: **BH47**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555446.90

Drilling Rig: Hydrapower Scout

Northings: 6873412.00

Driller: Redlands Drilling

RL: 14.37

Logged By: L. Bexley

Total Depth: 8.20

Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller			8.0			CI	Silty CLAY: As above but dark grey mottled orange brown and red brown.		M	H				
			7.0											
			7.0											
			8.0											
			8.2											
				Bedrock		BAS	BASALT: Medium strength, distinctly weathered, orange brown mottled grey.	DW		MS				
							8.20m: COMMENCE NMLC CORING							
			6.0											
			9.0											
			5.0											
			10.0											
			4.0											
			11.0											
			3.0											
			12.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH47**

Page: 3 of 4

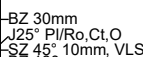
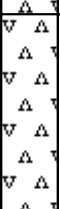
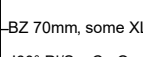
Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555446.90 Drilling Rig: Hydrapower Scout
Northing: 6873412.00 Driller: Redlands Drilling
RL: 14.37 Logged By: L. Bexley
Total Depth: 16.00 Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description		
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness			
NMLC Coring			8.0														
			6.5														
			7.5														
			7.0														
			7.5														
			6.5														
			8.0														
			6.0	8.5	Bedrock		BAS	BASALT: Extremely high strength, slightly weathered .to fresh, dark grey, slightly fractured	SW-Fr				12.53	92%		J20° St/Sm, Cn, O J10° Un/Ro, St, O J20° Pl/Sm, Cn, O	
			5.5	9.0				CORE LOSS						0%		J25° Pl/Sm, Cn, O J10° Pl/Sm, Cn, O	
			5.0	9.25			BAS	BASALT: Very high strength, slightly weathered, grey, moderately fractured.	SW								BZ 30mm J25° Pl/Ro, Ct, O SZ 45° 10mm, VLS BZ 130mm
			4.5	9.75			BAS	BASALT: Low strength, extremely weathered, grey, interbedded very high strength zones.	XW						28%		BZ 100mm
			4.0	10.5													
		3.5	10.85			BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey, slightly fractured.	SW-Fr									BZ 70mm, some XLS J60° Pl/Sm, Cn, O
		3.0	11.5														J45° Pl/Sm, St, O J40° Pl/Sm, St, O SZ 20mm, VLS
		2.5	12.0			BAS	BASALT: As above but fresh.	Fr									J40° Pl/Sm, Cn, O

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture D Dry M Moist W Wet		VHS Very high EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH47**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555446.90

Drilling Rig: Hydrapower Scout

Northing: 6873412.00

Driller: Redlands Drilling

RL: 14.37

Logged By: L. Bexley

Total Depth: 16.00

Date: 19/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			2.0 12.5			BAS	BASALT: As above but fresh	Fr					J45° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O
			1.5 13.0								87%		J50° Pl/Sm,Cn,O J35° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O
			1.0 13.5										J25° Pl/Sm,Cn,O
			0.5 14.0							11.85			J20° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
			0.0 14.5										J60° Pl/Sm,Cn,O
			-0.5 15.0								91%		J40° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
			-1.0 15.5										
			-1.5 15.7										
			16.0			BAS	BASALT: As above but vesicular.	Fr		6.60			J10° Pl/Ro,Cn,O J40° Pl/Ro,Cn,O
			16.00m: BOREHOLE TERMINATED										
			-2.0 16.5										
			-2.5 17.0										
			-3.0 17.5										
			-3.5 18.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH47
BOREHOLE DEPTH: 8.2m TO 16.0m





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Engineering Log - Borehole

Borehole No.: **BH48**

Page: 1 of 4

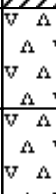
Job Number: GE18/144

Easting: 555495.30 **Drilling Rig:** Hydrapower Scout
Northing: 6873426.30 **Driller:** Redlands Drilling
RL: 22.24 **Logged By:** L. Bexley
Total Depth: 2.55 **Date:** 07/11/2018

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit		22.0	0.3	Residual		CH	Silty CLAY: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt		1	SPT	4,7,9, N=16: PP=400kPa
				Residual		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt-H				
			2.0	Bedrock		BAS	BASALT: Very low strength, extremely weathered, orange brown, mottled dark grey.	XW		VLS				
				2.1			BAS	BASALT: As above but medium strength and distinctly weathered.	DW					
Wash Bore - Rock		20.0	2.55				2.55m: COMMENCE NMLC CORING					2.5 –	SPT	30/50mm, no recovery
		19.0	3.0											
			4.0											
			18.0											
			5.0											
			17.0											
		6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	MS Medium	S Vane shear value kPa
		H Hard	VD Very dense	HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH48**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555495.30 Drilling Rig: Hydrapower Scout
Northings: 6873426.30 Driller: Redlands Drilling
RL: 22.24 Logged By: L. Bexley
Total Depth: 17.75 Date: 07/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring		22.0											
		21.5	0.5										
		21.0	1.0										
		20.5	1.5										
		20.0	2.0										
		19.5	2.5				Commence NMLC Coring at 2.55m						
		19.0	3.0	Bedrock		BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			11.72		J5° Pl/Sm,Vr,O J10° Pl/Ro,Vr,O J15° Pl/Sm,Vr,O J10° Pl/Sm,Vr,C
		18.5	3.5			BAS	BASALT: Medium strength to high strength, distinctly weathered, orange brown, mottled grey, with some very high strength zones.	DW			71%		J20° Pl/Sm,St,O J80° Un/Ro,Ct,O, 3mm cly J15° Pl/Sm,Ct,O, 3mm VLS J45° Pl/Sm,Vr,O J70° Un/Ro,Vr,O J15° Un/Ro,Vr,O J5° Pl/Sm,Vr,O
		18.0	4.0			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr					J10° Pl/Sm,Vr,O
		17.5	4.5			BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown.	DW					SZ 40° 30mm, LS J25° Pl/Sm,St,O J35° Pl/Sm,St,O J5° Pl/Sm,Vr,O BZ 300mm
		17.0	5.0			BAS	BASALT: Very low strength, extremely weathered, orange brown.	XW					
		16.5	5.5			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			11.51		SZ 10° 15mm, VLS & cly J5° Pl/Ro,St,O SZ 35° 25mm, LS J5° Un/Ro,St,O
		16.0	6.0			BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown.	DW					J5° Pl/Sm,St,O J5° Pl/Sm,Ct,O, 2mm feldspar J10° St/Ro,St,O

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH48**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555495.30

Drilling Rig: Hydrapower Scout

Northings: 6873426.30

Driller: Redlands Drilling

RL: 22.24

Logged By: L. Bexley

Total Depth: 17.75

Date: 07/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			16.0			BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown.	DW					
			6.5			BAS	BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey.	XW-DW					
			7.0			BAS	BASALT: As above but very low strength, extremely weathered.	XW					
			7.25			BAS	BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, grey and orange brown.	XW-DW					
			7.5			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			8.0			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			8.5			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			9.0			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			9.5			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			10.0			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			10.5			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			11.0			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			11.5			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					
			12.0			BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW					

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH48**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555495.30

Drilling Rig: Hydrapower Scout

Northing: 6873426.30

Driller: Redlands Drilling

RL: 22.24

Logged By: L. Bexley

Total Depth: 17.75

Date: 07/11/2018

Drilling Information				Material Description							Rock Mass Defects											
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength					IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description					
									ELS	VLS	LS	MS	HS	VHS	EHS		30	100	300	1000	3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring			10.0		V Δ	BAS	BASALT: Very low strength, extremely weathered, grey mottled pale grey and orange brown, clay layering.	XW									10%					
			12.35		V Δ		CORE LOSS															
			12.5																			
			9.5																			
			12.75		V Δ	BAS	BASALT: Very high strength, fresh, dark grey, vesicular lenses of feldspar.	Fr														
			13.0		V Δ																	J40° Un/Ro,Cn,O
			9.0		V Δ																	J40° Un/Ro,Cn,O
			13.5		V Δ																	J30° Un/Ro,Cn,O
			8.5		V Δ																	J45° Pl/Ro,Cn,O
			14.0		V Δ																	J20° Un/Ro,Cn,O
			8.0		V Δ																	J20° Pl/Sm,Cn,O
			14.5		V Δ																	J15° Un/Sm,Cn,O
			7.5		V Δ																	
			15.0		V Δ																	
			7.0		V Δ																	
			15.5		V Δ																	J50° Pl/Sm,Cn,O
			6.5		V Δ																	
			16.0		V Δ																	
			6.0		V Δ																	J20° Pl/Sm,Cn,O
			16.5		V Δ																	J25° Pl/Sm,Cn,O
			5.5		V Δ																	
			17.0		V Δ																	J10° Pl/Sm,Cn,O
			5.0		V Δ																	
			17.5		V Δ																	
			4.5		V Δ																	
			17.75		V Δ																	
			18.0				17.75m: BOREHOLE TERMINATED															

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH48
BOREHOLE DEPTH: 2.55m TO 17.75m





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Engineering Log - Borehole

Borehole No.: **BH49**

Page: 1 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555477.60 Drilling Rig: Hydrapower Scout
 Northings: 6873444.50 Driller: Redlands Drilling
 RL: 18.80 Logged By: L. Bexley
 Total Depth: 1.20 Date: 19/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
W/ 100mm Auger with			18.0	0.35	Slopewash		CH Silty CLAY: Stiff, high plasticity, red brown, fine to coarse sized gravel, moist.		M	St		1	SPT	15/100mm, bouncing on cobbles, no recovery
				1.0	Residual		CI Silty CLAY: Very stiff, medium to high plasticity, red brown with some grey mottling, fine to coarse sized gravel, with some cobbles, moist.		M	VSt				
				1.05	Bedrock		BASALT: Medium strength, distinctly weathered, grey mottled orange brown.	DW		MS				
				1.2										
1.20m: COMMENCE NMLC CORING														
			17.0	2.0										
			16.0	3.0										
			15.0	4.0										
			14.0	5.0										
			13.0	6.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH49**

Page: 2 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555477.60

Drilling Rig: Hydrapower Scout

Northing: 6873444.50

Driller: Redlands Drilling

RL: 18.80

Logged By: L. Bexley

Total Depth: 14.55

Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS (50) MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			18.5												
			18.0												
			17.5				Commence NMLC Coring at 1.2m								
			17.0	Bedrock		BAS	BASALT: Very high strength, slightly weathered, grey, slightly fractured.	SW				9.72			-SZ 5° 10mm, VLS & cly -SZ 15° 40mm, VLS & cly -SZ 5° 10mm, VLS -J5° Pl/Sm,Ct,O, cly 3mm -SZ 45° 10mm, VLS
			16.5												
			16.0												
			15.5												
			15.0												
			14.5												
			14.0												
			13.5												
			13.0												
			6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH49**

Page: 3 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555477.60 Drilling Rig: Hydrapower Scout
Northing: 6873444.50 Driller: Redlands Drilling
RL: 18.80 Logged By: L. Bexley
Total Depth: 14.55 Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects											
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description							
									ELS	VLS	LS	MS	HS	VHS	EHS		30	100	300	1000	3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring																						
			6				CORE LOSS															
			12.5																			
			6.5																			
			12.0																			
			7.0																			
			11.5																			
			7.5																			
			7.5			CI	Silty CLAY: Stiff to very stiff, medium plasticity, grey mottled orange brown, moist.															
			11.0																			
			8.0																			
			10.5																			
			8.3																			
			8.5			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW														
			10.0																			
			8.75			BAS	BASALT: High strength, distinctly weathered to slightly weathered, grey mottled orange brown.	DW-SW														
			9.0																			
			9.2			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW														
			9.5																			
			9.55			BAS	BASALT: Very high strength, fresh, dark grey, intact.	Fr														
			9.0																			
			10.0																			
			8.5																			
			10.5																			
			8.0																			
			11.0																			
			7.5																			
			11.5																			
			7.0																			
			12.0																			

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH49**

Page: 4 of 4

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555477.60

Drilling Rig: Hydrapower Scout

Northing: 6873444.50

Driller: Redlands Drilling

RL: 18.80

Logged By: L. Bexley

Total Depth: 14.55

Date: 19/11/2018

Drilling Information				Material Description							Rock Mass Defects																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH49
BOREHOLE DEPTH: 1.2m TO 14.55m





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Engineering Log - Borehole

Borehole No.: **BH50**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555537.30

Drilling Rig: Hydrapower Scout

Northing: 6873419.40

Driller: Redlands Drilling

RL: 24.47

Logged By: L. Bexley

Total Depth: 15.25

Date: 08/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			0.25	Slope wash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to medium sized gravel, with some organics, moist.		M	St		0.15 –	PP	180kPa
			24.0	Residual		CI	Silty CLAY: Very stiff, medium plasticity, red brown, with some fine to coarse sized gravel, moist.		M	VSt		0.5 –	PP	300kPa
Wash Bore - Rock Roller			1.0									1	SPT	3,6,5, N=11: PP=>600kPa
			23.0											
			2.0									2.5	SPT	4,5,5, N=10
			3.0	Rock		BAS	BASALT: Low strength extremely weathered, orange brown mottled grey.	XW		LS				
			3.3			BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS				
			4.0			BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS		4	SPT	10,12,18, N=30
		5.0			BAS	BASALT: As above but medium strength and distinctly weathered.	DW		MS					
		5.3			BAS	BASALT: As above but very low strength and extremely weathered.	XW		VLS		5.5	SPT	20,26,26, N=52	
		6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH50**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555537.30 Drilling Rig: Hydrapower Scout
Northing: 6873419.40 Driller: Redlands Drilling
RL: 24.47 Logged By: L. Bexley
Total Depth: 15.25 Date: 08/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller			18.0			BAS	BASALT: As above but very low strength and extremely weathered.	XW		VLS				
			7.0			BAS	BASALT: As above but low strength.	XW		LS				
			7.1			BAS	BASALT: As above but low strength.	XW		LS				
			17.0			BAS	BASALT: As above but very low strength.	XW		VLS				
			7.5			BAS	BASALT: As above but very low strength.	XW		VLS				
			8.0			BAS	BASALT: As above but very low strength.	XW		VLS				
			16.0			BAS	BASALT: As above but very low strength.	XW		VLS				
			9.0			BAS	BASALT: As above but very low strength.	XW		VLS				
			15.0			BAS	BASALT: As above but with some clay layering.	XW		VLS				
			9.5			BAS	BASALT: As above but with some clay layering.	XW		VLS				
			10.0			BAS	BASALT: As above but with some clay layering.	XW		VLS				
			14.0			BAS	BASALT: As above but with some clay layering.	XW		VLS				
			10.8			BAS	BASALT: As above but with some clay layering.	XW		VLS				
			11.0	Residual		CL	Silty CLAY: Stiff to very stiff, low to medium plasticity, grey mottled orange brown and dark grey, moist.		M	St-VSt				
			13.0			CL	Silty CLAY: Stiff to very stiff, low to medium plasticity, grey mottled orange brown and dark grey, moist.		M	St-VSt				
			12.0			CL	Silty CLAY: Stiff to very stiff, low to medium plasticity, grey mottled orange brown and dark grey, moist.		M	St-VSt				

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	LS Low	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	D Dense	MS Medium	S Vane shear value kPa
		H Hard	VD Very dense	HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH50**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555537.30

Drilling Rig: Hydrapower Scout

Northings: 6873419.40

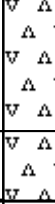
Driller: Redlands Drilling

RL: 24.47

Logged By: L. Bexley

Total Depth: 15.25

Date: 08/11/2018

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
Wash Bore - Rock Roller			12.0			CL	Silty CLAY: As above but stiff.		M	St					
			13.0												
			11.0												
			14.0												
			14.2			Bedrock		BAS	BASALT: Very low strength, extremely weathered, grey mottled orange brown.	XW		VLS			
			10.0												
			15.0												
			15.9					BAS	BASALT: .As above but medium strength and distinctly weathered	DW		MS			
			16.25												
			15.25m: COMMENCE NMLC CORING												
9.0															
16.0															
8.0															
17.0															
7.0															
18.0															

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
 Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
 Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.
 Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH50**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555537.30 Drilling Rig: Hydrapower Scout
Northings: 6873419.40 Driller: Redlands Drilling
RL: 24.47 Logged By: L. Bexley
Total Depth: 20.25 Date: 08/11/2018

Drilling Information				Material Description						Rock Mass Defects											
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description						
								ELS	VLS	LS	MS			HS	VHS	EHS	30	100	300	1000	3000
NMLC Coring			12.0																		
			12.5																		
			11.5																		
			11.0																		
			10.5																		
			10.0																		
			9.5																		
			9.0	Bedrock	▽ ▲	BAS	Commence NMLC Coring at 15.25m	Fr													
			15.5																		
			15.8		▽ ▲	BAS	As above but no vesicles and trace of feldspar.	Fr													
			16.0																		
			16.5																		
			17.0																		
			17.5																		
			18.0																		

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH50**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555537.30

Drilling Rig: Hydrapower Scout

Northings: 6873419.40

Driller: Redlands Drilling

RL: 24.47

Logged By: L. Bexley

Total Depth: 20.25

Date: 08/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			6.0			BAS	BASALT: As above but no vesicles and trace of feldspar.	Fr		13.24	95%		
			18.4			BAS	BASALT: As above but high strength to very high strength, slightly weathered to fresh, highly vesicular, with some feldspar lenses.	SW-Fr					J10° Un/Ro,Cn,O J15° Un/Ro,Cn,O
			5.5										J10° Un/Ro,Cn,O J60° Pl/Ro,Cn,O J45° Pl/Ro,Cn,O SZ 15° 30mm, VLS
			19.0										J5° Un/Ro,Cn,O
			5.0								86%		J5° Un/Ro,Cn,O
			19.5										
			4.5							3.92			
			20.0										
			20.25										
			20.25				20.25m: BOREHOLE TERMINATED						
			4.0										
			20.5										
			3.5										
			21.0										
			3.0										
			21.5										
			2.5										
			22.0										
			2.0										
			22.5										
			1.5										
			23.0										
			1.0										
			23.5										
			0.5										
			24.0										

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH50
BOREHOLE DEPTH: 15.25m TO 20.25m





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Engineering Log - Borehole

Borehole No.: **BH51**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555565.40

Drilling Rig: Hydrapower Scout

Northing: 6873442.90

Driller: Redlands Drilling

RL: 26.16

Logged By: L. Bexley

Total Depth: 10.80

Date: 13/11/2018

Drilling Information				Material Description							Test Samples					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result		
100mm Auger with T.C Bit			26.0	Residual Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St		1	SPT	3,7,6, N=13: PP=250-300kPa		
			0.3			CI	Silty CLAY: Very stiff, medium to high plasticity, red brown, trace of fine to coarse sized gravel, with some cobbles, moist.		M	VSt						
Wash Bore - Rock Roller			25.0	Bedrock								2.5	SPT	4,6,9, N=15: PP=250-500kPa		
			2.0													
			24.0													
			2.8			CI	Silty CLAY: As above but hard, with some extremely weathered basalt layering.		M	H						
			3.0													
			3.1			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS						
			3.5			BAS	BASALT: As above but medium strength to high strength, distinctly weathered to slightly weathered, with some extremely weathered zones.	DW-SW		MS-HS						
			4.0													
		22.0			BAS	BASALT: As above but very low strength and extremely weathered.	XW		VLS		4	SPT	11,25,30/80mm, N*=81			
		4.4		BAS	BASALT: As above but medium strength, distinctly weathered with some extremely weathered zones.	DW		MS								
		21.0										5.5	SPT	28/150mm, N*=56		
		5.4		BAS	BASALT: As above but low strength and extremely weathered.	XW		LS								
		6.0														

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	low	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH51**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555565.40

Drilling Rig: Hydrapower Scout

Northing: 6873442.90

Driller: Redlands Drilling

RL: 26.16

Logged By: L. Bexley

Total Depth: 10.80

Date: 13/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller		20.0				BAS	BASALT: As above but low strength and extremely weathered.	XW		LS		7	SPT	30/95mm, N*=95
		6.3				BAS	BASALT: As above but medium strength to high strength, distinctly weathered to slightly weathered, with some extremely weathered zones.	DW-SW		MS-HS				
		6.7				BAS	BASALT: As above but low strength, extremely weathered, with some medium strength and distinctly zones.	XW		LS				
		7.0				BAS	BASALT: As above but low strength, extremely weathered, with some medium strength and distinctly zones.	XW		LS				
		19.0				BAS	BASALT: As above but low strength, extremely weathered, with some medium strength and distinctly zones.	XW		LS				
		7.5				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS				
		8.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS				
		18.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS				
		9.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS				
		17.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS				
	10.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS					
	16.0				BAS	BASALT: As above but very low strength, extremely weathered, with some clay layering.	XW		VLS					
	10.6				BAS	BASALT: As above but high strength and slightly weathered.	SW		HS					
	10.8				BAS	BASALT: As above but high strength and slightly weathered.	SW		HS					
	11.0						10.80m: COMMENCE NMLC CORING							
	15.0													
	12.0													

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	U50 Undisturbed 50mm diam tube. D Disturbed sample. SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. PP Hand penetrometer estimate of unconfined compressive strength, kPa. S Vane shear value kPa DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes



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Engineering Log - Cored Borehole

Borehole No.: **BH51**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555565.40

Drilling Rig: Hydrapower Scout

Northing: 6873442.90

Driller: Redlands Drilling

RL: 26.16

Logged By: L. Bexley

Total Depth: 20.00

Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ⁽⁵⁰⁾ MPa	RQD %	Defect Spacing (mm)	Defect Description	
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							



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Engineering Log - Cored Borehole

Borehole No.: **BH51**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555565.40

Drilling Rig: Hydrapower Scout

Northing: 6873442.90

Driller: Redlands Drilling

RL: 26.16

Logged By: L. Bexley

Total Depth: 20.00

Date: 13/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			14.0			BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey, with some clay layers.	XW			36%		SZ 5° 50mm, VLS
			12.5				CORE LOSS						
			13.5										
			13.0										
			13.0										
			13.5										
			12.5			BAS	BASALT: Very low strength, extremely weathered grey mottled orange brown, with some clay layering	XW			26%		
			14.0							0.17			
			12.0										
			14.5										
			11.5										
			15.0										
			11.0			BAS	BASALT: Very high strength, fresh, grey, vesicular and feldspar lenses	Fr		6.35			J15° Un/Ro,St,O J25° Pl/Sm,Cn,O
			15.15										
			15.5										
			10.5										
			16.0										
			10.0										
			16.5								100%		J20° St/Pl,Cn,O
			9.5										
			17.0										
			9.0										
			17.5										
			8.5			BAS	BASALT: As above but no vesicles	Fr					J45° Pl/Sm,Cn,O
			17.65										
			18.0							8.91			

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH51**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555565.40

Drilling Rig: Hydrapower Scout

Northing: 6873442.90

Driller: Redlands Drilling

RL: 26.16

Logged By: L. Bexley

Total Depth: 20.00

Date: 13/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring		8.0				BAS	BASALT: As above but no vesicles.	Fr					
			18.5										
			19.0										
		7.5											
		7.0											
		19.35				BAS	BASALT: As above but vesicular.	Fr					
		6.5											J20° Un/Ro,Cn,O
		20.0											J35° St/Pl,Cn,O
		20.0											
		6.0					20.00m: BOREHOLE TERMINATED						
		5.5											
		5.0											
		21.0											
		21.5											
		22.0											
		22.5											
		23.0											
		23.5											
		24.0											

Comments:

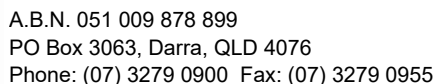
Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH51
BOREHOLE DEPTH: 10.8m TO 20.0m





Page: 1 of 5

Location: Cudgen Road, Kingscliff

Easting:	555609.70
Northing:	6873441.10
RL:	27.36
Total Depth:	3.95

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 13/11/2018

Comments:										Authorised by: Date:	
Water		Weathering		Consistency		Density		Rock Strength		Tests & Results	
 Water level  on date shown		RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.					
 Water inflow		XW Extremely weathered	S Soft	L Loose	D	D	Disturbed sample.				
 Water outflow		DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT	Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.				
		SW Slightly weathered	St Stiff	LS Low	MS Medium	PP	Hand penetrometer estimate of unconfined compressive strength, kPa.				
		FR Fresh	VSt Very stiff	HS High	S	S	Vane shear value kPa				
			H Hard	VD Very dense	VHS Very high	DC	Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.				
			Moisture		EHS Extremely high		From AS1289-1993 Methods of Testing Soils for Engineering Purposes				
			D Dry M Moist	W Wet							

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555609.70

Drilling Rig: Hydrapower Scout

Northing: 6873441.10

Driller: Redlands Drilling

RL: 27.36

Logged By: L. Bexley

Total Depth: 23.55

Date: 13/11/2018

[illegible]

Comments:				Authorised by: Date:			
Water	Weathering		Consistency		Density		Rock Strength
 Water level  on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet		
 Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low			
 Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low			
	SW Slightly weathered	St Stiff	D Dense	MS Medium			
	FR Fresh	VSt Very stiff	VD Very dense	HS High			
		Moisture			VHS Very high		
		D Dry M Moist W Wet			EHS Extremely high		



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Engineering Log - Cored Borehole

Borehole No.: **BH52**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555609.70

Drilling Rig: Hydrapower Scout

Northing: 6873441.10

Driller: Redlands Drilling

RL: 27.36

Logged By: L. Bexley

Total Depth: 23.55

Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			6.05			BAS	BASALT: Low strength to medium strength, extremely weathered to distinctly weathered, orange brown mottled grey, highly fractured, with some high strength zones.	XW-DW							HFZ & BZ 1400mm
		21.0	6.5			BAS		XW							
			20.5	7.0											
			20.0	7.5											
			19.5	7.45		BAS	BASALT: Very high strength, slightly weathered, grey, with some extremely weathered and distinctly weathered zones throughout.	SW						J10° Pl/Ro,Cn,O J50° Pl/Ro,Cn,O SZ 5° 100mm, LS & MS	
			19.0	8.0										SZ 5° 30mm, VLS SZ 15° 100mm, LS BZ 100mm	
			18.5	8.5										SZ 5° 80mm, LS	
			18.0	8.55		BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW						J25° Pl/Sm,Vr,O J25° Pl/Sm,Cn,O	
			17.5	8.7		BAS	BASALT: Very high strength, slightly weathered, grey, with some extremely weathered and distinctly weathered zones throughout.	SW						J35° Un/Ro,Ct,O SZ 5° 25mm, VLS BZ 30mm	
			17.0	9.0											J5° Pl/Ro,Vr,O J5° Pl/Ro,Ct,O BZ 50mm
		16.5	9.5											J15° Un/Sm,Cn,O J20° Pl/Sm,Cn,O BZ 30mm	
		16.0	10.0											BZ 150mm	
		15.5	10.5											J15° Pl/Sm,Cn,O SZ 25° 30mm, VLS	
			10.7			BAS	BASALT: Low strength, extremely weathered, orange brown mottled grey, with some high strength zones.	XW						J15° Pl/Sm,St,O J30° Pl/Sm,Cn,O	
			11.0											J30° Pl/Sm,St,O J35° Un/Ro,Cn,O	
			11.2			BAS	BASALT: As above but very low strength.	XW							
			11.5												
			12.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH52**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555609.70

Drilling Rig: Hydrapower Scout

Northing: 6873441.10

Driller: Redlands Drilling

RL: 27.36

Logged By: L. Bexley

Total Depth: 23.55

Date: 13/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring													
			15.0										
			12.5										
			14.5										
			13.0										
			14.0										
			13.5										
			13.0										
			14.5										
			15.0										
			12.0										
			15.5										
			11.5										
			16.0										
			11.0										
			16.5										
			10.5										
			17.0										
			10.0										
			17.5										
			9.5										
			18.0										

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture									
		D Dry M Moist W Wet									



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Engineering Log - Cored Borehole

Borehole No.: **BH52**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555609.70

Drilling Rig: Hydrapower Scout

Northing: 6873441.10

Driller: Redlands Drilling

RL: 27.36

Logged By: L. Bexley

Total Depth: 23.55

Date: 13/11/2018

Drilling Information				Material Description							Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			18.05			CL	Silty CLAY: Hard, low plasticity, pale grey mottled orange brown. moist.								
			18.5				CORE LOSS								
			19.0												
			19.1												
			19.4	Bedrock	▽ ▲	BAS	BASALT: Medium strength, distinctly weathered, dark grey mottled orange brown	DW							J5° Pl/Ro,St,O J10° Un/Ro,St,O SZ 30° 80mm, VLS
			19.4		▽ ▲	BAS	BASALT: Very high strength, slightly weathered to fresh, dark grey, vesicular, with some feldspar	SW-Fr							J30° St/Ro,Cn,O J15° Pl/Ro,St,O
			20.0		▽ ▲										
			20.5		▽ ▲										J5° Pl/Ro,St,O
			21.0		▽ ▲						7.29				
			21.5		▽ ▲										J60° Un/Ro,Cn,O
			21.5		▽ ▲	BAS	BASALT: .As above but no vesicles	SW-Fr							J20° Pl/Sm,Cn,O J30° Pl/Sm,Cn,O J45° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O
			22.0		▽ ▲						9.37				J90° Pl/Sm,Cn,O J5° Pl/Sm,Cn,O J15° Pl/Sm,Cn,O J10° Pl/Sm,Cn,O
			22.5		▽ ▲										J15° Pl/Sm,Cn,O
			23.0		▽ ▲										
			23.5		▽ ▲						11.93				J10° Un/Sm,Cn,O
			23.55		▽ ▲										
			24.0				23.55m: BOREHOLE TERMINATED								

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH52
BOREHOLE DEPTH: 3.95m TO 23.55m





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Engineering Log - Borehole

Borehole No.: **BH53**

Page: 1 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.70

Drilling Rig: Hydrapower Scout

Northing: 6873487.10

Driller: Redlands Drilling

RL: 26.00

Logged By: L. Bexley

Total Depth: 3.90

Date: 23/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with		26.0		Slopewash		CH	Silty CLAY: Stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	St				
			0.3		CH	Silty CLAY: As above but with some cobbles.		M	St					
			0.5	Residual	CI	Silty CLAY: Very stiff, medium plasticity, red brown, with some fine to coarse sized gravel, with some cobbles, moist.		M	VSt					
			1.0											
			25.0											
Wash Bore - Rock Roller			24.0											
			2.0											
			23.0	2.8	Bedrock	BAS	BASALT: Low strength extremely weathered, orange brown mottled grey.	XW		LS				
			3.2		BAS	BASALT: As above but medium strength, distinctly weathered to slightly weathered, with some high strength & slightly weathered layers.	DW-SW		MS					
			3.0											
		22.0	4.0				3.90m: COMMENCE NMLC CORING							
			5.0											
			6.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
				VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
				EHS Extremely high	

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting:	555564.70
Northing:	6873487.10
RL:	26.00
Total Depth:	25.10

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description						Rock Mass Defects						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength				IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
		26.0						ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000		type, inclination, planarity, roughness, coating, thickness	
</																

Comments:				Authorised by: Date:			
Water	Weathering	Consistency	Density	Rock Strength	Defects		
 Water level  Water inflow  Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Verv dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet		



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Engineering Log - Cored Borehole

Borehole No.: **BH53**

Page: 3 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.70

Drilling Rig: Hydrapower Scout

Northing: 6873487.10

Driller: Redlands Drilling

RL: 26.00

Logged By: L. Bexley

Total Depth: 25.10

Date: 23/11/2018

Drilling Information				Material Description						Rock Mass Defects					
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
		26.0						ELS VLS LS MS HS VHS EHS					30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			19.5	6.5		BAS	BASALT: Medium strength, distinctly weathered, grey mottled orange brown, with some extremely weathered and fresh zones, highly fractured.	DW							
			19.0	7.0		BAS	BASALT: Very high strength, slightly weathered, grey, slightly fractured.	SW							J20° Pl/Sm,Ct,O J5° Pl/Sm,St,O BZ 80mm
			18.5	7.3			BASALT: Very low strength to low strength, extremely weathered, grey mottled orange brown	XW							SZ 5° 10mm HFZ/SZ 170mm, some VLS
			18.0	7.6		BAS	BASALT: Very high strength, slightly weathered, grey.	SW							J5° Pl/Ro,St,O J5° Pl/Ro,St,O HFZ 230mm, MS
			17.5	8.0			BASALT: Low strength to medium strength, distinctly weathered, grey and grey brown mottled orange brown, extremely fractured.	DW							HFZ 500mm, LS, some HS
			17.0	8.5		BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr							J5° Un/Ro,St,O VLS-LS Rock 800mm
			16.5	9.0			BASALT: Very low strength to low strength, extremely weathered, grey and grey brown mottled orange brown.	XW							
			16.0	9.5			CORE LOSS								Core Loss 300mm
			15.5	10.0		BAS	BASALT: Very low strength to low strength, extremely weathered, grey and grey brown mottled orange brown.	XW							VLS-LS Rock 150mm
			15.0	10.5		BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr							J10° Un/Ro,St,O VLS-LS Rock 750mm
			14.5	11.0			BASALT: Very low strength to low strength, extremely weathered, grey and grey brown.	XW							Core Loss 500mm
			14.0	11.5			CORE LOSS								
				14.5	12.0		BAS	BASALT: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW						VLS Rock 700mm, some clay

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	VSt Very stiff	VD Very dense	HS High	
		H Hard		VHS Very high	
				EHS Extremely high	
		Moisture			
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH53**

Page: 4 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.70

Drilling Rig: Hydrapower Scout

Northing: 6873487.10

Driller: Redlands Drilling

RL: 26.00

Logged By: L. Bexley

Total Depth: 25.10

Date: 23/11/2018

Drilling Information				Material Description						Rock Mass Defects				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description	
		14.0						ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness	
NMLC Coring			12.1	V	Δ	BAS	BASALT: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW					Core Loss 1450mm	
			13.5				CORE LOSS							
			13.0											
			12.5											
			13.55	V	Δ	BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		11.16			SZ 5° 5mm J5° Un/Ro, Cn, O VLS Rock 1250mm, some clay	
			12.0	V	Δ	BAS	BASALT: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW						
			14.5	V	Δ						10%			
			11.5	V	Δ									
			11.0	V	Δ									
			15.0	V	Δ									
			15.15				CORE LOSS						Core Loss 350mm	
			10.5											
			15.5	V	Δ	BAS	BASALT: Very low strength, extremely weathered, grey brown mottled orange brown, with some clay layering.	XW						
			10.0	V	Δ	BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		7.06			J10° Un/Ro, Cn, O J10° Pl/Ro, Cn, O	
			16.5	V	Δ						55%			
			9.5	V	Δ									
			17.0	V	Δ									
			17.15	V	Δ	BAS	BASALT: Very low strength, extremely weathered, grey and orange brown, with some clay layering.	XW						
			17.5	V	Δ	BAS	BASALT: Medium strength, distinctly weathered to slightly weathered, grey and orange staining.	DW-SW					SZ 10° 15mm, LS & clay SZ 5° 20mm, LS & clay SZ 5° 10mm, LS & clay J20° Un/Ro, Cn, O J30° Un/Ro, Cn, O	
			17.8	V	Δ	BAS	BASALT: As above but medium strength to high strength, grey.	DW-SW		1.24	35%			
			18.0	V	Δ									

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet



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Engineering Log - Cored Borehole

Borehole No.: **BH53**

Page: 5 of 6

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555564.70 Drilling Rig: Hydrapower Scout
Northing: 6873487.10 Driller: Redlands Drilling
RL: 26.00 Logged By: L. Bexley
Total Depth: 25.10 Date: 23/11/2018

Drilling Information				Material Description							Rock Mass Defects																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength			IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		8.0							ELS	VLS	LS	MS	HS	VHS	EHS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting:	555564.70
Northing:	6873487.10
RL:	26.00
Total Depth:	25.10

Drilling Rig: Hydrapower Scout
Driller: Redlands Drilling
Logged By: L. Bexley
Date: 23/11/2018

Drilling Information				Material Description							Rock Mass Defects						
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength					IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
		2.0						ELS VLS LS MS HS VHS EHS								type, inclination,planarity, roughness, coating, thickness	
NMLC Coring		1.5	24.5	V A	A	BAS	BASALT: As above but very high strength.	SW-Ft					10.01	98%		J5° Un/Ro,Cn,O	
		1.0	25.0	V A	A												
			25.4				25.10m: BOREHOLE TERMINATED										
		0.5	25.5														
		0.0	26.0														
		-0.5	26.5														
		-1.0	27.0														
		-1.5	27.5														
		-2.0	28.0														
		-2.5	28.5														
		-3.0	29.0														
		-3.5	29.5														
		-4.0	30.0														

Comments:

Authorised by:

Date:

Water	Weathering		Consistency		Density		Rock Strength		Defects
 Water level  on date shown	RS	Residual soil	VS	Very soft	VL	Very loose	ELS	Extremely low	Refer to Attached Defect Description Sheet
	XW	Extremely weathered	F	Firm	MD	Medium dense	VLS	Very low	
 Water inflow	DW	Distinctly weathered	St	Stiff			LS	Low	
			VSt	Very stiff	D	Dense	MS	Medium	
 Water outflow	SW	Slightly weathered	H	Hard	VD	Very dense	HS	High	
							VHS	Very high	
	FR	Fresh	Moisture D Dry M Moist W Wet					EHS	Extremely high

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH53
BOREHOLE DEPTH: 3.9m TO 25.1m





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Engineering Log - Borehole

Borehole No.: **BH54**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555511.60 Drilling Rig: Hydrapower Scout
Northing: 6873480.20 Driller: Redlands Drilling
RL: 22.65 Logged By: L. Bexley
Total Depth: 5.30 Date: 20/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with			0.3	Slope wash		CH	Silty CLAY: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, trace of organics, moist.		M	VSt		1	SPT	4,6,8, N=14: PP=300kPa
			0.7	Residual		CI	Silty CLAY: Very stiff, medium to high plasticity, red brown, with some fine to medium sized gravel, moist.		M	VSt				
			1.0			CI	Silty CLAY: As above but with some cobbles.		M	VSt				
			2.0											
			3.0											
			4.0											
			4.15	Rock		BAS	BASALT: Very high strength, fresh, grey, (cobble).	Fr		VHS				
			4.25	Residual		CI	Silty CLAY: Hard, medium plasticity, orange brown mottled grey, moist.		M	H				
			5.0	Bedrock		BAS	BASALT: Very low strength, extremely weathered, grey mottled orange brown.			VLS				
			5.2			BAS	BASALT: As above but medium strength to high strength, distinctly weathered.	XW		MS-HS				
Wash Bore - Rock Roller			5.3					DW						
			6.0											
5.30m: COMMENCE NMLC CORING														
			17.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH54**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555511.60 Drilling Rig: Hydrapower Scout
Northing: 6873480.20 Driller: Redlands Drilling
RL: 22.65 Logged By: L. Bexley
Total Depth: 19.00 Date: 20/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
			22.5										
			0.5										
			22.0										
			1.0										
			21.5										
			1.5										
			21.0										
			2.0										
			20.5										
			2.5										
			20.0										
			3.0										
			19.5										
			3.5										
			19.0										
			4.0										
			18.5										
			4.5										
			18.0										
			5.0										
			17.5										
NMLC Coring			5.5	Bedrock	V A	BAS	BASALT: Very high strength, slightly weathered to fresh, grey with some orange brown staining.	SW-Fr		9.32			J15° Pl/Ro.St.O
			5.7		A A								J55° Un/Ro.St.O
			6.0		V A	BAS	BASALT: Medium strength, distinctly weathered, orange brown mottled grey, highly fractured.	DW					SZ 10° 40mm, VLS
													SZ 15° 20mm, VLS
													HFZ 400mm

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Defects		
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet		
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low			
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low			
	SW Slightly weathered	St Stiff	D Dense	MS Medium			
	FR Fresh	H Hard	VD Very dense	HS High			
		Moisture		VHS Very high			
		D Dry M Moist W Wet		EHS Extremely high			



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Engineering Log - Cored Borehole

Borehole No.: **BH54**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555511.60

Drilling Rig: Hydrapower Scout

Northing: 6873480.20

Driller: Redlands Drilling

RL: 22.65

Logged By: L. Bexley

Total Depth: 19.00

Date: 20/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			16.5			BAS	BASALT: Medium strength, distinctly weathered orange brown mottled grey, highly	XW			0%		BZ 200mm
			6.5			BAS	BASALT: Low strength with some medium and very high strength zones and extremely weathered.						HFZ 100mm
			16.0										J5° Un/Ro,Cn,O
			7.0										SZ 5° 20mm, VLS
			15.5										J5° Pl/Ro,Cn,O
			7.5										J5° Un/Ro,Cn,O
			15.0										BZ 100mm
			8.0										J5° Pl/Ro,Cn,O
			14.5										J30° Pl/Ro,Cn,O
			8.5										J30° Pl/Ro,Cn,O
			14.0				CORE LOSS						BZ 450mm
			9.0										
			13.5										
			9.3			BAS	BASALT: Very low strength to low strength, extremely weathered, grey brown mottled orange.	SW					1200mm VLS-LS
			13.0										
			10.0										
			12.5										
			10.5				CORE LOSS						Core Loss 1350mm
			12.0										
			11.0										
			11.5										
			11.0										
			11.85			BAS	BASALT: Very low strength to low strength, extremely weathered, grey brown.	SW					1760mm VLS-LS
			12.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	JT Joint
Water inflow	XW Extremely weathered	S Soft	L Loose	low	PT Parting
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SM Seam
	SW Slightly weathered	St Stiff	D Dense	LS Low	PL Planar
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	CV Curved
		H Hard		HS High	IR Irregular
		Moisture		VHS Very high	RO Rough
		D Dry M Moist W Wet		EHS Extremely high	SO Smooth
					SL Slickensided



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Engineering Log - Cored Borehole

Borehole No.: **BH54**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555511.60 Drilling Rig: Hydrapower Scout
Northing: 6873480.20 Driller: Redlands Drilling
RL: 22.65 Logged By: L. Bexley
Total Depth: 19.00 Date: 20/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
									ELS VLS LS MS HS VHS EHS			30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring		10.5	12.12	V	Δ	BAS	BASALT: Very low strength to low strength, extremely weathered, grey brown.	SW					
		10.0	12.5				Silty CLAY: Very stiff, medium plasticity, yellow brown, moist				0%		
			12.54			CI	Silty CLAY: Stiff, medium plasticity, grey, moist.						
		9.5	12.8	V	Δ	BAS	BASALT: Very low strength to low strength, extremely weathered, grey brown.	XW					
			13.0										
		9.0	13.5	V	Δ								
			13.61	V	Δ	BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr		6.77	36%		J5° Un/Ro,Cn,O BZ 20mm
		8.5	14.0	V	Δ								J5° Un/Ro,Cn,O J5° Un/Ro,Cn,O
		8.0	14.5	V	Δ								J10° Un/Ro,Cn,O J20° Un/Ro,Cn,O
		7.5	15.0	V	Δ								J5° Un/Ro,Cn,O
		7.0	15.5	V	Δ								J5° Un/Ro,Cn,O J10° Un/Ro,Cn,O J10° Un/Ro,Cn,O
		6.5	16.0	V	Δ					8.11	45%		
		6.0	16.5	V	Δ								J5° Un/Ro,Cn,O BZ 500mm
		5.5	17.0	V	Δ								SZ 10° 30mm, LS J10° Un/Ro,Cn,O
		5.0	17.5	V	Δ						20%		J5° Un/Ro,Cn,O SZ 10° 40mm, LS J30° Pl/Ro,Cn,O SZ 10° 30mm, MS SZ 10° 30mm, MS SZ 10° 20mm, MS SZ 10° 10mm, MS J10° Un/Ro,Cn,O
			18.0	V	Δ					3.90			

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	
	SW Slightly weathered	St Stiff	D Dense	MS Medium	
	FR Fresh	H Hard	VD Very dense	HS High	
		Moisture		VHS Very high	
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Cored Borehole

Borehole No.: **BH54**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555511.60

Drilling Rig: Hydrapower Scout

Northing: 6873480.20

Driller: Redlands Drilling

RL: 22.65

Logged By: L. Bexley

Total Depth: 19.00

Date: 20/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring		4.5	18.5			BAS	BASALT: Very high strength, slightly weathered to fresh, grey.	SW-Fr			10%		J10° Un/Ro,Cn,O
		4.0	19.0							9.50			
		3.5	19.5				19.00m: BOREHOLE TERMINATED						
		3.0	20.0										
		2.5	20.5										
		2.0	21.0										
		1.5	21.5										
		1.0	22.0										
		0.5	22.5										
		0.0	23.0										
		-0.5	23.5										
		-1.0	24.0										

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Defects
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	Refer to Attached Defect Description Sheet

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH54
BOREHOLE DEPTH: 5.3m TO 19.0m





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Engineering Log - Borehole

Borehole No.: **BH55**

Page: 1 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555541.20 Drilling Rig: Hydrapower Scout
Northings: 6873509.90 Driller: Redlands Drilling
RL: 23.95 Logged By: L. Bexley
Total Depth: 14.90 Date: 15/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger with T.C Bit			0.3	Residual Slopewash		CH	Silty CLAY: Very stiff, high plasticity, red brown, with some fine to coarse sized gravel, with some organics, moist.		M	VSt				
			1.0		CI	Silty CLAY: Very stiff to hard, medium plasticity, red brown, with some fine to coarse sized gravel, with some cobbles, moist.		M	VSt-H		0.5 –	PP	400kPa	
Wash Bore - Rock Roller			2.0									1	SPT	4,4,6, N=10: PP=400kPa
			2.0									2.5		SPT
			3.0									4	SPT	5,6,7, N=13
			4.0									5.5	SPT	3,5,6, N=11: PP=350-450kPa
			5.0											
		6.0												

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
► Water inflow	XW Extremely weathered	S Soft	L Loose	D Disturbed sample.	D Disturbed sample.
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	MS Medium	S Vane shear value kPa
		H Hard		HS High	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		VHS Very high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet		EHS Extremely high	



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Engineering Log - Borehole

Borehole No.: **BH55**

Page: 2 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555541.20

Drilling Rig: Hydrapower Scout

Northing: 6873509.90

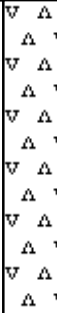
Driller: Redlands Drilling

RL: 23.95

Logged By: L. Bexley

Total Depth: 14.90

Date: 15/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller			17.0			CI	Silty CLAY: As above but no cobbles.		M	VSt-H				
			7.4	Rock		BAS	BASALT: Very low strength, extremely weathered, orange brown mottled grey.	XW		VLS		7	SPT	5,9,16, N=25
			16.0											
			15.0											
			14.0											
			10.3	Residual		CL	Silty CLAY: Stiff, low to medium plasticity, dark grey mottled orange brown and pale grey, moist.		M	St		10	SPT	30/115mm, N*=78
			13.0											
			12.0									11.5	SPT	1,3,4, N=7: PP=150-300kPa

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown Water inflow Water outflow	RS Residual soil XW Extremely weathered DW Distinctly weathered SW Slightly weathered FR Fresh	VS Very soft S Soft F Firm St Stiff VSt Very stiff H Hard Moisture D Dry M Moist W Wet	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely low VLS Very low LS Low MS Medium HS High VHS Very high EHS Extremely high	U50 Undisturbed 50mm diam tube. D Disturbed sample. SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. PP Hand penetrometer estimate of unconfined compressive strength, kPa. S Vane shear value kPa DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes



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Engineering Log - Borehole

Borehole No.: **BH55**

Page: 3 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555541.20
 Northing: 6873509.90
 RL: 23.95
 Total Depth: 14.90

Drilling Rig: Hydrapower Scout
 Driller: Redlands Drilling
 Logged By: L. Bexley
 Date: 15/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Wash Bore - Rock Roller	SWL	11.0	13.0	Residual		CL	Silty CLAY: Stiff, low to medium plasticity, dark grey mottled orange brown and pale grey, moist.		M	St		13 } 14.5 –	SPT	2,2,4, N=6: PP=120-200kPa 30/50mm, N*=180
		10.0	14.0											
		14.45		Bedrock			BAS	BASALT: Medium strength, distinctly weathered, dark grey.	DW		MS			
14.90m: COMMENCE NMLC CORING														
		8.0	16.0											
		7.0	17.0											
		6.0	18.0											

Comments:

Authorised by:

Date:

Water	Weathering	Consistency	Density	Rock Strength	Tests & Results
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	D Disturbed sample.
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.
		Moisture		EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes
		D Dry M Moist W Wet			



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Engineering Log - Cored Borehole

Borehole No.: **BH55**

Page: 4 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Eastings: 555541.20 Drilling Rig: Hydrapower Scout
Northings: 6873509.90 Driller: Redlands Drilling
RL: 23.95 Logged By: L. Bexley
Total Depth: 19.95 Date: 15/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
								ELS VLS LS MS HS VHS EHS				30 100 300 1000 3000	type, inclination, planarity, roughness, coating, thickness
NMLC Coring	SWL		11.5	Bedrock	V A	BAS	Commence NMLC Coring at 14.9m	SW-Fr					
			12.5										
			11.0										
			10.5										
			10.0										
			9.5										
			9.0										
			8.5										
			8.0										
			7.5										
			7.0										
			6.5										
			6.0										
			15.0										
			15.5										
			15.75										
			16.0										
			16.5										
			17.0										
			17.5										
			18.0										

Comments:					Authorised by:						
					Date:						
Water		Weathering		Consistency		Density		Rock Strength		Defects	
▼ Water level on date shown		RS Residual soil		VS Very soft		VL Very loose		ELS Extremely low		Refer to Attached Defect Description Sheet	
▶ Water inflow		XW Extremely weathered		S Soft		L Loose		VLS Very low			
▶ Water outflow		DW Distinctly weathered		St Stiff		MD Medium dense		LS Low			
		SW Slightly weathered		VSt Very stiff		D Dense		MS Medium			
		FR Fresh		H Hard		VD Very dense		HS High			
				Moisture				VHS Very high			
				D Dry M Moist W Wet				EHS Extremely high			



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Engineering Log - Cored Borehole

Borehole No.: **BH55**

Page: 5 of 5

Job Number: GE18/144

Client: Wood & Grieve Engineers

Project: Geotech Investigation - Tweed Valley Hospital

Location: Cudgen Road, Kingscliff

Easting: 555541.20

Drilling Rig: Hydrapower Scout

Northing: 6873509.90

Driller: Redlands Drilling

RL: 23.95

Logged By: L. Bexley

Total Depth: 19.95

Date: 15/11/2018

Drilling Information				Material Description						Rock Mass Defects			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm)	Defect Description
NMLC Coring			5.5 18.5			BAS	BASALT: As above but no vesicles.	SW-Fr		8.97	100%		J5° Pl/Sm,Cn,O
			5.0 19.0										
			4.5 19.5										
			4.0 20.0							8.78			
			3.5 20.5				19.95m: BOREHOLE TERMINATED						
			3.0 21.0										
			2.5 21.5										
			2.0 22.0										
			1.5 22.5										
			1.0 23.0										
			0.5 23.5										
			0.0 24.0										

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Defects						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	Refer to Attached Defect Description Sheet						
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low							
◄ Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low							
	SW Slightly weathered	St Stiff	D Dense	MS Medium							
	FR Fresh	H Hard	VD Very dense	HS High							
		Moisture		VHS Very high							
		D Dry M Moist W Wet		EHS Extremely high							

CLIENT: WOOD AND GRIEVE ENGINEERS PTY LTD
PROJECT: GEOTECHNICAL INVESTIGATION - TWEED VALLEY HOSPITAL
LOCATION: CUDGEN ROAD, KINGSCLIFF
JOB NUMBER: GE18/144
BOREHOLE NUMBER: BH55
BOREHOLE DEPTH: 14.9m TO 19.95m



Discontinuity Description: Refer to AS1726-1993, Table A10.

Anisotropic Fabric		Roughness (e.g. Planar, Smooth is abbreviated PI / Sm)				Class	Other	
BED	Bedding	Stepped (Stp)	Rough or irregular (Ro)		I		Cly	Clay
FOL	Foliation		Smooth (Sm)		II		Fe	Iron
LIN	Mineral lineation		Slickensided (Sl)		II		Co	Coal
Defect Type		Undulating (Un)	Rough (Ro)		IV		Carb	Carbonaceous
LM	Lamination Parting		Smooth (Sm)		V		Sinf	Soil Infill Zone
BP	Bedding Parting		Slickensided (Sl)		VI		Qz	Quartz
CLV	Cleavage / Foliation Parting	Planar (PI)	Rough (Ro)		VII		CA	Calcite
J, Js	Joint, Joints		Smooth (Sm)		VIII		Chl	Chlorite
SZ	Sheared Zone		Slickensided (Sl)		IX		Py	Pyrite
CZ	Crushed Zone	Infilling			Aperture		Int	Intersecting
BZ	Broken Zone	Clean	Cn	No visible coating or infill	Closed	C	Inc	Incipient
HFZ	Highly Fractured Zone	Stain	St	Surfaces discoloured by mineral	Open	O	DI	Drilling Induced
AZ	Alteration Zone	Veneer	Vr	Visible mineral or soil infill <1mm	Filled	F	H	Horizontal
VN	Vein	Coating	Ct	Visible mineral or soil infill >1mm	Tight	T	V	Vertical

Note: Describe 'Zones' and 'Coatings' in terms of composition and thickness (mm).

Discontinuity Spacing: On the geotechnical borehole log, a graphical representation of defect spacing Vs depth is shown. This representation takes into account all the natural rock defects occurring within a given depth interval, excluding breaks induced by the drilling / handling of core. Refer to AS1726-1993, BS5930-1999.

Defect Spacing			Bedding Thickness (Sedimentary Rock Stratification)		Defect Spacing in 3D	
Spacing/Width (mm)	Descriptor	Symbol	Descriptor	Spacing/Width (mm)	Term	Description
			Thinly Laminated	< 6	Blocky	Equidimensional
<20	Extremely Close	EC	Thickly Laminated	6 – 20	Tabular	Thickness much less than length or width
20 – 60	Very Close	VC	Very Thinly Bedded	20 – 60	Columnar	Height much greater than cross section
60 – 200	Close	C	Thinly Bedded	60 – 200	Defect Persistence (areal extent)	
200 – 600	Medium	M	Medium Bedded	200 – 600		
600 – 2000	Wide	W	Thickly Bedded	600 – 2000		
2000 – 6000	Very Wide	VW	Very Thickly Bedded	> 2000	trace length of defect given in metres	
>6000	Extremely Wide	EW				

Symbols: The list below provides an explanation of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

Test Results				Test Symbols	
PI	Plasticity Index	c'	Effective Cohesion	DCP	Dynamic Cone Penetrometer
LL	Liquid Limit	c _u	Undrained Cohesion	SPT	Standard Penetration Test
LI	Liquidity Index	c' _R	Residual Cohesion	CPTu	Cone Penetrometer (Piezocone) Test
DD	Dry Density	φ'	Effective Angle of Internal Friction	PANDA	Variable Energy DCP
WD	Wet Density	φ _u	Undrained Angle of Internal Friction	PP	Pocket Penetrometer Test
LS	Linear Shrinkage	φ' _R	Residual Angle of Internal Friction	U50	Undisturbed Sample 50 mm diameter
MC	Moisture Content	c _v	Coefficient of Consolidation	U100	Undisturbed Sample 100mm diameter
OC	Organic Content	m _v	Coefficient of Volume Compressibility	UCS	Uniaxial Compressive Strength
WPI	Weighted Plasticity Index	c _{az}	Coefficient of Secondary Compression	Pm	Pressuremeter
WLS	Weighted Linear Shrinkage	e	Voids Ratio	FSV	Field Shear Vane
DoS	Degree of Saturation	φ' _{cv}	Constant Volume Friction Angle	DST	Direct Shear Test
APD	Apparent Particle Density	q _t / q _c	Piezcone Resistance (Tip / Sleeve)	PR	Penetration Rate
s _u	Undrained Shear Strength	q _d	PANDA Cone Resistance	A	Point Load Test (axial)
q _u	Unconfined Compressive Strength	I _{s(50)}	Point Load Strength Index	D	Point Load Test (diametral)
R	Total Core Recovery	RQD	Rock Quality Designation	L	Point Load Test (irregular lump)

Groundwater Symbols:

 28/11/13	Groundwater level on the date shown		Water Inflow		Water Outflow
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