

**Figure – Site Layout Plan Showing Approximate
Location of Boreholes**

Appendix A - Borehole Logs, Photos and Explanatory Notes

Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 – 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 – 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 – 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 – 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 – 35
Medium Dense	35 – 65
Dense	65 – 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man-made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES USC (Excluding particles larger than 60 mm and basing fractions on estimated mass)					USC	PRIMARY NAME	
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	GRAVEL	
				Predominantly one size or a range of sizes with more intermediate sizes missing.	GP	GRAVEL	
			GRAVELS WITH FINES Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	SILTY GRAVEL	
				Plastic fines (for identification procedures see CL below)	GC	CLAYEY GRAVEL	
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes	SW	SAND	
				Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	SAND	
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	SM	SILTY SAND	
				Plastic fines (for identification procedures see CL below).	SC	CLAYEY SAND	
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	SILTS & CLAYS Liquid limit less than 50	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm				
			DRY STRENGTH	DILATANCY	TOUGHNESS		
			None to Low	Quick to slow	None	ML	SILT
			Medium to High	None	Medium	CL	CLAY
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low	CL	ORGANIC SILT
			Low to medium	Slow to very slow	Low to medium	MH	SILT
			High	None	High	CH	CLAY
			Medium to High	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS		Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			PT	PEAT	
● Low plasticity – Liquid Limit w _L less than 35%. ● Medium plasticity – w _L between 35% and 50%. ● High plasticity – w _L greater than 50%.							

● Low plasticity – Liquid Limit w_L less than 35%. ● Medium plasticity – w_L between 35% and 50%. ● High plasticity – w_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM	TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length		TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.		TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.		INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.						
DEFINITIONS: Rock substance, defect and mass are defined as follows: Rock Substance In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic. Defect Discontinuity or break in the continuity of a substance or substances. Mass Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.						
SUBSTANCE DESCRIPTIVE TERMS:			ROCK SUBSTANCE STRENGTH TERMS			
ROCK NAME	Simple rock names are used rather than precise geological classification.		Term	Abbre- viation	Point Load Index, I_{s(50)} (MPa)	Field Guide
PARTICLE SIZE	Grain size terms for sandstone are:		Very Low	VL	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
Coarse grained	Mainly 0.6mm to 2mm					
Medium grained	Mainly 0.2mm to 0.6mm					
Fine grained	Mainly 0.06mm (just visible) to 0.2mm					
FABRIC	Terms for layering of penetrative fabric (eg. bedding, cleavage etc.) are:		Low	L	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Massive	No layering or penetrative fabric.					
Indistinct	Layering or fabric just visible. Little effect on properties.					
Distinct	Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.					
CLASSIFICATION OF WEATHERING PRODUCTS						
Term	Abbreviation	Definition				
Residual Soil	RS	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.	Medium	M	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
Extremely Weathered Material	XW	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.	High	H	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Highly Weathered Rock	HW	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.	Very High	VH	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
Moderately Weathered Rock	MW	The whole of the rock substance is discoloured, usually by iron staining or bleaching , to the extent that the colour of the fresh rock is no longer recognisable.	Extremely High	EH	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.
Slightly Weathered Rock	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.	Notes on Rock Substance Strength: In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index I _{s(50)} . The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.			
Fresh Rock	FR	Rock substance unaffected by weathering.				
Notes on Weathering: AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726. Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.						

Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES					DEFECT SHAPE TERMS	
Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)		
Parting	A surface or crack across which the rock has little or no tensile strength, but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.				Planar	The defect does not vary in orientation
Joint	A surface or crack across which the rock has little or no tensile strength, but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.				Curved	The defect has a gradual change in orientation
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.				Undulating	The defect has a wavy surface
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.				Stepped	The defect has one or more well defined steps
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties				Irregular	The defect has many sharp changes of orientation
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.				Note: The assessment of defect shape is partly influenced by the scale of the observation.	
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.				ROUGHNESS TERMS	
Notes on Defects:					Slickensided	Grooved or striated surface, usually polished
1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.					Polished	Shiny smooth surface
2. Partings and joints are not usually shown on the graphic log unless considered significant.					Smooth	Smooth to touch. Few or no surface irregularities
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.					Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
					Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
					COATING TERMS	
					Clean	No visible coating
					Stained	No visible coating but surfaces are discoloured
					Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
					Veneer	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.
					BLOCK SHAPE TERMS	
					Blocky	Approximately equidimensional
					Tabular	Thickness much less than length or width
					Columnar	Height much greater than cross section

Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH1**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **25 Jan 2017**

date completed: **25 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance							
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
								SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components				
AD/T N	1							ASPHALT.				PAVEMENT
	2		E		0.5			Sandy GRAVEL: fine to coarse grained, grey, brown, angular to sub angular gravel, fine to coarse sands.	D	D		FILL (ROADBASE) PID: 1.4 ppm
	3				1.0			Gravelly CLAY: medium to high plasticity, brown, fine to coarse grained, angular to sub angular gravel, trace of coalwash.	M	St		FILL
			E U50		1.5	CI-CH		CLAY: medium to high plasticity, brown.				ALLUVIUM PID: 1.5 ppm
					2.0			Colour change to red, brown, grey		St to H		
					2.5							
			SPT 5, 8, 14 N=22		3.0			Borehole CBH1 terminated at 2.95 m				
				3.5								

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH2**

sheet: 1 of 3

project no. **754-WOLGE200229**

date started: **25 Jan 2017**

date completed: **25 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations		
ADIT N	1	water	E					ASPHALT.				PAVEMENT		
	2							Sandy GRAVEL: fine to coarse grained, grey, angular to sub angular gravel, trace amounts of brick, coalwash, slag, plastics.	M	D		FILL (ROADBASE) PID: 2.1 ppm		
	3													
							0.5			Gravelly CLAY: medium to high plasticity, brown, fine to coarse grained, angular to sub angular gravel.	W	St		FILL
							1.0		CI-CH	CLAY: medium to high plasticity, brown.				ALLUVIUM PID: 2.9 ppm
							1.5				M			PID: 3.4 ppm
						SPT 2, 3, 5 N=8				Colour change to red, brown, grey				
								2.0				St to VSt		
								2.5						PID: 1.4 ppm
						SPT 5, 7, 12 N=19							VSt to H	
					3.0									
					3.5									

method AD auger drilling* AS auger screwing* HA hand auger W washbore	support M mud C casing N nil	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
* bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	penetration water 10-Oct-12 water level on date shown water inflow water outflow		moisture D dry M moist W wet Wp plastic limit WI liquid limit	

Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH2**

sheet: 2 of 3

project no. **754-WOLGE200229**

date started: **25 Jan 2017**

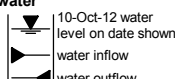
date completed: **25 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration		water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)		structure and additional observations
	1	2							SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components			100	200	
	3											300	400	

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing penetration  water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WI liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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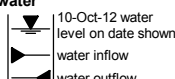
Engineering Log - Borehole

Borehole ID. **CBH2**
sheet: 3 of 3
project no. **754-WOLGE200229**
date started: **25 Jan 2017**
date completed: **25 Jan 2017**
logged by: **JNM**
checked by: **JPT/CCQ**

client: **University of Wollongong**
principal:
project: **Geotechnical and Land Contamination Assessment**
location: **Proposed Location for Molecular and Life Sciences Building**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information						material substance								
method & support	penetration			water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
ADT N	1	2	3							SANDSTONE: fine to medium grained, brown. (continued)			100	EXTREMELY TO HIGHLY WEATHERED SANDSTONE
											200			
							8.5			Borehole CBH2 terminated at 8.5 m			300	
							9.0						400	
							9.5							
							10.0							
							10.5							
							11.0							
							11.5							

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud N nil C casing penetration  water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WI liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH3**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **25 Jan 2017**

date completed: **25 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration		water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations	
	1	2												
AD/T N	1	2	Not Observed						ASPHALT.	D	D		PAVEMENT FILL (ROADBASE) PID: 1.2 ppm	
				E					Sandy GRAVEL: fine to coarse grained, grey, brown, angular to sub angular gravel, trace of silt, trace of slag.					
						0.5								
				E					Gravelly CLAY: medium to high plasticity, brown, fine to coarse grained, angular to sub angular gravel.	M	F		FILL PID: 1.6 ppm	
						1.0	CH	CLAY: high plasticity, brown.						
						1.5			Colour change to red, brown, grey	VSt to H			ALLUVIUM	
				SPT 3, 3, 8 N=11		2.0								
						2.5								
				SPT 5, 9, 11 N=20										
							3.0			Borehole CBH3 terminated at 2.95 m				
					3.5									

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WL liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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client: **University of Wollongong**

principal:

project: ***Geotechnical and Land Contamination Assessment***

location: ***Proposed Location for Molecular and Life Sciences Building***

Borehole ID. **CBH4**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified

surface elevation: Not Specified

angle from horizontal: 90°

drill model: Haniin DB08

drilling fluid: None

hole diameter : 100 mm

drilling information					material substance							
method & support	1 penetration	2 water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
								SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components				
AD/T N			E E SPT 3, 4, 7 N=11 SPT 5, 5, 9 N=14	RL (m) depth (m)		classification symbol	ASPHALT.				PAVEMENT FILL (ROADBASE) PID: 1.7 ppm FILL (COALWASH) PID: 1.5 ppm ALLUVIUM	
							Sandy GRAVEL: fine to coarse grained, grey, angular to sub angular gravel.	D	D			
							Gravelly CLAY: medium to high plasticity, black, fine to coarse grained, angular to sub angular gravel, trace of fine to coarse sands.	M	F			
							CLAY: medium to high plasticity, brown.	St				
							Colour change to red, brown, grey	VSt				
					3.0			Borehole CBH4 terminated at 2.95 m				
					3.5							

method AD auger drilling* AS auger screwing* HA hand auger WA washbore	support M mud C casing penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WL liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH5**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance							
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
								SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components				
ADT N	1 2 3							ASPHALT.				PAVEMENT
			E					Sandy GRAVEL: fine to coarse grained, grey, angular to sub angular gravel, trace of geofabric.	D	D		FILL (ROADBASE) PID: 0.8 ppm
					0.5			Gravelly CLAY: medium to high plasticity, brown, grey, fine to coarse grained, angular to sub angular gravel, trace of fine to coarse sands, trace of coalwash.	M	F		FILL PID: 1.7 ppm
			E					CLAY: medium to high plasticity, brown grey.		St		ALLUVIUM
					1.0		CI-CH					
			E SPT 2, 4, 6 N=10		1.5			Colour change to red, brown, grey				PID: 2.5 ppm
					2.0							
					2.5					VSt to H		
					3.0			Borehole CBH5 terminated at 2.95 m				
					3.5							

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WL liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

Borehole ID. **CBH6**
sheet: 1 of 6
project no. **754-WOLGE200229**
date started: **24 Jan 2017**
date completed: **24 Jan 2017**
logged by: **JNM**
checked by: **JPT/CCQ**

client: **University of Wollongong**
principal:
project: **Geotechnical and Land Contamination Assessment**
location: **Proposed Location for Molecular and Life Sciences Building**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations		
ADT N	1		E		0.5			ASPHALT.			100 200 300 400	PAVEMENT		
	2						Sandy GRAVEL: fine to coarse grained, grey, angular to sub angular gravel.	D	D	FILL (ROADBASE) PID: 1.4 ppm				
	3		E							PID: 2.2 ppm				
							Gravelly CLAY: medium to high plasticity, brown, fine to coarse grained, angular to sub angular gravel, trace of coalwash, trace of fine to coarse sands.	M	F to St	FILL				
			E		1.5		CI-CH	CLAY: medium to high plasticity, brown.				ALLUVIUM		
														PID: 3.1 ppm
			SPT 2, 2, 5 N=7		2.0			Colour change to red, brown, grey						
					2.5									
			SPT 7, 9, 16 N=25											

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH6**

sheet: 2 of 6

project no. **754-WOLGE200229**

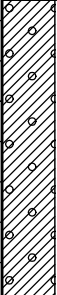
date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance													
method & support	penetration		water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations					
AD/T N	1	2				3.5		CI-CH	CLAY: medium to high plasticity, brown. (continued)	M	St to H	100	ALLUVIUM					
								200										
								300										
								400										
										4.0								
										4.5								
										5.0								
			SPT 5, 7, 8 N=15		5.5		CI	Gravelly CLAY: medium plasticity, brown, grey, red mottled, fine to coarse grained, angular to sub angular gravel.							RESIDUAL			

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud N nil C casing penetration water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

Borehole ID. **CBH6**
sheet: 3 of 6
project no. **754-WOLGE200229**
date started: **24 Jan 2017**
date completed: **24 Jan 2017**
logged by: **JNM**
checked by: **JPT/CCQ**

client: **University of Wollongong**
principal:
project: **Geotechnical and Land Contamination Assessment**
location: **Proposed Location for Molecular and Life Sciences Building**

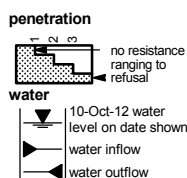
position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration			water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
AD/T ↓	1	2	3						Cl	Gravelly CLAY: medium plasticity, brown, grey, red mottled, fine to coarse grained, angular to sub angular gravel. <i>(continued)</i>	M	St to VSt	100	RESIDUAL
										200				
							6.5			Borehole CBH6 continued as cored hole				
							7.0							
							7.5							
							8.0							
							8.5							

method
AD auger drilling*
AS auger screwing*
HA hand auger
W washbore

* bit shown by suffix
e.g.
AD/T
B blank bit
T TC bit
V V bit

support
M mud
C casing
N nil



samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remoulded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
WI liquid limit

consistency / relative density
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Engineering Log - Cored Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH6**

sheet: 4 of 6

project no. **754-WOLGE200229**

date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: hole diameter : 100 mm vane id.:

drilling information				material substance				rock mass defects			
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is(50) X = axial O = diametral a = axial d = diametral	samples, field tests & Is(50) (MPa)	core run & RQD	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)
					started coring at 6.35m						
			6.5		SANDSTONE: fine to medium grained, grey, red, brown.	XW to HW		a=0.96 d=1.56			JT, 20°, PL, RO, CN
						HW					SM, 15°, PL, RO, CH Clay filled
			7.0		NO CORE: 0.16 m				18%		
					CLAY: medium to high plasticity.	XW					
			7.5		SANDSTONE: medium grained, brown.	HW					PT, 5°, PL, RO, Fe VN
											PT, 5°, PL, RO, Fe VN
									14%		PT, 10°, PL, RO, Fe VN
											PT, 10°, PL, RO, Fe VN
			8.0		NO CORE: 0.36 m						
					SANDSTONE: medium grained, brown, grey.	MW					PT, 5°, PL, RO, CN
											PT, 5°, PL, RO, CN
											PT, 5°, PL, RO, CN
											PT, 10°, PL, RO, Fe VN
			8.5		NO CORE: 0.04 m				26%		
					SANDSTONE: medium to coarse grained, brown, grey.	MW					PT, 15°, PL, RO, Fe VN
											PT, 0°, PL, RO, CN
											JT, 15°, PL, RO, CN
											PT, 0°, PL, RO, CN

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
SPT standard penetration test

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered
core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
DW distinctly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration
strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SZ shear zone
SS shear surface
CO contact
CS crushed seam
SM seam
roughness
SL slickensided
POL polished
SO smooth
RO rough
VR very rough
planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular
coating
CN clean
SN stain
VN veneer
CO coating

Engineering Log - Cored Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH6**

sheet: 5 of 6

project no. **754-WOLGE200229**

date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: hole diameter : 100 mm vane id.:

drilling information				material substance				rock mass defects			
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is(50) X = axial O = diametral a = axial d = diametral	samples, field tests & Is(50) (MPa) a = axial d = diametral	core run & RQD	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)
			9.5		SANDSTONE: medium to coarse grained, brown, grey. (continued)	MW		a=0.53 d=0.38	26%		PT, 0°, PL, RO, Fe VN JT, 85°, PL, RO, Fe VN PT, 0°, PL, RO, CN JT, 85°, PL, RO, Fe VN JT, 85°, IR, RO, Fe VN PT, 5°, PL, RO, Clay VN PT, 15°, PL, RO, CN
			10.0		NO CORE: 0.05 m SANDSTONE: coarse grained, brown, grey.	MW		a=0.19 d=0.31	88%		PT, 0°, PL, RO, CN PT, 10°, PL, RO, CN PT, 10°, PL, RO, CN PT, 5°, PL, RO, CN JT, 85°, PL, RO, Fe VN
			10.5		SANDSTONE: medium grained, brown, grey.			a=0.23 d=0.34			PT, 5°, PL, RO, Fe VN PT, 5°, PL, RO, CN PT, 5°, PL, RO, CN SM, 5°, PL, RO, Clay filled PT, 0°, PL, RO, CN
			11.0								
			11.5		SILTSTONE: grey.				31%		JT, 85°, PL, RO, CN PT, 0°, PL, RO, CN
					SANDSTONE: medium to coarse grained, grey.						
					SANDSTONE: fine grained, brown, grey, black.	XW to HW					
					SANDSTONE: medium grained, grey.	MW to SW					PT, 0°, PL, RO, Fe VN

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
SPT standard penetration test

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered
core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
DW distinctly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration
strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SZ shear zone
SS shear surface
CO contact
CS crushed seam
SM seam
planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular
roughness
SL slickensided
POL polished
SO smooth
RO rough
VR very rough
coating
CN clean
SN stain
VN veneer
CO coating

Engineering Log - Cored Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH6**

sheet: 6 of 6

project no. **754-WOLGE200229**

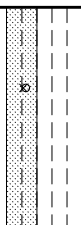
date started: **24 Jan 2017**

date completed: **24 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: hole diameter : 100 mm vane id.:

drilling information				material substance				rock mass defects			
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is(50) X = axial O = diametral a = axial d = diametral	samples, field tests & Is(50) (MPa)	core run & RQD	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)
NMLC			12.5		SANDSTONE: medium grained, grey. (continued)	MW to SW		a=0.34 d=0.41	31%		particular JT, 25°, PL, RO, Fe VN JT, 35°, PL, RO, Fe VN JT, 35°, PL, RO, Fe VN PT, 0°, PL, RO, Fe VN
			13.0		Borehole CBH6 terminated at 12.60 m						general
			13.5								
			14.0								
			14.5								

method & support AS auger screwing AD auger drilling CB claw or blade bit W washbore NMLC NMLC core (51.9 mm) NQ wireline core (47.6mm) HQ wireline core (63.5mm) PQ wireline core (85.0mm) SPT standard penetration test	water  10/10/12, water level on date shown  water inflow  complete drilling fluid loss  partial drilling fluid loss  water pressure test result (lugeons) for depth interval shown	graphic log / core recovery  core recovered (graphic symbols indicate material)  no core recovered core run & RQD  barrel withdrawn RQD = Rock Quality Designation (%)	weathering & alteration* RS residual soil XW extremely weathered HW highly weathered DW distinctly weathered MW moderately weathered SW slightly weathered FR fresh *W replaced with A for alteration strength VL very low L low M medium H high VH very high EH extremely high	defect type PT parting JT joint SZ shear zone SS shear surface CO contact CS crushed seam SM seam roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity PL planar CU curved UN undulating ST stepped IR irregular coating CN clean SN stain VN veneer CO coating
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PROJECT: UOW (Molecular and Life Sciences Building)

PROJECT No: 754-WOLGE200229

BOREHOLE No: CBH06 - Box 1 of 2

DEPTH: 6.35m to 11.0m

DATE: 24/01/2017



6.0m Started coring at 6.35m

CORE
LOSS

7.0m

CORE LOSS

8.0m

CORE LOSS

CORE
LOSS

9.0m

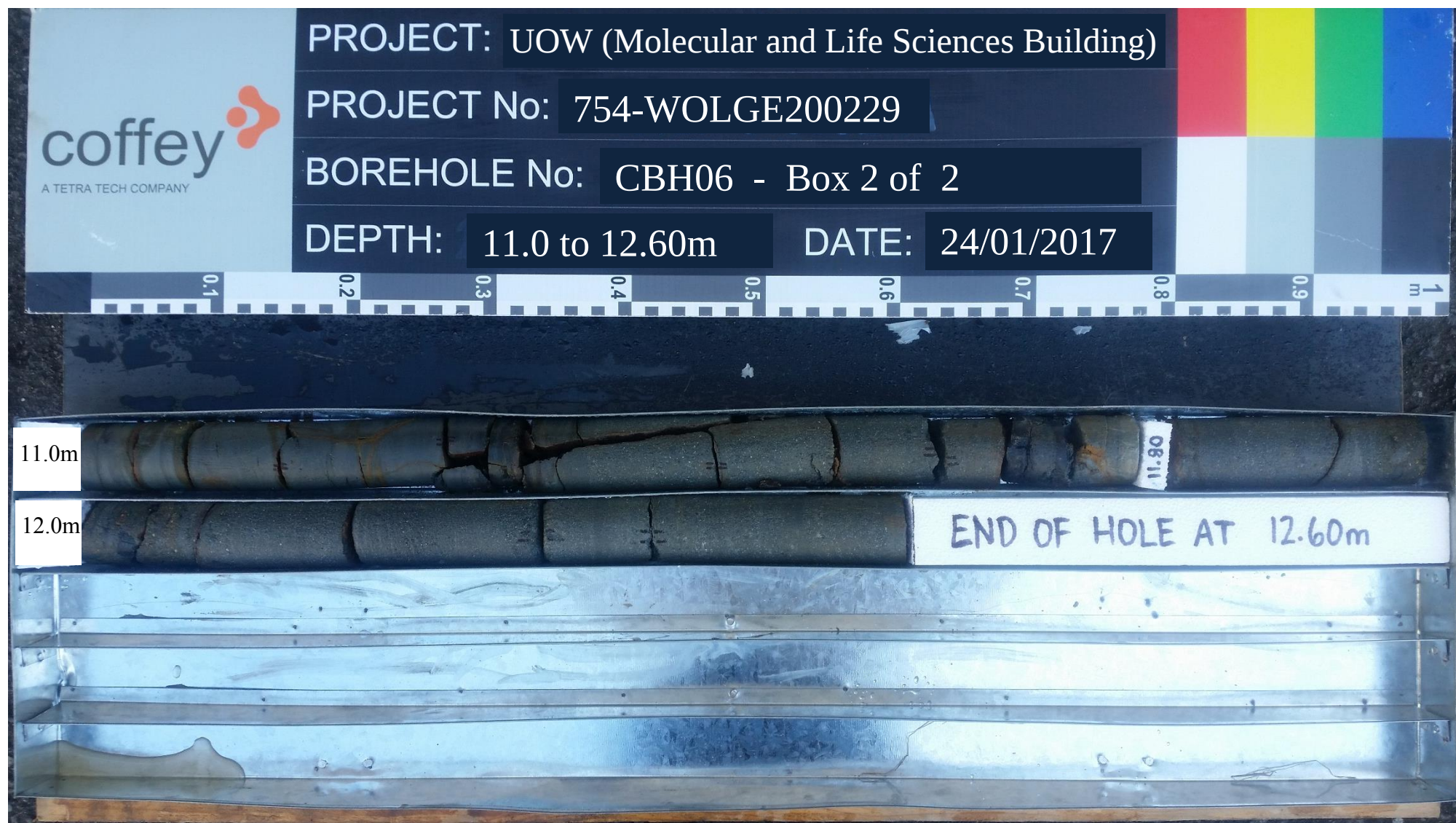
CORE
LOSS

10.0m

drawn	MB
approved	JPT
date	1/02/2016
scale	N.T.S.
original size	A4



client:	University of Wollongong	
project:	Proposed Building for Molecular and Life Sciences Building	
title:	Core photograph CBH06 – Box 1 of 2	
project no: 754-WOLGE200229	figure no:	



drawn	MB	 A TETRA TECH COMPANY	client:	University of Wollongong	
approved	JPT		project:	Proposed Building for Molecular and Life Sciences Building	
date	1/02/2016		title:	Core photograph CBH06 – Box 2 of 2	
scale	N.T.S.		project no:	754-WOLGE200229	figure no:
original size	A4				

Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH7**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **25 Jan 2017**

date completed: **25 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance									
method & support	penetration			water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
AD/T	1	2	3	Not Observed			0.5			ASPHALT.	D	D		

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing penetration water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WI liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH8**

sheet: 1 of 5

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

date completed: **23 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance								
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations	
								SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components					
AD/T N	1		E					Sandy GRAVEL: fine to coarse grained, grey, angular to sub angular gravels.	D	D		FILL (ROADBASE) PID: 0.7 ppm	
	2											PID: 0.5 ppm	
	3		E										
				E	0.5			Sandy GRAVEL: fine to coarse grained, black, angular to sub angular gravels, trace of medium plasticity brown to black clays.	M	MD		FILL (COALWASH) PID: 1.3 ppm	
			E		1.0		CH	CLAY: high plasticity, brown.		F		ALLUVIUM PID: 1.3 ppm	
			SPT 3, 3, 2 N=5		1.5			Colour change to red, brown, grey					
					2.0								
			E	2.5						St		PID: 0.9 ppm	
			SPT 3, 5, 8 N=13										

method AD auger drilling* AS auger screwing* HA hand auger W washbore	support M mud C casing N nil	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
* bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	penetration 	moisture D dry M moist W wet Wp plastic limit WL liquid limit		

Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH8**

sheet: 2 of 5

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

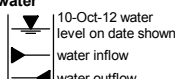
date completed: **23 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance							
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
	1 2 3										100 200 300 400	
					3.5		CH	CLAY: high plasticity, brown. (continued)	M	St		ALLUVIUM
					4.0							
					4.5							
					5.0							
			SPT 5, 13, 14 N=27				CI-CH	Gravelly CLAY: medium to high plasticity, brown, grey, red mottled, fine to coarse grained, angular to sub angular residual gravels.				RESIDUAL
					5.5							

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration  no resistance ranging to refusal water  10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WL liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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client: **University of Wollongong**

principal:

project: ***Geotechnical and Land Contamination Assessment***

location: ***Proposed Location for Molecular and Life Sciences Building***

Borehole ID. **CBH8**

sheet: 3 of 5

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

date completed: **23 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified

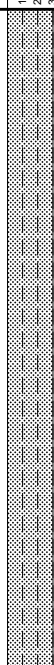
surface elevation: Not Specified

angle from horizontal: 90°

drill model: Haniin DB08

drilling fluid: None

hole diameter : 100 mm

drilling information					material substance							
method & support	1 penetration	2 water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T N					6.5		CI-CH	Gravelly CLAY: medium to high plasticity, brown, grey, red mottled, fine to coarse grained, angular to sub angular residual gravels. (continued)	M	St VSt to H		RESIDUAL
					7.0							
					7.5							
					8.0			Borehole CBH8 continued as cored hole				
					8.5							

method

AD auger drilling*

AS auger screwing*

HA hand auger

WA washbore

support

M mud

C casing

penetration



no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

B bulk disturbed sample

D disturbed sample

E environmental sample

SS split spoon sample

U## undisturbed sample ##mm diameter

HP hand penetrometer (kPa)

N standard penetration test (SPT)

N* SPT - sample recovered

Nc SPT with solid cone

VS vane shear; peak/remoulded (kPa)

R refusal

HB hammer bouncing

classification symbol & soil description

based on Unified Classification System

moisture

D dry

M moist

W wet

Wp plastic limit

WI liquid limit

consistency / relative density

VS very soft

S soft

F firm

St stiff

VSt very stiff

H hard

Fb friable

VL very loose

L loose

MD medium dense

D dense

VD very dense

Engineering Log - Cored Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH8**

sheet: 4 of 5

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

date completed: **23 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: hole diameter : 100 mm vane id.:

drilling information				material substance		rock mass defects							
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is(50) X = axial; O = diametral	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)		
			7.5										
					started coring at 7.65m								
			8.0		SANDSTONE: fine to coarse grained, brown, grey.	XW to HW							
						HW			45%		SM, 5°, PL, RO, Clay filled		
			8.5			XW	X	a=0.15 d=0.10	38%		SM, 5°, PL, RO, Clay filled PT, 15°, PL, RO, Fe VN		
						HW to MW					PT, 0°, PL, RO, Fe VN PT, 0°, PL, RO, Fe VN		
			9.0								PT, 0°, PL, RO, CN PT, 0°, PL, RO, Fe VN PT, 5°, PL, RO, Fe VN PT, 5°, PL, RO, Fe VN		
			9.5				X O	a=0.15 d=0.69	29%		PT, 0°, PL, RO, Fe VN		
				X	NO CORE: 0.10 m								
					SANDSTONE: fine to coarse grained, brown, grey.	HW to MW			33%				
method & support AS auger screwing AD auger drilling CB claw or blade bit washbore NMLCNMLC core (51.9 mm) NQ wireline core (47.6mm) HQ wireline core (63.5mm) PQ wireline core (85.0mm) SPT standard penetration test				water 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss water pressure test result (lugeons) for depth interval shown		graphic log / core recovery core recovered (graphic symbols indicate material) no core recovered core run & RQD barrel withdrawn RQD = Rock Quality Designation (%)		weathering & alteration* RS residual soil XW extremely weathered HW highly weathered DW distinctly weathered MW moderately weathered SW slightly weathered FR fresh *W replaced with A for alteration strength VL very low L low M medium H high VH very high EH extremely high		defect type PT parting JT joint SZ shear zone SS shear surface CO contact CS crushed seam SM seam roughness SL slickensided POL polished SO smooth RO rough VR very rough		planarity PL planar CU curved UN undulating ST stepped IR Irregular coating CN clean SN stain VN veneer CO coating	

Engineering Log - Cored Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH8**

sheet: 5 of 5

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

date completed: **23 Jan 2017**

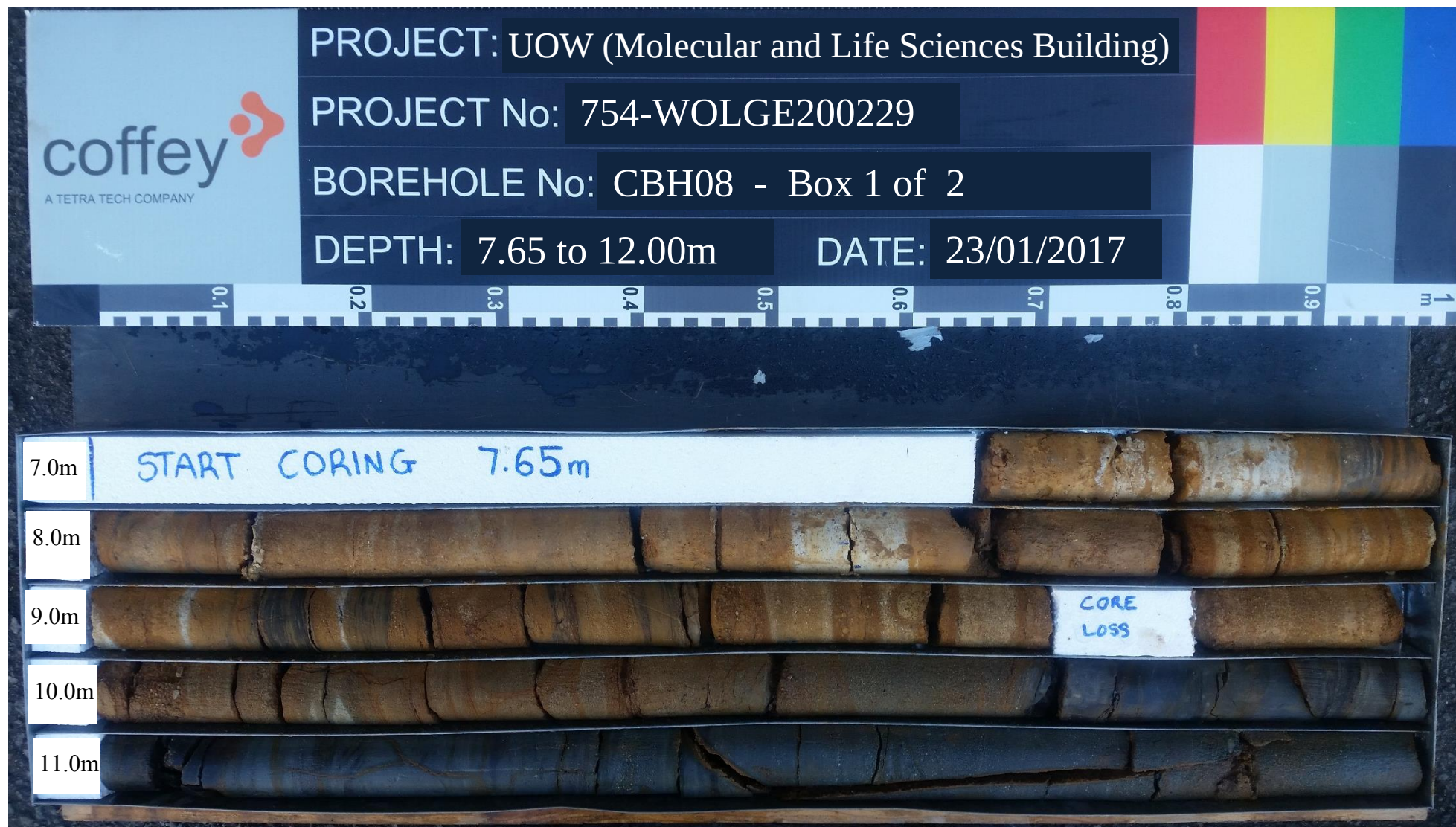
logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: hole diameter : 100 mm vane id.:

drilling information				material substance		rock mass defects			
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is(50) X = axial O = diametral a = axial d = diametral	samples, field tests & Is(50) (MPa) a = axial d = diametral	defect spacing (mm) 30 100 300 1000 3000
			10.5		SANDSTONE: fine to coarse grained, brown, grey. (continued)	HW to MW			
			11.0		SANDSTONE: fine grained, grey.	MW to SW		a=0.54 d=0.39	PT, 0°, PL, RO, CN PT, 0°, PL, RO, Fe VN PT, 0°, PL, RO, Fe VN PT, 5°, PL, RO, Fe VN PT, 15°, PL, RO, Fe VN PT, 15°, PL, RO, Fe VN JT, 25°, PL, RO, Fe VN JT, 25°, PL, RO, Fe VN JT, 25°, PL, RO, Fe VN JT, 20°, PL, RO, Fe VN
			11.5					a=0.31 d=0.66	PT, 15°, PL, RO, CN JT, 25°, PL, RO, CN PT, 5°, PL, RO, Fe VN PT, 5°, PL, RO, Fe VN PT, 5°, PL, RO, Fe VN
			12.0					a=0.41 d=0.75	JT, 90°, PL, RO, Fe VN PT, 0°, PL, RO, Fe VN JT, 75°, IR, RO, Fe VN
			12.5		Borehole CBH8 terminated at 12.40 m				

method & support AS auger screwing AD auger drilling CB claw or blade bit W washbore NMLC NMLC core (51.9 mm) NQ wireline core (47.6mm) HQ wireline core (63.5mm) PQ wireline core (85.0mm) SPT standard penetration test	water 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss water pressure test result (lugeons) for depth interval shown	graphic log / core recovery core recovered (graphic symbols indicate material) no core recovered core run & RQD barrel withdrawn RQD = Rock Quality Designation (%)	weathering & alteration* RS residual soil XW extremely weathered HW highly weathered DW distinctly weathered MW moderately weathered SW slightly weathered FR fresh *W replaced with A for alteration strength VL very low L low M medium H high VH very high EH extremely high	defect type PT parting JT joint SZ shear zone SS shear surface CO contact CS crushed seam SM seam roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity PL planar CU curved UN undulating ST stepped IR irregular coating CN clean SN stain VN veneer CO coating
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drawn	MB	 A TETRA TECH COMPANY	client:	University of Wollongong	
approved	JPT		project:	Proposed Building for Molecular and Life Sciences Building	
date	1/02/2016		title:	Core photograph CBH08 – Box 1 of 2	
scale	N.T.S.		project no:	754-WOLGE200229	figure no:
original size	A4				



PROJECT: UOW (Molecular and Life Sciences Building)

PROJECT No: 754-WOLGE200229

BOREHOLE No: CBH08 - Box 2 of 2

DEPTH: 12.0 to 12.40m

DATE: 23/01/2017



12.0m

END OF HOLE AT 12.40m

13

drawn	MB		client:	University of Wollongong	
approved	JPT		project:	Proposed Building for Molecular and Life Sciences Building	
date	1/02/2016		title:	Core photograph CBH08 – Box 2 of 2	
scale	N.T.S.		project no:	754-WOLGE200229	figure no:
original size	A4				

Engineering Log - Borehole

client: **University of Wollongong**

principal:

project: **Geotechnical and Land Contamination Assessment**

location: **Proposed Location for Molecular and Life Sciences Building**

Borehole ID. **CBH9**

sheet: 1 of 1

project no. **754-WOLGE200229**

date started: **23 Jan 2017**

date completed: **23 Jan 2017**

logged by: **JNM**

checked by: **JPT/CCQ**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
drill model: Hanjin DB08 drilling fluid: None hole diameter : 100 mm

drilling information					material substance							
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
AD/T N	1	Not Observed	E		0.5			SILTY SAND: fine to coarse grained, brown.	D	L	100 80 60 40	FILL (TOPSOIL)
	2		E					D	MD	FILL PID: 1.4 ppm		
	3							D	MD	FILL (COALWASH) PID: 1.6 ppm		
			E							PID: 1.8 ppm		
		SPT 3, 5, 7 N=12		1.5		CI-CH	CLAY: medium to high plasticity, brown.	M	St		RESIDUAL PID: 0.9 ppm	
			2.0			Colour change to red, brown, grey						
			2.5				St to VSt					
		SPT 5, 6, 9 N=15			3.0			Borehole CBH9 terminated at 2.95 m				
					3.5							

method AD auger drilling* AS auger screwing* HA hand auger W washbore * bit shown by suffix e.g. B blank bit T TC bit V V bit	support M mud C casing N nil penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet Wp plastic limit WI liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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