Borelog Symbols and Notes

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DRILLING INFORMATION:

Support		Method				Water	
None	No support provided	HA	HAND AUGER	BB	BLADE BIT		Inflow of water
Mud	Drilling mud used	RA	ROTARY AIR				Water Loss
NQ	NQ size drilling pipe (69.9 mm ODia)	ADV	Auger 'V'-STEEL BIT				Water Level during drilling / excavation
HQ	HQ size drilling pipe (88.9 mm ODia)	ADTC	Auger 'TUNGSTEN-CARBIDE' BIT				Stabilised Water Level
PQ	PQ size drilling pipe (139.9mm ODia)	NMLC	DIAMOND CORING				

SAMPLING:

Sample ID

ddmmyy-01-SM Date-Sample Number-Initials of Sampler

Note : Sample Depth is indicated by horizontal lines which define the start and end depths

Type		
	D	Small Disturbed Sample
	U50	Undisturbed 50mm dia. tube sample
	B	Bulk Disturbed Sample
	PT	Geoprobe Push Tube Sample in
	J	Environmental Sample collected in a laboratory supplied glass jar
	SPT	SPT Split Tube Sampler

FIELD TESTS:

Standard Penetration Test (SPT)

2 / 3 / 4	Number of blows per 150mm over a depth of 450mm
N = 7	SPT "N" number = sum of last two blow counts
R	Refusal. SPT not able to penetrate
HB	Hammer Bouncing

Vane Shear

VS=30 Vane Shear Reading of 30 kPa

Pocket Penetromenter

PP=100 Pocket Penetrometer Reading of 100 kPa

SYMBOLS:

Soils


FILL


TOPSOIL


CLAY


SANDY CLAY


SILTY CLAY


GRAVELLY CLAY


SILT


CLAYEY SILT


SANDY SILT


GRAVELLY SILT


SAND


CLAYEY SAND


SILTY SAND


GRAVELLY SAND


GRAVEL


CLAYEY GRAVEL


SILTY GRAVEL


SANDY GRAVEL


PEAT

Rocks


GNEISS


CONGLOMERATE


GRANITE


LIMESTONE


SANDSTONE


SILTSTONE, MUDSTONE


SHALE


SHALEY CLAY (Extremely Weathered Shale)


VOLCANIC BRECCIA


BASALT

Piezometer Details


CONCRETE


BENTONITE PLUG


PVC SCREEN


WELL SCREEN


GRAVEL PACK


SANDY GRAVEL

NATURAL ROCK DEFECTS:

Description Order:

Fracture Type, Orientation, Infilling, Shape, Roaghness, Other

Fracture Type

JT	Joint
BP	Bedding Plane Parting
SM	Seam
FZ	Fragmented Zone
SZ	Shear Zone
VN	Vein

Orientation

VT	Vertical
HZ (or 0o)	Horizontal
X o	X' degrees from Horizontal

Infilling

CN	Clean
X	Carbonaceous
CLAY	Clay
CA	Calcite
FE	Iron Oxide
MI	Micaceous
QZ	Quartz

Shape

PLN	Planar
CU	Curved
UN	Undulose
ST	Stepped
IR	Irregular

Roughness

POL	Polished
SLK	Slickensided
SO	Smooth
RF	Rough
VR	Very

Others

DIS	Discontinuous
TI	Tight
CO	Coating

SUMMARY OF SOIL LOGGING PROCEDURES (Based on AS 1726-1993 *Geotechnical Site Investigations*)

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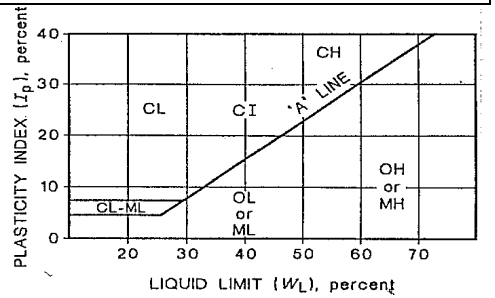
Coarse Material (Gravel and Sands): SOIL NAME: colour - grain size - particle shape - secondary components - minor constituents - moisture condition - relative density - origin - additional observations.
Example (Coarse material): Clayey SAND: dark grey, fine to medium sand, low plasticity, trace of fine gravel, moist and loose. (Alluvial)

Fine Material (Silts and Clays): SOIL NAME: colour - plasticity - secondary components - minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.
Example (Fine Material): sandy CLAY: dark grey, low to medium plasticity,fine grained sand, MC > PL, firm to stiff (Alluvial).

Guide to the Description, Identification and Classfication of Soils

Major Divisions				USCS Symbol	Typical Names
>200mm		BOULDERS			
63 to 200mm		COBBLES			
COARSE GRAINED SOILS	More than 50% by dry mass is less than 60mm is greater than 0.076m	Gravel	More than 50% of coarse fraction > 2.36mm	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
		Gravelly Soils		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
		SANDS	More than 50% of coarse fraction < 2.36mm	SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
		Sandy Soils		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	More than 50% by dry mass less than 60mm is less than 0.076m	Liquid Limit < 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
				OL	Organic silts and organic silty clays of low plasticity.
		Liquid Limit > 50%		MH	Inorganic silts, micaceous or diatomaneous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays.
				OH	Organic clays of medium or high plasticity, organic silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.

Grain Sizes			
Gravel		Sand	
Coarse -	63 to 20mm	Coarse -	2.36 to 0.6mm
Medium -	20 to 6mm	Medium -	0.6 to 0.2mm
Fine -	6 to 2.36mm	Fine -	0.2 to 0.075mm



GEOLOGICAL ORIGIN:

- **Fill** - artificial soils / deposits
- **Alluvium** - soils deposited by the action of water
- **Aeolian** - soils deposited by the action of wind
- **Topsoil** - soils supporting plant life containing significant organic cc
- **Residual** - soils derived from insitu weathering of parent rock.
- **Colluvial** - transported debris usually unsorted, loose and deposited by gravity towards the base of terrain of high relief

Field Identification of Fine Grained Soils - Silt or Clay?

Dry Strength - Allow the soil to dry completely and then test its strength by breaking and crumbling between the fingers.
High dry strength - Clays; Very slight dry strength - Silts.
Toughness Test - The soil is rolled by hand into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly until it has dried sufficiently to break into lumps. In this condition inorganic clays are fairly stiff and tough while inorganic silts produce a weak and often soft thread which may be difficult to form and readily breaks and crumbles.
Dilatancy Test - Add sufficient water to the soil, held in the palm of the hand, to make it soft but not sticky. Shake horizontally, striking vigorously against the other hand several times. Dilatancy is indicated by the appearance of a shiny film on the surface of the soil. If the soil is then squeezed or pressed with the fingers, the surface becomes dull as the soil stiffens and eventually crumbles. These reactions are pronounced only for predominantly silt size material. Plastic clays give no reaction.

Descriptive Terms for Material Portions

COARSE GRAINED SOILS			FINE GRAINED SOILS	
% Fines		*Term/Modifier*	*% Coarse*	*Term/Modifier*
< 5		Omit, or use "trace"	< 15	Omit, or use "trace"
> 5, < 12		"with clay/silt" as applicabl	> 15, < 30	"with sand/gravel" as applicable
> 12		Prefix soil as "silty/clayey"	> 30	Prefix as "sandy/gravelly"

Moisture Condition

Terminology		*for non cohesive soils:*	*for cohesive soils:*
Dry -		cohesionless, free running.	MC < PL. Typically hard and friable.
Moist -		Soils tend to cohere, no free water visible.	MC ~ PL. Soil can be moulded
Wet -		free water visible on soil su	MC > PL. Free water forms on hands during handling

* The plastic Limit (PL) is defined as the moisture content at which the soil crumbles when rolled into threads of 3mm dia.

Plasticity - for Clays & Silts

Low Plasticity		LL ≤35 %. A 3mm dia thread can barely be rolled at any water content.
Medium Plasticity		LL >35 % ≤50 %. The thread is easy to roll and not much time is required to reach PL. Cannot be re-rolled after reaching PL.
High Plasticity		LL > 50 %. It takes considerable time rolling and kneading to reach the PL. The thread can be rerolled several times after reaching the PL.

* Liquid Limit (LL) is defined as the moisture content (%) at which the soil begins to flow.

Consistency - for Clays & Silts

Description	*SPT "N" Value*	*UCS or q_u (kPa)* *	*Field guide to consistency*
Very Soft		<25	Exudes between the fingers when squeezed in hand
Soft		25 - 50	Can be moulded by light finger pressure
Firm		50 - 100	Can be moulded by strong finger pressure
Stiff		100 - 200	Cannot be moulded by fingers.
			Can be indented by thumb
Very Stiff		200 - 400	Can be indented by thumbnail
Hard		>400	Can be indented with difficulty by thumbnail

* UCS = Unconfined Compressive Strength. Can be estimated using a pocket penetrometer although it may overestimate UCS by a factor of 1.5 - 2.0

Relative Density for Gravels and Sands

Description	*SPT "N" Value*	*Relative Density %*	*Field guide (For sand)*
Very Loose	0 - 4	<15	Easily penetrated with a 13mm reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Can be excavated with a spade. 50mm wooden peg can be easily driven. Easily penetrated with a 13mm reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Hard shoveling. Penetrated 300mm with 13mm reinforcing rod driven with a 2kg hammer.
Dense	30 - 50	65 - 85	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation. 50mm wooden peg is hard to drive.
Very Dense	>50	>85	Penetrated only 25 - 50 mm with 13mm reinforcing rod driven with 2kg hammer.

SUMMARY OF ROCK LOGGING PROCEDURES

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DESCRIPTION ORDER: ROCK TYPE: grain size - colour - strength - weathering - structure - defects - minor constituents - additional observations.

EXAMPLE: SANDSTONE: medium to coarse grained, grey with orange streaks, medium strength, distinctly weathered, laminated, with rare quartz gravel

Rock Type

Rock Type is described on the basis of origin (sedimentary, pyroclastic, metamorphic and igneaous). Common rock types are listed below.

Origin	Definition	Common Types
□ Sedimentary Rocks:	Formed at the Earth's surface from the weathered and eroded fragments of pre-existing rocks (ie. clastic sedimentary rocks), from the hard parts of animals or plants (organic sedimentary rocks), or from the precipitation out of solution of dissolved minerals (chemical sedimentary rocks)	Clastic - conglomerate, sandstone, siltstone*, claystone*, shale. Organic - shelley limestone, coal. Chemical - limestonerock salt, gypsum, chert.
□ Pyroclastic	Fragmented (clastic(rock material) formed by a volcanic explosion or eruption from a volcanic vent.	Tuff, agglomerate, volcanic breccia
□ Metamorphic Rocks:	Formed from the mineralogical and/or textural transformation, in the solid state, of pre-existing rocks due to the action of temperature and/or pressure. Metamorphic rocks that have been subjected to deep burial typically display a foliated texture due to the parallel alignment of some constituent minerals (as in schist) or the segregation of minerals into separate bands of different composition (as in gneiss)	Slate, Gneiss, Schist, Quartzite, Phylite
□ Igneous rocks:	Formed by the cooling and solidification of magma, a hot molten material formed by localised melting within the Earth. If formed beneath the Earth's surface, the rock formed is an 'intrusive igneous rock. Magma extruded at the Earth's surface is known as lava which gives rise to extrusive igneous or volcanic rocks.	Intrusive - Granite, Dolerite, Porphyrite, Diorite. Extrusive - Basalt, Andesite.

* Both siltstone and claystone are also known as mudstone and commonly called shale if thinly laminated with a tendancy to split in parallel planes

Grain Size

Grain size is often only provided for conglomerate and sandstone sedimentary rocks.

* It is noted that the limit of unaided vision is 0.06mm.

Conglomerate		Sandstone	
Coarse -	> 20 mm	Coarse -	0.6 to 2mm
Medium -	6 to 20 mm	Medium -	0.2 to 0.6 mm
Fine -	2 to 6 mm	Fine -	0.06* to 0.2 mm

Colour

Colour is usually described in the as-received moisture condition (ie. wet). Although both wet and dry colours descriptions may be appropriate if significantly different.

Strength

The strength of rock based on point load testing is presented below. Note: the field guide assessment should be confirmed by point load testing when used in earthworks and foundation ir

Rock Strength Descriptions			
Term	**Letter Symbol**	**Point load index (Mpa) Is (50) ***	**Field Guide**
Extremely Low	EL	≤ 0.03	Easily remoulded by hand to a material with soil properties.
Very Low	VL	0.03 - 0.1	May be crumbled in the hand. Sandstone is "sugary" and friable.
Low	L	0.1 - 0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium	M	0.3 - 1.0	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.
High	H	1.0 - 3	A piece of core 150 mm long x 50 mm dia core cannot be broken by unaided hands, can be slightly scratched or scored with knife.
Very High	VH	3.0 - 10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.
Extremely High	EH	≥ 10	A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.

* rock strength defined by point load strength (Is 50) in direction normal to bedding

Weathering

The classification system for weathering in accordance with AS1726-1993 is provided below.

Weathering		
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a change in volume but the soil has not significantly transported.
Extremely Weathered	EW	Rock is weathered to such an extent that it has "soil" properties; i.e. it either disintegrates or can be remoulded, in water.
Highly Weathered	HW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron-staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	MW	Stained or discoloured throughout rock substance but little or no change of rock strength.
Slightly Weathered	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition or staining.

Structure

The structure of the rock mass (as opposed to the rock 'material') should be describbed using the following common terms:

- □ Sedimentary Rocks: Bedded (ie. layers greater than 20 mm thick on average); or Laminated (ie. layers less than 20mm thick on average)
- □ Metamorphic Rocks: Foliated, Banded or Cleaved.
- □ Igneous rocks: Massive or Flowbanded

Defects

Defects are 'natural' fractures in the rock mass and include: joints, faults, sheared planes, seams, bedding partings and veins. They do not include fractures caused by the drilling process or subsequent handling. Defects are an important feature which can have a significant bearing on the engineering behaviour of a rock mass. As such, they should be individually described including: orientation, infilling (eg. clay, Iron oxide, clean etc), shape, roughness and whether the defect is open or tight.

Defect spacing in accordance with P.J.N. Pells et al, 1998, is described below.

Defect Spacing (P.J.N. Pells et al, 1998)*	
Defect Spacing (mm)	Description
>2000	Very Widely Spaced
600 - 2000	Widely Spaced
200 - 600	Moderately Spaced
60 -200	Closely Spaced
20 - 60	Very Closely Spaced
0 - 20	Extremely Closely Spaced

* Spacing relates to of all types of natural fractures, but not articficial breaks, in cored bores

Rock Quality Designation (RQD):

The fracture spacing is shown where applicable and the Rock Quality Designation is

$$RQD\ (\%) = \frac{\text{sum of unbroken core pieces 100 mm or longer}}{\text{Length of Core}}$$

RQD provides information on the extent of fracturing and hence the competency of the rock mass.

Project ID:	CES111206-CA
Client:	Cadence Australia
Project:	Four Points Hotel
Location:	Slip Street

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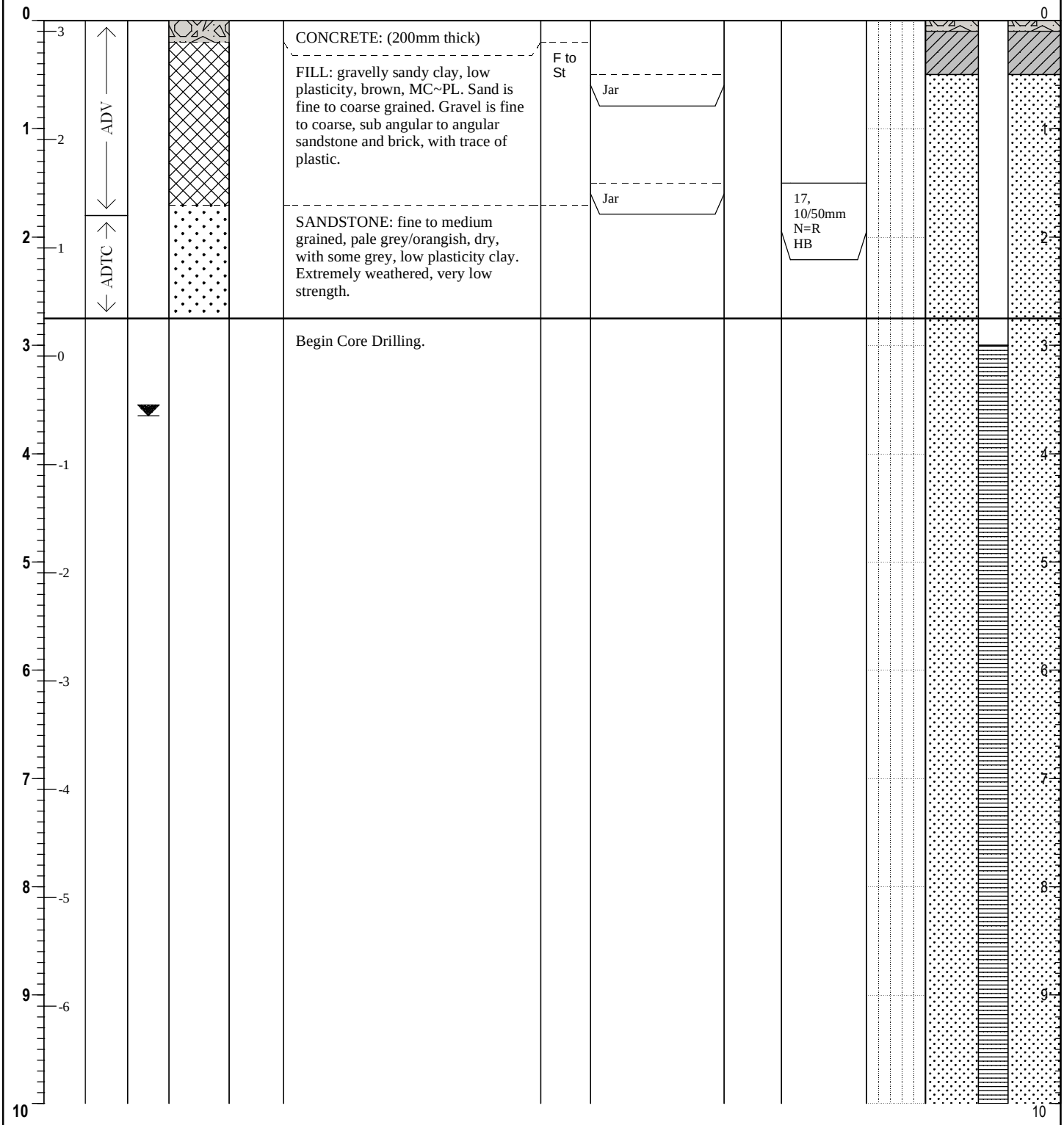
LOG ID: FP_BH1

Sheet: 1 of 4

X-Coord:	333824	GDA 94 MGA 56	**Date Commenced:**	26/04/2012	**Logged by:** MTP
Y-Coord:	6250726		**Date Completed:**	26/04/2012	**Checked by:** MTP
Surface Elevation (R.L) :	3.10	m AHD	**Hole Diameter (mm):**	100mm	

Drilling Information				LITHOLOGY				Samples		Tests		
Depth (mBGL)	R.L. (m)	Method (Support)	Water	Symbol	USCS Symbol	Description SOIL TYPE: plasticity or particle characteristics colour, moisture, secondary and minor components	Consistency / Density	Sample ID	Type	SPT	Pocket Penetrometer (kPa) 100 200 300 400	Well Installation Detail
0	3	ADV				CONCRETE: (200mm thick)						
						FILL: gravelly sandy clay, low plasticity, brown, MC~PL. Sand is fine to coarse grained. Gravel is fine to coarse, sub angular to angular sandstone and brick, with trace of plastic.	F to St	Jar				
1	2											
								Jar		17, 10/50mm N=R HB		
2	1	ADTC				SANDSTONE: fine to medium grained, pale grey/orangish, dry, with some grey, low plasticity clay. Extremely weathered, very low strength.						
3	0					Begin Core Drilling.						
4	-1											
5	-2											
6	-3											
7	-4											
8	-5											
9	-6											
10												



Drill Company:	Macquarie Drilling Pty Ltd	**Operator Name:**	Glen Gartside
Machine Type:	E50	**Operators Licence No.:**	

Refer to Standard Sheets for details of abbreviations

Project ID:	CES111206-CA	CONSULTING EARTH SCIENTISTS	**LOG ID: FP_BH1**
Client:	Cadence Australia	Suite 3, Level 1 55 Grandview Street, Pymble NSW 2073 PH: (02) 8569 2200 FAX: (02) 9983 0582 www.consultingearth.com.au	Sheet: 2 of 4
Project:	Four Points Hotel		
Location:	Slip Street		

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10	-7											
11	-8											
12	-9											
13	-10											
14	-11											
15	-12					End of Borehole.						
16	-13											
17	-14											
18	-15											
19	-16											
20												

Drill Company:	Macquarie Drilling Pty Ltd	**Operator Name:**	Glen Gartside
Machine Type:	E50	**Operators Licence No.:**	

Refer to Standard Sheets for details of abbreviations

Project ID:	CES111206-CA
Client:	Cadence Australia
Project:	Four Points Hotel
Location:	Slip Street

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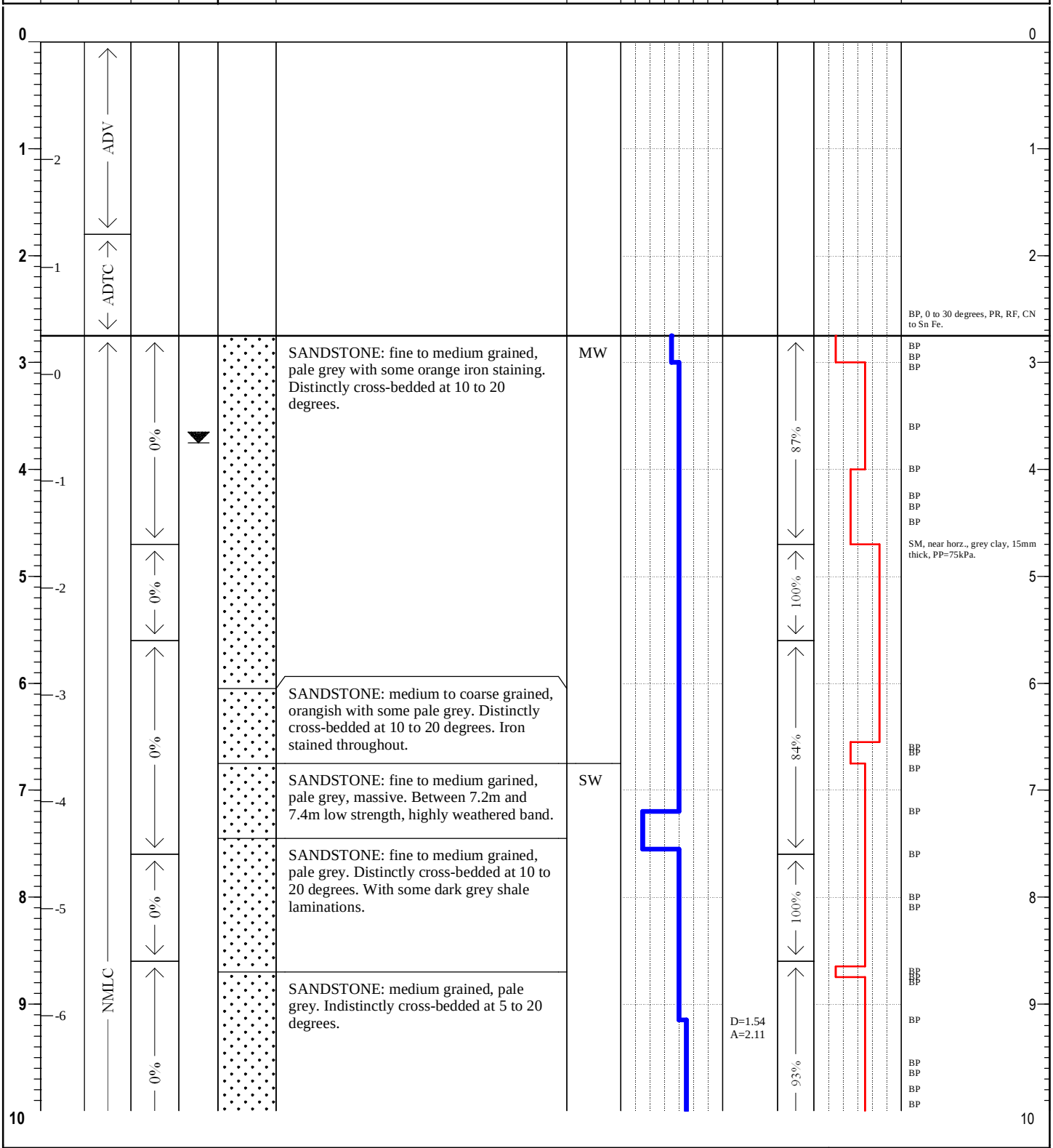
Corehole ID: FP_BH1

Sheet: 3 of 4

X-Coord:	6250726	**Date Commenced:**	26/04/2012	**Logged by:**	MTP
Y-Coord:	333824	**Date Completed:**	26/04/2012	**Checked by:**	MTP
Surface Elevation (R.L):	3.10 m AHD	**Hole Diameter (mm):**	NMLC		



Drill Company:	Macquarie Drilling Pty Ltd	**Operator Name:**	Glen Gartside
Machine Type:	E50		

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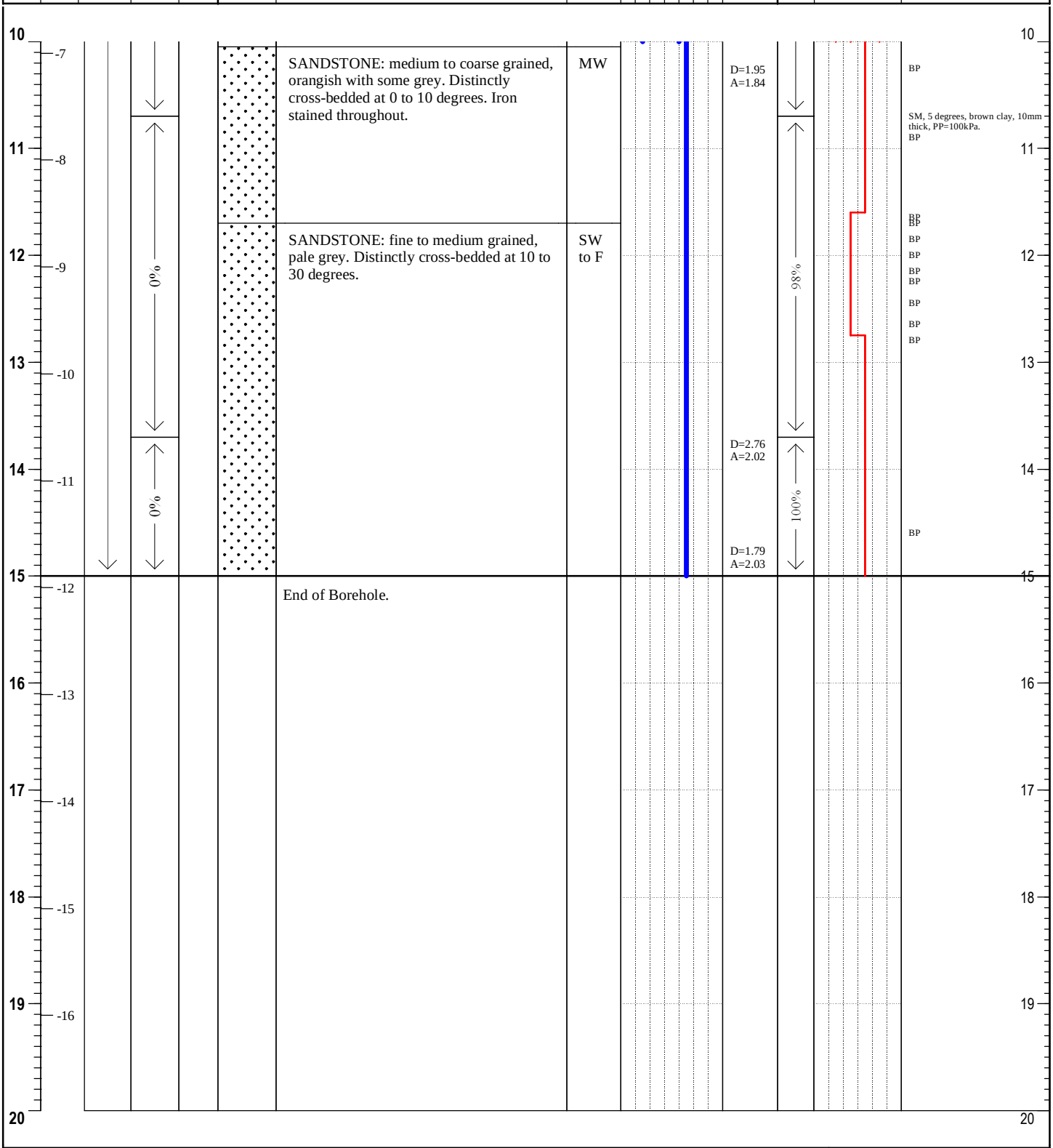
Corehole ID: FP_BH1

Sheet: 4 of 4

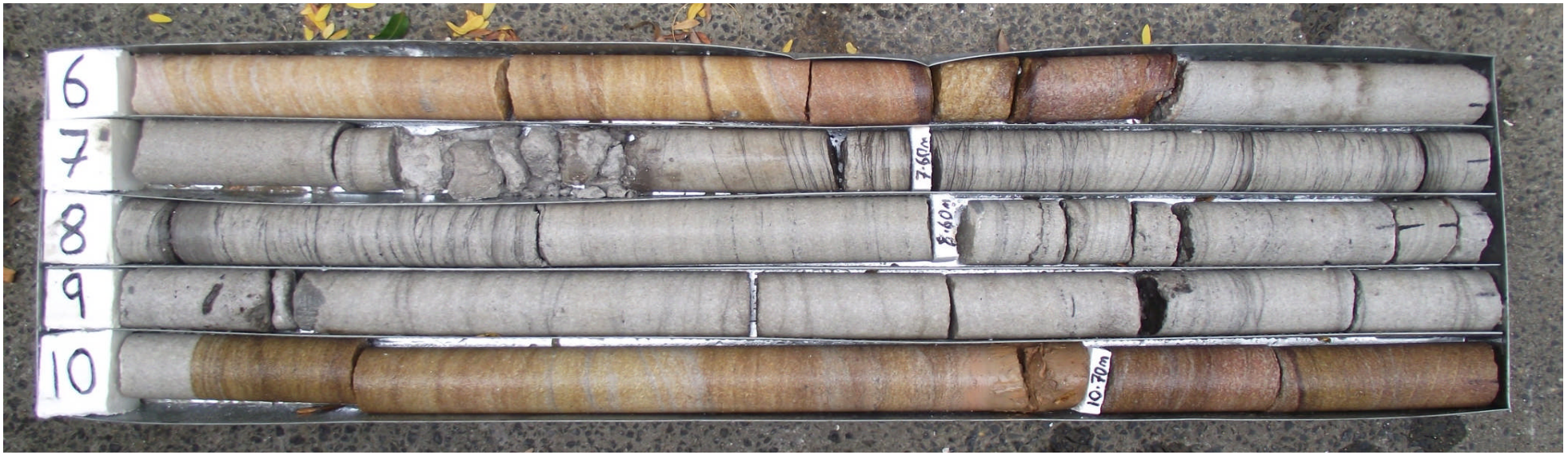
X-Coord:	6250726	**Date Commenced:**	26/04/2012	**Logged by:**	MTP
Y-Coord:	333824	**Date Completed:**	26/04/2012	**Checked by:**	MTP
Surface Elevation (R.L):	3.10 m AHD	**Hole Diameter (mm):**	NMLC		



Drill Company:	Macquarie Drilling Pty Ltd	**Operator Name:**	Glen Gartside
Machine Type:	E50		

Refer to Standard Sheets for details of abbreviations

Date:	26/04/2012	Title:	FP_BH1 Four Points 2.75m to 6.00m	CONSULTING EARTH SCIENTISTS
Prepared by:	M. Pickett			Suite 3, Level 1,
Checked by:	D. Lowe	CES Project ID:	CES111206-CA	55 Grandview Street
Scale:	NTS			Pymble NSW 2073
Size:	A4	Client:	Cadence Australia	ph: 02 8569 2200 fax: 02 9983 0582



Date:	26/04/2012	Title:	FP_BH1 Four Points 6.0m to 11.0m	
Prepared by:	M. Pickett			
Checked by:	D. Lowe	CES Project ID:	CES111206-CA	
Scale:	NTS			
Size:	A4	Client:	Cadence Australia	

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Date:	26/04/2012	Title:	FP_BH1 Four Points 11.0m to 15.00m	CONSULTING EARTH SCIENTISTS
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Checked by:	D. Lowe	CES Project ID:	CES111206-CA	55 Grandview Street
Scale:	NTS			Pymble NSW 2073
Size:	A4	Client:	Cadence Australia	ph: 02 8569 2200 fax: 02 9983 0582