

Report

College Road Breach Investigation - Geotechnical Factual Report

Prepared for Bay of Plenty Regional Council

Prepared by Beca Ltd (Beca)

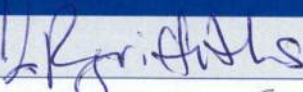
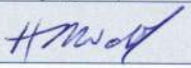
31 July 2017



Revision History

Revision N°	Prepared By	Description	Date
1	Daniel Beeler/James Griffiths	Draft for client comment	10/07/2017
2	James Griffiths	Final Issue	31/07/2017
3			
4			
5			

Document Acceptance

Action	Name	Signed	Date
Prepared by	James Griffiths		31/7/17
Reviewed by	James Burr		31/07/2017
Approved by	Harry Wahab		31/7/17
on behalf of	Beca Ltd		

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1 Introduction

A breach of the Rangitaiki River stop bank floodwall at College Road, Edgecumbe occurred on 6 April 2017. The breach was associated with Ex-tropical Cyclone Debbie and led to flooding of Edgecumbe.

Bay of Plenty Regional Council (BOPRC) has commissioned Beca Ltd (Beca) to undertake geotechnical investigations at the site of the Rangitaiki stopbank breach on College Road to provide information on the underlying ground conditions.

1.1 Object and Scope of the Investigation

The purpose of this investigation is to provide information on the ground conditions at the site and confirm the construction details of the flood wall and the crib wall adjacent to College Road.

The investigation was carried out during June 2017 and comprised:

- 2 Test Pits
- 4 Boreholes (incl. 4 standpipe installations)
- 7 Permeability Tests
- 4 Cone Penetration Tests (incl. 8 dissipation tests)
- Laboratory Testing
- Groundwater Monitoring

This report presents the factual data obtained from this investigation.

1.2 Site Location and Description

The site of the stopbank breach is located to the north of State Highway 2 (SH2) adjacent College Road. The longest river in the Bay of Plenty, the Rangitaiki River, flows south to north across the Rangitaiki Plains and past the eastern side of the town centre. The river is heavily managed by stopbanks, especially in areas in close proximity to the Edgecumbe township.

A temporary stopbank has been constructed at the site of the breach and the remaining sections of the flood wall have been buried within additional fill up to the level of the top of the flood wall. The top of the floodwall and temporary embankment is approximately at RL 7.0m. The Rangitaiki River runs along the eastern side of the embankment and the Edgecumbe township is located on the western side of the embankment on generally flat land at approximately RL 4.5m.

1.3 Site Geology

The relevant published geological map (Leonard et al, 2010) shows the site to be underlain by Tauranga Group Holocene (less than 10,000 years old) Swamp Deposits of sand, silt, clay and peat.

2 Site Investigation

The site investigation commenced on 14 June 2017 and was completed by 22 June 2017 with groundwater monitoring continuing until 29 June 2017. The investigation locations have been estimated post construction in terms of NZTM/Moturiki 1953 and are presented in Appendix A. The offset from investigation locations to

visible features was measured on site and coordinates obtained from the BOPRC online GIS system (Bay eXplorer, 2107). The site investigations were observed full-time by a Beca Engineering Geologist or Geotechnical Engineer. Unless otherwise stated, all soil and rock logging has been undertaken by a Beca Engineering Geologist or Geotechnical Engineer. All logs have been verified by a Beca Senior Engineering Geologist.

2.1 Standards and Calibration

A list of standards used during the site investigation is shown in Table 1, below.

Table 1 - Summary of Standards used in this Investigation

Field Procedure	Standard Used
Soil and Rock logging	In general accordance with New Zealand Geotechnical Society Guidelines (NZGS, 2005).
Hand held shear vane testing	In general accordance with New Zealand Geotechnical Society Guidelines (NZGS, 2001).
Standard Penetration Testing	ASTM D 1586 Rev A, 2008 ⁽¹⁾
Standard Penetration Testing – Hammer Efficiency	ASTM D4633-10
Cone Penetration Testing	ASTM D5778-12 ⁽²⁾

Note:

(1) Standard adopted to provide for variation in SPT split spoon diameter with results reported in 75mm increments including seating drive.

(2) Standard widely adopted by contractors in NZ with the requirement of a maximum of half the allowable Zero Drift limit

Up to date calibration certificates for the following testing equipment used in the investigations are attached in Appendix B.

- Hand held shear vane
- SPT Hammer Efficiency
- CPT Cone

2.2 Machine Boreholes

Machine boreholes were drilled by Pro-Drill (Auck) Ltd using a Fraste XLZ RotoSonic Rig. All boreholes were PQ diameter and drilled vertically. In boreholes SB01A and SB02A, drilling was undertaken using rotary sonic open barrel techniques to obtain core. Boreholes SB01B and SB02B were washdrilled with no core recovered between Standard Penetration Tests (SPTs). A standpipe was installed in each of the four boreholes. A summary of all machine boreholes is given Table 2.

Table 2 - Summary of Boreholes Drilled

BH No.	Location	Easting	Northing	R.L. ground (m)	Total Depth (m)	Installation Details
SB01A	Crest of temporary stop bank, on river side of flood wall	1936307	5790265	7.0	16.7	Standpipe
SB01B		1936307	5790264	7.0	17.15	Standpipe
SB02A		1936304	5790248	7.0	18.3	Standpipe
SB02B		1936304	5790249	7.0	18.75	Standpipe

Field testing, undertaken during drilling of the machine boreholes comprised:

- Standard Penetration Tests were typically carried out at nominal 1.5m centres and the uncorrected N-values are recorded on the borehole logs. SPT hammer efficiencies are presented on the borehole log sheets and calibration records included in Appendix B.
- Hand held shear vane tests were carried out within the end of the core barrel in cohesive soils. The corrected and uncorrected shear vane values are reported on the machine borehole logs.

All core samples were logged on site by a Beca Engineering Geologist or Geotechnical Engineer. Machine borehole logs are presented in Appendix C and core photographs in Appendix D. After the core samples had been logged, they were wrapped in plastic to reduce moisture loss and placed in labelled core boxes before being transferred to Beca's Tauranga Core Storage Facility. The core samples will be stored for a period of 3 months following delivery of this report. If samples are required to be stored for longer, please contact Beca to arrange for the samples to be transferred to your facility or agree the cost of additional storage. Some natural desiccation and degradation of the core samples will occur through time following storage.

2.3 Test Pits

Colin Amrein Contracting Ltd were contracted to excavate test pits using a 12 tonne and a 6 tonne machine excavator. The pits were approximately 2m by 2m in plan area and ranged from 1.6m to 2.1m depth below the top level of the flood wall concrete footing. Appendix E contains a sketch of the Test Pit locations for clarity. Material excavated from the test pit was logged and sampled by a Beca Engineering Geologist or Geotechnical Engineer. The test pit logs are presented in Appendix E and the photographs in Appendix F.

In order to provide material for laboratory testing, the following samples were obtained:

- Bulk disturbed samples, typically weighting 15kg each were taken from each engineering geologic unit,
- Bulk disturbed samples were taken of the crib wall backfill and drainage metal in TP02.

2.4 Cone Penetration Tests (CPT)

Static Cone Penetration Tests (CPT's) were conducted by Perry Geotech Limited using a Geomil 140KN fitted with a 10cm² to measure cone resistance, sleeve friction and water pressure. CPT test locations are summarised in Table 3 below and are presented in Appendix A.

Table 3 - Summary of CPT Locations

CPT No.	Location	Easting	Northing	R.L. ground (m)	Total Depth (m)	Type of Test
CPT01	College Road	1936304	5790285	4.5	19.69	Dissipation
CPT02	College Road	1936298	5798269	4.5	20.00	
CPT03	College Road	1936296	5790261	4.5	20.00	Dissipation
CPT04	College Road	1936293	5790251	4.5	15.57	

Notes: All survey coordinates are given in NZTM/Moturiki 1953.

Test records for cone resistance, sleeve friction and friction ratio, zero drift and pore pressure are included in Appendix G. Electronic records are included in Appendix M (embedded in PDF).

2.5 CPT Dissipation Testing

Pore pressure dissipation tests were conducted in CPT01 and CPT03 using the piezocone. Target zones were identified from the closest CPT test which had already been carried out. The dissipation of excess pore pressures, generated by insertion of the piezocone was monitored by stopping and fixing the piezocone at the scheduled depth and then recording the rate of dissipation of pore pressure with time. The test was continued until the degree of dissipation of excess pressure had been reduced by at least 50%, based on the groundwater level determined from the piezocone.

The test data is presented in Appendix H as normalised excess pore water pressure plotted against the log of time. Electronic records are included in Appendix M (embedded in PDF).

Table 4 - Summary of Dissipation Tests

CPT No.	Dissipation Test Depths (m bgl)
CPT01	3.5, 4.73, 7.0, 8.7, 15.0
CPT02	-
CPT03	4.0, 5.5, 11.4
CPT04	-

2.6 Instrumentation

2.6.1 Standpipe Piezometers

Standpipe piezometers were installed in all of the machine boreholes in order to carry out permeability tests in specific geologic units. A summary of the piezometer installations is provided in Table 5.

Table 5 - Summary of Standpipe Piezometer Installations

Borehole/ Piezometer	Piezometer Type	Response zone top (m.b.g.l)	Response zone bottom (m.b.g.l)	Response zone geology
SB01A	Single standpipe	3.0	3.5	Existing stopbank material
SB01B	Single standpipe	5.15	5.45	Holocene Swamp Deposits
SB02A	Single standpipe	2.5	3.0	Existing stopbank material
SB02B	Single standpipe	7.5	8.0	Holocene Swamp Deposits

The standpipe piezometer installations consist of 50mm internal diameter uPVC pipe with a machine slotted screen section located in the response zone of interest. All of the boreholes collapsed back to around 12m bgl. Bentonite pellets were used to backfill each of the boreholes from around 12m up to the response zone which was surrounded by a sand pack typically 0.5m above and below the screened section. A screen and filter sock was installed within the sand pack zone within each of the boreholes. Each piezo was finished at the surface with 0.5m of concrete and a lockable steel upstand toby cover.

Appendix I provides as-built record of the standpipe piezometers constructed at each location.

2.7 Permeability Testing

Rising head and falling head tests were carried out in each of the piezometers installed as outlined in Table 6. A rising head test was not carried out in SB02A because the piezometer was dry when measured.

Results from the rising and falling head test outlined below are presented in Appendix J.

Table 6 - Summary of Permeability Testing

Borehole/ Piezometer	Rising Head Test	Falling Head Test
SB01A	✓	✓
SB01B	✓	✓
SB02A	x	✓
SB02B	✓	✓
Note: ✓ = test carried out, x = no test carried out		

2.7.1 Rising Head Tests

Rising head permeability tests were conducted within piezometers as listed in Table 6 and detailed in Section 2.6. The static water level was recorded and then a volume of water was extracted from the piezometers using a repeat lifts with a bailer approximately 1500mm long and 40mm in diameter. After removing a volume of water, water levels were recorded until the water level had:

- Reached a constant rate of recovery and test time was greater than 3 hours
- Recovered to 90% of the static water level from the start of the test

2.7.2 Falling Head Tests

Falling head permeability tests were conducted within piezometers as listed in Table 6 and detailed in Section 2.6. The static water level was recorded and then a volume of water was added to the boreholes. After adding a volume of water, water levels were recorded until the water level had:

- Reached a constant rate of recovery and test time was typically greater than 3 hours (SB01A terminated earlier at 2.25 hours with no change in water level readings since 1 hour after the start of the test)
- Recovered to 90% of the static water level from the start of the test

2.8 Groundwater

2.8.1 Manual groundwater measurements

The piezometers installed were developed on 17 June and dipped on three occasions:

- 21 June 2017, prior to any permeability testing commencing
- 22 June 2017, prior to the second day of permeability testing commencing
- 29 June 2017, at the time of removal of data loggers

Table 7 presents the groundwater levels recorded.

Table 7 - Groundwater Measurements

Borehole/ Piezometer ID	21/06/2017 0800	22/06/2017 0740	29/06/2017 1440
	Depth to water (m bgl)	Depth to water (m bgl)	Depth to water (m bgl)
SB01A	3.24	3.33	3.09
SB01B	4.72	4.7	4.7
SB02A	dry	dry	dry
SB02B	5.58	5.28	5.08

2.8.2 Continuous Groundwater Monitoring

Data loggers were installed in SB01B and SB02B to record short term changes in groundwater levels. Measurements were recorded at 5 minute intervals between 22 June 2017 and 29 June 2017. This data is presented in Appendix K and electronically in Appendix M (embedded in PDF).

3 Laboratory Testing

Disturbed soil samples were collected from machine boreholes and bulk samples were obtained from test pits.

EnviroLab Geotest Ltd carried out testing of these samples. The tests undertaken, and the testing specifications, were as follows:

- Natural Moisture Content: NZS4402, 1986; test 2.1
- Atterberg Limits: NZS4402, 1986; tests 2.2, 2.3 and 2.4
- Wash Grading: NZS4402, 1986; test 2.8.1 (wet sieve)
- Hydrometer Grading: ASTM D422-63 (2007)

The results of the laboratory testing are given Appendix L together with a summary of the tests carried out.

4 Applicability Statement

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

This is a factual report of site investigation and laboratory testing. The site investigation has been undertaken at discrete locations and no inferences about the nature and continuity of ground conditions away from the investigation locations are made. Furthermore logs are provided presenting description of the soils and geology based on our observation of the samples recovered in the fieldwork and may not be truly representative of the actual underlying conditions.

No interpretation of the investigation results has been made in this report. Should you be in any doubt as to the applicability of this report for the proposed development described herein, it is essential that you carry out independent investigations to satisfy your needs.

5 References

ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils (Withdrawn 2016), ASTM International, West Conshohocken, PA, 2007, www.astm.org

ASTM D4633-10, Standard Test Method for Energy Measurement for Dynamic Penetrometers, ASTM International, West Conshohocken, PA, 2010, www.astm.org

ASTM D5778-12, Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils, ASTM International, West Conshohocken, PA, 2012, www.astm.org

Bay of Plenty Regional Council, online GIS *Bay eXplorer*, accessed online 5 July 2017 (<http://geospatial.boprc.govt.nz/Html5Viewer/Index.html?viewer=bayexplorer>).

Leonard, G.S.; Begg, J.G.; Wilson, C.J.J. (compilers) 2010: Geology of the Rotorua area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences Limited. Institute of Geological & Nuclear Sciences 1:250,000 geological map 5. 99 p. + 1 folded map

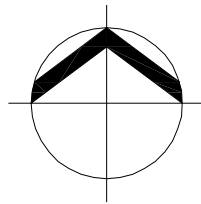
NZ Geotechnical Society, 2005: Field Description for Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes.

NZ Geotechnical Society, 2001: Guidelines for the Hand Held Shear Vane Test

NZ Standard 4402, 1986, Methods of Testing Soils for Civil Engineering Purposes

Appendix A

Geotechnical Investigation Location Plan



5790350

5790300

5790250

5790200

1936250

1936300

1936350

1936400

1936450

KEY



CONE PENETRATION TEST



TEST PIT



BOREHOLE

BACKGROUND SOURCED FROM
NZTA HIGHWAY CENTRELINES
IMAGERY. DOWNLOADED FROM
KOORDINATES.COM UNDER
CREATIVE COMMONS 3.0 LICENCE.

CPT01



CPT02



CPT03



CPT04



TP01



SB01A

SB01B

TP02



SB02B

SB02A

PDF ONLY
NO DWG FILE

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A	FOR INFORMATION	JRG	JH	HW	10/07/17
No.	Revision	By	Chk	Appd	Date

Drawing Originator:



Original Scale (A1)

Reduced Scale (A3)

1:600

Design:

Drawn

Dig Verifier

Dwg Check

* Refer to Revision 1 for Original Signature

JRG

10/7/17

Client:

BAY OF PLENTY REGIONAL COUNCIL

Project:

COLLEGE ROAD BREACH INVESTIGATION

Title:

GEOTECHNICAL INVESTIGATION LOCATION
PLAN

Discipline

GEOTECHNICAL

Drawing No.

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Rev.

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Appendix B

Calibration Records

Calibration certificate

GC10CFIIP.C15212 / 001



Cone number GC10CFIIP.C15212
Kind of cone Compression
Calibration date 21-Dec-15
Print date 21-Dec-15

Client Perry Geotech Ltd
37 Glenlyon Avenue
Greerton
3112 Tauranga
New Zealand

Channel 1			Channel 2			Channel 3		
Cone resistance (q_c)			Local sleeve friction (f_s)			Pore pressure (u)		
Range	0 ... 100 kN		Range	0 ... 22.5 kN		Range	0 ... 50 bar	
A_c	1000 mm ²		A_s	15000 mm ²				
Zero load reading	242 mV		Zero load reading	264 mV		Zero load reading	219 mV	
a-factor	0.8		b-factor	0				
			Offset	80 mm				
Load (kN)	Load (MPa)	Output (mV)	Load (kN)	Load (MPa)	Output (mV)	Load (bar)	Load (MPa)	Output (mV)
0	0	0	0.00	0.00	0	0	0.0	0
10	10	862	2.25	0.15	779	5	0.5	870
20	20	1729	4.50	0.30	1569	10	1.0	1746
30	30	2592	6.75	0.45	2339	15	1.5	2622
40	40	3454	9.00	0.60	3124	20	2.0	3497
50	50	4311	11.25	0.75	3906	25	2.5	4373
60	60	5180	13.50	0.90	4690	30	3.0	5249
70	70	6039	18.00	1.20	6254	35	3.5	6125
80	80	6899	20.25	1.35	7038	40	4.0	7001
90	90	7758	22.50	1.50	7822	45	4.5	7877
100	100	8614	20.25	1.35	7036	50	5.0	8752
90	90	7759	18.00	1.20	6277			
80	80	6903	13.50	0.90	4722			
70	70	6043	11.25	0.75	3940			
60	60	5188	9.00	0.60	3161			
50	50	4316	6.75	0.45	2393			
40	40	3458	4.50	0.30	1618			
30	30	2598	2.25	0.15	810			
20	20	1732	0.00	0.00	1			
10	10	864						
0	0	0						
Zero load error	0.00 %		Zero load error	0.01 %		Zero load error	0.06 %	
Max. linearity	0.23 %		Max. linearity	0.69 %		Max. linearity	0.06 %	
Max. hysteresis	0.09 %		Max. hysteresis	0.69 %				

Calibration certificate

GC10CFIIP.C15212 / 001



Channel 4 Range		Inclination X -20 ... 20 °	Channel 5 Range		Inclination Y -20 ... 20 °	Channel 6 None	
Angle (°)		Output (mV)	Angle (°)		Output (mV)		
-20		2511	-20		2476		
-15		2578	-15		2541		
-10		2645	-10		2610		
-5		2716	-5		2679		
0		2786	0		2750		
5		2855	5		2822		
10		2923	10		2888		
15		2990	15		2960		
20		3059	20		3025		

Calibration instrument(s)
CW-921007.01

Certificate number(s)
14203331

Date(s)
21-Aug-14

Remark

We declare that the electrical cone with serial number GC10CFIIP.C15212 has been calibrated and that the specifications are according to the ISO 22476-1:2012 (Geotechnical investigation and testing – Field testing - Part 1: Electrical cone and piezocone penetration test), Application Class 1. The calibrations are traceable to national and international standards.

Date
Calibrated by
21-Dec-15
Patricia Treffers

Date
Approved by
21-Dec-15
Awring Shaways

Signature

Signature

PILCON SHEAR VANE CALIBRATION REPORT SHEET

Vane Number: GEO958

Vane Dimensions

Measured by: T.Welsh

Date Measured: 26 June 2017

Diameter (mm)	Height (mm)	Thickness (mm)	Rod Diameter (mm)	Area Ratio	Vane Size (mm)	Friction	K
18.62	29.00	1.48	6.34	24.94	19	-	0.01917
33.20	49.52	1.52	6.31	13.06	33	-	0.10490

Calibration Authority: Strainer Systems

Calibration Standard: ISO 6789/2003

Calibration Date: 10 May 2016

Calibration Authority Rep #: 692

Calibration Interval: Yearly

Calculated by: S.Shah

Checked by: N.Agarkova

Date Entered: 12 May 2016

Date Checked: 12 May 2016

Report Number: 105161

The uncertainty of the shear vane (spring) calibration has been determined by Strainer Systems Limited to be:

Gauge Reading Kpa	30	90	140
Expanded uncertainty N.m	0.24	0.26	0.29
Coverage factor	2.0	2.0	2.0

Dial Gauge Reading	Applied Torque (Nm)	Vane Shear Strength 19mm (kPa)	Vane Shear Strength 33mm (kPa)	Dial Gauge Reading	Applied Torque (Nm)	Vane Shear Strength 19mm (kPa)	Vane Shear Strength 33mm (kPa)
0	0	0	0	50	1.59	83	15
2	0.08	4	1	52	1.65	86	16
4	0.15	8	1	54	1.71	89	16
6	0.23	12	2	56	1.77	92	17
8	0.31	16	3	58	1.83	95	17
10	0.39	20	4	60	1.89	98	18
12	0.45	23	4	62	1.94	101	19
14	0.51	27	5	64	2.00	104	19
16	0.57	30	5	66	2.06	107	20
18	0.63	33	6	68	2.11	110	20
20	0.70	36	7	70	2.17	113	21
22	0.76	40	7	72	2.23	116	21
24	0.82	43	8	74	2.28	119	22
26	0.88	46	8	76	2.34	122	22
28	0.94	49	9	78	2.40	125	23
30	1.01	52	10	80	2.46	128	23
32	1.07	56	10	82	2.51	131	24
34	1.13	59	11	84	2.56	133	24
36	1.19	62	11	86	2.61	136	25
38	1.25	65	12	88	2.66	139	25
40	1.31	68	12	90	2.71	142	26
42	1.36	71	13	92	2.76	144	26
44	1.42	74	14	94	2.81	147	27
46	1.48	77	14	96	2.86	149	27
48	1.53	80	15	98	2.91	152	28

Notes: Maximum Dial Gauge reading 130 recommended, due to non linear Torque measurement in this range.

Vane Shear Strength = Torque Applied / K

Authorised Signatory:

D.Anstiss - Quality Manager

PILCON SHEAR VANE CALIBRATION REPORT SHEET

Vane Number: GEO958

Vane Dimensions

Measured by: T.Welsh				Date Measured: 26 June 2017			
Diameter (mm)	Height (mm)	Thickness (mm)	Rod Diameter (mm)	Area Ratio	Vane Size (mm)	Friction	K
18.62	29.00	1.48	6.34	24.94	19	-	0.01917
33.20	49.52	1.52	6.31	13.06	33	-	0.10490

Calibration Authority: Strainer Systems
Calibration Standard: ISO 6789/2003
Calibration Date: 10 May 2016
Calibration Authority Rep #: 692
Calibration Interval: Yearly

Calculated by: S.Shah
Checked by: N.Agarkova
Date Entered: 12 May 2016
Date Checked: 12 May 2016
Report Number: 105161

The uncertainty of the shear vane (spring) calibration has been determined by Strainer Systems Limited to be:

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Expanded uncertainty N.m	0.24	0.26	0.29
Coverage factor	2.0	2.0	2.0

Dial Gauge Reading	Applied Torque (Nm)	Vane Shear Strength 19mm (kPa)	Vane Shear Strength 33mm (kPa)	Dial Gauge Reading	Applied Torque (Nm)	Vane Shear Strength 19mm (kPa)	Vane Shear Strength 33mm (kPa)
100	2.95	154	28				
102	3.01	157	29				
104	3.07	160	29				
106	3.13	163	30				
108	3.19	167	30				
110	3.25	170	31				
112	3.33	174	32				
114	3.41	178	32				
116	3.48	182	33				
118	3.56	186	34				
120	3.64	190	35				
122	3.71	194	35				
124	3.79	198	36				
126	3.87	202	37				
128	3.94	206	38				
130	3.98	208	38				

Notes: Maximum Dial Gauge reading 130 recommended, due to non linear Torque measurement in this range.

Vane Shear Strength = Torque Applied / K

Authorised Signatory.....
 D.Anstiss - Quality Manager

**Pro-Drill SPT Calibration
Certification**

RIG: FRASTE XL2 WHITE

Calibrated on: 01st April 2017

FRASTE XL2 RED - 13.0m

Centerport
Date: 01-April-2017

OP: Scott

AR: 11.68 cm²

SP: 7.88 t/m³

LE: 12.0 m

EM: 2,109 t/cm²

WS: 5,123.0 m/s

JC: 0.00 []

CSX: Max Measured Compr. Stress

RAT: SPT Length Ratio

DMX: Maximum Displacement

VMX: Maximum Velocity

EFV: Energy of FV

FMX: Maximum Force

ETR: Energy Transfer Ratio - Rated

DFN: Final Displacement

BPM: Blows per Minute

BL#	Depth m	BLC bl/m	TYPE	CSX Mpa	DMX mm	EFV J	ETR (%)	BPM bpm	RAT []	VMX m/s	FMX tn	DFN mm
2	0.0	0	AV1	154.9	20	431.91	91.0	19.5	1.2	4.40	18	15
4	0.0	0	AV2	153.6	22	428.72	90.3	19.5	1.3	4.37	18	18
6	0.0	0	AV2	154.2	28	432.24	91.1	19.5	1.2	4.57	18	26
8	0.0	0	AV2	154.9	22	435.17	91.7	19.5	1.3	4.67	18	16
10	0.0	0	AV2	151.1	13	427.50	90.1	19.5	1.3	4.59	18	7
12	0.0	0	AV2	154.7	14	424.87	89.5	19.5	1.3	4.57	18	4
14	0.0	0	AV2	160.3	15	433.52	91.4	19.5	1.2	4.84	19	10
16	0.0	0	AV2	159.4	16	439.60	92.6	19.5	1.2	4.89	19	13
18	0.0	0	AV2	152.3	16	444.93	93.8	19.5	1.2	5.18	18	9
20	0.0	0	AV2	147.1	15	442.17	93.2	19.5	1.2	5.19	18	10
22	0.0	0	AV2	148.9	15	447.66	94.3	19.5	1.2	5.21	18	12
24	0.0	0	AV2	148.1	18	437.94	92.3	19.5	1.2	5.10	18	12
26	0.0	0	AV2	146.3	15	447.48	94.3	19.3	1.2	5.28	17	11
Average				152.7	18	436.62	92.0	19.5	1.2	4.85	18	12

Total number of blows analyzed: 25

BL# Sensors

2-26 F1: [468BW1] 211.7 (1.00); F2: [468BW2] 211.4 (1.00); A3: [K5608] 300.0 (1.00);

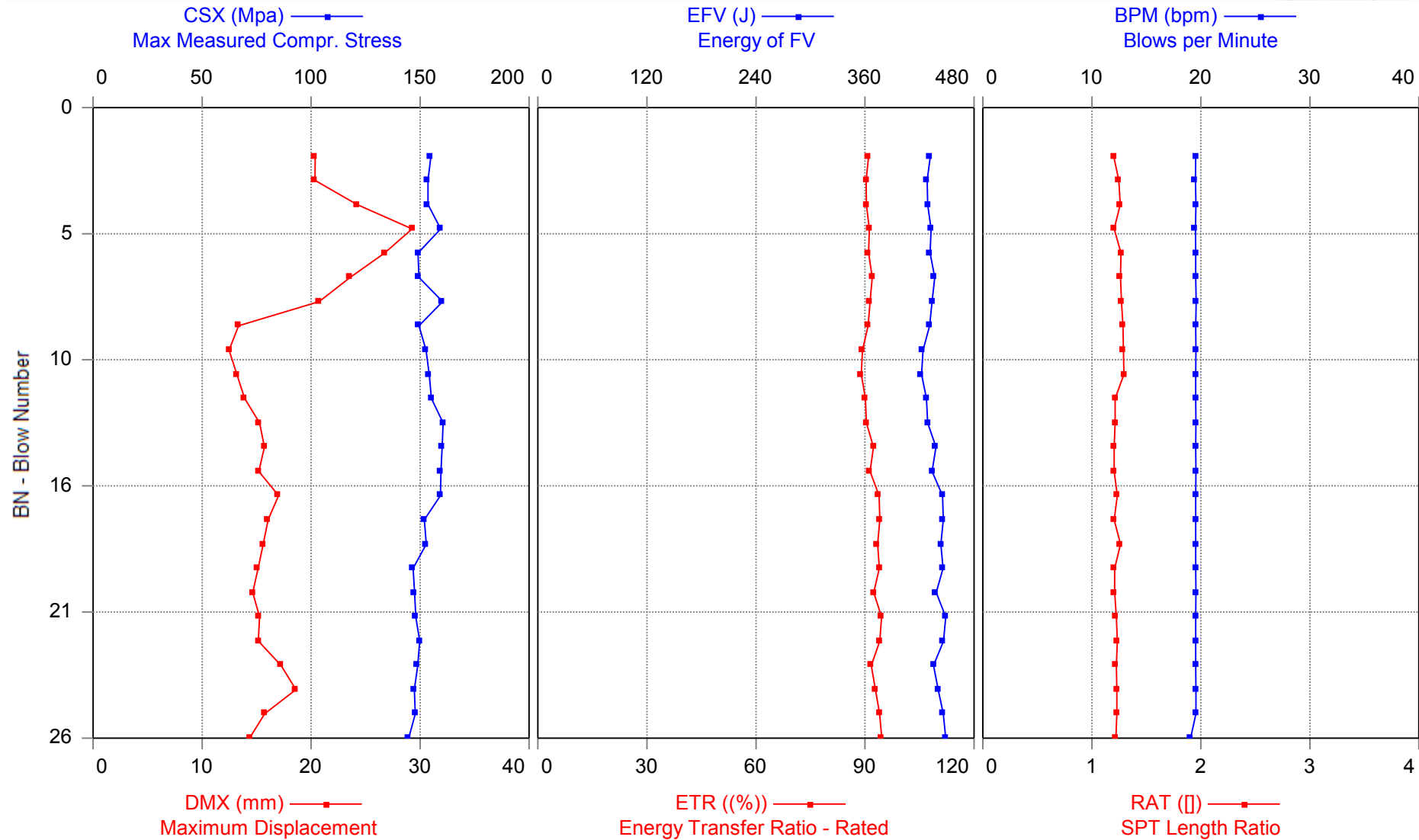
A4: [K5724] 322.0 (1.00)

Time Summary

Drive 1 minute 16 seconds 9:35 a.m. - 9:37 a.m. BN 1 - 26



FRASTE XL2 RED - 13.0m





Certificate of Training

**Scott Sherwin
PRO-DRILL**

participated in an **initial 1 day training course** (8 hrs) in the operation of
SPT Analyzer and PDA-S software

Subject Area: Civil Engineering

January 24, 2017



Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA



Training Provided By:

Richard Yu
EMP PILETEC PTY LTD
20 LARCH STREET
BLACKBURN
VICTORIA 3130
Australia
A Pile Dynamics, Inc. Authorized Instructor
January 2017

Appendix C

Machine Borehole Logs

WATER



Water level on date shown

METHOD (shows drilling method)

OB	open barrel
Wash	wash boring
TT	triple tube
UT	thin walled undisturbed tube
SPT	standard penetration test – open nose sampler
Nc	standard penetration test – solid nose sampler
MA	machine auger
PS	piston sample
PCT	percussion – top drive
PCB	percussion – bottom drive
Conc	concentrics
Sonic	sonic
HA	hand auger
VE	vacuum excavation

SAMPLES

Dx	Disturbed sample, number x
Bx	Bulk sample, number x
Ux(d)	Undisturbed sample, number x, tube diameter d in mm
Wx	Water sample, number x

MOISTURE

Dry, looks and feels dry
 Moist, no free water on hand when remoulding
 Wet, free water on hand when remoulding
 Saturated, soil below water table

SOIL AND ROCK DESCRIPTIONS

CONSISTENCY

Cohesive Soils	Undrained Shear Strength (kPa)
Very soft	<12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	>200

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.

Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

IN SITU TESTS

SV	= 40/10	In situ shear strength and remoulded shear strength respectively, as measured by Geotechnics/ Pilcon Shear Vane
τ	= 50/12	Vane shear strength and remoulded vane shear strength respectively, corrected to BS1377
UTP	=	Unable To Penetrate with Shear Vane
N	= 15	SPT uncorrected blow count for 300mm penetration
N _c	= 50+	SPT uncorrected blow count for 300 mm penetration using solid nose sampler

★

AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

Laboratory Test(s) carried out:

WEATHERING

CW	Completely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
UW	Unweathered

GRAPHIC LOG (1 or a combination of the following)

	Fill		Silt		Cobbles		Sandstone		Fine igneous
	Core loss		Sand		Boulders		Limestone		Coarse igneous
	Organics		Shells		Mudstone		Schist		
	Clay		Gravel		Siltstone		Basalt		

ORGANIC SOILS

Von Post Degree of Humification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Practically unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives marked muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
COORDINATES: N 5,790,265 m E 1,936,307 m						R.L: 7 m		COORDINATE ORIGIN: MAP			
						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L (m)	
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	↑ (kPa)							SPT 'N'
		70 %	RotoSonic								Tightly packed, fine to coarse GRAVEL, minor fine to coarse sand, minor silt; brownish orange; moist, matrix supported, non plastic. Gravel: angular to subrounded, HW; bluish grey; greywacke. [Temporary Embankment]	Fill	6.5	
		90 %									0.5			6.0
		100 %									1.0		ORGANICS; brown; moist, non plastic, fibrous. [Grass Surface] 1.12m, single coarse pebble, subrounded, SW, grey, pumice. 'Medium dense', silty fine to coarse SAND, minor fine to coarse gravel; grey; moist, non plastic. Gravel: angular to subangular, MW; brown; greywacke. [Existing Stopbank]	5.5
		100 %									1.5		1.60m, some gravel.	5.0
		100 %									2.0			4.5
		100 %									2.5			4.0
		100 %									3.0			3.5
		87 %									3.5			3.0
		90 %									4.0		4.30 - 4.55m, core loss, core bound on cobble, angular, HW, greywacke.	2.5
											4.5		Soft SILT, trace fine sand, trace clay; brownish grey; wet, low plasticity. 4.80m, minor fine sand.	

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB01B 1.5m along crest of flood wall from SB01A and are presented on the log for SB01B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±-5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 16/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: RotoSonic	
SHEAR VANE No: NA	DRILL FLUID: Water	
	DIAMETER/INCLINATION: 140 mm/ 90°	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: College Road Breach Investigation		JOB NUMBER: 3208176	
SITE LOCATION: College Road, Edgumbe		CLIENT: Bay of Plenty Regional Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.	
COORDINATES: N 5,790,265 m E 1,936,307 m		R.L.: 7 m DATUM: Moturiki 1953 COORDINATE ORIGIN: MAP ACCURACY: ±5m	

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	↑ (kPa)	SPT 'N'						
		100 %	RotoSonic								5.10m, 5mm bed of organics, moderately decomposed, fibrous wood.	Tauranga Group - Holocene Swamp Deposits	1.5	
		100 %									5.50m, non plastic.		1.0	
		100 %									5.75m, 5mm bed of organics, moderately decomposed, fibrous wood.		0.5	
		100 %									Very soft, sandy PEAT; brownish black; wet, H3. Sand: subrounded, pumice. 5.90m, single wood piece, slightly decomposed, <40mm.		0.0	
		100 %									'Loose', fine to medium SAND, trace silt; light grey; wet, subangular to subrounded, pumice.		-0.5	
		100 %									Very soft, PEAT; brownish black; H3, wet, non plastic.		-1.0	
		100 %									'Loose' fine to coarse SAND, minor silt, trace fine gravel, trace organics; brown; saturated, non plastic. Sand: subrounded, pumiceous. Gravel: subrounded, SW, pumiceous. Organics: rootlets. 6.60m; light brownish grey; no organics, minor fine gravel, quick behaviour.		-1.5	
		100 %									'Loose', fine to medium GRAVEL, minor fine to coarse sand; light grey; saturated, subangular to subrounded, pumiceous.		-2.0	
		100 %									'Loose', fine to coarse SAND, some fine gravel; light grey; saturated, subangular to subrounded, pumiceous.		-2.5	
		100 %									'Loose', fine to medium GRAVEL, minor fine to coarse sand; light grey; saturated, subangular to subrounded, pumiceous.		-3.0	
		100 %								7.80m, minor silt.	-3.5			
		100 %								'Loose', fine to medium SAND, trace coarse sand, trace fine gravel; light grey; saturated, pumiceous, poorly graded. Gravel: subrounded, MW, pumiceous.	-4.0			
		100 %								'Loose', fine to medium GRAVEL, minor fine to coarse sand: light grey, saturated, subangular to subrounded, pumiceous.	-4.5			
		100 %								'Loose', fine SAND, trace silt; grey; saturated, quick behaviour, pumiceous.	-5.0			
		100 %								'Medium dense', SILT, minor fine gravel; light grey; saturated, non plastic, gap graded, pumiceous. Gravel: subrounded, SW, pumice.	-5.5			
		100 %								8.90m, trace fine gravel.	-6.0			
		100 %								'Medium dense', SILT, trace fine sand, trace organics; light grey; saturated, non plastic, quick behaviour. Organics: fibrous wood, slightly decomposed, <5mm.	-6.5			
		100 %								9.80m, minor organics; greyish brown.	-7.0			
		100 %								9.90m, light grey; no organics.	-7.5			

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB01B 1.5m along crest of flood wall from SB01A and are presented on the log for SB01B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 16/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: RotoSonic	
SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
COORDINATES: N 5,790,265 m						R.L.: 7 m		COORDINATE ORIGIN: MAP			
E 1,936,307 m						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	↑ (kPa)						
		100 %	RotoSonic								10.1m, 20mm bed of medium to coarse SAND, trace fine sand, trace silt; light grey. Very soft, PEAT, some silt; brown; wet, H3, fibrous and amorphous.	Tauranga Group - Holocene Swamp Deposits	-3.5
		100 %									'Loose', fine to medium SAND, trace silt; light grey; saturated, pumiceous. 'Stiff', SILT, minor fine sand, trace clay; light grey; wet, high plasticity.		-4.0
		100 %									11.10m, some organics; dark brown; amorphous and fibrous. 'Loose', SILT, minor fine to medium gravel, trace organics; light grey speckled white; wet, non plastic, gap graded. Gravel: subrounded to rounded, pumice. Organics: fibrous, non decomposed wood, <5mm.		-4.5
		100 %									11.50m, firm. 11.7m, some organics, amorphous and fibrous.		-5.0
		100 %									Very soft, PEAT, some silt; brown mottled black; H3, wet, non plastic.		-5.5
		100 %									Soft SILT, minor clay, trace organics; light grey; wet, high plasticity. Organics: fibrous, slightly decomposed wood <5 mm.		-6.0
		100 %									'Loose', fine to medium SAND, trace silt; light grey; saturated, non plastic, pumiceous. 'Loose', sandy fine to medium GRAVEL, trace silt; light grey speckled white; saturated, non plastic. Sand and gravel: subangular to subrounded, pumiceous.		-6.5
		100 %									13.55m, 150mm thick bed of fine to medium SAND, pumiceous.		-7.0
		100 %									14.00m, 50mm thick bed of fine SAND, pumiceous. 'Loose', SILT, some fine sand, minor organics; light brown mottled light grey; moist, non plastic. Organics: amorphous and fibrous grass <5mm.		-7.5
		100 %									'Loose', SILT, some organics: black mottled brown, moist, non plastic. Organics: fibrous grass and amorphous.		

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB01B 1.5m along crest of flood wall from SB01A and are presented on the log for SB01B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 16/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: RotoSonic	
SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 4 of 4

[illegible]

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: College Road Breach Investigation		JOB NUMBER: 3208176	
SITE LOCATION: College Road, Edgecumbe		CLIENT: Bay of Plenty Regional Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.	
COORDINATES: N 5,790,264 m E 1,936,307 m		R.L.: 7 m DATUM: Moturiki 1953 COORDINATE ORIGIN: MAP ACCURACY: ±5m	

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'						
		0 %	WB									No core recovery.		
		89 %	SPT					1 1 2 4 4 4 N=14		1.5		Medium dense, silty fine to coarse SAND, minor fine to coarse gravel; grey; moist, matrix supported, non plastic. Gravel: angular to subangular, MW; brown; greywacke.		5.5
		0 %	WB							2.0		No core recovery.		5.0
		44 %	SPT					2 3 3 4 3 4 N=14		3.0		Medium dense, silty fine to coarse SAND, minor fine to coarse gravel; grey; moist, matrix supported, non plastic. Gravel: angular to subangular, MW; brown; greywacke.		4.0
		0 %	WB							3.5		No core recovery.		3.5
		11 %	SPT					1 1 1 1 1 1 N=4		4.5		Single coarse gravel pebble, UW; dark grey; greywacke. Bound in SPT sampler.		2.5
												No core recovery.		

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB01B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB01A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 16/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: College Road Breach Investigation		JOB NUMBER: 3208176	
SITE LOCATION: College Road, Edgumbe		CLIENT: Bay of Plenty Regional Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.	
COORDINATES: N 5,790,264 m E 1,936,307 m		R.L.: 7 m DATUM: Moturiki 1953 COORDINATE ORIGIN: MAP ACCURACY: ±5m	

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT N						
		0 %	WB											
		89 %	SPT					2 2 1 1 1 1 N=4		5.5				1.5
		0 %	WB							6.0				1.0
										6.5	Very soft, PEAT; brownish black; wet, H3, fibrous and amorphous.			0.5
		0 %	WB							7.0	No core recovery.			0.0
		67 %	SPT					2 2 2 2 2 2 N=8		7.5				-0.5
										8.0	Loose, fine to coarse SAND, minor gravel; light grey; saturated, non plastic. Sand and gravel: subangular to subrounded, SW; grey; pumiceous.			-1.0
		0 %	WB							8.5	No core recovery.			-1.5
		67 %	SPT							9.0				-2.0
								4 4 4 4 6 6 N=20		9.5	Medium dense, SILT, minor fine to medium gravel; light grey; saturated, gap graded, pumiceous. Gravel: subrounded, SW, pumice.			-2.5
		0 %	WB								No core recovery.			

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB01B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB01A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
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LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgecumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
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E 1,936,307 m						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)						
		0 %	WB					1	10.5				-3.5
		89 %	SPT					1		Very soft, PEAT, some silt; brown; wet, H3, fibrous and amorphous.			
								0	11.0	No core recovery.			-4.0
		0 %	WB					0	11.5				-4.5
								0	12.0				-5.0
		100 %	SPT					0	12.5	Very soft, PEAT, some silt; brown; wet, H3, fibrous and amorphous.			-5.5
								1		No core recovery.			
		0 %	WB					0	13.0				-6.0
								0	13.5				-6.5
		89 %	SPT					2	14.0	Loose, fine to coarse SAND, minor fine to medium gravel; light grey speckled white; saturated, non plastic. Sand and gravel: subangular to subrounded, pumiceous.			-7.0
								3		Very loose, SILT, some fine sand, minor organics; light brown; moist, non plastic. Organics: amorphous and fibrous <5 mm.			
		0 %	WB					2	14.5	No core recovery.			-7.5
								2					
								2					
								2					
								1					
								N=7					

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB01B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB01A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
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SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
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E 1,936,307 m						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)						
		0 %	WB					4					
		78 %	SPT					4			Medium dense, fine to coarse SAND, minor fine to medium gravel; light grey speckled white; saturated, non plastic. Sand and gravel: subangular to subrounded, pumiceous.		-8.5
		0 %	WB					3			No core recovery.		-9.0
		89 %	SPT					5					-9.5
								6			Medium dense, fine to coarse SAND, minor fine gravel; light grey; saturated, non plastic. Sand and gravel: subangular to subrounded, pumiceous.		-10.0
								7					
								7					
								7					
								N=27					
											END OF LOG @ 17.15 m		
													-10.5
													-11.0
													-11.5
													-12.0
													-12.5

DATE STARTED: 16/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB01B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB01A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 16/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No: NA	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
COORDINATES: N 5,790,248 m						R.L.: 7 m		COORDINATE ORIGIN: MAP			
E 1,936,304 m						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	γ (kPa)						
		100 %	Sonic								Tightly packed, fine to coarse GRAVEL, minor fine to coarse sand, minor silt; brownish orange; moist, matrix supported, non plastic. Gravel: angular to sub-rounded, HW, bluish grey, greywacke. [Temporary Embankment]	Fill	6.5
		83.3 %									'Very loose', SILT, some organics; brown; moist, non plastic. Organics: amorphous and rootlets. [Topsoil]		6.0
		100 %									'Medium dense', fine to coarse GRAVEL, some fine to coarse sand, minor silt; greyish brown; moist, non plastic. Gravel: angular to subangular, MW, greywacke.		5.5
		100 %									1.35-1.50m, core loss, core bound.		5.0
		100 %									2.50m, saturated.		4.5
		100 %									'Loose', fine to coarse SAND, some fine to coarse gravel, some silt; brown mottled orange and grey; wet, non plastic. Gravel: angular to subangular, MW, greywacke and subrounded, MW, pumice.		4.0
		100 %											3.5
		100 %											3.0
		100 %											2.5
		100 %									Soft SILT, minor organics, trace clay; bluish brown; moist, low plasticity. Organics: amorphous. Interbedded with 150mm spaced and 5mm thick beds of moderately decomposed fibrous wood stained with FeO.		

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB02B 1.5m along crest of flood wall from SB02A and are presented on the log for SB02B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±-5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: Sonic	
SHEAR VANE No: 1825	DRILL FLUID:	
DIAMETER/INCLINATION: - / 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
COORDINATES: N 5,790,248 m						R.L.: 7 m		COORDINATE ORIGIN: MAP			
E 1,936,304 m						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)	
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	γ (kPa)							SPT 'N'
		100 %	Sonic			14/2	28/5		5.5		5.50m, firm; light brown.	Tauranga Group - Holocene Swamp Deposits	1.5	
		100 %								6.0			Soft, PEAT; black; H4, fibrous and amorphous, wet, non plastic.	1.0
		100 %								6.10m, 20mm bed of fine to medium SAND, trace silt; grey; subangular to subrounded, pumiceous.				
		100 %								6.35m, single piece of moderately decomposed wood <70mm.				
		100 %								6.85, grey.				
		100 %								7.0			'Loose', fine to medium GRAVEL, minor medium to coarse sand; grey; wet, pumice. Gravel: subrounded to rounded. Sand: subangular to subrounded, pumiceous.	0.0
		100 %								7.20m, trace fine to medium gravel.				
		100 %								7.5			'Medium dense', fine SAND, minor medium to coarse sand, minor medium to coarse gravel, minor silt, wet, quick. Sand: subangular to subrounded, pumiceous. Gravel: subangular to subrounded, MW, pumice.	-0.5
		100 %								8.0				-1.0
		100 %								8.5				-1.5
		100 %							8.80m, trace medium to coarse sand, trace gravel.		-2.0			
		100 %							9.0			-2.5		
		100 %							9.5		9.5m, cross bedded, undulating 1mm laminations.			
		100 %									'Medium dense', silty fine SAND; grey; moist, pumiceous. Fine bands; light grey.			

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB02B 1.5m along crest of flood wall from SB02A and are presented on the log for SB02B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±-5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: Sonic	
SHEAR VANE No: 1825	DRILL FLUID: DIAMETER/INCLINATION: - / 90°	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

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MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM			BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.								
COORDINATES: N 5,790,248 m			R.L.: 7 m			COORDINATE ORIGIN: MAP					
E 1,936,304 m			DATUM: Moturiki 1953			ACCURACY: ±5m					

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	SV	γ (kPa)	SPT 'N'						
		100 %									'Medium dense', silty fine SAND; grey; moist, pumiceous.		
		100 %							10.5		PEAT; brown; H4, amorphous and fibrous, wood <50mm. Interbedded with 5mm beds spaced 100mm of silty fine sand.		-3.5
		100 %									'Very loose', silty fine to coarse SAND, trace fine gravel; grey; wet, non plastic. Gravel: subrounded, pumiceous.		
		100 %									'Very loose', SILT, trace fine sand; grey; wet, non plastic, pumiceous.		
		100 %							11.0		Very soft, PEAT; black mottled brown; H4, fibrous and amorphous, saturated, non plastic.		-4.0
		100 %									'Very loose', silty fine SAND, trace fine gravel; greenish grey; wet, non plastic.		
		100 %							11.5		Soft, organic SILT, minor fine sand, trace fine gravel; brown; wet, non plastic. Organics: amorphous, fibrous, trace wood (<50 mm). Gravel: subrounded, SW, pumice.		-4.5
		100 %											
		100 %							12.0		11.95m, 20mm bed of fine to coarse SAND, minor fine gravel, minor organics, pumiceous.		-5.0
		100 %									'Very loose', fine sandy SILT; light bluish grey, wet, non plastic.		
		100 %									Very soft PEAT; black mottled brown; saturated, H4, fibrous and amorphous, non plastic. Slightly decomposed single piece of wood: 100x40mm.		
		100 %							12.5		12.3m, some silt.		
		100 %									Soft, PEAT; black; H4, moist, non plastic.		-5.5
		100 %									Soft, SILT, minor clay; grey; moist, high plasticity.		
		100 %									'Loose', fine to medium SAND; grey; pumiceous.		
		100 %									'Loose', fine to coarse SAND, minor fine gravel; grey speckled white; saturated, non plastic. Sand and gravel: subangular to subrounded, pumiceous.		-6.0
		100 %											
		100 %							13.5		13.50m, 10mm thick bed of fine to medium SAND, trace organics; grey banded brown.		-6.5
		100 %											
		100 %							14.0		Bed of fine to medium SAND; grey banded brown.		-7.0
		100 %									'Loose', SILT, minor organics, trace fine sand; brown; moist, non plastic. Organics: amorphous and fibrous, slightly decomposed, fine rootlets.		
		100 %											
		100 %							14.5		Soft, PEAT; black; H4, amorphous and fibrous.		-7.5
		100 %									Soft, SILT, minor organics, trace clay; grey speckled brown; moist, low plasticity.		
		100 %									'Medium dense', fine to coarse SAND, minor fine to medium gravel, trace silt; grey; wet,		

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB02B 1.5m along crest of flood wall from SB02A and are presented on the log for SB02B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: Sonic	
SHEAR VANE No: 1825	DRILL FLUID: DIAMETER/INCLINATION: - / 90°	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM			BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.								
COORDINATES: N 5,790,248 m E 1,936,304 m			R.L.: 7 m			COORDINATE ORIGIN: MAP			ACCURACY: ±5m		
DATUM: Moturiki 1953											

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'						
		100 %	Sonic									non plastic. Sand: subangular to subrounded, pumiceous. Gravel: rounded to subrounded, SW, pumice.	Tauranga Group - Holocene Swamp Deposits	-8.5
		100 %										'Dense', silty fine SAND, trace coarse sand, trace gravel; grey; wet, non plastic. Sand: subangular to subrounded, pumiceous. Gravel: rounded to subrounded, SW, pumiceous.		-9.0
												'Dense', SILT, trace fine sand; grey; moist, non plastic.		-9.5
												'Dense', medium to coarse SAND, trace fine sand, trace fine gravel; grey; saturated. Sand: subangular to subrounded, pumiceous. Gravel: subrounded, SW, pumice.		-10.0
		100 %										17.00m, minor fine gravel.		-10.5
												'Dense', fine to medium SAND, trace silt; grey; wet, non plastic. [Estuarine Deposit]		-11.0
												'Dense', fine to coarse SAND, trace silt; bluish grey; wet, non plastic. [Estuarine Deposit]		-11.5
												END OF LOG @ 18.3 m		-12.0
														-12.5

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SPT's were carried out in SB02B 1.5m along crest of flood wall from SB02A and are presented on the log for SB02B. Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±-5m) and elevation est. from temporary embankment survey cross section 13/04/17.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: Sonic	
SHEAR VANE No: 1825	DRILL FLUID: DIAMETER/INCLINATION: -/ 90°	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

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MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: College Road Breach Investigation		JOB NUMBER: 3208176	
SITE LOCATION: College Road, Edgecumbe		CLIENT: Bay of Plenty Regional Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.	
COORDINATES: N 5,790,249 m E 1,936,304 m		R.L: 7 m DATUM: Moturiki 1953 COORDINATE ORIGIN: MAP ACCURACY: ±5m	

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	γ (kPa)	SPT N						
		0 %	WB									No core recovery.		
		100 %	SPT					2 3 2 5 4 4 N=15				Medium dense, silty fine to coarse SAND, minor fine to coarse gravel; grey; moist, non plastic. Gravel: angular to subangular, MW; brown; greywacke.		
		0 %	WB									No core recovery.		
		100 %	SPT					2 3 3 3 2 2 N=10				Loose, fine to coarse SAND, some fine to coarse gravel, some silt; brown mottled orange and grey; wet, non plastic. Gravel: angular to subangular, MW, greywacke and subrounded, MW, pumiceous.		
		0 %	WB									No core recovery.		
		100 %	SPT					1 1 2 1 0 0 N=3				Loose, fine to coarse SAND, some fine to coarse gravel, some silt; brown mottled orange and grey; wet, non plastic. Gravel: angular to subangular, MW, greywacke and subrounded, MW, pumiceous.		
												Soft SILT, minor organics, trace clay; bluish brown; moist, low plasticity. Organics: amorphous.		

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB02B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB02A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No:	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: College Road Breach Investigation				JOB NUMBER: 3208176			
SITE LOCATION: College Road, Edgecumbe				CLIENT: Bay of Plenty Regional Council			
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.		R.L.: 7 m		COORDINATE ORIGIN: MAP	
COORDINATES: N 5,790,249 m E 1,936,304 m		DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	↑ (kPa)	SPT N						
		0 %	WB									No core recovery.		1.5
		100 %	SPT					0 0 1 1 2 2 2 N=6		6.0		Soft PEAT; black; wet, H4, amorphous and fibrous, non plastic.		1.0
		0 %	WB							6.5		Loose, fine gravelly fine to coarse SAND, minor silt; brownish orange; moist, non plastic. Gravel: subrounded, HW, pumice. Sand: subangular to subrounded, pumiceous.		0.5
		0 %	WB							7.0		No core recovery.		0.0
		100 %	SPT					2 3 4 4 4 4 N=16		7.5		Medium dense, fine SAND, minor medium to coarse sand, trace silt, trace gravel; grey; wet, quick. Sand: subangular to subrounded, pumiceous. Gravel: subangular to subrounded, MW, pumice.		-0.5
		0 %	WB							8.0		No core recovery.		-1.0
		100 %	SPT					4 4 4 5 4 4 N=17		9.0		Medium dense, fine to medium GRAVEL, minor medium to coarse sand; grey; wet. Gravel: subrounded to rounded, pumice. Sand: subangular to subrounded, pumice.		-2.0
		0 %	WB							9.5		Medium dense, fine SAND, minor medium to coarse sand, minor medium to coarse gravel, minor silt, wet, quick. Sand: subangular to subrounded, pumiceous. Gravel: subangular to subrounded, MW, pumice.		-2.5
												No core recovery.		

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB02B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB02A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No:	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

RevA

MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: College Road Breach Investigation		JOB NUMBER: 3208176	
SITE LOCATION: College Road, Edgumbe		CLIENT: Bay of Plenty Regional Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.	
COORDINATES: N 5,790,249 m E 1,936,304 m		R.L.: 7 m DATUM: Moturiki 1953 COORDINATE ORIGIN: MAP ACCURACY: ±5m	

DRILLING						IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ _v (kPa)	SPT N						
		0 %	WB					2 1 1 1 0 1 N=3		10.5				-3.5
		100 %	SPT							11.0	No recovery in SPT			-4.0
		0 %	WB							11.5	No core recovery.			-4.5
		100 %	SPT					1 0 0 1 0 0 N=1		12.0				-5.0
		100 %	SPT							12.5	Very soft, PEAT; black mottled brown; saturated, H4, fibrous and amorphous, non plastic.			-5.5
		0 %	WB							13.0	No core recovery.			-6.0
		100 %	SPT					3 3 3 3 2 2 N=10		13.5				-6.5
		100 %	SPT							14.0	Poor recovery. Corebound on single gravel, subrounded, SW, rhyolite? Wood fragments also recovered.			-7.0
		0 %	WB							14.5	No core recovery.			-7.5

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB02B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB02A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No:	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

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MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: College Road Breach Investigation						JOB NUMBER: 3208176					
SITE LOCATION: College Road, Edgecumbe						CLIENT: Bay of Plenty Regional Council					
CIRCUIT: NZTM						BOREHOLE LOCATION: Crest of temporary stop bank. 0.5m on river side of flood wall.					
COORDINATES: N 5,790,249 m E 1,936,304 m						R.L.: 7 m		COORDINATE ORIGIN: MAP			
						DATUM: Moturiki 1953		ACCURACY: ±5m			

DRILLING					IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)						
		0 %	WB					3					
		100 %	SPT					4			Medium dense, fine to coarse SAND, some fine to medium gravel, trace silt; grey; wet, non plastic. Sand: subangular to subrounded, pumiceous. Gravel: rounded to subrounded, SW, pumice.		
								4			Wood fragments, slightly decomposed.		-8.5
		0 %	WB					4			No core recovery.		
								4					-9.0
		0 %	WB					3					
		100 %	SPT					7			Dense, silty fine SAND, trace coarse sand, trace gravel, grey, wet, non plastic. Sand: subangular to subrounded, pumiceous. Gravel: rounded to subrounded, SW, pumice.		
								9			SILT, trace fine sand; grey; moist, non plastic.		-10.0
								8			No core recovery.		
		0 %	WB					9					-10.5
								6					
								9					-11.0
								10					
			SPT					10			Dense, fine to coarse SAND, trace fine to medium gravel, trace silt; bluish grey; wet, non plastic. Gravel: shell fragments.		-11.5
								12					
								14					
								N=46					
											END OF LOG @ 18.75 m		
													-12.0
													-12.5

DATE STARTED: 15/6/17	DRILLED BY: Pro-Drill Auck. Ltd	COMMENTS: SB02B carried out for SPT's and piezo install 1.5m along crest of floodwall from SB02A. Coords est. from site measurements using BOPRC Bay eXplorer (accurate +/-5m) and elevation est. from temporary embankment survey cross section 13/04/17. SPT hammer average energy efficiency 92%.
DATE FINISHED: 15/6/17	EQUIPMENT: Fraste XLZ White	
LOGGED BY: JRG	DRILL METHOD: SPT/WB	
SHEAR VANE No:	DRILL FLUID: Water	
DIAMETER/INCLINATION: 140 mm/ 90°		

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

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Appendix D

Machine Borehole Core Photographs

College Road Breach Investigation



BOX: 1

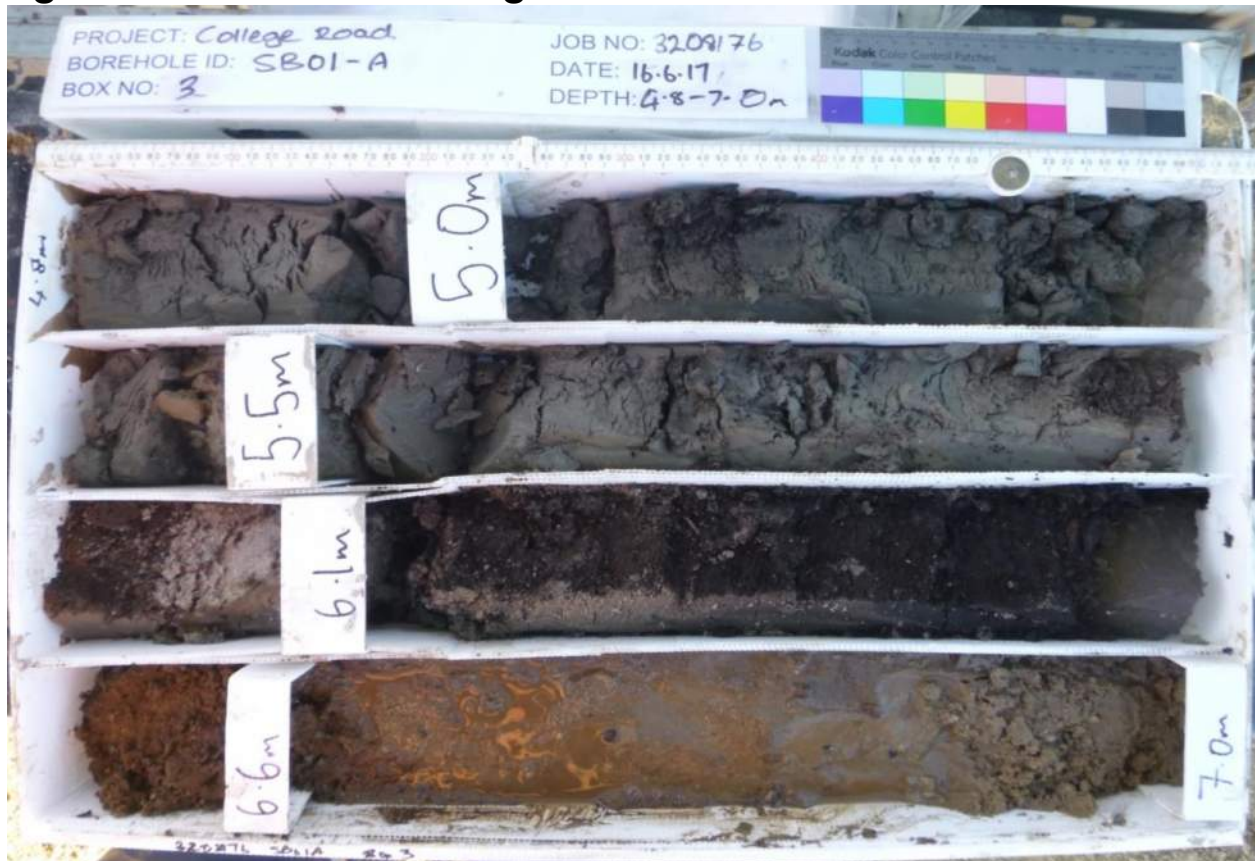
DEPTH: 0.00 to 2.40m



BOX: 2

DEPTH: 2.40 to 4.80m

College Road Breach Investigation



BOX: 3

DEPTH: 4.80 to 7.00m



BOX: 4

DEPTH: 7.00 to 9.30m

College Road Breach Investigation



BOX: 5

DEPTH: 9.30 to 11.50m



BOX: 6

DEPTH: 11.50 to 14.00m

College Road Breach Investigation



BOX: 7

DEPTH: 14.00 to 16.40m



BOX: 8

DEPTH: 16.40 to 16.70m

College Road Breach Investigation



BOX: 1

DEPTH: 0.00 to 2.50m



BOX: 2

DEPTH: 2.50 to 4.80

College Road Breach Investigation



BOX: 3

DEPTH: 4.80 to 7.25m



BOX: 4

DEPTH: 7.25 to 9.70m

College Road Breach Investigation



BOX: 5

DEPTH: 9.70 to 12.20m



BOX: 6

DEPTH: 12.20 to 14.60m

College Road Breach Investigation



BOX: 7

DEPTH: 14.60 to 17.00m



BOX: 8

DEPTH: 17.00 to 18.30m

Appendix E

Test Pit Logs

WATER



Water level on date shown

METHOD (shows drilling method)

OB	open barrel
Wash	wash boring
TT	triple tube
UT	thin walled undisturbed tube
SPT	standard penetration test – open nose sampler
Nc	standard penetration test – solid nose sampler
MA	machine auger
PS	piston sample
PCT	percussion – top drive
PCB	percussion – bottom drive
Conc	concentrics
Sonic	sonic
HA	hand auger
VE	vacuum excavation

SAMPLES

Dx	Disturbed sample, number x
Bx	Bulk sample, number x
Ux(d)	Undisturbed sample, number x, tube diameter d in mm
Wx	Water sample, number x

MOISTURE

Dry, looks and feels dry
 Moist, no free water on hand when remoulding
 Wet, free water on hand when remoulding
 Saturated, soil below water table

SOIL AND ROCK DESCRIPTIONS

CONSISTENCY

Cohesive Soils	Undrained Shear Strength (kPa)
Very soft	<12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	>200

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.

Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

IN SITU TESTS

SV	= 40/10	In situ shear strength and remoulded shear strength respectively, as measured by Geotechnics/ Pilcon Shear Vane
τ	= 50/12	Vane shear strength and remoulded vane shear strength respectively, corrected to BS1377
UTP	=	Unable To Penetrate with Shear Vane
N	= 15	SPT uncorrected blow count for 300mm penetration
N _c	= 50+	SPT uncorrected blow count for 300 mm penetration using solid nose sampler

★

AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

CW	Completely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
UW	Unweathered

GRAPHIC LOG (1 or a combination of the following)

	Fill		Silt		Cobbles		Sandstone		Fine igneous
	Core loss		Sand		Boulders		Limestone		Coarse igneous
	Organics		Shells		Mudstone		Schist		
	Clay		Gravel		Siltstone		Basalt		

ORGANIC SOILS

Von Post Degree of Humification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Practically unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives marked muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

TEST PIT LOG

SHEET 1 of 1

PROJECT: College Road Breach Investigation			JOB NUMBER: 3208176		
SITE LOCATION: College Road, Edgumbe			CLIENT: Bay of Plenty Regional Council		
CIRCUIT: NZTM		TEST PIT LOCATION: Excavated to inspect foundation soils beneath rd side of flood wall			
COORDINATES: N 5,790,268 m E 1,936,306 m		R.L.: 5.6 m		COORDINATE ORIGIN: MAP	
		DATUM: Moturiki 1953		ACCURACY: ±5m	

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	SV	γ (kPa)	WATER LEVEL	R.L. (m)
			Concrete footing for flood wall					5.5
0.5			Silty fine to medium SAND, trace fine gravel; brown; moist, non plastic. Gravel: sub-rounded, SW to MW; grey; pumice.					
			Tightly packed fine to coarse GRAVEL, minor fine to coarse sand, minor silt, trace cobbles and boulders; brown; moist, non plastic matrix. Gravel, cobbles and boulders: angular to subrounded, MW; brown; greywacke.					5.0
1.0			1.2m, some sand, wet.					4.5
1.5								4.0
2.0			Silty fine SAND, trace organics, trace fine gravel; brown; mottled orange and black; wet, non plastic. Gravel, subrounded, HW, pumice. Organics: amorphous.					3.5
			END OF LOG @ 2.1 m					
2.5								3.0
3.0								2.5
3.5								2.0
4.0								1.5
4.5								1.0

DATE EXCAVATED: 14/6/17	CONTRACTOR: Colin Amrein Ltd	COMMENTS: 0.0m datum for log taken as top of concrete slab (flood wall footing). Coords est. from site measurements using BOPRC Bay eXplorer (accurate +5m) and elevation est. from temporary embankment survey cross section 13/04/17. No groundwater encountered.
LOGGED BY: JRG	EQUIPMENT: 12T Machine Ex.	
SHEAR VANE No: NA	METHOD: Machine Ex.	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET	RevA
--	------

TEST PIT LOG

SHEET 1 of 1

PROJECT: College Road Breach Investigation			JOB NUMBER: 3208176		
SITE LOCATION: College Road, Edgumbe			CLIENT: Bay of Plenty Regional Council		
CIRCUIT: NZTM		TEST PIT LOCATION: Crib wall alongside College Road		COORDINATE ORIGIN: MAP	
COORDINATES: N 5,790,257 m E 1,936,301 m		R.L.: 5.6 m DATUM: Moturiki 1953		ACCURACY: ±5m	

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	SV	γ (kPa)	WATER LEVEL	R.L. (m)
		X X X	Fine sandy SILT, some organics; dark brown; moist, non plastic. [Topsoil]	Fill				5.5
0.5			Fine to coarse SAND, some silt, trace fine gravel; light brown mottled light grey; moist, non plastic. Sand: subangular to subrounded. Gravel: subangular to subrounded, SW; grey; pumice, and CW; reddish brown; lithics.					
			0.55m, 110mm cable conduit and 25mm cable. (Embedment material from cable trench not logged). Fine to medium SAND, minor silt; light grey speckled black; moist, non plastic.					5.0
			0.75m, single medium gravel, subangular, UW, dark grey, andesite.					
1.0			Fine to medium SAND, minor silt; light grey speckled black; moist, non plastic.	Tauranga Group - Holocene Swamp Deposits				
			Fine to coarse SAND, trace fine gravel; dark grey; moist, non plastic. Gravel: angular to subrounded, UW, black, mafic volcanic, and subrounded, SW, light grey, pumiceous. Discontinuous lense.					4.5
			Fine to medium SAND, minor silt; light grey speckled black; moist, non plastic.					
1.5		X X X	Fine sandy SILT, trace medium to coarse sand, trace clay; light grey mottled orange and dark orange; moist, low plasticity.			26/4	45/8	
			END OF LOG @ 1.6 m					4.0
2.0								
								3.5
2.5								
								3.0
3.0								
								2.5
3.5								
								2.0
4.0								
								1.5
4.5								
								1.0

DATE EXCAVATED: 14/6/17	CONTRACTOR: Colin Amrein Ltd	COMMENTS: This log presents the ground profile behind the crib wall. 0.0m datum for log taken as top of concrete slab (flood wall footing). Coords est. from site measurements using BOPRC Bay eXplorer (accurate ±5m) and elevation est. from temporary embankment survey cross section 13/04/17. No groundwater encountered.
LOGGED BY: JRG	EQUIPMENT: 12T Machine Ex.	
SHEAR VANE No: 1825	METHOD: Machine Ex.	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET	RevB
--	------

Appendix F

Test Pit Photographs

College Road Breach Investigation



Location Photo



Location Photo

College Road Breach Investigation



Depth: 0.0 - 1.5m



Depth 0.0 - 2.1m

TP01

College Road Breach Investigation



During removal of crib wall



During removal of crib wall

College Road Breach Investigation



0.0 - 1.5m

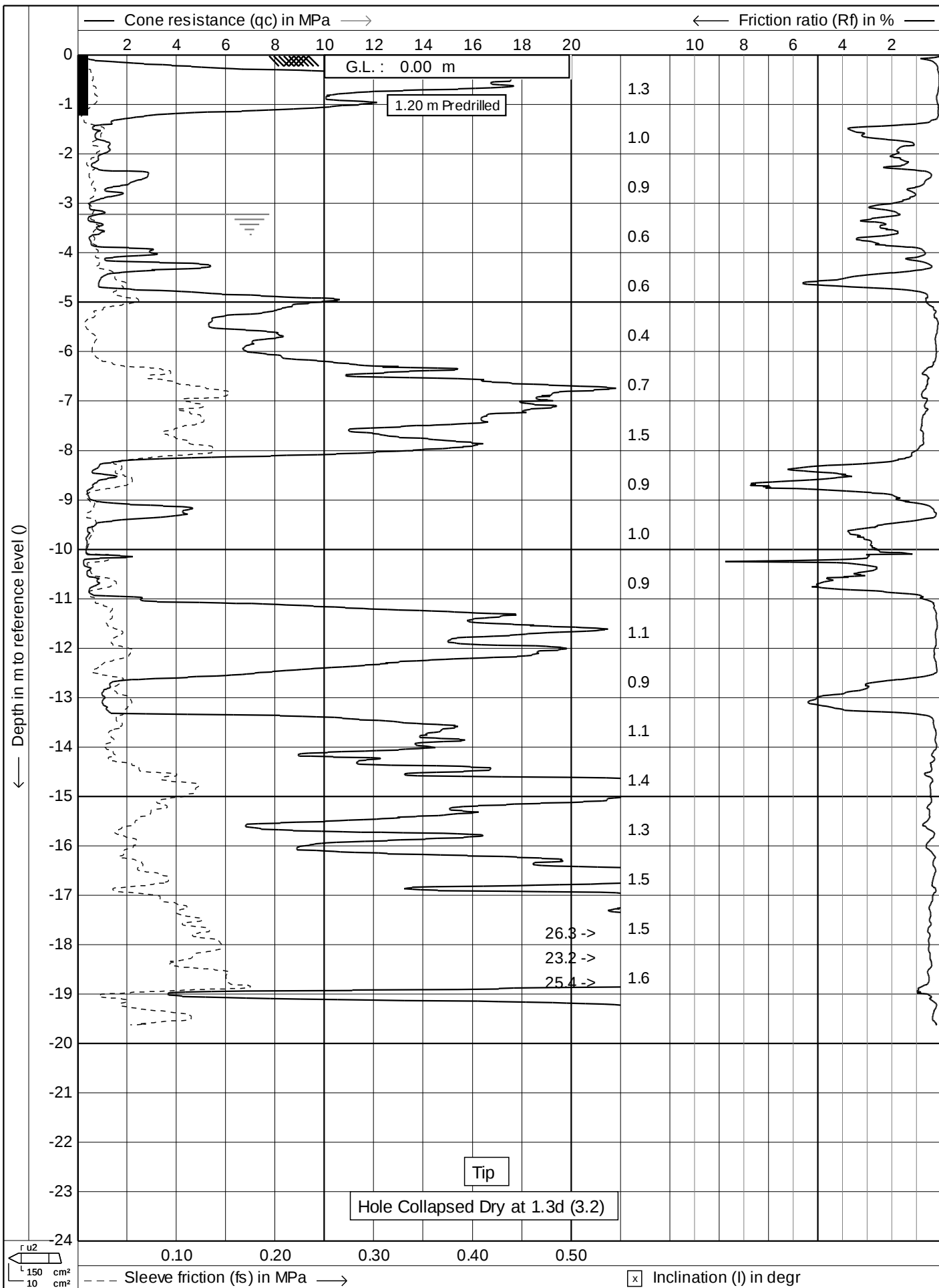


0.0 - 1.6m



Appendix G

Cone Penetration Test Data



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

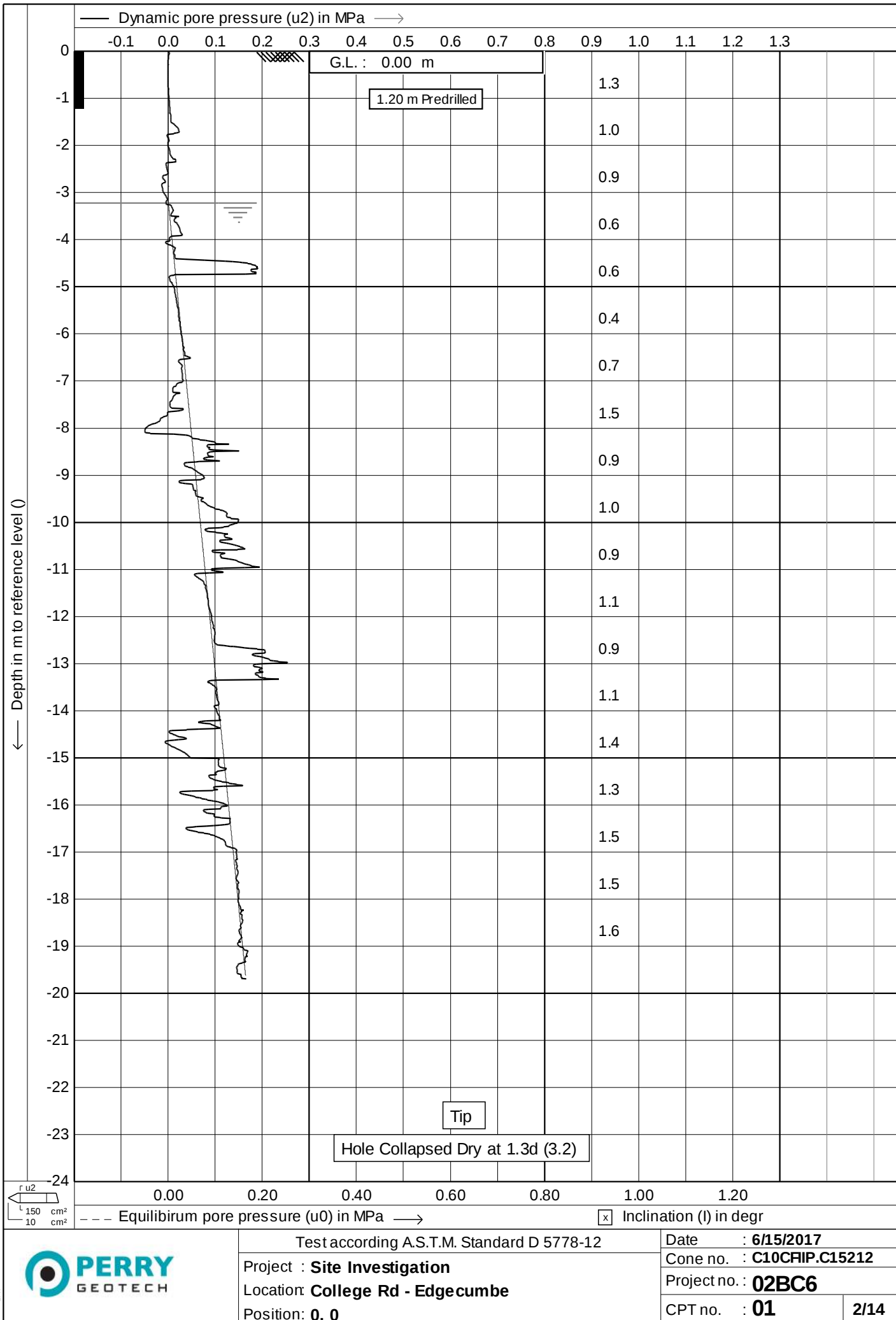
Position: **0, 0**

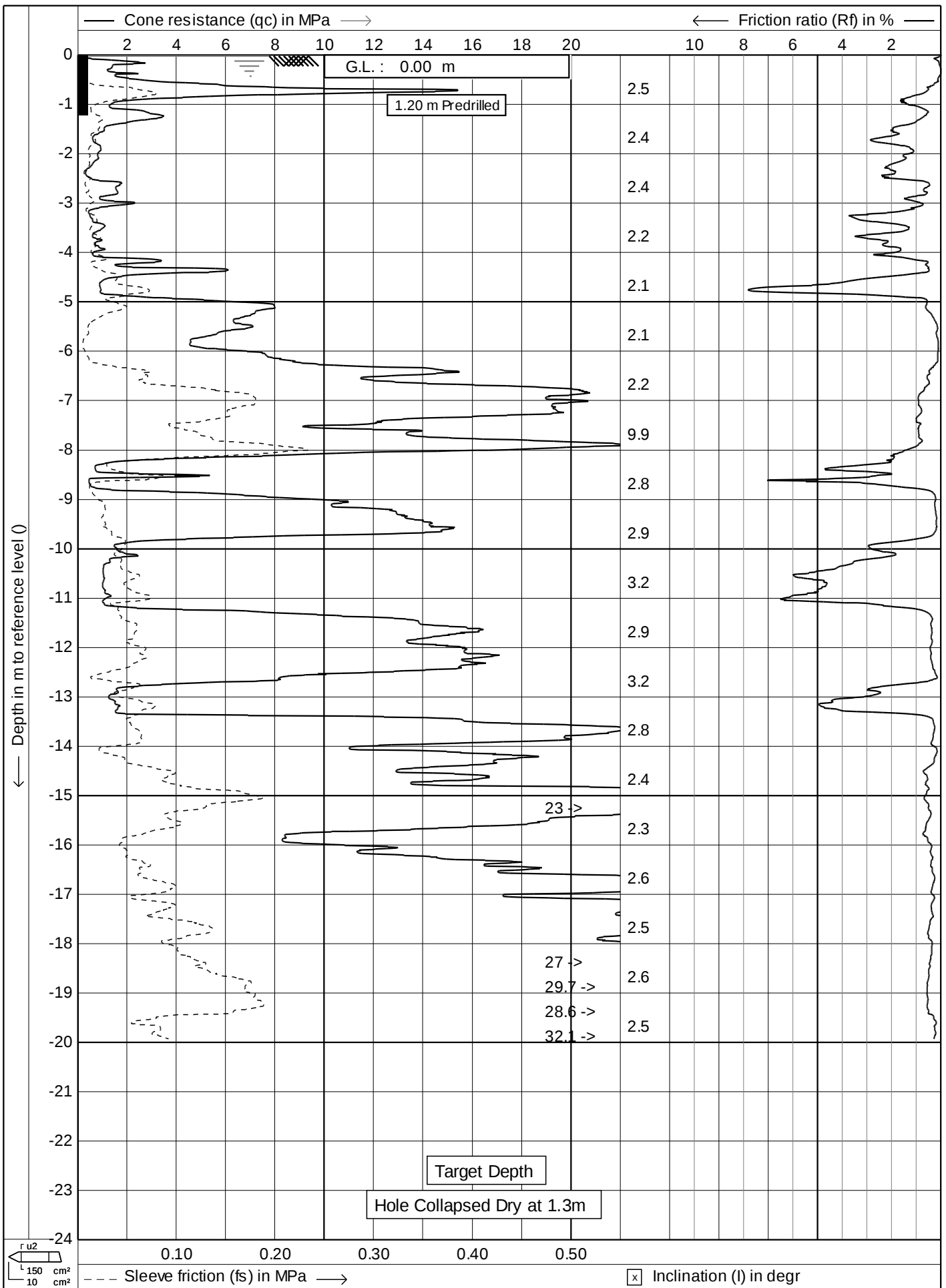
Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

Project no. : **02BC6**

CPT no. : **01**





Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

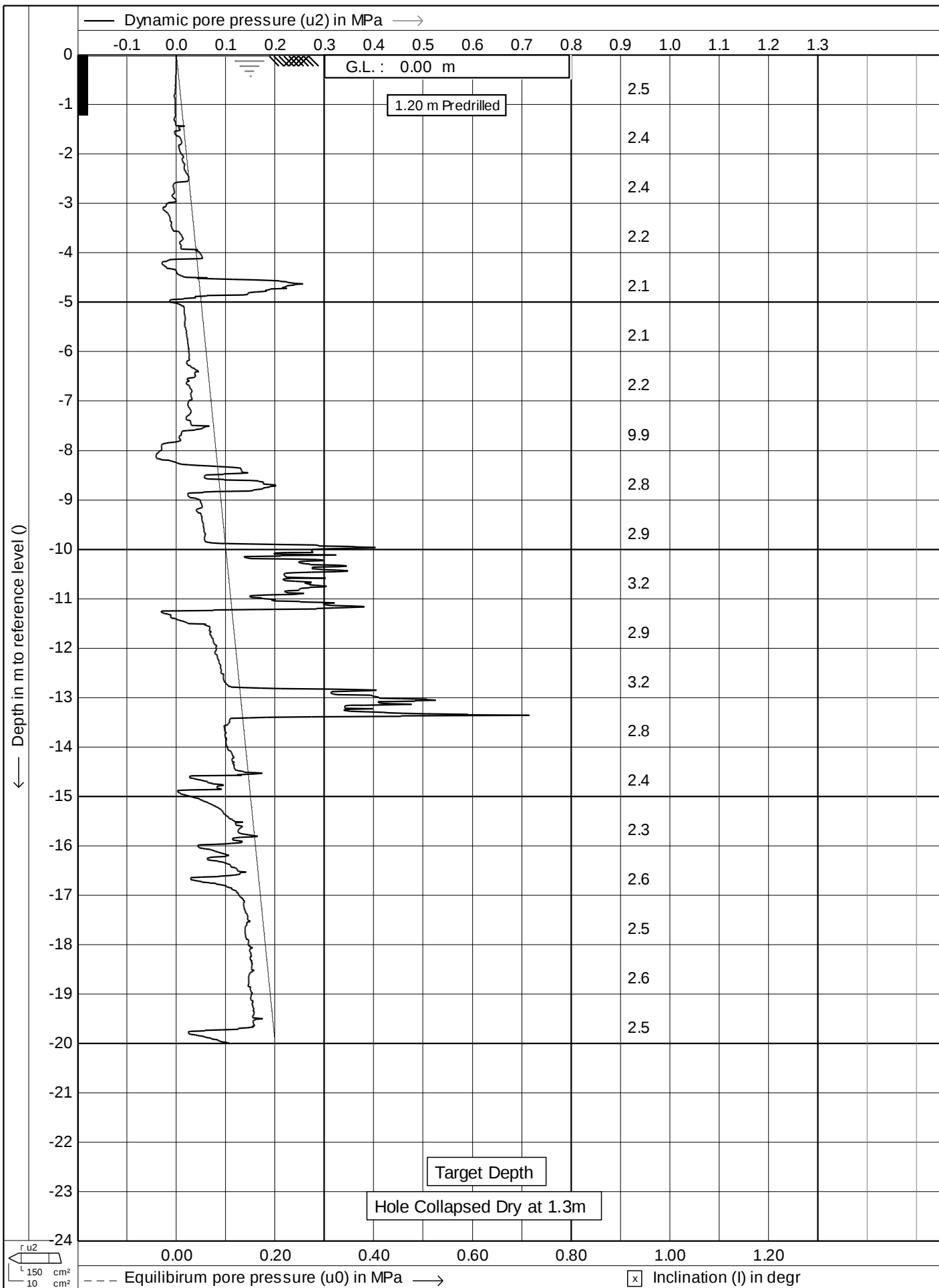
Position: **0, 0**

Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

Project no. : **02BC6**

CPT no. : **02** **1/14**



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

Position: **0, 0**

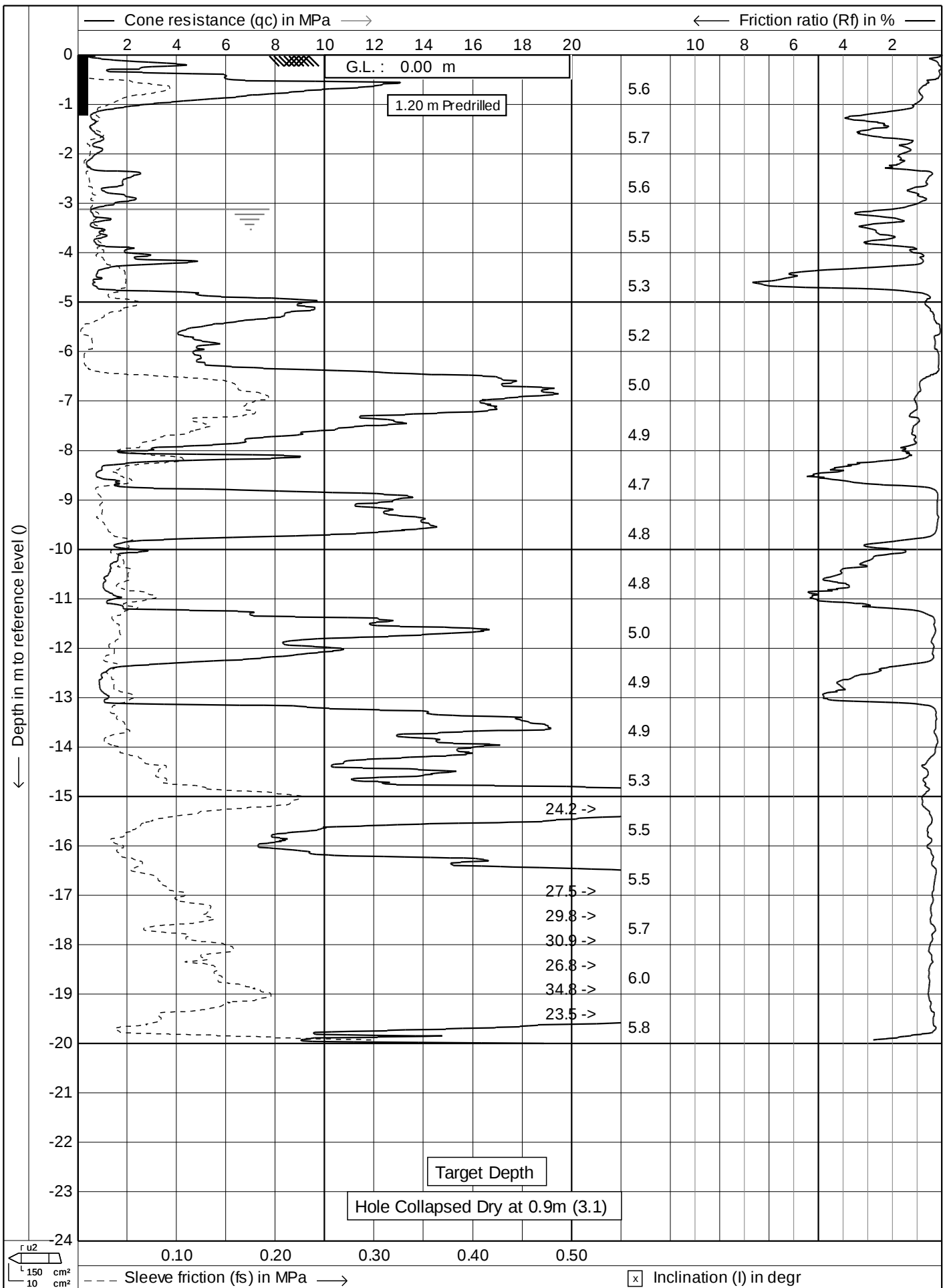
Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

Project no. : **02BC6**

CPT no. : **02**

2/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

Position: **0, 0**

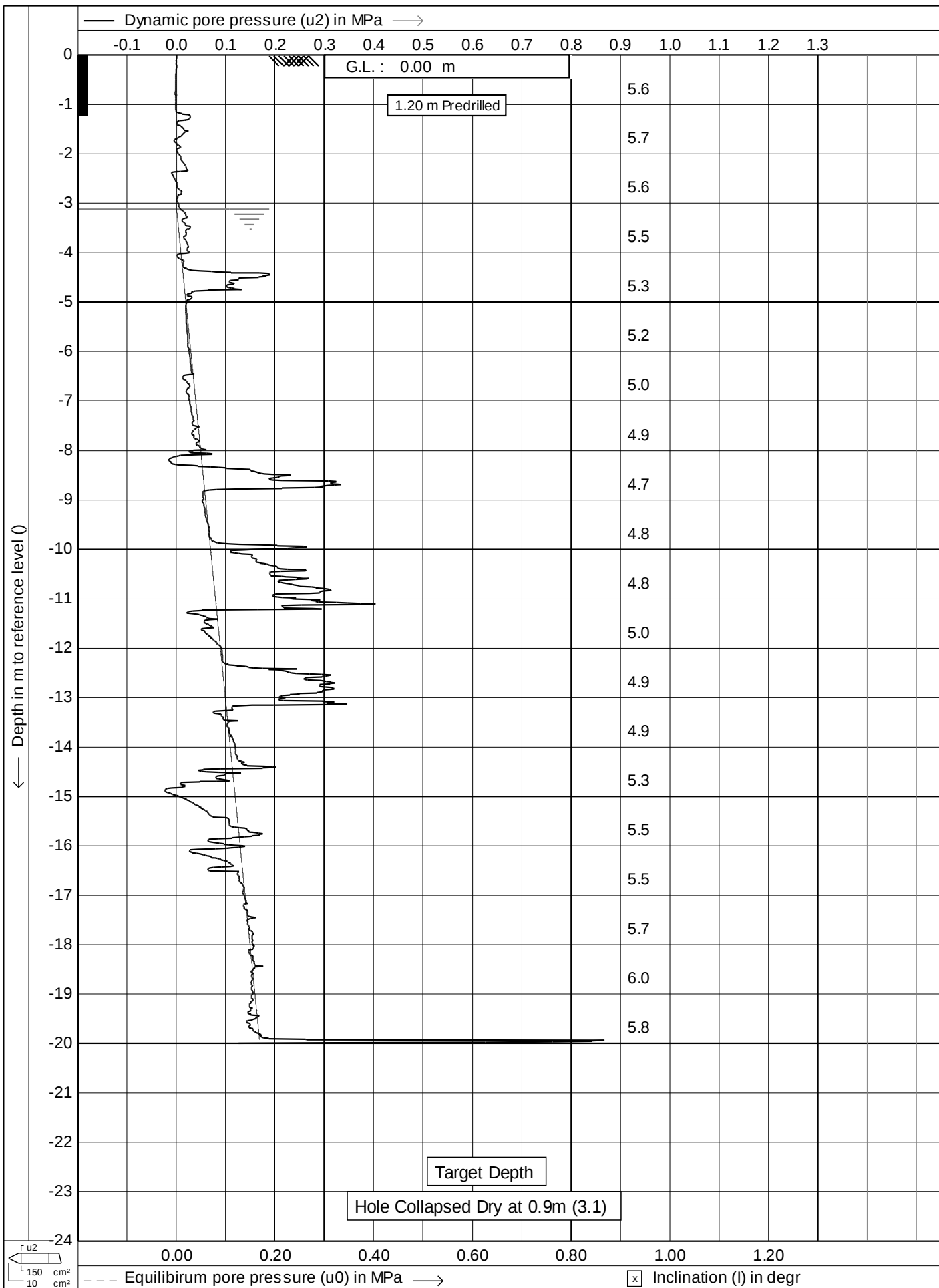
Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

Project no. : **02BC6**

CPT no. : **03**

1/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

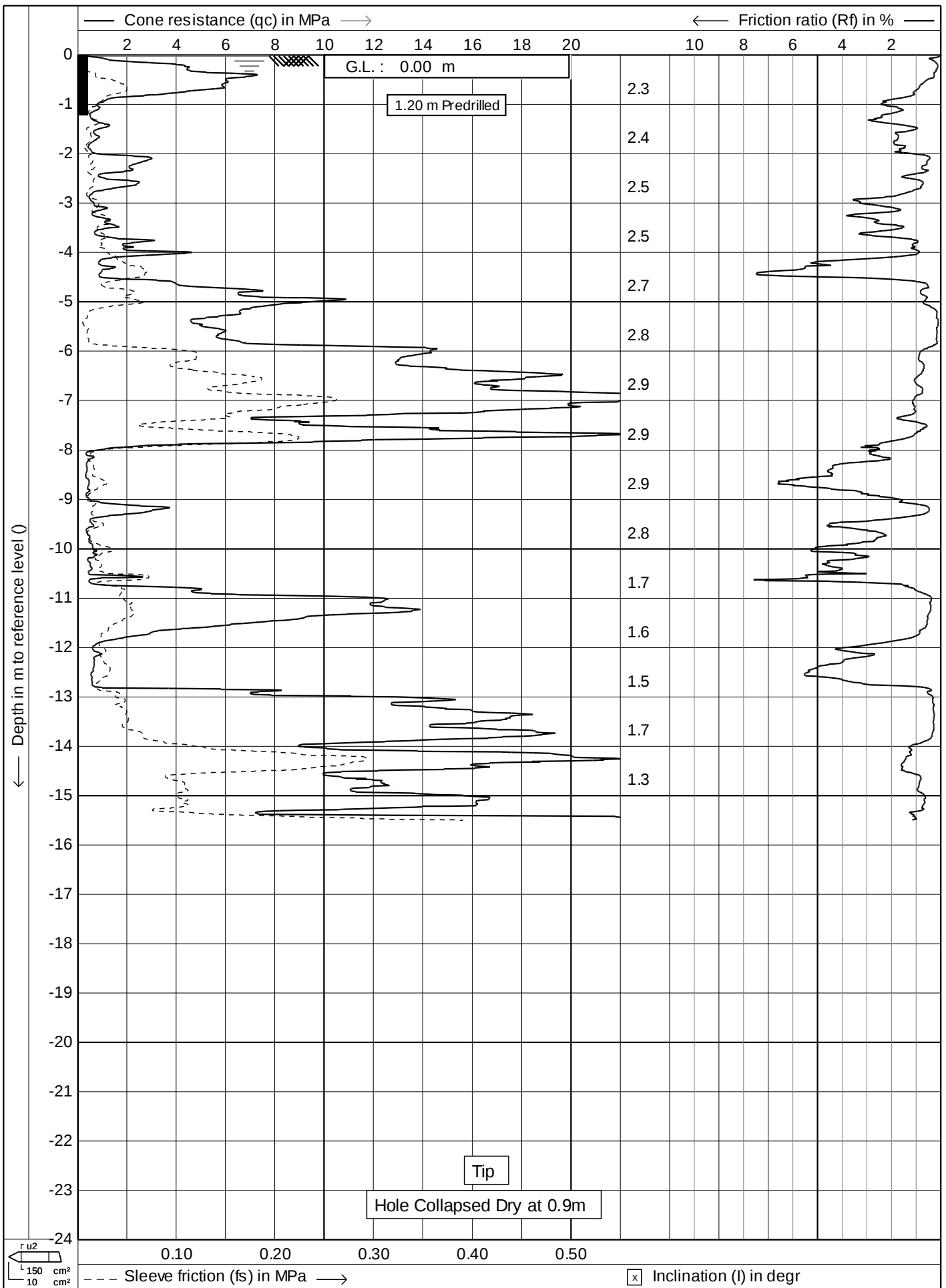
Position: **0, 0**

Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

Project no. : **02BC6**

CPT no. : **03**



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **College Rd - Edgecumbe**

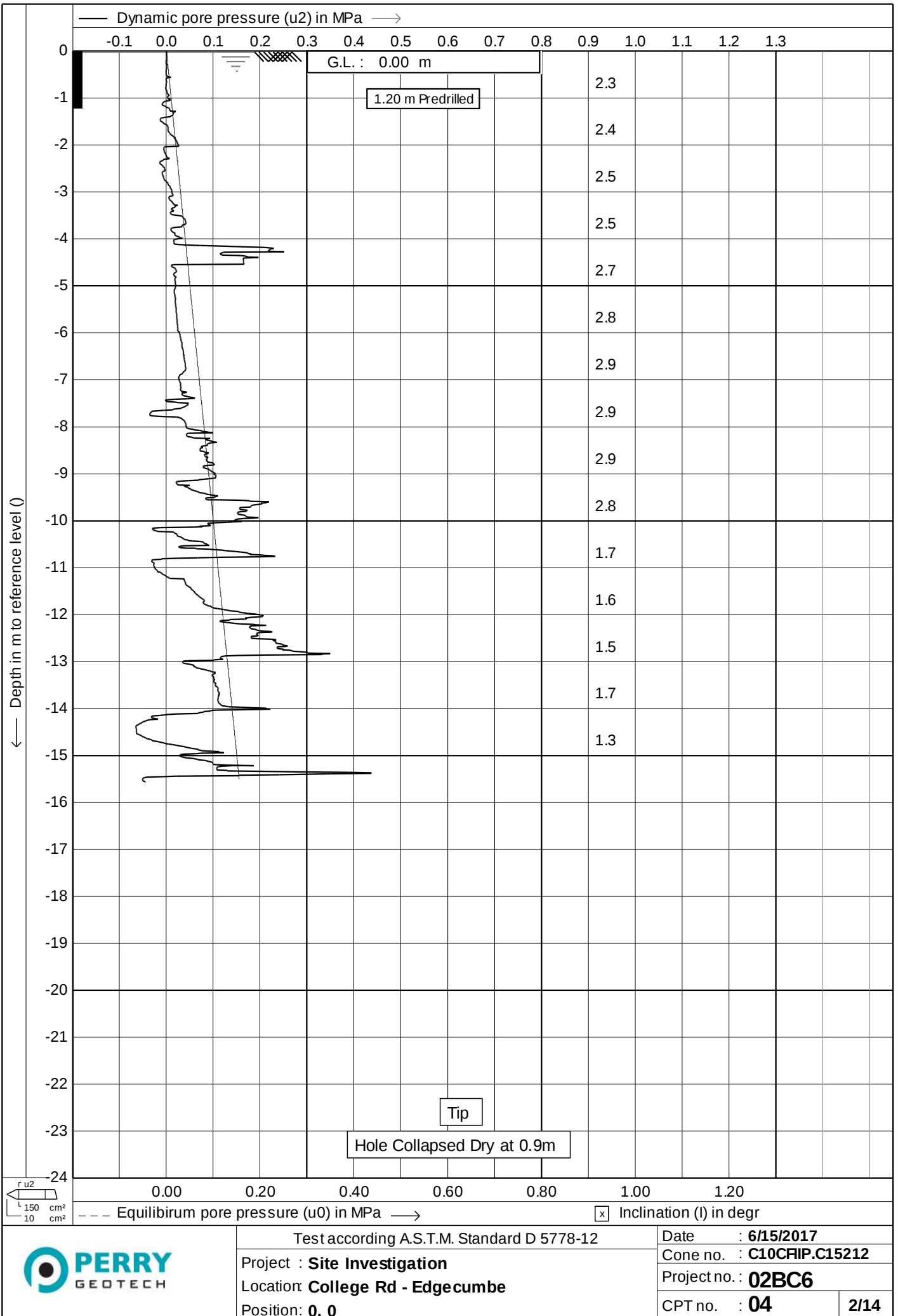
Position: **0, 0**

Date : **6/15/2017**

Cone no. : **C10CFIP.C15212**

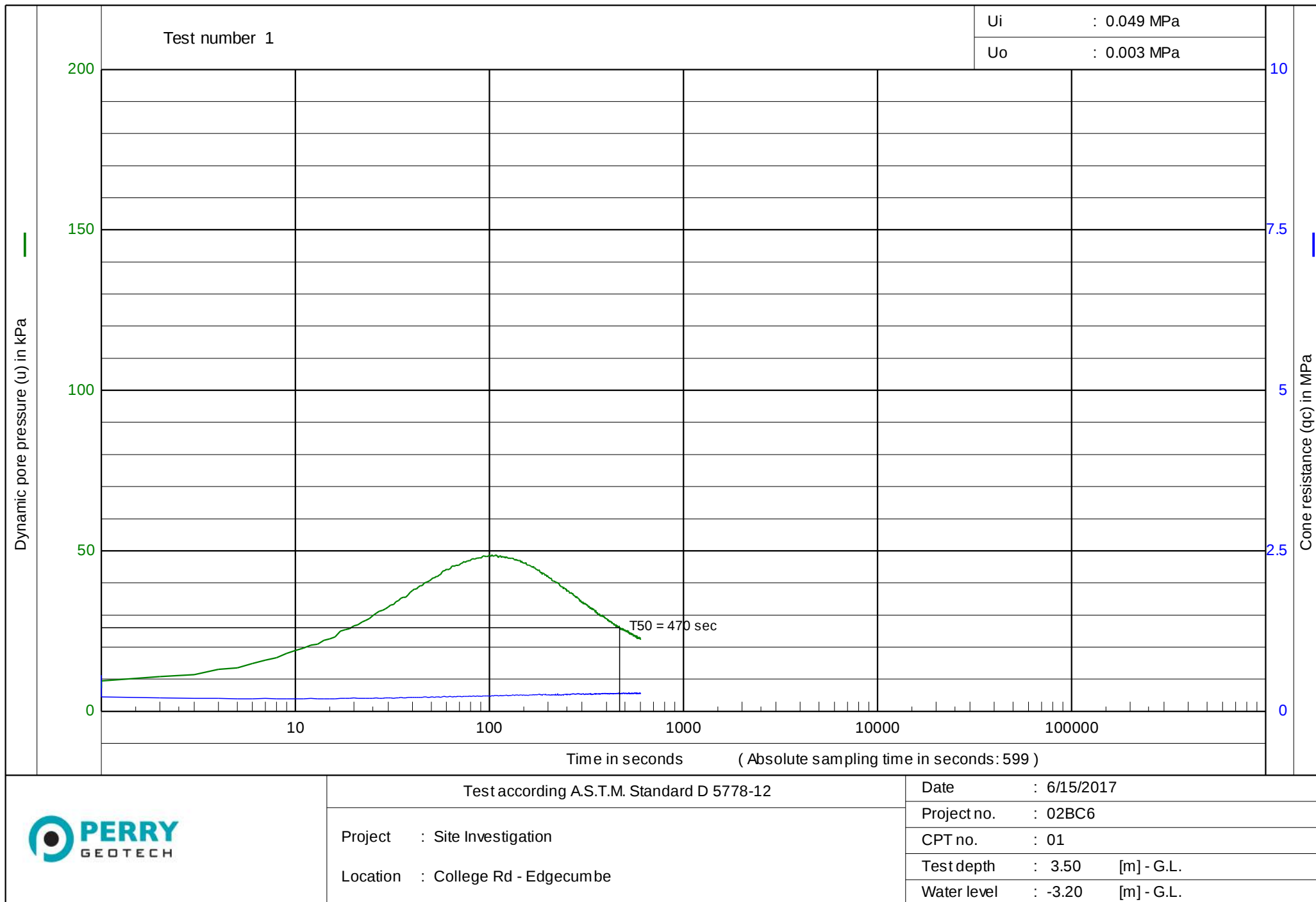
Project no. : **02BC6**

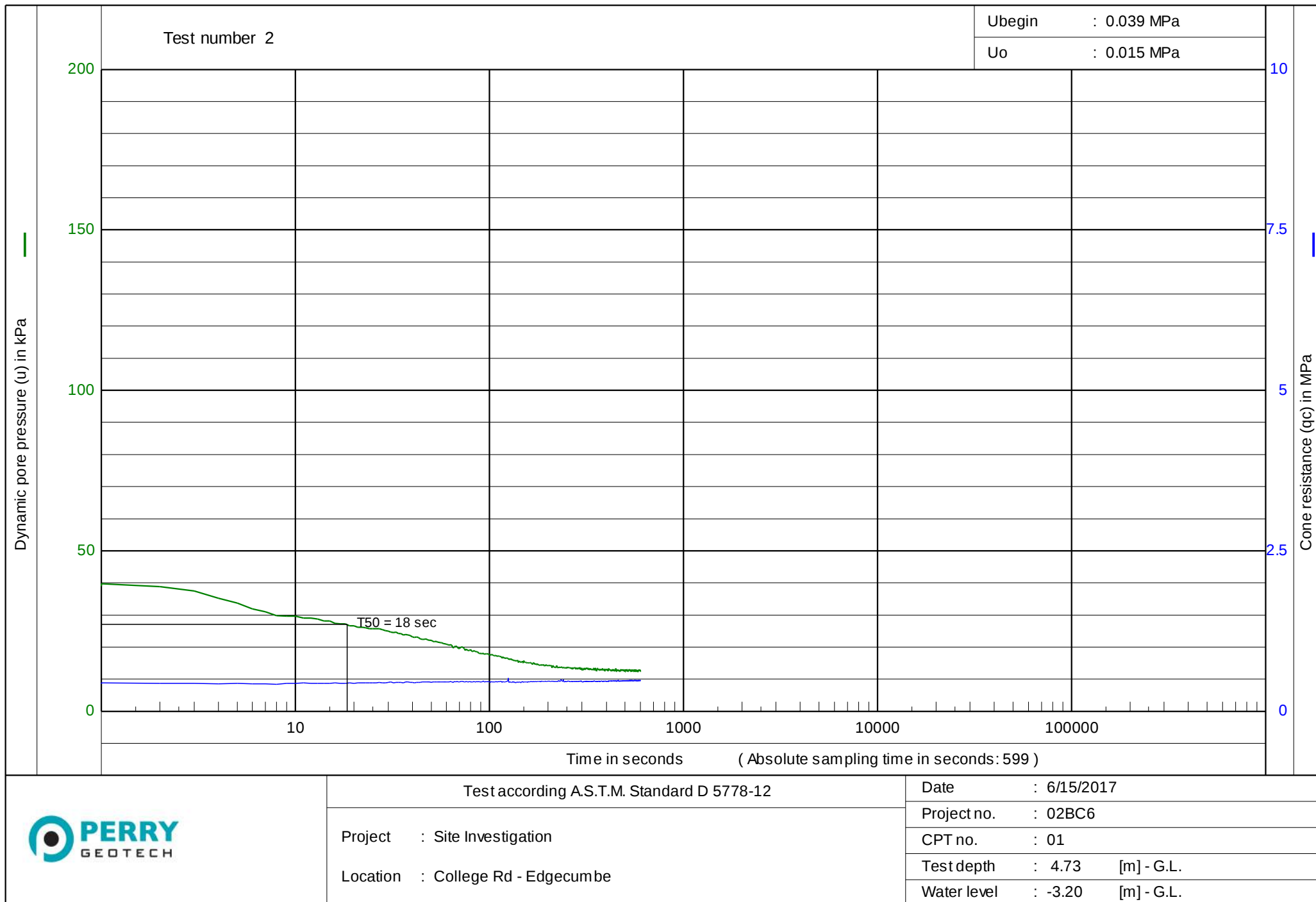
CPT no. : **04** **1/14**



Appendix H

Dissipation Test Data







Test according A.S.T.M. Standard D 5778-12

Project : Site Investigation

Location : College Rd - Edgecumbe

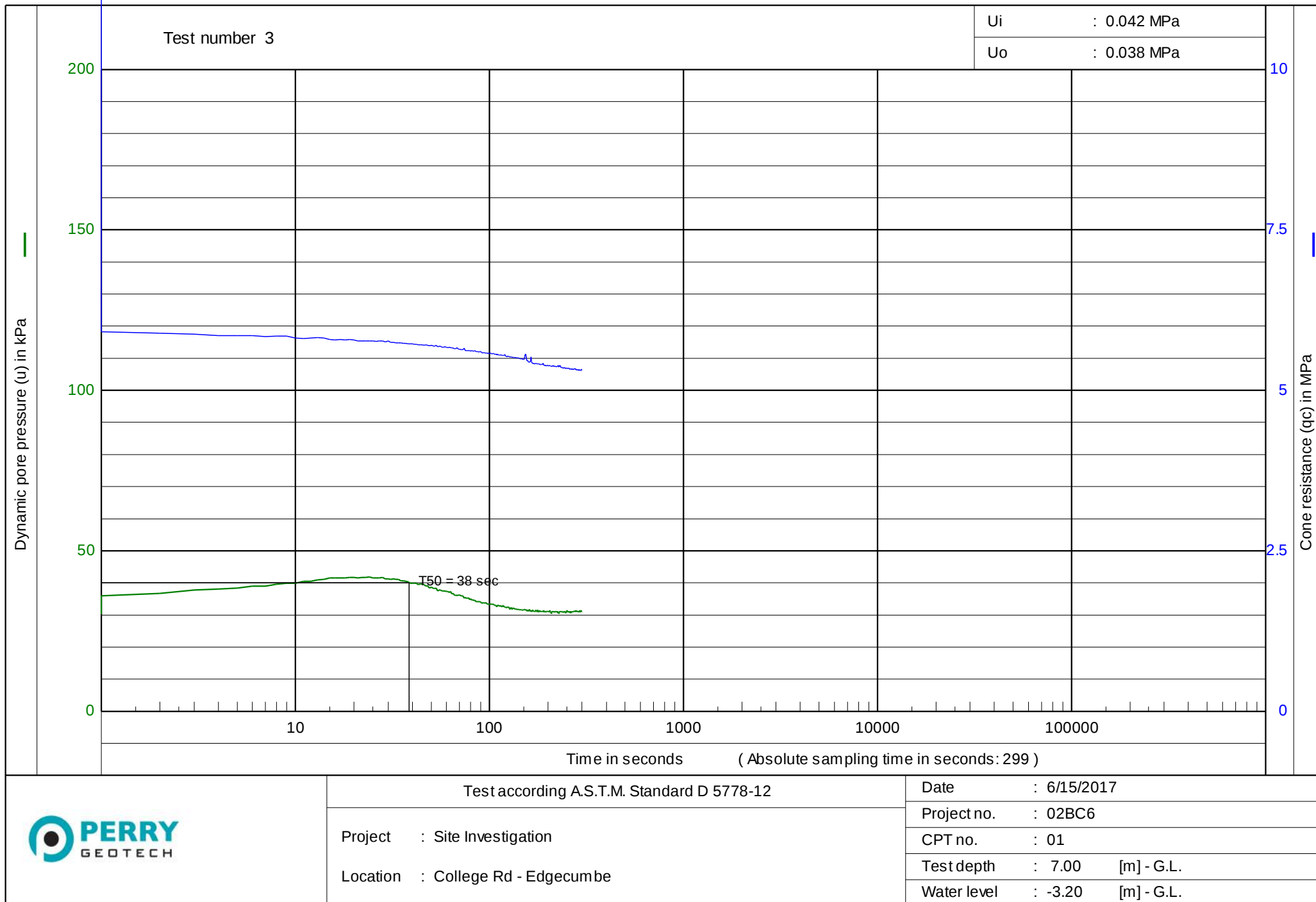
Date : 6/15/2017

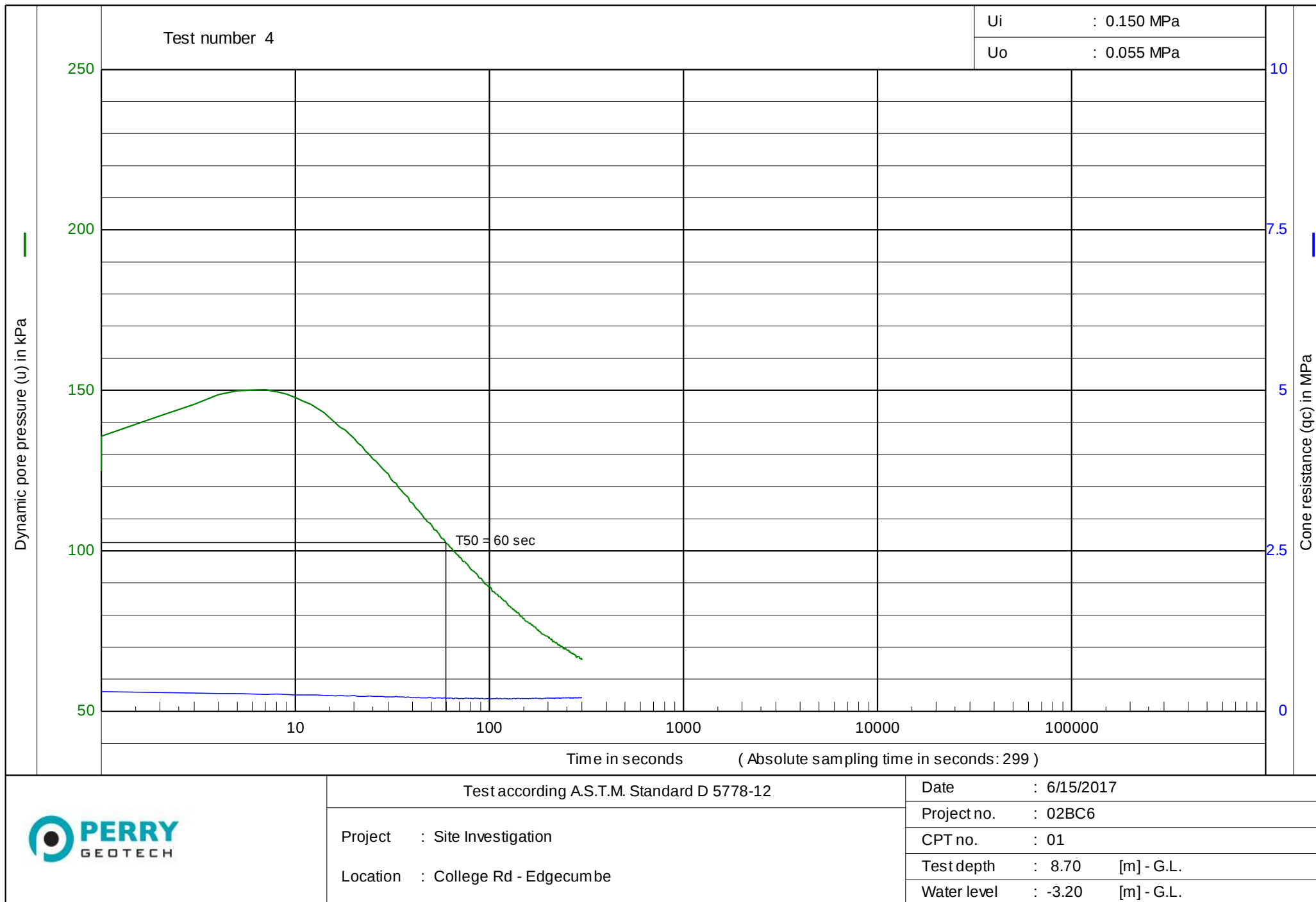
Project no. : 02BC6

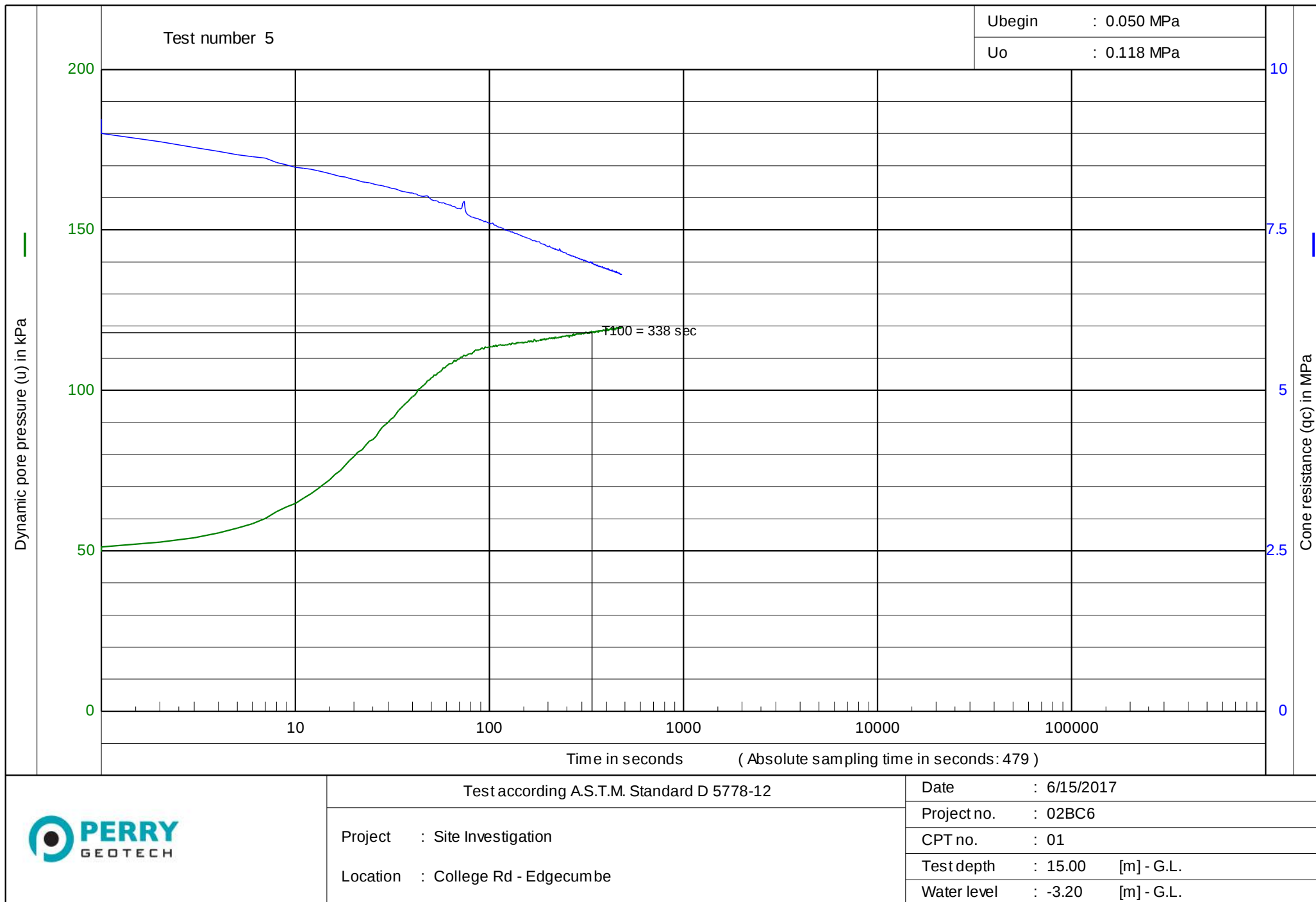
CPT no. : 01

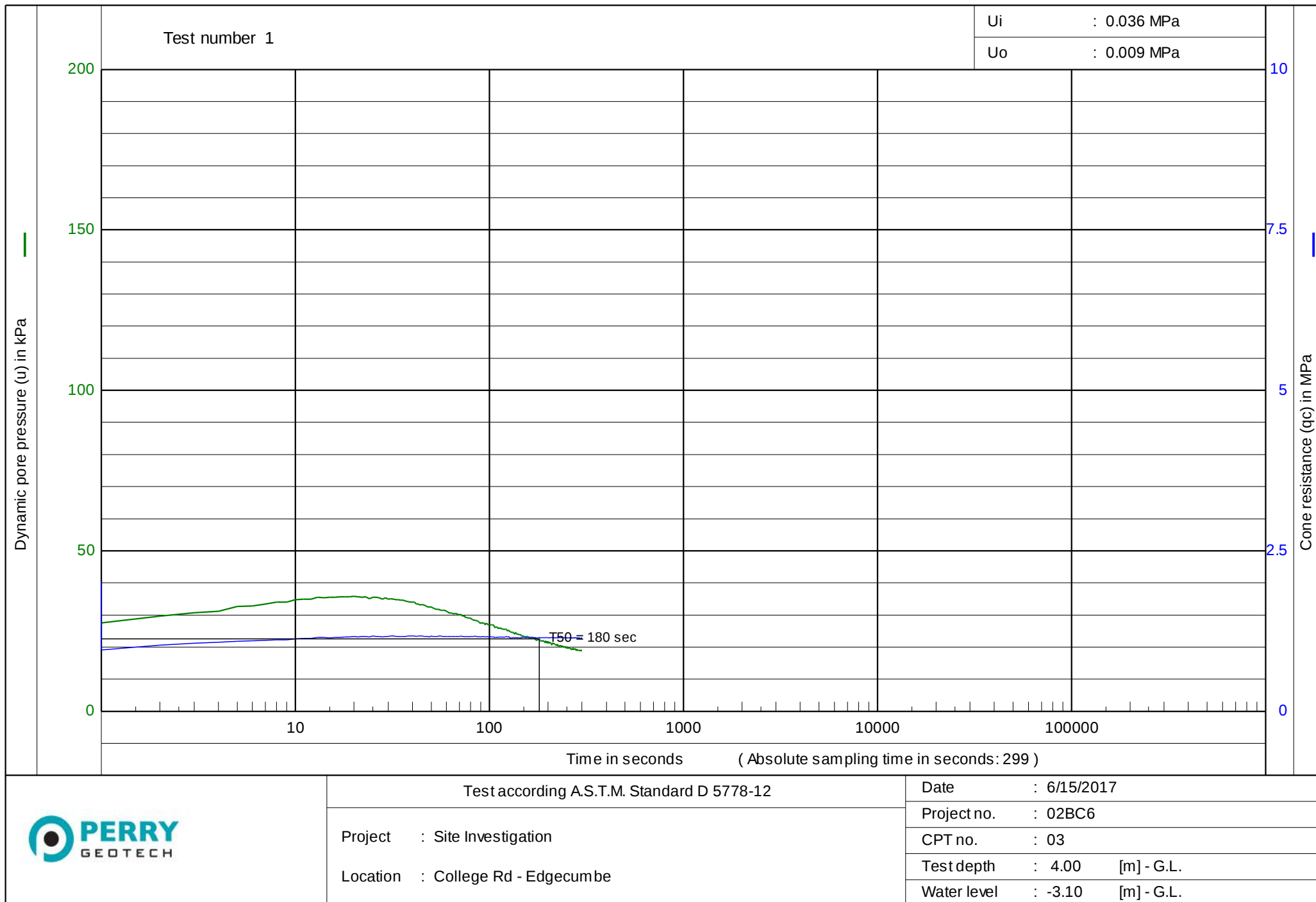
Test depth : 4.73 [m] - G.L.

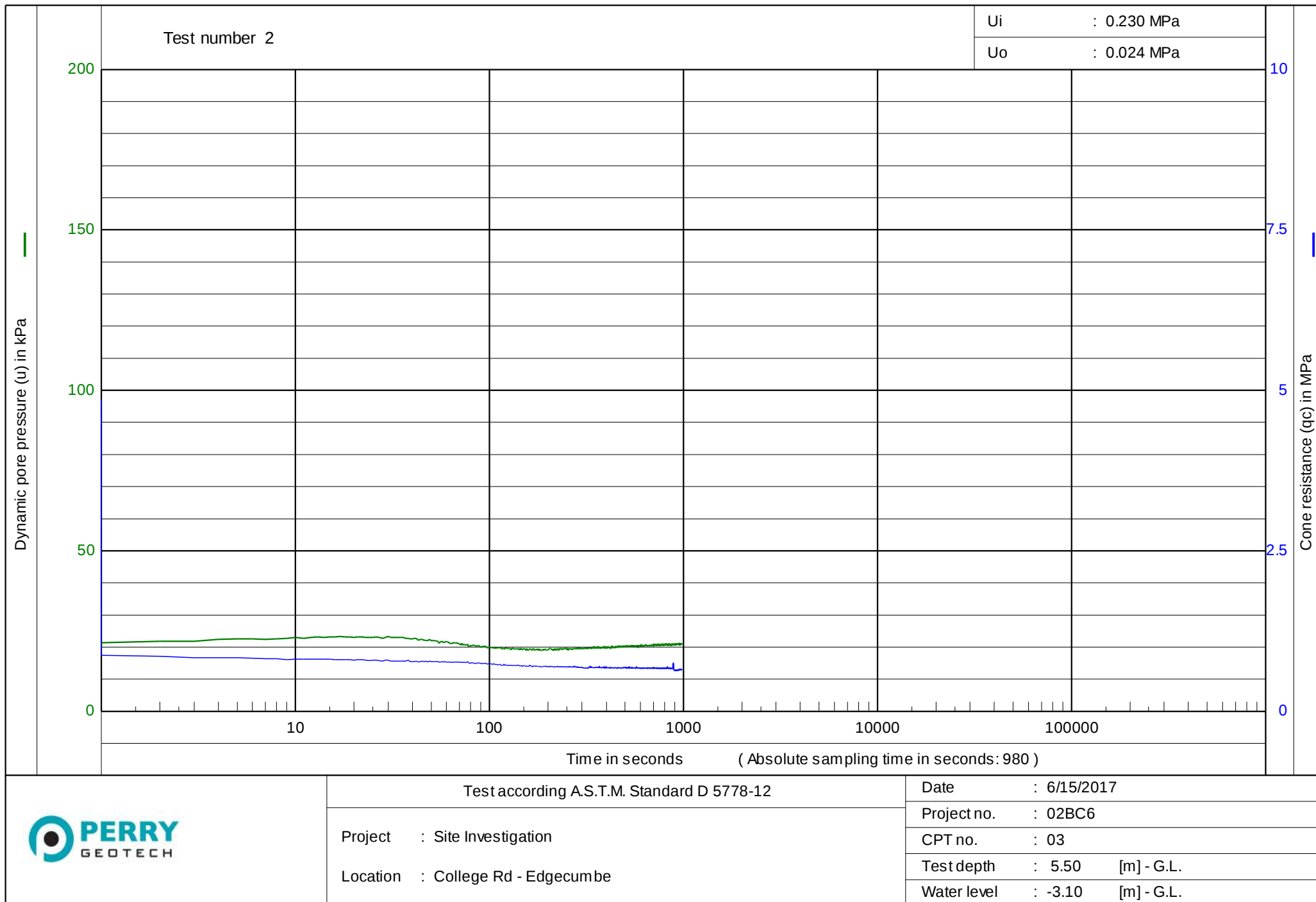
Water level : -3.20 [m] - G.L.

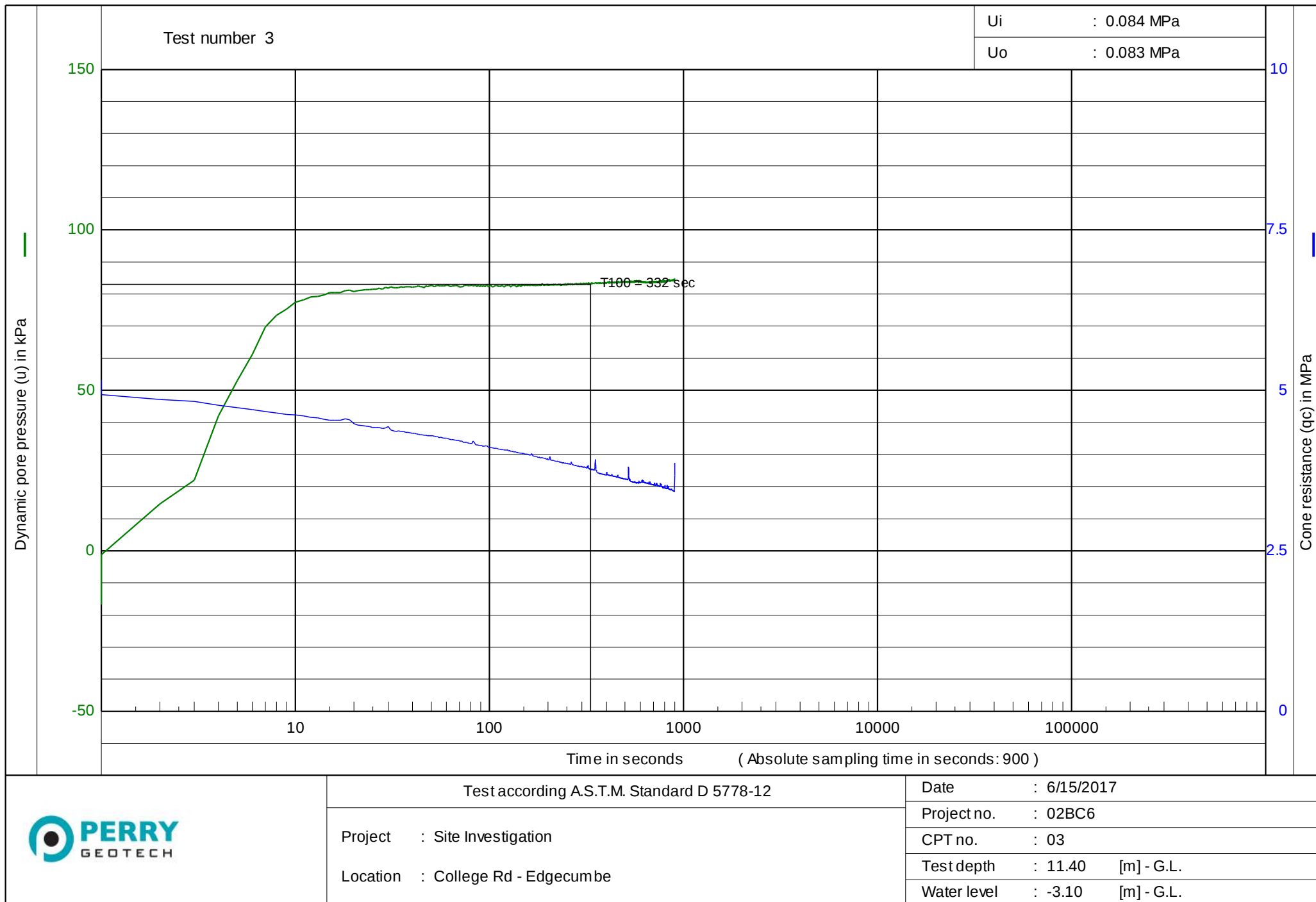












Appendix I

Standpipe Installation Details

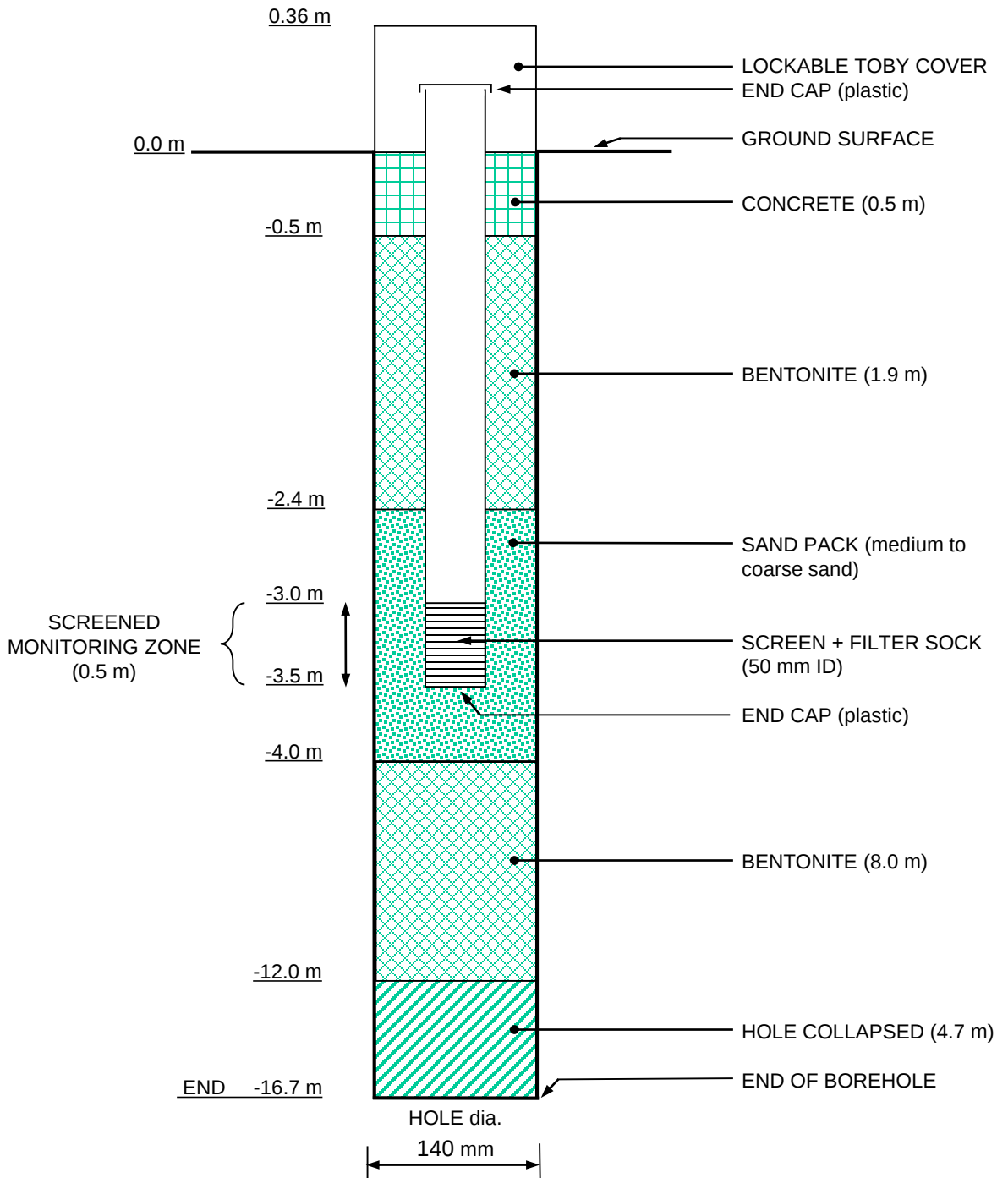
Coordinates / DATUM: NZTM / Moturiki 1953 mN: 5790265 mE: 1936307 RL: 7.0 m

Job Name: Wall Breach Investigation Location: College Road, Edgecumbe

Job No: 3208176	Date Drilling Commenced: 16/06/2017
Prepared by: Daniel Beeler	Date Installation Completed: 16/06/2017

RECORDED DEPTHS BGL

STANDARD DETAILS



Coordinates / DATUM: NZTM / Moturiki 1953 mN: 5790264 mE: 1936307 RL: 7.0 m

Job Name: Wall Breach Investigation Location: College Road, Edgumbe

Job No: 3208176

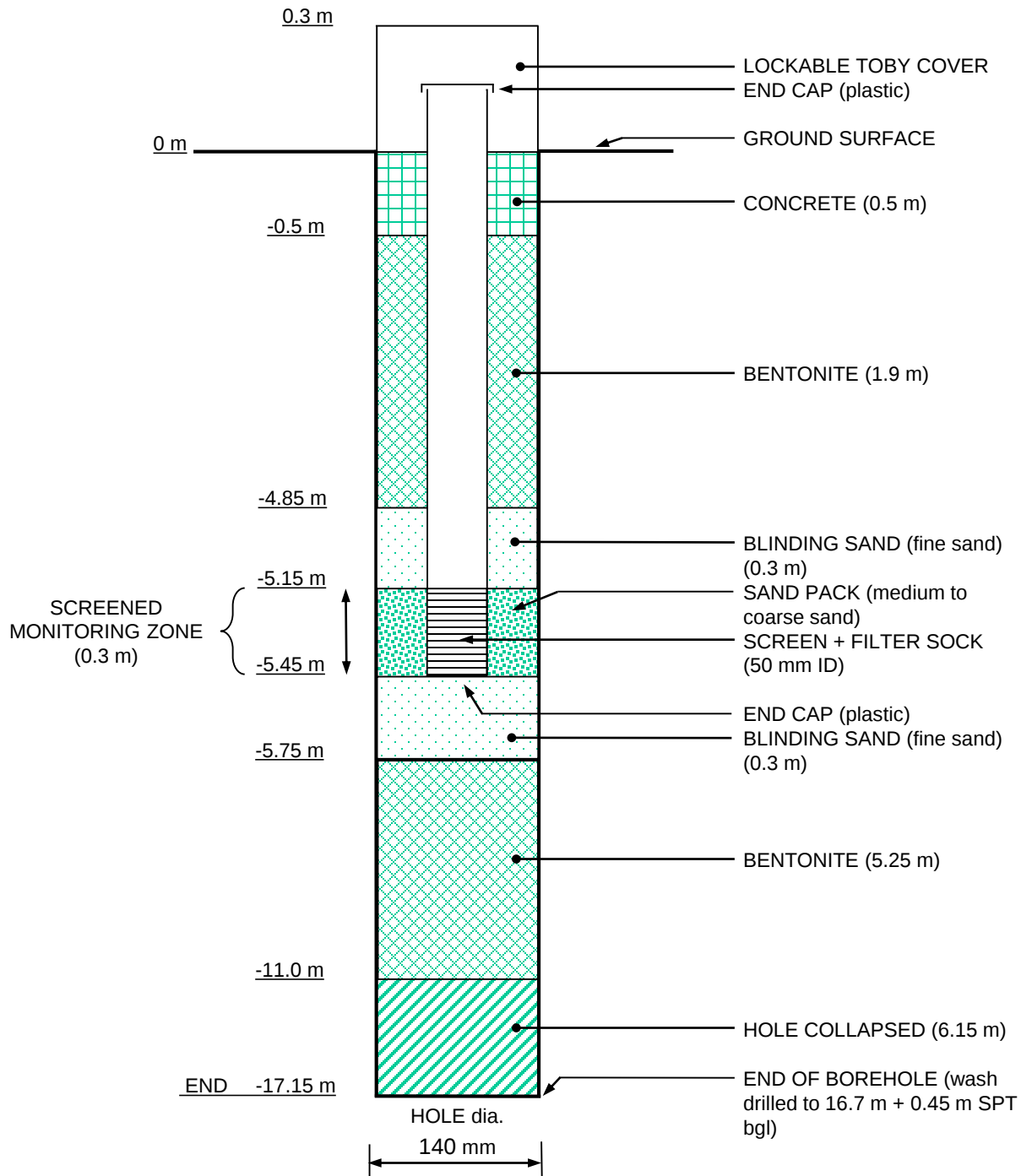
Date Drilling Commenced: 16/06/2017

Prepared by: Daniel Beeler

Date Installation Completed: 16/06/2017

RECORDED DEPTHS BGL

STANDARD DETAILS



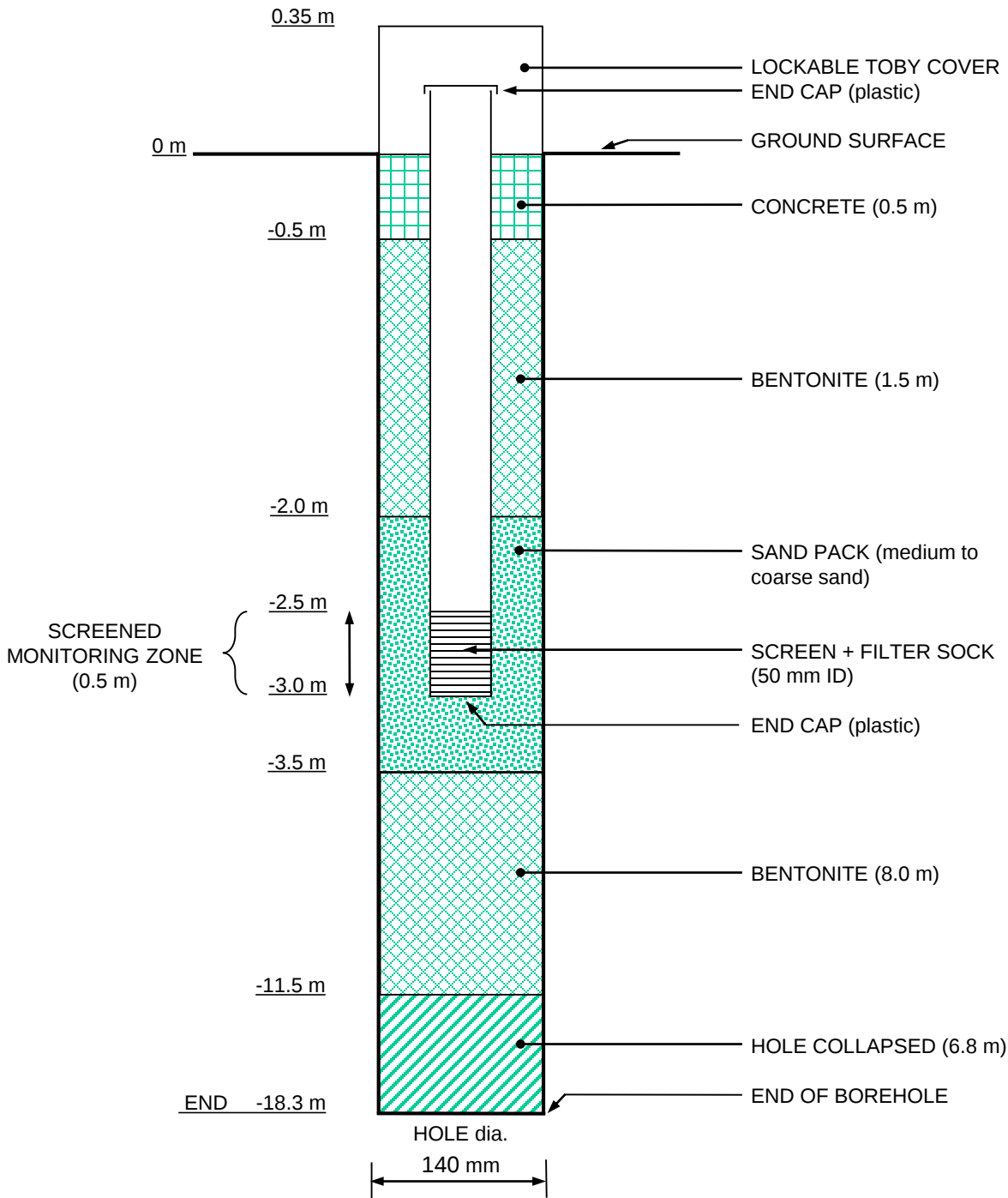
Coordinates / DATUM: NZTM / Moturiki 1953 mN: 5790248 mE: 1936304 RL: 7.0 m

Job Name: Wall Breach Investigation Location: College Road, Edgumbe

Job No: 3208176	Date Drilling Commenced: 15/06/2017
Prepared by: Daniel Beeler	Date Installation Completed: 15/06/2017

RECORDED DEPTHS BGL

STANDARD DETAILS



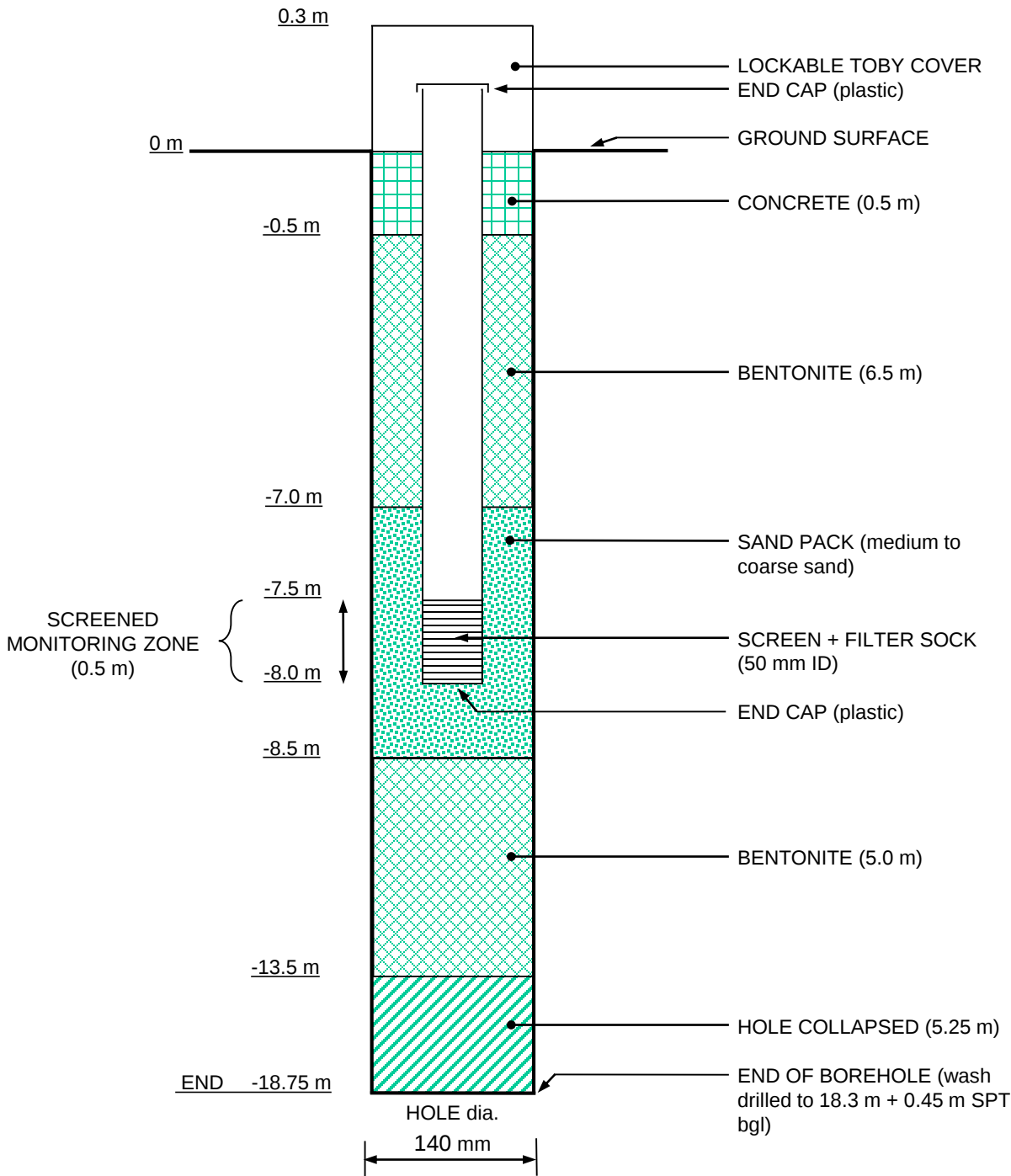
Coordinates / DATUM: NZTM / Moturiki 1953 mN: 5790249 mE: 1936304 RL: 7.0 m

Job Name: Wall Breach Investigation Location: College Road, Edgumbe

Job No: 3208176	Date Drilling Commenced: 15/06/2017
Prepared by: Daniel Beeler	Date Installation Completed: 15/06/2017

RECORDED DEPTHS BGL

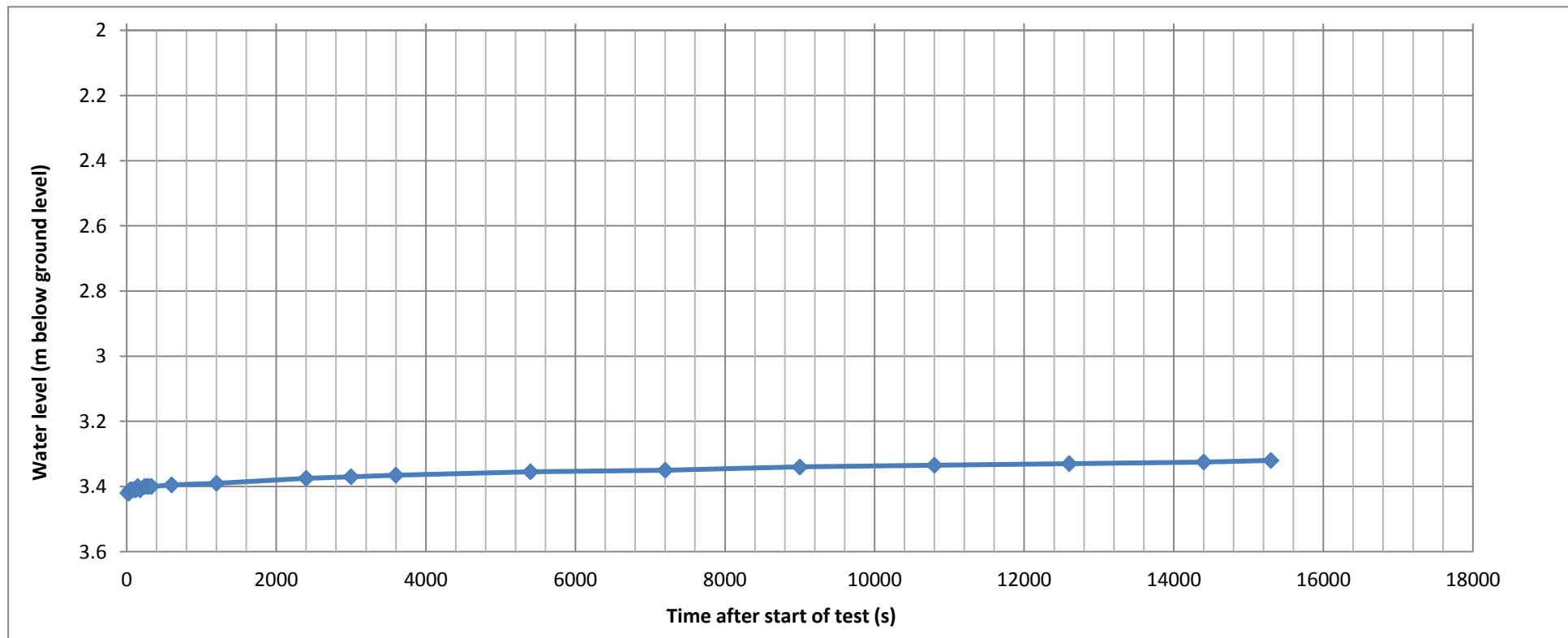
STANDARD DETAILS



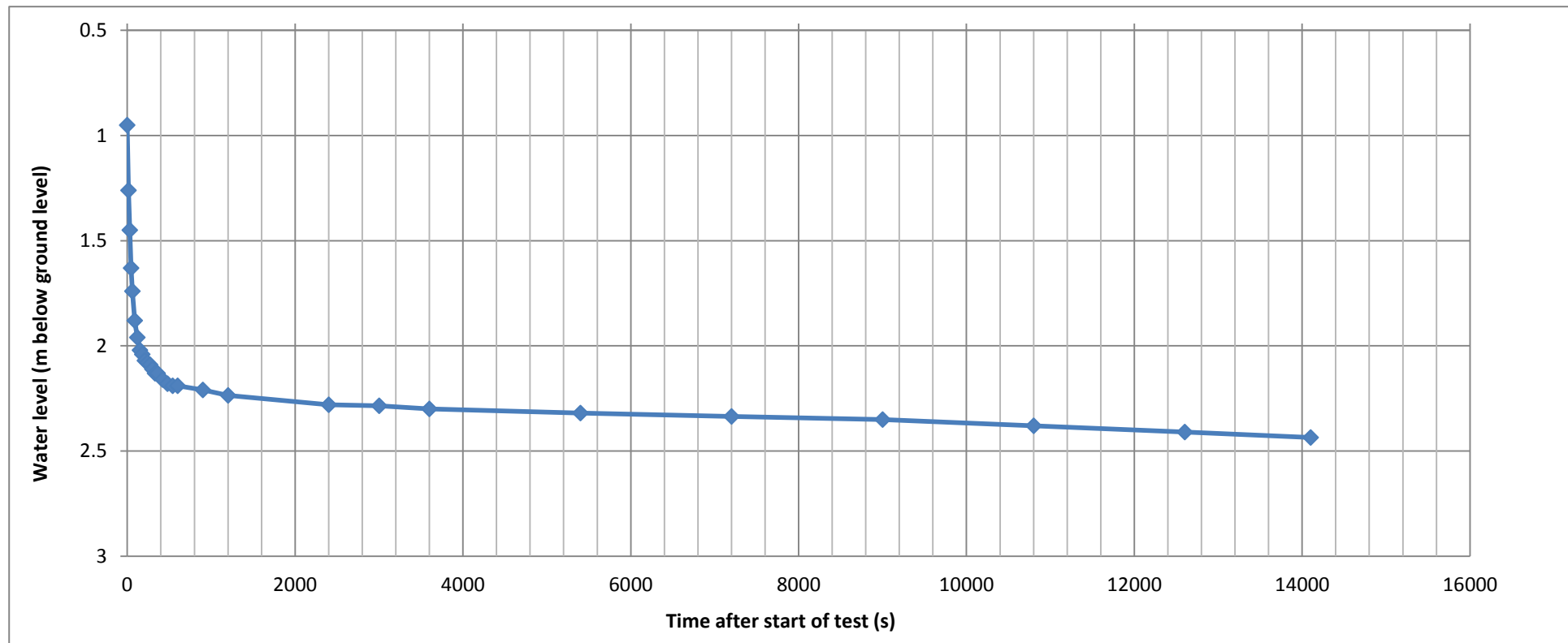
Appendix J

Permeability Testing Data

				Test ID	SB01A
Rising Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936307
Tested by	JRG	Start Date & Time	21/06/2017 8:45	Northing (m):	5790265
Static Water Level	3.22 m bgl (measured in borehole prior to testing)			GL Elevation (m RL):	7.0
Pre-soak?	NA	NA		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	NA	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	NA	Response Zone (m bgl)	3.0 - 3.5	Piezometer Construction	50mm ID uPVC

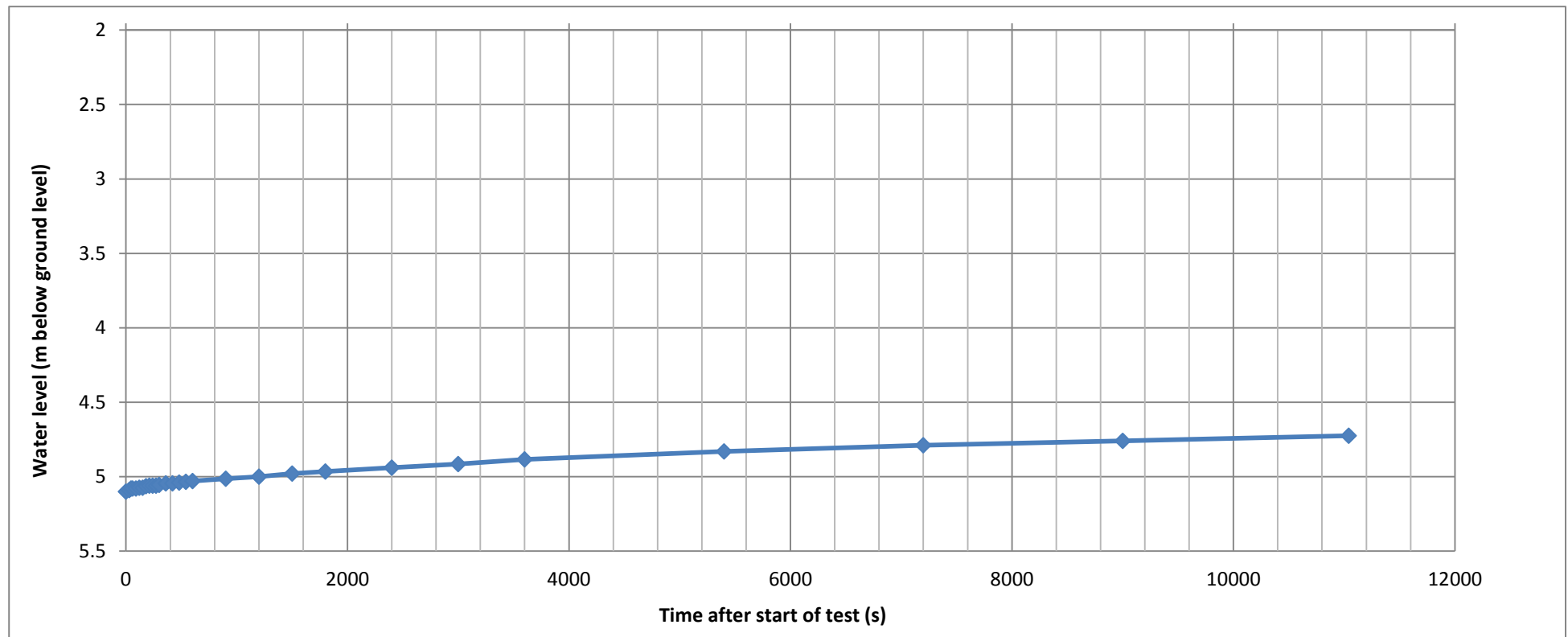


				Test ID	SB02A
Falling Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936304
Tested by	JRG	Start Date & Time	21/06/2017 12:50	Northing (m):	5790248
Static Water Level	Dry			GL Elevation* (m RL):	7.0
Pre-soak?	Yes	NA		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	21/06/2017 8:30	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	21/06/2017 12:50	Response Zone (m bgl)	2.5 - 3.0	Piezometer Construction	50 mm ID uPVC



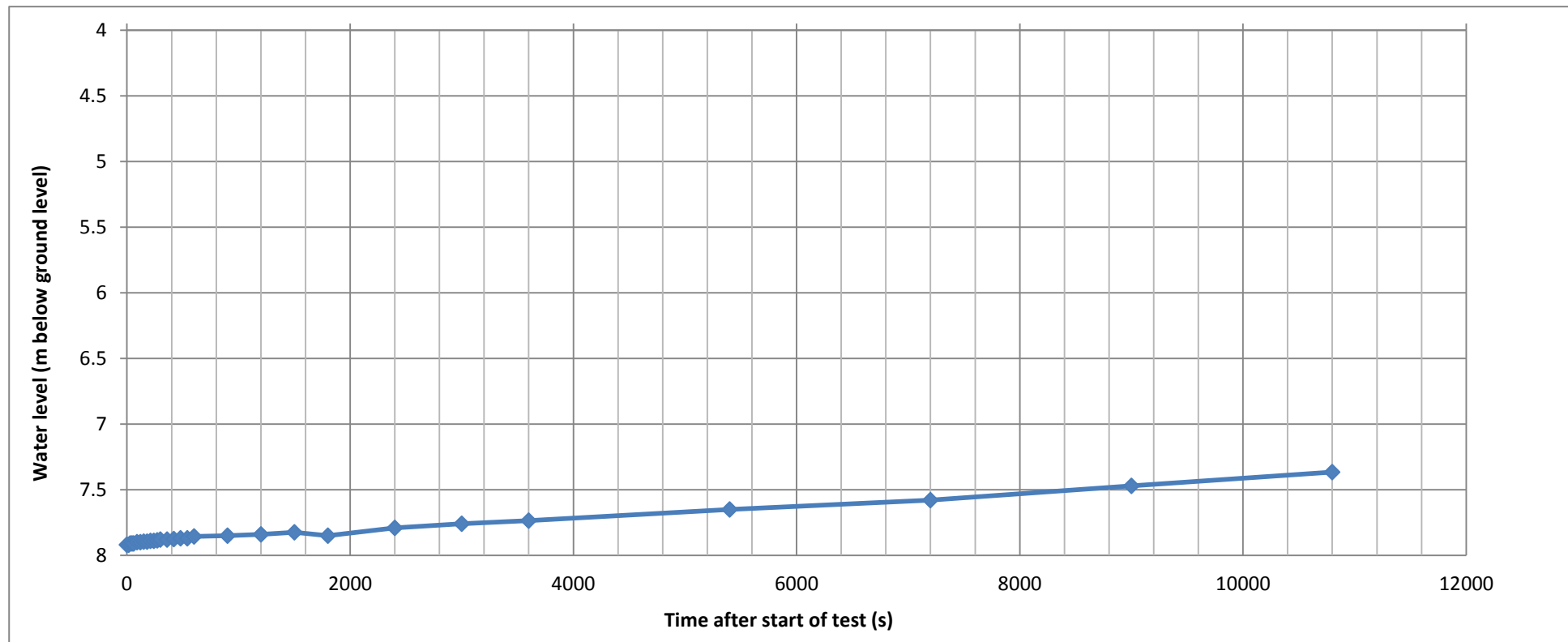
Test ID	SB01B
---------	-------

Rising Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936307
Tested by	JRG	Start Date & Time	21/06/2017 13:32	Northing (m):	5790264
Static Water Level	4.69 m bgl (measured in borehole prior to testing)			GL Elevation* (m RL):	7.0
Pre-soak?	NA	NA		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	NA	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	NA	Response Zone (m bgl)	5.15 - 5.45	Piezometer Construction	50 mm ID uPVC

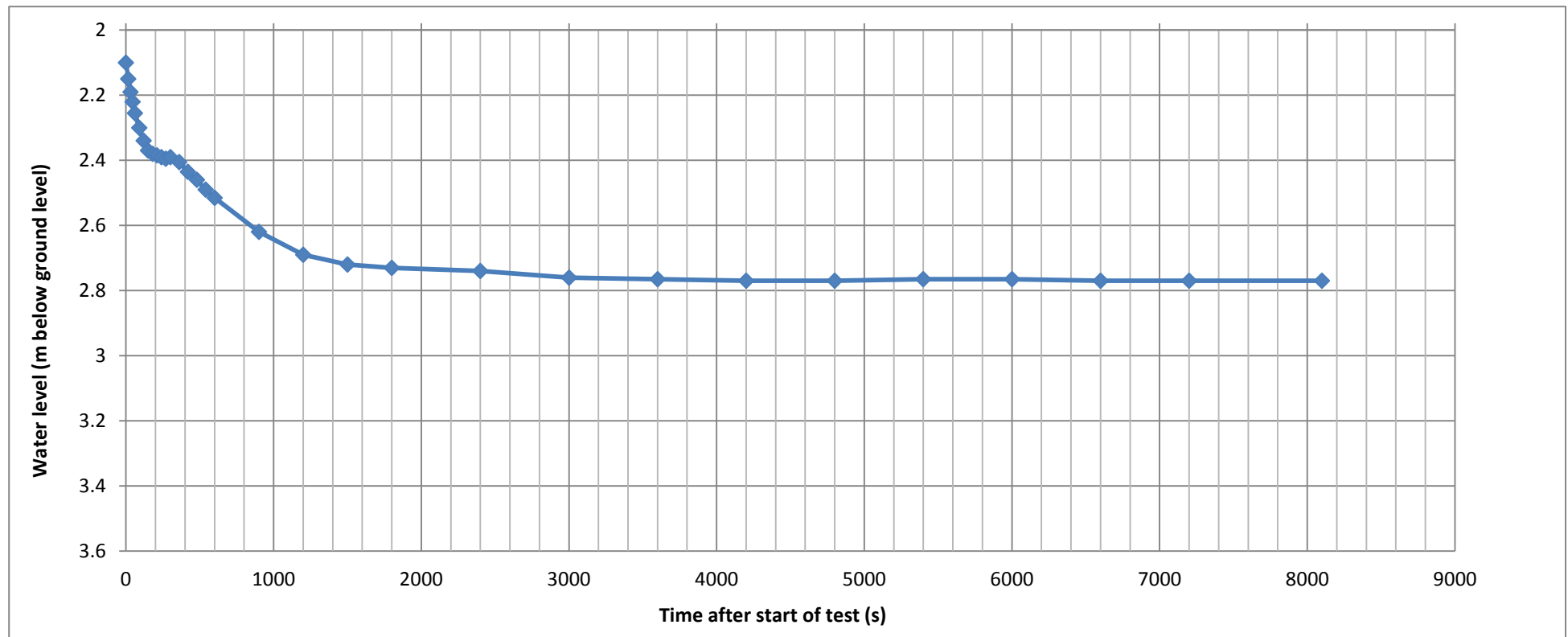


Test ID	SB02B
---------	-------

Rising Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936304
Tested by	JRG	Start Date & Time	22/06/2017 8:55	Northing (m):	5790249
Static Water Level	5.33 m bgl (measured in borehole prior to testing)			GL Elevation* (m RL):	7.0
Pre-soak?	NA	NA		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	NA	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	NA	Response Zone (m bgl)	7.5 -8.0	Piezometer Construction	50 mm ID uPVC

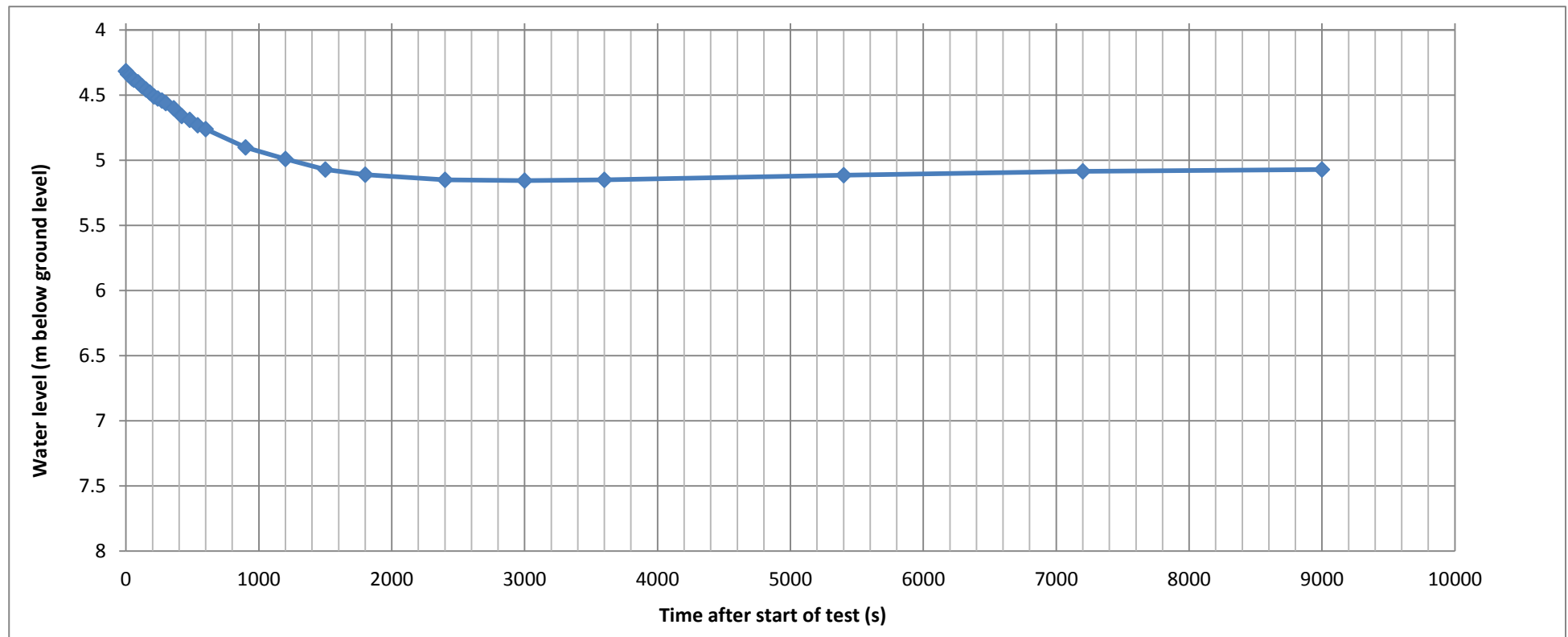


Test ID	SB01A
Job Number	3208176
Site	College Road, Edgecumbe
Easting (m):	1936307
Northing (m):	5790265
GL Elevation* (m RL):	7.0
Circuit (method):	NZTM (hh GPS)
Datum (method):	Moturiki 1953 (map)
Piezometer Construction	50 mm ID uPVC

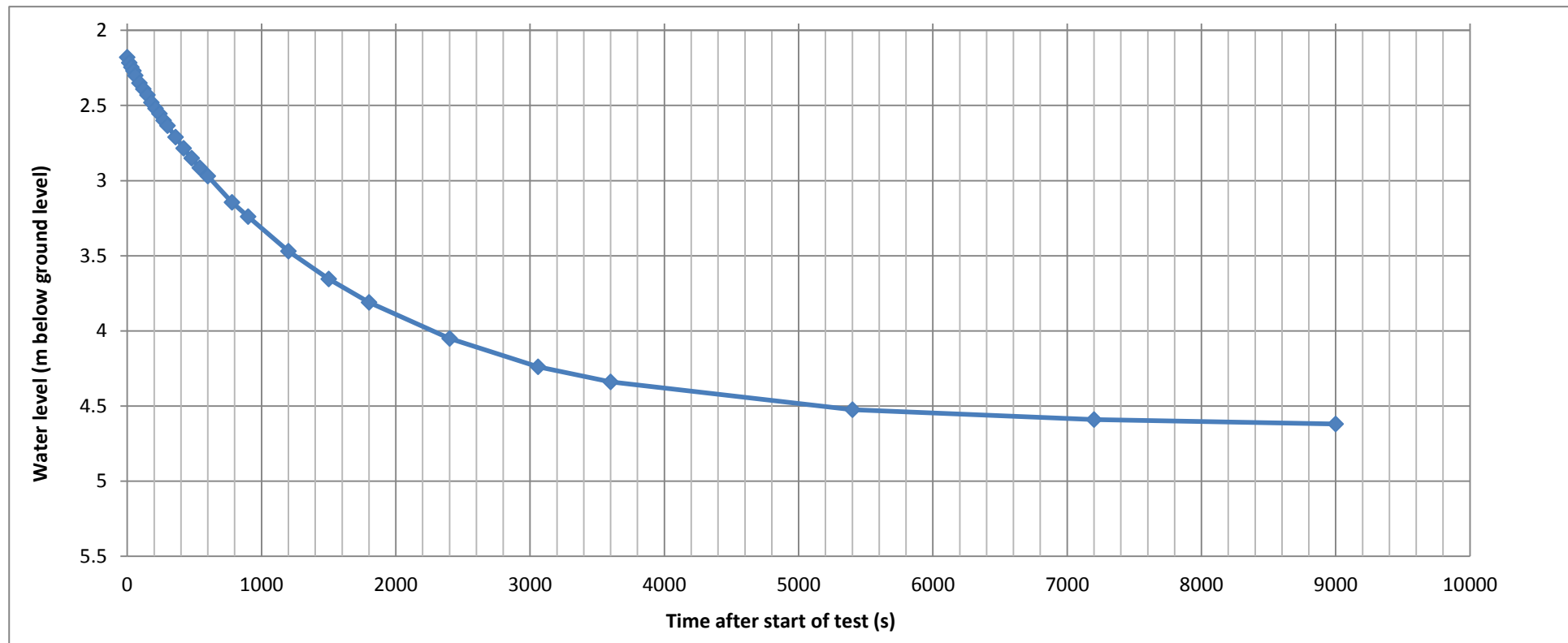


Test ID	SB02B
---------	-------

Falling Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936304
Tested by	JRG	Start Date & Time	22/06/2017 12:36	Northing (m):	5790249
Static Water Level	5.33 m bgl (measured in borehole prior to testing)			GL Elevation* (m RL):	7.0
Pre-soak?	Yes	Presoaked for 30 min		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	22/06/2017 12:05	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	22/06/2017 12:35	Response Zone (m bgl)	7.5 - 8.0	Piezometer Construction	50 mm ID uPVC



				Test ID	SB01B
Falling Head Test					
Job Name	College Road Breach Investigation			Job Number	3208176
Client	Bay of Plenty Regional Council			Site	College Road, Edgecumbe
Location	College Road, Edgecumbe (Wall Breach)			Easting (m):	1936307
Tested by	JRG	Start Date & Time	22/06/2017 13:10	Northing (m):	5790264
Static Water Level	4.71 m bgl (measured in borehole prior to testing)			GL Elevation* (m RL):	7.0
Pre-soak?	NA	NA		Circuit (method):	NZTM (hh GPS)
Pre-soak commenced	NA	Borehole Diameter (mm)	140	Datum (method):	Moturiki 1953 (map)
Pre-soak completed	NA	Response Zone (m bgl)	5.15 - 5.45	Piezometer Construction	50 mm ID uPVC





Rising Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB01A	Start Date & Time	21/06/2017 08.44 AM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	3.22 m bgl (measured in borehole prior to testing)		
Pre-soak?	NA	NA	
Pre-soak commenced	NA	Diameter of Borehole (mm)	140
Pre-soak completed	NA	Depth to Top of Response Zone (m)	3.0
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	3.5
		Sand Pack Material	Medium to coarse SAND

[illegible]



Falling Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB02A	Start Date & Time	21/06/2017 12:50 PM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	Dry		
Pre-soak?	Yes	Presoaked for 4 hr 20 min	
Pre-soak commenced	21/06/2017 8:30 AM	Diameter of Borehole (mm)	140
Pre-soak completed	21/06/2017 12:50 PM	Depth to Top of Response Zone (m)	2.5
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	3
		Sand Pack Material	Medium to coarse SAND

Time (sec)	Water Level (m below ground level)
0	0.95
15	1.26
30	1.45
45	1.63
60	1.74
90	1.88
120	1.96
150	2.02
180	2.04
210	2.07
240	2.08
270	2.09
300	2.11
330	2.13
360	2.16
420	2.18
480	2.19
540	2.19
600	2.21
1200	2.24
1800	-
2400	2.28
3000	2.29
3600	2.30
5400	2.32
7200	2.34
9000	2.35
10800	2.38
12600	2.41
14100	2.44



Rising Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB01B	Start Date & Time	21/06/2017 1:32 PM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	4.69		
Pre-soak?	NA	NA	
Pre-soak commenced	NA	Diameter of Borehole (mm)	140
Pre-soak completed	NA	Depth to Top of Response Zone (m)	5.15
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	5.45
		Sand Pack Material	Medium to coarse SAND

Time (sec)	Water Level (m below ground level)
0	5.1
15	-
30	5.09
45	5.08
60	5.08
90	5.08
120	5.075
150	5.075
180	5.065
210	5.06
240	5.06
270	5.06
300	5.055
360	5.045
420	5.045
480	5.04
540	5.035
600	5.03
900	5.015
1200	5.00
1500	4.98
1800	4.97
2400	4.94
3000	4.915
3600	4.89
5400	4.83
7200	4.79
9000	4.76
11040	4.725



Rising Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB02B	Start Date & Time	22/06/2017 8:55 AM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	5.33		
Pre-soak?	NA	NA	
Pre-soak commenced	NA	Diameter of Borehole (mm)	140
Pre-soak completed	NA	Depth to Top of Response Zone (m)	7.5
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	8.0
		Sand Pack Material	Medium to coarse SAND

Time (sec)	Water Level (m below ground level)
0	7.92
15	7.92
30	7.91
45	7.91
60	7.91
90	7.9
120	7.9
150	7.895
180	7.895
210	7.89
240	7.89
270	7.885
300	7.88
360	7.88
420	7.785
480	7.87
540	7.87
600	7.855
900	7.85
1200	7.84
1500	7.825
1800	7.85
2400	7.79
3000	7.76
3600	7.74
5400	7.65
7200	7.58
9000	7.47
10800	7.365

Falling Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB01A	Start Date & Time	22/06/2017 10:42 AM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	3.33		
Pre-soak?	Yes	Presoaked for 3 hr 12 min	
Pre-soak commenced	22/06/2017 7:30 AM	Diameter of Borehole (mm)	140
Pre-soak completed	22/06/2017 10:42 AM	Depth to Top of Response Zone (m)	3.0
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	3.5
		Sand Pack Material	Medium to coarse SAND

Time (sec)	Water Level (m below ground level)
0	2.1
15	2.15
30	2.19
45	2.22
60	2.255
90	2.3
120	2.34
150	2.37
180	2.38
210	2.385
240	2.39
270	2.395
300	2.39
360	2.405
420	2.435
480	2.46
540	2.49
600	2.515
900	2.62
1200	2.69
1500	2.72
1800	2.73
2400	2.74
3000	2.76
3600	2.77
4200	2.77
4800	2.77
5400	2.765
6000	2.765
6600	2.77
7200	2.77
8100	2.77

Falling Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB02B	Start Date & Time	22/06/2017 12:36 PM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	5.33		
Pre-soak?	Yes	Presoaked for 30 min	
Pre-soak commenced	22/06/2017 12:05 PM	Diameter of Borehole (mm)	140
Pre-soak completed	22/06/2017 12:35 PM	Depth to Top of Response Zone (m)	7.5
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	8.0
		Sand Pack Material	Medium to coarse SAND

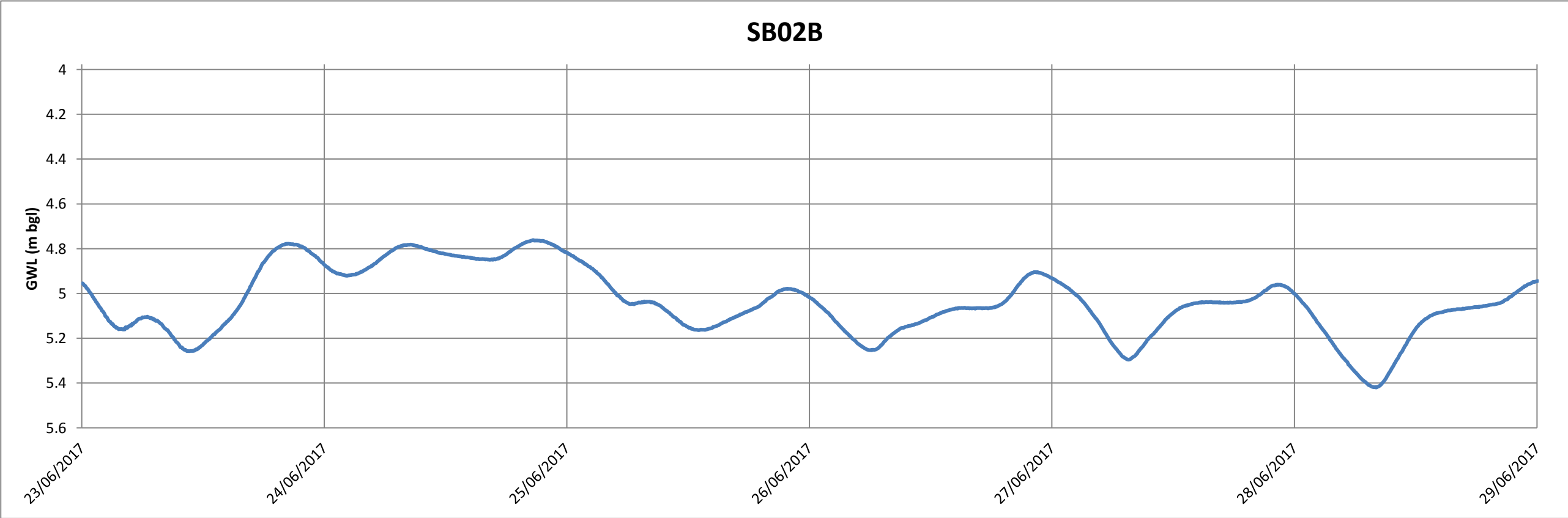
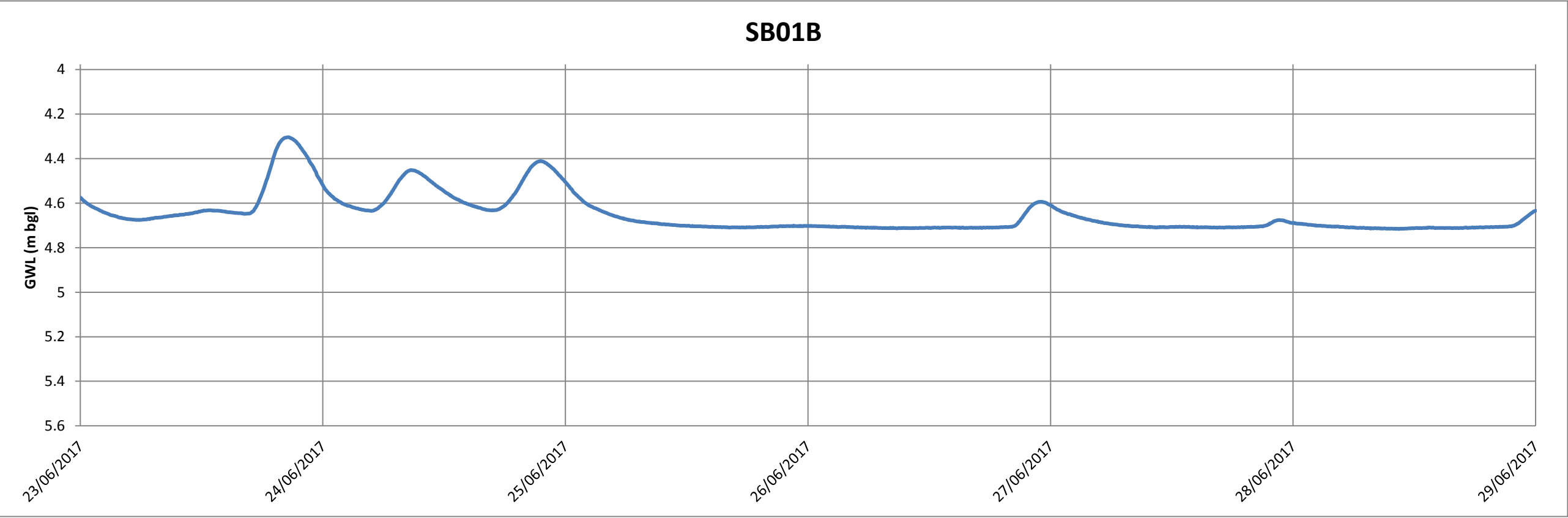
Time (sec)	Water Level (m below ground level)
0	4.315
15	4.34
30	4.35
45	4.37
60	4.38
90	4.4
120	4.43
150	4.455
180	4.48
210	4.51
240	4.525
270	4.54
300	4.56
360	4.6
420	4.66
480	4.69
540	4.73
600	4.76
900	4.9
1200	4.99
1500	5.07
1800	5.11
2400	5.15
3000	5.155
3600	5.15
5400	5.115
7200	5.085
9000	5.07

Falling Head Test			
Job Name	College Road Breach Investigation		
Client	Bay of Plenty Regional Council		
Job Number	3208176	Tested by	JRG
Test ID	SB01B	Start Date & Time	22/06/2017 13:10 PM
Location	College Road, Edgecumbe (Wall Breach)		
Static Water Level	4.71		
Pre-soak?	NA	NA	
Pre-soak commenced	NA	Diameter of Borehole (mm)	140
Pre-soak completed	NA	Depth to Top of Response Zone (m)	5.2
Piezometer Construction	50 mm ID uPVC	Depth to Base of Response Zone (m)	5.5
		Sand Pack Material	Medium to coarse SAND

Time (sec)	Water Level (m below ground level)
0	2.18
15	2.215
30	2.245
45	2.27
60	2.3
90	2.35
120	2.39
150	2.43
180	2.48
210	2.52
240	2.555
270	2.6
300	2.635
360	2.71
420	2.785
480	2.85
540	2.915
600	2.97
780	3.145
900	3.24
1200	3.47
1500	3.655
1800	3.81
2400	4.05
3060	4.24
3600	4.34
5400	4.525
7200	4.590
9000	4.62

Appendix K

Continuous Groundwater Monitoring



Appendix L

Laboratory Testing

SUMMARY OF TEST RESULTS

Job Name: College Road Breach Investigation

Job No: 3208176/200

Date: 6 July 2017

Client: Bay of Plenty Regional Council

Report:
1935L:01

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Wash)	P _a t/m ³	Clay Index	Consol	CBR	Grading (Hydro)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m ³	LL/ CPL	PL								
TP02	Q371	0.2-0.3	BULK	Fine to coarse GRAVEL, minor cobbles, minor sand, trace silt and clay, yellowish brown; moist, non plastic.	5.80				X*							
TP02	Q373	1.5-1.6	BULK	Fine to medium GRAVEL, trace sand, trace silt and clay; bluish grey; wet, non plastic.	3.39				X							
SB01A	Q374	2.5-3.0	BULK	Fine to coarse sandy fine to coarse GRAVEL, some silt, minor clay; yellowish brown, mottled orange brown; wet, non plastic.	18.0				X					X		
SB01A	Q375	5.5-5.8	SD	Clayey SILT, minor sand, trace organics; greyish brown, mottled bluish grey, speckled dark brown; wet, moderately plastic.	63.6		X	X								
SB01A	Q376	7.5-8.2	BULK	Fine to coarse SAND, some silt, minor fine to medium gravel, trace clay; light yellowish brown, mottled white; wet, non plastic.	87.3				X					X		
SB02A	Q377	3.5-4.5	BULK	Fine to coarse sandy fine to coarse GRAVEL, some silt, minor clay; light yellowish brown, mottled orange brown, speckled bluish grey, white; wet, non plastic.	18.0				X*					X		



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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

REPORT RELATES ONLY TO SAMPLES TESTED. SAMPLING WAS UNDERTAKEN BY OTHERS.

X = DATA ATTACHED, BULK = BULK SAMPLES, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1, 2.8.1
ASTM D422-63

AUTHORISED SIGNATORY

N. Agarkova - Authorised Signatory

Sheet 1 of 7

ATTERBERG LIMITS

Job Name: College Road Breach Investigation

Date: 6 July 2017

Job No: 3208176/200

Report No: 1935L:01

Client: Bay of Plenty Regional Council

Tested By: S.Shah

Sample Type: Small Disturbed

Checked By: N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.3,2.4,2.5

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
SB01A	Q375	5.5-5.8	Clayey SILT, minor sand, trace organics; greyish brown, mottled bluish grey, speckled dark brown; wet, moderately plastic.	63.6	-	61	49	12

Comments:

PARTICLE SIZE DISTRIBUTION

Job Name: College Road Breach Investigation

Job No.: 3208176/200

Bore/Test Pit No.: TP02

Sample Type: Bulk

Client: Bay of Plenty Regional Council

Tested By: N.Agarkova/
S.Shah

Sample No.: Q371

History: As Received

Date: 6 July 2017

Checked By: N.Agarkova

Depth (m): 0.2-0.3

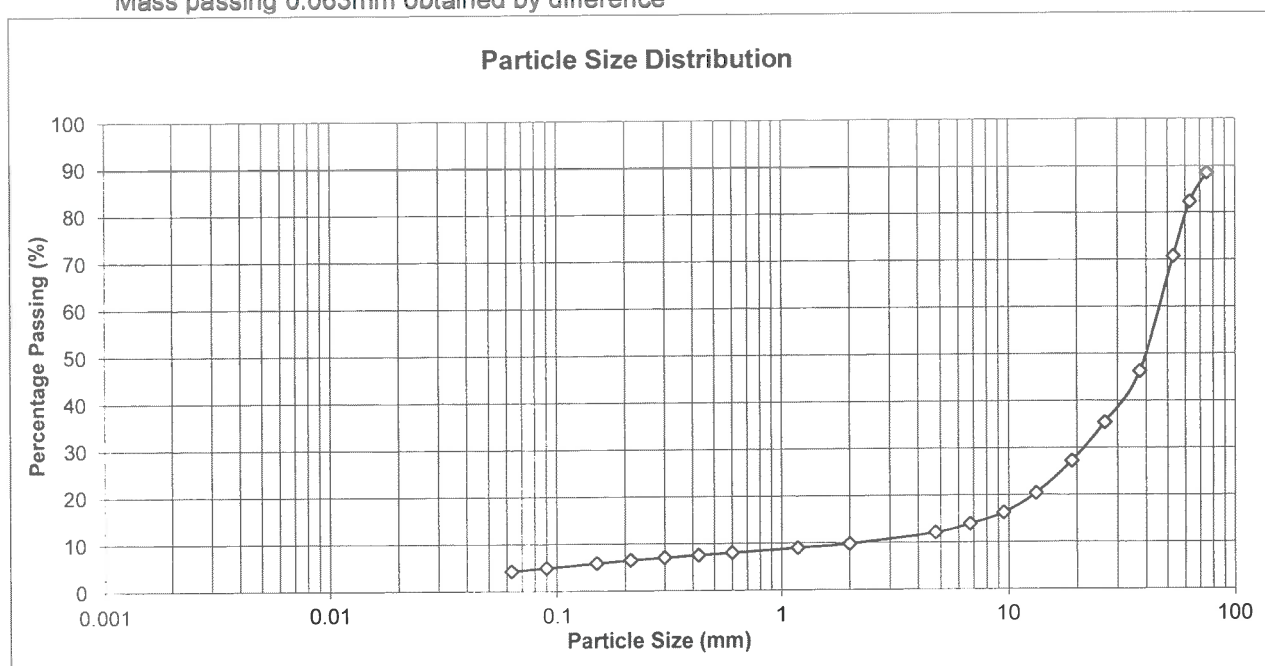
Report No: 1935L:01

Sample Description: Fine to coarse GRAVEL, minor cobbles, minor sand, trace silt and clay; yellowish brown; moist, non plastic.

Test Standard: NZS 4402:1986, Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75mm	88	2.00mm	10
63mm	82	1.18mm	9
53mm	71	600µm	8
37.5mm	46	425µm	8
26.5mm	35	300µm	7
19mm	27	212µm	6
13.2mm	20	150µm	6
9.5mm	16	90µm	5
6.7mm	14	63µm	4
4.75mm	12	<63µm*	4

*Mass passing 0.063mm obtained by difference


Authorised Signatory:

N.Agarkova - Authorised Signatory

PARTICLE SIZE DISTRIBUTION

Job Name: College Road Breach Investigation

Job No.: 3208176/200

Bore/Test Pit No.: TP02

Sample Type: Bulk

Client: Bay of Plenty Regional Council

Tested By: S.Shah/
N.Agarkova

Sample No.: Q373

History: As Received

Date: 6 July 2017

Checked By: N.Agarkova

Depth (m): 1.5-1.6

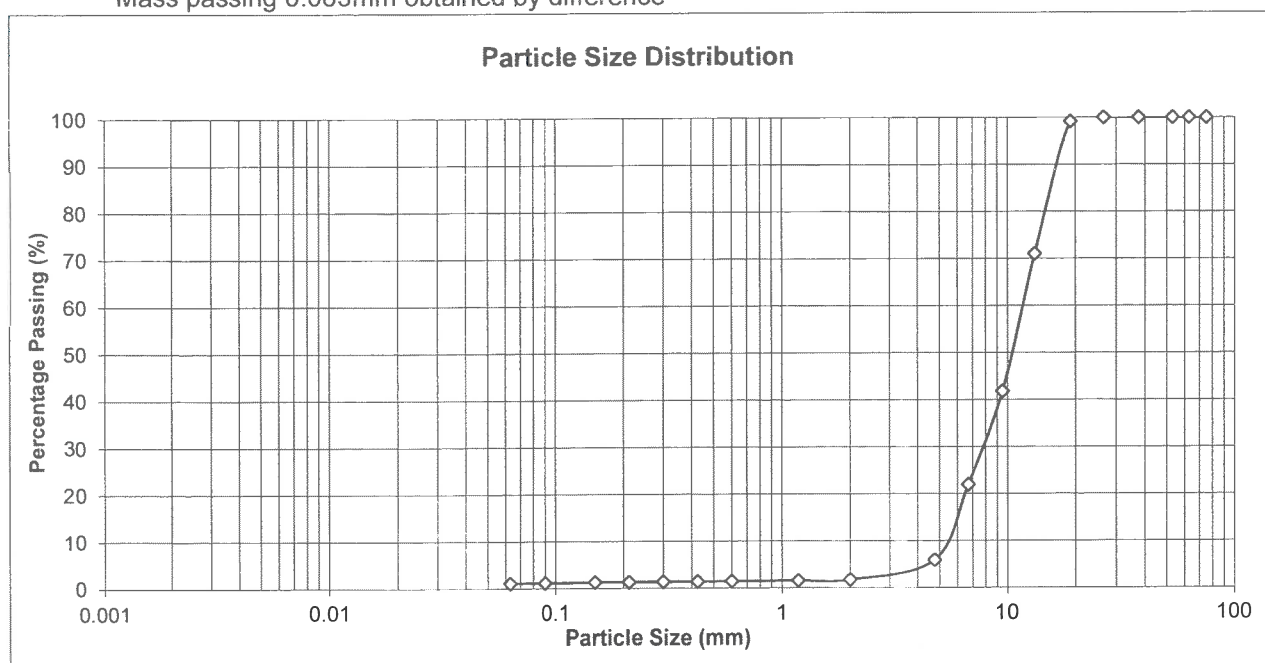
Report No: 1935L:01

Sample Description: Fine to medium GRAVEL, trace sand, trace silt and clay; bluish grey; wet, non plastic.

Test Standard: NZS 4402:1986, Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75mm	100	2.00mm	2
63mm	100	1.18mm	2
53mm	100	600µm	1
37.5mm	100	425µm	1
26.5mm	100	300µm	1
19mm	99	212µm	1
13.2mm	71	150µm	1
9.5mm	42	90µm	1
6.7mm	22	63µm	1
4.75mm	6	<63µm*	1

*Mass passing 0.063mm obtained by difference



PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: College Road Breach Investigation **Client:** Bay of Plenty Regional Council **Date:** 6 July 2017
Job No.: 3208176/200 **Tested By:** S.Shah **Checked By:** N.Agarkova
Bore No.: SB01A **Sample No.:** Q374 **Depth (m):** 2.5-3.0
Sample Type: Bulk **History:** As Received **Report No.:** 1935L:01

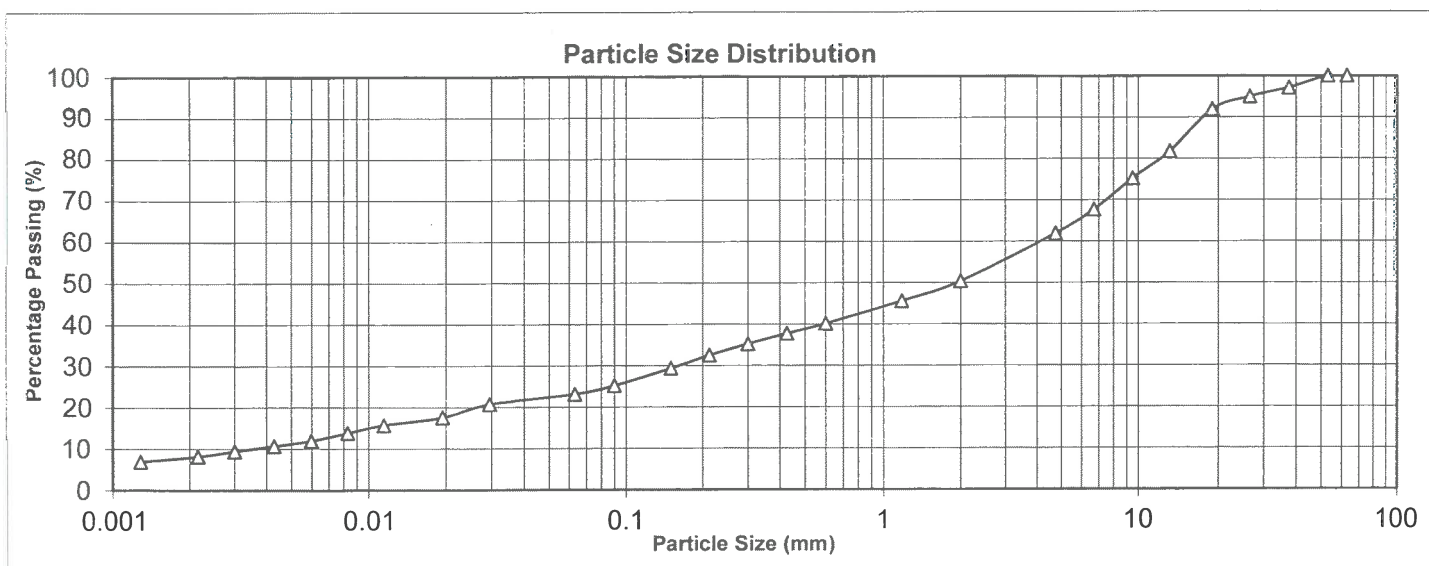
Sample Description: Fine to coarse sandy fine to coarse GRAVEL, some silt, minor clay; yellowish brown, mottled orange brown; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

NZS4402: 1986; Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	50
63.0mm	100	1.18mm	46
53.0mm	100	600µm	40
37.5mm	97	425µm	38
26.5mm	95	300µm	35
19.0mm	92	212µm	32
13.2mm	82	150µm	29
9.50mm	75	90µm	25
6.70mm	68	63µm	23
4.75mm	62	<63µm	23



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
8	15	27	50	37.5mm

PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: College Road Breach Investigation	Client: Bay of Plenty Regional Council	Date: 6 July 2017
Job No.: 3208176/200	Tested By: S.Shah/ N.Agarkova	Checked By: N.Agarkova
Bore No.: SB01A	Sample No.: Q376	Depth (m): 7.5-8.2
Sample Type: Bulk	History: As Received	Report No.: 1935L:01

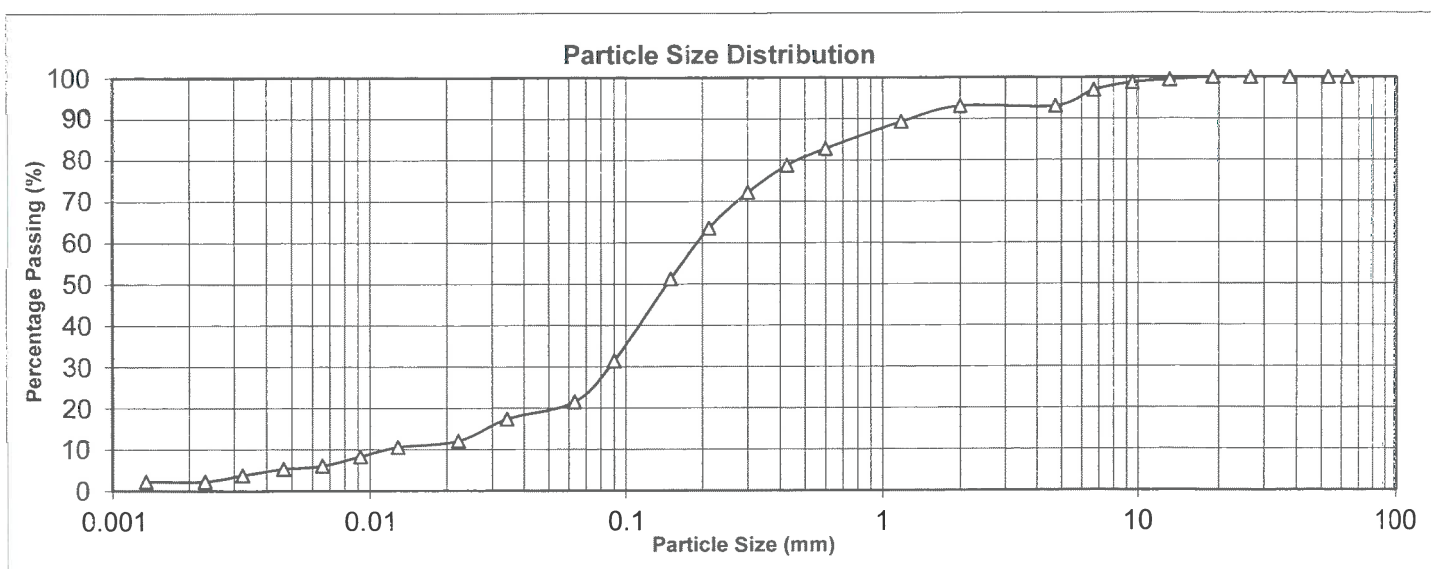
Sample Description: Fine to coarse SAND, some silt, minor fine to medium gravel, trace clay; light yellowish brown, mottled white; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

NZS4402: 1986; Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	93
63.0mm	100	1.18mm	89
53.0mm	100	600µm	83
37.5mm	100	425µm	79
26.5mm	100	300µm	72
19.0mm	100	212µm	64
13.2mm	99	150µm	51
9.50mm	99	90µm	31
6.70mm	97	63µm	21
4.75mm	93	<63µm	21



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
2	19	72	7	13.2mm

PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: College Road Breach Investigation	Client: Bay of Plenty Regional Council	Date: 6 July 2017
Job No.: 3208176/200	Tested By: S.Shah	Checked By: N.Agarkova
Bore No.: SB02A	Sample No.: Q377	Depth (m): 3.5-4.5
Sample Type: Bulk	History: As Received	Report No.: 1935L:01

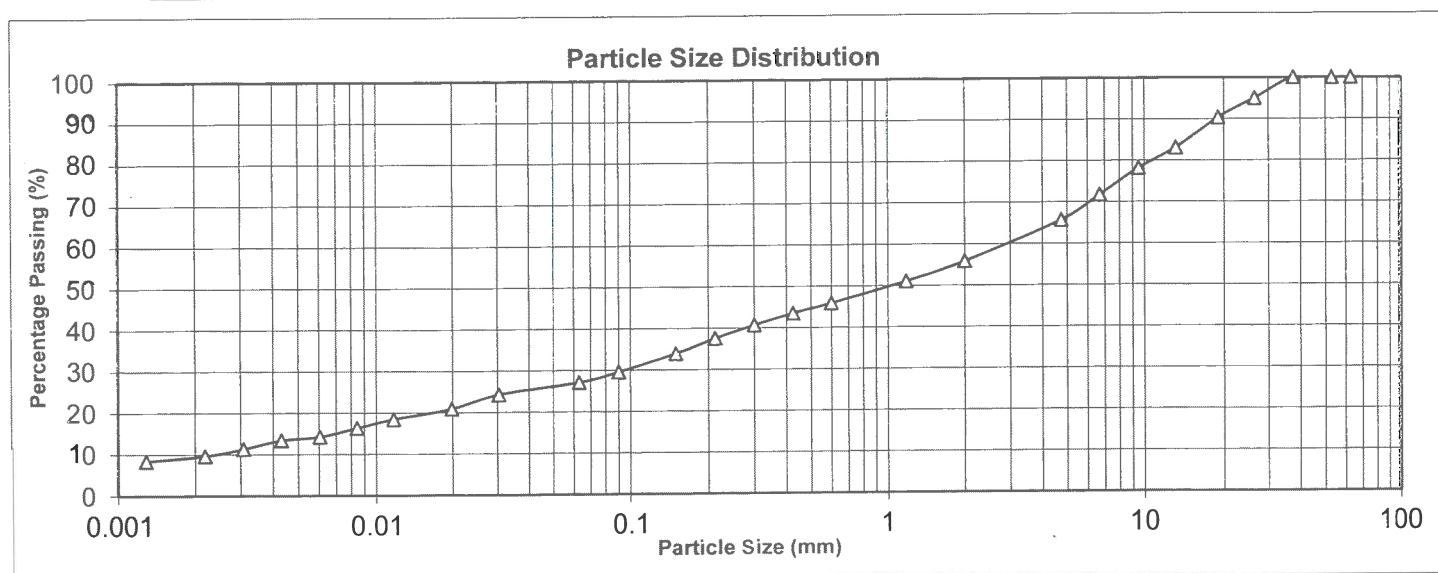
Sample Description: Fine to coarse sandy fine to coarse GRAVEL, some silt, minor clay; light yellowish brown, mottled orange brown, speckled bluish grey, white; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

NZS4402: 1986; Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	56
63.0mm	100	1.18mm	51
53.0mm	100	600µm	46
37.5mm	100	425µm	43
26.5mm	95	300µm	41
19.0mm	90	212µm	37
13.2mm	83	150µm	34
9.50mm	78	90µm	30
6.70mm	72	63µm	27
4.75mm	66	<63µm	27



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
9	18	29	44	26.5mm

SUMMARY OF TEST RESULTS

Report: 1935L:02

Job Name: College Road Breach Investigation **Job No:** 3208176/200

Client: Bay of Plenty Regional Council

[illegible]

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

REPORT RELATES ONLY TO SAMPLES TESTED, SAMPLING WAS UNDERTAKEN BY OTHERS.

X = DATA ATTACHED, BULK = BULK SAMPLES, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1, 2.8.1
ASTM D422-63

AUTHORISED SIGNATORY

N.Agarikova – Authorised Signatory

Sheet 1 of 3

PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: College Road Breach Investigation **Client:** Bay of Plenty Regional Council **Date:** 12 July 2017
Job No.: 3208176/200 **Tested By:** S.Shah **Checked By:** N.Agarkova
Bore No.: TP01 **Sample No.:** Q370 **Depth (m):** 0.7-0.8
Sample Type: Bulk **History:** As Received **Report No.:** 1935L:02

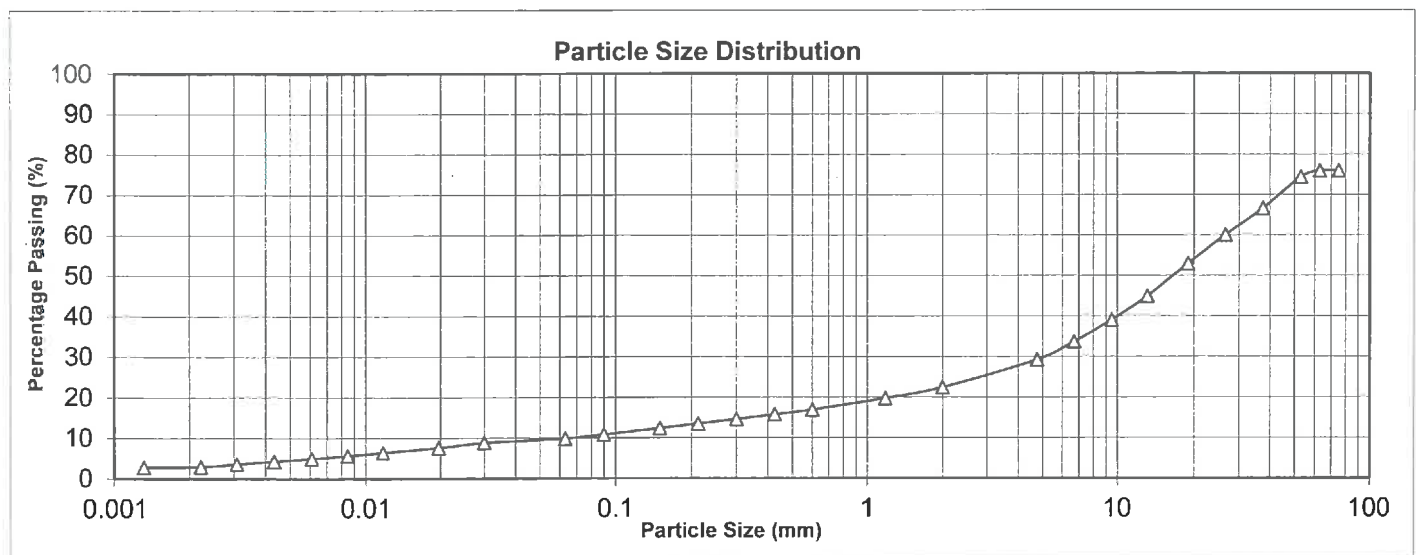
Sample Description: Cobbly fine to coarse GRAVEL, some sand, minor silt, trace clay; yellowish brown; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

NZS4402: 1986; Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	76	2.00mm	22
63.0mm	76	1.18mm	20
53.0mm	74	600µm	17
37.5mm	67	425µm	16
26.5mm	60	300µm	15
19.0mm	53	212µm	13
13.2mm	45	150µm	12
9.50mm	39	90µm	11
6.70mm	34	63µm	10
4.75mm	29	<63µm	10



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
3	7	12	78	75.0mm

Authorised Signatory.....

N.Agarkova - Authorised Signatory

PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: College Road Breach Investigation **Client:** Bay of Plenty Regional Council **Date:** 12 July 2017
Job No.: 3208176/200 **Tested By:** S.Shah **Checked By:** N.Agarkova
Bore No.: SB02A **Sample No.:** Q388 **Depth (m):** 6.6-7.25
Sample Type: Bulk **History:** As Received **Report No.:** 1935L:02

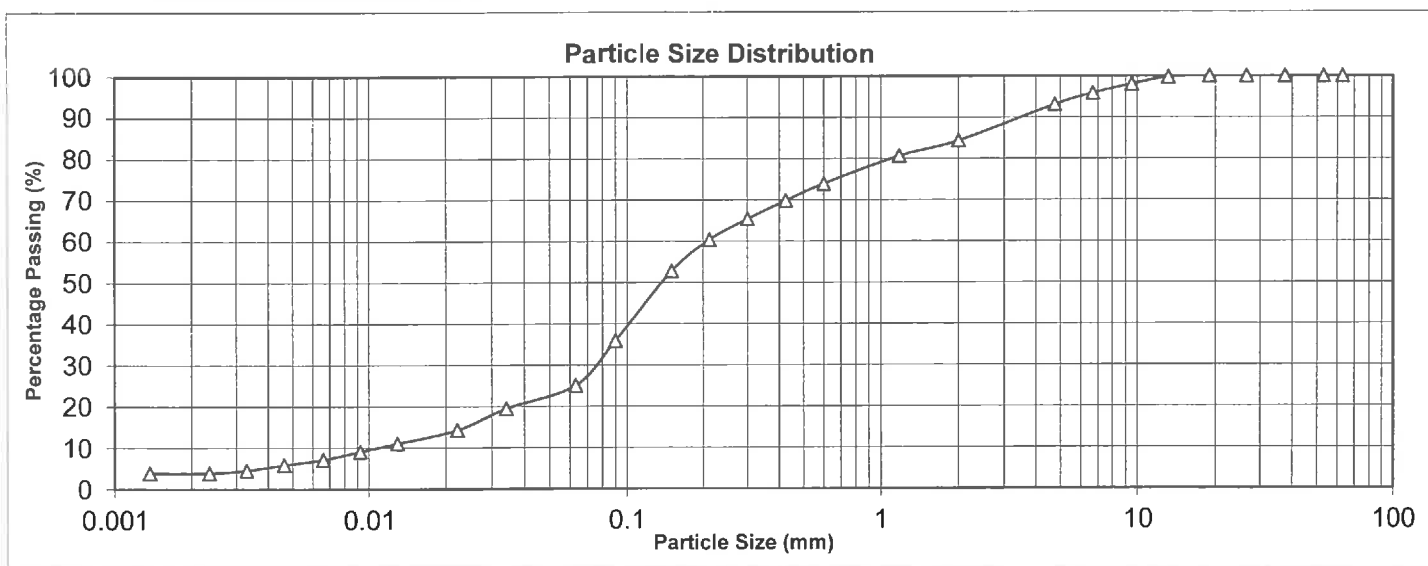
Sample Description: Silty fine to coarse SAND, some fine to medium gravel, trace clay; light yellowish brown, mottled white, black; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

NZS4402: 1986; Test 2.8.1

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	84
63.0mm	100	1.18mm	81
53.0mm	100	600µm	74
37.5mm	100	425µm	70
26.5mm	100	300µm	65
19.0mm	100	212µm	60
13.2mm	100	150µm	53
9.50mm	98	90µm	36
6.70mm	96	63µm	25
4.75mm	93	<63µm	25



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	20	60	16	9.50mm

Appendix M

Electronic Appendices

- Cone Penetration Test Data
- Dissipation Test Data
- Permeability Testing Data
- Continuous Groundwater Monitoring Data

Electronic files are embedded in PDF document, click the icons below.



CPT01



CPT02



CPT03



CPT04



Dissipation Test Data



Permeability Testing Data



Continuous Groundwater Monitoring Data