



Waitakere Coastal Communities Landslide Risk Assessment



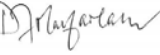

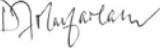

Overall Report - Muriwai

Auckland Council

15 May 2024

→ The Power of Commitment



Project name		Waitakere Coastal Communities Landslide Risk Assessment					
Document title		Waitakere Coastal Communities Landslide Risk Assessment Overall Report - Muriwai					
Project number		12612462					
File name		12612462_Overall Report_FINALRev2.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	Matt Howard	Don Macfarlane		Matt Howard		03/11/2023
S4	1	Matt Howard	Don Macfarlane		Matt Howard		30/04/2024
S4	2	Matt Howard	Don Macfarlane		Matt Howard		15/05/2024
[Status code]							
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Appendix C	Slope Stability Report
Appendix D	RAMMS Debris Flow Analysis
Appendix E	Landslide Risk Assessment
Appendix F	Geotechnical Investigations Report

Appendix F

Geotechnical Investigations Report



Waitakere Coastal Communities Landslide Risk Assessment







Appendix F – Geotechnical Investigations Report - Muriwai

Auckland Council

15 May 2024

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Project name		Waitakere Coastal Communities Landslide Risk Assessment					
Document title		Waitakere Coastal Communities Landslide Risk Assessment Appendix F – Geotechnical Investigations Report - Muriwai					
Project number		12612462					
File name		12612462_Appendix F GIR_FINALRev2.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	Johan Mendonca / Mi-Nu Kang / Johnie Xu	Don Macfarlane		Roy Pearson		03/11/2023
S4	1	Luke Agnew	Don Macfarlane		Roy Pearson		30/04/2024
S4	2	Luke Agnew	Don Macfarlane		Roy Pearson		15/04/2024
[Status code]							
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F1. Introduction

F1.1 Purpose of this report

GHD has been engaged by Auckland Council (AC)¹ to carry out landslide risk assessments and to provide associated landslide risk management advice and geotechnical investigations in the Waitakere area, specifically for the residential areas of Muriwai, Piha and Karekare.

One of the project work items is to conduct a geotechnical borehole investigation to understand the subsurface conditions in the vicinity of the 80 m-high escarpment to the east of Muriwai township that experienced damaging landslides in February 2023. This report is a factual account of the work undertaken, the materials that were encountered and their geotechnical characterisation from laboratory testing. These results are used to inform the engineering geological characterisation in Overall Report Appendix B.

Groundwater monitoring was installed in some boreholes for future groundwater monitoring by AC and some of this data is presented.

This report is an appendix to the overall GHD landslide risk report and should be read in conjunction with it, as well as associated appendices. The overall report contains additional information and synthesises the results of other appended assessments carried out by GHD.

F1.2 Background

Two significant rainfall events affected the Waitakere area in late January and early February 2023, resulting from the impacts of ex-tropical cyclones Hale and Gabrielle, respectively.

The Cyclone Gabrielle weather event of 14 February 2023 resulted in widespread catastrophic flooding and slope instability in the settlement of Muriwai where several debris avalanches (which included rocks and trees) occurred, some of which developed into saturated debris flows that resulted in damage to buildings and infrastructure. Two fatalities occurred due to impact of landslides on private dwellings. This tragic event was similar to a 1965 storm event that also claimed two lives.

Following the event, rapid building assessment of residential properties was undertaken in Muriwai, with some houses having access by owners restricted (a yellow placard – e.g. access in daylight hours only) and some for which no access was permitted (a red placard). Dwellings that retained unrestricted access were white placarded.

F1.3 Scope

The intention of the geotechnical investigation and groundwater monitoring installation was to:

- Support the development of the ground model of the site
- Provide an of understanding of geotechnical properties of previously failed landslide material
- Understand the presence of significant geological boundaries that may be influencing slope failure
- Identify groundwater profiles within the slope and their response to rain events, and to provide ongoing, telemetered data for use by AC.

¹ As part of contract CW198379, Master Services Agreement CCCS: CW74240 dated 7/09/2019, subsequent work item 'Waitakere Coastal Communities Landslide Risk Assessment', dated 26/04/2023

The scope for this investigation is as follows:

Boreholes

- Drill nine boreholes advanced to a depth of between 11 m and 80 m below ground level (bgl) at Muriwai in locations at the top and below the escarpment where landslides occurred in February 2023, with the following distribution:
 - Three approximately 80 m deep boreholes at Oaia Road, east of (above) the Muriwai escarpment
 - Three boreholes below the Muriwai escarpment on Domain Crescent (two to approximately 11 m bgl and one to approximately 41 m bgl)
 - Three boreholes below the Muriwai escarpment on Motutara Road (two to approximately 11 m bgl and one to approximately 41 m bgl)
- Log the recovered material using NZGS (2005) guidelines
- Conduct Standard Penetration Tests (SPTs) at 1.5 m intervals
- Record data in AGS4 format and upload borehole logs to the New Zealand Geotechnical Database

Groundwater monitoring

- Install standpipe piezometer screens in some of the boreholes
- Measure initial water levels during drilling and following screen installation
- Supervise installation of water level data recorders and AC monitoring-compatible telemetry hardware to allow ongoing data collection (by AC)

Laboratory testing

- Testing of recovered soils and rocks including:
 - Atterberg Limit testing
 - Particle size distribution (wet sieve) tests
 - Unconfined Compressive Strength tests
 - Pinhole and Crumb dispersibility

This report may be updated in the future to include ongoing data.

F1.4 Report structure

This report is a factual account of the Muriwai geotechnical investigation and is one of six appendices that are part of assessing the risk-to-life from landslides at Muriwai. A list of report appendices is presented in Table F1.

Table F1 Summary of accompanying Muriwai landslide risk assessment reports

Report Section	Description
Overall Report	Waitakere Coastal Communities Landslide Risk Assessment (Muriwai) Overall Report
Appendix A	Figures
Appendix B	Engineering Geological Report
Appendix C	Slope Stability Assessment
Appendix D	RAMMS debris flow analysis
Appendix E	Landslide Risk Assessment
Appendix F	<i>Geotechnical Investigations Report (this report)</i>

F2. Site investigation overview

F2.1 General

Intrusive site investigations commenced on the 29th of June 2023 and were completed on the 18th of August 2023. The location of Muriwai is shown in Figure F1 below and a plan showing the borehole locations is presented in Figure F1-1 in Appendix F1.

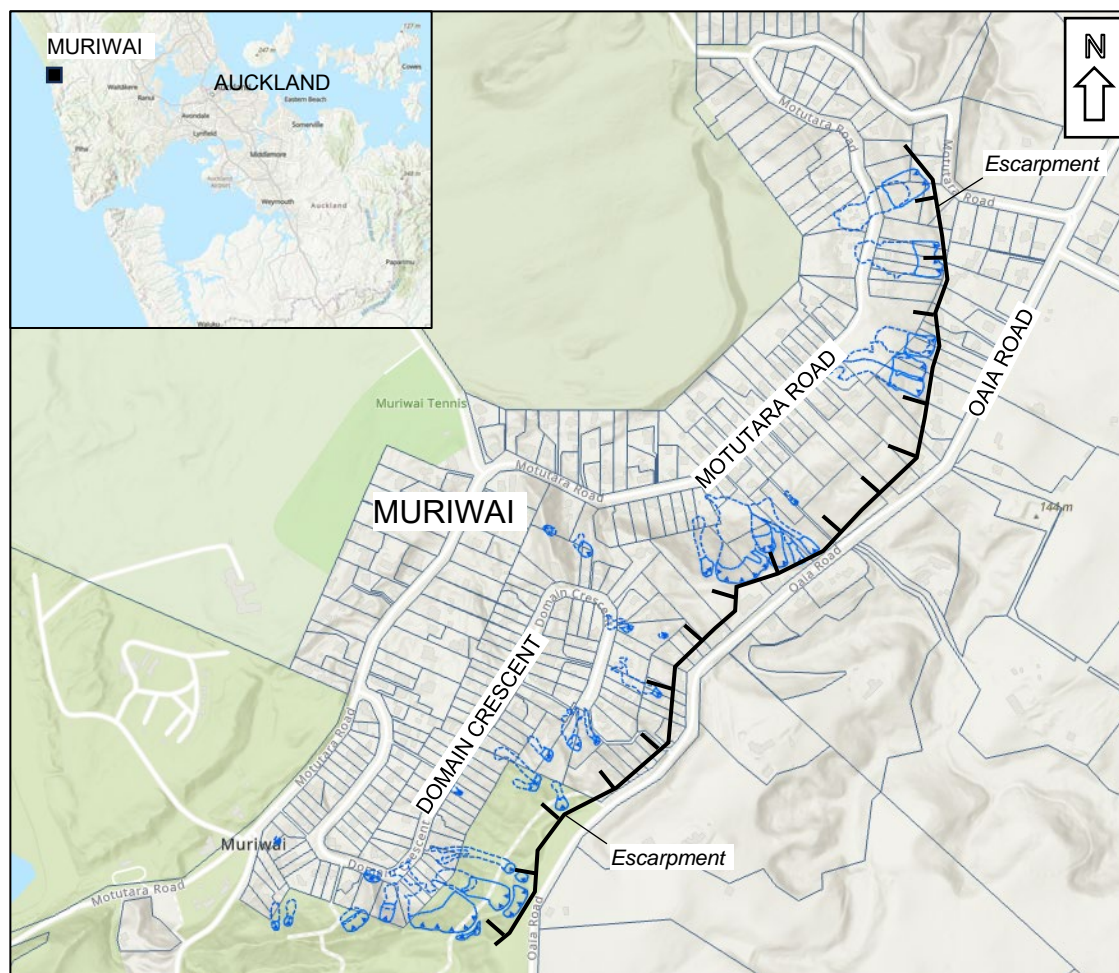


Figure F1 Muriwai location showing the February 2023 landslides mapped by GHD (blue lines)

All nine boreholes were drilled within the road reserve, with three holes along each of Oaia Road, Domain Crescent and Motutara Road. Six groundwater dataloggers with telemetry hardware were installed in the boreholes with piezometer screens. The location, depth and installation summary of these holes are presented in Table F2 below.

F2.2 Subcontractor management

GHD engaged DCN Drilling Limited (DCN) to undertake the site investigation physical works. DCN directly engaged and managed additional subcontractors required to complete the physical works on site, including traffic management and buried services clearance.

Babbage Geotechnical Laboratory (BGL) and Geotechnics Ltd were engaged to carry out geotechnical laboratory testing. ConnectM2M Limited installed piezometer dataloggers and telemetry.

Table F2 Borehole investigations summary (all holes to target depth)

Location ID	Street location	Easting	Northing	Reduced level (m)	Termination depth (m bgl)	Screen interval (m bgl)
BH-M01	Oaia Road	1728691	5923873	138.0	79.60	73 – 79
BH-M02		1728387	5923493	144.5	79.57	60 – 66
BH-M03		1728010	5923112	150.0	79.64	73 – 79
BH-M04	Domain Crescent	1727699	5923031	53.0	10.95	No installation
BH-M05		1727856	5923234	63.5	10.95	No installation
BH-M06		1728033	5923293	90.0	40.95	21 – 27
BH-M07	Motutara Road	1728235	5923652	52.0	40.64	33 – 39
BH-M08		1728392	5923798	63.0	10.95	No installation
BH-M09		1728448	5923911	72.5	10.95	7.2 – 10.2

F3. Site investigation methodology

F3.1 Boreholes

Boreholes were completed as follows:

- Hand auger or hydro-excavation to 1.5 m bgl to avoid striking buried services.
- Conventional ('Open Barrel') coring to recover nominal 83 mm diameter core in low strength near surface material.
- Wireline triple tube (HQTT) coring to recover nominal 61mm diameter core at greater depths.

Boreholes without piezometers installed were backfilled with bentonite and the surface reinstated. All well covers were capped with plastic lockable lids and rubber gaskets ('toby box'), flush to ground level. All receiver/transmitter units that house the telemetry equipment were installed in an adjacent service box, which itself is covered with a lockable plastic lid flush to ground level.

For BH-M06 & 07 wells are within the road, with the service boxes being offset less than 1 m away (outside of carriageway).

A short length of connecting wire is buried at shallow depth (less than 1 m bgl) between the well head and the service box. For BH-M06 and BH-M07, this is encased in a PVC plastic sleeve. Wire connections are not marked at ground level.

Borehole logs, core photographs and piezometer installation details are presented in Appendix F2.

F3.2 In-situ strength testing

The following in-situ strength testing was performed during the drilling of boreholes.

F3.2.1 Standard penetration testing (SPT)

Standard Penetration Testing (SPTs) were performed at 1.5 m intervals in accordance with NZS 4402: 1988 Test 6.5.1 "*Determination of the penetration resistance of a soil*". SPT results are recorded on the borehole logs in Appendix F2 with the associated hammer calibration sheets. SPT results plotted against reduced level are presented in Figure F2.

Values given on the attached borehole logs are uncorrected N values. Table F3 gives the hammer efficiency value for each SPT hammer used during the site investigations. The associated drilling rig is reported on the corresponding borehole log. SPT calibration documentation is presented in Appendix F4.

Table F3 *Overview of the SPT hammer efficiency of the drilling rig*

Drilling Rig	SPT Trip Hammer Reference	SPT Hammer Efficiency	Boreholes Drilled
TR 200	3	68.5 %	All boreholes except BH-M04
MOR 700	1	68.1 %	BH-M04

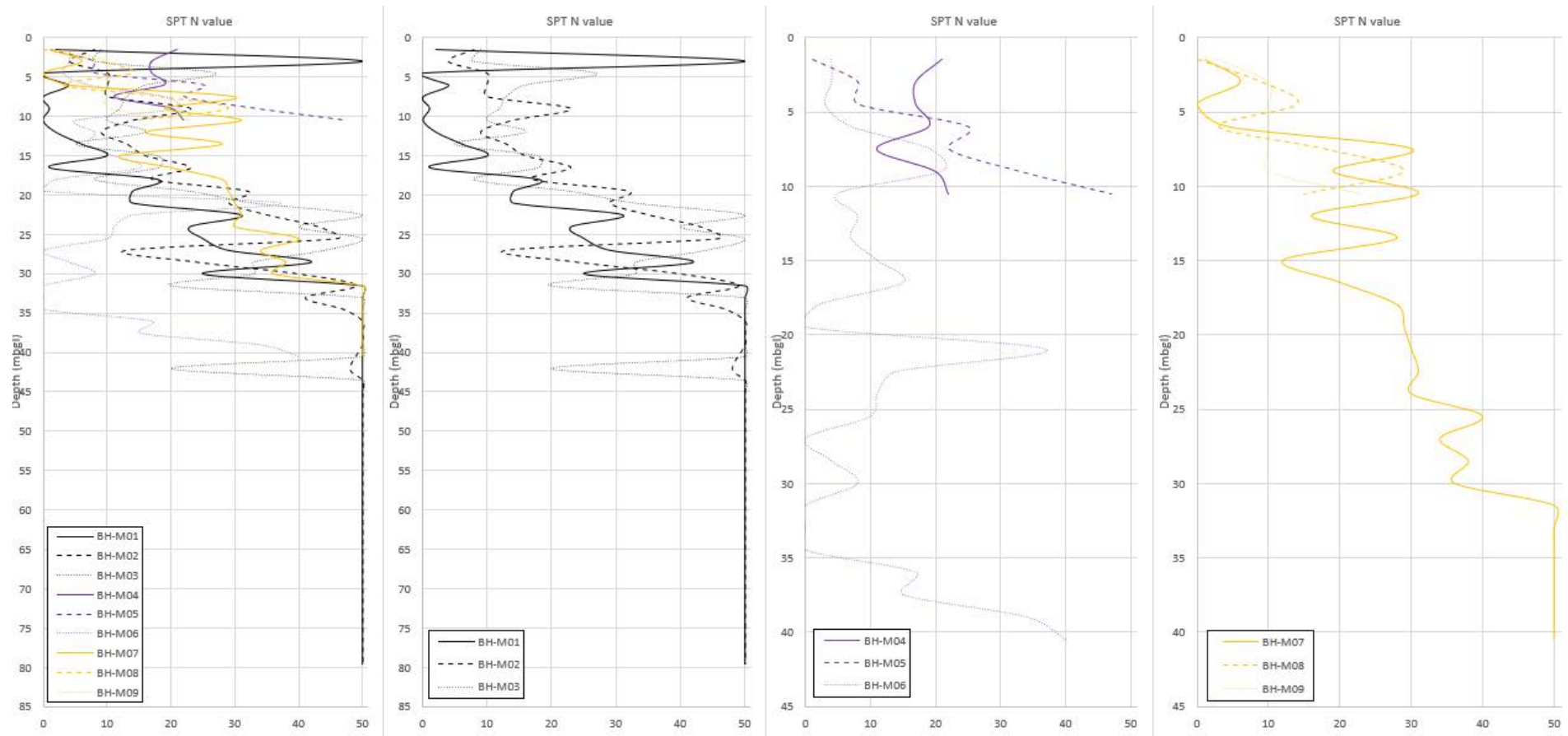


Figure F2 *Uncorrected SPT 'N' value graphs against depth (m bgl) for all boreholes (left graph), with the same information separated into borehole groupings for clarity*

F3.2.2 Handheld shear vane

Shear vane testing was performed during drilling of machine boreholes where cohesive soils were encountered. Measurements were typically taken every 1.5 m depth from core prior to extrusion from the core barrel.

All shear strengths shown on the appended logs are corrected vane shear strengths derived in accordance with the NZGS “*Guideline for Hand Held Shear Vanes Test*” (2001). The peak and remoulded vane readings represent hand-held dial readings from a 19 mm vane, adjusted using the calibration sheets attached in Appendix F4. These are reported on the logs as undrained shear strength and are summarised in Table F4.

Table F4 *Shear vane testing summary*

Borehole	Test Depth (m bgl)	Vane Serial Number	Corrected Peak Undrained Shear Strength (kPa)	Corrected Residual Undrained Shear Strength (kPa)	Note
BH-M01	3.0	GEO902	>211	n/a	Vane unable to penetrate
BH-M02	0.5	GEO1060	155	87	
BH-M02	1.0	GEO1060	142	74	
BH-M02	1.5	GEO1060	111	59	
BH-M02	3.0	GEO1060	>211	n/a	Vane unable to penetrate
BH-M06	3.0	GEO902	>211	n/a	Vane unable to penetrate
BH-M06	4.5	GEO902	>211	n/a	Vane unable to penetrate
BH-M08	3.0	GEO902	>211	n/a	Vane unable to penetrate

F3.3 Groundwater level monitoring

F3.3.1 Piezometer construction and static readings

Groundwater readings were periodically taken during the drilling programme (see Table F5). Groundwater levels measured in piezometers following bore development are summarised in Table F5.

F3.3.2 Variable head permeability (slug) testing

Slug testing was carried out between the 28th and 30th of August 2023 to estimate the permeability of the materials in the screened range of the piezometers. Rising and falling head tests were carried out in all six piezometers installed.

The data obtained from the rising and falling head tests were analysed using Aqtesolv Software (v 4.51), and the hydraulic conductivity values were obtained using the Bower and Rice (1976) and Hvorslev (1951) solutions. The results are provided in Table F6.

Table F5 Groundwater levels following piezometer installation and bore development.

Bore ID	Ground Elevation	Screen Interval	Groundwater level											
			28 Aug 2023		29 Aug 2023		30 Aug 2023		9 th Apr 2024		17 th Apr 2024		19 th Apr 2024	
			(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)
BH-M01	138.0	73 – 79	59.38	78.62	Not read				51.51	86.49	Not read		Not read	
BH-M02	144.5	60 – 66	84.79	59.73	84.76	59.74	Not read		Not read		59.75	84.75	59.74	84.76
BH-M03	150.0	73 – 79	Dry	-	Dry	-	Dry	-	Not read		Dry	-	Dry	-
BH-M06	90.0	21 – 27	19.97	70.02	19.82	70.17	19.86	70.14	Not read		19.65	70.35	18.51	71.49
BH-M07	52.0	33 – 39	Not read	-	7.32	44.68	Not read		Not read		7.36	44.64	7.52	44.48
BH-M09	72.5	7.2 – 10.2	6.83	65.67	6.83	65.67	Not read		Not read		7.22	65.28	7.23	65.27

Table F6 Results from the hydraulic conductivity tests (data from BH-M09 was not credible and is not presented)

Bore ID	Hydraulic conductivity (m/s)		
	Bouwer-Rice	Hvorslev	Mean
BH-M01	8.8E-08	1.0E-07	9.5E-08
BH-M02	5.5E-09	6.5E-09	5.9E-09
BH-M06	1.7E-08	2.3E-08	2.0E-08
BH-M07	3.4E-08	4.1E-08	7.1E-08
	1.4E-07	1.3E-07	

F3.3.3 Telemetry

To allow long-term remote monitoring of water levels in piezometers by AC each piezometer was fitted with a pressure transducer data logger and cellular telemetry unit. Data loggers and telemetry are self-contained, vented and battery powered.

The telemetered groundwater monitoring equipment includes:

- Hydrostatic Level Sensor (PTX-002) and associated cable,
- Site Sentinel (X1-001 4G),
- Road Marker Antenna (XANT-007),
- Analogue Junction Box - 1 input with vent (XIO-004)
- Marley 250 mm x 250 mm sealed cable management pit.

Each hydrostatic level sensor records and reports the level of water above the sensor. Each telemetered unit is configured to record this water level at 15-minute intervals. The data is transmitted daily at 2 pm. Once transmitted, the data is pushed directly to Auckland Council's Hydrotel system. A summary of the installation depths of the hydrostatic level sensors in meters below ground level (m bgl), and an approximated² value in m RL, is provided in Table F7.

Groundwater plots from the telemetered data, between the period of 19th October 2023 and 22nd March 2024 are presented in Appendix F5. Rainfall data taken from the Muriwai Golf Course (available on Auckland Council's Environmental Data Portal) for the same date range has been plotted on the graphs also. The groundwater data trace presented in Appendix F5 for BH-M01 represents a signal that is unverifiable and as such has been assumed to be erroneous.

Table F7 Hydrostatic Level Sensor install depth summary.

Bore ID	Hydrostatic Level Sensor Installation Depth	
	Measured value in m bgl	Approximate value in m RL ²
BH-M01	66.2	71.8
BH-M02	65.85	78.7
BH-M03	79.0	71.0
BH-M06	27.0	63.0
BH-M07	39.0	13.0
BH-M09	10.3	62.2

² Hydrostatic Level Sensor installation depth presented in m RL is calculated using the estimated collar height of the bore. This collar height has been estimated from a local GIS viewer and has not been measured using GNSS techniques.

F3.4 Investigation locations

The location of each borehole was recorded using handheld GPS, which has a metre-scale accuracy. This was compared with Auckland Council's online GIS viewer using measurements of investigation locations relative to known features.

Latitude and longitude are presented in terms of the New Zealand Transverse Mercator (NZTM 2000), the internationally recognised type of projection formally defined as the LINZS25002 standard (standard for New Zealand Geodetic Datum 2000 Projections), with elevation shown in the Auckland 1946 local mean sea level (MSL), one of thirteen local MSL circuits used in New Zealand.

F4. Geotechnical laboratory testing

F4.1 General

The following tests were scheduled for selected samples by BGL:

- Atterberg Limit, (NZS 4402:1986, Test 2.2, 2.3 & 2.4)
- Particle Size Distribution (Wet Sieve), (NZS 4402:1986, Test 2.8.1)
- Particle Size Distribution (Hydrometer), (NZS 4402:1986, Test 2.8.4)
- Detection of Presence of Allophane in Soils: (NZS4402:1986, Test 3.4)
- Unconfined Compressive Strength (UCS). (NZS4402:1986,Test 6.3.1)

The following tests were scheduled for selected samples by Geotechnics Ltd:

- Pinhole, (ASTM D4647-13 2020)
- Dispersibility by the Crumb Method (BS 1377: Part 5: 1990 Clause 6.3, not IANZ accredited)
- Water Content, (NZS 4402: 1986, Test 2.1)

The number and type of tests are presented in Table F8. Testing results are presented in Appendix F3.

Table F8 General summary of geotechnical laboratory testing scheduled.

Investigation ID	Water content	Atterberg limits (PL, LL, PI)	Particle size distribution (wet sieve)	Particle size distribution (hydrometer)	Crumb test	Uniaxial compressive strength (UCS)	Pinhole	Allophane Presence
BH-M01	1	1	2	1	1		1	
BH-M02	1		1			13	1	
BH-M03			1			9		
BH-M05			1					
Bh-M06			1					
BH-M07			3					
BH-M08			2					1
BH-M09			2					

F4.2 Atterberg Limit

One sample was tested for Atterberg Limits, (NZS 4402:1986, Test 2.2, 2.3 & 2.4); the result is plotted on the plasticity index chart in Figure F3.

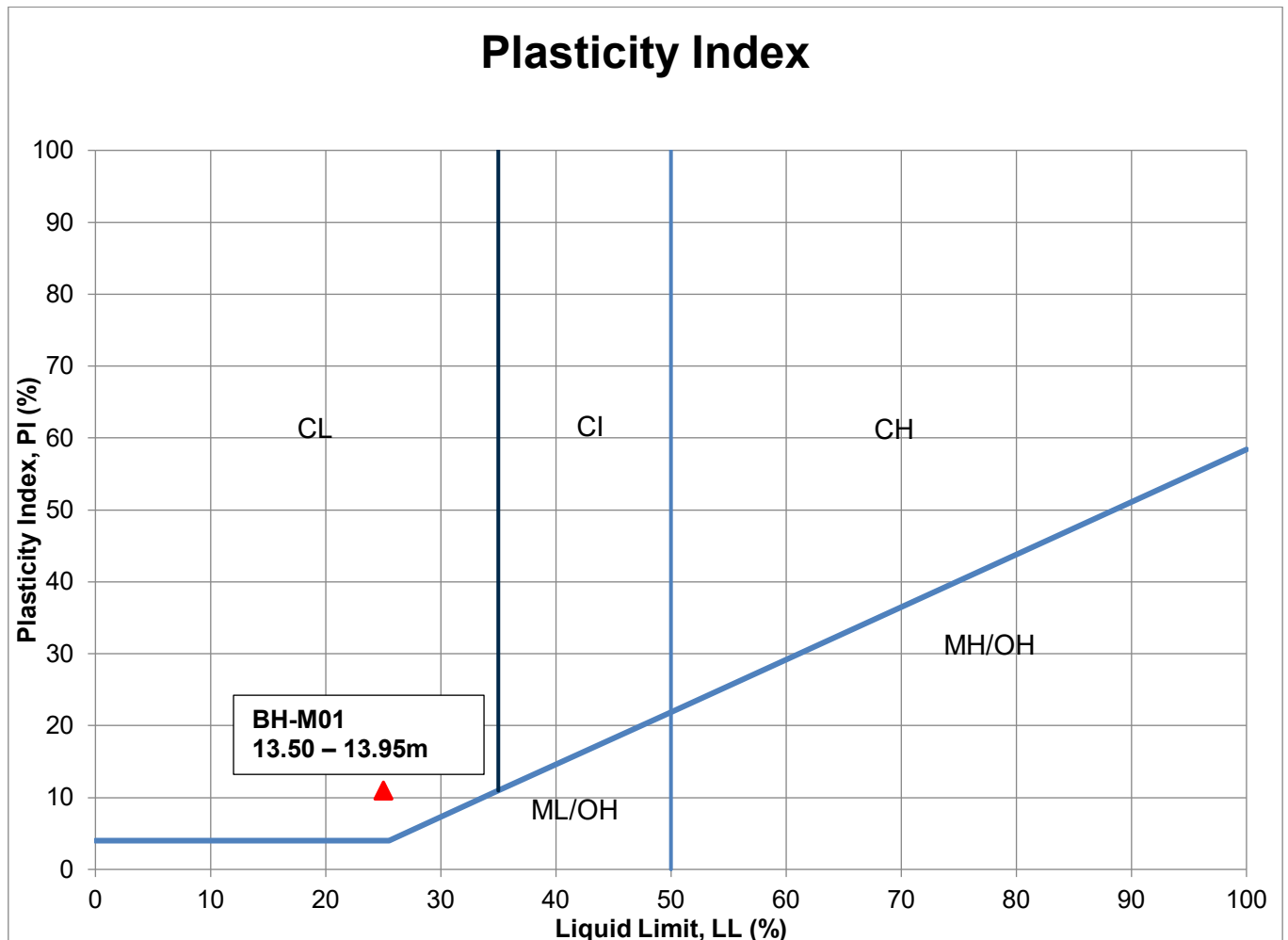


Figure F3 Plasticity Index chart

F4.3 Particle Size Distribution

Thirteen samples were taken from BH-M01 to BH-M09 and tested for Particle Size Distribution (PSD - wet sieve). One PSD sample from BH-M01 was tested for PSD - hydrometer (NZS 4402:1986 Test 2.8.4). The results are presented in Figure F4.

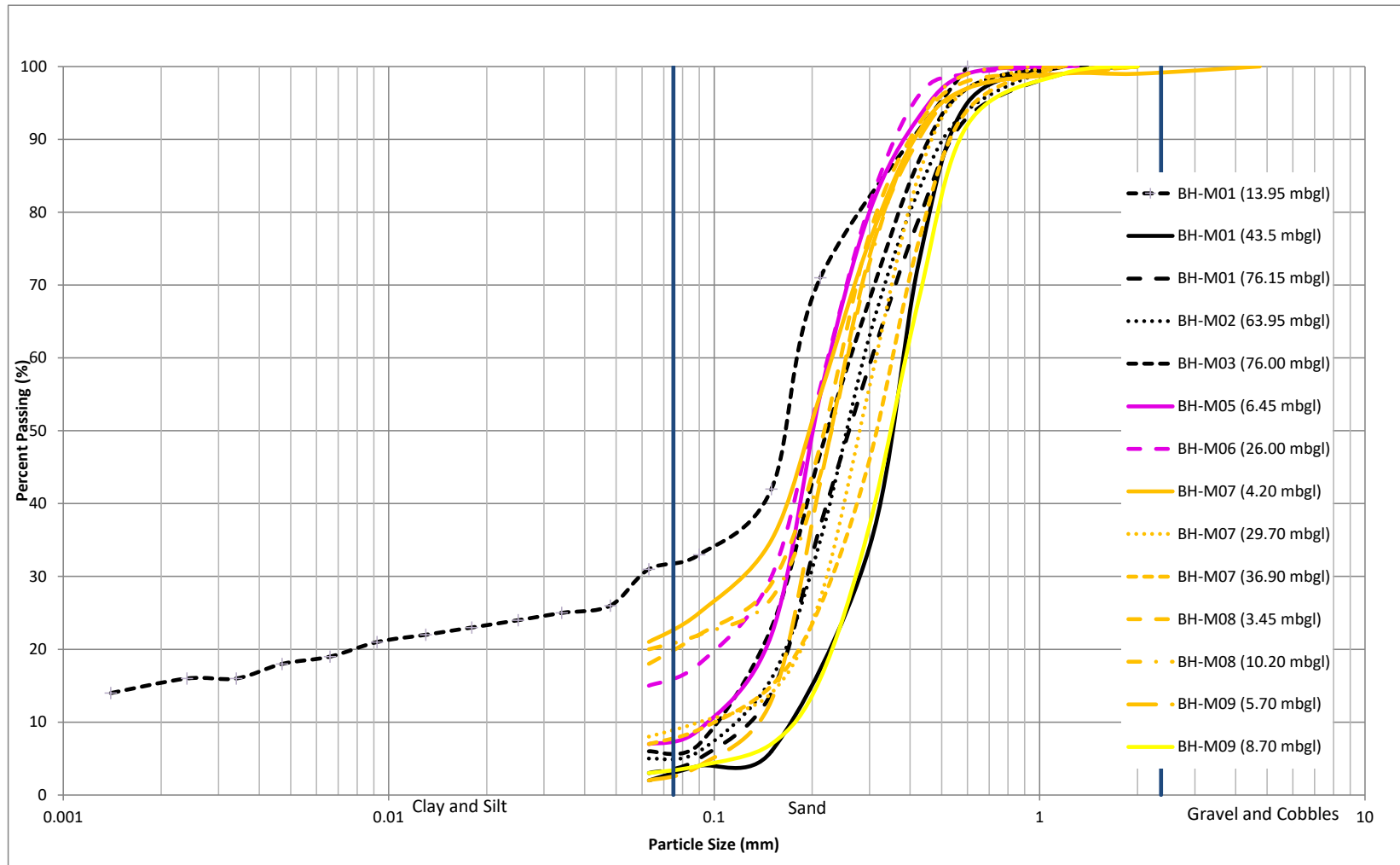


Figure F4 Particle Size Distribution chart

F4.4 Detection of Presence of Allophane in Soils:

One sample (BH-M08, 10.00-10.10m) was tested for presence of allophane (NZS4402:1986, Test 3.4). The result indicates an allophane content of less than 5%.

F4.5 Pinhole and Crumb Testing

Two samples were tested for dispersibility using Pinhole (ASTM D4647-13) and Crumb (BS 1377: Part 5: 1990 Clause 6.3) methods. The results are outlined in Table F9.

Table F9 Summary of Pinhole and Crumb Testing

Sample (BH & Depth)	Lab Description	Pinhole Method Classification	Crumb Method Classification
BH-M01 - 2.02 -2.06 m	Clayey SILT, dark brown; very soft, wet, high plasticity.	D1 (dispersive)	Grade 4 - Strong reaction (dispersive)
BH-M02 – 1.96 – 2.00 m	Silty CLAY, orange brown; very soft, wet, high plasticity	ND1 (non-dispersive)	Grade 4 - Strong reaction (dispersive)

F4.6 Uniaxial Compressive Strength (UCS)

UCS testing was undertaken by BGL on Awhiti Group core samples from BH-M02 and BH-M03 (NZS4402:1986, Test 6.3.1). The results are presented against depth in Figure F5 .

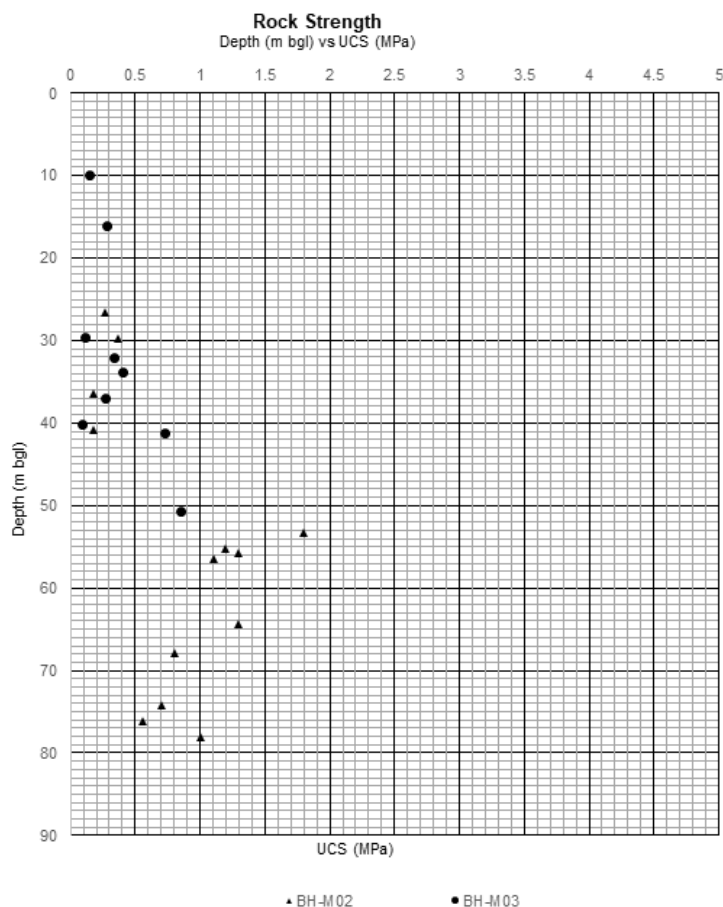


Figure F5 Uniaxial Compressive Strength (UCS) versus depth

F5. References

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Hvorslev, 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bul. no. 26, Waterways Experiment Station, Corps of Engineers, U.S. Army, Vicksburg, Mississippi

New Zealand Geotechnical Society (2005) “Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes”

New Zealand Geotechnical Society (2001) “Guideline for Hand Held Shear Vane Test”

New Zealand Standard 4402 (1986) “Methods of testing soils for civil engineering purposes”

F6. Limitations

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This report presents information obtained from, and testing undertaken at or in connection with, specific sample points, investigation locations and test points. Conditions at other parts of the site may be different from conditions found at the specific sample points. The actual characteristics of materials may vary significantly.

Sampling, investigations and testing were undertaken at a specific point in time. Ground conditions, including groundwater levels and contaminant concentrations can change over time. Therefore, the information from the sampling, investigations and testing may not represent the conditions that may be encountered across the site at any future point in time.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as physical access and the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended, abbreviated, or issued in part in any way without prior written approval by GHD. GHD does not accept liability in connection with the issuing of an unapproved or modified version of this report.

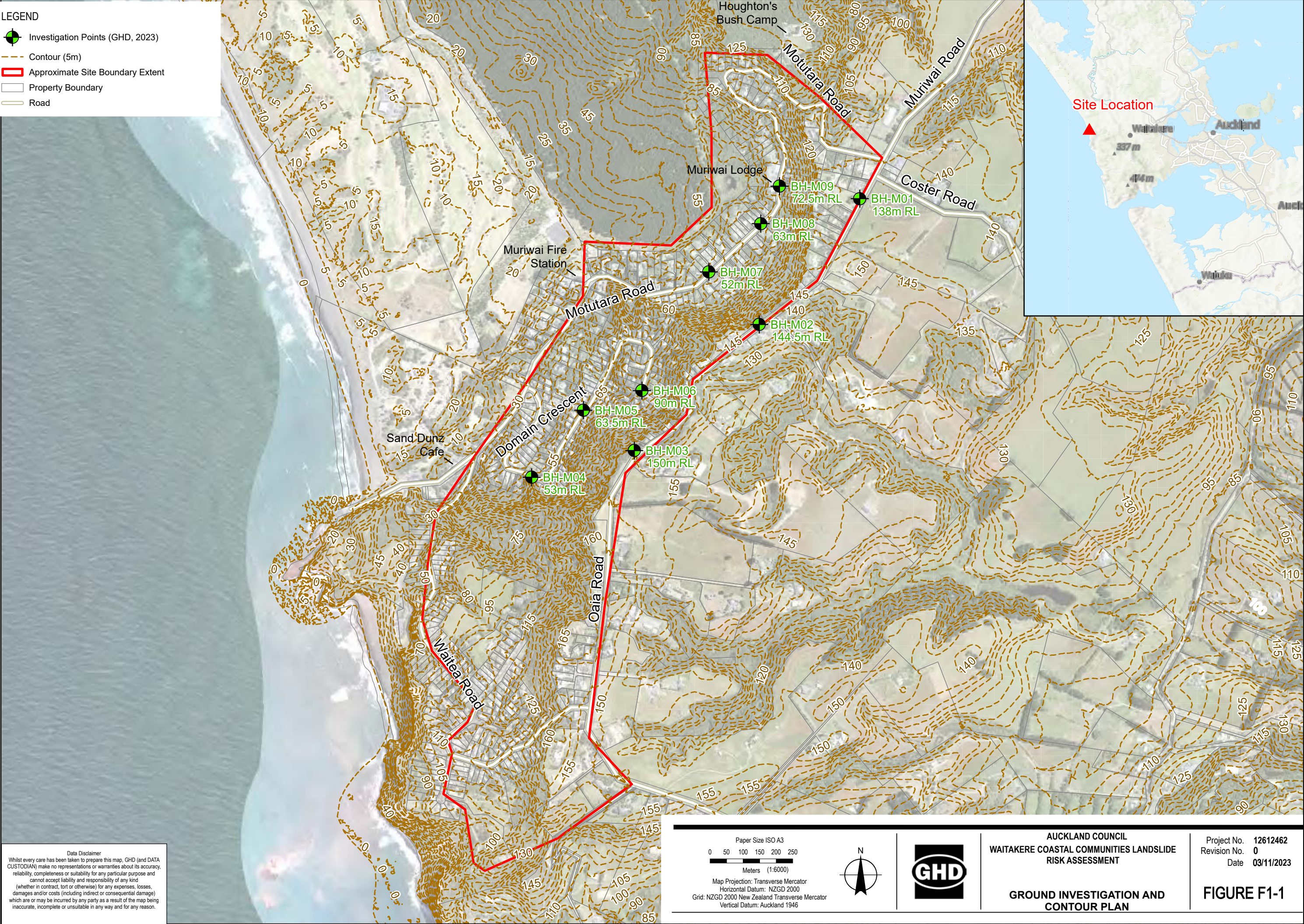
Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. If the revealed ground or groundwater conditions vary from those assumed or described in this report the matter should be referred back to GHD.

Appendices

Appendix F1

Site Plan

- LEGEND
- Investigation Points (GHD, 2023)
 - Contour (5m)
 - Approximate Site Boundary Extent
 - Property Boundary
 - Road



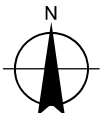
Data Disclaimer

Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: World Hillshade: Esri, CGIAR
World Imagery: Auckland Council, Maxar
World Topographic Map: Stats NZ, Esri, HERE, Garmin, Foursquare, FAO, METINASA, USGS, LINZ-Parcel, Road, GHD- Borehole Locations, Site extend - 20230811. Created by: gullan

Paper Size ISO A3
0 50 100 150 200 250
Meters (1:6000)

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator
Vertical Datum: Auckland 1946



AUCKLAND COUNCIL
WAITAKERE COASTAL COMMUNITIES LANDSLIDE
RISK ASSESSMENT

GROUND INVESTIGATION AND
CONTOUR PLAN

Project No. 12612462
Revision No. 0
Date 03/11/2023

FIGURE F1-1

Appendix F2

Borehole Logs and Photographs

- Glossary of symbols
- Borehole logs and photoboards

GLOSSARY OF SYMBOLS



This standard sheet should be read in conjunction with all test hole log sheets and any idealised geological sections prepared for the investigation report.

GENERAL ABBREVIATIONS

Activity type / drilling method

DT	Dual tube	OP	Observation pit/trench
CA	Casing advancement	PM	Pressuremeter test hole
EXP	Logged exposure	PQTT	PQ triple tube coring
GCOP	GCO probe	RC	Rotary cored
HA	Hand Auger	RCG	Rotary drilling in common ground
HV	Hydro Vacuum excavation	RO	Rotary open hole
HQTT	HQ triple tube coring	SCP	Static cone penetrometer
ICBR	In situ CBR test	SH	Shaft
IDEN	In situ density test	SNC	Sonic core drilling
INST	Instrument	SPT	Standard penetration test
IVAN	In situ vane test	TP	Trial pit/trench
MHA	Machine Hollow auger	TT	Triple tube coring
MSA	Machine Solid auger	VC	Vibrocore
NQTT	NQ triple tube coring	W	Wash boring
OB	Open barrel		

Sampling type

AMAL	Amalgamated sample	LB	Large bulk disturbed sample (for earthworks testing)
B	Bulk disturbed sample	LDS	Large Disturbed Sample
BLK	Block sample	M	Mazier type sample
C	Core sample	P	Piston sample
CBR	CBR mould sample	TW	Thin walled push in sample
D	Small disturbed sample	U	Undisturbed sample - open drive
ES	Soil sample for environmental testing	U100	U110 Undisturbed Sample
EW	Water sample for environmental testing	U76	U76 Undisturbed Sample
G	Gas sample	UT	Thin wall open drive tube sampler
J	Jar	W	Water sample

Other testing

F	Falling Head Permeability Test
N	Total blows - SPT Value
PK	Packer Test
PP	Pocket Penetrometer (suffixed by value in kPa)
PT	Pressuremeter Test
R	Rising Head Permeability Test
SV	Shear Vane Test (suffixed by value in kPa, peak/residual values)
UTP	Unable to penetrate (shear vane testing)
TD	Target depth
HCL	Hydrochloric acid

WELL SYMBOLS



Sand



Grout



Solid Pipe



Gravel



Concrete



Slotted Pipe



Bentonite

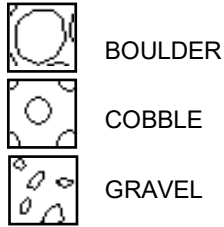
GROUNDWATER SYMBOLS



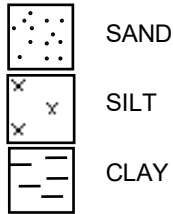
Groundwater level

SOIL SYMBOLS

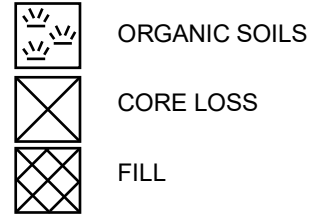
Main Components




BOULDER
COBBLE
GRAVEL



SAND
SILT
CLAY



ORGANIC SOILS
CORE LOSS
FILL

Note: Composite soil types will be signified by combined symbols, e.g.  Sandy CLAY

SOIL DESCRIPTION ABBREVIATIONS

Consistency

D	Dense
D-VD	Dense to very dense
F	Firm
F-St	Firm to stiff
H	Hard
L	Loose
L-MD	Loose to medium dense
MD	Medium dense
MD-D	Medium dense to dense
S	Soft

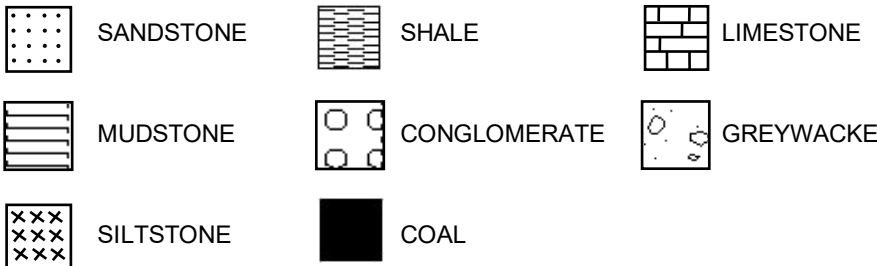
S-F	Soft to firm
St	Stiff
St-VSt	Stiff to very stiff
VD	Very dense
VL	Very loose
VL-L	Very loose to loose
VS	Very soft
VS-S	Very soft to soft
VSt	Very stiff
VSt-H	Very Stiff to hard

Moisture Condition

D	Dry
D-M	Dry to moist
M	Moist
M-W	Moist to wet
S	Saturated
W	Wet

ROCK SYMBOLS

Sedimentary



Metamorphic



Igneous



Note: Additional rock symbols may be allocated for a particular project. Interbedded rock will be represented using alternatively the above symbols

ROCK DESCRIPTION ABBREVIATIONS

Rock Strength

EW	Extremely weak
EW - VW	Extremely to very weak
VW	Very weak
VW - W	Very weak to weak
W	Weak
W - MS	Weak to moderately strong
MS	Moderately strong
MS - S	Moderately strong to strong
S	Strong
S – VS	Strong to very strong
VS	Very strong
VS - ES	Very strong to extremely strong
ES	Extremely strong

Weathering

RS	Residual soil
CW-RS	Completely weathered to residual soil
CW	Completely weathered
HW-CW	Highly weathered to completely weathered
HW	Highly weathered
MW-HW	Moderately weathered to highly weathered
MW	Moderated weathering
SW-MW	Slightly weathered to moderately weathered
SW	Slightly Weathered
UW-SW	Unweathered to slightly weathered
UW	Unweathered (fresh)

DEFECT DESCRIPTION ABBREVIATIONS

Fracture Type

BP	Bedding Plane
CB	Cross Bed
CI	Cleavage
CS	Crushed Seam
CZ	Crush zone
FI	Foliation
FZ	Fractured Zone (>250 mm)
JS	Joint set

JT	Joint
SF	Sheared Surface
SM	Seam
SS	Sheared Seam
SZ	Sheared Zone (>250 mm)
VN	Vein

Inclination

SB	Sub-horizontal
G	Gently inclined
M	Moderately inclined
S	Steeply inclined
VS	Very steeply inclined
SV	Sub-vertical

Aperture

T	Tight
VN	Very Narrow
N	Narrow
MN	Moderately Narrow
MW	Moderately Wide
W	Wide
VW	Very Wide

Roughness

sl	Slickensided
r	Rough
sm	Smooth

Infilling or Coating

CN	Clean
X	Carbonaceous
CLAY	Clay
KT	Chlorite
CA	Calcite
Fe	Iron Oxide
MI	Micaceous
QZ	Quartz
VE	Veneer

Texture

PI	Planar
St	Stepped
U	Undulating

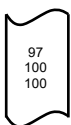
Spacing

EC	Extremely closely spaced
VC	Very closely spaced
C	Closely spaced
MW	Moderately widely spaced
W	Widely spaced
VW	Very widely spaced

Joint Set Counts

X 2	2 joints
X 3	3 joints
X 4	4 joints
X 5	5 joints
X 6	6 joints
X 7	7 joints
X 8	8 joints
X 9	9 joints
> 10	> 10 joints

Core Recovery Parameters





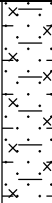
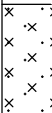
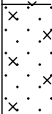
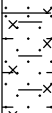
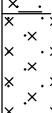
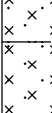
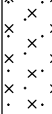
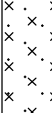
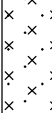
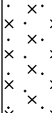
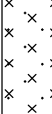
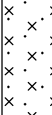
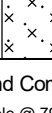
TCR – Total Core Recovery %
 SCR – Solid Core Recovery %
 RQD – Rock Quality Designation %

Visual Defects


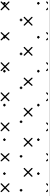
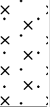

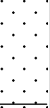
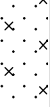


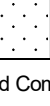
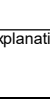


Visual representation of defect angle
 from horizontal (example shown is 45°)

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023					Hole No. : BH-M01 Sheet : 1 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS									
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946					System: NZTM2000									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
137	0		Clayey SILT with some organics; brown, mottled orange and grey. 'Soft to firm', moist, low plasticity. Organics, rootlets and roots. [TOPSOIL].	TOPSOIL	M	CS											
1	0.5		Clayey SILT with minor organics; brown, mottled orange and grey. 'Soft to firm', moist, low plasticity. Organics, rootlets. [FILL].	FILL						HA				100			
1.9	1.2		Clayey SILT with some roots; brown, speckled grey. 'Soft', moist, low plasticity. Roots, 3 to 25 mm in diameter. [AWHITU SAND FORMATION]. 1.35 - 1.50 Wet.		W	'S'											
2	1.9		Silty CLAY; brown, speckled grey. 'Soft', moist, high plasticity.		M					SPT				100			
2.7	2.7									OB				100			
3	3.3		Silty fine SAND; dark brown, speckled black-grey. Very dense, moist.			VD											
3.3	3.3		CORE LOSS		-	-				SPT				100			
3.65	3.65		Silty fine SAND; dark brown, speckled black and grey. Very dense, moist.		M	VD				HQTT				71			
4	4.64		CORE LOSS		-	-				SPT				0			
5	6.64									HQTT				0			
6	6		Silty fine SAND; grey, speckled black. Loose, moist.		M	L				SPT				38			
6.45	6.45		CORE LOSS		-	-											
6.64	6.64		Silty fine SAND; grey, speckled black. Loose, moist.		M	VL				HQTT				82			
7	7.95									SPT				0			
130	7.95																
Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols			Inclination: Vertical Orientation: Contractor: DCN Equipment: TR 200 Shear Vane Id: GEO902					Ground Water Level Date Time Reading (mbgl) Hole depth (mbgl)									


<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023</div>				<div>Hole No. : BH-M01</div> <div>Sheet : 2 of 10 Hole Length : 79.60m Scale @ A4 : 1:40</div> <div>Completed: 5/07/2023</div>														
<div>Easting: 1728691.45 RL: 138</div> <div>Northing: 5923873.69 Datum: AUCKHT1946</div> <div>System: NZTM2000</div>				<div>Logged : JM</div> <div>Processed : JM</div> <div>Checked : JHS</div>														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
129	9		Clayey silty fine SAND; grey, speckled black. Very loose, moist. (continued from layer starting at 8.0m)	AWHITU SAND FORMATION			SPT 0/0 0/0 0/1 N = 1			HQTT				78				
			Sandy SILT with some clay; grey with minor brown streaks. 'Very soft', saturated, non-plastic. Sand, fine.		S	'VS'				SPT					100			
128	9.7		Silty fine SAND; grey with minor light brown streaks. Wet.		W	-				HQTT					100			
			Clayey silty fine SAND; grey with some light brown streaks. Very loose, moist.		M	VL	SPT 0/0 0/0 0/0 N = 0		SPT				0					
127	10.35		Sandy SILT with minor clay; grey, streaked light brown. 'Very soft', wet, non-plastic. Sand, fine to medium.		W	'VS'			HQTT					100				
126	11		Silty fine SAND; light grey, streaked brown, speckled black. Very loose, wet.			VL	SPT 0/0 0/0 1/1 N = 2		SPT				0					
						VL-L			HQTT					100				
125	12		12.45 - 18.00 Very loose to loose.				SPT 0/0 0/0 1/5 N = 6		SPT				100					
124	13								HQTT					100				
123	14						SPT 0/0 0/0 1/5 N = 6		SPT					100				
									HQTT					100				
122	15						SPT 1/1 1/2 2/5 N = 10		SPT					0				
									HQTT					100				
<div>Notes and Comments:</div> <div>End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.</div> <div>Refer to explanation sheets for abbreviation and symbols</div>				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)			
				Contractor: DCN		Equipment: TR 200												
				Shear Vane Id: GEO902														


Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023						Hole No. : BH-M01 Sheet : 3 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS														
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946			System: NZTM2000																	
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation	Water level						
							Number / Type	Result															
114	17		Silty fine SAND; light grey, streaked brown, speckled black. Very loose, wet. (continued from layer starting at 11.7m) 16.40 - 16.50 Brown streaks.	AWHITU SAND FORMATION	M	MD	SPT 0/0 0/1 0/0 N = 1			HQTT					100								
121	18		18.00 - 18.50 Medium dense.							SPT 2/2 3/3 4/8 N = 18	SPT						0						
120	19		Fine SAND, trace silt; grey. Medium dense, moist.																				
119	20																						
118	21		Silty fine to medium SAND with trace clay; light brown, streaked light orange. Medium dense, moist.				SPT 1/1 2/3 4/5 N = 14			HQTT					100								
117	22									SPT					0								
116	23		Fine to medium SAND, trace silt; grey, mottled orange; indistinctly, very thinly bedded at 5-10°. Medium dense to dense, moist.			MD-D	SPT 2/2 2/3 4/5 N = 14			HQTT					100								
115	24						SPT 3/5 8/8 7/8 N = 31			SPT					0								
114	25									HQTT					100								


Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO902							


4-07-2023

<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023</div>				<div>Hole No. : BH-M01</div> <div>Sheet : 5 of 10 Hole Length : 79.60m Scale @ A4 : 1:40</div> <div>Logged : JM Processed : JM Checked : JHS</div>																
<div>Easting: 1728691.45 RL: 138</div> <div>Northing: 5923873.69 Datum: AUCKHT1946</div> <div>System: NZTM2000</div>																				
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering		Estimated Strength (MPa)	TCR SQR RQR (%)	Defect Sounding (mm)	Instrumentation Installation	Water level		
			Highly weathered, brown, streaked orange and black, fine to medium grained SANDSTONE; extremely weak.	AWHITU SAND FORMATION				SPT 14/20 24/26 for 55mm N > 50		HQTT		MW			100					
			CORE LOSS							SPT				HW			100			
			Highly weathered, orange brown, speckled grey and dark brown, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°.							SPT 19/21 25/25 for 65mm N > 50 (solid cone)		HQTT					8			
										SPT							0			
										HQTT							100			
										SPT							0			
										HQTT							100			
			Highly weathered, orange brown, speckled grey and dark brown, fine to medium grained SANDSTONE; extremely weak.							SPT 27/23 for 50mm N > 50 (solid cone)							0			
										HQTT							100			
										SPT							0			
										HQTT							100			
										SPT 26/24 for 55mm N > 50 (solid cone)							0			
								HQTT							100					
								SPT 27/23 for 55mm N > 50 (solid cone)							0					
								HQTT							100					
<div>Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.</div> <div>Refer to explanation sheets for abbreviation and symbols</div>				<div>Inclination: Vertical</div> <div>Contractor: DCN</div> <div>Equipment: TR 200</div> <div>Shear Vane Id: GEO902</div>				<div>Orientation:</div>				<div>Ground Water Level</div> <div>Date</div> <div>Time</div> <div>Reading (mbgl)</div> <div>Hole depth (mbgl)</div>								



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023						Hole No. : BH-M01 Sheet : 6 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS									
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946			System: NZTM2000												
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
197	41		Highly weathered, brown, speckled grey and dark brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-20°. (continued from layer starting at 39.8m)	AWHITU SAND FORMATION				SPT 28/22 for 50mm N > 50 (solid cone)		HQTT				100				
										SPT					0			
196	42								SPT 25/25 for 60mm N > 50 (solid cone)		HQTT				100			
										SPT					0			
195	43		Highly weathered, brown, speckled dark orange brown, fine to medium grained SANDSTONE; extremely weak.					SPT 29/21 for 45mm N > 50 (solid cone)		HQTT				100				
194	44							SPT 29/21 for 45mm N > 50 (solid cone)		HQTT				100				
193	45		45.00 - 45.03 Extremely weak, dark brown LIGNITE.					SPT 28/22 for 50mm N > 50 (solid cone)		HQTT				100				
192	46							SPT 35/15 for 20mm N > 50 (solid cone)		HQTT				100				
191	47		Highly weathered, brown, speckled grey and dark orange brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30°.							HQTT				100				
90																		


Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical	Orientation:	Ground Water Level			
	Contractor: DCN		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Equipment: TR 200 Shear Vane Id: GEO902					

		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023					Hole No. : BH-M01 Sheet : 7 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS										
Easting: 1728691.45 RL: 138		Northing: 5923873.69 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR ROD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
48.65			Highly weathered, brown, speckled grey and dark orange brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30°. (continued from layer starting at 46.8m) 48.00 - 48.65 Trace organic fragments to 5 mm.	AWHITU SAND FORMATION				SPT 32/18 for 25mm N > 50 (solid cone)		HQTT		HW		0			
49			Highly weathered, orange brown, distinctly bedded, fine to medium grained SANDSTONE; trace organics to 5 mm; extremely weak; very thinly bedded at 10-30°.														
49.5			Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.														
50																	
50.75																	
51			Completely weathered, brown, mottled light yellowish brown, SILTSTONE; extremely weak.														
51			Moderately weathered, grey, speckled light brown, fine to medium grained SANDSTONE; extremely weak. 51.20 - 51.35 20-40 mm shell fragments.														
52																	
52.5																	
53			Moderately weathered, dark grey-green, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30° with very closely spaced irregular laminations of silty sandstone.														
54																	
54.2																	
54.8			Moderately weathered, brown, mixed grey and light yellow, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly laminated at 15-25°.														
55			Moderately weathered, dark grey-brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-35°.														
55																	
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82																	
Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level									
				Contractor: DCN		Equipment: TR 200		Date		Time		Reading (mbgl)		Hole depth (mbgl)			
				Shear Vane Id: GEO902				04/07/23		08:00		22.25		55.63			

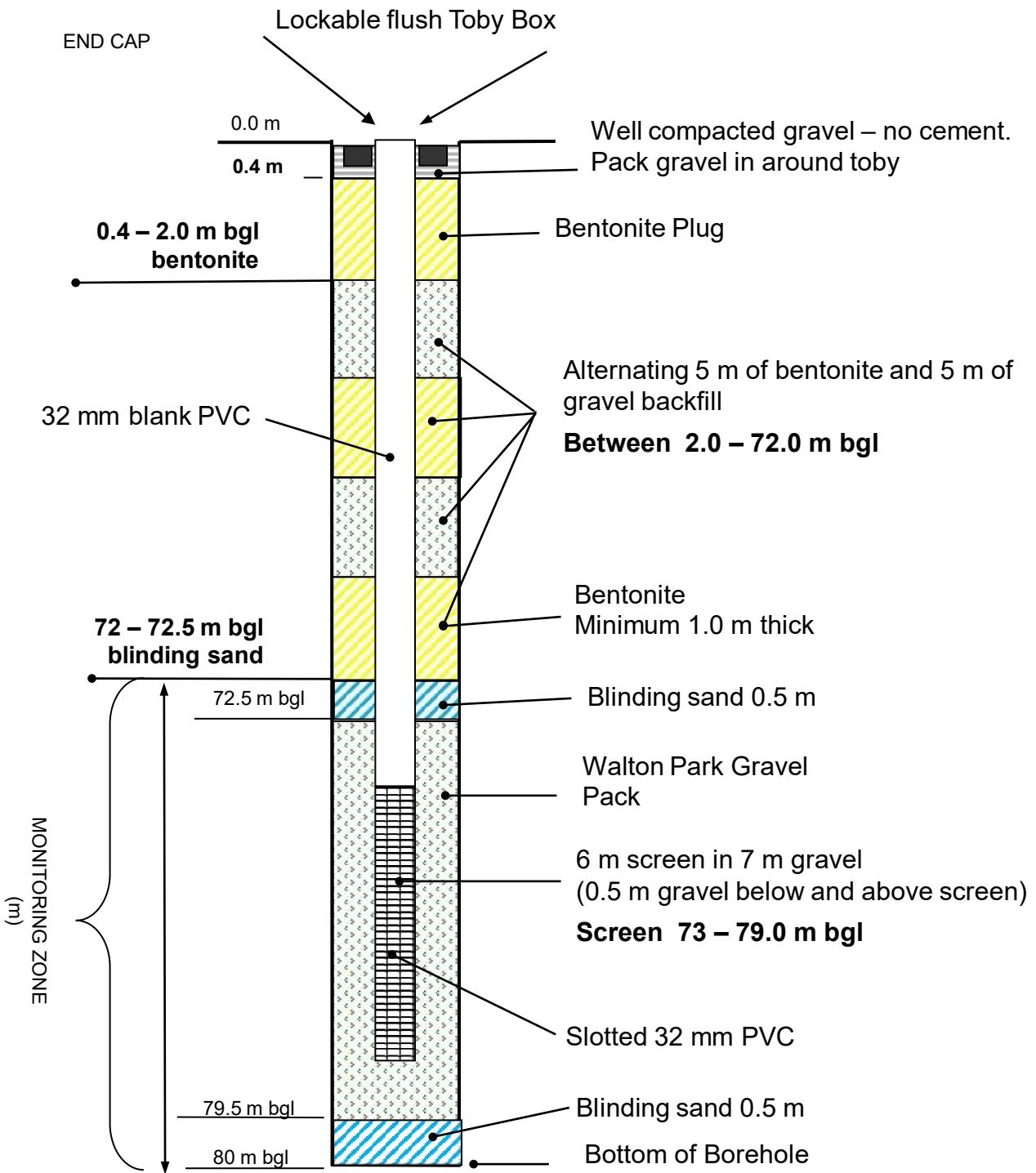
			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023						Hole No. : BH-M01 Sheet : 8 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS										
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946			System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level		
							Number / Type	Result											
57			Moderately weathered, dark grey-brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-35°. (continued from layer starting at 54.8m)	AWHITU SAND FORMATION				SPT 24/26 for 55mm N > 50 (solid cone)		HQTT				100					
										SPT					0				
58								SPT 20/30 for 55mm N > 50 (solid cone)		HQTT			MW		100				
										SPT					0				
59								SPT 29/21 for 50mm N > 50 (solid cone)		HQTT					88				
			Moderately weathered, dark grey, mixed brown and orange, fine to medium grained SANDSTONE; extremely weak.							SPT					0				
60			CORE LOSS							SPT					81				
			Highly to moderately weathered, dark grey, mottled brown-orange, fine to medium grained SANDSTONE; extremely weak.							HQTT			MW-HW		0				
61								SPT 25/25 for 55mm N > 50 (solid cone)							84				
										SPT					0				
62			Moderately weathered, grey, mottled orange, fine to medium grained SANDSTONE; extremely weak.							HQTT			MW		22				
										SPT					0				
63			Moderately weathered, dark grey, fine to medium grained SANDSTONE; extremely weak.							HQTT									
										SPT									
64			CORE LOSS																
Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical				Orientation:				Ground Water Level							
				Contractor: DCN								Date				Time			
				Equipment: TR 200								Reading (mbgl)				Hole depth (mbgl)			
				Shear Vane Id: GEO902															

Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023					Hole No. : BH-M01 Sheet : 9 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS																							
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946			System: NZTM2000																									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level														
							Number / Type	Result																							
64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3	64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3 64.3		CORE LOSS (continued from layer starting at 63.1m)	AWHITU SAND FORMATION																											
			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 5-15°.																												
			CORE LOSS																												
			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 30-45°.																												
			CORE LOSS																												
			Moderately weathered, dark grey-green, mottled brown and grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-20°.																												
			LIGNITE; black. 'Hard', moist.																												
			Moderately weathered, dark grey-green, mottled brown and grey, fine to medium grained SANDSTONE; extremely weak.																												
			CORE LOSS																												
			Moderately weathered, dark grey-green, mottled brown and grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-20°.																												
			CORE LOSS																												
			Moderately weathered, grey, fine to medium grained SANDSTONE; extremely weak.																												
			Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols															Inclination: Vertical		Orientation:		Ground Water Level									
																		Contractor: DCN				Date		Time		Reading (mbgl)		Hole depth (mbgl)			
																		Equipment: TR 200													
																		Shear Vane Id: GEO902													

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 17 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 29/06/2023					Hole No. : BH-M01 Sheet : 10 of 10 Hole Length : 79.60m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS										
Easting: 1728691.45 RL: 138			Northing: 5923873.69 Datum: AUCKHT1946					System: NZTM2000										
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR RQD (%)	Defect	Instrumentation	Water level	
65	73		Moderately weathered, grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 71.6m)	AWHITU SAND FORMATION				SPT 34/16 for 20mm N > 50 (solid cone)		HQTT				0				
64	74		Moderately weathered, dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; thinly bedded at 25-35°.					SPT 40/10 for 10mm N > 50 (solid cone)		HQTT					0			
63	75							SPT 33/17 for 30mm N > 50 (solid cone)		HQTT					0			
62	76							SPT 26/24 for 55mm N > 50 (solid cone)		HQTT					0			
61	77							SPT 29/21 for 50mm N > 50 (solid cone)		HQTT					0			
60	78													0				
59	79													0				
58			End of Hole @ 79.60m,Target Depth.					SPT 35/15 for 20mm N > 50 (solid cone)						0				
Notes and Comments: End of Hole @ 79.60m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical				Orientation:				Ground Water Level						
				Contractor: DCN								Date						
				Equipment: TR 200								Time						
				Shear Vane Id: GEO902								Reading (mbgl)						
												Hole depth (mbgl)						
												05/07/23 08:05 26.9 72.095						
												18/07/23 16:15 35.5 79.59						

BH-M01 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs

Site identification – BH-M01



Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
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Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		

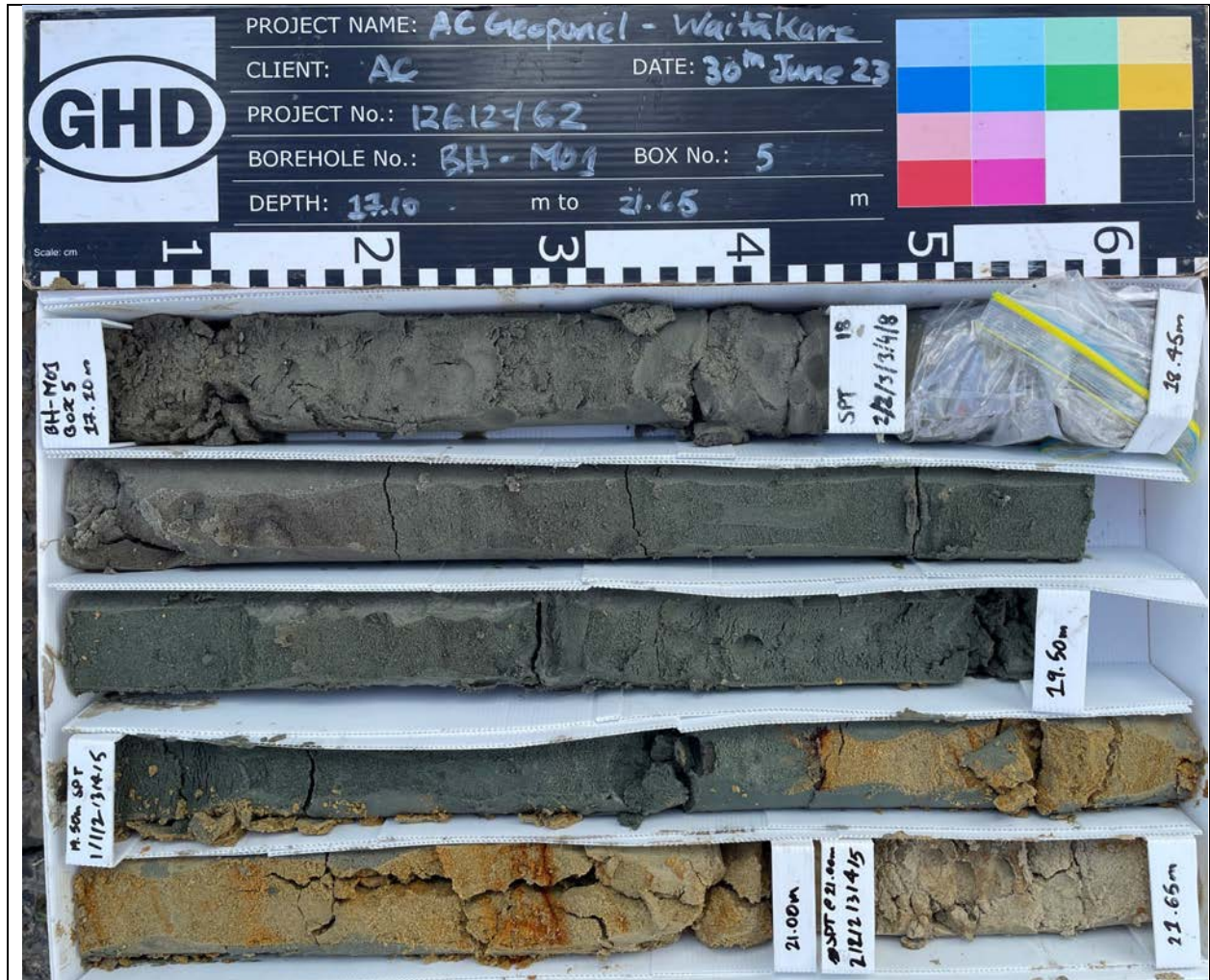


Report of photographs

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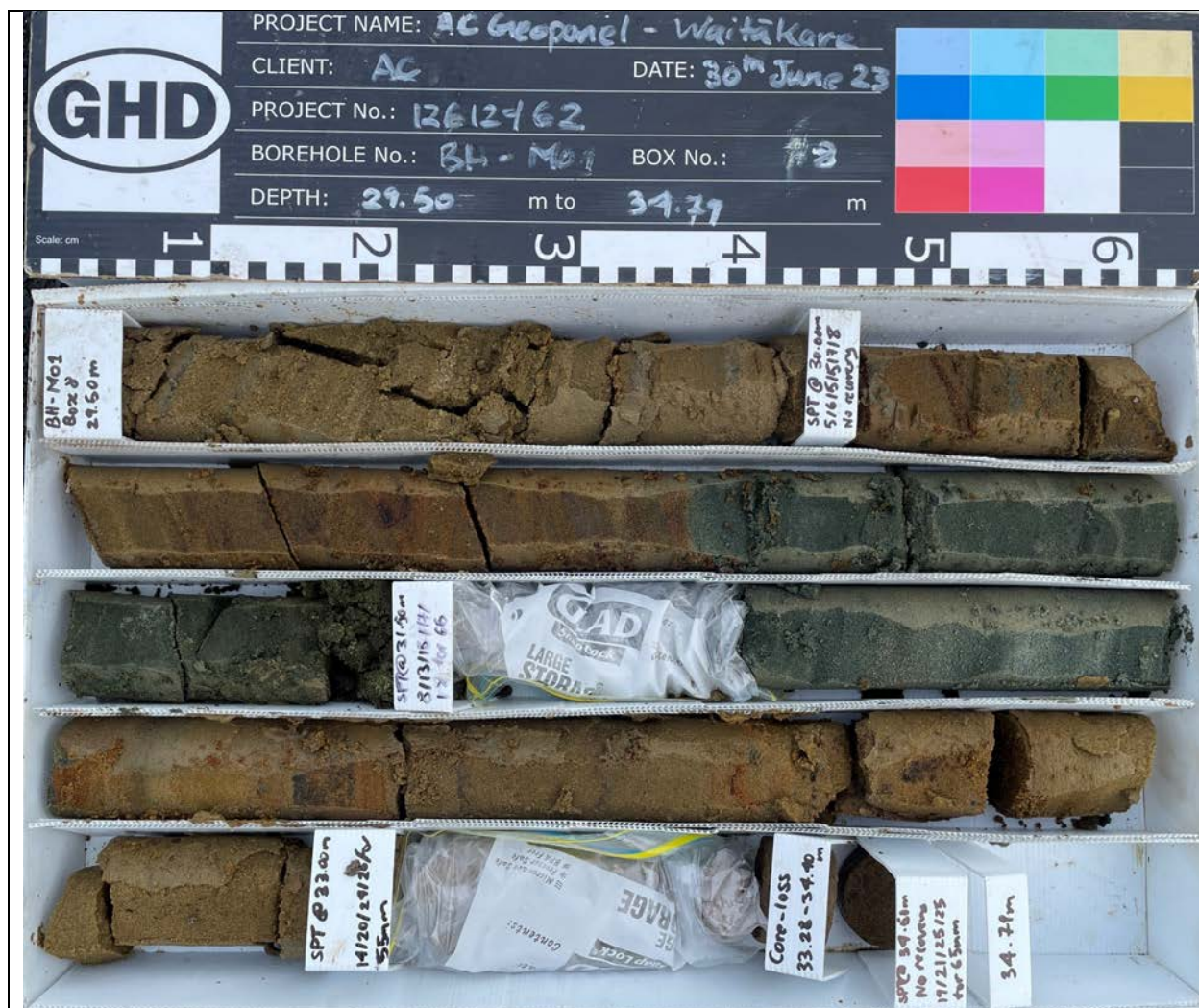


Report of photographs

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Photograph @ 6.0 m not recovered.

Report of photographs

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











Report of photographs
















Site identification – BH-M01



Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		




		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023					Hole No. : BH-M02 Sheet : 1 of 10 Hole Length : 79.57m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS 23/08/2023										
Easting: 1728387.63 RL: 144.5		Northing: 5923493.52 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
144	0		Clayey SILT; dark brown, mottled orange-brown. 'Very stiff', moist, low plasticity. [TOPSOIL].	TOPSOIL	M	'VSt'											
	0.4		Clayey SILT; brown, speckled orange-dark brown. Very stiff, moist, low plasticity. [FILL].	FILL		VSt	SV@0.5m 155/87 kPa			HA							
1	0.85		Clayey SILT with trace sand; brown, mottled and streaked orange. Very stiff, moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION].				SV@1m 142/74 kPa										
143	1.7		Clayey SILT; brown, mottled and streaked orange. 'Very stiff', moist, low plasticity.			'VSt'	SV@1.5m 111/59 kPa SPT 1/1 2/2 2/2 N = 8			SPT				100			
2										OB				100			
3	3.2		3.00 - 3.20 Hard.			H	SV@3m UTP SPT 1/0 1/1 1/1 N = 4			SPT				100			
141	3.95		Clayey SILT with minor sand; brown streaked yellow-orange. 'Stiff', moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION]			'St'				SPT				100			
4	4.3		3.80 - 3.95 Speckled black. Clayey fine SAND; grey speckled black. Moist.	AWHITU SAND FORMATION		-				OB				100			
140			Silty fine SAND; light grey speckled black, streaked orange. Loose, moist.			L	SPT 1/1 1/2 3/4 N = 10			SPT				100			
5										OB				100			
139							SPT 1/1 1/3 3/3 N = 10			SPT				0			
6										OB				100			
7			6.80 With trace clay.							SPT				100			
137	7.957.8		Amorphous PEAT; brown-black, streaked red-orange. 'Very			'VSt'				SPT				100			
Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: TR 200											
				Shear Vane Id: GEO1060													

		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023				Completed: 17/08/2023		Hole No. : BH-M02 Sheet : 2 of 10 Hole Length : 79.57m Scale @ A4 : 1:40									
		Easting: 1728387.63 RL: 144.5		Northing: 5923493.52 Datum: AUCKHT1946		System: NZTM2000		Logged : JM Processed : JM Checked : JHS 23/08/2023									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
136	8.15		stiff, moist. CORE LOSS (continued from layer starting at 8.0m)	AWHITU SAND FORMATION	-	-	SPT 1/2 4/6 6/7 N = 23			OB				81			
			Amorphous PEAT; brown-black, streaked red-orange. 'Very stiff', moist.		M	'VS'											
9	8.7		Silty fine to medium SAND; grey-brown, streaked orange-yellow. Medium dense, moist.			MD											
135	9.45		CORE LOSS		-	-	SPT 1/1 2/3 4/5 N = 14			HOTT				52			
10	10		Silty fine to medium SAND; light grey, streaked dark grey. Medium dense, moist; indistinctly, closely bedded at 0-5°.		M	MD											
134	11.74		CORE LOSS		-	-											
12	12		Silty fine to medium SAND; light grey, streaked dark grey. Loose, moist.		M	L	SPT 3/0 1/1 3/4 N = 9			SPT				0			
133	12.66		Clayey SILT; grey. 'Stiff', moist.			'St'											
13	13		Silty fine to medium SAND; light grey, speckled black; indistinctly very thinly bedded at 0-5°. Medium dense, moist.			MD											
132	13.95		CORE LOSS		-	-	SPT 2/2 2/2 4/5 N = 13			SPT				0			
131	14.3		Silty fine to medium SAND; grey-orange, speckled light grey-black. Medium dense, moist.		M	MD											
130	15.45		CORE LOSS		-	-	SPT 2/1 2/3 5/6 N = 16			HOTT				67			
129																	
																	


Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level			
				Contractor: DCN Equipment: TR 200 Shear Vane Id: GEO1060				Date	Time	Reading (mbgl)	Hole depth (mbgl)

Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO1060							



		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023				Hole No. : BH-M02 Sheet : 4 of 10 Hole Length : 79.57m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS 23/08/2023												
Easting: 1728387.63 RL: 144.5		Northing: 5923493.52 Datum: AUCKHT1946		System: NZTM2000														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
			Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. (continued from layer starting at 23.6m)	AWHITU SAND FORMATION			SPT 3/3 7/11 12/13 N = 43			SPT				44				
	25							SPT 4/8 10/12 12/12 N = 46			HQTT				100			
											SPT				44			
	26										HQTT				100			
	27		27.00 - 29.40 Medium dense.			MD		SPT 2/2 2/3 3/5 N = 13			SPT				0			
	28		28.00 - 28.25 With patches of carbonaceous material.							HQTT				100				
	29					D	SPT 3/2 4/5 6/9 N = 24			SPT				100				
	30									HQTT				100				
	31						SPT 6/7 8/9 10/13 N = 40			SPT				100				
										HQTT				100				
							SPT 9/10 12/14 14/9 N = 49 (solid cone)			SPT				0				
Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.				Inclination: Vertical		Orientation:		Ground Water Level										
				Contractor: DCN		Equipment: TR 200		Shear Vane Id: GEO1060		Date	Time	Reading (mbgl)	Hole depth (mbgl)					
Refer to explanation sheets for abbreviation and symbols																		

Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO1060							

<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023</div>				<div>Hole No. : BH-M02</div> <div>Sheet : 5 of 10 Hole Length : 79.57m Scale @ A4 : 1:40</div> <div>Logged : JM Processed : JM Checked : JHS 23/08/2023</div>													
Easting: 1728387.63 RL: 144.5		Northing: 5923493.52 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
112			Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. (continued from layer starting at 23.6m)	AWHITU SAND FORMATION			SPT 12/12 8/9 12/12 N = 41 (solid cone)			HQTT				100			
33										SPT				0			
34										HQTT				100			
111			36.00 - 40.50 Very dense.		VD	SPT 9/11 10/12 12/13 N = 47 (solid cone)				SPT				0			
35										HQTT				100			
36										SPT				0			
110			37.90 - 38.00 Very thinly bedded at 20-30°.			SPT 14/16 18/18 14 for 55mm N > 50 (solid cone)	36.35 C 36.65			HQTT				100			
37										SPT				0			
38										HQTT				100			
109						SPT 15/16 19 for 75mm N > 50 (solid cone)				SPT				0			
39										HQTT				100			
108										HQTT				100			
107						SPT 11/11 12/16 for 75mm N > 50 (solid cone)				SPT				0			
39										HQTT				100			
106										HQTT				100			
105																	

Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN				Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Equipment: TR 200							
	Shear Vane Id: GEO1060							

Notes and Comments:

End of Hole @ 79.57m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:


Contractor: DCN


Equipment: TR 200

Shear Vane Id: GEO1060

Ground Water Level

Date Time Reading (mbgl) Hole depth (mbgl)

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023					Completed: 17/08/2023					Hole No. : BH-M02 Sheet : 6 of 10 Hole Length : 79.57m Scale @ A4 : 1:40						
Easting: 1728387.63 RL: 144.5			Northing: 5923493.52 Datum: AUCKHT1946			System: NZTM2000			Logged : JM Processed : JM Checked : JHS 23/08/2023										
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level		
104	40.5		Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. (continued from layer starting at 23.6m)	AWHITU SAND FORMATION			41.00 C 40.80	SPT 9/10 12/12 12/12 N = 48 (solid cone)		HQTT				100					
41			Highly weathered, orange brown, streaked orange, speckled black, fine to medium grained, indistinctly bedded SANDSTONE; extremely weak; very thinly bedded at 20-30°.		-	-				HQTT			MW		100				
103	41.8		Highly weathered, greenish grey, streaked brown-orange, speckled black, fine to medium grained SANDSTONE; extremely weak.							SPT					0				
42	42.8		Silty CLAY; ligh grey, streaked dark grey-orange. 'Stiff', moist, low plasticity.		M	'St'						HQTT			100				
102	42.642.45		Highly weathered, light grey, speckled dark grey-black, SILTSTONE; extremely weak.		-	-						SPT				0			
43	43		Highly weathered, brown, streaked and speckled orange-black, fine to medium grained SANDSTONE; extremely weak.									HQTT				100			
101			Highly weathered, light orange brown, streaked orange, speckled black, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°.									SPT				0			
44												HQTT				100			
100												SPT				0			
45												HQTT				100			
99												SPT				0			
46												HQTT				100			
98									SPT				0						
47									HQTT				100						
97																			
Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level											
				Contractor: DCN		Equipment: TR 200		Shear Vane Id: GEO1060		Date	Time	Reading (mbgl)	Hole depth (mbgl)						
										09/08/23	08:30	13.6	40.95						

<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023</div>				<div>Hole No. : BH-M02</div> <div>Sheet : 7 of 10 Hole Length : 79.57m Scale @ A4 : 1:40</div> <div>Logged : JM Processed : JM Checked : JHS 23/08/2023</div>													
<div>Easting: 1728387.63 Northing: 5923493.52 System: NZTM2000</div> <div>RL: 144.5 Datum: AUCKHT1946</div>																	
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
196			Highly weathered, light orange brown, streaked orange, speckled black, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°. (continued from layer starting at 43.0m)	AWHITU SAND FORMATION			SPT 14/14 18/18 14 for 50mm N > 50 (solid cone)		SPT					0			
49							SPT 13/16 22/28 for 75mm N > 50 (solid cone)		HQTT					100			
195							SPT 16/18 24/26 for 50mm N > 50 (solid cone)		SPT					0			
50									HQTT					100			
194			52.00 - 52.63 Light orange brown, streaked orange.						HQTT					100			
51							SPT 21/29 for 60mm N > 50 (solid cone)		SPT					0			
193									HQTT					100			
52																	
192																	
53			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak.						SPT					0			
191			53.50 - 54.00 100% flush loss.					HQTT					100				
54			53.90 - 54.13 Dark greyish brown.										0				
190			CORE LOSS														
55			Highly weathered, dark brown-grey, speckled black, fine to medium grained SANDSTONE; extremely weak.					SPT 23/27 for 60mm N > 50 (solid cone)		HQTT			73				
189																	
55			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak.					SPT 25/25 for 50mm N > 50 (solid cone)		HQTT			0				
													100				

<div>Notes and Comments:</div> <div>End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.</div> <div>Refer to explanation sheets for abbreviation and symbols</div>				Inclination: Vertical		Orientation:		Ground Water Level			
				Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
				Shear Vane Id: GEO1060		14/08/23	08:30	36.63	54		

Notes and Comments:

End of Hole @ 79.57m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

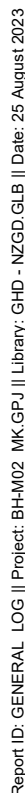
Contractor: DCN


Equipment: TR 200


Shear Vane Id: GEO1060

Ground Water Level

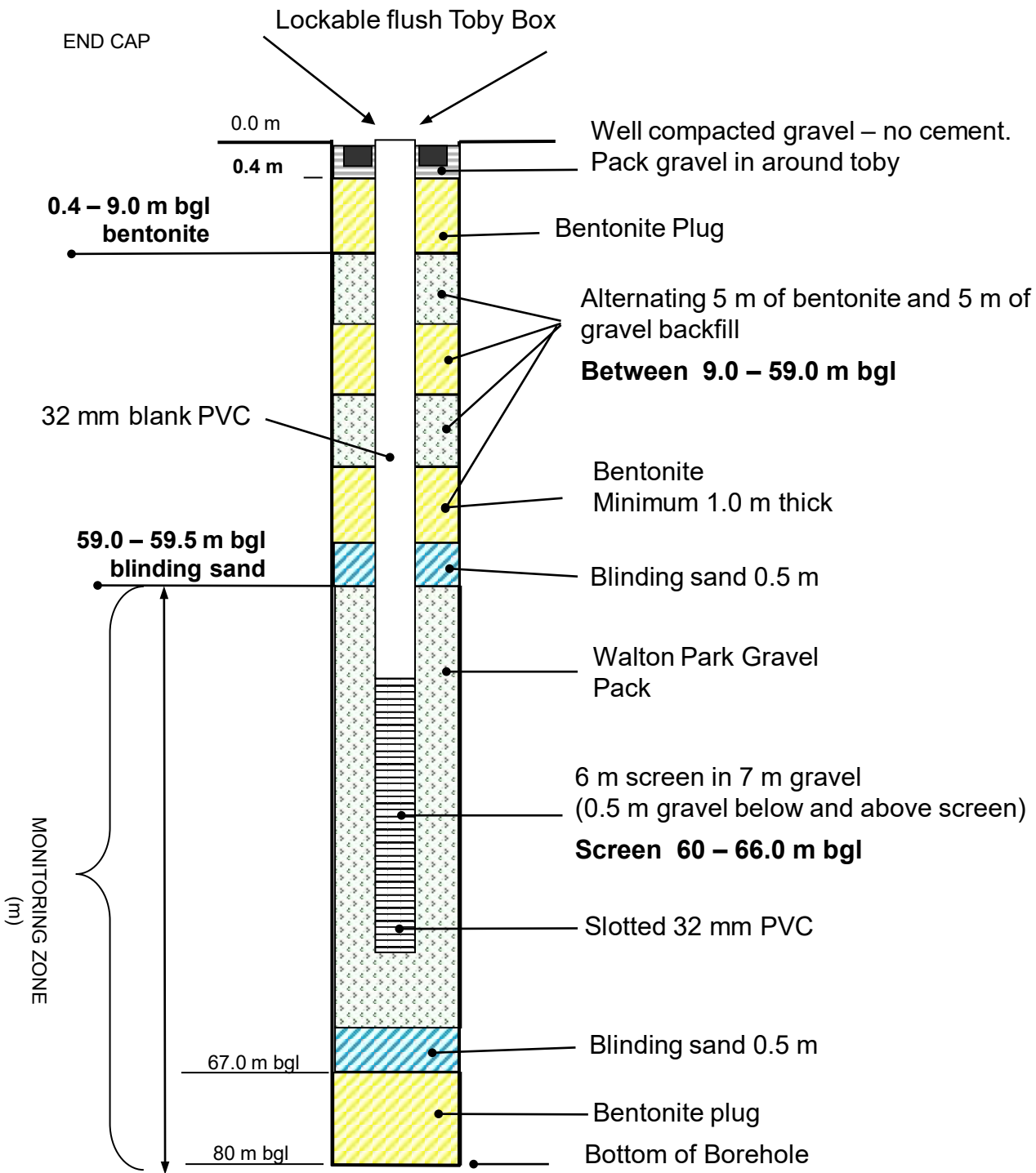
Date	Time	Reading (mbgl)	Hole depth (mbgl)
14/08/23	08:30	36.63	54



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023					Completed: 17/08/2023					Hole No. : BH-M02 Sheet : 9 of 10 Hole Length : 79.57m Scale @ A4 : 1:40				
Easting: 1728387.63 RL: 144.5			Northing: 5923493.52 Datum: AUCKHT1946			System: NZTM2000			Logged : JM Processed : JM Checked : JHS 23/08/2023								
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
180			Highly weathered, orange brown, speckled black-grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 63.5m)	AWHITU SAND FORMATION			64.44 C	SPT 26/24 for 55mm N > 50 (solid cone)		HQTT		HW		100			
65							64.72			SPT				0			
79										HQTT				100			
66			Moderately weathered, greyish green, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.					SPT 25/25 for 65mm N > 50 (solid cone)		SPT				0			
67										HQTT		MW		100			
68							67.93 C	SPT 50 for 65mm bouncing @ 65 mm		HQTT				0			
76							68.33			HQTT				100			
69			Silty fine to medium SAND; greyish green, speckled black-grey. Very dense, moist.	CORE LOSS				SPT 50 for 70mm bouncing @ 70 mm						0			
69			CORE LOSS														
70			Moderately weathered, greenish grey, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.							HQTT		MW		69			
71								SPT 23/27 for 65mm N > 50 (solid cone)						0			
71			CORE LOSS														
71			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°.						HQTT		MW		86				
73																	
Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: TR 200		Shear Vane Id: GEO1060				16/08/23	08:05	18.3	70.5		

		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 150 Oaia Rd, Muriwai 0881 Job Number: 12612462 Commenced: 4/08/2023					Hole No. : BH-M02 Sheet : 10 of 10 Hole Length : 79.57m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS 23/08/2023										
Easting: 1728387.63 RL: 144.5		Northing: 5923493.52 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect	Instrumentation Installation	Water level
72			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°. (continued from layer starting at 70.8m)	AWHITU SAND FORMATION				SPT 35/15 for 15mm N > 50 (solid cone)		HQTT		MW		0			
73																	
74			CORE LOSS					SPT 31/19 for 20mm N > 50 (solid cone)		HQTT		MW		0			
75			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°. 74.50 - 75.12 Distinctly bedded, very closely spaced, very thinly bedded, dark grey, sandstone beds at sub-horizontal angles.					SPT 30/20 for 45mm N > 50 (solid cone)		HQTT		MW		59			
76			CORE LOSS											0			
77			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely bedded at 0-10°.					SPT 31/19 for 25mm N > 50 (solid cone)		HQTT		MW		87			
78								SPT 50 for 75mm bouncing @ 75 mm		HQTT		HW		100			
79			Highly weathered, dark grey, fine to medium grained SANDSTONE, trace carbonaceous material; extremely weak.											0			
			End of Hole @ 79.57m, Target Depth.				SPT 50 for 70mm bouncing @ 70 mm							0			
Notes and Comments: End of Hole @ 79.57m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: TR 200											
				Shear Vane Id: GEO1060													

BH-M02 - Muriwai



NOT TO SCALE

Report of photographs

Site identification – BH-M02



Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs

Site identification – BH-M02



Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs

Site identification – BH-M02



Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



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Site identification – BH-M02



Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
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Site identification – BH-M02



Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
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Report of photographs

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Job Number	12612462	(NZTM 2000)	5923493.52 N
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Site identification – BH-M02




Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 1 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023									
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946					System: NZTM2000									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
149	0		HAND AUGERED. NOT LOGGED		-	-				HA				0			
148	1.5		Silty fine to medium SAND; orange-brown, speckled black. Loose, moist. [AWHITU SAND FORMATION]		M	L		SPT 2/2 2/2 2/3 N = 9		SPT				100			
147	2		2.55 - 2.73 Light brown. 2.73 - 4.30 Orange brown.					SPT 1/1 1/2 2/3 N = 8		OB				100			
146	3									SPT				100			
145	4									OB				100			
145	4.3		Silty fine to medium SAND; light grey streaked orange. Medium dense, moist. 4.65 - 4.70 Orange brown.	AWHITU SAND FORMATION		MD		SPT 5/5 5/6 7/9 N = 27		SPT				100			
144	5		5.30 Grey. Silty CLAY, some sand; grey. 'Hard', moist, high plasticity. Sand: fine, orange.			'H'				HQTT				100			
144	5.55		Silty fine to medium SAND; light grey. Medium dense, moist. 5.60 - 6.00 Grey-orange brown.			MD		SPT 3/3 4/4 4/4 N = 16		SPT				100			
143	6		CORE LOSS		-	-				HQTT							
143	6.45									SPT							
142	6.8		Silty fine to medium SAND; light grey mottled orange brown. Medium dense, moist.		M	MD		SPT 1/2 2/3 3/5 N = 13		HQTT				67			
142	7									SPT				100			
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical Contractor: DCN Equipment: TR 200 Shear Vane Id:				Orientation:				Ground Water Level Date Time Reading (mbgl) Hole depth (mbgl)					

		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 2 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023											
Easting: 1728010.05 RL: 150		Northing: 5923112.26 Datum: AUCKHT1946		System: NZTM2000														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Number / Type	Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect	Instrumentation	Water level	
			CORE LOSS (continued from layer starting at 8.0m)	AWHITU SAND FORMATION	-	-				HQTT				0				
141	9		Silty fine to medium SAND; light grey. Medium dense, moist. 9.00 - 9.05 Orange.		M	MD		SPT 2/2 2/3 3/4 N = 12		SPT					100			
140	10		9.70 - 10.50 Grey locally mottle orange brown. 9.95 Gently inclined, orange brown, 15 mm bed.				10.13 C 9.93			HQTT					100			
139	11		Silty fine to medium SAND, some carbonaceous inclusions; grey. Medium dense, moist.					SPT 1/1 1/2 2/5 N = 10		SPT					0			
138	12		Completely to highly weathered, grey, fine to medium grained SANDSTONE; extremely weak.					SPT 1/1 2/3 4/7 N = 16		HQTT			CW		100			
137	13		12.50 - 12.52 Sub-horizontal carbonaceous bed. Highly weathered, grey, fine to medium grained SANDSTONE; very weak with carbonaceous fragments to 5mm.							HQTT			HW		100			
136	14		13.20 - 13.33 Orange-grey. Silty CLAY, minor sand; grey. 'Very stiff', moist, high plasticity. Sand: fine.		M	'VSt'		SPT 0/1 0/1 1/3 N = 5		SPT					0			
135	15		14.03 - 14.13 Mottled orange. Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist.				MD		SPT 3/3 4/4 4/6 N = 18		HQTT				100			
134	16		Highly weathered, light grey, fine to medium grained SANDSTONE; extremely weak.			-	-	16.00			HQTT		HW		100			
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols					Inclination: Vertical		Orientation:		Ground Water Level									
				Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)							
				Shear Vane Id:														

		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023				Hole No. : BH-M03 Sheet : 3 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023											
Easting: 1728010.05 RL: 150		Northing: 5923112.26 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect RQR Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
16.27	16		Highly weathered, light grey, fine to medium grained SANDSTONE; very weak. 16.21 - 16.27 Stained orange.	AWHITU SAND FORMATION	M	MD	16.27 C	SPT 2/3 4/4 4/6 N = 18	HQTT			HW		100			2-08-2023
			Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist.						SPT					100			
17.15	17		Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist. Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.		-	-			HQTT			HW		100			
18.55	18		Silty fine to medium SAND; orange brown. Loose to medium dense, moist.		M	L-MD		SPT 1/1 1/2 2/3 N = 8	SPT					100			
19.35	19		Highly weathered, brown, fine to medium grained SANDSTONE; extremely weak. 19.00 - 19.15 Orange.		-	-			HQTT			HW		100			
19.95	20		Completely weathered, orange, fine to medium grained SANDSTONE; extremely weak Silty fine to medium SAND; orange. Medium dense, moist.		M	MD		SPT 2/3 4/6 6/7 N = 23	SPT			CW		0			
20.4	20		CORE LOSS						HQTT								
21.45	21		Silty fine to medium SAND; orange. Dense, moist.		M	D		SPT 3/5 7/8 9/9 N = 33	SPT					57			
22.45	22		CORE LOSS		-	-			HQTT								
23.7	23		Sandy SILT; brownish grey. 'Stiff', moist, low plasticity. Sand: fine. Silty fine to medium SAND; orange. Moist. Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.		M	'St'		SPT 6/10 15/15 15/6 for 25mm N > 50	SPT			HW		100			
									HQTT					100			
			Silty fine to medium SAND; orange. Dense, moist.		M	D											

Notes and Comments:

End of Hole @ 79.64m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Ground Water Level

Contractor: DCN

Equipment: TR 200


Shear Vane Id:












Date

Time


Reading (mbgl)

Hole depth (mbgl)


		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 4 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023										
Easting: 1728010.05 RL: 150		Northing: 5923112.26 Datum: AUCKHT1946		System: NZTM2000													
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR ROD (%)	Defect	Instrumentation	Water level
							Number / Type	Result									
125	24.45	X	Silty fine to medium SAND; orange. Dense, moist. (continued from layer starting at 23.7m)	AWHITU SAND FORMATION				SPT 6/8 8/9 11/12 N = 40		SPT				0			
	24.9	X	CORE LOSS		-	-				HQTT				57			
25	25.23	X	Silty fine to medium SAND; orange. Moist.		M												
	25.91	X	Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.					SPT 7/11 16/18 16 for 35mm N > 50		SPT		HW		100			
26	26.085	X	CORE LOSS														
	26.91	X	Highly weathered, light brown, fine to medium grained SANDSTONE; extremely weak. 26.35 - 26.92 Grades to dark orange.							HQTT		HW		82			
27	27.45	X	Completely weathered, orange, fine to medium grained SANDSTONE; extremely weak.					SPT 6/7 10/11 11/12 N = 44		SPT				0			
	28.45	X	Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.					SPT 6/7 8/8 8/9 N = 33		SPT				0			
29	29.75	X								HQTT				100			
30	31.95	X						SPT 4/4 6/8 9/10 N = 33		SPT		HW		100			
31	31.55	X	31.45 - 31.55 Completely weathered. Clayey SILT, some sand; grey. 'Hard', moist, low plasticity. Sand: fine.		M	'H'		SPT 3/4 5/5 5/5 N = 20		SPT				100			
32	32.50	X	31.55 - 32.50 Grades to underlying geology with depth.							HQTT				100			
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: TR 200											
				Shear Vane Id:													

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 5 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023										
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946			System: NZTM2000												
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect	Instrumentation	Water level	
							Number / Type	Result										
32.5	32.5		Clayey SILT, some sand; grey. 'Hard', moist, low plasticity. Sand: fine. (continued from layer starting at 31.6m)	AWHITU SAND FORMATION			C	32.23		HQTT				100				
33	33		Silty fine to medium SAND with some clay; grey. Very dense, moist.			VD				SPT				100				
33.45	33.45														100			
34	34		Highly weathered, orange-brown, fine to medium grained SANDSTONE; extremely weak.					C	33.76		HQTT				100			
35	35														100			
36	36														100			
37	37													100				
38	38		CORE LOSS											100				
39	39		Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.											100				
40	40		Highly weathered, dark brown-orange, fine to medium grained SANDSTONE; very weak.											100				

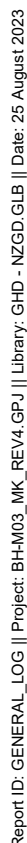
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols		Inclination: Vertical		Orientation:		Ground Water Level			
		Contractor: DCN Equipment: TR 200 Shear Vane Id:				Date	Time	Reading (mbgl)	Hole depth (mbgl)


			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 6 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023									
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946			System: NZTM2000											
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
109	41		Highly weathered, dark brown-orange, fine to medium grained SANDSTONE; very weak. (continued from layer starting at 39.5m)	AWHITU SAND FORMATION			40.14 C	SPT 8/10 12/12 13/13 N > 50		HQTT		HW		100			
109	41		Highly weathered, grey SILTSTONE; very weak.				40.43 C			SPT		HW		0			
108	42		Highly weathered, grey-brown, indistinctly bedded SILTSTONE; very weak; very thinly bedded at 0-5°.				41.15 C			HQTT		HW		100			
108	42		Completely weathered, greyish brown MUDSTONE; extremely weak.				41.43 C	SPT 3/3 5/5 5/5 N > 50 (solid cone)		SPT		CW		100			
107	43		Highly weathered, grey-orange, indistinctly bedded, fine to medium grained SANDSTONE; very weak.							HQTT		HW		100			
106	44		Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak. 43.00 - 43.03 Dark brown layer. 43.02 - 43.03 Moderately strongly cemented layer.					SPT 12/16 18/20 12 for 35mm N > 50 (solid cone)		SPT		HW		0			
106	44		43.84 Dark orange brown.							HQTT		HW		100			
105	45							SPT 23/27 for 65mm N > 50 (solid cone)		SPT		HW		0			
104	46		Highly weathered, red streaked brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin iron oxide laminations, inclined 10-30°.							HQTT		HW		100			
103	47							SPT 21/29 for 70mm N > 50 (solid cone)		SPT		HW		0			
102										HQTT		HW		100			
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: TR 200						28/07/23	08:00	8.4	40.95		
				Shear Vane Id:													



Report ID: GENERAL_LOG || Project: BH-M03_MK_REV4.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 7 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023									
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946			System: NZTM2000											
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Number / Type	Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect	Instrumentation	Water level
101	49.1		Highly weathered, red streaked brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin iron oxide laminations, inclined 10-30°. (continued from layer starting at 45.4m)	AWHITU SAND FORMATION				SPT 21/29 for 60mm N > 50 (solid cone)		SPT				0			
49			Highly weathered, orange, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin, black and red, iron oxide beds inclined 5-10°.														
50			49.74 Reddish brown.														
			50.00 - 50.03 Black, moderately strongly cemented.														
			50.00 - 50.73 Orange brown.														
51			50.73 - 51.00 Reddish brown.														
			51.12 Dark orange brown.														
			51.42 Brown.														
52																	
53			52.50 - 55.63 Brown-orange.					SPT 28/22 for 45mm N > 50 (solid cone)		SPT				0			
			CORE LOSS														
			Highly weathered, orange, distinctly thinly to very thinly bedded brown, fine to medium grained SANDSTONE; extremely weak; very closely spaced, very thin, black-red, iron oxide stained beds inclined 5-10°.											89			
54																	
55								SPT 21/29 for 55mm N > 50 (solid cone)		SPT				0			
														100			
56			55.63 - 56.60 Dark brown, speckled black.					SPT 22/28 for 55mm N > 50 (solid cone)		SPT				0			
														100			

Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical	Orientation:	Ground Water Level			
	Contractor: DCN		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Equipment: TR 200		31/07/23	08:15	13.6	54.13
	Shear Vane Id:					



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023						Hole No. : BH-M03 Sheet : 9 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023								
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946			System: NZTM2000											
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RCD (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
185	65		CORE LOSS (continued from layer starting at 64.0m)					SPT 22/28 for 55mm N > 50 (solid cone)		HQTT				60			64
	65.15									SPT				0			
	66		Silty fine to medium SAND; brown, streaked and speckled orange; indistinctly very thinly bedded at 10-25°. Very dense, moist.		M	VD		SPT 21/29 for 70mm N > 50 (solid cone)		HQTT				62			65
	66.54									SPT				0			66
	67		CORE LOSS							HQTT				33			67
	67.5									SPT				0			
	68		Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist.		M	VD		SPT 14/16 24/26 for 70mm N > 50 (solid cone)		HQTT				100			68
	69							SPT 11/12 14/17 19 for 75mm N > 50 (solid cone)		SPT				0			69
	70									HQTT				100			70
	71							SPT 8/11 13/16 18/3 for 10mm N > 50 (solid cone)		SPT				0			71
	72									HQTT				100			72
Notes and Comments: End of Hole @ 79.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level									
				Contractor: DCN Equipment: TR 200 Shear Vane Id:				Date	Time	Reading (mbgl)	Hole depth (mbgl)						

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 250 Oaia Road, Muriwai 0881 Job Number: 12612462 Commenced: 25/07/2023					Hole No. : BH-M03 Sheet : 10 of 10 Hole Length : 79.64m Scale @ A4 : 1:40 Logged : JM, MK Processed : MK Checked : JHS 23/08/2023																				
Easting: 1728010.05 RL: 150			Northing: 5923112.26 Datum: AUCKHT1946					System: NZTM2000																				
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect (mm)	Instrumentation	Water level											
							Number / Type	Result																				
72.29	72.29		Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist. (continued from layer starting at 67.5m) CORE LOSS	AWHITU SAND FORMATION	-	-	SPT 14/17 22/28 for 65mm N > 50 (solid cone)	SPT	SPT	HOTT	SPT	HOTT	SPT	HOTT	SPT	HOTT	SPT	HOTT										
73	72.97	Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist.	M		VD	SPT 12/14 16/16 18 for 65mm N > 50 (solid cone)	0	43																				
74	74.08	CORE LOSS	-		-	SPT 10/12 15/16 7 for 65mm N > 50 (solid cone)	0	18																				
75	75.95	Silty fine to medium SAND; greyish brown, streaked reddish brown. Very dense, moist.	M		VD	SPT 14/23 26/24 for 55mm N > 50 (solid cone)	0	100																				
76	76.00	75.90 - 76.00 Very weakly cemented iron oxide bed.																										
76	76.40	76.30 - 76.40 Very weakly cemented iron oxide bed.																										
77	76.98 76.78	CORE LOSS	-		-	SPT 27/23 for 50mm N > 50 (solid cone)	0	81																				
78	78.43	Highly weathered, greyish brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, very thinly bedded, brown sandstone beds at 5-15°. 76.98 - 77.08 Completely weathered, recovered as sand. 77.50 - 77.60 Completely weathered, recovered as sand.																										
79		CORE LOSS																										
79		End of Hole @ 79.64m, Target Depth.																										

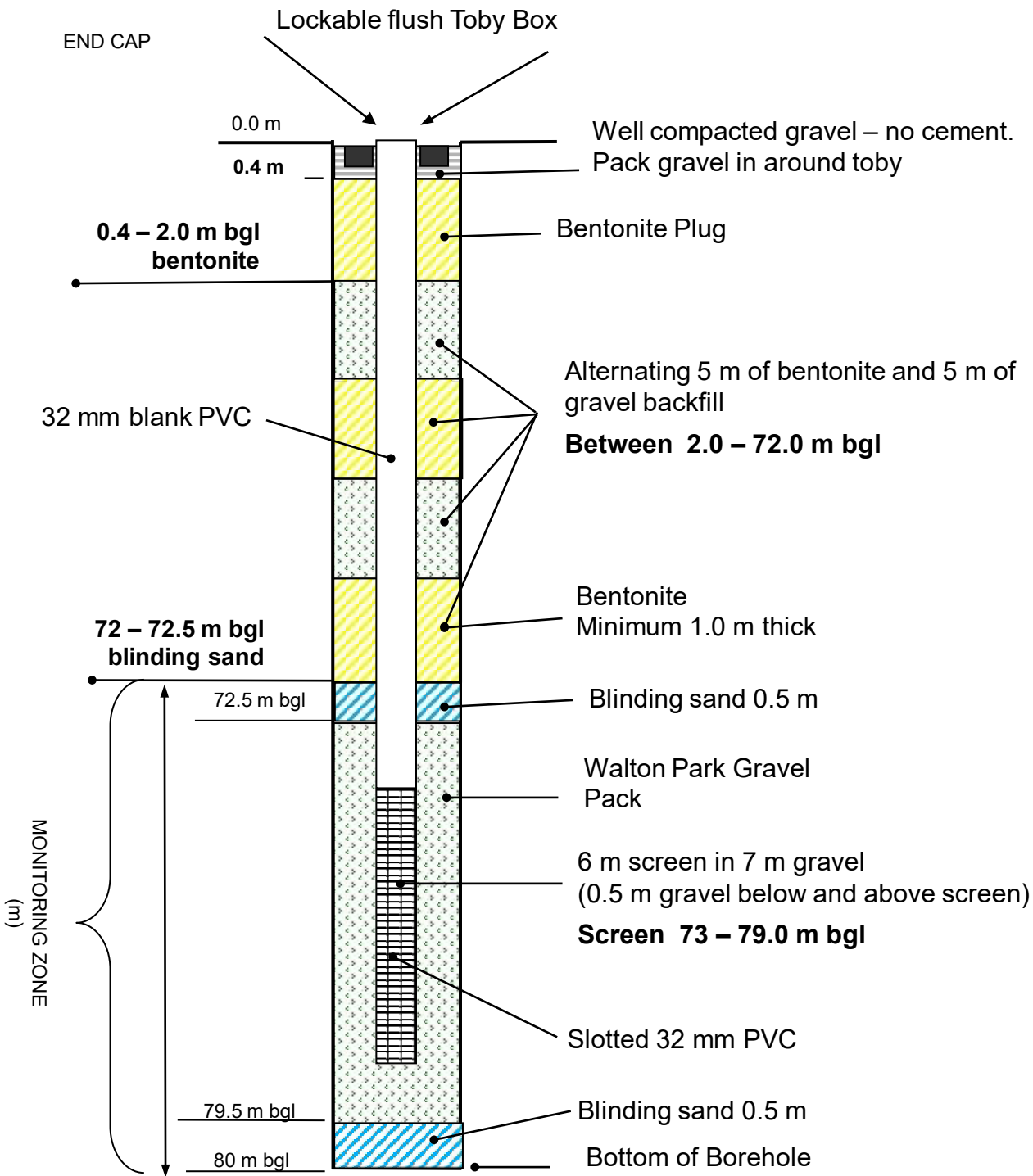
Notes and Comments:
End of Hole @ 79.64m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
Orientation:
Contractor: DCN
Equipment: TR 200
Shear Vane Id:

Ground Water Level
Date: 02/08/23
Time: 08:00
Reading (mbgl): 16.3
Hole depth (mbgl): 72.29

BH-M03 - Muriwai



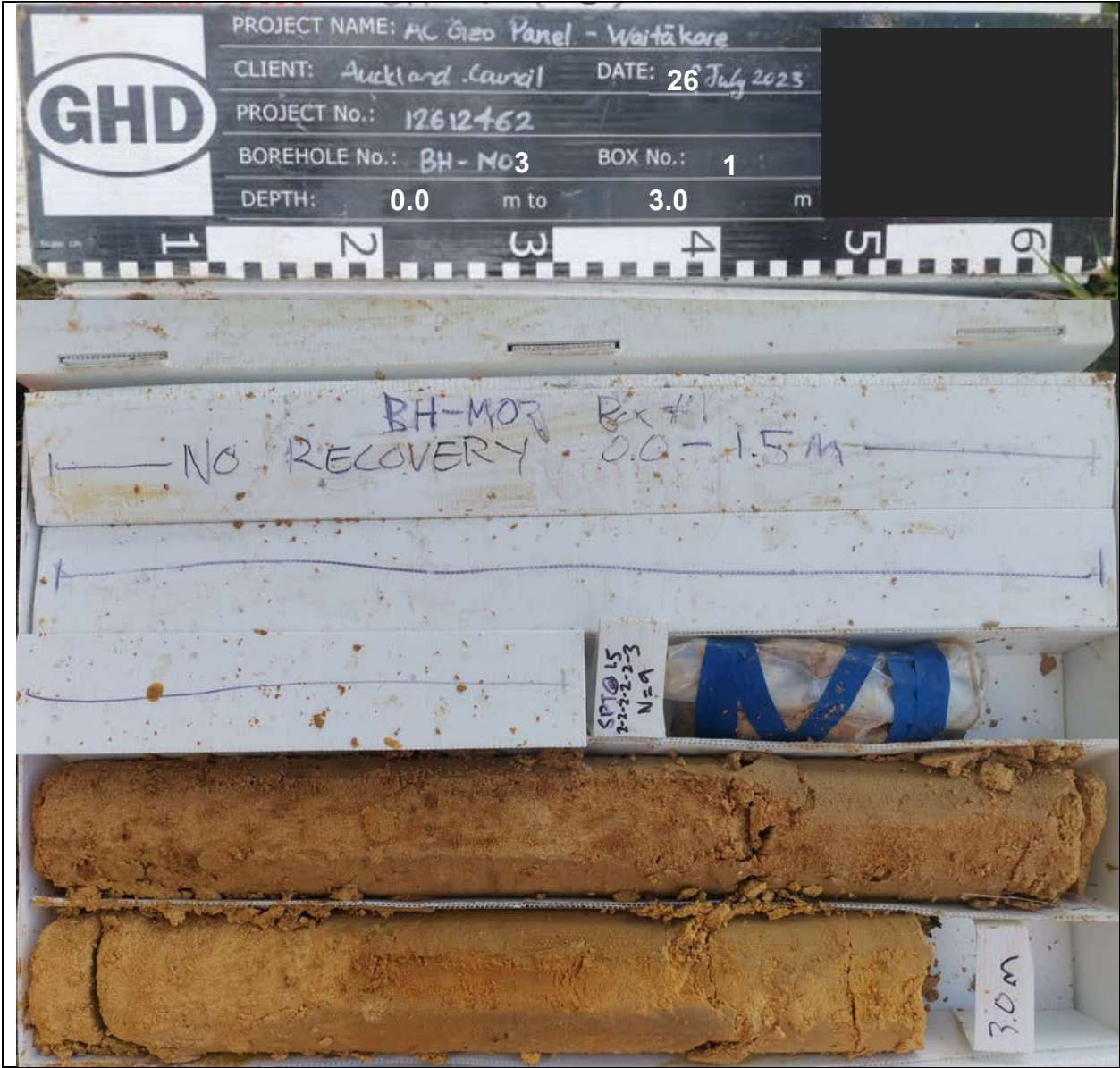
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Report of photographs

Site identification – BH-M03



Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		

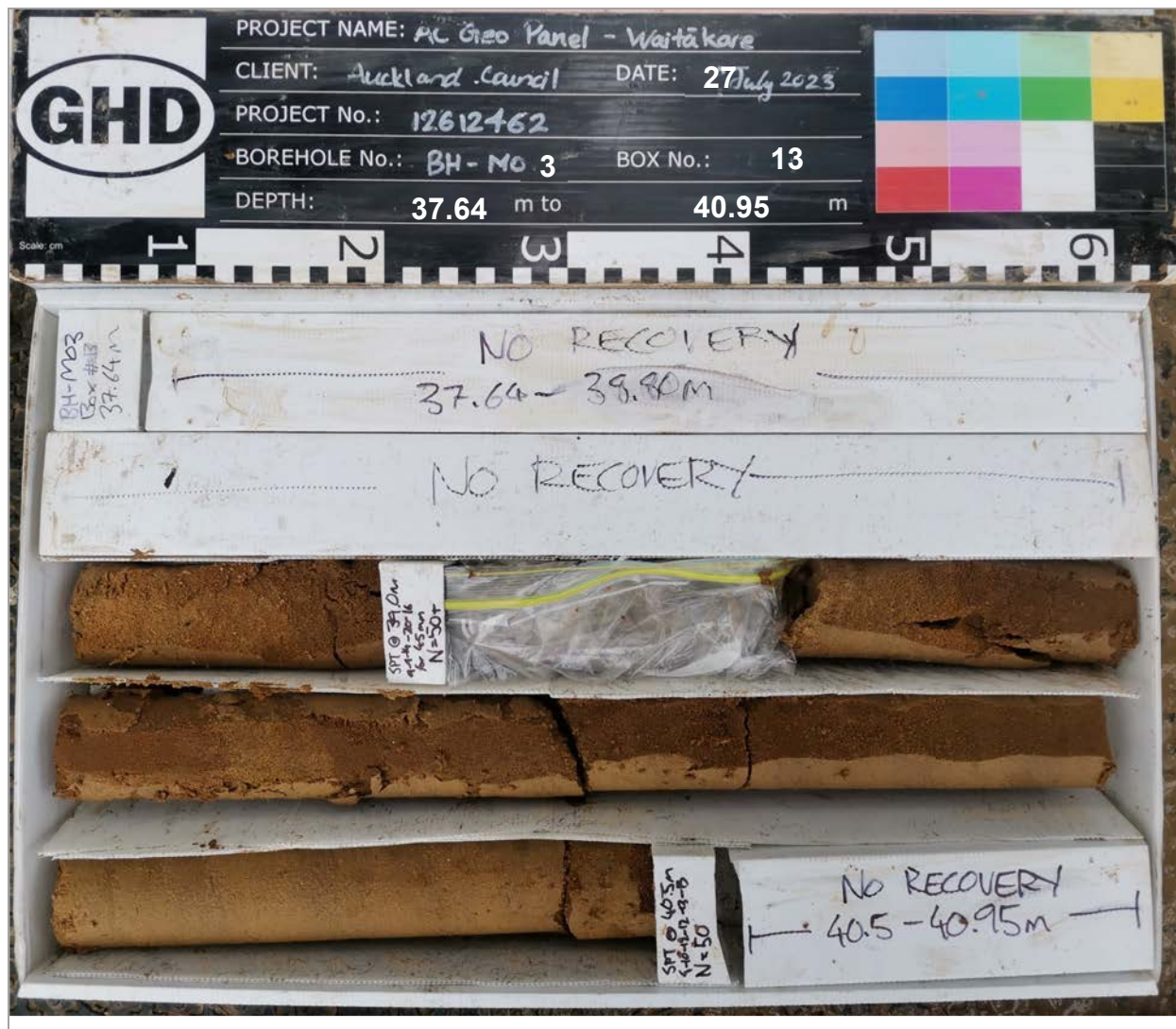


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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Report of photographs

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Report of photographs

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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Report of photographs

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Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		

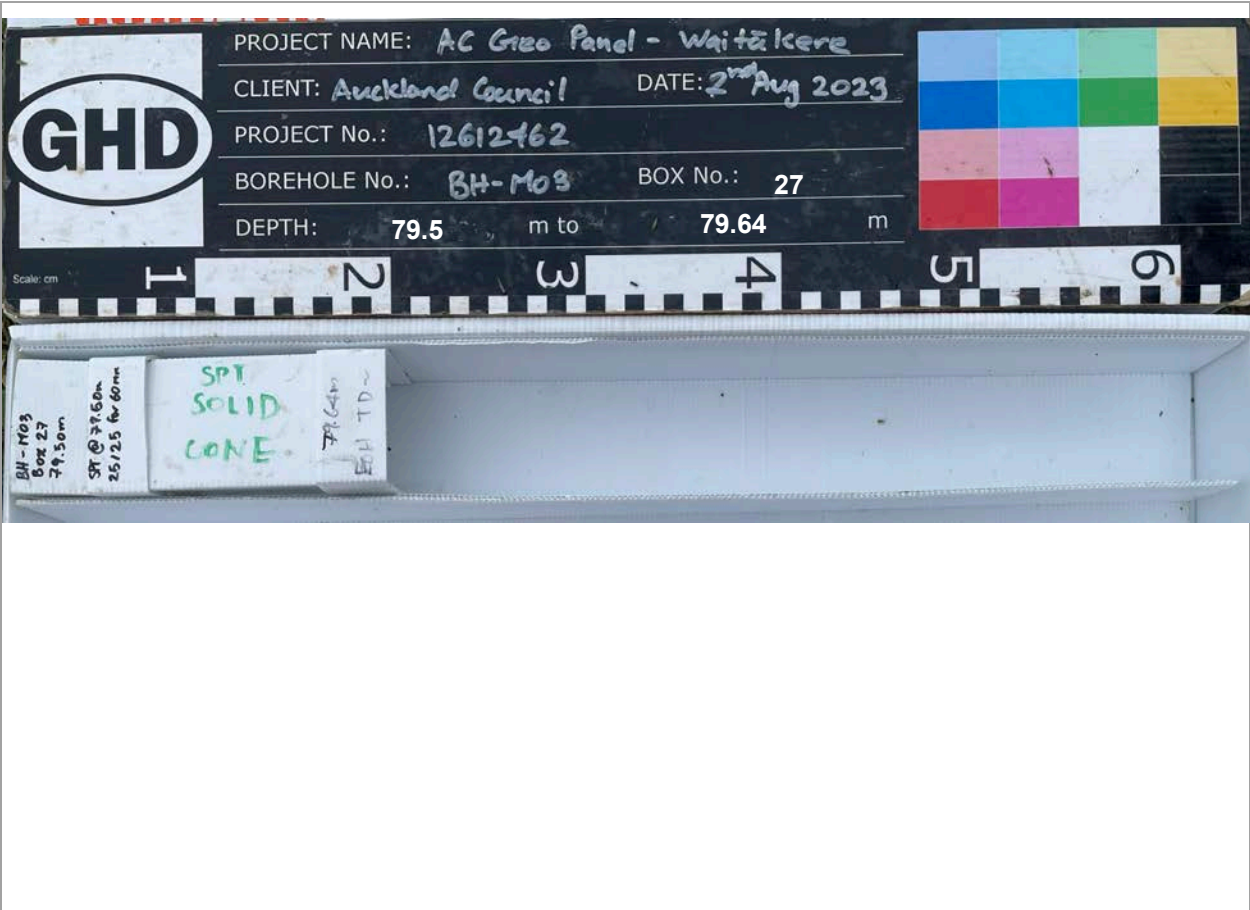


Report of photographs



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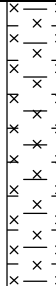
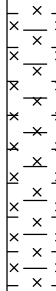
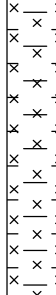
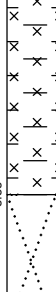
Site identification – BH-M03


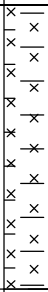


Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 45 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 10/08/2023 Completed: 10/08/2023</div>										Hole No. : BH-M04 Sheet : 1 of 3 Hole Length : 10.95m Scale @ A4 : 1:25 Logged : JM Processed : JM Checked : JHS 24/08/23																											
Easting: 1727699.87 RL: 53					Northing: 5923031.54 Datum: AUCKHT1946					System: NZTM2000																											
<div><div><div>RL (m)</div><div>Depth (m)</div><div>Graphic</div></div><div><div>0</div><div>0.7</div><div>0.85</div><div>1</div><div>1.25</div><div>1.35</div><div>1.5</div><div>1.65</div><div>1.8</div><div>1.95</div><div>2</div><div>2.15</div><div>2.3</div><div>2.45</div><div>2.6</div><div>2.75</div><div>2.9</div><div>3</div><div>3.15</div><div>3.3</div><div>3.45</div><div>3.6</div><div>3.75</div><div>3.9</div><div>4</div><div>4.15</div><div>4.3</div><div>4.45</div><div>4.6</div><div>4.75</div><div>4.9</div><div>5</div><div>5.15</div><div>5.3</div><div>5.45</div><div>5.6</div><div>5.75</div><div>5.9</div><div>6</div><div>6.15</div><div>6.3</div><div>6.45</div><div>6.6</div><div>6.75</div><div>6.9</div><div>7</div><div>7.15</div><div>7.3</div><div>7.45</div><div>7.6</div><div>7.75</div><div>7.9</div><div>8</div><div>8.15</div><div>8.3</div><div>8.45</div><div>8.6</div><div>8.75</div><div>8.9</div><div>9</div><div>9.15</div><div>9.3</div><div>9.45</div><div>9.6</div><div>9.75</div><div>9.9</div><div>10</div></div></div>										Material Description		Geological Unit		Moisture condition		Consistency / Relative density		Sample		Casing		Method		Flush Return (%)		Weathering		Estimated Strength (MPa)		TCR RCR RQD (%)		Defect Spacing (mm)		Instrumentation Installation		Water level	
										HYDROVAC. NO RECOVERY.		-		-		-		-		-		-		-		-		-		-		-		-		-	
Completely weathered, brown, streaked orange-black, fine grained SANDSTONE; extremely weak. [AWHITU SAND FORMATION].		M		"VSt"		-		-		-		-		-		-		-		-		-		-		-											
Silty CLAY; brown with orange, grey and orange-red streaks. 'Very stiff', moist, high plasticity.		AWHITU SAND		-		-		-		-		-		-		-		-		-		-		-		-											
Clayey SILT; grey with light grey streaks. 'Very stiff', moist, low plasticity.		-		-		-		-		-		-		-		-		-		-		-		-		-											
Clayey SILT; red. 'Very stiff', moist, low plasticity. [NIHOTUPU FORMATION]		-		-		-		-		-		-		-		-		-		-		-		-		-											
Clayey SILT, some gravel; dark brown, mottled orange-grey. 'Very stiff to hard', moist, low plasticity. Gravel, fine to medium, subangular, siltstone.		NIHOTUPU FORMATION		VSt-H		-		-		-		-		-		-		-		-		-		-		-											
Clayey SILT, trace gravel; reddish brown, mottled and streaked grey and brown. 'Very stiff'; moist, low plasticity. Gravel, fine to medium, subangular, siltstone.		-		"VSt"		-		-		-		-		-		-		-		-		-		-		-											
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			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 45 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 10/08/2023					Hole No. : BH-M04 Sheet : 2 of 3 Hole Length : 10.95m Scale @ A4 : 1:25 Logged : JM Processed : JM Checked : JHS 24/08/23									
Easting: 1727699.87 RL: 53			Northing: 5923031.54 Datum: AUCKHT1946		System: NZTM2000												
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
147	6		Clayey SILT, trace gravel; reddish brown, mottled and streaked grey and brown. 'Very stiff'; moist, low plasticity. Gravel, fine to medium, subangular, siltstone. (continued from layer starting at 3.3m)	NIHOTUPU FORMATION				SPT 3/3 4/4 5/6 N = 19		OB				100			
			6.65 - 7.20 Contains minor subangular siltstone gravel.							SPT				100			
146	7		6.80 - 8.95 Trace fine sand.		M	'VSt'		SPT 2/2 2/3 3/3 N = 11		OB				51			
			8.10 30mm interbed of very stiff red clay.							OB				62			
145	8																
			CORE LOSS														
144	9		Clayey SILT with trace gravel; reddish brown, mottled and streaked orange-brown-black. 'Very stiff', moist, low plasticity. Sand, fine. Gravel, fine, subangular, siltstone.		M	'VSt'		SPT 2/3 4/5 5/6 N = 20		SPT				100			
										OB				100			
143																	
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level				Date	Time	Reading (mbgl)	Hole depth (mbgl)		
				Contractor: DCN		Equipment: MAR 700											
				Shear Vane Id:													

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 45 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 10/08/2023 Completed: 10/08/2023						Hole No. : BH-M04 Sheet : 3 of 3 Hole Length : 10.95m Scale @ A4 : 1:25 Logged : JM Processed : JM Checked : JHS 24/08/23								
Easting: 1727699.87 Northing: 5923031.54 System: NZTM2000 RL: 53 Datum: AUCKHT1946																	
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
142	11		Clayey SILT with trace gravel; reddish brown, mottled and streaked orange-brown-black. 'Very stiff', moist, low plasticity. Sand, fine. Gravel, fine, subangular, siltstone. (continued from layer starting at 9.0m)	NIHOTUPU FORMATION				SPT 3/4 5/5 6/6 N = 22		OB				100			
141	12									SPT				100			
140	13																
139	14																
138	15																
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical Orientation:				Ground Water Level									
				Contractor: DCN Equipment: MAR 700 Shear Vane Id:				Date Time Reading (mbgl) Hole depth (mbgl)									

Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		

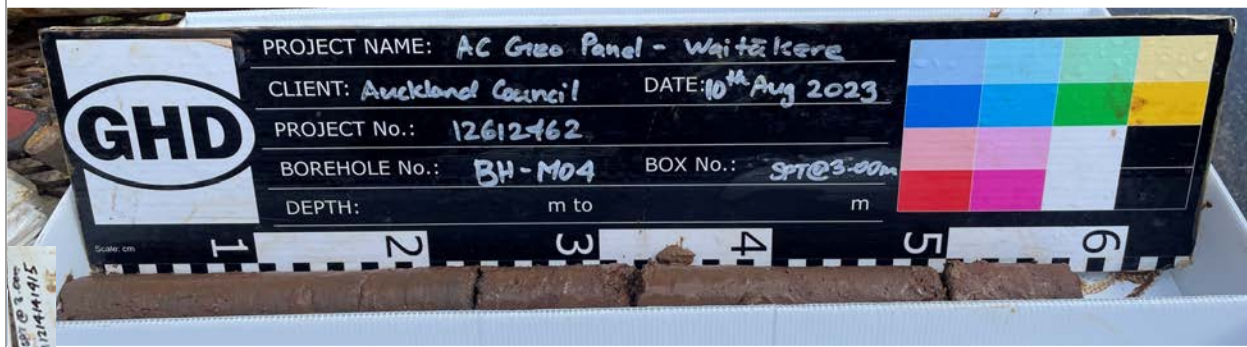


Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
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Report of photographs

Site identification – BH-M04



Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		














Report of photographs


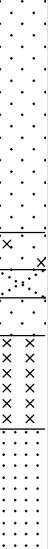


Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 58 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 18/07/2023					Hole No. : BH-M05 Sheet : 1 of 2 Hole Length : 10.95m Scale @ A4 : 1:40 Logged : MK Processed : MK Checked : JHS 22/08/2023										
		Completed: 18/07/2023															
Easting: 1727856.03		Northing: 5923234.43		System: NZTM2000													
RL: 63.5		Datum: AUCKHT1946															
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Number / Type	Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
63	0.15		ASPHALT	FILL	M	'F'											
	0.50		Sandy SILT with some clay; dark grey-black. 'Firm', moist, low plasticity. Sand, fine. [FILL] Silty fine to coarse GRAVEL; dark grey. Moist. Gravel, sub-rounded to sub-angular, greywacke.			-	'St'										
1	1.00		Sandy SILT with some clay; brown-grey-orange. 'Stiff', moist, low plasticity. Sand: fine to medium. [PALAEO-COLLUVIUM] 1.10 Wood fragments up to 50 mm.								HA						
2	1.99		Sandy organic SILT; black. 'Stiff', moist, low plasticity. Sand, fine to medium. CORE LOSS	PALAEO-COLLUVIUM	-	-				SPT				100			
	2.4		Sandy organic SILT; black. 'Stiff', moist, low plasticity. Sand, fine to medium.		M	'St'				OB				57			
3	2.9		Silty fine to medium SAND; grey. Loose, moist.			L				SPT				100			
	3.3		Sandy organic SILT; grey-brown. 'Stiff', moist, low plasticity. Sand, fine to medium.			'St'											
4	3.8		Sandy SILT, some clay, minor organics; dark greyish brown. 'Very stiff', moist, low plasticity. Sand, fine to medium. Organics, fibrous.			'VS'				OB				100			
5	4.45		Fine to medium SAND with some silt; grey. Loose, moist. [AWHITU SAND FORMATION] 4.50 - 4.65 Light brown.	AWHITU SAND FORMATION		L				SPT				100			
	4.95		CORE LOSS		-	-				OB				0			
6	5.6		Fine to medium SAND with some silt; grey. Medium dense, moist.		M	MD				HQTT				44			
	6.7									SPT				100			
7	7.0								HQTT				100				
	7.7								SPT				100				
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical Orientation: Contractor: DCN Equipment: TR 200 Shear Vane Id:					Ground Water Level Date Time Reading (mbgl) Hole depth (mbgl)								

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 58 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 18/07/2023						Hole No. : BH-M05 Sheet : 2 of 2 Hole Length : 10.95m Scale @ A4 : 1:40 Logged : MK Processed : MK Checked : JHS 22/08/2023																													
Easting: 1727856.03 RL: 63.5			Northing: 5923234.43 Datum: AUCKHT1946			System: NZTM2000																																
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect	Instrumentation	Water level																					
							Number / Type	Result																														
155	9		Fine to medium SAND with some silt; grey. Medium dense, moist. (continued from layer starting at 5.6m)	AWHITU SAND FORMATION	-	-	SPT 3/4 6/7 9/11 N = 33			HOTT				100																								
154	8.40 - 9.25 Greenish grey.		M																SPT 6/8 9/11 12/15 N = 47	HOTT				86														
154	Silty fine SAND; grey. Medium dense, moist.																											CORE LOSS										
154	Fine to medium SAND with some silt; grey. Moist.																																					
153	10.3		Moderately weathered, greenish grey, fine to medium grained SANDSTONE; extremely weak.																																			
11	11		End of Hole @ 10.95m, Target Depth.																																			
152	12																																					
151	13																																					
150	14																																					
149	15																																					
148																																						

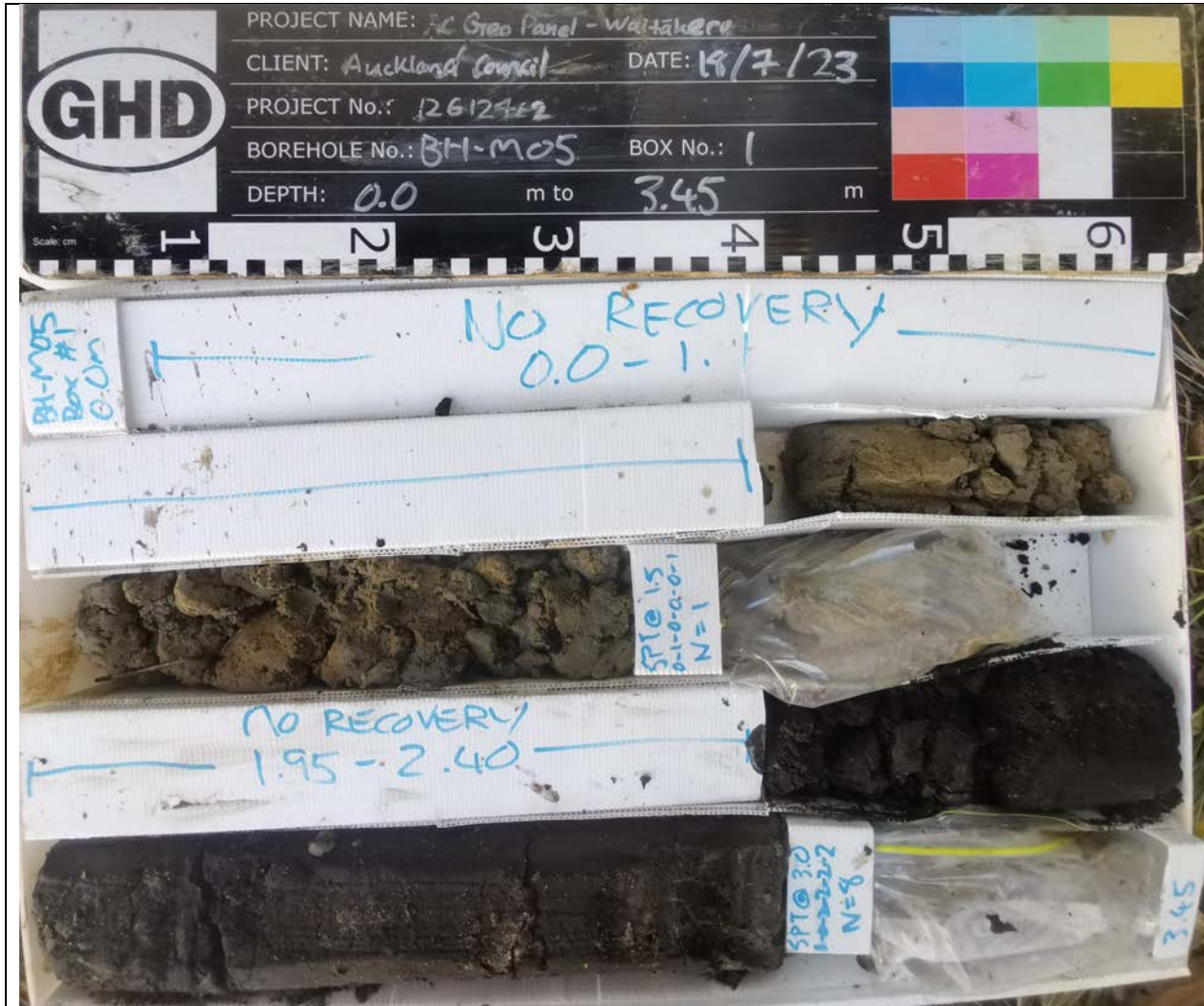
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level			
				Contractor: DCN		Equipment: TR 200		Shear Vane Id:		Date	Time

Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		

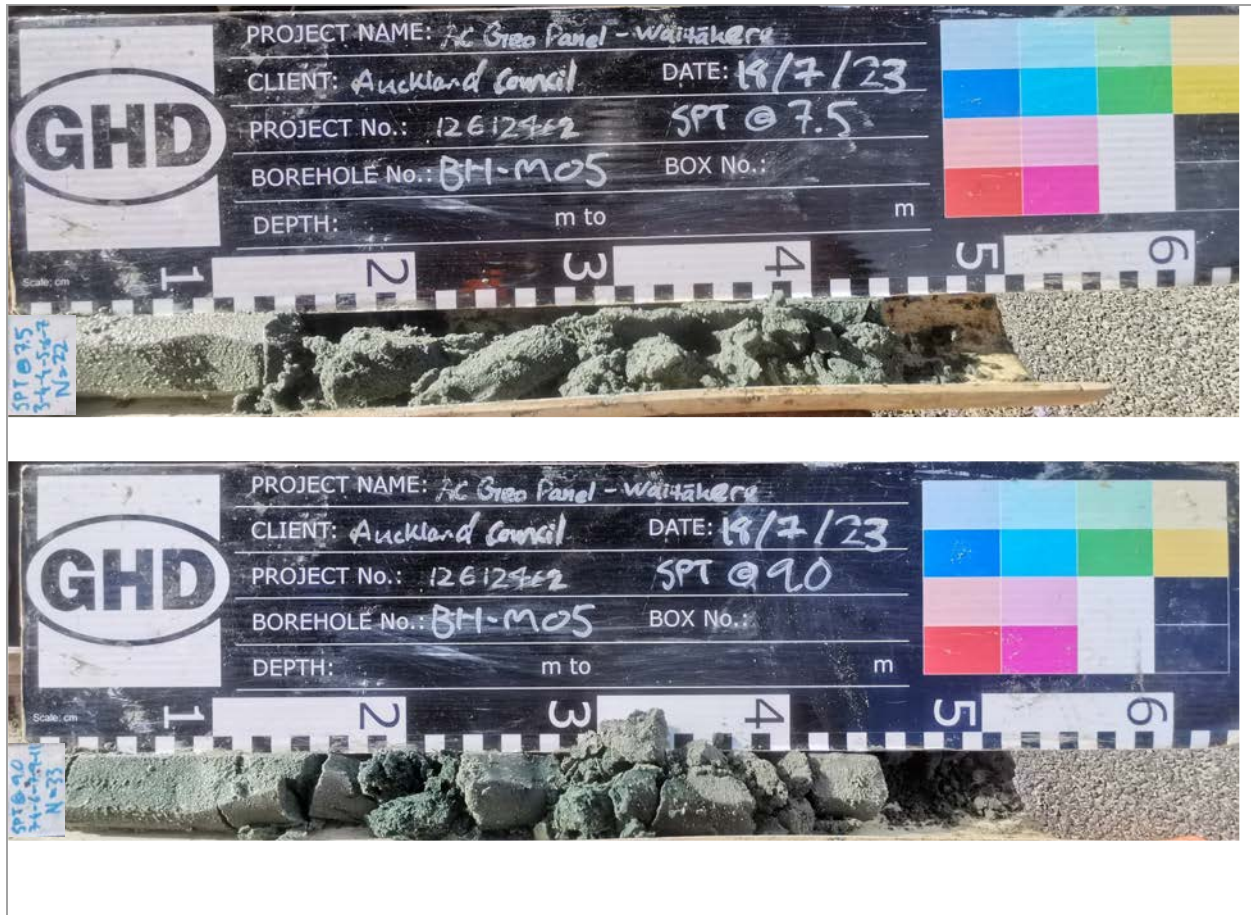


Report of photographs

Site identification – BH-M05



Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		




Report of photographs










Site identification – BH-M05

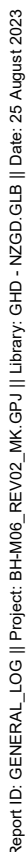



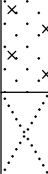
Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



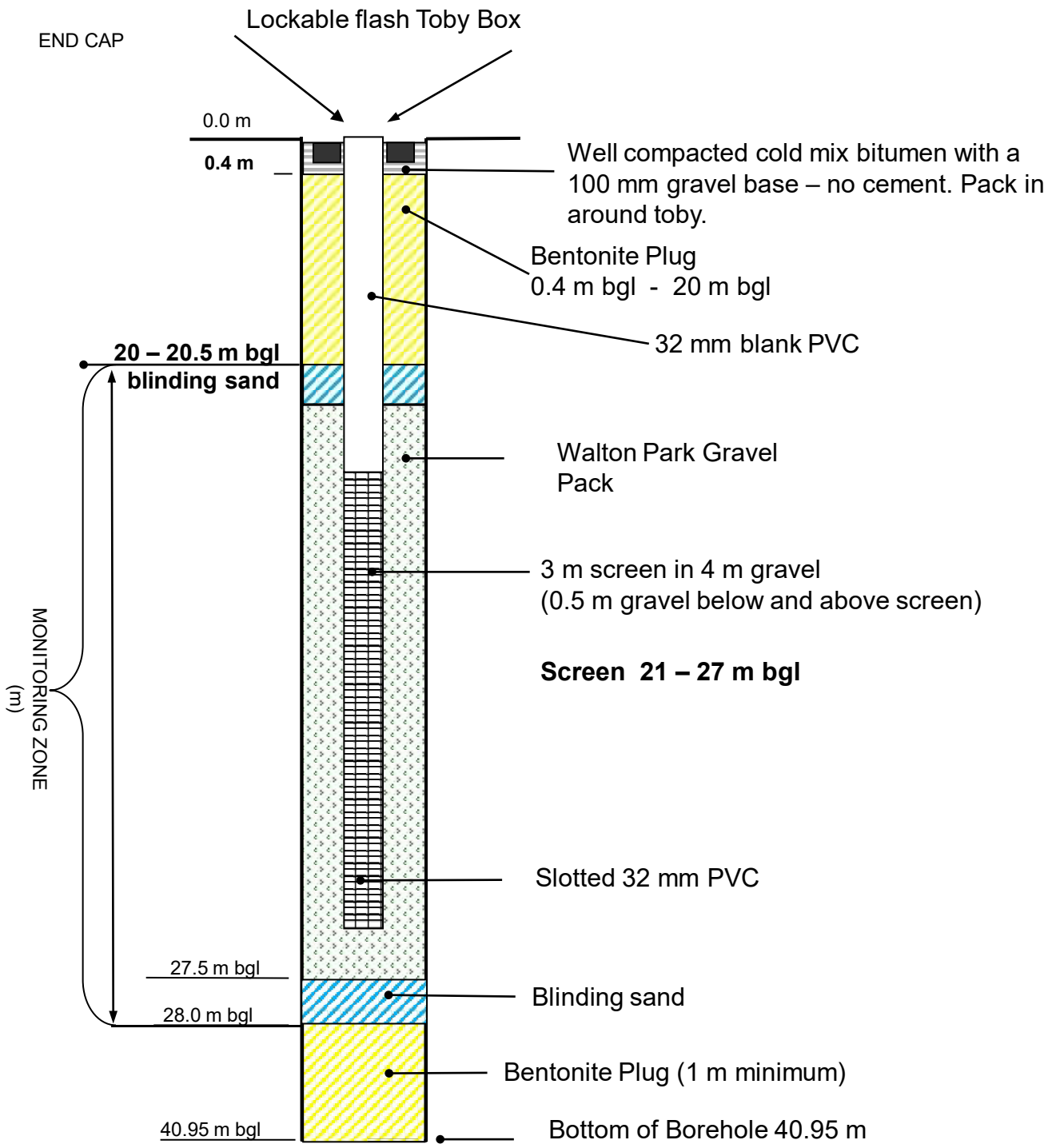
		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 128 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 20/07/2023				Hole No. : BH-M06 Sheet : 1 of 6 Hole Length : 40.95m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS																		
Easting: 1728033.15 RL: 89.5		Northing: 5923293.53 Datum: AUCKHT1946		System: NZTM2000																				
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Number / Type	Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect	Instrumentation	Water level							
89	0		HYDROVAC. NO RECOVERY.		-	-				HV				0										
88	1.5		Sandy SILT with trace clay; light brown, streaked orange-grey. 'Stiff to very stiff', moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION].		M	F		SPT 1/1 1/1 1/1 N = 4		SPT				100										
87	2									OB				100										
86	3		CORE LOSS					SV@3m UTP SPT 1/1 1/1 1/1 N = 4		SPT				0										
85	3.45		Sandy SILT with trace clay; grey, speckled black. Very stiff to hard, moist. Sand, fine to medium.	AWHITU SAND FORMATION		M	VS-H			OB				100										
84	5							SV@4.5m UTP SPT 0/0 0/1 1/1 N = 3		SPT				100										
83	5.4		Silty fine to medium SAND; grey, streaked orange-red, speckled black. Loose, moist. [PALAEO-COLLUVIUM] 5.40 - 5.85 Orange brown-grey. 5.45 5-10mm very weakly iron oxide cemented lamination. 5.80 5-10mm very weakly iron oxide cemented lamination.	PALAEO-COLLUVIUM			L			OB				100										
82	7.1		Fine SAND with trace silt and fine gravel sized organic fragments; light brown. Medium dense, moist. [AWHITU SAND FORMATION]				MD	SPT 1/1 1/1 2/3 N = 7		SPT				100										
								SPT 2/3 3/4 5/7 N = 19		OB				100										
										SPT				89										
Notes and Comments: End of Hole @ 40.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey. Refer to explanation sheets for abbreviation and symbols			Inclination: Vertical Contractor: DCN Equipment: TR 200 Shear Vane Id: GEO902			Orientation:			Ground Water Level <table><tr><td>Date</td><td>Time</td><td>Reading (mbgl)</td><td>Hole depth (mbgl)</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>								Date	Time	Reading (mbgl)	Hole depth (mbgl)				
Date	Time	Reading (mbgl)	Hole depth (mbgl)																					

<div></div> <div>Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 128 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 20/07/2023</div>										<div>Hole No. : BH-M06</div> <div>Sheet : 3 of 6 Hole Length : 40.95m Scale @ A4 : 1:40</div> <div>Logged : JM Processed : JM Checked : JHS</div>									
Easting: 1728033.15					Northing: 5923293.53					System: NZTM2000									
RL: 89.5					Datum: AUCKHT1946														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level		
							Number / Type	Result											
17.3	16.65		Silty fine SAND; light brown, streaked orange, speckled black. Medium dense, moist. (continued from layer starting at 15.5m)	PALAEO-COLLUVIUM				SPT 1/1 2/4 6/3 N = 15		HQTT				100					
17			Silty CLAY; grey, speckled and streaked orange-red speckles. 'Firm', moist, high plasticity.			'F'	MD			SPT				93					
17.2			Silty fine SAND with closely spaced thin interbeds of silty clay; light grey mottled orange. Medium dense, moist. Clay, firm, moist, high plasticity.							HQTT				100					
18	18		CORE LOSS		-	-		SPT 1/1 0/0 1/1 N = 2		SPT				0					
18.45	18.45		Clayey SILT with minor sand with very closely spaced very thin interbeds of sandy silt and trace fine gravel sized organic fragments; light grey, mottled orange. Firm, moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION]	AWHITU SAND FORMATION	M	'F'				HQTT				100					
19			CORE LOSS			-	-		SPT 0/0 0/0 0/0 N = 0		SPT				0				
19.5	19.5		Silty CLAY; grey-brown. 'Firm', moist, high plasticity.			M	'F'	D			HQTT				29				
20	20.6		Silty fine SAND; light grey, streaked orange. Dense, moist.						SPT 4/6 9/9 9/10 N = 37		SPT				100				
21	21.45		CORE LOSS			-	-				HQTT				48				
22	22		Silty fine SAND; light grey. Medium dense, moist.		M	MD				HQTT									
22.5	22.5		CORE LOSS		-	-		SPT 2/3 4/4 3/3 N = 14		SPT				0					
23	22.95		Silty fine SAND; light grey. Loose to medium dense, wet.		W	L-MD				HQTT				100					
23																			
24																			
Notes and Comments: End of Hole @ 40.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level											
				Contractor: DCN		Equipment: TR 200		Shear Vane Id: GEO902		Date	Time	Reading (mbgl)	Hole depth (mbgl)						
								20/07/23	15:45	19.6	21.95								
								21/07/23	08:30	3.8	21.95								



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 128 Domain Crescent, Muriwai 0881 Job Number: 12612462 Commenced: 20/07/2023						Hole No. : BH-M06 Sheet : 6 of 6 Hole Length : 40.95m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS								
Easting: 1728033.15 RL: 89.5			Northing: 5923293.53 Datum: AUCKHT1946			System: NZTM2000											
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
149	40.5		Silty fine to medium SAND; brown, speckled black. Dense, moist. (continued from layer starting at 39.1m)							HQTT				100			
			CORE LOSS		-	-		SPT 6/7 8/9 11/12 N = 40		SPT					0		
41			End of Hole @ 40.95m,Target Depth.														
148																	
42																	
147																	
43																	
146																	
44																	
145																	
45																	
144																	
46																	
143																	
47																	
142																	
Notes and Comments: End of Hole @ 40.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical Contractor: DCN Equipment: TR 200 Shear Vane Id: GEO902				Orientation:				Ground Water Level Date: 24/07/23 Time: 08:45 Reading (mbgl): 21.26 Hole depth (mbgl): 40.95					

BH-M06 - Muriwai



NOT TO SCALE

Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		

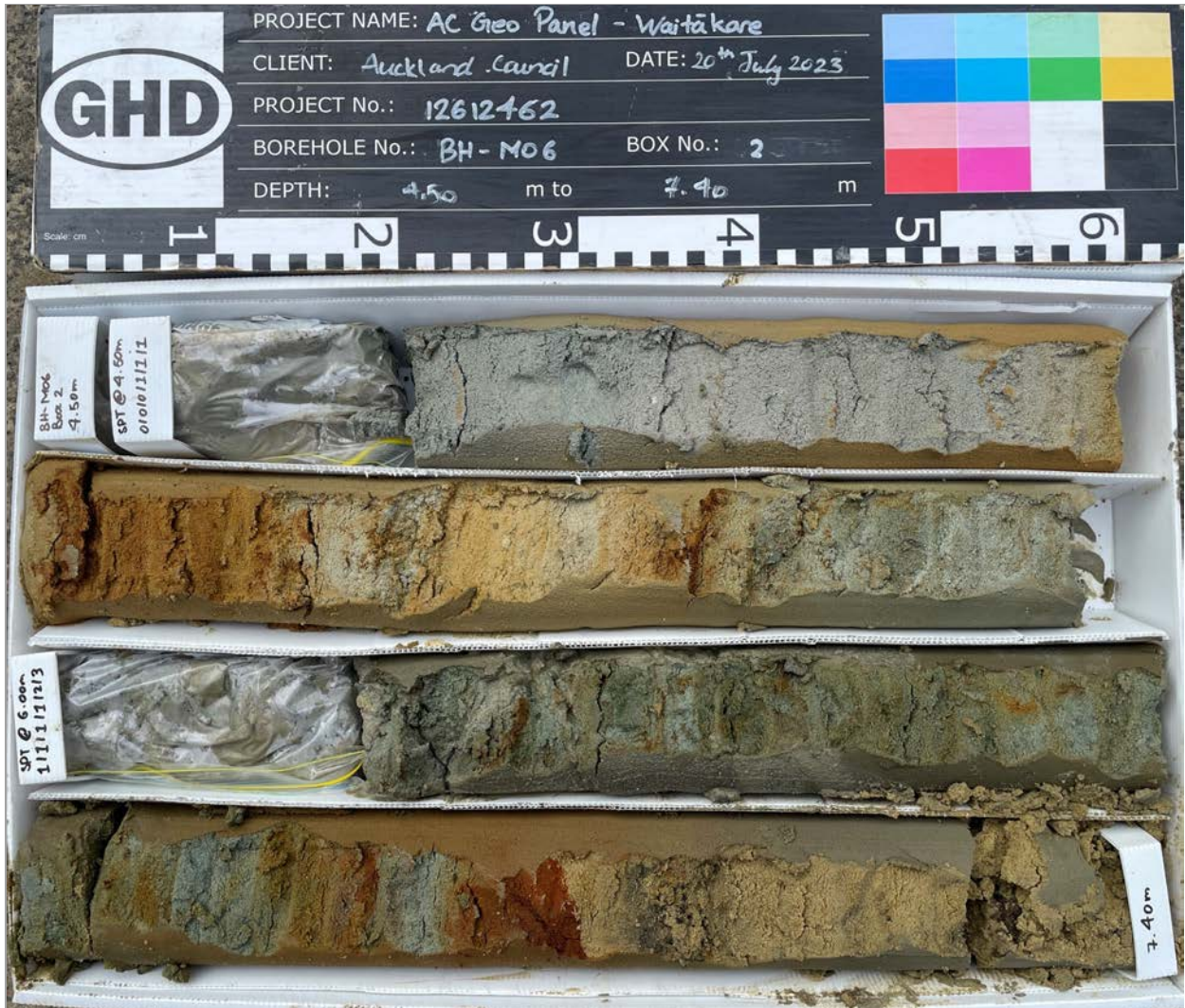


Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
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Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
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Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		

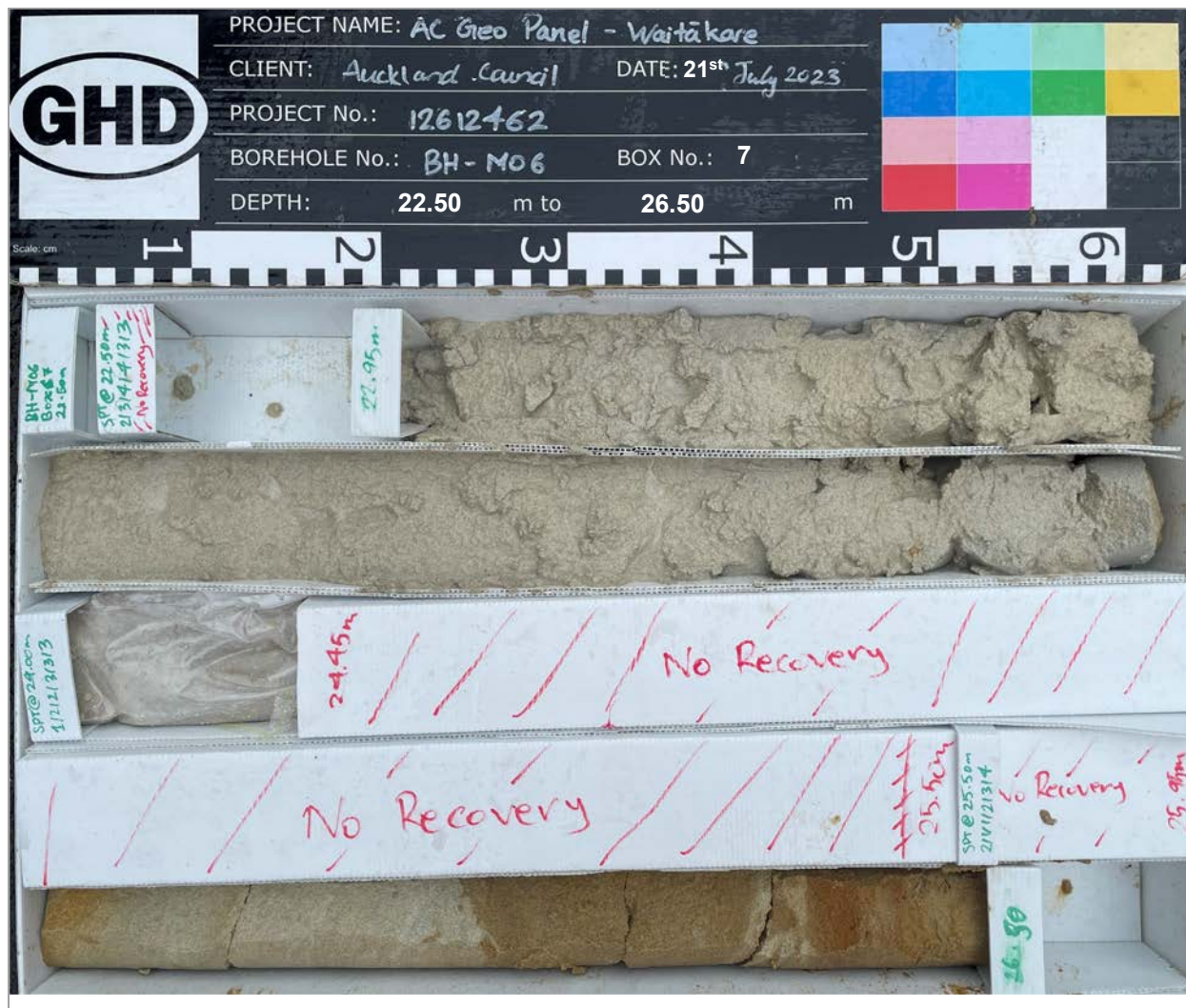


Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		

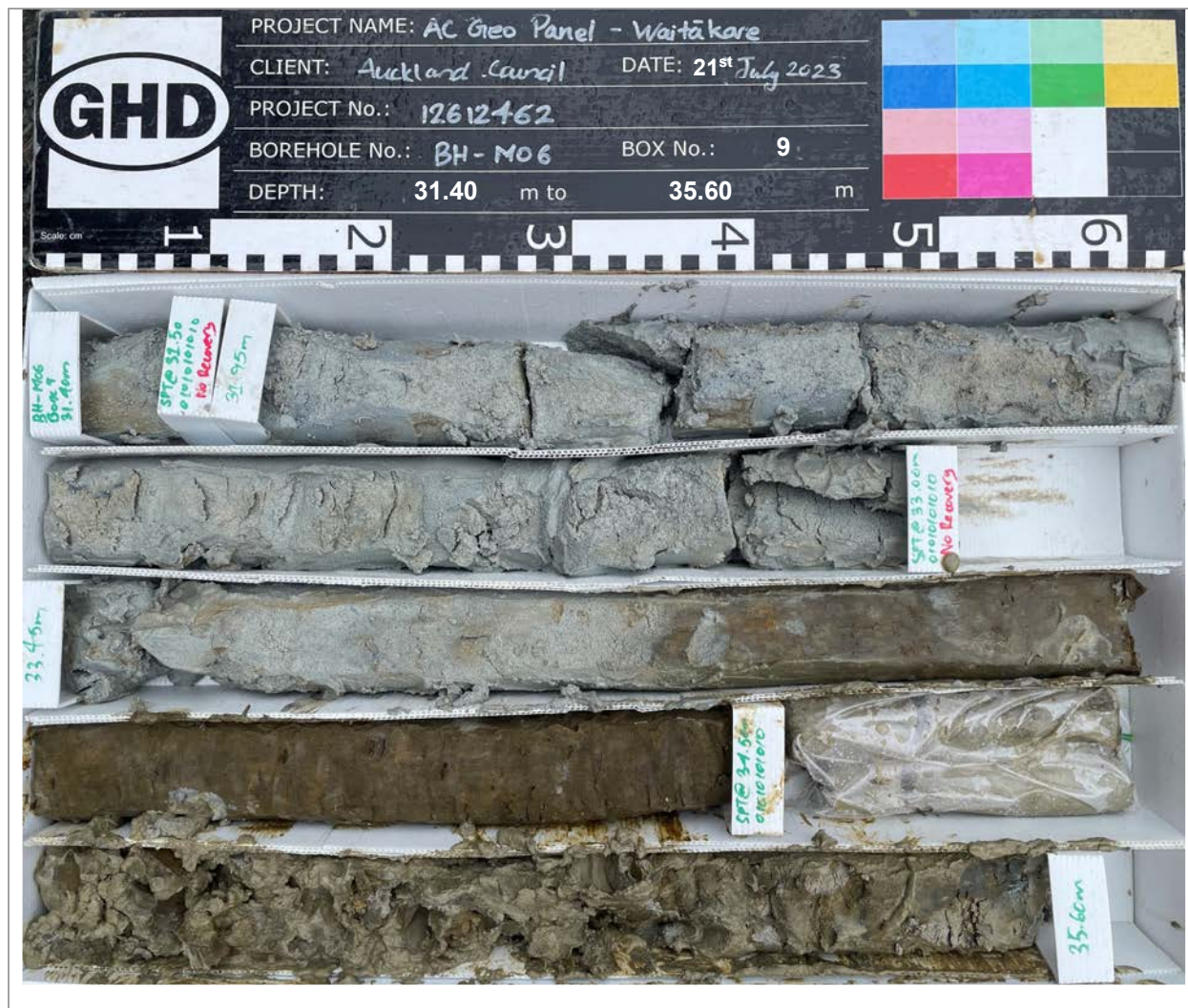


Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		













Report of photographs


Site identification – BH-M06














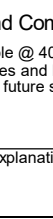
Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent,
Date	20 to 21 July 2023		Muriwai














<div></div>		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023						Hole No. : BH-M07 Sheet : 1 of 6 Hole Length : 40.64m Scale @ A4 : 1:40																			
		Completed: 12/07/2023						Logged : LA, MK Processed : MK Checked : JHS																			
Easting: 1728235.26		Northing: 5923652.39		System: NZTM2000																							
RL: 52		Datum: AUCKHT1946																									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SSCR RQDR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level										
	0.2		ASPHALT	FILL																							
	1		HYDROVAC. NO RECOVERY							HV				0													
1.51																											
	2		Organic SILT with some sand and minor roots; dark brown. 'Stiff', moist, low plasticity. Sand, fine to medium. [PALAEO-COLLUVIUM]		M	'St'		SPT 0/0 0/1 N = 1		SPT				0													
1.95																											
	2.9		Clayey SILT with some sand; grey. 'Soft', wet, low plasticity. Sand, fine.		W	'S'				OB				100													
2.726																											
	3		Silty fine to medium SAND; grey. Wet.			'VSt'		SPT 0/1 0/0 1/5 N = 6		SPT				67													
2.9			Sandy SILT; light orange brown. 'Very stiff', wet, Low plasticity. Sand, fine.																								
3.534																											
	4		Highly weathered, orange brown, fine to medium grained SANDSTONE; very weak.		W	-																					
3.534			Silty fine to medium SAND; orange brown. Loose to medium dense, wet.																								
4.0				PALEO-COLLUVIUM						OB				100													
	5		Silty fine to coarse SAND with trace gravel; light to dark grey, streaked brown-orange, mottled brown-grey. Very loose, moist. Gravel, fine to coarse, sub-angular to sub-rounded.		M	VL		SPT 0/0 0/0 N = 0		SPT				0													
4.0																											
	6		Silty fine to medium SAND; orange. Loose, moist. [AWHITU SAND FORMATION]			L		SPT 0/1 0/1 1/2 N = 4		SPT				100													
6.3																											
	7		CORE LOSS							OB				76													
7.25																											
	7.5		Highly weathered, light grey-brown SILTSTONE; extremely weak.	AWHITU SAND FORMATION				SPT 4/4 4/5 10/11 N = 30		SPT				100													
7.5																											
44																											
Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical				Orientation:				Ground Water Level															
				Contractor: DCN								Date				Time				Reading (mbgl)				Hole depth (mbgl)			
				Equipment: Tr-200																							
				Shear Vane Id:																							


		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023 Completed: 12/07/2023						Hole No. : BH-M07 Sheet : 2 of 6 Hole Length : 40.64m Scale @ A4 : 1:40 Logged : LA, MK Processed : MK Checked : JHS										
Easting: 1728235.26 RL: 52		Northing: 5923652.39 Datum: AUCKHT1946		System: NZTM2000														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
143 9 9.45 10 10.5 11 11.125 12 13 13.95 14 14.53 15 15.35 15.85	8.1	X	Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.	AWHITU SAND FORMATION				SPT 2/2 3/4 5/7 N = 19		HQTT		HW		100				
									SPT				100					
	9.45		CORE LOSS							HQTT				0				
	10.5	X	Silty fine SAND; dark greenish grey. Medium dense to dense, moist.		M	MD-D		SPT 3/4 6/7 9/9 N = 31		SPT				100				
	11.125	X	Silty fine to medium SAND; dark orange brown. Moist. CORE LOSS		-	-				HQTT				33				
	12	X	Silty fine to medium SAND; dark orange brown. Medium dense, moist.		M	MD		SPT 2/2 3/3 5/5 N = 16	120mm	SPT					67			
	13	X								HQTT					100			
	13.95	X	CORE LOSS		-	-		SPT 5/5 6/6 7/9 N = 28		SPT					100			
	14.53	X	Highly weathered, dark orange brown, fine to medium grained SANDSTONE; extremely weak. Fine to medium SAND with some silt; orange brown. Moist.		M					HQTT		HW		62				
	15	X	CORE LOSS		-	-		SPT 1/0 2/3 3/4 N = 12		SPT					0			
	15.35	X	Silty fine to medium SAND; light grey. Medium dense, moist.		M	MD				HQTT					100			

Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level			
				Contractor: DCN				Date	Time	Reading (mbgl)	Hole depth (mbgl)
				Equipment: Tr-200							
				Shear Vane Id:							


			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023					Hole No. : BH-M07 Sheet : 3 of 6 Hole Length : 40.64m Scale @ A4 : 1:40 Logged : LA, MK Processed : MK Checked : JHS										
Easting: 1728235.26 RL: 52			Northing: 5923652.39 Datum: AUCKHT1946					System: NZTM2000										
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
35	16.95		Silty fine to medium SAND; orange brown. Medium dense, moist. (continued from layer starting at 15.9m)	AWHITU SAND FORMATION			SPT 1/2 3/4 6/7 N = 20		HQTT					100				
17	17.6		CORE LOSS		-	-			SPT						100			
34	18.45		Silty fine to medium SAND; orange brown. Medium dense, moist.		M	MD			HQTT						38			
18	18.75		CORE LOSS		-	-			SPT						0			
19	18.90		Silty fine to medium SAND; orange brown. Medium dense, moist. 18.90 - 19.40 Brownish grey.		M	MD			HQTT						76			
20	20.4		CORE LOSS		-	-			SPT						100			
21	20.9		Silty fine to medium SAND; orange brown. Medium dense, moist.		M	MD			HQTT						48			
21	21.62		CORE LOSS		-	-			SPT						100			
22	21.62		Silty fine to medium SAND; orange brown. Medium dense to dense, moist.		M	MD-D			HQTT						76			
23	23.20		23.20 - 24.50 Dark reddish brown.						SPT 3/5 6/7 9/9 N = 31		SPT				100			
24	24.50								HQTT				100					
Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level										
				Contractor: DCN		Equipment: Tr-200		Shear Vane Id:		Date	Time	Reading (mbgl)	Hole depth (mbgl)					

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023						Hole No. : BH-M07 Sheet : 4 of 6 Hole Length : 40.64m Scale @ A4 : 1:40 Logged : LA, MK Processed : MK Checked : JHS												
Easting: 1728235.26 RL: 52			Northing: 5923652.39 Datum: AUCKHT1946			System: NZTM2000															
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect mm Spacing (mm)	Instrumentation Installation	Water level				
							Number / Type	Result													
24	24.7		Silty fine to medium SAND; orange brown. Medium dense to dense, moist. (continued from layer starting at 21.6m)	AWHITU SAND FORMATION	-	-	SPT 6/7 6/7 8/9 N = 30	SPT 6/7 9/10 10/11 N = 40	SPT 4/6 7/8 9/10 N = 34	SPT 5/6 7/8 11/12 N = 38	SPT 3/5 6/8 11/11 N = 36	HW		100							
25	24.7		24.50 - 24.70 Fine sand. CORE LOSS															-	-	HQTT	57
26	25.15		Silty fine to medium SAND; orange brown. Moist. 25.20 - 25.30 Carbonaceous inclusions.															M		SPT	100
26	25.5		Silty fine to medium SAND; reddish orange brown. Dense, moist. 25.50 - 25.67 Carbonaceous fragments to 10 mm.																D	HQTT	100
27	26.33		26.33 - 26.47 Very closely spaced iron oxide stained laminations at 20-30°.																	SPT	100
28	26.33		26.33 - 26.47 Very closely spaced iron oxide stained laminations at 20-30°.																	HQTT	100
29	29.00		29.00 - 30.00 Very closely spaced, orange brown laminations at 15-30°.																	SPT	100
30	29.00		29.00 - 30.00 Very closely spaced, orange brown laminations at 15-30°.																	HQTT	100
31	31.3		Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak. Recovered as; Silty SAND. Very dense, moist.																	SPT	100
32	31.3		Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak. Recovered as; Silty SAND. Very dense, moist.																		100

Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical	Orientation:	Ground Water Level				
	Contractor: DCN	Equipment: Tr-200	Shear Vane Id:	Date	Time	Reading (mbgl)	Hole depth (mbgl)

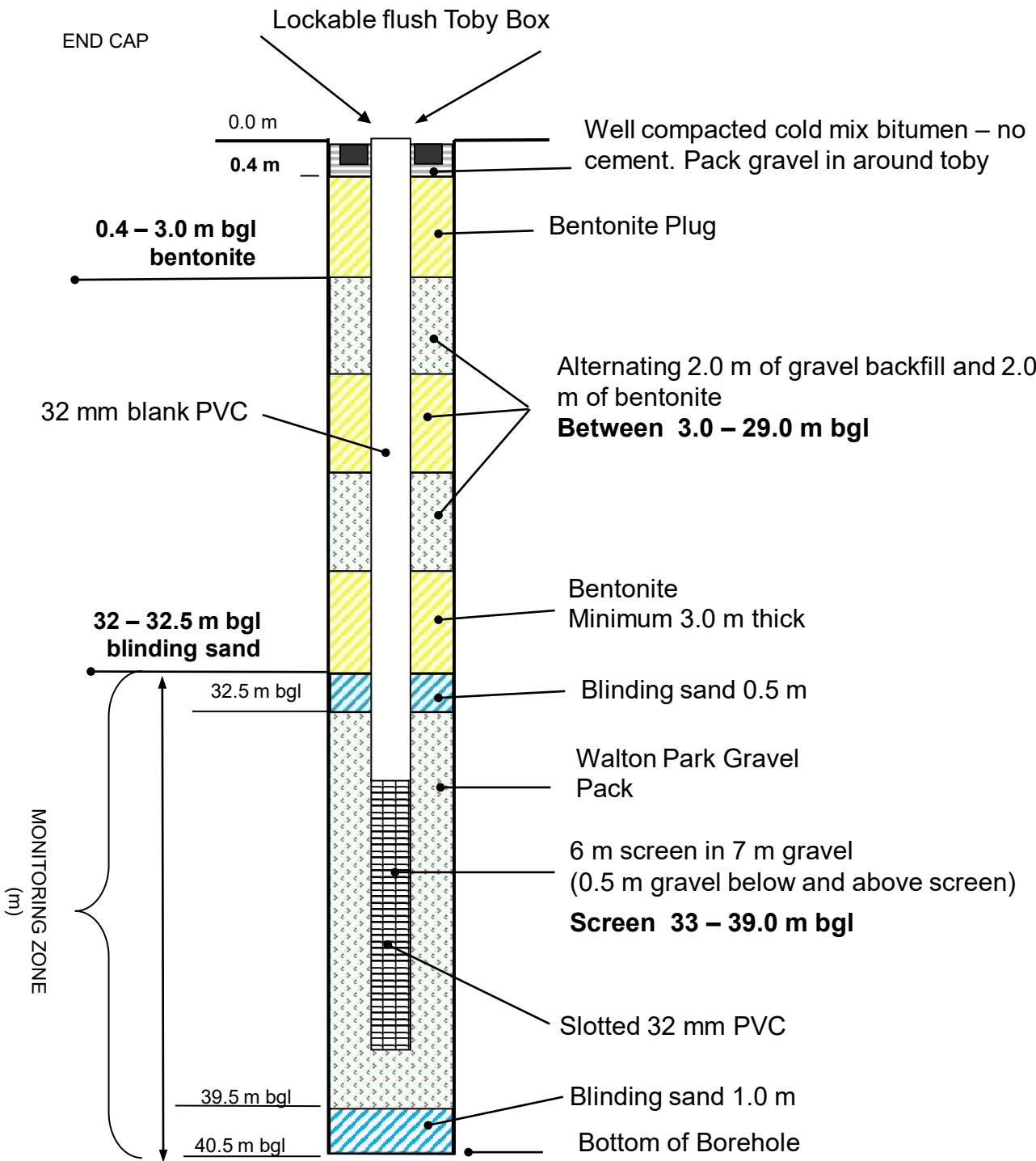
		Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023					Hole No. : BH-M07 Sheet : 5 of 6 Hole Length : 40.64m Scale @ A4 : 1:40 Logged : LA, MK Processed : MK Checked : JHS											
Easting: 1728235.26 RL: 52		Northing: 5923652.39 Datum: AUCKHT1946		System: NZTM2000														
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
	32.25		Silty fine to medium SAND; dark reddish orange brown. Very dense, moist.	AWHITU SAND FORMATION	M	VD		SPT 10/12 13/14 12/12 N > 50 (solid cone)		HQTT		HW		100				
	32.69		32.69 - 32.82 Carbonaceous fragments to 10 mm.															
	33		Completely weathered, dark orange brown, distinctly bedded, fine to coarse SANDSTONE; extremely weak; very thinly bedded at 40-45°.		-	-		SPT 7/12 14/15 15/6 for 25mm N > 50 (solid cone)		SPT		CW		0				
	33.35		33.35 - 33.40 Iron staining.															
	33.65		CORE LOSS							HQTT				52				
	34		Completely weathered, brown, streaked red-orange, fine to medium grained SANDSTONE; extremely weak.							SPT				0				
	34.15									HQTT				100				
	35									SPT				0				
	36									HQTT				100				
	36.3		Fine to medium SAND with some silt; dark orange brown. Very dense, moist.		M	VD		SPT 14/19 24/26 for 65mm N > 50 (solid cone)		SPT				0				
	37									HQTT				100				
	37.50		37.50 ~20 mm layer of fine to medium, sub-angular, dark red iron stained, sandstone gravel.					SPT 23/27 for 70mm N > 50 (solid cone)		SPT				0				
	38		Highly weathered, dark reddish brown, mottled dark grey-orange brown, fine to medium grained SANDSTONE; extremely weak.			-	-			HQTT				100				
	38																	
	39							SPT 9/14 24/26 for 65mm N > 50 (solid cone)		SPT			HW		0			
	39.8									HQTT				100				
Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols					Inclination: Vertical		Orientation:		Ground Water Level									
				Contractor: DCN				Date	Time	Reading (mbgl)	Hole depth (mbgl)							
				Equipment: Tr-200				12/07/23	08:30	0.2	33.45							
				Shear Vane Id:														

Report ID: GENERAL_LOG || Project: BH-M07 GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 265 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 10/07/2023 Completed: 12/07/2023						Hole No. : BH-M07 Sheet : 6 of 6 Hole Length : 40.64m Scale @ A4 : 1:40 Logged : LA, MK Processed : MK Checked : JHS								
Easting: 1728235.26 RL: 52			Northing: 5923652.39 Datum: AUCKHT1946			System: NZTM2000											
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect	Instrumentation	Water level
							Number / Type	Result									
			Highly weathered, dark grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 39.8m)							HOTT		HW		100			
								SPT 25/25 for 60mm N > 50 (solid cone)		SPT				0			
41			End of Hole @ 40.64m, Target Depth.														
42																	
43																	
44																	
45																	
46																	
47																	
48																	

Notes and Comments: End of Hole @ 40.64m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols		Inclination: Vertical		Orientation:		Ground Water Level			
		Contractor: DCN Equipment: Tr-200 Shear Vane Id:				Date	Time	Reading (mbgl)	Hole depth (mbgl)
						12/07/23	14:00	1.02	40.635

BH-M07 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road,
Date	10 to 12 July 2023		Muriwai



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road,
Date	10 to 12 July 2023		Muriwai



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
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Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
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Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
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Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
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Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		

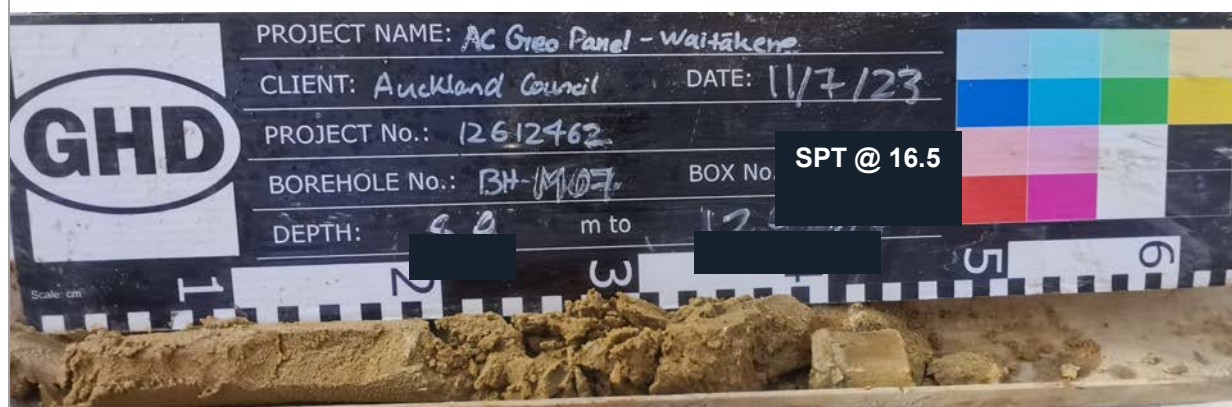


Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road,
Date	10 to 12 July 2023		Muriwai



Report of photographs

Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road,
Date	10 to 12 July 2023		Muriwai




Report of photographs



Site identification – BH-M07



Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road,
Date	10 to 12 July 2023		Muriwai



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 217 Motutara Rd, Muriwai 0881 Job Number: 12612462 Commenced: 7/07/2023						Hole No. : BH-M08 Sheet : 1 of 2 Hole Length : 10.95m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS								
Easting: 1728392.17 RL: 63			Northing: 5923798.19 Datum: AUCKHT1946			System: NZTM2000			Completed: 7/07/2023								
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
62	0		HYDROVAC - NO RECOVERY		-	-				HV				0			
61	1		Silty fine to medium SAND with pockets of organics to 25 mm; grey, mottled light grey. Very loose, moist. [PALAEO-COLLUVIUM]		M	VS		SPT 0/0 0/0 N = 0		SPT				0			
60	2		2.85 - 3.15 Grey-green.							OB				100			
59	3		Silty fine to medium SAND; light grey, mottled orange. Loose, moist.			L		SV@3m UTP SPT 1/1 1/1 3/4 N = 9		SPT				100			
58	4		4.55 - 4.65 Medium dense.			MD L		SPT 1/1 2/3 4/5 N = 14		OB				100			
57	5		6.10 - 7.20 Dark brown, speckled black.					SPT 1/0 1/0 1/1 N = 3		SPT				0			
56	6		Silty fine to medium SAND; dark grey-green, speckled black. Medium dense, moist.			MD				OB				100			
55	7		6.85 - 7.05 Brown, speckled black-light grey, streaked green-orange. 7.20 - 7.30 Light grey, speckled black. 7.30 - 8.05 Brown, speckled black-light grey, streaked green-orange. 7.55 - 7.65 Reddish orange, speckled black.					SPT 1/1 3/3 5/7 N = 18		SPT				100			
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical		Orientation:		Ground Water Level									
				Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)						
				Shear Vane Id: GEO902													

			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 217 Motutara Rd, Muriwai 0881 Job Number: 12612462 Commenced: 7/07/2023					Hole No. : BH-M08 Sheet : 2 of 2 Hole Length : 10.95m Scale @ A4 : 1:40 Logged : JM Processed : JM Checked : JHS										
Easting: 1728392.17 RL: 63			Northing: 5923798.19 Datum: AUCKHT1946					System: NZTM2000										
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Number / Type	Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR RQR (%)	Defect	Instrumentation	Water level	
154	8.76		Silty fine to medium SAND; dark grey-green, speckled black. Medium dense, moist. (continued from layer starting at 6.5m) 8.05 - 8.70 Orange brown, speckled black-light grey. 8.25 - 8.35 Indistinctly, very thinly bedded at 5-15°	PALAEO-COLLUVIUM	-	'St'	SPT 2/2 5/7 8/9 N = 29	10.50 B-10 10.00 12/22	OB	SPT	HOTT	SPT	25 50 75	76	76	100	83	0
9	9.2		Silty CLAY; light grey, streaked orange-brown. 'Stiff', moist, high plasticity.		M	MD												
9	9.45		CORE LOSS		-	-												
9	9.63		Silty fine to medium SAND; orange-brown, speckled black-light grey. Medium dense, moist.		M	MD												
10	9.45		Silty fine to medium SAND; light grey; distinctly, very thinly bedded at 20-30° Medium dense, moist.		M	MD												
153	10		CORE LOSS															
153	10		Silty fine to medium SAND; light grey; distinctly, very thinly bedded at 20-30° Medium dense, moist.															
152	11		End of Hole @ 10.95m, Target Depth.															
151	12																	
150	13																	
149	14																	
148	15																	
147	16																	
Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols				Inclination: Vertical Orientation: Contractor: DCN Equipment: TR 200 Shear Vane Id: GEO902				Ground Water Level Date Time Reading (mbgl) Hole depth (mbgl)										

Report of photographs

Site identification – BH-M08



Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs

Site identification – BH-M08



Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs

Site identification – BH-M08



Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs

Site identification – BH-M08



Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		















Report of photographs

Site identification – BH-M08



Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road,
Date	7 July 2023		Muriwai



			Project : AC Geo Panel - Waitakere Client : Auckland Council Site : 140 Motutara Road, Muriwai 0881 Job Number: 12612462 Commenced: 13/07/2023					Hole No. : BH-M09 Sheet : 1 of 2 Hole Length : 10.95m Scale @ A4 : 1:40 Logged : MK Processed : MK Checked : JHS 23/08/2023									
Easting: 1728448.77 RL: 72.5			Northing: 5923911.2 Datum:					System: NZTM2000									
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
72	0.40.3		Silty fine SAND; orange brown. Moist. [FILL]	FILL	M	-											
			Sandy fine to medium GRAVEL; grey. Moist. Gravel, sub-rounded to sub-angular. Sand, fine. HYDROVAC. NO RECOVERY.		-					HV				0			
71	1.5		Silty fine to medium SAND, minor clay; dark orange brown, mottled black-grey. Very loose, moist. [AWHITU SAND FORMATION]		M	VL				SPT				100			
	1.95		CORE LOSS		-	-											
70	2.45		Silty fine to medium SAND, minor clay; dark orange brown, mottled black-grey. Loose, moist.		M	L				OB				52			
	3.2		Silty fine to medium SAND; dark orange brown. Loose, moist.							SPT				100			
69	4		CORE LOSS		-	-				OB				100			
	4.5		Silty fine to medium SAND; dark orange brown. Loose, moist.	AWHITU SAND FORMATION	M	L				HQTT				0			
68	4.5									SPT				100			
	5									HQTT				100			
67	6									SPT				100			
	6.00									HQTT				100			
66	6.70									SPT				100			
	7									HQTT				100			
65	7.20		7.20 - 9.63 With moderately widely spaced 100-200 mm extremely weakly cemented beds.							SPT				100			
	9.63																

Notes and Comments:

End of Hole @ 10.95m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:


Contractor: DCN

Equipment: TR 200

Shear Vane Id:

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere

Client : Auckland Council

Site : 140 Motutara Road, Muriwai 0881

Job Number: 12612462

Commenced: 13/07/2023

Completed: 13/07/2023

Hole No. : BH-M09

Sheet : 2 of 2

Hole Length : 10.95m

Scale @ A4 : 1:40

Logged : MK

Processed : MK

Checked : JHS 23/08/2023

Easting: 1728448.77

Northing: 5923911.2

System: NZTM2000

RL: 72.5

Datum:

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect	Instrumentation	Water level	
							Number / Type	Result										
164			Silty fine to medium SAND; dark orange brown. Loose, moist. <i>(continued from layer starting at 4.5m)</i>	AWHITU SAND FORMATION										100				
9															100			
163															78			
9.63			Highly weathered, dark orange brown, fine to medium grained SANDSTONE; extremely weak.		-	-						HW			100			
10																		
162			Silty fine to coarse SAND; dark orange brown. Medium dense, moist.		M	MD								100				
10.35																		
11			End of Hole @ 10.95m, Target Depth.															
161																		
12																		
160																		
13																		
159																		
14																		
158																		
15																		
157																		

Notes and Comments:

End of Hole @ 10.95m, Target Depth.
Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Contractor: DCN

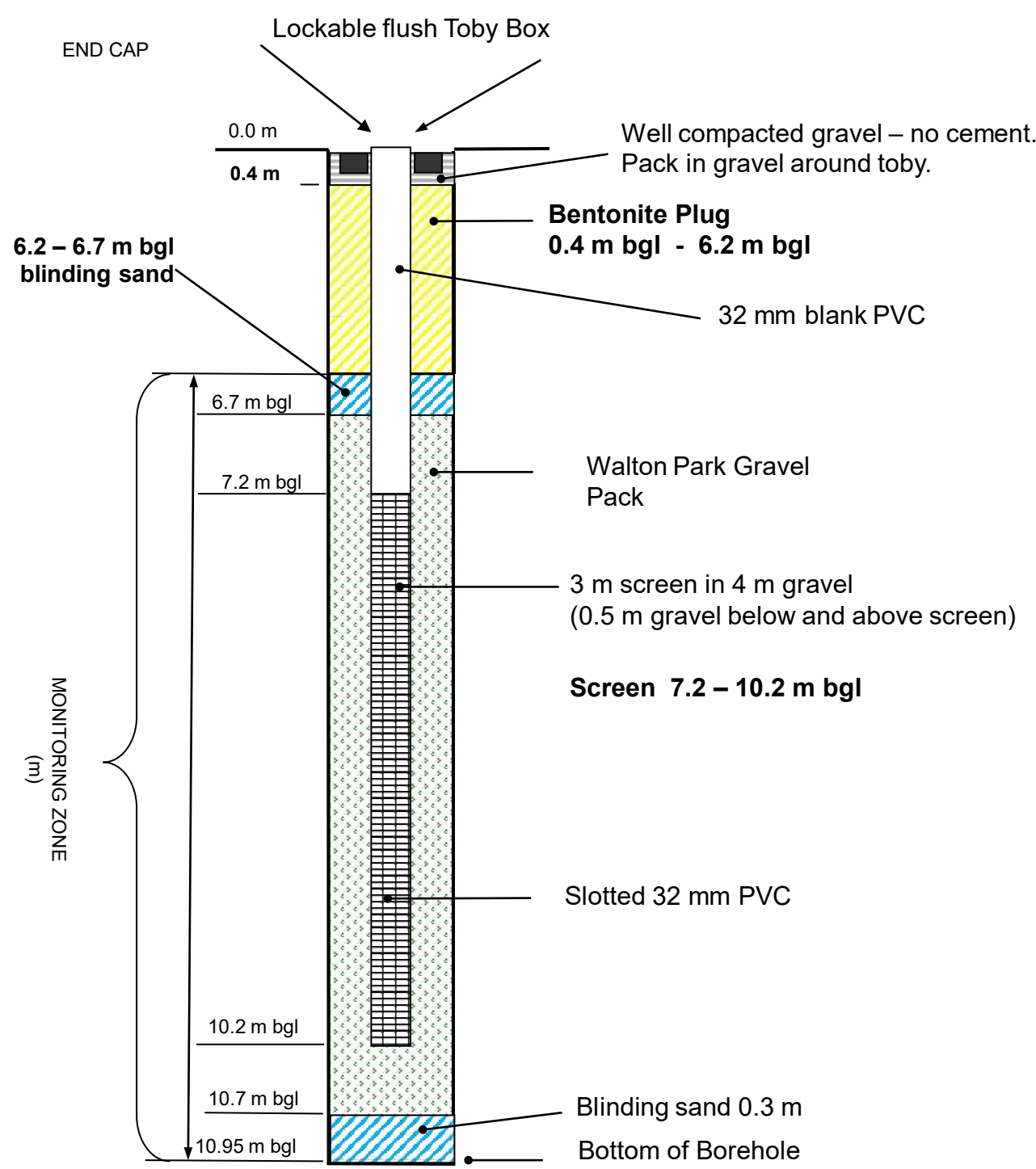
Equipment: TR 200

Shear Vane Id:

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
17/07/23	12:15	1.5	10.95
17/07/23	14:15	3.27	10.95

BH-M09 - Muriwai



NOT TO SCALE

Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		

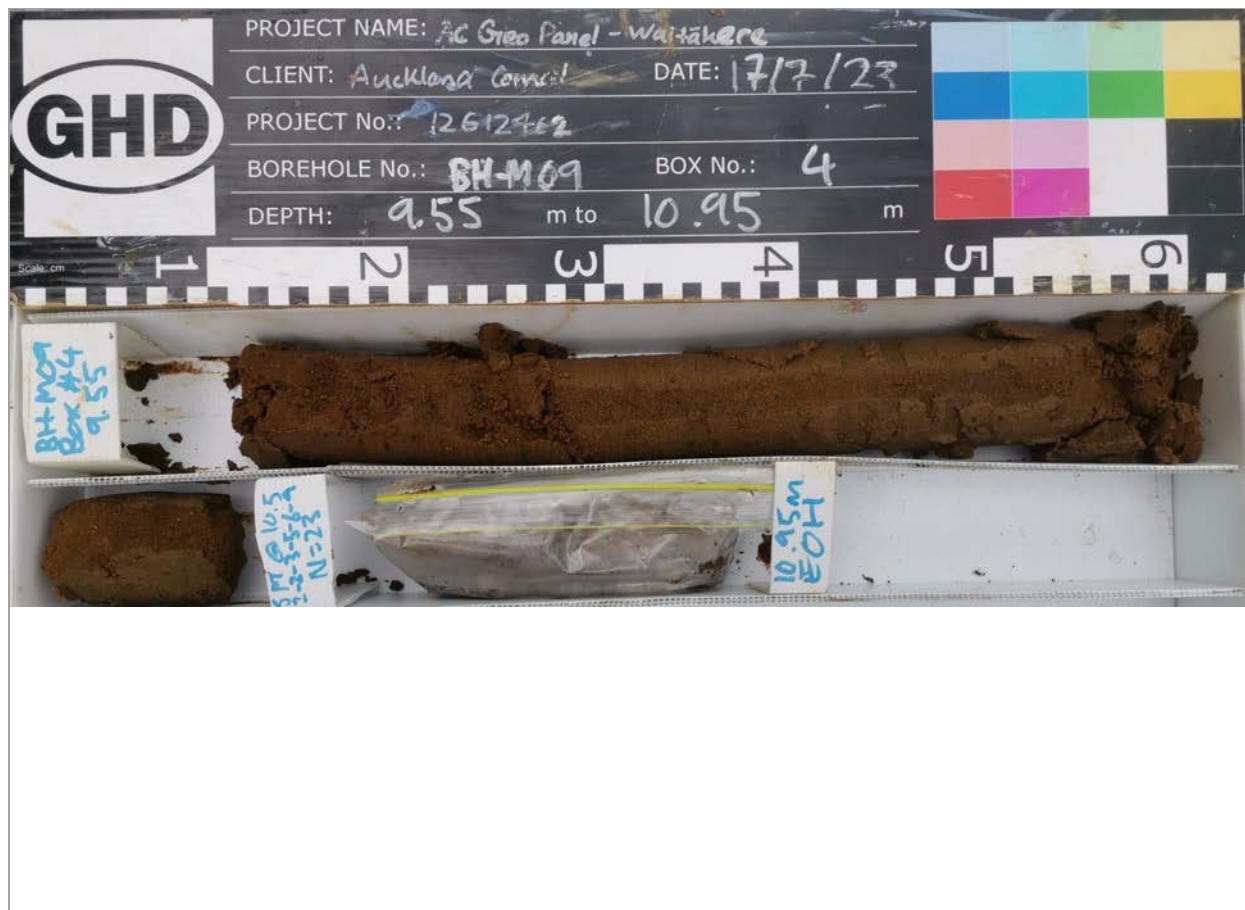


Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs

Site identification – BH-M09



Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Appendix F3

Laboratory Test Results

Please reply to: W.E. Campton

Page 1 of 3

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

ATTERBERG LIMITS TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of Atterberg Limits testing at BGL of a soil sample delivered to this laboratory during August 2023. Test results are summarised below, with page 3 showing where the sample plots on the Unified Soil Classification System (Casagrande) Chart. Test standards used were:

Water Content:	NZS4402:1986:Test 2.1
Liquid Limit:	NZS4402:1986:Test 2.2
Plastic Limit:	NZS4402:1986:Test 2.3
Plasticity Index:	NZS4402:1986:Test 2.4

Borehole Number	Sample Number	Depth (m)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH-M01	S1	13.50 – 13.95	29.0	25 ♦	14 ♦	11 ♦

♦ = The soil fraction passing a 425µm sieve was used for the liquid limit and plastic limit tests.

The whole soil was used for the water content test (the soil was in a natural state), and the soil fraction passing a 0.425mm sieve was used for the liquid limit and plastic limit tests. The soil was wet up and dried where required for the liquid limit and plastic limit tests.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.2: liquid limit and test 2.3: plastic limit are reported to the nearest whole number.

Please note that the test results relate only to the sample as-received, and relate only to the sample under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

**DETERMINATION OF THE LIQUID LIMIT, PLASTIC
LIMIT & THE PLASTICITY INDEX**

Test Methods: NZS4402: 1986: Test 2.2, Test 2.3 and Test 2.4

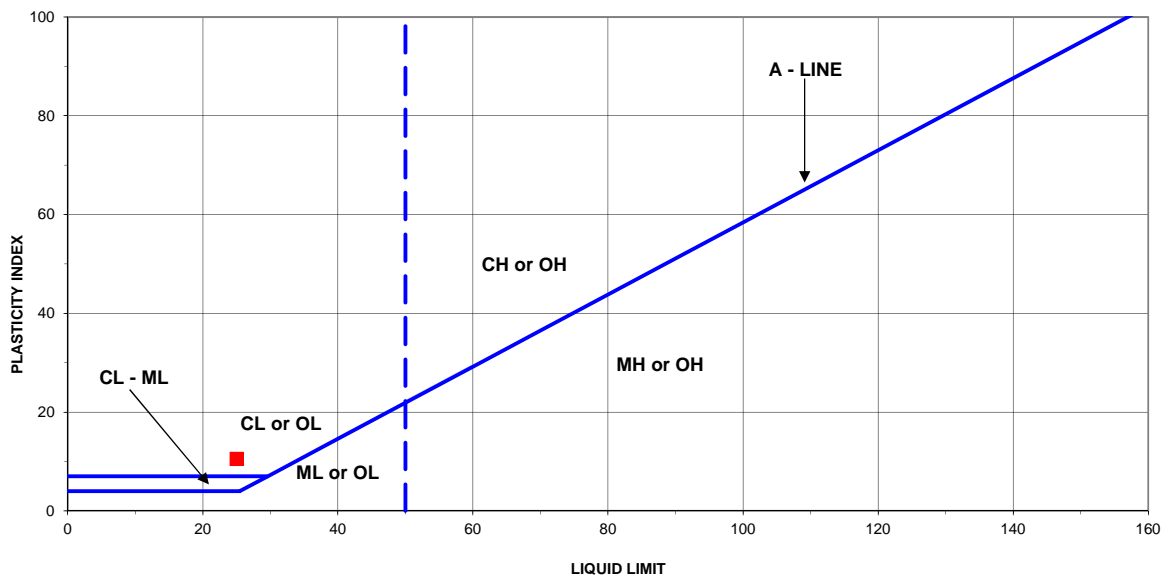
Tested By:	JL	August 2023
Compiled By:	JF	10/08/2023
Checked By:	JF	10/08/2023

SUMMARY OF TESTING

Borehole Number	Sample Number	Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification Based on USCS Chart Below
BH-M01	S1	13.50 - 13.95	25	14	11	CL

The chart below & soil classification terminology is taken from ASTM D2487-17^{e1} "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)", April 2020, & is based on the classification scheme developed by A. Casagrande in the 1940's (Casagrande, A., 1948: Classification and identification of soil. Transactions of the American Society of Civil Engineers, v. 113, p. 901-930). The chart below & the soil classification given in the table above are included for your information only, and are not included in the IANZ endorsement for this report.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) PLASTICITY (CASAGRANDE) CHART



■ **BH-M01 / S1 / 13.50 - 13.95m**

CHART LEGEND

CL = CLAY, low plasticity ('lean' clay)

OL = ORGANIC CLAY or ORGANIC SILT, low liquid limit

ML = SILT, low liquid limit

CL - ML = SILTY CLAY

CH = CLAY, high plasticity ('fat' clay)

OH = ORGANIC CLAY or ORGANIC SILT, high liquid limit

MH = SILT, high liquid limit ('elastic silt')

Please reply to: W.E. Campton

Page 1 of 16

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

25th September 2023

WET SIEVE PARTICLE-SIZE DISTRIBUTION TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of wet sieve particle-size distribution testing at BGL of soil samples delivered to this laboratory during August & September 2023. Test results are summarised below, with the following pages showing graphs and detailed results.

Test standards used were:

Water Content: NZS4402:1986:Test 2.1

Wet Sieve Test: NZS4402:1986:Test 2.8.1

Borehole Number	Sample Number	Depth (m)	Fraction of Sample (% of Dry Mass)		
			GRAVEL (2 – 60mm)	SAND (0.06 – 2mm)	SILT & CLAY FRACTIONS (< 0.06mm)
BH-M01	S3	43.50 – 43.80	0	98	2
BH-M05	S1	6.45 – 6.65	0	93	7
BH-M07	S1	4.20 – 4.50	1	78	21
BH-M07	S2	29.70 – 30.00	0	92	8
BH-M08	S1	3.45 – 3.70	0	82	18
BH-M08	S3	10.20 – 10.50	0	80	20
BH-M09	S1	5.70 – 6.00	0	98	2

Please note that the results table immediately above with the various particle-size fractions is included for your information only, and is not included in the IANZ endorsement for this report.

Borehole Number	Sample Number	Depth (m)	Fraction of Sample (% of Dry Mass)		
			GRAVEL (2 – 60mm)	SAND (0.06 – 2mm)	SILT & CLAY FRACTIONS (< 0.06mm)
BH-M01	D4	76.15 – 76.50	0	97	3
BH-M02	D14	63.95 – 64.25	0	95	5
BH-M03	D10	76.00 – 76.30	0	94	6
BH-M06	D1	26.00 – 26.30	0	85	15
BH-M07	D3	36.90 – 37.20	0	93	7
BH-M09	D2	8.70 – 9.00	0	97	3

Please note that the results table immediately above with the various particle-size fractions is included for your information only, and is not included in the IANZ endorsement for this report.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.8.1: wet sieve, the percentages passing the sieves are reported to nearest 1%.

The wet sieve method used by BGL is a slight variation of the 2.8.1 test standard. It is, in our opinion, a more accurate method as it does not rely on an assumed total dry mass determined from water content testing of sub-samples, but actually determines & uses the exact total dry mass (*opinion not IANZ endorsed*).

The following departures from the test standard occurred ;

- The total dry mass of the entire sieved sample was determined, and was not calculated by using two water content sub-samples as in the standard.
- A detergent was used to deflocculate the sample rather than a sodium hexametaphosphate/sodium carbonate dispersing agent solution.
- The recovery of the wet fines (i.e. the silt & clay passing the 63µm wash sieve) for determining the percentage of silt & clay was omitted (as per 2.8.1 Note 7), therefore the percentage passing the 63µm was obtained by difference. A 10% hydrochloric acid flocculating agent was therefore not used.

Please note that the test results relate only to the samples as-received, and relate only to the samples under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Job Number:	63532#L	Sheet 1 of 1	Page 4 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE		Tested By:	WEC / JL
		Compiled By:	JL
		Checked By:	JF
Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1			

BH: BH-M01

Sample No: S3

Depth: 43.50 - 43.80m

Water Content: 22.1 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	95
0.425	73
0.300	34
0.212	11
0.150	6
0.090	4
0.063	2

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 5
(Medium) 0.6 - 0.2mm 84
(Fine) 0.2 - 0.06mm 9

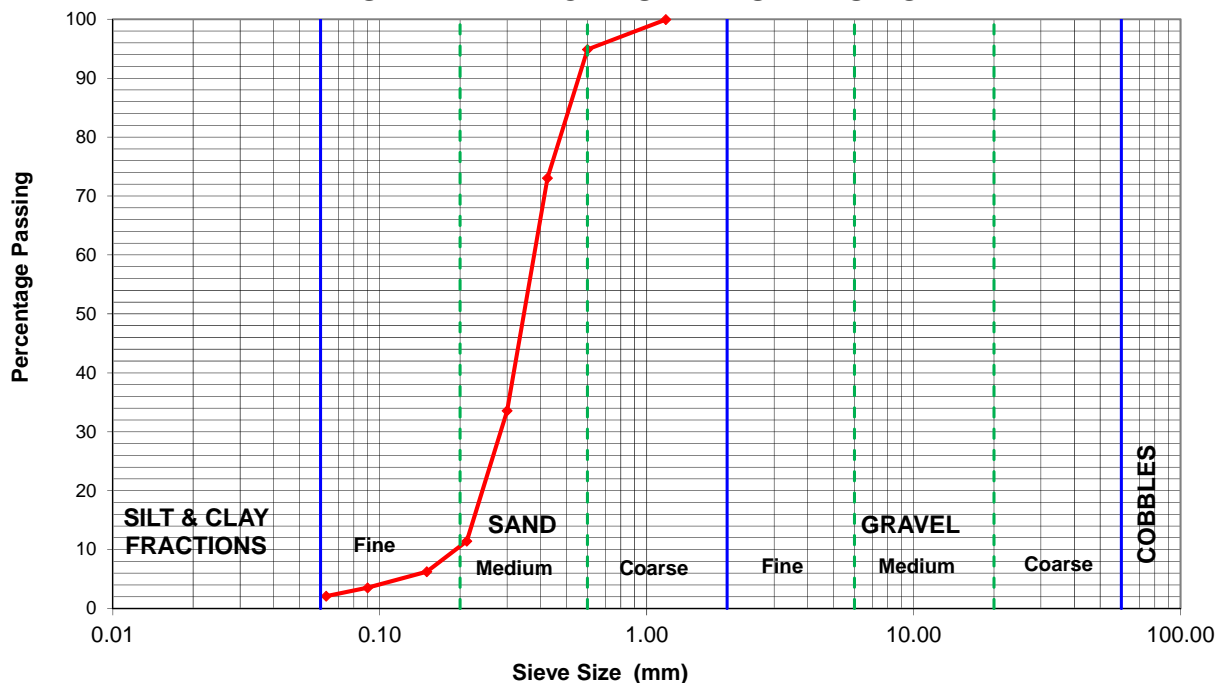
98 %

SILT & CLAY FRACTIONS: < 0.06mm

2 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	11-Aug-23
Compiled By:	JL	11-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M05**

Sample No: **S1**

Depth: **6.45 - 6.65m**

Water Content: **27.7 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	99
0.425	93
0.300	80
0.212	55
0.150	22
0.090	9
0.063	7

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 1
(Medium) 0.6 - 0.2mm 50
(Fine) 0.2 - 0.06mm 42

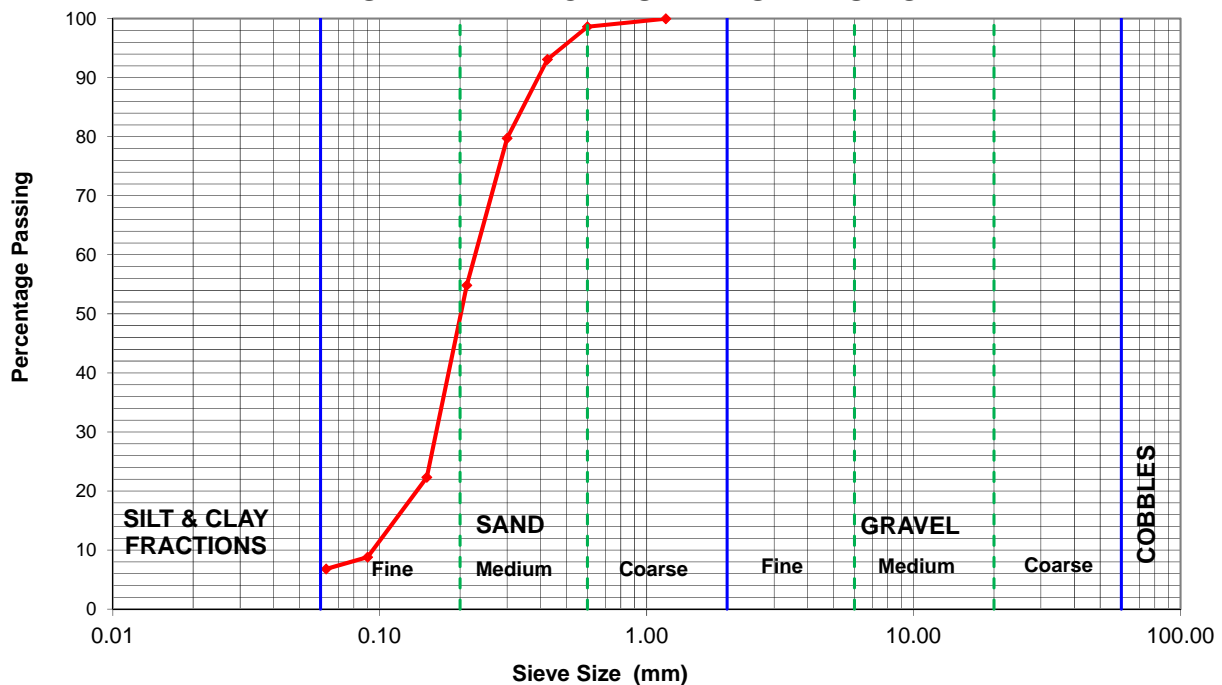
93 %

SILT & CLAY FRACTIONS: < 0.06mm

7 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Job Number:	63532#L	Sheet 1 of 1	Page 6 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE		Tested By:	WEC / JL
		Compiled By:	JL
		Checked By:	JF
Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1			

BH: BH-M07

Sample No: S1

Depth: 4.20 - 4.50m

Water Content: 31.0 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
4.75	100
2.00	99
1.18	99
0.600	97
0.425	91
0.300	76
0.212	55
0.150	35
0.090	25
0.063	21

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 1

1 %

SAND: (Coarse) 2.0 - 0.6mm 2
(Medium) 0.6 - 0.2mm 46
(Fine) 0.2 - 0.06mm 30

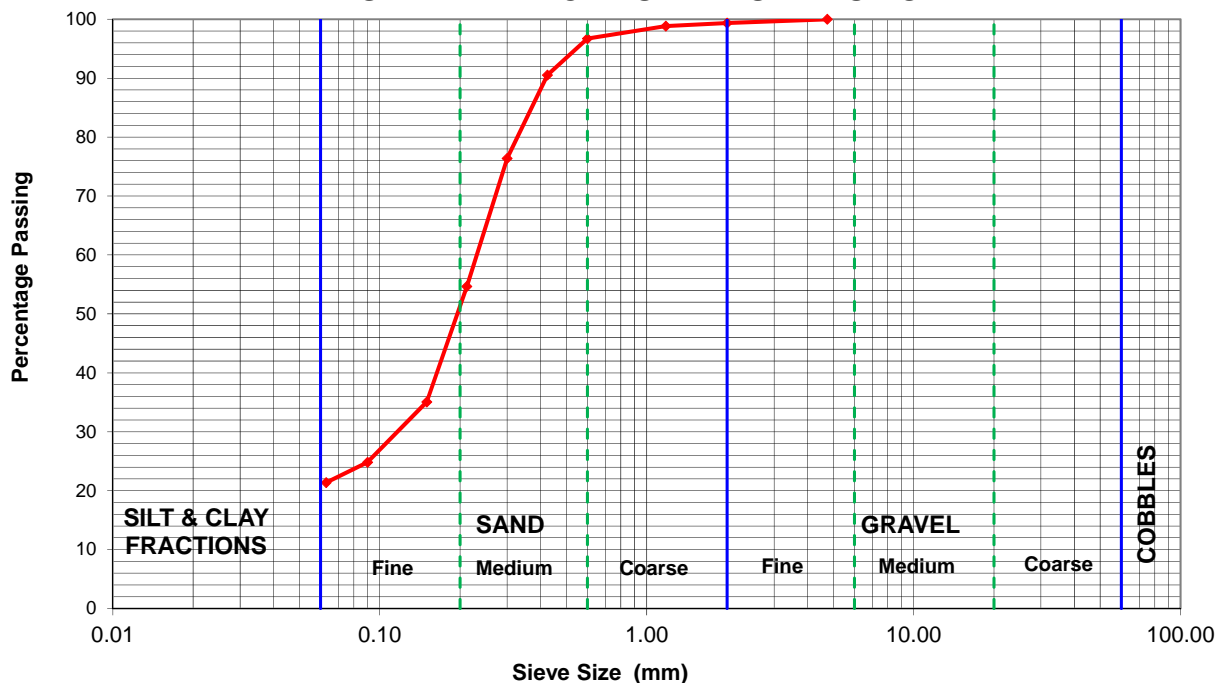
78 %

SILT & CLAY FRACTIONS: < 0.06mm

21 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Job Number:	63532#L	Sheet 1 of 1	Page 7 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1		Tested By:	WEC / JL
		Compiled By:	JL
		Checked By:	JF

BH: BH-M07

Sample No: S2

Depth: 29.70 - 30.00m

Water Content: 25.4 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	97
0.425	85
0.300	56
0.212	27
0.150	14
0.090	10
0.063	8

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 3
(Medium) 0.6 - 0.2mm 72
(Fine) 0.2 - 0.06mm 17

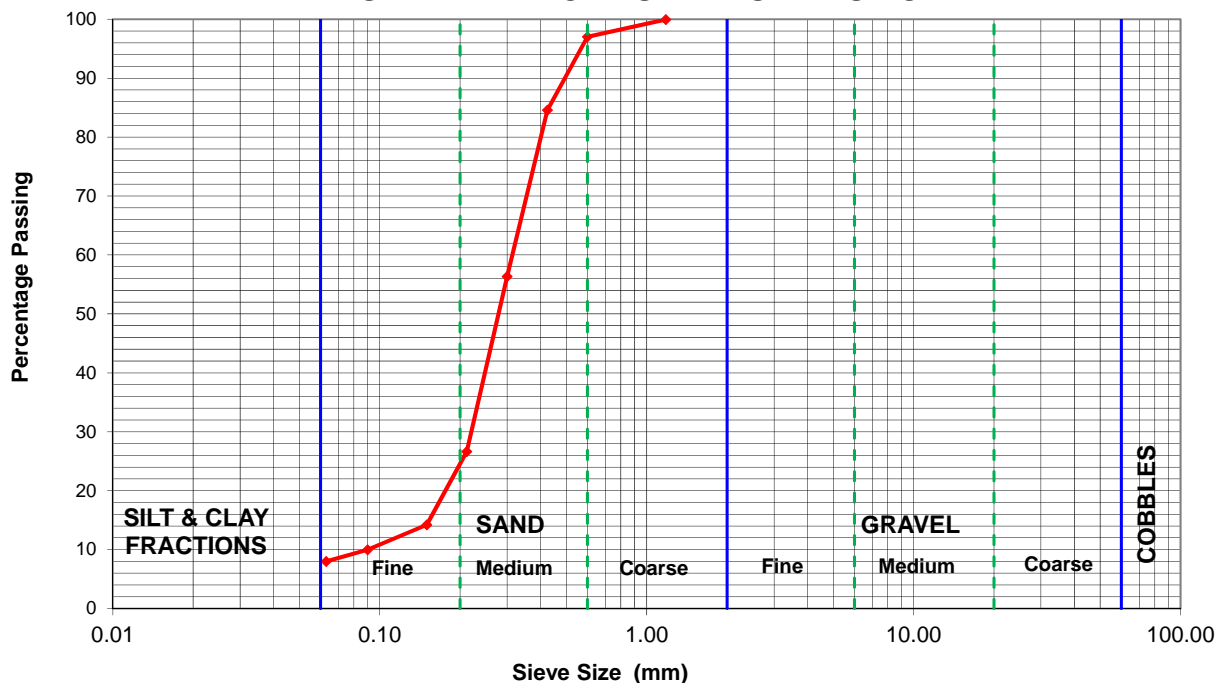
92 %

SILT & CLAY FRACTIONS: < 0.06mm

8 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Job Number:	63532#L	Sheet 1 of 1	Page 8 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE		Tested By:	WEC / JL
		Compiled By:	JL
		Checked By:	JF
Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1			

BH: **BH-M08**

Sample No: **S1**

Depth: **3.45 - 3.70m**

Water Content: **42.5 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	98
0.425	92
0.300	77
0.212	48
0.150	29
0.090	22
0.063	18

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 2
(Medium) 0.6 - 0.2mm 53
(Fine) 0.2 - 0.06mm 27

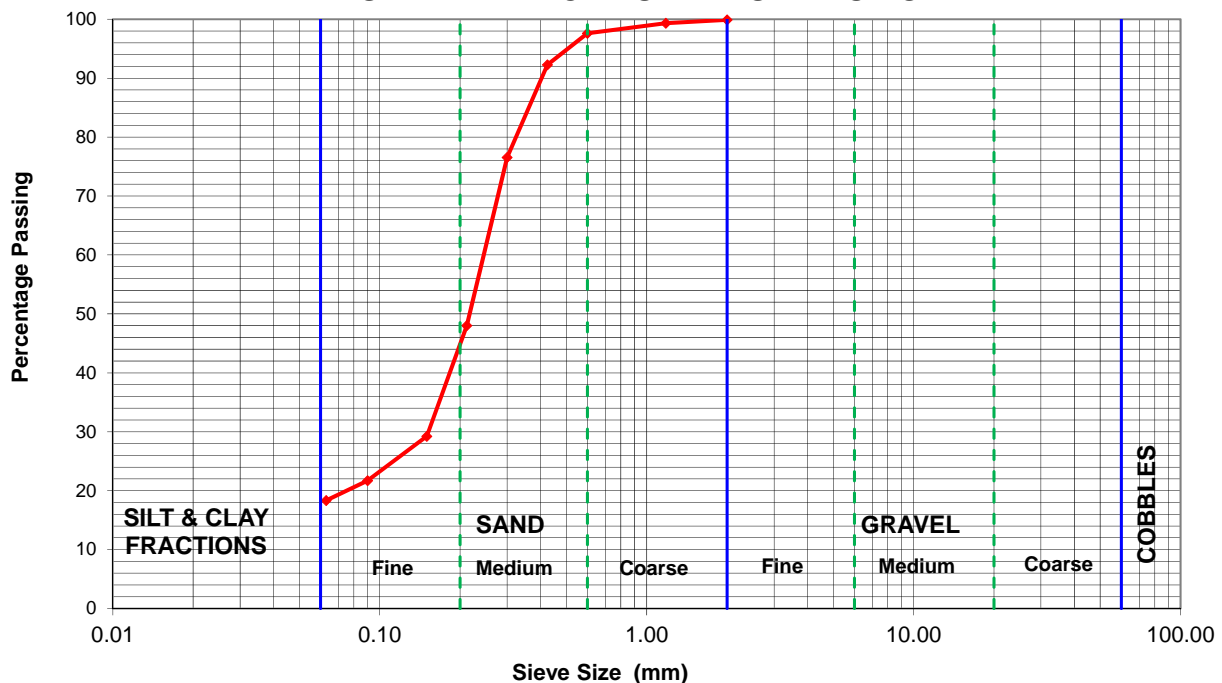
82 %

SILT & CLAY FRACTIONS: < 0.06mm

18 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M08**

Sample No: **S3**

Depth: **10.20 - 10.50m**

Water Content: **26.2 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	99
0.425	92
0.300	73
0.212	44
0.150	27
0.090	22
0.063	20

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 1
(Medium) 0.6 - 0.2mm 58
(Fine) 0.2 - 0.06mm 21

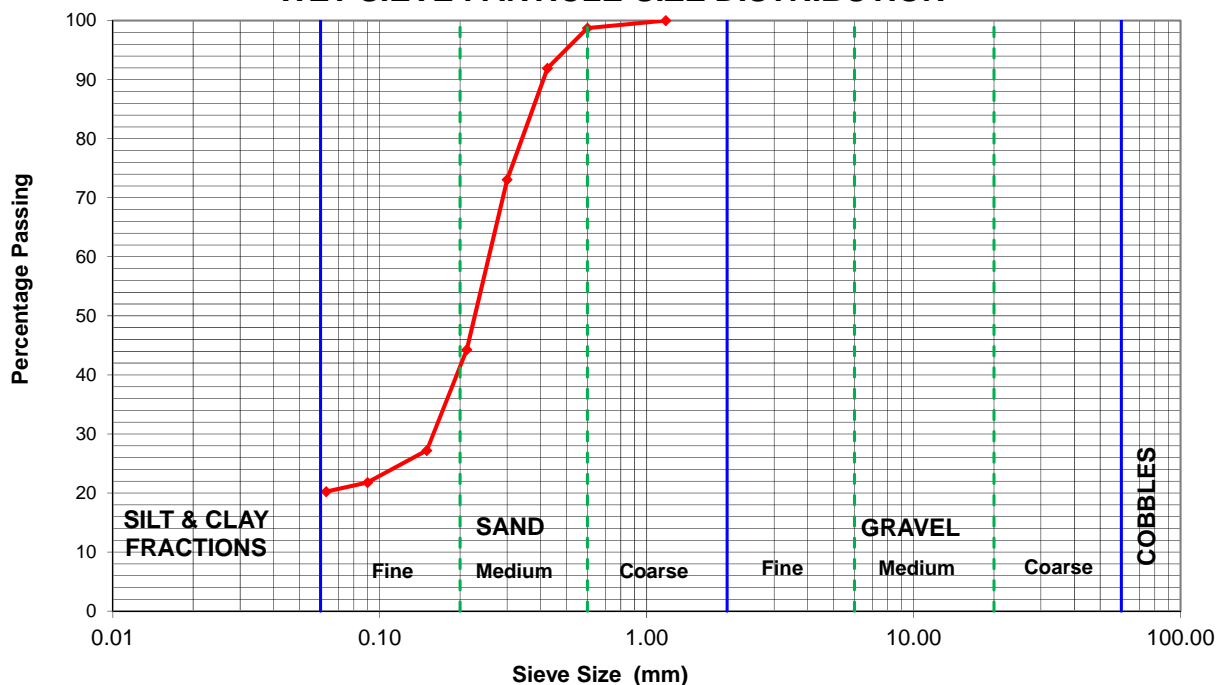
80 %

SILT & CLAY FRACTIONS: < 0.06mm

20 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M09**

Sample No: **S1**

Depth: **5.70 - 6.00m**

Water Content: **26.2 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	97
0.425	90
0.300	74
0.212	43
0.150	13
0.090	4
0.063	2

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 3
(Medium) 0.6 - 0.2mm 59
(Fine) 0.2 - 0.06mm 36

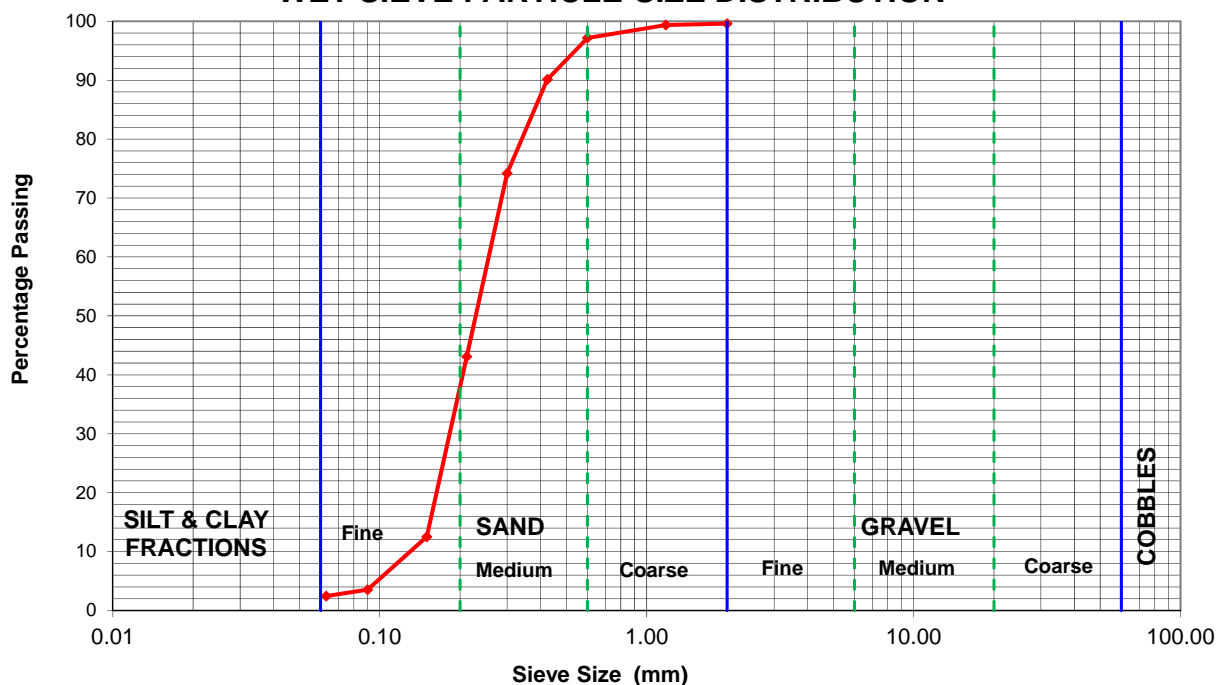
98 %

SILT & CLAY FRACTIONS: < 0.06mm

2 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Job Number:	63532#L	Sheet 1 of 1	Page 11 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE		Tested By:	JW / JL
		Compiled By:	JL
		Checked By:	JF
Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1			21 & 25/09/23
			25-Sep-23
			25-Sep-23

BH: **BH-M01**

Sample No: **D4**

Depth: **76.15 - 76.50m**

Water Content: **26.2 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	93
0.425	79
0.300	59
0.212	37
0.150	14
0.090	5
0.063	3

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 7
(Medium) 0.6 - 0.2mm 60
(Fine) 0.2 - 0.06mm 30

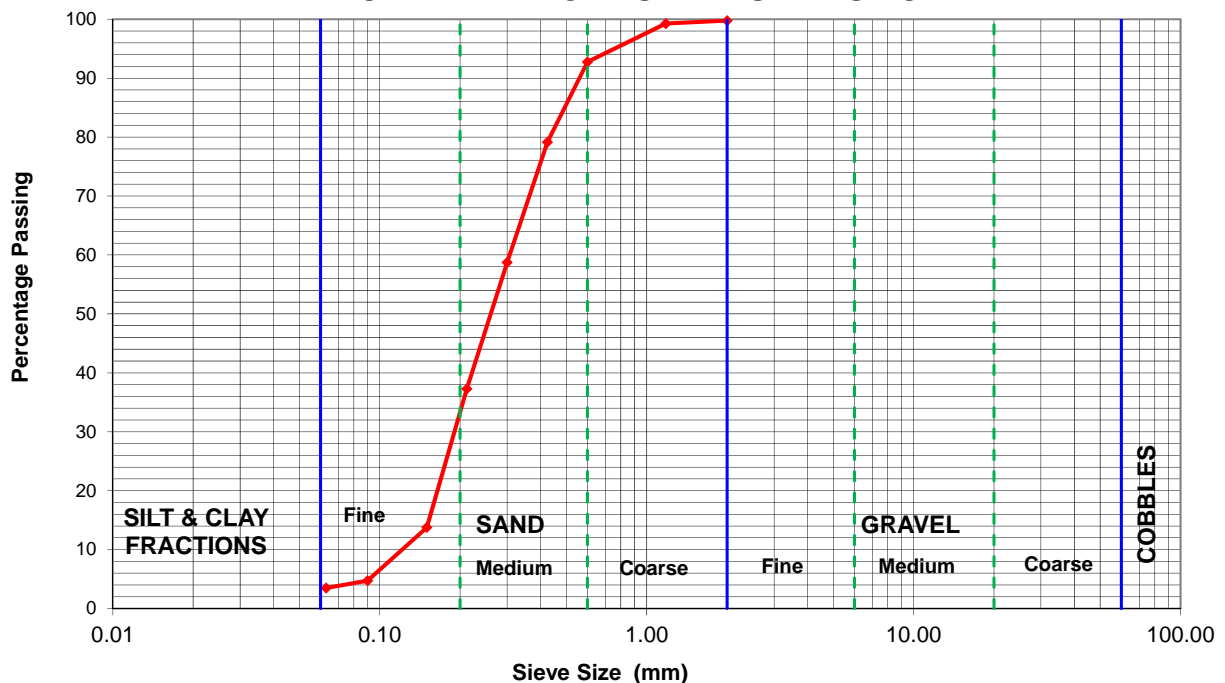
97 %

SILT & CLAY FRACTIONS: < 0.06mm

3 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: BH-M02

Sample No: D14

Depth: 63.95 - 64.25m

Water Content: 24.2 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	94
0.425	83
0.300	63
0.212	35
0.150	16
0.090	6
0.063	5

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 6
(Medium) 0.6 - 0.2mm 62
(Fine) 0.2 - 0.06mm 27

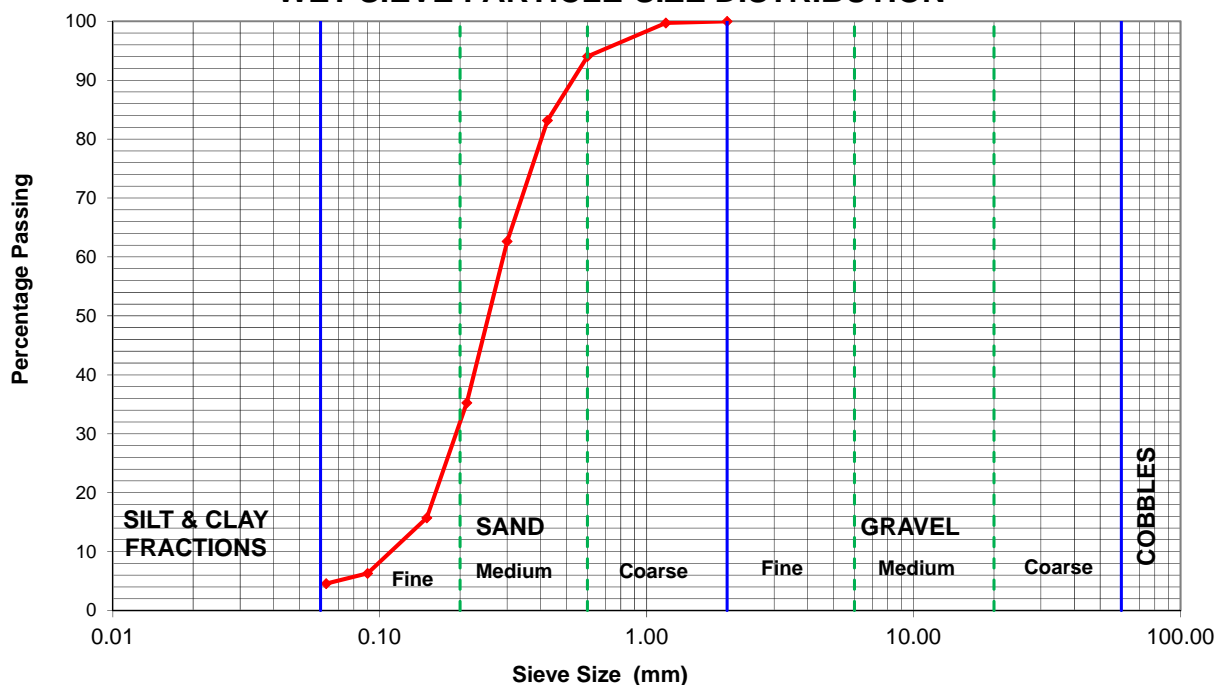
95 %

SILT & CLAY FRACTIONS: < 0.06mm

5 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: BH-M03

Sample No: D10

Depth: 76.00 - 76.30m

Water Content: 25.2 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	97
0.425	87
0.300	68
0.212	47
0.150	23
0.090	7
0.063	6

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 3
(Medium) 0.6 - 0.2mm 54
(Fine) 0.2 - 0.06mm 37

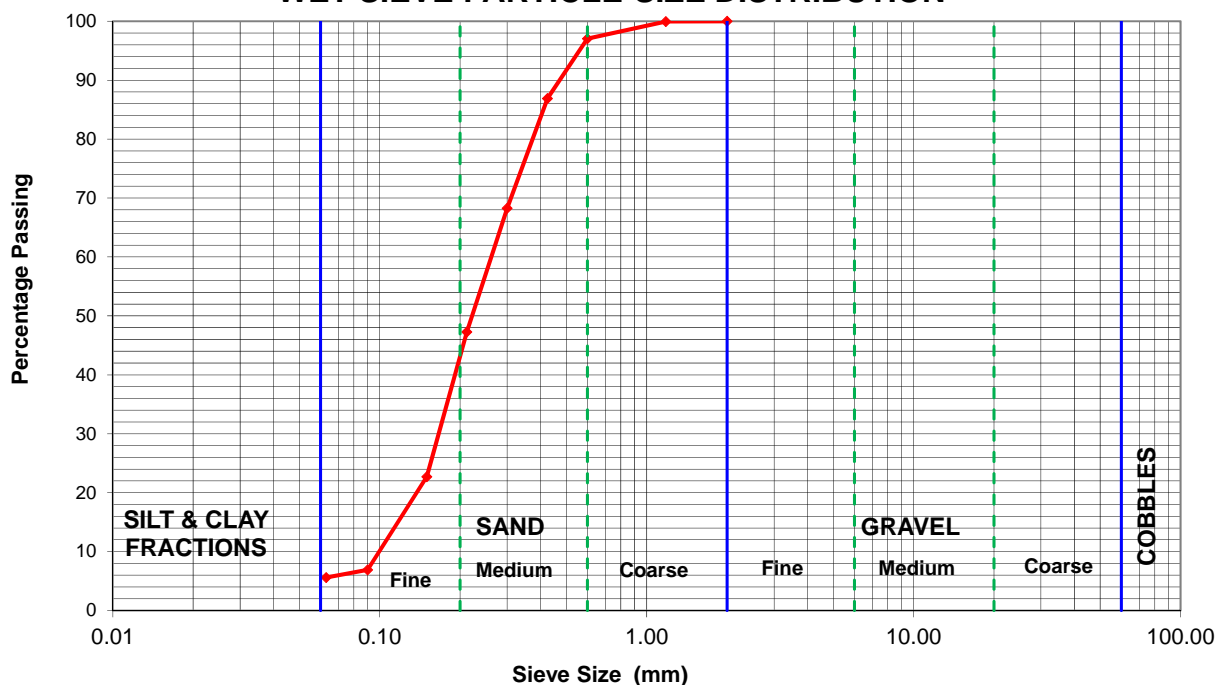
94 %

SILT & CLAY FRACTIONS: < 0.06mm

6 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: **BH-M06**

Sample No: **D1**

Depth: **26.00 - 26.30m**

Water Content: **19.9 %** (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	99
0.425	96
0.300	81
0.212	56
0.150	30
0.090	18
0.063	15

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 1
(Medium) 0.6 - 0.2mm 47
(Fine) 0.2 - 0.06mm 37

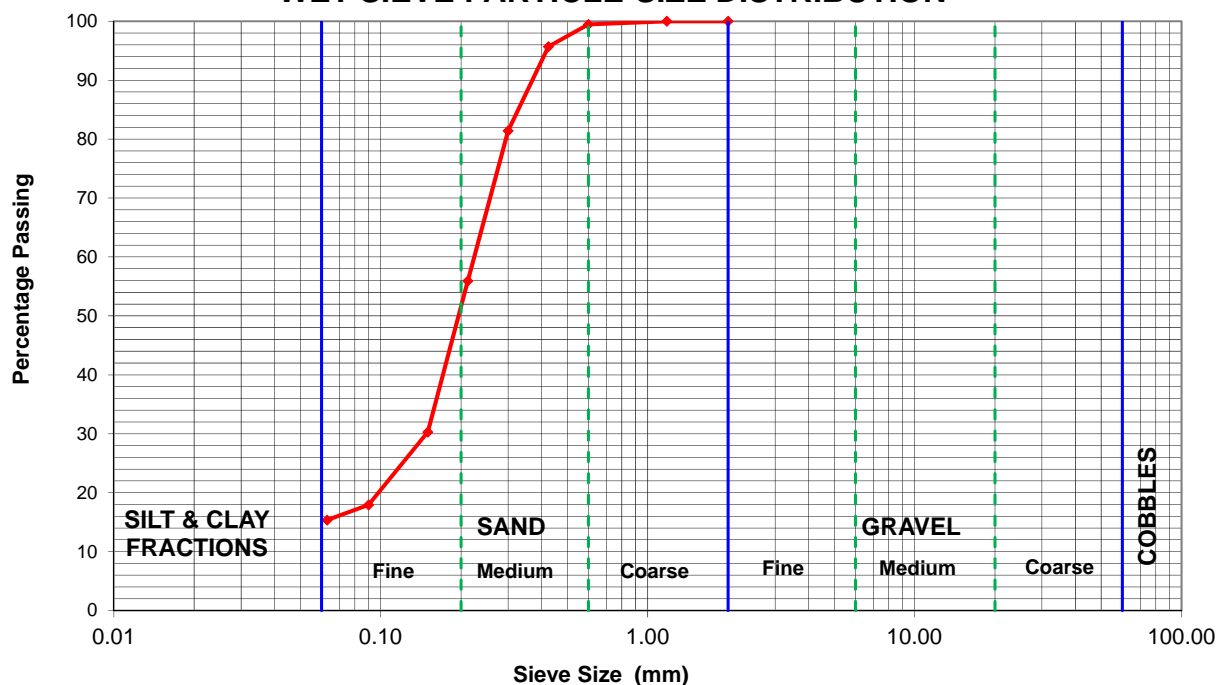
85 %

SILT & CLAY FRACTIONS: < 0.06mm

15 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: BH-M07

Sample No: D3

Depth: 36.90 - 37.20m

Water Content: 25.8 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	94
0.425	76
0.300	46
0.212	26
0.150	15
0.090	9
0.063	7

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 6
(Medium) 0.6 - 0.2mm 70
(Fine) 0.2 - 0.06mm 17

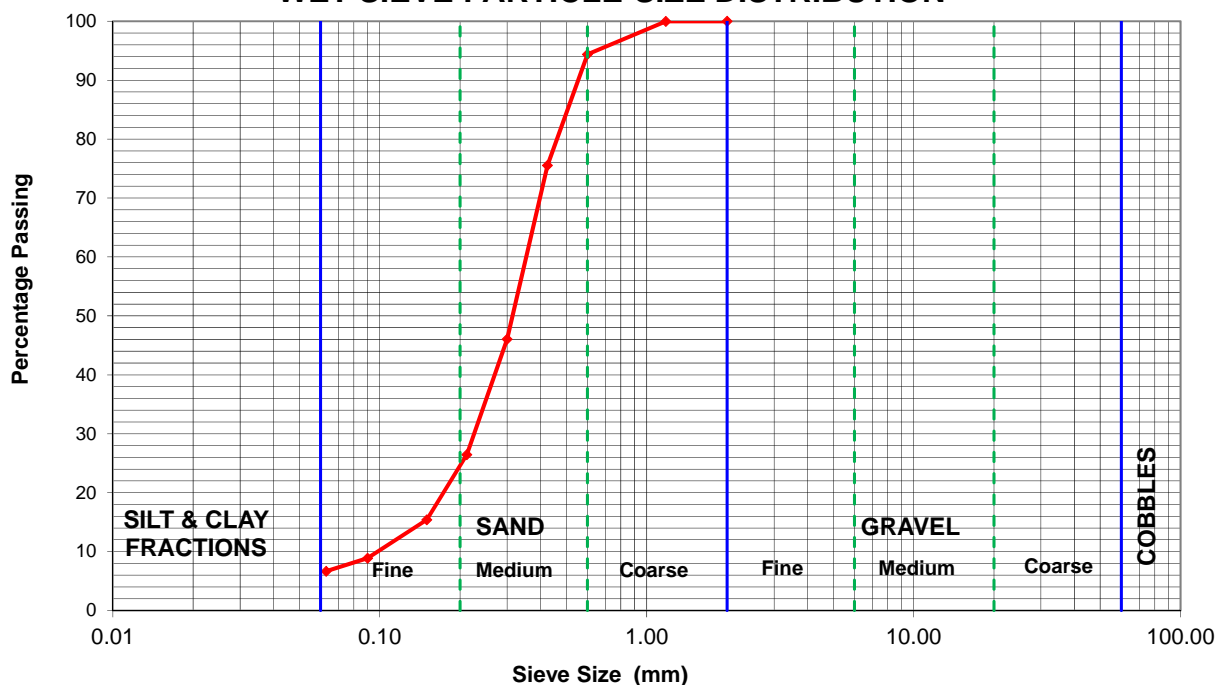
93 %

SILT & CLAY FRACTIONS: < 0.06mm

7
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Job Number:	63532#L	Sheet 1 of 1	Page 16 of 16
Reg. Number:	2806	Version No:	5
Report No:	63532#L/PSD Waitakere LHRA	Issue Date:	July 2022
Project:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
PARTICLE-SIZE DISTRIBUTION BY WET SIEVE		Tested By:	JL
		Compiled By:	JL
		Checked By:	JF
Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1			

BH: BH-M09

Sample No: D2

Depth: 8.70 - 9.00m

Water Content: 25.8 % (material < 37.5mm)

TEST METHOD:

Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	92
0.425	68
0.300	37
0.212	16
0.150	7
0.090	4
0.063	3

COBBLES: 200 - 60mm

TOTAL
0 %

GRAVEL: (Coarse) 60 - 20mm 0
(Medium) 20 - 6mm 0
(Fine) 6 - 2mm 0

0 %

SAND: (Coarse) 2.0 - 0.6mm 8
(Medium) 0.6 - 0.2mm 78
(Fine) 0.2 - 0.06mm 11

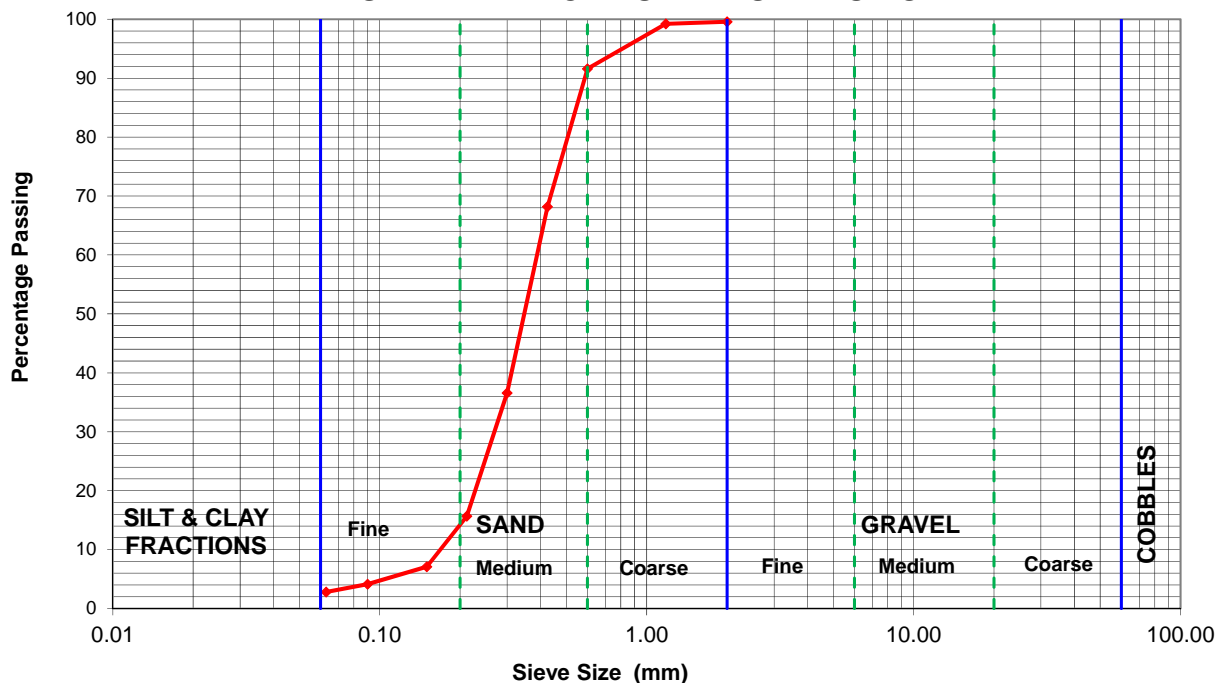
97 %

SILT & CLAY FRACTIONS: < 0.06mm

3 %
100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.

WET SIEVE PARTICLE-SIZE DISTRIBUTION



Please reply to: W.E. Campton

Page 1 of 3

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

HYDROMETER PARTICLE-SIZE DISTRIBUTION TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of hydrometer particle-size distribution testing at BGL of a soil sample delivered to this laboratory during August 2023. Test results are summarised below, with page 3 showing a graph and detailed results.

Test standards used were:

Water Content:	NZS4402:1986:Test 2.1
Wet Sieve Test:	NZS4402:1986:Test 2.8.1
Hydrometer Test:	NZS4402:1986:Test 2.8.4

Borehole Number	Sample Number	Depth (m)	Hydrometer Grading (% of Dry Mass)			
			GRAVEL (2 – <9.50mm)	SAND (0.06 – 2mm)	SILT FRACTION (0.002 – 0.06mm)	CLAY FRACTION (< 0.002mm)
BH-M01	S2	13.95 – 14.30	0	70	15	15

The whole soil was used for this hydrometer test. As the organic content of the soil tested was very low, peroxide pretreatment was not carried out. A solid density of 2.65t/m³ was assumed for this hydrometer test, and is not part of the IANZ endorsement for this report.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.8.1: wet sieve & Test 2.8.4: hydrometer, the 'percentages passing' and 'percentages finer than' are reported to nearest 1%.

Please note that the test results relate only to the sample as-received, and relate only to the sample under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

PARTICLE-SIZE DISTRIBUTION BY HYDROMETER

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1, Test 2.8.4

Tested By:	WEC	10-Aug-23
Compiled By:	WEC	11-Aug-23
Checked By:	JF	14-Aug-23

BH No: BH-M01

Sample No: S2

Depth: 13.95 - 14.30m

Water Content (%): 26.4

Sample History: Natural / Air Dried / Oven Dried / Unknown

pH of sedimentation suspension: 8.5

Particle Size (mm)	% Finer Than
0.600	100
0.212	71
0.150	42
0.090	33
0.063	31
0.048	26
0.034	25
0.025	24
0.018	23
0.013	22
0.0092	21
0.0066	19
0.0047	18
0.0034	16
0.0024	16
0.0014	14

HYDROMETER ANALYSIS (% of dry mass)

TOTAL

GRAVEL:	(Medium)	< 9.5 - 6mm	0	0	%
	(Fine)	6 - 2mm	0		

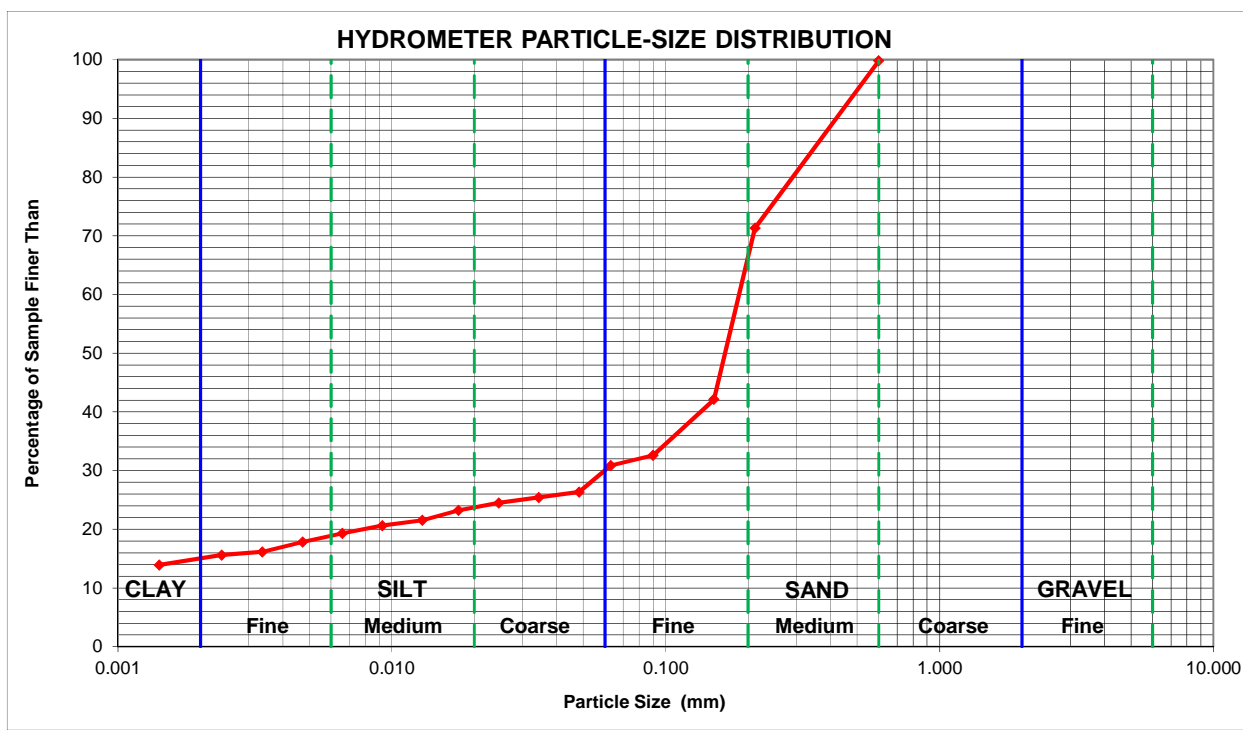
SAND:	(Coarse)	2.0 - 0.6mm	0	70	%
	(Medium)	0.6 - 0.2mm	33		
	(Fine)	0.2 - 0.06mm	37		

SILT FRACTION:	(Coarse)	0.06 - 0.02mm	6	15	%
	(Medium)	0.02 - 0.006mm	5		
	(Fine)	0.006 - 0.002mm	4		

CLAY FRACTION:	< 0.002mm	
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15
100%

HYDROMETER TEST WAS CARRIED OUT ON THE WHOLE SOIL / SOIL FRACTION PASSING A 9.50mm SIEVE



Please reply to: W.E. Campton

Page 1 of 1

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

DETECTION OF THE PRESENCE OF ALLOPHANE

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following table presents the results of 'Detection of the Presence of Allophane in Soils' testing at BGL of a soil sample delivered to this laboratory during August 2023. This sample was tested in accordance with the following standard:

Detection of Presence of Allophane in Soils:

NZS4402:1986:Test 3.4

Borehole Number	Sample Number	Depth (m)	Allophane Content
BH-M08	S2	10.00 – 10.10	< 5%

Please note that the test results relate only to the sample as-received, and relate only to the sample under test. Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Please reply to: W.E. Campton

Page 1 of 69

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

2nd October 2023

UNCONFINED COMPRESSIVE STRENGTH (UCS) TESTING

Dear Mette,

Re: **WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION**

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of Uniaxial Unconfined Compressive Strength Testing at BGL of rock core samples delivered to this laboratory on the 18th of September 2023. These samples were tested in accordance with the following standards:

Water Content: NZS4402:1986:Test 2.1

Unconfined Compressive Strength Test: NZS4402:1986:Test 6.3.1

The table below summarises the test results, with the following pages presenting sample measurements and test data.

Borehole Number	Sample Number	Depth (m)	FAILURE CONDITIONS			
			Unconfined Compressive Strength (kPa)	Strain at Failure		Failure Mode
				%	mm	
BH-M02	S1	26.50 – 26.75	270	0.74	0.89	planar
BH-M02	S2	29.69 – 29.92	370	0.75	0.86	planar
BH-M02	S3	36.35 – 36.65	180	0.50	0.61	planar
BH-M02	S4	40.80 – 41.00	180	0.46	0.55	planar

Borehole Number	Sample Number	Depth (m)	FAILURE CONDITIONS			
			Unconfined Compressive Strength (kPa)	Strain at Failure		Failure Mode
				%	mm	
BH-M02	S5	53.30 – 53.90	1,800	0.49	0.59	brittle
BH-M02	S6	55.20 – 55.50	1,200	0.52	0.63	planar
BH-M02	S7	55.80 – 56.11	1,300	0.42	0.51	brittle
BH-M02	S8	56.50 – 56.90	1,100	0.50	0.60	brittle
BH-M02	S9	64.44 – 64.72	1,300	0.45	0.55	brittle
BH-M02	S10	67.93 – 68.33	800	0.48	0.58	brittle
BH-M02	S11	74.20 – 74.50	700	0.59	0.71	brittle
BH-M02	S12	76.13 – 76.40	560	0.43	0.51	brittle
BH-M02	S13	78.14 – 78.47	1,000	0.45	0.54	brittle
BH-M03*	UCS01	9.93 – 10.13	140	1.0	0.81	plastic / brittle
BH-M03	UCS02	16.00 – 16.27	280	1.0	1.2	brittle
BH-M03	UCS03	29.55 – 29.75	110	0.75	0.81	planar
BH-M03	UCS04	31.95 – 32.23	330	1.7	2.0	planar
BH-M03	UCS05	33.76 – 34.06	400	0.55	0.67	planar / brittle
BH-M03	UCS06	37.00 – 37.25	270	0.60	0.72	planar / brittle
BH-M03	UCS07	40.14 – 40.43	92	0.74	0.85	plastic
BH-M03	UCS08	41.15 – 41.43	720	0.81	0.94	planar
BH-M03	UCS09	50.73 – 51.00	850	0.62	0.74	brittle

Please note that the sample indicated with an asterisk () was less than that required by the test standard i.e. "The test is limited to specimens in the form of right cylinders of height approximately equal to twice the diameter", therefore the results for this sample are not IANZ endorsed. In our experience the UCS value determined for this sample will be higher than if the sample had a length of twice the diameter (*opinion not IANZ endorsed*).

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. As per the reporting requirements of NZS4402: 1986: Test 6.3.1: UCS, dry density is reported to the nearest 0.05t/m³, the unconfined compressive strength is reported to two significant figures, and the strain & rate of axial compression at failure is reported to two significant figures.

Please note that the test results relate only to the samples as-received, and relate only to the samples under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Job No:	Reg. No:	Report No:	Page 4 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: **S1**

Depth: 26.50 – 26.75m

[illegible]

Unconfined Compressive Strength: 270 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S1

Depth: 26.50 – 26.75m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.54** mm

Initial Length: **119.87** mm

Initial Mass: **663.65** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.50** t/m³

Water Content After Test: **29.0** %

Failure Conditions:

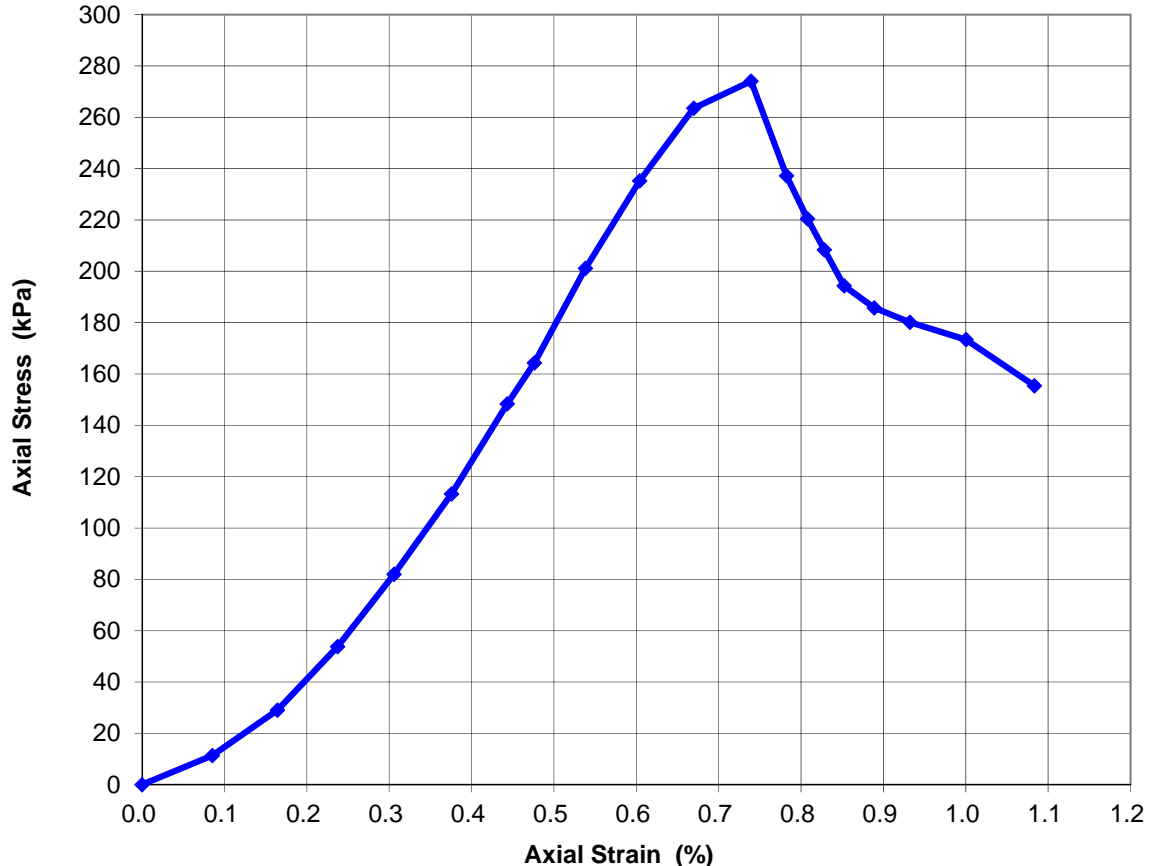
Strain at failure: **0.74** %

Compression at failure: **0.89** mm

Rate of Compression: **0.22** mm / minute

Mode of Failure: planar

Stress - Strain Curve



Job No:	Reg. No:	Report No:	Page 6 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S1**

Depth: **26.50 – 26.75m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 7 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: **S2**

Depth: 29.69 – 29.92m

[illegible]

Unconfined Compressive Strength: 370 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S2

Depth: 29.69 – 29.92m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.86** mm

Initial Length: **115.09** mm

Initial Mass: **641.83** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.45** t/m³

Water Content After Test: **32.1** %

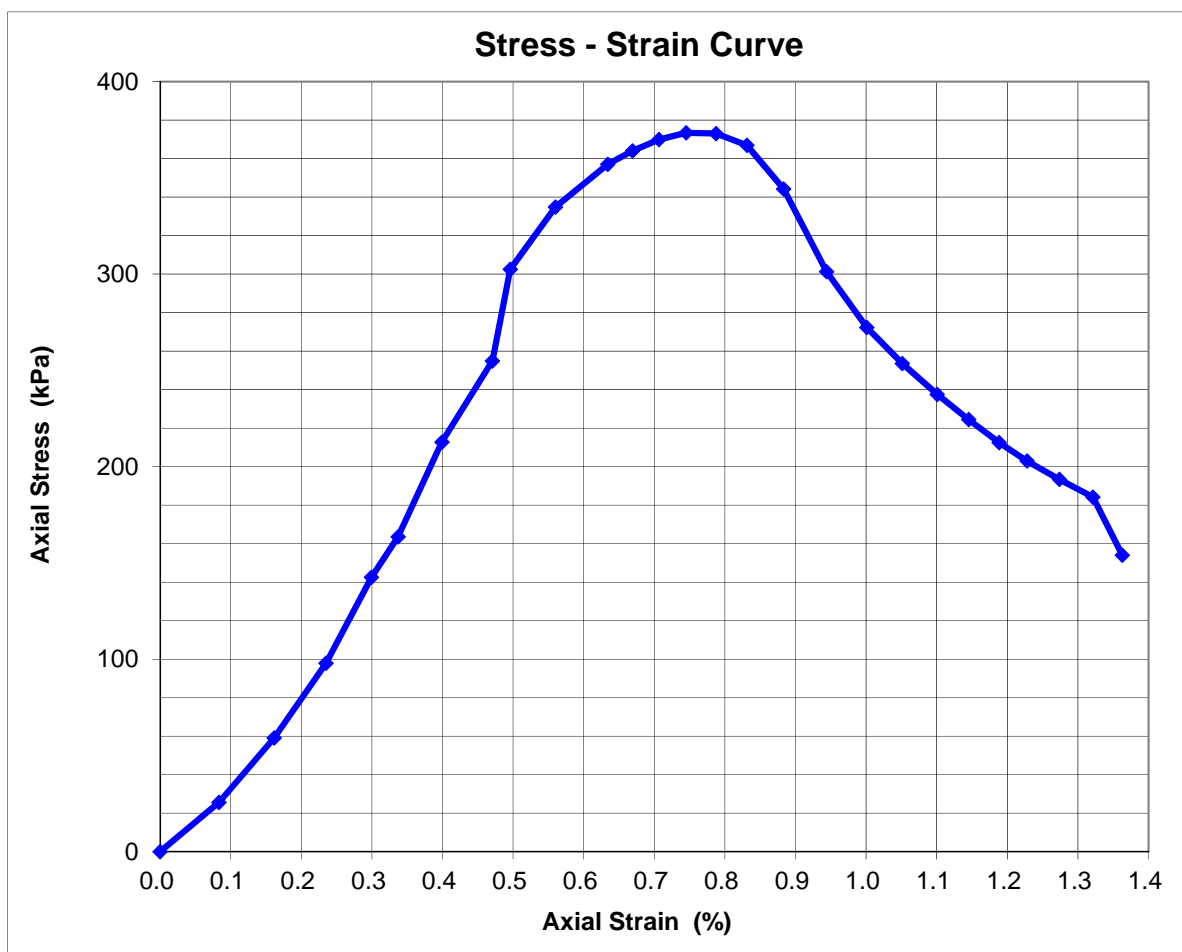
Failure Conditions:

Strain at failure: **0.75** %

Compression at failure: **0.86** mm

Rate of Compression: **0.21** mm / minute

Mode of Failure: planar



Job No:	Reg. No:	Report No:	Page 9 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S2**

Depth: **29.69 – 29.92m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 10 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	<div>WAITAKERE LHRA - MURIWAI</div> <div>GROUND INVESTIGATION</div>		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S3

Depth: 36.35 – 36.65m

[illegible]

Unconfined Compressive Strength:	180	kPa
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S3

Depth: 36.35 – 36.65m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.05** mm

Initial Length: **120.04** mm

Initial Mass: **662.61** g

Initial Bulk Density: **2.02** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **23.8** %

Failure Conditions:

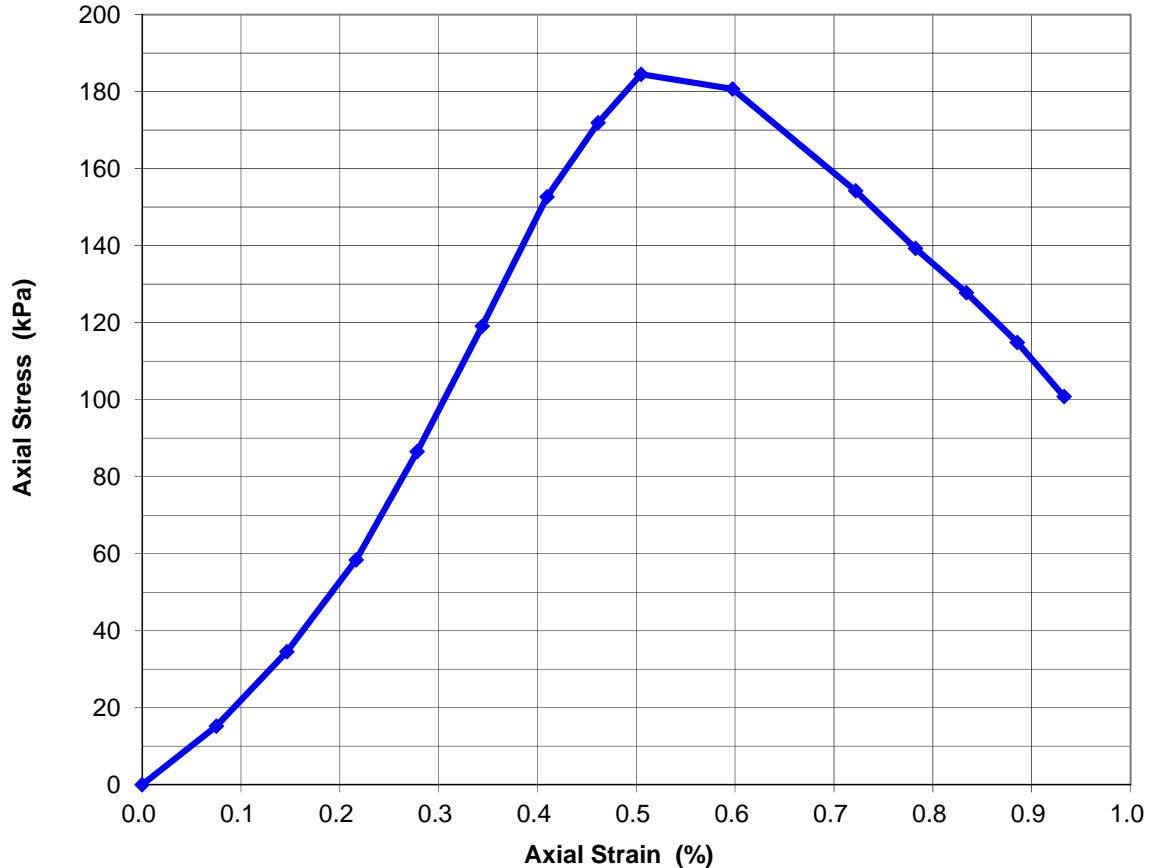
Strain at failure: **0.50** %

Compression at failure: **0.61** mm

Rate of Compression: **0.20** mm / minute

Mode of Failure: planar

Stress - Strain Curve



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63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S3**

Depth: **36.35 – 36.65m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 13 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: **S4**

Depth: 40.80 – 41.00m

[illegible]

Unconfined Compressive Strength: 180 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M02**

Sample Number: **S4**

Depth: **40.80 – 41.00m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.61** mm

Initial Length: **119.91** mm

Initial Mass: **690.28** g

Initial Bulk Density: **2.00** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **24.6** %

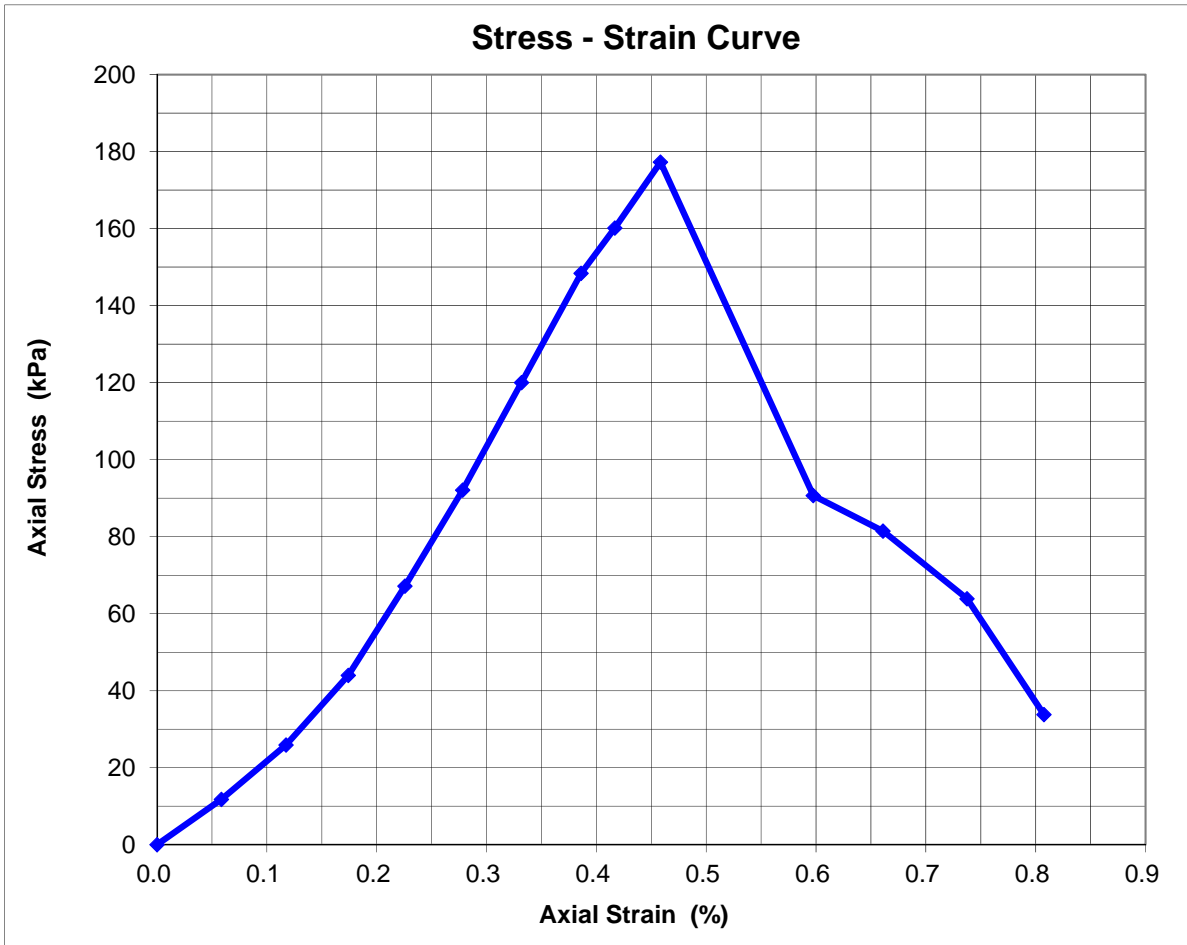
Failure Conditions:

Strain at failure: **0.46** %

Compression at failure: **0.55** mm

Rate of Compression: **0.16** mm / minute

Mode of Failure: planar



BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 15 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			


Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	27-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M02 **Sample Number:** S4 **Depth:** 40.80 – 41.00m


Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 16 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S5

Depth: 53.30 – 53.90m

[illegible]

Unconfined Compressive Strength: 1,800 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S5

Depth: 53.30 – 53.90m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.39** mm

Initial Length: **120.43** mm

Initial Mass: **662.48** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **24.7** %

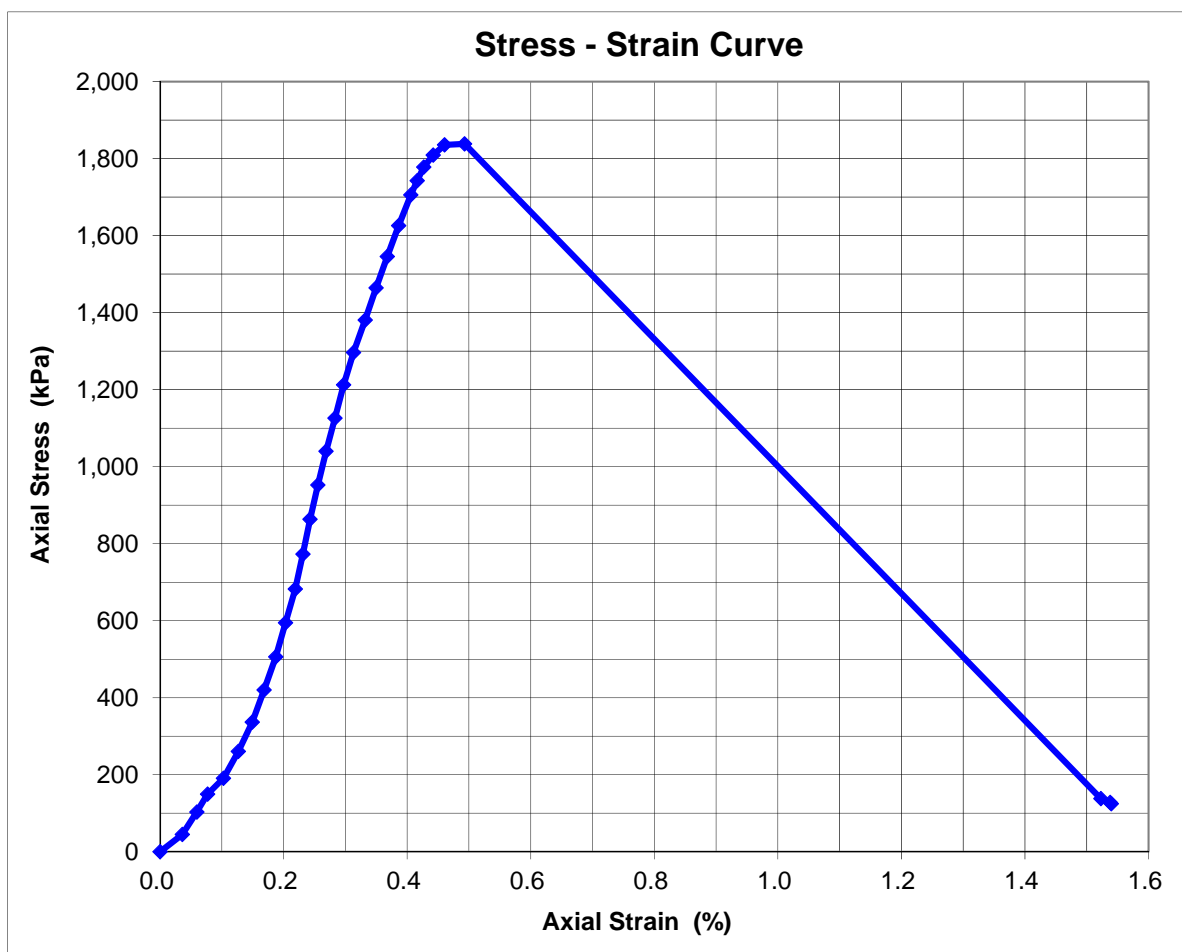
Failure Conditions:

Strain at failure: **0.49** %

Compression at failure: **0.59** mm

Rate of Compression: **0.084** mm / minute

Mode of Failure: brittle



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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S5**

Depth: **53.30 – 53.90m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, very weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 19 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	<div style="text-align: center;"> WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION </div>		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: **S6**

Depth: 55.20 – 55.50m

[illegible]

Unconfined Compressive Strength: 1,200 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S6

Depth: 55.20 – 55.50m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.39** mm

Initial Length: **119.93** mm

Initial Mass: **673.48** g

Initial Bulk Density: **1.96** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **19.5** %

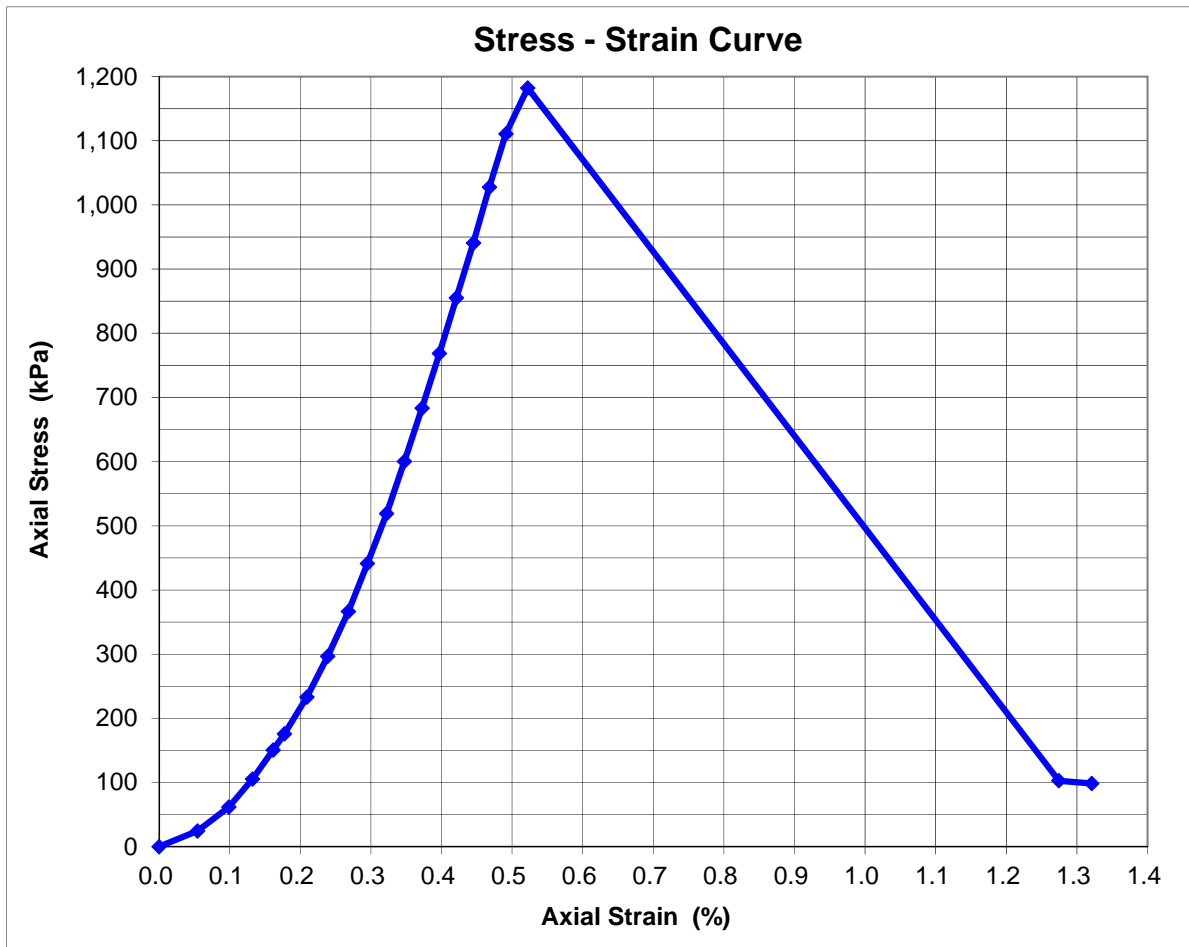
Failure Conditions:

Strain at failure: **0.52** %

Compression at failure: **0.63** mm

Rate of Compression: **0.093** mm / minute

Mode of Failure: planar



BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 21 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23
Borehole: BH-M02 Sample Number: S6 Depth: 55.20 – 55.50m Sample Description (not part of BGL IANZ Accreditation): SANDSTONE, fine to medium, very weak, dark orange, weakly cemented.				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: **S7**

Depth: 55.80 – 56.11m

[illegible]

Unconfined Compressive Strength: 1,300 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M02**

Sample Number: **S7**

Depth: **55.80 – 56.11m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **56.94** mm

Initial Length: **120.02** mm

Initial Mass: **586.43** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.6** %

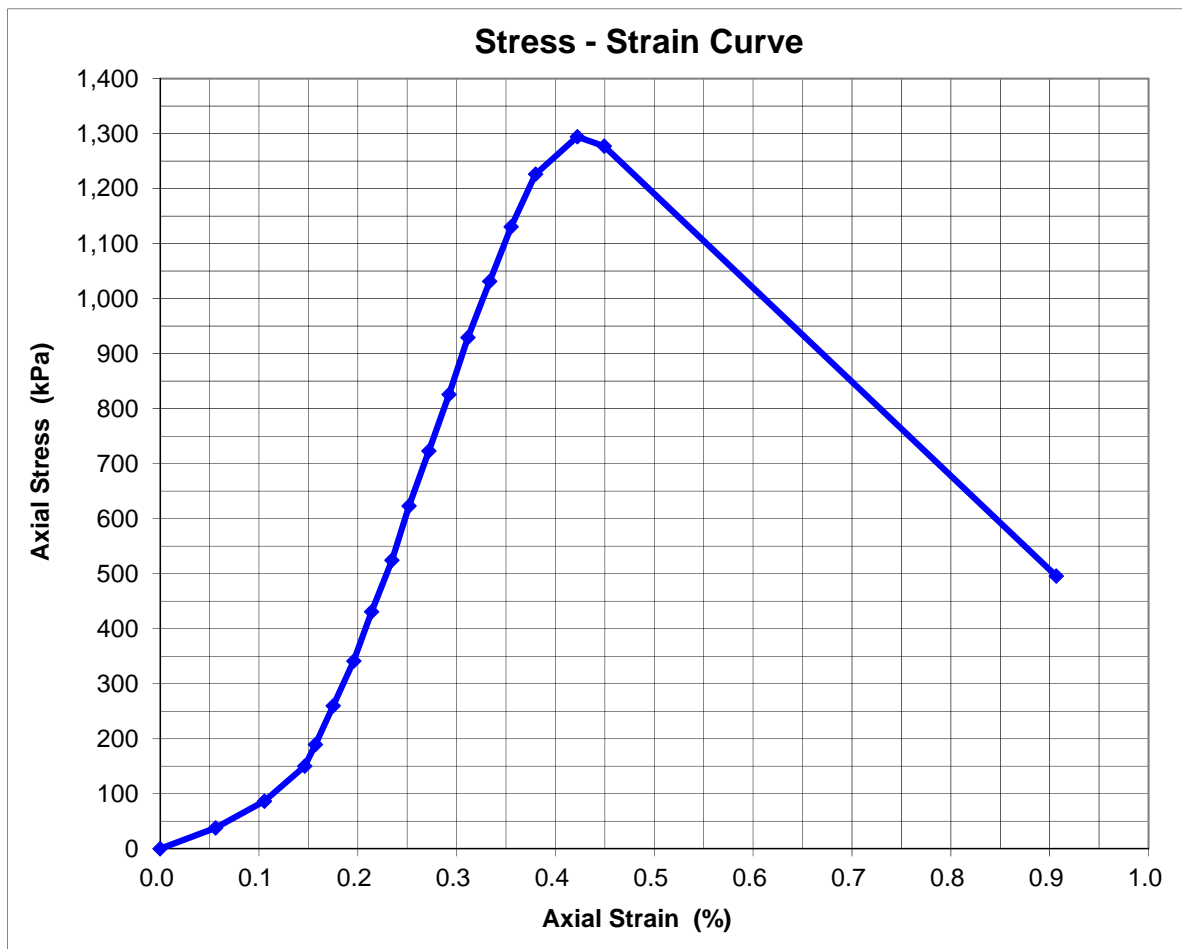
Failure Conditions:

Strain at failure: **0.42** %

Compression at failure: **0.51** mm

Rate of Compression: **0.085** mm / minute

Mode of Failure: brittle



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63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S7**

Depth: **55.80 – 56.11m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, very weak, dark orange, weakly to moderately cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 25 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	<div>WAITAKERE LHRA - MURIWAI</div> <div>GROUND INVESTIGATION</div>		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S8

Depth: 56.50 – 56.90m

[illegible]

Unconfined Compressive Strength: 1,100 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S8

Depth: 56.50 – 56.90m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.05** mm

Initial Length: **120.11** mm

Initial Mass: **636.25** g

Initial Bulk Density: **1.93** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.8** %

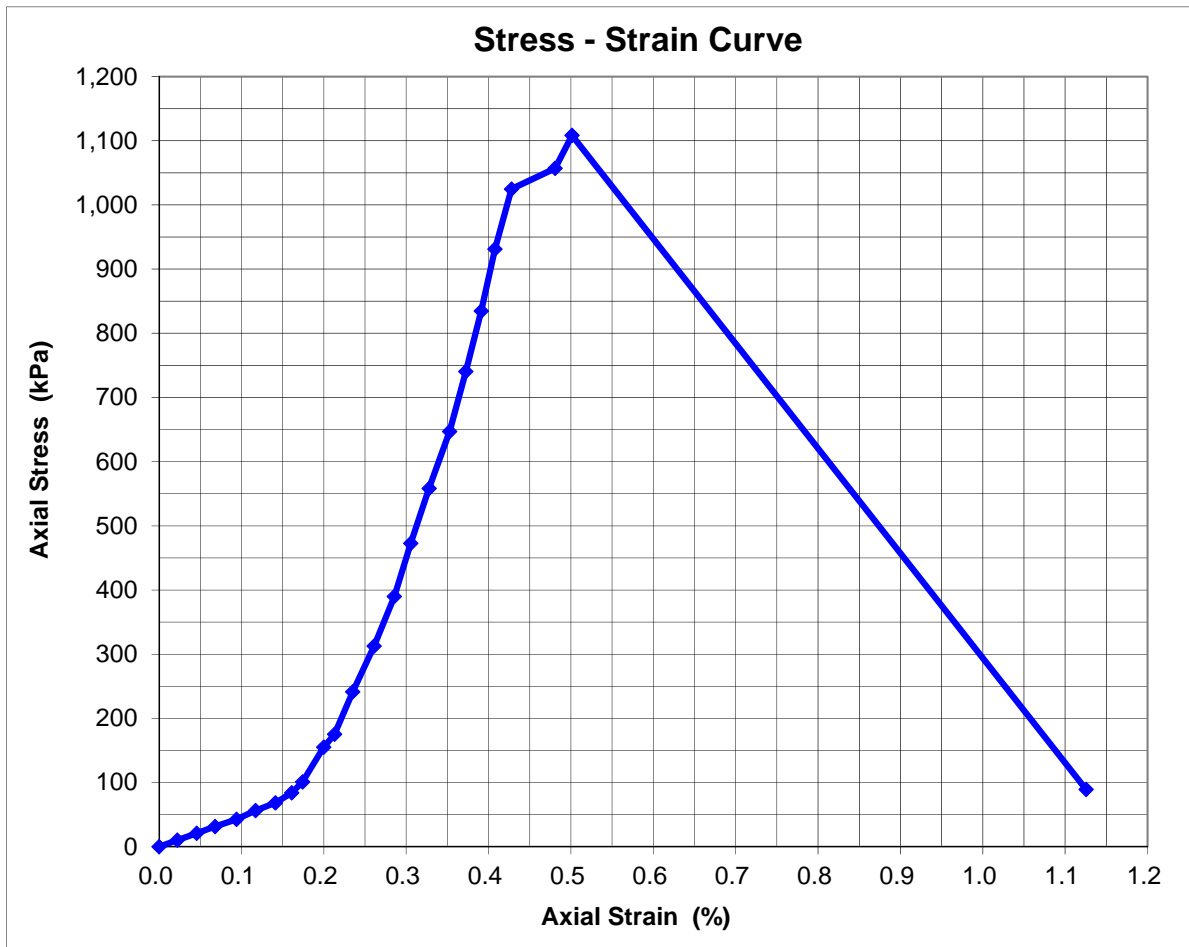
Failure Conditions:



Strain at failure: **0.50** %

Compression at failure: **0.60** mm

Rate of Compression: **0.098** mm / minute

Mode of Failure: brittle



BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 27 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23
Borehole: BH-M02 Sample Number: S8 Depth: 56.50 – 56.90m Sample Description (<i>not part of BGL IANZ Accreditation</i>): <p style="text-align: center;">SANDSTONE, fine to coarse, very weak, dark orange, weakly cemented.</p>				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S9

Depth: 64.44 – 64.72m

[illegible]

Unconfined Compressive Strength: 1,300 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S9

Depth: 64.44 – 64.72m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **58.56** mm

Initial Length: **121.19** mm

Initial Mass: **667.98** g

Initial Bulk Density: **2.05** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **22.9** %

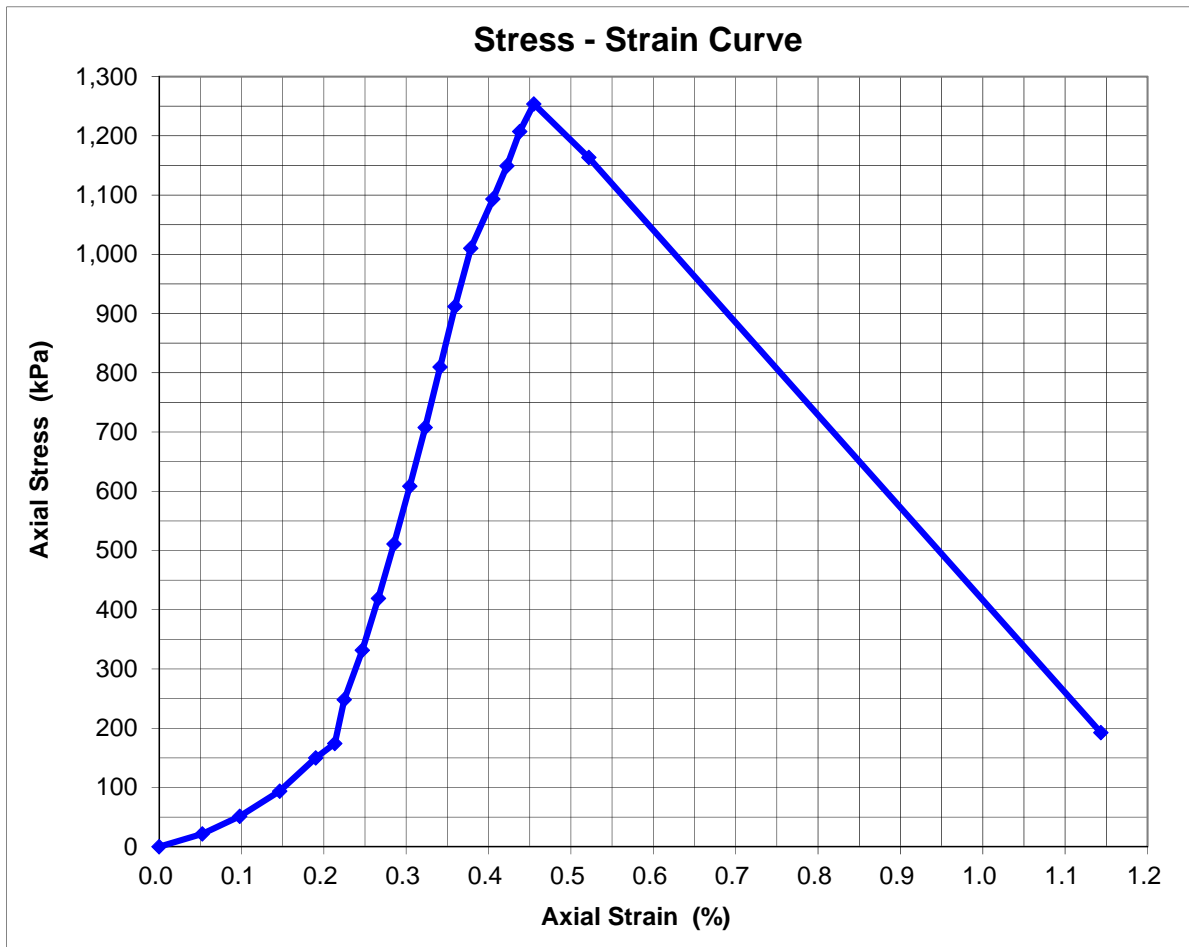
Failure Conditions:

Strain at failure: **0.45** %

Compression at failure: **0.55** mm

Rate of Compression: **0.088** mm / minute

Mode of Failure: brittle



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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S9**

Depth: **64.44 – 64.72m**

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, very weak, dark brownish orange, weakly to moderately cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S10

Depth: 67.93 – 68.33m

[illegible]

Unconfined Compressive Strength:	800	kPa
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S10

Depth: 67.93 – 68.33m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **57.92** mm

Initial Length: **120.24** mm

Initial Mass: **643.51** g

Initial Bulk Density: **2.03** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **24.2** %

Failure Conditions:

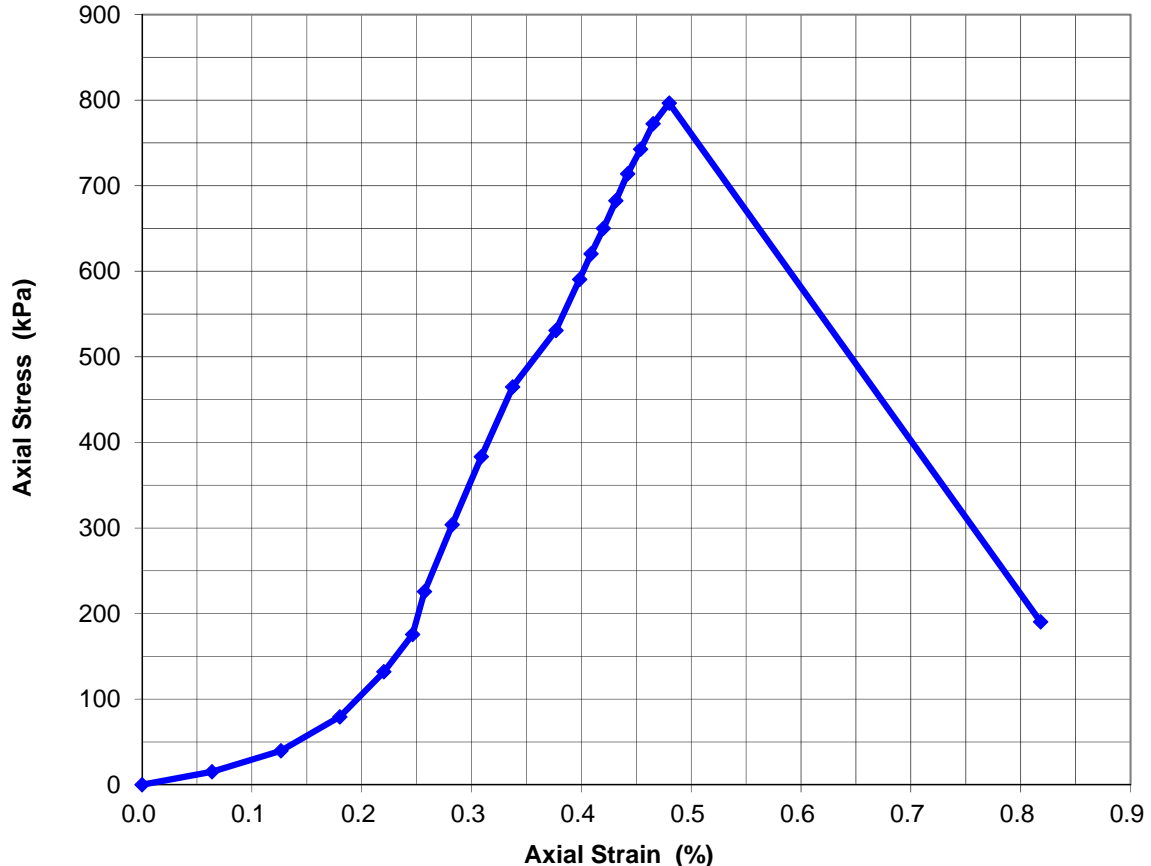
Strain at failure: **0.48** %



Compression at failure: **0.58** mm

Rate of Compression: **0.12** mm / minute

Mode of Failure: brittle

Stress - Strain Curve



BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 33 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23
Borehole: BH-M02 Sample Number: S10 Depth: 67.93 – 68.33m Sample Description (<i>not part of BGL IANZ Accreditation</i>): SANDSTONE, fine to coarse, extremely weak, dark orangish brown, weakly cemented.				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

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63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S11

Depth: 74.20 – 74.50m

[illegible]

Unconfined Compressive Strength: **700 kPa**

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S11

Depth: 74.20 – 74.50m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.76** mm

Initial Length: **120.00** mm

Initial Mass: **655.99** g

Initial Bulk Density: **1.89** t/m³

Initial Dry Density: **1.45** t/m³

Water Content After Test: **31.8** %

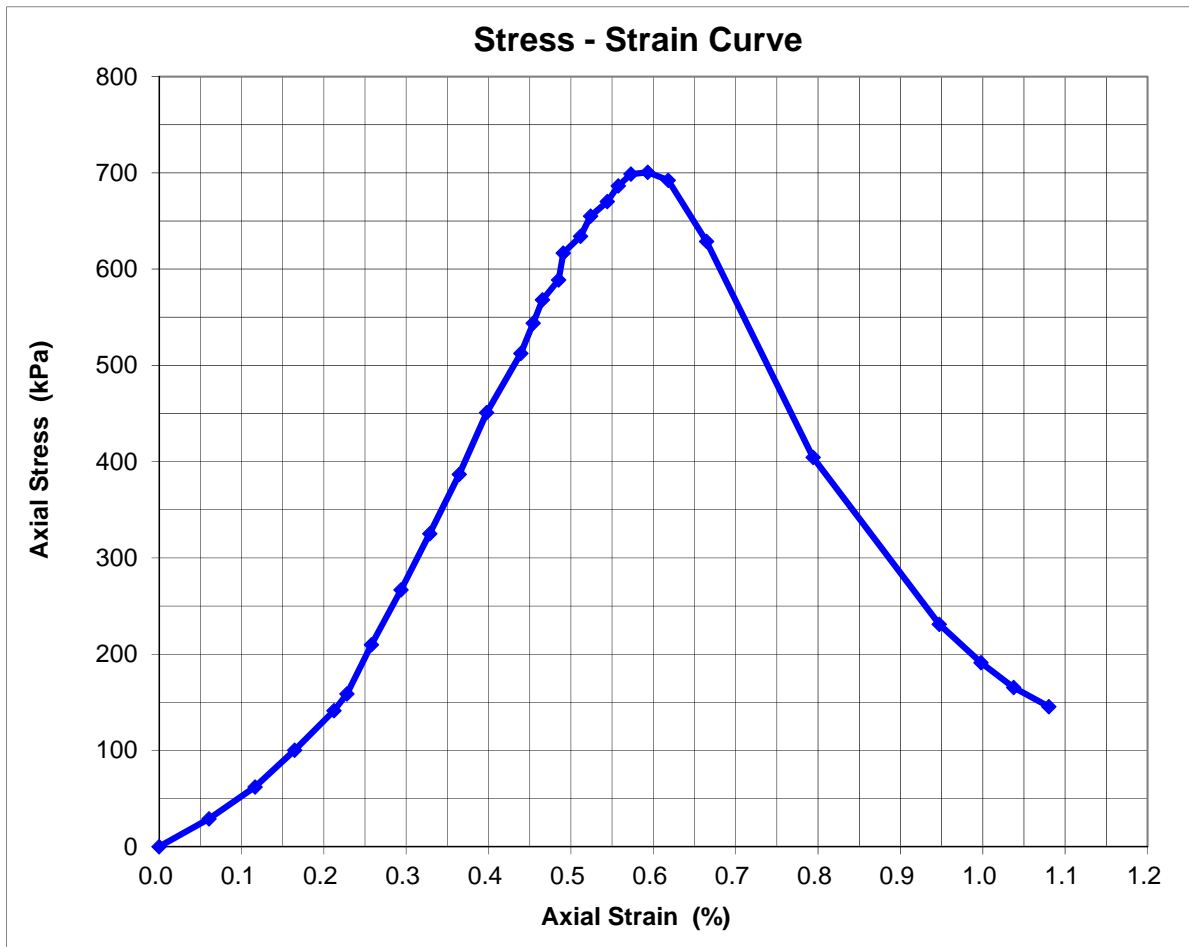
Failure Conditions:

Strain at failure: **0.59** %

Compression at failure: **0.71** mm

Rate of Compression: **0.13** mm / minute

Mode of Failure: brittle



BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 36 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23

Borehole: **BH-M02**

Sample Number: **S11**

Depth: **74.20 – 74.50m**

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, brown, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 37 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S12

Depth: 76.13 – 76.40m

[illegible]

Unconfined Compressive Strength: 560 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S12

Depth: 76.13 – 76.40m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.63** mm

Initial Length: **119.95** mm

Initial Mass: **647.59** g

Initial Bulk Density: **1.87** t/m³

Initial Dry Density: **1.40** t/m³

Water Content After Test: **31.8** %

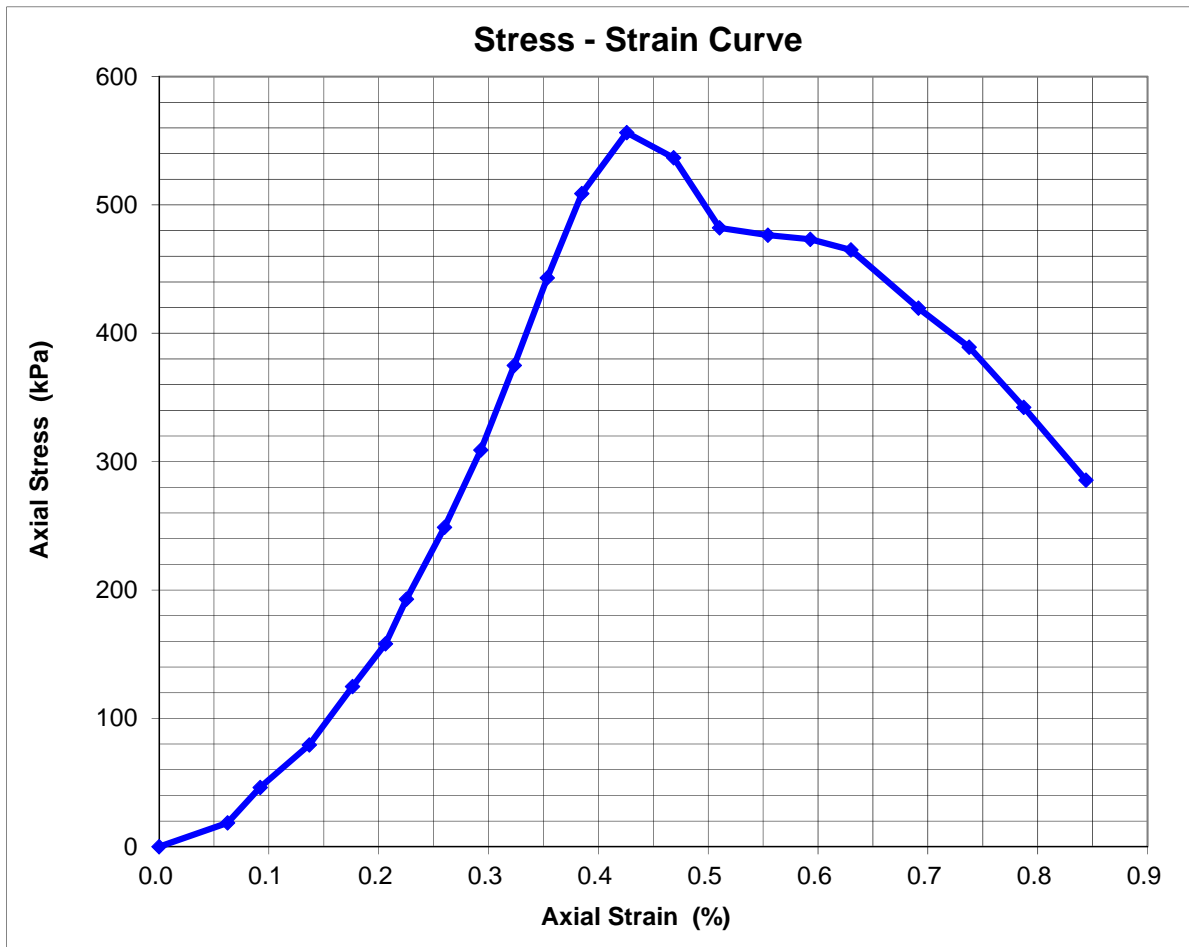
Failure Conditions:



Strain at failure: **0.43** %

Compression at failure: **0.51** mm

Rate of Compression: **0.11** mm / minute

Mode of Failure: brittle



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	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23
Borehole: BH-M02 Sample Number: S12 Depth: 76.13 – 76.40m Sample Description (<i>not part of BGL IANZ Accreditation</i>): SANDSTONE, fine to coarse, extremely weak, grey with light brown oxidation around circumference, weakly cemented.				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M02

Sample Number: S13

Depth: 78.14 – 78.47m

[illegible]

Unconfined Compressive Strength: 1,000 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M02**

Sample Number: **S13**

Depth: **78.14 – 78.47m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **58.59** mm

Initial Length: **120.07** mm

Initial Mass: **633.33** g

Initial Bulk Density: **1.96** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **25.4** %

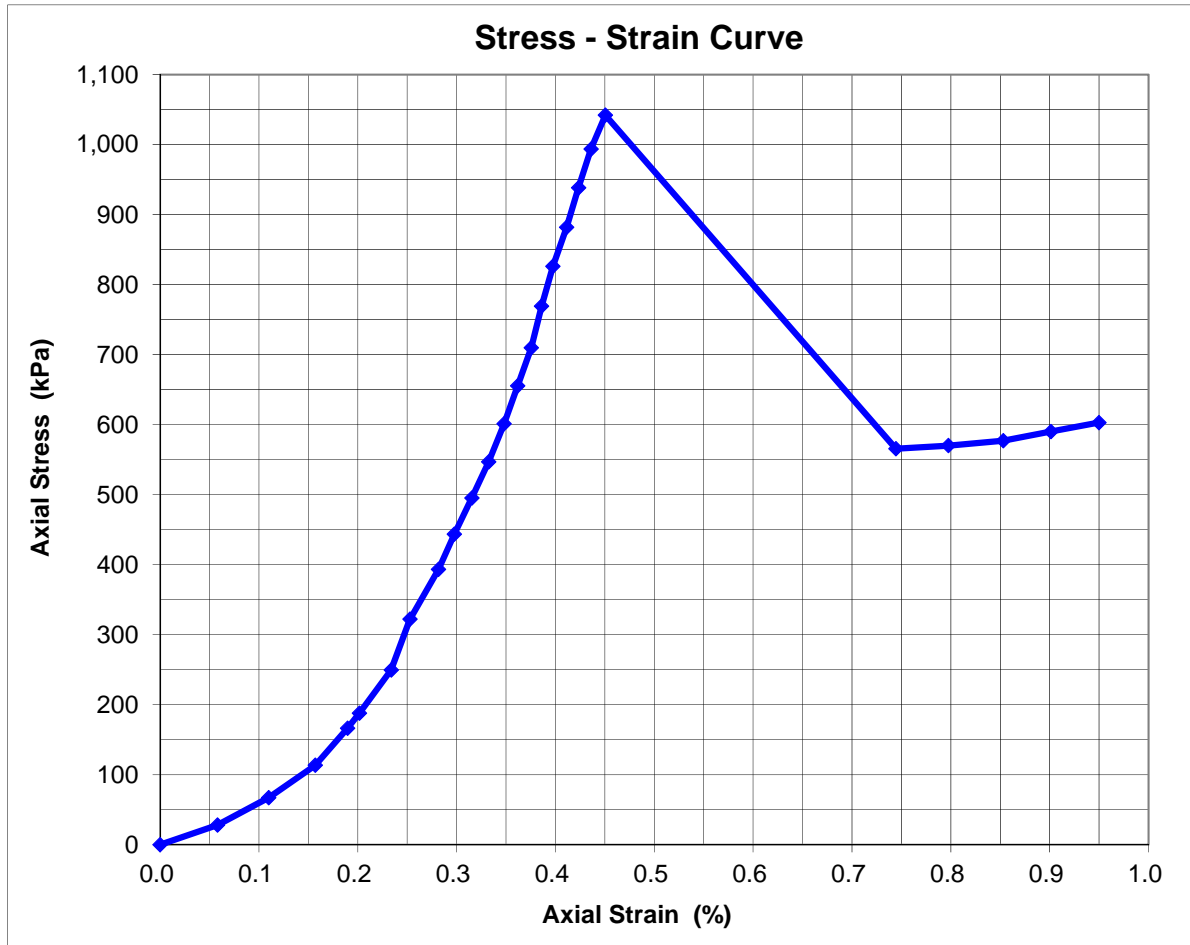
Failure Conditions:

Strain at failure: **0.45** %

Compression at failure: **0.54** mm

Rate of Compression: **0.092** mm / minute

Mode of Failure: brittle




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	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			

Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	27-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23


Borehole: BH-M02 **Sample Number:** S13 **Depth:** 78.14 – 78.47m

Sample Description (*not part of BGL IANZ Accreditation*):
SANDSTONE, fine to coarse, extremely weak to very weak, banded brown & dark brown, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M03

Sample Number: UCS01

Depth: 9.93 – 10.13m

[illegible]

Unconfined Compressive Strength:	140	kPa
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS01**

Depth: **9.93 – 10.13m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.13** mm

Initial Length: **79.91** mm

Initial Mass: **432.98** g

Initial Bulk Density: **1.97** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **24.5** %

Failure Conditions:

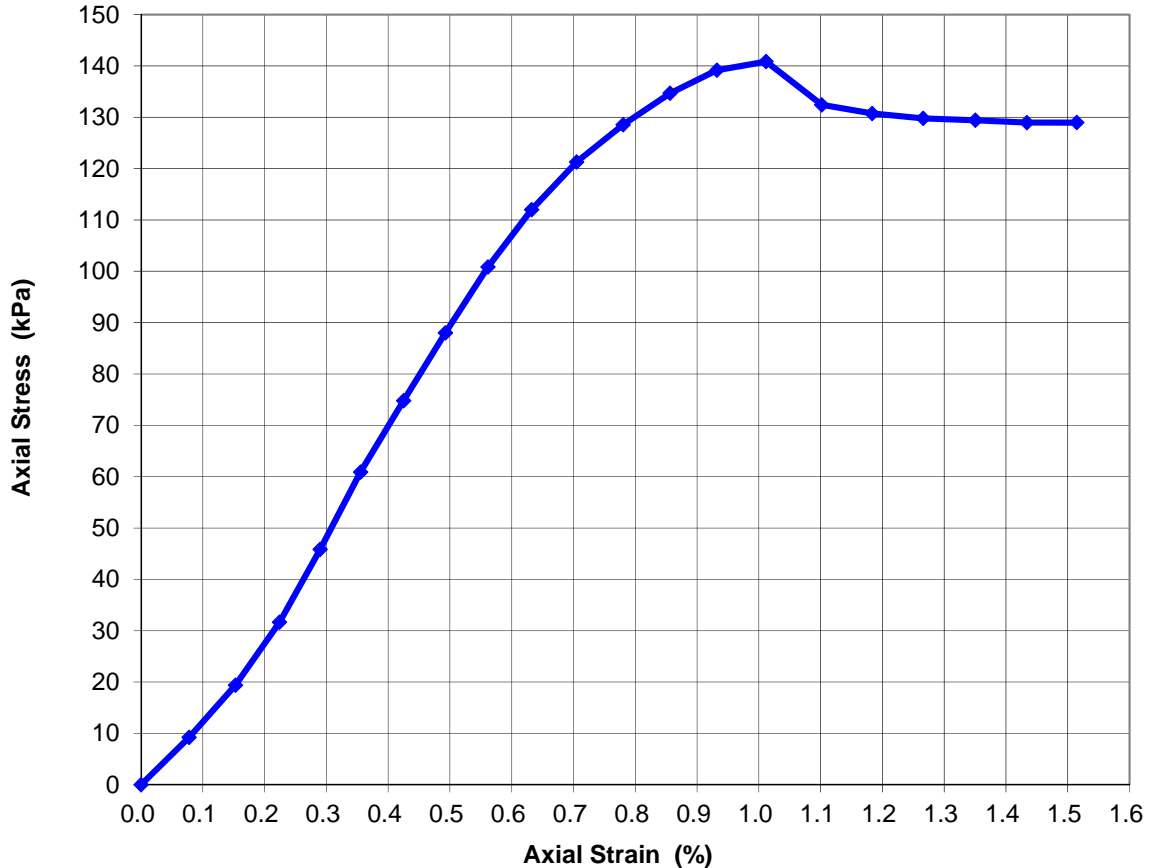
Strain at failure: **1.0** %

Compression at failure: **0.81** mm

Rate of Compression: **0.20** mm / minute

Mode of Failure: plastic / brittle

Stress - Strain Curve



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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS01**

Depth: **9.93 – 10.13m**


Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine, extremely weak, banded orange, dark orange & yellow, very weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST



 <p>BGL Babbage Geotechnical Laboratory</p>	Job No:	Reg. No:	Report No:	Page 46 of 69			
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	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION						
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By:	WEC	27-Sep-23		
			Compiled By:	WEC	28-Sep-23		
			Checked By:	JF	2-Oct-23		
Borehole: BH-M03 Sample Number: UCS02 Depth: 16.00 – 16.27m							
Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	3.064	0.000	0.000	5.256	0.0	2645.0	0
0.28	3.120	0.057	0.000	5.265	42.0	2646.3	16
0.58	3.183	0.120	0.001	5.270	70.8	2647.7	27
0.87	3.240	0.177	0.001	5.278	106.4	2648.9	40
1.15	3.297	0.234	0.002	5.286	149.7	2650.2	56
1.45	3.354	0.290	0.002	5.295	194.2	2651.5	73
1.73	3.406	0.343	0.003	5.305	245.3	2652.6	92
2.02	3.454	0.391	0.003	5.317	302.0	2653.7	114
2.32	3.507	0.443	0.004	5.327	353.9	2654.8	133
2.60	3.559	0.495	0.004	5.338	410.2	2656.0	154
2.88	3.612	0.548	0.005	5.349	464.8	2657.2	175
3.18	3.657	0.593	0.005	5.354	487.9	2658.2	184
3.47	3.697	0.633	0.005	5.358	508.1	2659.1	191
3.60	3.725	0.661	0.006	5.362	529.7	2659.7	199
3.75	3.754	0.690	0.006	5.366	550.0	2660.3	207
3.88	3.782	0.718	0.006	5.370	568.1	2661.0	213
4.02	3.811	0.747	0.006	5.373	584.8	2661.6	220
4.17	3.840	0.776	0.006	5.376	602.2	2662.3	226
4.30	3.867	0.804	0.007	5.380	619.5	2662.9	233
4.43	3.896	0.832	0.007	5.383	635.6	2663.5	239
4.58	3.923	0.860	0.007	5.386	651.6	2664.1	245
4.72	3.953	0.889	0.007	5.389	664.5	2664.8	249
4.85	3.982	0.918	0.008	5.392	678.4	2665.4	255
5.00	4.012	0.948	0.008	5.394	690.5	2666.1	259
5.13	4.042	0.978	0.008	5.396	701.4	2666.8	263
5.27	4.072	1.009	0.008	5.398	710.4	2667.5	266
5.42	4.103	1.040	0.009	5.400	720.3	2668.2	270
5.55	4.132	1.069	0.009	5.402	730.7	2668.8	274
5.68	4.162	1.098	0.009	5.404	740.2	2669.5	277
5.83	4.194	1.130	0.009	5.405	747.1	2670.2	280
5.97	4.226	1.162	0.010	5.406	751.9	2670.9	282
6.10	4.258	1.194	0.010	5.407	754.0	2671.6	282
6.25	4.291	1.227	0.010	5.407	754.5	2672.4	282
6.38	4.323	1.260	0.010	5.406	752.6	2673.1	282
6.52	4.359	1.295	0.011	5.405	747.2	2673.9	279
6.67	4.396	1.332	0.011	5.404	740.3	2674.7	277
6.80	4.431	1.367	0.011	5.402	729.7	2675.5	273
6.93	4.467	1.403	0.012	5.400	718.9	2676.3	269
7.08	4.502	1.439	0.012	5.397	707.6	2677.1	264
7.22	4.537	1.474	0.012	5.394	693.2	2677.9	259
7.35	4.573	1.509	0.013	5.391	674.0	2678.7	252
Unconfined Compressive Strength:				280	kPa		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS02

Depth: 16.00 – 16.27m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **58.03** mm

Initial Length: **119.99** mm

Initial Mass: **612.76** g

Initial Bulk Density: **1.93** t/m³

Initial Dry Density: **1.50** t/m³

Water Content After Test: **30.8** %

Failure Conditions:

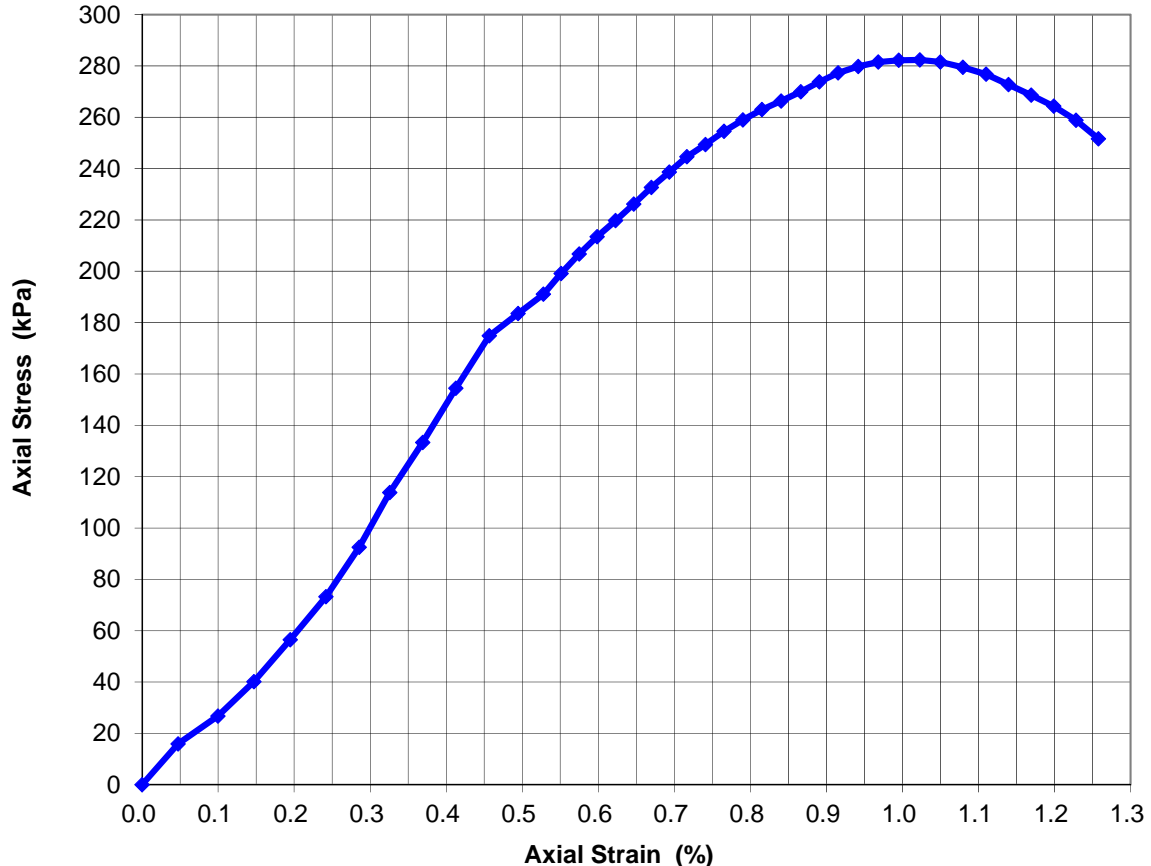
Strain at failure: **1.0** %

Compression at failure: **1.2** mm

Rate of Compression: **0.20** mm / minute

Mode of Failure: brittle

Stress - Strain Curve



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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS02**

Depth: **16.00 – 16.27m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine, extremely weak, light grey, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



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PROJECT:	<div style="text-align: center;"> WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION </div>		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M03

Sample Number: UCS03

Depth: 29.55 – 29.75m

[illegible]

Unconfined Compressive Strength: 110 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS03

Depth: 29.55 – 29.75m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.93** mm

Initial Length: **108.76** mm

Initial Mass: **614.84** g

Initial Bulk Density: **2.00** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **23.4** %

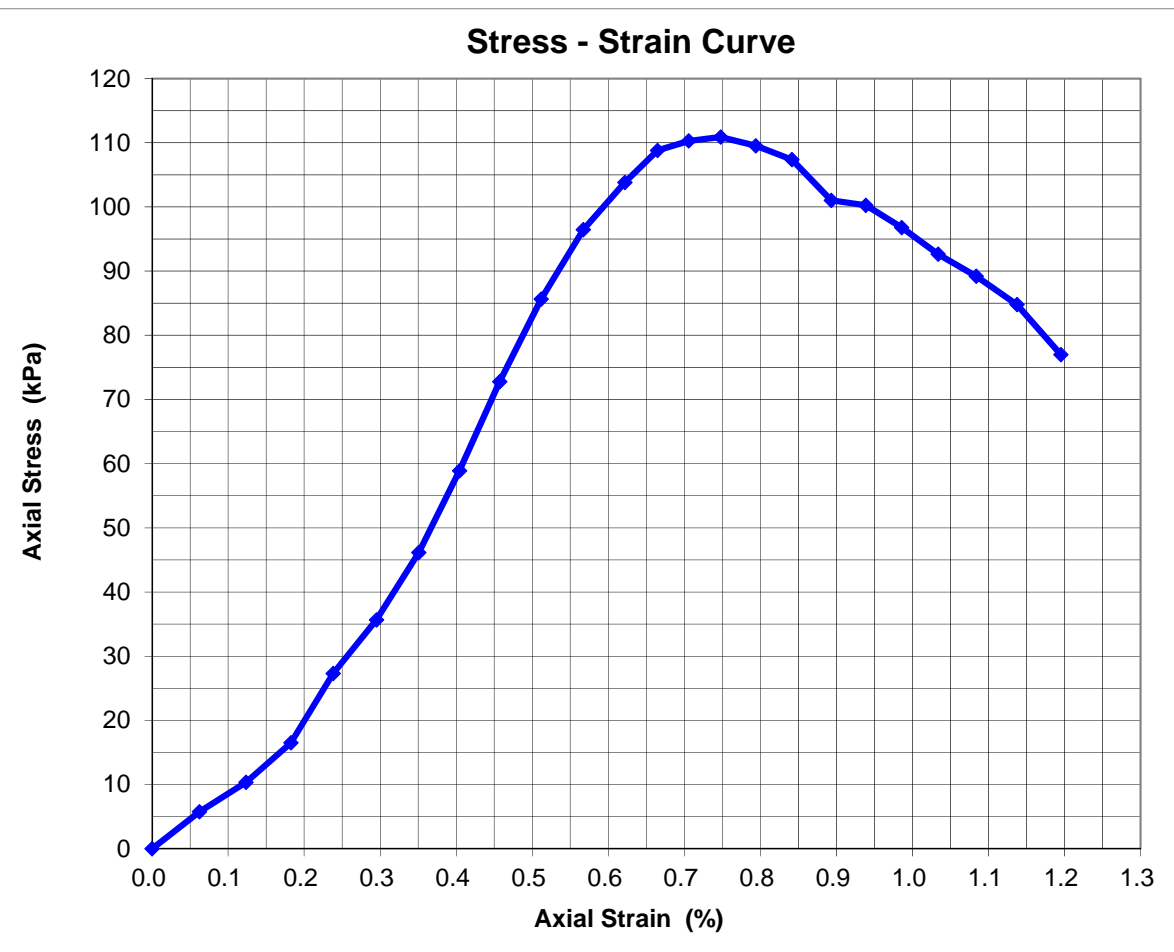
Failure Conditions:

Strain at failure: **0.75** %

Compression at failure: **0.81** mm

Rate of Compression: **0.21** mm / minute

Mode of Failure: planar



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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 27-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS03**

Depth: **29.55 – 29.75m**

Sample Description (not part of BGL IANZ Accreditation):


SANDSTONE, fine to medium, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



 <p>BGL Babbage Geotechnical Laboratory</p>	Job No:	Reg. No:	Report No:	Page 52 of 69			
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	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION						
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By:	WEC	27-Sep-23		
			Compiled By:	WEC	28-Sep-23		
			Checked By:	JF	2-Oct-23		
Borehole: BH-M03 Sample Number: UCS04 Depth: 31.95 – 32.23m							
Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	2.463	0.000	0.000	5.251	0.0	2604.0	0
0.28	2.522	0.059	0.000	5.257	30.8	2605.2	12
0.58	2.580	0.117	0.001	5.262	54.0	2606.5	21
0.87	2.641	0.178	0.001	5.266	76.2	2607.8	29
1.15	2.702	0.239	0.002	5.271	99.0	2609.2	38
1.45	2.763	0.300	0.003	5.275	121.1	2610.5	46
1.73	2.825	0.362	0.003	5.280	144.3	2611.8	55
2.02	2.886	0.423	0.004	5.285	168.9	2613.2	65
2.32	2.947	0.484	0.004	5.290	193.3	2614.5	74
2.60	3.008	0.545	0.005	5.295	219.4	2615.9	84
2.88	3.069	0.606	0.005	5.300	244.7	2617.2	93
3.18	3.128	0.665	0.006	5.305	272.2	2618.5	104
3.47	3.188	0.725	0.006	5.311	300.2	2619.8	115
3.75	3.247	0.784	0.007	5.316	327.4	2621.1	125
3.97	3.289	0.826	0.007	5.321	349.2	2622.0	133
4.17	3.329	0.866	0.007	5.325	370.3	2622.9	141
4.37	3.370	0.907	0.008	5.329	391.0	2623.8	149
4.58	3.410	0.947	0.008	5.333	412.8	2624.7	157
4.78	3.451	0.988	0.008	5.338	436.1	2625.6	166
5.00	3.492	1.029	0.009	5.342	457.6	2626.5	174
5.40	3.550	1.087	0.009	5.347	480.5	2627.8	183
5.82	3.610	1.147	0.010	5.354	518.4	2629.1	197
6.23	3.692	1.229	0.010	5.364	565.2	2630.9	215
6.63	3.773	1.311	0.011	5.373	609.2	2632.7	231
7.05	3.857	1.394	0.012	5.381	653.1	2634.6	248
7.47	3.938	1.475	0.012	5.390	695.1	2636.4	264
7.87	4.020	1.557	0.013	5.398	735.0	2638.2	279
8.28	4.104	1.641	0.014	5.405	773.3	2640.1	293
8.48	4.146	1.683	0.014	5.409	790.8	2641.0	299
8.90	4.230	1.768	0.015	5.415	821.2	2642.9	311
9.12	4.273	1.810	0.015	5.417	834.9	2643.9	316
9.32	4.314	1.852	0.015	5.420	846.9	2644.8	320
9.52	4.358	1.895	0.016	5.422	856.1	2645.8	324
9.73	4.402	1.939	0.016	5.423	864.1	2646.8	326
9.93	4.447	1.984	0.017	5.424	866.5	2647.8	327
10.13	4.493	2.030	0.017	5.423	864.0	2648.8	326
10.35	4.541	2.078	0.017	5.420	849.7	2649.9	321
10.55	4.593	2.130	0.018	5.415	821.0	2651.1	310
10.75	4.649	2.186	0.018	5.407	782.4	2652.3	295
10.97	4.703	2.240	0.019	5.399	743.6	2653.5	280
11.17	4.761	2.298	0.019	5.388	685.5	2654.8	258
Unconfined Compressive Strength:				330	kPa		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS04

Depth: 31.95 – 32.23m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **57.58** mm

Initial Length: **119.87** mm

Initial Mass: **590.37** g

Initial Bulk Density: **1.89** t/m³

Initial Dry Density: **1.45** t/m³

Water Content After Test: **31.7** %

Failure Conditions:

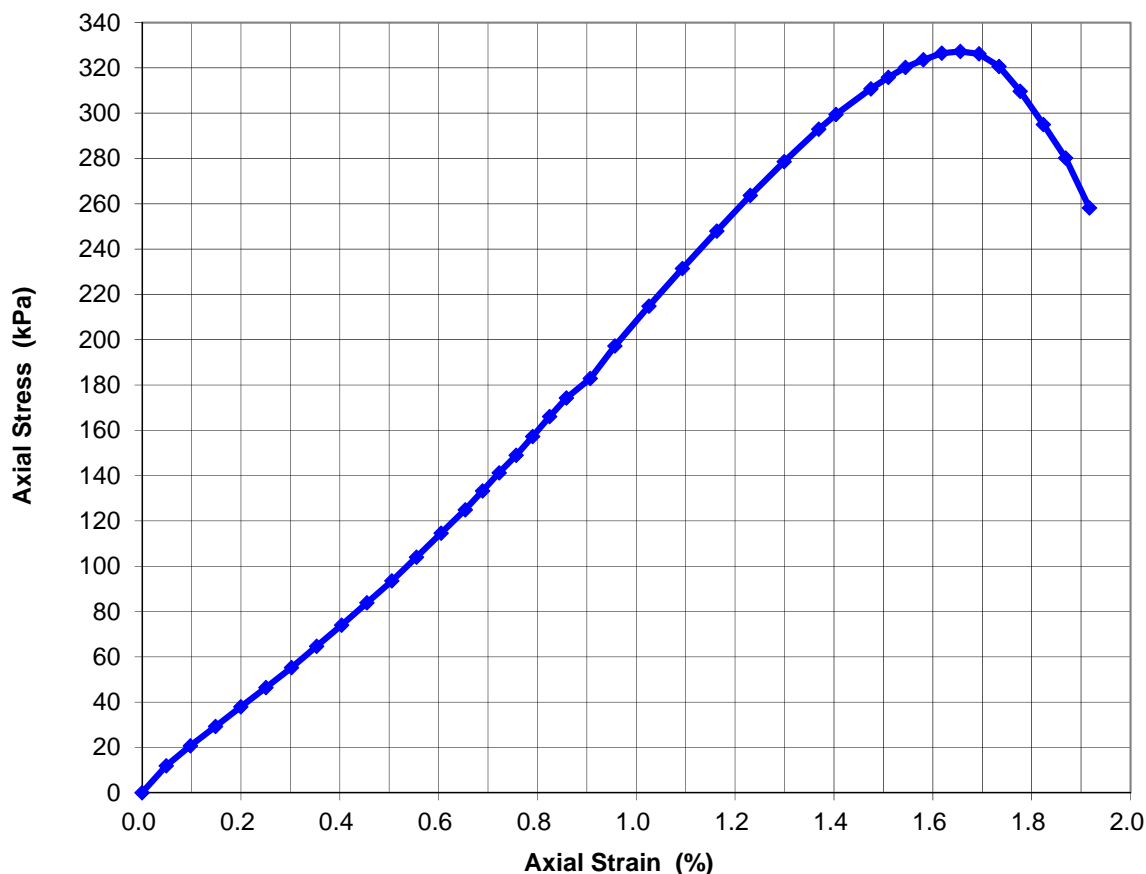
Strain at failure: **1.7** %



Compression at failure: **2.0** mm

Rate of Compression: **0.20** mm / minute

Mode of Failure: **planar**

Stress - Strain Curve



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	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	27-Sep-23 28-Sep-23 2-Oct-23
Borehole: BH-M03 Sample Number: UCS04 Depth: 31.95 – 32.23m Sample Description (<i>not part of BGL IANZ Accreditation</i>): SANDSTONE, fine to medium, extremely weak, light grey, weakly cemented.				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

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PROJECT:	<div>WAITAKERE LHRA - MURIWAI</div> <div>GROUND INVESTIGATION</div>		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M03

Sample Number: UCS05

Depth: 33.76 – 34.06m

[illegible]

Unconfined Compressive Strength: 400 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS05**

Depth: **33.76 – 34.06m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **57.58** mm

Initial Length: **120.16** mm

Initial Mass: **611.10** g

Initial Bulk Density: **1.95** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **24.6** %

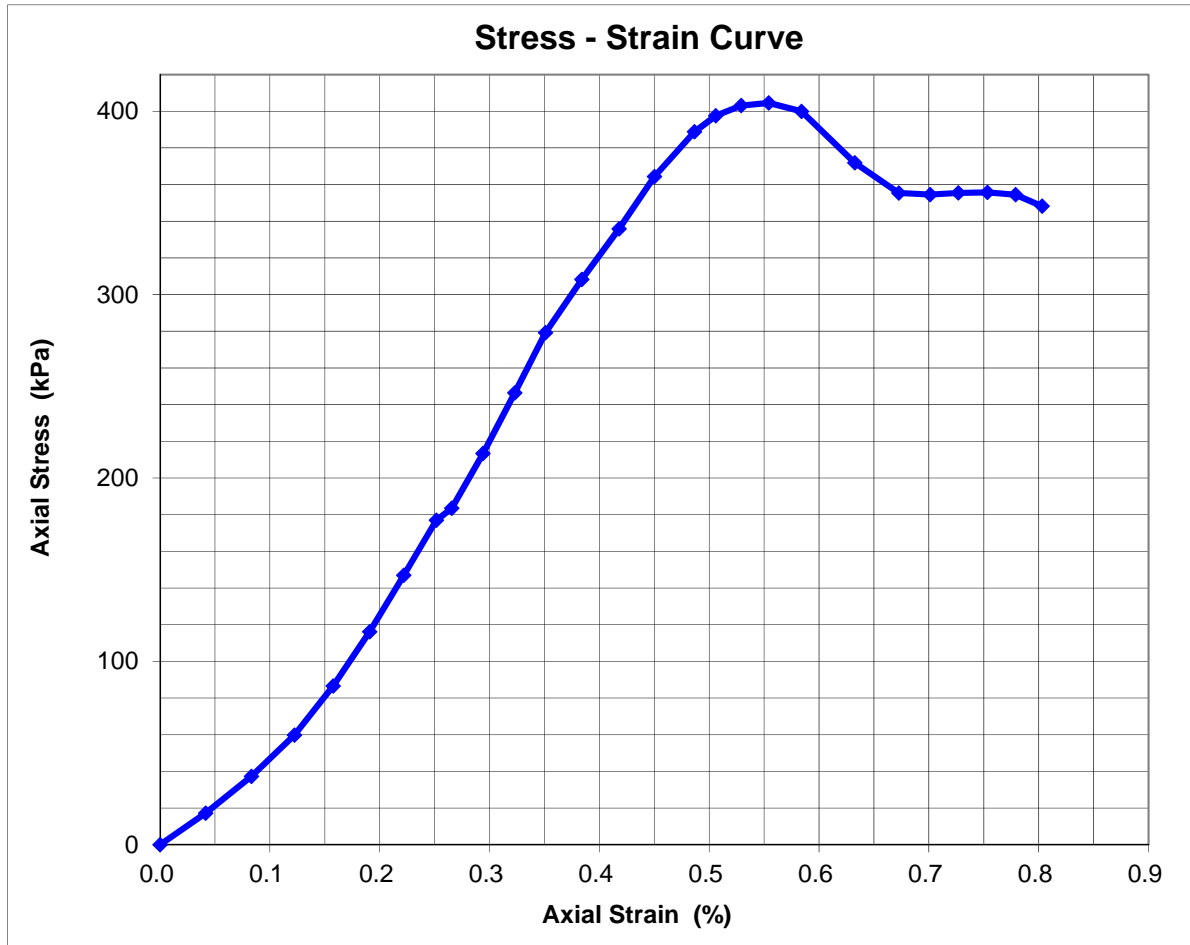
Failure Conditions:

Strain at failure: **0.55** %

Compression at failure: **0.67** mm

Rate of Compression: **0.14** mm / minute

Mode of Failure: **planar / brittle**



Job No:	Reg. No:	Report No:	Page 57 of 69
63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 28-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS05**

Depth: **33.76 – 34.06m**

Sample Description (*not part of BGL IANZ Accreditation*):


SANDSTONE, fine to medium, extremely weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



 BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 58 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			

Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	28-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M03

 Sample Number: UCS06

 Depth: 37.00 – 37.25m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	7.535	0.000	0.000	5.252	0.0	2836.6	0
0.13	7.564	0.028	0.000	5.254	14.0	2837.3	5
0.28	7.591	0.056	0.000	5.256	22.9	2838.0	8
0.42	7.614	0.079	0.001	5.259	35.4	2838.5	12
0.55	7.640	0.105	0.001	5.261	47.9	2839.1	17
0.70	7.667	0.132	0.001	5.263	59.7	2839.7	21
0.83	7.692	0.157	0.001	5.267	75.3	2840.3	27
0.98	7.720	0.184	0.002	5.270	90.2	2841.0	32
1.12	7.746	0.211	0.002	5.273	107.8	2841.6	38
1.27	7.772	0.237	0.002	5.276	124.0	2842.2	44
1.40	7.797	0.261	0.002	5.281	147.1	2842.8	52
1.53	7.821	0.286	0.002	5.286	170.8	2843.4	60
1.68	7.844	0.309	0.003	5.291	198.7	2844.0	70
1.82	7.867	0.332	0.003	5.297	226.6	2844.5	80
1.95	7.888	0.353	0.003	5.303	259.0	2845.0	91
2.10	7.910	0.374	0.003	5.310	291.7	2845.5	103
2.23	7.930	0.394	0.003	5.317	326.3	2846.0	115
2.37	7.949	0.414	0.003	5.324	363.7	2846.4	128
2.52	7.968	0.432	0.004	5.331	401.3	2846.9	141
2.65	7.986	0.451	0.004	5.340	443.2	2847.3	156
2.78	8.002	0.467	0.004	5.342	452.6	2847.7	159
2.93	8.015	0.480	0.004	5.343	458.5	2848.0	161
3.07	8.022	0.487	0.004	5.345	470.7	2848.2	165
3.20	8.040	0.505	0.004	5.354	513.3	2848.6	180
3.35	8.061	0.525	0.004	5.362	552.3	2849.1	194
3.48	8.082	0.546	0.005	5.369	590.8	2849.6	207
3.62	8.104	0.568	0.005	5.377	627.8	2850.1	220
3.77	8.127	0.591	0.005	5.384	662.6	2850.7	232
3.90	8.150	0.614	0.005	5.390	696.1	2851.2	244
4.03	8.176	0.640	0.005	5.396	724.0	2851.9	254
4.18	8.201	0.666	0.006	5.401	750.0	2852.5	263
4.32	8.226	0.691	0.006	5.406	773.8	2853.1	271
4.45	8.253	0.718	0.006	5.406	774.8	2853.7	271
4.60	8.344	0.809	0.007	5.363	558.7	2855.9	196
4.73	8.375	0.840	0.007	5.361	547.3	2856.6	192
4.87	8.401	0.866	0.007	5.361	551.3	2857.3	193
5.02	8.428	0.893	0.007	5.362	552.5	2857.9	193
5.15	8.470	0.934	0.008	5.358	533.5	2858.9	187

Unconfined Compressive Strength:	270	kPa
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS06**

Depth: **37.00 – 37.25m**

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.10** mm

Initial Length: **119.92** mm

Initial Mass: **686.61** g

Initial Bulk Density: **2.02** t/m³

Initial Dry Density: **1.70** t/m³

Water Content After Test: **19.5** %

Failure Conditions:

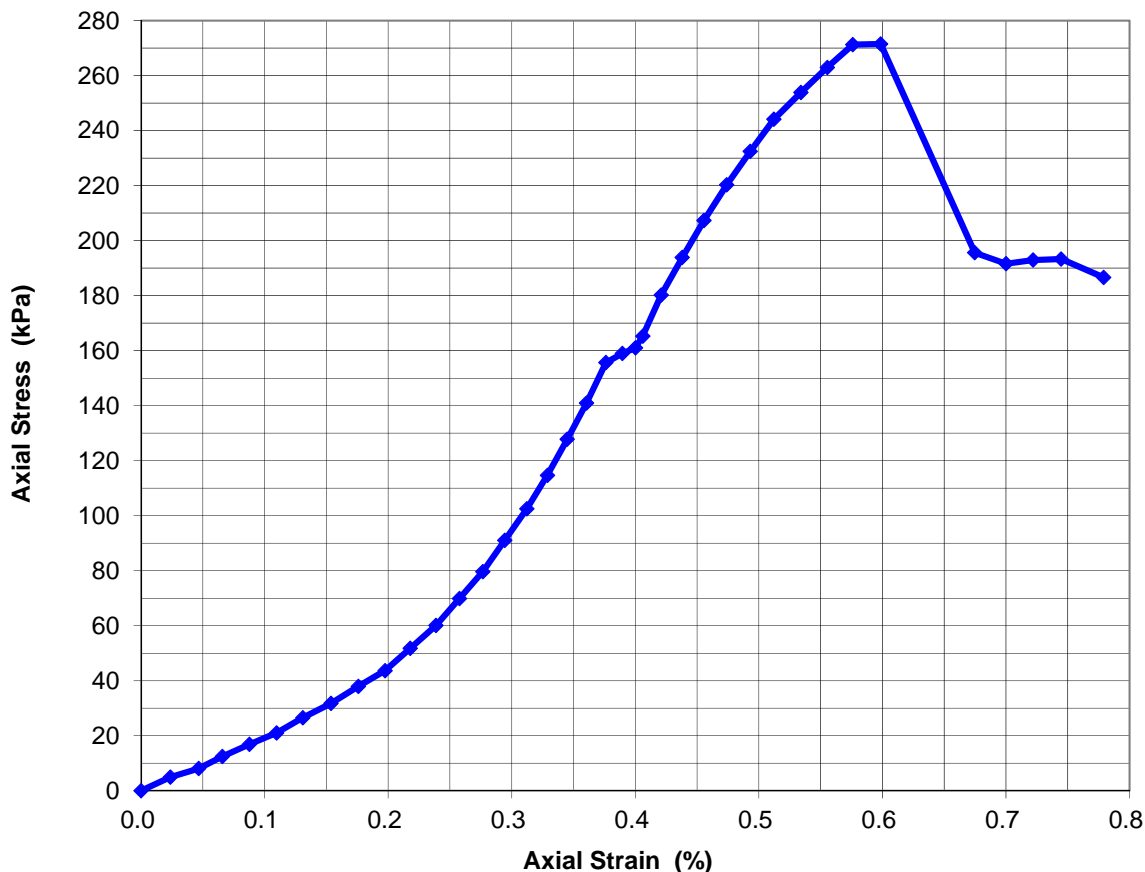
Strain at failure: **0.60** %

Compression at failure: **0.72** mm

Rate of Compression: **0.16** mm / minute

Mode of Failure: **planar / brittle**

Stress - Strain Curve



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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1		Tested By:	WEC 28-Sep-23
		Compiled By:	WEC 28-Sep-23
		Checked By:	JF 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS06**

Depth: **37.00 – 37.25m**

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, dark orange, uncemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Job No:	Reg. No:	Report No:	Page 61 of 69
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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M03

Sample Number: UCS07

Depth: 40.14 – 40.43m

[illegible]

Unconfined Compressive Strength:	92	kPa
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS07

Depth: 40.14 – 40.43m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.04** mm

Initial Length: **114.86** mm

Initial Mass: **660.65** g

Initial Bulk Density: **2.03** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **23.4** %

Failure Conditions:

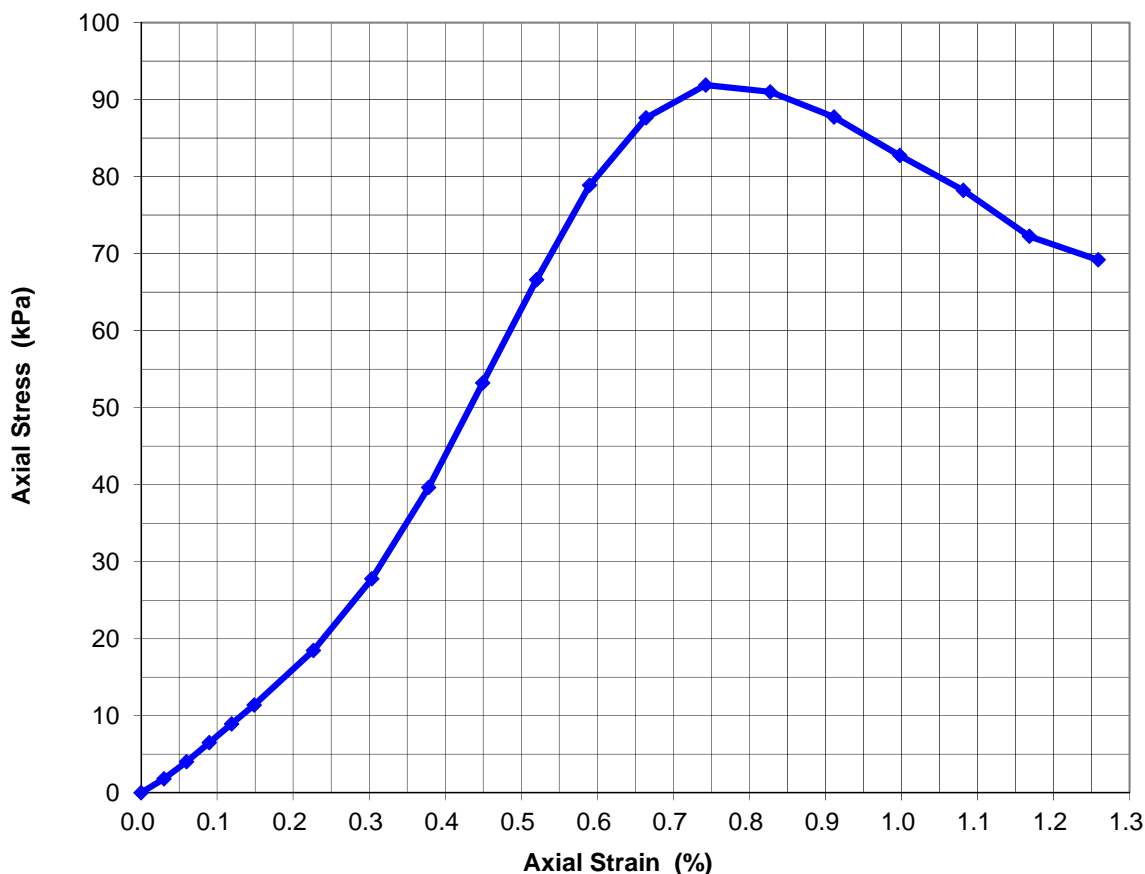
Strain at failure: **0.74** %

Compression at failure: **0.85** mm

Rate of Compression: **0.23** mm / minute

Mode of Failure: plastic

Stress - Strain Curve



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	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	28-Sep-23 28-Sep-23 2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS07**

Depth: **40.14 – 40.43m**

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, dark orange, uncemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



**Unconfined Compressive Strength of
Cohesive Soils**

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	2-Oct-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS08 Depth: 41.15 – 41.43m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	10.723	0.000	0.000	5.249	0.0	2914.3	0
0.37	10.791	0.068	0.001	5.257	43.0	2916.0	15
0.75	10.855	0.133	0.001	5.267	89.7	2917.6	31
1.12	10.907	0.185	0.002	5.285	181.8	2918.9	62
1.50	10.953	0.230	0.002	5.308	295.4	2920.1	101
1.87	10.994	0.271	0.002	5.332	419.8	2921.1	144
2.23	11.015	0.293	0.003	5.345	482.5	2921.6	165
2.62	11.053	0.330	0.003	5.364	577.7	2922.6	198
2.98	11.099	0.376	0.003	5.388	701.2	2923.7	240
3.27	11.134	0.411	0.004	5.408	796.8	2924.6	272
3.53	11.168	0.445	0.004	5.428	899.7	2925.5	308
3.82	11.201	0.478	0.004	5.449	1003.2	2926.3	343
3.95	11.219	0.496	0.004	5.459	1056.8	2926.7	361
4.23	11.254	0.531	0.005	5.480	1161.6	2927.6	397
4.52	11.289	0.567	0.005	5.500	1263.3	2928.5	431
4.65	11.307	0.584	0.005	5.511	1315.4	2929.0	449
4.78	11.325	0.602	0.005	5.521	1366.7	2929.4	467
4.93	11.343	0.620	0.005	5.531	1419.0	2929.9	484
5.07	11.361	0.638	0.005	5.542	1470.3	2930.3	502
5.20	11.378	0.655	0.006	5.552	1522.3	2930.7	519
5.35	11.396	0.673	0.006	5.562	1573.4	2931.2	537
5.48	11.414	0.691	0.006	5.572	1623.3	2931.7	554
5.63	11.432	0.709	0.006	5.582	1673.5	2932.1	571
5.77	11.452	0.729	0.006	5.592	1720.6	2932.6	587
5.90	11.471	0.748	0.006	5.601	1769.1	2933.1	603
6.05	11.491	0.768	0.007	5.610	1814.7	2933.6	619
6.18	11.510	0.787	0.007	5.619	1859.9	2934.1	634
6.32	11.530	0.807	0.007	5.629	1907.0	2934.6	650
6.47	11.551	0.828	0.007	5.637	1948.9	2935.1	664
6.60	11.571	0.848	0.007	5.645	1988.8	2935.6	677
6.75	11.593	0.870	0.007	5.651	2020.2	2936.2	688
6.88	11.616	0.893	0.008	5.659	2058.3	2936.8	701
7.02	11.641	0.918	0.008	5.663	2081.5	2937.4	709
7.17	11.666	0.943	0.008	5.667	2101.4	2938.0	715
7.30	11.693	0.970	0.008	5.666	2096.0	2938.7	713
7.43	11.726	1.003	0.009	5.656	2046.6	2939.5	696
7.58	11.893	1.170	0.010	5.490	1212.5	2943.8	412
7.72	11.970	1.247	0.011	5.433	923.8	2945.7	314
7.87	12.025	1.302	0.011	5.421	863.6	2947.1	293
8.00	12.069	1.347	0.012	5.413	825.6	2948.3	280
8.13	12.106	1.383	0.012	5.408	800.0	2949.2	271

Unconfined Compressive Strength: 720 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	2-Oct-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS08

Depth: 41.15 – 41.43m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.92** mm

Initial Length: **116.96** mm

Initial Mass: **585.46** g

Initial Bulk Density: **1.72** t/m³

Initial Dry Density: **1.15** t/m³

Water Content After Test: **49.9** %

Failure Conditions:

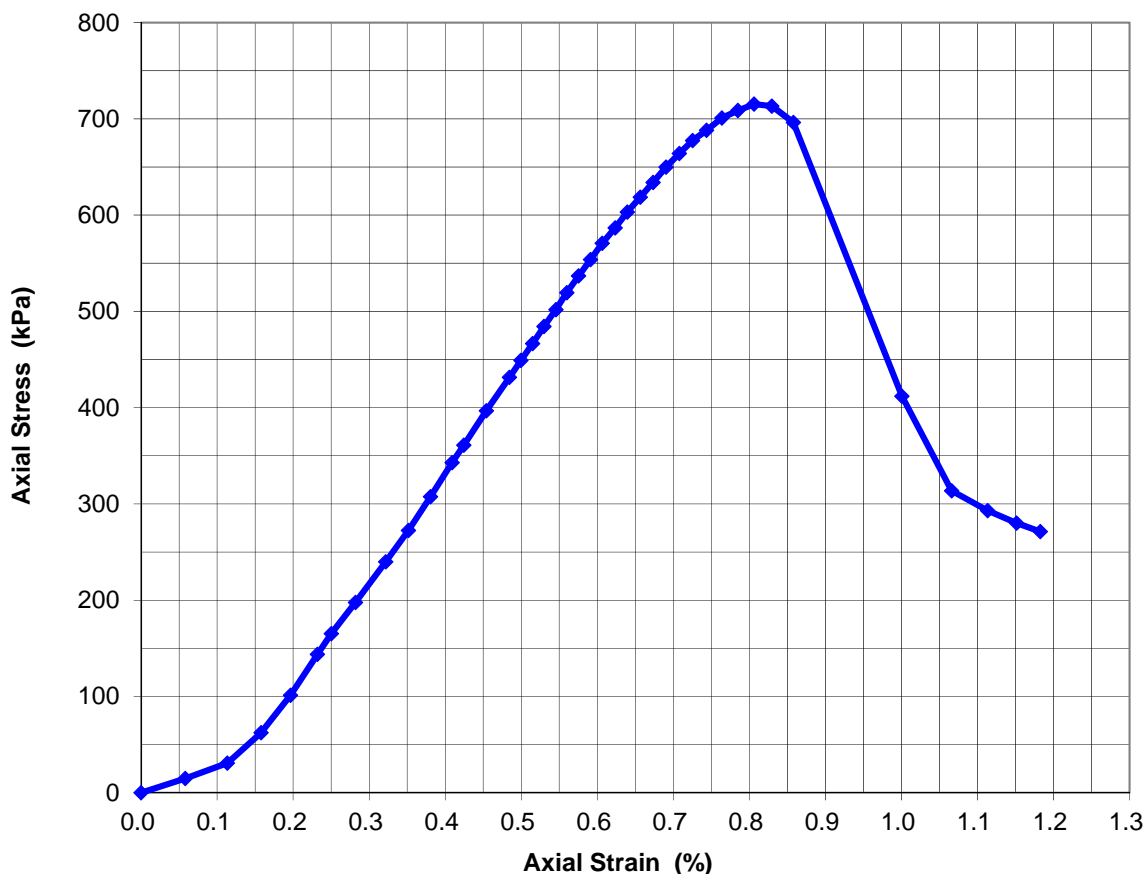
Strain at failure: **0.81** %


Compression at failure: **0.94** mm

Rate of Compression: **0.13** mm / minute

Mode of Failure: planar

Stress - Strain Curve



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	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			
Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1			Tested By: WEC Compiled By: WEC Checked By: JF	28-Sep-23 2-Oct-23 2-Oct-23
<p> Borehole: BH-M03 Sample Number: UCS08 Depth: 41.15 – 41.43m </p> <p>Sample Description (<i>not part of BGL IANZ Accreditation</i>):</p> <p>SILTSTONE, extremely weak, grey.</p>				
SAMPLE BEFORE TEST		SAMPLE AFTER TEST		
				

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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
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Compiled By:	WEC	28-Sep-23
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Checked By:	JF	2-Oct-23
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Borehole: BH-M03

Sample Number: **UCS09**

Depth: 50.73 – 51.00m

[illegible]

Unconfined Compressive Strength: 850 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS09

Depth: 50.73 – 51.00m

Test Performed on: rock / whole soil
Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.73** mm

Initial Length: **119.88** mm

Initial Mass: **652.28** g

Initial Bulk Density: **1.94** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.2** %

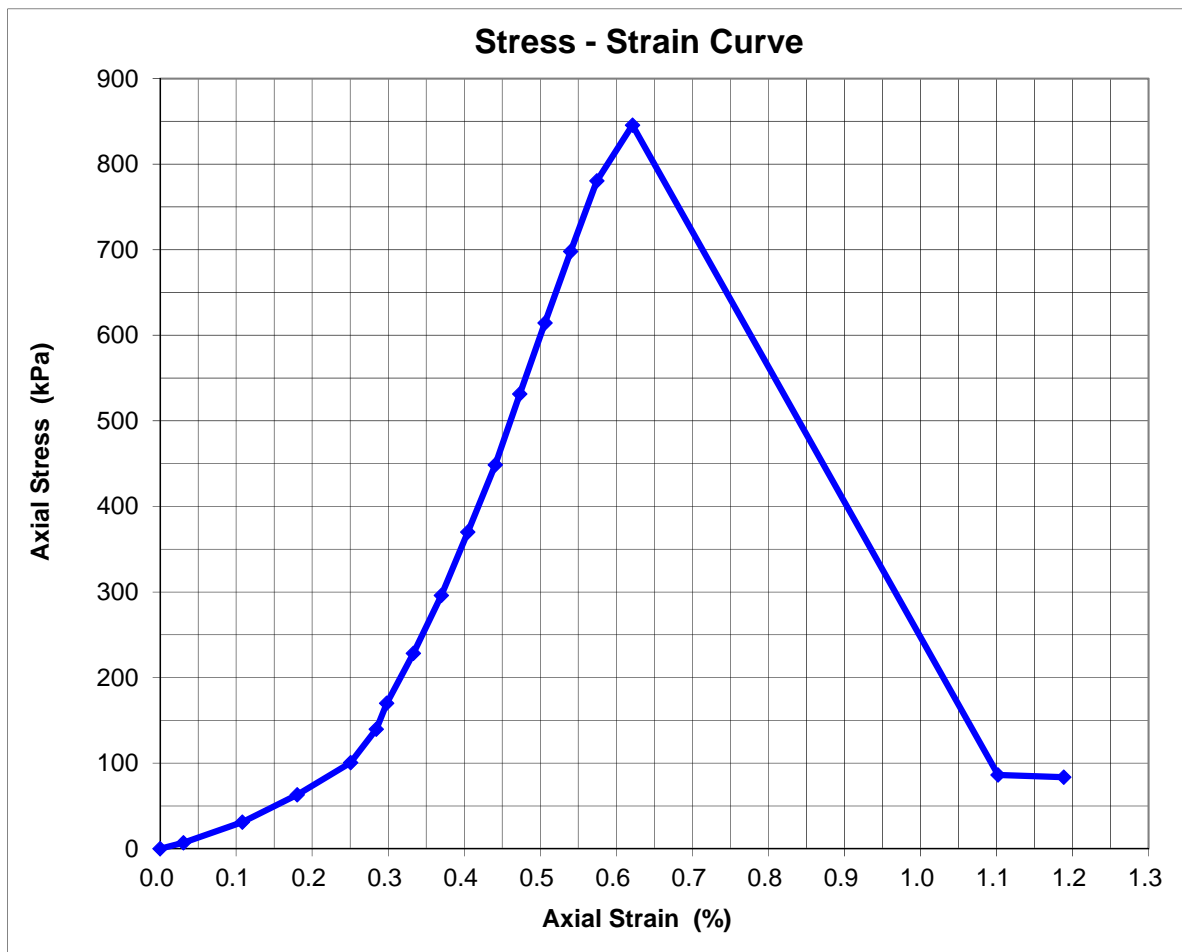
Failure Conditions:

Strain at failure: **0.62** %

Compression at failure: **0.74** mm

Rate of Compression: **0.14** mm / minute

Mode of Failure: brittle




BGL Babbage Geotechnical Laboratory	Job No:	Reg. No:	Report No:	Page 69 of 69
	63532#L	2806	63532#L/UCS Waitakere LHRA	Version 3, July 2022
	PROJECT: WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION			

Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	28-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23


Borehole: BH-M03 **Sample Number:** UCS09 **Depth:** 50.73 – 51.00m

Sample Description (not part of BGL IANZ Accreditation):
SANDSTONE, fine to medium, extremely weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST





18 October 2023

Our Ref: 1092481.0.1.0 & 1092481.0.2.0/Rep1

Customer Ref: 12612462

GHD Limited
Level 2, GHD Centre
27 Napier Street
Freemans Bay
Auckland 1011

Attention: John Southworth

Dear John

Muriwai Laboratory Test Report

Customer's Instructions

The detailed testing instructions were provided with a schedule from Mr. John Southworth.

Sampling Procedure

Samples have been tested as received from the customer.

Sample Location Plan

Not applicable.

Samples

Three core samples were received. All samples were labelled with Borehole number, sample reference, and depth.

Date of Sample Receipt

27 September 2023

Test Method(s)

ASTM D4647-13 (2020) - Pinhole

BS 1377: Part 5: 1990 Clause 6.3 - Dispersibility by the Crumb Method (not IANZ accredited)

NZS 4402: 1986 Test 2.1 - Water Content

Material Description

Descriptions are provided in the attached presentation pages.

Test Results

Test results are attached.

Test Remarks

Test remarks are detailed on the presentation pages.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information but are not covered under the IANZ endorsement of this report.


This report has been prepared for the benefit of GHD Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

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If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of the letterhead page.

GEOTECHNICS LTD

Report approved by:



.....
Helen Wang
Triaxial Laboratory Manager
Key Technical Person

Authorised for Geotechnics by:


.....
Corey Papu-Gread
Project Director



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

18-Oct-23

t:\geotechnicsgroup\projects\1092481\1000 triaxial\issueddocuments\20231018 muriwai pihe.rep1.docx

 GEOTECHNICS	1 Hill Street Onehunga Auckland New Zealand p. +64 9 356 3510	Geotechnics Project ID: 1092481.0.1.0 QESTLab Work Order ID: Customer Project ID: 12612462
Site/Location:	Muriwai	Location ID: BH-M01
Sample Ref.:	C5	Depth: 2.02 - 2.06 (m)
Test Method Used:	ASTM D4647-13 (2020) Pinhole Test (Method A) NZS 4402:1986 Test 2.1 Determination of Water Content	
Initial Water Content	48.7 (%)	Initial Bulk Density 1.65 (t/m ³)
Final Water Content	61.5 (%)	Initial Dry Density 1.11 (t/m ³)


Hydraulic head H (mm)	Duration of flow (min)	Rate of flow q (mL/sec)	Cloudiness of flow	
			From side	From top
50	5	1.14	Dark	Very dark
		1.25	Dark	Very dark
		1.28	Dark	Very dark
50	--			
180	--			
380	--			
1020	--			
Hole diameter after test:		2.2	(mm)	Dispersion Category: D1


Sample Description: Clayey SILT, dark brown; very soft, wet, high plasticity.

Sample History: Undisturbed core trimmed at natural water content.

Test Remarks:

1. The pinhole was formed with 1.1 mm diameter pin.
2. Distilled water was used in test.
3. Classification:
 D1, D2 -- Dispersive;
 ND4, ND3 -- Moderately to slightly dispersive;
 ND2, ND1 -- Non-dispersive.
4. The soil classified as non-dispersive still can erode in some circumstances.

Tested by: PIHE	Date: 12/10/2023	Approved by KTP: 	Date: 18/10/2023
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 GEOTECHNICS	1 Hill Street Onehunga Auckland New Zealand p. +64 9 356 3510	Geotechnics Project ID: 1092481.0.1.0 QESTLab Work Order ID: Customer Project ID: 12612462
Site/Location:	Muriwai	Location ID: BH-M02
Sample Ref.:	C15	Depth: 1.96 - 2.00 (m)
Test Method Used:	ASTM D4647-13 (2020) Pinhole Test (Method A) NZS 4402:1986 Test 2.1 Determination of Water Content	
Initial Water Content	52.3 (%)	Initial Bulk Density 1.69 (t/m ³)
Final Water Content	47.9 (%)	Initial Dry Density 1.11 (t/m ³)


Hydraulic head H (mm)	Duration of flow (min)	Rate of flow q (mL/sec)	Cloudiness of flow	
			From side	From top
50	5	0.36	Perfectly clear	Perfectly clear
		0.36	Perfectly clear	Perfectly clear
		0.35	Perfectly clear	Perfectly clear
50	5	0.33	Perfectly clear	Perfectly clear
		0.34	Perfectly clear	Perfectly clear
		0.34	Perfectly clear	Perfectly clear
180	5	0.75	Perfectly clear	Perfectly clear
		0.76	Perfectly clear	Perfectly clear
		0.74	Perfectly clear	Perfectly clear
380	5	1.20	Perfectly clear	Perfectly clear
		1.16	Perfectly clear	Perfectly clear
		1.15	Perfectly clear	Perfectly clear
1020	5	2.39	Perfectly clear	Perfectly clear
		2.43	Perfectly clear	Perfectly clear
		2.38	Perfectly clear	Perfectly clear
Hole diameter after test:		1.0	(mm)	Dispersion Category: ND1

Sample Description: Silty CLAY, orange brown; very soft, wet, high plasticity.

Sample History: Undisturbed core trimmed at natural water content.

Test Remarks:

- The pinhole was formed with 1.1 mm diameter pin.
- Distilled water was used in test.
- Classification:
 D1, D2 -- Dispersive;
 ND4, ND3 -- Moderately to slightly dispersive;
 ND2, ND1 -- Non-dispersive.
- The soil classified as non-dispersive still can erode in some circumstances.

Tested by: PIHE	Date: 10/10/2023	Approved by KTP: 	Date: 18/10/2023
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		1 Hill Street, Onehunga, Auckland 1061 P 64 09 356 3510 www.geotechnics.co.nz	
Determination of Dispersibility - Crumb Method - BS 1377: Part 5: 1990 Clause 6.3			
Site:	Muriwai	Job No:	1092481.0000.2.0
Test Pit/BH No:	BH-M01 / C5	Sample No:	AKL657.1
Stopwatch ID:	S0596	Depth (m):	2.0 m
Sample Description:	clayey SILT, dark brown; very soft, wet, high plasticity		
Descriptive behaviour of the crumbs observed after allowing to stand for 5 to 10 min			
Observations:	Grade 4 - Strong reaction		
The soil classified asdispersive..... according to this test method.			
Remarks:			
Test Pit/BH No:	BH-M02 / C15	Sample No:	AKL657.2
Stopwatch ID:	S0596	Depth (m):	1.95 m
Sample Description:	silty CLAY, orange brown; very soft, wet, high plasticity		
Descriptive behaviour of the crumbs observed after allowing to stand for 5 to 10 min			
Observations:	Grade 4 - Strong reaction		
The soil classified asdispersive..... according to this test method.			
Remarks:			
Balance ID:	B0012		
Reagent Used: 0.001M solution of Sodium Hydroxide: Dissolve 0.04g of anhydrous sodium hydroxide in distilled water to make 1L of solution.			
Procedure: Prepare a few crumbs, each about 6mm to 10mm diameter, from a representative portions of the soil at the natural moisture content. Drop the crumbs into a beaker about one-third full of the sodium hydroxide solution. Observe the reaction after allowing to stand for 5 min to 10 min.			
OBSERVATIONS: Observe the behaviour of the crumbs in accordance with the following guidelines. Grade 1: No reaction: Crumbs may slake or run out to form a shallow heap on the bottom of the beaker, but there is no sign of cloudiness caused by colloids in suspension. Grade 2: Slight reaction: A very slight cloudiness can be seen in the water at the surface of a crumb. Grade 3: Moderate reaction: There is an easily recognizable cloud of colloids in suspension, usually spreading out in thin streaks at the bottom of the beaker Grade 4: Strong reaction: A colloidal cloud covers most of the bottom beaker, usually as a thin skin. In extreme cases all the water becomes cloudy.			
Grades 1 and 2 represent a non- dispersive reaction. Grades 3 and 4 represent a dispersive reaction. Remarks:			
Tested by:	KESA	Date:	10/10/2023
Checked by:	GEGO	Date:	10/10/2023

Appendix F4

Calibration Certificates for Shear Vane and SPT Hammer



Calibration Certificate

Certificate No: M720664.01

Certificate Issued To	GHD Limited		Address	3/27 Napier Street Freemans Bay Auckland		
Purchase Order No						
Manufacturer	Geotechnics	Model	Geovane	S/No	902	
				Unique ID		
Description	Handheld shear vane with matching blade(s)					
Calibration Date	3/04/2023		Temp During Test		19.7 to 20.1 °C	
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.					

Results

19 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	1.446	Area Ratio	23.3%
------------------------------	-------------	-------	------------	-------

Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)
0	0	30	43	60	87	90	130	120	174
2	3	32	46	62	90	92	133	122	176
4	6	34	49	64	93	94	136	124	179
6	9	36	52	66	95	96	139	126	182
8	12	38	55	68	98	98	142	128	185
10	14	40	58	70	101	100	145	130	188
12	17	42	61	72	104	102	148	132	191
14	20	44	64	74	107	104	150	134	194
16	23	46	67	76	110	106	153	136	197
18	26	48	69	78	113	108	156	138	200
20	29	50	72	80	116	110	159	140	202
22	32	52	75	82	119	112	162		
24	35	54	78	84	121	114	165		
26	38	56	81	86	124	116	168		
28	40	58	84	88	127	118	171		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ± 4.1 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in good condition.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of GHD Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by

 Ivan Caresosa
Calibration Technician

Checked by

 Agnelo Vaz
Senior Metrologist

Key Technical Person

 Agnelo Vaz
Senior Metrologist



All measurements reported herein have been performed in accordance with the laboratory's scope of accreditation



Calibration Certificate

Certificate No: M720829.03

Certificate Issued To	GHD Limited - Auckland		Address	3, GHD Centre 27 Napier Street Freemans Bay Auckland 1011		
Purchase Order No	11910201_BG-01.BG-01-04					
Manufacturer	Geotechnics	Model	Geovane	S/No	1060	
				Unique ID		
Description	Handheld shear vane with matching blade(s)					
Calibration Date	15/05/2023		Temp During Test	19.1 to 19.5 °C		
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.					

Results

19 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	1.547	Area Ratio	23.5%
------------------------------	-------------	-------	------------	-------

Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)
0	0	30	46	60	93	90	139	120	186
2	3	32	49	62	96	92	142	122	189
4	6	34	53	64	99	94	145	124	192
6	9	36	56	66	102	96	148	126	195
8	12	38	59	68	105	98	152	128	198
10	15	40	62	70	108	100	155	130	201
12	19	42	65	72	111	102	158	132	204
14	22	44	68	74	114	104	161	134	207
16	25	46	71	76	118	106	164	136	210
18	28	48	74	78	121	108	167	138	213
20	31	50	77	80	124	110	170	140	217
22	34	52	80	82	127	112	173		
24	37	54	84	84	130	114	176		
26	40	56	87	86	133	116	179		
28	43	58	90	88	136	118	183		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ± 7.6 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in good condition.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of GHD Limited - Auckland, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by

 Ivan Caresosa
Calibration Technician

Checked by

 Annalyse Ryan
Metrologist | Team Leader

Key Technical Person

 Annalyse Ryan
Metrologist | Team Leader



All measurements reported herein have been performed in accordance with the laboratory's scope of accreditation



Attention: Dave Penney
Organisation: DCN Drilling Limited
Email: dave@dcndrilling.co.nz

Letter Report:

SPT Energy Measurements on 5No. SPT Trip Hammers

1. Introduction

This letter report summarises the results of the Standard Penetration Test (SPT) energy measurements on 5No. SPT trip hammers for DCN Drilling Limited on 9 February 2023, at the site of 70A Maxwell Road, Maramarua, Waikato.

The SPT energy measurements were carried out to determine the average energy transfer ratio from the SPT hammer to the SPT rods during the Standard Penetration Tests. The SPT energy measurements were undertaken in accordance with ASTM D4633-16: *Standard Test Method for Energy Measurement for Dynamic Penetrometers*.

A Pile Driving Analyzer (PDA) Model 8G with add on SPT Analyzer software and a NW size instrumented SPT rod (manufactured by Pile Dynamics, Inc.) were used to acquire the test data. Adaptors from NW thread to tapered API thread were used on both ends of the instrumented rod to connect to the SPT rods.

The PDA system uses the Case Method equations to evaluate the test data. The maximum energy transfer (EMX) at the gauge location was obtained as the maximum value from integrating the product of force (F) and velocity (v) over time: $EMX = \max \int F(t)v(t)dt$.

In summary, the measured energy transfer ratios (ETR) for the 5No. SPT trip hammers are:

- Trip Hammer #1, average ETR of 68.1%.
- Trip Hammer #2, average ETR of 69.0%.
- Trip Hammer #3, average ETR of 68.5%.
- Trip Hammer #4, average ETR of 73.5%.
- Trip Hammer #5, average ETR of 63.9%.

The calibration certificates of the instruments used for SPT energy measurements are attached in Appendix A. The results of energy measurements are attached in Appendix B. The representative force and velocity plots are attached in Appendix C.



2. Drill Rigs

The Morooka drill rig and approximate 61 mm outer diameter SPT rods were used for energy measurements on the trip hammers #1 and #2. The trailer mounted drill rig and approximate 60 mm outer diameter SPT rods were used for energy measurements on the trip hammers #3, #4 and #5. Photos of the two rigs are presented in Figures 2-1 and 2-2 below.



Figure 2-1: Photos of the Morooka drill rig and the instrumented SPT rod assembly.



Figure 2-2: Photos of the trailer mounted drill rig and the instrumented SPT rod assembly.



3. Energy Measurements of SPT Trip Hammer #1

Photos of the SPT trip hammer #1 are presented in Figure 3-1 below.



Figure 3-1: Photos of SPT trip hammer #1

A summary of energy measurements on the trip hammer #1 is presented in Table 3-1 below.

Table 3-1: Summary of energy measurements on SPT trip hammer #1

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #1	1	13.5	35	0.281 – 0.351	0.303	59.2% - 73.9%	63.9%
	2	15	35	0.306 – 0.380	0.339	64.4% - 80.1%	71.3%
	3	16.5	44	0.311 – 0.352	0.327	65.5% - 74.1%	69.0%
	Overall			-	0.323	-	68.1%



4. Energy Measurements of SPT Trip Hammer #2

Photos of the SPT trip hammer #2 are presented in Figure 4-1 below.



Figure 4-1: Photos of SPT trip hammer #2

A summary of energy measurements on the trip hammer #2 is presented in Table 4-1 below.

Table 4-1: Summary of energy measurements on SPT trip hammer #2

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #2	1	9	31	0.265 – 0.330	0.299	55.8% - 69.6%	63.0%
	2	10.5	37	0.329 – 0.364	0.347	69.2% - 76.7%	73.1%
	3	12	29	0.319 – 0.363	0.336	67.2% - 76.5%	70.8%
	Overall			-	0.327	-	69.0%



5. Energy Measurements of SPT Trip Hammer #3

Photos of the SPT trip hammer #3 are presented in Figure 5-1 below.



Figure 5-1: Photos of SPT trip hammer #3

A summary of energy measurements on the trip hammer #3 is presented in Table 5-1 below.

Table 5-1: Summary of energy measurements on SPT trip hammer #3

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #3	1	9	19	0.336 – 0.401	0.360	70.7% - 84.4%	75.9%
	2	10.5	34	0.292 – 0.336	0.312	61.5% - 70.9%	65.7%
	3	12	50	0.277 – 0.323	0.304	58.5% - 68.1%	64.0%
	Overall			-	0.325	-	68.5%



6. Energy Measurements of SPT Trip Hammer #4

Photos of the SPT trip hammer #4 are presented in Figure 6-1 below.



Figure 6-1: Photos of SPT trip hammer #4

A summary of energy measurements on the trip hammer #4 is presented in Table 6-1 below.

Table 6-1: Summary of energy measurements on SPT trip hammer #4

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #4	1	9	32	0.321 – 0.376	0.354	67.7% - 79.2%	74.7%
	2	10.5	35	0.335 – 0.377	0.359	70.6% - 79.4%	75.6%
	3	12	50	0.288 – 0.372	0.334	60.6% - 78.4%	70.3%
	Overall			-	0.349	-	73.5%



7. Energy Measurements of SPT Trip Hammer #5

Photos of the SPT trip hammer #5 are presented in Figure 7-1 below.



Figure 7-1: Photos of SPT trip hammer #5

A summary of energy measurements on the trip hammer #5 is presented in Table 7-1 below.

Table 7-1: Summary of energy measurements on SPT trip hammer #5

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #5	1	9	49	0.274 – 0.340	0.301	57.6% - 71.7%	63.5%
	2	10.5	29	0.270 – 0.339	0.300	56.9% - 71.4%	63.3%
	3	12	48	0.278 – 0.330	0.309	58.5% - 69.6%	65.0%
	Overall			-	0.303	-	63.9%



8. Limitations

This letter report has been prepared solely for the benefit of our client DCN Drilling Limited with respect to the particular instructions and relevant information provided to us. This letter report shall not be relied upon by any third parties or for any other purposes without our prior review and written agreement.

Authorised for Roc Consulting Limited by:

Richard (Liqiang) Zhang

Director | Principal Geotechnical Engineer

Email: Richard@roconconsulting.co.nz

Phone: +64 27 506 5893

Appendix:

- A. Instrument Calibration Certificates
- B. SPT Energy Measurements Results
- C. Representative Force and Velocity Plots



Appendix A

Instrument Calibration Certificates

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model 8G

Serial Number: 5402 LE

was calibrated on 14 JAN 2023

using a PDA Calibration Box whose output was calibrated with test equipment
traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by:



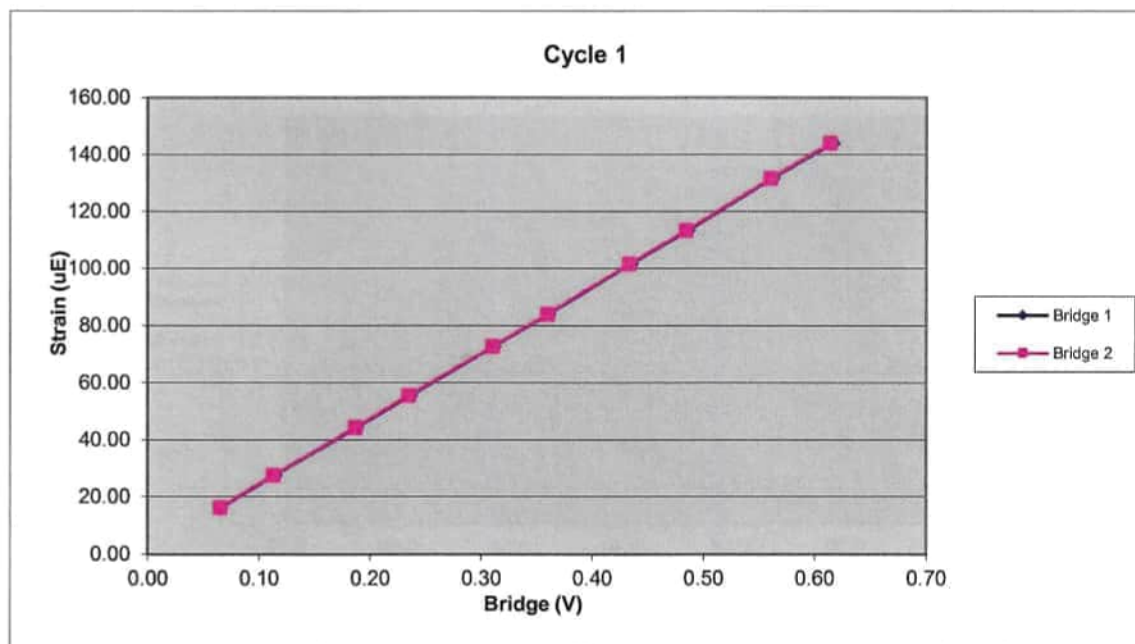
Mog

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

680NW		Cycle 1		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1047.49	16.11	0.07	0.06
3	1838.02	27.52	0.11	0.11
4	3029.38	44.17	0.19	0.19
5	3792.43	55.49	0.24	0.23
6	4997.05	72.74	0.31	0.31
7	5790.22	84.07	0.36	0.36
8	6984.70	101.62	0.44	0.43
9	7812.18	113.27	0.49	0.48
10	9035.41	131.64	0.56	0.56
11	9892.03	143.89	0.62	0.61

Bridge 1		Bridge 2	
Force Calibration (lb/V)	16069.95	Force Calibration (lb/V)	16102.53
Offset	-7.33	Offset	12.05
Correlation	0.999998	Correlation	0.999997
Strain Calibration ($\mu\text{E/V}$)	232.27	Strain Calibration ($\mu\text{E/V}$)	232.74
Offset	0.58	Offset	0.86
Correlation	0.999985	Correlation	0.999981

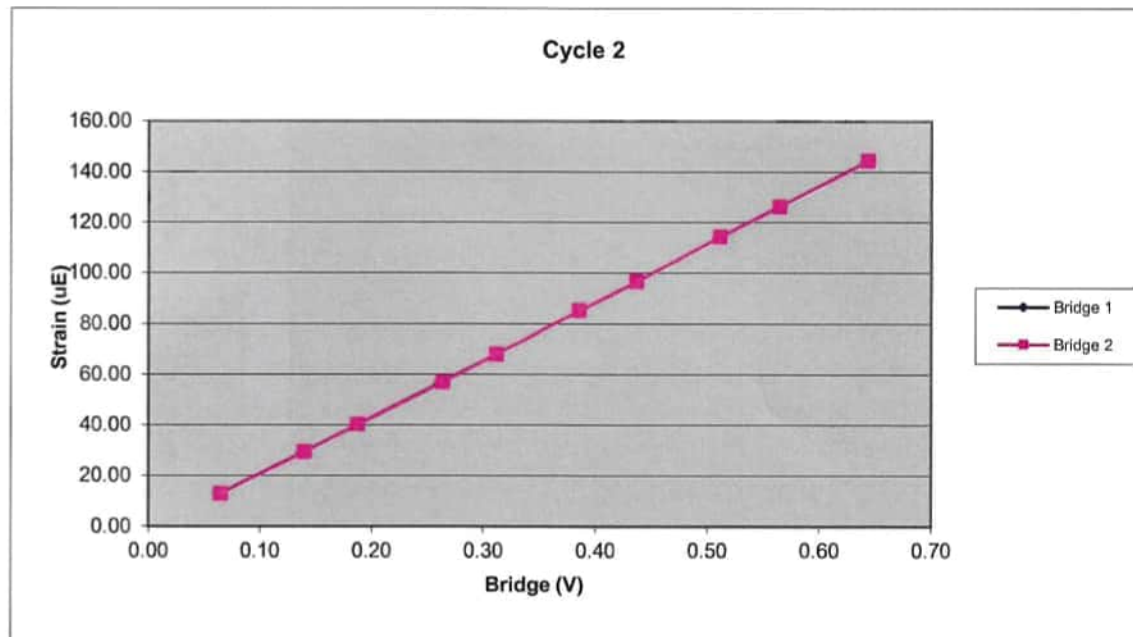
Force Strain Calibration	
EA (Kips)	69183.82
Offset	-47.26
Correlation	0.999980



680NW		Cycle 2		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1021.07	12.60	0.06	0.06
3	2216.04	29.05	0.14	0.14
4	2992.44	40.06	0.19	0.19
5	4197.45	56.78	0.26	0.26
6	4972.97	67.81	0.31	0.31
7	6170.08	84.96	0.39	0.39
8	6996.98	96.33	0.44	0.44
9	8196.33	113.89	0.51	0.51
10	9059.10	125.94	0.57	0.56
11	10316.06	143.97	0.64	0.64

Bridge 1		Bridge 2	
Force Calibration (lb/V)	16051.95	Force Calibration (lb/V)	16067.32
Offset	-10.90	Offset	-22.23
Correlation	0.999998	Correlation	0.999998
Strain Calibration ($\mu\text{E/V}$)	227.16	Strain Calibration ($\mu\text{E/V}$)	227.38
Offset	-2.46	Offset	-2.62
Correlation	0.999971	Correlation	0.999975

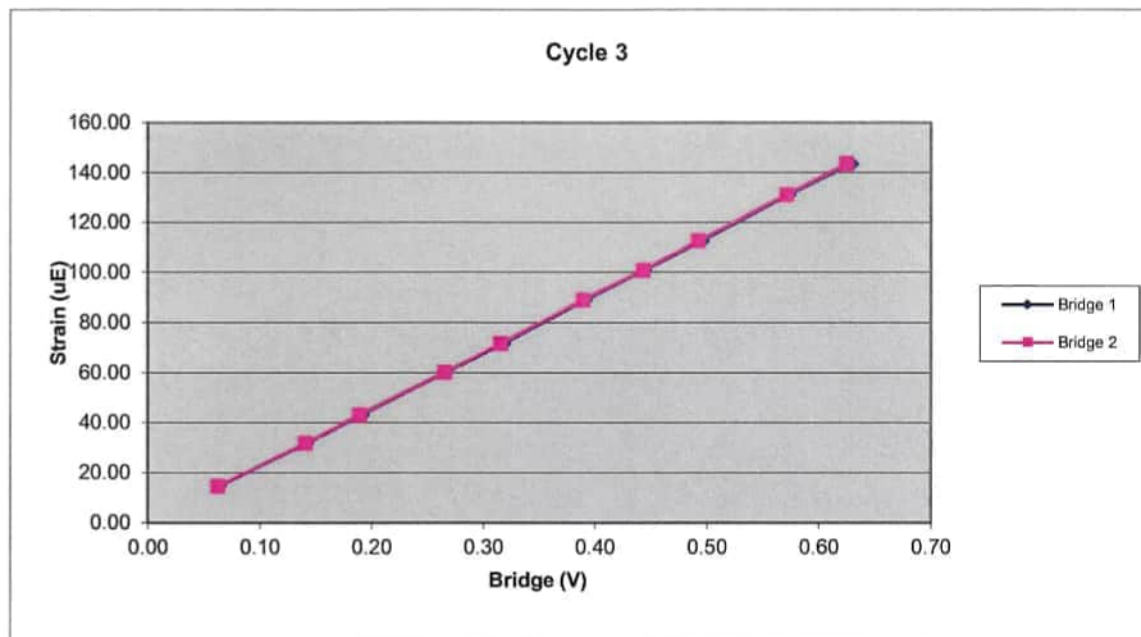
Force Strain Calibration	
EA (Kips)	70660.67
Offset	163.19
Correlation	0.999981



680NW		Cycle 3		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1020.49	14.40	0.06	0.06
3	2263.02	31.58	0.14	0.14
4	3049.95	43.03	0.19	0.19
5	4268.70	60.16	0.27	0.27
6	5085.36	71.61	0.32	0.32
7	6271.27	88.94	0.39	0.39
8	7122.33	100.84	0.44	0.44
9	7937.92	112.58	0.50	0.49
10	9201.80	131.04	0.57	0.57
11	10082.99	143.34	0.63	0.62

Bridge 1		Bridge 2	
Force Calibration (lb/V)	16048.19	Force Calibration (lb/V)	16118.06
Offset	-13.64	Offset	2.18
Correlation	0.999997	Correlation	0.999996
Strain Calibration ($\mu\text{E/V}$)	228.89	Strain Calibration ($\mu\text{E/V}$)	229.89
Offset	-0.75	Offset	-0.52
Correlation	0.999975	Correlation	0.999975

Force Strain Calibration	
EA (Kips)	70109.18
Offset	39.07
Correlation	0.999984



Bridge Excitation (V) 5
Shunt Resistor (ohm) 60.4k

Calibration Factors	680NW		
Bridge 1 ($\mu\text{E/V}$)	229.44	Bridge 2 ($\mu\text{E/V}$)	230.00
EA Factor (Kips)	69984.56	Area (in^2)	2.33

Calibrated by: Sea Baw
Calibrated Date: 1/12/2023

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.

Calibration performed on 14 JAN 2023

Serial No: K12864 Temperature: 73.0 °F

Model: PR Humidity: 49%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

416.1 mv/5000g

(83.2 μ v/g)

R²: 0.999916 [Chip programmed]

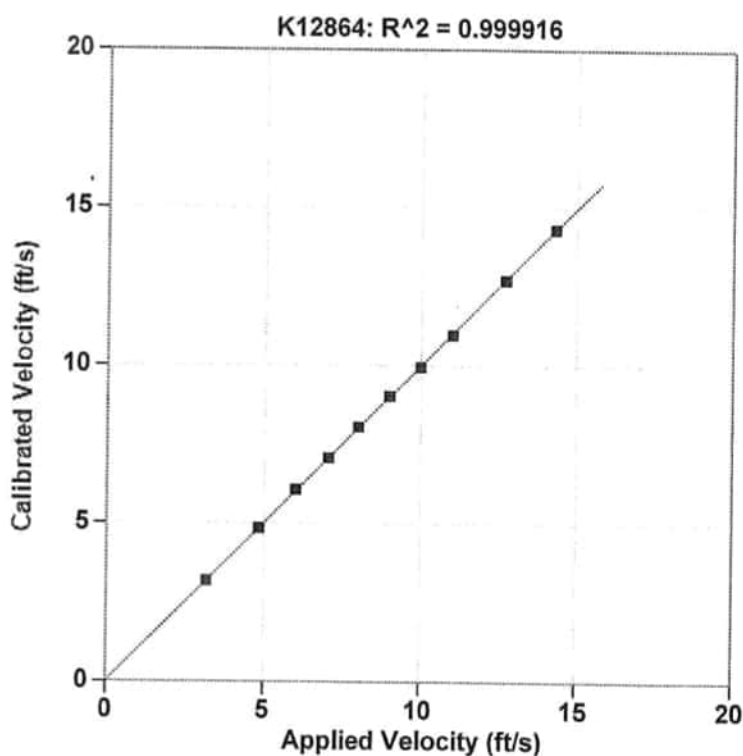
Operator: William Johnson

William Johnson
Signed

Ref Acc 1: 72505! Cal on: 24Mar2022
1035 g's/volt

Ref Acc 2: 72517! Cal on: 24Mar2022
1049 g's/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Reference Velocity	S/N K12864 Velocity
ft/s	ft/s
3.178	3.180
4.832	4.851
6.009	6.063
7.063	7.059
8.019	8.055
9.010	9.034
9.990	9.952
11.010	10.962
12.703	12.691
14.307	14.318
Maximum Acceleration: 959 g's	

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.

Calibration performed on **14 JAN 2023**

Serial No: K12865 Temperature: 73.0 °F

Model: PR Humidity: 50%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

430.9 mv/5000g

(86.2 μ v/g)

R²: 0.999905 [Chip programmed]

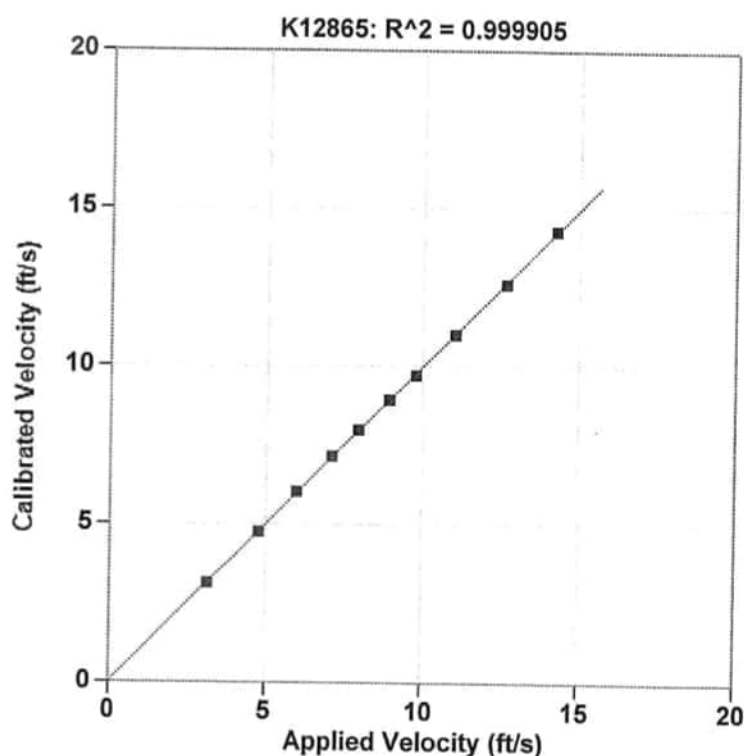
Operator: William Johnson

Ref Acc 1: 72505! Cal on: 24Mar2022
1035 g's/volt

Ref Acc 2: 72517! Cal on: 24Mar2022
1049 g's/volt


Signed

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Reference Velocity	S/N K12865 Velocity
ft/s	ft/s
3.173	3.138
4.769	4.760
5.982	6.019
7.127	7.146
7.959	7.988
8.938	8.943
9.775	9.724
11.013	11.001
12.641	12.601
14.249	14.294
Maximum Acceleration: 963 g's	



Appendix B

SPT Energy Measurements Results

Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1

BH02 Test 1 at 13.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 15.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
14	13.5	0	284.7	60.0	140	2.24	21.0	2,170	15	92.8	0.5
15	13.5	0	293.1	61.8	161	2.42	23.0	2,208	10	107.0	1.1
16	13.5	0	289.2	60.9	140	2.21	22.8	2,040	18	93.3	0.5
17	13.5	0	310.3	65.4	152	2.31	21.7	2,223	24	101.0	0.4
18	13.5	0	309.9	65.3	155	2.43	21.2	2,237	25	103.0	0.9
19	13.5	0	305.3	64.3	159	2.44	21.0	2,295	20	105.5	1.0
20	13.5	0	317.4	66.9	156	2.70	21.6	2,377	25	103.7	0.9
21	13.5	0	332.1	70.0	153	2.31	20.9	2,298	42	101.7	0.6
22	13.5	0	280.8	59.2	145	2.24	21.0	2,152	21	96.4	0.4
23	13.5	0	350.6	73.9	152	2.37	20.5	2,358	71	101.1	0.4
24	13.5	0	301.4	63.5	144	2.30	12.2	2,283	31	95.5	0.5
25	13.5	0	334.0	70.4	161	2.51	18.2	2,405	41	107.4	0.3
26	13.5	0	280.8	59.2	149	2.29	21.3	2,250	12	99.3	0.3
27	13.5	0	288.6	60.8	150	2.31	21.8	2,294	13	99.9	0.5
28	13.5	0	300.1	63.2	151	2.29	21.8	2,220	28	100.4	0.2
29	13.5	0	304.3	64.1	162	2.49	22.1	2,254	16	107.7	0.9
30	13.5	0	317.5	66.9	175	2.80	21.7	2,344	29	116.6	0.7
31	13.5	0	308.1	64.9	157	2.49	12.7	2,112	18	104.3	1.0
32	13.5	0	322.6	68.0	159	2.41	21.6	2,190	33	106.0	0.5
33	13.5	0	299.1	63.0	156	2.72	21.5	2,228	8	104.0	0.8
34	13.5	0	292.0	61.5	157	2.28	21.1	2,092	10	104.4	0.8
35	13.5	0	300.1	63.2	161	2.69	21.4	2,145	12	107.2	0.7
36	13.5	0	299.7	63.2	170	2.77	20.7	2,045	8	113.2	0.8
37	13.5	0	311.7	65.7	162	2.51	21.4	2,095	36	107.8	0.8
38	13.5	0	300.9	63.4	165	2.39	20.8	2,033	25	109.8	0.9
39	13.5	0	302.9	63.8	160	2.45	21.9	2,017	16	106.3	1.0
40	13.5	0	301.4	63.5	165	2.62	22.3	1,846	8	109.9	0.8
41	13.5	0	304.4	64.2	149	2.32	21.1	1,818	19	99.4	0.8
42	13.5	0	290.0	61.1	151	2.32	21.3	1,861	18	100.7	1.1
43	13.5	0	287.3	60.5	145	2.29	21.5	1,860	14	96.8	0.7
44	13.5	0	306.6	64.6	161	2.65	22.4	1,851	25	106.9	0.9
45	13.5	0	283.6	59.8	163	2.19	22.5	1,836	22	108.3	0.5
46	13.5	0	301.2	63.5	165	2.52	22.5	1,875	10	109.7	1.0
47	13.5	0	294.6	62.1	146	2.31	21.4	1,750	10	97.4	0.7
48	13.5	0	312.1	65.8	160	2.80	20.9	1,898	15	106.5	0.7
Average			303.4	63.9	156	2.44	20.9	2,113	21	103.7	0.7

Total number of blows analyzed: 35

BL# Sensors

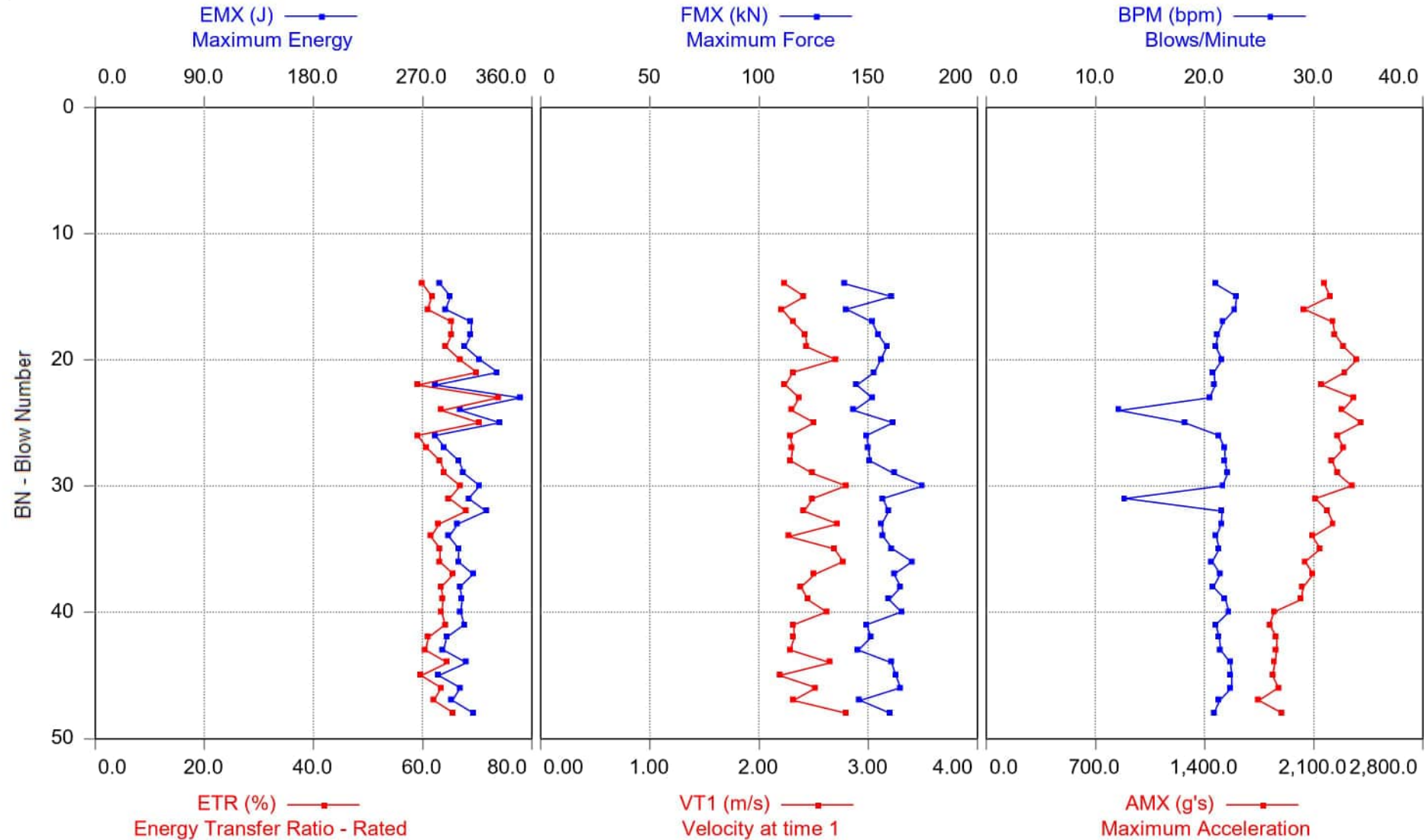
14-48 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 19 seconds 12:16 pm - 12:18 pm BN 1 - 48



2023-02-09 DCN Drilling - SPT Drop Hammer No.1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1_1

BH02 Test 2 at 15m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 16.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
16	15.0	0	349.9	73.7	151	2.75	21.3	2,928	36	100.3	0.5
17	15.0	0	351.4	74.1	156	2.79	21.8	3,026	30	103.5	0.7
18	15.0	0	379.9	80.1	157	2.76	23.0	2,919	50	104.3	0.6
19	15.0	0	362.2	76.3	147	2.71	22.8	2,782	47	97.5	0.6
20	15.0	0	336.4	70.9	150	2.74	21.3	2,909	34	99.8	0.5
21	15.0	0	335.8	70.8	145	2.68	21.2	2,754	34	96.8	0.6
22	15.0	0	360.9	76.1	152	2.71	21.1	2,915	39	101.2	0.6
23	15.0	0	366.7	77.3	152	2.70	20.9	2,829	38	101.2	0.6
24	15.0	0	344.4	72.6	161	2.70	22.0	2,940	27	107.3	0.6
25	15.0	0	340.2	71.7	150	2.71	20.4	2,861	34	100.1	0.6
26	15.0	0	349.4	73.6	153	2.73	9.2	2,982	33	102.0	0.7
27	15.0	0	342.0	72.1	150	2.63	21.8	2,826	32	99.5	0.7
28	15.0	0	313.5	66.1	143	2.59	22.9	2,668	31	95.0	0.6
29	15.0	0	343.0	72.3	145	2.62	21.5	2,763	39	96.5	0.6
30	15.0	0	338.3	71.3	147	2.63	21.3	2,721	41	98.0	0.6
31	15.0	0	334.4	70.5	158	2.74	22.0	2,952	31	105.2	0.6
32	15.0	0	374.1	78.8	149	2.68	22.0	2,892	38	99.5	0.5
33	15.0	0	343.9	72.5	152	2.67	22.2	2,891	32	101.2	0.6
34	15.0	0	342.9	72.3	141	2.63	22.3	2,633	40	94.1	0.6
35	15.0	0	311.1	65.6	149	2.62	22.4	2,762	31	98.8	0.6
36	15.0	0	338.7	71.4	147	2.64	22.3	2,690	43	97.8	0.6
37	15.0	0	348.5	73.4	145	2.60	22.1	2,629	38	96.4	0.6
38	15.0	0	315.0	66.4	147	2.62	21.6	2,704	32	98.1	0.6
39	15.0	0	334.4	70.5	147	2.59	21.5	2,760	28	97.9	0.7
40	15.0	0	318.1	67.0	148	2.64	22.9	2,756	26	98.5	0.6
41	15.0	0	324.2	68.3	145	2.53	22.1	2,659	23	96.6	0.6
42	15.0	0	331.0	69.7	144	2.63	21.5	2,782	29	96.0	0.7
43	15.0	0	334.2	70.4	151	2.58	21.6	2,779	29	100.6	0.5
44	15.0	0	324.7	68.4	146	2.54	22.6	2,548	30	96.8	0.5
45	15.0	0	305.6	64.4	149	2.54	21.5	2,586	23	99.2	0.5
46	15.0	0	329.9	69.5	148	2.58	22.3	2,653	30	98.4	0.5
47	15.0	0	309.1	65.1	146	2.58	21.9	2,614	17	96.9	0.6
48	15.0	0	323.0	68.1	145	2.59	16.4	2,660	19	96.2	0.7
49	15.0	0	349.4	73.6	145	2.64	21.4	2,699	37	96.8	0.6
50	15.0	0	341.2	71.9	165	2.93	21.3	3,043	29	109.9	0.8
Average			338.5	71.3	149	2.66	21.3	2,786	33	99.4	0.6

Total number of blows analyzed: 35

BL# Sensors

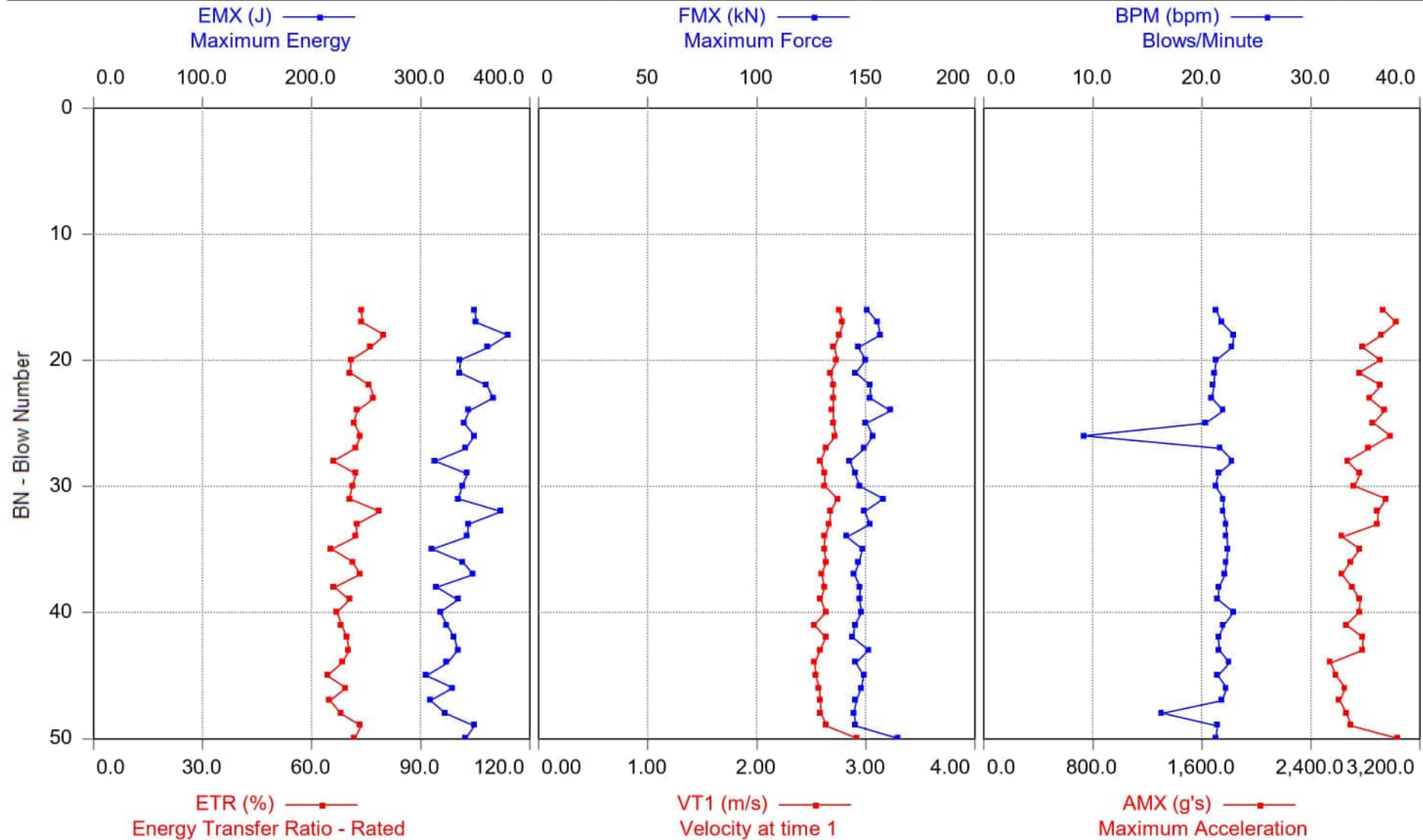
16-50 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 18 seconds 12:54 pm - 12:57 pm BN 1 - 50



2023-02-09 DCN Drilling - SPT Drop Hammer No.1_1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1_2

BH02 Test 3 at 16.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 18.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
19	16.5	0	311.8	65.7	156	2.89	20.7	2,551	13	104.0	0.7
20	16.5	0	314.7	66.3	162	2.94	21.8	2,543	19	107.8	0.7
21	16.5	0	329.9	69.5	209	3.18	20.8	2,737	10	139.4	0.4
22	16.5	0	331.7	69.9	193	3.43	20.2	2,758	12	128.5	0.4
23	16.5	0	311.9	65.7	173	2.86	20.6	2,647	14	115.3	0.7
24	16.5	0	331.9	69.9	182	3.26	19.9	2,765	12	121.1	0.5
25	16.5	0	351.7	74.1	217	3.51	19.8	2,703	18	144.4	0.3
26	16.5	0	323.2	68.1	179	3.06	21.3	2,644	9	118.9	0.6
27	16.5	0	318.4	67.1	179	2.82	21.2	2,635	14	119.3	0.7
28	16.5	0	341.3	71.9	238	3.67	21.1	2,927	9	158.1	0.2
29	16.5	0	324.5	68.4	237	3.18	21.6	3,022	10	157.7	0.2
30	16.5	0	324.3	68.3	183	3.14	21.1	2,749	11	121.6	0.5
31	16.5	0	321.3	67.7	218	3.40	21.9	2,838	10	144.7	0.3
32	16.5	0	319.7	67.4	178	3.10	22.3	2,664	13	118.3	0.5
33	16.5	0	319.6	67.4	179	2.97	20.7	2,590	8	119.3	0.6
34	16.5	0	330.5	69.6	174	3.25	21.6	2,582	8	115.7	0.5
35	16.5	0	321.9	67.8	182	3.19	21.7	2,682	12	121.4	0.5
36	16.5	0	322.6	68.0	176	3.28	21.6	2,616	9	117.0	0.4
37	16.5	0	314.6	66.3	185	3.35	15.4	2,407	8	123.3	0.6
38	16.5	0	326.2	68.7	253	3.13	21.1	2,811	8	168.4	0.7
39	16.5	0	326.8	68.9	169	3.00	21.2	2,466	17	112.4	0.7
40	16.5	0	325.5	68.6	255	3.10	22.0	2,826	8	169.9	0.7
41	16.5	0	347.9	73.3	236	3.85	21.9	2,771	15	156.8	0.3
42	16.5	0	344.1	72.5	200	3.35	20.6	2,427	14	132.9	0.6
43	16.5	0	335.8	70.8	210	3.64	21.3	2,687	8	139.4	0.4
44	16.5	0	322.4	67.9	196	3.47	21.3	2,545	8	130.7	0.5
45	16.5	0	343.5	72.4	209	3.55	21.7	2,452	17	139.2	0.4
46	16.5	0	325.9	68.7	244	3.69	12.3	2,704	8	162.2	0.2
47	16.5	0	349.0	73.5	186	3.28	20.3	2,490	19	123.6	0.6
48	16.5	0	320.3	67.5	185	3.17	21.7	2,482	8	123.2	0.7
49	16.5	0	345.7	72.8	210	3.64	21.0	2,486	18	140.0	0.4
50	16.5	0	321.9	67.8	204	3.59	21.6	2,550	8	135.6	0.5
51	16.5	0	310.7	65.5	247	3.60	22.1	2,705	11	164.4	0.2
52	16.5	0	331.4	69.8	218	3.75	21.8	2,560	19	144.7	0.4
53	16.5	0	323.4	68.2	247	3.60	22.0	2,690	8	164.6	0.3
54	16.5	0	319.6	67.3	260	3.28	17.7	2,712	12	172.9	0.5
55	16.5	0	316.4	66.7	189	3.33	21.7	2,525	31	125.5	0.5
56	16.5	0	332.6	70.1	251	3.73	20.8	2,627	18	167.3	0.2
57	16.5	0	335.2	70.6	242	3.54	20.3	2,508	31	161.3	0.2
58	16.5	0	334.2	70.4	210	3.50	21.1	2,429	29	139.5	0.4
59	16.5	0	327.9	69.1	243	3.71	21.5	2,540	22	161.9	0.2
60	16.5	0	321.9	67.8	204	3.62	21.0	2,408	23	135.5	0.4
61	16.5	0	321.5	67.7	262	3.32	20.5	2,760	17	174.1	0.5
62	16.5	0	329.8	69.5	237	3.71	11.4	2,475	27	158.0	0.3
Average			327.4	69.0	208	3.36	20.6	2,629	14	138.6	0.5

Total number of blows analyzed: 44

BL# Sensors

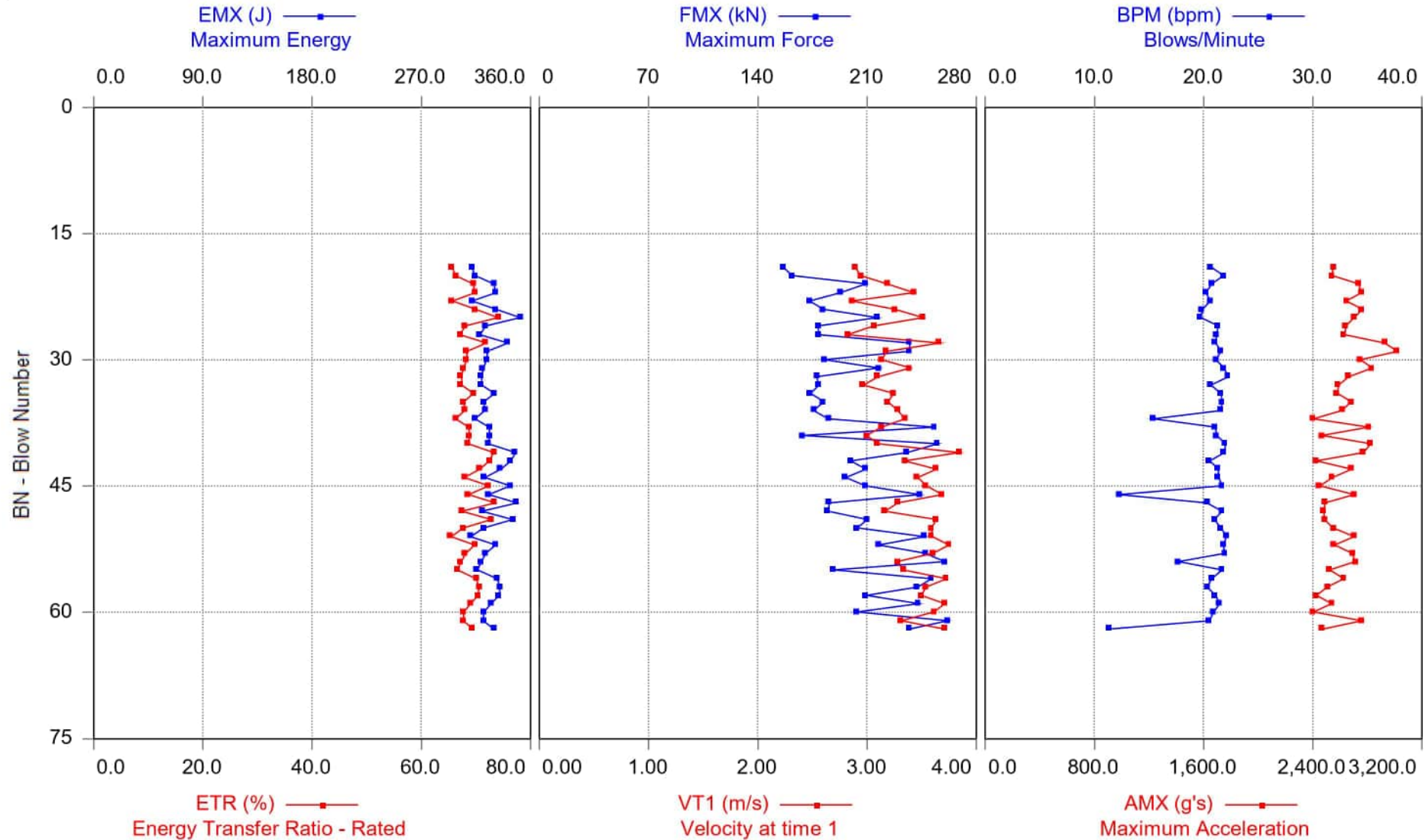
19-62 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 59 seconds 1:30 pm - 1:33 pm BN 1 - 62



2023-02-09 DCN Drilling - SPT Drop Hammer No.1_2



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2

BH02 Test 1 at 9m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 10.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
12	9.0	0	281.0	59.2	184	2.24	13.0	1,329	18	122.7	0.6
13	9.0	0	317.7	66.9	210	3.02	10.4	1,457	21	139.9	0.6
14	9.0	0	317.3	66.9	249	3.16	12.3	1,640	19	165.7	0.5
15	9.0	0	288.4	60.8	192	2.60	19.6	1,240	21	127.9	0.7
16	9.0	0	294.9	62.2	202	2.63	14.7	1,359	16	134.3	0.6
17	9.0	0	317.1	66.8	254	3.03	18.8	1,652	21	169.3	0.6
18	9.0	0	290.8	61.3	215	2.91	18.8	1,248	19	143.1	0.6
19	9.0	0	292.1	61.5	191	2.50	19.8	1,112	19	126.9	0.5
20	9.0	0	276.7	58.3	184	2.15	17.7	1,048	18	122.6	0.4
21	9.0	0	279.3	58.9	197	2.17	19.8	1,083	16	130.9	0.8
22	9.0	0	315.5	66.5	252	3.12	21.0	1,712	18	167.7	0.6
23	9.0	0	264.6	55.8	185	2.40	18.9	1,126	16	123.1	0.7
24	9.0	0	294.5	62.1	231	2.92	11.2	1,548	16	153.5	0.6
25	9.0	0	297.0	62.6	205	2.80	19.9	1,137	14	136.5	0.6
26	9.0	0	287.0	60.5	225	2.78	18.7	1,217	17	149.5	0.6
27	9.0	0	295.2	62.2	246	2.97	19.9	1,450	15	163.9	0.7
28	9.0	0	316.8	66.8	226	2.83	11.2	1,736	20	150.2	0.6
29	9.0	0	330.4	69.6	222	3.09	11.7	1,485	17	147.9	0.5
30	9.0	0	315.6	66.5	194	3.12	15.2	1,185	11	129.2	0.5
31	9.0	0	285.0	60.1	219	2.38	16.1	1,277	15	145.4	0.8
32	9.0	0	279.7	58.9	251	2.90	10.3	1,463	16	166.9	0.6
33	9.0	0	302.1	63.7	197	2.40	18.4	1,070	19	131.2	0.6
34	9.0	0	311.2	65.6	243	3.00	19.1	1,481	12	161.6	0.7
35	9.0	0	308.3	65.0	245	3.15	16.6	1,528	15	162.8	0.6
36	9.0	0	324.3	68.3	254	3.17	17.5	1,718	19	169.1	0.6
37	9.0	0	303.9	64.0	183	2.96	16.2	1,716	19	121.8	0.5
38	9.0	0	274.9	57.9	196	2.64	15.5	1,152	15	130.3	0.6
39	9.0	0	291.6	61.4	190	2.60	19.5	1,315	13	126.1	0.6
40	9.0	0	290.8	61.3	193	2.76	14.2	1,127	15	128.5	0.6
41	9.0	0	308.1	64.9	224	3.19	20.7	1,342	16	149.2	0.6
42	9.0	0	311.9	65.7	244	3.09	14.7	1,599	15	162.1	0.6
Average			298.8	63.0	216	2.79	16.5	1,373	17	143.9	0.6

Total number of blows analyzed: 31

BL# Sensors

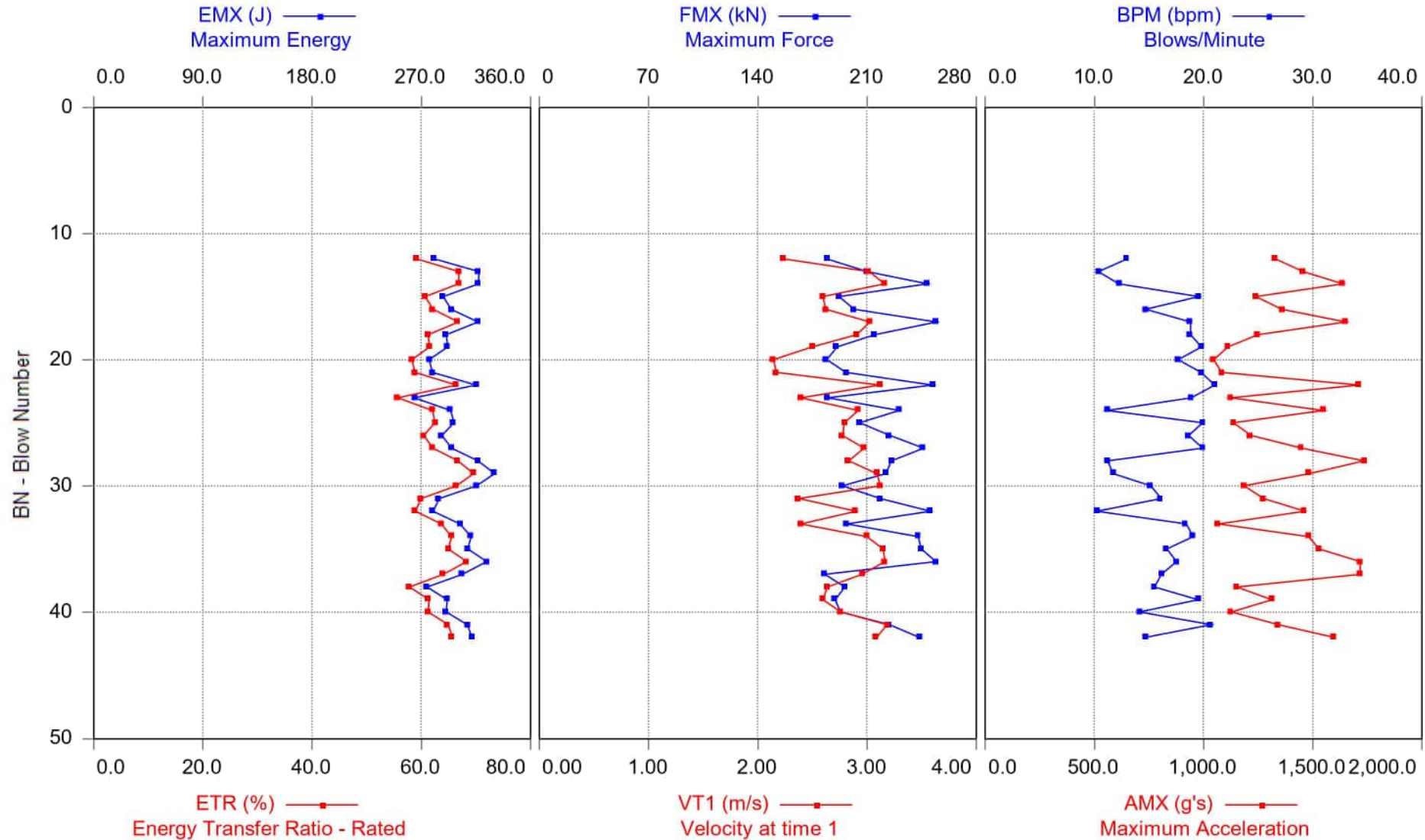
12-42 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 26 seconds 10:16 am - 10:18 am BN 3 - 42



2023-02-09 DCN Drilling - SPT Drop Hammer No.2



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2_1

BH02 Test 2 at 10.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 12.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
13	10.5	0	350.1	73.8	219	3.26	20.7	2,702	34	145.8	0.2
14	10.5	0	352.0	74.2	238	3.40	22.4	2,814	25	158.3	0.2
15	10.5	0	359.0	75.7	211	3.43	21.7	2,752	29	140.1	0.3
16	10.5	0	343.3	72.4	200	3.32	22.2	2,692	24	133.1	0.3
17	10.5	0	359.2	75.7	216	3.39	22.4	2,579	28	143.7	0.3
18	10.5	0	348.5	73.4	233	3.13	22.8	2,699	27	155.3	0.1
19	10.5	0	339.5	71.5	205	3.42	23.1	2,606	29	136.5	0.5
20	10.5	0	348.7	73.5	210	3.28	22.9	2,723	29	139.7	0.5
21	10.5	0	341.4	71.9	188	3.28	22.4	2,506	19	125.3	0.6
22	10.5	0	340.6	71.8	232	3.51	22.3	2,547	21	154.1	0.2
23	10.5	0	336.8	71.0	244	3.30	21.4	2,813	24	162.4	0.1
24	10.5	0	352.2	74.2	219	3.54	22.0	2,694	24	145.5	0.3
25	10.5	0	351.3	74.0	228	3.45	21.7	2,871	25	151.9	0.2
26	10.5	0	338.8	71.4	212	3.43	23.1	2,623	24	141.1	0.3
27	10.5	0	352.3	74.2	211	3.35	22.4	2,690	27	140.6	0.4
28	10.5	0	358.3	75.5	267	3.43	21.4	3,219	22	177.6	0.2
29	10.5	0	340.4	71.7	213	3.50	22.0	2,673	25	141.9	0.3
30	10.5	0	328.6	69.2	192	2.95	22.1	2,652	28	127.5	0.7
31	10.5	0	348.9	73.5	197	3.25	22.8	2,770	24	130.8	0.5
32	10.5	0	349.8	73.7	202	3.08	22.2	2,757	27	134.4	0.5
33	10.5	0	348.8	73.5	196	3.42	22.3	2,811	25	130.3	0.4
34	10.5	0	338.0	71.2	192	3.31	22.7	2,795	27	128.0	0.4
35	10.5	0	340.4	71.7	200	3.09	23.6	2,721	25	132.8	0.5
36	10.5	0	340.3	71.7	224	3.57	22.6	2,812	18	149.3	0.3
37	10.5	0	344.9	72.7	205	3.15	22.2	2,587	33	136.6	0.5
38	10.5	0	352.7	74.3	255	3.49	21.6	3,164	19	169.7	0.2
39	10.5	0	339.4	71.5	197	3.20	22.0	2,741	24	130.8	0.5
40	10.5	0	364.0	76.7	196	3.20	22.1	2,719	29	130.5	0.5
41	10.5	0	355.2	74.8	196	3.02	23.1	2,565	29	130.2	0.6
42	10.5	0	357.7	75.4	202	3.20	22.2	2,688	24	134.5	0.4
43	10.5	0	349.9	73.7	212	3.31	22.4	2,783	26	141.2	0.3
44	10.5	0	354.8	74.8	227	3.59	22.0	2,839	20	150.8	0.2
45	10.5	0	333.5	70.3	197	3.33	22.3	2,651	13	130.8	0.4
46	10.5	0	360.5	76.0	206	3.12	22.6	2,523	31	136.9	0.6
47	10.5	0	341.5	72.0	196	2.98	22.0	2,643	27	130.6	0.6
48	10.5	0	337.0	71.0	189	3.24	21.2	2,530	23	125.6	0.6
49	10.5	0	339.5	71.5	211	3.43	21.9	2,745	21	140.4	0.4
Average			347.0	73.1	212	3.31	22.2	2,722	25	140.9	0.4

Total number of blows analyzed: 37

BL# Sensors

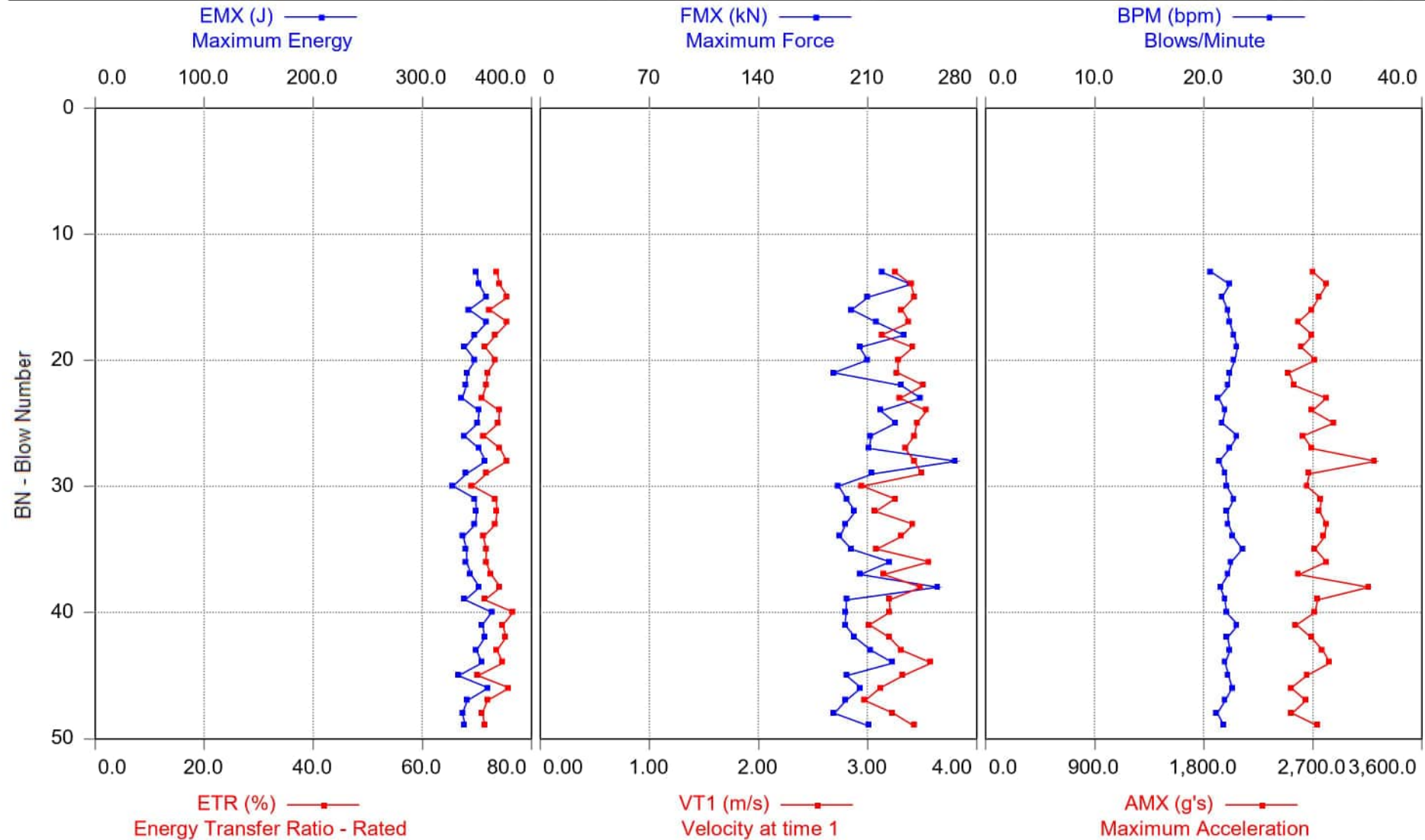
13-49 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 9 seconds 10:45 am - 10:47 am BN 1 - 49



2023-02-09 DCN Drilling - SPT Drop Hammer No.2_1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2_2

BH02 Test 3 at 12m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 13.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	336.6	70.9	252	3.39	20.8	2,896	24	167.7	0.6
11	12.0	0	336.2	70.8	255	3.18	21.3	3,276	30	169.9	0.7
12	12.0	0	325.6	68.6	198	3.27	20.6	2,627	24	131.8	0.6
13	12.0	0	335.9	70.8	251	3.73	20.6	2,792	25	167.1	0.3
14	12.0	0	352.5	74.3	213	3.48	21.9	2,577	30	141.9	0.4
15	12.0	0	339.4	71.5	258	3.63	21.3	2,951	29	171.4	0.3
16	12.0	0	356.7	75.2	216	3.45	21.4	2,658	29	144.0	0.3
17	12.0	0	336.5	70.9	260	3.26	15.3	3,163	23	172.7	0.7
18	12.0	0	344.9	72.7	229	3.51	21.8	2,761	23	152.3	0.3
19	12.0	0	318.7	67.2	192	2.82	21.6	2,536	25	127.9	0.8
20	12.0	0	338.4	71.3	260	3.29	21.6	3,115	25	173.3	0.6
21	12.0	0	335.9	70.8	208	3.40	21.8	2,556	21	138.2	0.6
22	12.0	0	346.6	73.0	248	3.69	21.3	2,699	33	165.0	0.3
23	12.0	0	328.9	69.3	210	3.39	20.5	2,548	22	140.0	0.4
24	12.0	0	329.0	69.3	266	3.23	21.9	2,843	22	177.1	0.6
25	12.0	0	352.7	74.3	230	3.34	21.6	2,707	36	152.7	0.4
26	12.0	0	340.6	71.8	258	3.23	22.3	2,937	22	171.3	0.7
27	12.0	0	344.2	72.5	266	3.64	21.4	3,132	22	177.1	0.2
28	12.0	0	322.5	68.0	229	3.74	21.7	2,627	20	152.2	0.3
29	12.0	0	325.9	68.7	259	3.60	21.1	2,771	17	172.4	0.3
30	12.0	0	328.3	69.2	259	3.43	22.1	2,742	19	172.0	0.5
31	12.0	0	330.6	69.7	213	3.53	21.7	2,657	21	141.5	0.4
32	12.0	0	321.8	67.8	230	3.58	21.6	2,615	19	152.8	0.3
33	12.0	0	326.1	68.7	256	3.39	22.6	2,535	14	170.1	0.5
34	12.0	0	362.9	76.5	259	3.70	21.7	2,792	39	172.0	0.3
35	12.0	0	335.3	70.7	253	3.79	22.2	2,753	23	168.0	0.2
36	12.0	0	342.1	72.1	262	3.41	21.7	2,777	23	174.2	0.3
37	12.0	0	325.4	68.6	198	3.09	21.2	2,370	23	131.8	0.7
38	12.0	0	328.0	69.1	248	3.66	21.8	2,617	21	165.3	0.2
Average			336.1	70.8	239	3.44	21.3	2,760	24	159.1	0.4

Total number of blows analyzed: 29

BL# Sensors

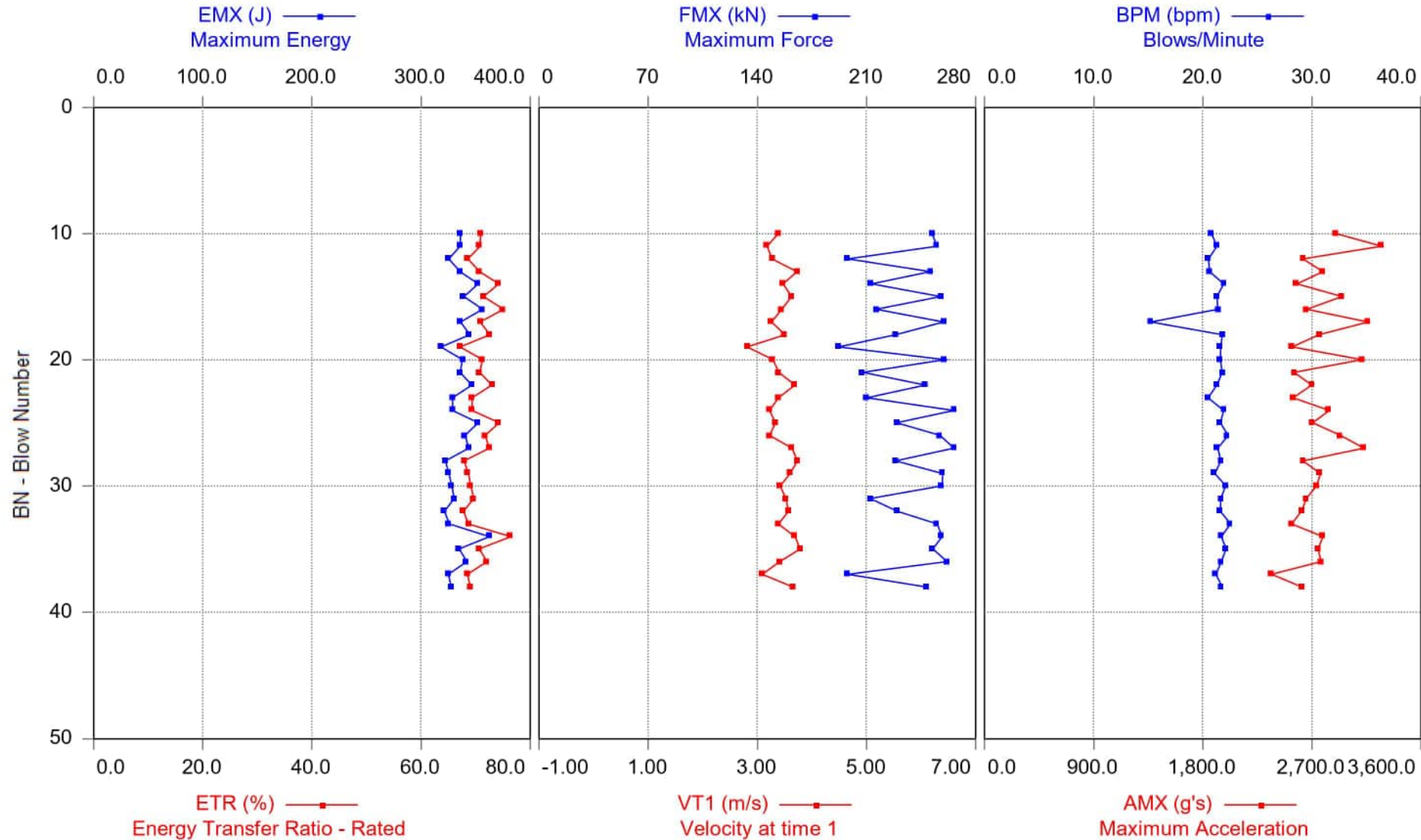
10-38 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 45 seconds 11:18 am - 11:19 am BN 1 - 38



2023-02-09 DCN Drilling - SPT Drop Hammer No.2_2



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3

BH03 Test 1 at 9m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 10.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
8	9.0	0	361.7	76.2	226	3.75	19.0	2,910	32	150.5	0.5
9	9.0	0	366.2	77.2	219	3.94	20.6	2,749	24	145.8	0.5
10	9.0	0	348.7	73.5	276	3.53	20.6	3,211	24	183.5	0.3
11	9.0	0	349.1	73.6	197	3.33	21.1	2,718	24	131.2	0.8
12	9.0	0	400.6	84.4	206	3.77	20.0	2,654	44	136.9	0.6
13	9.0	0	359.3	75.7	223	3.99	18.3	2,859	29	148.2	0.5
14	9.0	0	353.2	74.4	243	3.85	21.0	3,051	22	161.4	0.5
15	9.0	0	354.6	74.7	188	3.58	21.2	2,601	25	124.9	0.7
16	9.0	0	343.7	72.4	192	3.43	20.2	2,668	25	127.9	0.8
17	9.0	0	360.1	75.9	236	3.97	14.0	2,844	23	156.7	0.6
18	9.0	0	367.2	77.4	199	3.93	20.8	3,131	21	132.1	0.6
19	9.0	0	363.3	76.6	209	3.92	20.0	2,563	20	138.8	0.7
20	9.0	0	370.6	78.1	210	4.07	21.4	2,653	22	139.7	0.6
21	9.0	0	357.6	75.4	263	3.91	20.2	2,882	24	175.2	0.6
22	9.0	0	368.3	77.6	233	4.22	21.3	2,711	21	155.1	0.5
23	9.0	0	347.6	73.3	201	3.69	21.0	2,595	17	133.8	0.7
24	9.0	0	358.8	75.6	248	4.33	20.7	2,636	17	164.8	0.5
25	9.0	0	335.5	70.7	244	3.58	21.1	2,770	25	162.1	0.5
26	9.0	0	373.5	78.7	243	4.59	19.8	2,912	17	161.9	0.5
Average			360.0	75.9	224	3.86	20.1	2,796	24	149.0	0.6

Total number of blows analyzed: 19

BL# Sensors

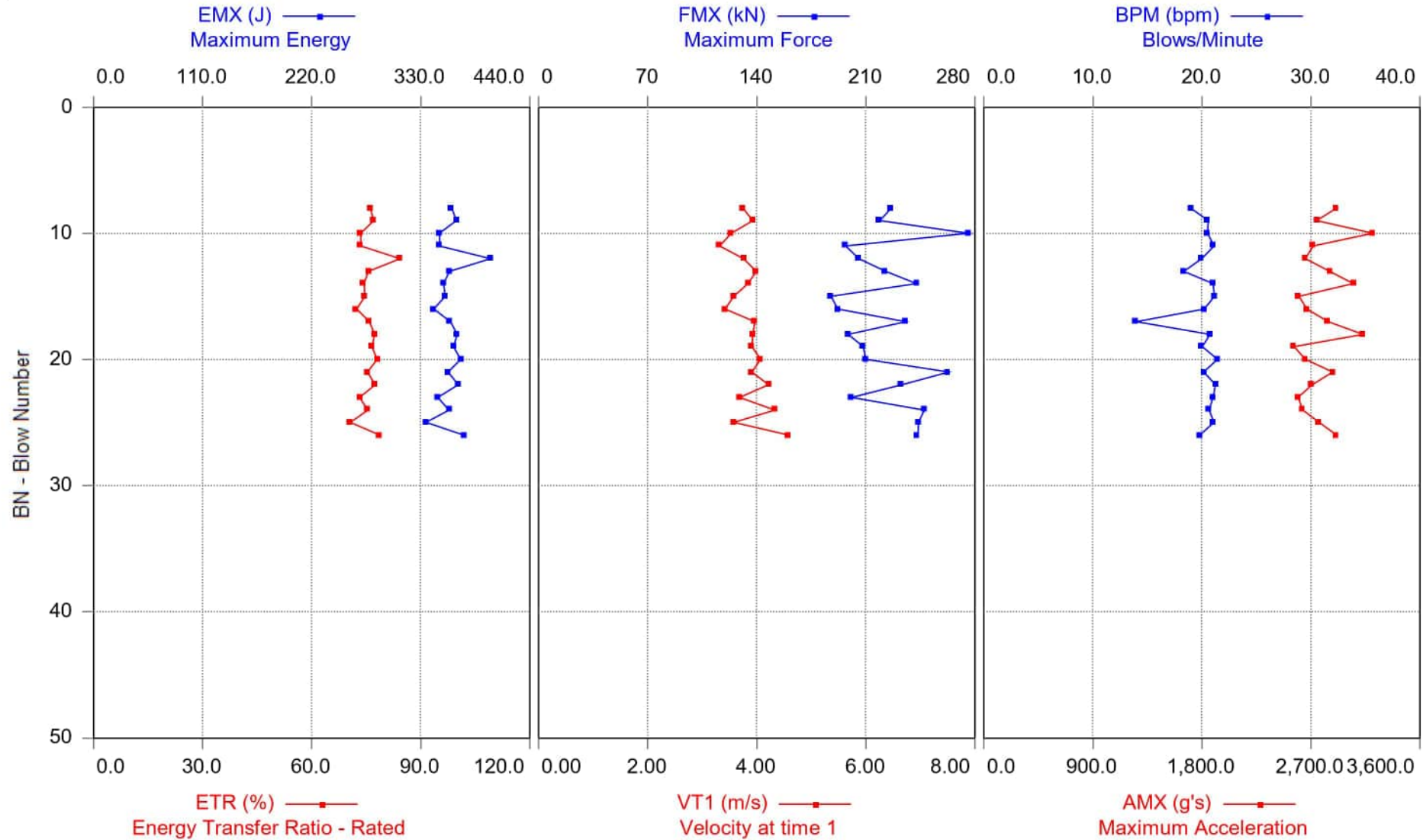
8-26 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 16 seconds 11:35 am - 11:36 am BN 1 - 26



2023-02-09 DCN Drilling - SPT Drop Hammer No.3



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_1

BH03 Test 2 at 10.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 12.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
11	10.5	0	336.4	70.9	219	3.51	16.9	3,086	30	145.6	0.3
12	10.5	0	301.1	63.4	191	3.06	22.9	2,665	27	126.7	0.6
13	10.5	0	296.2	62.4	181	2.72	23.0	2,513	20	120.4	0.4
14	10.5	0	318.4	67.1	215	3.25	22.3	3,115	23	143.1	0.5
15	10.5	0	304.8	64.2	233	3.15	21.4	3,315	21	155.2	0.2
16	10.5	0	299.0	63.0	184	3.44	14.7	2,607	17	122.5	0.4
17	10.5	0	308.2	64.9	203	3.56	21.3	2,676	17	134.8	0.4
18	10.5	0	310.0	65.3	222	3.30	20.9	2,853	16	147.5	0.2
19	10.5	0	313.6	66.1	192	3.32	21.0	2,604	17	128.0	0.4
20	10.5	0	304.9	64.3	242	3.10	21.2	3,208	16	160.8	0.6
21	10.5	0	315.6	66.5	236	3.28	21.4	3,203	20	157.3	0.6
22	10.5	0	312.5	65.9	210	3.69	21.3	2,855	15	139.6	0.4
23	10.5	0	320.3	67.5	192	3.54	21.4	2,741	24	127.4	0.5
24	10.5	0	318.7	67.2	246	3.33	21.7	3,153	21	163.6	0.2
25	10.5	0	291.7	61.5	185	3.04	21.6	2,518	14	123.4	0.6
26	10.5	0	298.1	62.8	191	2.76	22.8	2,470	18	126.8	0.4
27	10.5	0	319.1	67.2	232	3.56	22.3	2,990	24	154.6	0.2
28	10.5	0	325.6	68.6	226	3.50	22.9	3,013	21	150.3	0.3
29	10.5	0	319.0	67.2	254	3.55	21.0	3,225	20	168.9	0.2
30	10.5	0	308.7	65.1	166	3.16	20.3	2,466	26	110.4	0.8
31	10.5	0	321.2	67.7	174	3.40	22.0	2,368	35	115.6	0.6
32	10.5	0	315.2	66.4	183	3.42	21.3	2,562	25	121.5	0.4
33	10.5	0	303.4	63.9	238	3.12	21.3	3,327	19	158.5	0.3
34	10.5	0	313.3	66.0	173	3.12	22.5	2,428	22	115.3	0.5
35	10.5	0	318.3	67.1	186	3.65	20.9	2,520	16	123.6	0.4
36	10.5	0	307.0	64.7	184	3.56	21.2	2,451	14	122.2	0.5
37	10.5	0	317.8	67.0	192	3.66	20.9	2,438	17	127.9	0.5
38	10.5	0	315.5	66.5	194	3.66	21.5	2,462	16	129.2	0.5
39	10.5	0	309.8	65.3	241	3.38	20.8	3,034	18	160.5	0.4
40	10.5	0	316.7	66.7	233	3.41	20.5	3,042	19	155.2	0.3
41	10.5	0	295.5	62.3	172	2.95	20.6	2,384	18	114.6	0.6
42	10.5	0	318.7	67.2	208	3.78	20.7	2,418	17	138.3	0.3
43	10.5	0	296.9	62.6	177	2.91	15.7	2,272	16	117.9	0.7
44	10.5	0	327.8	69.1	196	3.30	20.2	2,518	32	130.4	0.5
Average			311.7	65.7	205	3.33	20.9	2,750	20	136.4	0.4

Total number of blows analyzed: 34

BL# Sensors

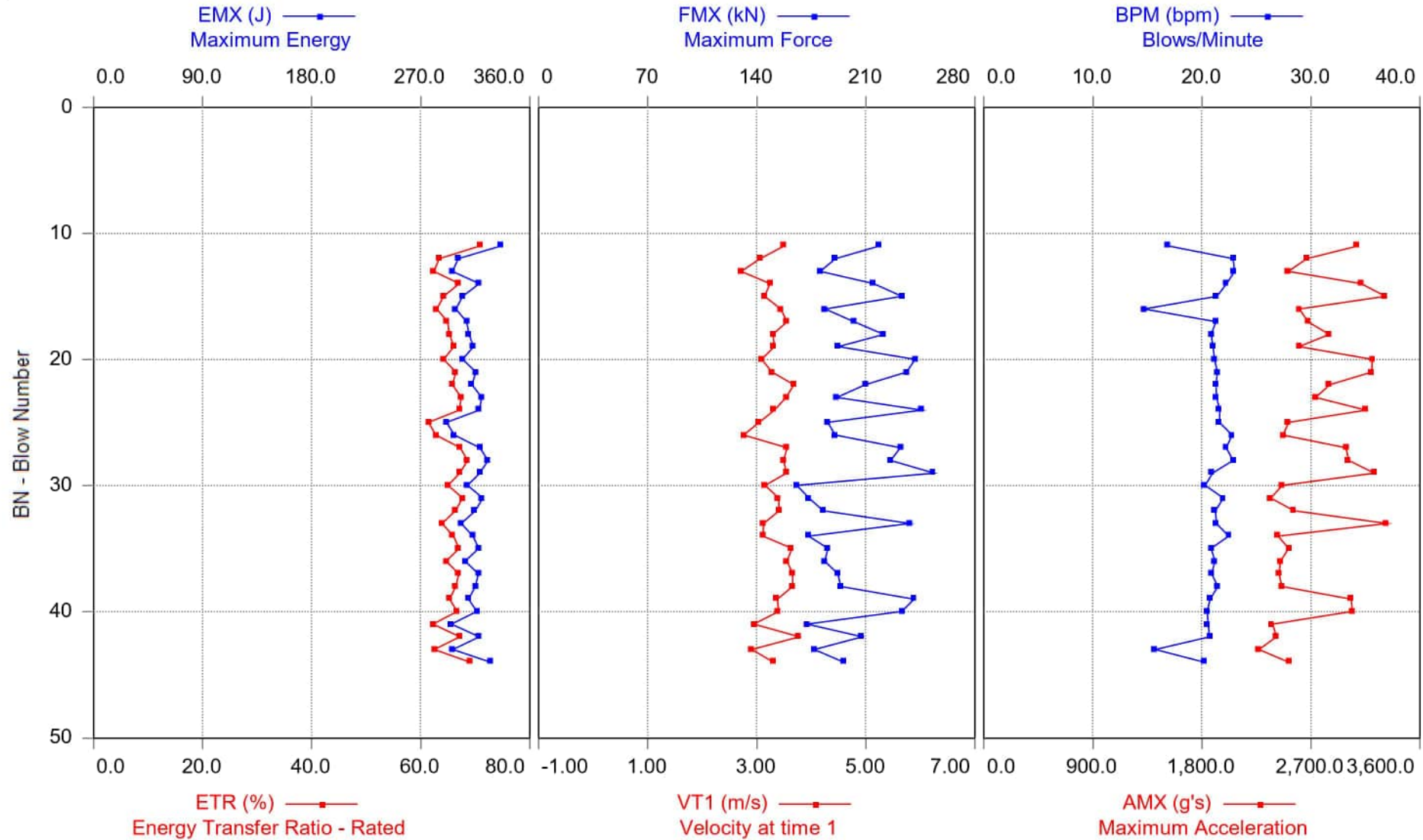
11-44 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 26 seconds 12:03 pm - 12:05 pm BN 1 - 44



2023-02-09 DCN Drilling - SPT Drop Hammer No.3_1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2

BH03 Test 3 at 12m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 13.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
11	12.0	0	323.3	68.1	252	3.24	16.1	2,854	14	167.9	0.5
12	12.0	0	318.7	67.2	251	3.33	20.0	2,831	9	166.7	0.3
13	12.0	0	323.1	68.1	191	3.23	20.6	2,498	24	127.3	0.6
14	12.0	0	305.7	64.4	186	3.11	20.3	2,444	9	123.9	0.5
15	12.0	0	310.6	65.4	188	3.25	20.3	2,318	14	125.2	0.4
16	12.0	0	319.3	67.3	197	3.45	21.6	2,464	8	131.0	0.3
17	12.0	0	321.2	67.7	237	3.43	20.5	2,464	10	157.6	0.1
18	12.0	0	322.9	68.0	231	3.44	20.0	2,423	17	154.0	0.2
19	12.0	0	312.5	65.8	208	3.27	20.7	2,350	9	138.2	0.3
20	12.0	0	300.2	63.3	174	3.29	20.4	2,202	8	115.6	0.6
21	12.0	0	305.4	64.4	213	3.66	19.9	2,187	8	141.4	0.3
22	12.0	0	319.0	67.2	225	3.78	19.8	2,288	8	149.4	0.3
23	12.0	0	290.2	61.2	245	3.11	20.0	2,478	10	162.7	0.6
24	12.0	0	316.6	66.7	243	3.50	20.6	2,711	8	161.6	0.2
25	12.0	0	296.5	62.5	216	3.24	19.8	2,006	7	143.5	0.2
26	12.0	0	299.9	63.2	181	3.08	21.4	2,168	10	120.4	0.6
27	12.0	0	310.2	65.4	181	3.45	20.2	2,130	7	120.5	0.5
28	12.0	0	296.5	62.5	166	3.12	20.7	2,093	7	110.4	0.7
29	12.0	0	290.9	61.3	170	3.01	19.4	2,005	7	112.9	0.5
30	12.0	0	309.5	65.2	218	3.65	19.0	2,106	7	144.7	0.3
31	12.0	0	293.9	61.9	240	3.39	19.6	2,337	7	159.8	0.5
32	12.0	0	307.7	64.8	228	3.58	20.1	2,303	7	151.8	0.2
33	12.0	0	294.5	62.1	209	3.19	20.7	1,979	10	138.9	0.4
34	12.0	0	288.0	60.7	188	3.21	20.2	1,984	7	125.4	0.4
35	12.0	0	300.2	63.3	245	3.32	19.7	2,100	7	163.0	0.2
36	12.0	0	297.8	62.8	243	3.48	19.6	2,151	7	161.4	0.6
37	12.0	0	319.6	67.3	215	3.58	22.4	2,166	15	143.2	0.4
38	12.0	0	295.4	62.2	202	3.08	16.7	1,918	7	134.5	0.5
39	12.0	0	300.1	63.2	194	3.14	20.4	1,940	7	129.2	0.6
40	12.0	0	291.4	61.4	167	2.99	21.5	1,804	7	111.1	0.6
41	12.0	0	306.9	64.7	226	3.60	20.8	1,933	7	150.3	0.3
42	12.0	0	316.1	66.6	232	3.81	21.3	2,104	7	154.1	0.2
43	12.0	0	306.4	64.6	159	2.91	15.9	1,571	12	105.8	0.7
44	12.0	0	307.9	64.9	200	3.29	20.5	1,664	7	133.1	0.3
45	12.0	0	310.8	65.5	173	3.07	20.2	1,701	9	115.4	0.7
46	12.0	0	298.9	63.0	157	3.05	14.7	1,633	9	104.5	0.5
47	12.0	0	312.3	65.8	175	3.01	19.6	1,707	11	116.2	0.6
48	12.0	0	304.1	64.1	231	3.33	20.9	2,221	7	153.9	0.6
49	12.0	0	302.1	63.7	193	3.29	19.8	1,583	7	128.3	0.4
50	12.0	0	300.7	63.4	194	3.17	20.6	1,584	9	128.9	0.5
51	12.0	0	296.0	62.4	171	2.88	20.8	1,438	8	113.5	0.7
52	12.0	0	299.9	63.2	187	3.03	19.5	1,581	9	124.5	0.6
53	12.0	0	301.4	63.5	247	3.50	20.4	2,237	7	164.2	0.6
54	12.0	0	311.2	65.6	248	3.45	19.4	1,980	15	164.8	0.5
55	12.0	0	291.8	61.5	213	3.30	19.8	1,517	10	141.6	0.4
56	12.0	0	285.2	60.1	235	3.06	20.9	1,381	7	156.6	0.6
57	12.0	0	277.4	58.5	224	2.88	20.4	1,593	7	148.9	0.6
58	12.0	0	293.2	61.8	188	3.06	20.7	1,340	13	125.3	0.5
59	12.0	0	295.5	62.3	239	3.24	13.5	1,853	9	159.1	0.5
60	12.0	0	277.6	58.5	224	2.93	20.5	1,408	7	149.3	0.3

Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2

BH03 Test 3 at 12m

OP: RZ

Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
		Average	303.5	64.0	208	3.27	19.8	2,035	9	138.6	0.5

Total number of blows analyzed: 50

BL# Sensors

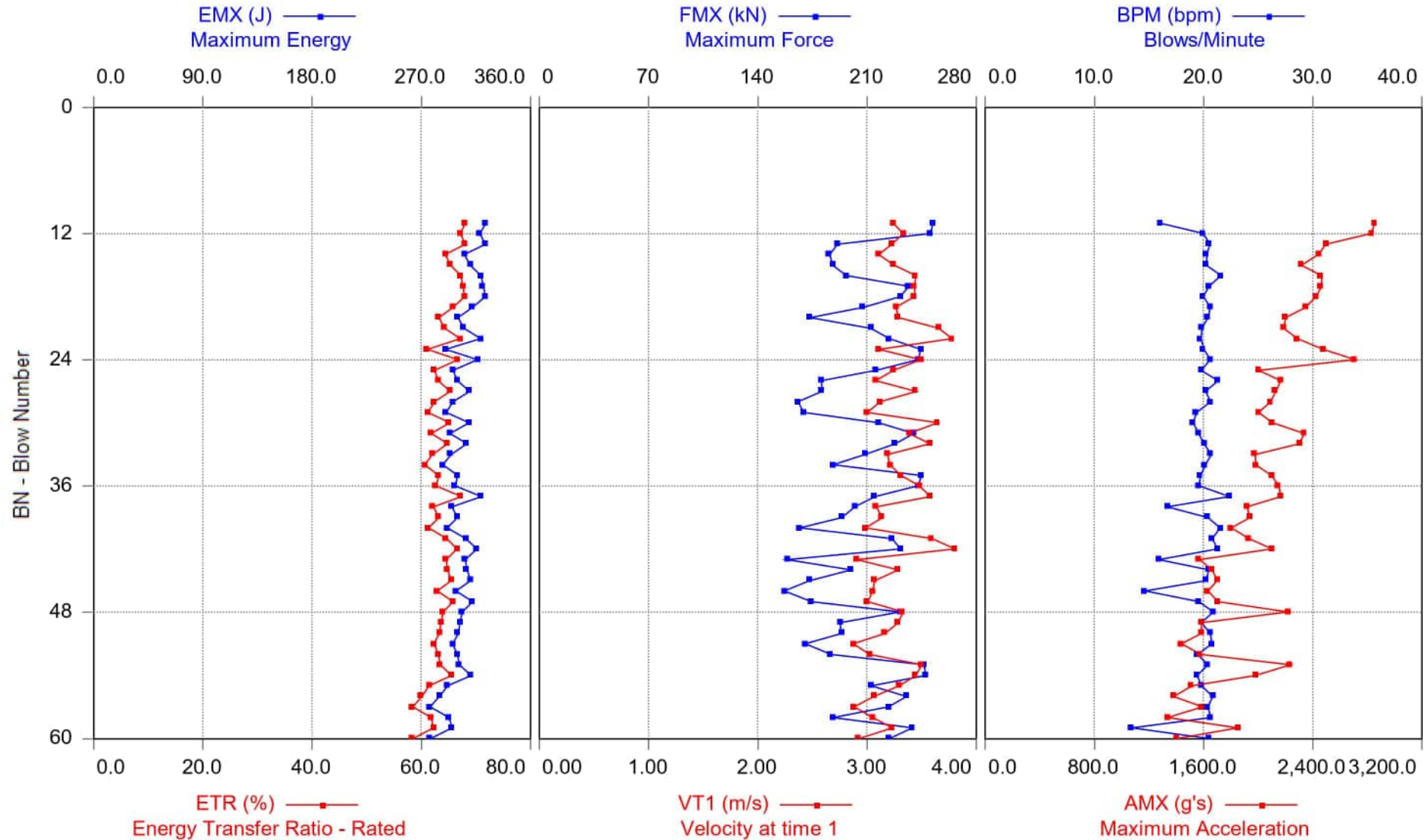
11-60 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 58 seconds 12:27 pm - 12:30 pm BN 1 - 60



2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4

BH01 Test 1 at 9m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 10.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
12	9.0	0	339.0	71.4	210	3.25	14.8	3,041	21	139.8	0.8
13	9.0	0	376.0	79.2	202	3.22	18.9	2,998	52	134.5	0.8
14	9.0	0	353.8	74.6	218	3.37	20.6	3,239	18	145.4	0.8
15	9.0	0	344.4	72.6	222	3.23	19.6	2,876	20	147.7	0.7
16	9.0	0	336.5	70.9	211	3.24	19.3	3,012	20	140.2	0.7
17	9.0	0	321.0	67.7	202	3.23	15.5	2,990	20	134.5	0.8
18	9.0	0	353.5	74.5	228	3.34	18.1	3,156	16	151.4	0.6
19	9.0	0	368.9	77.7	234	3.45	18.6	3,285	20	155.4	0.6
20	9.0	0	356.2	75.1	231	3.39	20.8	3,278	19	154.0	0.8
21	9.0	0	355.5	74.9	214	3.52	18.8	3,105	18	142.2	0.6
22	9.0	0	356.5	75.1	290	3.96	20.3	4,159	12	193.2	0.6
23	9.0	0	368.7	77.7	249	3.68	18.5	3,610	20	165.9	0.7
24	9.0	0	359.9	75.8	235	3.54	19.0	3,450	15	156.0	0.5
25	9.0	0	367.4	77.4	235	3.46	18.6	3,211	21	156.4	0.6
26	9.0	0	345.3	72.8	208	3.50	18.4	3,180	15	138.5	0.6
27	9.0	0	369.9	78.0	256	3.71	19.9	3,858	15	170.6	0.6
28	9.0	0	347.4	73.2	210	3.48	18.9	3,104	19	139.6	0.7
29	9.0	0	373.4	78.7	237	3.70	20.0	3,391	18	157.6	0.6
30	9.0	0	328.4	69.2	206	3.21	14.5	2,959	20	136.9	0.7
31	9.0	0	370.7	78.1	223	3.46	19.9	3,128	16	148.6	0.8
32	9.0	0	356.5	75.1	240	3.53	12.7	3,377	13	159.9	0.5
33	9.0	0	366.3	77.2	215	3.56	19.0	2,875	23	142.8	0.7
34	9.0	0	354.3	74.7	242	3.74	18.4	3,016	12	160.9	0.5
35	9.0	0	352.8	74.3	217	3.64	18.4	2,767	21	144.4	0.6
36	9.0	0	337.8	71.2	219	3.51	19.3	2,793	14	145.4	0.6
37	9.0	0	360.7	76.0	233	3.73	18.8	2,649	18	155.1	0.6
38	9.0	0	366.0	77.1	239	3.72	17.4	2,884	19	158.8	0.6
39	9.0	0	349.3	73.6	225	3.51	19.5	2,742	13	150.0	0.7
40	9.0	0	346.4	73.0	239	3.95	18.8	2,732	17	159.3	0.6
41	9.0	0	347.8	73.3	223	3.81	18.6	2,835	22	148.0	0.6
42	9.0	0	367.0	77.3	226	3.67	18.2	2,778	18	150.5	0.7
43	9.0	0	344.3	72.5	217	3.67	18.2	2,739	9	144.4	0.7
Average			354.4	74.7	227	3.53	18.4	3,101	19	150.9	0.7

Total number of blows analyzed: 32

BL# Sensors

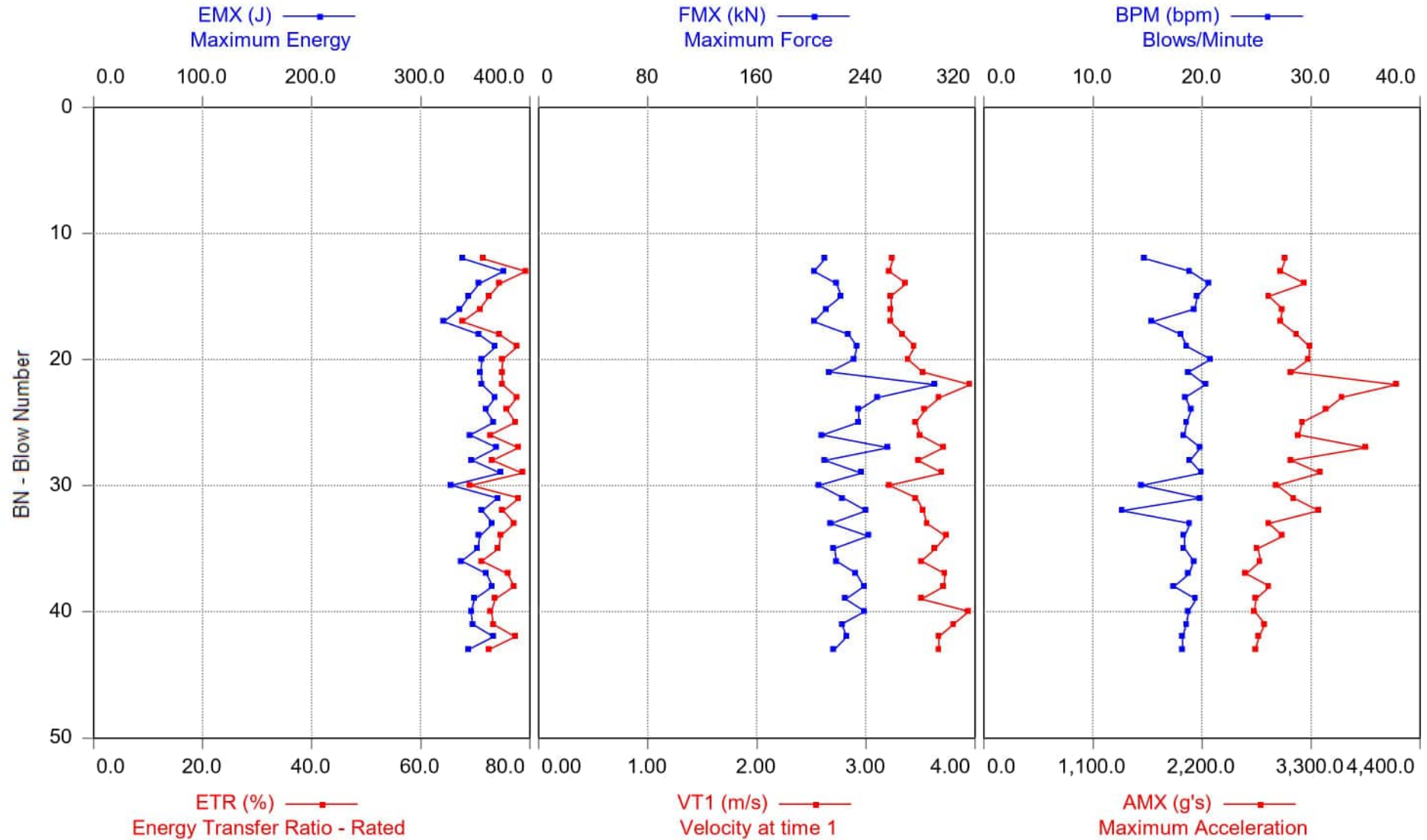
12-43 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 24 seconds 9:09 am - 9:11 am BN 1 - 43



2023-02-09 DCN Drilling - SPT Drop Hammer No.4



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_1

BH01 Test 2 at 10.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 12.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
13	10.5	0	376.8	79.4	254	3.49	19.7	3,351	20	169.2	0.7
14	10.5	0	362.5	76.4	231	3.47	19.6	3,022	22	153.9	0.7
15	10.5	0	372.8	78.6	235	3.52	19.9	2,980	27	156.6	0.6
16	10.5	0	359.4	75.7	267	3.66	19.7	3,594	20	177.5	0.6
17	10.5	0	369.6	77.9	236	3.45	19.5	2,948	26	156.7	0.7
18	10.5	0	374.7	79.0	237	3.47	15.3	3,226	20	157.6	0.7
19	10.5	0	372.2	78.4	250	3.52	19.8	3,493	24	166.4	0.6
20	10.5	0	357.9	75.4	279	3.90	18.5	3,818	17	185.6	0.6
21	10.5	0	350.7	73.9	239	3.54	18.9	3,061	18	159.0	0.5
22	10.5	0	346.3	73.0	209	3.41	19.9	3,111	17	138.8	0.7
23	10.5	0	364.7	76.9	296	4.02	20.2	3,935	21	197.1	0.6
24	10.5	0	348.8	73.5	243	3.77	19.0	3,008	14	161.5	0.6
25	10.5	0	370.7	78.1	257	3.68	15.8	3,150	18	170.9	0.5
26	10.5	0	357.2	75.3	257	3.85	19.6	3,090	18	170.7	0.5
27	10.5	0	348.5	73.4	215	3.19	20.3	2,820	22	143.0	0.7
28	10.5	0	341.9	72.1	200	3.26	18.8	2,803	25	132.9	0.8
29	10.5	0	357.9	75.4	220	3.64	14.7	2,891	18	146.3	0.7
30	10.5	0	355.1	74.8	259	4.00	20.4	2,920	17	172.2	0.5
31	10.5	0	374.4	78.9	238	3.91	19.2	2,980	19	158.5	0.6
32	10.5	0	362.2	76.3	220	3.69	20.5	2,985	13	146.5	0.5
33	10.5	0	362.3	76.4	219	3.89	19.2	2,728	17	145.6	0.5
34	10.5	0	346.6	73.0	285	3.61	19.6	3,169	16	189.9	0.2
35	10.5	0	365.1	76.9	222	3.82	20.1	2,822	20	147.7	0.6
36	10.5	0	334.9	70.6	217	3.67	20.0	2,501	15	144.6	0.6
37	10.5	0	365.9	77.1	220	3.94	13.3	2,840	20	146.6	0.5
38	10.5	0	362.2	76.3	241	4.01	19.1	2,736	18	160.0	0.6
39	10.5	0	337.7	71.2	210	3.45	19.7	2,549	17	140.0	0.7
40	10.5	0	361.4	76.2	277	3.84	19.9	3,192	16	184.4	0.6
41	10.5	0	370.0	78.0	286	3.73	19.5	3,606	15	190.2	0.6
42	10.5	0	350.2	73.8	224	3.77	19.8	2,726	12	148.9	0.7
43	10.5	0	363.3	76.6	256	3.93	19.9	2,754	19	170.3	0.6
44	10.5	0	357.0	75.2	231	3.89	18.9	2,673	13	153.5	0.5
45	10.5	0	357.6	75.4	240	4.08	19.5	2,699	19	160.0	0.6
46	10.5	0	347.5	73.2	225	3.89	19.2	2,589	14	149.4	0.5
47	10.5	0	347.9	73.3	213	3.14	18.2	2,388	25	141.4	0.9
Average			358.7	75.6	240	3.69	19.0	3,005	19	159.8	0.6

Total number of blows analyzed: 35

BL# Sensors

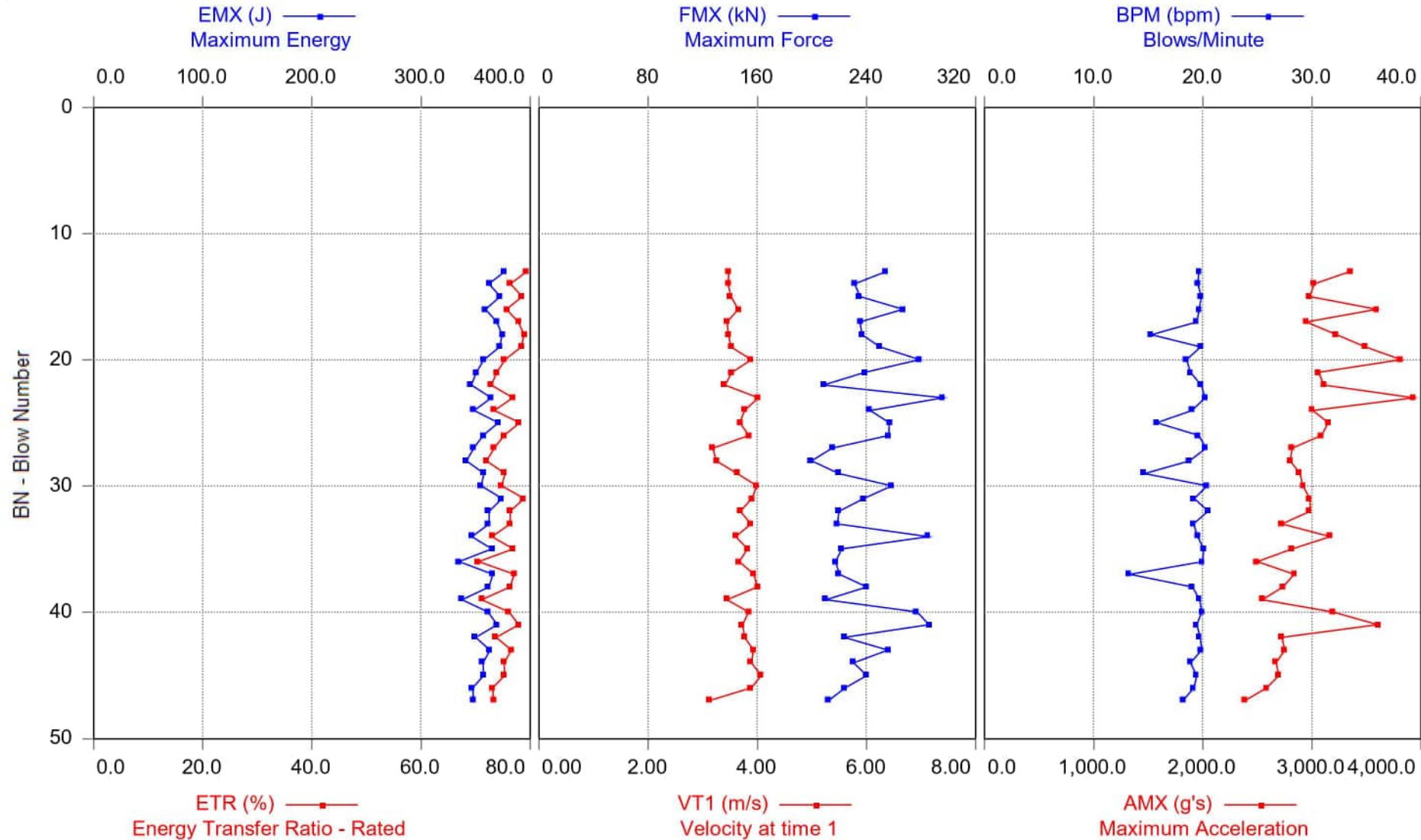
13-47 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 25 seconds 9:35 am - 9:38 am BN 1 - 47



2023-02-09 DCN Drilling - SPT Drop Hammer No.4_1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2

BH01 Test 3 at 12m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 13.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	358.9	75.6	226	3.28	20.2	2,659	17	150.3	0.7
11	12.0	0	354.2	74.6	224	3.17	20.4	2,822	19	149.2	0.5
12	12.0	0	322.2	67.9	212	2.95	16.2	2,586	23	140.9	0.5
13	12.0	0	371.9	78.4	236	3.79	20.5	3,096	17	157.3	0.6
14	12.0	0	358.4	75.5	231	3.66	20.7	2,572	25	153.7	0.6
15	12.0	0	338.3	71.3	216	3.34	21.5	2,414	20	143.7	0.7
16	12.0	0	368.5	77.6	233	3.97	21.4	2,755	22	155.1	0.6
17	12.0	0	332.9	70.2	208	2.78	21.0	2,351	27	138.3	0.7
18	12.0	0	364.0	76.7	224	3.74	21.4	2,953	18	149.2	0.6
19	12.0	0	347.2	73.2	216	3.34	21.9	2,324	25	144.0	0.6
20	12.0	0	357.2	75.3	235	3.81	14.8	2,925	18	156.0	0.7
21	12.0	0	347.4	73.2	203	2.80	20.8	2,562	31	135.2	0.5
22	12.0	0	358.2	75.5	228	3.72	16.7	2,984	11	151.6	0.6
23	12.0	0	344.7	72.6	219	2.84	22.4	2,286	42	145.4	0.8
24	12.0	0	353.4	74.5	242	4.01	22.8	2,790	17	160.9	0.5
25	12.0	0	342.9	72.3	239	3.98	20.0	2,514	15	158.9	0.5
26	12.0	0	330.3	69.6	255	3.47	19.9	2,761	11	169.9	0.7
27	12.0	0	346.4	73.0	233	3.80	20.6	2,468	13	154.7	0.6
28	12.0	0	348.3	73.4	222	3.62	21.1	2,186	14	147.7	0.7
29	12.0	0	341.4	71.9	235	3.71	21.7	2,268	10	156.4	0.6
30	12.0	0	344.3	72.6	257	3.98	21.5	2,583	12	171.1	0.5
31	12.0	0	347.2	73.2	258	3.89	20.9	2,314	14	171.9	0.5
32	12.0	0	356.7	75.2	244	4.02	20.4	2,300	11	162.3	0.6
33	12.0	0	342.3	72.1	230	3.55	17.6	2,133	13	152.7	0.6
34	12.0	0	358.3	75.5	241	4.16	19.6	2,220	10	160.2	0.5
35	12.0	0	319.3	67.3	227	3.25	19.2	2,011	16	150.7	0.7
36	12.0	0	304.6	64.2	211	2.75	20.0	1,792	12	140.7	0.6
37	12.0	0	348.6	73.5	238	4.10	19.6	2,363	11	158.3	0.5
38	12.0	0	316.5	66.7	216	2.80	19.9	2,094	9	143.4	0.6
39	12.0	0	347.9	73.3	227	3.94	20.1	2,388	15	151.2	0.5
40	12.0	0	321.7	67.8	236	3.81	16.7	2,071	9	157.1	0.5
41	12.0	0	325.0	68.5	231	3.66	12.2	1,943	13	153.9	0.6
42	12.0	0	316.2	66.6	223	3.80	19.2	2,144	9	148.4	0.5
43	12.0	0	363.6	76.6	220	3.83	20.4	2,585	22	146.3	0.6
44	12.0	0	334.1	70.4	273	3.47	19.9	2,400	10	181.6	0.6
45	12.0	0	287.8	60.6	212	2.66	19.4	1,925	10	140.9	0.6
46	12.0	0	330.4	69.6	223	3.58	19.3	1,865	10	148.3	0.5
47	12.0	0	288.2	60.7	262	2.68	20.1	1,790	8	174.3	0.8
48	12.0	0	300.0	63.2	207	2.64	20.2	1,616	8	137.4	0.4
49	12.0	0	309.6	65.3	217	2.61	20.9	1,759	12	144.1	0.5
50	12.0	0	320.9	67.6	228	2.82	16.6	1,677	12	151.7	0.6
51	12.0	0	299.9	63.2	178	2.25	19.2	1,458	18	118.1	0.7
52	12.0	0	319.5	67.3	261	2.86	19.0	1,933	12	173.9	0.8
53	12.0	0	318.6	67.1	229	2.87	20.9	1,823	12	152.1	0.6
54	12.0	0	299.3	63.1	206	2.85	20.6	1,547	12	136.9	0.5
55	12.0	0	297.7	62.7	204	2.81	14.3	1,558	9	135.5	0.5
56	12.0	0	328.9	69.3	207	2.84	20.7	1,566	14	137.9	0.6
57	12.0	0	316.0	66.6	254	2.63	21.8	1,865	13	169.0	0.6
58	12.0	0	316.2	66.6	219	2.98	20.5	1,605	11	145.6	0.6
59	12.0	0	308.8	65.1	191	2.36	20.9	1,338	9	126.9	0.6

Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2

BH01 Test 3 at 12m

OP: RZ

Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
		Average	333.5	70.3	227	3.32	19.8	2,219	15	151.2	0.6

Total number of blows analyzed: 50

BL# Sensors

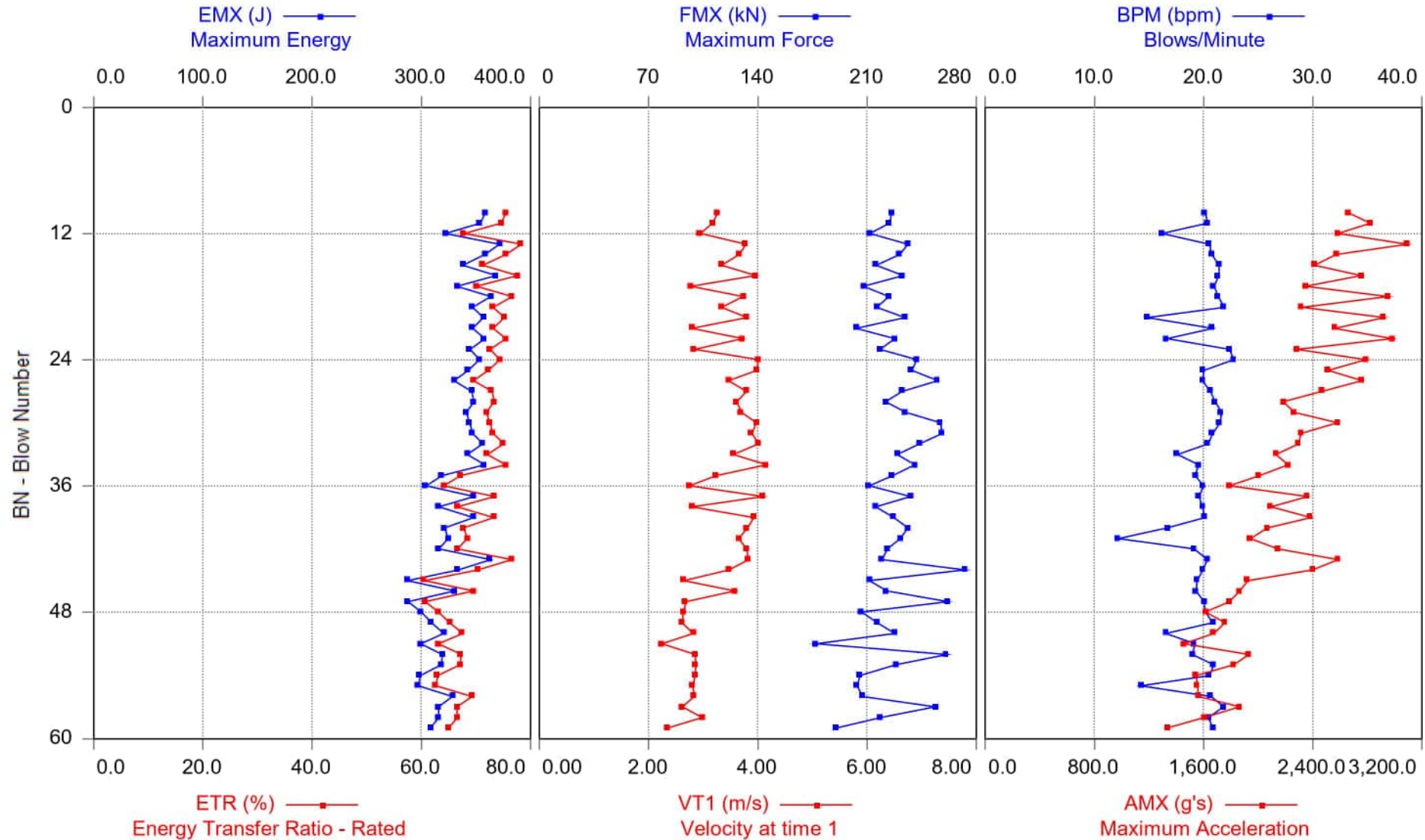
10-59 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 57 seconds 10:05 am - 10:08 am BN 1 - 59



2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5

BH04 Test 1 at 9m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 10.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
15	9.0	0	292.3	61.6	168	2.60	22.3	2,670	19	111.6	0.3
16	9.0	0	280.0	59.0	165	2.59	22.5	2,573	21	109.5	0.4
17	9.0	0	296.2	62.4	173	2.67	20.3	2,697	15	114.8	0.8
18	9.0	0	310.4	65.4	182	2.77	23.1	2,765	21	121.3	0.3
19	9.0	0	304.2	64.1	187	2.87	20.2	2,883	18	124.4	0.3
20	9.0	0	309.0	65.1	204	3.25	21.0	2,914	12	135.4	0.5
21	9.0	0	302.1	63.7	196	2.84	22.0	2,699	17	130.6	0.4
22	9.0	0	299.9	63.2	198	2.96	21.8	2,803	16	132.0	0.3
23	9.0	0	295.8	62.3	202	2.91	22.4	2,830	14	134.3	0.3
24	9.0	0	311.5	65.6	206	3.35	22.0	2,817	14	137.0	0.5
25	9.0	0	305.1	64.3	190	2.88	21.7	2,730	18	126.3	0.3
26	9.0	0	293.0	61.8	197	2.94	21.5	2,781	12	130.9	0.3
27	9.0	0	296.6	62.5	204	2.97	21.5	2,860	16	136.0	0.4
28	9.0	0	293.2	61.8	197	2.94	21.8	2,838	12	131.1	0.4
29	9.0	0	294.9	62.1	192	2.83	21.7	2,679	19	127.6	0.5
30	9.0	0	327.8	69.1	200	3.41	22.2	2,896	19	133.3	0.4
31	9.0	0	292.8	61.7	193	2.84	22.3	2,705	18	128.3	0.4
32	9.0	0	300.5	63.3	200	2.92	20.9	2,815	15	133.1	0.8
33	9.0	0	312.4	65.8	190	2.78	21.7	2,643	26	126.6	0.4
34	9.0	0	308.1	64.9	206	3.09	20.9	2,909	11	136.9	0.6
35	9.0	0	303.9	64.0	194	2.84	21.1	2,646	18	129.1	0.4
36	9.0	0	291.6	61.5	197	2.95	21.6	2,777	12	130.8	0.4
37	9.0	0	299.2	63.0	205	2.98	21.6	2,859	13	136.4	0.5
38	9.0	0	298.8	63.0	211	2.98	22.8	2,840	11	140.1	0.4
39	9.0	0	298.1	62.8	208	2.95	22.6	2,843	11	138.2	0.4
40	9.0	0	292.1	61.5	206	2.90	17.8	2,778	10	137.2	0.7
41	9.0	0	295.0	62.2	200	2.83	23.2	2,651	19	133.1	0.4
42	9.0	0	297.8	62.8	192	2.84	23.8	2,745	26	127.5	0.5
43	9.0	0	292.6	61.7	197	2.92	22.1	2,731	17	130.8	0.4
44	9.0	0	283.8	59.8	200	2.91	22.3	2,755	10	132.8	0.4
45	9.0	0	306.3	64.5	203	2.88	22.2	2,680	24	135.0	0.5
46	9.0	0	285.1	60.1	203	2.90	22.0	2,708	11	135.1	0.5
47	9.0	0	297.7	62.7	205	2.94	22.2	2,807	15	136.6	0.4
48	9.0	0	288.8	60.9	201	2.90	21.1	2,659	12	133.9	0.4
49	9.0	0	296.1	62.4	207	2.90	20.3	2,722	13	137.6	0.5
50	9.0	0	273.5	57.6	197	2.85	21.7	2,628	12	131.1	0.4
51	9.0	0	335.1	70.6	224	3.63	21.5	2,901	13	148.7	0.4
52	9.0	0	291.5	61.4	194	2.91	21.7	2,599	14	129.3	0.7
53	9.0	0	300.4	63.3	207	3.09	21.6	2,765	12	137.8	0.8
54	9.0	0	295.9	62.4	200	2.89	23.6	2,581	11	132.8	0.7
55	9.0	0	317.3	66.9	204	2.91	22.5	2,774	21	135.5	0.4
56	9.0	0	340.2	71.7	237	3.59	21.2	3,105	12	157.8	0.3
57	9.0	0	305.1	64.3	211	3.13	21.0	2,689	10	140.7	0.7
58	9.0	0	333.6	70.3	230	3.61	21.0	2,861	13	152.9	0.4
59	9.0	0	302.2	63.7	212	3.01	21.4	2,619	18	140.8	0.7
60	9.0	0	321.3	67.7	225	3.60	21.2	2,930	7	149.7	0.4
61	9.0	0	306.4	64.6	206	2.76	22.1	2,582	28	136.8	0.5
62	9.0	0	291.8	61.5	203	2.81	21.3	2,657	13	134.8	0.5
63	9.0	0	303.8	64.0	198	2.77	20.8	2,592	30	132.0	0.5
Average			301.4	63.5	200	2.97	21.7	2,755	16	133.4	0.5

Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5

BH04 Test 1 at 9m

OP: RZ

Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
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Total number of blows analyzed: 49

BL# Sensors

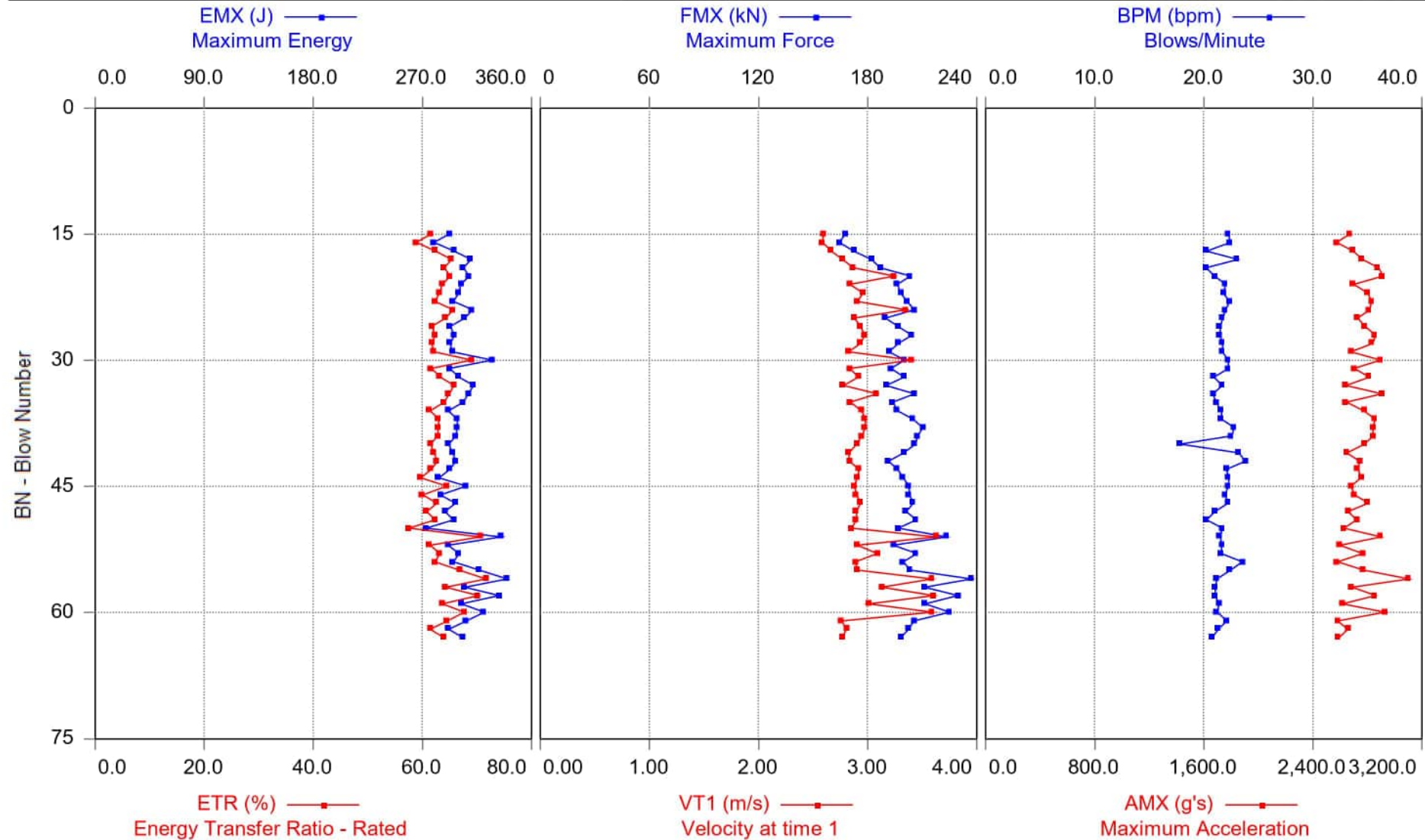
15-63 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 51 seconds 2:05 pm - 2:08 pm BN 1 - 63



2023-02-09 DCN Drilling - SPT Drop Hammer No.5



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_1

BH04 Test 2 at 10.5m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 12.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
9	10.5	0	294.4	62.0	160	2.66	19.5	2,541	46	106.5	0.5
10	10.5	0	339.0	71.4	174	2.82	19.8	2,957	47	115.5	0.4
11	10.5	0	318.2	67.1	168	2.64	19.8	2,705	38	111.8	0.4
12	10.5	0	312.6	65.9	177	2.94	19.6	2,896	27	117.9	0.7
13	10.5	0	296.9	62.6	170	2.64	19.5	2,605	29	113.3	0.5
14	10.5	0	299.7	63.2	168	2.46	14.1	2,547	33	112.0	0.4
15	10.5	0	280.6	59.1	178	2.77	22.1	2,662	39	118.2	0.4
16	10.5	0	287.2	60.5	177	2.73	20.9	2,571	33	117.7	0.4
17	10.5	0	319.7	67.4	183	2.81	19.4	2,806	34	121.8	0.5
18	10.5	0	270.1	56.9	180	2.78	20.9	2,743	28	120.1	0.4
19	10.5	0	320.7	67.6	190	2.96	19.7	2,978	36	126.7	0.4
20	10.5	0	280.8	59.2	178	2.78	21.5	2,650	34	118.2	0.5
21	10.5	0	321.8	67.8	187	3.28	16.4	2,812	25	124.5	0.6
22	10.5	0	316.1	66.6	192	2.94	21.1	2,620	28	127.8	0.8
23	10.5	0	315.1	66.4	189	2.77	14.8	2,698	32	125.5	0.7
24	10.5	0	311.7	65.7	195	2.87	20.8	2,760	29	129.5	0.8
25	10.5	0	288.5	60.8	190	2.82	19.8	2,665	19	126.4	0.4
26	10.5	0	284.7	60.0	192	2.84	21.2	2,683	20	127.5	0.4
27	10.5	0	285.6	60.2	195	2.87	19.3	2,691	16	130.0	0.4
28	10.5	0	280.4	59.1	195	2.81	20.5	2,647	17	130.0	0.5
29	10.5	0	301.1	63.5	196	2.78	20.2	2,557	20	130.5	0.4
30	10.5	0	301.1	63.5	205	3.10	19.9	2,775	15	136.1	0.6
31	10.5	0	287.3	60.6	192	2.76	20.8	2,591	28	127.7	0.4
32	10.5	0	299.6	63.1	202	3.01	20.1	2,713	17	134.4	0.7
33	10.5	0	317.7	66.9	201	3.25	20.6	2,633	20	133.9	0.7
34	10.5	0	292.7	61.7	196	2.84	20.7	2,712	15	130.2	0.7
35	10.5	0	294.2	62.0	204	2.99	15.8	2,642	16	135.8	0.8
36	10.5	0	279.7	58.9	199	2.76	21.0	2,548	15	132.6	0.4
37	10.5	0	310.7	65.5	195	3.06	16.3	2,662	24	129.6	0.8
Average			300.3	63.3	187	2.85	19.5	2,692	27	124.5	0.5

Total number of blows analyzed: 29

BL# Sensors

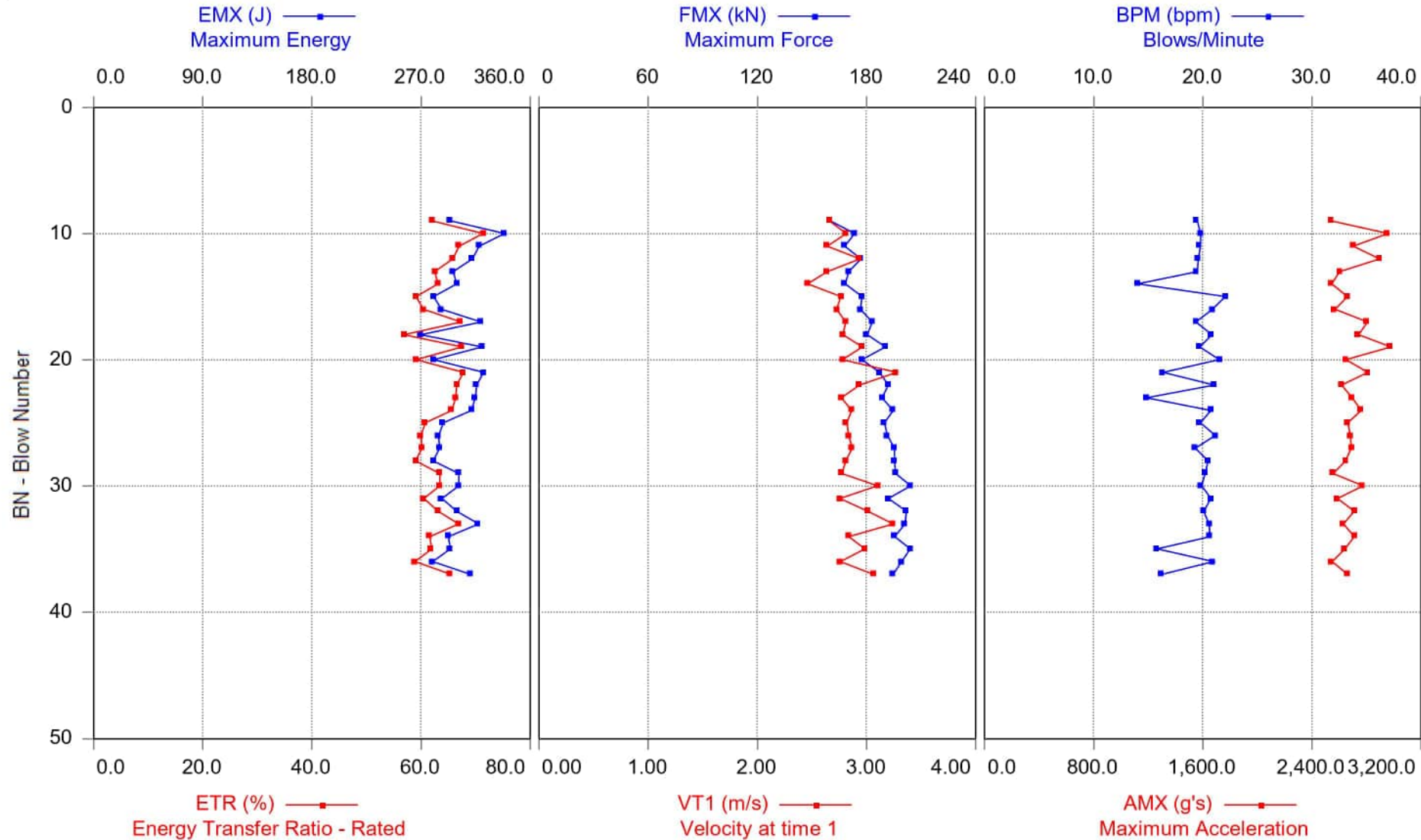
9-37 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 51 seconds 2:38 pm - 2:40 pm BN 1 - 37



2023-02-09 DCN Drilling - SPT Drop Hammer No.5_1



Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2

BH04 Test 3 at 12m

OP: RZ

Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m³

LE: 13.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	313.0	66.0	199	2.99	20.2	2,997	33	132.7	0.4
11	12.0	0	312.5	65.9	191	2.93	21.9	2,933	26	126.9	0.4
12	12.0	0	308.5	65.0	193	2.96	19.5	2,999	26	128.2	0.4
13	12.0	0	289.0	60.9	186	2.88	20.1	2,838	25	123.6	0.4
14	12.0	0	283.8	59.8	194	2.86	18.9	2,765	25	128.8	0.5
15	12.0	0	291.0	61.3	195	2.83	19.6	2,774	27	129.4	0.5
16	12.0	0	308.0	64.9	200	2.89	19.4	2,881	35	133.1	0.5
17	12.0	0	307.3	64.8	200	2.98	19.5	2,968	35	132.9	0.5
18	12.0	0	295.6	62.3	203	2.91	19.8	2,825	36	135.1	0.5
19	12.0	0	325.8	68.7	199	3.00	20.9	2,939	35	132.5	0.4
20	12.0	0	295.5	62.3	187	2.88	16.5	2,837	18	124.7	0.4
21	12.0	0	299.2	63.1	181	2.84	19.2	2,758	20	120.7	0.8
22	12.0	0	303.3	63.9	198	2.88	20.0	2,793	31	131.7	0.6
23	12.0	0	307.7	64.8	203	2.95	19.5	2,874	25	135.3	0.7
24	12.0	0	296.5	62.5	203	2.95	21.0	2,833	30	135.3	0.4
25	12.0	0	314.8	66.3	206	2.97	12.6	2,890	23	137.2	0.5
26	12.0	0	304.0	64.1	189	3.26	19.1	2,823	13	125.7	0.6
27	12.0	0	321.8	67.8	193	3.27	19.9	2,897	13	128.4	0.7
28	12.0	0	329.4	69.4	192	3.29	19.8	2,972	16	127.5	0.8
29	12.0	0	314.0	66.2	208	3.40	19.2	3,069	14	138.2	0.5
30	12.0	0	303.7	64.0	197	3.12	19.3	2,789	13	130.8	0.6
31	12.0	0	309.1	65.1	210	3.18	19.7	2,987	13	139.5	0.6
32	12.0	0	290.4	61.2	200	2.82	19.7	2,733	20	133.0	0.5
33	12.0	0	291.3	61.4	185	2.52	18.2	2,603	29	122.8	0.4
34	12.0	0	292.4	61.6	191	2.98	20.5	2,743	15	126.9	0.8
35	12.0	0	308.4	65.0	197	2.85	21.0	2,837	25	131.0	0.5
36	12.0	0	318.7	67.2	202	2.89	17.3	2,829	38	134.7	0.4
37	12.0	0	310.5	65.4	206	2.96	21.5	2,838	20	137.1	0.5
38	12.0	0	315.8	66.5	202	2.91	19.7	2,889	23	134.7	0.5
39	12.0	0	309.3	65.2	204	2.98	21.0	3,013	15	135.7	0.5
40	12.0	0	308.9	65.1	208	2.96	20.4	2,918	24	138.2	0.5
41	12.0	0	310.3	65.4	201	2.94	19.8	2,800	28	133.5	0.5
42	12.0	0	277.8	58.5	192	2.88	19.5	2,650	24	127.6	0.5
43	12.0	0	308.1	64.9	201	2.93	19.6	2,879	26	133.6	0.5
44	12.0	0	309.5	65.2	194	3.10	20.1	3,028	15	129.0	0.7
45	12.0	0	315.8	66.5	188	3.13	17.1	2,750	18	125.0	0.8
46	12.0	0	324.1	68.3	208	3.35	20.7	3,011	23	138.6	0.6
47	12.0	0	296.9	62.6	195	2.87	19.1	2,895	16	129.6	0.5
48	12.0	0	316.8	66.8	199	3.07	20.0	2,935	18	132.2	0.8
49	12.0	0	323.5	68.2	210	3.30	19.4	3,144	23	139.7	0.6
50	12.0	0	330.3	69.6	224	3.67	19.5	3,098	17	149.0	0.4
51	12.0	0	307.0	64.7	214	3.29	20.1	2,844	17	142.1	0.6
52	12.0	0	310.2	65.4	196	2.80	20.8	2,724	21	130.5	0.5
53	12.0	0	328.2	69.2	203	3.27	19.2	2,830	24	134.9	0.7
54	12.0	0	328.1	69.1	219	3.53	19.8	3,162	14	146.0	0.5
55	12.0	0	312.5	65.9	203	2.99	19.5	2,808	21	134.8	0.8
56	12.0	0	306.5	64.6	203	3.00	19.0	2,954	17	134.8	0.6
57	12.0	0	327.3	69.0	200	2.85	20.1	2,754	30	132.7	0.4
Average			308.6	65.0	199	3.02	19.5	2,877	23	132.6	0.6

Total number of blows analyzed: 48

Case Method & iCAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2

BH04 Test 3 at 12m

OP: RZ

Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
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BL# Sensors

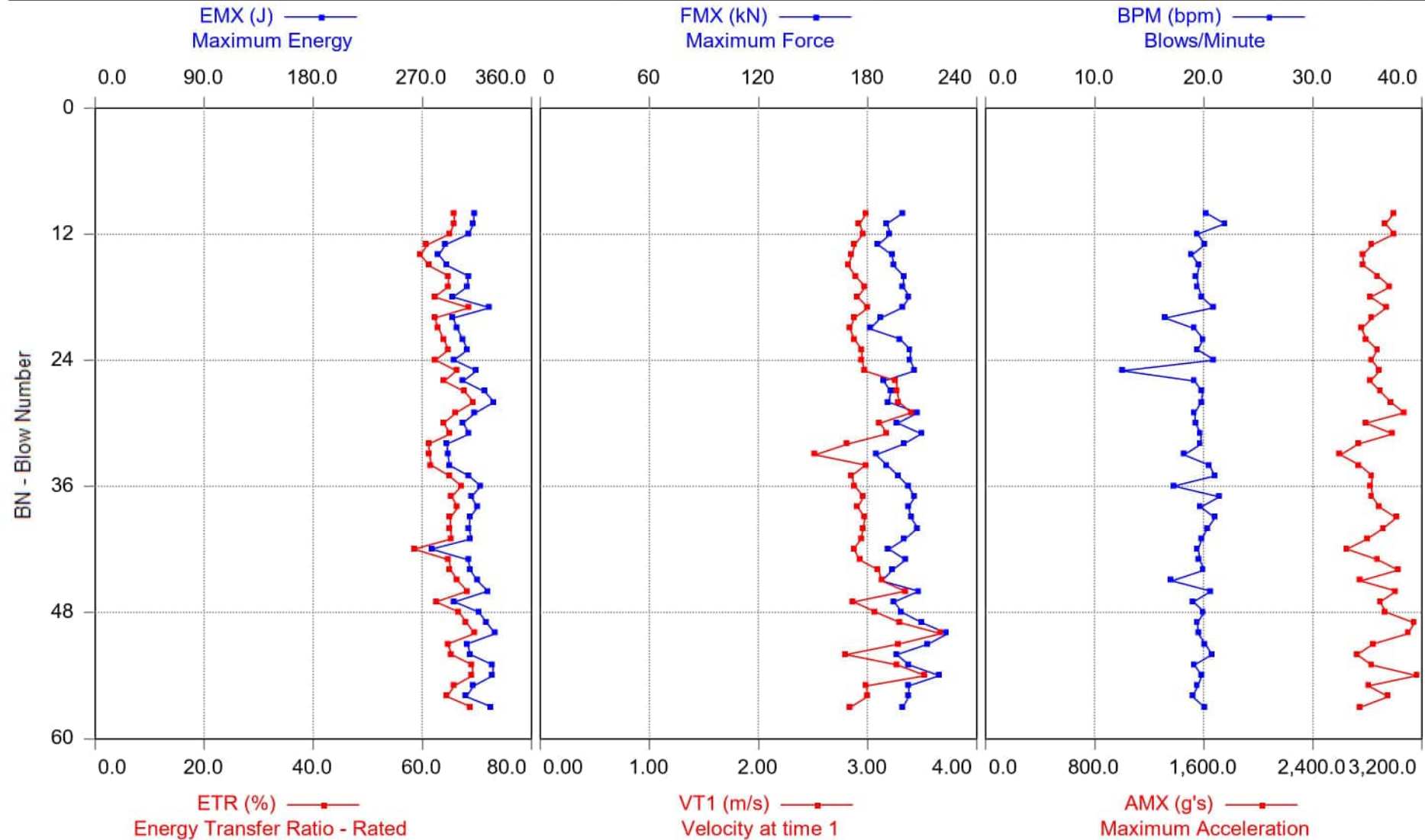
10-57 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 52 seconds 3:04 pm - 3:06 pm BN 1 - 57



2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2





Appendix C

Representative Force and Velocity Plots

Roc Consulting Limited

2023-02-09 DCN Drilling

SPT Drop Hammer No.1

BH02 Test 1 at 13.5m

PDA Operator: RZ

Pile Driving Analyzer® (PDA)

Version: 2022.35.2

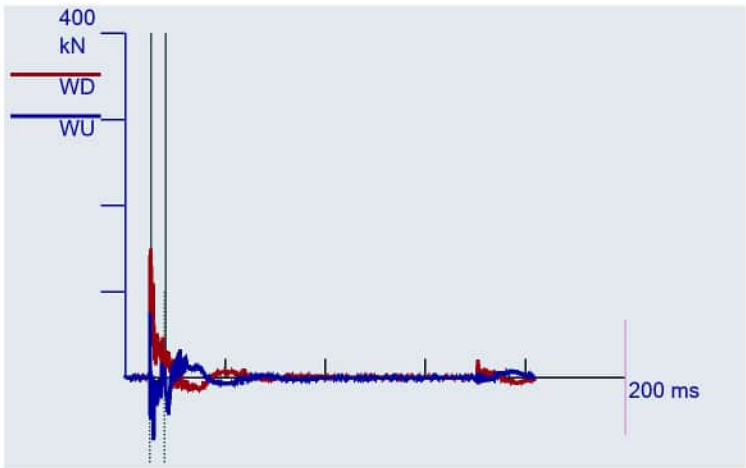


BN 36
09Feb2023 12:18:02 pm

CSX 113.2 MPa
DMX 8 mm
EFV 300 J
ETR 63.2 %
BPM 20.7 bpm
RAT 0.3
VMX 2.77 m/s
FMX 170 kN
DFN 7 mm
MEX 547 μ E
EMX 300 J

LE 15.2 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5117.8 m/s
JC 0.90
JF 1.00

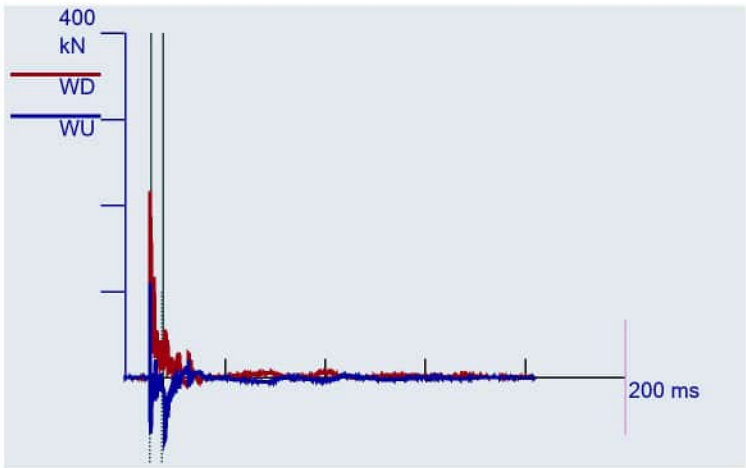
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Roc Consulting Limited

2023-02-09 DCN Drilling
SPT Drop Hammer No.4_1
BH01 Test 2 at 10.5m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2



BN 40
09Feb2023 09:37:48 am

CSX 184.4 MPa
DMX 16 mm
EFV 361 J
ETR 76.2 %
BPM 19.9 bpm
RAT 1.1
VMX 3.84 m/s
FMX 277 kN
DFN 16 mm
MEX 891 µE
EMX 361 J

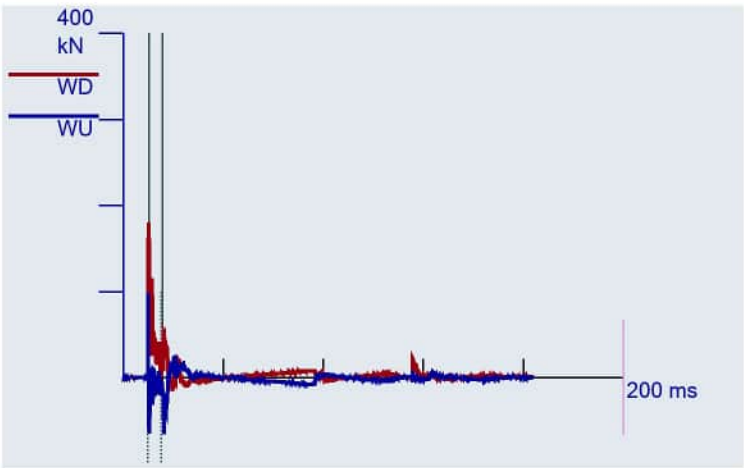
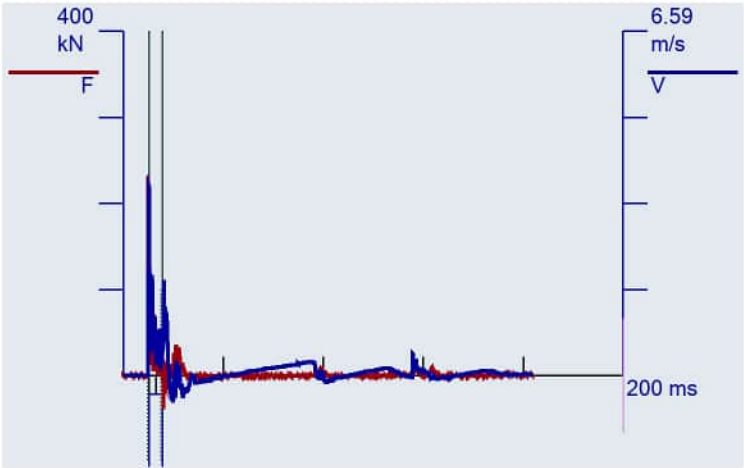
LE 12.2 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m3
WS 5123.0 m/s
WC 5104.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

Roc Consulting Limited

2023-02-09 DCN Drilling
SPT Drop Hammer No.4_2
BH01 Test 3 at 12m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2



BN 41
09Feb2023 10:07:22 am

CSX 153.9 MPa
DMX 13 mm
EFV 325 J
ETR 68.5 %
BPM 12.2 bpm
RAT 1.1
VMX 3.66 m/s
FMX 231 kN
DFN 13 mm
MEX 744 µE
EMX 325 J

LE 13.7 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m3
WS 5123.0 m/s
WC 5111.9 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

Roc Consulting Limited

2023-02-09 DCN Drilling

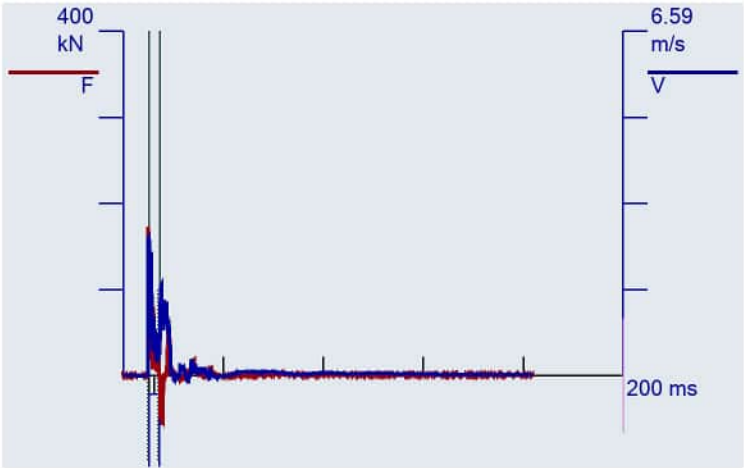
SPT Drop Hammer No.5

BH04 Test 1 at 9m

PDA Operator: RZ

Pile Driving Analyzer® (PDA)

Version: 2022.35.2

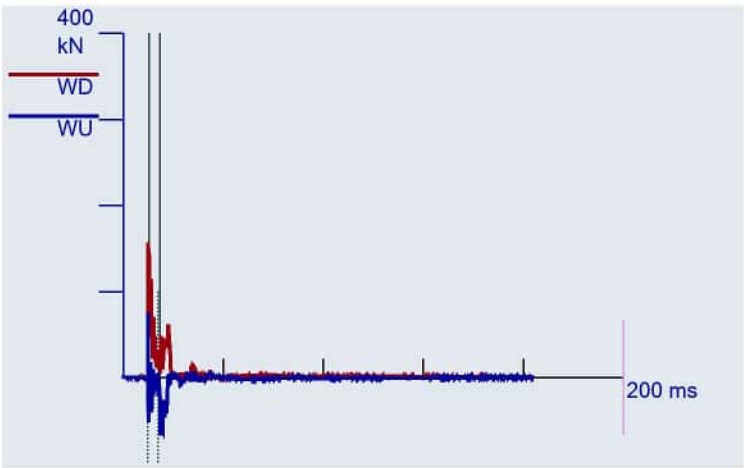


BN 17
09Feb2023 02:06:43 pm

CSX 114.8 MPa
DMX 15 mm
EFV 296 J
ETR 62.4 %
BPM 20.3 bpm
RAT 1.1
VMX 2.67 m/s
FMX 173 kN
DFN 15 mm
MEX 555 μ E
EMX 296 J

LE 10.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

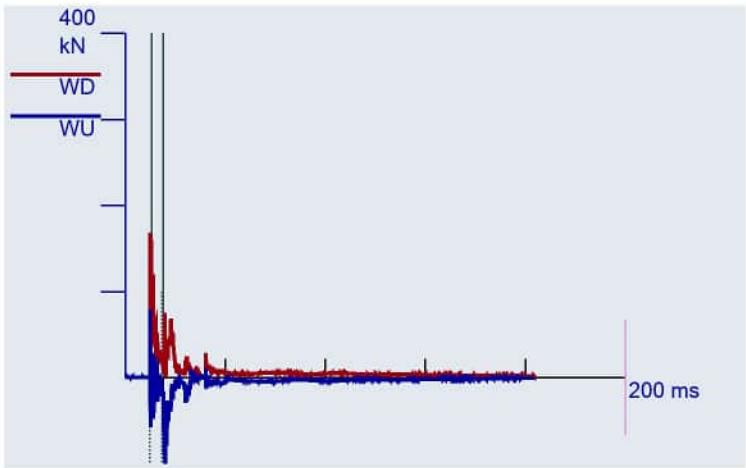
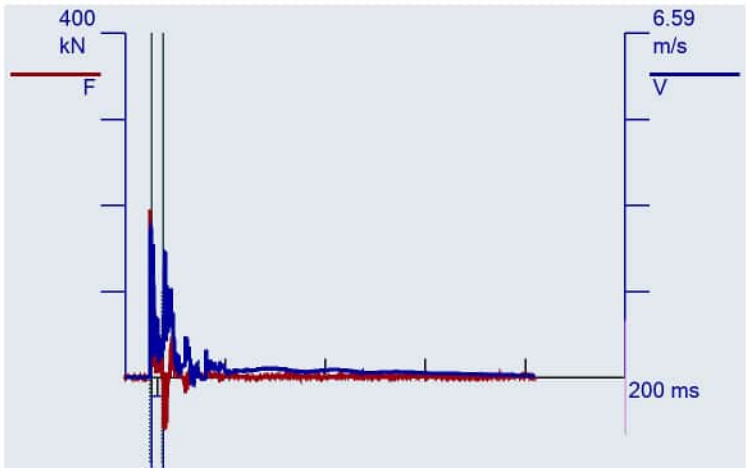
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Roc Consulting Limited

2023-02-09 DCN Drilling
SPT Drop Hammer No.5_1
BH04 Test 2 at 10.5m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2



BN 24
09Feb2023 02:40:02 pm

CSX 129.5 MPa
DMX 29 mm
EFV 312 J
ETR 65.7 %
BPM 20.8 bpm
RAT 1.1
VMX 2.87 m/s
FMX 195 kN
DFN 29 mm
MEX 626 μ E
EMX 312 J

LE 12.2 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5104.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

Roc Consulting Limited

2023-02-09 DCN Drilling
SPT Drop Hammer No.5_2
BH04 Test 3 at 12m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2

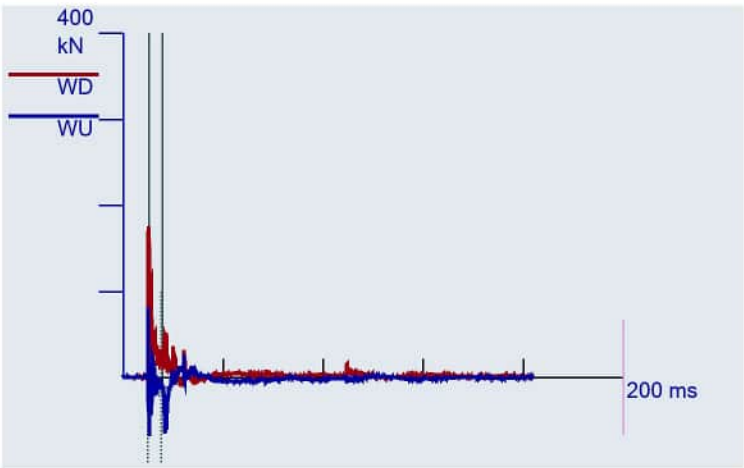


BN 28
09Feb2023 03:05:25 pm

CSX 127.5 MPa
DMX 16 mm
EFV 329 J
ETR 69.4 %
BPM 19.8 bpm
RAT 1.1
VMX 3.29 m/s
FMX 192 kN
DFN 16 mm
MEX 616 μ E
EMX 329 J

LE 13.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5111.9 m/s
JC 0.90
JF 1.00

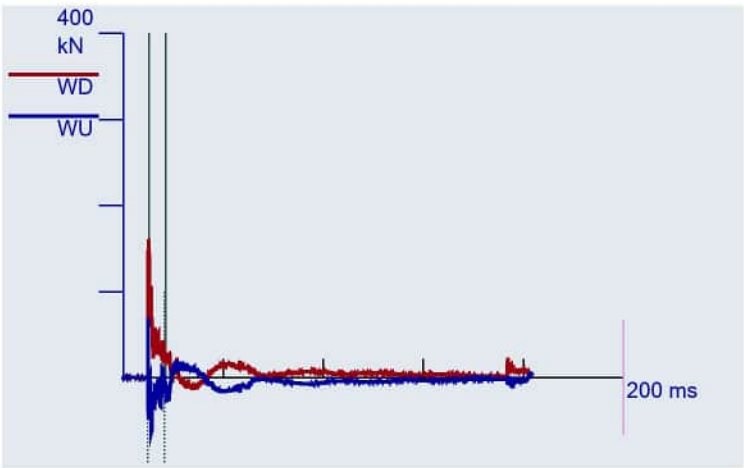
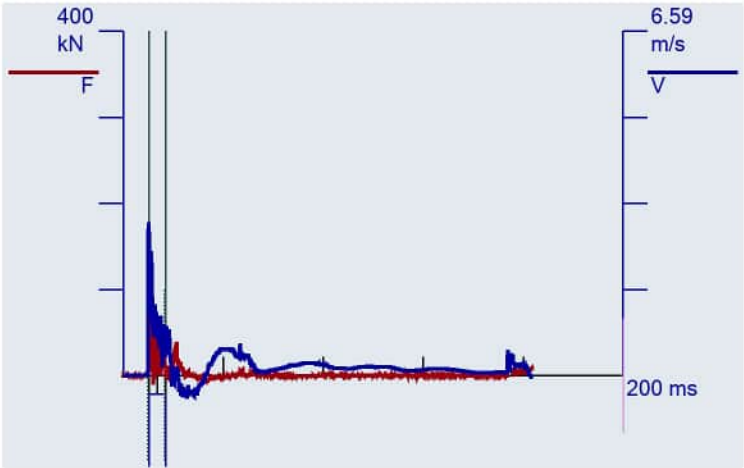
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
SPT Drop Hammer No.1_1
BH02 Test 2 at 15m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2

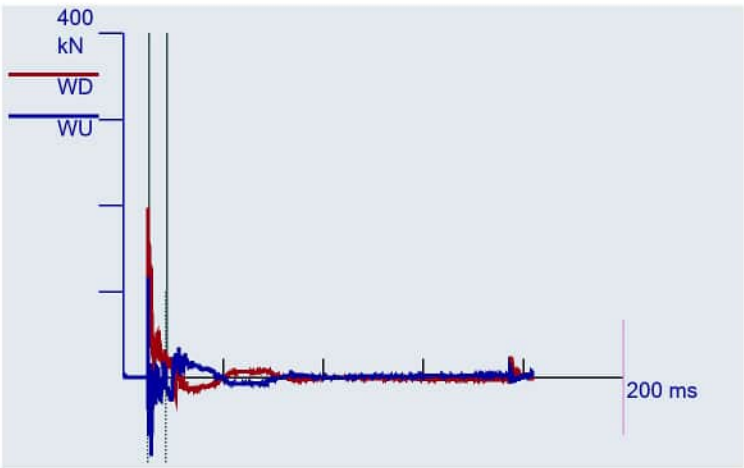
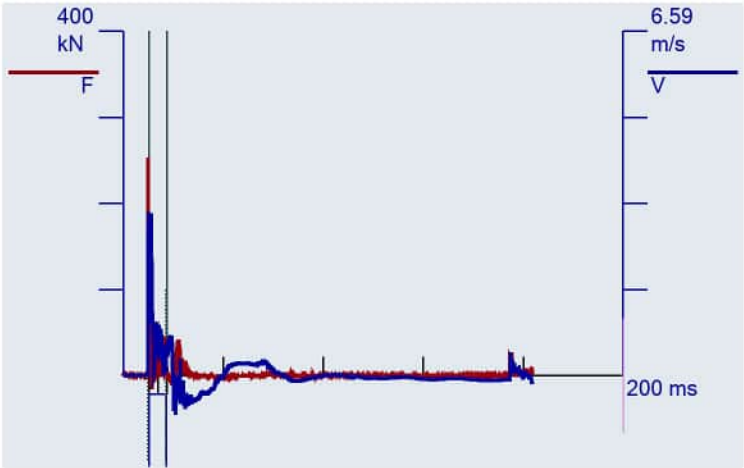


BN 50	
09Feb2023 12:57:01 pm	
CSX	109.9 MPa
DMX	29 mm
EFV	341 J
ETR	71.9 %
BPM	21.3 bpm
RAT	0.3
VMX	2.93 m/s
FMX	165 kN
DFN	27 mm
MEX	531 µE
EMX	341 J
LE	16.7 m
AR	15.03 cm^2
EM	206843 MPa
SP	77.3 kN/m3
WS	5123.0 m/s
WC	5122.7 m/s
JC	0.90
JF	1.00
F1: [680NW1]	229.44 PDICAL (1) FF1
F2: [680NW2]	230 PDICAL (1) FF1
A3 (PR): [K12864]	416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865]	430.944 mv/6.4v/5000g (1) VF1

Roc Consulting Limited

2023-02-09 DCN Drilling
SPT Drop Hammer No.1_2
BH02 Test 3 at 16.5m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2



BN 38	
09Feb2023 01:32:11 pm	
CSX	168.4 MPa
DMX	8 mm
EFV	326 J
ETR	68.7 %
BPM	21.1 bpm
RAT	0.2
VMX	3.13 m/s
FMX	253 kN
DFN	-3 mm
MEX	814 µE
EMX	326 J
LE	18.2 m
AR	15.03 cm^2
EM	206843 MPa
SP	77.3 kN/m3
WS	5123.0 m/s
WC	5112.4 m/s
JC	0.90
JF	1.00
F1: [680NW1]	229.44 PDICAL (1) FF1
F2: [680NW2]	230 PDICAL (1) FF1
A3 (PR): [K12864]	416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865]	430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling

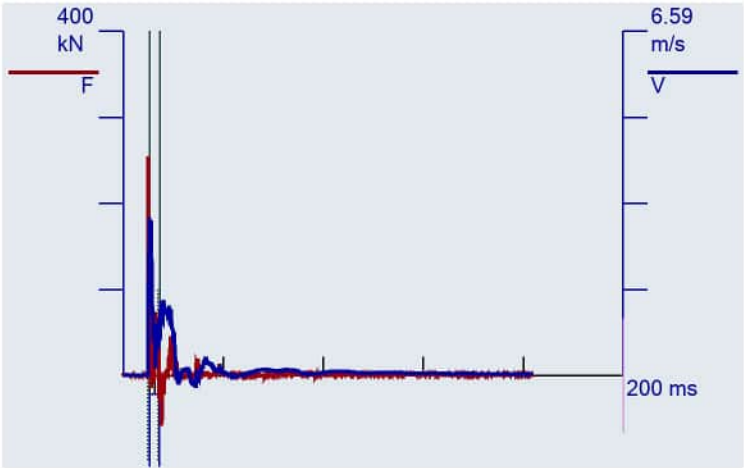
SPT Drop Hammer No.2

BH02 Test 1 at 9m

PDA Operator: RZ

Pile Driving Analyzer® (PDA)

Version: 2022.35.2

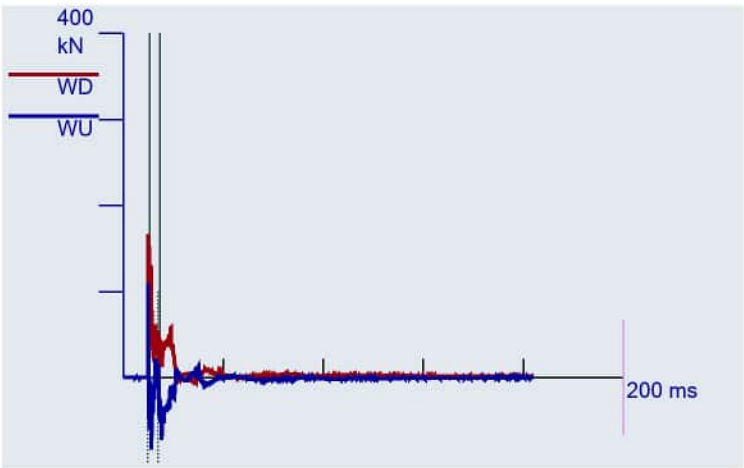


BN 17
09Feb2023 10:17:26 am

CSX 169.3 MPa
DMX 21 mm
EFV 317 J
ETR 66.8 %
BPM 18.8 bpm
RAT 0.3
VMX 3.03 m/s
FMX 254 kN
DFN 21 mm
MEX 818 µE
EMX 317 J

LE 10.7 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m3
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
SPT Drop Hammer No.2_1
BH02 Test 2 at 10.5m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2

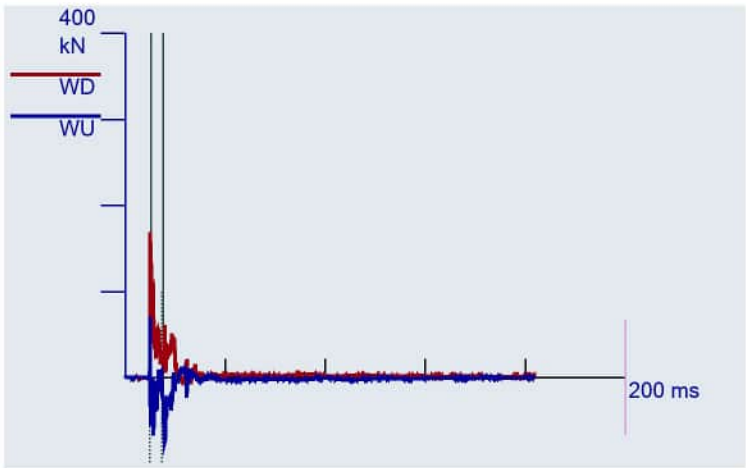


BN 21
09Feb2023 10:46:12 am

CSX 125.3 MPa
DMX 19 mm
EFV 341 J
ETR 71.9 %
BPM 22.4 bpm
RAT 0.3
VMX 3.28 m/s
FMX 188 kN
DFN 19 mm
MEX 606 μ E
EMX 341 J

LE 12.2 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5104.6 m/s
JC 0.90
JF 1.00

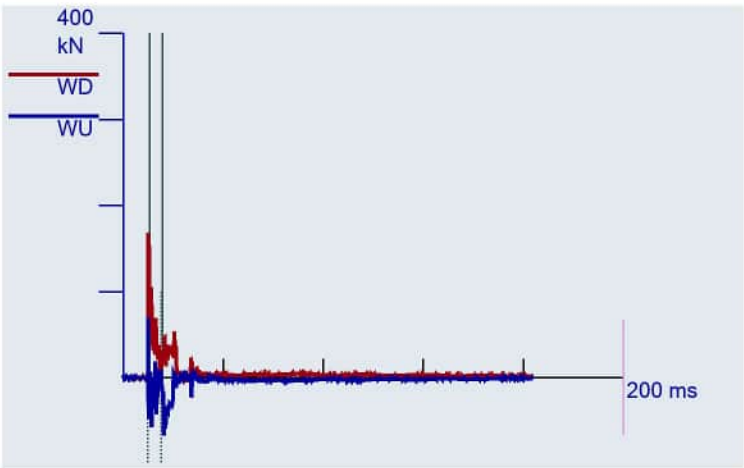
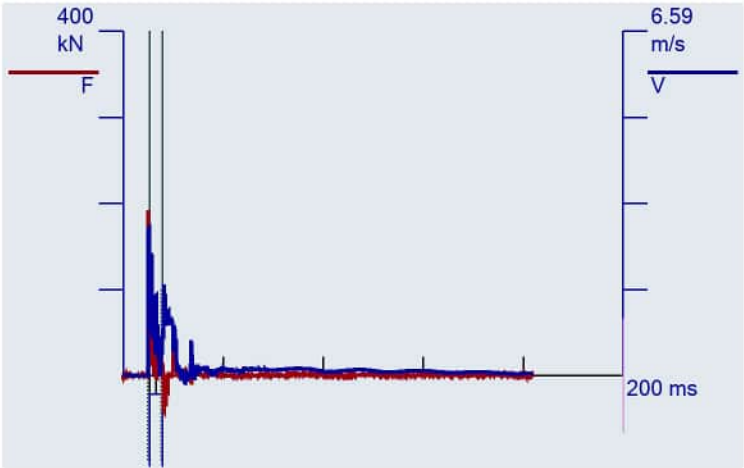
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
SPT Drop Hammer No.2_2
BH02 Test 3 at 12m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2



BN 19	
09Feb2023 11:19:04 am	
CSX	127.9 MPa
DMX	25 mm
EFV	319 J
ETR	67.2 %
BPM	21.6 bpm
RAT	0.6
VMX	2.82 m/s
FMX	192 kN
DFN	25 mm
MEX	618 µE
EMX	319 J
LE	13.7 m
AR	15.03 cm^2
EM	206843 MPa
SP	77.3 kN/m3
WS	5123.0 m/s
WC	5111.9 m/s
JC	0.90
JF	1.00
F1: [680NW1]	229.44 PDICAL (1) FF1
F2: [680NW2]	230 PDICAL (1) FF1
A3 (PR): [K12864]	416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865]	430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling

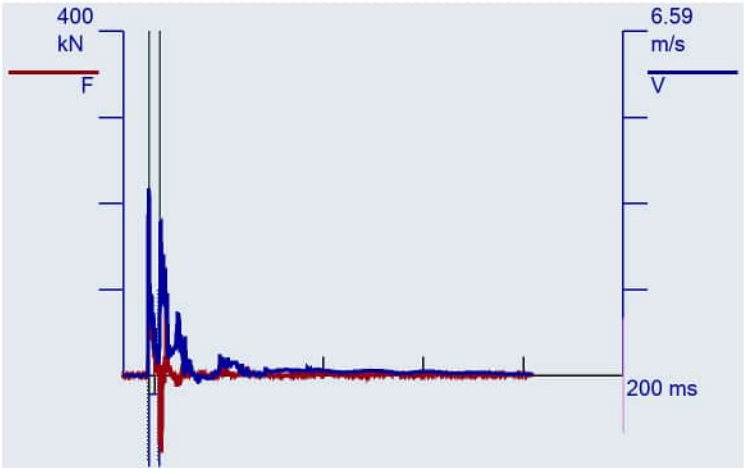
SPT Drop Hammer No.3

BH03 Test 1 at 9m

PDA Operator: RZ

Pile Driving Analyzer® (PDA)

Version: 2022.35.2

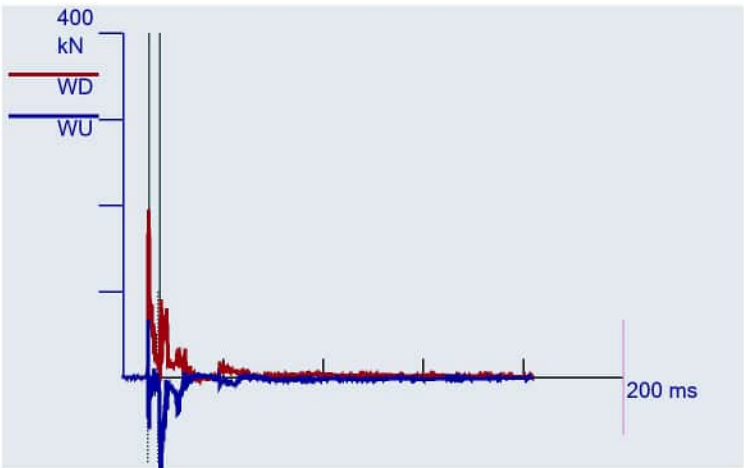


BN 15
09Feb2023 11:35:44 am

CSX 124.9 MPa
DMX 25 mm
EFV 355 J
ETR 74.7 %
BPM 21.2 bpm
RAT 1.1
VMX 3.58 m/s
FMX 188 kN
DFN 25 mm
MEX 604 μ E
EMX 355 J

LE 10.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

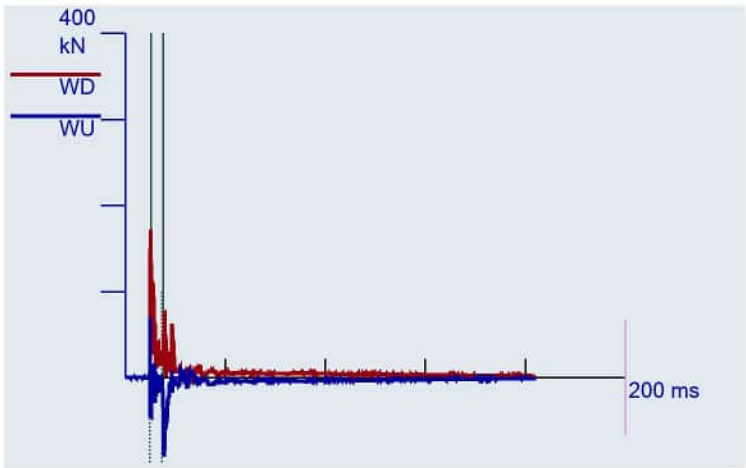
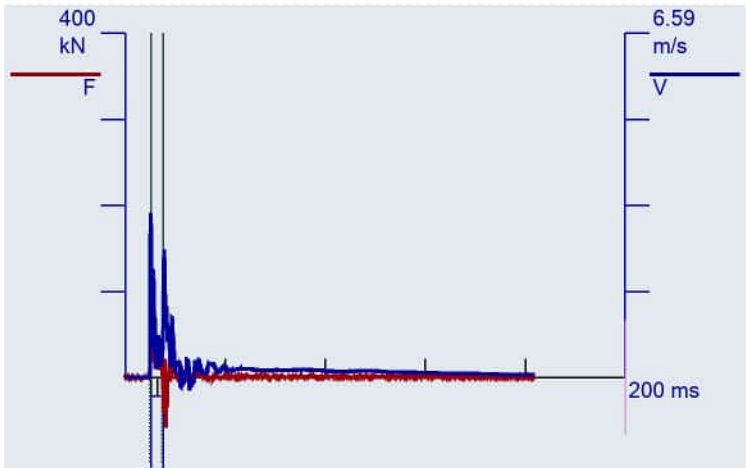
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
SPT Drop Hammer No.3_1
BH03 Test 2 at 10.5m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2

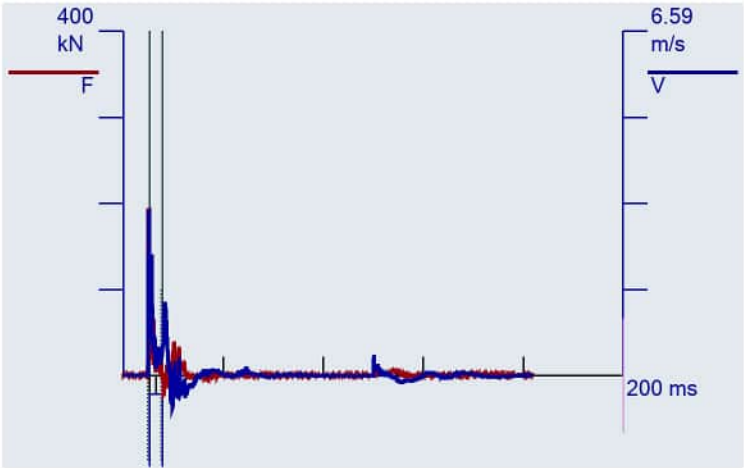


BN 30	
09Feb2023 12:05:14 pm	
CSX	110.4 MPa
DMX	26 mm
EFV	309 J
ETR	65.1 %
BPM	20.3 bpm
RAT	1.1
VMX	3.16 m/s
FMX	166 kN
DFN	26 mm
MEX	534 µE
EMX	309 J
LE	12.2 m
AR	15.03 cm^2
EM	206843 MPa
SP	77.3 kN/m3
WS	5123.0 m/s
WC	5104.6 m/s
JC	0.90
JF	1.00
F1: [680NW1]	229.44 PDICAL (1) FF1
F2: [680NW2]	230 PDICAL (1) FF1
A3 (PR): [K12864]	416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865]	430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling
SPT Drop Hammer No.3_2
BH03 Test 3 at 12m
PDA Operator: RZ

Pile Driving Analyzer® (PDA)
Version: 2022.35.2

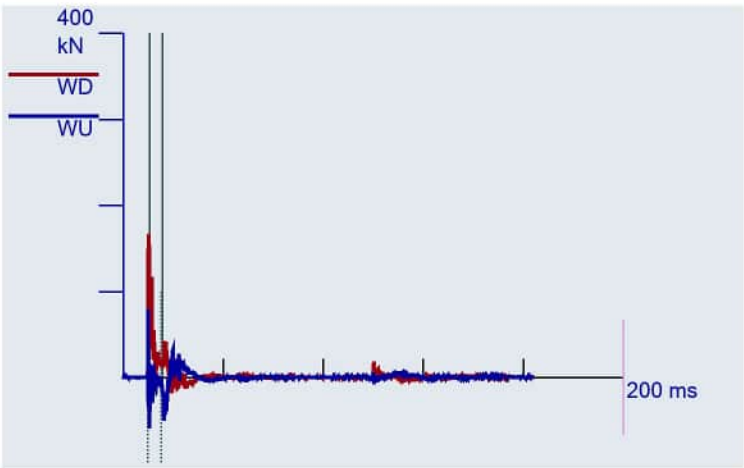


BN 39
09Feb2023 12:29:12 pm

CSX 129.2 MPa
DMX 7 mm
EFV 300 J
ETR 63.2 %
BPM 20.4 bpm
RAT 1.1
VMX 3.14 m/s
FMX 194 kN
DFN 5 mm
MEX 624 µE
EMX 300 J

LE 13.7 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m3
WS 5123.0 m/s
WC 5111.9 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling

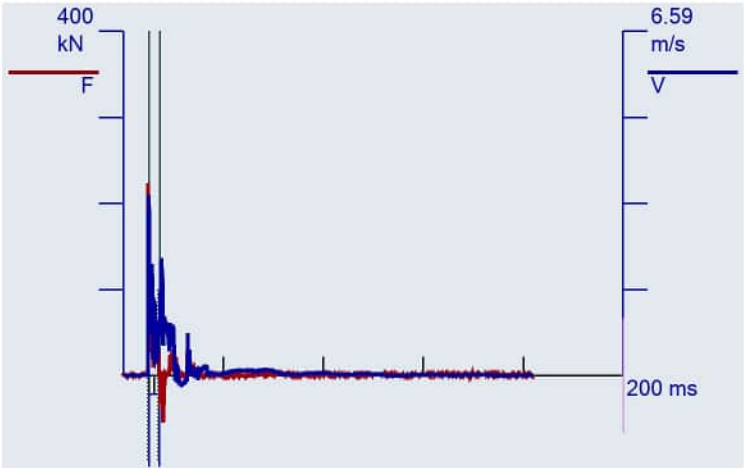
SPT Drop Hammer No.4

BH01 Test 1 at 9m

PDA Operator: RZ

Pile Driving Analyzer® (PDA)

Version: 2022.35.2

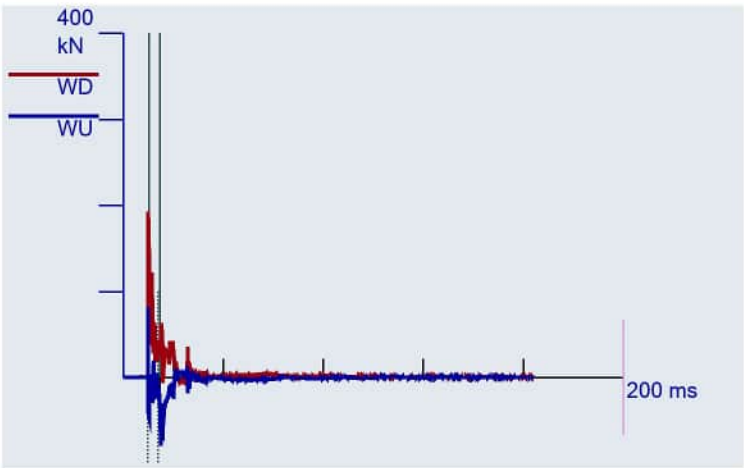


BN 31
09Feb2023 09:11:00 am

CSX 148.6 MPa
DMX 16 mm
EFV 371 J
ETR 78.1 %
BPM 19.9 bpm
RAT 1.1
VMX 3.46 m/s
FMX 223 kN
DFN 16 mm
MEX 719 µE
EMX 371 J

LE 10.7 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m3
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Appendix F5

Telemetered Groundwater Data Plots

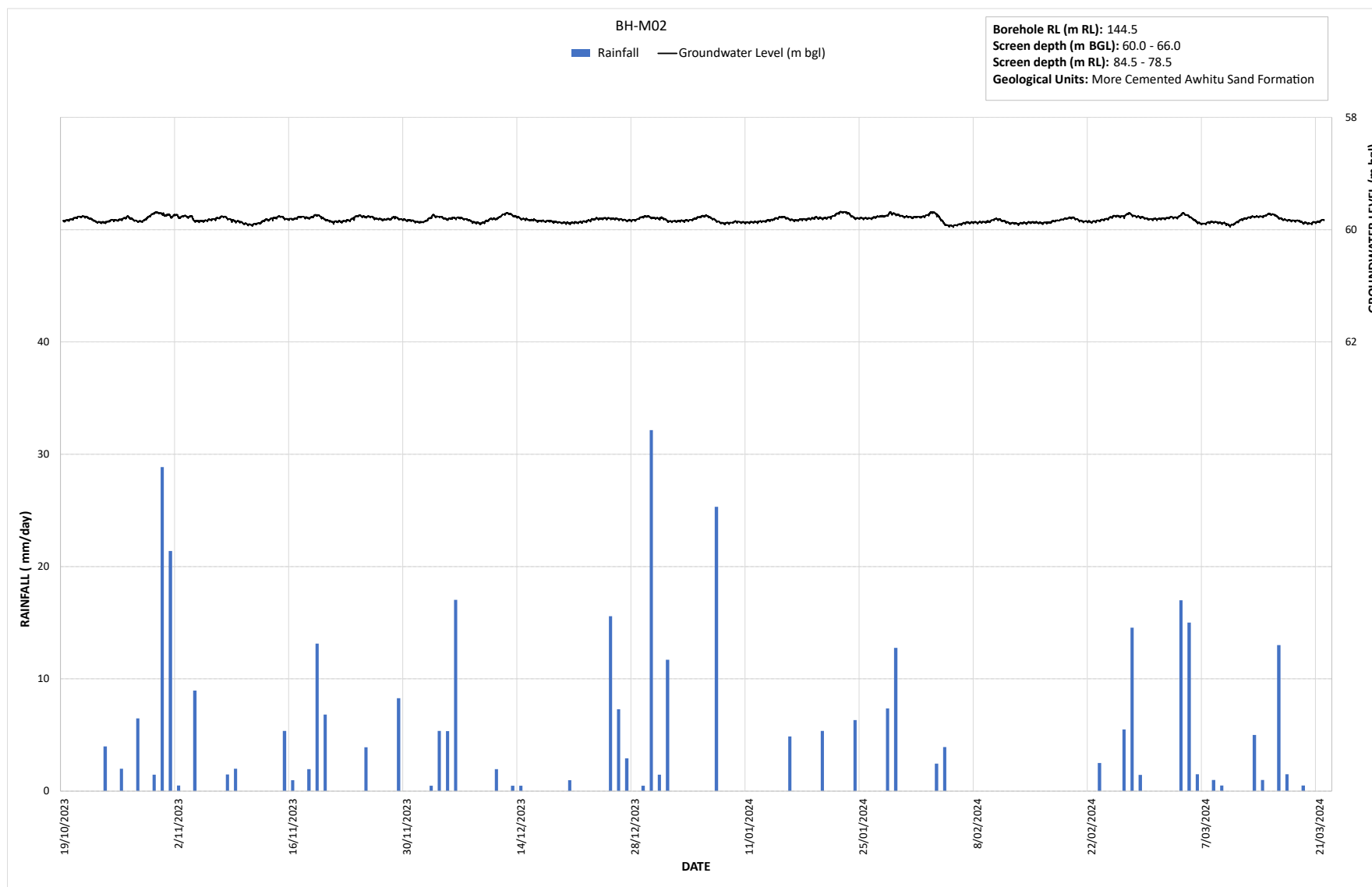


Figure F5-1: Plot of rainfall and telemetered groundwater data from BH-M02. Rainfall data sourced from Auckland Council's Environmental Data Portal

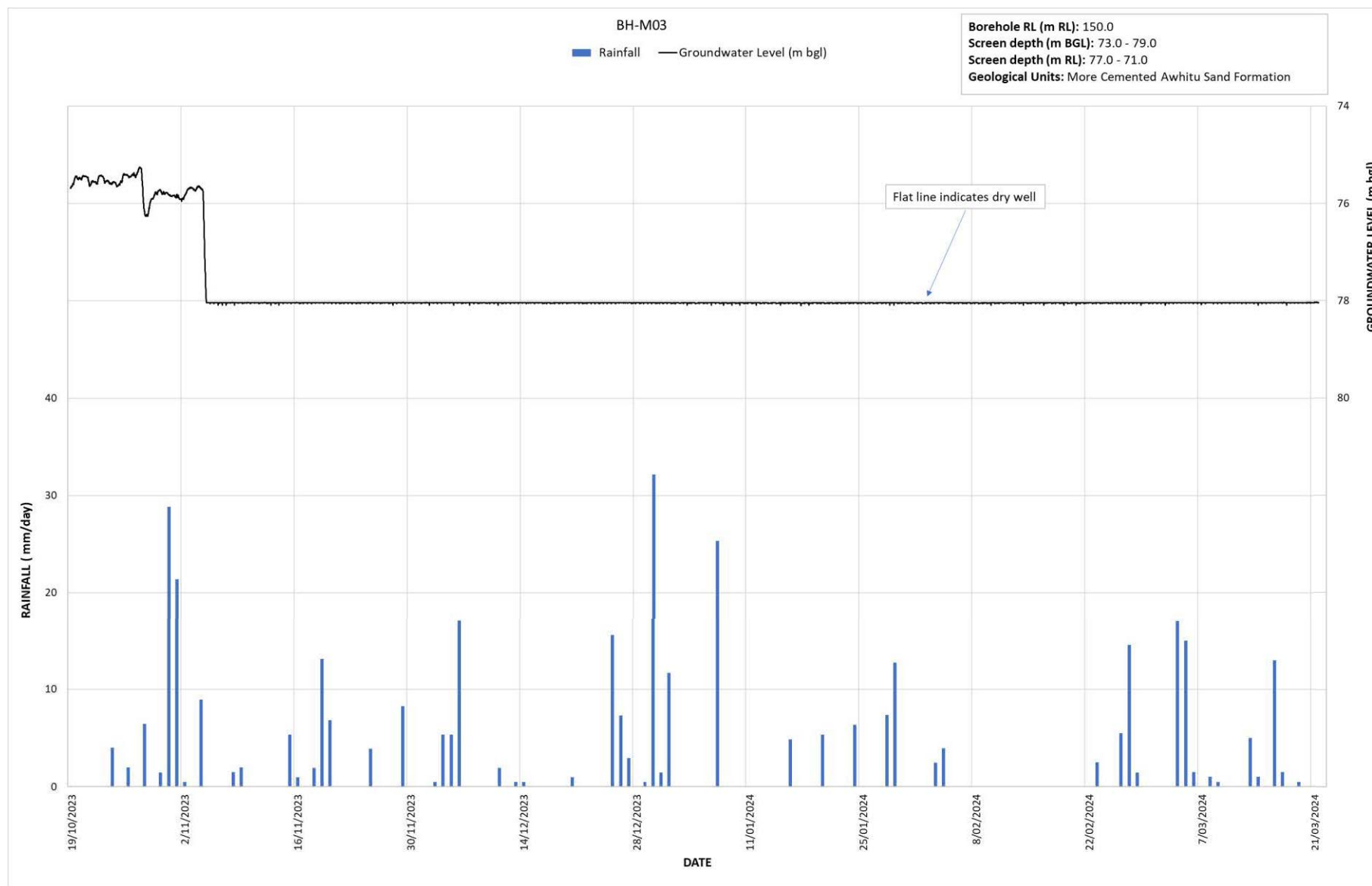


Figure F5-2: Plot of rainfall and telemetered groundwater data from BH-M03. Rainfall data sourced from Auckland Council's Environmental Data Portal

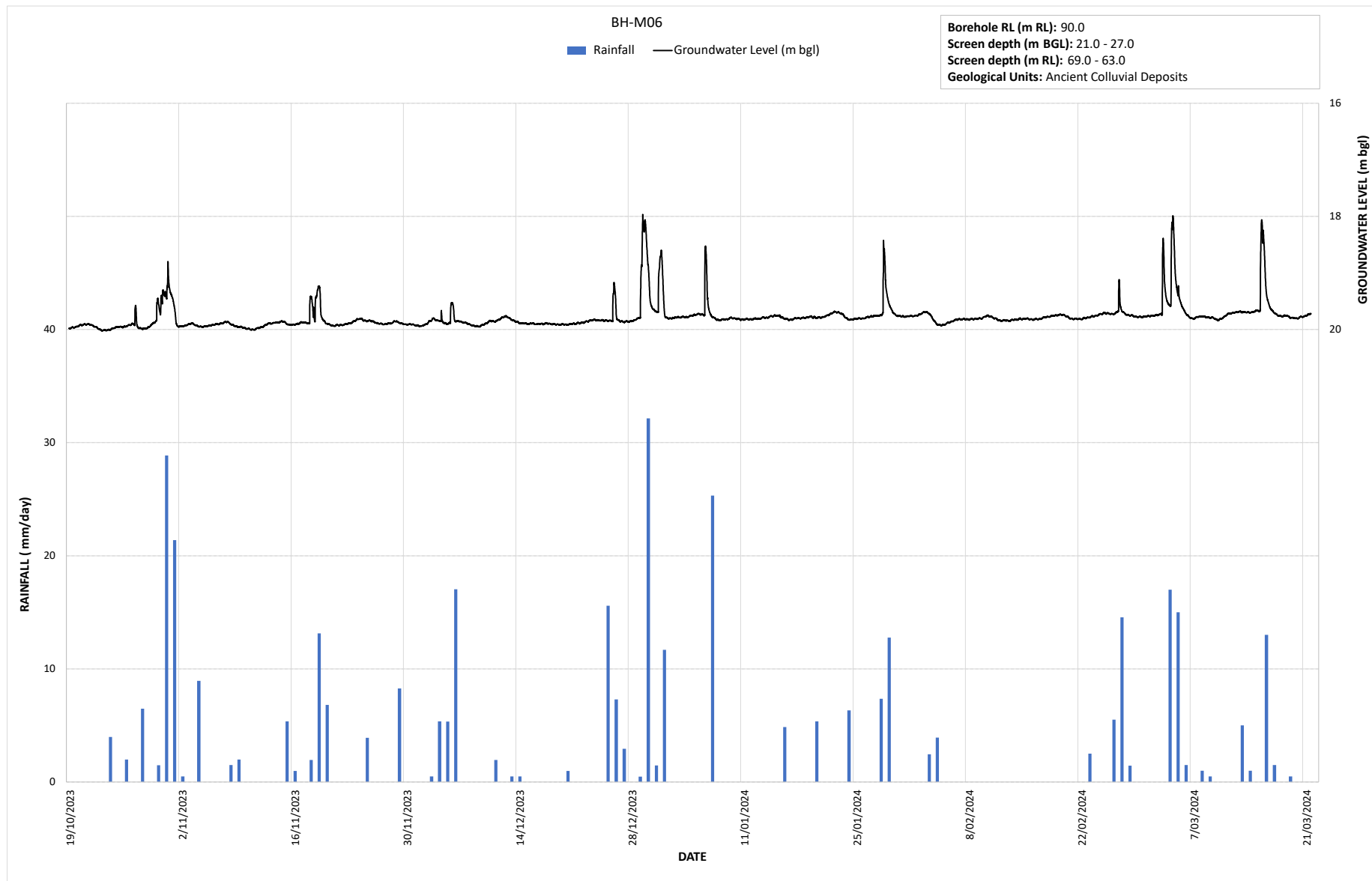


Figure F5-3: Plot of rainfall and telemetered groundwater data from BH-M06. Rainfall data sourced from Auckland Council's Environmental Data Portal

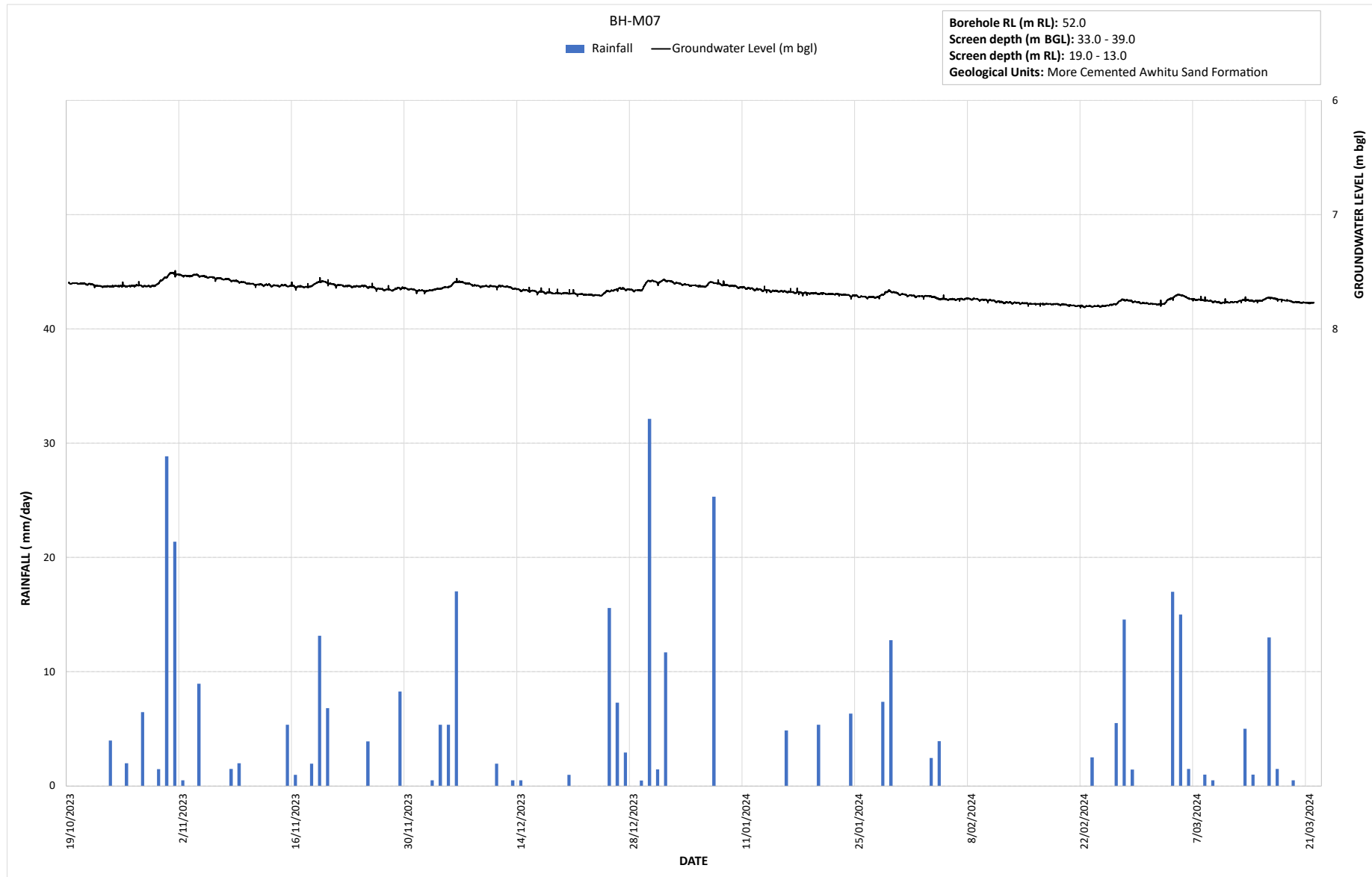


Figure F5-4: Plot of rainfall and telemetered groundwater data from BH-M07. Rainfall data sourced from Auckland Council's Environmental Data Portal

ISBN 978-1-991146-40-3 (PDF)
May 2024

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