APPENDIX B

NAPIER PORT 6 WHARF DEVELOPMENT GEOTECHNICAL FACTUAL REPORT

NAPIER PORT

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Report

6 Wharf Development - Geotechnical Factual Report

Prepared for Napier Port

Prepared by Beca Ltd (Beca)

3 October 2016

Revision History

Revision N°	Prepared By	Description	Date
A	**Jeremy Eade**	Draft for Client Review	29/2/2016
1	Nicola Ridgley	Final	3/10/2016

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Jeremy Eade**		3/10/16
Reviewed by	**Nicola Ridgley**		3/10/16
Approved by	**Connon Andrews**		3/10/16
on behalf of	Beca Ltd		

Contents

Appendices

1 Introduction

Beca Ltd has been commissioned by Napier Port to undertake a geotechnical investigation to inform the design of a new wharf (Wharf 6) at Napier Port.

1.1 Object and Scope of the Investigation

Napier Port proposes to construct an additional wharf alongside the existing container terminal at Napier Port. A geotechnical investigation was undertaken to provide subsurface information about the reclamation fill as well as soil and rock levels. This information will inform the design of piles for the proposed wharf as well as assist in the consenting process for dredging offshore.

The investigation was undertaken in three phases and comprised:

- Nine land based machine boreholes to depths between 18.62 and 41.0m below ground level
- 16 barge based machine boreholes to depths between 2.8 and 27.65m below sea bed level
- 27 vibrocores to depths between 0.65 and 4.67m below sea bed level
- Three downhole shear wave velocity tests conducted in BH601, BH604 and BH606
- Laboratory testing as detailed in Section 3.0

1.2 Site Location and Description

Napier Port is located approximately 2km north of Napier CBD. The site is flat reclaimed land situated immediately north of Bluff Hill. The proposed Wharf 6 development is located just west of the existing Wharf 5 along the northern edge of the container terminal.

1.3 Site Geology

The 1:250,000 Geology of the Hawkes Bay area map shows the Napier Port site to be underlain by reclamation fill. The cliff immediately south of Napier Port (Bluff Hill) is mapped as Pliocene Scinde Island Formation (Mangaheia Group) comprising calcareous sandstone and limestone. The Scinde Island Formation at Bluff Hill is overlain by early Pleistocene Kidnappers Group comprising gravel, silt and sand deposits.

2 Site Investigation

The site investigation was commenced on 17 November, 2015 and was completed by 8 February, 2016. The investigation locations were measured during drilling with a handheld GPS and are in terms of NZTM. Elevations for land based investigations were estimated using a survey data. Elevations for offshore investigations were estimated by measuring water level and adjusted using tide height data. All elevations are given in Chart Datum. Site plans showing the investigations are presented in Appendix A. The site investigations were observed full-time by a Beca Engineering Geologist. Unless otherwise stated, all soil and rock logging has been undertaken by a Beca Engineering Geologist. All logs have been verified by a Beca Senior Engineering Geologist.

2.1 Standards and Calibration

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

Table 1 - Summary of Standards used in this Investigation

Field Procedure	Standard Used
Soil and Rock logging	In general accordance with New Zealand Geotechnical Society Guidelines (NZGS, 2005).
Standard Penetration Testing	ASTM D 1586 Rev A, 2008 (1)
Standard Penetration Testing – Hammer Efficiency	ASTM D4633-10
Downhole Seismic Testing	ASTM D7400-14

Note

(1) Standard adopted to provide for variation in SPT split spoon diameter. Varied by SPT recorded in 75mm increments including the seating drive.

A calibration report for the following testing equipment used in the investigations is attached in Appendix B.

- SPT Hammer Efficiency

2.2 Machine Boreholes

Machine boreholes were drilled by Pro-Drill (Auck) Ltd using a Fraste CRSXL dual head sonic/rotary rig. Drilling was undertaken using sonic and triple tube drilling methods. Boreholes 601 to 609 were drilled from the existing reclamation and Wharf 5. Boreholes 610 to 625 were drilled over water from Marine Services Auckland Ltd (MSAL) Barge “Mercury Mover”. The barge is 20m by 7m in size, the drill rig was set up over a moon pool through the centre of the barge and was held on location with two spuds. A summary of all machine boreholes undertaken is given Table 2.

Table 2 - Summary of Boreholes Drilled

BH No.	Easting	Northing	R.L. ground (m Chart Datum)	Total Depth (m)	Installation Details
BH601	1936561	5623181	3.13	18.62	PVC liner
BH602	1936677	5623245	3.1	24.84	-
BH603	1936799	5623283	3.18	26.37	-
BH604	1936610	5623267	2.84	35.05	PVC liner
BH605	1936663	5623265	2.92	26.15	-
BH606	1936749	5623320	3.16	41.0	PVC liner
BH607	1936844	5623325	3.21	24.77	-
BH608	1936953	5623345	3.71	29.39	-
BH609	1936974	5623372	-10.5	21.45	-
BH610	1936563	5623290	-4.15	26.75	-
BH611	1936662	5623318	-3.6	21.83	-
BH612	1936835	5623347	-6.05	14.55	-
BH613	1936619	5623319	-3.85	27.65	-
BH614	1936751	5623343	-4.8	21.02	-
BH615	1936912	5623382	-9.1	11.42	-
BH616	1936648	5623359	-5.15	12.15	-
BH617	1936859	5623387	-9.05	6.76	-
BH618	1936585	5623377	-6.45	9.15	-
BH619	1936716	5623403	-9.35	7.25	-
BH620	1936944	5623451	-12.84	5.08	-
BH621	1936499	5623308	-5.1	11.73	-
BH622	1936425	5623477	-6.6	9.38	-
BH623	1936665	5623533	-10.4	7.23	-
BH624	1936352	5623757	-10.45	6.2	-
BH625	1937170	5623405	-12.4	2.8	-

Notes: All survey coordinates are given in NZTM and elevations in Chart Datum.

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

- Standard Penetration Tests were typically carried out at nominal [1.5m] centres and the uncorrected N-values are recorded on the borehole logs.

All core samples were logged on site by a Beca Engineering Geologist. Machine borehole logs are presented in Appendix B and core photographs in Appendix C. After the core samples had been logged, they were wrapped in plastic to reduce moisture loss and placed in labelled core boxes before being transferred to a container onsite for storage. Some natural desiccation and degradation of the core samples will occur through time following storage. Upon completion, all boreholes not requiring installations were backfilled with gravel and capped with asphalt where appropriate.

During drilling of BH612, a 1.7m length of sonic casing broke off downhole and was unable to be recovered. The casing was lost at a depth of 1.5m to 3.2m depth below ground level (-7.55m to -9.25m below chart datum). The borehole was abandoned and shifted approximately 2m adjacent. The casing will pose a hazard to any dredging or piling that occurs at that location.

2.3 Vibrocores

SEAS Offshore Pty Ltd were commissioned by Napier Port to conduct 27 vibrocores at the entrance to Napier Harbour. Vibrocores were undertaken using the SEAS VC-450 equipment mounted on the Torea 2 fishing vessel.

A summary of all vibrocores undertaken is provided in Table 3 below.

Table 3 - Summary of Vibrocores Drilled

BH No.	Easting	Northing	R.L. ground (m Chart Datum)	Total Depth (m)
VB01a	1937520.9	5626199	-14.4	2.1
VB02a	1937196.6	5626146.4	-14.0	2.76
VB03c	1937320.5	5625838.9	-13.9	1.7
VB04a	1937027.8	5625485.6	-13.4	1.84
VB05a	1937003.2	5625719.7	-13.6	1.65
VB05b	1937003.2	5625719.7	-13.6	2.35
VB06b	1936689.9	5625400.8	-13.0	3.7
VB07a	1936569.4	5625735.8	-13.2	3.57
VB08a	1936461.9	5625147.5	-12.4	3.92
VB09a	1936659.9	5624984.9	-12.9	2.05
VB10a	1936410.9	5624701	-12.6	0.7
VB10b	1936410.9	5624701	-12.6	0.9
VB11a	1936394.4	5624331.6	-12.7	4.2
VB12a	1936573	5624327	-13.0	4.67
VB13a	1937040.1	5624499.3	-12.4	4.25
VB14a	1936514.6	5623880.8	-12.3	4.3
VB15a	1936526.5	5624811.7	-12.1	2.3
VB16a	1936331.8	5623669.4	-10.1	3.85
VB17a	1936322.1	5623505.3	-7.8	4.45
VB18a	1936448.2	5623453.1	-7.1	3.5
VB19a	1936619.2	5623534.1	-10.4	3.02
VB20a	1936788.7	5623586.8	-13.4	4.4
VB21a	1936942.2	5623465.3	-12.8	0.65
VB22a	1937186	5623386	-12.5	0.88
VB23a	1937132.8	5625009	-13.0	4.65
VB24a	1936515.7	5624123	-13.1	4.03
VB25a	1936654.3	5623707.5	-13.1	3.8

Notes: All survey coordinates are given in [enter circuit/coordinate system/datum used].

Vibrocores were taken to a workshop on site at Napier Port and cut open. All cores were logged by a Beca Engineering Geologist. Vibrocore logs are presented in Appendix D and photographs are presented in

Appendix E. Representative samples were taken from the vibrocores for laboratory testing where appropriate. The vibrocores were resealed with tape and moved to storage onsite.

2.4 Down-hole Shear Wave Velocity Testing

AJ Sutherland Consulting Ltd was commissioned by Napier Port to undertake down-hole shear wave velocity testing in four of the boreholes, BH601, BH604, and BH606. The driller, Pro-Drill (Auck) Ltd was commissioned to case the machine boreholes to between 18.5m and 41.0m depth with 50mm ID PVC casing grouted in place to ASTM – D7400-08 standard.

The methodology and results for the shear-wave testing is provided in the report provided by AJ Sutherland Consulting Ltd, attached as Appendix F.

3 Laboratory Testing

3.1 Soil Classification

Disturbed soil samples were collected from machine boreholes and vibrocores as well as rock samples obtained from the machine boreholes.

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

- Natural Moisture Content: NZS4402, 1986; test 2.1
- Atterberg Limits: NZS4402, 1986; tests 2.2, 2.3 and 2.4
- Wash Grading: NZS4402, 1986; test 2.8.1 (wet sieve)
- Hydrometer Grading: ASTM D422-63 (2007)
- Solid Particle Density: NZS4402, 1986, tests 2.7.1 and 2.7.2
- Unconfined Compression Test: NZS4402, 1986, test 6.3.1

In addition Point Load Tests (ASTM: D 5731-08) were undertaken by Opus where samples were not suitable for UCS testing.

The results of the laboratory testing are given in Appendix G.

3.2 Settling Velocity

Particle settling velocity tests using the Bottom Withdrawal Tube Method were undertaken on disturbed soil samples collected from the vibrocores.

The results of the laboratory testing are given in Appendix H.

4 Applicability Statement

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

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

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

5 References

ASTM D 1586 REV A Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

ASTM D7400-14, Standard Test Methods for Downhole Seismic Testing, ASTM International, West Conshohocken, PA, 2014, www.astm.org British Standard (BS1377: 1990 Part 8, Test 7)

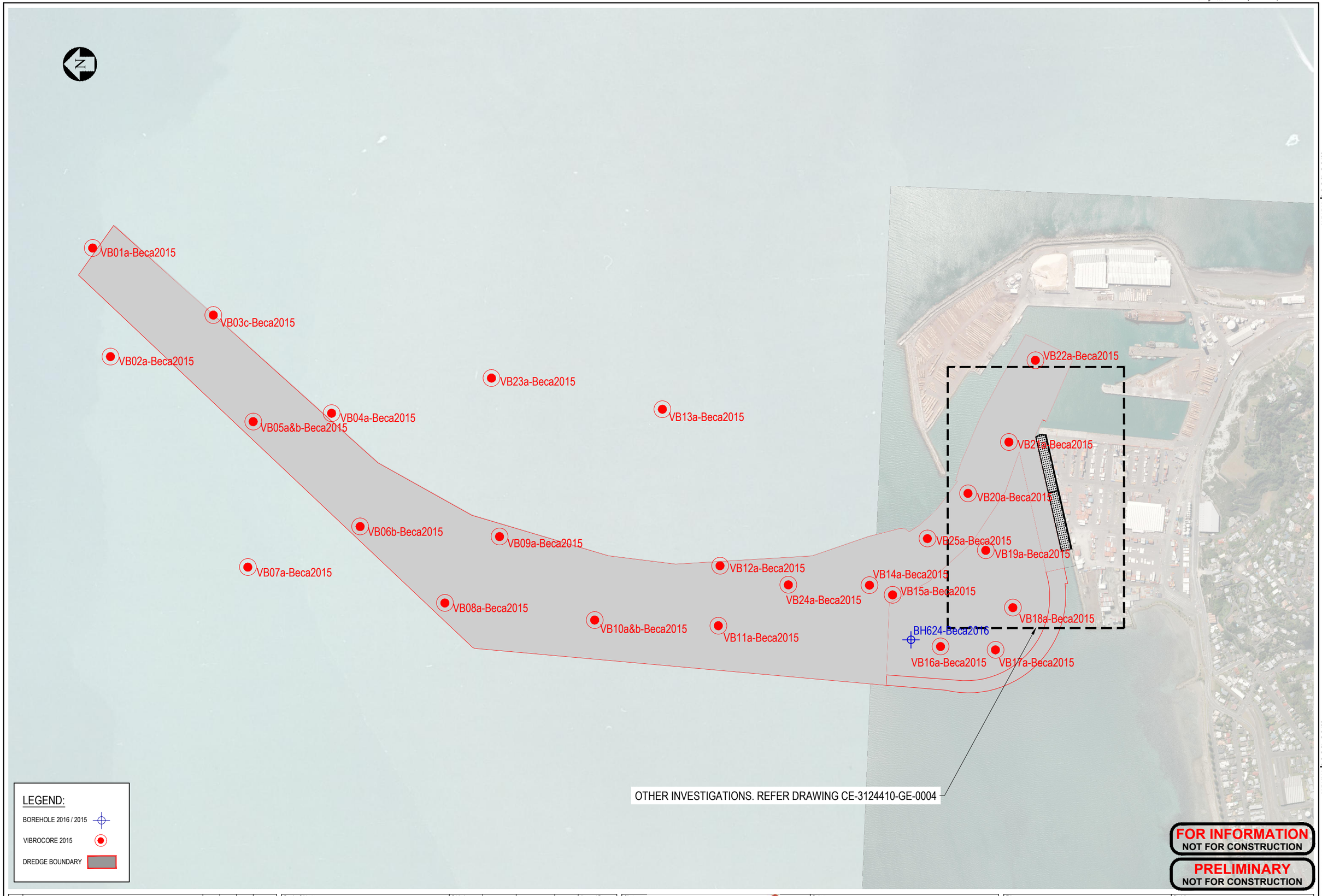
NZ Geotechnical Society, 2005: Field Description for Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes.

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

Appendix A

Site Plans

Drawing Plotted: 18 May 2016 3:56 p.m.



LEGEND:

- BOREHOLE 2016 / 2015
- VIBROCORE 2015
- DREDGE BOUNDARY

FOR INFORMATION
NOT FOR CONSTRUCTION

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION				

Drawing Originator: Beca

Original Scale (A1) 1:5000
Reduced Scale (A3) 1:10000

Design			Approved For Construction*
Drawn	MC	16.05.16	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: NAPIER PORT

Project:

Title: GEOTECHNICAL TEST LOCATIONS PLAN SHEET 1 OF 2

Discipline: GEOTECHNICAL

Drawing No.: 3124410-GE-0003

Rev.: A

Document No. 3124410-GE-0003.DWG

DO NOT SCALE

IF IN DOUBT ASK.

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Drawing Plotted: 18 May 2016 3:58 p.m.

N

BH15A-1993
BH4-1993
BH2-GA2015
BH20-1993
BH14-1993
BH8A-1993
BH8-1993
BH19-1993
BH3-1993
BH21-1977
BH13-1993
BH8B-1993
BH18-1993
BH9-1
BH21-1993
BH9B-199
BH12-197
VB20a-Beca2015
VB19a-Beca2015
BH623-Beca2016
BH622-Beca2016
VB18a-Beca2015
VB21a-Beca2015
BH620-Beca2016
BH619-Beca2016
BH617-Beca2016
BH615-Beca2016
BH618-Beca2016
BH609-Beca2015
BH616-Beca2016
BH20-1977
BH13-1977
BH614-Beca2016
BH612-Beca2016
BH608-Beca2015
BH613-Beca2016
BH607-Beca2015
BH611-Beca2016
BH621-Beca2016
BH5-Beca2014
BH23-1977
BH606-Beca2015
BH610-Beca2016
BH603-Beca2015
BH25-1977
BH604-Beca2015
BH605-Beca2015
TP1-2003
BH10-Beca2014
TP3-2003
TP2-2003
BH27-1977
BH602-Beca2016
BH9-Beca2014
BH19-1977
CPT8-T&T2014
CPT9-T&T2014
BH4-Beca2014
BH2-T&T2014
CPT10-T&T2014
BH601-Beca2015
BH8-Beca2014
BH18-1977
BH3-Beca2014
BH12-1977

LEGEND:

- BOREHOLE 2016 / 2015
- BOREHOLE
- TESTPIT
- VIBROCORE 2015
- CPT
- DREDGE BOUNDARY

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NOT FOR CONSTRUCTION

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No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION				

Drawing Originator: Beca

Original Scale (A1) 1:1000
Reduced Scale (A3) 1:2000

Design			Approved For Construction*
Drawn	MC	16.05.16	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: NAPIER PORT

Project:

Title: GEOTECHNICAL TEST LOCATIONS PLAN

Discipline: GEOTECHNICAL

Drawing No.: 3124410-GE-0004

Rev.: A

Document No.: 3124410-GE-0004.DWG

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Appendix B

Machine Borehole Logs

Log Key Sheet

WATER

Water level on date shown

METHOD *(shows drilling method)*

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

SAMPLES

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

MOISTURE

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

SOIL AND ROCK DESCRIPTIONS

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.
Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

INSITU TESTS

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

★	**Laboratory Test(s) carried out:**
AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

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

CONSISTENCY

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

Non-cohesive Soils	SPT – Uncorrected
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	>50

GRAPHIC LOG (1 or a combination of the following)


Fill


Silt


Cobbles


Sandstone


Fine igneous


Core loss


Sand


Boulders


Limestone


Coarse igneous


Organics


Shells


Mudstone


Schist


Clay


Gravel


Siltstone


Basalt

ORGANIC SOILS

Von Post Degree of Humification

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

Beca

BOREHOLE No: BH601

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-west

COORDINATES: N 5,623,181 m — R L: 3.13 m — COORDINATE ORIGIN: hhGPS

E 1,936,561 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	VC							1		0.0-1.3m - Vacuum excavation. Logged from visual inspection. 0.0-1.3m - 'Tightly packed', medium to coarse sandy, fine to coarse GRAVEL.		3
		92 %	Sonic							2		'Loose', medium to coarse sandy, fine to coarse GRAVEL, minor silt; brown speckled grey; wet, non plastic. Trace refuse (bricks).		2
												'Loose', medium to coarse SAND, some silt, minor fine to coarse gravel; yellowish brown speckled black; moist, non plastic. Gravel: rounded to subrounded, UW, greywacke.		
												Loose, fine to medium GRAVEL, some silt, minor medium to coarse sand, trace clay; grey with yellowish brown matrix; moist, low plasticity (matrix). Gravel: rounded to subrounded, UW, greywacke.		1
									SD1			Very stiff, clayey SILT, minor medium gravel, trace sand; yellowish brown; moist, high plasticity.		
		58 %	SPT					1 1 1 1 1 1 N=4		3		Loose, fine to medium GRAVEL, minor silt, trace sand; grey mottled yellowish brown; moist, non plastic. Gravel: rounded, UW, greywacke.		0
												Very stiff, SILT, some clay, minor fine sand; yellowish brown; moist, high plasticity.		
		56 %	Sonic									Loose, fine to medium GRAVEL, minor silt, trace sand; grey mottled yellowish brown; moist, non plastic. Gravel: rounded, UW, greywacke. 20mm bed of SILT, some clay; high plasticity. Some silt, trace clay; low plasticity (matrix).		
		44 %	SPT					1 1 2 2 3 2 N=9		4				-1
												20mm bed of SILT, some clay; high plasticity.		
		78 %	Sonic							5		Loose, medium to coarse SAND, some fine to medium gravel, minor silt; bluish grey speckled yellow; saturated, non plastic. Gravel: subangular to subrounded, SW, sandstone.	Recent Marine Sediments	-2
												80mm subangular, SW, sandstone cobble.		
		89 %	SPT					2 5 5 4 2 2 N=13		6		Wet.		-3
												Saturated, dilatant.		
		100 %	Sonic							7		Very loose, fine to medium SAND, trace medium gravel, trace silt; grey mottled yellowish brown; saturated, non plastic, dilatant. Gravel: subangular to subrounded, SW, sandstone.		-4
		100 %	SPT					0 0 0 0 1 2 N=3		8		Soft, clayey SILT, minor fine sand; bluish grey; moist, high plasticity.	Quaternary Marine Sediments	-5
		100 %	Sonic									Trace shells.		
		100 %	SPT					0 0 0 1 0 0 N=1	SD2	9				-6
		100 %	Sonic											

DATE STARTED: 25/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 26/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VC

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH601

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,181 m
E 1,936,561 m
BOREHOLE LOCATION: Container terminal - North-west
R L: 3.13 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic					3 2 2 3 2 2 N=9		11		Firm, fine sandy SILT, minor clay, trace shells; grey; moist, low plasticity. 80mm SW sandstone cobble. Loose, silty fine SAND, trace organics, trace shells; grey speckled brown; moist, non plastic.	Quaternary Marine Sediments	-7 -8
		100 %	SPT											
		100 %	Sonic							12				-9
		100 %	SPT					2 3 4 5 6 7 N=22				Very stiff, SILT, some fine sand, some clay; bluish grey; moist, high plasticity. [CW Siltstone]		
		100 %	Sonic							13				-10
		0 %	SPT					1 2 4 4 4 6 N=18				13.7-14.15m - No recovery - slipped from SPT.		
		100 %	Sonic							14		Very stiff, fine sandy SILT, some clay; bluish grey; moist, high plasticity. [CW Siltstone]		-11
		100 %	SPT					2 4 8 12 13 17/50mm N=50/275mm		15			Mangaheia Group	-12
		70 %	TT									Extremely weak, SW, bluish grey, fine to medium SANDSTONE Very weak.		-13
		100 %	TT							16				
		0 %	SPT					18 32/70mm Nc=50+		17		Very weak, SW, grey, calcareous SANDSTONE. Defects: extremely closely spaced.		-14
		100 %	TT							18		Extremely weak, SW, greenish grey, silty fine to medium SANDSTONE. Weakly cemented. Extremely weak to very weak, SW, greyish green mottled white, calcareous SANDSTONE. Defects: extremely closely spaced. Weak, well cemented.		-15
		0 %	SPT					27 23/40mm Nc=50+				END OF LOG @ 18.62 m		
										19				-16

DATE STARTED: 25/11/15
DATE FINISHED: 26/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT/VC
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH602

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,245 m
E 1,936,677 m
BOREHOLE LOCATION: Container terminal - North
R L: 3.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	VC							1		0.0-2.0m - No recovery - Vacuum excavation	Fill	3
		77 %	Sonic							2		Loose, fine to medium SAND, minor shells, trace fine to medium gravel; dark grey; saturated, non plastic.		2
		33 %	SPT					1 1 1 1 1 1 N=4		3				1
		100 %	Sonic							4				0
		44 %	SPT					0 0 0 0 1 0 N=1				Very loose.		-1
		100 %	Sonic						SD3	5				-2
		22 %	SPT					0 0 0 0 0 0 N=0		6				-3
		100 %	Sonic							7				-4
		99 %	SPT Sonic							8		'Firm', fine sandy SILT, some clay, trace shells; dark grey; saturated, high plasticity (when dried).	Quaternary Marine Sediments	-5
												Medium dense, fine to coarse SAND, trace gravel; dark grey; wet, non plastic. Some shells. 80mm SW, sandstone cobble,		
		100 %	SPT					1 0 4 7 7 9 N=27		9				-6
		100 %	Sonic									Medium dense, silty fine to medium SAND, trace clay; dark grey; wet, low plasticity.		

DATE STARTED: 21/11/15
DATE FINISHED: 22/11/15
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT/VC
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH602

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,245 m — R L: 3.1 m — COORDINATE ORIGIN: hhGPS

E 1,936,677 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Medium dense, silty fine to medium SAND, trace clay; dark grey; wet, low plasticity.	Quaternary Marine Sediments	-7
		145 %	SPT					3 3 5 6 6 7 N=24		11				
		74 %	Sonic											-8
		100 %	SPT					1 4 6 7 7 8 N=28		12				-9
		84 %	Sonic											
		100 %	SPT					3 4 4 8 8 8 N=28		13				-10
		100 %	Sonic											
		100 %	SPT					3 10 23 15 12 N=50/225mm		14				-11
		100 %	Sonic						SD4			Very dense, fine gravelly, fine to coarse SAND, some silt; dark grey speckled white; wet, non plastic. Gravel: subrounded to subangular, SW-MW, siltstone and sandstone.		-12
		100 %	SPT					2 4 6 7 9 11 Nc=33		15				
		100 %	Sonic									Very dense, fine to medium SAND, trace shells; dark grey speckled white; wet, non plastic.		-13
		100 %	SPT					3 6 6 7 7 10 Nc=30		16				-14
		100 %	Sonic									Dense.		
		100 %	SPT					4 7 20		17				-15
												Moderately thin (50mm) bed of SILT; pink. [Tephra]		
										18		Very stiff, fine sandy SILT, trace clay; dark greenish grey; wet, low plasticity. [CW Siltstone]		-16
												Dense, fine to coarse SAND; light grey; wet, non plastic. [CW Sandstone]	Mangaheia Group	
										19		Very dense.		

DATE STARTED: 21/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 22/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JMC — DRILL METHOD: Sonic/SPT/TT/VC

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH602

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,245 m
E 1,936,677 m
BOREHOLE LOCATION: Container terminal - North
R L: 3.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
								22 24 4/10mm Nc=50/160mm				Extremely weak, SW, greenish grey, fine to medium SANDSTONE. Weakly cemented.	Mangaheia Group	-17
		84 %	TT							21				-18
		0 %	SPT					50/70mm Nc=50+				Weak.		
		91 %	TT							22		Extremely weak.		-19
		0 %	SPT					30 20/25mm Nc=50+		23		Very weak.		-20
		84 %	TT							24				-21
		0 %	SPT					12 16 20 16						
								14/35mm Nc=50/185mm		25		END OF LOG @ 24.84 m		-22
										26				-23
										27				-24
										28				-25
										29				-26

DATE STARTED: 21/11/15
DATE FINISHED: 22/11/15
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT/VC
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH603

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,283 m
E 1,936,799 m
BOREHOLE LOCATION: Container terminal- North
R L: 3.18 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic							0		0.0-0.1m - ASPHALT Tightly packed, fine to coarse GRAVEL, trace silt; dark grey; dry, non plastic. Gravel: angular to subrounded, UW-SW, greywacke. Some fine to coarse sand, some silt; brown speckled grey. 100mm moderately strong, SW, limestone COBBLE.		3
										1		Medium dense, fine to medium SAND, some fine to medium gravel; brown speckled grey; moist, non plastic. Gravel: rounded to subrounded, UW, greywacke.		2
		40 %	SPT					3 4 4 4 4 N=16				Medium dense, fine to medium SAND; dark grey; moist, non plastic.		
		100 %	Sonic							2		Some shells.		1
		50 %	SPT					1 1 1 2 1 2 N=6	SD5	3		Loose. Trace shells.		0
		100 %	Sonic							4		Very loose.	Fill	-1
		33 %	SPT					0 0 1 0 1 0 N=2		5				-2
		100 %	Sonic							6		Loose.		-3
		67 %	SPT					0 0 1 1 1 1 N=4		7				-4
		100 %	Sonic							8		Loose, fine to medium SAND, minor fine gravel, minor shells; brown speckled grey; wet, non plastic. Gravel: subrounded, SW, greywacke. Some fine to medium gravel.	Quaternary Marine Sediments	-5
		70 %	SPT					1 1 3 3 4 2 N=12						
		100 %	Sonic							9		Extremley weak, CW, greenish grey, fine to medium SANDSTONE.		-6
		20 %	SPT					3 4 5 3 2 3 N=13				Extremely weak, SW, dark grey, variably cemented, fine to medium SANDSTONE.		
		100 %	Sonic											

DATE STARTED: 20/11/15
DATE FINISHED: 21/11/15
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH603

MACHINE BOREHOLE LOG

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal- North

COORDINATES: N 5,623,283 m — R L: 3.18 m — COORDINATE ORIGIN: hhGPS

E 1,936,799 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic							11		Extremely weak, SW, dark grey, variably cemented, fine to medium SANDSTONE.	Mangaheia Group	-7
		67 %	SPT					5 8 11 10 11 11 N=43				Uncemented.		-8
		100 %	Sonic							12				-9
		100 %	SPT					3 6 6 13 17 14/50mm N=50/275mm						
		50 %	TT							13		12.8-13.5m - No recovery.		-10
		0 %	SPT					35 15/50mm Nc=50+		14		Very weak to weak, UW, greenish grey, variably cemented, fine to medium SANDSTONE.		-11
		67 %	TT									Weak.		
										15		Moderately strong.		-12
		0 %	SPT					11 25 30 20/50mm Nc=50/125mm		16				-13
		90 %	TT											
		0 %	SPT					23 21 18 15 17/50mm Nc=50/200mm		17				-14
		95 %	TT						UCS1			Very weak to weak, UW, light brown, silty fine to medium SANDSTONE. Weakly cemented.		
		0 %	SPT					20 30/20mm Nc=50+		18				-15
		100 %	TT						UCS2	19				-16
								23						

DATE STARTED: 20/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 21/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JMC — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH603

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal- North

COORDINATES: N 5,623,283 m — R L: 3.18 m — COORDINATE ORIGIN: hhGPS

E 1,936,799 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					14 15 15 20/70mm Nc=50/220mm				Very weak to weak, UW, light brown, silty fine to medium SANDSTONE. Weakly cemented.		-17
		95 %	TT							21		Uncemented.		-18
		0 %	SPT					15 35/75mm Nc=50+	UCS3			Very weak to weak, UW, light brown, coarse SANDSTONE.		
		75 %	TT							22		Extremely weak. Disturbed by drilling action.		-19
												Weak.		
		0 %	SPT					11 14 16 16 18 Nc=50/225mm		23			Mangaheia Group	-20
		100 %	TT							24		Very weak, UW, dark grey, silty fine to medium SANDSTONE. Defects widely spaced, moderately inclined, stepped, rough.		-21
		0 %	SPT					35 15/20mm Nc=50+						
		100 %	TT						UCS4	25				-22
		0 %	SPT					10 13 17 15 18/70mm Nc=50/220mm		26				-23
												END OF LOG @ 26.37 m		
										27				-24
										28				-25
										29				-26

DATE STARTED: 20/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 21/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JMC — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH604

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,267 m
E 1,936,610 m
BOREHOLE LOCATION: Container terminal - North
R L: 2.84 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	VC							1		0.0-1.5m - Vacuum excavation. No visual inspection prior to drilling.		2
		40 %	SPT					0 0 0 1 2 5 N=8		2		Loose, medium to coarse sandy, fine to coarse GRAVEL, minor silt; brown; moist, non plastic. Gravel: rounded to subrouned, UW, greywacke and angular to subangular, UW, asphalt and concrete.	Fill	1
		100 %	Sonic									Trace silt; black mottled brown.		
										3		2.7-2.9m - ASPHALT. Aggreate: angular to subangular, UW, greywacke.		0
		0 %	SPT					1 2 2 1 1 1 N=5				Loose, fine to coarse GRAVEL, minor medium to coarse sand; brown mottled black; wet, non plastic. Gravel: rounded to subrounded, UW, greywacke and angular to subangular, UW, asphalt.		
												3.0-3.45m - No recovery.		
		100 %	Sonic							4		Loose, fine to coarse GRAVEL, minor medium to coarse sand, trace silt; grey with brown matrix; wet, non plastic. Gravel: rounded to subrounded, UW-SW, greywacke and subangular, UW, asphalt.		-1
												Loose, medium to coarse sandy, fine to coarse GRAVEL, some silt, trace clay; grey; wet, low plasticity (matrix). Gravel: rounded to subrounded, UW-SW, greywacke and subangular, UW, asphalt.		
		58 %	SPT					1 2 3 3 4 3 N=13	SD6			Medium dense, fine to medium SAND; dark grey; wet, non plastic.		
		100 %	Sonic							5		Dilatant.		-2
												10mm bed of SILT, some clay; high plasticity. 70mm bed of SILT, some clay, trace organics; high plasticity.		
		100 %	SPT					1 1 0 1 1 2 N=4		6		Loose.		-3
		100 %	Sonic										Recent Marine Sediments	-4
		47 %	SPT					1 1 2 2 2 2 N=8		7		50mm bed with clayey SILT laminations. 30mm bed of clayey SILT; high plasticity. 50mm bed of clayey SILT; high plasticity. 50mm bed of fine to medium GRAVEL. Gravel: rounded, UW, greywacke.		-5
		100 %	Sonic							8		Sand: fine to coarse; pumiceous. Sand: medium to coarse, trace medium gravel. Gravel: subrounded, SW, sandstone. Sand: fine to medium, no gravel.		
												50mm bed of fine to medium GRAVEL. Gravel: angular to subangular, SW, sandstone. Sand: medium to coarse.		-6
		100 %	SPT					0 0 0 0 0 0 N=0		9		Soft, clayey SILT, minor fine sand; grey; moist, high plasticity. Very loose, medium to coarse SAND; dark grey speckled white; moist, non plastic.		
		100 %	Sonic						SD7			Soft, clayey SILT, minor fine sand, trace shells; grey; moist, high plasticity.		-7

DATE STARTED: 26/11/15
DATE FINISHED: 27/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT/VC
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH604

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,267 m, E 1,936,610 m — R L: 2.84 m — DATUM: Chart Datum — COORDINATE ORIGIN: hhGPS — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic					0				Soft, clayey SILT, minor fine sand, trace shells; grey; moist, high plasticity.		
		100 %	SPT					0						
								1				Trace fibrous organics.		
		100 %	Sonic					0		11				-8
								1						
								0						
								N=2				Some fine sand.		
		100 %	SPT					1						-9
								2		12		Medium dense, silty fine SAND, trace clay, trace shells; grey; moist, low plasticity.		
								4						
		100 %	Sonic					4				Trace fibrous organics.		
								4						-10
								N=16		13				
		100 %	SPT					1						
								2						-11
								3						
		100 %	Sonic					4		14				
								4						
								5						
								N=16						
		100 %	SPT					3						-12
								6		15				
		100 %	Sonic					5				Medium dense, fine to medium SAND, trace silt, trace shells; grey; moist, non plastic.		
								6						
								8						
								9						
								N=28		16				-13
		84 %	SPT					3						
								6						
		84 %	Sonic					10						
								10		17		Dense.		
								10						-14
								10						
								N=40				Minor silt.		
		89 %	SPT					4						
								6		18				-15
		100 %	Sonic					7						
								8						
								10						
								11						
								N=36		19				-16
		100 %	SPT					3						
								3						-17

Quaternary Marine Sediments

DATE STARTED: 26/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 27/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VC

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH604

MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,267 m — R L: 2.84 m — COORDINATE ORIGIN: hhGPS

E 1,936,610 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
								5						
								7				Medium dense, silty fine SAND; grey; moist, non plastic.		
								7				Dense, fine to medium SAND, trace silt; grey; moist, non plastic.		
								7						
		100 %	Sonic					N=26						
										21				-18
								4						
		78 %	SPT					7						
								9						
								10						
								11						
		100 %	Sonic					13						
								N=43		22				-19
								7						
		82 %	SPT					16						
								10		23				-20
								12						
								12						
		100 %	Sonic					14						
								N=48				Dense, fine to coarse SAND, minor shells, trace medium gravel; grey speckled white; wet, non plastic. Gravel: rounded, UW, greywacke.	Quaternary Marine Sediments	-21
										24		Medium dense, silty fine to medium SAND, trace clay; bluish grey; moist, low plasticity. [CW Sandstone]		
								4						
		89 %	SPT					8						
								7				Very stiff, clayey SILT, trace fine sand; dark green; moist, high plasticity. [CW Siltstone]		-22
								5						
								6						
		100 %	Sonic					6				Very stiff, SILT, some clay, minor fine sand; bluish grey; moist, high plasticity [CW Siltstone]		
								N=24		25				
												Dense, silty, fine to coarse gravelly, fine to coarse SAND, trace clay; green mottled white; moist, low plasticity (matrix). Gravel: angular to subangular, SW, limestone. [HW Limestone]		
								4						
		100 %	SPT					2				100mm bed of fine sandy SILT, minor clay. [CW Siltstone]		-23
								3		26				
								7						
								9						
		100 %	Sonic					13						
								N=32				Dense, fine to medium SAND; greenish grey speckled white; wet, non plastic. [CW Sandstone]		-24
										27				
								12						
		0 %	SPT					24				Extremely weak, MW, greenish grey, silty fine to medium SANDSTONE		
								24						
		67 %	TT					26/60mm						
								N=50/135mm						-25
										28				
		59 %	TT									Extremely weak, SW. Variably cemented. Poor recovery in uncemented zones.		
		0 %	SPT					50/50mm						-26
								Nc=50+		29				
		79 %	TT											
														-27

DATE STARTED: 26/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 27/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VC

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH604

MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,267 m — R L: 2.84 m — COORDINATE ORIGIN: hhGPS

E 1,936,610 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		79 %	TT									Extremely weak, SW, greenish grey, silty fine to medium SANDSTONE		
		0 %	SPT					24 26/60mm Nc=50+						
										31		30.5-32.0m - No recovery. Driller comment: uncemented sand.		-28
		0 %	TT											
														-29
		100 %	SPT					4 6 7		32		Dense, fine to medium SAND; greyish green; moist, non plastic. [Extremely weak, SANDSTONE]	Mangaheia Group	
		40 %	TT					10 11 10 N=38						
		75 %	TT									Very weak, UW, greyish green, variably cemented SANDSTONE.		-30
		0 %	SPT					50/60mm Nc=50+		33		Extremely weak, uncemented.		
		88 %	TT											-31
										34		Extremely weak to very weak, variably cemented.		
		0 %	SPT					50/50mm Nc=50+		35		Weak.		-32
												END OF LOG @ 35.05 m		
										36				-33
														-34
										37				
														-35
										38				
														-36
										39				
														-37

DATE STARTED: 26/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 27/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VC

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH605

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,265 m
E 1,936,663 m
BOREHOLE LOCATION: Container terminal - North
R L: 2.92 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	VE							1		0.0-1.4m - Vacuum excavation. Logged from visual inspection. 0.0-1.0m - 'Tightly packed', sandy medium to coarse GRAVEL 1.0-1.4m - 'Loose', silty fine to medium SAND.		2
		0 %	SPT					0 0 0 0 0 1 N=1				1.4-1.85m - No recovery.		
		76 %	Sonic							2		Very loose, medium to coarse gravelly, fine to medium SAND, minor silt; dark grey; saturated, non plastic. Gravel: rounded to subrounded, UW-SW, greywacke.		1
												Very loose, fine to medium SAND, trace medium to coarse gravel; dark grey; moist, non plastic.		
		11 %	SPT					1 0 1 1 0 0 N=2		3		3.1-3.5m - No recovery - corebound gravel in SPT		0
		70 %	Sonic									Very loose, fine to medium SAND; dark grey; saturated, non plastic.		
										4		Very loose, medium to coarse GRAVEL; dark grey; wet, non plastic. Gravel: rounded to subrounded, UW-SW, greywacke.		-1
		0 %	SPT					1 0 1 1 0 0 N=2				4.55-5.0m - No recovery.		
		28 %	Sonic							5		Very loose, medium to coarse GRAVEL; dark grey; wet, non plastic. Gravel: rounded to subrounded, UW-SW, greywacke.		-2
												5.3-6.1m - No recovery.		
		44 %	SPT					0 1 0 0 2 4 N=6		6		Loose, fine to medium GRAVEL, minor fine to medium sand; dark grey; wet, non plastic, uniformly graded. Gravel: rounded to subrounded, UW-SW, greywacke.	Fill	-3
		100 %	Sonic											
		33 %	SPT					1 3 1 2 2 1 N=6		7				-4
		100 %	Sonic											
		82 %	SPT					1 5 7 4 6 7 N=24	SD	8		Loose, fine to medium SAND; dark grey; wet, non plastic.		-5
		100 %	Sonic									Minor medium to coarse gravel, trace shells. Gravel: subangular to subrounded, UW-SW, sandstone and greywacke.		-6
										9		Medium dense, medium to coarse gravelly, medium to coarse SAND, trace shells; dark grey speckled white; wet, non plastic. Gravel: subrounded, SW, limestone and sandstone.	Recent Marine Sediments	-7

DATE STARTED: 23/11/15
DATE FINISHED: 23/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT/VE
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH605

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,265 m — R L: 2.92 m — COORDINATE ORIGIN: hhGPS

E 1,936,663 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Very stiff, clayey SILT, minor fine sand, trace coarse gravel; grey; moist, high plasticity.		
												Very stiff, fine sandy SILT, minor clay, trace organics; grey; moist, low plasticity. Organics: fibrous.		
		89 %	SPT					2 3 2 2 3 3 N=10				Medium dense, silty fine SAND, trace shells, trace organics; grey; wet, non plastic.		
		100 %	Sonic							11		Medium dense, fine to medium SAND, minor silt; grey; wet, non plastic.	Quaternary Marine Sediments	-8
		89 %	SPT					3 5 6 6 7 7 N=26		12				-9
		100 %	Sonic						SD9	13				-10
		100 %	SPT					3 5 6 7 7 7 N=27		14				-11
		100 %	Sonic									Some medium to coarse gravel. Gravel: rounded, UW, greywacke.		
			SPT							15		Very stiff, SILT, some clay, minor fine sand; bluish grey; moist, high plasticity. [CW SILTSTONE]		-12
		100 %	SPT					3 3 5 6 5 7 N=23		16				-13
		100 %	Sonic									Extremely weak, SW, grey, medium to coarse SANDSTONE.		
		100 %	SPT					6 23 59/70mm N=59/70mm		17		Moderately strong, UW, dark greenish grey, calcareous SANDSTONE	Mangaheia Group	-14
		68 %	TT						UCS5			Extremely weak, uncemented.		
												Extremely weak to very weak, variably cemented.		-15
										18		18.0-18.5m - No recovery.		
		0 %	SPT					8 12 25 25/65mm N=50/140mm				Extremely weak to very weak, UW, greenish grey, silty fine SANDSTONE.		
										19		Weak, UW, greenish grey, bioclastic LIMESTONE. Defects extremely closely spaced.		-16
		76 %	TT									Very weak, UW, greyish green, silty fine SANDSTONE.		
												Defect: very steeply inclined, undulating, smooth, clean.		
								23						-17

DATE STARTED: 23/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 23/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VE

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH605

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,265 m — R L: 2.92 m — COORDINATE ORIGIN: hhGPS

E 1,936,663 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					27/75mm Nc=50+						
		79 %	TT						UCS6	21		Very weak to weak, UW, greyish green, calcareous SANDSTONE.		-18
		0 %	SPT					23 27/70mm						
		89 %	TT							22		Weak to moderately strong, UW, grey mottled white, bioclastic LIMESTONE. Defects: very closely to closely spaced, predominately subhorizontal, undulating, rough, clean.		-19
		0 %	SPT					10 40/75mm Nc=50+		23		Extremely weak to weak, UW, greyish green, variably cemented SANDSTONE.	Mangaheia Group	-20
		34 %	TT							24		23.6-24.5m - No recovery. Driller comment: very sandy, washed away.		-21
		0 %	SPT					10 20 25 25/60mm Nc=50/135mm		25		Extremely weak to weak, UW, greyish green, variably cemented SANDSTONE. Poor recovery in uncemented zones.		-22
		56 %	TT											-23
			SPT					15 35/70mm Nc=50+		26		END OF LOG @ 26.15 m		
										27				-24
										28				-25
										29				-26
														-27

DATE STARTED: 23/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 23/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VE

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH606

MACHINE BOREHOLE LOG

SHEET 1 of 5

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,320 m
E 1,936,749 m
BOREHOLE LOCATION: Container terminal - North
R L: 3.16 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		99 %	Sonic							0		0.0-0.1m - ASPHALT		3
												'Tightly packed, fine to coarse GRAVEL; grey; wet, non plastic. Gravel: angular to subrounded, UW-SW, greywacke.		
												'Tightly packed', fine to coarse sandy, fine to coarse GRAVEL, minor silt; grey with brown matrix; moist, non plastic. Gravel: angular to subrounded, UW-SW, greywacke.		
										1		'Tightly packed', fine to coarse gravelly, fine to coarse SAND, minor silt; brown; moist, non plastic, uniformly graded. Gravel: angular to subangular, UW-SW, greywacke.		2
												Dark brown.		
		0 %	SPT					1 0 0 0 1 0 N=1				1.5-1.95m - No recovery.		
		100 %	Sonic							2		Very loose, medium to coarse GRAVEL. trace coarse sand; grey; wet, non plastic. Gravel: rounded to subrounded, UW-SW, greywacke.		1
												Very loose, fine to medium SAND; dark grey; wet, non plastic.		
												Very loose, medium to coarse GRAVEL, some medium to coarse sand; light brown; wet, non plastic. Gravel: angular to subangular, SW, limestone and rounded to subrounded, UW, greywacke.		
		67 %	SPT					4 6 4 2 0 1 N=7		3		Very loose, fine to medium SAND; grey; saturated, non plastic.		0
		72 %	Sonic									Loose, medium to coarse sandy, fine to coarse GRAVEL; grey speckled light brown; saturated, non plastic, uniformly graded. Gravel: angular to subangular, SW, limestone and rounded to subrounded, UW, greywacke. Trace refuse (glass).	Fill	
										4		Grey.		-1
		51 %	SPT					2 3 2 2 2 2 N=8				Loose, fine to medium gravelly, medium to coarse SAND; light brown speckled grey; saturated, non plastic. Gravel: angular to subangular, SW, limestone and rounded to subrounded, UW, greywacke.		
		84 %	Sonic							5				-2
												Loose, fine to medium GRAVEL, trace coarse sand; grey; wet, non plastic, uniformly graded. Gravel: rounded to subrounded, UW, greywacke.		
		33 %	SPT					1 1 0 1 1 0 N=2		6				-3
		100 %	Sonic											
										7		Minor fine sand. 50mm bed of fine to medium gravelly, fine to medium SAND, minor silt.		-4
		56 %	SPT					2 1 1 1 1 2 N=5						
		100 %	Sonic						SD10	8		Very loose, fine to medium SAND; dark grey; saturated, non plastic.		-5
												100mm bed of SILT, some clay, minor fine sand; high plasticity.	Recent Marine Sediments	
		44 %	SPT					0 0 0 0 0 0 N=0		9				-6
		100 %	Sonic											

DATE STARTED: 23/11/15
DATE FINISHED: 25/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
HB = SPT hammer bouncing.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH606

MACHINE BOREHOLE LOG

SHEET 2 of 5

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,320 m — R L: 3.16 m — COORDINATE ORIGIN: hhGPS

E 1,936,749 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Extremely weak, HW, bluish grey, fine sandy SILTSTONE.		-7
		100 %	SPT					4 8 8						
								25 10/10mm HB		11		Weak, SW, grey mottled white, bioclastic LIMESTONE. Defects drilling induced.		-8
		100 %	Sonic					N=43/160mm				Very weak, UW, grey, calcareous SANDSTONE. Defects drilling induced.		
		0 %	SPT					25 5/5mm HB		12		80mm weak bed.		-9
		100 %	TT									130mm weak bed.		
		100 %	TT							13		Extemely weak to very weak, UW, greyish green, silty fine SANDSTONE.		-10
												100mm uncemented bed.		
												50mm uncemented bed.		
		0 %	SPT					30 20/20mm Nc=50+		14		100mm uncemented bed.		-11
		100 %	TT						UCS7				Mangaheia Group	
										15		Extremely weak to very weak, UW, grey spckled white, calcareous SANDSTONE.		-12
		0 %	SPT					10 15 15 15 20/70mm Nc=50/220mm				Extremely weak, UW, greenish grey, uncemented fine to medium SANDSTONE.		
		73 %	TT							16				-13
		0 %	SPT					20 30 for 75mm Nc=50+		17				-14
		19 %	TT									17.4-18.5m - No recovery.		
		0 %	SPT					18 32/45mm Nc=50+		18				-15
		88 %	TT									Extremely weak, UW, greenish grey, uncemented fine to medium SANDSTONE. Defects very widely spaced.		
										19		Weakly cemented.		-16
												Very weak.		
												Defect: very steeply inclined, undulating, rough, clean.		
									UCS8			Weak.		
								25						

DATE STARTED: 23/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 25/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
HB = SPT hammer bouncing.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH606

MACHINE BOREHOLE LOG

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North

COORDINATES: N 5,623,320 m — R L: 3.16 m — COORDINATE ORIGIN: hhGPS

E 1,936,749 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					25/65mm Nc=50+				Extremely weak to weak, UW, dark grey, variably cemented fine to medium SANDSTONE. Defect: very steeply inclined to subvertical, 120mm persistence, undulating, rough, clean. 200mm uncemented bed.		-17
		92 %	TT									150mm uncemented bed.		
										21				-18
		0 %	SPT					8 12 16 17						
								17/70mm Nc=50/220mm	UCS9	22		Very thinly cross-bedded.		-19
		91 %	TT											
		0 %	SPT					25 25/65mm Nc=50+		23				-20
		96 %	TT									20mm bed of SILTSTONE.		
		0 %	SPT					50/70mm Nc=50+		24				-21
		94 %	TT							25				-22
		0 %	SPT					30 5/5mm HB		26		650mm uncemented zone.	Mangaheia Group	-23
		99 %	TT							27				-24
		0 %	SPT					25 5/0mm HB				500mm uncemented zone.		
		100 %	TT							28				-25
		0 %	SPT					12 38/70mm Nc=50+		29				-26
		89 %	TT											

DATE STARTED: 23/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 25/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
HB = SPT hammer bouncing.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH606

MACHINE BOREHOLE LOG

SHEET 4 of 5

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,320 m
E 1,936,749 m
BOREHOLE LOCATION: Container terminal - North
R L: 3.16 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		89 %	TT									Extremely weak to weak, UW, dark grey, variably cemented fine to medium SANDSTONE.		-27
		0 %	SPT					30 20/50mm Nc=50+						
										31				
		96 %	TT									Very weak, UW. grey, crossbedded medium to coarse SANDSTONE. 5° bedding contact with overlying unit. Defect: subvertical, 350mm persistence, undulating, rough, clean.		-28
		0 %	SPT					30 20/40mm Nc=50+		32		Very weak, UW, greenish grey, fine to medium SANDSTONE. Defects very widely spaced. Defect: subvertical, 350mm persistence, closed, 3-4mm grey calcareous silt (?) infill.		-29
		100 %	TT									Extremely weak, uncemented.		
										33				-30
		0 %	SPT					25 25/70mm Nc=50+						
												Very weak to weak, well cemented.		
		100 %	TT							34				-31
		0 %	SPT					25 25/50mm Nc=50+						
										35				-32
		100 %	TT											
										36				-33
		100 %	TT											
										37				-34
		100 %	TT											
										38				-35
		100 %	TT											
										39				-36

Mangaheia Group

DATE STARTED: 23/11/15
DATE FINISHED: 25/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
HB = SPT hammer bouncing.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH606

MACHINE BOREHOLE LOG

SHEET 5 of 5

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,320 m
E 1,936,749 m
BOREHOLE LOCATION: Container terminal - North
R L: 3.16 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS								
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	TT									Very weak to weak, UW, greenish grey, fine to medium SANDSTONE. Defects very widely spaced.		-37
										41		END OF LOG @ 41 m		-38
										42				-39
										43				-40
										44				-41
										45				-42
										46				-43
										47				-44
										48				-45
										49				-46

DATE STARTED: 23/11/15
DATE FINISHED: 25/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
HB = SPT hammer bouncing.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH607

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-east

COORDINATES: N 5,623,325 m — R L: 3.21 m — COORDINATE ORIGIN: hhGPS

E 1,936,844 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	VE									0.0-0.13m - ASPHALT Very dense, medium to coarse GRAVEL, some fine sand, minor silt; bluish grey with white matrix; moist, non plastic. Cement stabilised fill		3
		100 %	Sonic							1		Very dense, medium to coarse GRAVEL, trace coarse sand; bluish grey; wet, non plastic. Gravel: subrounded to angular, SW-UW, greywacke, limestone and asphalt. Very dense, fine to medium sandy, medium to coarse GRAVEL, minor silt; bluish grey with grey matrix; moist, non plastic. Cement stabilised fill.		2
		100 %	SPT					3 5 3 2 2 3 N=10				Medium dense, fine to medium GRAVEL, minor coarse sand; grey; moist, non plastic, uniformly graded. Gravel: rounded, UW, greywacke.		
		90 %	Sonic							2		Medium dense, silty fine to medium SAND, some medium gravel; brown speckled grey; moist, non plastic. Dense, fine to medium sandy, medium to coarse GRAVEL, some silt, trace cobbles, trace clay; light brownish white; moist, low plasticity. Gravel: angular to subangular, SW, limestone. [Boulder - broken by drilling]		1
		67 %	SPT					26 16 11 5 3 3 N=22		3		Dense, coarse SAND, minor silt; brownish yellow; moist, non plastic. Medium dense, medium to coarse sandy, fine to medium GRAVEL; grey with light grey matrix; saturated, non plastic. Gravel: subangular to rounded, UW, greywacke.		0
		91 %	Sonic									Trace cobbles. Cobbles: SW, limestone. Dense, medium to coarse gravelly COBBLES, some silt, minor medium to coarse sand, trace clay; light brownish white; moist, low plasticity. Gravel/cobbles: angular to subangular, SW, limestone. [Boulder - broken by drilling]		
		46 %	SPT					10 12 6 3 1 1 N=11		4		'Loose', fine to medium GRAVEL; dark grey; wet, non plastic. Gravel: rounded, UW, greywacke. Dense, medium to coarse gravelly COBBLES, some silt, minor medium to coarse sand, trace clay; light brownish white; moist, low plasticity. Gravel/cobbles: angular to subangular, SW, limestone. [Boulder - broken by drilling]	Fill	-1
		100 %	Sonic							5		4.8-5.05m - No recovery. Very loose, fine to medium GRAVEL, trace coarse sand; dark grey; wet, non plastic, uniformly graded. Gravel: rounded, UW, greywacke.		-2
		0 %	SPT					1 1 1 0 1 0 N=2		6		6.1-6.55m - No recovery.		-3
		60 %	Sonic							7		Very loose, fine to medium GRAVEL, trace coarse sand; dark grey; wet, non plastic, uniformly graded. Gravel: rounded, UW, greywacke. 7.2-7.6m - No recovery		-4
		67 %	SPT					0 1 2 2 1 2 N=7		8		Very loose, fine to medium GRAVEL, trace coarse sand; dark grey; wet, non plastic, uniformly graded. Gravel: rounded, UW, greywacke.		-5
		50 %	Sonic						SD11			Loose, fine to medium SAND, minor fine to medium gravel; dark grey; saturated, non plastic. Gravel: rounded, UW, greywacke. 8.6-9.1m - No recovery.		
		100 %	SPT					10 16 15 25 10/25mm N=50/175mm		9		Dense, fine to medium SAND; dark grey; wet, non plastic. [Recent Marine Sediments]		-6
		100 %	Sonic									Dense, silty fine to medium SAND; light green speckled white; moist, non plastic. Extremely weak to very weak, SW, greyish green, calcareous SANDSTONE.		

DATE STARTED: 17/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 18/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VE

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH607

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-east

COORDINATES: N 5,623,325 m — R L: 3.21 m — COORDINATE ORIGIN: hhGPS

E 1,936,844 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Extremely weak to very weak, SW, greyish green, calcareous SANDSTONE.		-7
												Extremely weak, uncemented.		
		100 %	SPT					6 6 18 18 14/50mm Nc=50/200mm		11				-8
		100 %	Sonic											
										12				-9
		0 %	SPT					7 8 8 10 11 9 Nc=38						
		100 %	TT							13				-10
												70mm weak, well cemented bed. Greyish brown. 60mm weak, well cemented bed. 50mm very weak bed.		
		0 %	SPT					8 9 11 19 20/70mm Nc=50/220mm		14				-11
		100 %	TT									70mm weak bed.		
										15				-12
		0 %	SPT					4 5 11 12 21 6/20mm Nc=50/245mm						
		82 %	TT							16		30mm bed of extremely weak, SILTSTONE.		-13
												Very weak.		
		0 %	SPT					20 30/50mm Nc=50+		17		Extremely weak.		-14
		100 %	TT						USC10			Very weak. 30mm weak bed.		
										18		150mm weak bed.		-15
		0 %	SPT					21 29 for 75mm Nc=50+				50mm weak bed. Extremely weak.		
		100 %	TT						USC11 USC12	19		100mm weak bed. Very weak.		-16
								50/70mm						

DATE STARTED: 17/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 18/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VE

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH607

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-east

COORDINATES: N 5,623,325 m — R L: 3.21 m — COORDINATE ORIGIN: hhGPS

E 1,936,844 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					Nc=50+				Extremely weak to very weak, SW, orange brown, silty fine SANDSTONE.		-17
		100 %	TT							21				
		0 %	SPT					25 25/20mm Nc=50+				Weak, UW-SW, bluish grey calcareous SANDSTONE. Defect: very steeply inclined, undulating, rough, stained brown, tight - opened by drilling. Extremely weak, uncemented. Very weak, moderately cemented.		-18
		100 %	TT							22			Mangaheia Group	-19
		0 %	SPT					28 22/25mm Nc=50+		23				-20
		100 %	TT									Extremely weak, SW, greenish grey, silty fine SANDSTONE		
										24		Extremely weak to weak, UW, bluish grey, fine to medium SANDSTONE. 200mm extremely weak, uncemented bed.		-21
		0 %	SPT					14 19 30 20/45mm Nc=50/120mm						
												END OF LOG @ 24.77 m		
										25				-22
										26				-23
										27				-24
										28				-25
										29				-26

DATE STARTED: 17/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 18/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT/VE

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH608

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,345 m
E 1,936,953 m
BOREHOLE LOCATION: Container terminal - North-east
R L: 3.71 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS								
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		99 %	Sonic							0		0.0-0.2m - ASPHALT		
												'Tightly packed', medium to coarse sandy, fine to coarse GRAVEL, minor silt; grey with brown matrix; wet, non plastic.		
		71 %	SPT					1 1 1 0 1 1 N=3		1		Stiff, fine to medium sandy SILT, some clay, minor medium to coarse gravel; brown; moist, high plasticity. 80mm Concrete cobble. Some gravel.		3
		98 %	Sonic							2		'Medium dense', silty, fine to coarse sandy, fine to coarse GRAVEL, trace clay; brown speckled grey; wet, low plasticity (matrix), matrix supported. Gravel: subangular to rounded, UW-SW, greywacke.		2
		22 %	SPT					4 4 4 3 3 3 N=13		3		Medium dense, medium to coarse GRAVEL, minor medium to coarse sand, trace silt; grey with brown matrix; wet, non plastic, uniformly graded. Gravel: subangular to rounded, SW-UW, greywacke. No sand, no silt.		1
		61 %	Sonic							4				0
		11 %	SPT					1 1 0 0 0 1 N=1		5		4.6-5.05m - No recovery.	Fill	-1
		98 %	Sonic									Very loose, medium to coarse GRAVEL, trace sand; dark grey; wet, non plastic. Gravel: rounded to subrounded, UW, greywacke.		
		44 %	SPT					2 2 1 3 5 17 N=26		6		Medium dense, fine to medium sandy, medium to coarse GRAVEL, some silt, trace cobbles, trace clay; light brownish white; moist, low plasticity. Gravel: angular to subangular, SW, limestone. [Boulder - broken by drilling]		-2
												Loose, fine to medium gravelly, medium to coarse SAND; light brown; saturated, non plastic. Gravel: rounded to subrounded, UW, greywacke. Brown.		
		100 %	Sonic							7		Dense, fine to medium sandy, medium to coarse GRAVEL, some silt, trace cobbles, trace clay; light brownish white; moist, low plasticity. Gravel: angular to subangular, SW, limestone. [Boulder - broken by drilling]		-3
												Very loose, fine to medium GRAVEL; dark grey; wet, non plastic, uniformly graded. Gravel: rounded to subrounded, UW, greywacke.		
		0 %	SPT					1 1 0 0 0 1 N=1		8		7.6-9.55m - No recovery. Driller comment: fine gravel falling through fingers in catcher.		-4
		0 %	Sonic											-5
		0 %	SPT					1 0 0 0 0 0 N=0		9				
		100 %	Sonic									Very loose, fine to medium GRAVEL, trace medium sand; dark grey; wet, non plastic. Gravel: rounded to subrounded, UW, greywacke.		-6
												Dense, medium to coarse gravelly COBBLES, some silt, minor medium to coarse		

DATE STARTED: 18/11/15
DATE FINISHED: 19/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH608

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-east

COORDINATES: N 5,623,345 m — R L: 3.71 m — COORDINATE ORIGIN: hhGPS

E 1,936,953 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic					3 6 8				sand, trace clay; light brownish white; moist, low plasticity. Gravel/cobbles: angular to subangular, SW, limestone. [Boulder - broken by drilling] Dense, medium to coarse gravelly COBBLES, some silt, minor medium to coarse sand, trace clay; light brownish white; moist, low plasticity. Gravel/cobbles: angular to subangular, SW, limestone. [Boulder - broken by drilling]		
		44 %	SPT					2 2 3 N=15		11		Medium dense, fine to medium SAND, minor silt; greyish green; saturated, non plastic.		-7
		75 %	Sonic									Medium dense, medium to coarse sandy, fine to coarse GRAVEL, minor silt, trace cobbles; grey speckled white; wet, non plastic. Gravel/cobbles: rounded to subrounded, UW, greywacke and angular to subangular, SW, limestone. Dense, medium to coarse gravelly COBBLES, some silt, minor medium to coarse sand, trace clay; light brownish white; moist, low plasticity. Gravel/cobbles: angular to subangular, SW, limestone. [Boulder - broken by drilling]	Fill	-8
		29 %	SPT					3 2 3 1 2 1 N=7	SD12	12		12.0-12.2m - No recovery. Driller comment: soft. Loose, silty fine SAND; dark grey; moist, non plastic. 12.3-12.55m - No recovery. Firm, fine sandy SILT, some clay; dark grey; moist, high plasticity.		-9
		100 %	Sonic							13		Some fine to medium gravel. Gravel: rounded, UW-SW, greywacke. 'Very loose', fine to medium GRAVEL, trace coarse sand; dark grey; wet, non plastic, uniformly graded. Gravel: rounded, UW-SW, greywacke.		
		83 %	SPT					11 15 15 20 15/55mm N=50/205mm		14		Extremely weak, MW, yellowish brown, silty fine to medium SANDSTONE. Homogeneous, defects extremely widely spaced.		-10
		87 %	TT											-11
		0 %	SPT					28 22/25mm Nc=50+		15		Extremely to very weak, SW.		-12
		100 %	TT							16		50mm weak bed. 50mm weak bed. 50mm weak bed.	Mangaheia Group	-13
		0 %	SPT					29 21/35mm Nc=50+		17		Very weak. 17.1-17.45m - No recovery. Driller comment: uncemented/sandy.		
		76 %	TT						UCSI2	18		Very weak, SW, yellowish brown, silty fine SANDSTONE. Homogeneous, defects extremely widely spaced.		-14
		0 %	SPT					22 18/70mm Nc=50+						-15
		100 %	TT					6		19		Extremely weak. UW. Weakly cemented. Uncemented.		-16

DATE STARTED: 18/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 19/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH608

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Container terminal - North-east

COORDINATES: N 5,623,345 m — R L: 3.71 m — COORDINATE ORIGIN: hhGPS

E 1,936,953 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					8 8 8 8 8 Nc=32	UCS13			Extremely weak, UW, yellowish brown, silty fine SANDSTONE. Homogeneous, defects extremely widely spaced.		
		72 %	TT							21		Extremely weak to weak, UW, grey, variably cemented SANDSTONE.		-17
		0 %	SPT					25 25/45mm						-18
		76 %	TT							22		Extremely weak, UW, grey, silty fine SANDSTONE. Homogeneous, defects extremely widely spaced.		
		0 %	SPT					8 10 10 10 12 13 Nc=45		23				-19
		95 %	TT											-20
		0 %	SPT					7 10 12 15 15 8/50mm Nc=50/275mm		24				-21
		100 %	TT							25				-22
		0 %	SPT					7 8 8 8 11 14 Nc=41		26				-23
		67 %	TT							27		Very weak.		
												27.15-27.5m - No recovery - corebound.		-24
		0 %	SPT					8 10 11 12 14 13/60mm Nc=50/285mm		28		Extremely weak to very weak, UW, grey, silty fine SANDSTONE. Homogeneous. 27.94-29.0m - drilling induced defects.		
		80 %	TT											-25
		0 %	SPT					10 15 15 15 15 5/15mm Nc=50/240mm		29				
												END OF LOG @ 29.39 m		-26

Mangaheia Group

DATE STARTED: 18/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 19/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH609

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,372 m
E 1,936,974 m
BOREHOLE LOCATION: Northern end of 5 Wharf
R L: -10.5 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		25 %	TT							1		Very soft, SILT, some clay, minor fine sand, trace shells; dark grey; saturated, high plasticity (when dried). Trace medium gravel. Gravel: subangular, UW, greywacke. 0.4-1.5m - No recovery.	Recent Marine Sediments	-11
		44 %	TT							2		Very soft, SILT, some clay, minor fine sand, trace medium gravel, trace shells; dark grey; saturated, high plasticity (when dried). Very loose, silty fine to medium SAND, trace organics; bluish grey; wet, non plastic. Organics: semi decomposed fibrous. 1.85-2.3m - No recovery.		-12
		50 %	TT							3		Very loose, silty fine to medium SAND, minor organics; bluish grey; saturated, non plastic. Organics: semi decomposed fibrous, strong odour. 50mm fibrous wood. 2.65-3.0m - No recovery - corebound on wood.		-13
		86 %	TT						SD13			'Firm', fine sandy SILT, some organics, trace clay; brown; moist, low plasticity. Organics: fibrous and amorphous, strong odour.		-14
		75 %	TT							4		Very loose, fine to coarse SAND, trace organics; bluish grey speckled white; wet, non plastic, pumiceous. Organics: semi decomposed fibrous. Minor organics. Some organics.		
		100 %	SPT					1 1 0 0	SD14			Trace organics.		-15
		100 %	TT					0 0 N=0		5				
		100 %	TT									Very loose, fine sandy SILT, some organics; brown; wet, non plastic. Organics: semi decomposed fibrous and amorphous.		-16
		100 %	SPT					2 4 4 6		6		Loose, fine to coarse SAND, trace organics; bluish grey speckled white; wet, non plastic, pumiceous. 100mm bed of fine sandy SILT, some organics.		
		100 %	TT					7 5 N=22				20mm bed with minor minor gravel. Minor fibrous organics.		-17
		64 %	TT									Medium dense, fine to coarse sandy, fine to coarse GRAVEL, trace silt, trace organics, trace shells; bluish grey speckled white; wet, non plastic. Gravel: subangular to subrounded, SW, sandstone.		
										7		Weak, SW, bluish grey, fine to coarse SANDSTONE. Recovered as cobbles >60mm	Mangaheia Group	
		100 %	SPT					5 10 11 15				Extremely weak, SW, bluish grey, fine to medium SANDSTONE. Homogeneous, defects extremely widely spaced.		-18
		82 %	TT					18/25mm N=44/175mm		8		Very weak.		
												Extremely weak to very weak.		-19
		0 %	SPT					10 17 22 18		9				
		95 %	TT					10/35mm Nc=50/185mm						-20

DATE STARTED: 19/11/15
DATE FINISHED: 20/11/15
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH609

MACHINE BOREHOLE LOG

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Northern end of 5 Wharf

COORDINATES: N 5,623,372 m — R L: -10.5 m — COORDINATE ORIGIN: hhGPS

E 1,936,974 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		95 %	TT							11		Extremely weak, SW, greenish grey, fine to medium SANDSTONE. Defects extremely widely spaced.	Mangaheia Group	-21
		0 %	SPT					4 5 7 7 9 20 Nc=43						
		100 %	TT						UCS14			Weak, UW, dark grey, fine to medium SANDSTONE. Defects: very closely spaced, rough, undulating. Moderately strong, well cemented from 11.45m to 11.65m Weak.		-22
		0 %	SPT					50/70mm Nc=50+		12		Extremely weak, uncemented.		
		91 %	TT									Extremely weak, UW, greenish grey, fine to medium SANDSTONE. Defects extremely widely spaced.		-23
		0 %	SPT					5 7 6 7 7 9 Nc=29		13				-24
		100 %	TT							14				-25
		0 %	SPT					4 7 10 12 12 13 Nc=47		15				-26
		95 %	TT							16				
		0 %	SPT					8 9 11 12 13 14/65mm Nc=50/290mm		17		Weak.		-27
		47 %	TT									17.5-18.0m - No recovery - corebound.		-28
		0 %	SPT					5 7 13 13 11 10 Nc=47		18		Extremely weak, UW, greenish grey, fine to medium SANDSTONE.		-29
		74 %	TT							19				
		114 %	TT											
		0 %	SPT					4 4 6 7						-30

DATE STARTED: 19/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 20/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH609

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Northern end of 5 Wharf

COORDINATES: N 5,623,372 m — R L: -10.5 m — COORDINATE ORIGIN: hhGPS

E 1,936,974 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	TT					8 10 Nc=31				Extremely weak, UW, greenish grey, fine to medium SANDSTONE.	Mangaheia Group	-31
		0 %	SPT					6 7 7 7 8 8 Nc=30		21		21.0-21.45m - No recovery - Solid SPT.		
												END OF LOG @ 21.45 m		-32
										22				-33
										23				-34
										24				-35
										25				-36
										26				-37
										27				-38
										28				-39
										29				-40

DATE STARTED: 19/11/15 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 20/11/15 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
Nc = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH610

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,290 m
E 1,936,563 m
BOREHOLE LOCATION: Approximately 20m offshore of container terminal seawall
R L: -4.15 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	Sonic							0		0.0-0.7m - No recovery. Driller comment: very soft.		-4
										1		'Very loose', fine to medium SAND, trace shells; dark grey; saturated, non plastic.	Recent Marine Sediments	-5
												Minor silt.		
										2		No silt.		-6
		36 %	Sonic									2.0-4.0m - No recovery. Driller comment: drill rods sank under own weight to 4.0m		
										3				-7
										4				-8
		100 %	Sonic									'Very soft', SILT, some fine sand, some clay; grey; moist, high plasticity, homogeneous.		
										5				-9
		100 %	SPT					0 0 0 0 1 1 N=2				'Soft', fine sandy SILT, some clay; grey; moist, high plasticity.		
		100 %	Sonic									'Soft', SILT, some fine sand, some clay, trace shells; moist, high plasticity.		-10
										6				
		100 %	SPT					0 0 0 1 1 1 N=3						-11
		56 %	Sonic							7				
												7.55-8.0m - No recovery.		-12
		100 %	SPT					0 0 1 1 1 1 N=4		8		Soft, SILT, some clay, minor fine sand; grey; moist, high plasticity.	Quaternary Marine Sediments	
		100 %	Sonic									Firm, fine sandy SILT, some clay; grey; moist, high plasticity.		-13
										9		Medium dense, silty fine SAND, trace clay, trace shells; grey; moist, low plasticity.		
		100 %	SPT					3 2 2 2				Trace fibrous organics.		
												Stiff, fine sandy SILT, minor clay, trace organics, trace shells; grey; moist, low plasticity.		-14

DATE STARTED: 30/1/16
DATE FINISHED: 30/1/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH610

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,290 m
E 1,936,563 m

BOREHOLE LOCATION: Approximately 20m offshore of container terminal seawall
R L: -4.15 m — COORDINATE ORIGIN: hhGPS
DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		79 %	Sonic					3 4 N=11				Organics: fibrous.		
												Stiff, SILT, some fine sand, minor clay, trace organics; grey; moist, low plasticity.		-15
		100 %	SPT					2 2 2 2 2 3 N=9		11		Loose, silty fine SAND, trace clay, trace organics; grey; moist, low plasticity.		
		75 %	Sonic							12				-16
		78 %	SPT					3 6 6 7 8 11 N=32				Dense, fine to medium SAND, some silt, trace organics; grey; moist, non plastic. Minor silt.	Quaternary Marine Sediments	-17
		90 %	Sonic							13		Trace silt.		
												Some silt. Trace silt.		-18
		100 %	SPT					3 3 5 5 6 7 N=23		14		Medium dense, silty fine to medium SAND, trace clay; grey; moist, low plasticity.		
												Very stiff, fine sandy SILT, minor clay, trace organics; grey; moist, low plasticity.		
		82 %	Sonic							15		Medium dense, silty fine SAND, trace clay; grey; wet, low plasticity.		-19
												Medium dense, fine to medium SAND, trace silt; grey; moist, non plastic.		
												Some silt.		-20
										16		Medium dense, silty fine to medium SAND, trace clay; grey; moist, low plasticity.		
		71 %	SPT					9 10 10 10 12 11 N=43				Dense, fine to medium SAND, minor silt; dark grey; moist, non plastic.		
		89 %	Sonic							17		Saturated, dilatant.		-21
												Wet.		
		70 %	SPT					6 10 10 13 13 14/50mm N=50/275mm		18		Very dense.	Mangaheia Group	-22
		90 %	Sonic											
										19		Medium dense, silty fine to medium SAND, trace clay, trace shells; grey; moist, low plasticity.		-23
		100 %	SPT					9 7 6 6 7				Medium dense, fine to coarse SAND, some silt, trace clay; dark grey; moist, low plasticity.		
			TT									Stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity.		-24

DATE STARTED: 30/1/16 — DRILLED BY: Pro-Drill (Auck) Ltd
DATE FINISHED: 30/1/16 — EQUIPMENT: Fraste CRSXL2
LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT
SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH610

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 20m offshore of container terminal seawall

COORDINATES: N 5,623,290 m — R L: -4.15 m — COORDINATE ORIGIN: hhGPS

E 1,936,563 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		20 %	TT					6 N=25		21		Stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity.		-25
		88 %										Very stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity.		
		89 %	SPT					5 5 5 7 5		22				-26
		100 %	TT					14 N=31						
		100 %	SPT					3 3 3 4 7		23				-27
		60 %	TT					8 N=22		24		100mm subrounded, SW, limestone cobble. Very stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity. [Extremely weak, CW-MW, SANDSTONE] Minor medium to coarse gravel. Gravel: subangular, SW, limestone.	Mangaheia Group	-28
		111 %	SPT					8 10 11 14 14		25		24.4-24.8m - No recovery - corebound. Very stiff, fine sandy SILT, minor medium to coarse gravel, minor clay; bluish grey; moist, low plasticity. Gravel: subangular, SW, sandstone. [Extremely weak, CW-MW, SANDSTONE]		-29
		100 %	TT					11 N=50				24.85-25.25m - No recovery. Corebound by limestone cobble. Very stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity. [Extremely weak, CW-MW, SANDSTONE]		
		100 %	SPT					2 4 4 4 7		26		30mm SW limestone gravel. Medium dense, silty fine to medium SAND, minor clay; bluish grey; moist, low plasticity.		-30
								8 N=23		27		END OF LOG @ 26.75 m		-31
										28				-32
										29				-33
														-34

DATE STARTED: 30/1/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 30/1/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH611

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,318 m
E 1,936,662 m
BOREHOLE LOCATION: Approximately 25m offshore of container terminal seawall
R L: -3.6 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		82 %	Sonic							1		Very loose, fine to medium SAND; dark grey; saturated, non plastic, dilatant.	Recent Marine Sediments	-4
												Wet.		-5
		77 %	Sonic							2		'Very soft', fine sandy SILT, minor clay; grey; moist, low plasticity. 10mm bed of fine to medium SAND. Saturated.		-6
										3		'Very loose', fine to medium SAND; dark grey; moist, non plastic. 100mm bed of medium to coarse gravelly, fine to medium SAND. Gravel: subangular, UW, sandstone.		-7
		100 %	Sonic							4		'Very loose', coarse sandy, medium to coarse GRAVEL; grey; moist, non plastic. Gravel: subanulgar to subrounded, UW-SW, sandstone. 'Firm', SILT, some fine sand, some clay, trace shells, trace organics; grey; moist, high plasticity, odourous, homogeneous.	Quaternary Marine Sediments	-8
		89 %	SPT					3 4 4 4 6 5 N=19		5		'Stiff', fine sandy SILT, some clay, trace shells; grey; moist, high plasticity. Medium dense, silty fine to medium SAND, trace fine gravel, trace shells; dark grey; moist, non plastic. Gravel: subrounded, SW, sandstone.		-9
		89 %	Sonic							6		Medium dense, fine to medium SAND, trace silt; grey; moist, non plastic. Minor silt, trace medium gravel, trace organics.		-10
		67 %	SPT					1 2 1 2 1 2 N=6		7		Some medium gravel. Gravel: subrounded, SW, sandstone. Stiff, medium gravelly SILT, some fine sand, trace clay; grey speckled bluish grey; moist, low plasticity. Gravel: subrounded, SW, sandstone.		-11
		100 %	Sonic									Very stiff to hard, SILT, some clay, minor fine sand; bluish grey; moist, high plasticity.	Mangaheia Group	
		100 %	SPT					3 4 6 5 5 7 N=23		8		Some fine sand.		-12
		100 %	Sonic									Minor fine sand.		
		100 %	SPT					2 3 4 5 6 6 N=21		9		Bluish grey mottled orange brown.		-13
		100 %	Sonic									Very stiff to hard, clayey SILT, some fine sand; light orange brown; moist, high plasticity.		

DATE STARTED: 2/2/16
DATE FINISHED: 2/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH611

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 25m offshore of container terminal seawall

COORDINATES: N 5,623,318 m — R L: -3.6 m — COORDINATE ORIGIN: hhGPS

E 1,936,662 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Very stiff to hard, clayey SILT, some fine sand; light orange brown; moist, high plasticity.		-14
		100 %	SPT					2 4 6 6 7 8 N=27		11		Very stiff to hard, fine sandy SILT, some clay; light orange brown; moist, high plasticity.		
		100 %	Sonic									Very stiff to hard, SILT, some fine sand, some clay; light brown mottled orange brown; moist, high plasticity.		-15
		100 %	SPT					2 2 4 5 5 6 N=20		12				-16
		100 %	Sonic							13				
		100 %	SPT					5 5 5 5 6 6 N=22				Very stiff to hard, fine sandy SILT, some clay; bluish grey mottled orange brown; moist, high plasticity.		-17
		100 %	Sonic							14				-18
		100 %	SPT					6 7 7 20 23/70mm N=50/220mm		15		Extremely weak, SW, greenish grey, silty fine SANDSTONE. Defects extremely closely to very closely spaced. Very weak, UW.	Mangaheia Group	-19
		100 %	TT						UCS16			Very weak to weak, UW, dark grey, coarse sandy LIMESTONE. Defects extremely closely spaced. Fossiliferous. (Grainstone) 15.8-16.0m - Recovered as coarse sandy medium to coarse GRAVEL.		
		0 %	SPT					28 22/45mm	PL 1	16				-20
		80 %	TT									Very weak, UW, greenish grey, silty fine SANDSTONE.		
		0 %	SPT					25 25/50mm		17				-21
		68 %	TT						UCS17	18		Weak, UW, grey, coarse sandy LIMESTONE. Defects extremely closely spaced. (Grainstone) Very weak, UW, greenish grey, silty fine SANDSTONE.		-22
										19		Very weak to weak, UW, dark grey, coarse sandy LIMESTONE. Defects very closely spaced. (Grainstone) Very weak to weak, UW, greenish grey, well cemented SANDSTONE. Defects very closely spaced. 19.5-20.0m - No recovery - corebound on fractured rock.		-23
								14						

DATE STARTED: 2/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 2/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH611

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,318 m
E 1,936,662 m
BOREHOLE LOCATION: Approximately 25m offshore of container terminal seawall
R L: -3.6 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					15 25 25/60mm N=50/135mm				Very weak to weak, UW, greenish grey, silty fine SANDSTONE. Defects very closely spaced.		-24
		71 %	TT									Weak, UW, grey, coarse sandy LIMESTONE. Defects extremely closely spaced. (Grainstone)	Mangaheia Group	
										21		Weak, UW, greenish grey, fine to medium SANDSTONE. Defects extremely closely spaced.		-25
		0 %	SPT					10 40/50mm						
										22		END OF LOG @ 21.83 m		-26
										23				-27
										24				-28
										25				-29
										26				-30
										27				-31
										28				-32
										29				-33

DATE STARTED: 2/2/16
DATE FINISHED: 2/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH612

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 20m offshore of container terminal seawall

COORDINATES: N 5,623,347 m — R L: -6.05 m — COORDINATE ORIGIN: hhGPS

E 1,936,835 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		67 %	Sonic						PL2			'Very soft', fine sandy SILT; grey; saturated, non plastic. [Recent Marine Sediments]		
												'Very loose', silty fine to medium SAND; grey; wet, non plastic. [Recent Marine Sediments]		
		100 %	Sonic							1		Very weak to weak, UW-SW, grey, coarse sandy LIMESTONE.		-7
												Very weak to weak, UW-SW, grey, calcareous SANDSTONE.		
		100 %	Sonic							2				-8
		0 %	SPT					5 5 10 15 25/70mm N=50/220mm	PL3					
		63 %	TT							3		2.75-3.0m - No recovery.		-9
												Extremely weak to very weak, UW-SW, greenish grey, poorly cemented fine to medium SANDSTONE. (Very dense, fine to medium SAND). Poor recovery in uncemented zones.		
		55 %	TT							4				-10
												4.2-5.1m - No recovery.		
		0 %	SPT					12 13 25 25/40mm N=50/115mm	PL4	5			Mangaheia Group	-11
		65 %	TT									Extremely weak to very weak, UW-SW, greenish grey, poorly cemented fine to medium SANDSTONE. (Very dense, fine to medium SAND). Poor recovery in uncemented zones.		
		0 %	SPT					10 15 25 25/60mm N=50/135mm		6				-12
		74 %	TT									Very weak to weak, well cemented for 100mm.		
		0 %	SPT					12 12 20 30/50mm N=50/125mm	PL5	7				-13
		28 %	TT							8		8.0-9.0m - No recovery.		-14
		0 %	SPT					6 17 14 15 21/70mm N=50/220mm						
		58 %	TT							9		Extremely weak to very weak, UW-SW, greenish grey, poorly cemented fine to medium SANDSTONE. (Very dense, fine to medium SAND). Poor recovery in uncemented zones. 30mm bed of uncemented fine sandy SILTSTONE. Pumiceous, gently inclined. (Tephra) 30mm bed of uncemented fine sandy SILTSTONE. Pumiceous, gently inclined. (Tephra)		-15
														-16

DATE STARTED: 5/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 5/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
1.7m sonic casing length lost down hole at 1.5-3.2m below ground level. Hole abandoned and restarted approximate 2m adjacent.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH612

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 20m offshore of container terminal seawall

COORDINATES: N 5,623,347 m — R L: -6.05 m — COORDINATE ORIGIN: hhGPS

E 1,936,835 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	SPT					7 20 25/25mm 5/5mm HB N=30/30mm		11		Extremely weak to very weak, UW-SW, greenish grey, poorly cemented fine to medium SANDSTONE. (Very dense, fine to medium SAND). Poor recovery in uncemented zones.		-17
		56 %	TT											
		0 %	SPT					35 15/60mm		12		Extremely weak, UW, light orange brown, weakly cemented silty fine SANDSTONE.	Mangaheia Group	-18
		82 %	TT											
		0 %	SPT					23 27/70mm	UCS18	13				-19
		40 %	TT									13.5-14.2m - No recovery.		
										14				-20
		0 %	SPT					9 10 10 20 20/50mm N=50/200mm				14.2-14.55m - No recovery - Solid SPT.		
												END OF LOG @ 14.55 m		-21
										15				
										16				-22
														-23
										17				
										18				-24
										19				-25
														-26

DATE STARTED: 5/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 5/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
1.7m sonic casing length lost down hole at 1.5-3.2m below ground level. Hole abandoned and restarted approximate 2m adjacent.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH613

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall

COORDINATES: N 5,623,319 m — R L: -3.85 m — COORDINATE ORIGIN: hhGPS

E 1,936,619 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		35 %	Sonic							1		'Very loose', fine to medium SAND; dark grey; saturated, non plastic, dilatant. Wet. 'Very loose', silty fine SAND; grey; wet, non plastic, dilatant. 0.7-2.0m - No recovery. Driller comment: catcher stuck in barrel - corebound.	Recent Marine Sediments	-4 -5
		100 %	Sonic							2		'Very loose', fine to medium SAND, trace shells; dark grey; saturated, non plastic, dilatant. Wet. 60mm subrounded, UW limestone cobble. 'Very loose', medium to coarse SAND, minor medium to coarse gravel; dark grey speckled white; moist, non plastic, 30% shells. 'Very loose', medium SAND; grey; moist, non plastic.		-6
		100 %	Sonic							3		'Soft', SILT, some fine sand, some clay; grey; moist, high plasticity.		-7
		100 %	SPT					0 0 0 0 1 1 N=2		4				-8
		0 %	Sonic							5		5.4-6.5m - No recovery. Driller comment: corebound on SPT overdrill.		-9
		82 %	SPT					1 1 1 1 2 2 N=6		6			Quaternary Marine Sediments	-10
		91 %	Sonic							7		'Firm', SILT, some fine sand, some clay; grey; moist, high plasticity. Stiff, trace fibrous organics. Medium dense, silty fine to medium SAND, trace clay, trace shells; grey; moist, low plasticity. No clay; non plastic.		-11
		100 %	SPT					2 3 4 5 5 5 N=19		8		Trace fibrous organics.		-12
		100 %	Sonic							9				-13
		84 %	SPT					1 1 2 3 3				80mm bed of fine to medium SAND.		

DATE STARTED: 3/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 3/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH613

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,319 m
E 1,936,619 m

BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall
R L: -3.85 m — COORDINATE ORIGIN: hhGPS
DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic					6 N=14				30mm gently inclined bed of medium SAND, minor silt; light pinkish white; moist, non plastic. [Tephra]		-14
		89 %	SPT					7 7 5 5		11		Dense, fine to medium SAND, minor silt, trace shells; grey; moist, non plastic.	Quaternary Marine Sediments	-15
		100 %	Sonic					14 15 N=39		12		Trace fine to medium gravel. Gravel: subrounded, MW, siltstone.		-16
		100 %	SPT					2 3 6 6						
		100 %	Sonic					8 10 N=30		13		Trace semi-decomposed organics. Dark bluish grey. Some silt.		-17
		100 %	SPT					1 2 3 3		14		10mm bed of light grey, pumiceous fine SAND. [Tephra] Stiff, fine sandy SILT, minor medium gravel, trace clay; greenish grey mottled dark grey; moist, low plasticity. Gravel: subrounded, MW, siltstone.		-18
		100 %	Sonic					4 5 N=15				Very stiff, SILT some clay, minor fine sand; bluish grey; moist, high plasticity, homogeneous.		
		100 %	SPT					2 5 5		15		Very stiff to hard.		-19
		100 %	Sonic					8 8 8 N=29		16			Mangaheia Group	-20
		100 %	SPT					3 4 8 6						
		100 %	Sonic					6 8 N=28		17				-21
		100 %	SPT					2 3 3 4		18		Very stiff, fine sandy SILT, minor clay; bluish grey; moist, low plasticity. Trace clay.		-22
		100 %	Sonic					6 10 N=23				Very stiff to hard, SILT, some clay, minor fine sand; bluish grey; moist, high plasticity, homogeneous.		
		100 %	SPT					2 2 3 4		19				-23
		100 %	Sonic					4 6 N=17						

DATE STARTED: 3/2/16
DATE FINISHED: 3/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH613

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,319 m
E 1,936,619 m
BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall
R L: -3.85 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic									Hard, fine sandy SILT, some clay; bluish grey; moist, high plasticity.		-24
		100 %	SPT					4 4 5 7 8 15 N=35		21				-25
		100 %	Sonic									Dense, silty fine to medium SAND, minor clay, trace medium gravel; bluish grey; moist, low plasticity. Some medium to coarse gravel. Gravel: subangular, SW, limestone and sandstone.		
		100 %	SPT TT					6 17 50/70mm N=50/70mm	PL6	22		Very dense, medium to coarse sandy, medium to coarse GRAVEL, some silt; dark grey; moist, non plastic. Gravel: subrounded, UW-SW, sandstone. [Extremely weak, MW, LIMESTONE (Grainstone)]		-26
		87 %	TT						UCS19	23		Extremely weak, UW, bluish grey, silty fine SANDSTONE. (Very dense, silty fine SAND)	Mangaheia Group	-27
		0 %	SPT					5 12 27 23/65mm N=50/140mm	UCS20	24				-28
		100 %	TT							25		100mm bed of calcareous SANDSTONE. Defects extremely closely spaced.		-29
		0 %	SPT					30 20/30mm	PL7	26		Extremely weak to very weak, UW, dark grey, coarse sandy LIMESTONE. Defects extremely closely spaced. (Very dense, coarse sandy, medium to coarse GRAVEL)		-30
		93 %	TT							27		100mm bed of silty fine SANDSTONE.		-31
		0 %	SPT					50/50mm						
										28		END OF LOG @ 27.65 m		-32
										29				-33

DATE STARTED: 3/2/16
DATE FINISHED: 3/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH614

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall

COORDINATES: N 5,623,343 m — R L: -4.8 m — COORDINATE ORIGIN: hhGPS

E 1,936,751 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		38 %	Sonic							0		0.0-1.0m - No recovery. Driller comment: very soft.		-5
										1		'Very loose', fine to medium SAND, trace medium gravel, trace silt; grey; moist, non plastic. Gravel: rounded, UW, greywacke.	Recent Marine Sediments	
												Some silt, no gravel.		-6
		100 %	Sonic							2		Minor silt.		-7
												Medium dense, fine to medium SAND, trace silt; grey speckled white; moist, non plastic, 30% coarse sand sized shell fragments.		
		67 %	SPT					0 1 2 4 4 5 N=15		3		Medium dense, fine to medium SAND, trace silt; dark grey; moist, non plastic.	Quaternary Marine Sediments	-8
		100 %	Sonic							4		Very stiff, SILT, some clay, minor fine sand; bluish grey mottled light orange brown; moist, high plasticity, homogeneous.		-9
		100 %	SPT					2 3 3 3 6 7 N=19		5		Light orange brown.		-10
		100 %	Sonic							6		Hard Some fine sand.		-11
		100 %	SPT					4 4 7 10 10 10 N=37		7			Mangaheia Group	-12
		100 %	Sonic											
		100 %	SPT					6 5 5 5 5 6 N=21		8		8.05-8.85m - No recovery. Driller comment: miscounted rods - overdrilled.		-13
		67 %	Sonic							9		Very stiff, SILT, some fine sand, some clay; light brown; moist, high plasticity, homogeneous.		-14

DATE STARTED: 31/1/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 31/1/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH614

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall

COORDINATES: N 5,623,343 m — R L: -4.8 m — COORDINATE ORIGIN: hhGPS

E 1,936,751 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		67 %	Sonic							11		Very stiff, SILT, some fine sand, some clay; light brown; moist, high plasticity, homogeneous.		-15
		100 %	SPT					4 7 8 10 10 12 N=40				Hard, fine sandy SILT, minor clay; light brown; moist, low plasticity, homogeneous.		
		100 %	Sonic											-16
		100 %	SPT					4 6 7 5 6 8 N=26		12				-17
		91 %	TT									Medium dense, silty fine SAND, minor clay; bluish grey; moist, low plasticity.		
		100 %	SPT					5 6 8 10 12 12 N=42		13				-18
		81 %	TT							14		Dense.		-19
		100 %	SPT					12 12 15 35/70mm N=50/145mm	UCS21	15		Extremely weak, SW, bluish grey, homogeneous silty fine SANDSTONE. (Dense to very dense, silty fine SAND)	Mangaheia Group	-20
		69 %	TT						PL8	16				-21
		0 %	SPT					35 15/50mm		17		Extremely weak to very weak. Drilling induced disking. 150mm bed of extremely weak, SW, light grey, laminated cemented SILT. Tephra.		-22
		68 %	TT									17.1-17.6m - No recovery.		
		0 %	SPT					5 5 9 10 20 11/50mm N=50/275mm		18		Extremely weak, UW-SW, bluish grey, silty fine to medium SANDSTONE. (Very dense, silty fine to medium SAND)		-23
		16 %	TT							19		150mm bed of very weak, UW, dark grey, LIMESTONE. Defects extremely closely spaced. 50mm bed of very weak, UW, dark grey, LIMESTONE. Defects extremely closely spaced. 18.7-19.2m - No recovery. 19.2-19.63m - No recovery - solid SPT. Extremely weak, UW, dark grey, variably cemented SANDSTONE. Very poor recovery. Recovered as 20-30mm sized blocks.		-24

DATE STARTED: 31/1/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 31/1/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH614

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall

COORDINATES: N 5,623,343 m — R L: -4.8 m — COORDINATE ORIGIN: hhGPS

E 1,936,751 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		16 %	TT							20		20-21.02m - No recovery.		-25
		0 %	SPT					26 24/40mm		21		END OF LOG @ 21.02 m		-26
										22				-27
										23				-28
										24				-29
										25				-30
										26				-31
										27				-32
										28				-33
										29				-34

DATE STARTED: 31/1/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 31/1/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH615

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT:	6 Wharf Development	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,382 m
E 1,936,912 m

BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall
R L: -9.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		71 %	Sonic									0.0-0.4m - No recovery.		
										1		'Very soft', SILT, minor fine sand, trace clay; dark grey; wet, low plasticity.	Recent Marine Sediments	-10
		81 %	Sonic							2		'Soft', minor clay. Some fine sand.		-11
		100 %	Sonic							3		'Medium dense', fine to medium SAND, minor silt, trace medium gravel; greenish grey; wet, non plastic. 60mm bed of silty fine to medium SAND, minor gravel.		-12
		100 %	SPT					6 15 15 15 20/60mm N=50/210mm		4		Extremley weak to very weak, MW, greenish grey, variably cemented fine to medium SANDSTONE. (Very dense, fine to coarse SAND). Very weak zones 30-70mm thick.		-13
		100 %	Sonic							5		100mm bed of fine sandy SILTSTONE. Uncemented.		-14
		0 %	SPT					35 15/70mm						
		56 %	TT						PL9	6			Mangaheia Group	-15
												6.6-7.1m - No recovery.		-16
		0 %	SPT					10 12 15 15		7		7.1-7.55m - No recovery - Solid SPT.		
		62 %	TT					12 8 N=50				Extremely weak to weak, UW-SW, yellowish brown, well cemented, fine to medium SANDSTONE. (Very dense, fine to medium SAND). Uncemented.		-17
		0 %	SPT					25 25/70mm		8				
		85 %	TT											-18
		0 %	SPT					18		9				-19

DATE STARTED: 1/2/16
DATE FINISHED: 1/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH615

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 35m offshore of container terminal seawall

COORDINATES: N 5,623,382 m — R L: -9.1 m — COORDINATE ORIGIN: hhGPS

E 1,936,912 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
								32/55mm				Extremely weak, UW, grey, uncemented fine to medium SANDSTONE. Orange brown.		
		71 %	TT									10.4-10.6m - No recovery.		
										11		Extremely weak, UW, grey, variably cemented fine to medium SANDSTONE. (Very dense, fine to medium SAND) 10.6-10.8m - recovered as 20-40mm sized blocks - uncemented sandstone not recovered.	Mangaheia Group	-20
		0 %	SPT					25 25/40mm				11.05-11.42m - No recovery.		
												END OF LOG @ 11.42 m		
										12				-21
										13				-22
										14				-23
										15				-24
										16				-25
										17				-26
										18				-27
										19				-28
														-29

DATE STARTED: 1/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 1/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT/TT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH616

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT:	6 Wharf Development	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,359 m
E 1,936,648 m

BOREHOLE LOCATION: Approximately 70m offshore of container terminal seawall
R L: -5.15 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		59 %	Sonic						SD71	0		'Very loose', fine to medium SAND, minor silt; dark grey; saturated, non plastic, dilatant.		-5
												Wet.		
												Trace medium gravel. Gravel: rounded, UW, sandstone.		
										1		1.0-1.7m - No recovery.		-6
		42 %	Sonic							2		'Very loose', fine to medium SAND; dark grey; saturated, non plastic.	Recent Marine Sediments	-7
												Trace medium to coarse gravel. Gravel: rounded, UW, sandstone.		
										3		'Very soft', fine sandy SILT, minor clay; grey; moist, low plasticity.		-8
												2.65-3.65m - No recovery. Driller comment: barrel sank while advancing casing. Overdrill logged as SILT, some clay.		
		100 %	Sonic							4		'Soft', SILT, some clay, minor fine sand, trace shells; grey; moist, high plasticity.	Quaternary Marine Sediments	-9
		100 %	Sonic							5				-10
		78 %	SPT					1 1 2 2 2 1 N=7		6		'Firm', fine sandy SILT, minor clay, trace shells; grey; moist, low plasticity.		-11
		100 %	Sonic									Loose, silty fine to medium SAND, trace clay, trace shells, trace organics; grey speckled brown; moist, low plasticity. Organics: fibrous. Trace medium gravel. Gravel: subrounded, SW, siltstone.		-12
		100 %	SPT					3 3 3 5 5 5 N=18	SD72	7		Some medium gravel.		-13
		100 %	Sonic							8		Very stiff, SILT, some clay, minor fine sand, trace shells; bluish grey speckled white; moist, high plasticity, homogeneous. 100mm bed of medium gravelly SILT, minor clay. Gravel: subrounded, UW, siltstone. No gravel, no shells.	Mangaheia Group	-14
		100 %	SPT					3 4 5 6 7 8 N=26	SD88	9		Light orange brown.		-15
		100 %	Sonic											

DATE STARTED: 4/2/16
DATE FINISHED: 4/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH616

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,359 m
E 1,936,648 m
BOREHOLE LOCATION: Approximately 70m offshore of container terminal seawall
R L: -5.15 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SPT					3 3 4 5 10 10 N=29		11		Hard, SILT, some clay, minor fine sand, trace shells; light orange brown; moist, high plasticity, homogeneous.	Mangaheia Group	-16
		100 %	Sonic											
		100 %	SPT					5 6 6 7 8 12 N=33		12				-17
												END OF LOG @ 12.15 m		
										13				-18
														-19
										14				
														-20
										15				
														-21
										16				
														-22
										17				
														-23
										18				
														-24
										19				
														-25

DATE STARTED: 4/2/16
DATE FINISHED: 4/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH617

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,387 m
E 1,936,859 m
BOREHOLE LOCATION: Approximately 55m offshore of container terminal seawall
R L: -9.05 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		52 %	Sonic						SD73	0		'Very soft', SILT, minor fine sand, trace clay; grey; saturated, low plasticity.	Recent Marine Sediments	-9.05
										1		0.7-1.35m - No recovery.		-10
		77 %	Sonic							2		'Very soft', SILT, minor fine sand, minor clay; grey; moist, low plasticity. 'Very soft', SILT, some clay, minor fine sand; grey; moist, high plasticity.		-11
									SD74	3				-12
		100 %	Sonic							4		Extremely weak, MW, greenish grey, fine to medium SANDSTONE. (Very dense, silty fine to medium SAND)	Mangaheia Group	-13
		100 %	SPT					2 8 15 15 15 5/40mm N=50/265mm		5		SW, variably cemented. Poor recovery in uncemented zones.		-14
		32 %	TT							6				-15
		0 %	SPT					15 10 10 20 20/55mm N=50/205mm		7		END OF LOG @ 6.76 m		-16
										8				-17
										9				-18
														-19

DATE STARTED: 4/2/16
DATE FINISHED: 4/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT/TT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

Beca

BOREHOLE No: BH618

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,377 m
E 1,936,585 m
BOREHOLE LOCATION: Approximately 100m offshore of container terminal seawall
R L: -6.45 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		71 %	Sonic					0 0 0 0 0 0 N=0		1 2 3		'Very soft', SILT, some fine sand, some clay, trace shells; grey; moist, high plasticity, homogeneous. 80mm bed of fine sandy SILT, some clay.	Quaternary Marine Sediments	-7 -8 -9
		100 %	SPT											
		100 %	Sonic											
		100 %	SPT					0 0 0 1 1 N=3	SD75	4		30mm bed with some shells. 'Soft to firm'.		-10 -11
		100 %	Sonic							5				
		100 %	SPT					0 0 0 0 1 1 N=2		6				-12
		100 %	Sonic											-13
		100 %	SPT					0 0 1 1 1 1 N=4		7		Minor fine sand.		-14
		62 %	Sonic							8		30mm bed of fine to medium SAND, some silt. Firm.		-15
		100 %	SPT					0 0 1 1 0 1 N=3		9		END OF LOG @ 9.15 m		-16

DATE STARTED: 29/1/16
DATE FINISHED: 29/1/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH619

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,403 m
E 1,936,716 m
BOREHOLE LOCATION: Approximately 100m offshore of container terminal seawall
R L: -9.35 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		60 %	Sonic						SD76	1		'Very soft', SILT, minor fine sand, trace clay; dark grey; saturated, low plasticity.	Recent Marine Sediments	-10
												Minor clay.		
												Some fine sand; moist.		
										2		1.2-2.0m - No recovery.		-11
		100 %	Sonic									'Very soft', SILT, some fine sand, minor clay; dark grey; wet, low plasticity.		
										3		Trace fibrous organics.		-12
												'Very stiff', fine sandy SILT, minor clay; bluish grey banded light orange brown; moist, low plasticity, homogeneous. [CW Mangaheia Group?]		
												Some clay; high plasticity.		
		100 %	SPT					2 3 4 7 8 9 N=28	SD77			Bluish grey mottled orange brown.		-13
										4		Brownish grey.		
		94 %	Sonic									Brownish grey banded dark brownish grey.		-14
										5		Very stiff, fine sandy SILT, some clay; grey; moist, high plasticity, homogeneous. [CW Mangaheia Group]	Mangaheia Group	
		100 %	SPT					2 2 3 7 7 10 N=27	SD78					-15
		100 %	Sonic							6				-16
		122 %	SPT					7 5 5 7 10 12 N=34		7		Hard		
												END OF LOG @ 7.25 m		-17
										8				-18
										9				-19

DATE STARTED: 29/1/16
DATE FINISHED: 29/1/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH620

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 80m north-west of end of 5 Wharf

COORDINATES: N 5,623,451 m — R L: -12.84 m — COORDINATE ORIGIN: hhGPS

E 1,936,944 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		87 %	Sonic					3 3 2 1		1		'Very soft', SILT, minor fine sand, trace clay; dark grey; saturated, low plasticity. [Recent Marine Sediments]	Mangaheia Group	-13
												Very loose, fine to coarse SAND, minor silt, trace fine gravel; greenish grey; saturated, non plastic.		
												Very loose, silty fine to medium SAND, minor fine to medium gravel, trace clay; greenish grey; moist, low plasticity. Gravel: subangular, SW, sandstone.		
		80 %	SPT					2 1 N=6	SD79			Very loose, medium to coarse GRAVEL, some fine sand, minor silt; greenish grey; wet, non plastic. Gravel: angular to subangular, UW-SW, sandstone.		-14
												Loose, silty fine to medium SAND, trace medium gravel, trace clay; greenish grey mottled grey; moist, low plasticity.		
		83 %	Sonic							2		Loose, coarse sandy, fine to medium GRAVEL, minor silt, trace clay; greenish grey; wet, non plastic. Gravel: angular to subangular, UW-SW, sandstone.		
												Loose, fine to medium SAND, some silt, trace clay; greenish grey; moist, low plasticity.		
												'Stiff', SILT, some clay, minor fine sand, trace medium gravel; dark green; moist, high plasticity.		-15
												Loose, fine to medium SAND, minor silt; greenish grey; moist, non plastic. 30mm bed of SILT, some clay; high plasticity. 30° inclination. 30mm bed of SILT, some clay; high plasticity. 10° inclination.		
		83 %	SPT					2 8 12 18 20/60mm N=50/210mm		3		Very dense, silty fine to medium SAND; greenish grey; moist, non plastic. Minor medium to coarse gravel. Gravel: rounded, UW, sandstone.		-16
		85 %	Sonic									Very dense, fine to medium SAND, some silt, trace medium gravel; greenish grey; moist, non plastic. [Extremely weak, MW, uncemented SANDSTONE]		
										4				-17
		0 %	SPT					2 4 8 20 20 2/5mm N=50/230mm		5		4.7-5.08m - No recovery - Solid SPT.		
												END OF LOG @ 5.08 m		-18
										6				-19
										7				-20
										8				-21
										9				-22

DATE STARTED: 1/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 1/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH621

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,308 m
E 1,936,499 m
BOREHOLE LOCATION: Approximately 50m offshore of logging yard seawall
R L: -5.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		14 %	Sonic							1		Very soft, SILT, minor fine sand, trace clay; dark grey; wet, low plasticity. [Recent Marine Sediments]		-6
												0.3-2.1m - No recovery.		
		100 %	Sonic							2		Soft, clayey SILT, trace fine sand, trace shells; grey; wet, high plasticity.		-7
		100 %	Sonic							3				-8
		100 %	SPT					0 0 0 1 0 1 N=2	SD80	4				-9
		100 %	Sonic							5				-10
		100 %	SPT					0 0 1 0 0 1 N=2		6				-11
		100 %	Sonic							7				-12
		95 %	SPT							8				-13
		100 %	Sonic							9				-14
		100	SPT											-15

Quaternary Marine Sediments

DATE STARTED: 6/2/16
DATE FINISHED: 6/2/16
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH621

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,308 m
E 1,936,499 m
BOREHOLE LOCATION: Approximately 50m offshore of logging yard seawall
R L: -5.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	Sonic					0 0 1 1 1 1 N=4		11		Soft, clayey SILT, trace fine sand, trace shells; grey; wet, high plasticity.	Quaternary Marine Sediments	-16
		100 %	SPT					1 0 0 1 0 1 N=2		12		END OF LOG @ 11.73 m		-17
										13				-18
										14				-19
										15				-20
										16				-21
										17				-22
										18				-23
										19				-24
														-25

DATE STARTED: 6/2/16
DATE FINISHED: 6/2/16
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH622

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 230m offshore of logging yard seawall

COORDINATES: N 5,623,477 m — R L: -6.6 m — COORDINATE ORIGIN: hhGPS

E 1,936,425 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		91 %	Sonic							1		'Very soft to soft', SILT, trace fine sand, trace clay; grey; moist, low plasticity, homogeneous.		-7
		98 %	Sonic							2		Some fine sand.		-8
		100 %	SPT					0 0 0 0 1 1 N=2	SD81	3				-9
		88 %	Sonic							4		'Soft', minor clay.		-10
		100 %	SPT					0 0 0 1 0 1 N=2		5			Quaternary Marine Sediments	-11
		100 %	Sonic							6				-12
		100 %	SPT					0 1 1 1 0 1 N=3		7		'Firm'		-13
		84 %	Sonic							8				-14
		100 %	SPT					0 1 1 1 1 1 N=4	SD82	9				-15
		100 %	Sonic											-16
												END OF LOG @ 9.38 m		

DATE STARTED: 7/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 7/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JMC — DRILL METHOD: Sonic/SPT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS: Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH623

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,533 m
E 1,936,665 m
BOREHOLE LOCATION: Approximately 240m offshore of container terminal seawall
R L: -10.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		27 %	Sonic						SD83	0		'Very soft', fine sandy SILT, trace clay; grey; saturated, low plasticity.		-11
										1		0.6-2.2m - No recovery.	Recent Marine Sediments	-12
		85 %	Sonic							2		'Very soft', fine sandy SILT, trace clay; grey; wet, low plasticity.		-13
		100 %	Sonic							3		'Soft', SILT, some fine sand, some clay; grey; wet, high plasticity.		-14
									SD84	4				-15
		95 %	Sonic							5			Quaternary Marine Sediments	-16
										6				-17
		0 %	SPT					0 0 0 0 0 0 N=0		7		6.78-7.23m - No recovery.		
												END OF LOG @ 7.23 m		-18
										8				-19
										9				-20

DATE STARTED: 7/2/16
DATE FINISHED: 7/2/16
LOGGED BY: JMC
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic/SPT
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH624

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development
JOB NUMBER: 3124410/500
SITE LOCATION: Napier Port
CLIENT: Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,757 m
E 1,936,352 m
BOREHOLE LOCATION: Approximately 520m offshore of logging yard seawall
R L: -10.45 m
DATUM: Chart Datum
COORDINATE ORIGIN: hhGPS
ACCURACY: 5

DRILLING						IN-SITU TESTS							
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		33 %	Sonic						SD85	0		'Very loose', silty fine to medium SAND, trace cobbles, trace clay; grey; saturated, low plasticity. Cobbles: rounded, UW, greywacke. [Recent Marine Sediments] No cobbles.		-10
										1		0.5-1.5m - No recovery.		-11
		100 %	Sonic							2		'Very loose', silty fine to medium SAND, trace clay; grey; saturated, low plasticity. 70mm rounded, UW, greywacke cobble.	Quaternary Marine Sediments	-12
										3				-13
		79 %	Sonic						SD86			'Soft to firm', fine sandy SILT, trace clay; grey; moist, low plasticity.		-14
												'Very loose', silty fine SAND, trace shells; grey; moist, non plastic.		
									SD87	4		'Soft to firm', fine sandy SILT, trace clay, trace shells; grey; moist, low plasticity. Minor clay.		-15
		90 %	Sonic							5		'Soft to firm', fine sandy SILT, some clay; grey; moist, high plasticity.		-16
										6		END OF LOG @ 6.2 m		-17
										7				-18
										8				-19
										9				-20

DATE STARTED: 8/2/16
DATE FINISHED: 8/2/16
LOGGED BY: JGE
SHEAR VANE No: N/A

DRILLED BY: Pro-Drill (Auck) Ltd
EQUIPMENT: Fraste CRSXL2
DRILL METHOD: Sonic
DRILL FLUID: Polymer/Water
DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.
SPTs not conducted due to rough conditions/swell causing casing deflection.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BOREHOLE No: BH625

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: 6 Wharf Development — JOB NUMBER: 3124410/500

SITE LOCATION: Napier Port — CLIENT: Port of Napier Ltd

CIRCUIT: NZTM — BOREHOLE LOCATION: Approximately 190m east of end of 5 Wharf

COORDINATES: N 5,623,405 m — R L: -12.4 m — COORDINATE ORIGIN: hhGPS

E 1,937,170 m — DATUM: Chart Datum — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		50 %	Sonic							0		0.0-0.35m - No recovery.		-13
		89 %	SPT					1 1 1 3 4 6 N=14		1		Medium dense, silty fine to medium SAND, trace clay; grey; moist, low plasticity, homogeneous. [Extremely weak, CW-HW, SANDSTONE]	Mangaheia Group	-14
		100 %	Sonic							2				-15
		100 %	SPT					6 6 8 10 12 12 N=42		3		Dense. END OF LOG @ 2.8 m		-16
										4				-17
										5				-18
										6				-19
										7				-20
										8				-21
										9				-22

DATE STARTED: 8/2/16 — DRILLED BY: Pro-Drill (Auck) Ltd

DATE FINISHED: 8/2/16 — EQUIPMENT: Fraste CRSXL2

LOGGED BY: JGE — DRILL METHOD: Sonic/SPT

SHEAR VANE No: N/A — DRILL FLUID: Polymer/Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Target depth reached.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

REPORT

EARTHQUAKE COMMISSION

SPT Energy Measurements
Prodrill Sonic Drill Rig (FRASTE1)
with Auto Hammer

Report prepared for:

EARTHQUAKE COMMISSION

Report prepared by:

Tonkin & Taylor Ltd

Distribution:

EARTHQUAKE COMMISSION	Electronic copy
Tonkin & Taylor Ltd (FILE)	1 copy

November 2012

T&T Ref: 52003.300

Table of contents

1 Introduction

This report summarizes the results from the Standard Penetration Test (SPT) energy measurements made on Prodrill's Sonic drill rig (Red) "FRASTE1" equipped with an automatic SPT hammer. The measurements were undertaken at 73 St Martins Road, Christchurch on 10 September 2012. The purpose of the dynamic measurements was to determine the average energy transfer from the SPT hammer to an N-type drill rod during SPT sampling events.

A PAX Model, Pile Driving Analyser (PDA) acquired and processed the dynamic test data to meet the test objective. Information on the dynamic testing instrumentation, the test sequence and analytical procedures is presented in Section 3 of this report. SPT energy measurements were performed in accordance with ASTM D4633-10.

2 Drill Rig and SPT Hammer Details

Testing was conducted on a track mounted Sonic drill rig (FRASTE1) equipped with an automatic SPT hammer (refer to Figure 1 below). The automatic hammer operates by hydraulically lifting the SPT weight, which free falls inside an enclosed cylinder. N-type drill rods with taper threads were used during the sampling events. A diagram of typical SPT hammers is presented in Appendix D.

Figure 1. Track mounted Sonic drill rig "FRASTE1" with automatic SPT hammer

3 Dynamic Test Field Details

3.1 Instrumentation

A PAX Model PDA with SPT Analyser software was used to process dynamic measurements of strain and acceleration taken on an instrumented NWJ rod segment inserted in the drill string immediately below the anvil of the hammer. Couplers were used on both ends of the instrumented NWJ rod to connect to the N-type SPT rods. The strain and acceleration signals were conditioned and converted to forces and velocities by the PDA. During SPT sampling, the PDA calculated values for the hammer energy transferred to the gauge location, the energy transfer ratio, the maximum impact force, the maximum impact velocity, and the hammer operating rate. Calibration information for the PDA unit, instrumented rod segment and accelerometers used are included in Appendix A. Force and velocity records from the PDA were also viewed on a graphic LCD screen during sampling to evaluate data quality. These records were digitally stored for subsequent analysis.

3.2 Test Sequence

On 10 September 2012 energy measurements were made during SPT sampling in one borehole (Borehole ref STM-POD5-BH5) undertaken at 73 St. Martins Road in Christchurch. The drill rig was operated by personnel from Prodrill. Measurements were obtained during four sampling events (Samples 1, 2, 3 & 4) at 1.5m depth intervals. Energy measurements were taken at depths of 10.5m, 12m, 13.5m and 15m. The split-spoon sampler was driven 450mm as blows were recorded for each of the three 150mm increments. The SPT N value for each sampling event was then calculated as the number of blows for the second and third sampling increments. A summary of energy measurements, rod lengths, sampling depths, reported SPT N values and blow rates for Test Samples 1 to 4 are presented in Table 2.

3.3 Dynamic testing analysis details

3.3.1 Case Method

The PDA interprets the measured dynamic data according to the Case Method equations. The dynamic test data was evaluated for the following:

- energy transferred to the gauge location (EMX)
- energy transfer ratio (ETR)
- maximum impact force at the gauge location (FMX)
- maximum impact velocity at the gauge location (VT1)
- maximum impact acceleration (AMX)
- SPT hammer operating rate (BPM).

These quantities are presented in the dynamic testing result summaries in Appendix B. A plot of the force and velocity data for a single hammer blow from each testing sequence is included in Appendix C.

The maximum energy transfer to the gauge location was calculated by integrating both the force and velocity records over time as follows:

$$EMX = \int F(t)V(t)dt$$

Where: F = the force at time t
V = the velocity at time t

The integration begins at the hammer impact time and continues until the maximum transferred energy is reached. Using this equation, the average energy transfer over the SPT N value increment was computed and is presented in Table 1. Data from the seating blows in the first 150mm increment was not used in this calculation. A summary of the energy measurement results is presented below in Table 1.

Table 1. Summary of SPT Hammer Energy Transfer Measurements on Prodrill's Sonic Drill Rig "FRASTE1" with Auto SPT Hammer and N-type Rod

Number of Samples	Average Transferred Energy	Average Energy Transfer Ratio	Range in Transferred Energy	Range in Energy Transfer Ratio	Average Blow Rate (blows per min)
4	0.452kNm	95.2%	0.441kNm to 0.462kNm	93% to 97.3%	26

The maximum, minimum, and standard deviation in energy transfer for each SPT sample over the SPT N value increment are included in Appendix B.

4 Results

A summary of results for the three samples of the energy measurements with reported SPT N values and the SPT N value corrected for 60% transferred energy (N_{60}) are presented below in Table 2. The N_{60} value was calculated using the Schmertman correction as follows:

$$N_{60} = (e_m / 60)\, N_m$$

Where: e_m = the measured transferred energy ratio (based upon measured energy / theoretical energy of 0.475kNm)

N_m = the measured SPT N value.

Table 2. Summary of SPT Hammer Energy Transfer Measurements, Field SPT N Value & N_{60} Prodrills Sonic Drill Rig "FRASTE1" with Auto Hammer and N-type Rod

Test Sample	SPT rod length(1)	Sample Starting Depth	Reported SPT Values per 150mm increment	SPT Field N Value	Average Energy Transferred to Rod(2)	Average Energy Transfer Ratio(3)	SPT N Value Corrected for 60% Energy(4) N_{60}	Average Blow Rate (blows/ min)
1	11.8m	10.5m	8-12-15	27	0.441kNm	93.0%	42	25.8
2	13.4m	12.0m	5-4-8	12	0.451kNm	95.1%	19	25.7
3	14.9m	13.5m	8-12-8	20	0.453kNm	95.5%	32	25.6
4	16.2m	15.0m	3-5-8	13	0.462kNm	97.3%	21	25.5

(1) Below gauge station. Add 300mm for total N-type rod length
(2) Average energy transfer over second and third increment from FV method
(3) Based upon average energy transferred to the calibrated NWJ SPT rod divided by 0.475kNm (theoretical energy)
(4) SPT N Value corrected for 60% energy using Schmertman Correction Method

5 Conclusions

Based upon the dynamic test data obtained and the analyses performed, the following conclusions are presented:

1) Energy measurements were taken during four SPT sampling events performed with Prodrills track mounted Sonic drill rig "FRASTE1" equipped with an automatic SPT hammer and N-type SPT rods.

2) The energy transfer to the SPT rod for the three sampling events ranged from 0.441kNm to 0.462kNm. This corresponds to a range in energy transfer ratio of 93.0% to 97.3% of the 0.475kNm theoretical SPT hammer energy.

3) The overall average energy transfer for the four sampling events was 0.452kNm or 95.2% of the theoretical energy.

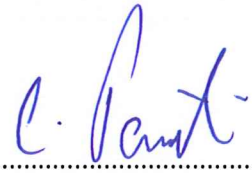
4) The overall average hammer blow rate during the sampling events was 26 blows per minute.

6 Applicability

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

Tonkin & Taylor LTD
Environmental and Engineering Consultants

Report prepared by:



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Cory Pointon
Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

.....

Andrew Langbein
Senior Geotechnical Engineer

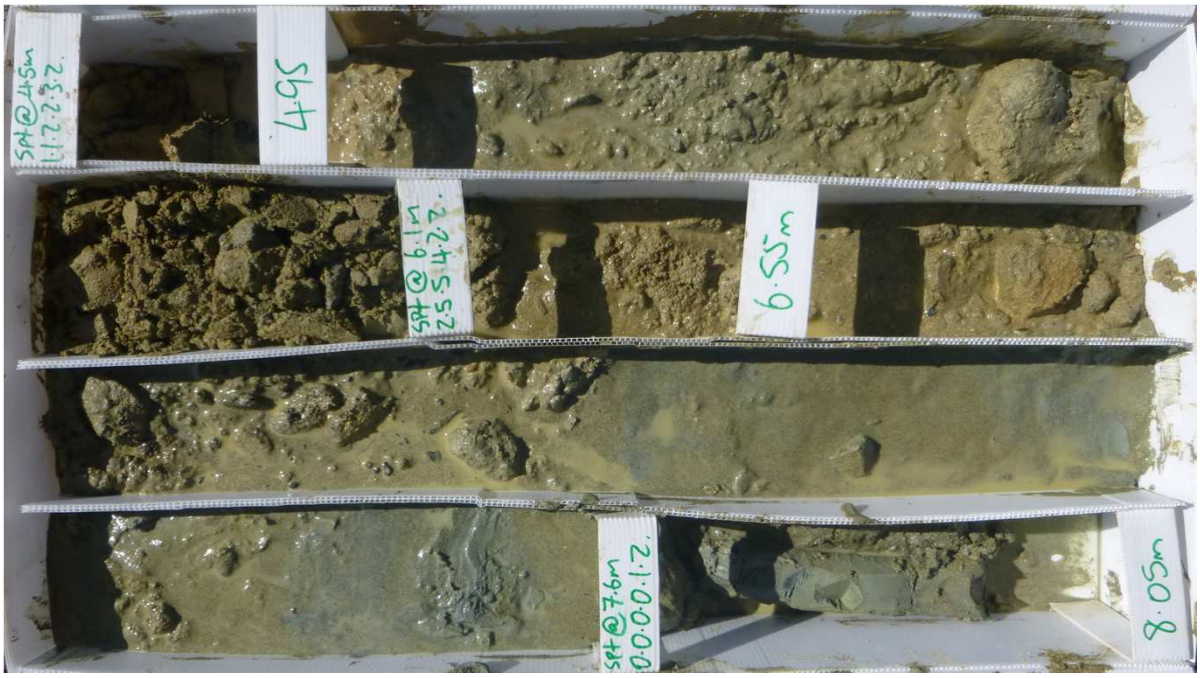
capp

T:\Christchurch\TT Projects\52003\52003.3000\IssuedDocuments\SPT calibration reports\capp171012_Prodrill_Fraste1_Red_SPT_Calibration.REPORT.Rev1.docx

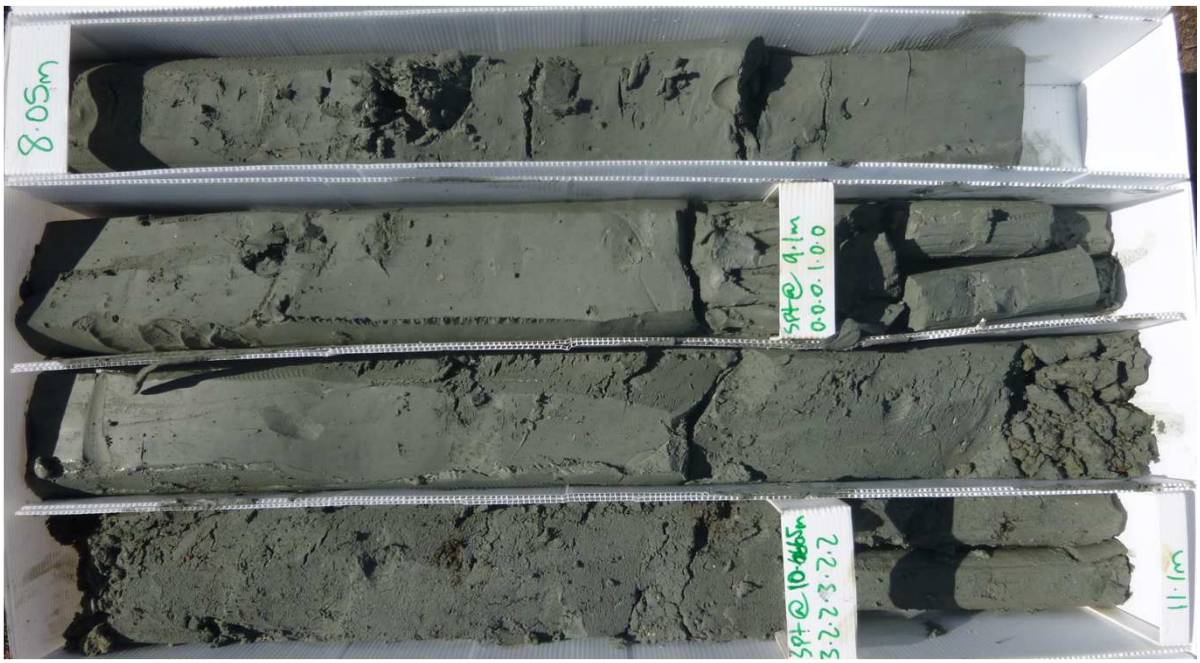
Appendix C

Machine Borehole Photographs

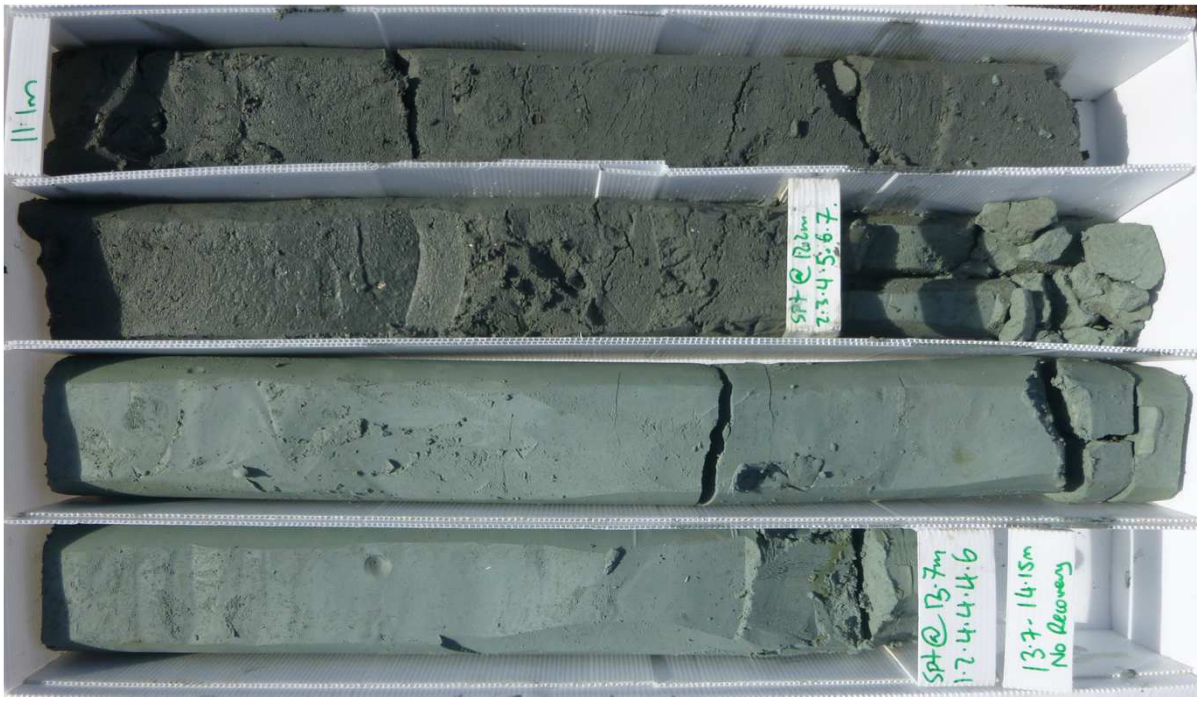
BOX: 1 **DEPTH: 0.0 to 4.5m**



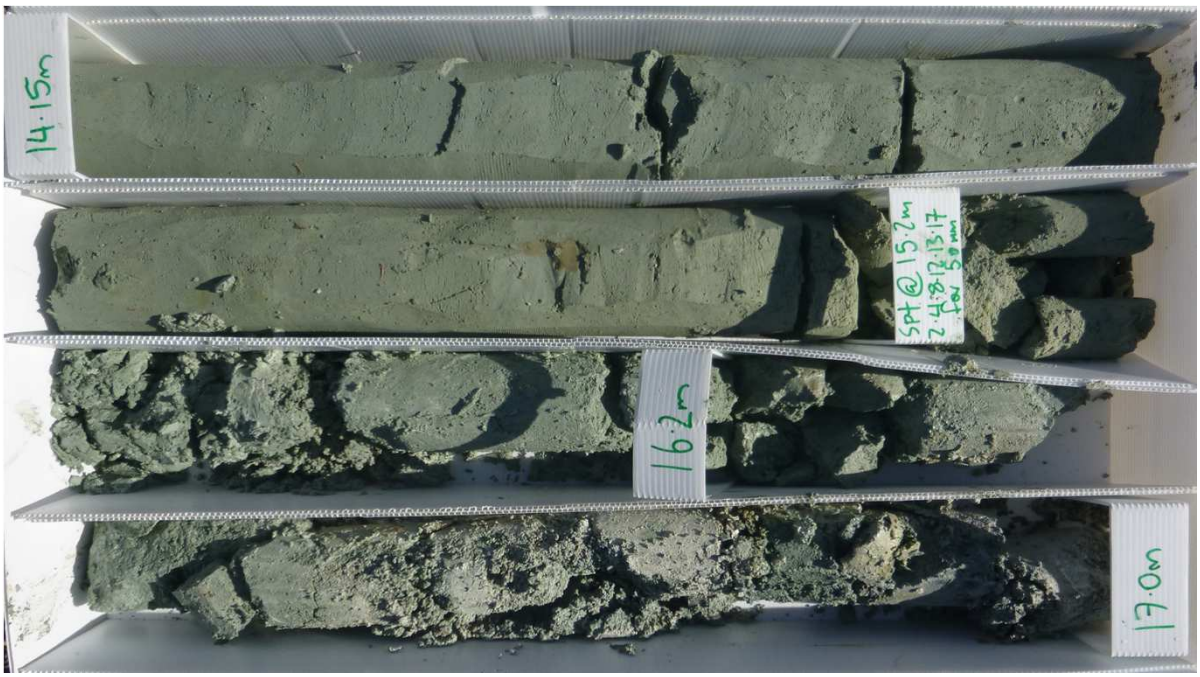
BOX: 2 **DEPTH: 4.5 to 8.05m**



BOX: 3 **DEPTH: 8.05 to 11.1m**



BOX: 4 **DEPTH: 11.1 to 14.15m**



BOX: 5 **DEPTH: 14.15 to 17.0m**

BOX: 6 **DEPTH: 17.0 to 18.62m**

BOX: 1 **DEPTH: 0.0 to 4.95m**

BOX: 2 **DEPTH: 4.95 to 7.7m**

BOX: 3 **DEPTH: 7.7 to 10.6m**

BOX: 4 **DEPTH: 10.6 to 14.05m**

BOX: 5 **DEPTH: 14.05 to 16.6m**

BOX: 6 **DEPTH: 16.6 to 19.35m**

BOX: 7 **DEPTH: 19.35 to 22.2m**

BOX: 8 **DEPTH: 22.2 to 24.84m**

BOX: 1 **DEPTH: 0.0 to 2.65m**

BOX: 2 **DEPTH: 2.65 to 5.7m**

BOX: 3 **DEPTH: 5.7 to 8.7m**

BOX: 4 **DEPTH: 8.7 to 11.65m**

BOX: 5 **DEPTH: 11.65 to 15.8m**

BOX: 6 **DEPTH: 15.8 to 19.9m**

BOX: 7 **DEPTH: 19.9 to 24.2m**

BOX: 8 **DEPTH: 24.2 to 26.37m**

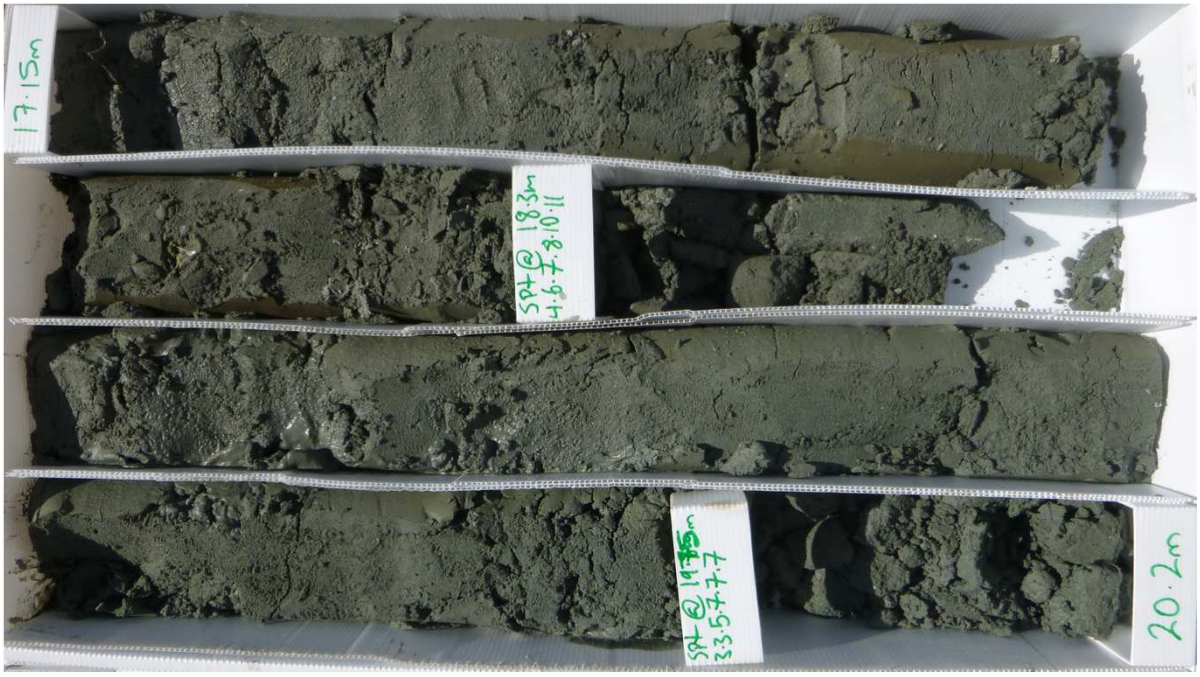
BOX: 1 **DEPTH: 0.0 to 5.0m**

BOX: 2 **DEPTH: 5.0 to 8.05m**

BOX: 3 **DEPTH: 8.05 to 11.1m**

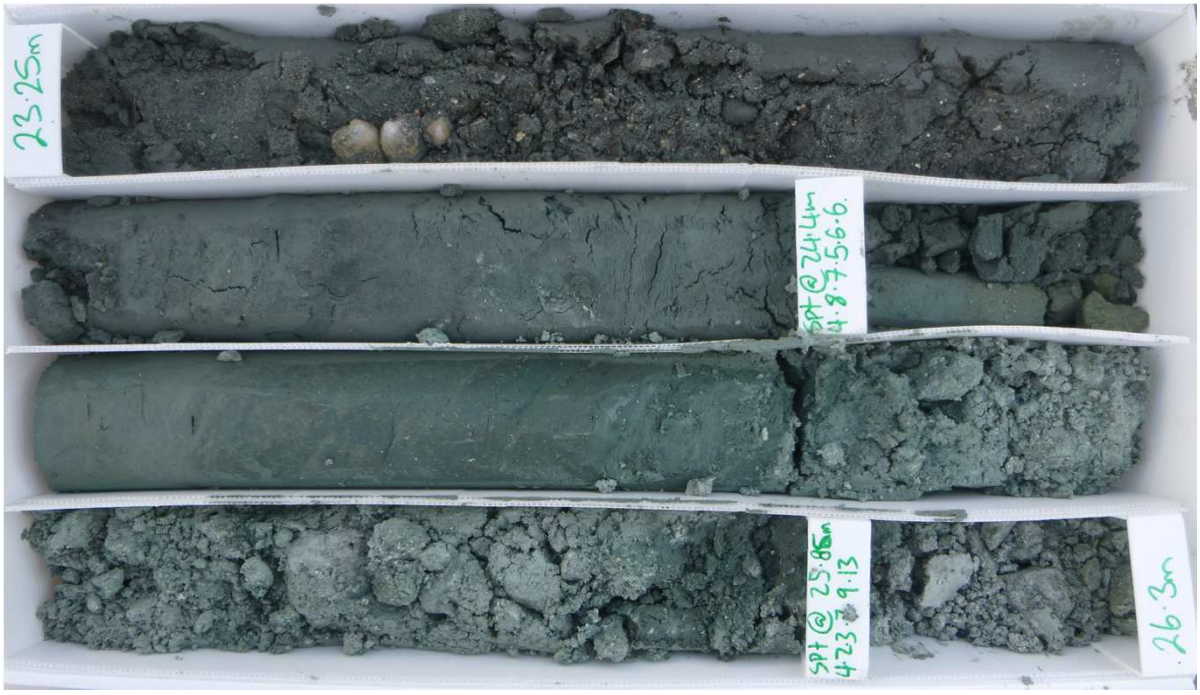
BOX: 4 **DEPTH: 11.1 to 14.15m**

BOX: 5 **DEPTH: 14.15 to 17.15m**



BOX: 6 **DEPTH: 17.15 to 20.0m**

BOX: 7 **DEPTH: 20.2 to 23.25m**



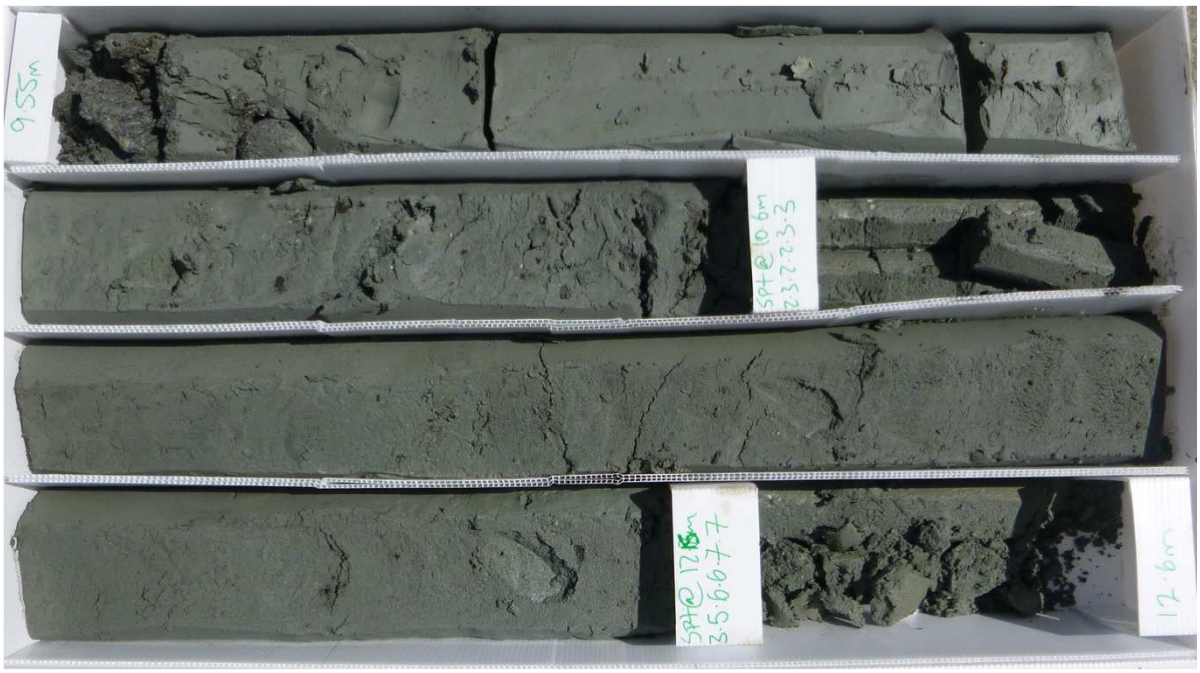
BOX: 8 **DEPTH: 23.25 to 26.3m**

BOX: 9 **DEPTH: 26.3 to 29.8m**

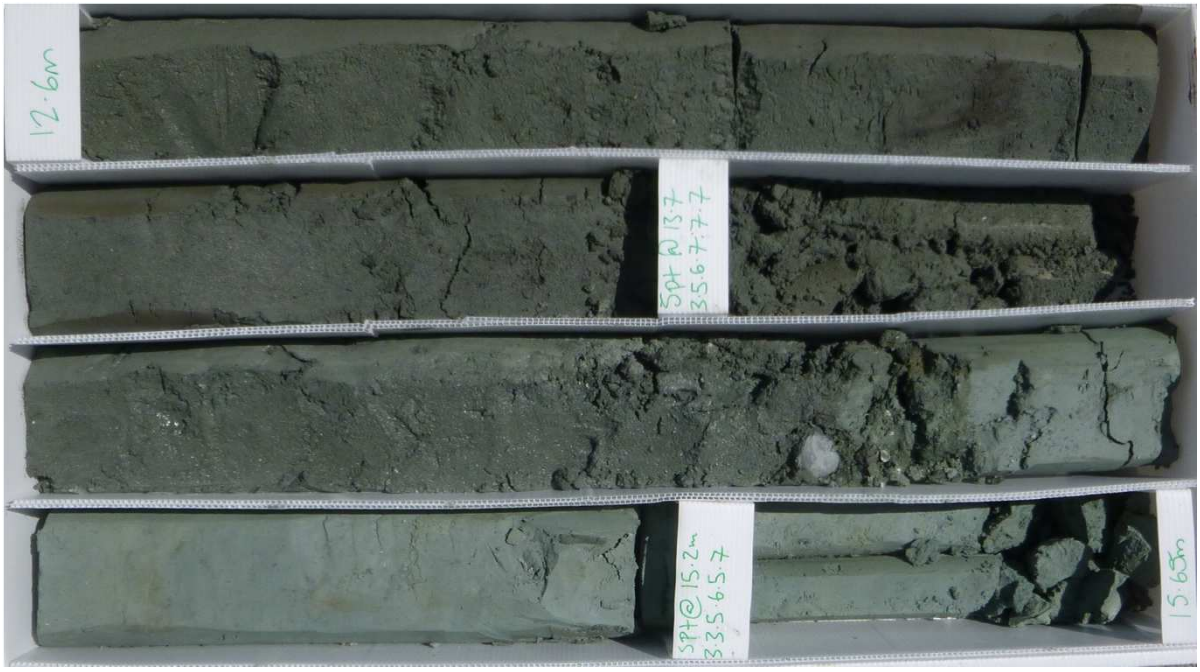
BOX: 10 **DEPTH: 29.8 to 35.05m**

BOX: 1 **DEPTH: 0.0 to 6.55m**

BOX: 2 **DEPTH: 6.55 to 9.55m**



BOX: 3 **DEPTH: 9.55 to 12.6m**



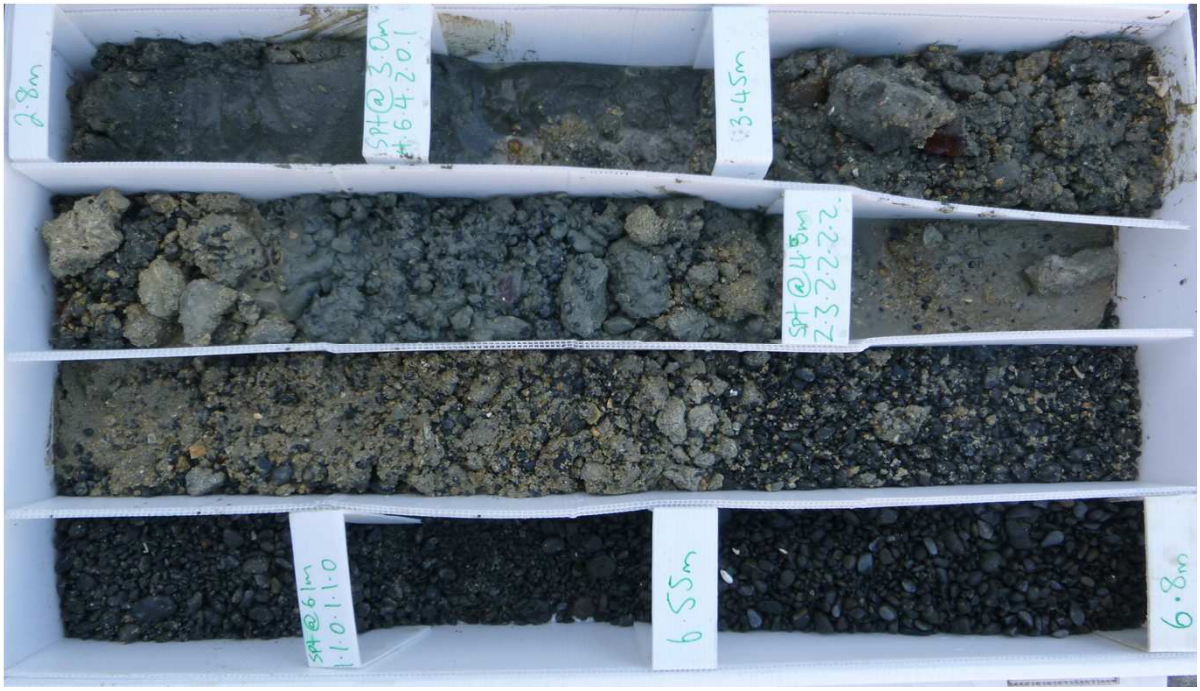
BOX: 4 **DEPTH: 12.6 to 15.65m**

BOX: 5 **DEPTH: 15.65 to 18.0m**

BOX: 6 **DEPTH: 18.0 to 22.6m**

BOX: 7 **DEPTH: 22.6 to 26.15m**

BOX: 1 **DEPTH: 0.0 to 2.8m**



BOX: 2 **DEPTH: 2.8 to 6.8m**

BOX: 3 **DEPTH: 6.8 to 9.85m**

BOX: 4 **DEPTH: 9.85 to 12.25m**

BOX: 5 **DEPTH: 12.25 to 15.5m**

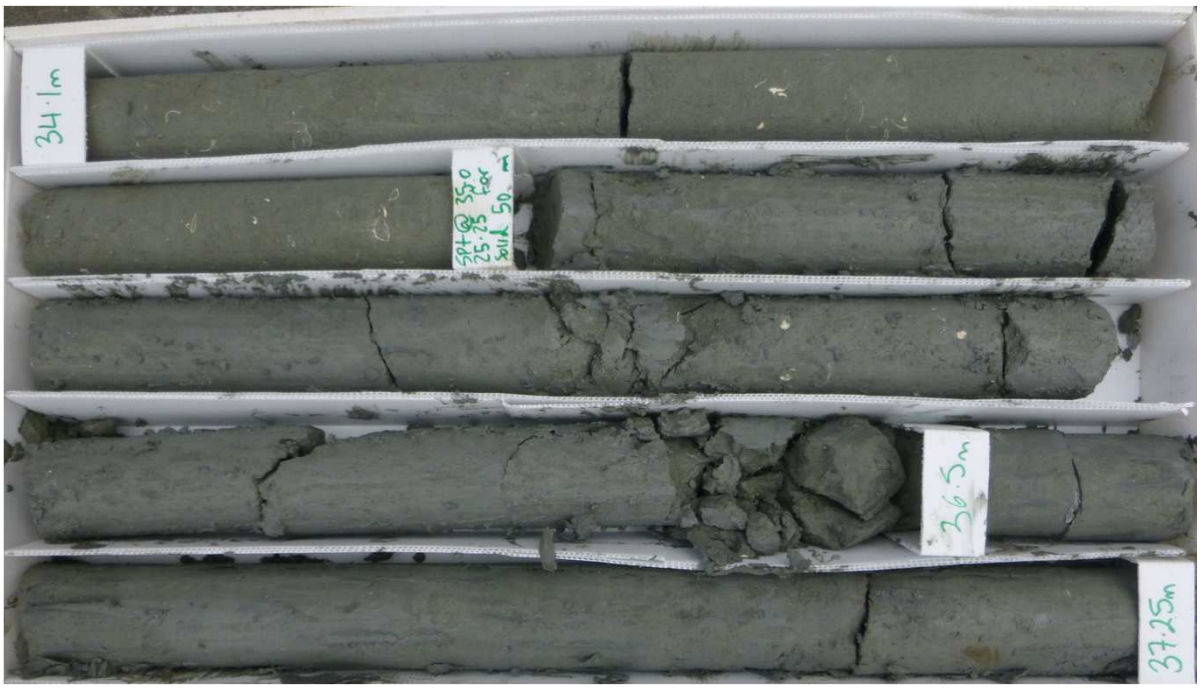
BOX: 6 **DEPTH: 15.5 to 20.7m**

BOX: 7 **DEPTH: 20.7 to 24.35m**

BOX: 8 **DEPTH: 24.35 to 27.5m**

BOX: 9 **DEPTH: 27.35 to 30.9m**

BOX: 10 **DEPTH: 30.9 to 34.1m**



BOX: 11 **DEPTH: 34.1 to 37.25m**

BOX: 12 **DEPTH: 37.25 to 40.2m**

BOX: 13 **DEPTH: 40.2 to 41.0m**

BOX: 1 **DEPTH: 0.0 to 3.45m**

BOX: 2 **DEPTH: 3.45 to 6.85m**

BOX: 3 **DEPTH: 6.85 to 10.4m**

BOX: 4 **DEPTH: 10.4 to 13.5m**

BOX: 5 **DEPTH: 13.5 to 17.5m**

BOX: 6 **DEPTH: 17.5 to 20.65m**

BOX: 7 **DEPTH: 20.65 to 23.7m**

BOX: 8 **DEPTH: 23.7 to 24.77m**

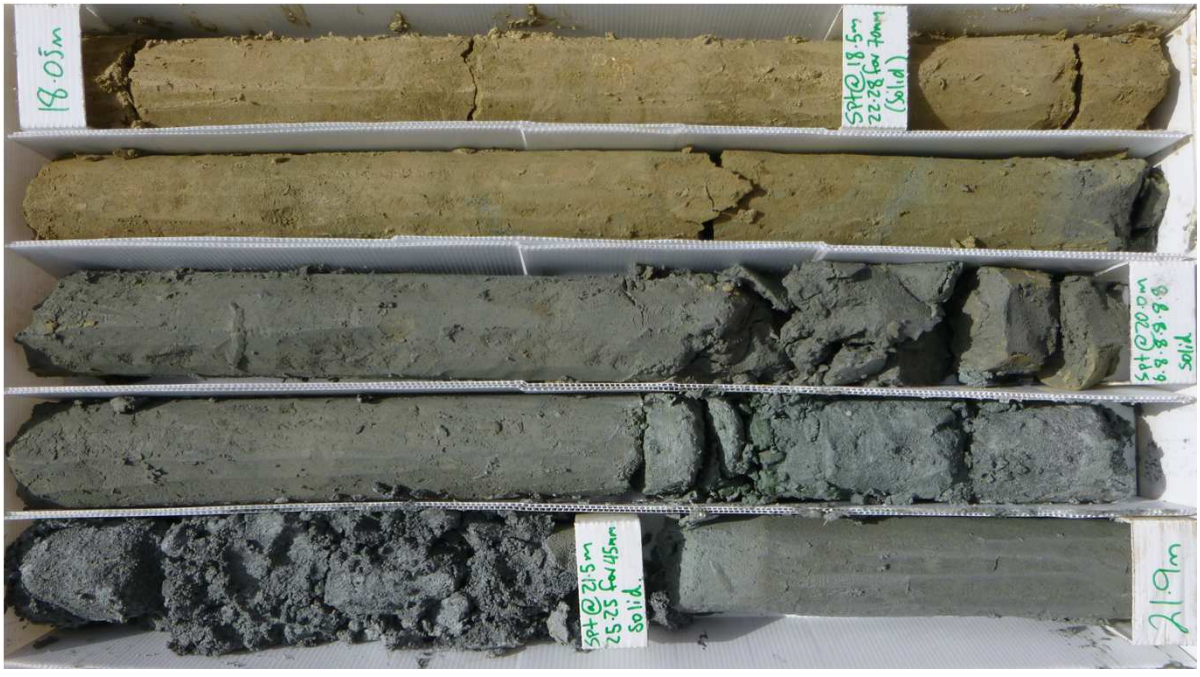
BOX: 1 **DEPTH: 0.0 to 2.6m**

BOX: 2 **DEPTH: 2.6 to 6.55m**

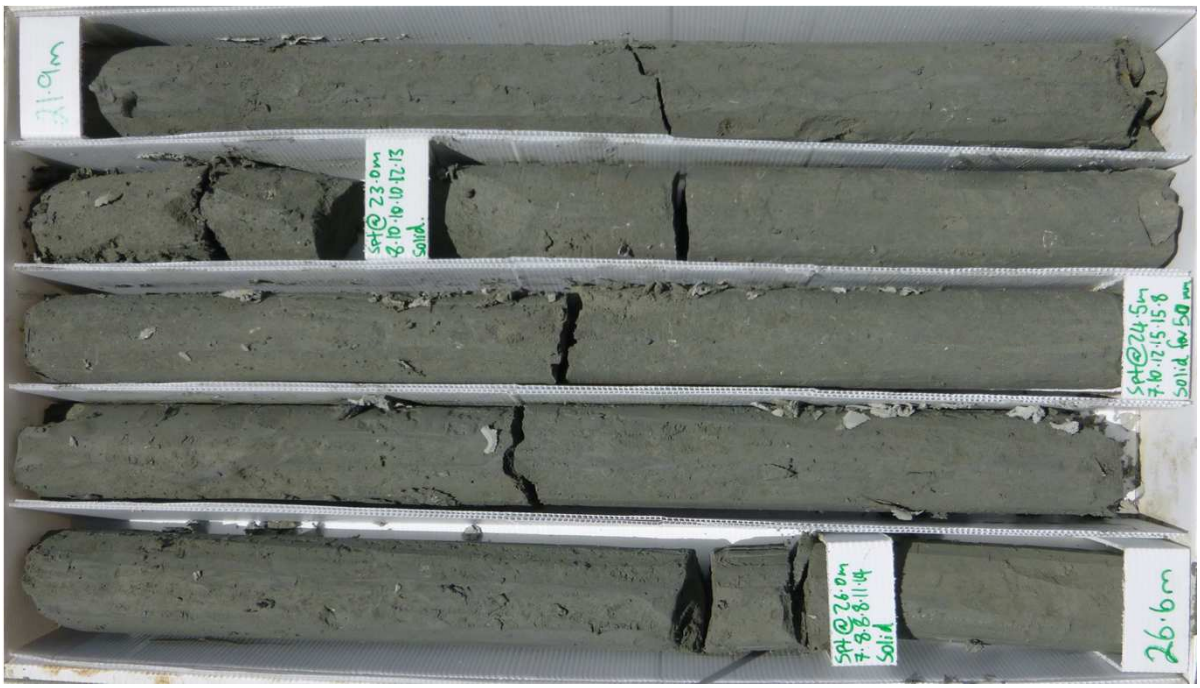
BOX: 3 **DEPTH: 6.55 to 11.3m**

BOX: 4 **DEPTH: 11.3 to 14.25m**

BOX: 5 **DEPTH: 14.25 to 18.05m**



BOX: 6 **DEPTH: 18.05 to 21.9m**



BOX: 7 **DEPTH: 21.9 to 26.6m**

BOX: 8 **DEPTH: 26.6 to 29.39m**

6 Wharf Development

BOX: 1 **DEPTH: 0.0 to 5.55m**

BOX: 2 **DEPTH: 5.55 to 10.0m**

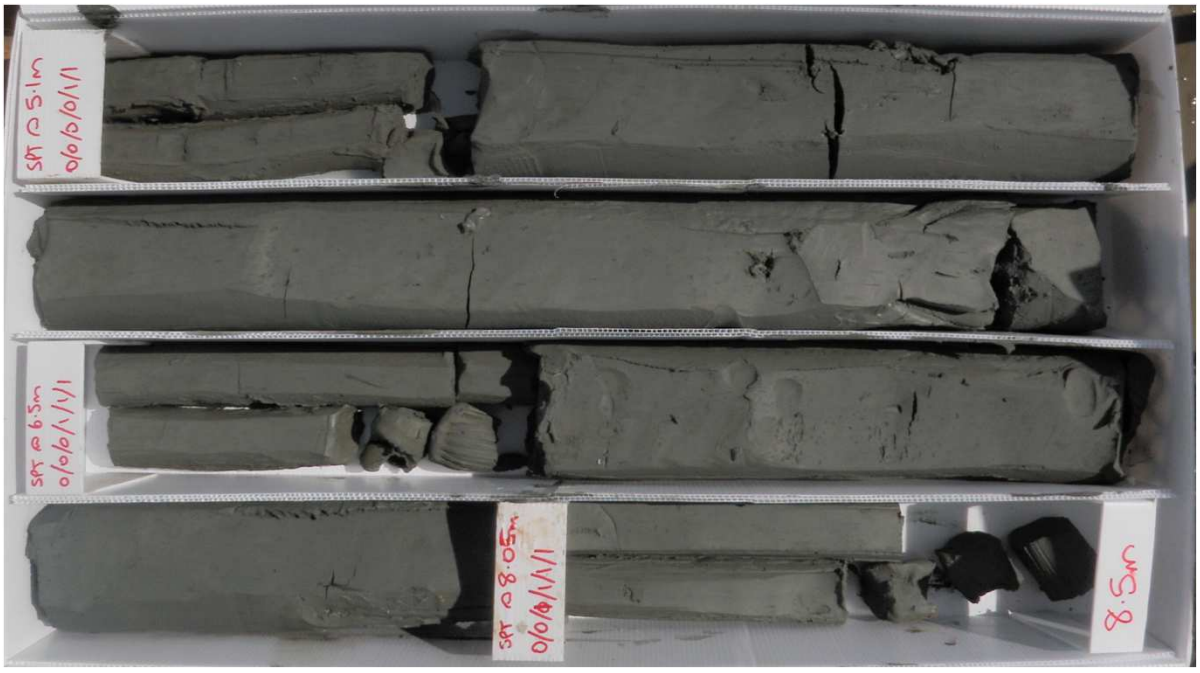
BH609

BOX: 3 **DEPTH: 10.0 to 13.5m**

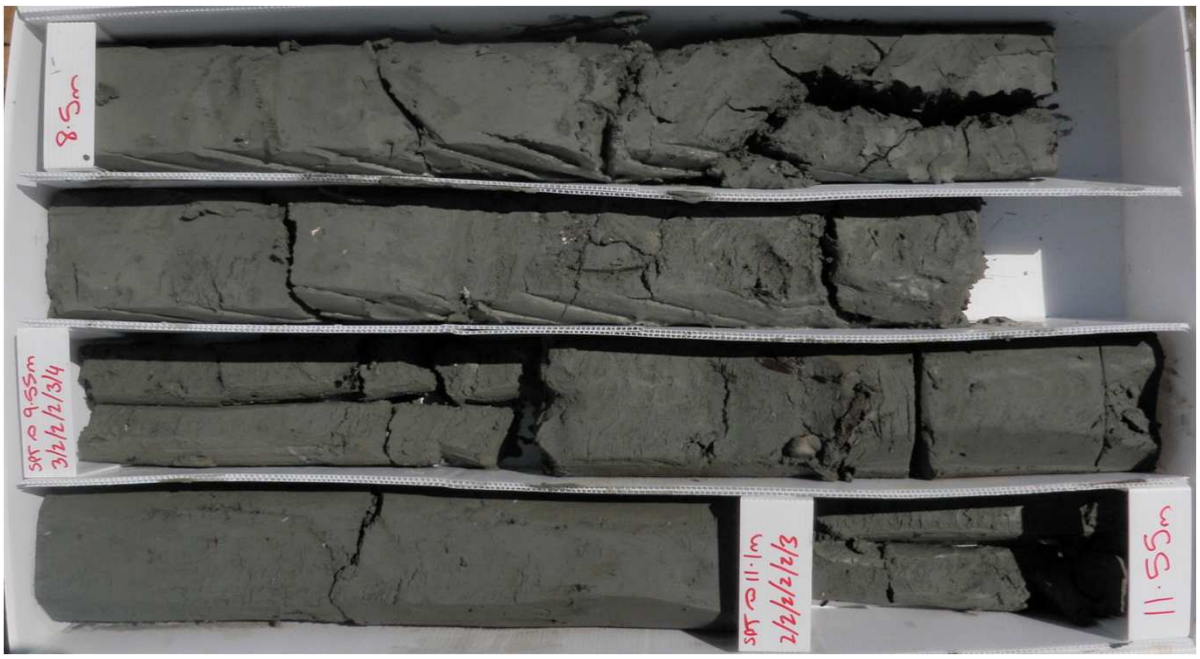
BOX: 4 **DEPTH: 13.5 to 18.9m**

BOX: 5 **DEPTH: 18.9 to 21.45m**

BOX: 1 **DEPTH: 0.0 to 5.1m**



BOX: 2 **DEPTH: 5.1 to 8.5m**



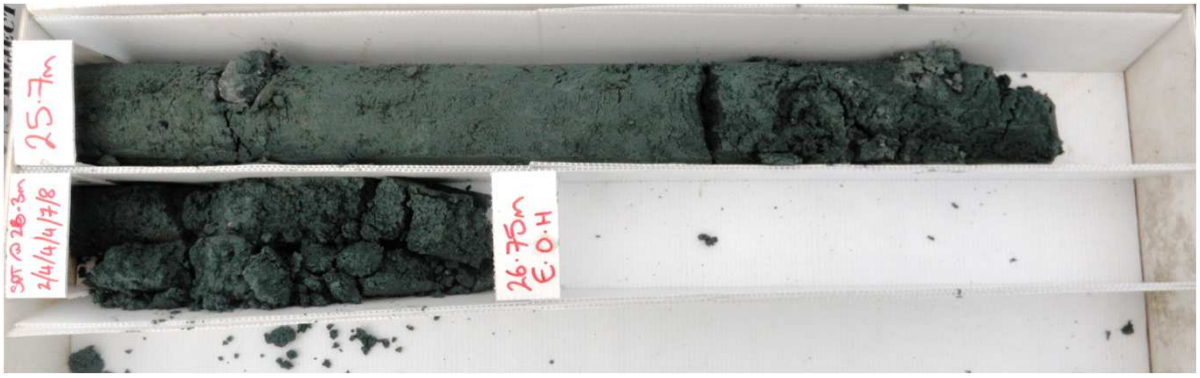
BOX: 3 **DEPTH: 8.5 to 11.55m**

BOX: 4 **DEPTH: 11.55 to 14.7m**

BOX: 5 **DEPTH: 14.7 to 17.8m**

BOX: 6 **DEPTH: 17.8 to 21.2m**

BOX: 7 **DEPTH: 21.2 to 25.7m**



BOX: 8 **DEPTH: 25.7 to 26.75m**

BOX: 1 **DEPTH: 0.0 to 3.3m**

BOX: 2 **DEPTH: 3.3 to 6.1m**

BOX: 3 **DEPTH: 6.1 to 9.1m**

BOX: 4 **DEPTH: 9.1 to 11.9m**

BOX: 5 **DEPTH: 11.9 to 14.95m**

BOX: 6 **DEPTH: 14.95 to 18.5m**

BOX: 7 **DEPTH: 18.5 to 21.83m**

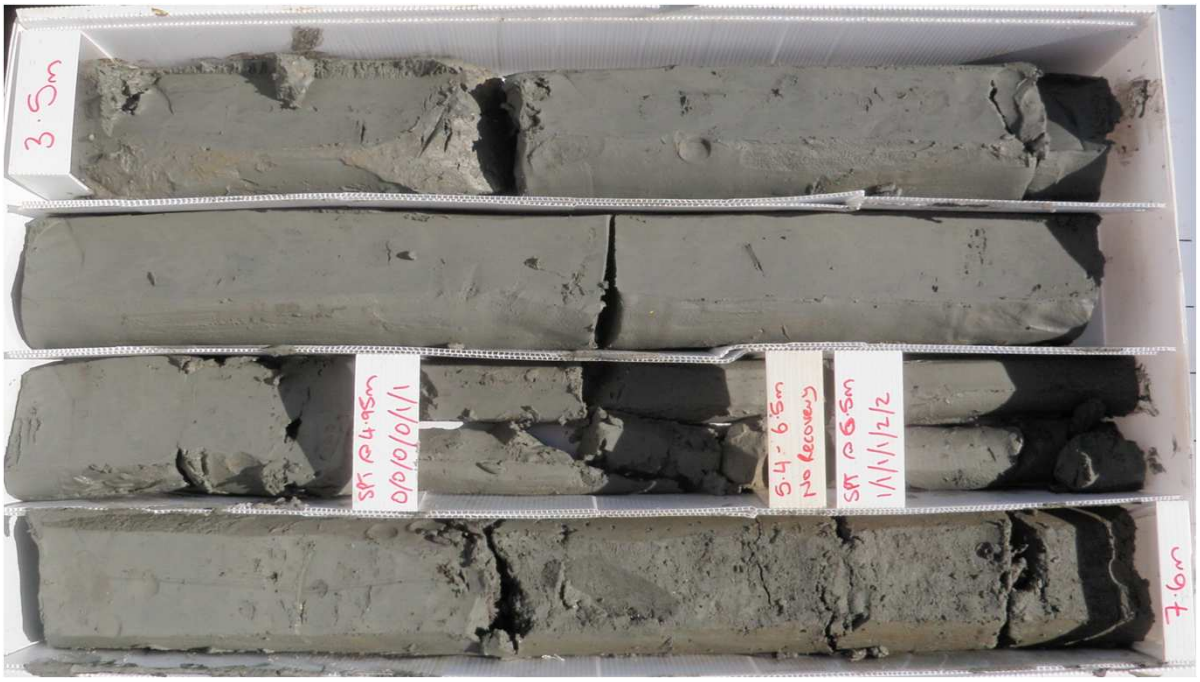
BOX: 1 **DEPTH: 0.0 to 2.55m**

BOX: 2 **DEPTH: 2.55 to 7.0m**

BOX: 3 **DEPTH: 7.0 to 12.8m**

BOX: 4 **DEPTH: 12.8 to 14.55m**

BOX: 1 **DEPTH: 0.0 to 3.5m**



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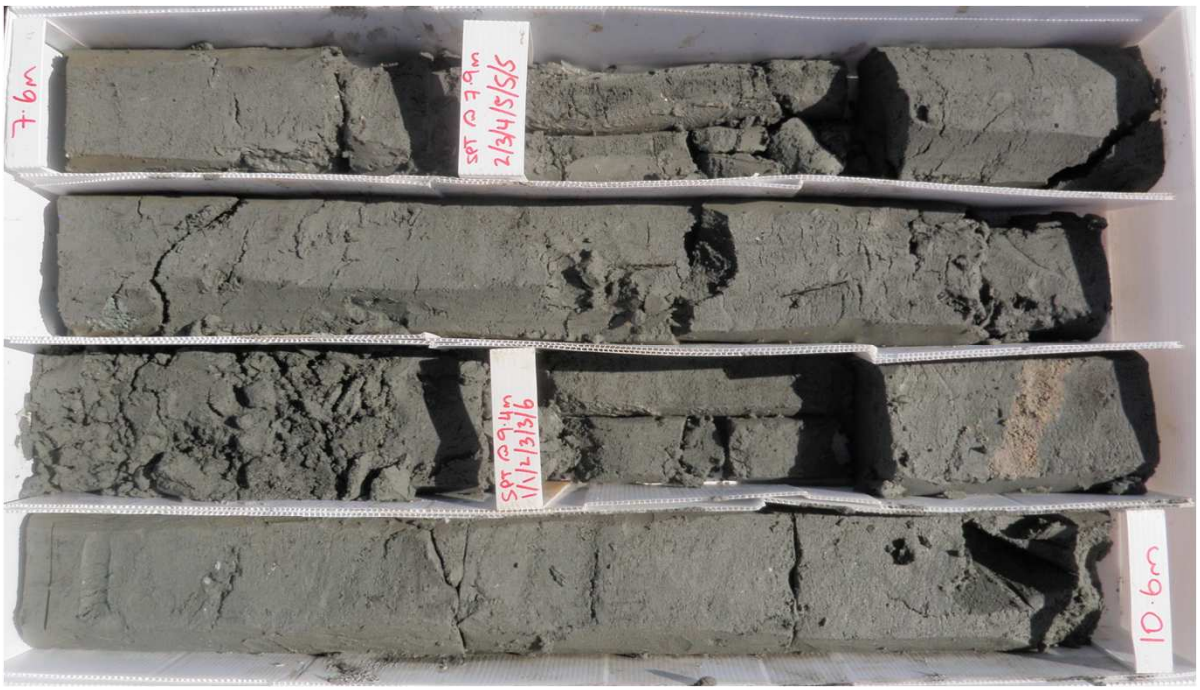


BOX: 3 **DEPTH: 7.6 to 10.6m**

BOX: 4 **DEPTH: 10.6 to 13.65m**

BOX: 5 **DEPTH: 13.65 to 16.5m**

BOX: 6 **DEPTH: 16.5 to 19.65m**

BOX: 7 **DEPTH: 19.65 to 22.25m**

BOX: 8 **DEPTH: 22.25 to 25.2m**

BOX: 9

DEPTH: 25.2 to 27.65m

BOX: 1 **DEPTH: 0.0 to 3.6m**

BOX: 2 **DEPTH: 3.6 to 6.75m**

BOX: 3 **DEPTH: 6.75 to 10.3m**

BOX: 4 **DEPTH: 10.3 to 13.3m**

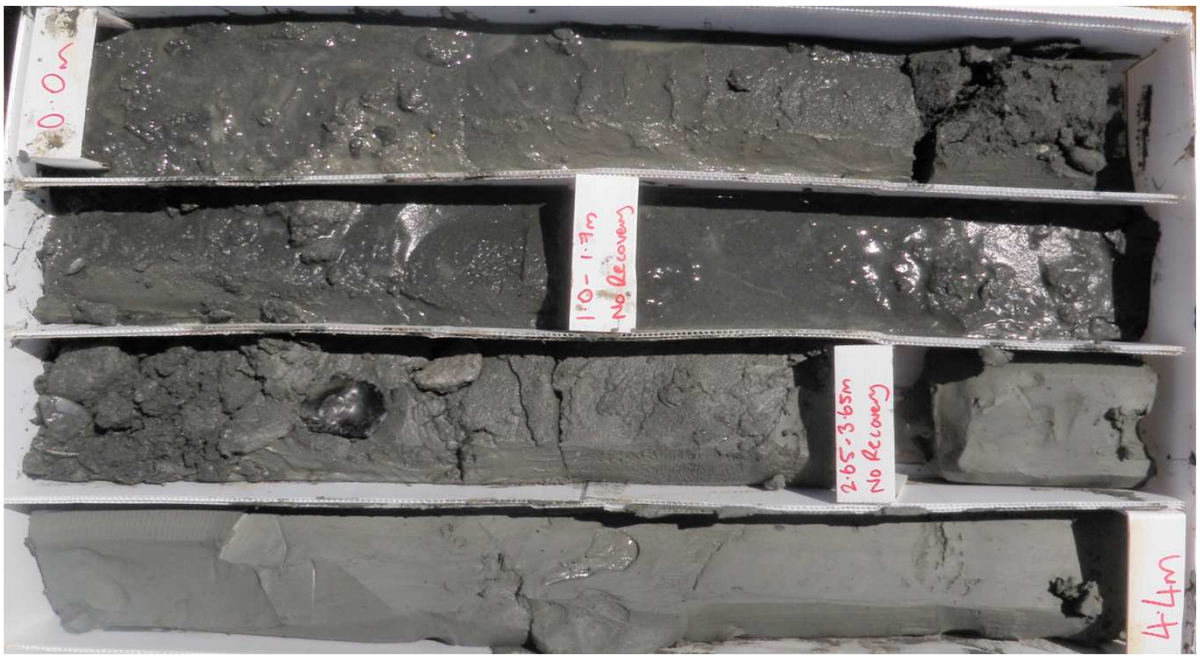
BOX: 5 **DEPTH: 13.3 to 16.9m**

BOX: 6 **DEPTH: 16.9 to 21.02m**

BOX: 1 **DEPTH: 0.0 to 3.1m**

BOX: 2 **DEPTH: 3.1 to 6.0m**

BOX: 3 **DEPTH: 6.0 to 11.42m**



BOX: 1 **DEPTH: 0.0 to 4.4m**

BOX: 2 **DEPTH: 4.4 to 6.95m**

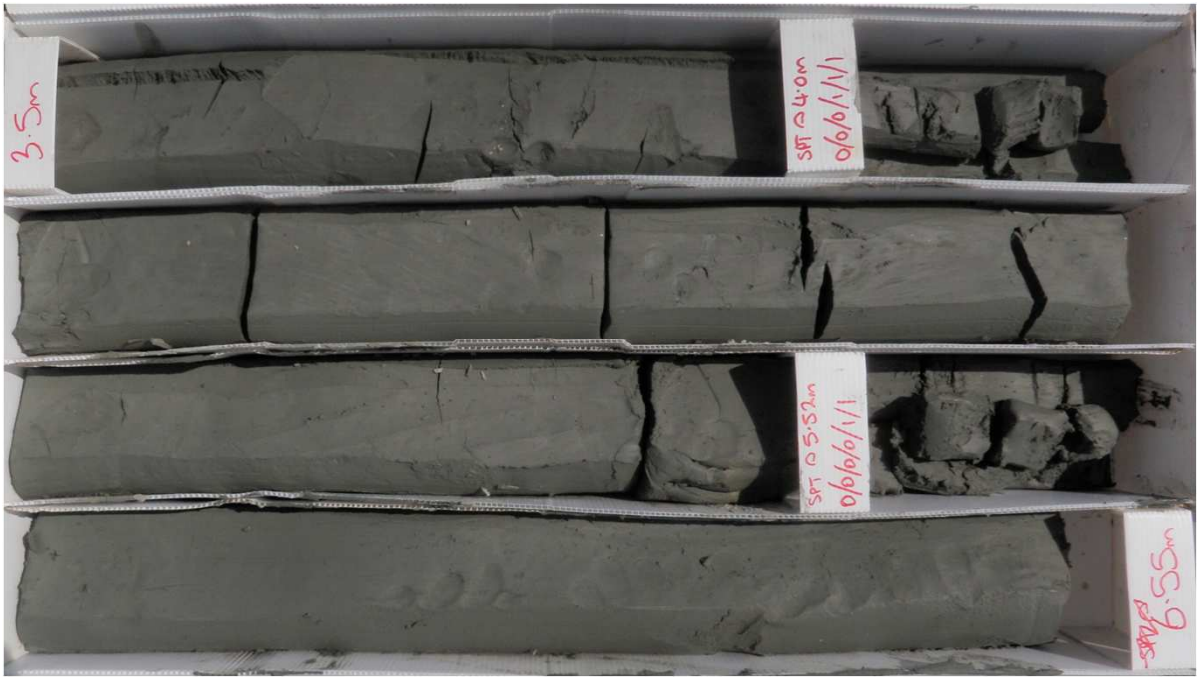
BOX: 3 **DEPTH: 6.95 to 9.8m**

BOX: 4 **DEPTH: 9.8 to 12.15m**

BOX: 1 **DEPTH: 0.0 to 3.4m**

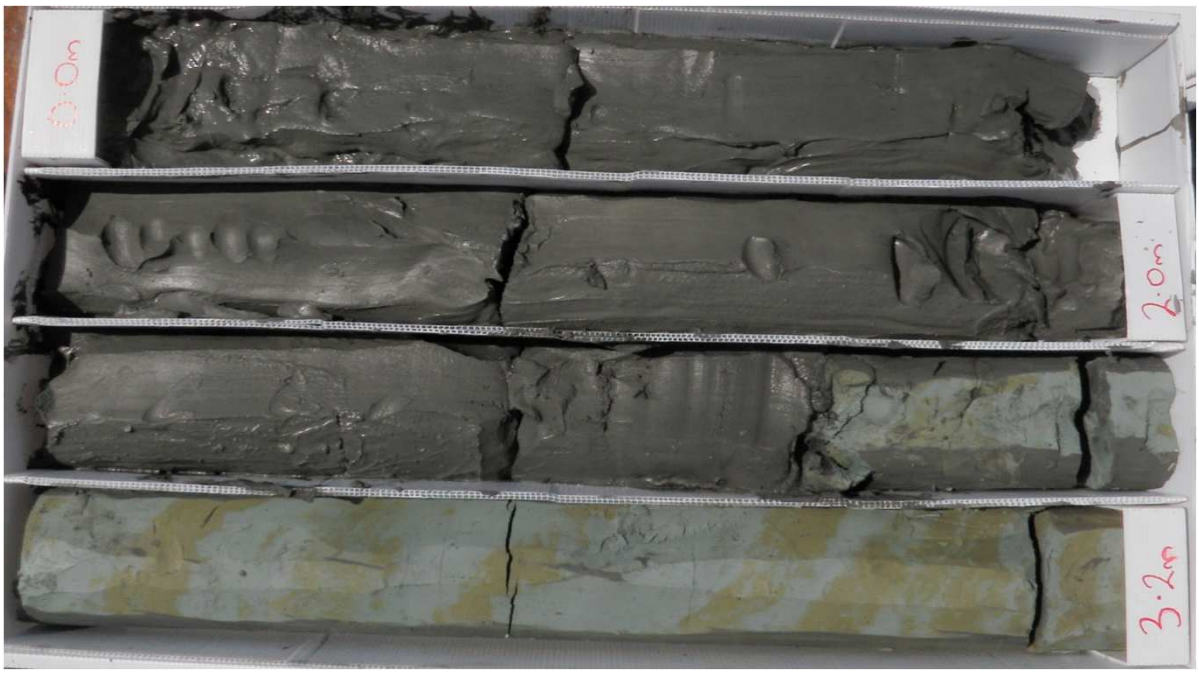
BOX: 2 **DEPTH: 3.4 to 6.76m**

BOX: 1 **DEPTH: 0.0 to 3.5m**



BOX: 2 **DEPTH: 3.5 to 6.55m**

BOX: 3 **DEPTH: 6.55 to 9.15m**



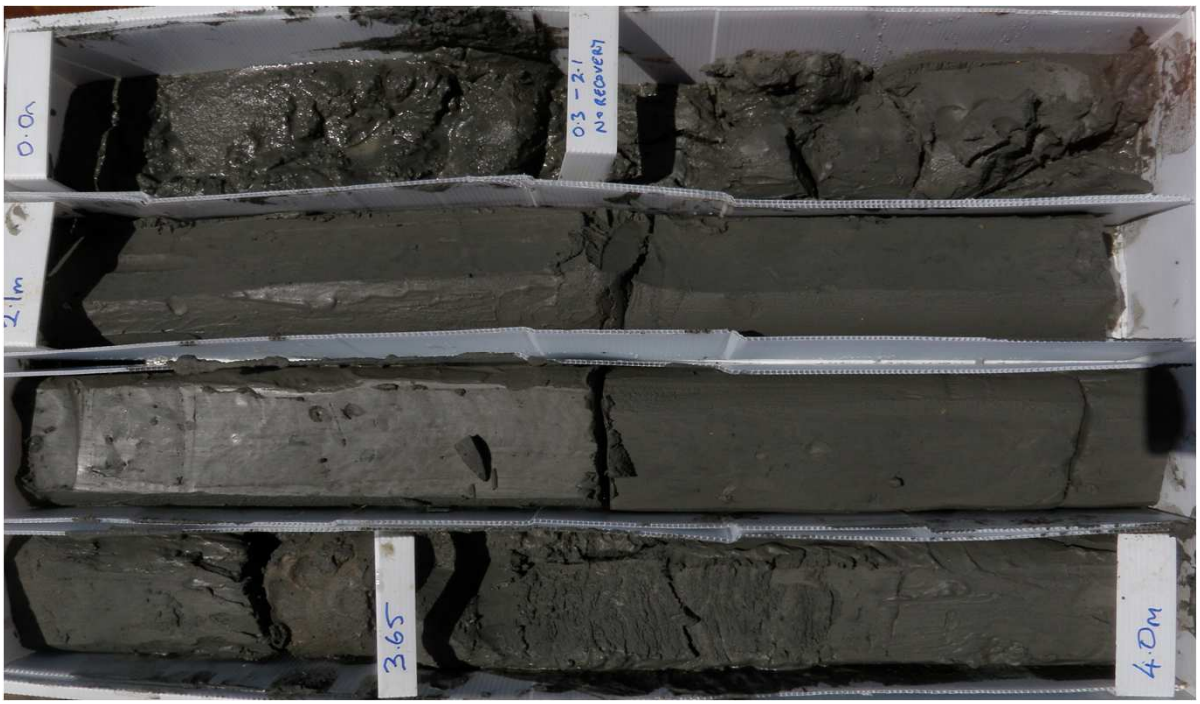
BOX: 1 **DEPTH: 0.0 to 3.2m**

BOX: 2 **DEPTH: 3.2 to 6.1m**

BOX: 3 **DEPTH: 6.1 to 7.25m**

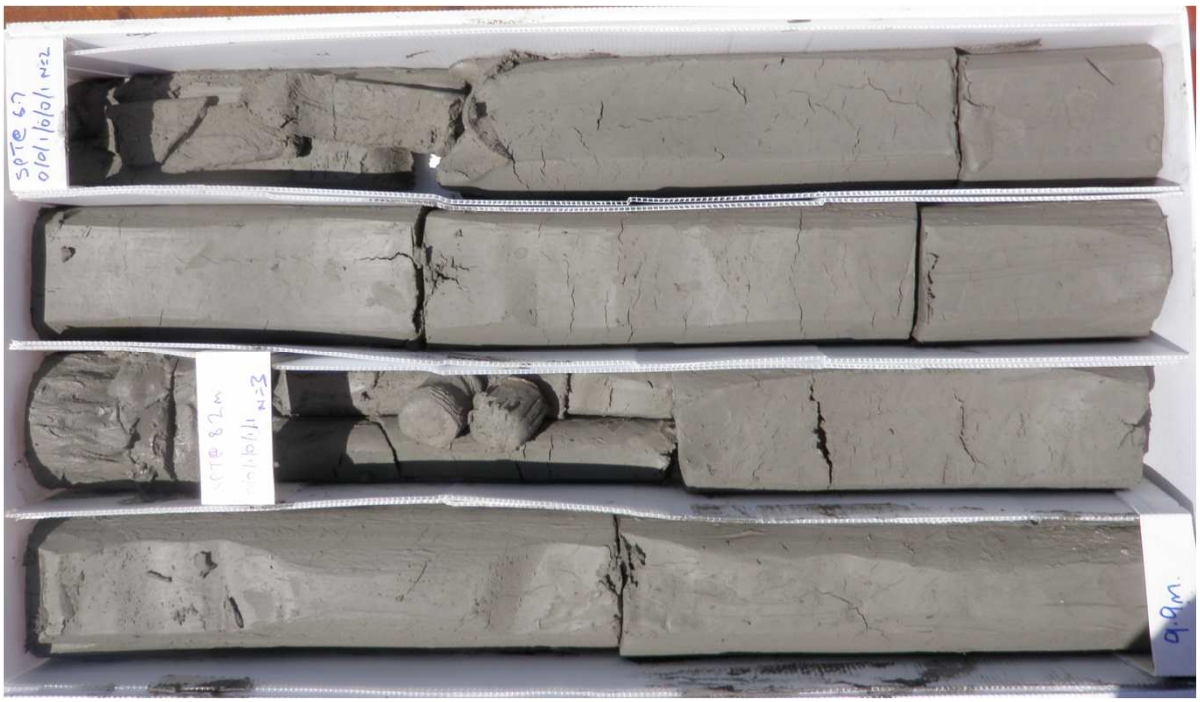
BOX: 1 **DEPTH: 0.0 to 2.98m**

BOX: 2 **DEPTH: 2.98 to 5.08m**



BOX: 1 **DEPTH: 0.0 to 4.0m**

BOX: 2 **DEPTH: 4.0 to 6.7m**



BOX: 3 **DEPTH: 6.7 to 9.9m**

BOX: 4 **DEPTH: 9.9 to 11.73m**

BOX: 1 **DEPTH: 0.0 to 2.5m**

BOX: 2 **DEPTH: 2.5 to 5.3m**

BOX: 3 **DEPTH: 5.3 to 8.5m**

BOX: 4 **DEPTH: 8.5 to 9.38m**

BOX: 1 **DEPTH: 0.0 to 4.2m**

BOX: 2 **DEPTH: 4.2 to 7.25m**

BOX: 1 **DEPTH: 0.0 to 3.5m**

BOX: 2 **DEPTH: 3.5 to 6.2m**

BOX: 1 **DEPTH: 0.0 to 2.8m**

Appendix D

Vibrocore Logs

Log Key Sheet

WATER

Water level on date shown

METHOD *(shows drilling method)*

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

SAMPLES

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

MOISTURE

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

SOIL AND ROCK DESCRIPTIONS

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.
Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

INSITU TESTS

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

★	**Laboratory Test(s) carried out:**
AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

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

CONSISTENCY

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

Non-cohesive Soils	SPT – Uncorrected
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	>50

GRAPHIC LOG (1 or a combination of the following)


Fill


Silt


Cobbles


Sandstone


Fine igneous


Core loss


Sand


Boulders


Limestone


Coarse igneous


Organics


Shells


Mudstone


Schist


Clay


Gravel


Siltstone


Basalt

ORGANIC SOILS

Von Post Degree of Humification

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

VIBROCORE No: VB01a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,626,199 m
E 1,937,520.9 m
VIBROCORE LOCATION: Approximately 2.6km north of port breakwater
R L: -14.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND, trace shells; grey; saturated, non plastic, homogeneous.	Recent Marine Sediments					-14.5
	SD45								
0.5									-15.0
1.0									-15.5
			50mm bed with minor coarse sandstone gravel.						
1.5									-16.0
2.0									-16.5
			END OF LOG @ 2.1 m						
2.5									-17.0
3.0									-17.5
3.5									-18.0
4.0									-18.5
4.5									-19.0

DATE AUGERED: 8/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration not recorded.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB02a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,626,146.4 m
E 1,937,196.6 m
VIBROCORE LOCATION: Approximately 2.5km north of port breakwater
R L: -14 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0	SD46		Fine to medium SAND; grey; saturated, non plastic, homogeneous.	Recent Marine Sediments					-14.0
0.5									-14.5
1.0									-15.0
			Trace shells.						
1.5									-15.5
2.0									-16.0
2.5									-16.5
			END OF LOG @ 2.76 m						
3.0									-17.0
3.5									-17.5
4.0									-18.0
4.5									-18.5

DATE AUGERED: 8/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 2.76m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB03c

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,838.9 m
E 1,937,320.5 m
VIBROCORE LOCATION: Approximately 2.2km north of port breakwater
R L: -13.9 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD52		Fine to medium SAND, trace shells; dark grey; saturated, non plastic, homogeneous.	**Recent Marine Sediments**					-14.0
1.0									-14.5
1.5									-15.0
									-15.5
			END OF LOG @ 1.7 m						
2.0									-16.0
2.5									-16.5
3.0									-17.0
3.5									-17.5
4.0									-18.0
4.5									-18.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 1.9m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB04a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,485.6 m
E 1,937,027.8 m
VIBROCORE LOCATION: Approximately 1.8km north of port breakwater
R L: -13.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0	SD51		Fine to medium SAND, trace shells; grey; saturated, non plastic.	Recent Marine Sediments					-13.5
0.5	TS3		0.5-0.8m - Tube Sample 3						-14.0
1.0			Fine to medium SAND, trace shells; grey; saturated, non plastic.						-14.5
1.5			Minor shells.						
			Fine to medium sandy, medium to coarse GRAVEL, minor shells; grey speckled white; non plastic. Gravel: subrounded to angular, SW, sandstone and limestone.						-15.0
2.0			END OF LOG @ 1.84 m						-15.5
2.5									-16.0
3.0									-16.5
3.5									-17.0
4.0									-17.5
4.5									-18.0

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 1.84m
Normally graded core due to low frequency sonic drilling.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB05a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT:	NZTM	VIBROCORE LOCATION:	Approximately 2.05km north of port breakwater		
COORDINATES:	N 5,625,719.7 m	R L:	-13.6 m	COORDINATE ORIGIN:	dGPS
	E 1,937,003.2 m	DATUM:	Chart Datum	ACCURACY:	2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD23		Fine to medium SAND; grey; non plastic.	Recent Marine Sediments					-14.0
			Minor shells.						
1.0			Medium to coarse sandy, fine to medium GRAVEL, minor shells; grey speckled white. Gravel: rounded to subrounded, UW, greywacke.						-14.5
1.5	SD24		Fine to medium GRAVEL, trace shells; grey. Gravel: rounded to subrounded, UW, greywacke.						-15.0
			END OF LOG @ 1.65 m						
2.0									-15.5
2.5									-16.0
3.0									-16.5
3.5									-17.0
4.0									-17.5
4.5									-18.0
									-18.5

DATE AUGERED:	9/12/15	DIAMETER:	
LOGGED BY:	JGE	METHOD:	VC
SHEAR VANE No:	N/A		

COMMENTS:
Vibrocore penetration = 3.26m
Normally graded core due to low frequency sonic drilling.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB05b

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,719.7 m
E 1,937,003.2 m
VIBROCORE LOCATION: Approximately 2.05km north of port breakwater
R L: -13.6 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0	SD53		Fine to medium SAND; dark grey; non plastic.	Recent Marine Sediments					-14.0
0.5	SD54		Medium to coarse SAND, minor shells; dark grey speckled white; non plastic.						
	SD55		Fine gravelly, coarse SAND, minor shells; dark grey. Gravel: rounded to subrounded, UW, greywacke.						-14.5
1.0			Fine to medium GRAVEL, minor shells; dark grey. Gravel: rounded to subrounded, UW, greywacke.						
1.5									-15.0
			Medium to coarse GRAVEL, trace shells; dark grey. Gravel: rounded to subrounded, UW, greywacke.						
2.0									-15.5
2.35			END OF LOG @ 2.35 m						-16.0
2.5									
3.0									-16.5
3.5									-17.0
4.0									-17.5
4.5									-18.0
									-18.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.25m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB06b

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,400.8 m
E 1,936,689.9 m
VIBROCORE LOCATION: Approximately 1.7km north of port breakwater
R L: -13 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND. trace shells; grey; non plastic.	Recent Marine Sediments					-13.0
0.5	SD48								-13.5
1.0									-14.0
1.5			Minor shells.						-14.5
2.0									-15.0
2.5									-15.5
3.0									-16.0
3.5			Medium to coarse GRAVEL; dark grey. Gravel: rounded to subrounded, UW, greywacke.						-16.5
			END OF LOG @ 3.7 m						
4.0									-17.0
4.5									-17.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 2.4m
Core not photographed.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB07a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,735.8 m
E 1,936,569.4 m
VIBROCORE LOCATION: Approximately 2.1km north of port breakwater
R L: -13.2 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD67		Fine to medium SAND, minor shells; grey; non plastic.	Recent Marine Sediments					-13.5
1.0			Medium to coarse SAND, minor shells; grey speckled white; non plastic.						-14.0
1.5			Coarse sandy, fine GRAVEL, trace shells; grey. Gravel: subangular to subrounded, SW, sandstone and rounded to subrounded, UW, greywacke.						-14.5
			10mm glass fragment - likely pushed from surface during drilling.						-15.0
2.0			Medium to coarse GRAVEL, trace coarse sand; grey. Gravel: subangular to subrounded, SW, sandstone and rounded to subrounded, UW, greywacke.						-15.5
2.5			Coarse GRAVEL; dark grey. Gravel: subangular to subrounded, SW, sandstone and rounded to subrounded, UW, greywacke.						-16.0
3.0			Fine to medium GRAVEL, minor shells; grey speckled white. Gravel: rounded to subrounded, UW, greywacke.						-16.5
3.5			Gravel: medium to coarse.						
4.0			END OF LOG @ 3.57 m						-17.0
4.5									-17.5
									-18.0

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.17m
Normally graded core due to low frequency sonic drilling.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB08a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,147.5 m
E 1,936,461.9 m
VIBROCORE LOCATION: Approximately 1.5km north of port breakwater
R L: -12.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND; grey; saturated, non plastic.	Recent Marine Sediments					-12.5
0.5	SD40								-13.0
1.0			Minor shells.						-13.5
1.5	SD41		Fine sandy SILT, minor clay; grey; low plasticity. Abrupt contact with overlying unit.						-14.0
2.0			Silty fine SAND; grey; non plastic.						-14.5
2.5			Fine to medium SAND, minor silt; grey; non plastic.						-15.0
3.0									-15.5
3.5									-16.0
4.0			END OF LOG @ 3.92 m						-16.5
4.5									-17.0

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 4.48m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB09a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,984.9 m
E 1,936,659.9 m
VIBROCORE LOCATION: Approximately 1.3km north of port breakwater
R L: -12.9 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0	SD20		Silty fine to medium SAND, trace clay; grey; non plastic.	Recent Marine Sediments					-13.0
			Fine to medium gravelly, fine to medium SAND, minor shells; grey speckled white; non plastic.						
0.5	SD21								-13.5
1.0									-14.0
1.5									-14.5
2.0	SD22		Medium to coarse sandy, fine to medium GRAVEL, trace shells; grey speckled white; non plastic.						
			END OF LOG @ 2.05 m						-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0									-17.0
4.5									-17.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 2.28m
Normally graded core due to low frequency sonic drilling.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB10a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,701 m
E 1,936,410.9 m
VIBROCORE LOCATION: Approximately 1.1km north of port breakwater
R L: -12.6 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD29 SD30		Fine to medium SAND, minor shells; dark grey, non plastic.	Recent Marine Sediments					-13.0
			END OF LOG @ 0.7 m						
1.0									-13.5
1.5									-14.0
2.0									-14.5
2.5									-15.0
3.0									-15.5
3.5									-16.0
4.0									-16.5
4.5									-17.0
									-17.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 1.18m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB10b

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,701 m
E 1,936,410.9 m
VIBROCORE LOCATION: Approximately 1.1km north of port breakwater
R L: -12.6 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD56		Fine to medium SAND, trace shells; dark grey; non plastic.	**Recent Marine Sediments**					-13.0
	SD57		Silty fine SAND; grey; non plastic.						-13.5
1.0			END OF LOG @ 0.9 m						-14.0
1.5									-14.5
2.0									-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0									-17.0
4.5									-17.5

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 0.9m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB11a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,331.6 m
E 1,936,394.4 m
VIBROCORE LOCATION: Approximately 800m north-west of port breakwater
R L: -12.7 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
			Fine sandy SILT; dark grey; wet, non plastic.	Recent Marine Sediments					-13.0
0.5	SD47		Fine to medium SAND, minor silt; grey; non plastic.						-13.5
1.0			50mm bed of SILT, some clay; high plasticity.						-14.0
1.5									-14.5
2.0			30mm bed of shells.						-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0			Fine to medium SAND; grey; non plastic. Interbedded with: clayey SILT; grey; high plasticity. Bedding: very thin, subhorizontal.						-17.0
4.5			END OF LOG @ 4.2 m						-17.5

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 4.34m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB12a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,327 m
E 1,936,573 m
VIBROCORE LOCATION: Approximately 710m north of port breakwater
R L: -13 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND, minor silt; dark grey; wet, non plastic, homogeneous.	Recent Marine Sediments					-13.0
0.5	SD31								-13.5
1.0									-14.0
1.5									-14.5
2.0									-15.0
2.5	SD32		Silty fine to medium SAND, trace shells; dark grey; non plastic.						-15.5
3.0			Fine sandy SILT, minor clay; dark grey; low plasticity.						-16.0
3.5	SD33								-16.5
4.0			Some clay; high plasticity.						-17.0
4.5									-17.5
4.67			END OF LOG @ 4.67 m						

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 4.85m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB13a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,499.3 m
E 1,937,040.1 m
VIBROCORE LOCATION: Approximately 850m north-west of port breakwater
R L: -12.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0	SD62		Fine to medium SAND; dark grey; non plastic.	Recent Marine Sediments					-12.5
0.5									-13.0
1.0			Trace shells.						-13.5
1.5	SD63		SILT, some clay, minor fine sand; grey; high plasticity.						-14.0
			FIne sandy SILT, trace clay; grey; low plasticity.						
2.0	SD64								-14.5
2.5									-15.0
3.0									-15.5
			SILT, some clay, minor fine sand; grey; high plasticity.						
3.5									-16.0
4.0									-16.5
			END OF LOG @ 4.25 m						
4.5									-17.0

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 4.75m
Core not photographed.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB14a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,880.8 m
E 1,936,514.6 m
VIBROCORE LOCATION: Approximately 400m north-west of port breakwater
R L: -12.3 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0	SD65		Silty fine to medium SAND, trace clay; dark grey; low plasticity.	Recent Marine Sediments					-12.5
0.5			Fine to medium SAND, some silt, trace clay; dark grey; low plasticity.						-13.0
1.0									-13.5
1.5	TS5		1.5-1.8m - Tube Sample 5						-14.0
1.8			Fine to medium SAND, some silt, trace clay; dark grey; low plasticity.						
2.0	SD66		SILT, some fine sand, some clay; grey; high plasticity.						-14.5
2.5									-15.0
3.0									-15.5
3.5			Clayey SILT, minor fine sand; grey; high plasticity.						-16.0
4.0									-16.5
4.3			END OF LOG @ 4.3 m						
4.5									-17.0

DATE AUGERED: 8/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration not recorded.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB15a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,811.7 m
E 1,936,526.5 m
VIBROCORE LOCATION: Approximately 400m west of port breakwater
R L: -12.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			SILT, minor sand; grey; non plastic.	Recent Marine Sediments					-12.0
			Fine sandy SILT, minor clay; grey; low plasticity.						
0.5	SD42								-12.5
	SD43		Silty fine SAND, minor clay; grey; low plasticity.						
1.0			Fine sandy SILT, minor clay; grey; low plasticity.						-13.0
1.5			Clayey SILT, minor fine sand; grey; high plasticity.						-13.5
	SD44								
2.0			Pocket Penetrometer measurement = 0.5 (50kPa)						-14.0
			END OF LOG @ 2.3 m						-14.5
2.5									
3.0									-15.0
3.5									-15.5
4.0									-16.0
4.5									-16.5
									-17.0

DATE AUGERED: 8/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration not recorded.
Core not photographed.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB16a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,669.4 m
E 1,936,331.8 m
VIBROCORE LOCATION: Approximately 520m west of port breakwater
R L: -10.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
			Silty fine to medium SAND; grey; non plastic.	Recent Marine Sediments					
	SD34		Fine to medium SAND, minor silt; grey; non plastic.						-10.5
0.5	TS1		0.5-0.8m - Tube Sample 1						
	SD35		Fine to medium SAND, some silt; grey; non plastic.						-11.0
1.0									
									-11.5
1.5			Silty fine to medium SAND; grey; non plastic.						
									-12.0
2.0	TS2		2.0-2.3m - Tube Sample 2						
			Fine sandy SILT, some clay; grey; high plasticity.						-12.5
2.5									
									-13.0
3.0	SD36		SILT, some clay, minor fine sand; grey; high plasticity.						
									-13.5
3.5									
			END OF LOG @ 3.85 m						-14.0
4.0									
									-14.5
4.5									
									-15.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.85m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB17a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,505.3 m
E 1,936,322.1 m
VIBROCORE LOCATION: Approximately 550m west of port breakwater
R L: -7.8 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Medium to coarse GRAVEL, minor fine to medium sand, trace organics; grey; saturated. Gravel: rounded to subrounded, UW, greywacke. Seaweed growing on some gravels.	Recent Marine Sediments					-8.0
			Fine sandy SILT, minor clay; grey; low plasticity. 0.05-0.5m - 10-20mm diameter bioturbation (burrows) present.						
0.5	SD69								-8.5
1.0									-9.0
			Silty fine to medium SAND, trace clay; grey; low plasticity.						
1.5			Fine sandy SILT, trace clay; grey; low plasticity.						-9.5
	SD70		Silty fine SAND, trace clay; grey; low plasticity.						
2.0									-10.0
			100mm bed of fine sandy SILT, minor clay.						
2.5									-10.5
3.0									-11.0
			SILT, minor fine sand, minor clay; grey; low plasticity.						
3.5			Silty fine SAND, trace clay; grey; low plasticity.						-11.5
4.0			SILT, some clay, minor fine sand; grey; high plasticity.						-12.0
4.5			END OF LOG @ 4.45 m						-12.5

DATE AUGERED: 10/12/15 DIAMETER:
LOGGED BY: JGE METHOD: VC
SHEAR VANE No: N/A

COMMENTS:
Vibrocore penetration = 4.78m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB18a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,453.1 m
E 1,936,448.2 m
VIBROCORE LOCATION: Approximately 460m south-west of port breakwater
R L: -7.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0			'Stiff', fine sandy SILT, minor clay; grey; low plasticity.	Recent Marine Sediments					-7.0
			Pocket Penetrometer measurement = 0.5 (50kPa)						
			Silty fine SAND, trace clay; grey; low plasticity.						-7.5
0.5			Fine sandy SILT, minor clay; grey; low plasticity.						
	SD37								-8.0
1.0									
									-8.5
1.5									
									-9.0
2.0									
			Silty fine SAND, trace clay; grey; low plasticity.						-9.5
	SD38								
2.5									
			SILT, some clay, minor fine sand; grey; high plasticity.						-10.0
3.0	SD39								
									-10.5
3.5			END OF LOG @ 3.5 m						
									-11.0
4.0									
									-11.5
4.5									
									-12.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.71m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB19a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,534.1 m
E 1,936,619.2 m
VIBROCORE LOCATION: Approximately 270m south-west of port breakwater
R L: -10.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Silty fine SAND, trace clay; dark grey; low plasticity.	Recent Marine Sediments					-10.5
			Fine sandy SILT, trace clay; dark grey; low plasticity.						
0.5	TS4		0.5-0.8m - Tube Sample 4						-11.0
	SD49		Fine sandy SILT, trace clay; dark grey; low plasticity.						
1.0									-11.5
			Silty fine SAND, trace clay; grey; low plasticity.						
1.5			Clayey SILT, minor fine sand; grey; high plasticity.						-12.0
	SD50								
2.0									-12.5
2.5									-13.0
3.0			END OF LOG @ 3.02 m						-13.5
3.5									-14.0
4.0									-14.5
4.5									-15.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.5m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB20a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,586.8 m
E 1,936,788.7 m
VIBROCORE LOCATION: Approximately 100m south-west of port breakwater
R L: -13.4 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
	SD26		'Very soft', fine sandy SILT, minor clay; dark grey; low plasticity.	Recent Marine Sediments					-13.5
0.5			'Soft', SILT, minor fine sand, minor clay; grey; low plasticity.						-14.0
1.0	SD27		Pocket Penetrometer measurement = 0.25 (25kPa) Some clay; high plasticity.						-14.5
1.5									-15.0
2.0			Pocket Penetrometer measurement = 0.5 (50kPa)						-15.5
2.5	SD28		Pocket Penetrometer measurement = 0.75 (75kPa)						-16.0
			Pocket Penetrometer measurement = 2.0 (200kPa) Trace fibrous organics.						
3.0			'Very stiff', fine sandy SILT, some clay; grey; high plasticity.						-16.5
3.5			Pocket Penetrometer measurement = 2.25 (225kPa)						-17.0
4.0			'Very stiff', SILT, minor clay; grey; high plasticity. Pocket Penetrometer measurement = 1.0 (100kPa)						-17.5
4.5			END OF LOG @ 4.4 m						-18.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 4.8m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB21a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,465.3 m
E 1,936,942.2 m
VIBROCORE LOCATION: Approximately 220m south-east of port breakwater
R L: -12.8 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND, some medium to coarse gravel; bluish grey; non plastic. Gravel: subrounded to subangular, SW, sandstone. [Recent Marine Sediments]						-13.0
			Extremely weak, SW, bluish grey, silty fine SANDSTONE.	Mangaheia Group					
0.5			Pocket Penetrometer measurement = >4.5 (450kPa)						
			Pocket Penetrometer measurement = >4.5 (450kPa)						
			Refusal - tube buckled.						-13.5
			END OF LOG @ 0.65 m						
1.0									-14.0
1.5									-14.5
2.0									-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0									-17.0
4.5									-17.5

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 0.89m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB22a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,386 m
E 1,937,186 m
VIBROCORE LOCATION: Approximately 440m south-east of port breakwater
R L: -12.5 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
	SD25		Fine to medium SAND; grey; non plastic. [Recent Marine Sediments]						
0.5			Medium to coarse SAND, minor fine gravel; grey. [Extremely weak, SW, calcareous SANDSTONE]. Disturbed by drilling.	**Mangaheia Group**					-13.0
			Medium GRAVEL; grey. [Extremely weak, SW, calcareous SANDSTONE]. Disturbed by drilling.						
1.0			END OF LOG @ 0.88 m						-13.5
1.5									-14.0
2.0									-14.5
2.5									-15.0
3.0									-15.5
3.5									-16.0
4.0									-16.5
4.5									-17.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 0.88m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB23a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,625,009 m
E 1,937,132.8 m
VIBROCORE LOCATION: Approximately 1.4km north of port breakwater
R L: -13 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Fine to medium SAND, trace shells; grey; saturated, non plastic, homogeneous.	Recent Marine Sediments					-13.0
0.5	SD58								-13.5
1.0									-14.0
1.5									-14.5
2.0									-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0			Fine to medium GRAVEL, minor coarse sand; grey speckled white. Gravel: rounded to subrounded, UW, greywacke, and angular to subangular, SW, limestone.						-17.0
4.5			Medium to coarse GRAVEL; grey speckled white. Gravel: rounded to subrounded, UW, greywacke, and angular to subangular, SW, limestone.						-17.5
			END OF LOG @ 4.65 m						

DATE AUGERED: 9/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

COMMENTS:
Vibrocore penetration = 3.2m
Normally graded core due to low frequency sonic drilling.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB24a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,624,123 m
E 1,936,515.7 m
VIBROCORE LOCATION: Approximately 560m north-west of port breakwater
R L: -13.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.0			Silty fine to medium SAND; grey; non plastic, homogeneous.	Recent Marine Sediments					-13.0
0.5	SD59								-13.5
1.0									-14.0
1.5			Fine sandy SILT, minor clay; grey; low plasticity.						-14.5
2.0	SD60		SILT, some clay, minor fine sand; grey; high plasticity.						-15.0
2.5	SD61								-15.5
3.0									-16.0
3.5									-16.5
4.0			Clayey SILT, minor fine sand; grey; high plasticity.						-17.0
			END OF LOG @ 4.03 m						
4.5									-17.5
									-18.0

DATE AUGERED:	10/12/15	DIAMETER:	
LOGGED BY:	JGE	METHOD:	VC
SHEAR VANE No:	N/A		

COMMENTS:
Vibrocore penetration = 4.03m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

VIBROCORE No: VB25a

VIBROCORE LOG

SHEET 1 of 1

PROJECT:	6 Wharf Geotech and Tender Design	JOB NUMBER:	3124410/500
SITE LOCATION:	Napier Port	CLIENT:	Port of Napier Ltd

CIRCUIT: NZTM
COORDINATES: N 5,623,707.5 m
E 1,936,654.3 m
VIBROCORE LOCATION: Approximately 200m west of port breakwater
R L: -13.1 m
DATUM: Chart Datum
COORDINATE ORIGIN: dGPS
ACCURACY: 2

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	τ (kPa)	WATER LEVEL	R L (m)
0.5	SD68		Clayey SILT, minor fine sand, trace shells; grey; high plasticity, homogeneous.	Recent Marine Sediments					-13.5
1.0									-14.0
1.5									-14.5
2.0									-15.0
2.5									-15.5
3.0									-16.0
3.5									-16.5
4.0			END OF LOG @ 3.8 m						-17.0
4.5									-17.5
									-18.0

DATE AUGERED: 10/12/15
LOGGED BY: JGE
SHEAR VANE No: N/A
DIAMETER:
METHOD: VC

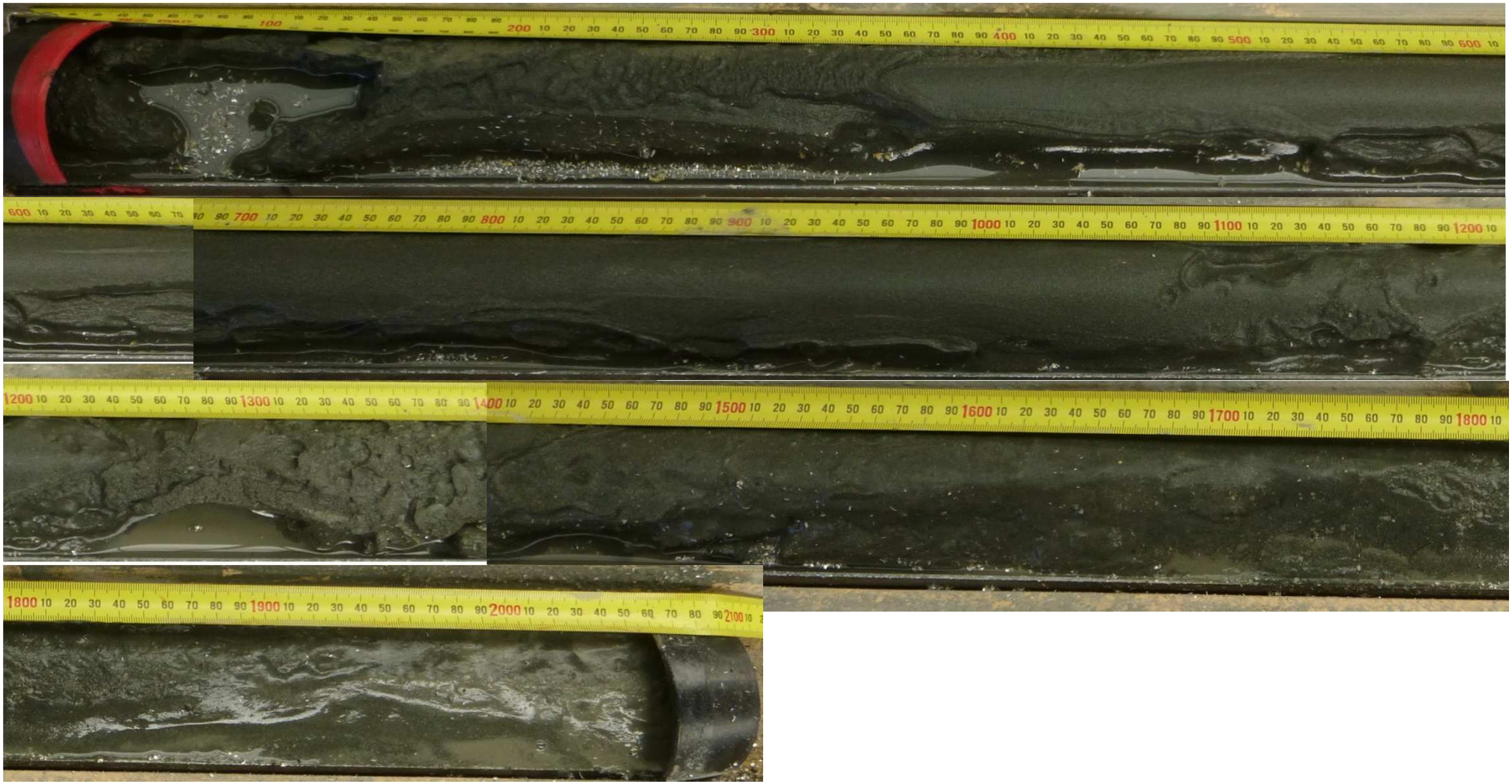
COMMENTS:
Vibrocore penetration = 3.9m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25

Appendix E

Vibrocore Photographs



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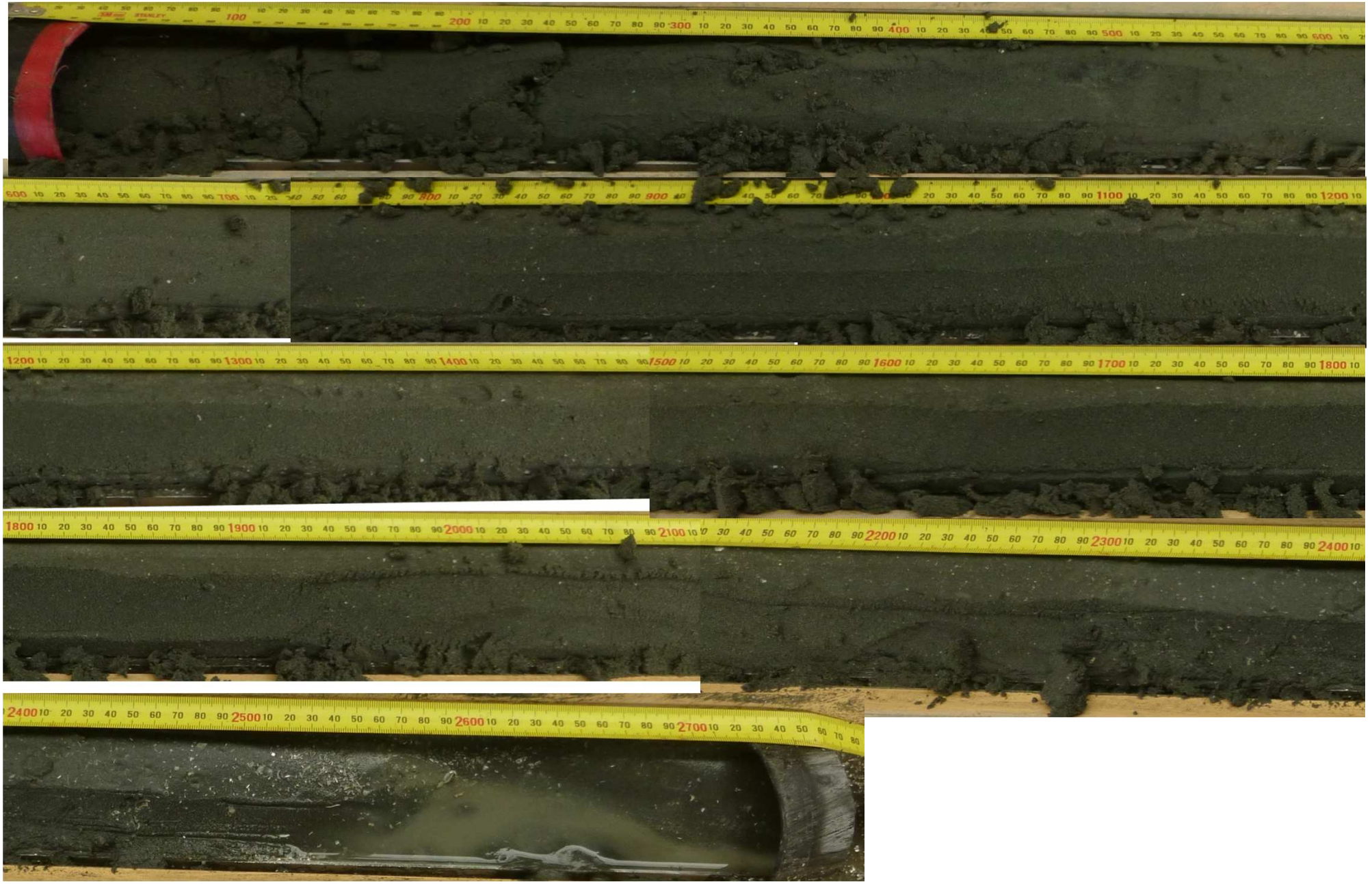
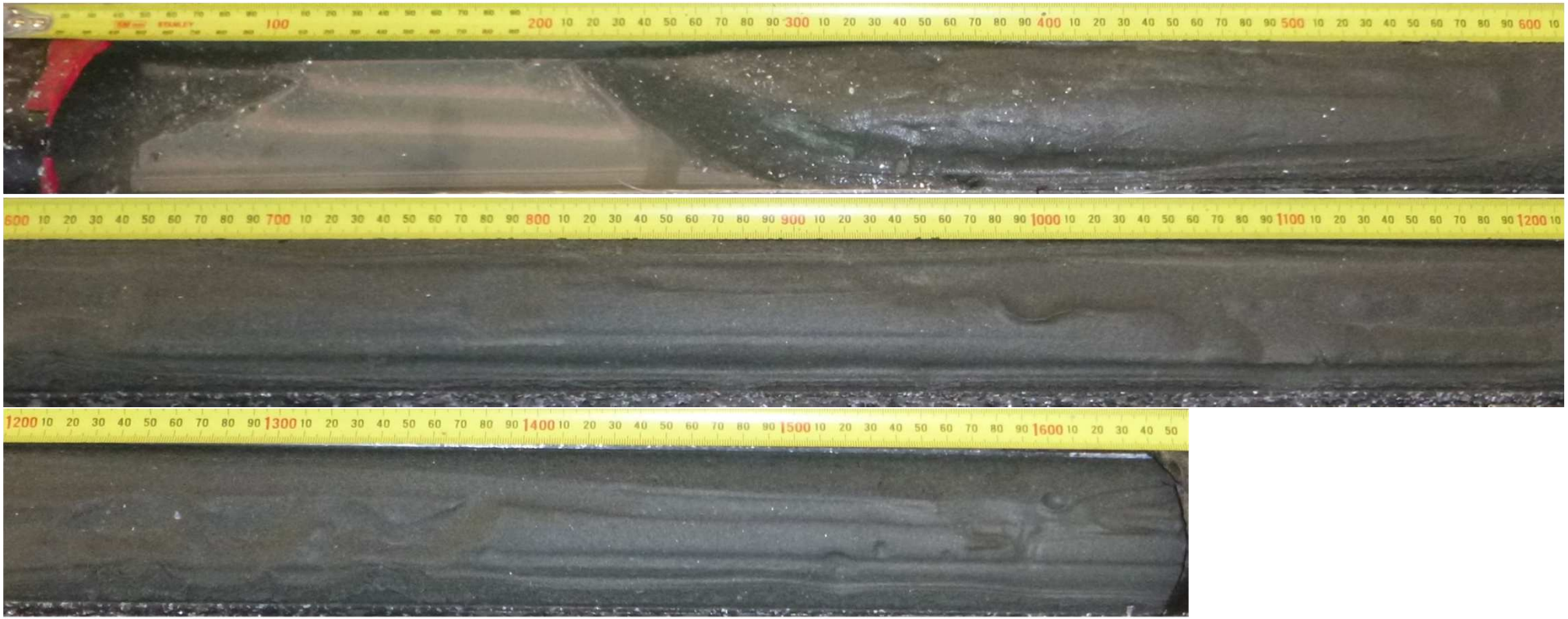


DEPTH: 0.00 to 2.76 m **VB02a**

3124410/500

6 Wharf Development



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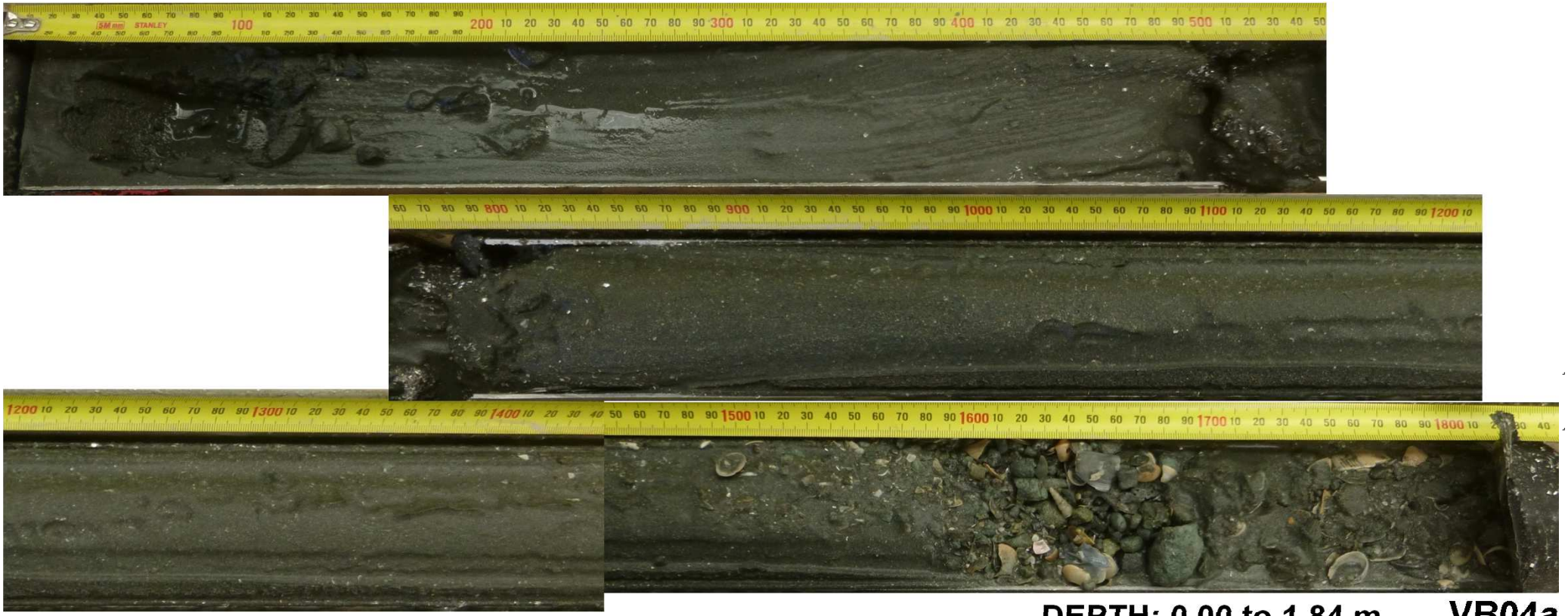

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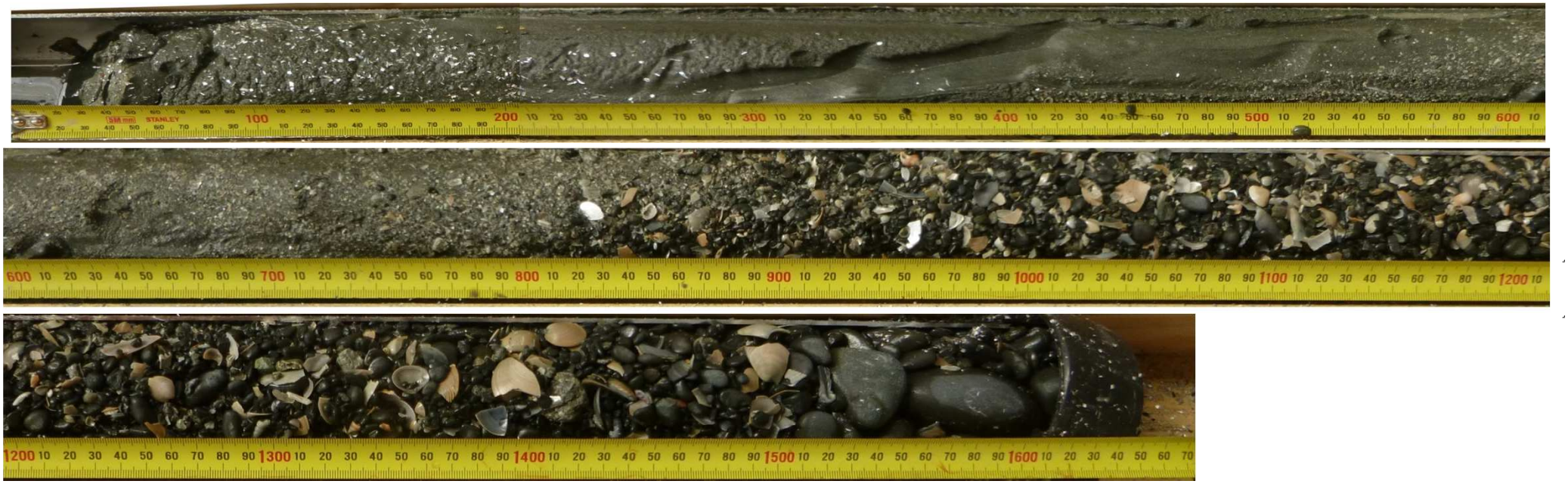
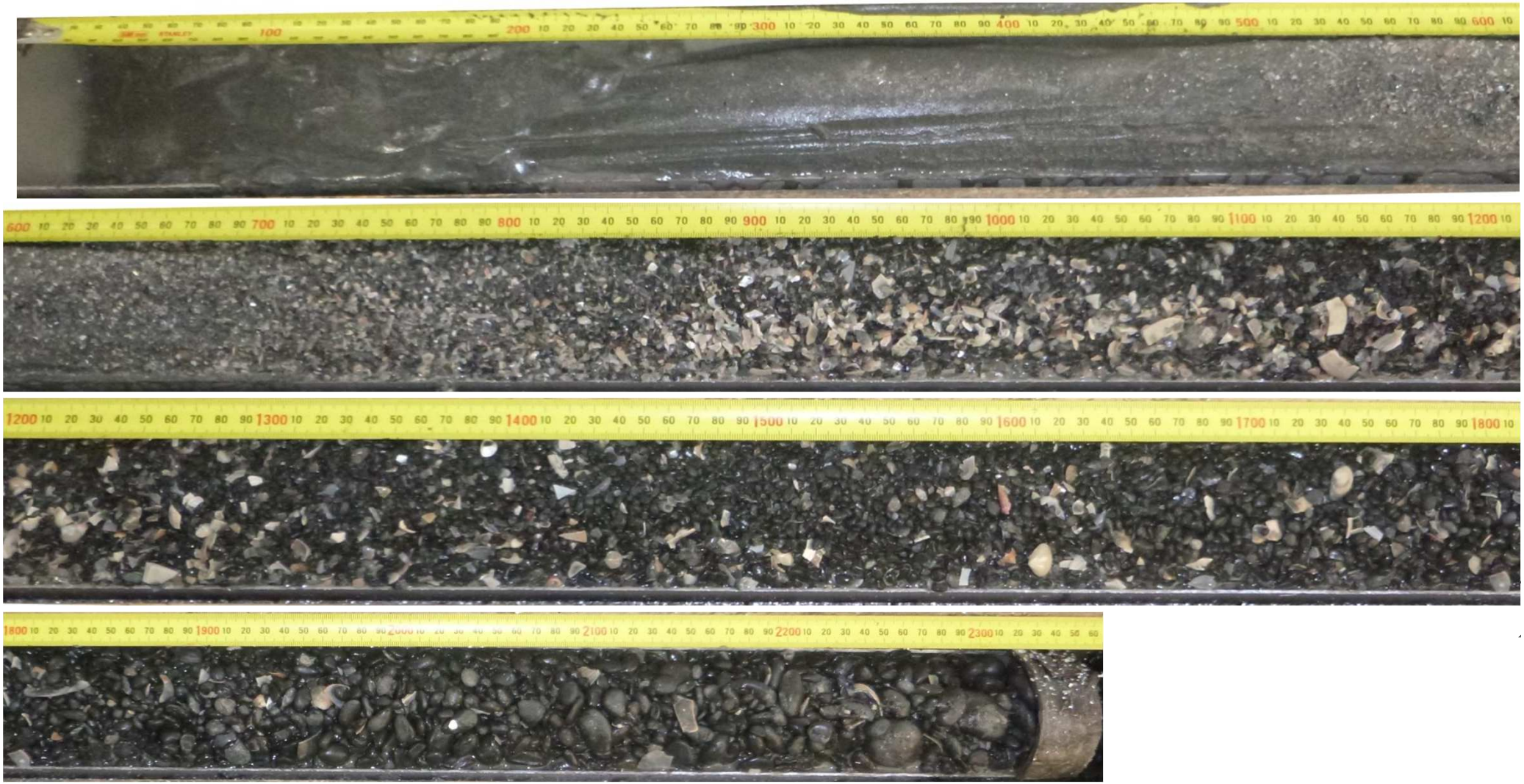


DEPTH: 0.00 to 1.65 m **VB05a**



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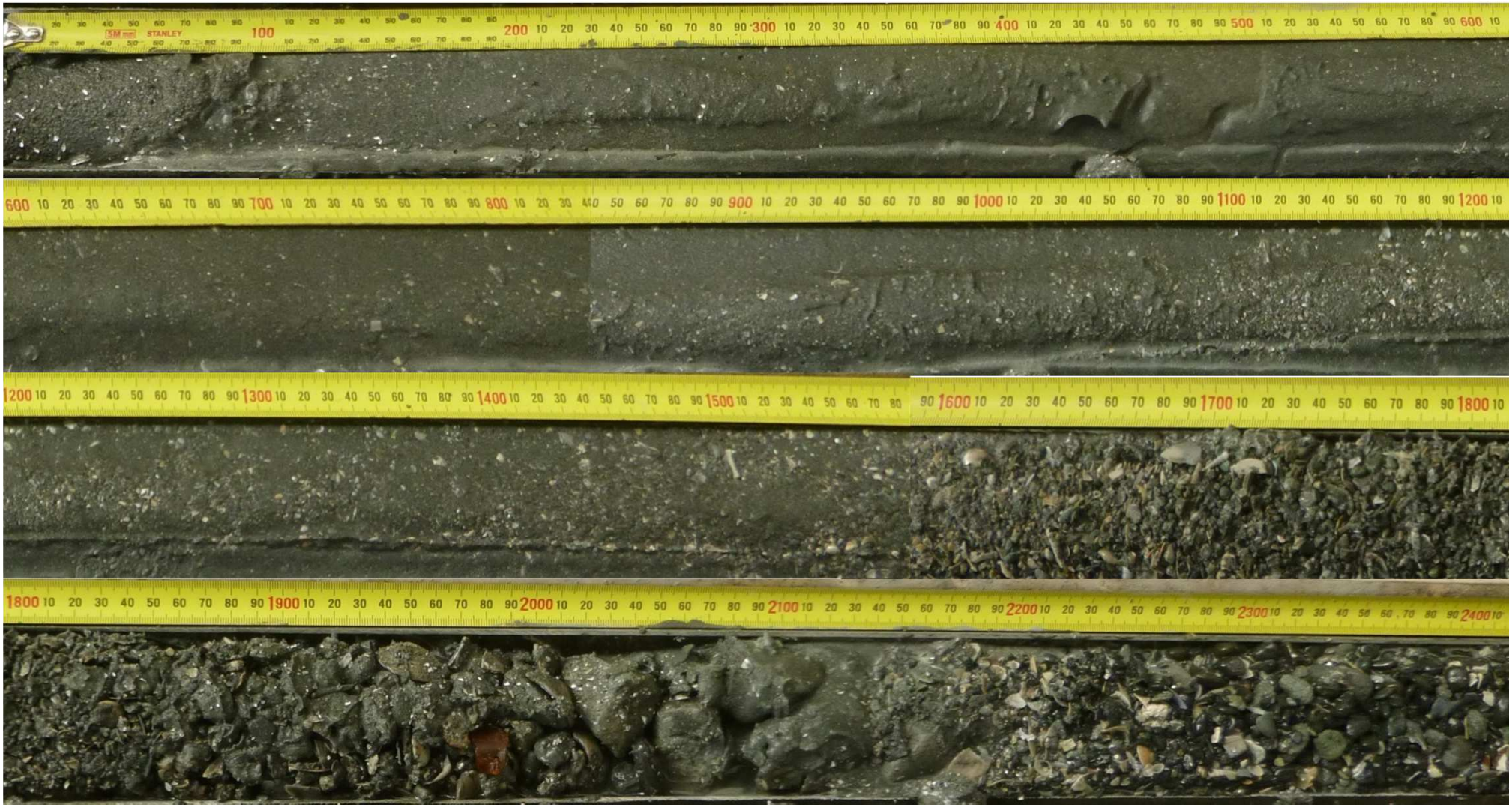
3124410/500

6 Wharf Development

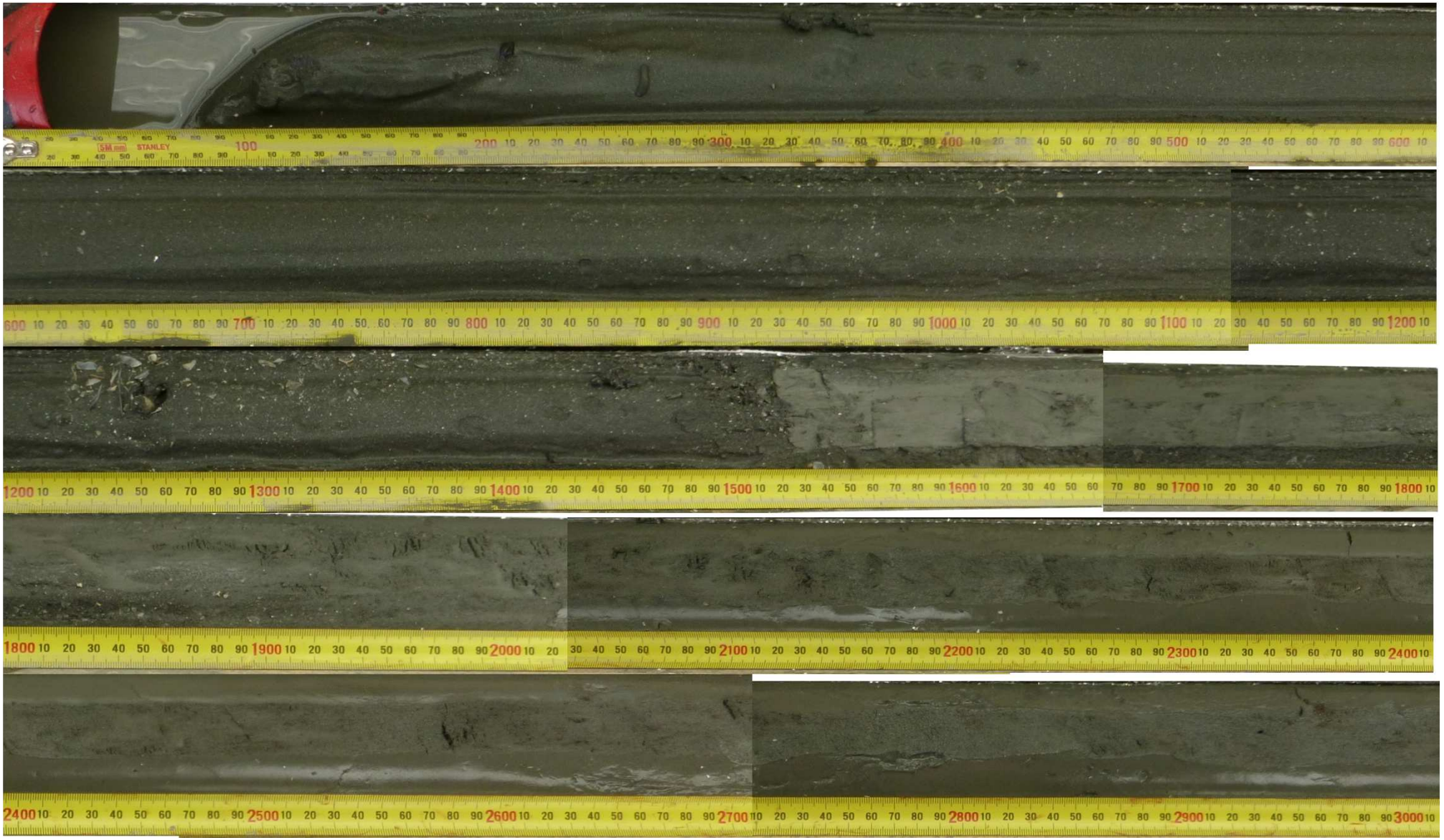


DEPTH: 0.00 to 2.40 m **VB07a**

DEPTH: 2.40 to 3.57 m **VB07a**

3124410/500

6 Wharf Development



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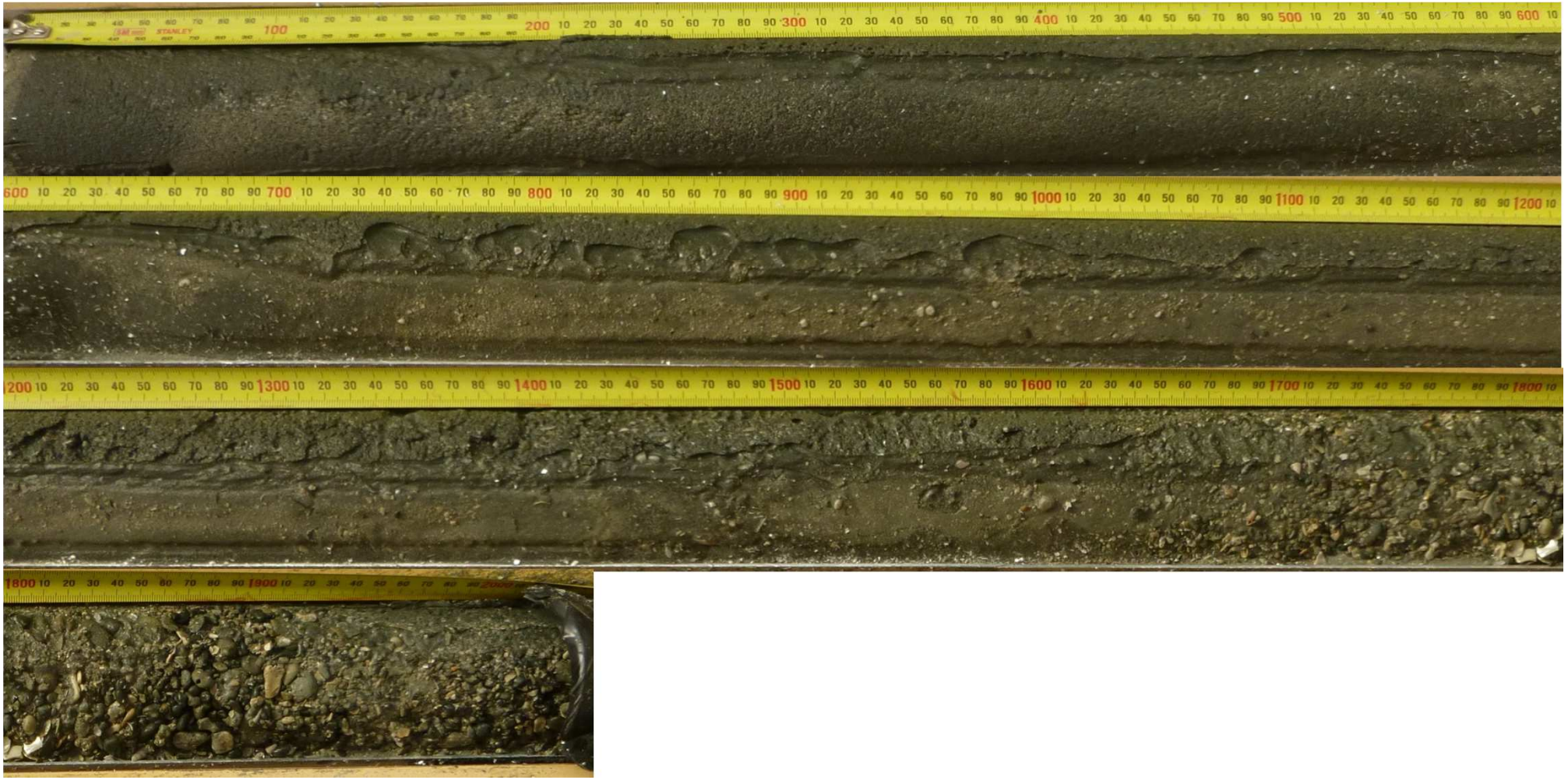
3124410/500

6 Wharf Development

DEPTH: 3.00 to 3.92 m **VB08a**



DEPTH: 0.00 to 2.05 m **VB09a**

3124410/500

6 Wharf Development

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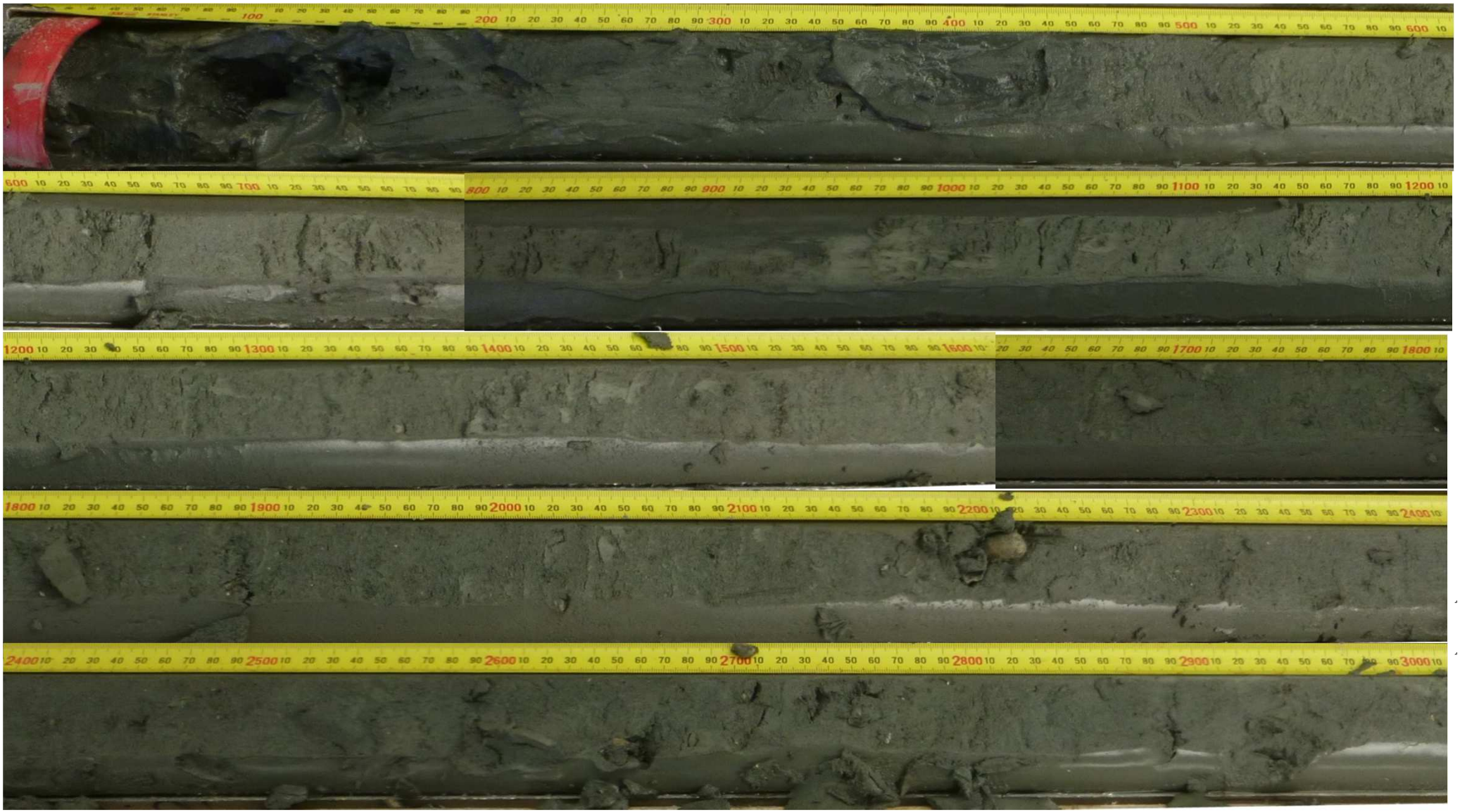
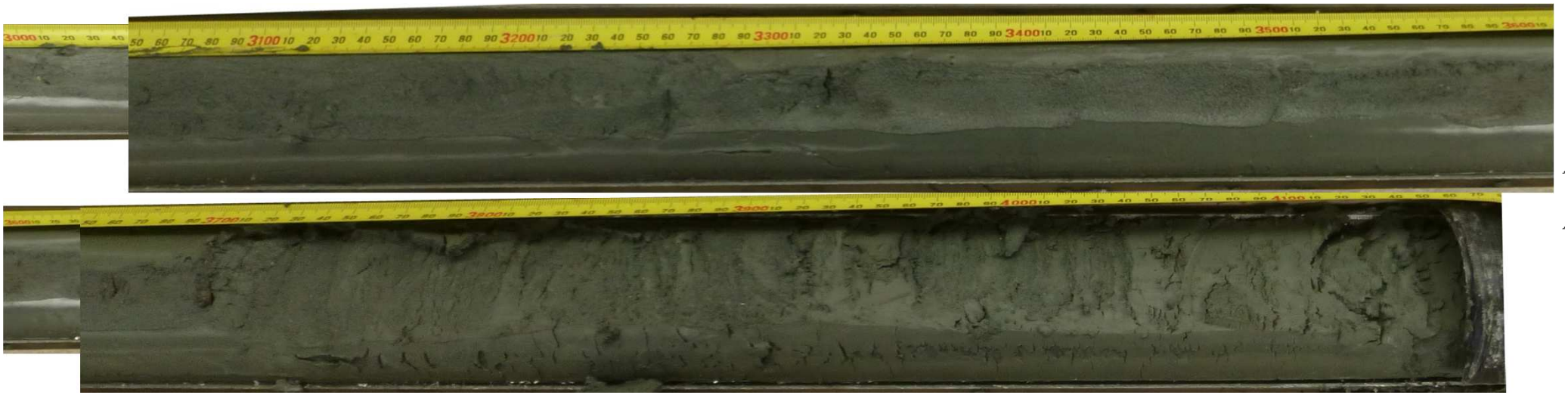
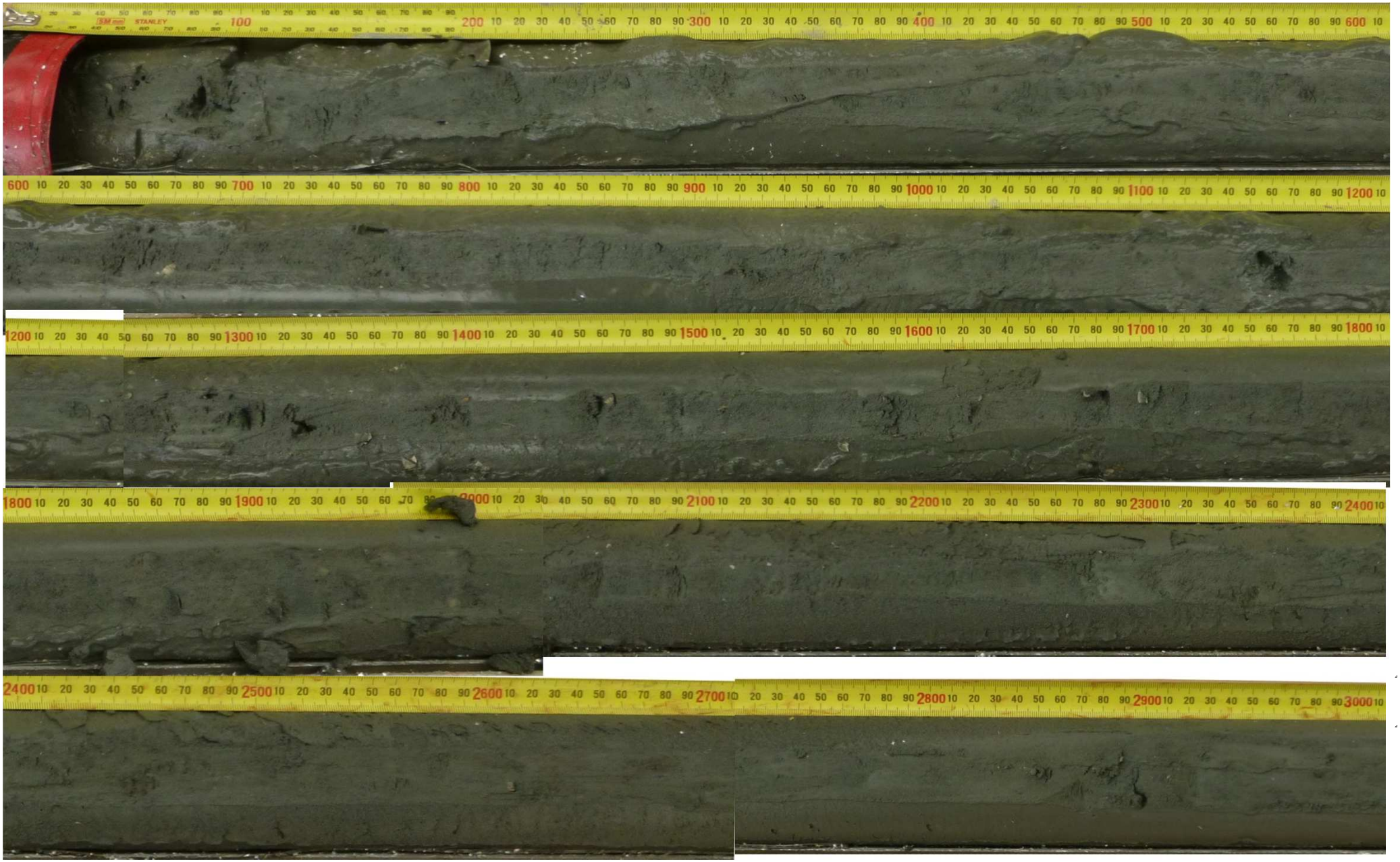
DEPTH: 0.00 to 0.90 m **VB10b**



DEPTH: 0.00 to 3.00 m **VB11a**



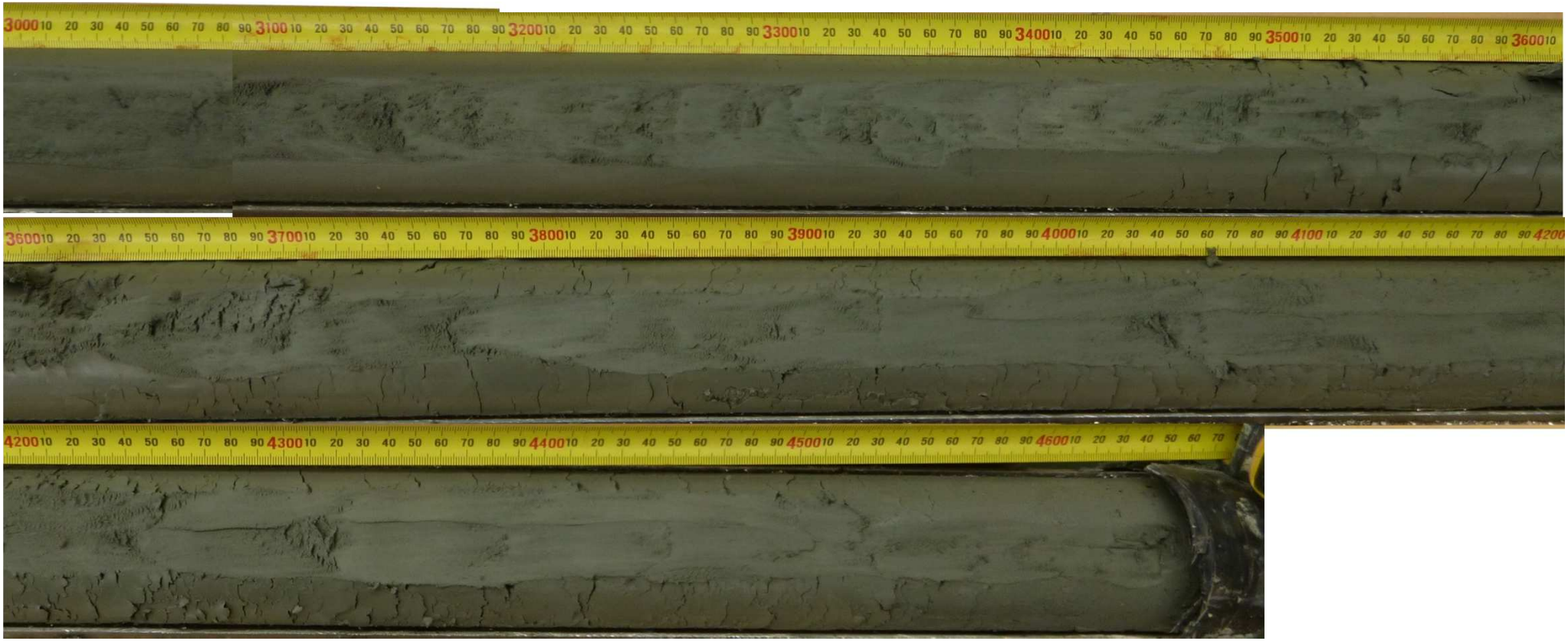
DEPTH: 3.00 to 4.20 m **VB11a**



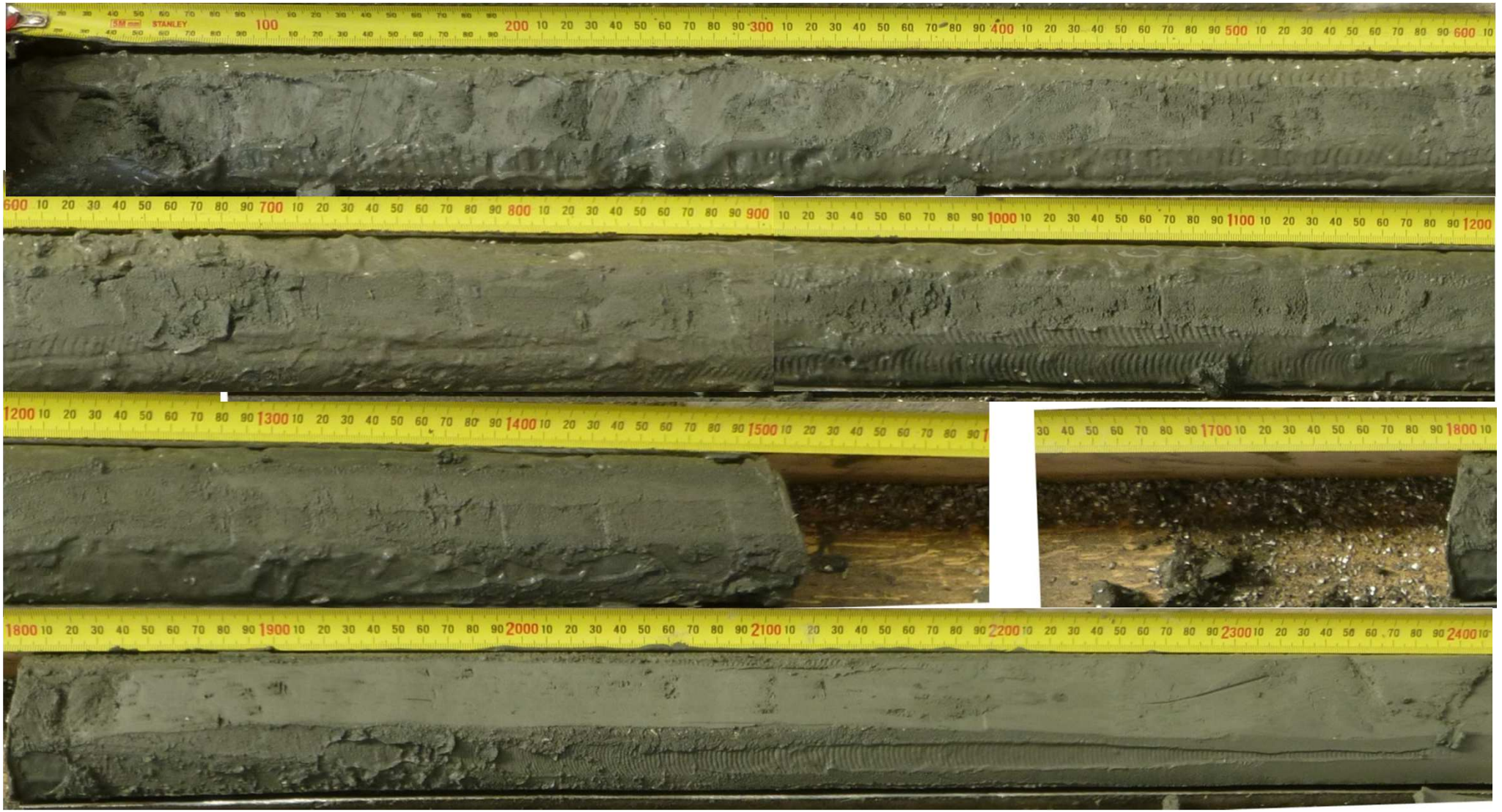
DEPTH: 0.00 to 3.00 m **VB12a**

3124410/500

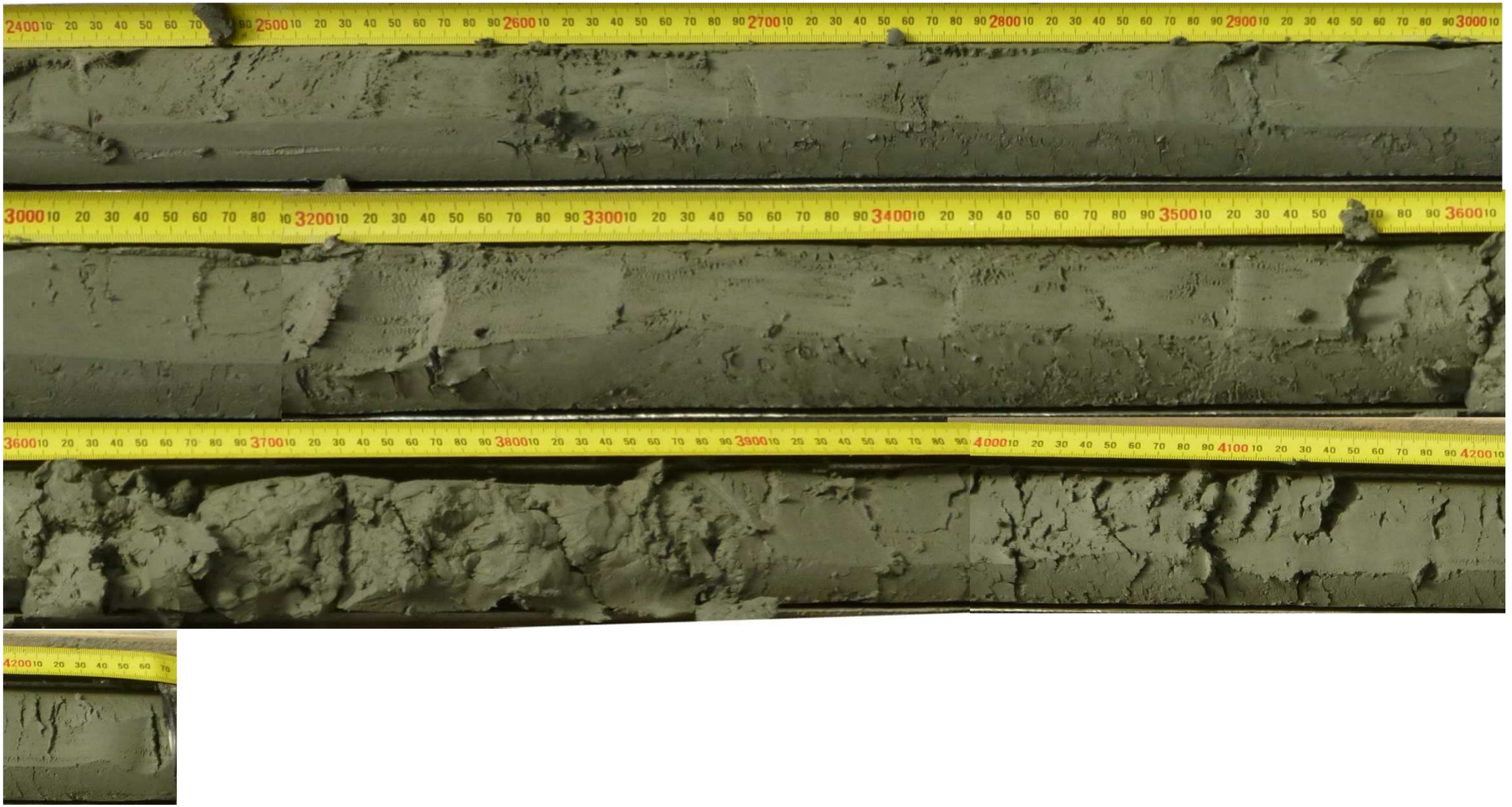
6 Wharf Development



DEPTH: 3.00 to 4.67 m **VB12a**



DEPTH: 0.00 to 2.40 m **VB14a**



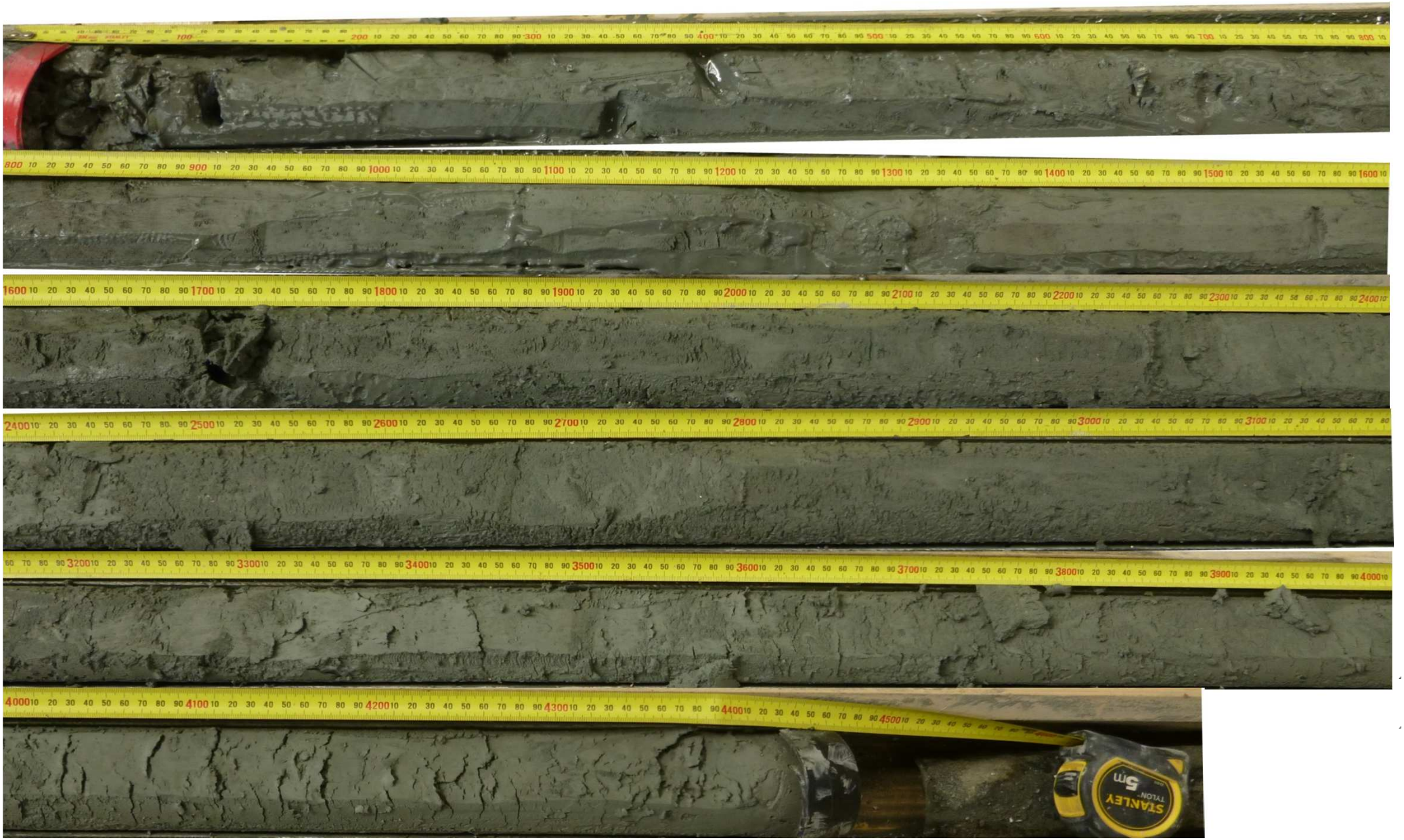
DEPTH: 2.40 to 4.30 m **VB14a**

3124410/500

6 Wharf Development

DEPTH: 0.00 to 3.00 m **VB16a**

DEPTH: 3.00 to 3.85 m **VB16a**

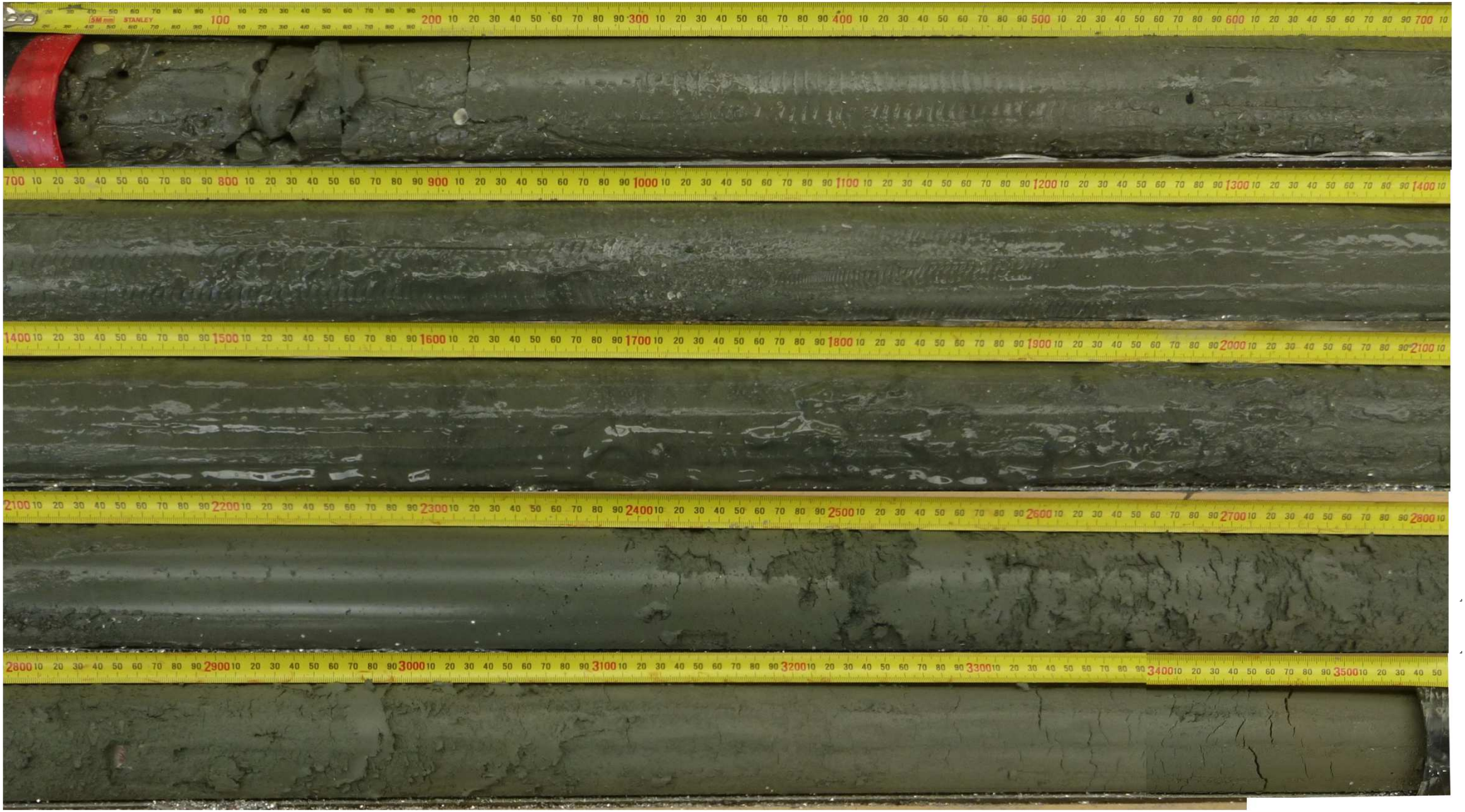


DEPTH: 0.00 to 4.45 m **VB17a**

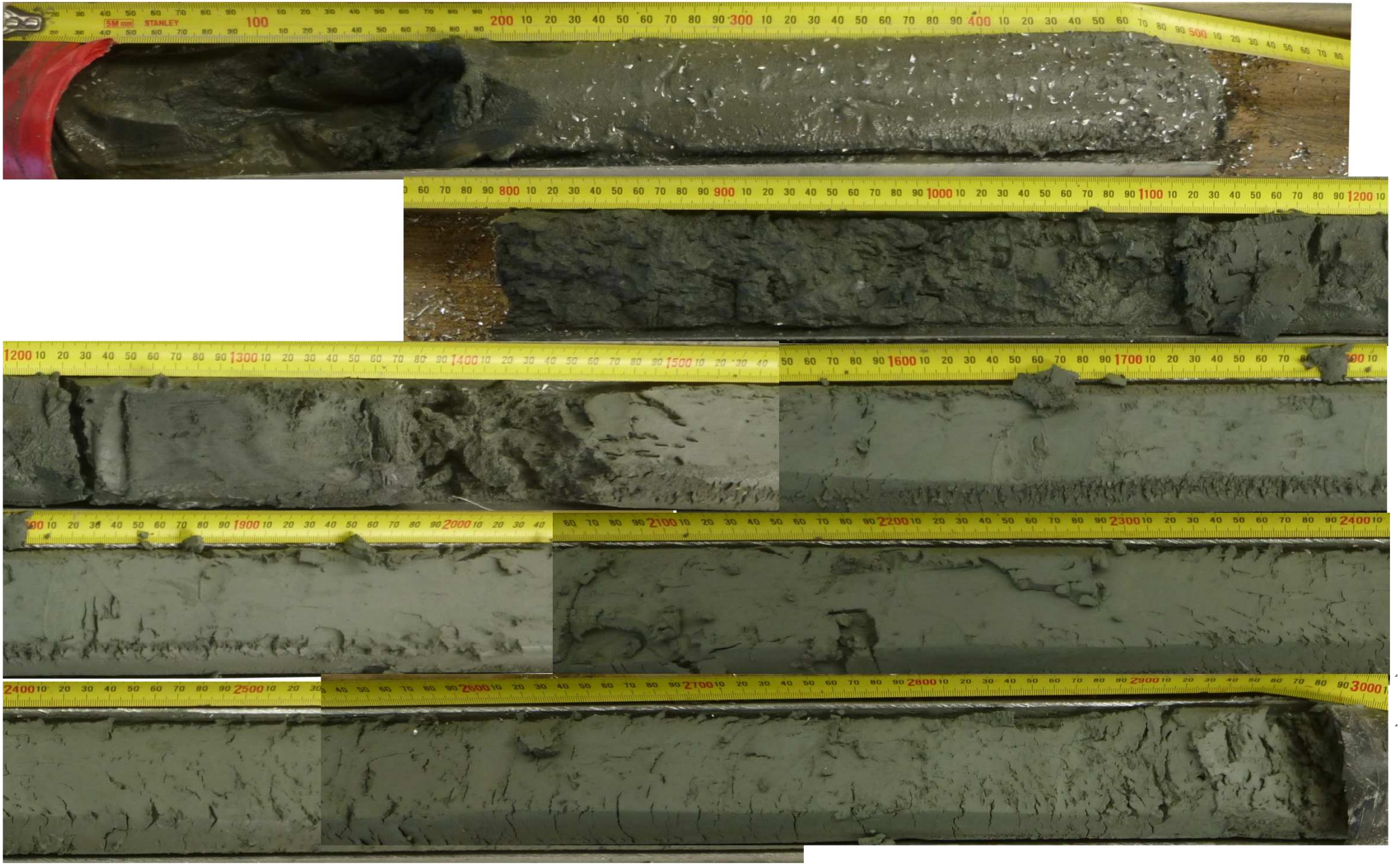
Beca

3124410/500

6 Wharf Development



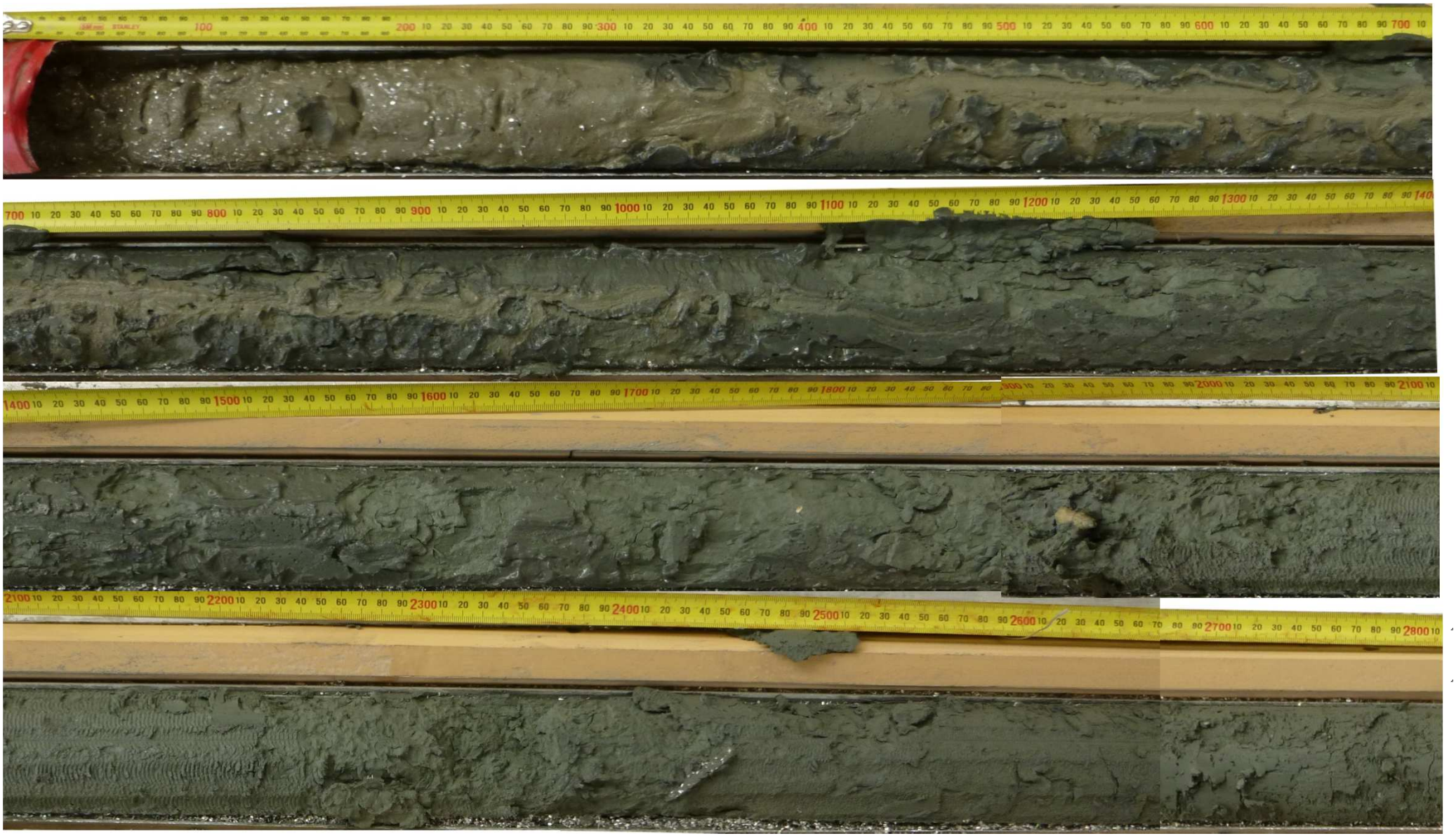
DEPTH: 0.00 to 3.50 m **VB18a**



DEPTH: 0.00 to 3.02 m **VB19a**

3124410/500

6 Wharf Development



DEPTH: 0.00 to 2.80 m **VB20a**

Beca

3124410/500

6 Wharf Development

DEPTH: 2.80 to 4.40 m **VB20a**

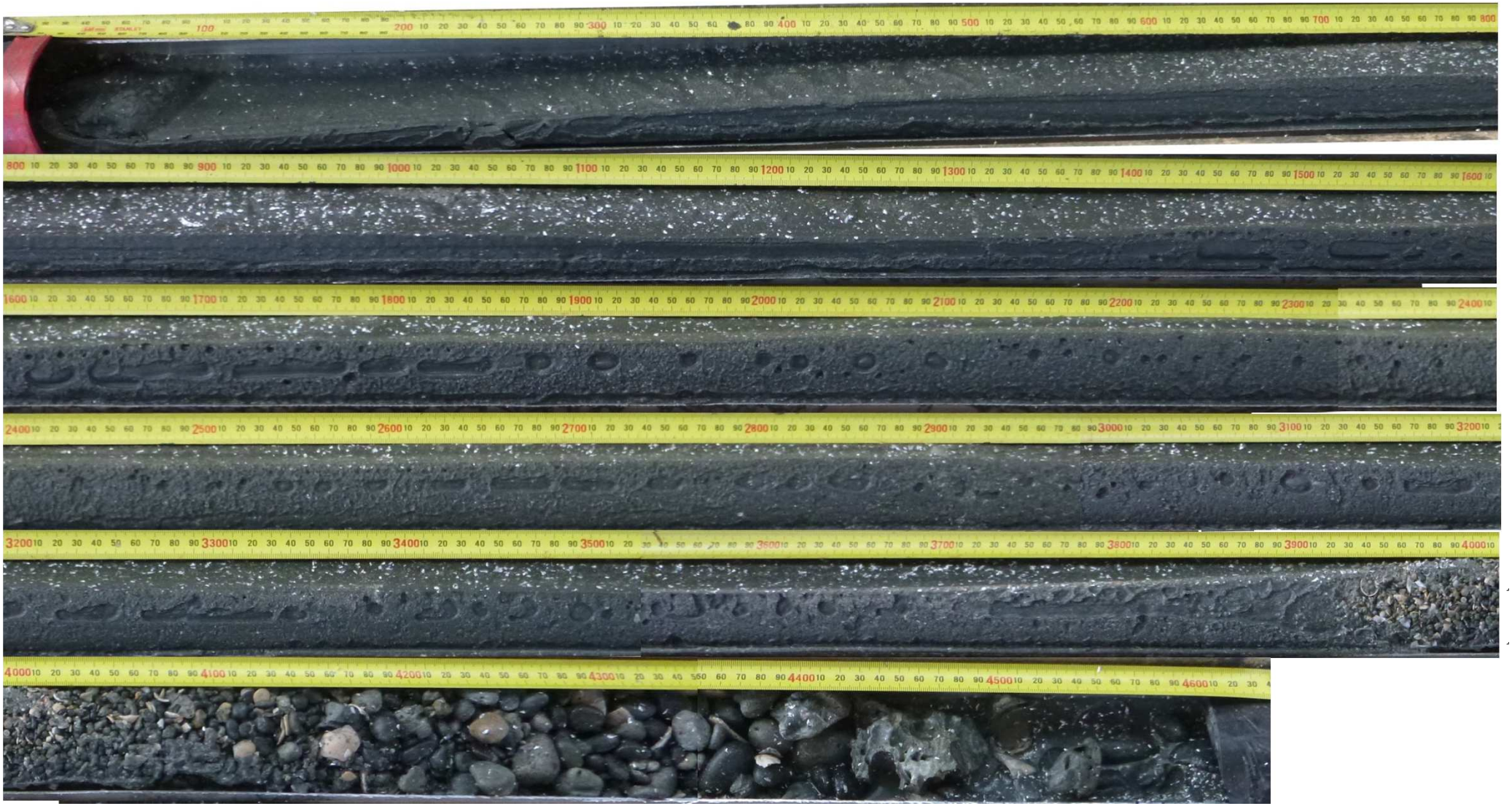
Beca

3124410/500

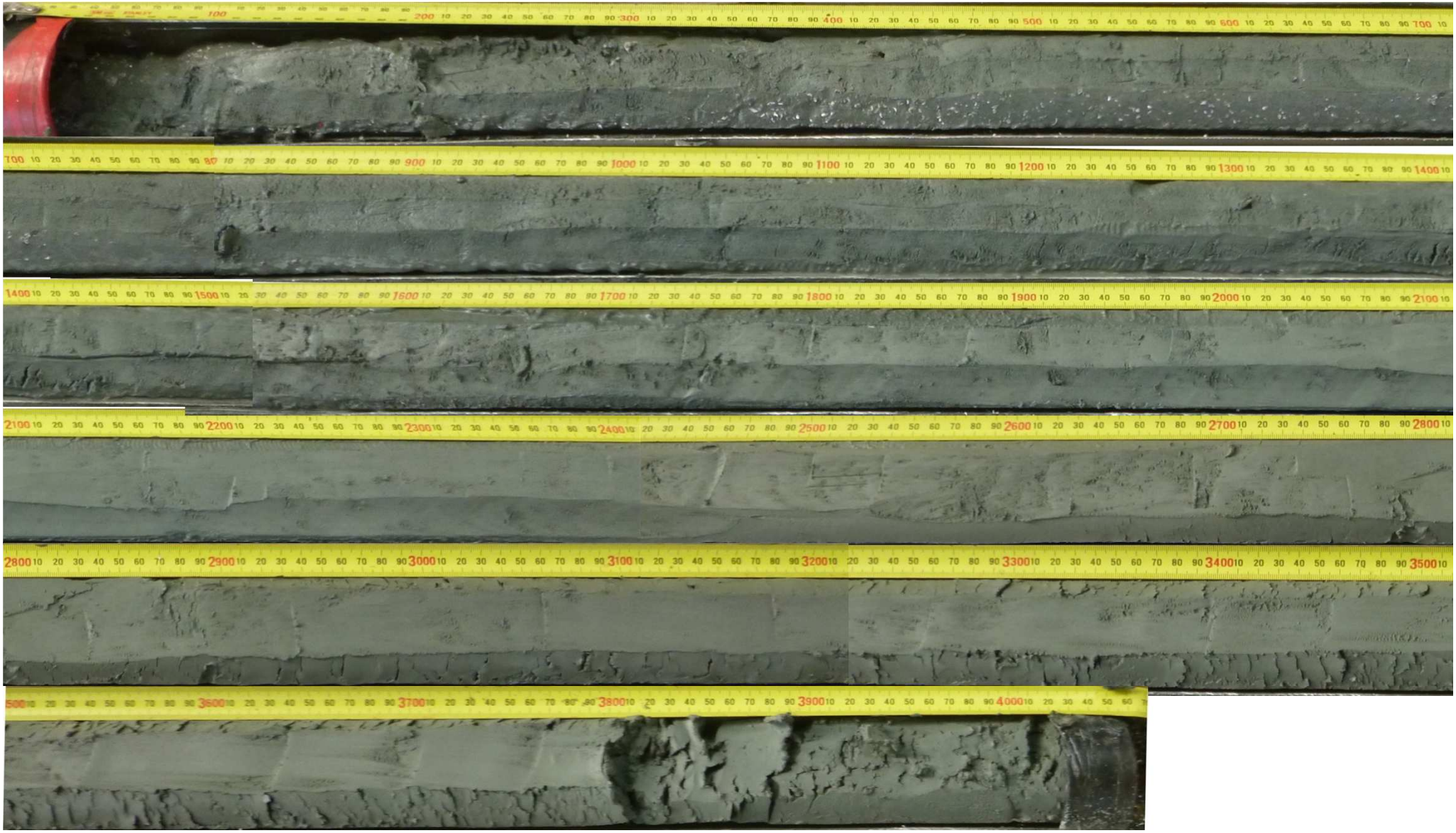
6 Wharf Development

DEPTH: 0.00 to 0.65 m **VB21a**

DEPTH: 0.00 to 0.88 m **VB22a**



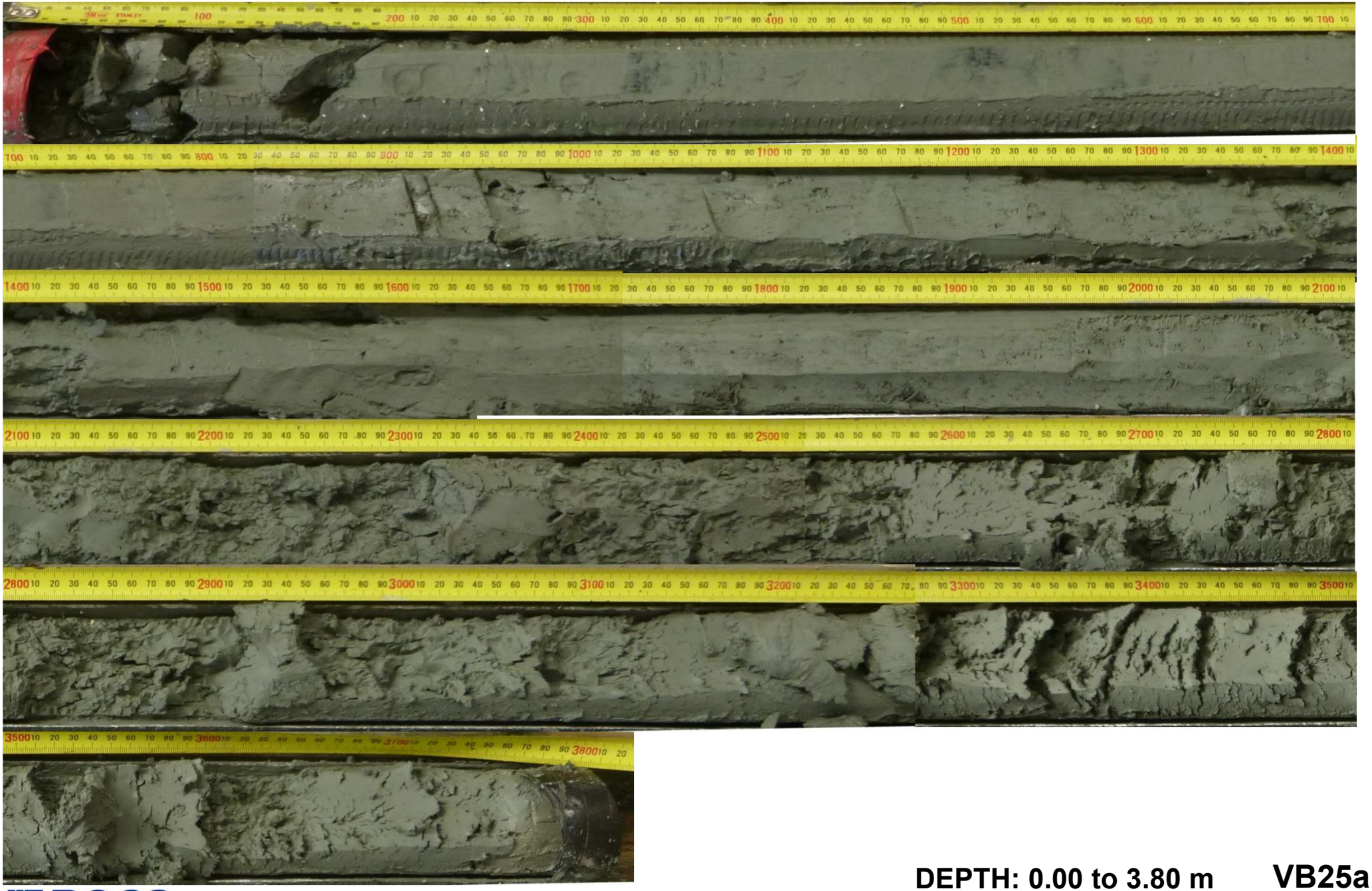
DEPTH: 0.00 to 4.46 m **VB23a**



DEPTH: 0.00 to 4.03 m **VB24a**

3124410/500

6 Wharf Development



DEPTH: 0.00 to 3.80 m **VB25a**

Appendix F

Shear Wave Velocity Test Results

Port of Napier
Reclaim Area, Wharf 6
Shearwave Survey

December 2015

A J Sutherland Consulting Ltd

Contents

1 Introduction

Shear wave velocity profiles were measured in four boreholes, located on the reclaim area of wharf 6, Napier Port. Site measurements were made on 28 December 2015.

The boreholes, designated as BH601, BH603, BH604 and BH606, were lined with 32mm PVC pressure pipe (PN15) prior to the shear wave measurements.

This report describes the shear wave testing methodology adopted along with the resulting shear wave and compression wave velocities estimated for various layers within the boreholes. The velocity profiles and time history plots are given in Appendices A and B, respectively.

2 Shear Wave Testing Methodology

Shear waves were generated by using a sledge hammer to strike the ends of a plank, which was held in contact with the ground by parking a loaded vehicle on it. For these tests the plank was situated 1.0m from the top of the borehole. Compression waves were also created by striking a metal plate on the ground, vertically.

The resulting shear waves were recorded using an assembly of five pairs of horizontally and vertically orientated geophones, spaced at 0.5m intervals. The geophone pairs were individually spring loaded to ensure good contact with the PVC liner, which had been grouted into the borehole. The pairs of geophones were isolated from each other by flexible spacers.

Striking the end of the plank creates a horizontally oriented shear wave which travels down through the ground surrounding the borehole. Some compression wave is also created but this is mainly vertically oriented and since the horizontal geophones are used to record the shear wave, these have little effect on the signal.

Data from the geophones was recorded using an ABEM digital seismograph. The seismograph was triggered by the closing of an electrical circuit between the hammer and the steel plates on the ends of the plank.

The acquired data was processed using phase velocities between pairs of geophones, to determine the velocity of the shear waves, averaged over sections of the borehole. Once the profile had been determined, a first arrival time was calculated for each depth and this was superimposed on the time history plot. This first arrival line should match the first break of the shear wave seen on the time history plot. The first break is characterised by the waveforms generated by hits on opposite ends of the plank, breaking in opposite directions, i.e. one up and one down on the time history plot.

Compression wave velocities were calculated from the first arrival times of waves generated by the vertical hits. The time history plot includes a line representing the first arrivals of the wave travelling down the borehole.

3 Processed Data

The calculated shear wave and compression wave profiles are presented in Appendix A. The time history for each geophone element, plotted at the depth of the reading, for both shear wave and compression wave readings are presented in Appendix B. The estimated first arrival of the shear wave, determined from the calculated velocities, are also shown on the time history plots as a blue line.

3.1 Borehole BH601 Results

The shearwave arrivals are strong with little background noise. The compression wave arrivals are mostly clear although there is noise on some of the signals.

The calculated shear wave and compression wave velocities are shown in Table 1.

Table 1: Calculated shear wave and compression wave velocities, BH601

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
0.0 - 1.0	188	660
1.0 - 2.0	191	660
2.0 - 3.0	192	660
3.0 - 4.0	163	1280
4.0 - 5.0	294	1280
5.0 - 6.0	360	1280
6.0 - 7.0	281	1280
7.0 - 8.0	199	2290
8.0 - 9.0	184	2290
9.0 - 10.0	234	2290
10.0 - 11.0	217	2290
11.0 - 12.0	291	2290
12.0 - 13.0	434	2290
13.0 - 14.0	521	1220
14.0 - 15.0	532	1220
15.0 – 16.0	611	1220
16.0 – 17.0	479	1220
17.0 – 18.0	521	1220
18.0 – 18.5	521	-

3.2 Borehole BH603 Results

The shearwave arrivals are strong with little background noise. There is a sharp change in the velocity at 9 metres. The compression wave arrivals are clear, with little background noise.

The calculated shear wave and compression wave velocities are shown in Table 2.

Table 2: Calculated shear wave and compression wave velocities, BH603

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
0.0 - 1.0	136	630
1.0 - 2.0	142	630
2.0 - 3.0	91	630
3.0 - 4.0	100	630
4.0 - 5.0	105	1830
5.0 - 6.0	180	1830
6.0 - 7.0	172	1830
7.0 - 8.0	192	1830
8.0 - 9.0	175	1830
9.0 - 10.0	912	1830
10.0 - 11.0	904	2680
11.0 - 12.0	814	2680
12.0 - 13.0	665	2680
13.0 - 14.0	831	2680
14.0 - 15.0	798	2680
15.0 – 16.0	739	2680
16.0 – 17.0	688	2680
17.0 – 18.0	540	2680
18.0 – 19.0	555	2680
19.0 – 20.0	624	2680
20.0 – 21.0	644	2680
21.0 – 22.0	526	1860
22.0 – 23.0	605	1860
23.0 – 24.0	487	1860
24.0 – 25.0	555	1860

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
25.0 – 26.0	476	1860

3.3 Borehole BH604 Results

The shearwave arrivals are strong and clear, with little background noise. The compression wave arrivals are mostly clear, with little background noise, there is an unusual reduction in velocity below 17 metres.

The calculated shear wave and compression wave velocities are shown in Table 3.

Table 3: Calculated shear wave and compression wave velocities, BH604

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
0.0 - 1.0	175	740
1.0 - 2.0	178	740
2.0 - 3.0	199	740
3.0 - 4.0	142	740
4.0 - 5.0	128	740
5.0 - 6.0	117	1430
6.0 - 7.0	142	1430
7.0 - 8.0	291	1430
8.0 - 9.0	209	1430
9.0 - 10.0	170	1430
10.0 - 11.0	251	1430
11.0 - 12.0	196	1430
12.0 - 13.0	227	1430
13.0 - 14.0	227	1430
14.0 - 15.0	256	1430
15.0 – 16.0	285	1430
16.0 – 17.0	293	1430
17.0 – 18.0	316	630
18.0 – 19.0	284	630
19.0 - 20.0	320	630
20.0 - 21.0	284	630

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
21.0 - 22.0	320	630
22.0 - 23.0	320	630
23.0 - 24.0	284	630
24.0 - 25.0	394	800
25.0 – 26.0	365	800
26.0 – 27.0	465	800

3.4 Borehole BH606 Results

The shearwave arrivals are strong and clear, although there is some background noise toward the bottom of the hole. Between 10 and 11 metres there is an anomaly where the signals at 11 metres arrive before the signals at 10 metres. It is not possible to calculate a velocity over this section and it is shown as a discontinuity.

The compression wave arrivals are mostly clear, with little background noise. There is also a slight discontinuity in the compression wave arrivals.

The calculated shear wave and compression wave velocities are shown in Table 4.

Table 4: Calculated shear wave and compression wave velocities, BH606

Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
0.0 - 1.0	86	590
1.0 - 2.0	136	590
2.0 - 3.0	502	590
3.0 - 4.0	150	590
4.0 - 5.0	445	1980
5.0 - 6.0	92	1980
6.0 - 7.0	137	1980
7.0 - 8.0	269	1980
8.0 - 9.0	234	1980
9.0 - 10.0	282	1980
10.0 - 11.0	Discontinuity	Discontinuity
11.0 - 12.0	983	2550
12.0 - 13.0	676	2550

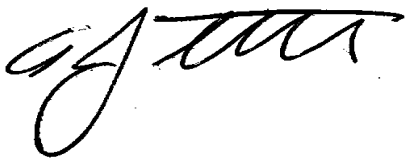
Depth Range (m)	Shear wave velocities (m/s)	Compression wave velocities (m/s)
13.0 - 14.0	606	2550
14.0 - 15.0	817	2550
15.0 – 16.0	591	2080
16.0 – 17.0	575	2080
17.0 – 18.0	626	2080
18.0 – 19.0	568	2080
19.0 - 20.0	589	2080
20.0 - 21.0	604	2080
21.0 - 22.0	589	2080
22.0 - 23.0	659	2080
23.0 - 24.0	639	2080
24.0 - 25.0	540	2080
25.0 – 26.0	640	2080
26.0 – 27.0	640	2080
27.0 – 28.0	731	2080
28.0 – 29.0	731	2080
29.0 - 30.0	670	2080
30.0 - 31.0	555	2080
31.0 - 32.0	640	2080
32.0 - 33.0	616	2080
33.0 - 34.0	605	2080
34.0 - 35.0	622	2080
35.0 – 36.0	605	2080
36.0 – 37.0	616	2080
37.0 – 38.0	640	2080
38.0 – 39.0	593	2080
39.0 - 40.0	650	2080

4 Conclusions

The shear wave data were generally of good quality with the first arrival of the shear wave obvious on the time history plots. There is an unusual discontinuity in BH606 between 10 and 11 metres which results in earlier arrivals at the deeper depths.

The compression wave data were generally of good quality, with obvious first arrivals. Compression wave velocities were averaged over sections of the hole.

The shear wave first arrival times, calculated from the interpreted velocities, match well with the visible first arrivals on the time history plots.



Alan Sutherland
Geophysical Consultant

Appendix A: Velocity Profiles

Figure A1: Shear Wave Velocity Profile, BH601

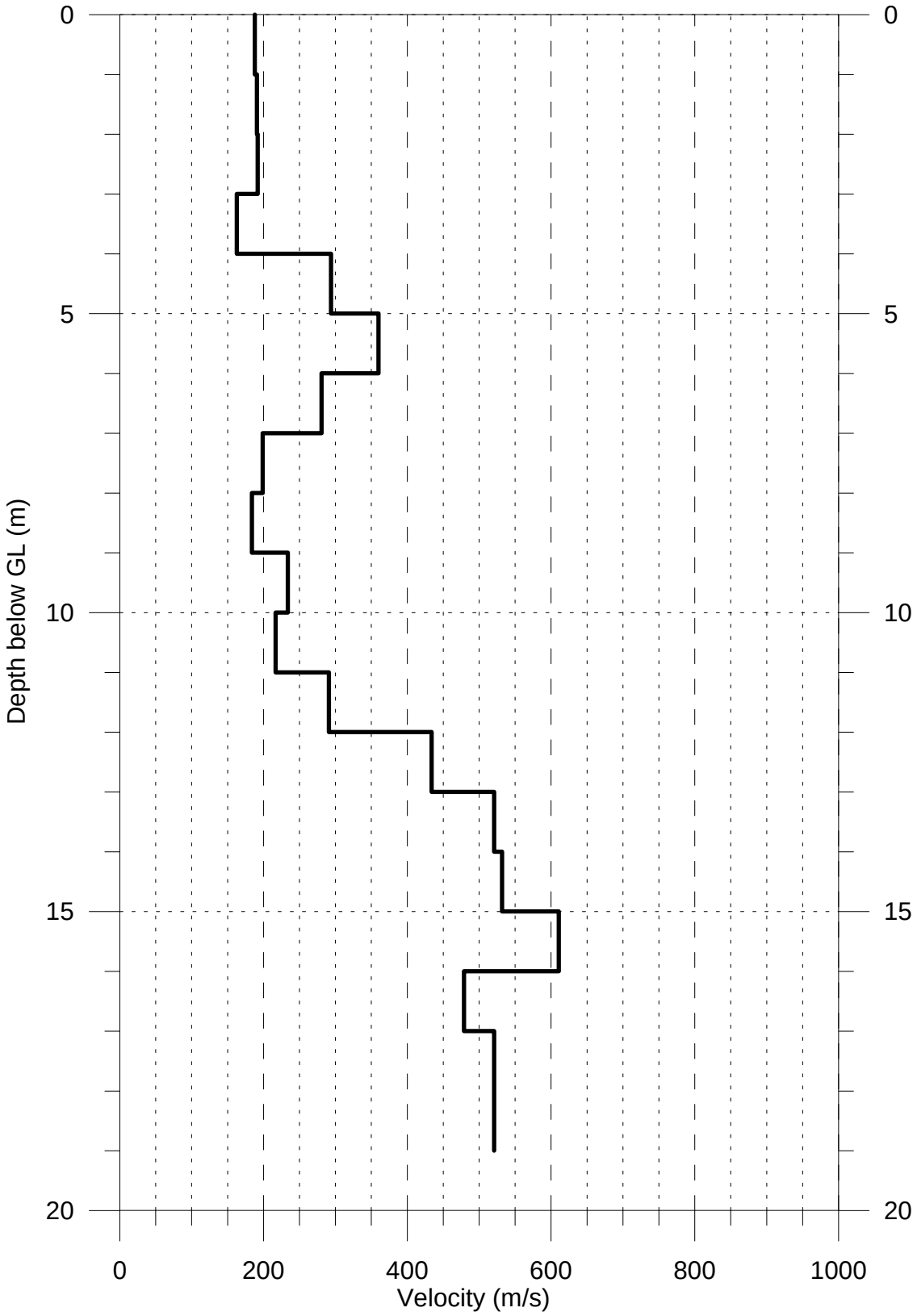


Figure A2: Compression Wave Velocity Profile, BH601

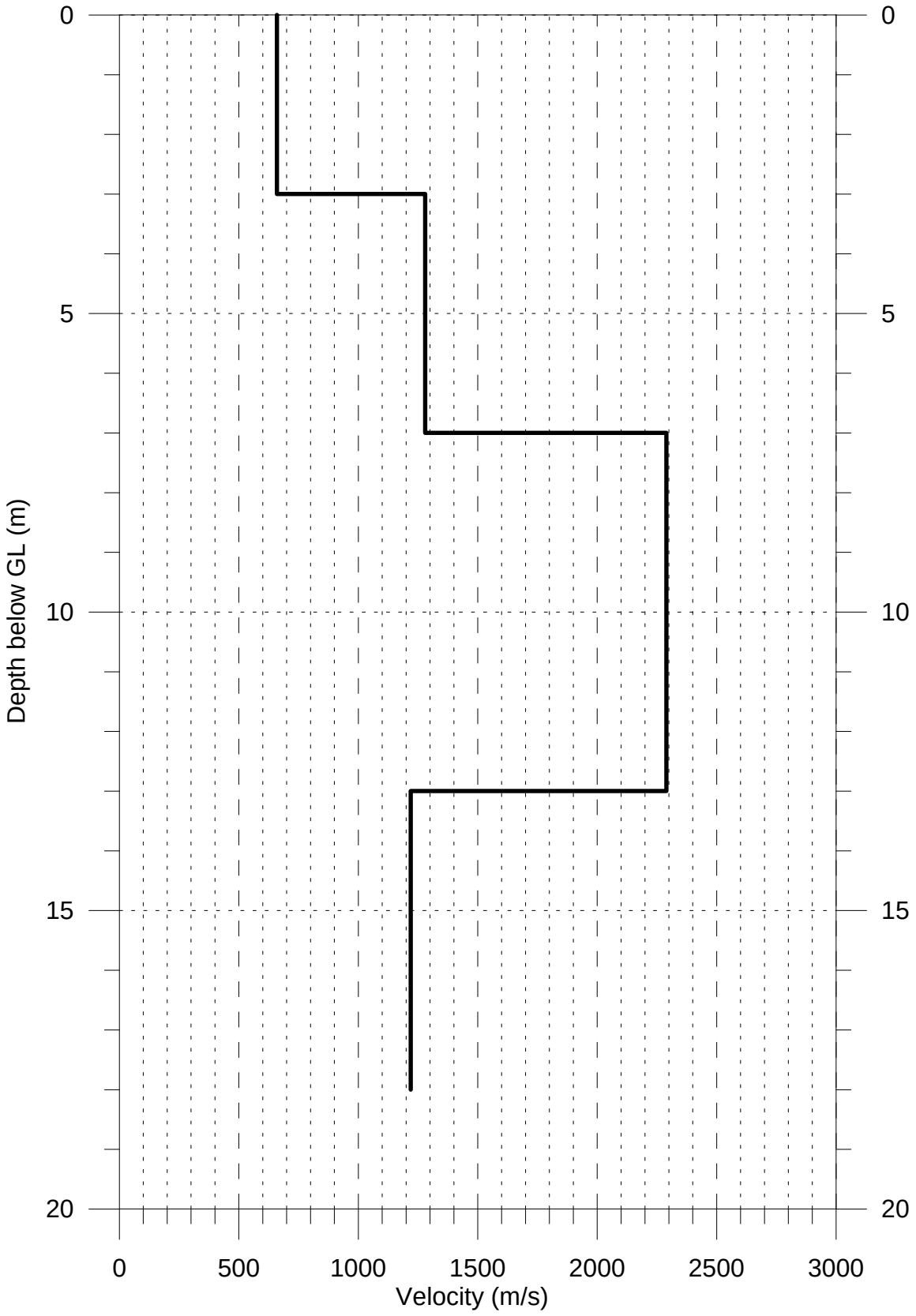


Figure A3: Shear Wave Velocity Profile, BH603

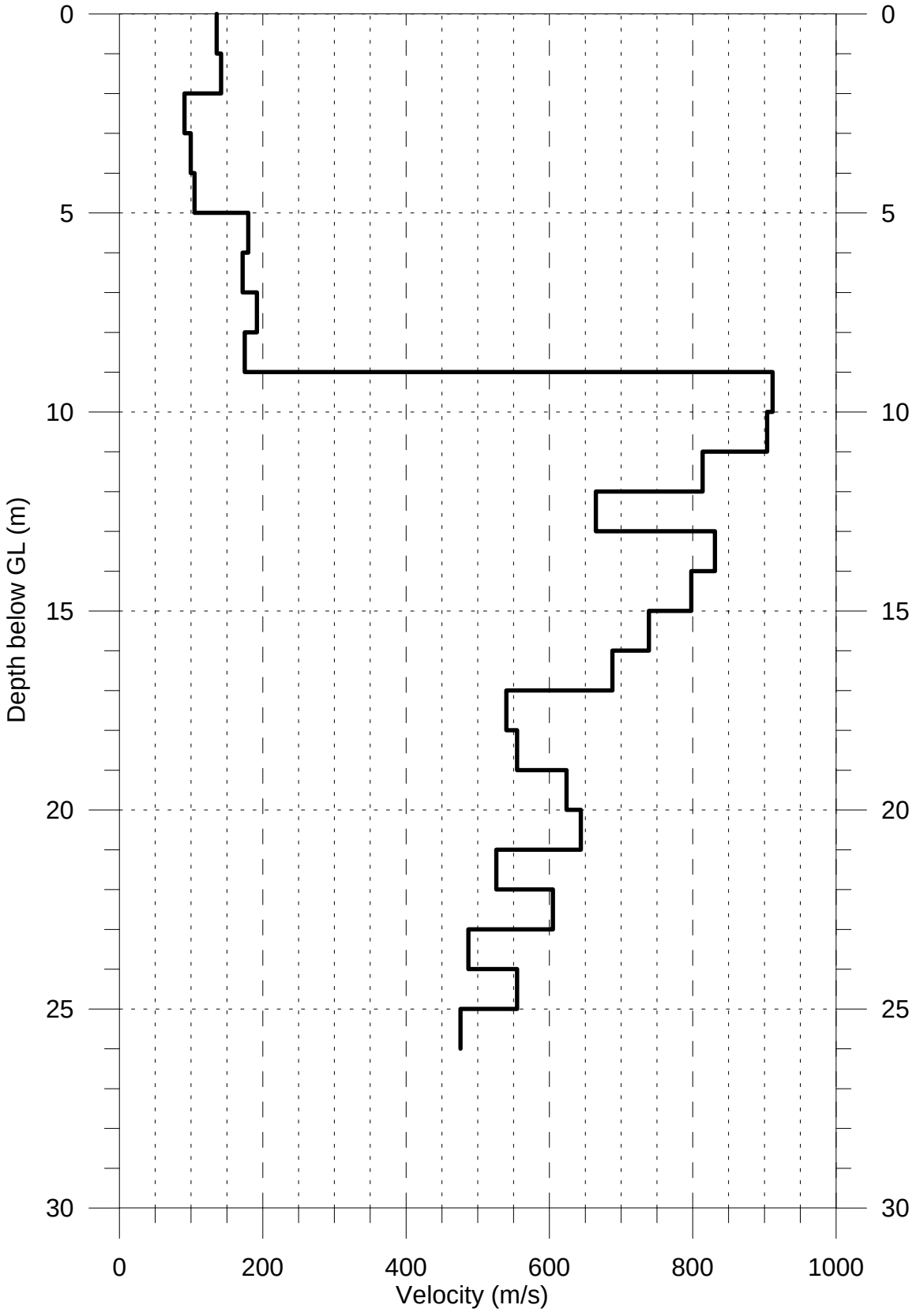


Figure A4: Compression Wave Velocity Profile, BH603

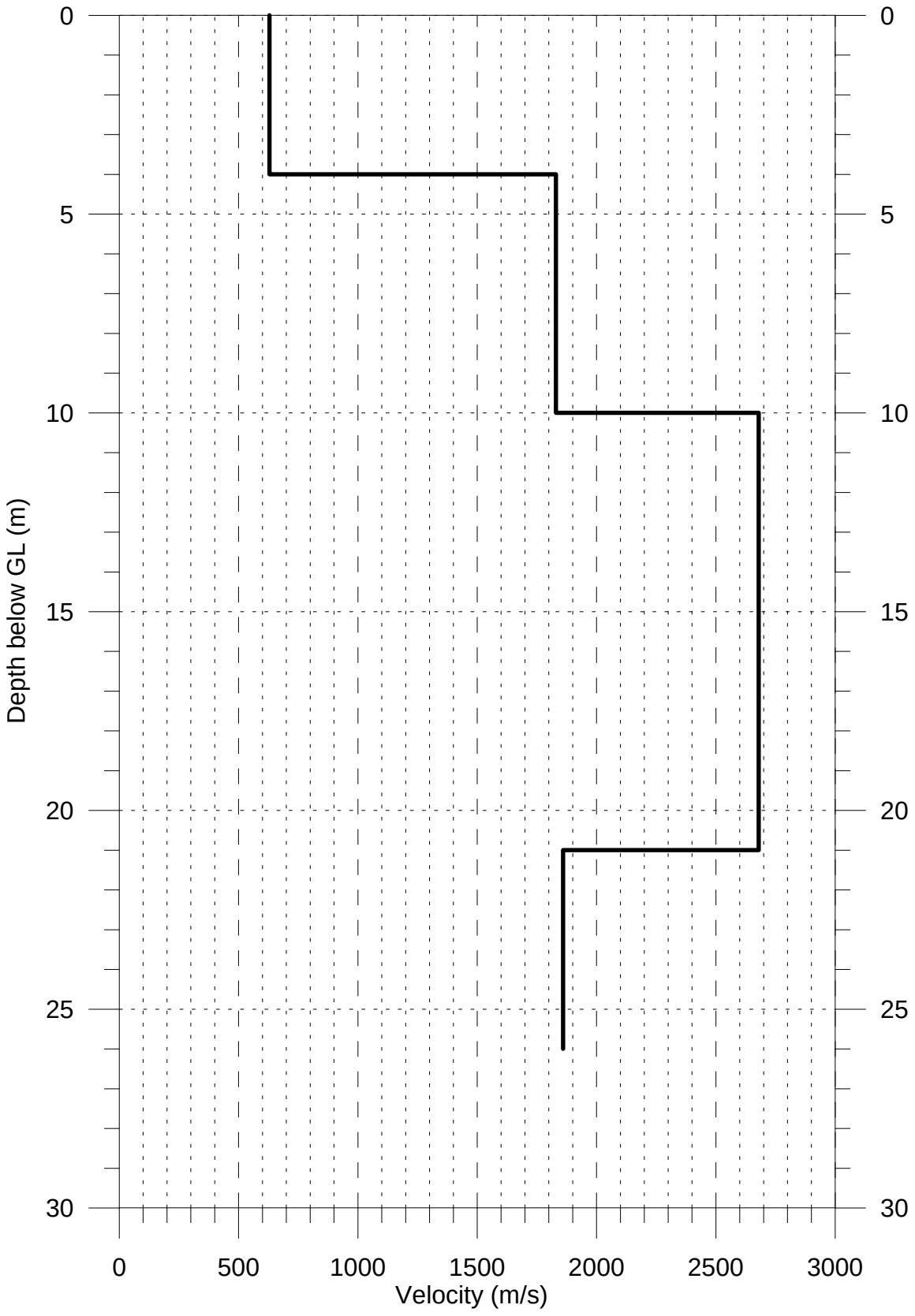


Figure A5: Shear Wave Velocity Profile, BH604

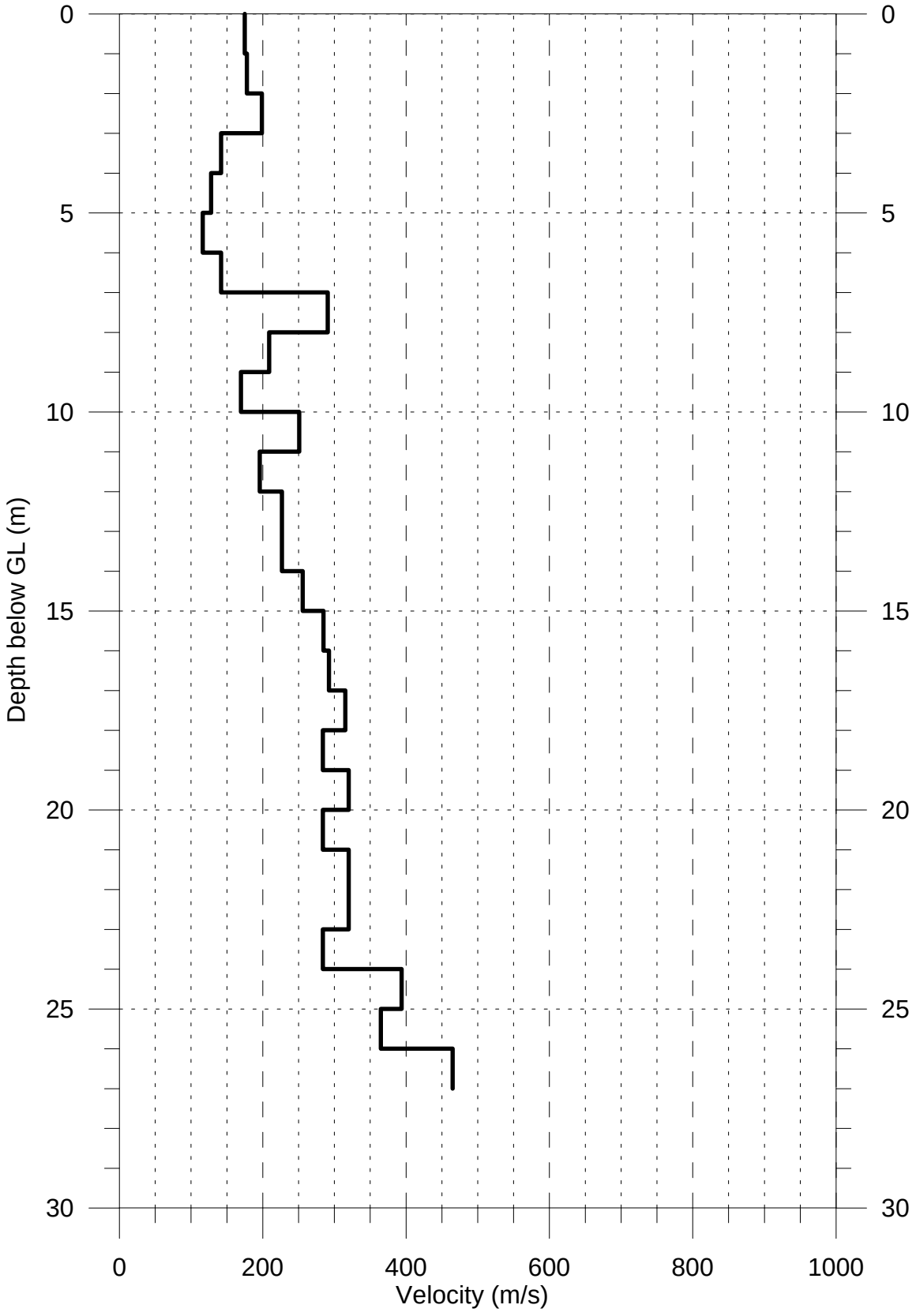


Figure A6: Compression Wave Velocity Profile, BH604

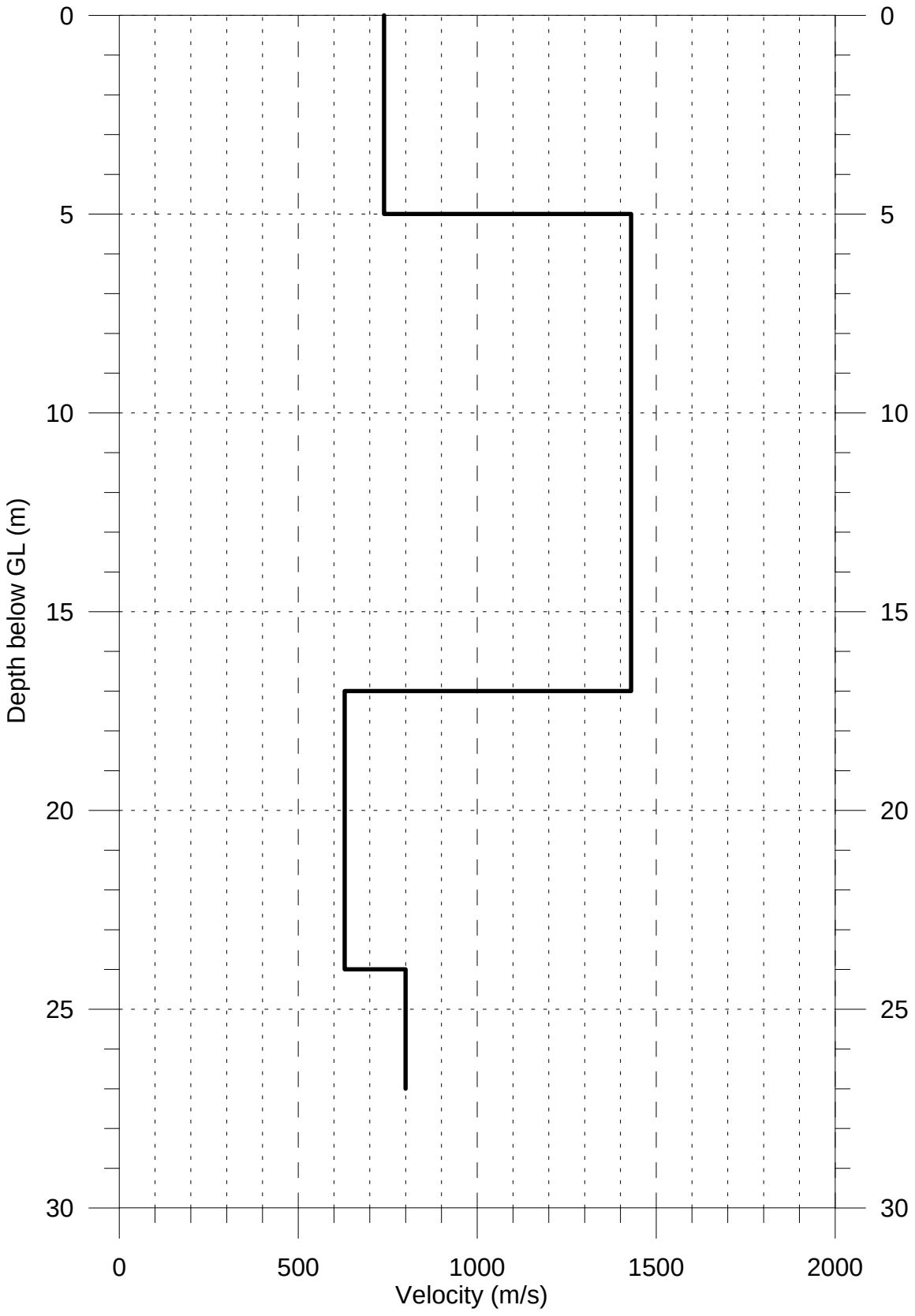


Figure A7: Shear Wave Velocity Profile, BH606

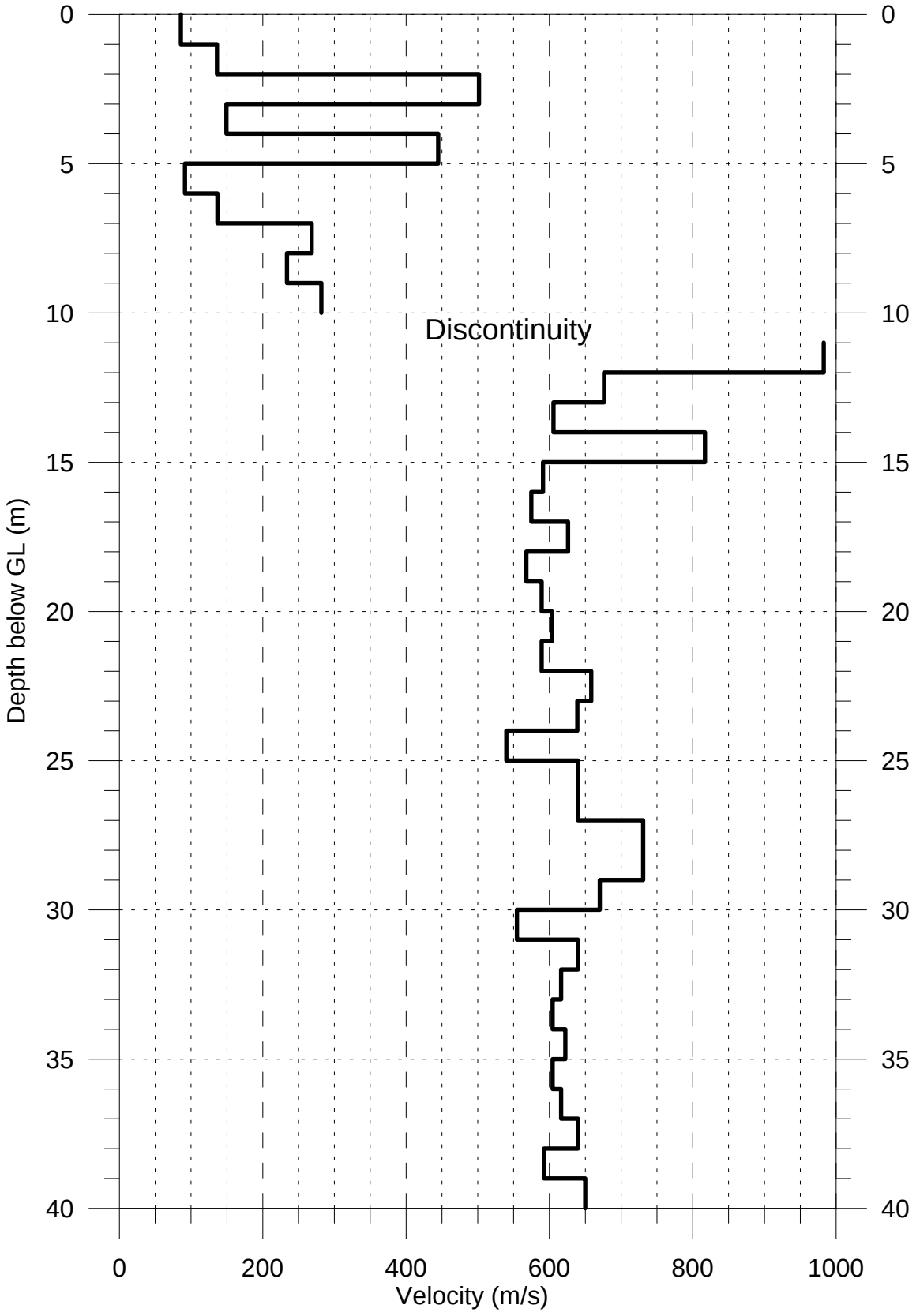
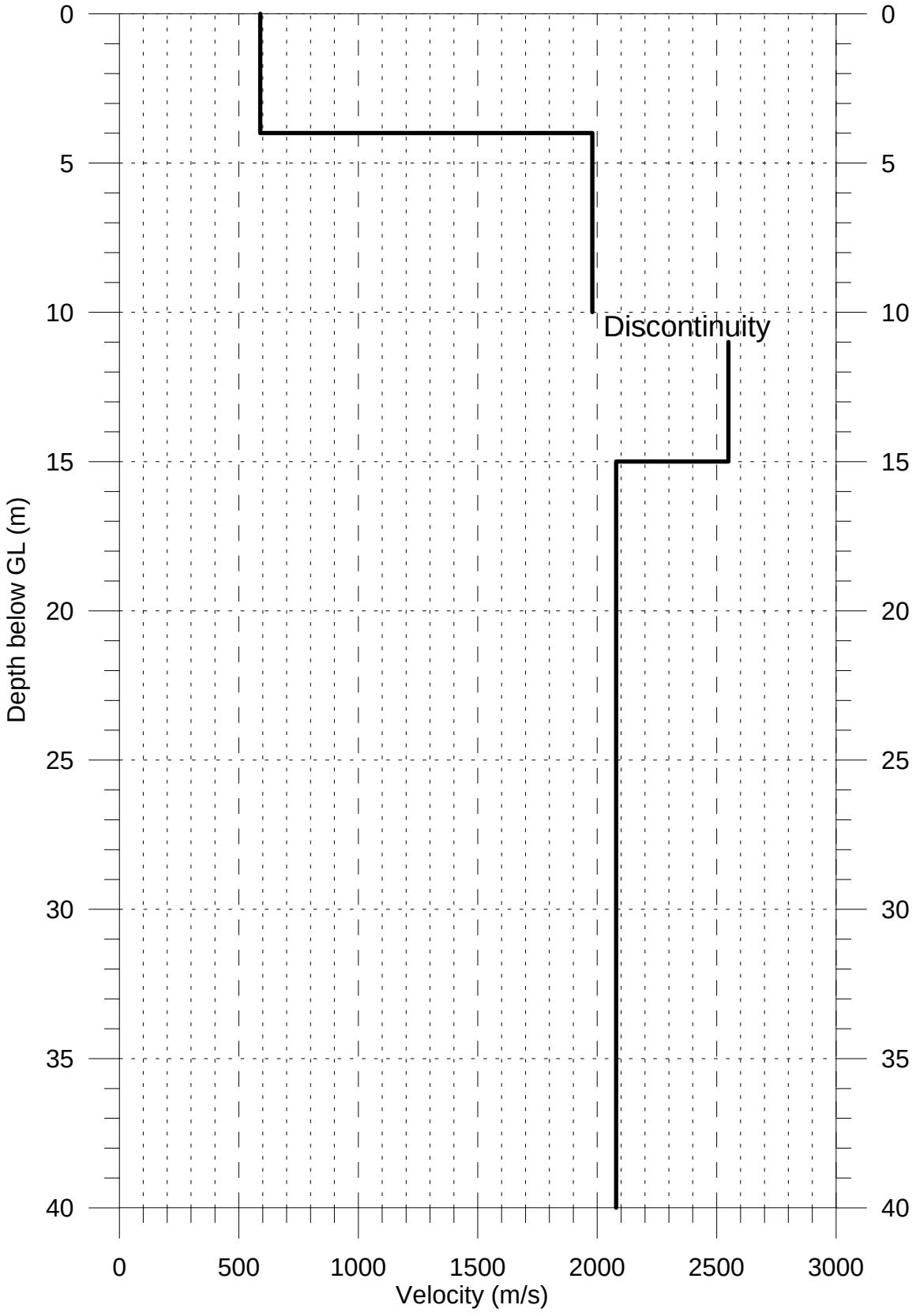


Figure A8: Compression Wave Velocity Profile, BH606



Appendix B: Time Histories

Figure B1: Shear Wave Velocity Time History, BH601

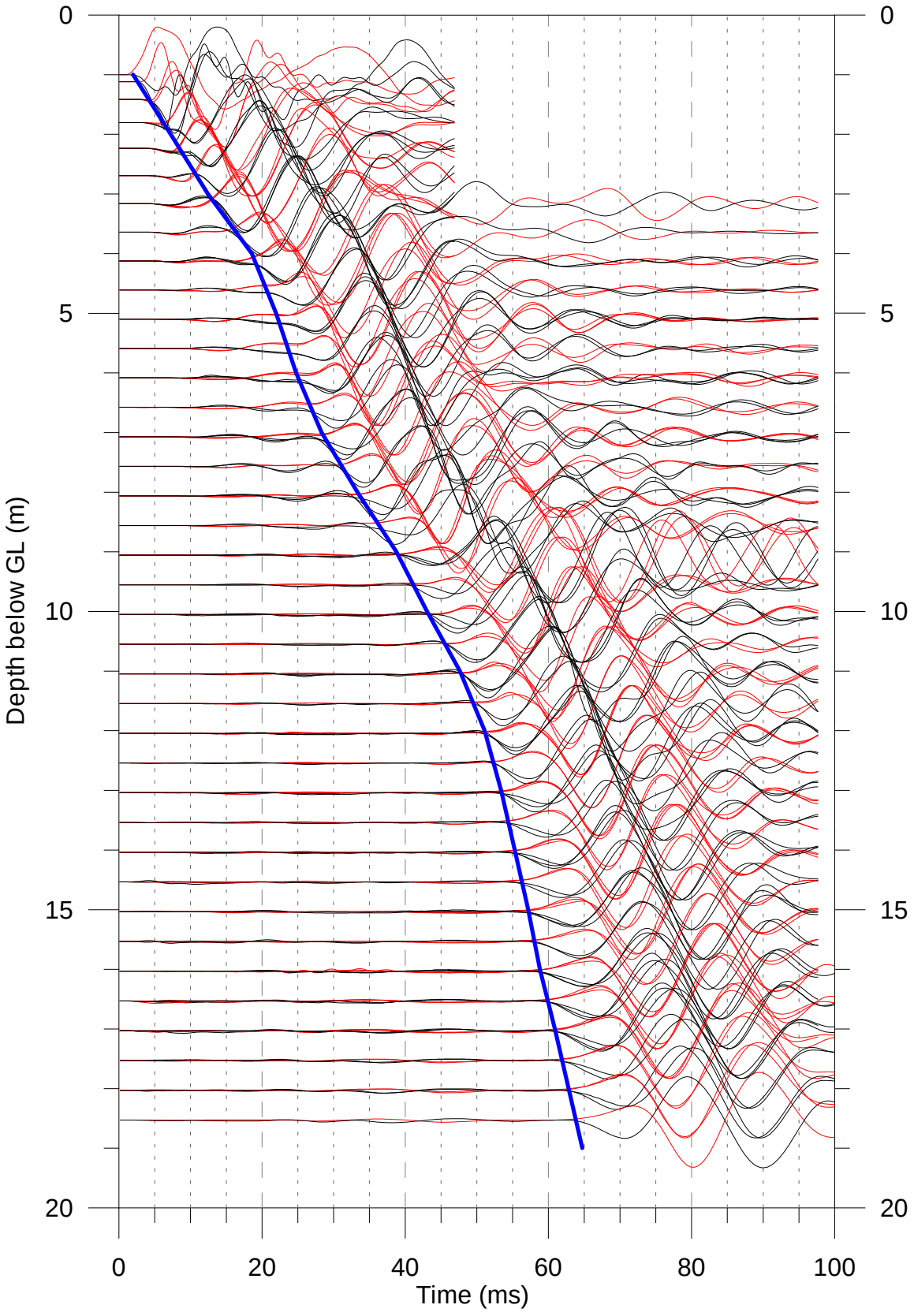


Figure B2: Compression Wave Velocity Time History, BH601

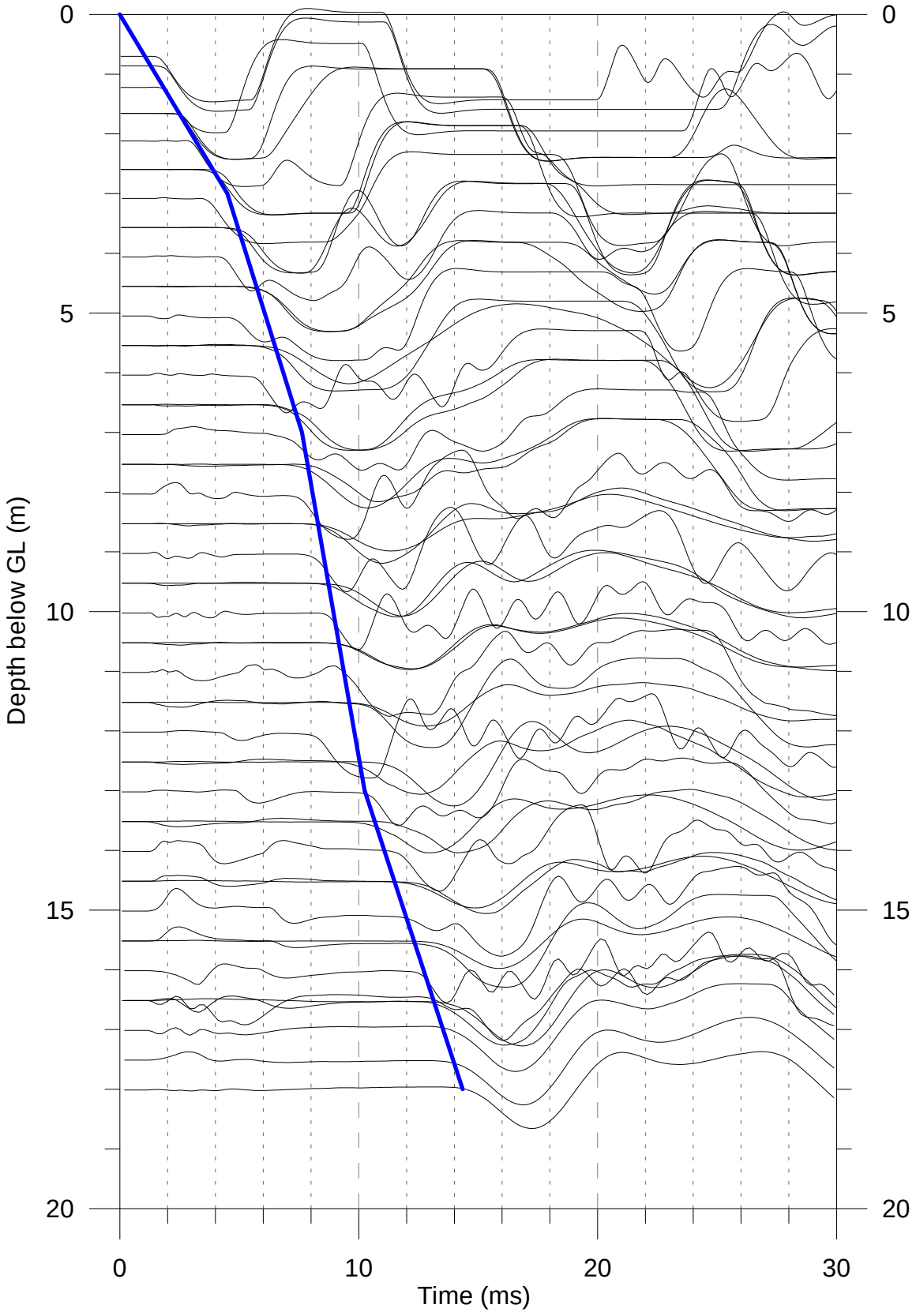


Figure B3: Shear Wave Velocity Time History, BH603

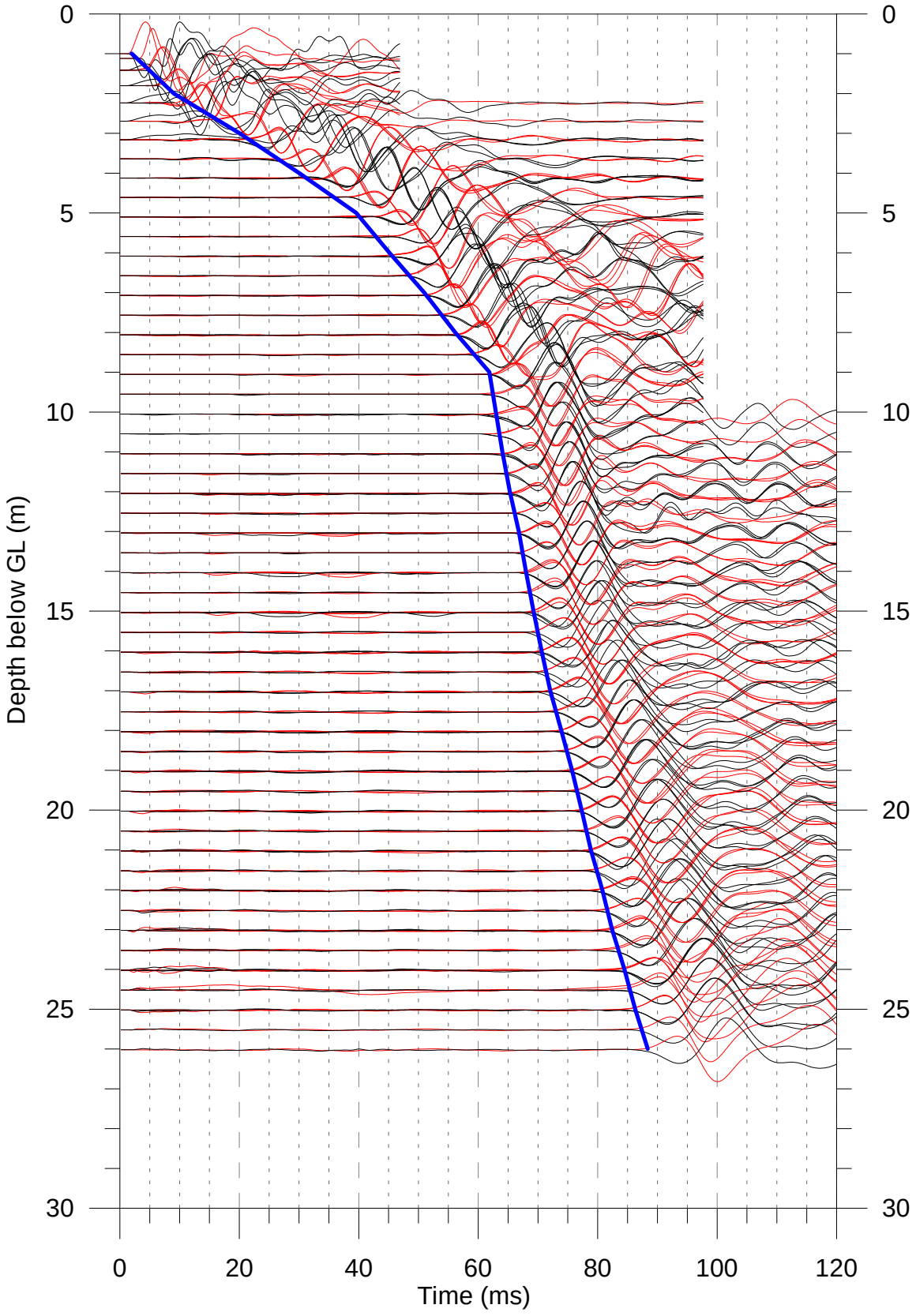


Figure B4: Compression Wave Velocity Time History, BH603

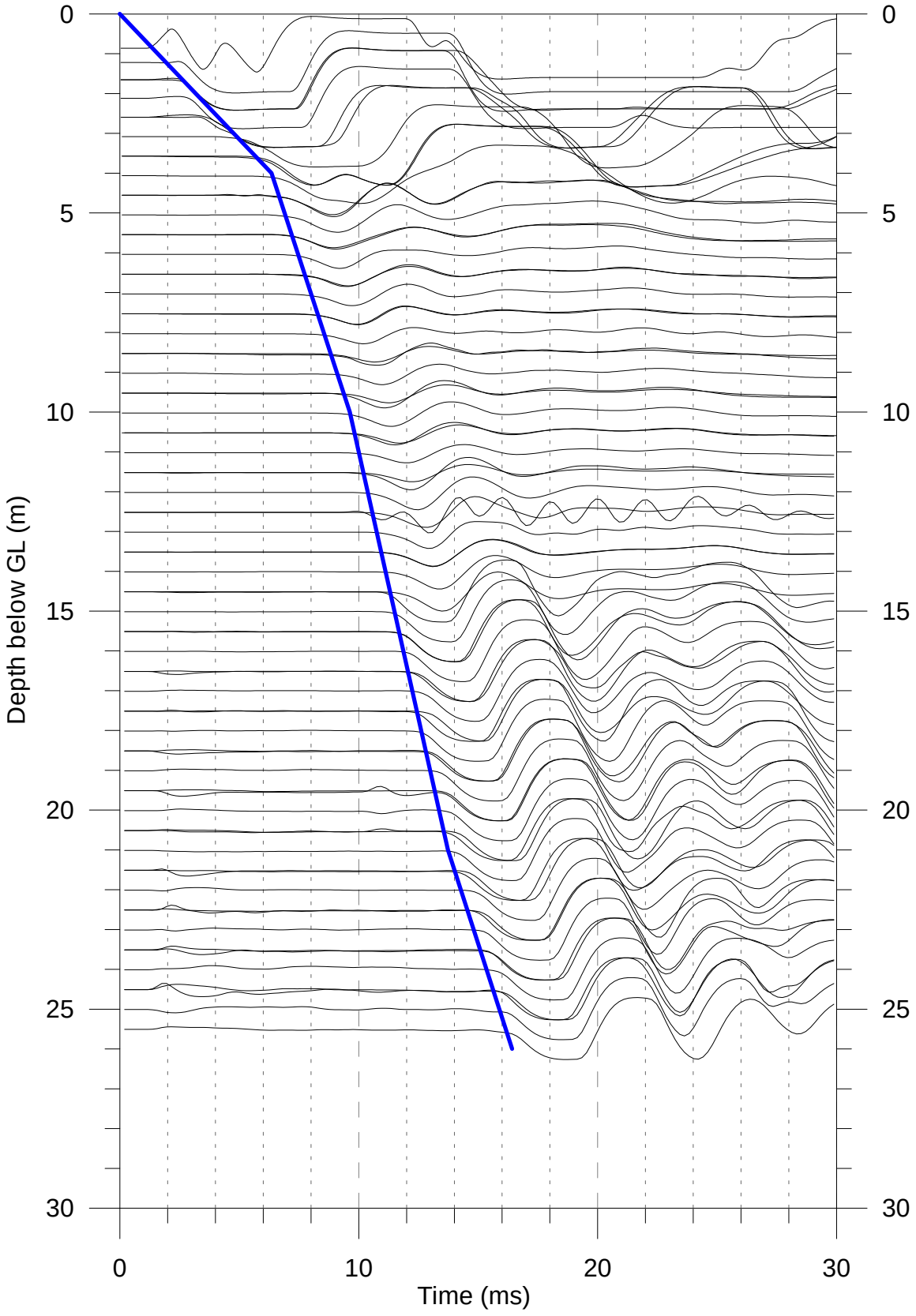


Figure B5: Shear Wave Velocity Time History, BH604

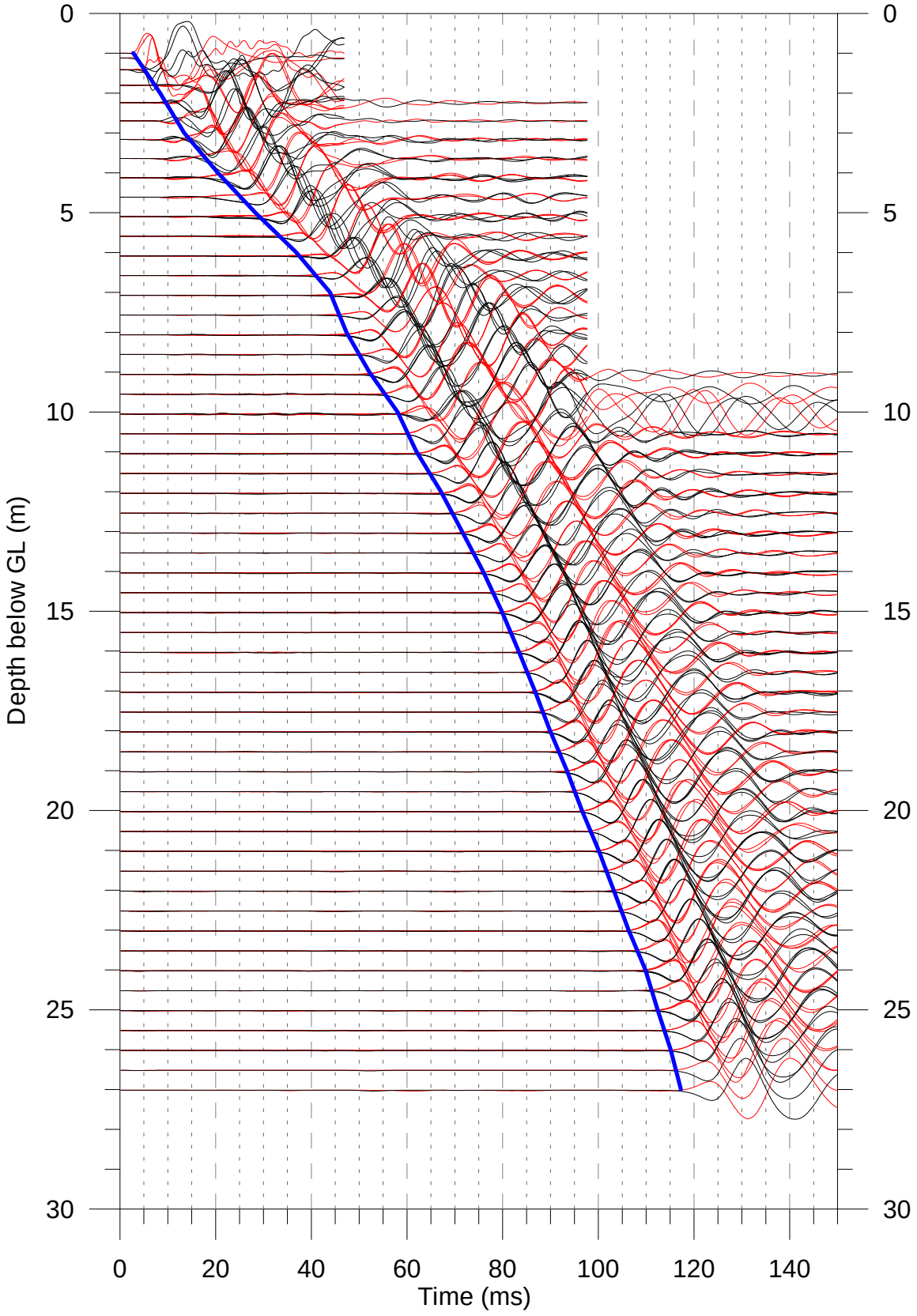


Figure B6: Compression Wave Velocity Time History, BH604

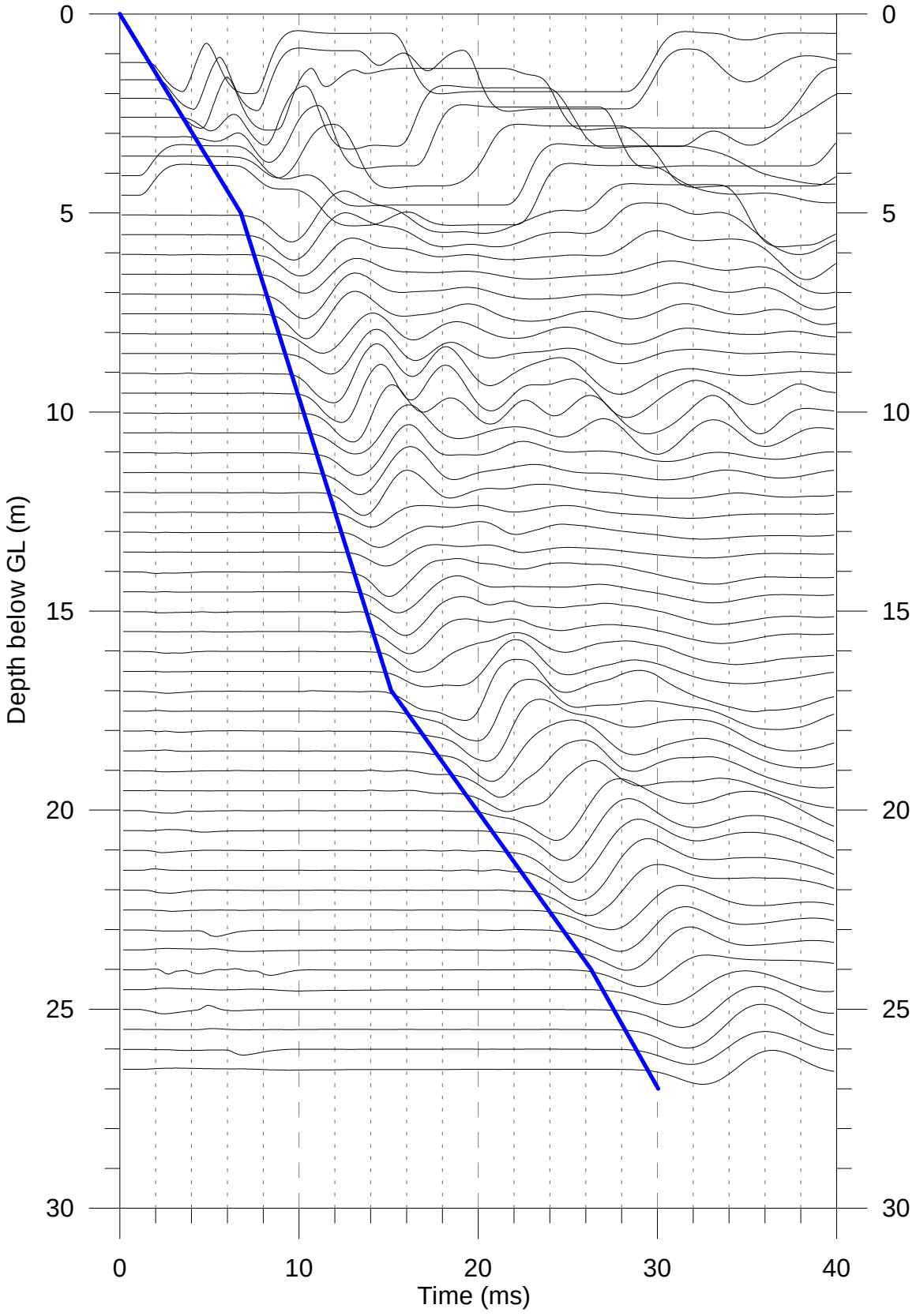


Figure B7: Shear Wave Velocity Time History, BH606

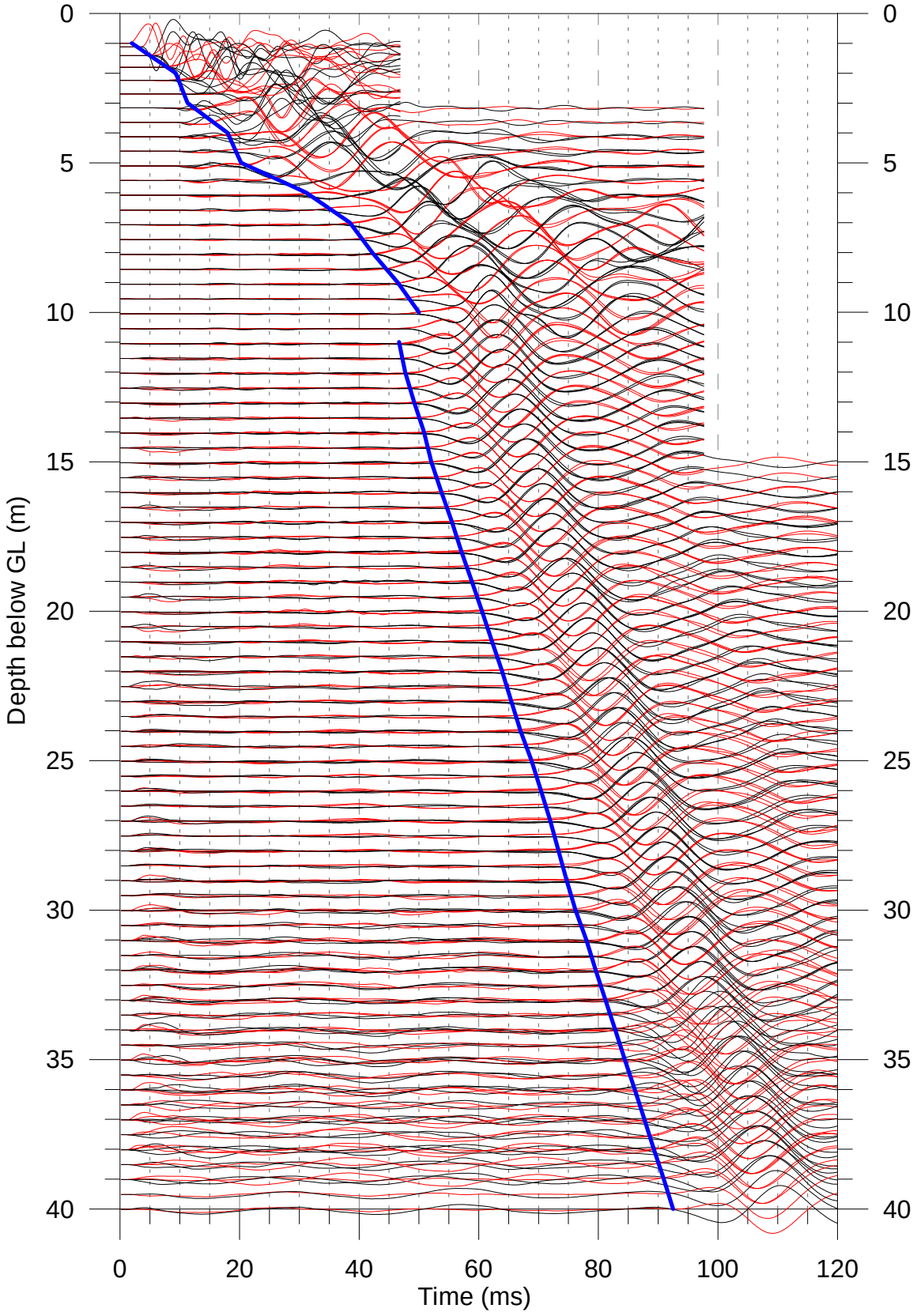
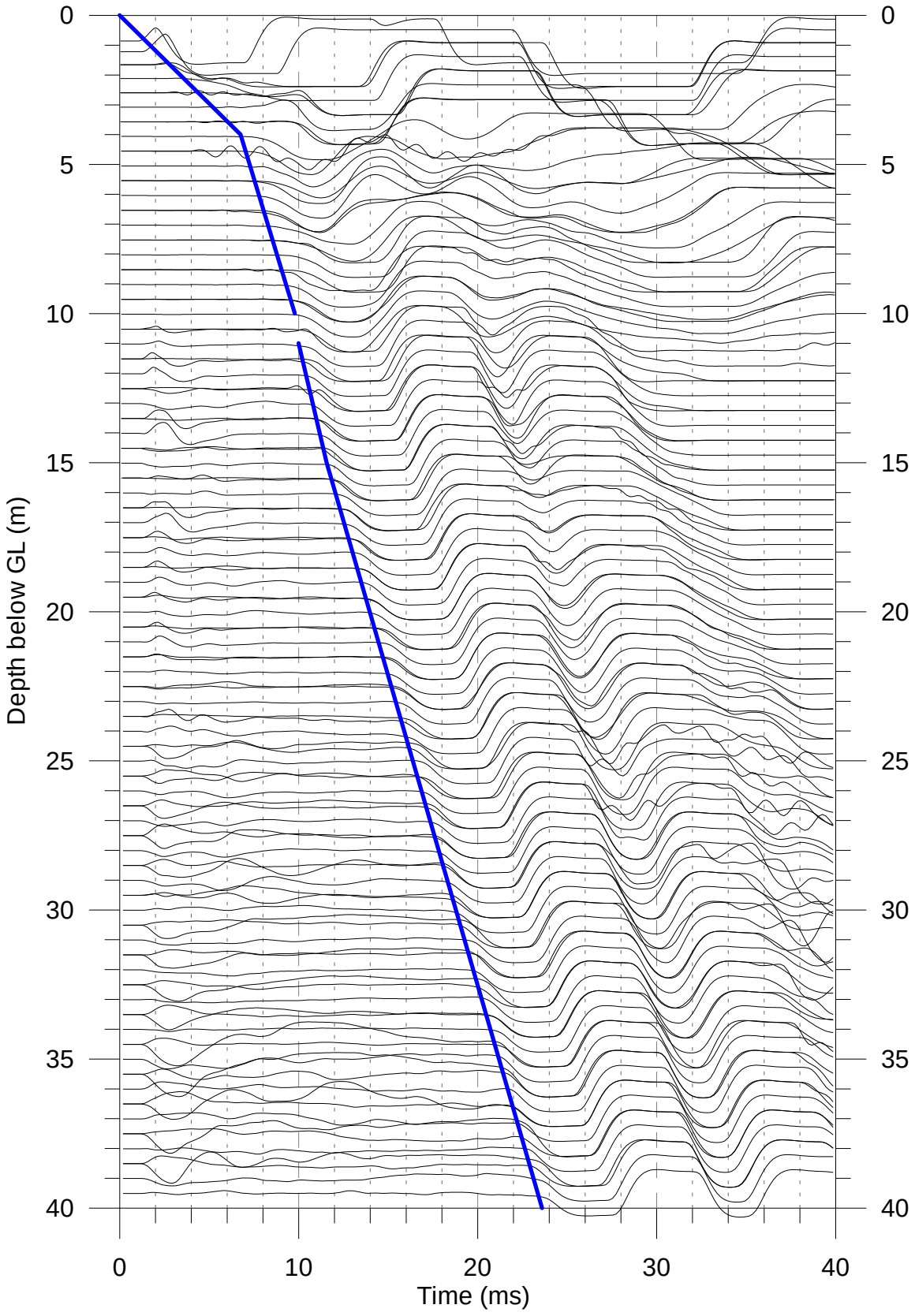


Figure B8: Compression Wave Velocity Time History, BH606



Appendix G

Laboratory Test Results

21 Pitt Street
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Auckland 1141
Ph. 300-9380

SUMMARY OF TEST RESULTS

Report:
1871L:01

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/500

Client: Port of Napier Ltd **Date:** 23 December 2015

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Unconfined Cpmpressive Strength
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH601	N867	2.7-2.95	SD	Fine to medium sandy SILT, some clay; light yellowish grey, speckled orange; moist, highly plastic.	26.5				X							
BH601	N868	8.9-9.55	SD	Fine to medium sandy clayey SILT; greenish grey; wet, moderately plastic.	30.9		X	X	X							
BH602	N869	5.5-5.8	SD	Fine to medium SAND, trace clay; greenish grey; moist, non plastic.	25.4				X							
BH602	N870	16.15 -16.4	SD	Fine to coarse SAND, some silt, minor clay, trace fine gravel; greenish grey; moist, non plastic.	26.2				X							
BH603	N871	3.45-3.7	SD	Fine to medium SAND, trace clay, trace silt; greenish grey; moist, non plastic.	23.1				X							
BH603	N881	18.9-19.1	CORE	Very weak light yellowish brown SANDSTONE	20.2											X
BH603	N882	21.65 -21.9	CORE	Very weak light yellowish grey SANDSTONE	17.5											X
BH603	N883	25.0-25.2	CORE	Extremely weak bluish grey SILTSTONE	17.9											X
BH604	N872	5.0-5.3	SD	Fine to medium SAND, minor clay, trace silt; greenish grey; moist, non plastic.	25.2				X							
BH604	N873	9.65-9.9	SD	Clayey SILT, some fine sand, trace shells; greenish grey; wet, moderately plastic.	31.3		X	X	X							

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

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.3.1,
ASTM D422-63
ASTM D2938-95

AUTHORISED SIGNATORY

N.Agarkova – Authorised Signatory

Sheet 1 of 22

21 Pitt Street
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Auckland 1141
Ph. 300-9380

SUMMARY OF TEST RESULTS

Report:
1871L:01

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/500

Client: Port of Napier Ltd **Date:** 23 December 2015

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Unconfined Compressive Strength
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH605	N874	9.8-10.05	SD	Clayey SILT, minor fine sand, trace shells; greenish grey; wet, moderately plastic.	32.4		X	X	X							
BH605	N875	13.3-13.6	SD	Fine to medium SAND, some silt, minor clay; greenish grey; wet, non plastic.	24.5				X							
BH605	N884	17.15 -17.3	CORE	Weak light bluish grey SANDSTONE.	12.8											2X
BH605	N885	20.95 -21.1	CORE	Weak yellowish grey SANDSTONE.	10.6											X
BH606	N876	8.2-8.5	SD	Silty fine to coarse SAND, minor clay, trace fine gravel; greenish grey; wet, non plastic.	25.7				X							
BH606	N886	19.75 -20.0	CORE	Very weak yellowish grey SANDSTONE.	17.8											X
BH607	N877	8.3-8.6	SD	Fine to coarse sandy fine to medium GRAVEL, some silt, minor clay; greenish grey; wet, non plastic.	13.4				X					X		
BH607	N887	17.5-17.7	CORE	Extremely weak light bluish grey SANDSTONE.	19.1											X
BH607	N890	19.75 19.95	CORE	Very weak yellowish grey SANTSTONE.	12.8											X
BH608	N878	12.55 -12.8	SD	Clayey SILT, some fine to coarse sand, trace fine gravel; dark greenish grey; wet, highly plastic.	40.2		X	X	X							

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

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

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.3.1,
ASTM D422-63
ASTM D2938-95

AUTHORISED SIGNATORY

N.Agarkova – Authorised Signatory

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SUMMARY OF TEST RESULTS

Report:
1871L:01

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/500

Client: Port of Napier Ltd **Date:** 23 December 2015

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Unconfined Compressive Strength
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH609	N879	3.0-3.8	SD	Organic fine to coarse sandy clayey SILT; dark greyish brown; wet, highly plastic.	101		X	X	X							
BH609	N880	4.0-4.95	SD	Fine to coarse SAND, minor silt, minor clay; dark brownish grey; wet, non plastic.	50.7				X							
BH609	N889	11.3-11.5	CORE	Moderately strong bluish grey SANDSTONE.	7.1											X

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

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

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.3.1,
ASTM D422-63
ASTM D2938-95

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Sheet 3 of 22

Geotest

21 Pitt Street
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Auckland 1141
Ph: (09) 300-9380

ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 23 December 2015

Job No: 3124410/500

Report No: 1871L:01

Client: Port of Napier Ltd

Tested By: S.Shah

Sample Type: Small Disturbed

Checked By: N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4,2.5

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
BH601	N868	8.9-9.55	Fine to medium sandy clayey SILT; greenish grey; wet, moderately plastic.	30.9	40	-	20	**20**
BH604	N873	9.65-9.90	Clayey SILT, some fine sand, trace shells; greenish grey; wet, moderately plastic.	31.3	40	-	20	**20**
BH605	N874	9.8-10.05	Clayey SILT, minor fine sand, trace shells; greenish grey; wet, moderately plastic.	32.4	46	-	22	**24**
BH608	N878	12.55-12.80	Clayey SILT, some fine to coarse sand, trace fine gravel; dark greenish grey; wet, highly plastic.	40.2	51	-	24	**27**
BH609	N879	3.0-3.8	Organic fine to coarse sandy clayey organic SILT; dark greyish brown; wet, highly plastic.	101	-	98	63	**35**

Comments:

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Authorised Signatory: .....
N. Agarkova – Authorised Signatory

Geotest

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

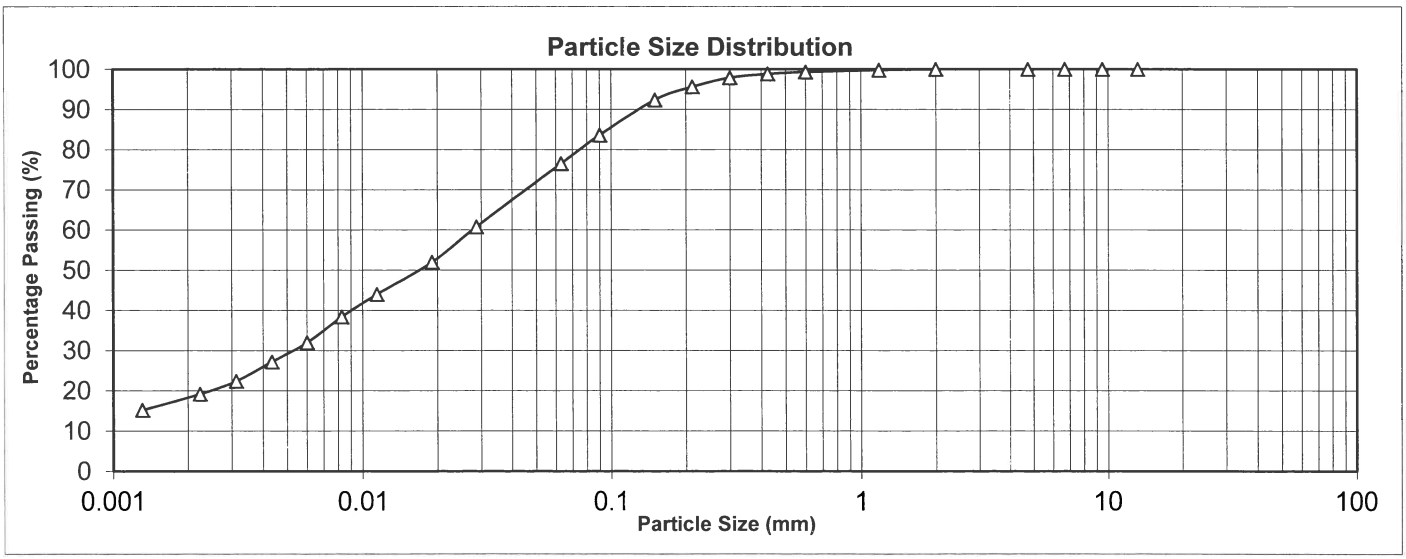
Bore No.: BH601
Sample No.: N867
Depth (m): 2.7-2.95

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to medium sandy SILT, some clay; light yellowish grey, speckled orange; moist, highly plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	98
19.0mm	100	212µm	96
13.2mm	100	150µm	92
9.50mm	100	90µm	84
6.70mm	100	63µm	77
4.75mm	100	<63µm	77



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
18	57	25	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

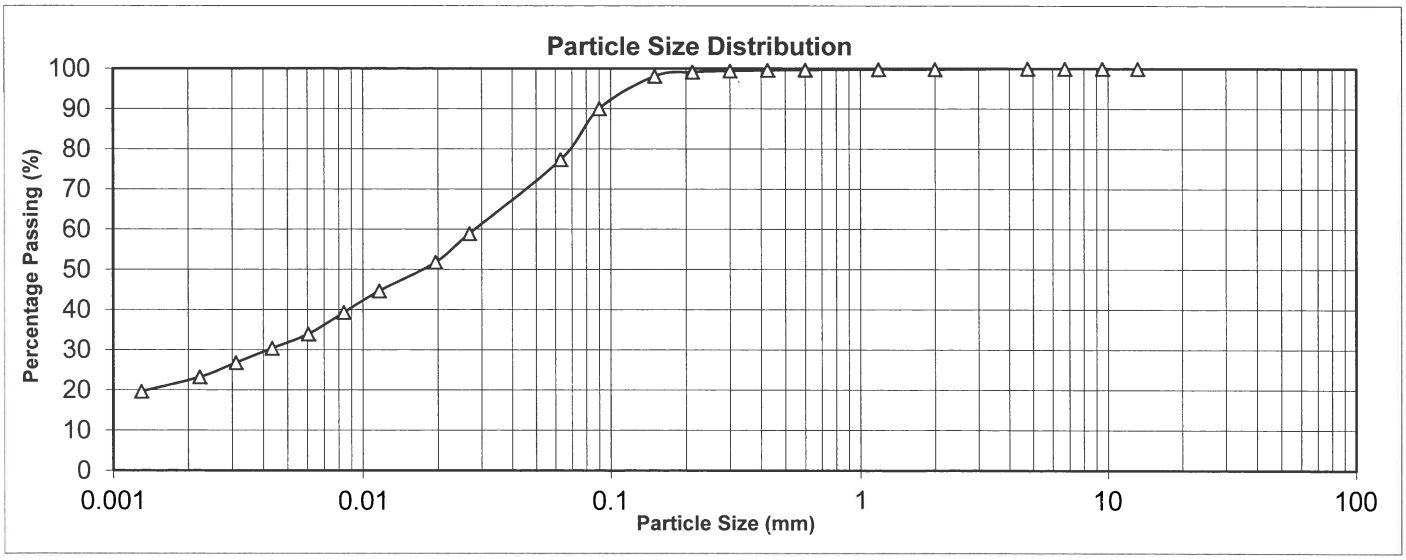
Bore No.: BH601
Sample No.: N868
Depth (m): 8.9-9.55

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to medium sandy clayey SILT; greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	90
6.70mm	100	63µm	77
4.75mm	100	<63µm	77



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
22	54	24	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH602
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: N869
History: As Received

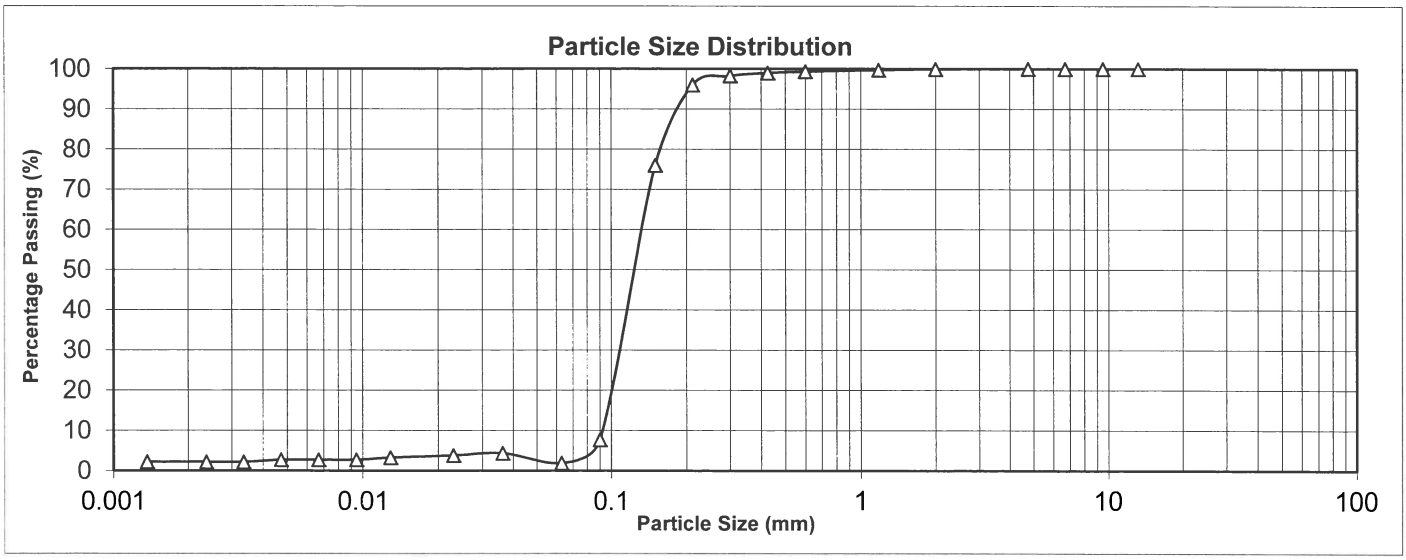
Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 5.5-5.8
Report No.: 1871L:01

Sample Description: Fine to medium SAND, trace clay; greenish grey; moist, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	98
19.0mm	100	212µm	96
13.2mm	100	150µm	76
9.50mm	100	90µm	8
6.70mm	100	63µm	2
4.75mm	100	<63µm	2



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
2	0	98	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

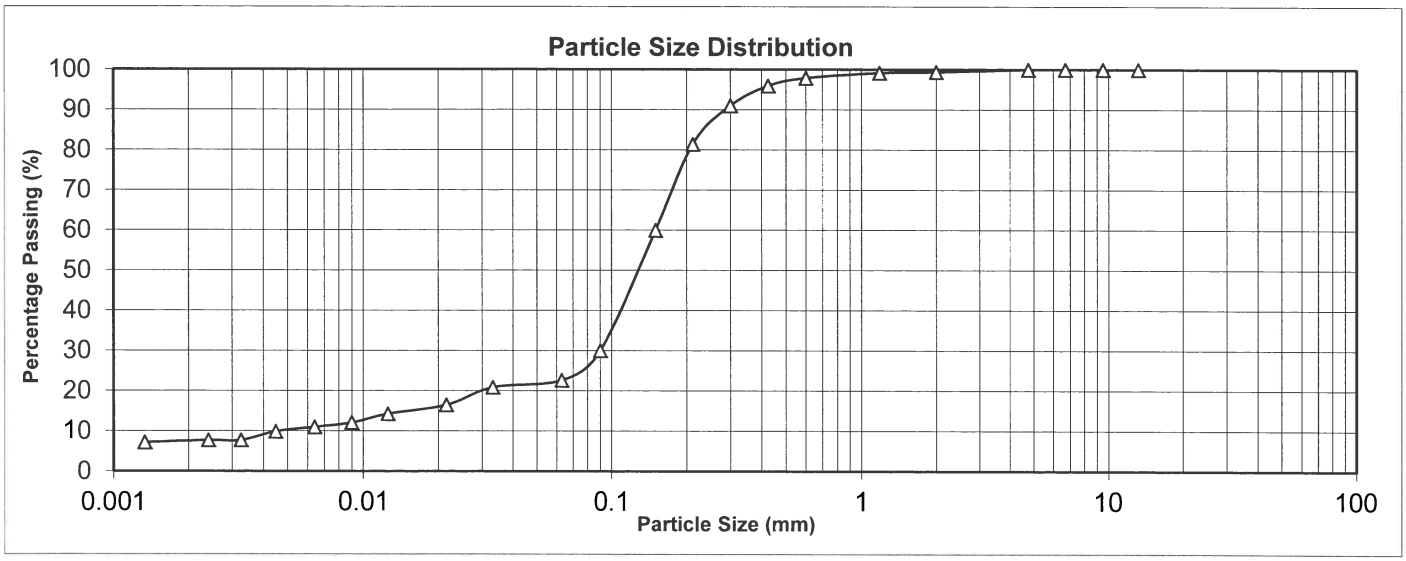
Bore No.: BH602
Sample No.: N870
Depth (m): 16.15-16.4

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to coarse SAND, some silt, minor clay, trace fine gravel; greenish grey; moist, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600μm	98
37.5mm	100	425μm	96
26.5mm	100	300μm	91
19.0mm	100	212μm	81
13.2mm	100	150μm	60
9.50mm	100	90μm	30
6.70mm	100	63μm	23
4.75mm	100	<63μm	23



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
7	15	77	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH603
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: N871
History: As Received

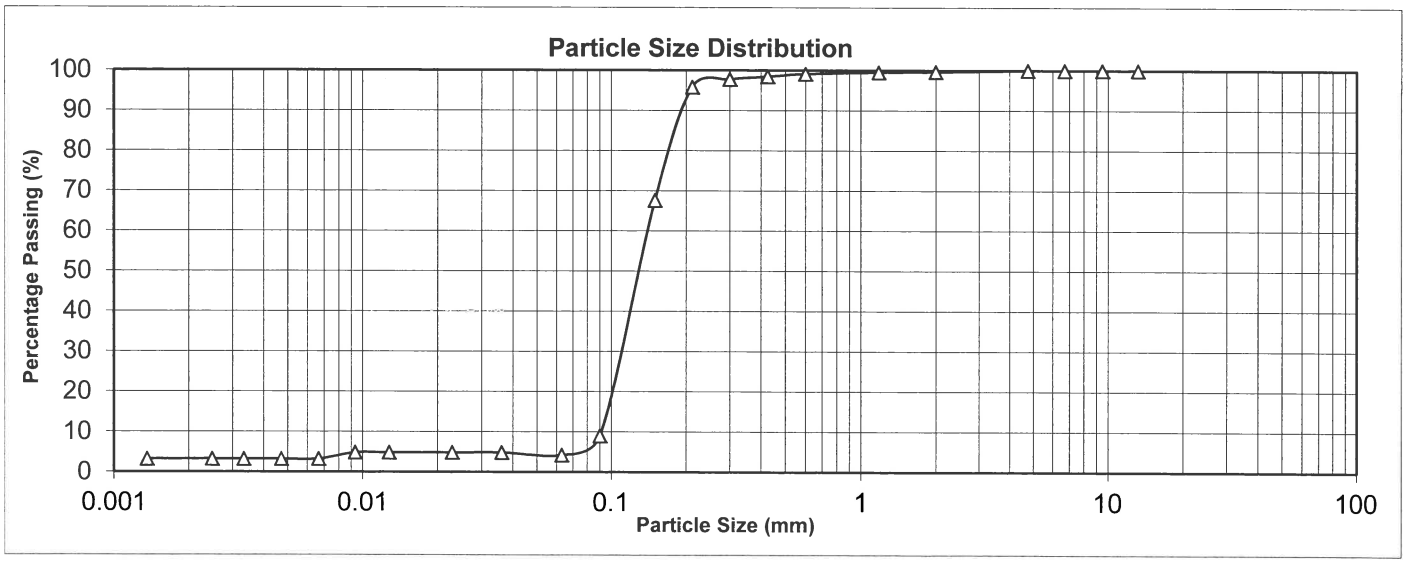
Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 3.45-3.70
Report No.: 1871L:01

Sample Description: Fine to medium SAND, trace clay, trace silt; greenish grey; moist, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	98
26.5mm	100	300µm	98
19.0mm	100	212µm	96
13.2mm	100	150µm	68
9.50mm	100	90µm	9
6.70mm	100	63µm	4
4.75mm	100	<63µm	4



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
3	1	96	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

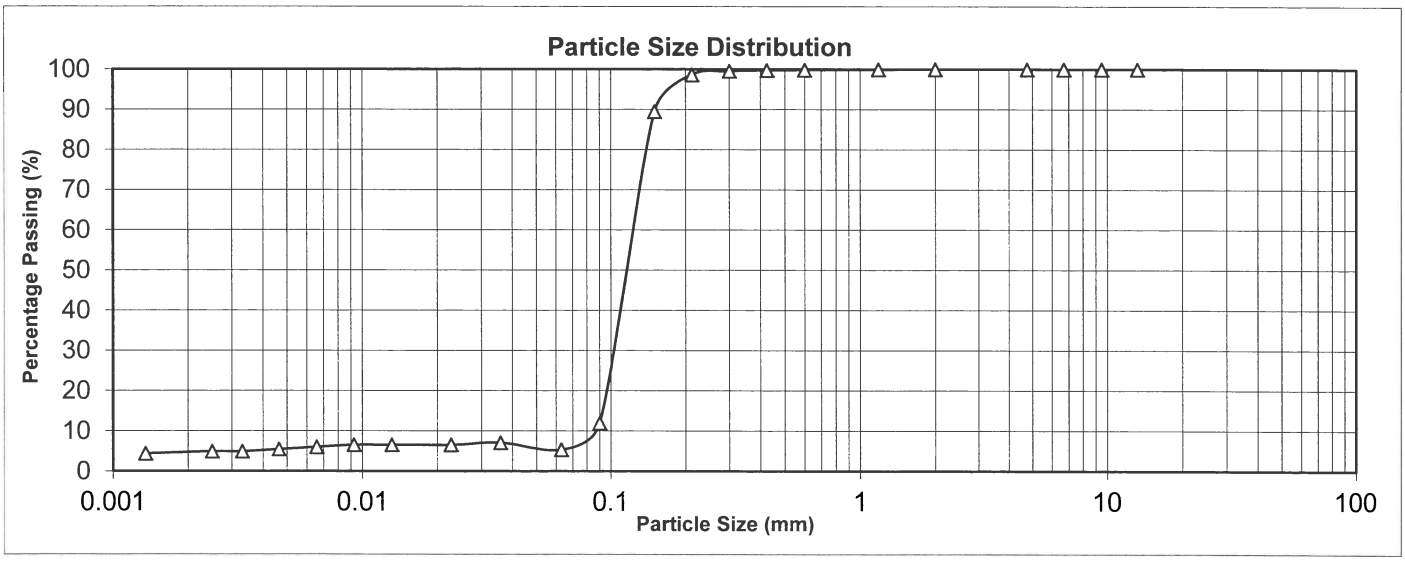
Bore No.: BH604
Sample No.: N872
Depth (m): 5.0-5.3

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to medium SAND, minor clay, trace silt; greenish grey; moist, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	89
9.50mm	100	90µm	12
6.70mm	100	63µm	5
4.75mm	100	<63µm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
5	1	94	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

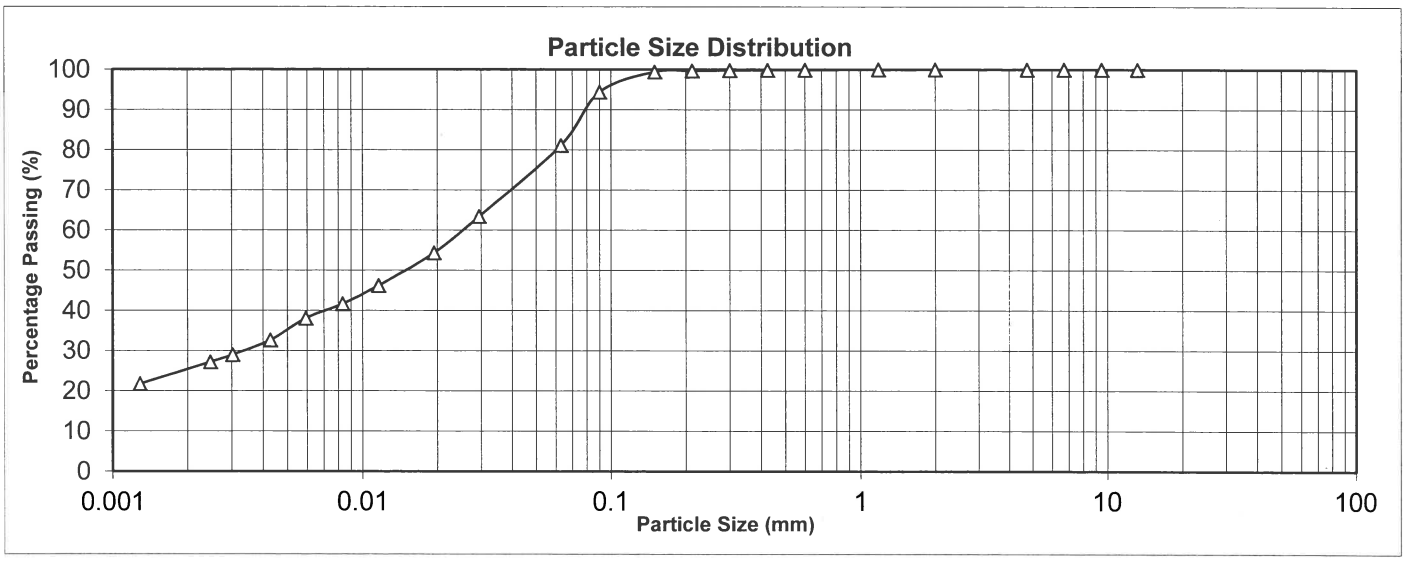
Bore No.: BH604
Sample No.: N873
Depth (m): 9.65-9.90

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Clayey SILT, some fine sand, trace shells; greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	94
6.70mm	100	63µm	81
4.75mm	100	<63µm	81



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
25	55	20	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

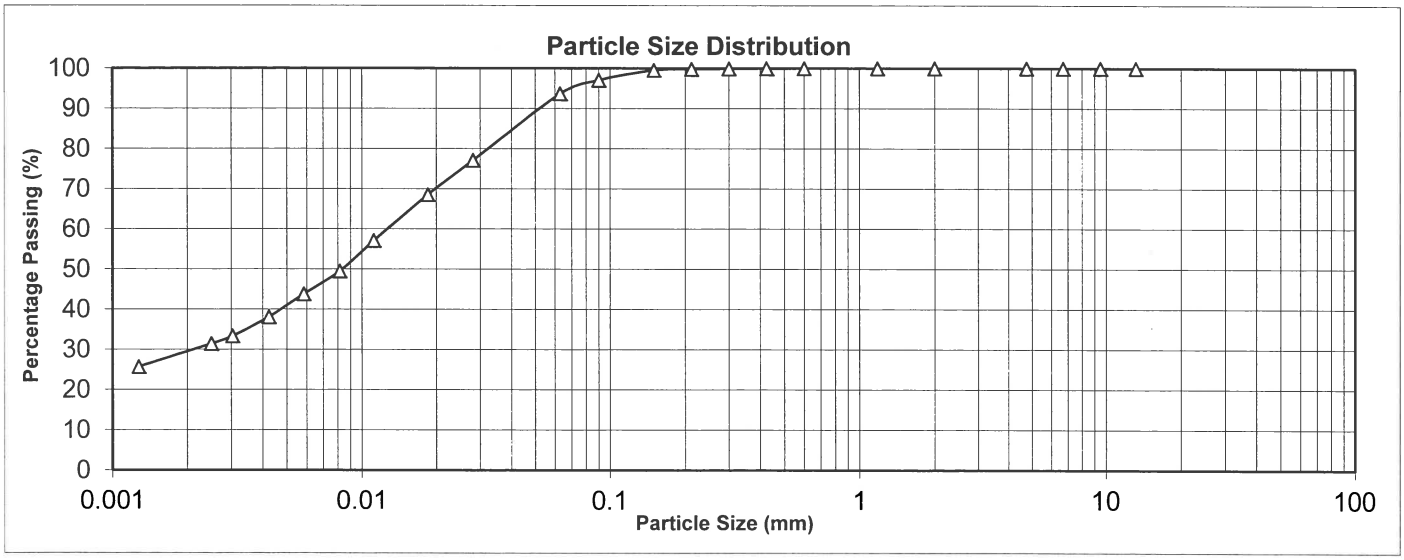
Bore No.: BH605
Sample No.: N874
Depth (m): 9.8-10.05

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Clayey SILT, minor fine sand, trace shells; greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	97
6.70mm	100	63µm	94
4.75mm	100	<63µm	94



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
29	63	8	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015

Job No.: 3124410/500
Tested By: S.Shah/ H.Alexander
Checked By: N.Agarkova/ S.Shah

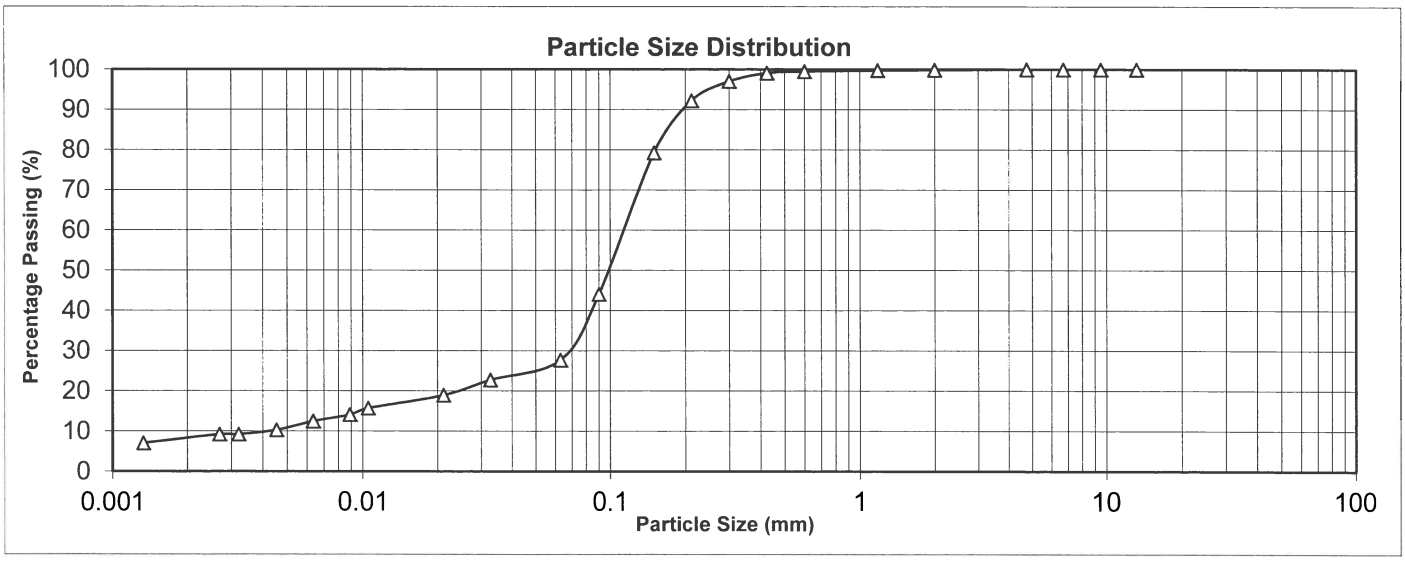
Bore No.: BH605
Sample No.: N875
Depth (m): 13.3-13.6

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to medium SAND, some silt, minor clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600μm	100
37.5mm	100	425μm	99
26.5mm	100	300μm	97
19.0mm	100	212μm	92
13.2mm	100	150μm	79
9.50mm	100	90μm	44
6.70mm	100	63μm	28
4.75mm	100	<63μm	28



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
8	19	73	0	425μm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH606
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ H.Alexander
Sample No.: N876
History: As Received

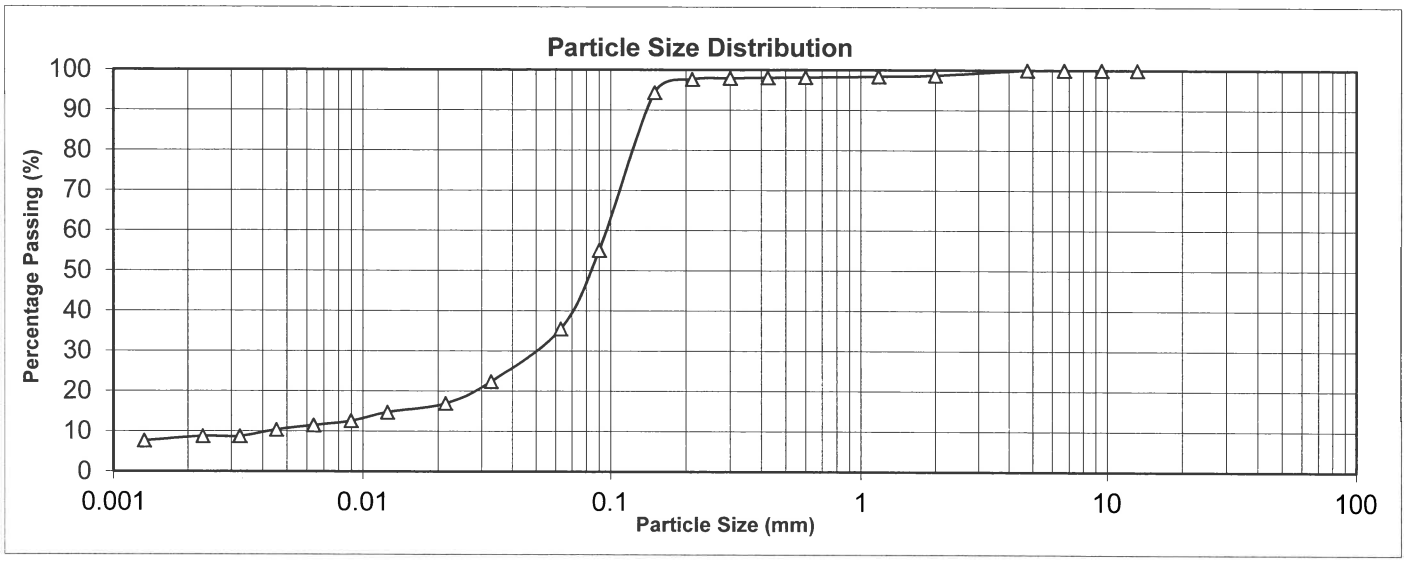
Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 8.2-8.5
Report No.: 1871L:01

Sample Description: Silty fine to coarse SAND, minor clay, trace fine gravel; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	98
53.0mm	100	600μm	98
37.5mm	100	425μm	98
26.5mm	100	300μm	98
19.0mm	100	212μm	98
13.2mm	100	150μm	94
9.50mm	100	90μm	55
6.70mm	100	63μm	36
4.75mm	100	<63μm	36



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
8	26	65	1	2.00mm

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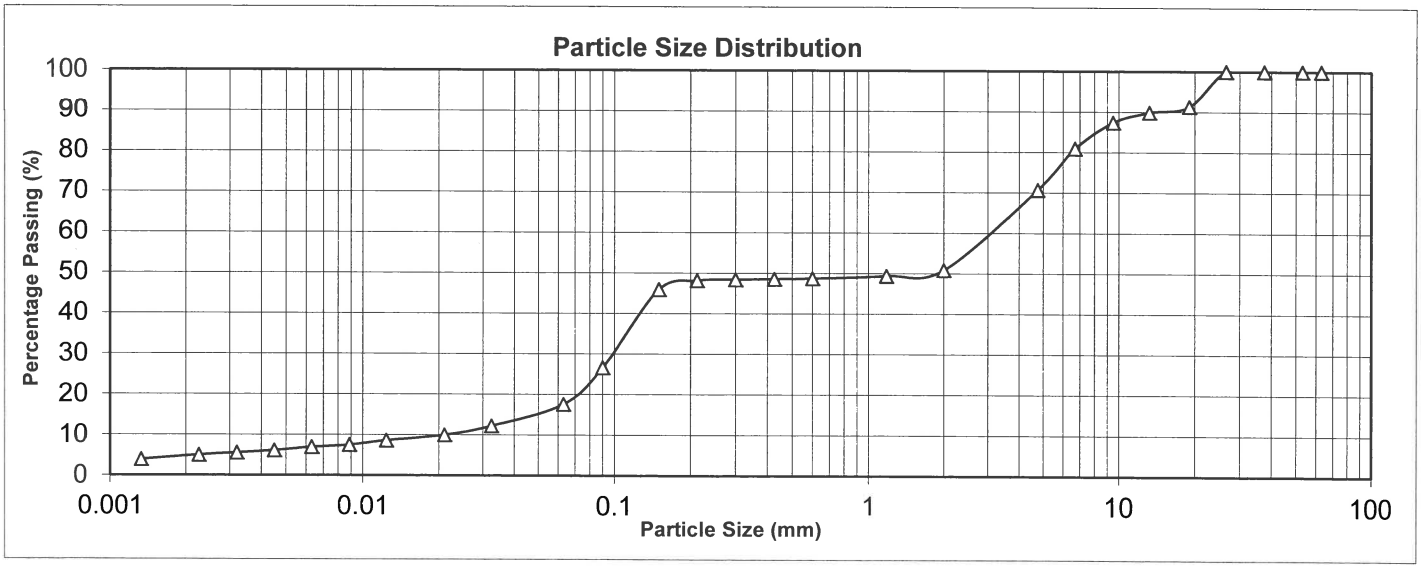
PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 December 2015
Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah
Bore No.: BH607
Sample No.: N877
Depth (m): 8.3-8.6
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:01

Sample Description: Fine to coarse sandy fine to medium GRAVEL, some silt, minor clay; greenish grey; wet, non plastic.
Test Standard: ASTM D422-63
NZS4402: 1986; Test 2.8.1
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	51
63.0mm	100	1.18mm	49
53.0mm	100	600μm	49
37.5mm	100	425μm	49
26.5mm	100	300μm	48
19.0mm	91	212μm	48
13.2mm	90	150μm	46
9.50mm	87	90μm	27
6.70mm	81	63μm	18
4.75mm	71	<63μm	18



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
5	12	34	49	19mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

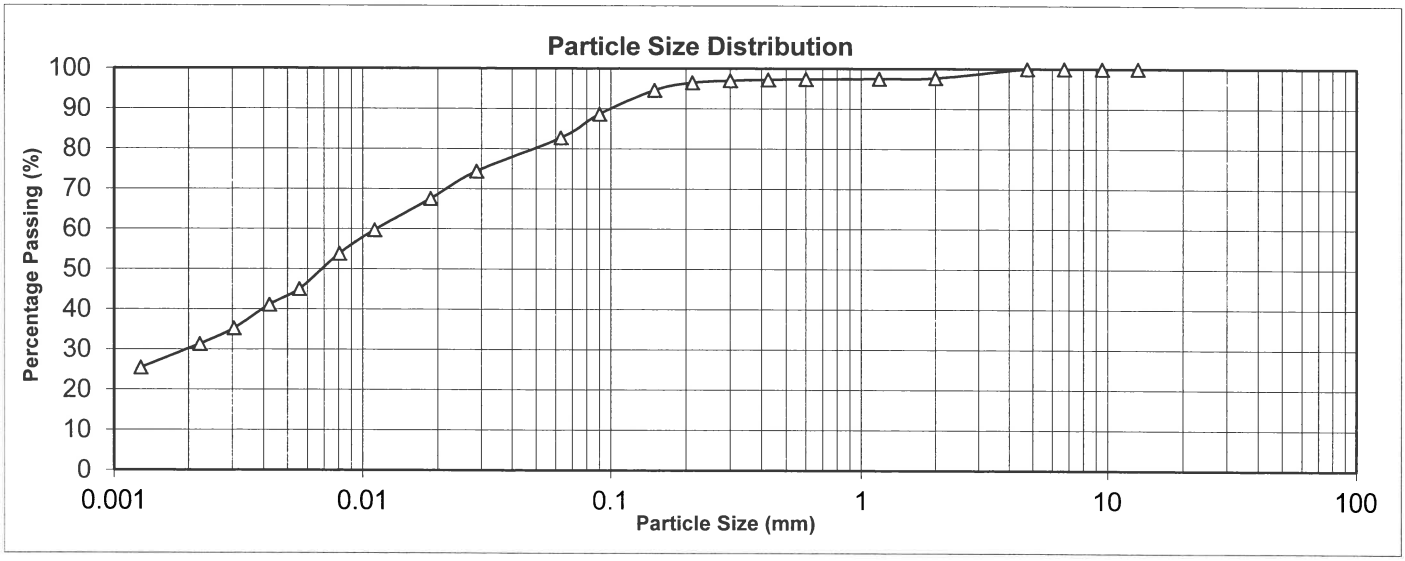
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH608
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ H.Alexander
Sample No.: N878
History: As Received

Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 12.55-12.80
Report No.: 1871L:01

Sample Description: Clayey SILT, some fine to coarse sand, trace fine gravel; dark greenish grey; wet, highly plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	98
63.0mm	100	1.18mm	98
53.0mm	100	600μm	97
37.5mm	100	425μm	97
26.5mm	100	300μm	97
19.0mm	100	212μm	96
13.2mm	100	150μm	95
9.50mm	100	90μm	89
6.70mm	100	63μm	83
4.75mm	100	<63μm	83



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
30	52	16	2	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH609
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ H.Alexander
Sample No.: N879
History: As Received

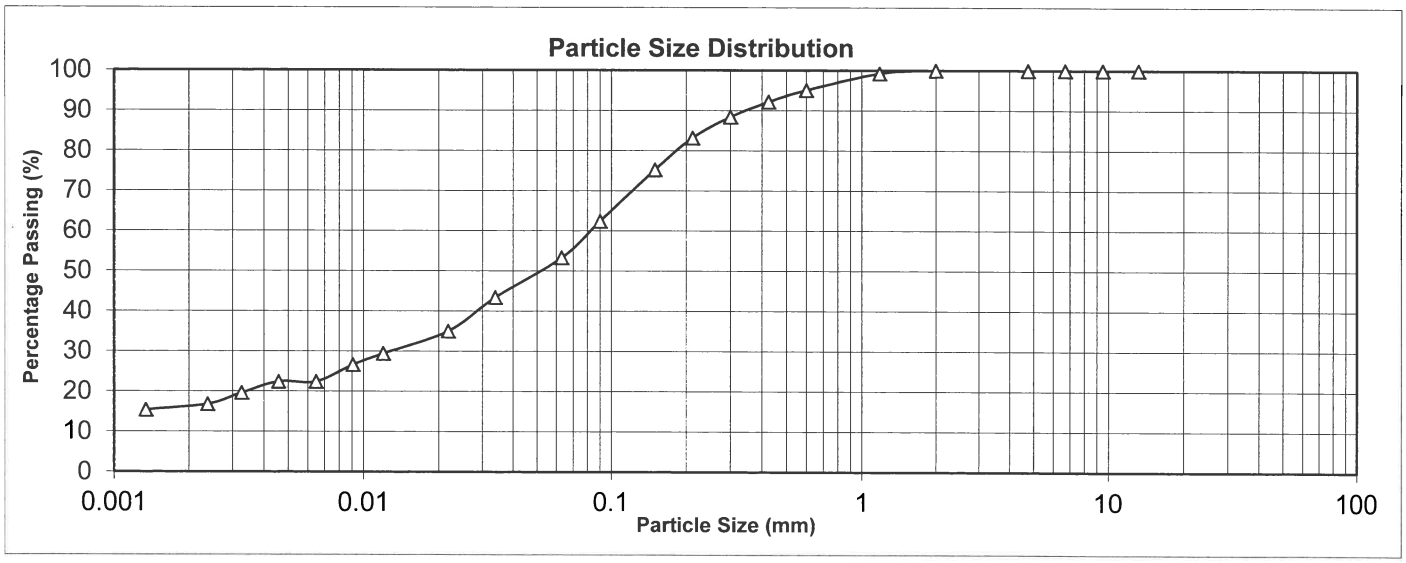
Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 3.0-3.8
Report No.: 1871L:01

Sample Description: Organic fine to coarse sandy clayey SILT; dark greyish brown; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600μm	95
37.5mm	100	425μm	92
26.5mm	100	300μm	88
19.0mm	100	212μm	83
13.2mm	100	150μm	75
9.50mm	100	90μm	62
6.70mm	100	63μm	53
4.75mm	100	<63μm	53



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
16	36	48	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Bore No.: BH609
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ H.Alexander
Sample No.: N880
History: As Received

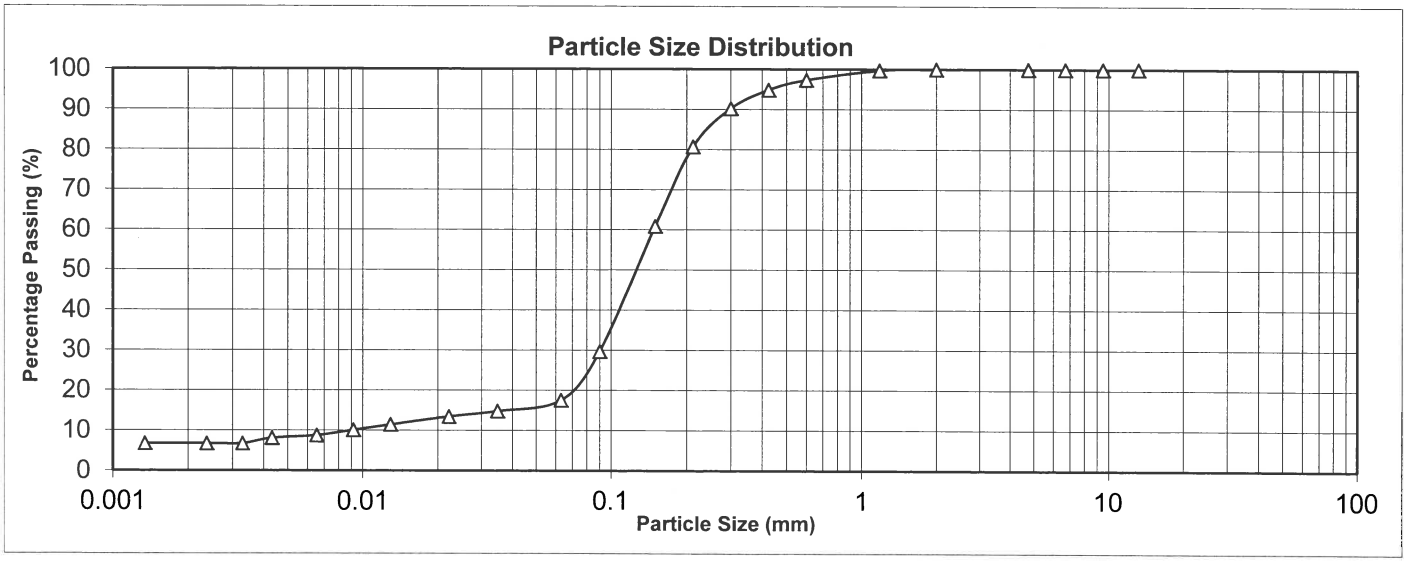
Date: 23 December 2015
Checked By: N.Agarkova/ S.Shah
Depth (m): 4.0-4.95
Report No.: 1871L:01

Sample Description: Fine to coarse SAND, minor silt, minor clay; dark brownish grey; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	97
37.5mm	100	425µm	95
26.5mm	100	300µm	90
19.0mm	100	212µm	81
13.2mm	100	150µm	61
9.50mm	100	90µm	30
6.70mm	100	63µm	18
4.75mm	100	<63µm	18



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
7	10	83	0	600µm

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UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd.
Date: 23 December 2015
Job No.: 3124410/500
Location: -
Report No: 1871L:01

Sample Description (881): Very weak light yellowish brown SANDSTONE

Sample Description (882): Very weak light yellowish grey SANDSTONE

Sample Description (883): Extremely weak bluish grey SILTSTONE

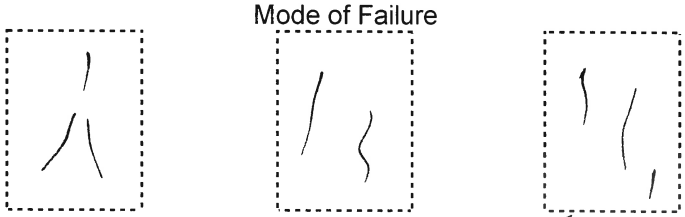
Sample Type: Core
Tested By: N.Agarkova
Checked By: S.Shah

Test Standard: NZS 4402: 1986, Test 6.3.1/ASTM D2166-91/D2938-95/RRUTR 7 Test 6

History:

Sample Reference		881	882	883
Borehole No.		BH603	BH603	BH603
Depth	(m)	18.9-19.1	21.65-21.9	25.0-25.2
Date Tested		7/12/2015	7/12/2015	7/12/2015
Length	(mm)	122.8	99.5	122.9
Diameter	(mm)	60.1	59.7	60.4
Volume	(mm^3)	348000	279000	352000
Bulk Density	(t/m^3)	2.07	2.12	2.10
Water Content	(%)	20.2	17.5	17.9
Dry Density	(t/m^3)	1.70	1.80	1.80
Unconfined Compressive Strength (UCS)	(kPa)	1300	3000	760
Rate of Strain	(mm/min)	0.14	0.16	0.19
Strain at Failure	(%)	0.67	1.3	1.5
Mode of Failure		Cone	Columnar	Columnar

Mode of Failure



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UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd.
Date: 23 December 2015
Job No.: 3124410/500
Location: -
Report No: 1871L:01

Sample Description (N884): Weak light bluish grey SANDSTONE.

Sample Description (N887): Extremely weak light bluish grey SANDSTONE.

Sample Description (N890): Very weak yellowish grey SANTSTONE.

Sample Type: Core
Tested By: N.Agarkova
Checked By: S.Shah

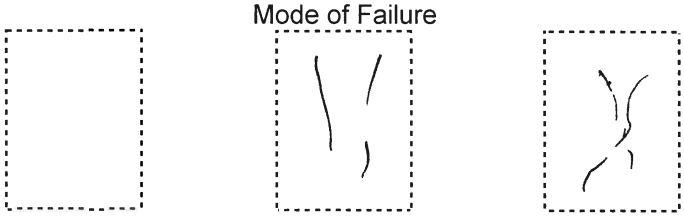
Test Standard: ASTM D2938-95

History: As Received

Sample Reference		N884*	N887	N890
Borehole No.		BH605	BH607	BH607
Depth	(m)	17.15-17.30	17.5-17.7	19.75-19.95
Date Tested		7/12/2015	7/12/2015	7/12/2015
Length	(mm)	106.5	121.7	115.8
Diameter	(mm)	60.8	59.1	62.1
Volume	(mm^3)	309000	334000	350000
Bulk Density	(t/m^3)	2.20	2.11	2.25
Water Content	(%)	12.8	19.1	12.8
Dry Density	(t/m^3)	1.95	1.75	2.00
Unconfined Compressive Strength (UCS)	(kPa)	>13000	940	2100
Rate of Strain	(mm/min)	0.13	0.15	0.14
Strain at Failure	(%)	1.6	1.1	0.9
Mode of Failure		-	Columnar	Cone

Comments: *Sample strength exesided equipment capability

Mode of Failure



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UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Client: Port of Napier Ltd.
Location: -
Date: December 2015
Report No: 1871L:01

Sample Description (N885): Weak yellowish grey SANDSTONE.

Sample Description (886): Very weak yellowish grey SANDSTONE.

Sample Description (889): Moderately strong bluish grey SANDSTONE.

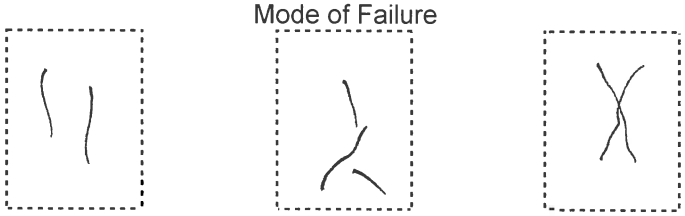
Sample Type: Core
Tested By: N.Agarkova
Checked By: S.Shah

Test Standard: NZS 4402: 1986, Test 6.3.1

History: As Received

Sample Reference		N885	B886	N889
Borehole No.		BH605	BH606	BH609
Depth	(m)	20.95-21.1	19.75-20.0	11.3-11.5
Date Tested		22/12/2015	22/12/2015	22/12/2015
Length	(mm)	105.9	125.1	124.8
Diameter	(mm)	61.1	60.7	59.4
Volume	(mm^3)	310000	362000	346000
Bulk Density	(t/m^3)	2.22	2.11	2.44
Water Content	(%)	10.6	17.8	7.1
Dry Density	(t/m^3)	2.00	1.80	2.25
Unconfined Compressive Strength (UCS)	(kPa)	7500	3800	22000
Rate of Strain	(mm/min)	0.63	0.84	0.28
Strain at Failure	(%)	1.5	1.3	0.90
Mode of Failure		Columnar	Cone	Cone

Mode of Failure



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UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/500
Client: Port of Napier Ltd.
Location: -
Date: 23 December 2015
Report No: 1871L:01

Sample Description (884): Oven dried, weak light bluish grey SANDSTONE.

Sample Description (2):

Sample Description (3):

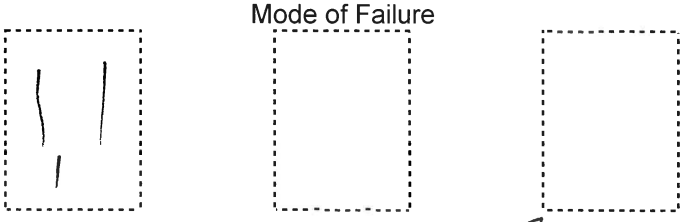
Sample Type: Core
Tested By: N.Agarkova
Checked By: S.Shah

Test Standard: ASTM D2938-95

History: Oven dried

Sample Reference	884	-	-
Borehole No.	BH605	-	-
Depth (m)	17.15-17.3	-	-
Date Tested	22/12/2015	-	-
Length (mm)	106.5	-	-
Diameter (mm)	61.2	-	-
Volume (mm^3)	313000	-	-
Bulk Density (t/m^3)	1.93	-	-
Water Content (%)	-	-	-
Dry Density (t/m^3)	-	-	-
Unconfined Compressive Strength (UCS) (kPa)	12000	-	-
Rate of Strain (mm/min)	0.26	-	-
Strain at Failure (%)	1.0	-	-
Mode of Failure	Columnar		

Mode of Failure



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SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB01a	P001 (SD45)	0.20-0.40	SD	Fine to medium SAND, trace silt, trace clay, trace shells; greenish grey; wet, non plastic.	28.8				X							
VB02	P002 (SD46)	0.00-0.30	SD	Fine to medium SAND, minor silt, trace clay; greenish grey; wet, non plastic.	26.0				X							
VB03c	P003 (SD52)	0.50-0.80	SD	Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.	25.2				X							
VB04a	P004 (SD51)	0.20-0.50	SD	Fine to medium SAND, minor silt, trace clay; greenish grey; wet, non plastic.	25.4				X							
VB04a	P056 (TS3)	0.50-0.80	UT	Fine to medium SAND, trace silt, trace clay; bluish grey; wet, non plastic.	25.3	1.99			X							
VB05a	P006 (SD23)	0.20-0.40	SD	Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.	27.3				X							
VB05a	P005 (SD24)	1.00-1.65	SD	Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.	8.0				X					X		
VB05b	P007 (SD53)	0.20-0.40	SD	Fine to medium SAND, trace silt, trace clay, trace shells; greenish grey, speckled white; wet, non plastic.	27.0				X							
VB05b	P008 (SD54)	0.50-0.75	SD	Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey, mottled white; wet, non plastic.	23.5				X							
VB05b	P010 (SD55)	0.75-1.60	SD	Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.	10.1				X					X		

X = DATA ATTACHED, UT = UNDISTURBED TUBE SAMPLES, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

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Sheet 1 of 65

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SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB06b	P011 (SD48)	0.50-0.80	SD	Fine to coarse SAND, trace silt, trace clay; greenish grey, speckled white; wet, non plastic.	26.7				X							
VB07a	P012 (SD67)	0.60-0.90	SD	Fine to coarse SAND, trace silt, trace clay; dark greenish grey, speckled white; wet, non plastic.	24.9				X							
VB08a	P013 (SD40)	0.30-0.50	SD	Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.	26.4				X							
VB08a	P014 (SD41)	1.60-1.80	SD	Fine to medium sandy clayey SILT; dark greenish grey; wet, moderately plastic.	31.8		X	X	X							
VB09a	P015 (SD20)	0.10-0.30	SD	Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey, speckled white; wet, non plastic.	27.2				X							
VB09a	P016 (SD21)	0.50-0.80	SD	Fine to coarse SAND, trace silt, trace clay; greenish grey; wet, non plastic.	26.5				X							
VB09a	P017 (SD22)	1.65-2.05	SD	Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.	11.6				X					X		
VB10a	P018 (SD29)	0.20-0.40	SD	Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey; wet, non plastic.	24.5				X							
VB10a	P019 (SD30)	0.40-0.70	SD	Fine to coarse SAND, trace fine gravel, trace silt, trace clay, trace shells; bluish grey; wet, non plastic.	24.3				X							
VB10b	P020 (SD56)	0.10-0.30	SD	Fine to coarse SAND, trace fine gravel, trace silt, trace clay, trace shells; bluish grey; moist, non plastic.	25.3				X							

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X = DATA ATTACHED, UT = UNDISTURBED TUBE SAMPLES, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

AUTHORISED SIGNATORY

N.Agarkova – Authorised Signatory

Sheet 2 of 65

21 Pitt Street
P O Box 6345
Auckland 1141
Ph. 300-9380

SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB10b	P021 (SD57)	0.70-0.90	SD	Silty fine to medium SAND, some clay, trace organics; bluish dark grey; moist, slightly plastic.	28.4				X							
VB11a	P022 (SD47)	0.60-0.80	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; moist, slightly plastic.	29.2				X							
VB12a	P023 (SD31)	0.20-0.50	SD	Fine to medium silty SAND, some clay, trace organics; bluish grey; wet, slightly plastic.	30.8				X							
VB12a	P024 (SD32)	2.40-2.70	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.	28.2				X							
VB12a	P025 (SD33)	3.20-3.50	SD	Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	36.1		X	X	X							
VB13a	P026 (SD62)	0.10-0.40	SD	Fine to medium SAND, trace silt, minor clay, trace shells; greenish grey, speckled white; wet, non plastic.	29.3				X							
VB13a	P027 (SD63)	1.50-1.80	SD	Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells; greenish grey; wet, moderately plastic.	30.8		X	X	X							
VB13a	P028 (SD64)	2.00-2.30	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.	30.1		X	X	X							
VB14a	PO29 (SD65)	0.10-0.40	SD	Fine to medium sandy clayey SILT, trace organics; greenish grey; wet, moderately plastic.	35.3		X	X	X							
VB14a	P058 (TS5)	1.50-1.80	UT	Fine to medium sandy SILT, some clay; greenish grey; wet, slightly plastic.	28.9	1.96			X							

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TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

AUTHORISED SIGNATORY

N Agarkova – Authorised Signatory

Sheet 3 of 65

21 Pitt Street
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SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB14a	P030 (SD66)	1.90-2.20	SD	Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	34.2		X	X	X							
VB15a	P031 (SD42)	0.40-0.60	SD	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	34.1		X	X	X							
VB15a	PO32 (SD43)	0.7-0.95	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.	31.1		X	X	X							
VB15a	P033 (SD44)	1.60-1.80	SD	Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.	38.0		X	X	X							
VB16a	P034 (SD34)	0.20-0.50	SD	Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells; bluish grey; wet, highly plastic.	30.5				X							
VB16a	P054 (TS1)	0.50-0.80	UT	Fine to medium sandy SILT, some clay; bluish grey; wet, slightly plastic.	30.4	1.85			X							
VB16A	P035 (SD35)	0.80-1.10	SD	Fine to medium sandy SILT, some clay, trace shells; bluish grey; wet, highly plastic.	27.7				X							
VB16a	P055 (TS2)	2.00-2.30	UT	Fine sandy clayey SILT; bluish grey; wet, moderately plastic.	32.3	1.84	X	X	X							
VB16a	P036 (SD36)	3.00-3.30	SD	Clayey SILT, minor fine sand, trace organics; greenish grey; wet, moderately plastic.	35.0		X	X	X							
VB17A	P037 (SD69)	0.50-0.80	SD	Fine to coarse sandy SILT, some clay, trace fine gravel, trace organics, trace shells; bluish grey; wet, moderately plastic.	33.3		X	X	X							

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TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

AUTHORISED SIGNATORY

N.Agarkova – Authorised Signatory

Sheet 4 of 65

21 Pitt Street
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SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB17a	P038 (SD70)	1.70-2.00	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.	30.5		X	X	X							
VB18a	P039 (SD37)	0.60-0.80	SD	Fine to coarse sandy clayey SILT, trace gravel, trace shells, trace organics; greenish grey; wet, moderately plastic.	35.5		X	X	X							
VB18a	P040 (SD38)	2.20-2.40	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.	28.3				X							
VB18a	P041 (SD39)	2.90-3.10	SD	Clayey SILT, some fine sand, trace organics; bluish grey; wet, highly plastic.	37.2		X	X	X							
VB19a	P057 (TS4)	0.50-0.80	UT	Fine to medium sandy clayey SILT; dark greenish grey; wet, highly plastic.	60.6	1.51	X	X	X							
VB19a	P042 (SD49)	0.80-1.00	SD	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, highly plastic.	66.8		X	X	X							
VB19a	P043 (SD50)	1.60-1.80	SD	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	40.7		X	X	X							
VB20a	P044 (SD26)	0.10-0.40	SD	Clayey SILT, some fine to medium sand, trace organics; dark greenish grey; wet, highly plastic.	79.9		X	X	X							
VB20a	P045 (SD27)	0.80-1.10	SD	Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.	43.1		X	X	X							
VB20a	P046 (SD28)	2.20-2.50	SD	Clayey SILT, some fine sand, trace organics; bluish grey; wet, moderately plastic.	36.8		X	X	X							

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TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

AUTHORISED SIGNATORY

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Sheet 5 of 65

Geotest

21 Pitt Street
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SUMMARY OF TEST RESULTS

Report:
1871L:02

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 23 February 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
VB22a	P047 (SD25)	0.00-0.20	SD	Fine to coarse SAND, trace clay; greenish grey; wet, non plastic.	28.2				X							
VB23a	P048 (SD58)	0.40-0.70	SD	Fine to coarse SAND, trace clay, trace shells; bluish grey, speckled white; wet, non plastic.	26.2				X							
VB24a	P050 (SD59)	0.30-0.60	SD	Fine sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.	30.2				X							
VB24a	P051 (SD60)	1.60-1.80	SD	Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells, trace organics; bluish grey; wet, moderately plastic.	30.7		X	X	X							
VB24a	P052 (SD61)	2.20-2.40	SD	Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.	35.8		X	X	X							
VB25a	P053 (SD68)	0.30-0.60	SD	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	44.0		X	X	X							

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X = DATA ATTACHED, UT = UNDISTURBED TUBE SAMPLES, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,5.1.3
ASTM D422-63

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Sheet 6 of 65

Geotest

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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 23 February 2016

Job No: 3124410/520

Report No: 1871L:02

Client: Port of Napier Ltd

Tested By: N.Agarkova/S.Shah

Sample Type: Small Disturbed

Checked By: S.Shah/N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
VB08a	P014	1.60-1.80	Fine to medium sandy clayey SILT; dark greenish grey; wet, moderately plastic.	31.8	40	-	21	**19**
VB12a	P025	3.20-3.50	Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	36.1	43	-	22	**21**
VB13a	P027	1.50-1.80	Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells; greenish grey; wet, moderately plastic.	30.8	36	-	22	**14**
VB13a	P028	2.00-2.30	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, highly plastic.	30.1	36	-	21	**15**
VB14a	P029	0.10-0.40	Fine to medium sandy clayey SILT, trace organics; greenish grey; wet, moderately plastic.	35.3	39	-	21	**18**
VB14a	P030	1.90-2.20	Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	34.2	42	-	21	**21**
VB15a	P031	0.40-0.60	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	34.1	41	-	21	**20**
VB15a	P032	0.75-0.95	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.	31.1	34	-	22	**12**
VB15a	P033	1.60-1.80	Clayey SILT, minor fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	38.0	43	-	23	**20**
VB16a	P055	2.00-2.30	Fine to medium sandy clayey SILT; bluish grey; wet, moderately plastic.	32.3	39	-	22	**17**
VB16a	P036	3.00-3.30	Clayey SILT, minor fine to medium sand, trace organics; greenish grey; wet, moderately plastic.	34.9	44	-	21	**23**

Comments:

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Authorised Signatory:.....

N. Agarkova – Authorised Signatory

Geotest

21 Pitt Street
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Auckland 1141
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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 23 February 2016

Job No: 3124410/520

Report No: 1871L:02

Client: Port of Napier Ltd

Tested By: N.Agarkova/S.Shah

Sample Type: Small Disturbed

Checked By: S.Shah/N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
VB17a	P037	0.50-0.80	Fine to coarse sandy SILT, some clay, trace fine gravel, trace organics, trace shells; bluish grey; wet, moderately plastic.	33.3	33	-	24	**9**
VB17a	P038	1.70-2.00	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.	30.5	32	-	22	**10**
VB18a	P039	0.60-0.80	Fine to medium sandy clayey SILT, trace shells, trace organics; greenish grey; wet, moderately plastic.	35.5	39	-	21	**18**
VB18a	P041	2.90-3.10	Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, highly plastic.	37.2	50	-	22	**28**
VB19a	P057	0.50-0.80	Fine to medium sandy clayey SILT; dark greenish grey; wet (very), highly plastic.	60.6	49	-	24	**25**
VB19a	P042	0.80-1.00	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, highly plastic.	66.8	51	-	25	**26**
VB19a	P043	1.60-1.80	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	40.7	49	-	23	**26**
VB20a	P044	0.10-0.40	Clayey SILT, some fine to medium sand, trace organics; dark greenish grey; wet (very), highly plastic.	79.9	55	-	24	**31**
VB20a	P045	0.80-1.10	Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.	43.1	49	-	25	**24**
VB20a	P046	2.20-2.50	Clayey SILT, some fine sand, trace organics; bluish grey; wet, moderately plastic.	36.8	45	-	22	**23**

Comments:

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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 23 February 2016

Job No: 3124410/520

Report No: 1871L:02

Client: Port of Napier Ltd

Tested By: N.Agarkova/S.Shah

Sample Type: Small Disturbed

Checked By: S.Shah/N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
VB24a	P051	1.60-1.80	Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells, trace organics; bluish grey; wet, moderately plastic.	30.7	33	-	22	**11**
VB24	P052	2.20-2.40	Clayey SILT, minor fine to medium sand, trace organics; bluish grey; wet, moderately plastic.	35.7	41	-	21	**20**
VB25a	P053	0.30-0.60	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	44.0	50	-	24	**26**

Comments:

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Geotest

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

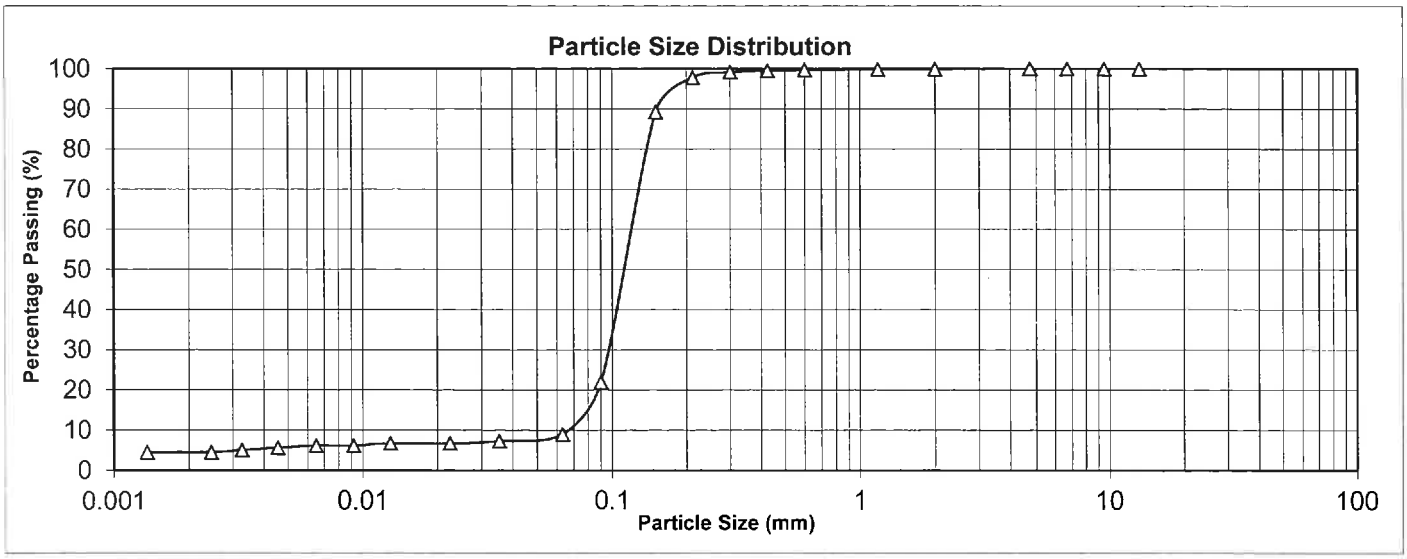
Bore No.: VB01a
Sample No.: P001 (SD45)
Depth (m): 0.20-0.40

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, trace clay, trace shells; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	89
9.50mm	100	90µm	22
6.70mm	100	63µm	9
4.75mm	100	<63µm	9



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	5	91	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

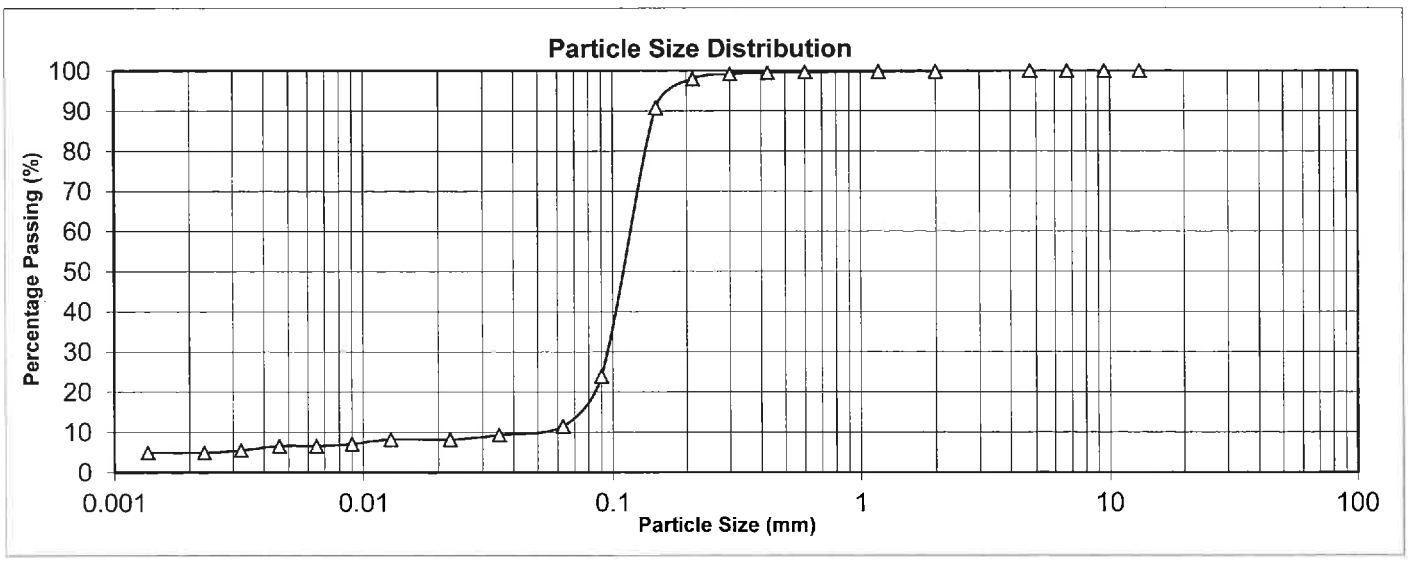
Bore No.: VB02a
Sample No.: P002 (SD46)
Depth (m): 0.0-0.30

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, minor silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	91
9.50mm	100	90µm	24
6.70mm	100	63µm	12
4.75mm	100	<63µm	12



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
5	6	89	0	300µm

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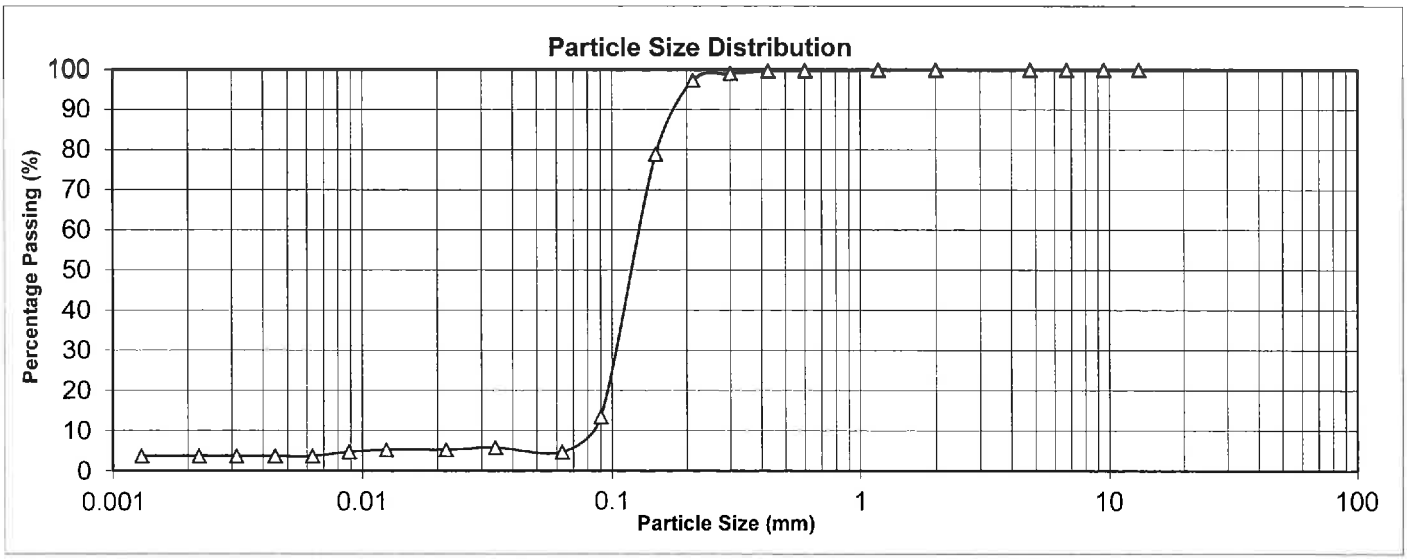
PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016
Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Bore No.: VB03c
Sample No.: P003 (SD52)
Depth (m): 0.50-0.80
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	97
13.2mm	100	150µm	79
9.50mm	100	90µm	13
6.70mm	100	63µm	5
4.75mm	100	<63µm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	95	1	300µm

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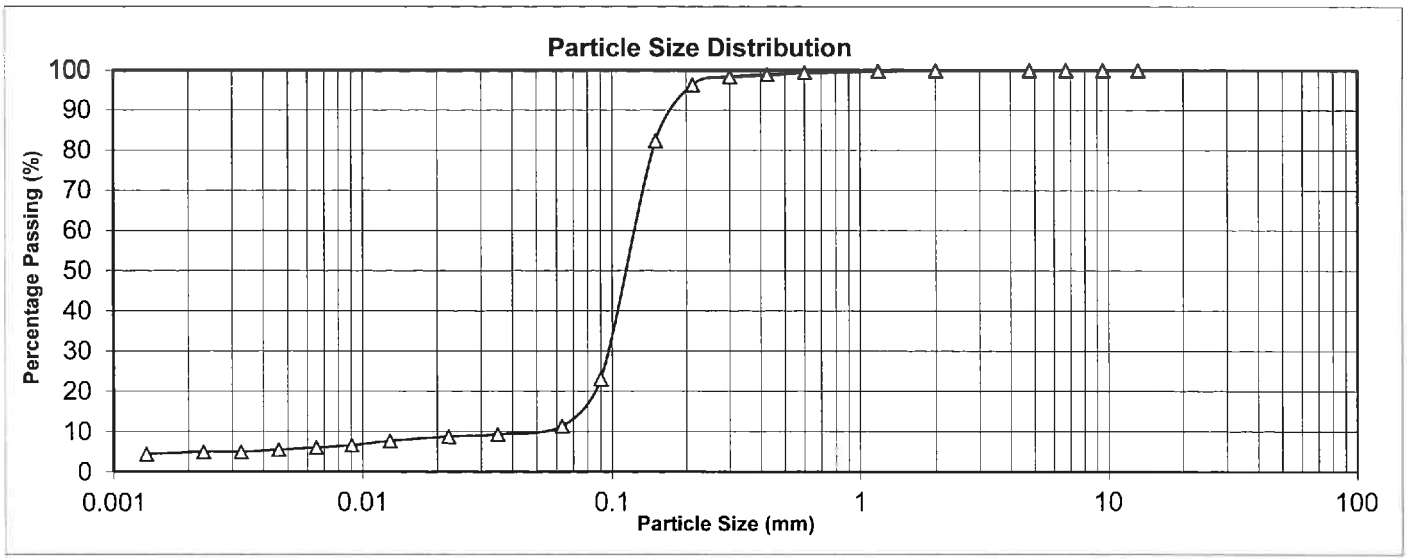
PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016
Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Bore No.: VB04a
Sample No.: P004 (SD51)
Depth (m): 0.20-050
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, minor silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	98
19.0mm	100	212µm	96
13.2mm	100	150µm	82
9.50mm	100	90µm	23
6.70mm	100	63µm	11
4.75mm	100	<63µm	11



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
5	6	89	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB04a
Sample Type: Undisturbed Tube

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P056 (TS3)
History: Natural

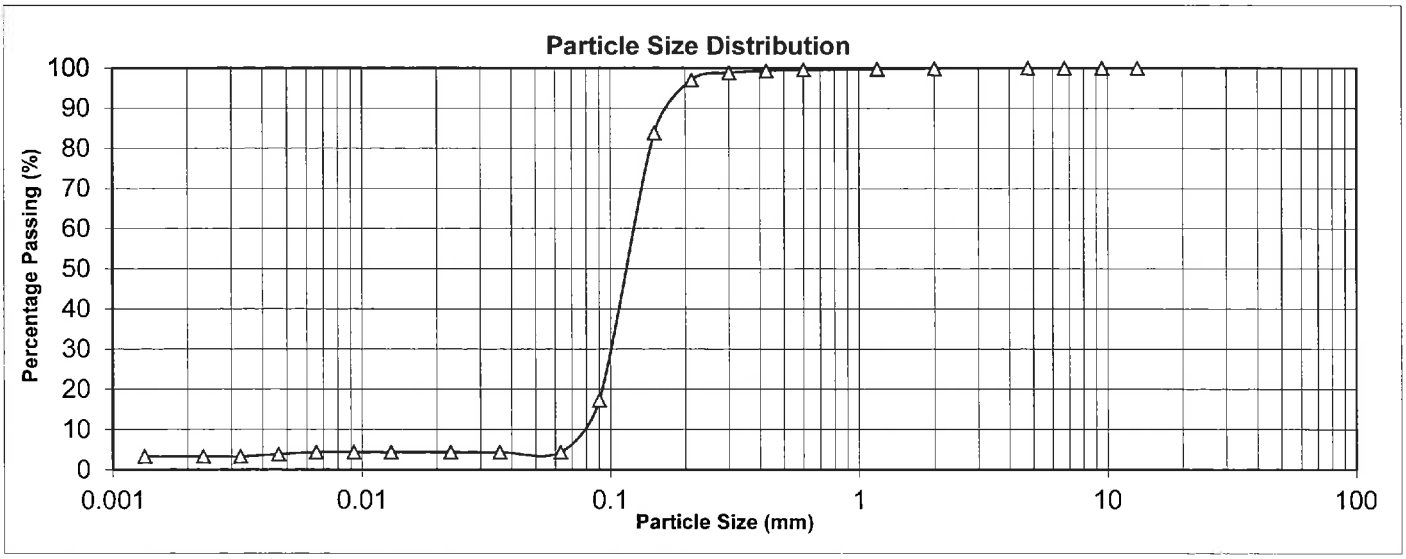
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.50-0.80
Report No.: 1871L:02

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

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	97
13.2mm	100	150µm	84
9.50mm	100	90µm	17
6.70mm	100	63µm	4
4.75mm	100	<63µm	4



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
3	1	96	0	425µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

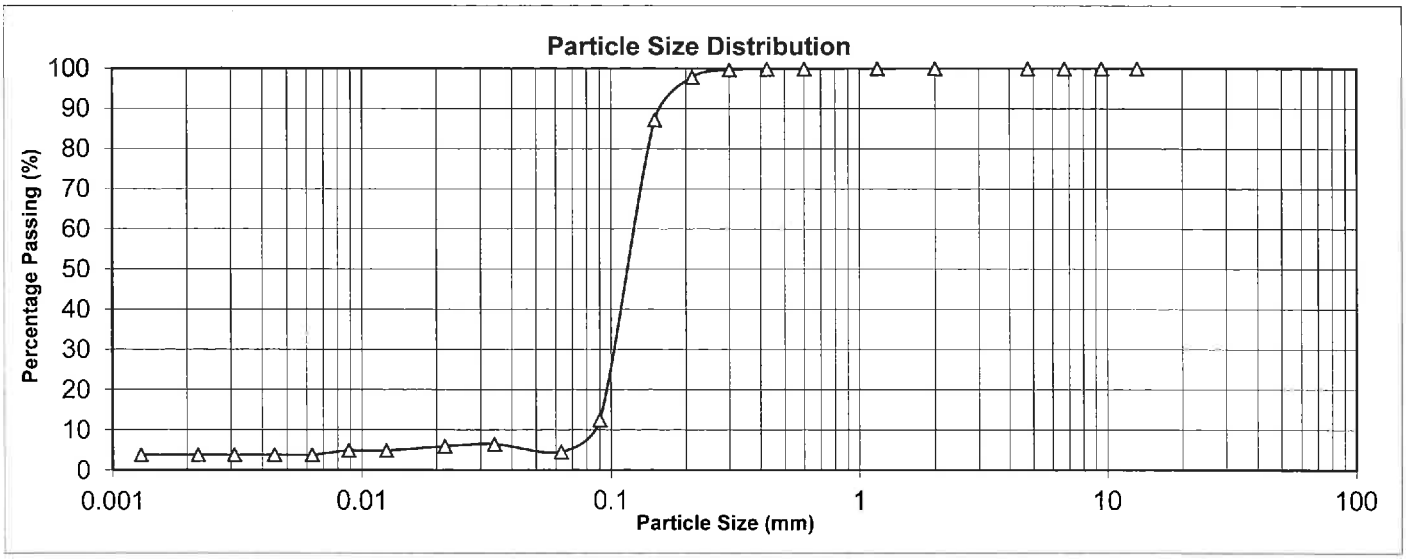
Bore No.: VB05a
Sample No.: P006 (SD23)
Depth (m): 0.20-0.40

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	98
13.2mm	100	150µm	87
9.50mm	100	90µm	12
6.70mm	100	63µm	5
4.75mm	100	<63µm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	95	1	212µm

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PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

Bore No.: VB05a
Sample No.: P005 (SD24)
Depth (m): 1.00-1.654

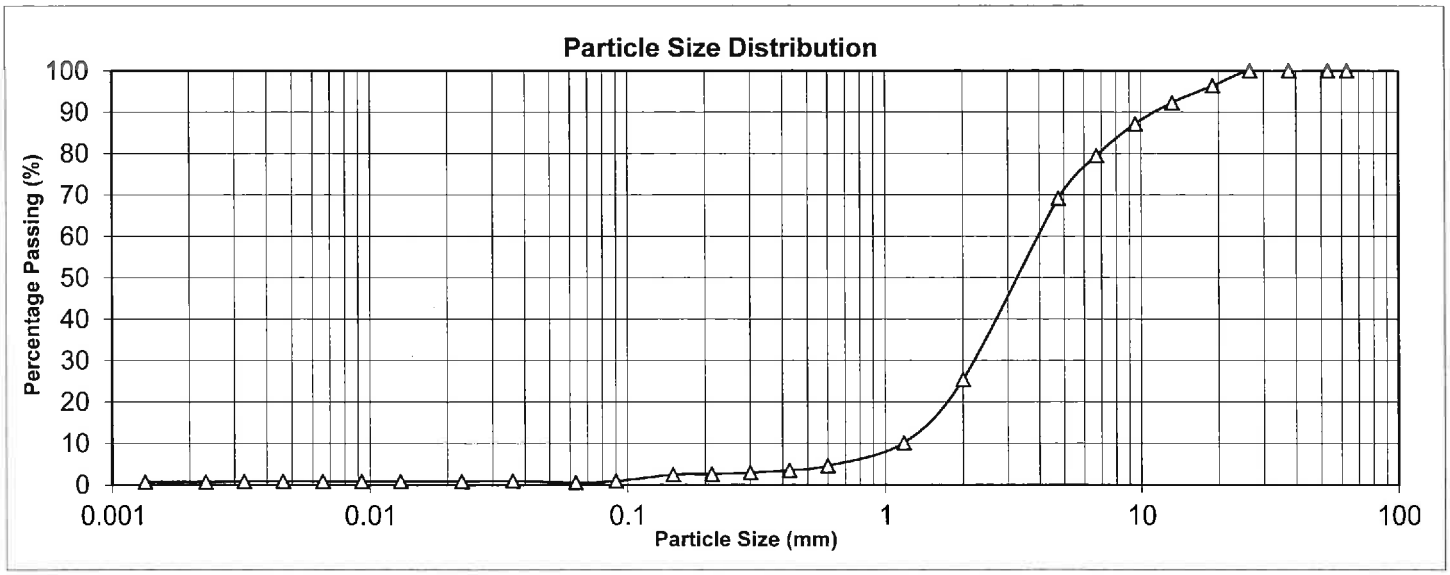
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.

Test Standard: ASTM D422-63
NZS4402: 1986; Test 2.8.1

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	25
63.0mm	100	1.18mm	10
53.0mm	100	600μm	5
37.5mm	100	425μm	4
26.5mm	100	300μm	3
19.0mm	96	212μm	3
13.2mm	92	150μm	2
9.50mm	87	90μm	1
6.70mm	79	63μm	1
4.75mm	69	<63μm	1



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
1	0	24	75	19.0mm

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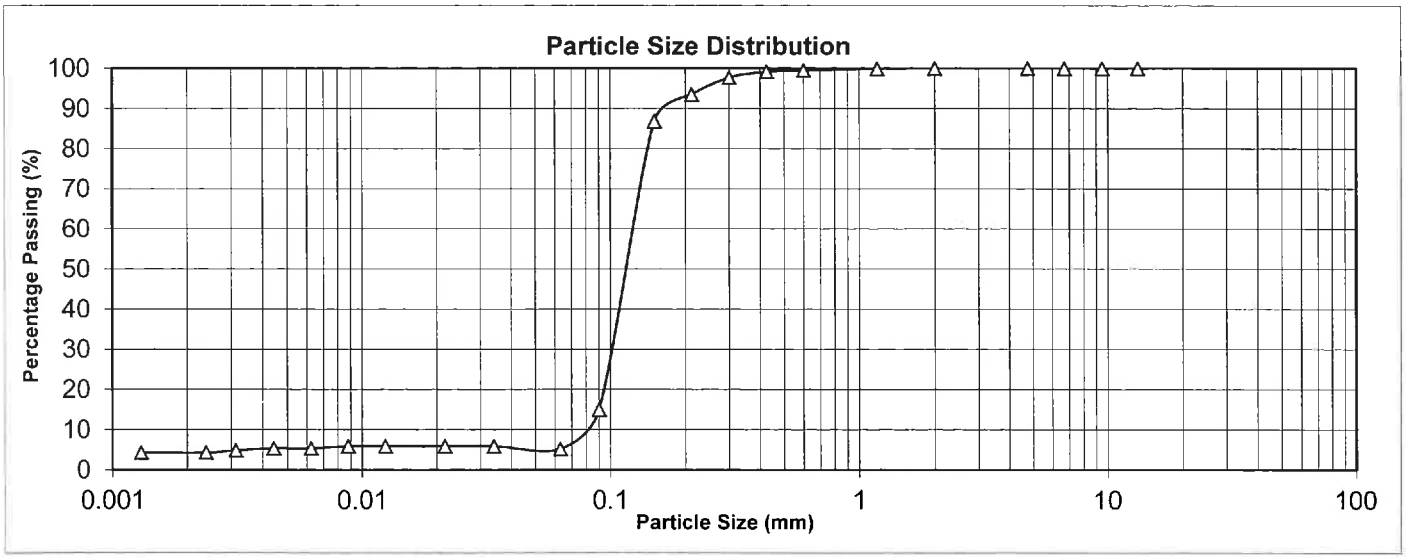
PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016
Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah
Bore No.: VB05b
Sample No.: P007 (SD53)
Depth (m): 0.20-0.40
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, trace clay, trace shells; greenish grey, speckled white; wet, non plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	99
26.5mm	100	300µm	98
19.0mm	100	212µm	93
13.2mm	100	150µm	87
9.50mm	100	90µm	15
6.70mm	100	63µm	5
4.75mm	100	<63µm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	95	0	425µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

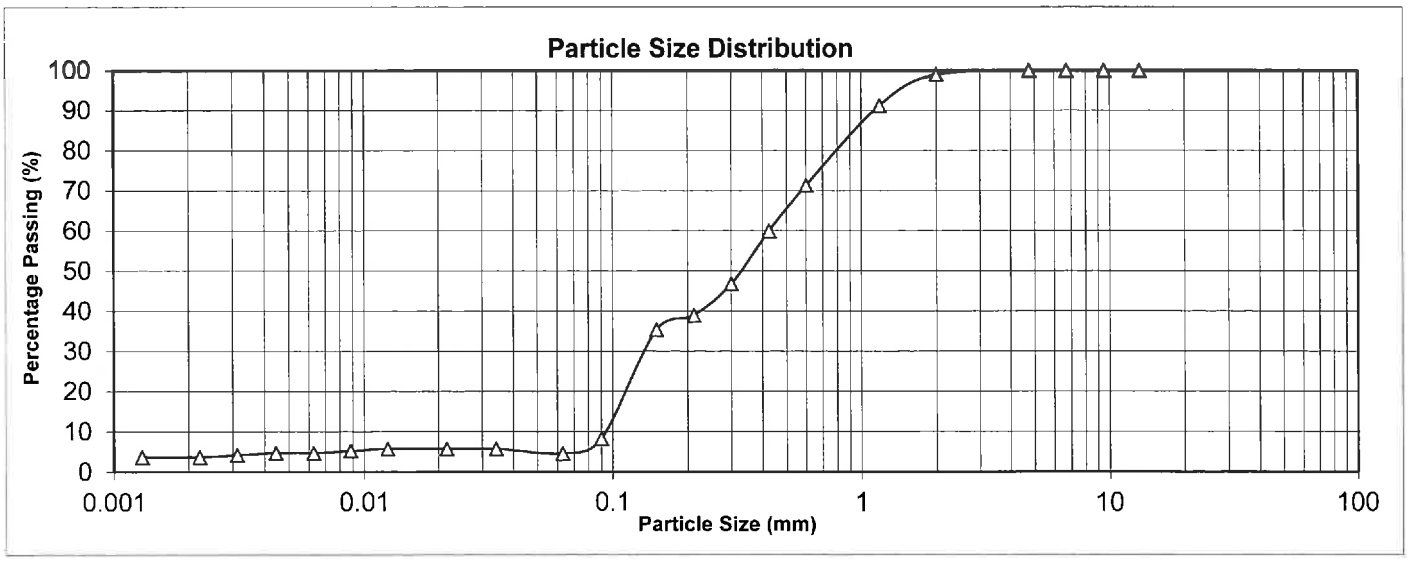
Bore No.: VB05b
Sample No.: P008 (SD54)
Depth (m): 0.50-0.75

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey, mottled white; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	91
53.0mm	100	600μm	71
37.5mm	100	425μm	60
26.5mm	100	300μm	47
19.0mm	100	212μm	39
13.2mm	100	150μm	35
9.50mm	100	90μm	8
6.70mm	100	63μm	5
4.75mm	100	<63μm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	94	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah

Bore No.: VB05b
Sample No.: P010 (SD55)
Depth (m): 0.75-1.60

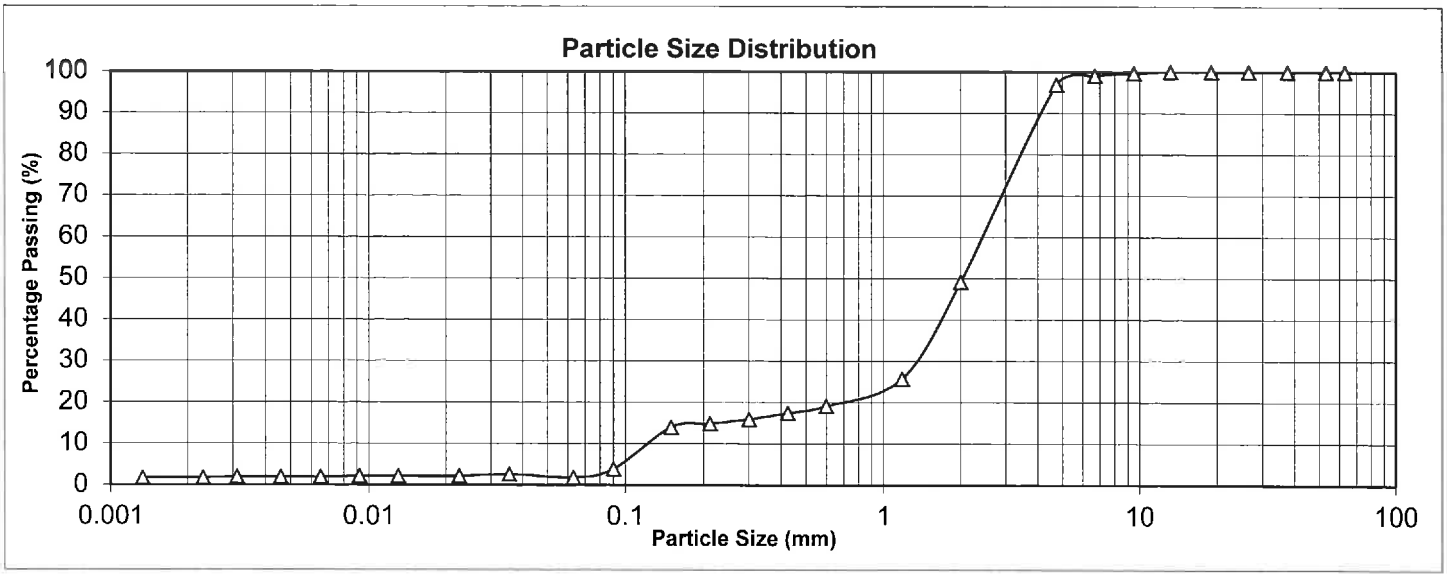
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.

Test Standard: ASTM D422-63
NZS4402: 1986; Test 2.8.1

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	49
63.0mm	100	1.18mm	26
53.0mm	100	600μm	19
37.5mm	100	425μm	17
26.5mm	100	300μm	16
19.0mm	100	212μm	15
13.2mm	100	150μm	14
9.50mm	100	90μm	4
6.70mm	99	63μm	2
4.75mm	97	<63μm	2



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
2	0	47	51	19.0mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

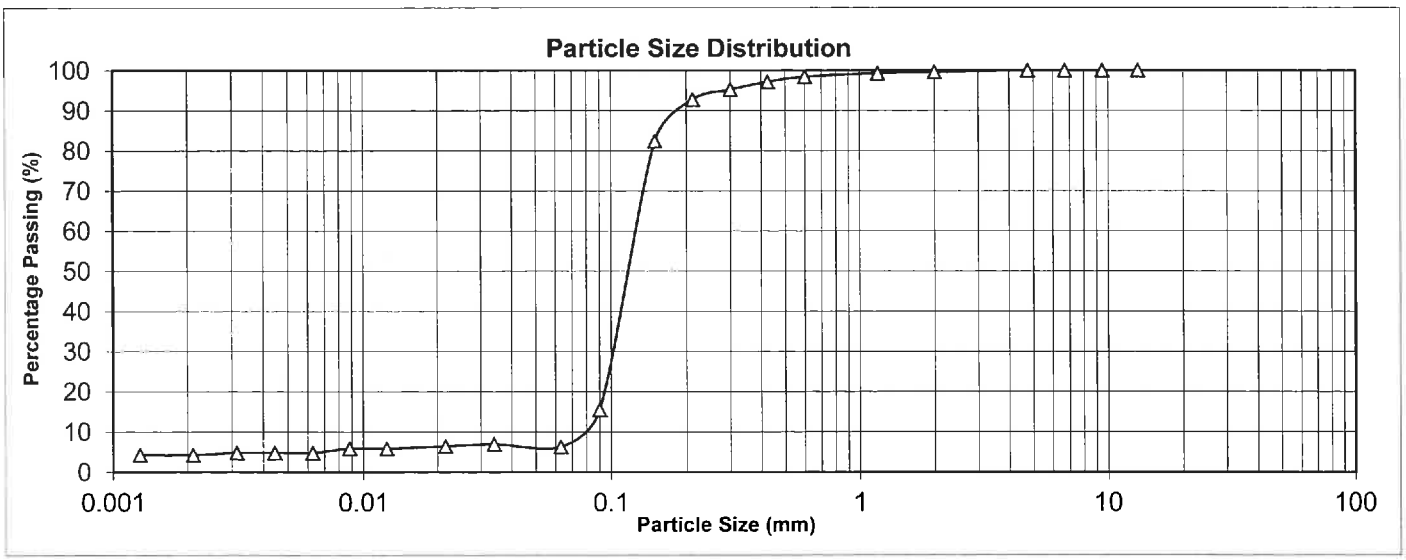
Bore No.: VB06b
Sample No.: P011 (SD48)
Depth (m): 0.50-0.80

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay; greenish grey, speckled white; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600μm	98
37.5mm	100	425μm	97
26.5mm	100	300μm	95
19.0mm	100	212μm	93
13.2mm	100	150μm	82
9.50mm	100	90μm	15
6.70mm	100	63μm	6
4.75mm	100	<63μm	6



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	2	94	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

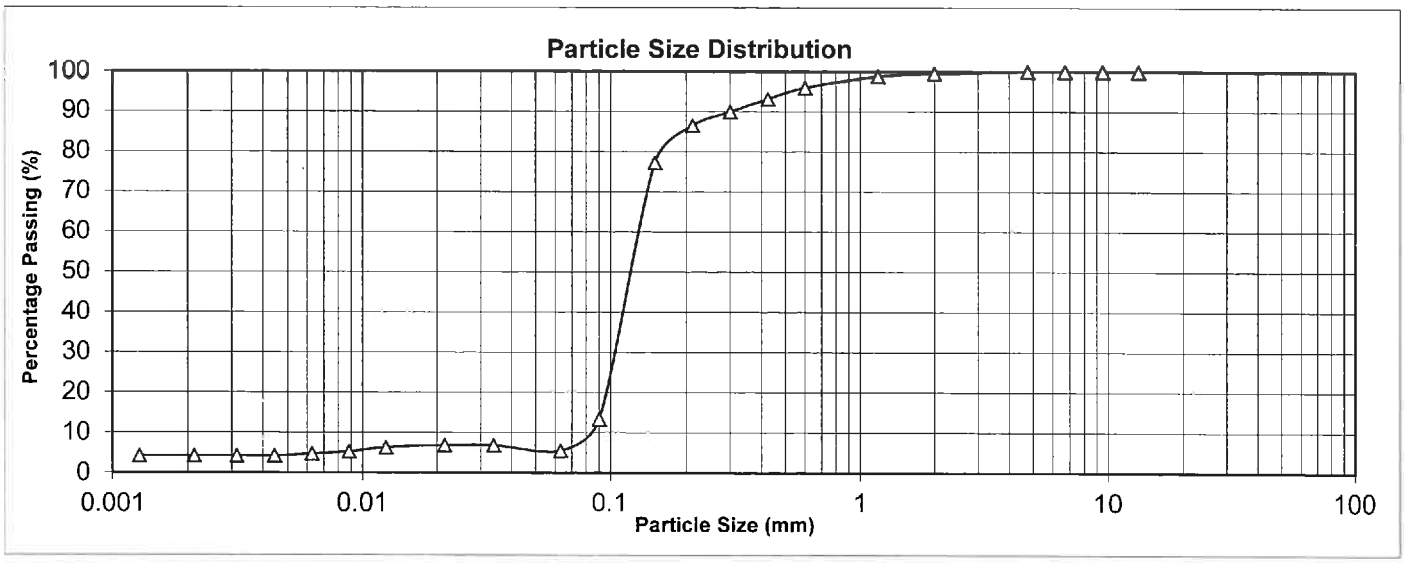
Bore No.: VB07a
Sample No.: P012 (SD67)
Depth (m): 0.60-0.90

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay; dark greenish grey, speckled white; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600μm	96
37.5mm	100	425μm	93
26.5mm	100	300μm	90
19.0mm	100	212μm	86
13.2mm	100	150μm	77
9.50mm	100	90μm	13
6.70mm	100	63μm	6
4.75mm	100	<63μm	6



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	2	94	1	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB08a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P013 (SD40)
History: As Received

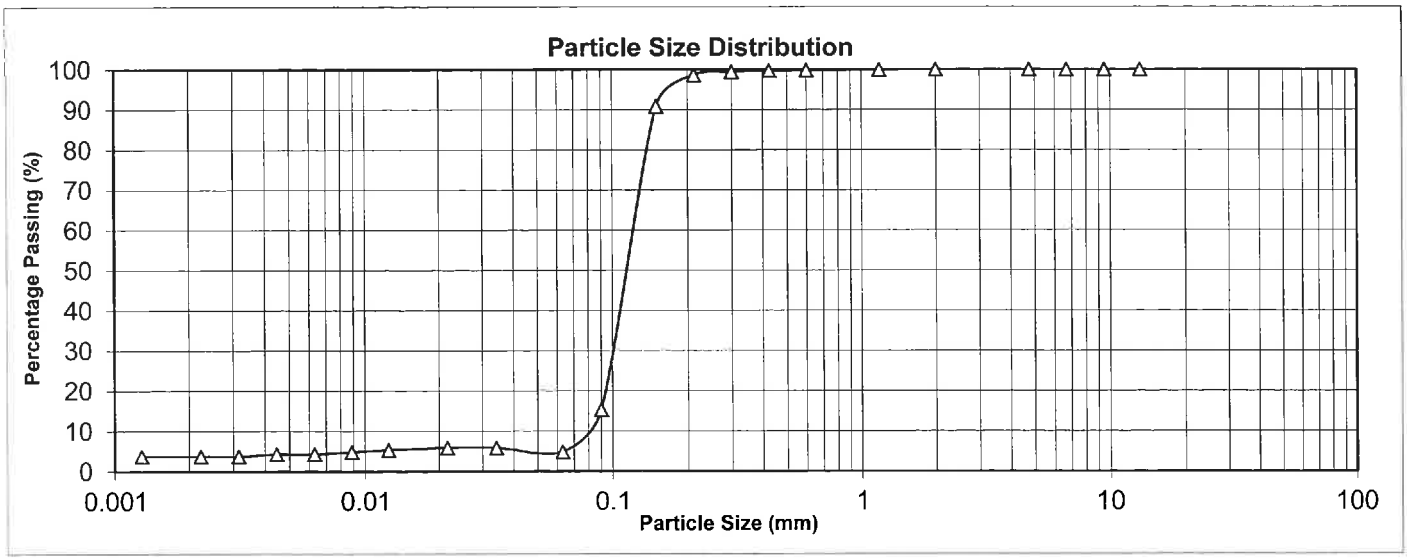
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 0.30-0.50
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	91
9.50mm	100	90µm	15
6.70mm	100	63µm	5
4.75mm	100	<63µm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	95	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/500
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Checked By: N.Agarkova/ S.Shah/E.Kennedy

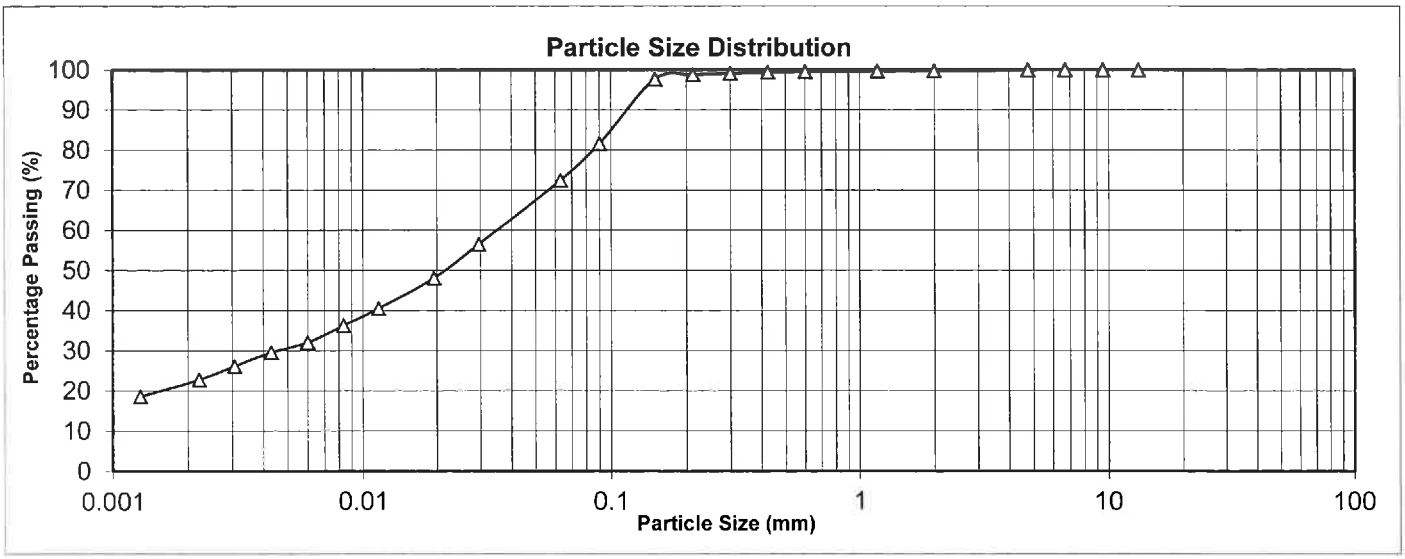
Bore No.: VB08a
Sample No.: P014 (SD41)
Depth (m): 1.60-1.80

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium sandy clayey SILT; dark greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	82
6.70mm	100	63µm	72
4.75mm	100	<63µm	72



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
22	49	29	0	425µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

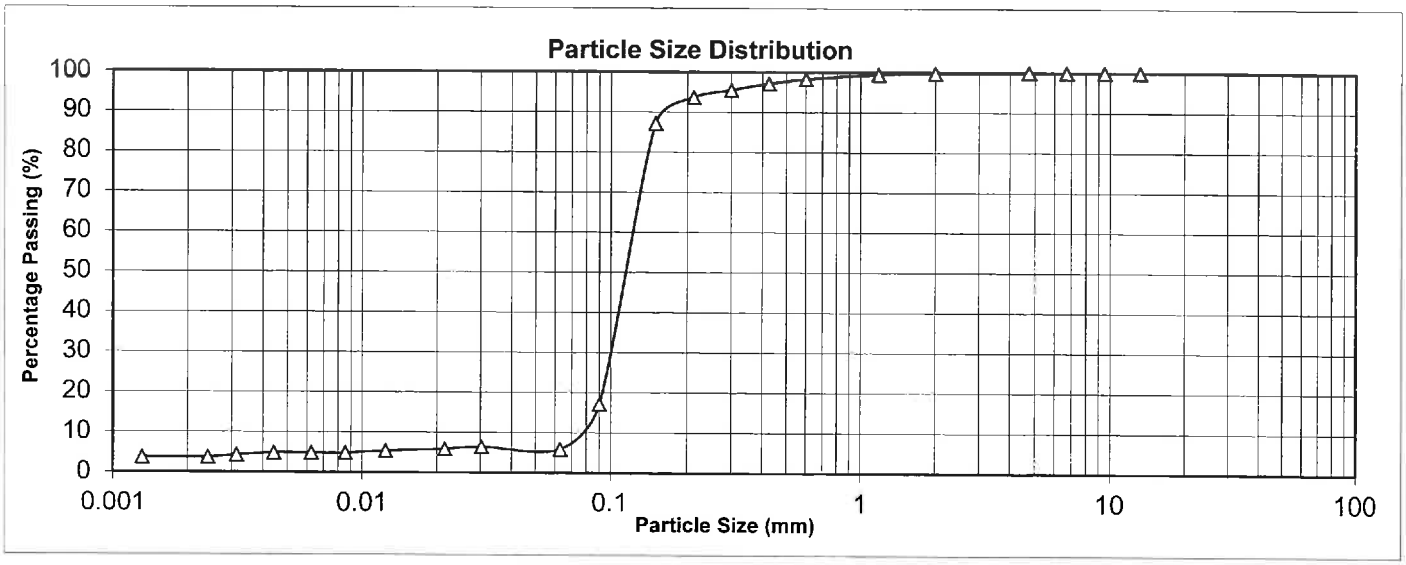
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB09a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P015 (SD20)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.10-0.30
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey, speckled white; wet, non plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600µm	98
37.5mm	100	425µm	97
26.5mm	100	300µm	96
19.0mm	100	212µm	94
13.2mm	100	150µm	87
9.50mm	100	90µm	17
6.70mm	100	63µm	6
4.75mm	100	<63µm	6



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	2	94	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah/ N.Agarkova
Checked By: N.Agarkova/ S.Shah/E.Kennedy

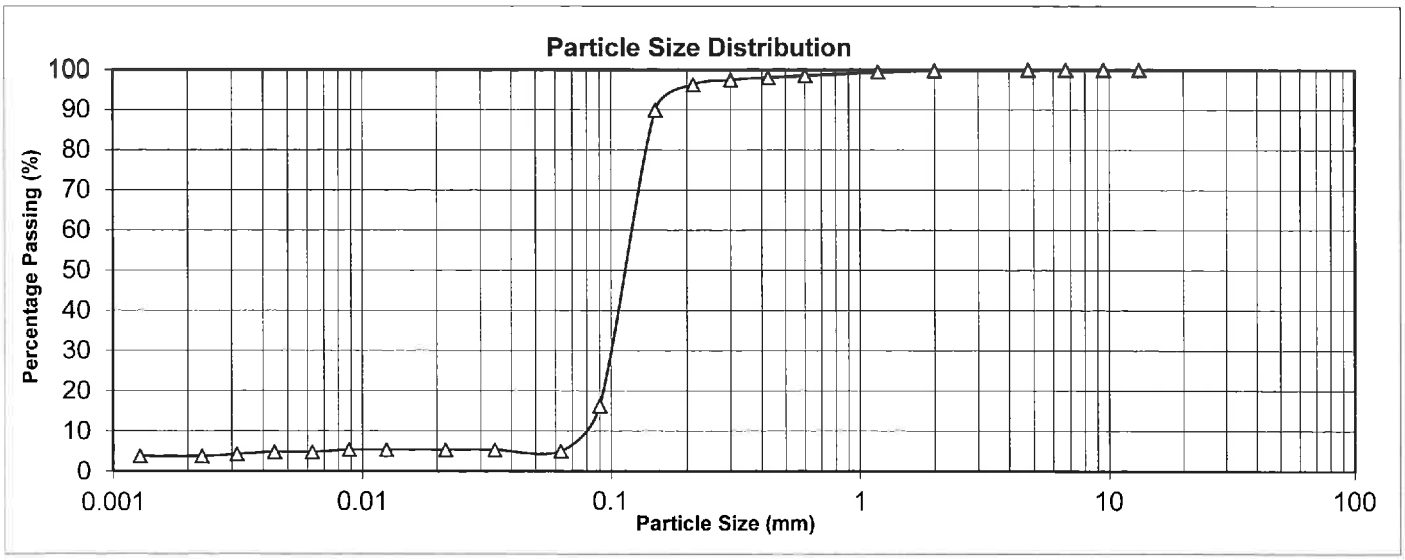
Bore No.: VB09a
Sample No.: P016 (SD21)
Depth (m): 0.50-0.80

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600μm	99
37.5mm	100	425μm	98
26.5mm	100	300μm	97
19.0mm	100	212μm	96
13.2mm	100	150μm	90
9.50mm	100	90μm	16
6.70mm	100	63μm	5
4.75mm	100	<63μm	5



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	1	95	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - WET SIEVE/HYDROMETER METHOD

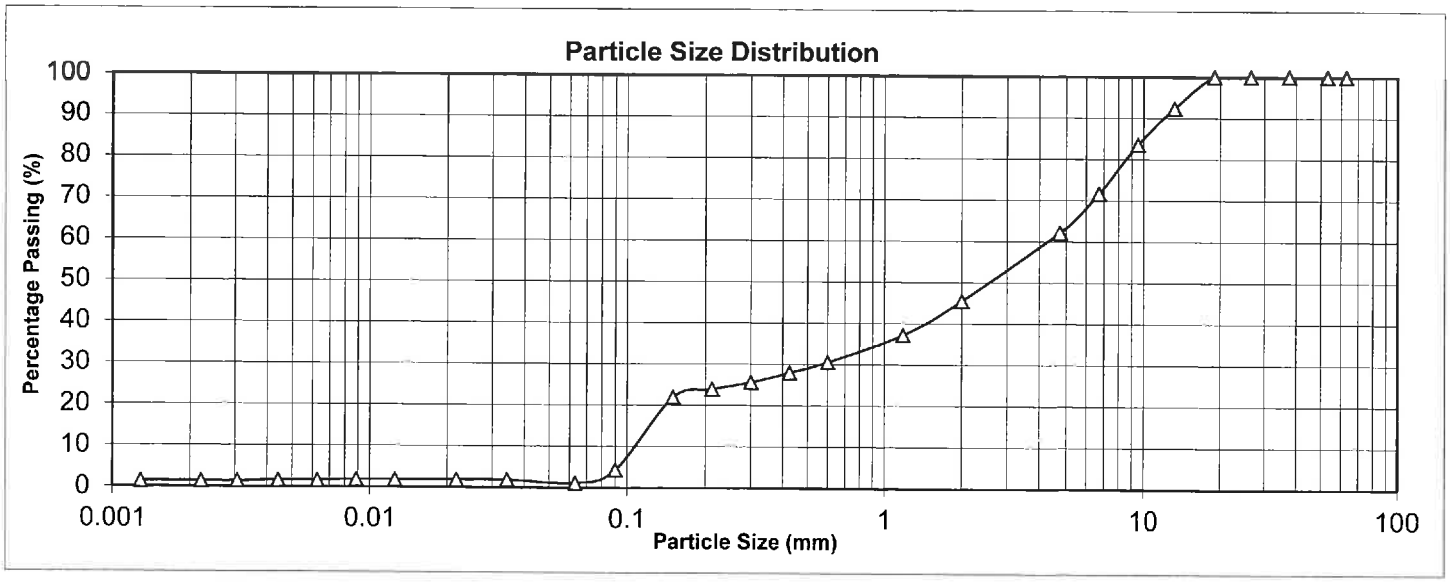
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB09a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P017 (SD22)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.65-2.05
Report No.: 1871L:02

Sample Description: Fine to coarse sandy fine to medium GRAVEL, trace clay, some shells; bluish grey; wet, non plastic.
Test Standard: ASTM D422-63 NZS4402: 1986; Test 2.8.1
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	45
63.0mm	100	1.18mm	37
53.0mm	100	600µm	31
37.5mm	100	425µm	28
26.5mm	100	300µm	26
19.0mm	100	212µm	24
13.2mm	92	150µm	22
9.50mm	83	90µm	4
6.70mm	72	63µm	1
4.75mm	62	<63µm	1



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
1	0	44	55	13.2mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah
Checked By: N.Agarkova/ S.Shah/E.Kennedy

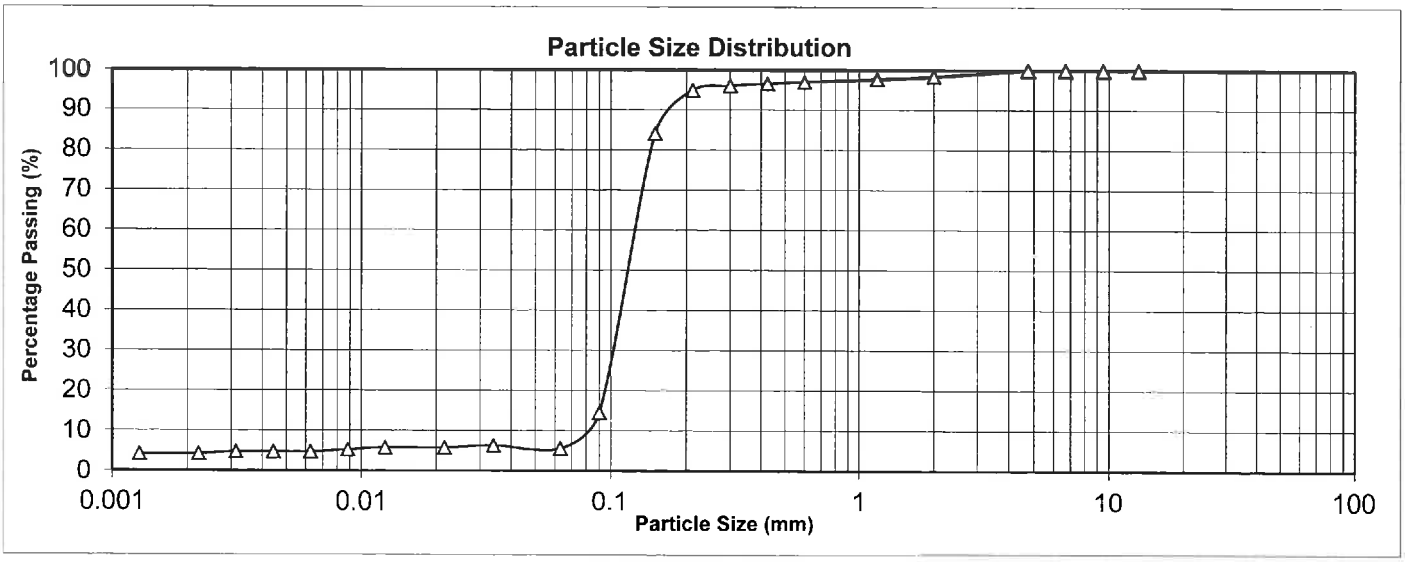
Bore No.: VB10a
Sample No.: P018 (SD29)
Depth (m): 0.20-0.40

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace silt, trace clay, trace shells; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	98
63.0mm	100	1.18mm	98
53.0mm	100	600µm	97
37.5mm	100	425µm	97
26.5mm	100	300µm	96
19.0mm	100	212µm	95
13.2mm	100	150µm	84
9.50mm	100	90µm	14
6.70mm	100	63µm	6
4.75mm	100	<63µm	6



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	2	92	2	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

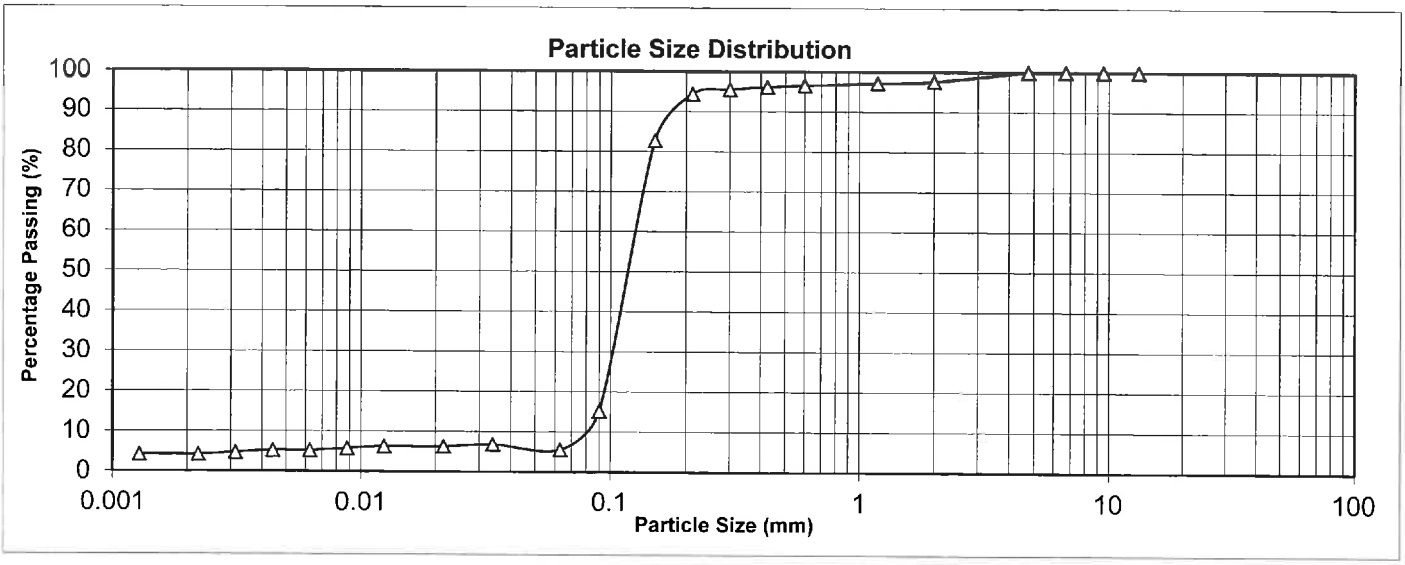
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB10a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P019 (SD30)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 0.40-0.70
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace fine gravel, trace silt, trace clay, trace shells; bluish grey; wet, non plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	98
63.0mm	100	1.18mm	97
53.0mm	100	600μm	97
37.5mm	100	425μm	96
26.5mm	100	300μm	95
19.0mm	100	212μm	94
13.2mm	100	150μm	83
9.50mm	100	90μm	15
6.70mm	100	63μm	6
4.75mm	100	<63μm	6



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	2	92	3	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/500
Tested By: S.Shah
Checked By: N.Agarkova/ E.Kennedy

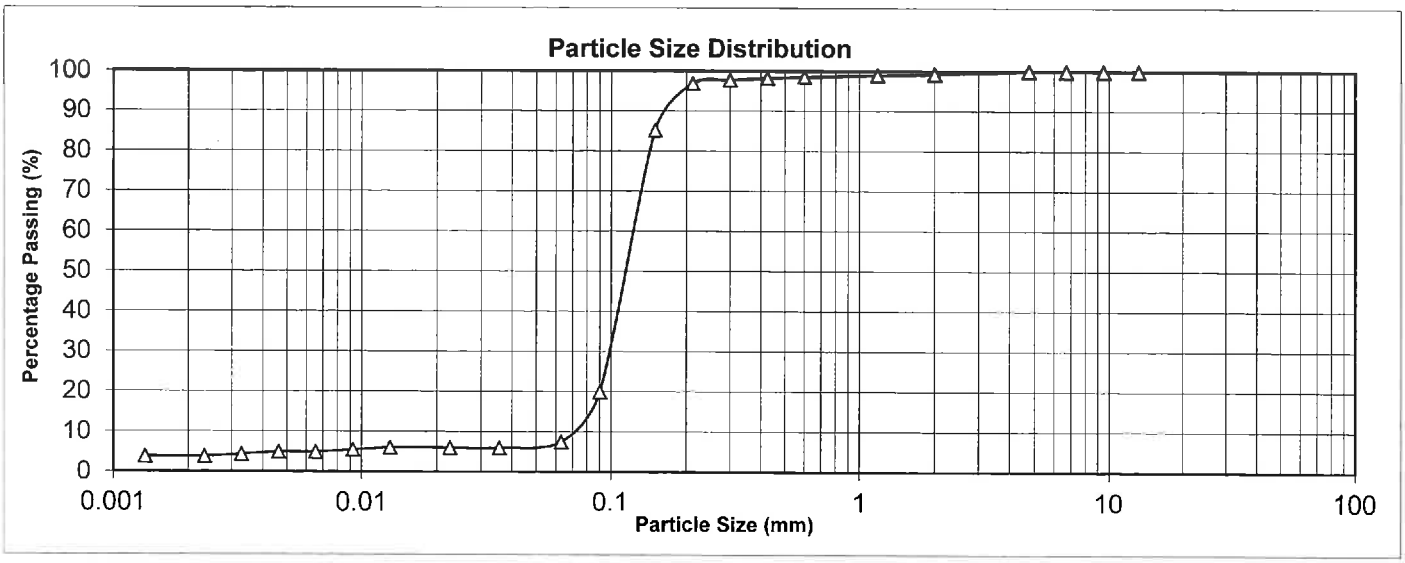
Bore No.: VB10b
Sample No.: P020 (SD56)
Depth (m): 0.10-0.30

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace fine gravel, trace silt, trace clay, trace shells; bluish grey; moist, non plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600µm	99
37.5mm	100	425µm	98
26.5mm	100	300µm	98
19.0mm	100	212µm	97
13.2mm	100	150µm	85
9.50mm	100	90µm	20
6.70mm	100	63µm	7
4.75mm	100	<63µm	7



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	3	92	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 23 February 2016

Checked By: N.Agarkova/ E.Kennedy

Bore No.: VB10b

Sample No.: P021 (SD57)

Depth (m): 0.70-0.90

Sample Type: Small Disturbed

History: As Received

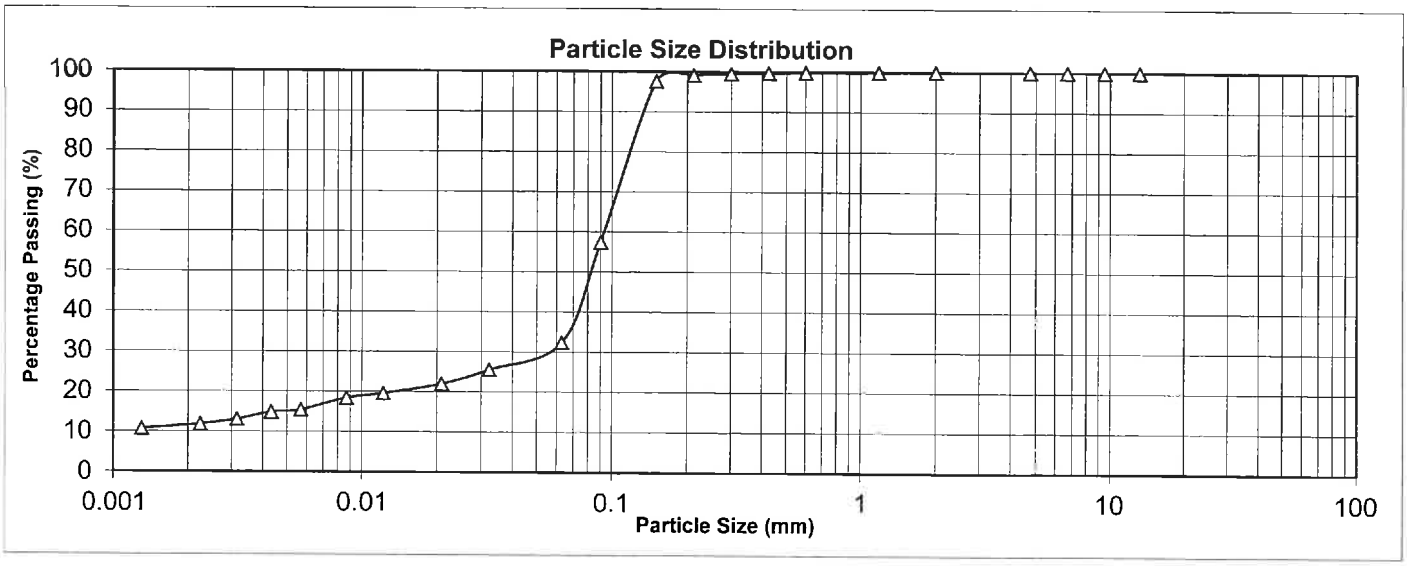
Report No.: 1871L:02

Sample Description: Silty fine to medium SAND, some clay, trace organics; bluish dark grey; moist, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	57
6.70mm	100	63µm	32
4.75mm	100	<63µm	32



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
12	20	68	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 23 February 2016

Job No.: 3124410/520
Tested By: S.Shah
Checked By: N.Agarkova/ E.Kennedy

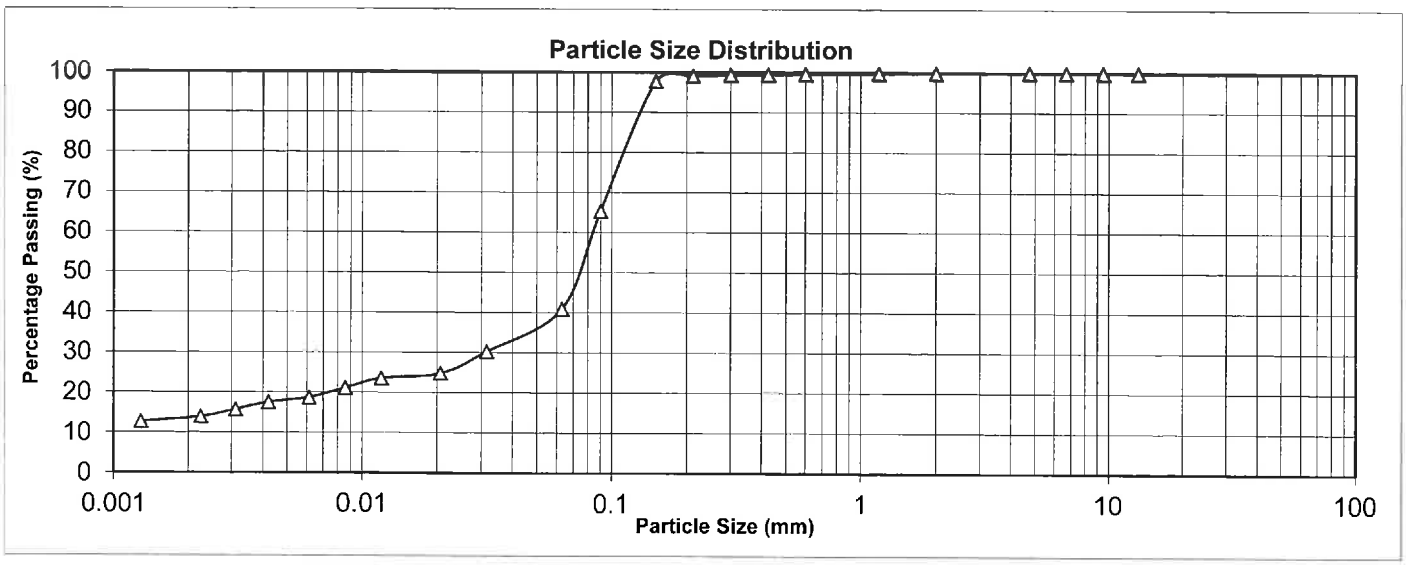
Bore No.: VB11a
Sample No.: P022 (SD47)
Depth (m): 0.60-0.80

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; moist, slightly plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	65
6.70mm	100	63µm	41
4.75mm	100	<63µm	41



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
14	26	60	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB12a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P023 (SD31)
History: As Received

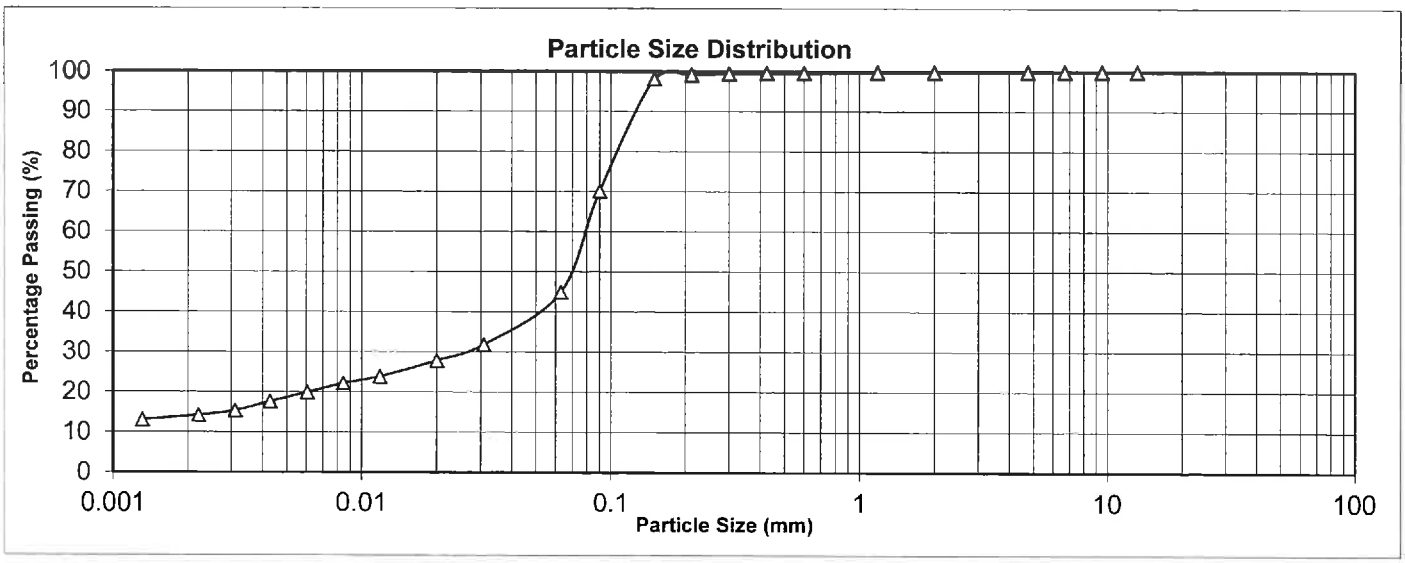
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 0.20-0.50
Report No.: 1871L:02

Sample Description: Fine to medium silty SAND, some clay, trace organics; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	70
6.70mm	100	63µm	45
4.75mm	100	<63µm	45



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
14	30	56	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB12a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P024 (SD32)
History: As Received

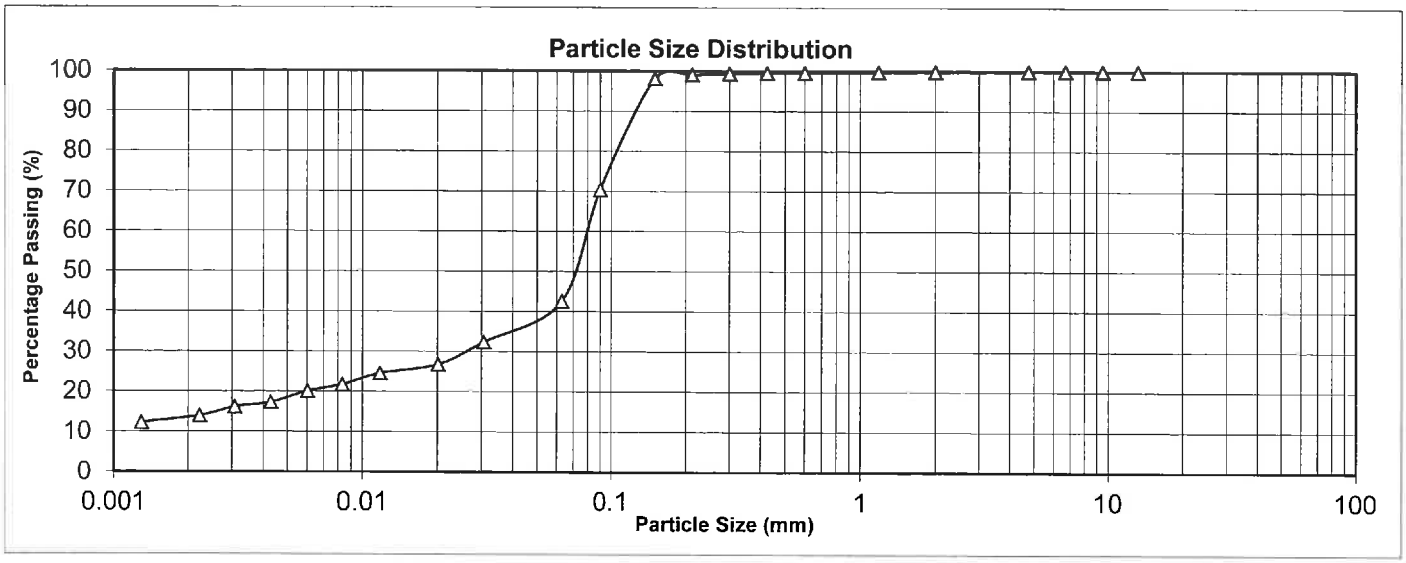
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Keneedy
Depth (m): 2.40-2.70
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	70
6.70mm	100	63µm	43
4.75mm	100	<63µm	43



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
14	28	58	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB12a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P025 (SD33)
History: As Received

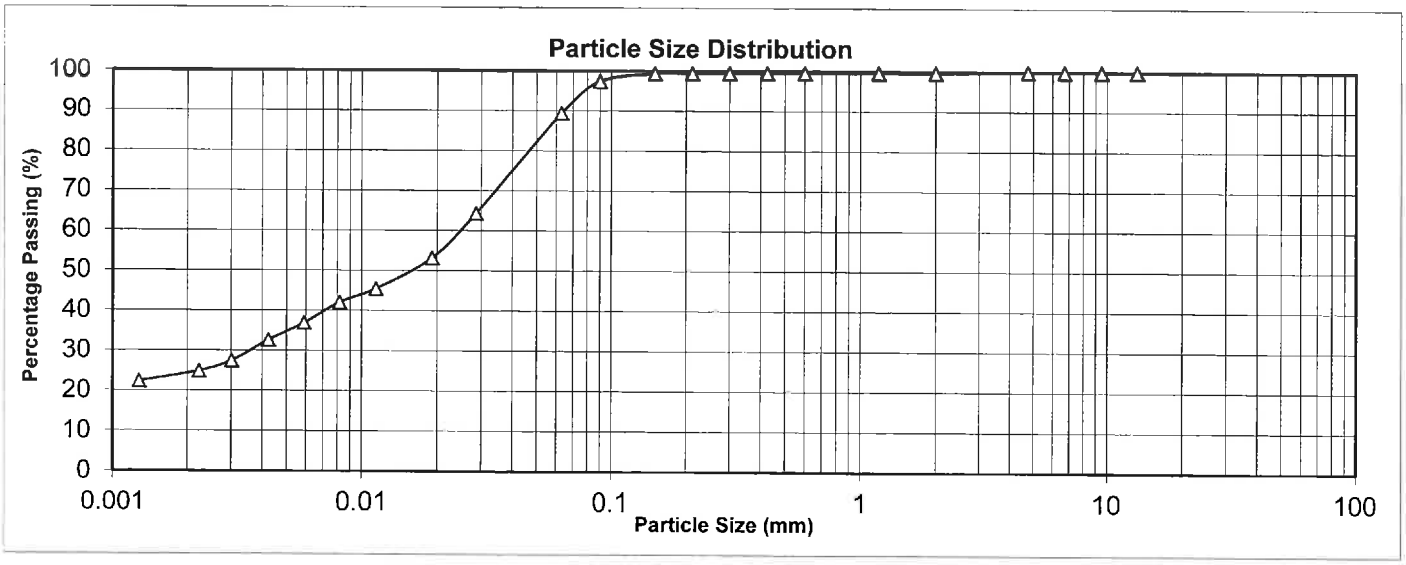
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Keneedy
Depth (m): 3.20-3.50
Report No.: 1871L:02

Sample Description: Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	97
6.70mm	100	63µm	89
4.75mm	100	<63µm	89



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
24	63	13	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

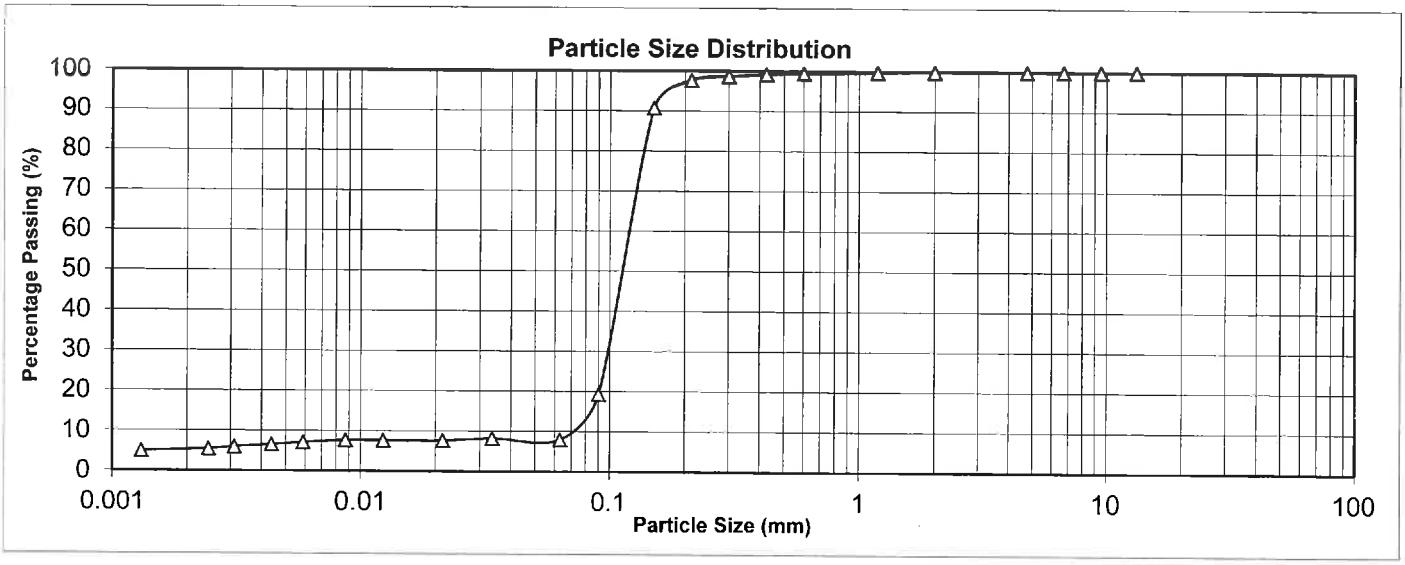
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB13a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P026 (SD62)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.10-0.40
Report No.: 1871L:02

Sample Description: Fine to medium SAND, trace silt, minor clay, trace shells; greenish grey, speckled white; wet, non plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	91
9.50mm	100	90µm	19
6.70mm	100	63µm	8
4.75mm	100	<63µm	8



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
5	3	92	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

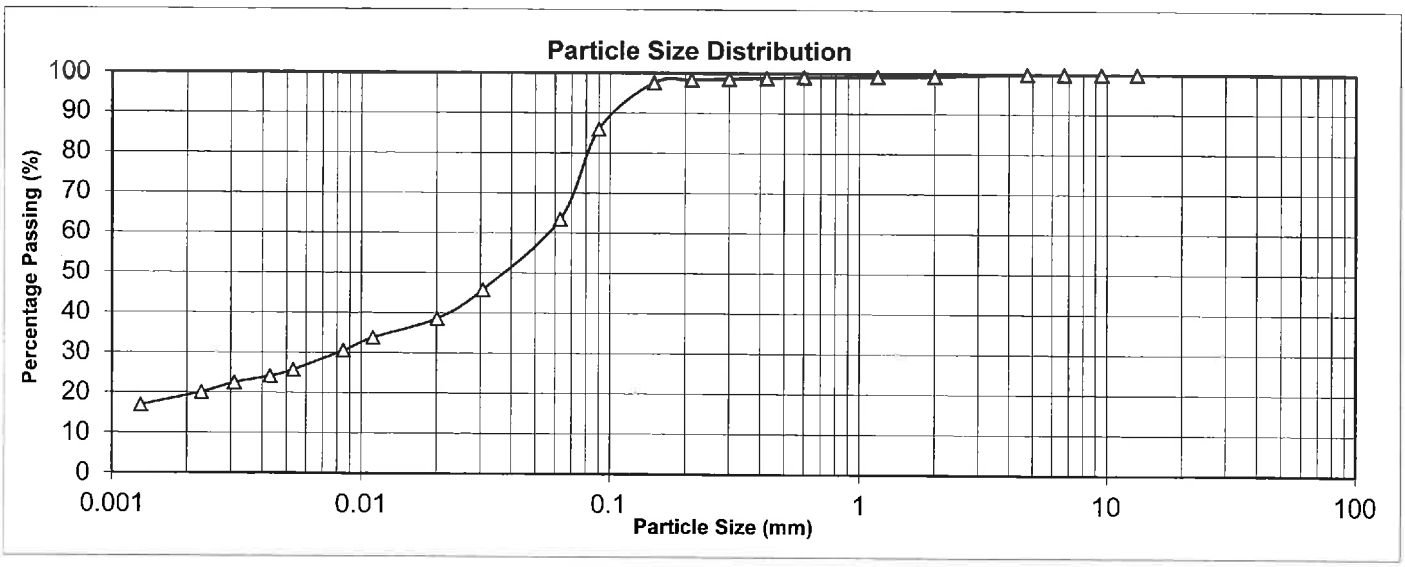
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB13a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P027 (SD63)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 1.50-1.80
Report No.: 1871L:02

Sample Description: Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells; greenish grey; wet, moderately plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	98
9.50mm	100	90µm	86
6.70mm	100	63µm	63
4.75mm	100	<63µm	63



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
19	43	37	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB13a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P028 (SD64)
History: As Received

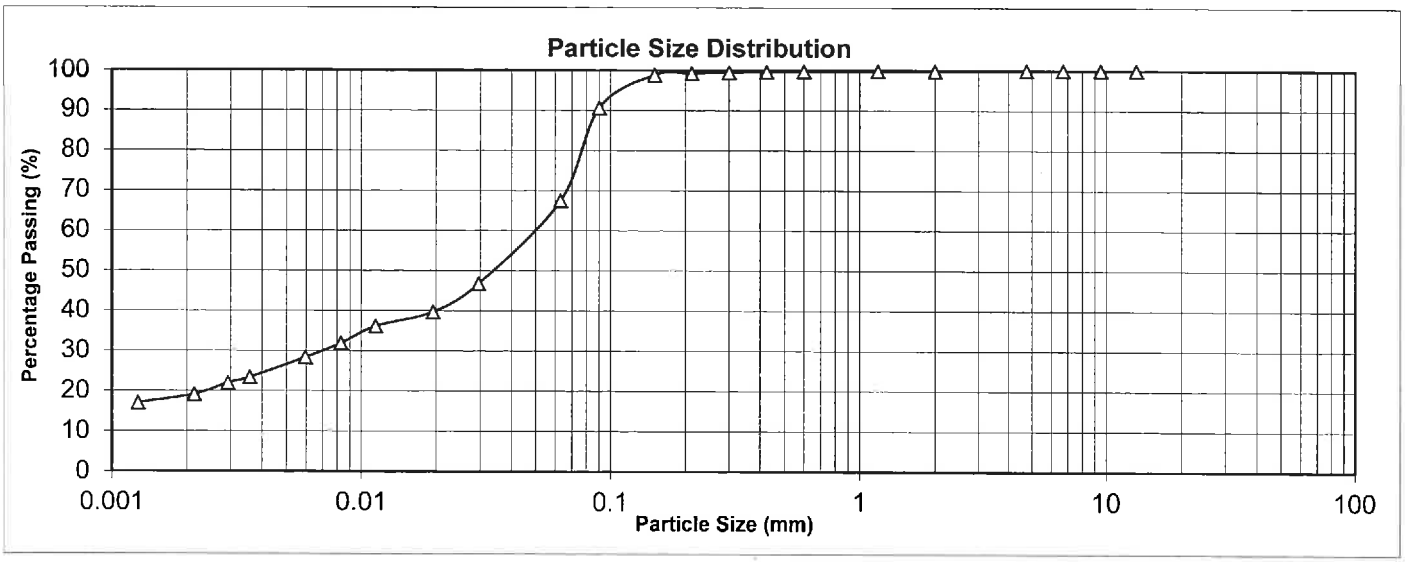
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 2.00-2.30
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	91
6.70mm	100	63µm	67
4.75mm	100	<63µm	67



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
19	47	34	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB14a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P029 (SD65)
History: As Received

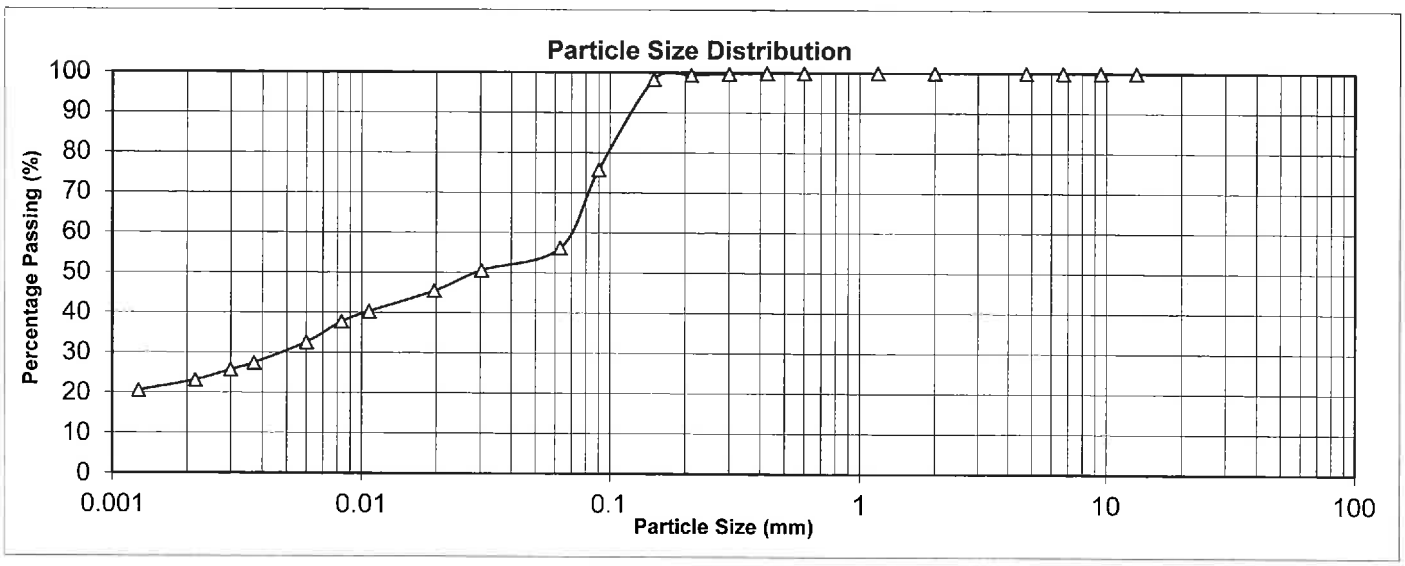
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 0.10-0.40
Report No.: 1871L:02

Sample Description: Fine to medium sandy clayey SILT, trace organics; greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	76
6.70mm	100	63µm	56
4.75mm	100	<63µm	56



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
23	33	44	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB14a
Sample Type: Undisturbed Tube

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P058 (TS5)
History: Natural

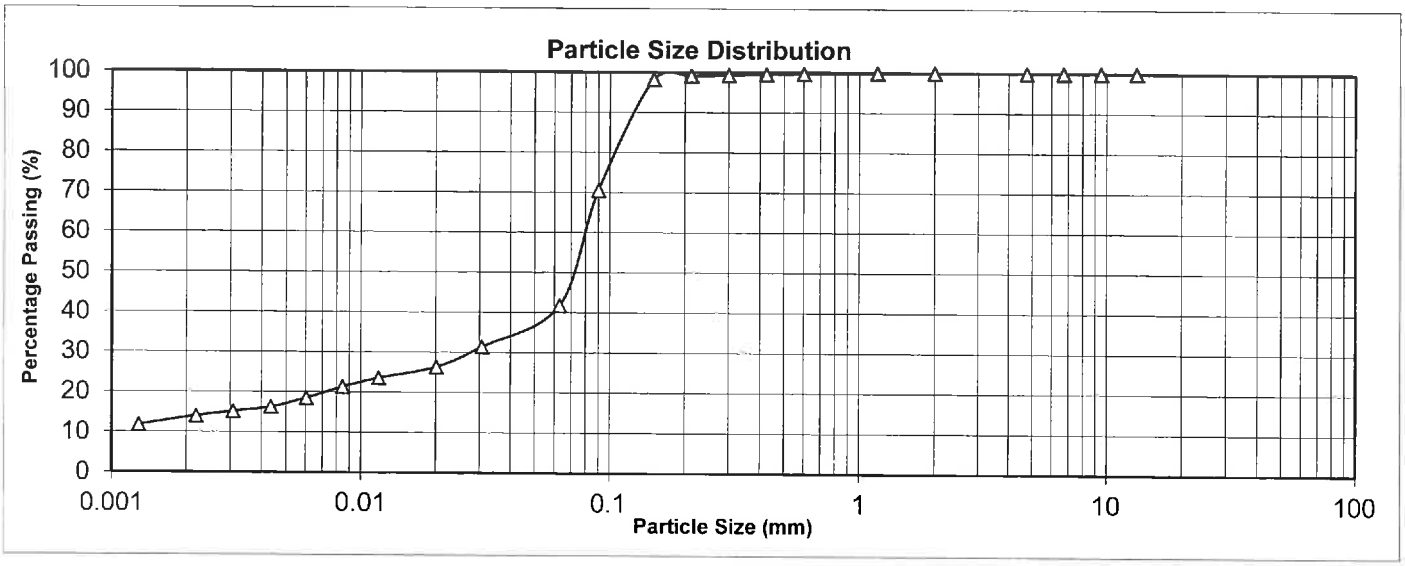
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.50-1.80
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay; greenish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	71
6.70mm	100	63µm	42
4.75mm	100	<63µm	42



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
14	27	59	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB14a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P030 (SD66)
History: As Received

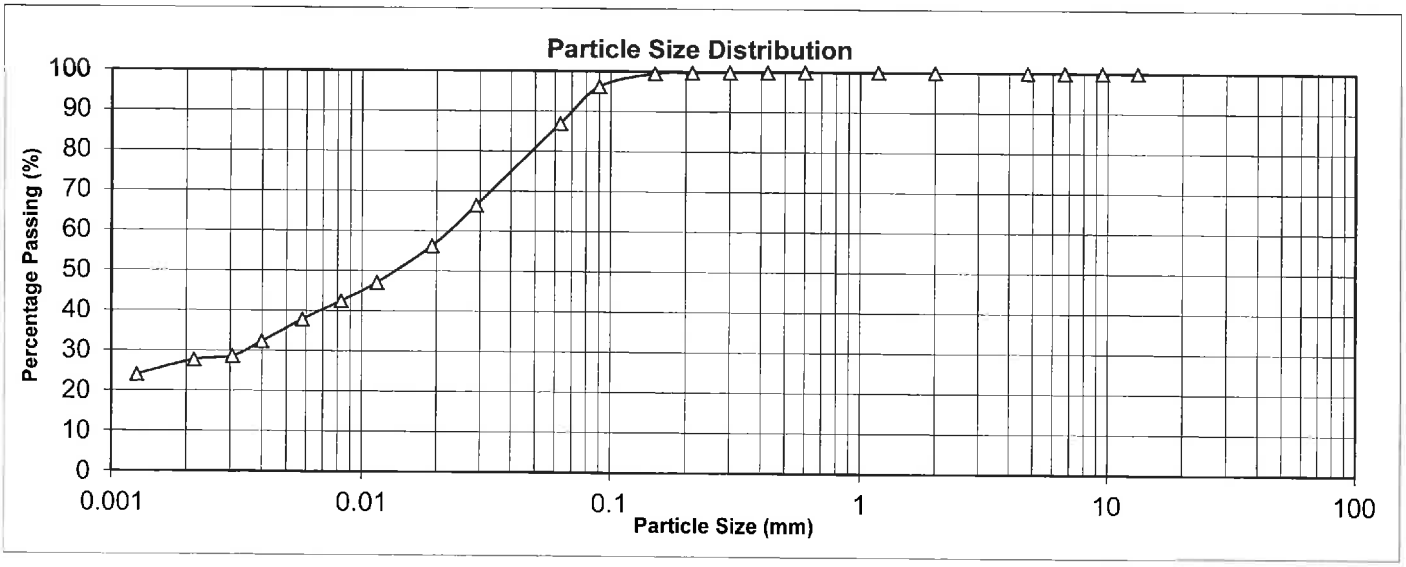
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 1.90-2.20
Report No.: 1871L:02

Sample Description: Clayey SILT, some fine to medium sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	96
6.70mm	100	63µm	87
4.75mm	100	<63µm	87



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
27	58	15	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB15a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P031 (SD42)
History: As Received

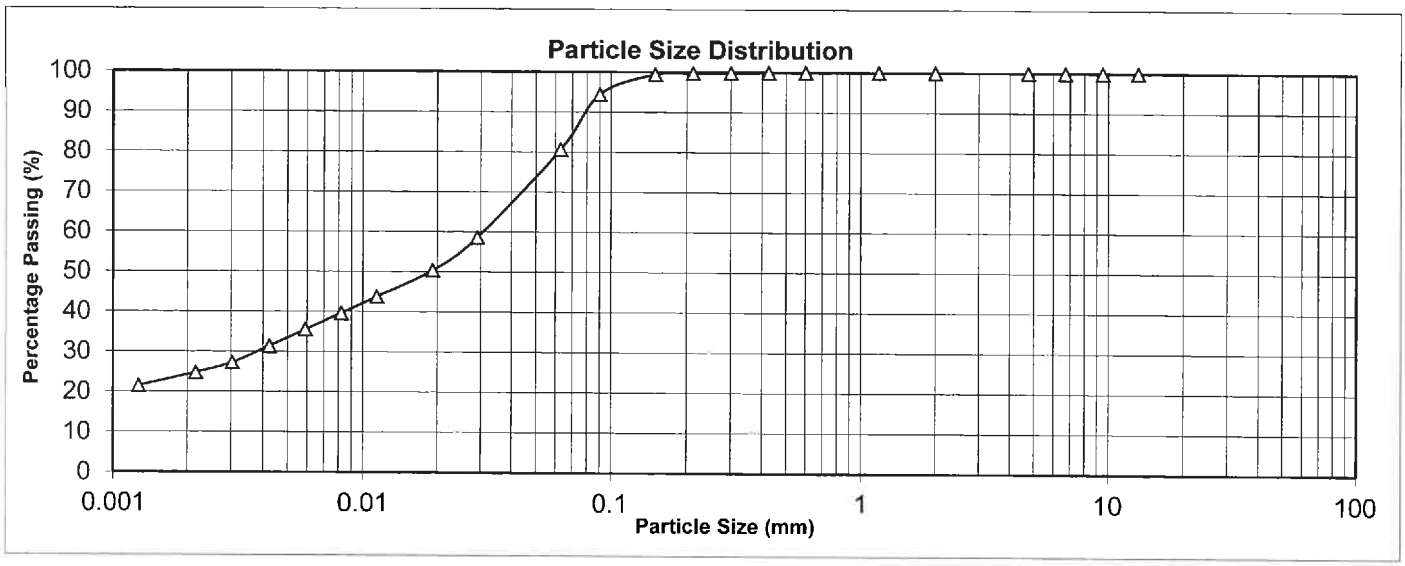
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah/E.Kennedy
Depth (m): 0.40-0.60
Report No.: 1871L:02

Sample Description: Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	94
6.70mm	100	63µm	81
4.75mm	100	<63µm	81



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
24	55	21	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB15a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Sample No.: P032 (SD43)
History: As Received

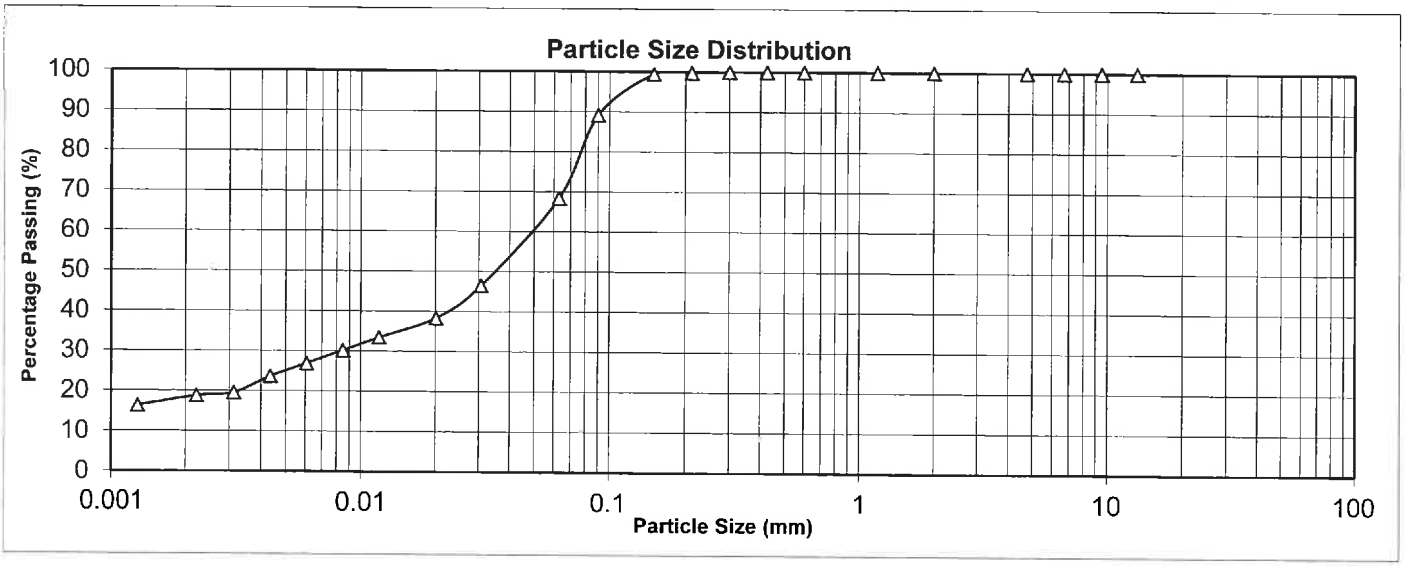
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.75-0.95
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	89
6.70mm	100	63µm	68
4.75mm	100	<63µm	68



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
18	48	34	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB15a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Sample No.: P033 (SD44)
History: As Received

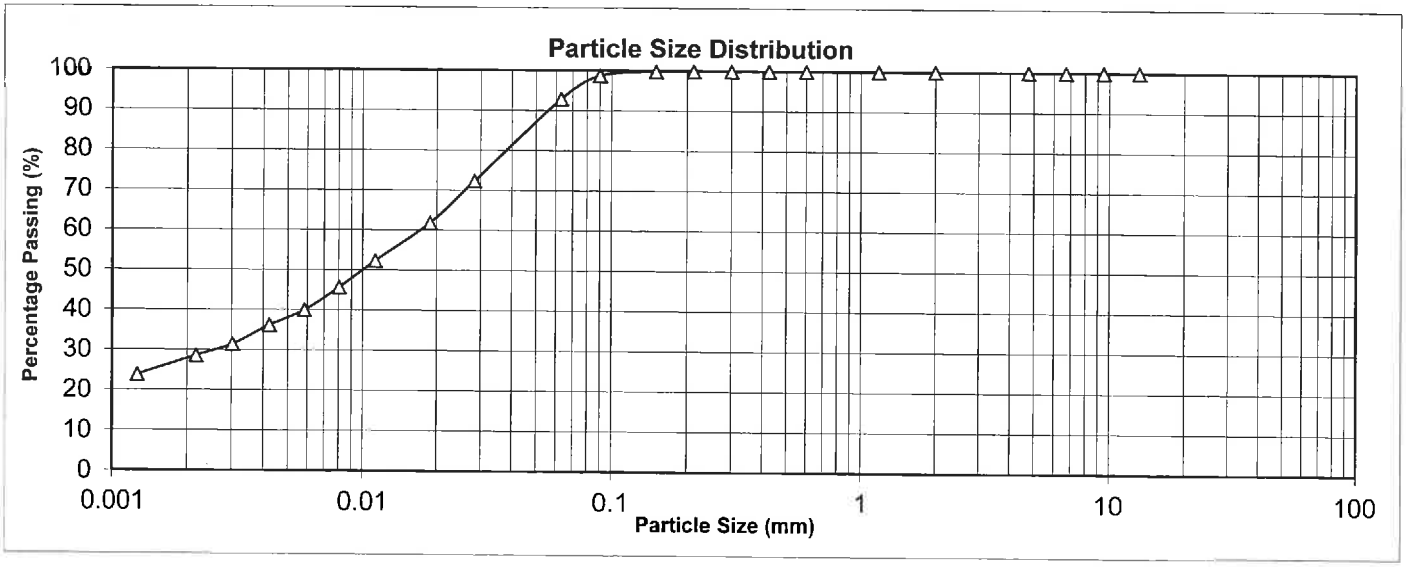
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.60-1.80
Report No.: 1871L:02

Sample Description: Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600μm	100
37.5mm	100	425μm	100
26.5mm	100	300μm	100
19.0mm	100	212μm	100
13.2mm	100	150μm	100
9.50mm	100	90μm	99
6.70mm	100	63μm	93
4.75mm	100	<63μm	93



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
28	63	9	0	90μm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

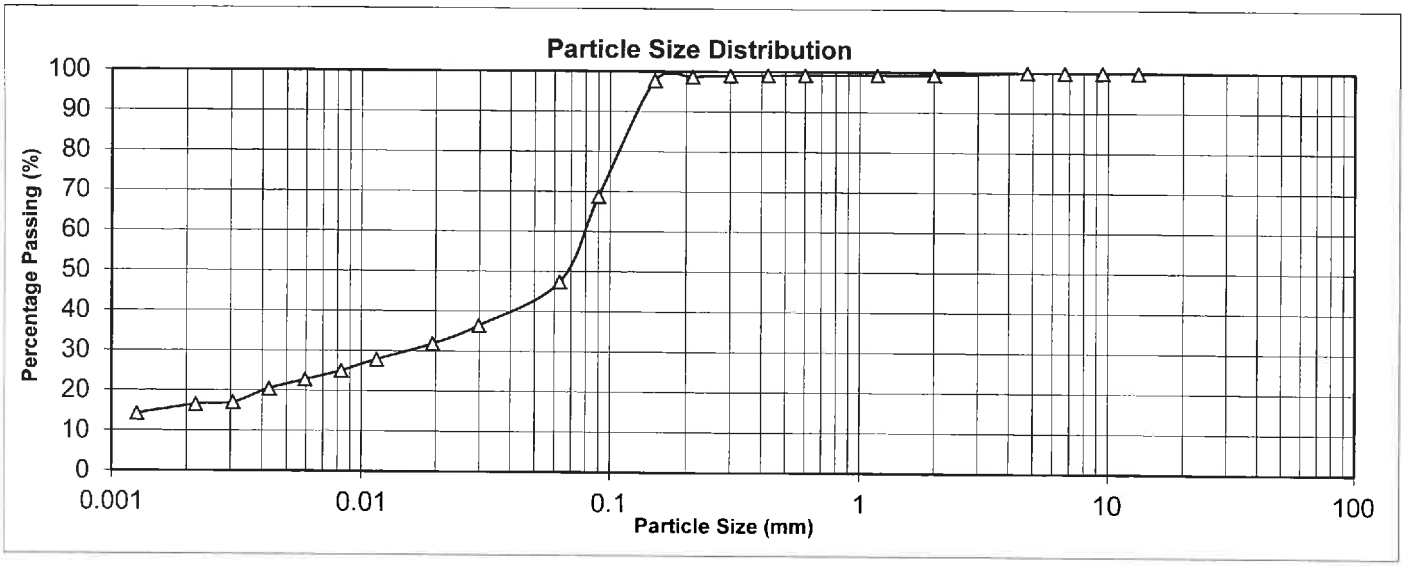
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB16a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Sample No.: P034 (SD34)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.20-0.50
Report No.: 1871L:02

Sample Description: Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells; bluish grey; wet, highly plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	69
6.70mm	100	63µm	47
4.75mm	100	<63µm	47



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
16	30	53	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Date: 23 February 2016

Bore No.: VB16a

Tested By: S.Shah/ N.Agarkova

Checked By: N.Agarkova/ S.Shah

Sample No.: P054 (TS1)

Depth (m): 0.50-0.80

Sample Type: Undisturbed Tube

History: Natural

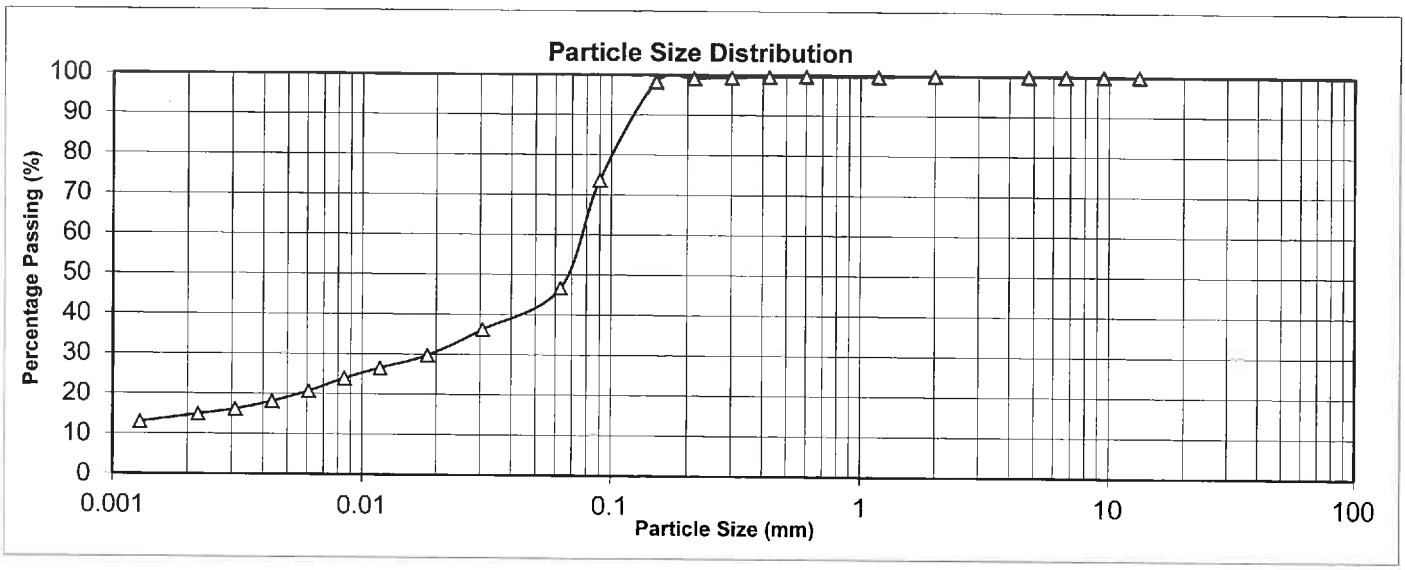
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600μm	100
37.5mm	100	425μm	100
26.5mm	100	300μm	99
19.0mm	100	212μm	99
13.2mm	100	150μm	98
9.50mm	100	90μm	74
6.70mm	100	63μm	47
4.75mm	100	<63μm	47



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
14	32	54	0	300μm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB16a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova/E.Kennedy
Sample No.: P035 (SD35)
History: As Received

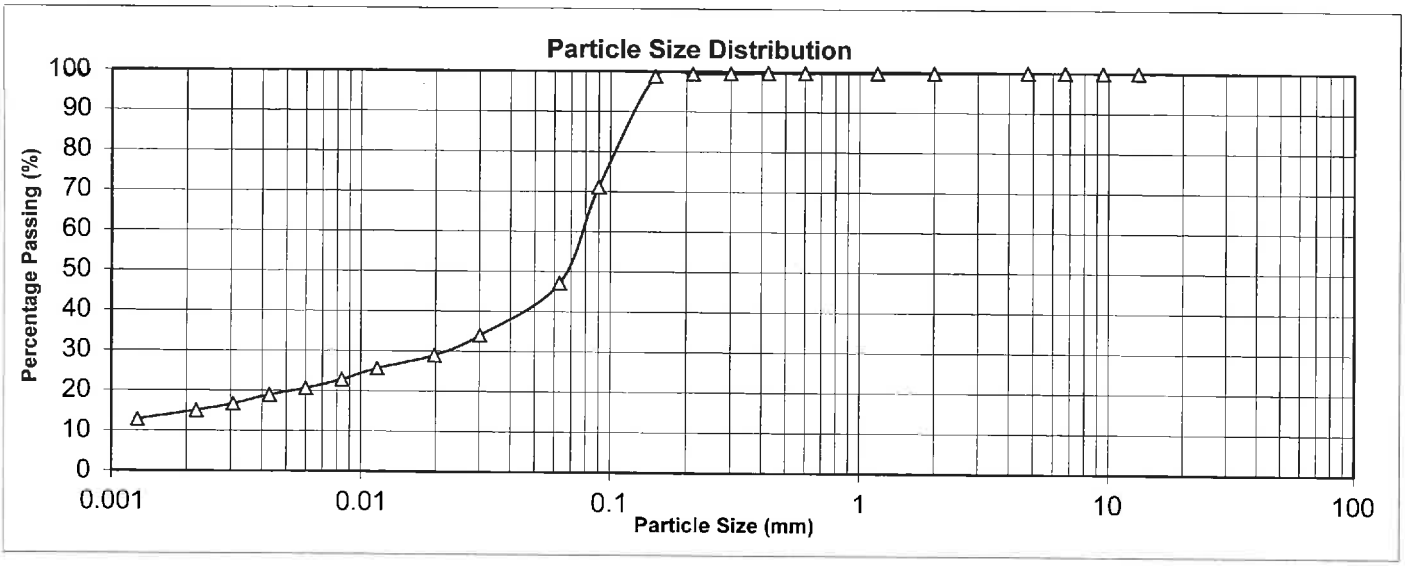
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.80-1.10
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace shells; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	71
6.70mm	100	63µm	47
4.75mm	100	<63µm	47



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
15	31	54	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB16a
Sample Type: Undisturbed Tube

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P055 (TS2)
History: Natural

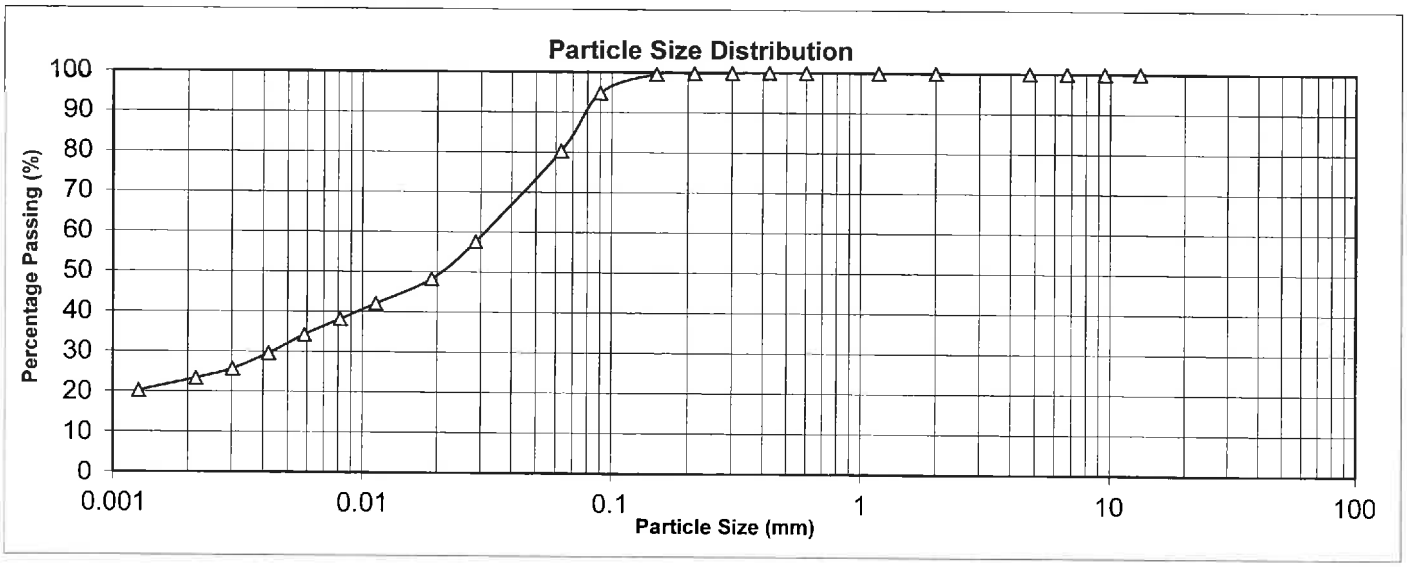
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 2.00-2.30
Report No.: 1871L:02

Sample Description: Fine sandy clayey SILT; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600μm	100
37.5mm	100	425μm	100
26.5mm	100	300μm	100
19.0mm	100	212μm	100
13.2mm	100	150μm	100
9.50mm	100	90μm	95
6.70mm	100	63μm	80
4.75mm	100	<63μm	80



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
23	55	22	0	90μm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Date: 23 February 2016

Tested By: S.Shah/ N.Agarkova/E.Kennedy

Checked By: N.Agarkova/ S.Shah

Bore No.: VB16a

Sample No.: P036 (SD36)

Depth (m): 3.00-3.30

Sample Type: Small Disturbed

History: As Received

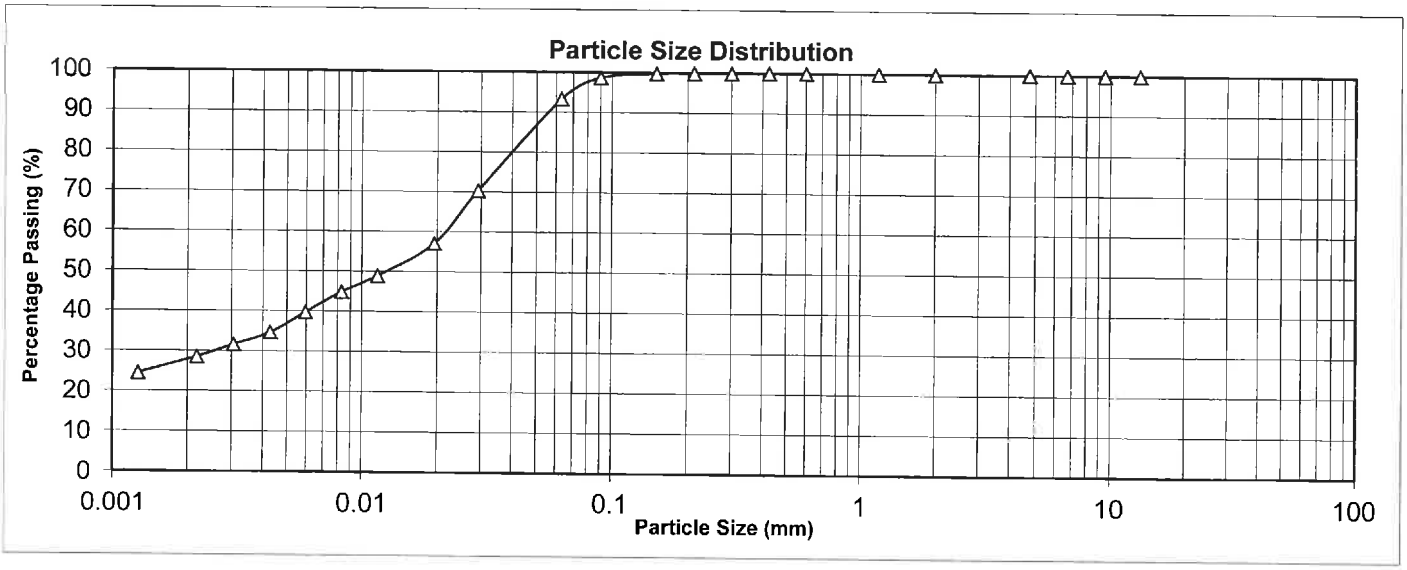
Report No.: 1871L:02

Sample Description: Clayey SILT, minor fine sand, trace organics; greenish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	99
6.70mm	100	63µm	93
4.75mm	100	<63µm	93



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
28	63	9	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

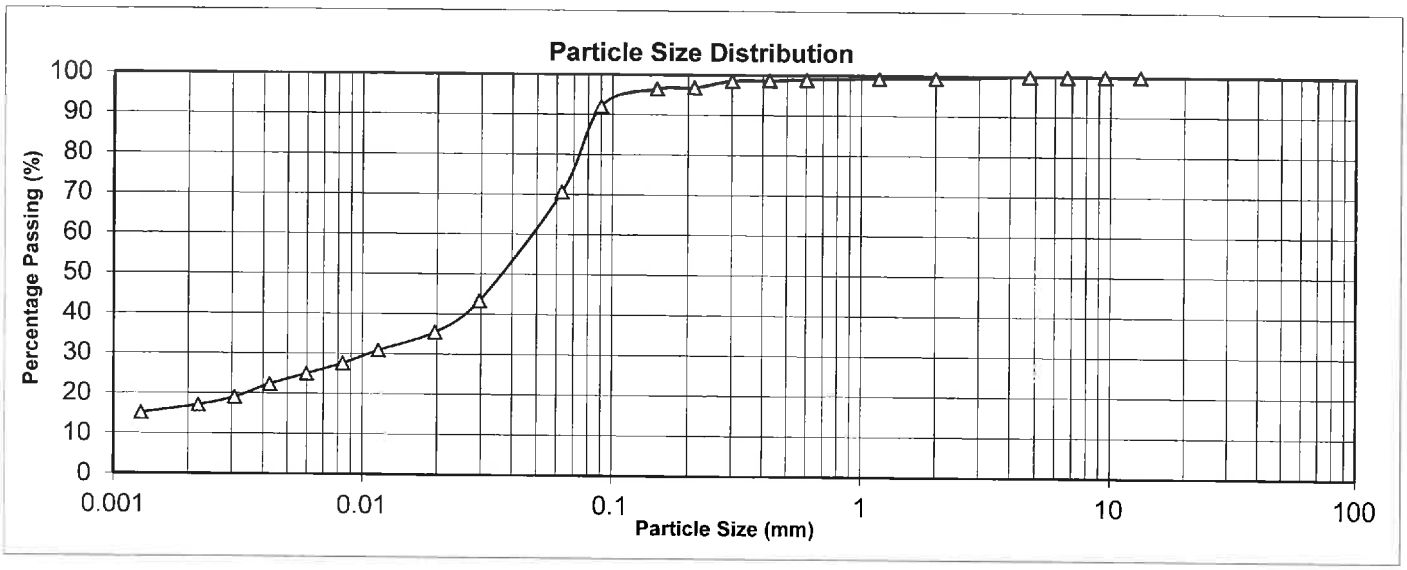
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB17a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P037 (SD69)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.50-0.80
Report No.: 1871L:02

Sample Description: Fine to coarse sandy SILT, some clay, trace fine gravel, trace organics, trace shells; bluish grey; wet, moderately plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600μm	99
37.5mm	100	425μm	99
26.5mm	100	300μm	99
19.0mm	100	212μm	97
13.2mm	100	150μm	96
9.50mm	100	90μm	92
6.70mm	100	63μm	71
4.75mm	100	<63μm	71



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
17	51	31	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB17a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P038 (SD70)
History: As Received

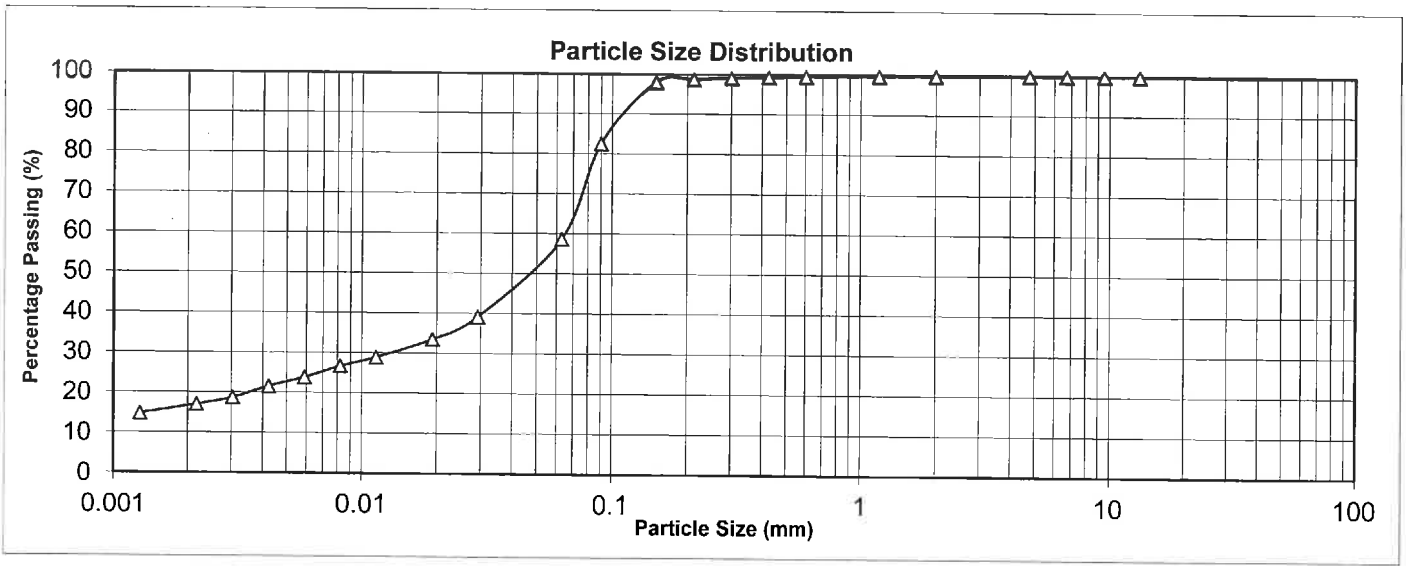
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.70-2.00
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	82
6.70mm	100	63µm	59
4.75mm	100	<63µm	59



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
17	40	43	0	425µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

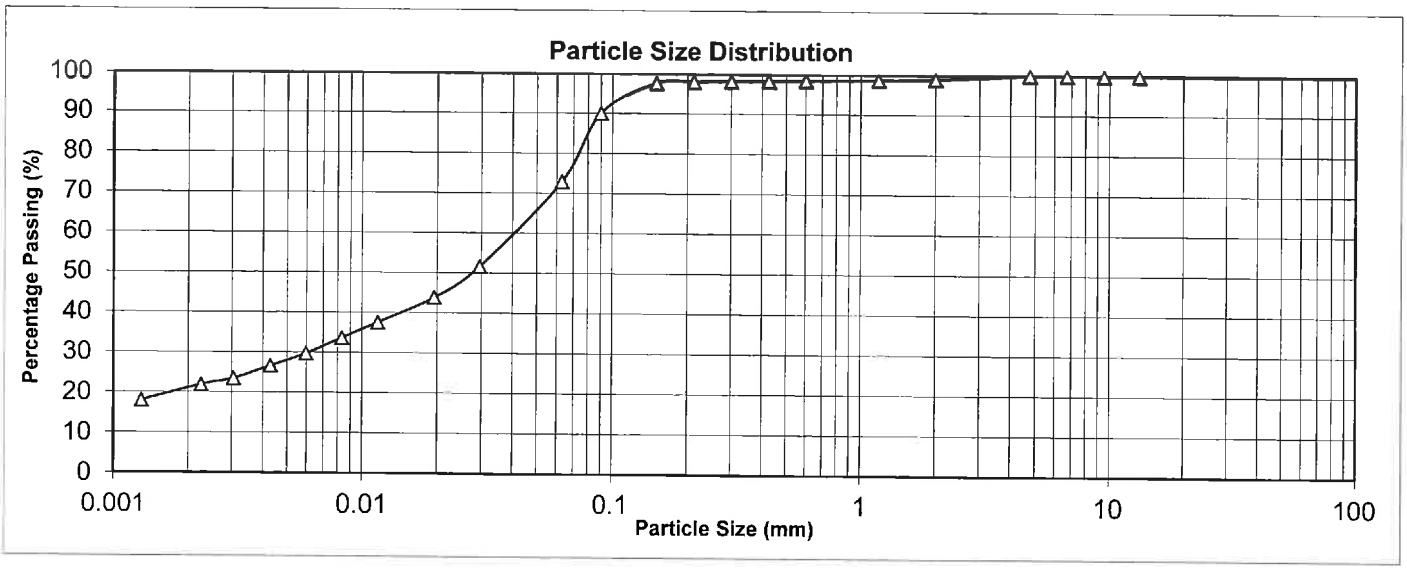
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB18a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P039 (SD37)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.60-0.80
Report No.: 1871L:02

Sample Description: Fine to coarse sandy clayey SILT, trace gravel, trace shells, trace organics; greenish grey; wet, moderately plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600μm	98
37.5mm	100	425μm	98
26.5mm	100	300μm	98
19.0mm	100	212μm	98
13.2mm	100	150μm	98
9.50mm	100	90μm	90
6.70mm	100	63μm	73
4.75mm	100	<63μm	73



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
21	50	28	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB18a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P040 (SD38)
History: As Received

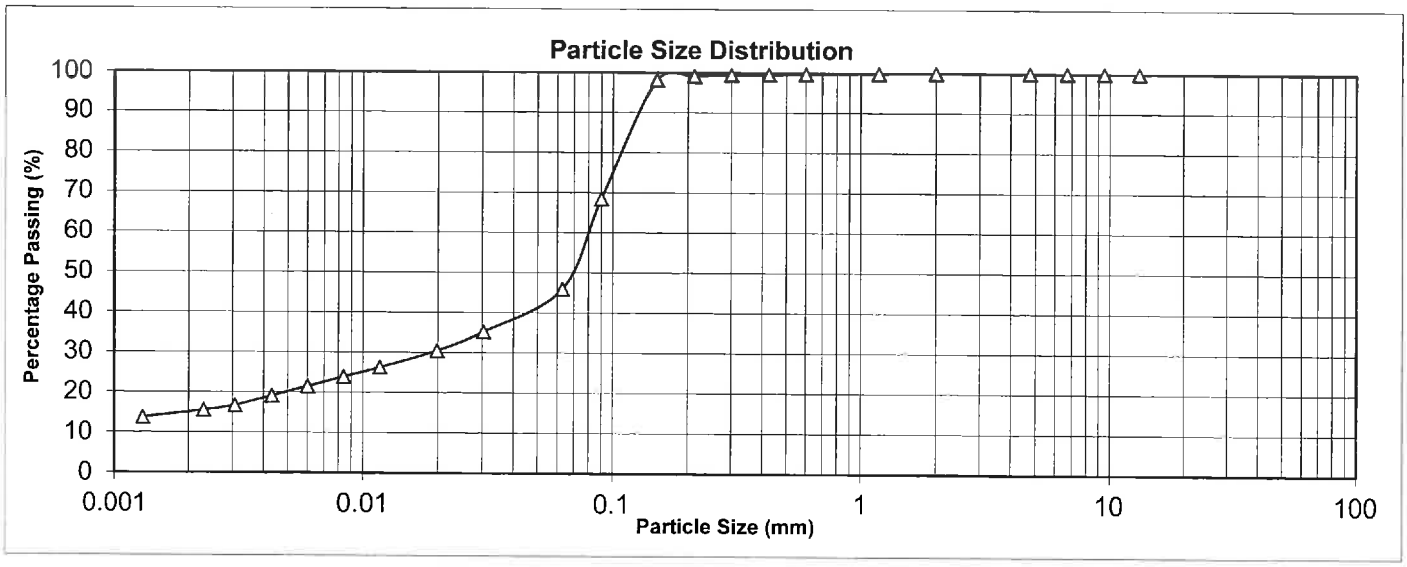
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 2.20-2.40
Report No.: 1871L:02

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	68
6.70mm	100	63µm	46
4.75mm	100	<63µm	46



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
15	30	55	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB18a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P041 (SD39)
History: As Received

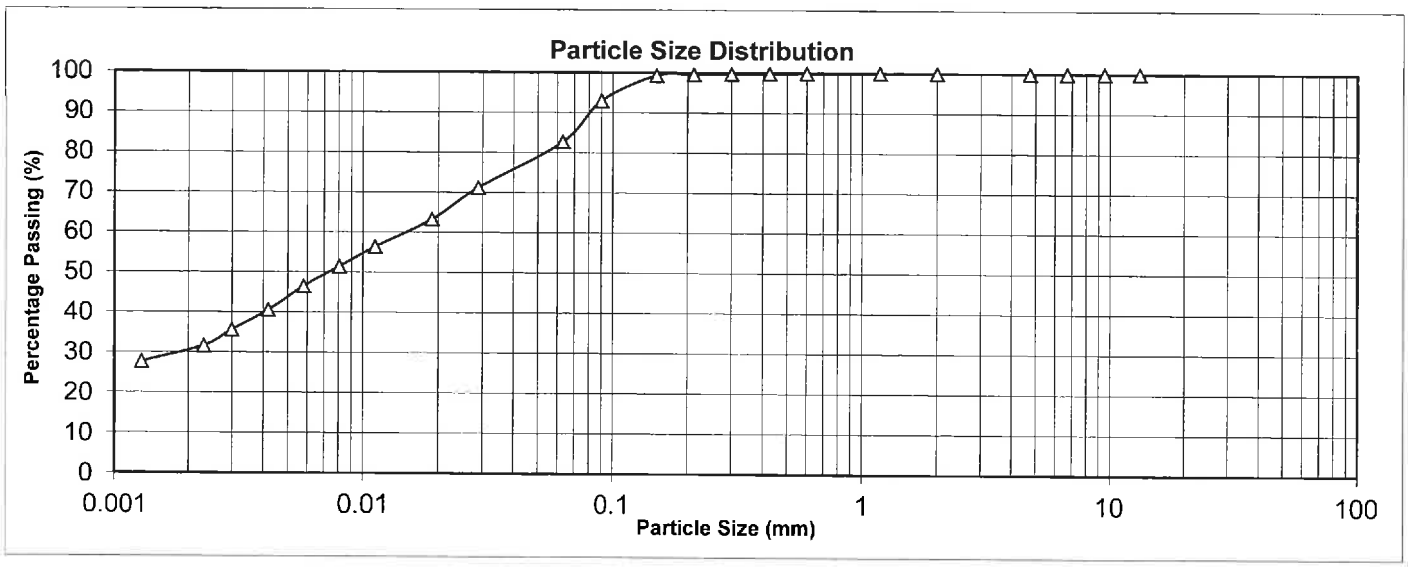
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 2.90-3.10
Report No.: 1871L:02

Sample Description: Clayey SILT, some fine sand, trace organics; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	93
6.70mm	100	63µm	83
4.75mm	100	<63µm	83



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
30	52	18	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB19a
Sample Type: Undisturbed Tube

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P057 (TS4)
History: Natural

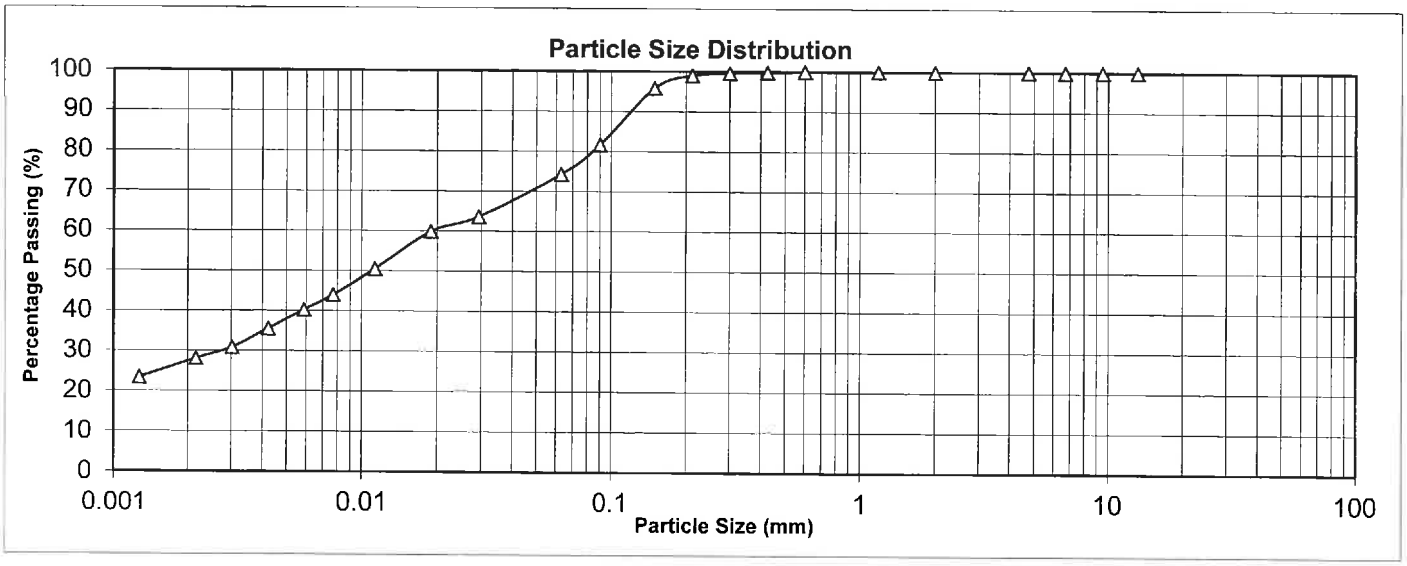
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.50-0.80
Report No.: 1871L:02

Sample Description: Fine to medium sandy clayey SILT; dark greenish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	96
9.50mm	100	90µm	82
6.70mm	100	63µm	74
4.75mm	100	<63µm	74



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
27	46	27	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB19a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P042 (SD49)
History: As Received

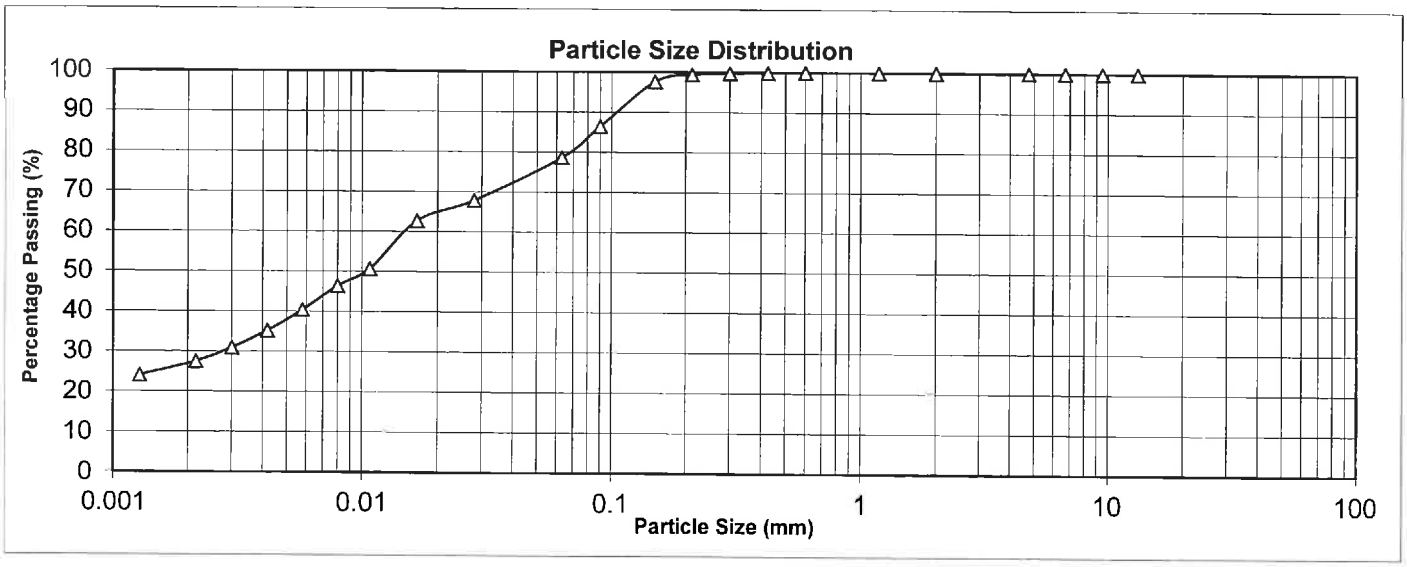
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.80-1.00
Report No.: 1871L:02

Sample Description: Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	86
6.70mm	100	63µm	79
4.75mm	100	<63µm	79



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
27	51	22	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB19a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P043 (SD50)
History: As Received

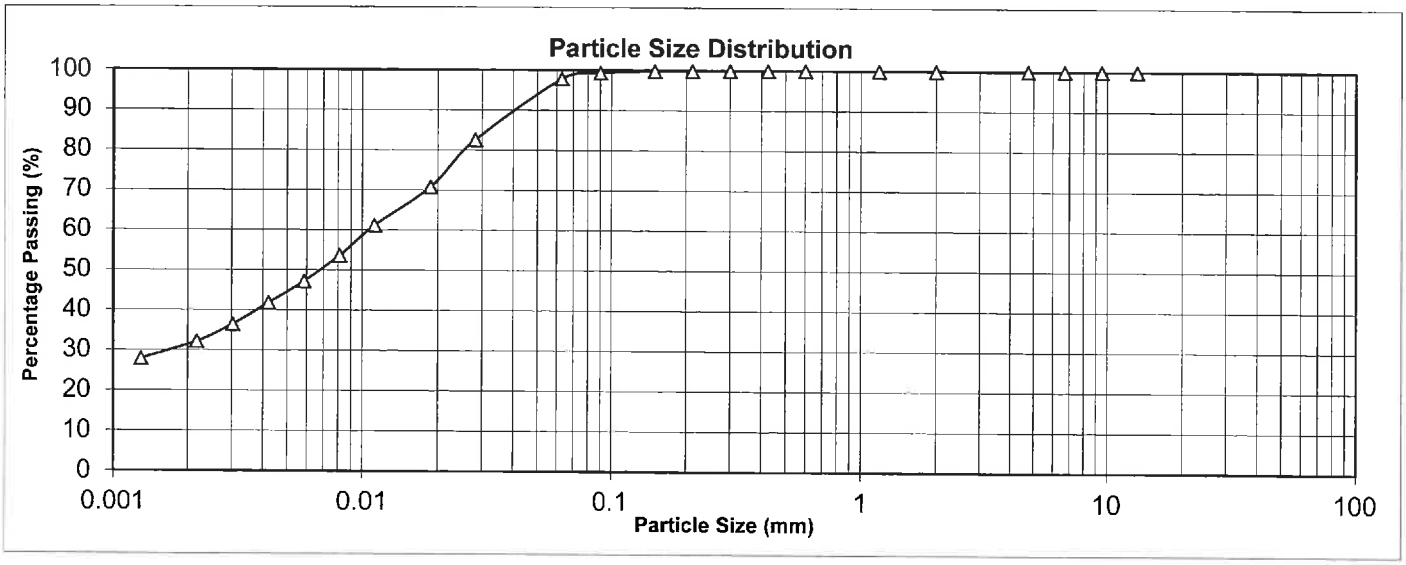
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.60-1.80
Report No.: 1871L:02

Sample Description: Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	99
6.70mm	100	63µm	98
4.75mm	100	<63µm	98



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
31	66	3	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

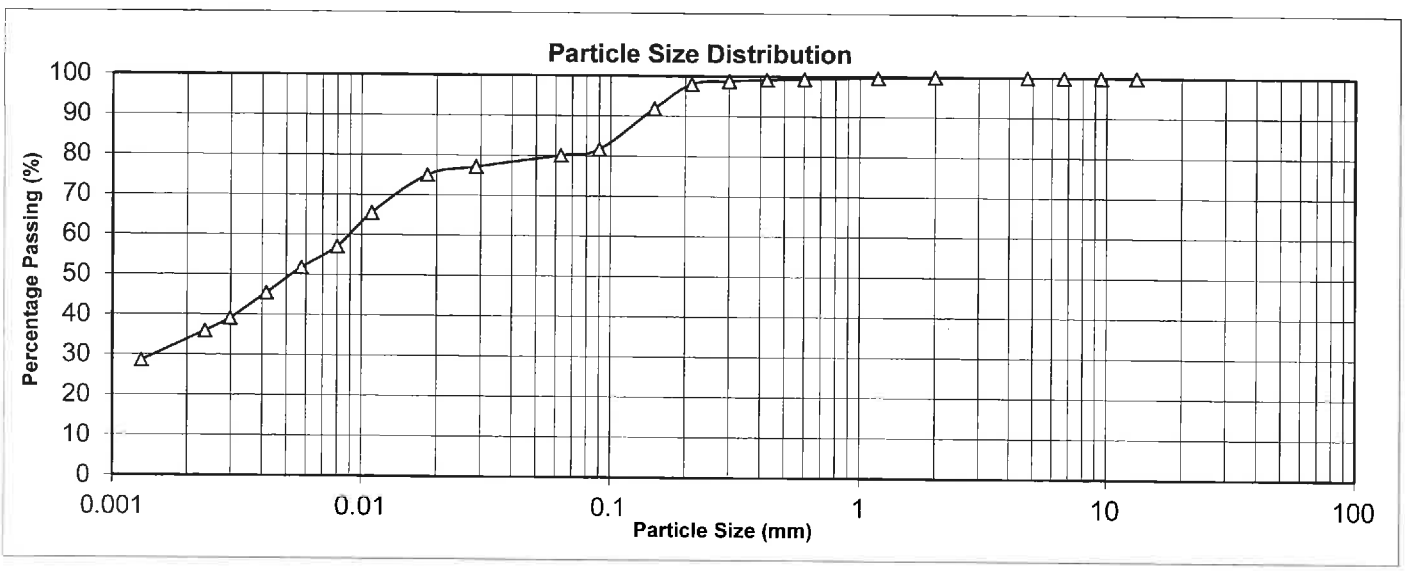
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB20a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P044 (SD26)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.10-0.40
Report No.: 1871L:02

Sample Description: Clayey SILT, some fine to medium sand, trace organics; dark greenish grey; wet, highly plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	92
9.50mm	100	90µm	82
6.70mm	100	63µm	80
4.75mm	100	<63µm	80



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
33	47	20	0	600µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB20a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P045 (SD27)
History: As Received

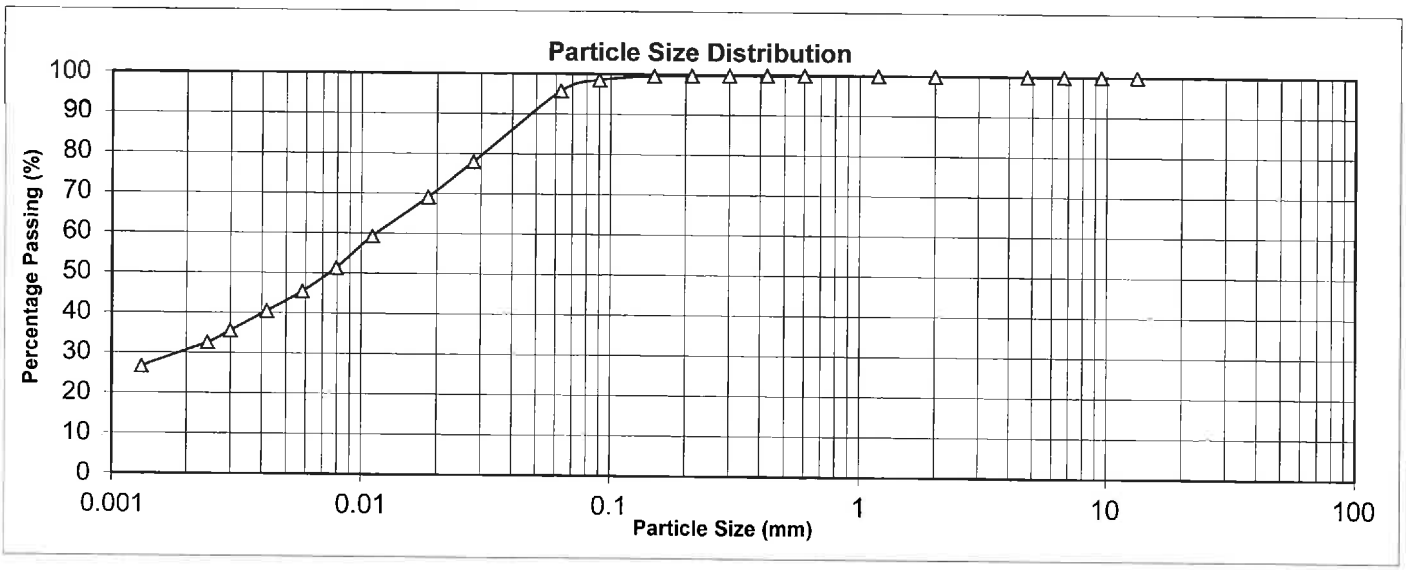
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.80-1.10
Report No.: 1871L:02

Sample Description: Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	99
6.70mm	100	63µm	96
4.75mm	100	<63µm	96



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
30	64	6	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Bore No.: VB20a

Sample Type: Small Disturbed

Client: Port of Napier Ltd

Tested By: S.Shah/ N.Agarkova
Sample No.: P046 (SD28)
History: As Received

Date: 23 February 2016

Checked By: N.Agarkova/ S.Shah
Depth (m): 2.20-2.50

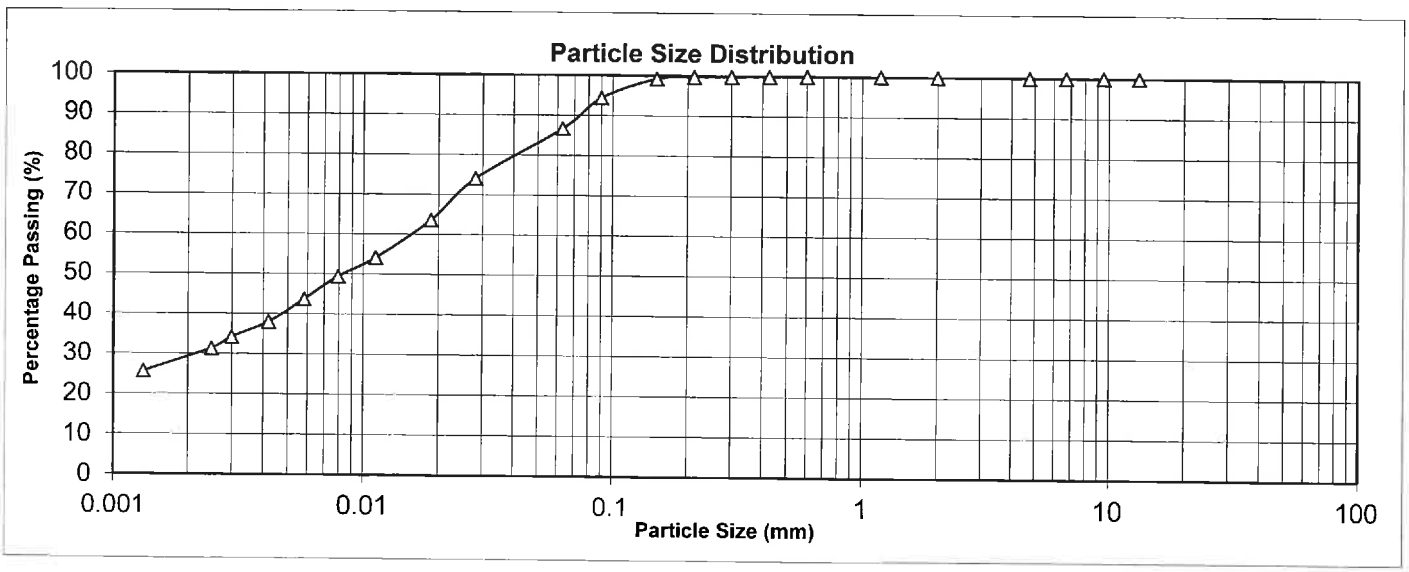
Report No.: 1871L:02

Sample Description: Clayey SILT, some fine sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	94
6.70mm	100	63µm	87
4.75mm	100	<63µm	87



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
29	57	14	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Bore No.: VB22a

Sample Type: Small Disturbed

Client: Port of Napier Ltd

Tested By: S.Shah/ N.Agarkova
Sample No.: P047 (SD25)
History: As Received

Date: 23 February 2016

Checked By: N.Agarkova/ S.Shah
Depth (m): 0.00-0.20

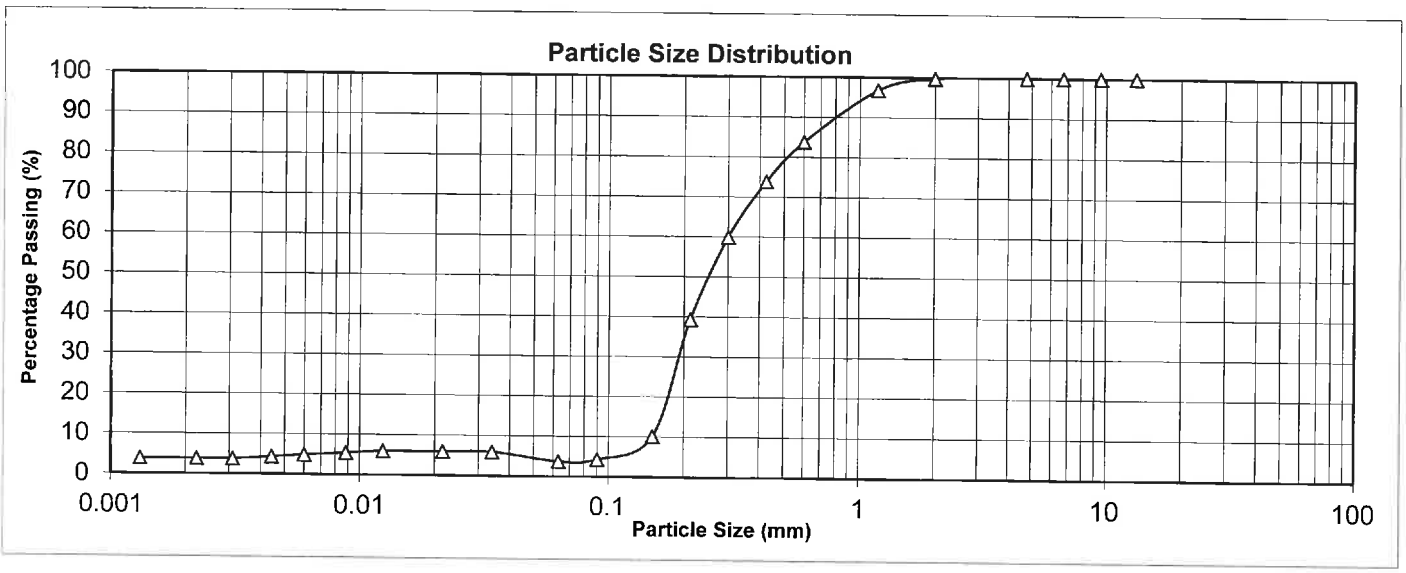
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace clay; greenish grey; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	97
53.0mm	100	600μm	84
37.5mm	100	425μm	74
26.5mm	100	300μm	60
19.0mm	100	212μm	39
13.2mm	100	150μm	10
9.50mm	100	90μm	4
6.70mm	100	63μm	4
4.75mm	100	<63μm	4



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	0	96	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB23a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P048 (SD58)
History: As Received

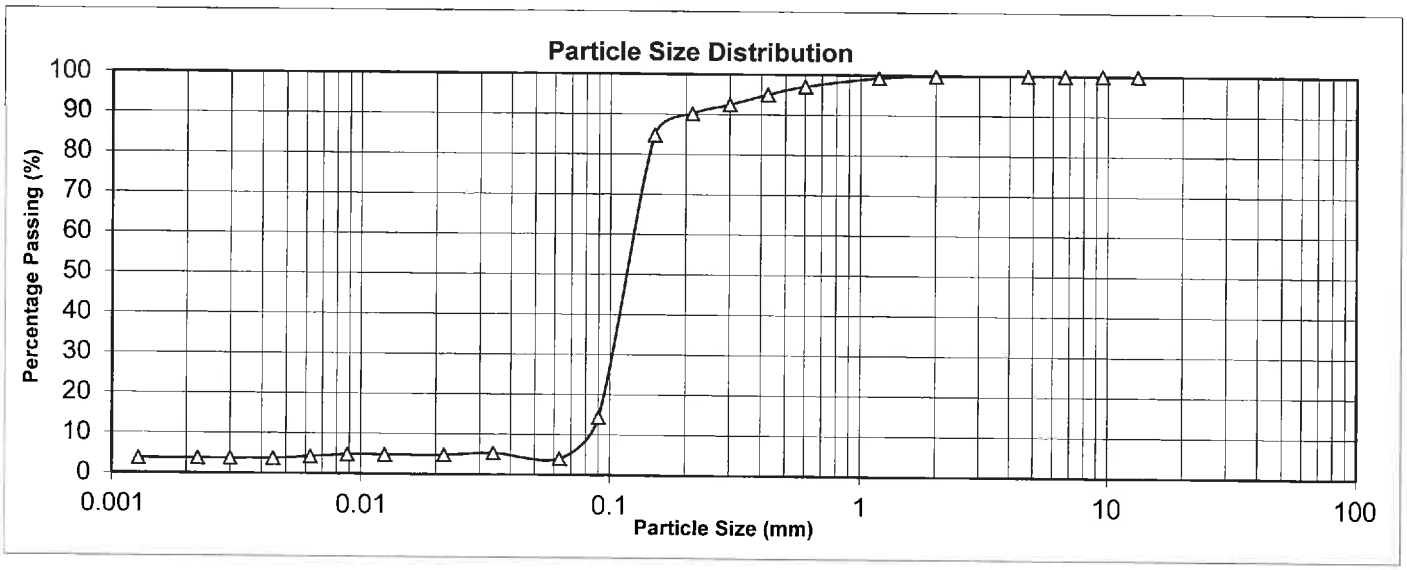
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.40-0.70
Report No.: 1871L:02

Sample Description: Fine to coarse SAND, trace clay, trace shells; bluish grey, speckled white; wet, non plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	99
53.0mm	100	600µm	97
37.5mm	100	425µm	95
26.5mm	100	300µm	92
19.0mm	100	212µm	90
13.2mm	100	150µm	85
9.50mm	100	90µm	14
6.70mm	100	63µm	4
4.75mm	100	<63µm	4



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
4	0	96	0	1.18mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB24a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P050 (SD59)
History: As Received

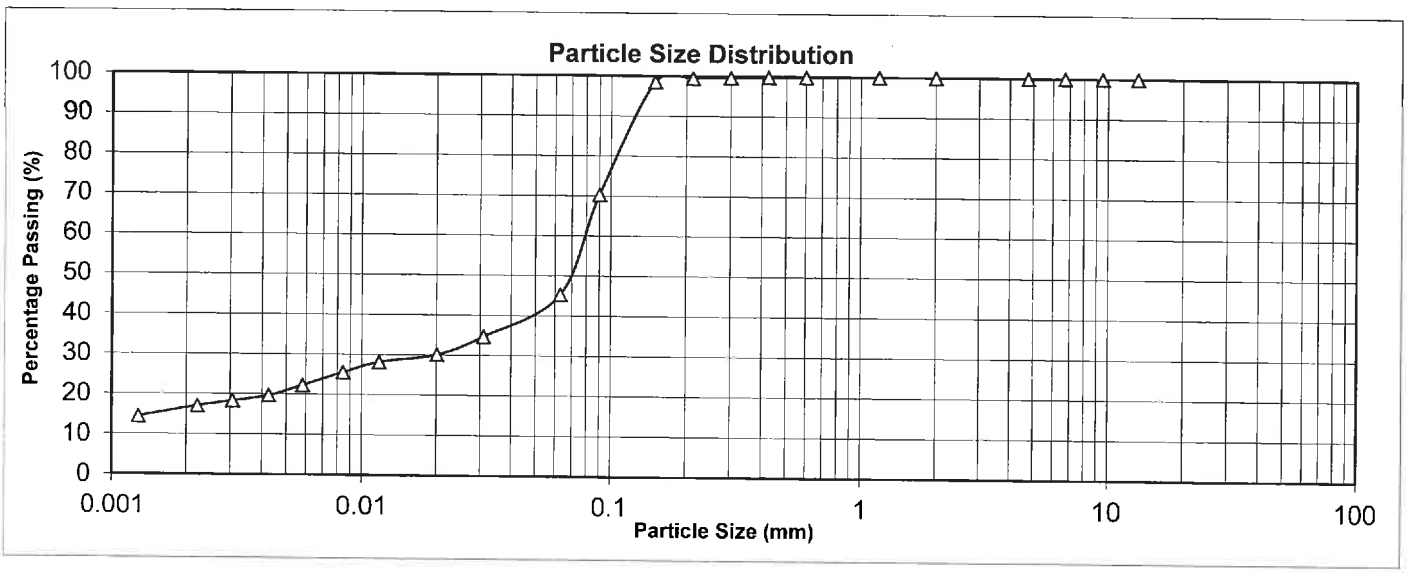
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 0.30-0.60
Report No.: 1871L:02

Sample Description: Fine sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	70
6.70mm	100	63µm	45
4.75mm	100	<63µm	45



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
16	28	56	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

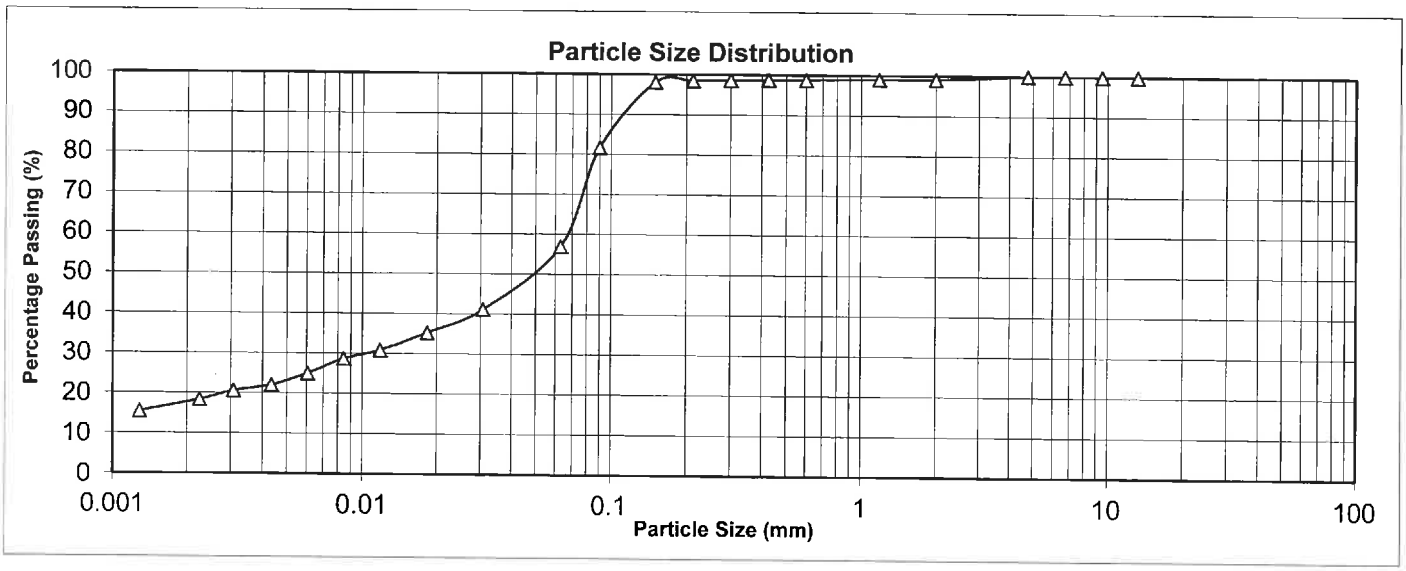
Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB24a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P051 (SD60)
History: As Received

Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 1.60-1.80
Report No.: 1871L:02

Sample Description: Fine to coarse sandy SILT, some clay, trace fine gravel, trace shells, trace organics; bluish grey; wet, moderately plastic.
Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	99
63.0mm	100	1.18mm	99
53.0mm	100	600µm	99
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	98
9.50mm	100	90µm	82
6.70mm	100	63µm	57
4.75mm	100	<63µm	57



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
18	37	44	1	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Bore No.: VB24a
Sample Type: Small Disturbed

Client: Port of Napier Ltd
Tested By: S.Shah/ N.Agarkova
Sample No.: P052 (SD61)
History: As Received

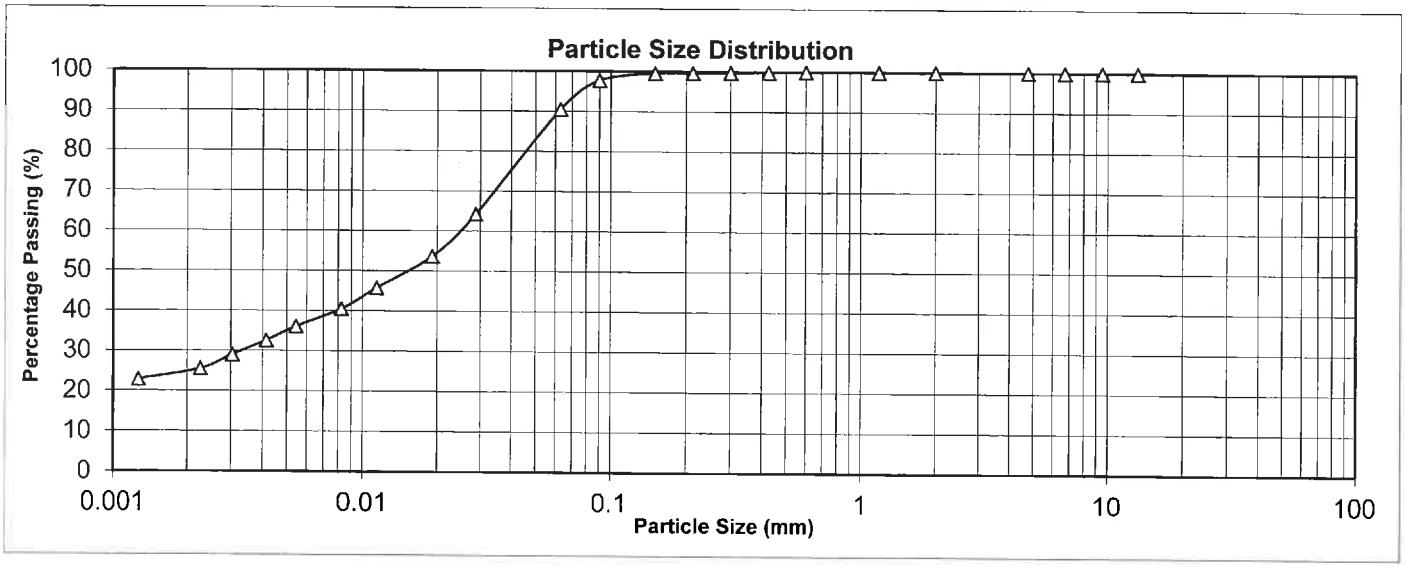
Date: 23 February 2016
Checked By: N.Agarkova/ S.Shah
Depth (m): 2.20-2.40
Report No.: 1871L:02

Sample Description: Clayey SILT, minor fine sand, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	98
6.70mm	100	63µm	90
4.75mm	100	<63µm	90



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
25	63	12	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Bore No.: VB25a

Sample Type: Small Disturbed

Client: Port of Napier Ltd

Tested By: S.Shah/ N.Agarkova
Sample No.: P053 (SD68)
History: As Received

Date: 23 February 2016

Checked By: N.Agarkova/ S.Shah
Depth (m): 0.30-0.60

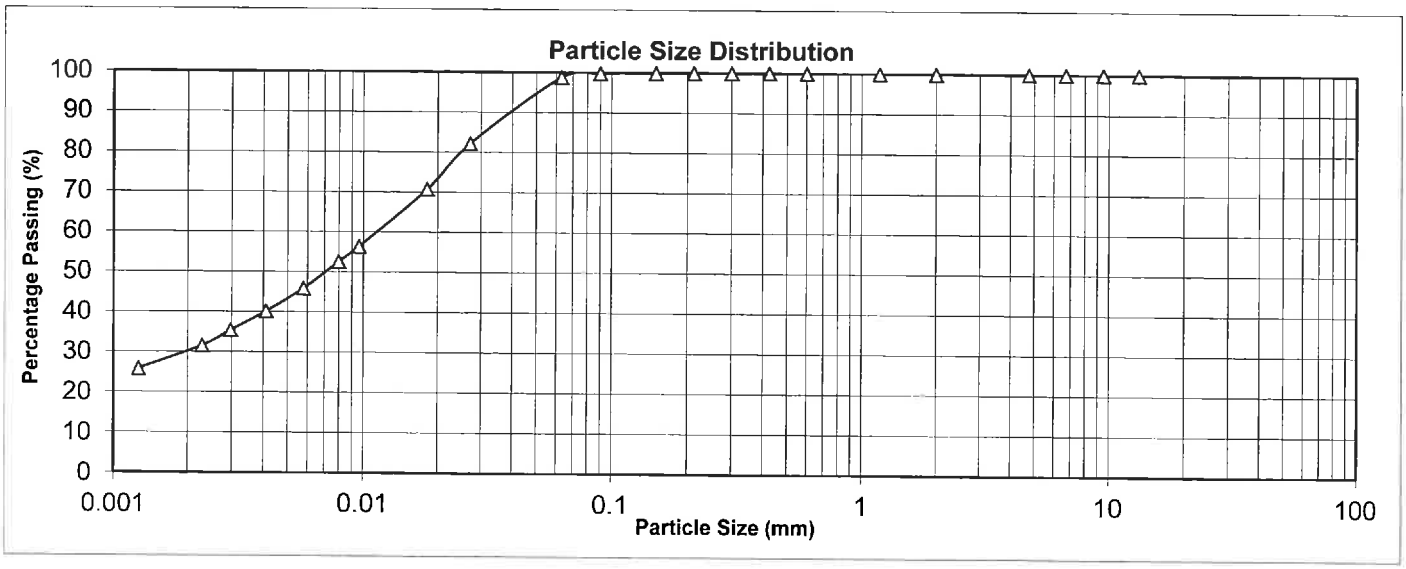
Report No.: 1871L:02

Sample Description: Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	100
6.70mm	100	63µm	99
4.75mm	100	<63µm	99



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
30	67	3	0	63µm

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SUMMARY OF TEST RESULTS

Report:
1871L:03

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 4 March 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	CBR	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH616	P129	0.20-0.50	SD	Fine to medium SAND, some silt, minor clay; bluish grey; wet, slightly plastic.	23.4		X	X	X							
BH616	P130	7.50-7.95	SD	Clayey SILT, minor fine sand; greenish grey; moist, moderately plastic.	25.9		X	X	X							
BH616	P146	8.95-9.40	SD	Clayey SILT, minor fine sand; greenish brown, mottled light bluish grey, speckled light brown; moist, highly plastic.	26.1		X	X	X							
BH617	P131	0.00-0.40	SD	Clayey SILT, minor fine sand; bluish dark grey; wet, highly plastic.	81.2		X	X	X							
BH617	P132	2.50-2.80	SD	Clayey SILT, minor fine sand; bluish dark grey; wet, highly plastic.	76.5		X	X	X							
BH618	P133	4.00-4.50	SD	Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.	40.0		X	X	X							
BH619	P134	0.3-0.6	SD	Clayey SILT, minor fine sand; bluish grey; wet, highly plastic.	75.9		X	X	X							
BH619	P135	3.50-3.95	SD	Clayey SILT, minor fine sand; greenish grey; wet, highly plastic.	24.9		X	X	X							
BH619	P136	5.25-5.70	SD	Clayey SILT, minor fine sand; bluish grey; wet, moderately plastic.	26.4		X	X	X							
BH620	P137	1.70-1.90	SD	Fine to coarse sandy SILT, some clay, trace fine gravel; greenish grey, mottled bluish grey; moist, highly plastic.	56.3		X	X	X							

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

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

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.1.1
ASTM D422-63

AUTHORISED SIGNATORY

N Agarkova – Authorised Signatory

Sheet 1 of 25

geotest

21 Pitt Street
P O Box 6345
Auckland 1141
Ph. 300-9380

SUMMARY OF TEST RESULTS

Report: 1871L:03

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 4 March 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	UCS	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH621	P138	5.18-5.63	SD	Clayey SILT, some fine sand; bluish grey; moist, moderately plastic.	35.2		X	X	X							
BH622	P139	3.30-3.75	SD	Fine sandy clayey SILT; bluish dark grey; moist, moderately plastic.	29.3		X	X	X							
BH622	P140	7.80-8.25	SD	Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.	39.1		X	X	X							
BH623	P141	0.20-0.60	SD	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	45.0		X	X	X							
BH623	P142	5.00-5.20	SD	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	40.2				X							
BH624	P143	0.10-0.40	SD	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.	28.0		X	X	X							
BH624	P144	3.30-3.50	SD	Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	29.7		X	X	X							
BH624	P145	4.00-4.20	SD	Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	31.7		X	X	X							
BH611	P148	18.7-18.85	CORE	Very weak greenish grey SANDSTONE.	17.4								X			
BH612	P149	12.95-13.1	CORE	Extremely weak yellowish brown SANDSTONE.	19.1								X			

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

X = DATA ATTACHED, CORE = CORE SAMPLE, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.1.1
ASTM D422-63

AUTHORISED SIGNATORY

N.Agarkova – Authorised Signatory

Sheet 2 of 25

21 Pitt Street
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SUMMARY OF TEST RESULTS

Report:
1871L:03

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 4 March 2016

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading (Hydro)	Pσ t/m³	Clay Index	Consol	UCS	Grading (Wash)	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH613	P150	23.6-23.8	CORE	Extremely weak bluish grey SANDSTONE.	20.1								X			
BH613	P151	24.7-24.85	CORE	Extremely weak bluish grey SANDSTONE.	20.0								X			

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NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

X = DATA ATTACHED, CORE = CORE SAMPLE, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4,2.5,6.1.1
ASTM D422-63

AUTHORISED SIGNATORY

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Sheet 3 of 25

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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 4 March 2016

Job No: 3124410/520

Report No: 1871L:03

Client: Port of Napier Ltd

Tested By: N.Agarkova/S.Shah

Sample Type: Small Disturbed

Checked By: S.Shah/N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
BH616	P129 (SD71)	0.20-0.50	Fine to medium SAND, some silt, minor clay; bluish grey; wet, slightly plastic.	23.4	-	29	23	**6**
BH616	P130 (SD72)	7.50-7.95	Clayey SILT, minor fine sand; greenish grey; moist, moderately plastic.	25.9	44	-	21	**23**
BH616	P146 (SD88)	8.95-9.40	Clayey SILT, minor fine sand; greenish brown, mottled light bluish grey, speckled light brown; moist, highly plastic.	26.1	48	-	22	**26**
BH617	P131 (SD73)	0.00-0.40	Clayey SILT, minor fine sand; bluish dark grey; wet (very), highly plastic.	81.2	68	-	27	**41**
BH617	P132 (SD74)	2.50-2.80	Clayey SILT, minor fine sand; bluish dark grey; wet (very), highly plastic.	76.5	66	-	29	**37**
BH618	P133 (SD75)	4.00-4.45	Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.	40.0	49	-	25	**24**
BH619	P134 (SD76)	0.30-0.60	Clayey SILT, minor fine sand; bluish grey; wet (very), highly plastic.	75.9	63	-	29	**34**
BH619	P135 (SD77)	3.50-3.95	Clayey SILT, minor fine sand; greenish grey; wet, highly plastic.	24.9	48	-	22	**26**
BH619	P136 (SD78)	5.25-5.70	Clayey SILT, minor fine sand; bluish grey; wet, moderately plastic.	26.4	45	-	22	**23**
BH620	P137 (SD79)	1.70-1.90	Fine to coarse sandy SILT, some clay, trace fine gravel; greenish grey, mottled bluish grey; moist, highly plastic.	56.3	71	-	30	**41**

Comments:

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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 4 March 2016

Job No: 3124410/520

Report No: 1871L:03

Client: Port of Napier Ltd

Tested By: N.Agarkova/S.Shah

Sample Type: Small Disturbed

Checked By: S.Shah/N.Agarkova

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
BH621	P138 (SD80)	5.18-5.63	Clayey SILT, some fine sand; bluish grey; moist, moderately plastic.	35.2	45	-	22	**23**
BH622	P139 (SD81)	3.30-3.75	Fine sandy clayey SILT; bluish dark grey; moist, moderately plastic.	29.6	34	-	21	**13**
BH622	P140 (SD82)	7.80-8.25	Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.	39.1	49	-	25	**24**
BH623	P141 (SD83)	0.20-0.60	Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	45.0	38	-	23	**15**
BH624	P143 (SD85)	0.10-0.40	Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.	28.0	31	-	24	**7**
BH624	P144 (SD86)	3.30-3.50	Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	29.7	34	-	22	**12**
BH624	P145 (SD87)	4.00-4.20	Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.	32.0	37	-	22	**15**

Comments:

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH616

Sample No.: P129 (SD71)

Depth (m): 0.20-0.50

Sample Type: Small Disturbed

History: As Received

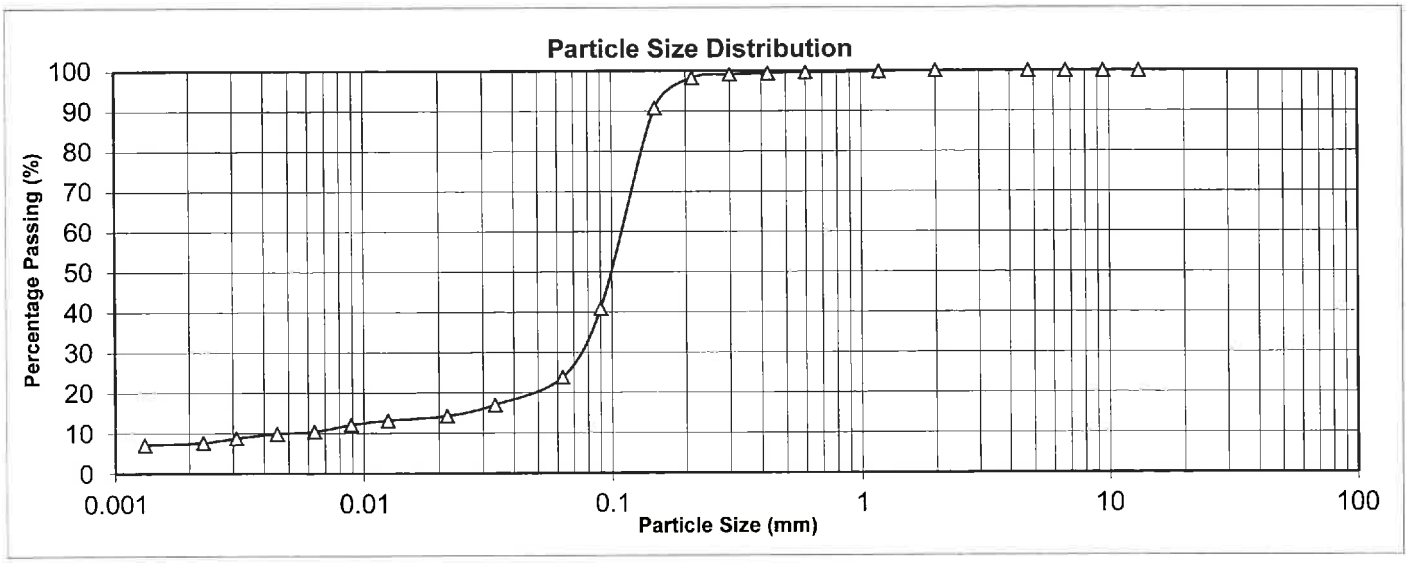
Report No.: 1871L:03

Sample Description: Fine to medium SAND, some silt, minor clay; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	99
26.5mm	100	300µm	99
19.0mm	100	212µm	98
13.2mm	100	150µm	91
9.50mm	100	90µm	41
6.70mm	100	63µm	24
4.75mm	100	<63µm	24



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
8	15	77	0	425µm

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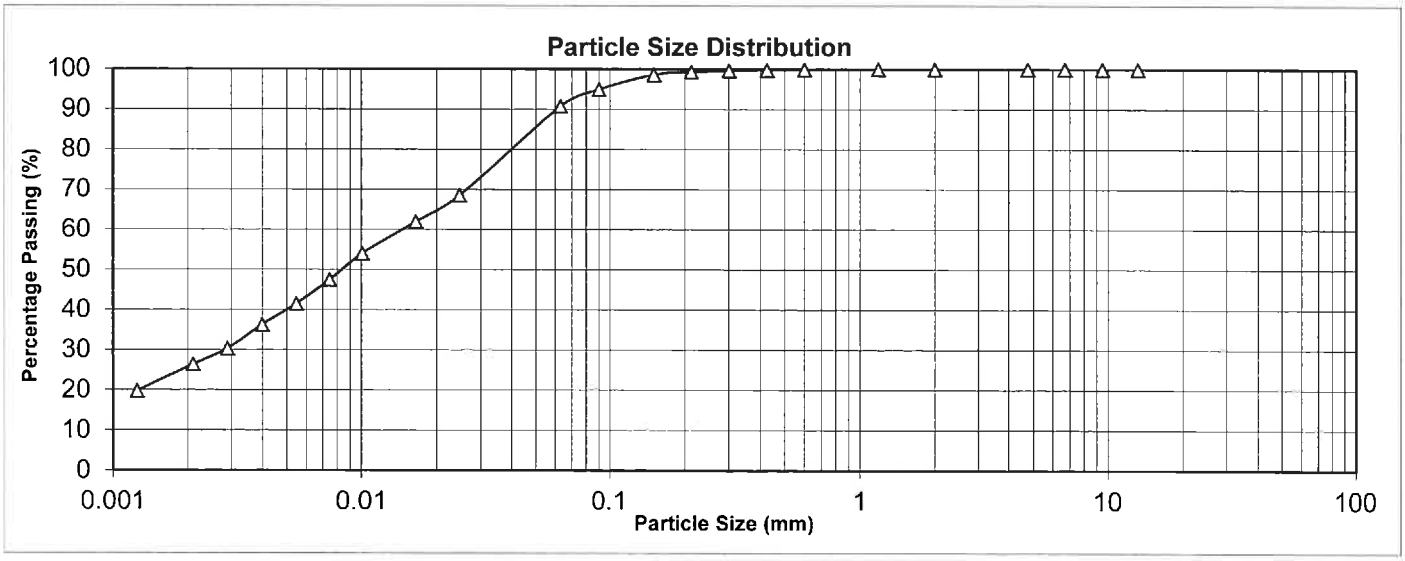
PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 4 March 2016
Job No.: 3124410/520
Tested By: S.Shah
Checked By: N.Agarkova
Bore No.: BH616
Sample No.: P130 (SD72)
Depth (m): 7.50-7.95
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; greenish grey; moist, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	95
6.70mm	100	63µm	91
4.75mm	100	<63µm	91



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
26	63	11	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH616

Sample No.: P146 (SD88)

Depth (m): 8.95-9.40

Sample Type: Small Disturbed

History: As Received

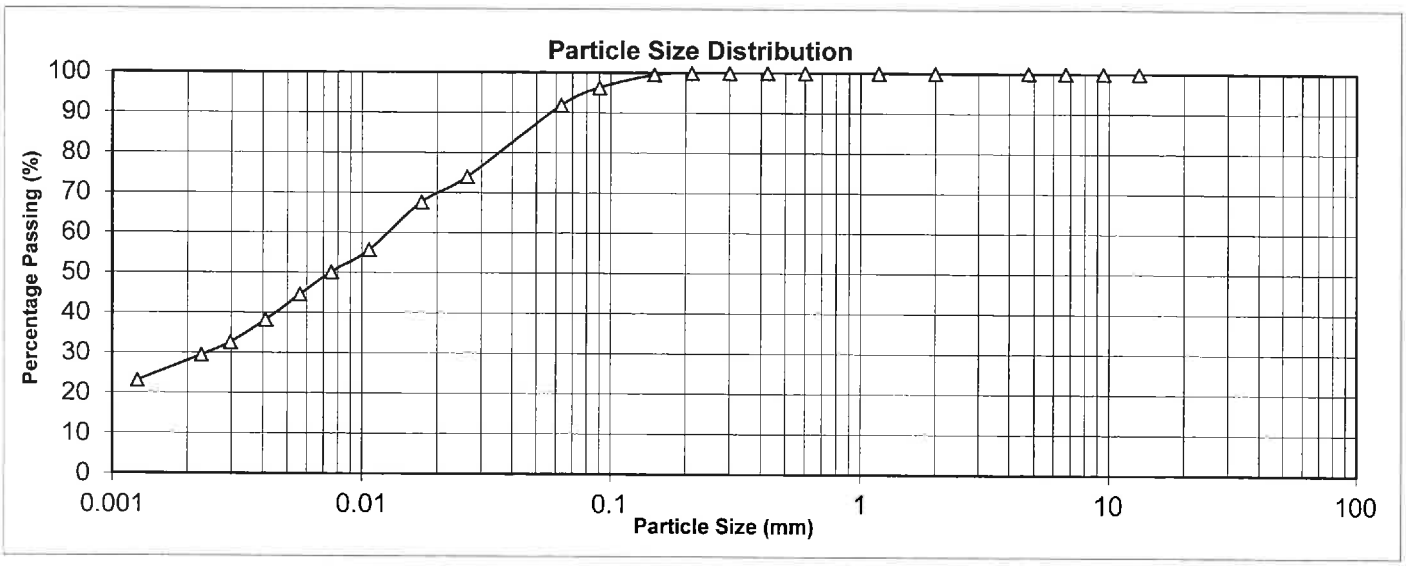
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; greenish brown, mottled light bluish grey, speckled light brown; moist, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	96
6.70mm	100	63µm	92
4.75mm	100	<63µm	92



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
28	62	10	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd
Tested By: S.Shah

Date: 4 March 2016
Checked By: N.Agarkova

Bore No.: BH617
Sample Type: Small Disturbed

Sample No.: P131 (SD73)
History: As Received

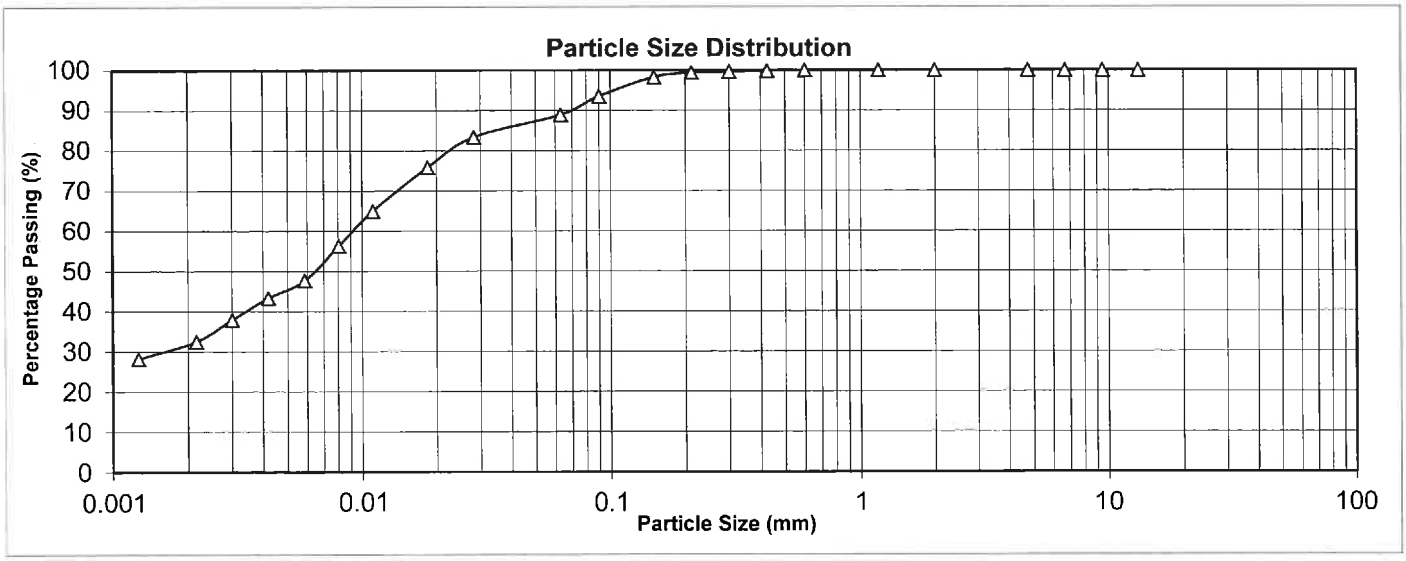
Depth (m): 0.00-0.40
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; bluish dark grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	94
6.70mm	100	63µm	89
4.75mm	100	<63µm	89



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
32	56	12	0	212µm

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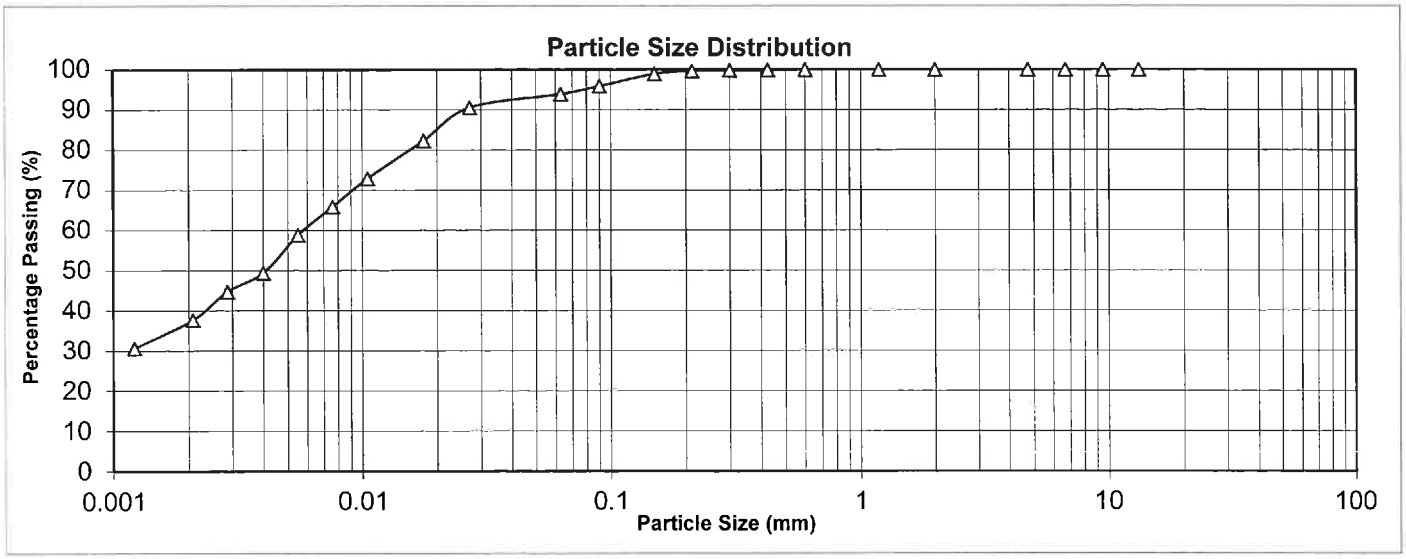
PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 4 March 2016
Job No.: 3124410/520
Tested By: S.Shah
Checked By: N.Agarkova
Bore No.: BH617
Sample No.: P132 (SD74)
Depth (m): 2.50-2.80
Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; bluish dark grey; wet, highly plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	96
6.70mm	100	63µm	94
4.75mm	100	<63µm	94



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
37	57	6	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Client: Port of Napier Ltd
Date: 4 March 2016

Job No.: 3124410/520
Tested By: S.Shah
Checked By: N.Agarkova

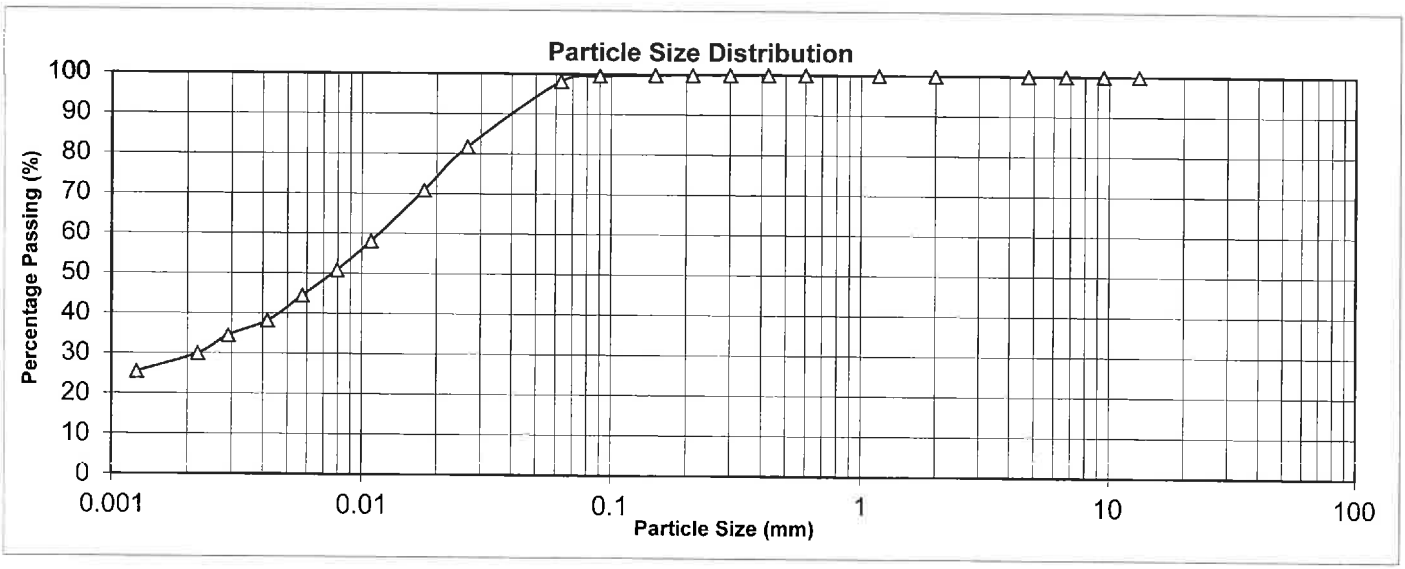
Bore No.: BH618
Sample No.: P133 (SD75)
Depth (m): 4.00-4.45

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:03

Sample Description: Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	100
6.70mm	100	63µm	98
4.75mm	100	<63µm	98



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
29	68	3	0	63µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH619

Sample No.: P134 (SD76)

Depth (m): 0.30-0.60

Sample Type: Small Disturbed

History: As Received

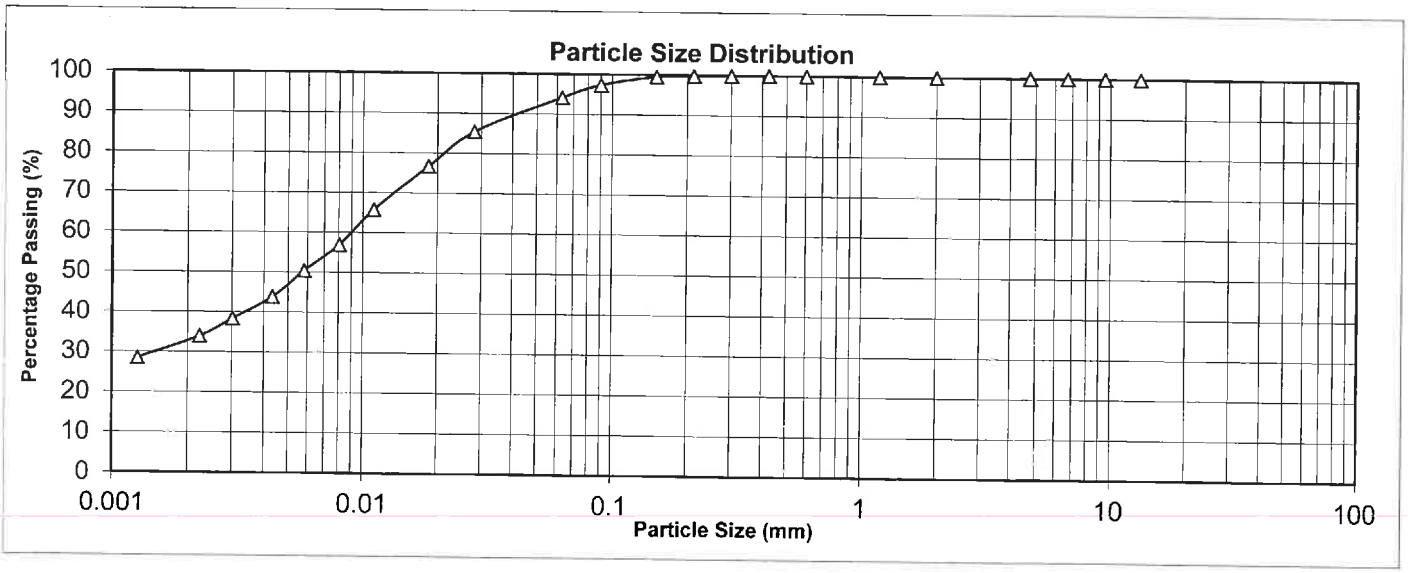
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	97
6.70mm	100	63µm	94
4.75mm	100	<63µm	94



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
33	60	7	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH619

Sample No.: P135 (SD77)

Depth (m): 3.50-3.95

Sample Type: Small Disturbed

History: As Received

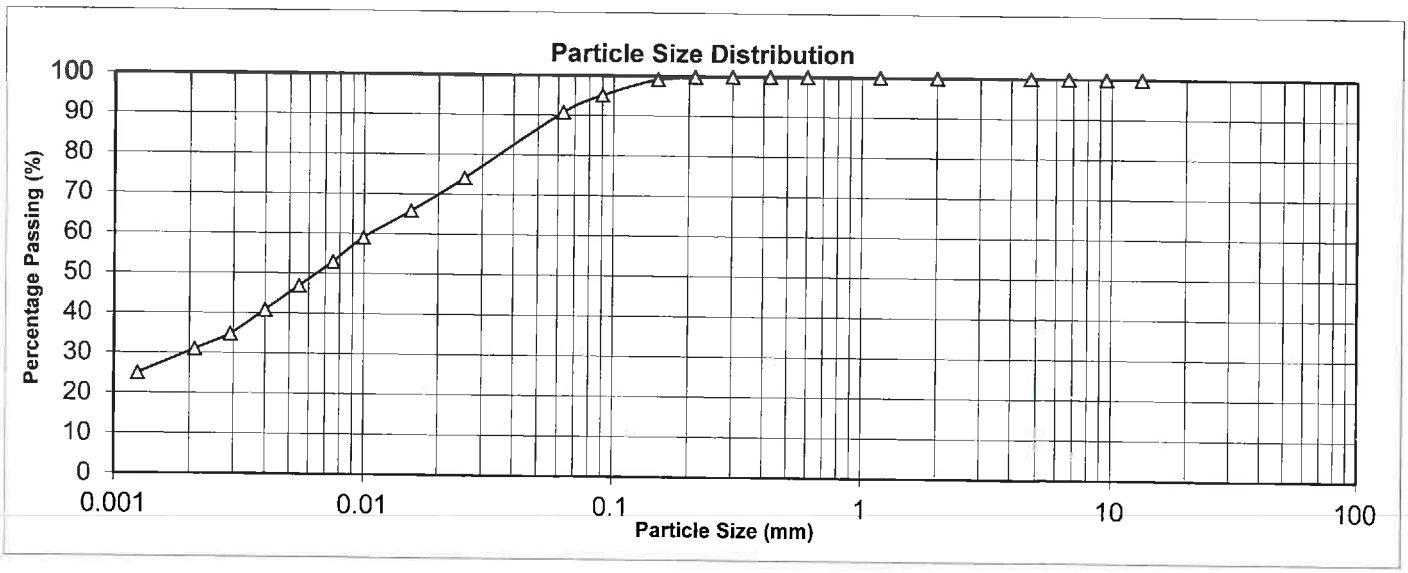
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; greenish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	95
6.70mm	100	63µm	91
4.75mm	100	<63µm	91



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
30	59	11	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd
Tested By: S.Shah

Date: 4 March 2016
Checked By: N.Agarkova

Bore No.: BH619
Sample Type: Small Disturbed

Sample No.: P136 (SD78)
History: As Received

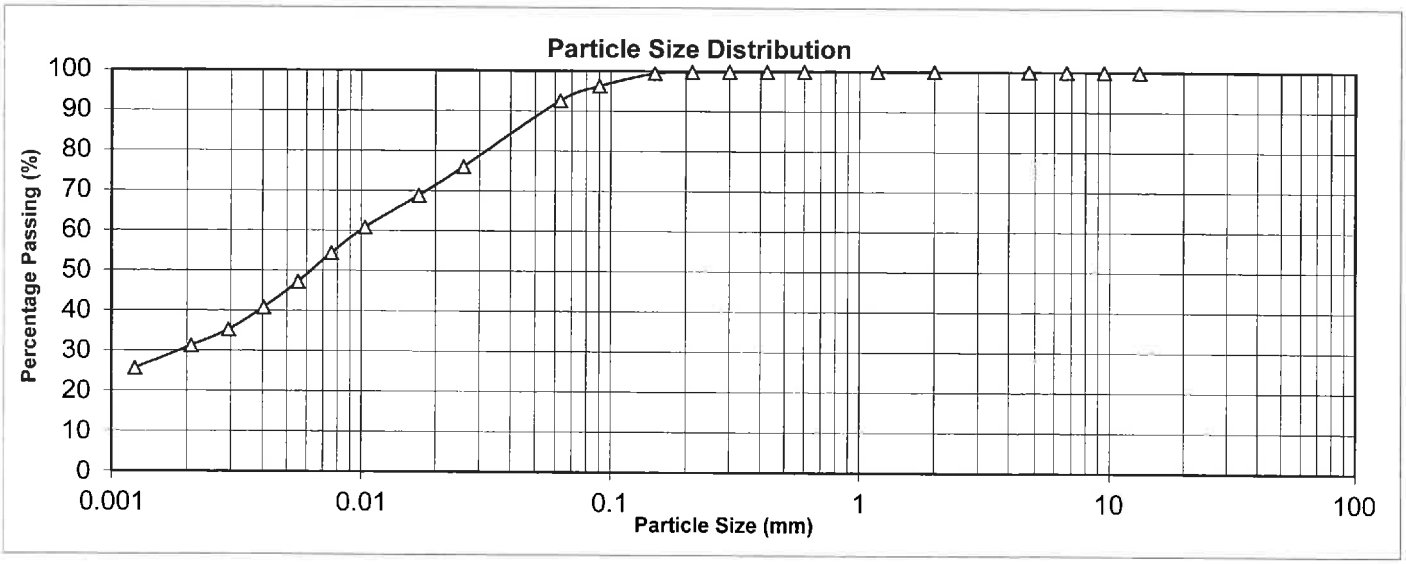
Depth (m): 5.25-5.70
Report No.: 1871L:03

Sample Description: Clayey SILT, minor fine sand; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	**% Passing**	**Sieve Size**	**% Passing**
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	96
6.70mm	100	63µm	93
4.75mm	100	<63µm	93



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
31	60	9	0	150µm

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N.Agarkova - Authorised Signatory

Geotest

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH620

Sample No.: P137 (SD79)

Depth (m): 1.70-1.90

Sample Type: Small Disturbed

History: As Received

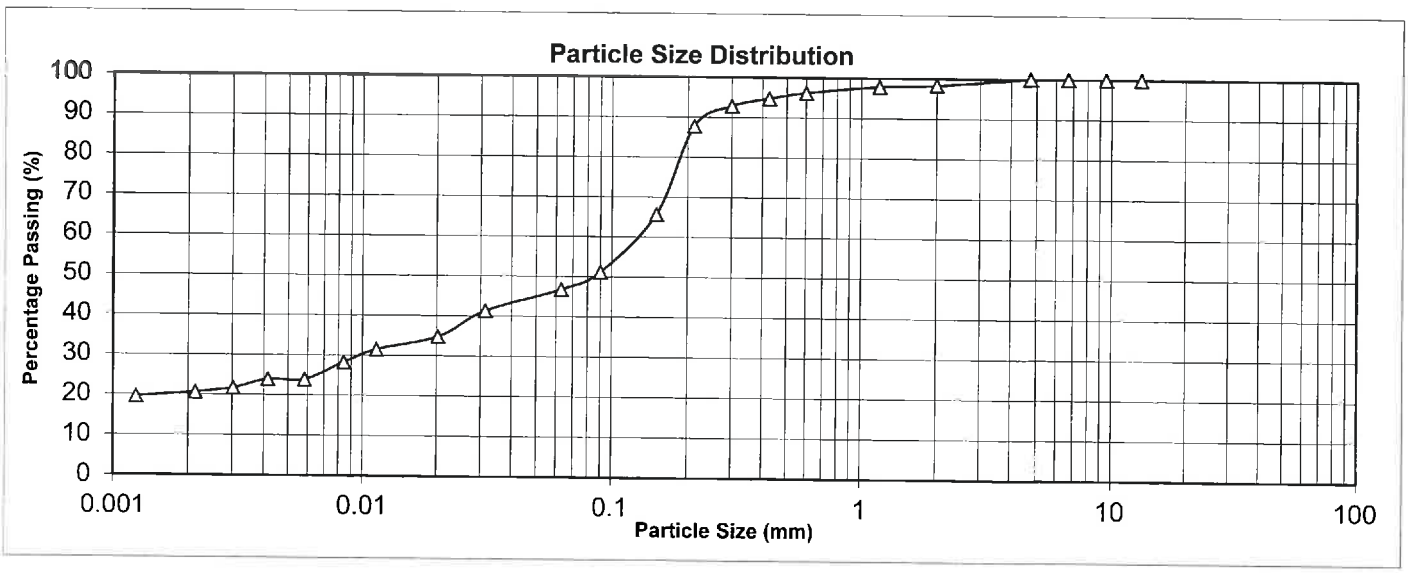
Report No.: 1871L:03

Sample Description: Fine to coarse sandy SILT, some clay, trace fine gravel; greenish grey, mottled bluish grey; moist, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	98
63.0mm	100	1.18mm	98
53.0mm	100	600µm	96
37.5mm	100	425µm	95
26.5mm	100	300µm	93
19.0mm	100	212µm	88
13.2mm	100	150µm	66
9.50mm	100	90µm	51
6.70mm	100	63µm	47
4.75mm	100	<63µm	47



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
20	26	52	2	2.00mm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520
Client: Port of Napier Ltd
Tested By: S.Shah
Date: 4 March 2016
Checked By: N.Agarkova

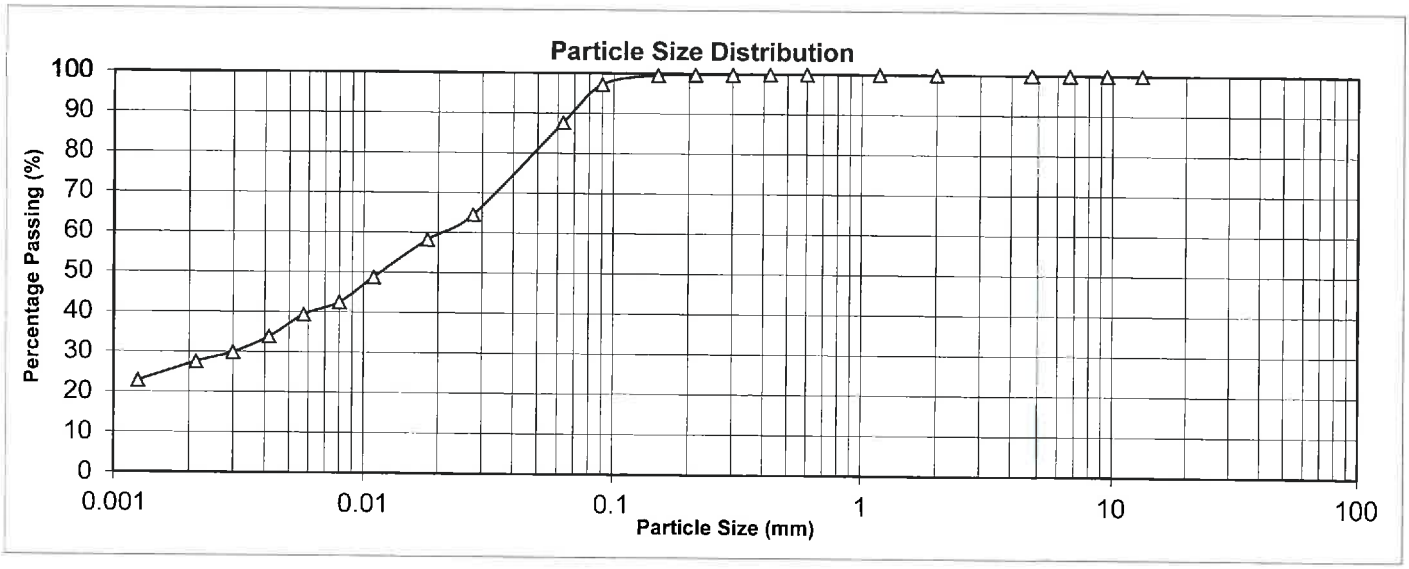
Bore No.: BH621
Sample No.: P138 (SD80)
Depth (m): 5.18-5.63

Sample Type: Small Disturbed
History: As Received
Report No.: 1871L:03

Sample Description: Clayey SILT, some fine sand; bluish grey; moist, moderately plastic.

Test Standard: ASTM D422-63
Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	97
6.70mm	100	63µm	88
4.75mm	100	<63µm	88



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
27	59	14	0	90µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd
Tested By: S.Shah

Date: 4 March 2016
Checked By: N.Agarkova

Bore No.: BH622
Sample Type: Small Disturbed

Sample No.: P139 (SD81)
History: As Received

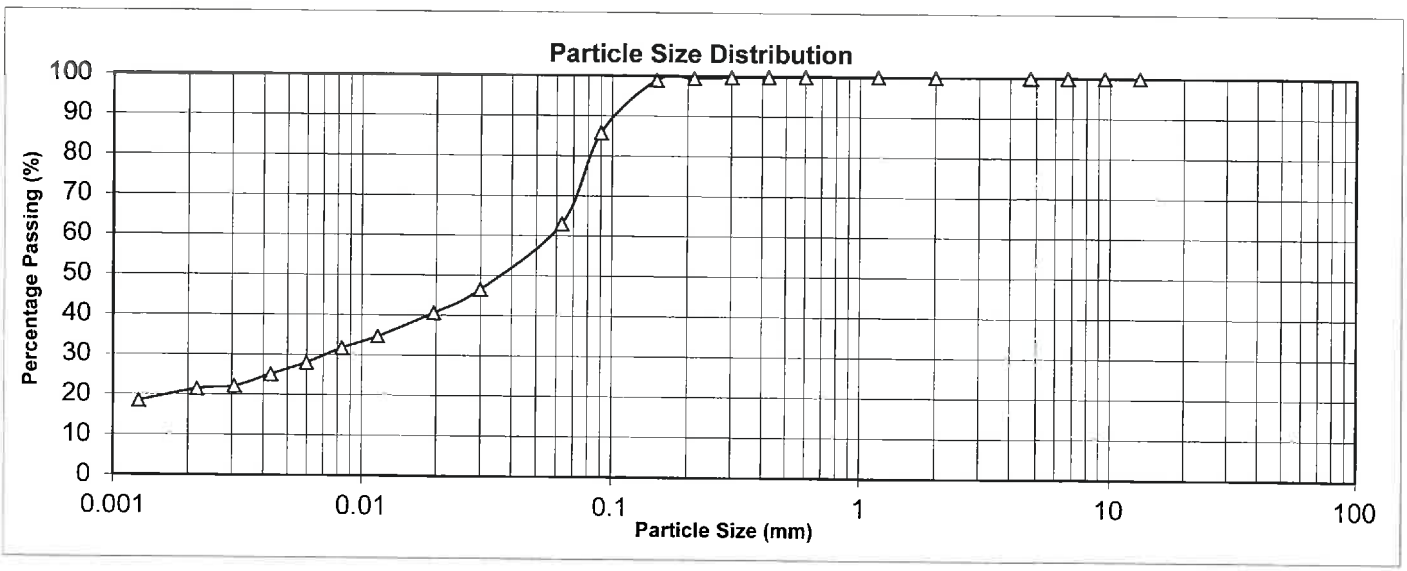
Depth (m): 3.30-3.75
Report No.: 1871L:03

Sample Description: Fine sandy clayey SILT; bluish dark grey; moist, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	99
9.50mm	100	90µm	86
6.70mm	100	63µm	63
4.75mm	100	<63µm	63



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
21	41	38	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH622

Sample No.: P140 (SD82)

Depth (m): 7.80-8.25

Sample Type: Small Disturbed

History: As Received

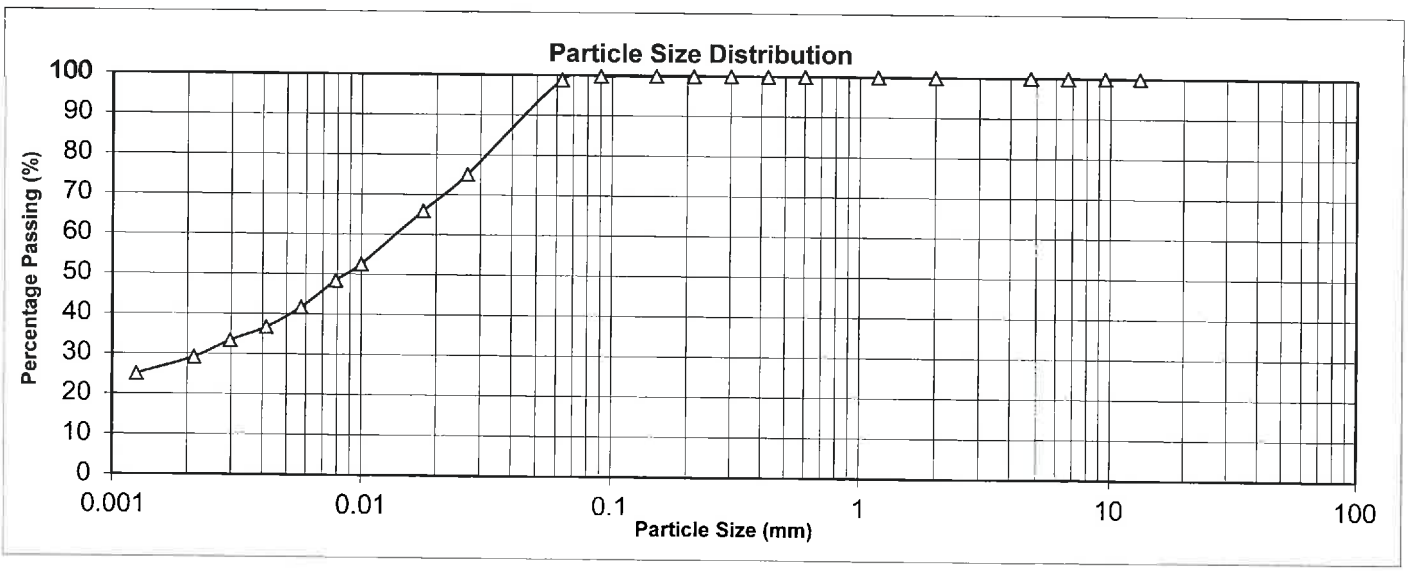
Report No.: 1871L:03

Sample Description: Clayey SILT, trace fine sand; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	100
6.70mm	100	63µm	99
4.75mm	100	<63µm	99



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
29	68	3	0	212µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH623

Sample No.: P141 (SD83)

Depth (m): 0.20-0.60

Sample Type: Small Disturbed

History: As Received

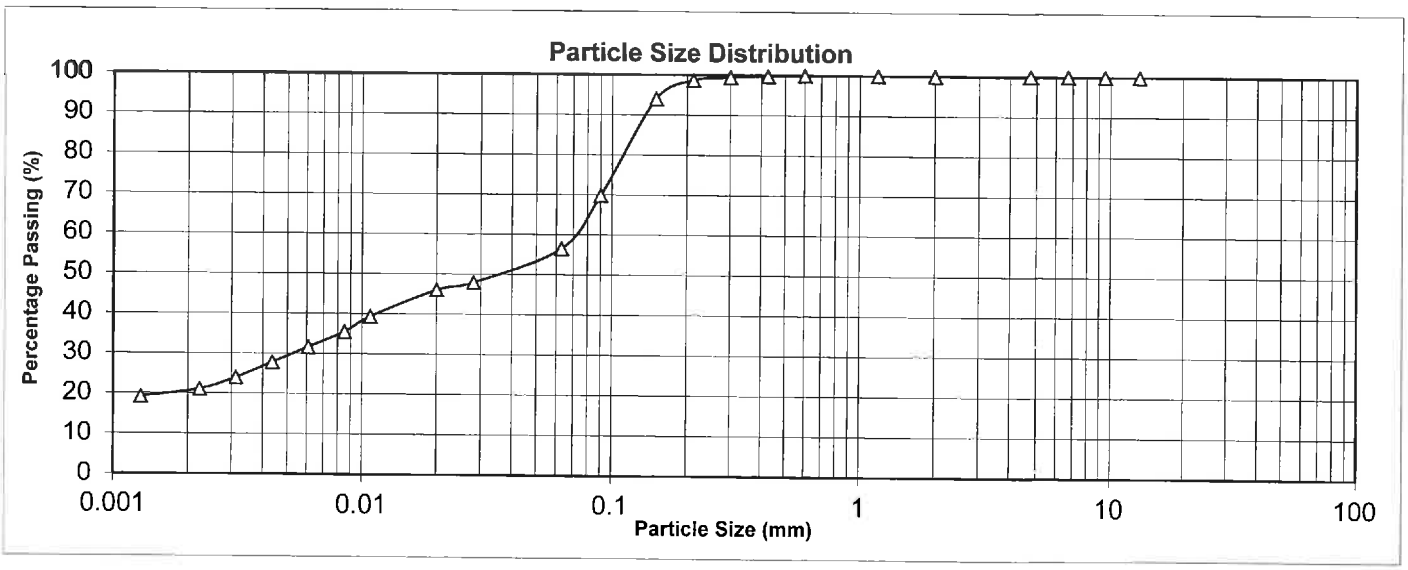
Report No.: 1871L:03

Sample Description: Fine to medium sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	99
19.0mm	100	212µm	99
13.2mm	100	150µm	94
9.50mm	100	90µm	70
6.70mm	100	63µm	57
4.75mm	100	<63µm	57



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
21	35	44	0	300µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH623

Sample No.: P142 (SD84)

Depth (m): 5.00-5.20

Sample Type: Small Disturbed

History: As Received

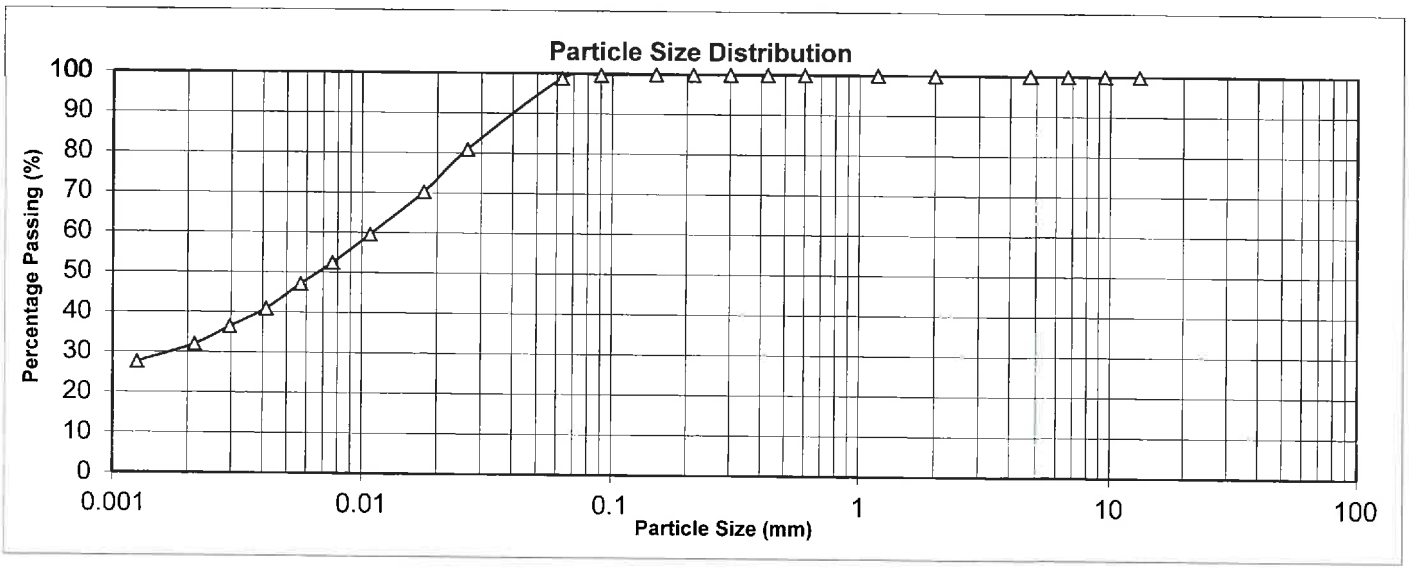
Report No.: 1871L:03

Sample Description: Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	100
9.50mm	100	90µm	100
6.70mm	100	63µm	99
4.75mm	100	<63µm	99



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
31	66	3	0	63µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd
Tested By: S.Shah

Date: 4 March 2016
Checked By: N.Agarkova

Bore No.: BH624
Sample Type: Small Disturbed

Sample No.: P143 (SD85)
History: As Received

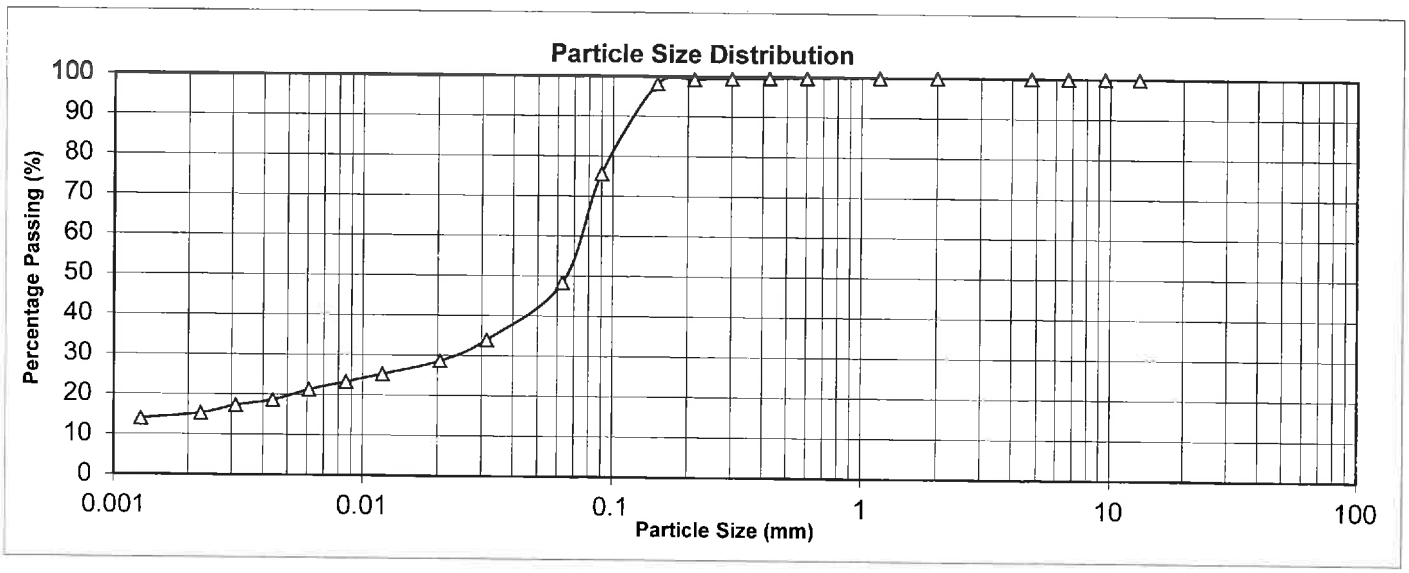
Depth (m): 0.10-0.40
Report No.: 1871L:03

Sample Description: Fine to medium sandy SILT, some clay, trace organics; bluish grey; wet, slightly plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	99
13.2mm	100	150µm	98
9.50mm	100	90µm	76
6.70mm	100	63µm	48
4.75mm	100	<63µm	48



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
15	32	53	0	425µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd
Tested By: S.Shah

Date: 4 March 2016
Checked By: N.Agarkova

Bore No.: BH624
Sample Type: Small Disturbed

Sample No.: P144 (SD86)
History: As Received

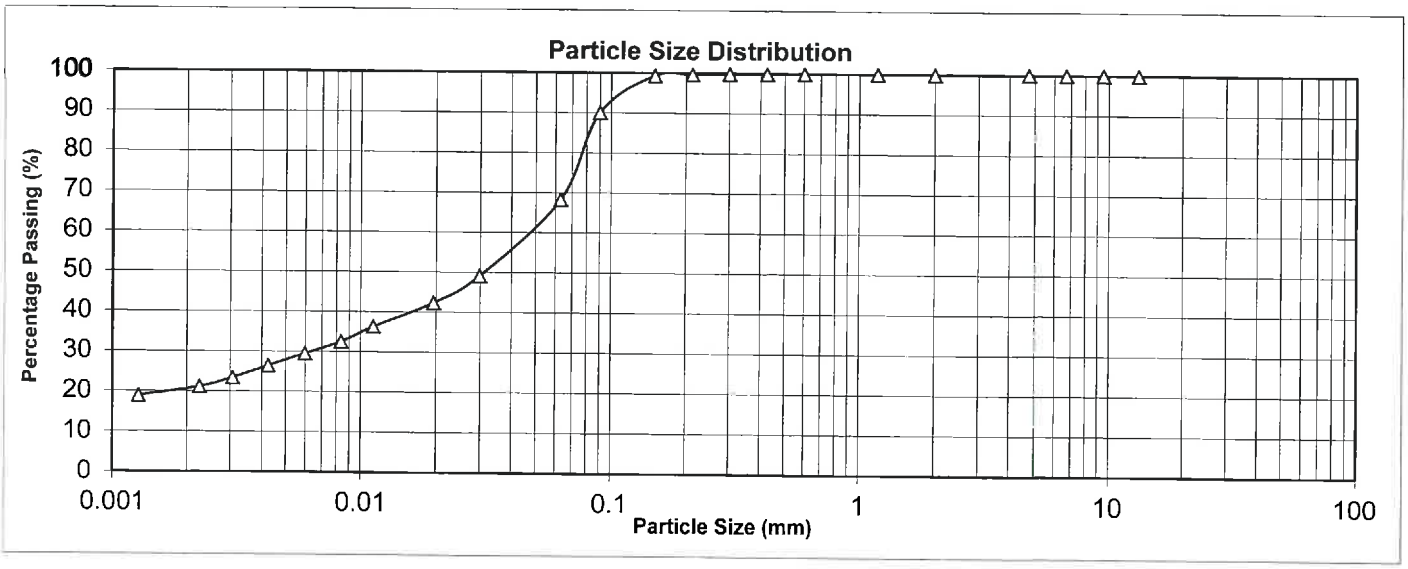
Depth (m): 3.30-3.50
Report No.: 1871L:03

Sample Description: Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	90
6.70mm	100	63µm	68
4.75mm	100	<63µm	68



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
21	46	33	0	150µm

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PARTICLE SIZE DISTRIBUTION - HYDROMETER METHOD

Job Name: 6 Wharf Geotech and Tender Design
Job No.: 3124410/520

Client: Port of Napier Ltd

Tested By: S.Shah

Date: 4 March 2016

Checked By: N.Agarkova

Bore No.: BH624

Sample No.: P145 (SD87)

Depth (m): 4.00-4.20

Sample Type: Small Disturbed

History: As Received

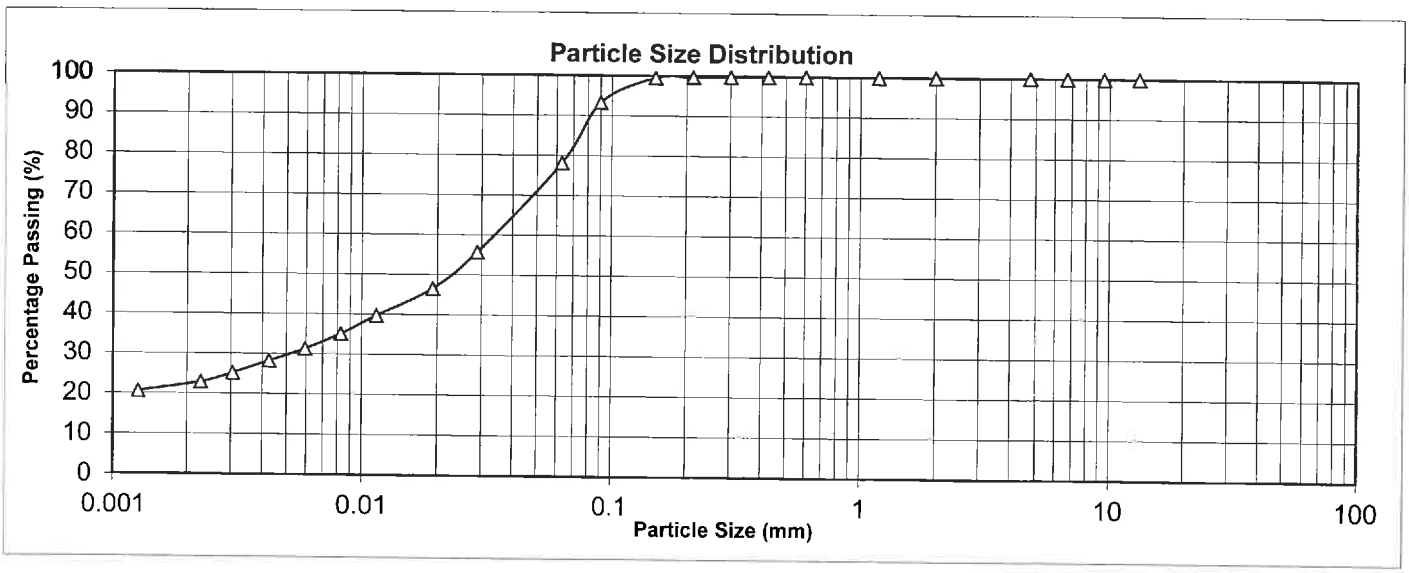
Report No.: 1871L:03

Sample Description: Fine sandy clayey SILT, trace organics; bluish grey; wet, moderately plastic.

Test Standard: ASTM D422-63

Dispersion: Sodium hexametaphosphate, Soaked for >16 hours

Coarse & Intermediate Fraction		Fine Fraction	
Sieve Size	% Passing	Sieve Size	% Passing
75.0mm	100	2.00mm	100
63.0mm	100	1.18mm	100
53.0mm	100	600µm	100
37.5mm	100	425µm	100
26.5mm	100	300µm	100
19.0mm	100	212µm	100
13.2mm	100	150µm	99
9.50mm	100	90µm	93
6.70mm	100	63µm	78
4.75mm	100	<63µm	78



% Clay	% Silt	% Sand	% Gravel	Max. Particle Size
22	54	24	0	150µm

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UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech & Tender Desig **Client:** Port of Napier Ltd **Date:** 4 March 2016

Job No.: 3124410/520 **Location:** - **Report No:** 1871L:03

Sample Description (P148): Very weak greenish grey SANDSTONE.

Sample Description (P149): Extremely weak yellowish brown SANDSTONE.

Sample Description (P150): Extremely weak bluish grey SANDSTONE.

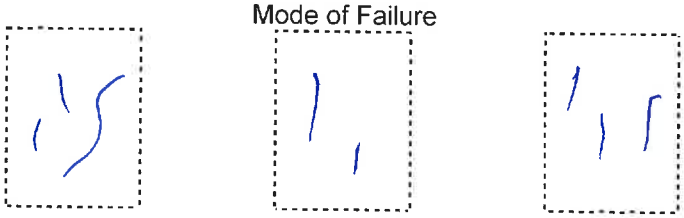
Sample Type: Core **Tested By:** S.Shah **Checked By:** N.Agarkova

Test Standard: NZS 4402: 1986, Test 6.3.1

History: As Received

Sample Reference		P148	P149	P150
Borehole No.		BH611	BH612	BH613
Depth	(m)	18.70-18.85	12.95-13.10	23.60-23.80
Date Tested		3/03/2016	3/03/2016	3/03/3016
Length	(mm)	107.4	100.5	105.3
Diameter	(mm)	61.3	60.7	62.5
Volume	(mm^3)	317000	291000	323000
Bulk Density	(t/m^3)	2.10	2.18	2.05
Water Content	(%)	17.4	19.1	20.1
Dry Density	(t/m^3)	1.80	1.85	1.70
Unconfined Compressive Strength (UCS)	(kPa)	3800	910	440
Rate of Strain	(mm/min)	0.13	0.19	0.18
Strain at Failure	(%)	1.0	3.3	3.3
Mode of Failure		Cone	Columnar	Columnar

Mode of Failure



Authorised Signatory: N.Agarkova - Authorised Signatory

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Auckland 1141
Ph: (09) 300-9380

UNCONFINED COMPRESSIVE STRENGTH REPORT

Job Name: 6 Wharf Geotech & Tender Desig **Client:** Port of Napier Ltd **Date:** 4 March 2016

Job No.: 3124410/520 **Location:** - **Report No:** 1871L:03

Sample Description (P151): Extremely weak bluish grey SANDSTONE.

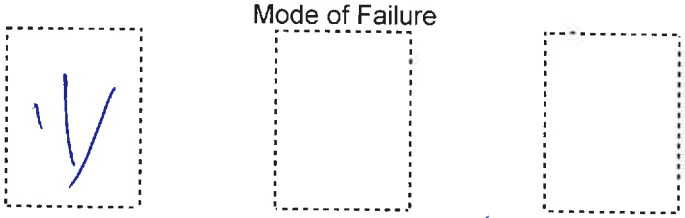
Sample Type: Core **Tested By:** S.Shah **Checked By:** N.Agarkova

Test Standard: NZS 4402: 1986, Test 6.3.1

History: As Received

Sample Reference		P151	-	-
Borehole No.		BH613	-	-
Depth	(m)	24.70-24.85	-	-
Date Tested		3/03/2016	-	-
Length	(mm)	113.6	-	-
Diameter	(mm)	61.9	-	-
Volume	(mm^3)	341000	-	-
Bulk Density	(t/m^3)	2.13	-	-
Water Content	(%)	20.0	-	-
Dry Density	(t/m^3)	1.80	-	-
Unconfined Compressive Strength (UCS)	(kPa)	620	-	-
Rate of Strain	(mm/min)	0.19	-	-
Strain at Failure	(%)	1.2	-	-
Mode of Failure		Cone	-	-

Mode of Failure



Authorised Signatory: N.Agarkova - Authorised Signatory.

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Ph. 300-9380

SUMMARY OF TEST RESULTS

Job Name: 6 Wharf Geotech & Tender Design **Job No:** 3124410/520

Client: Port of Napier Ltd **Date:** 7 March 2016

Report:
1871L:04

Test Pit No.	Sample No.	Depth (m)	Sample Type	Sample Description	Natural		Atterberg Limits		Grading	Pσ t/m³	Clay Index	Consol	CBR	Compaction	Perm k m/s	Triaxial CUPP
					WC%	Bulk Density t/m³	LL/ CPL	PL								
BH623	P142	5.00-5.20	SD	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	27.0		X	X								

ENVIROLAB GEOTEST IS ACCREDITED BY INTERNATIONAL ACCREDITATION NEW ZEALAND. 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
NOTE: IANZ ENDORSEMENT DOES NOT COVER SOIL DESCRIPTIONS.

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

X = DATA ATTACHED, SD = SMALL DISTURBED SAMPLES

TEST STANDARDS:

NZS 4402: 1986; Test 2.1,2.2,2.3,2.4

AUTHORISED SIGNATORY

S.Shah – Authorised Signatory

21 Pitt Street
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ATTERBERG LIMITS

Job Name: 6 Wharf Geotech & Tender Design

Date: 7 March 2016

Job No: 3124410/520

Report No: 1871L:04

Client: Port of Napier Ltd

Tested By: S.Shah

Sample Type: Small Disturbed

Checked By: E.Kennedy

Test Standard: NZS 4402: 1986, Test 2.1,2.2,2.3,2.4

History: As Received

Test Performed On: Sub 425µm

Bore No.	Sample No.	Depth (m)	Sample Description	Water Content (%)	Liquid Limit	Cone Penetration Limit	Plastic Limit	Plasticity Index
BH623	P142 (SD84)	5.00-5.20	Clayey SILT, trace fine sand; bluish grey; wet, highly plastic.	27.0	52	-	24	**28**

Comments:

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Authorised Signatory:.....

S.Shah – Authorised Signatory

POINT LOAD TEST REPORT

OPUS

Job:	6 Wharf Development	**Tested By:**	AB
Location:	Port of Napier	**Date Tested:**	29/02/16
Client:	Port of Napier c/o Beca		
Contractor:	Not Stated		
Sampled By:	Jeremy Eade		
Sampling Method:	Disturbed		
Date Sampled:	December 2015		
Date Received:	26/02/16		
Sample Condition:	As Received		

Project Number:	1-LA148.16
Lab Ref Number:	021-025/16
Client Ref Number:	3124410
Folder Number:	N/A

Lab sample reference	Bore Hole Number	Depth (m)	Sample description	Diameter (w), mm	Length (D), mm	Load (P), N	De², mm²	De, mm	I_s, MPa	F	$I_{s(50)}$, MPa	Estimated Qu (MPa)
021/16	BH611	16.5	See Below	61.30	45.80	2260	3574.67	59.79	0.63	1.1	0.70	17.04
022/16	BH611	16.0	See Below	61.70	41.70	2470	3275.91	57.24	0.75	1.1	0.83	20.32
023/16	BH612	5.0	See Below	61.10	28.20	1240	2193.82	46.84	0.57	1.1	0.62	15.23
024/16	BH613	26.3	See Below	61.00	33.00	4200	2563.03	50.63	1.64	1.1	1.80	44.16
025/16	BH614	16.8	See Below	57.20	49.20	80	3583.20	59.86	0.02	1.08	0.02	0.58

	Sample Description
021/16	Very weak to weak, coarse sandy LIMESTONE
022/16	Very weak, UW, grey calcareous SANDSTONE
023/16	Very weak fine to medium SANDSTONE
024/16	Very weak to weak, coarse sandy LIMESTONE
025/16	Extremely weak, laminated SILTSTONE

Test Methods	Notes
ASTM : D 5731 - 08	Test type: Axial, perpendicular to plane of weakness Estimated Qu is site dependant. For this report a factor of either 24 or 24.5 was used. (Table 1 from ASTM : D 5731 - 08) Factor F is taken from FIG. 8 from ASTM : D 5731 - 08 All tests were undertaken using a Shimadzu REH100TV Universal Testing Machine.

Approved By: Thirushen Pillay
Designation: Senior Civil Engineering Technician
Date: 01/03/2016

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Auckland Laboratory
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POINT LOAD TEST REPORT

OPUS

Job:	6 Wharf Development	**Tested By:**	AB
Location:	Port of Napier	**Date Tested:**	29/02/16
Client:	Port of Napier Ltd c/o Beca		
Contractor:	Not Stated		
Sampled By:	Jeremy Eade		
Sampling Method:	Disturbed		
Date Sampled:	December 2015		
Date Received:	26/02/16		
Sample Condition:	As Received		

Project Number:	1-LA148.16
Lab Ref Number:	026-030/16
Client Ref Number:	3124410
Folder Number:	N/A

Lab sample reference	Bore Hole Number	Depth (m)	Sample description	Diameter (w), mm	Length (D), mm	Load (P), N	De², mm²	De, mm	I_s, MPa	F	$I_{s(50)}$, MPa	Estimated Qu (MPa)
026/16	BH612	1.00	See below	54.60	32.10	4120	2231.56	47.24	1.85	0.97	1.80	43.19
027/16	BH612	3.00	See below	61.70	37.00	6700	2906.68	53.91	2.31	1.03	2.38	58.42
028/16	BH612	8.00	See below	60.00	30.30	3700	2314.75	48.11	1.60	0.98	1.57	38.49
029/16	BH613	22.70	See below	50.10	34.60	60	2207.11	46.98	0.03	0.97	0.03	0.61
030/16	BH615	6.00	See below	59.70	33.00	860	2508.41	50.08	0.34	1.00	0.34	8.41

	Sample Description
026/16	Very weak to weak, coarse sandy LIMESTONE
027/16	Extremely weak to very weak, fine to medium SANDSTONE
028/16	Very weak fine to medium SANDSTONE
029/16	Very weak, UW, grey calcareous SANDSTONE
030/16	Extremely weak, silty fine SANDSTONE

Test Methods	Notes
ASTM : D 5731 - 08	Test type: Irregular Lump Estimated Qu is site dependant. For this report a factors were taken from (Table 1 from ASTM : D 5731 - 08) Factor F was calculated using the following formula: ((De/50)^0.45) in ASTM : D 5731 - 08 All tests were undertaken using a Shimadzu REH100TV Universal Testing Machine.

Approved By: Thirushen Pillay
Designation: Senior Civil Engineering Technician
Date: 01/03/2016

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Appendix H

Settling Velocity

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E: info@beca.com // **www.beca.com**

Port of Napier Ltd
PO Box 947
Napier 4140
New Zealand

4 February 2016

Attention: Michel De Vos

Report: 16:016

Dear Michel,

Results of Port of Napier Marine Sediment Settling Velocity Testing - February 2016

Beca Ltd trading as Envirolab was commissioned by the Port of Napier Ltd to undertake determination of particle settling velocity on marine sediment samples using a Bottom Withdrawal Tube Method. The testing was undertaken on Marine sediment samples from the Port of Napier, this report presents the testing results.

This report relates only to the samples as tested, sampling was undertaken by others.

Bottom Withdrawal Tube Method Summary

Detailed Test Procedure for Bottom Withdrawal Tube; Measurement and Analysis of Sediment Loads in Streams, Report 7; St Paul U.S. Engineer District Sub-Office Hydraulic Laboratory, University of Iowa; 1943.

The device is a glass tube of 100cm in length, graduated with volumetric scale and a quick-acting tap outlet at the bottom of the tube. A sample is uniformly dispersed in the tube. Then the tube is placed in an upright position and series of samples of known volumes are drawn from the bottom at known time intervals (increasingly spaced). The sediment weight of each sample fraction is determined. Based on Stokes Principle that a particle of 1mm will fall 90cm in six seconds and a 62 micron particle will take 5 minutes to fall the same height, the particle size distribution can be calculated with the aid of an Oden curve.

As consecutive samples are taken, the fall height reduces and allows for the calculated sediment load to be extrapolated for longer sampling periods. Hence, a sediment load of fine silt and clay material, which may normally take over 24 hours to settle, can be reduced to within a 2 hour sampling programme due to the falling head height. This method can be applied to lower sediment loads (~10g/L) unlike the particle size determination method using an hydrometer, which requires a high sediment load (~300g/L)

Deviation from Method

The method was investigated by the St Paul U.S. Engineer District Sub-Office Hydraulic Laboratory for the use of sediment loads in streams. We have undertaken the testing on solid sediment material suspended in seawater.

Sample Description

Detailed in **Table 1** are the samples presented for testing.

Table 1 – Sample Details Summary

Geotest Reference	Description (as given)						
-	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material	Notes
P001	-14.4	VB01a	0.20	0.40	SD45	Fine to medium SAND	Sea floor characteristic
P007	-13.6	VB05b	0.20	0.40	SD53	Fine to medium SAND	Sea floor characteristic
P015	-12.9	VB09a	0.10	0.30	SD20	Silty fine to medium SAND	Sea floor characteristic
P026	-12.4	VB13a	0.10	0.40	SD62	Fine to medium SAND	Sea floor characteristic
P039	-7.1	VB18a	0.60	0.80	SD37	Fine sandy SILT, minor clay	Silt and clay layer characteristic
P040	-7.1	VB18a	2.20	2.40	SD38	Silty fine to medium SAND	Silt and clay layer characteristic
P041	-7.1	VB18a	2.90	3.10	SD39	SILT, some clay, minor fine sand	Silt and clay layer characteristic
P044	-13.4	VB20a	0.10	0.40	SD26	Fine sandy SILT, minor clay	Silt and clay layer characteristic footprint
P045	-13.4	VB20a	0.80	1.10	SD27	SILT, minor fine sand, minor clay	Silt and clay layer characteristic footprint
P046	-13.4	VB20a	2.20	2.50	SD28	SILT, some clay, minor fine sand	Silt and clay layer characteristic footprint

Sample Preparation

Materials were received as moist sediments. A sub-sample of approximately 30 – 40 g was taken and mixed with seawater in a container. The containers of mixed material were placed on a rolling table for a number of hours to aid the breakup of the aggregate to allow dispersal of the material. The resulting slurry was passed through a 2mm sieve to remove large material (e.g. shell fragments) and transferred into the testing tube with the aid of additional seawater until the tube was filled to a fixed mark (0.67 litres).

The tube was then mixed as per the procedure, by repeatedly inverting until the material was dispersed uniformly, at which point the tube was placed upright in a stand and a timer started. At each specific time interval the bottom fraction (of 55mL) was sampled from the tube.

The timed fractions were taken at 10 & 30 seconds, 1, 3, 7, 10, 16, 40, 80, 100, 120 minutes.

Each sampled fraction was tested for total suspended solid content and calculated to represent the % suspended, depth factor and time to settle 100cm. Data was plotted to form the Oden curve from which a tangent line is drawn to the Y-intercept to determine the % solid in suspension. From this, the particle distribution can be determined as it relates to the settling velocity of particles.

Results

The results of the settling velocity, Oden curve and particle distributions are detailed in **Tables 2** to **11** and **Plots 2** to **11**.

The Oden curve is presented with two time scales, one showing 24 hours (1,440 minutes), the other 2 hours (120 minutes).

Classification of the fraction size is based on the Wentworth Scale, 1922 which is included in **Appendix A**.

Table 2: Sample SD45

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P001	-14.4	VB01a	0.20	0.40	SD45	Fine to medium SAND

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	272.9	0.9	248.1	100.0	0
0.167	100	250.6	1.0	250.6	91.8	0.2
0.5	90	220.1	1.1	244.5	80.6	0.6
1	80	152.3	1.3	190.4	55.8	1.3
3	70	66.3	1.4	94.7	24.3	4.3
7	60	9.9	1.7	16.5	3.63	11.7
10	50	5.1	2.0	10.3	1.88	20.0
16	40	3.6	2.5	9.0	1.31	40.0
40	30	2.3	3.3	7.8	0.86	133.3
80	20	0.8	5.0	4.2	0.30	400
100	10	0.3	10.0	2.7	0.10	1,000
120	1	0.1	100.0	8.3	0.03	12,000

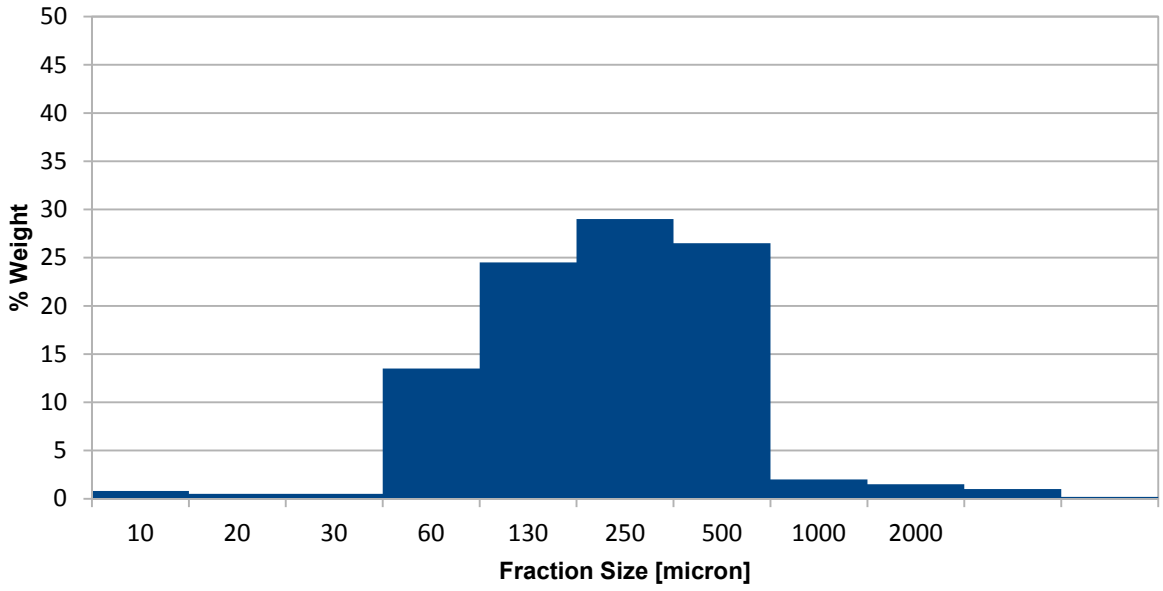
Table 2b: Sample SD45

Particle Faction [micron]	% in Fraction [weight]
2	0.8
4	0.5
8	0.5
16	13.5
31	24.5
62	29.0
125	26.5
250	2.0
500	1.5
1,000	1.0
2,000	0.2

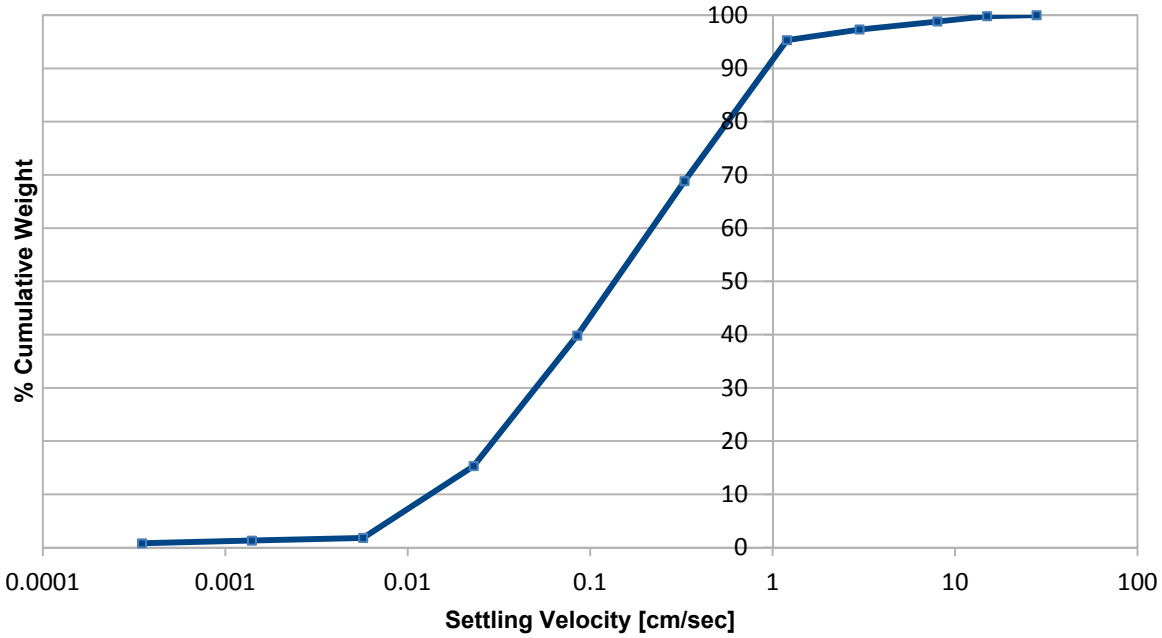
Table 2c: Sample SD45

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.8
0.0014	1.3
0.0057	1.8
0.023	15.3
0.085	39.8
0.329	68.8
1.2	95.3
3	97.3
8	98.8
15	99.8
28	100.0

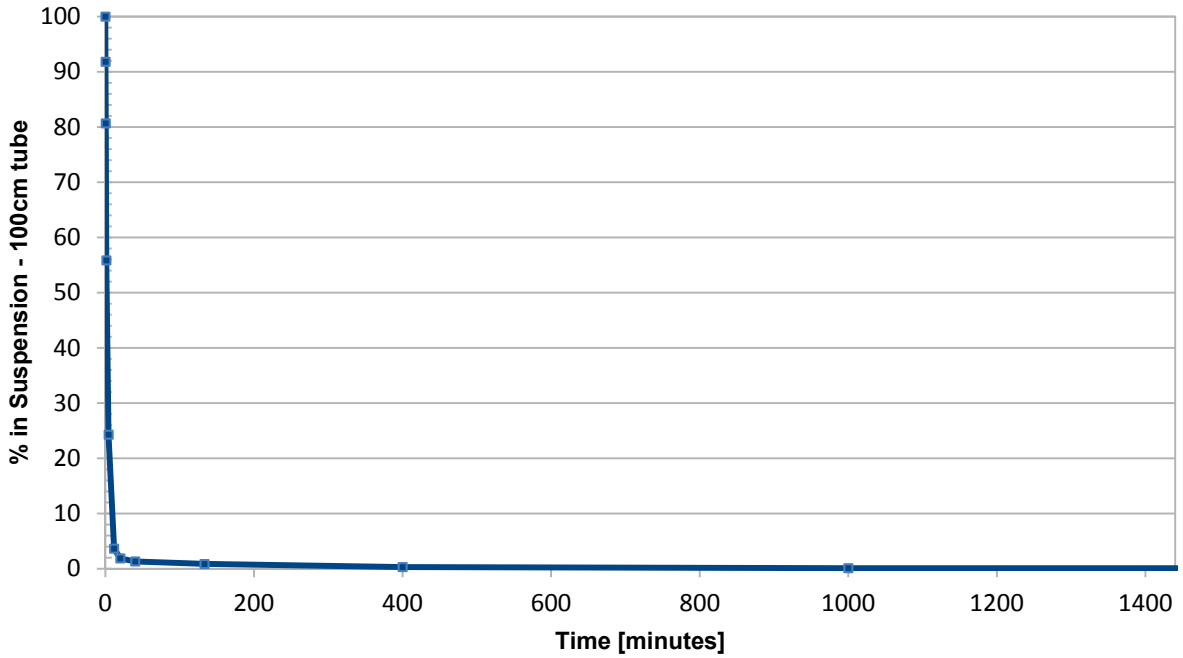
Plot 2a: Sample SD45: % Fraction Range



Plot 2b: Sample SD45: Settling Velocity



Plot 2c: Sample SD45: Oden Curve



Plot 2d: Sample SD45: Oden Curve

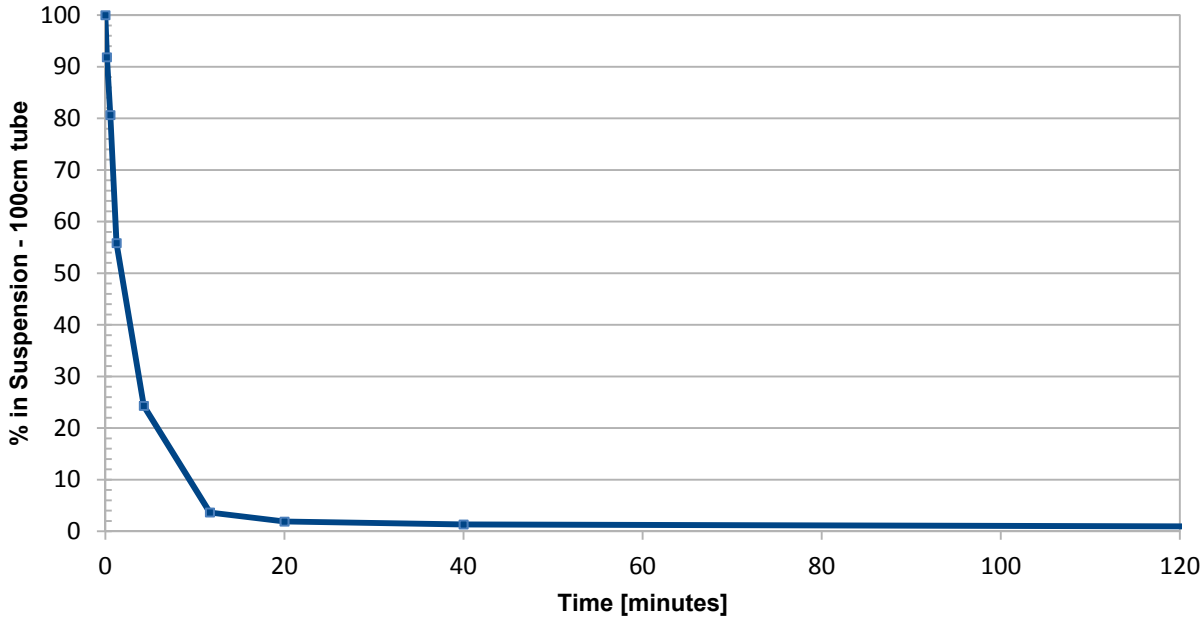


Table 3: Sample SD53

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P007	-13.6	VB05b	0.20	0.40	SD53	Fine to medium SAND

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	479.1	0.9	435.5	100.0	0
0.167	100	439.1	1.0	439.1	91.7	0.2
0.5	90	370.6	1.1	411.7	77.4	0.6
1	80	242.0	1.3	302.6	50.5	1.3
3	70	89.9	1.4	128.5	18.8	4.3
7	60	10.1	1.7	16.8	2.11	11.7
10	50	5.2	2.0	10.4	1.09	20.0
16	40	3.7	2.5	9.3	0.77	40.0
40	30	2.3	3.3	7.6	0.48	133.3
80	20	0.9	5.0	4.3	0.18	400
100	10	0.3	10.0	2.7	0.06	1,000
120	1	0.1	100.0	14.0	0.03	12,000

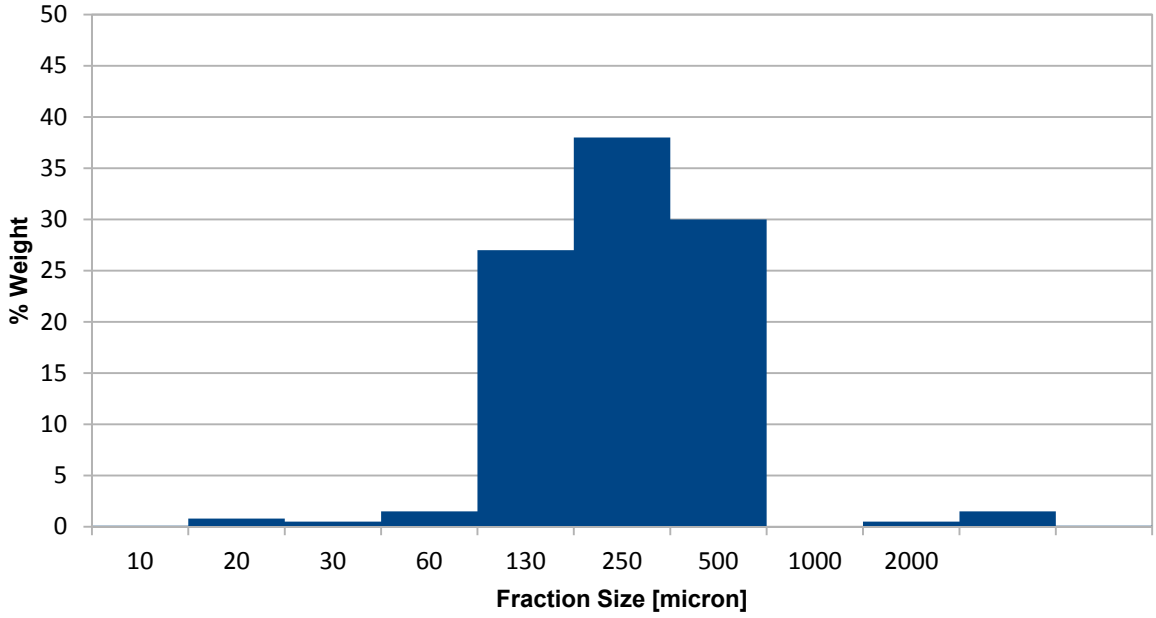
Table 3b: Sample SD45

Particle Faction [micron]	% in Fraction [weight]
2	0.1
4	0.8
8	0.5
16	1.5
31	27
62	38
125	30
250	0
500	0.5
1,000	1.5
2,000	0.1

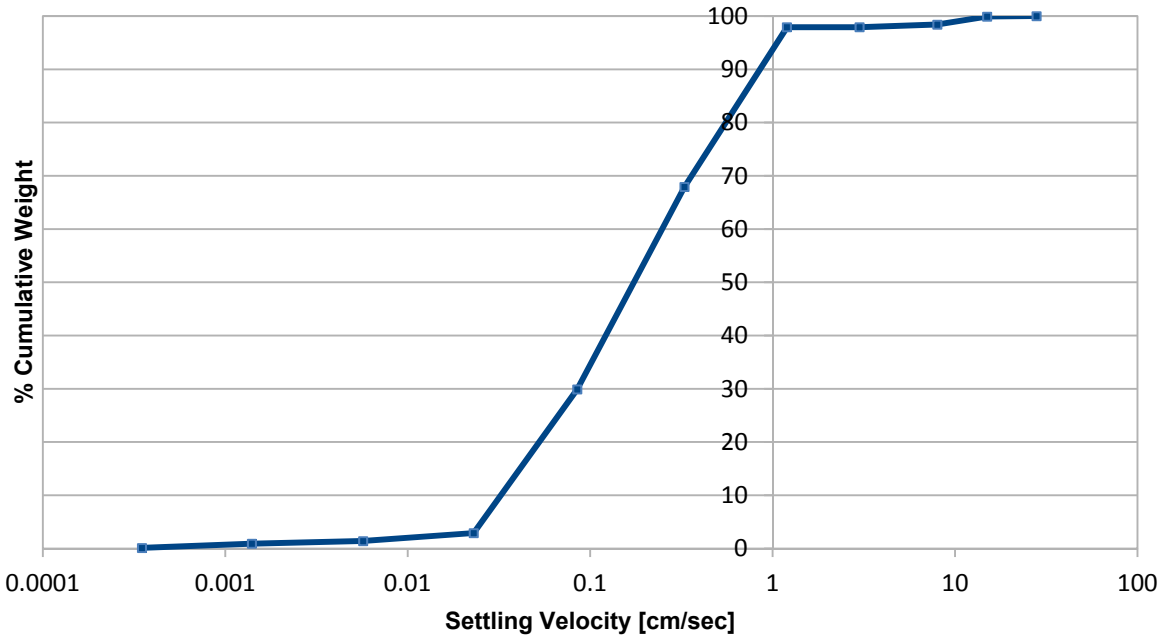
Table 3c: Sample SD45

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.1
0.0014	0.9
0.0057	1.4
0.023	2.9
0.085	29.9
0.329	67.9
1.2	97.9
3	97.9
8	98.4
15	99.9
28	100.0

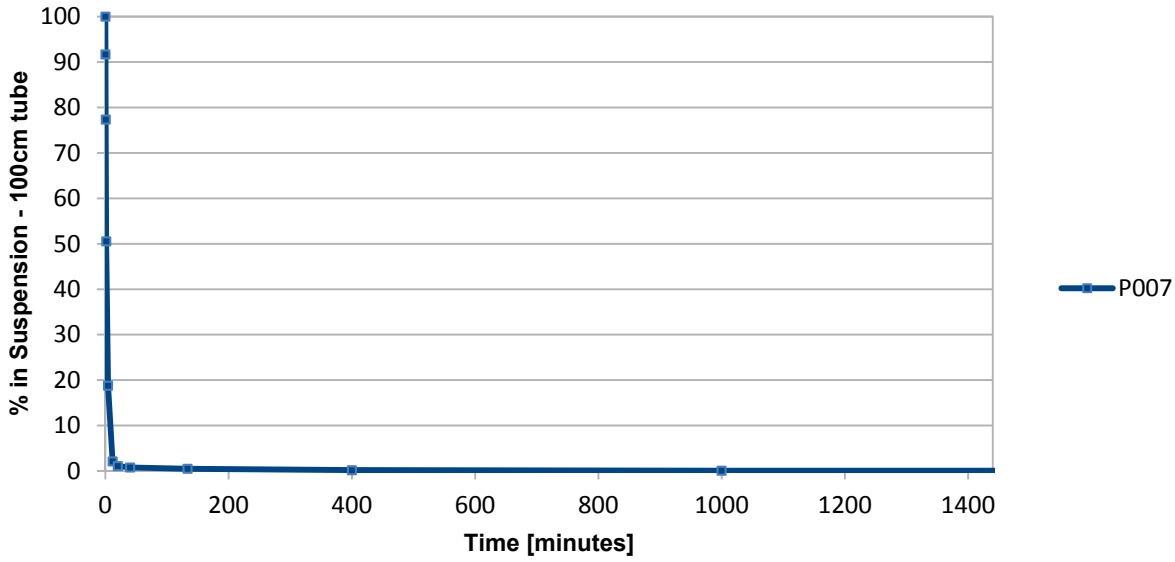
Plot 3a: Sample SD45: % Fraction Range



Plot 3b: Sample SD45: Settling Velocity



Plot 3c: Sample SD45: Oden Curve



Plot 3a: Sample SD45: Oden Curve

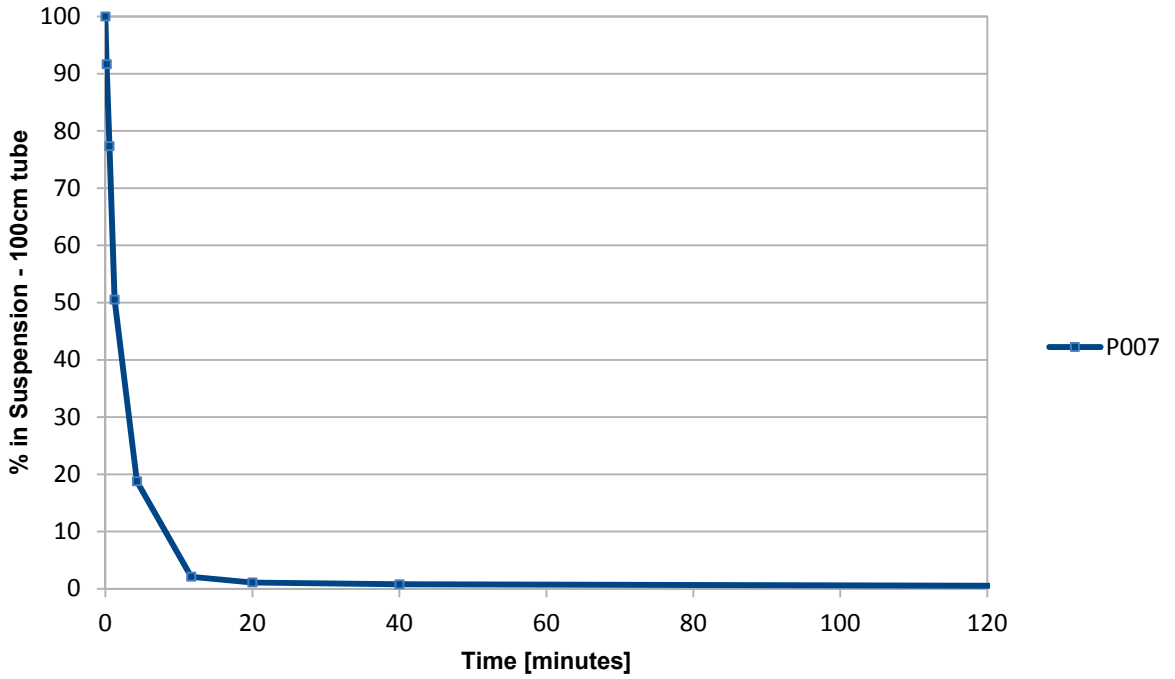


Table 4: Sample SD20

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P015	-12.9	VB09a	0.10	0.30	SD20	Silty fine to medium SAND

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	525.8	0.9	478.0	100.0	0
0.167	100	484.8	1.0	484.8	92.2	0.2
0.5	90	319.1	1.1	354.5	60.7	0.6
1	80	209.5	1.3	261.8	39.8	1.3
3	70	69.4	1.4	99.2	13.2	4.3
7	60	9.4	1.7	15.7	1.80	11.7
10	50	5.0	2.0	9.9	0.95	20.0
16	40	3.0	2.5	7.4	0.56	40.0
40	30	1.8	3.3	5.8	0.33	133.3
80	20	0.5	5.0	2.7	0.10	400
100	10	0.2	10.0	2.2	0.04	1,000
120	1	0.1	100.0	9.8	0.02	12,000

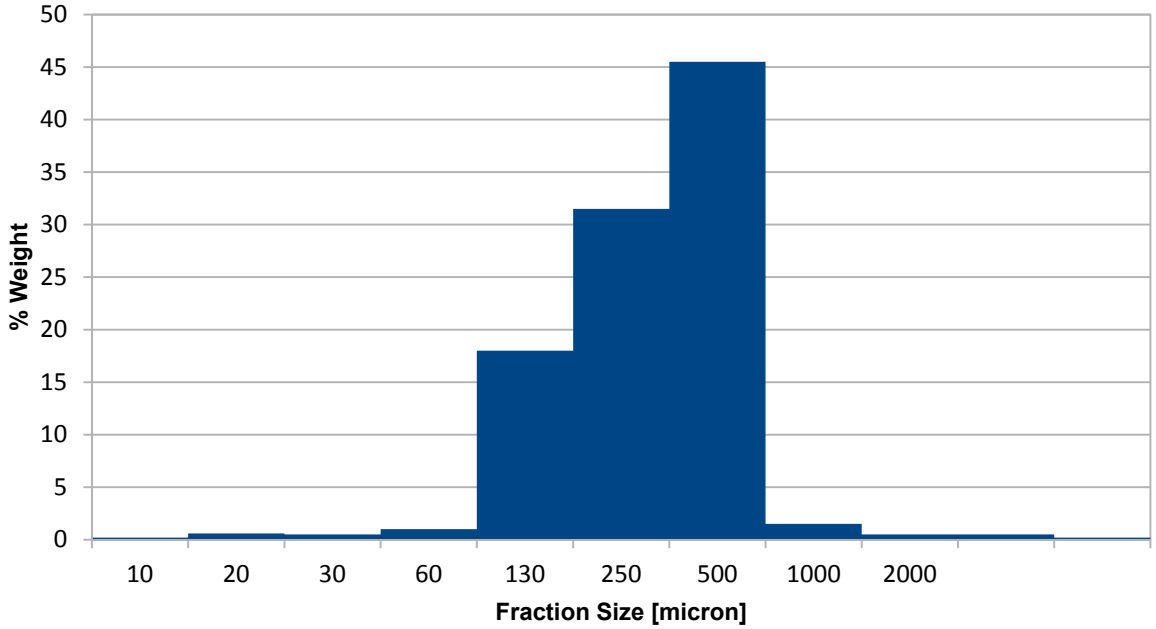
Table 4b: Sample SD20

Particle Faction [micron]	% in Fraction [weight]
2	0.2
4	0.6
8	0.5
16	1.0
31	18
62	31.5
125	45.5
250	1.5
500	0.5
1,000	0.5
2,000	0.2

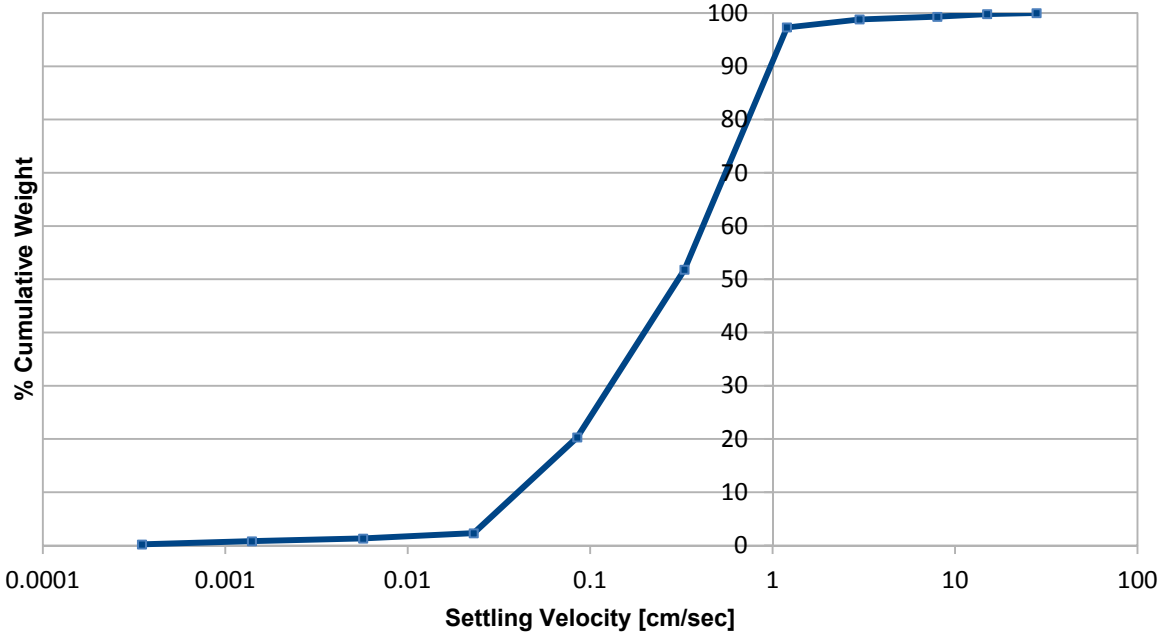
Table 4c: Sample SD20

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.2
0.0014	0.8
0.0057	1.3
0.023	2.3
0.085	20.3
0.329	51.8
1.2	97.3
3	98.8
8	99.3
15	99.8
28	100.0

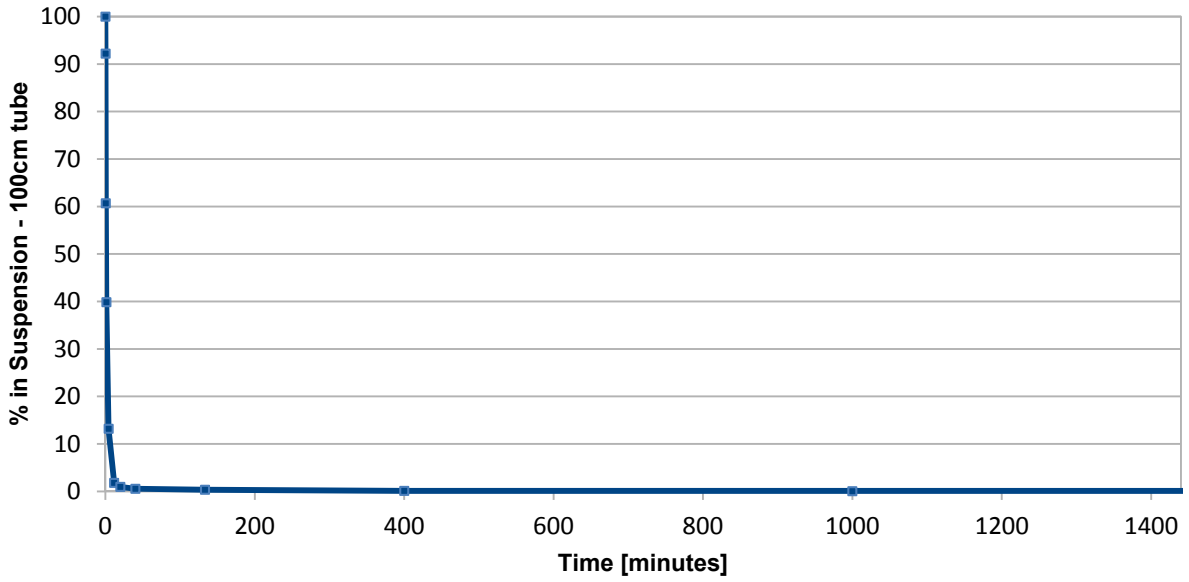
Plot 4a: Sample SD20: % Fraction Range



Plot 4b: Sample SD20: Settling Velocity



Plot 4c: Sample SD20: Oden Curve



Plot 4d: Sample SD20: Oden Curve

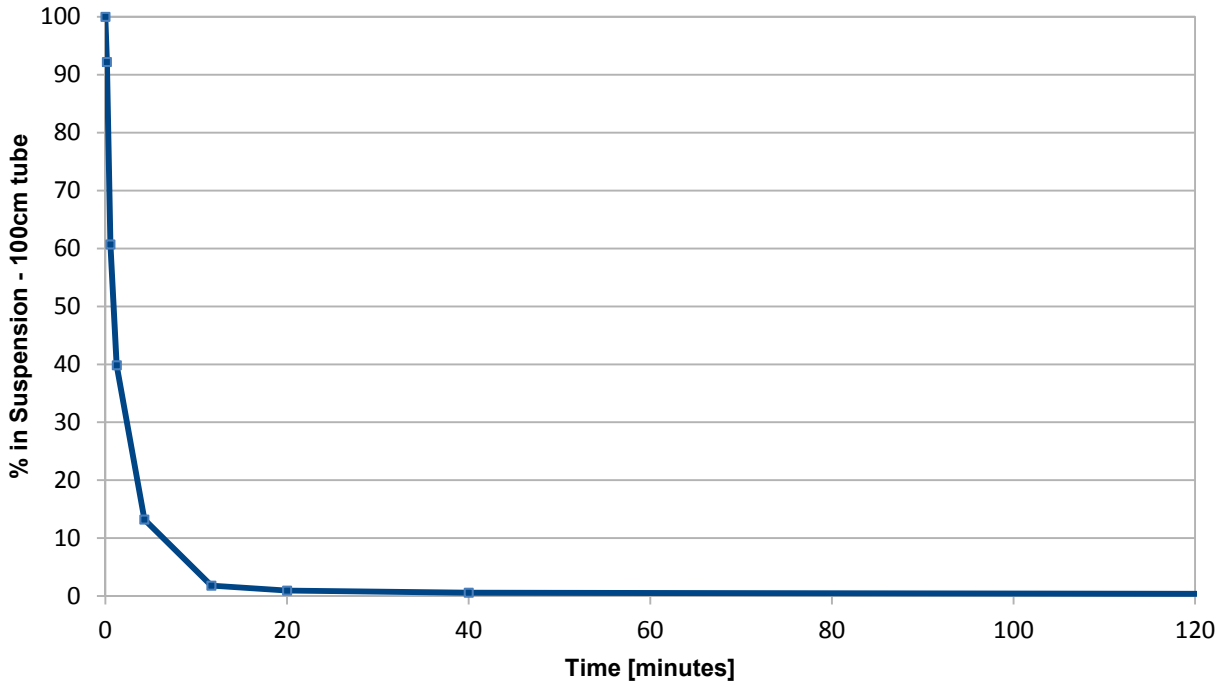


Table 5: Sample SD62

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P026	-12.4	VB13a	0.10	0.40	SD62	Fine to medium SAND

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	544.3	0.9	494.8	100.0	0
0.167	100	500.5	1.0	500.5	92.0	0.2
0.5	90	462.4	1.1	513.8	85.0	0.6
1	80	347.2	1.3	434.0	93.8	1.3
3	70	132.9	1.4	189.9	24.4	4.3
7	60	19.8	1.7	33.1	3.65	11.7
10	50	11.6	2.0	23.1	2.12	20.0
16	40	6.6	2.5	16.5	1.21	40.0
40	30	2.5	3.3	8.5	0.47	133.3
80	20	0.7	5.0	3.5	0.13	400
100	10	0.3	10.0	2.8	0.05	1,000
120	1	0.1	100.0	10.5	0.02	12,000

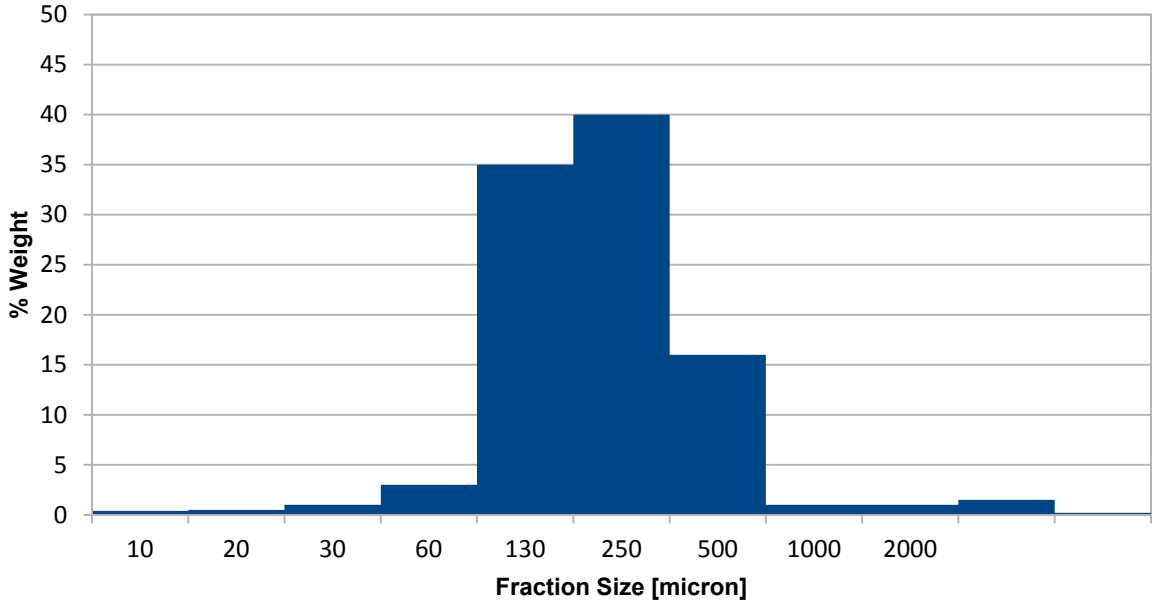
Table 5b: Sample SD62

Particle Faction [micron]	% in Fraction [weight]
2	0.4
4	0.5
8	1.0
16	3.0
31	35
62	40
125	16
250	1.0
500	1.0
1,000	1.5
2,000	0.2

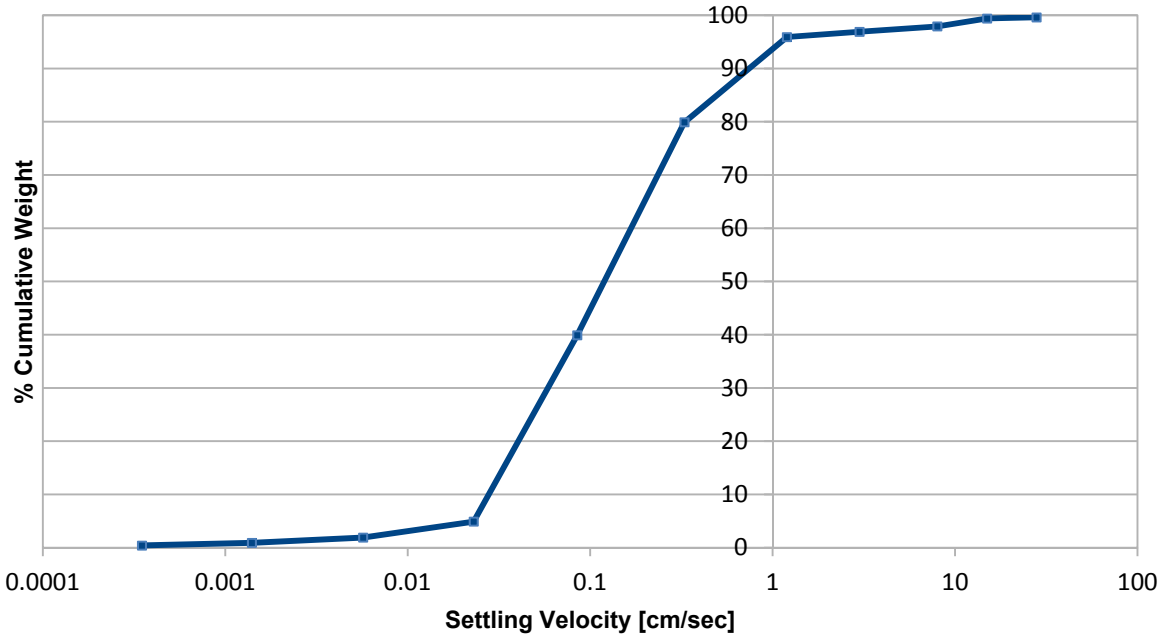
Table 5c: Sample SD62

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.4
0.0014	0.9
0.0057	1.9
0.023	4.9
0.085	39.9
0.329	79.9
1.2	95.9
3	96.9
8	97.9
15	99.4
28	99.6

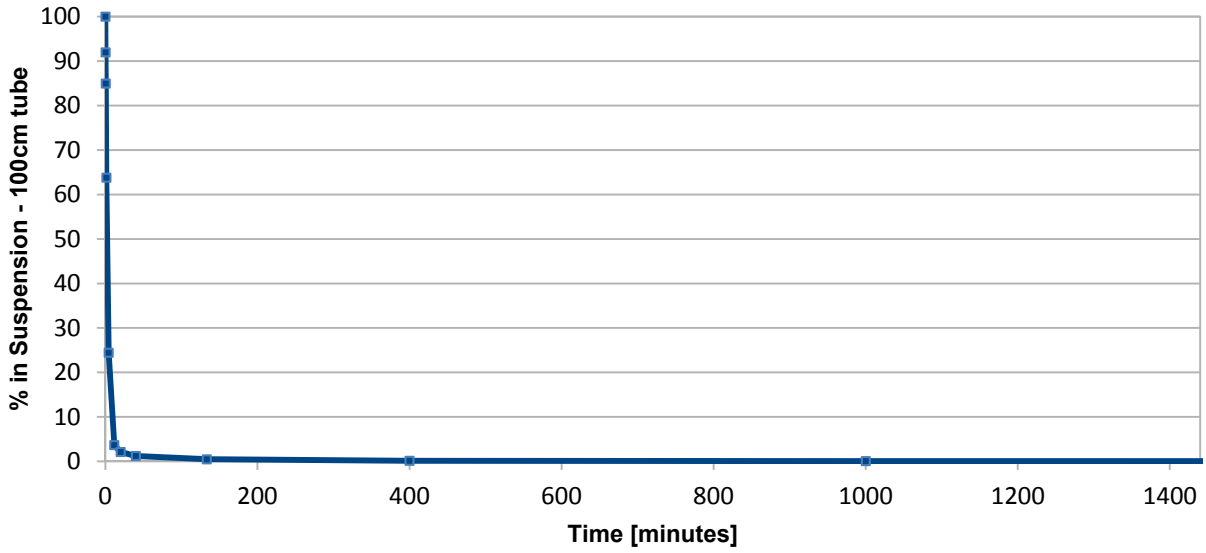
Plot 5a: Sample SD62: % Fraction Range



Plot 5b: Sample SD62: Settling Velocity



Plot 5c: Sample SD62: Oden Curve



Plot 5d: Sample SD62: Oden Curve

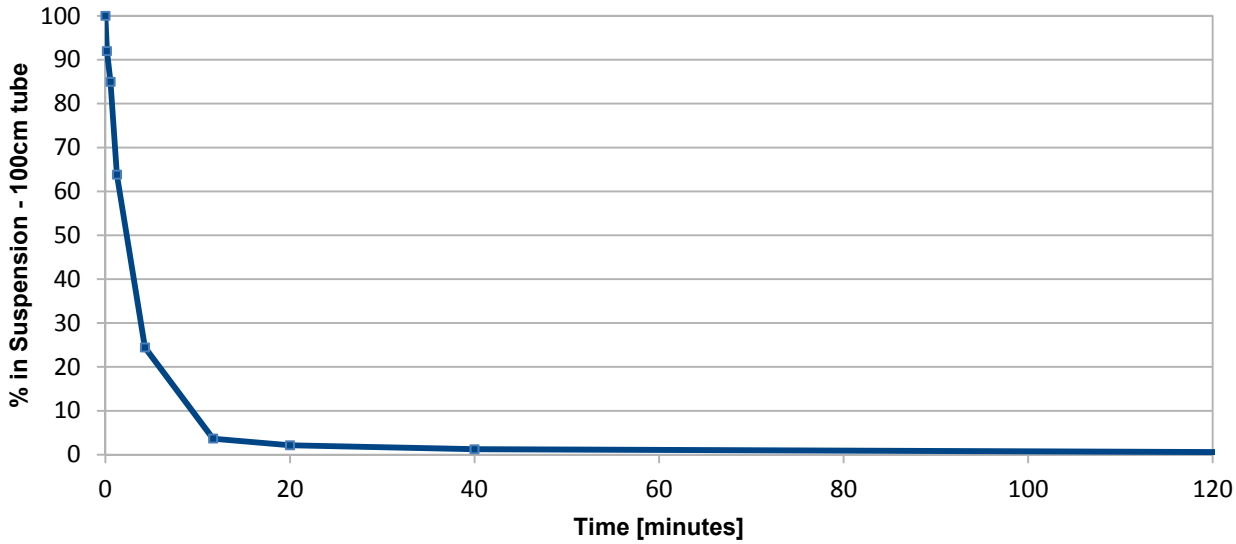


Table 6: Sample SD37

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P039	-7.1	VB18a	0.60	0.80	SD37	Fine sandy SILT, minor clay

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	630.7	0.9	573.3	100.0	0
0.167	100	578.9	1.0	578.9	91.8	0.2
0.5	90	511.1	1.1	567.9	81.1	0.6
1	80	440.5	1.3	550.6	69.8	1.3
3	70	359.3	1.4	513.3	57.0	4.3
7	60	234.5	1.7	390.8	37.2	11.7
10	50	142.7	2.0	285.5	22.6	20.0
16	40	93.6	2.5	234.1	14.9	40.0
40	30	43.8	3.3	146.0	6.94	133.3
80	20	2.3	5.0	11.6	0.37	400
100	10	0.3	10.0	3.3	0.05	1,000
120	1	0.1	100.0	11.6	0.02	12,000

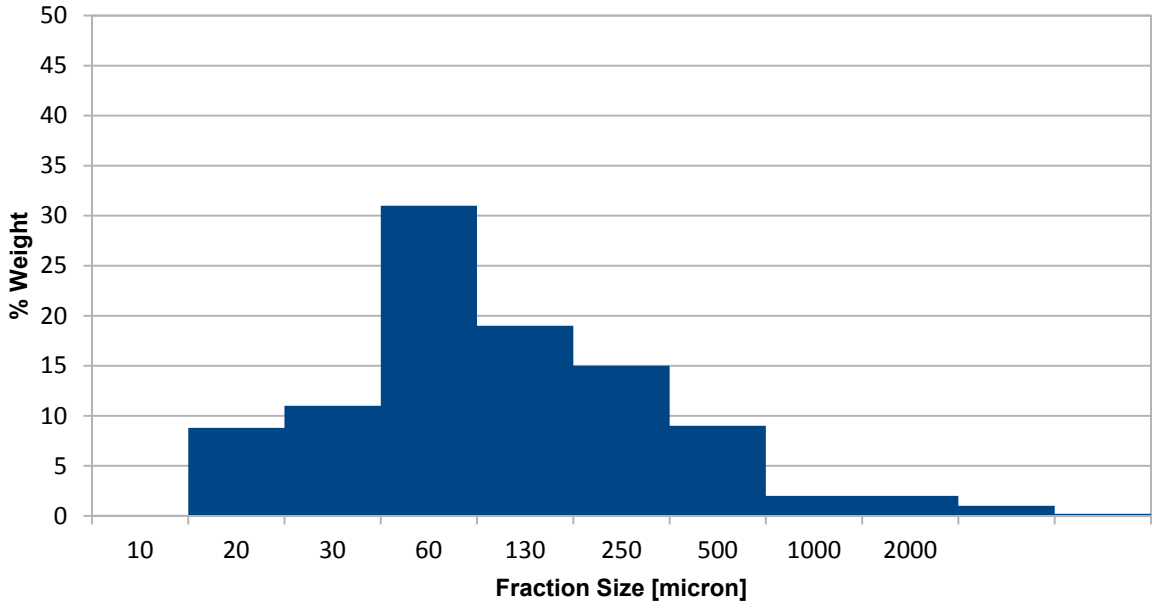
Table 6b: Sample SD37

Particle Faction [micron]	% in Fraction [weight]
2	0.1
4	8.8
8	11
16	31
31	19
62	15
125	9
250	2
500	2
1,000	1
2,000	0.2

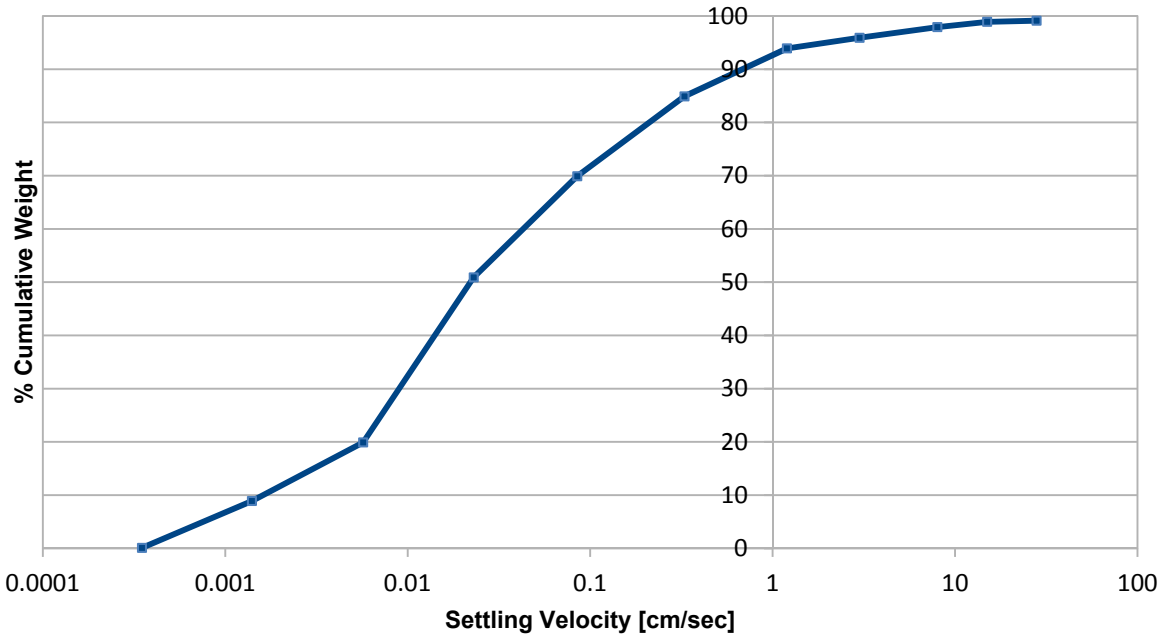
Table 5c: Sample SD37

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.1
0.0014	8.9
0.0057	19.9
0.023	50.9
0.085	69.9
0.329	84.9
1.2	93.9
3	95.9
8	97.9
15	98.9
28	99.1

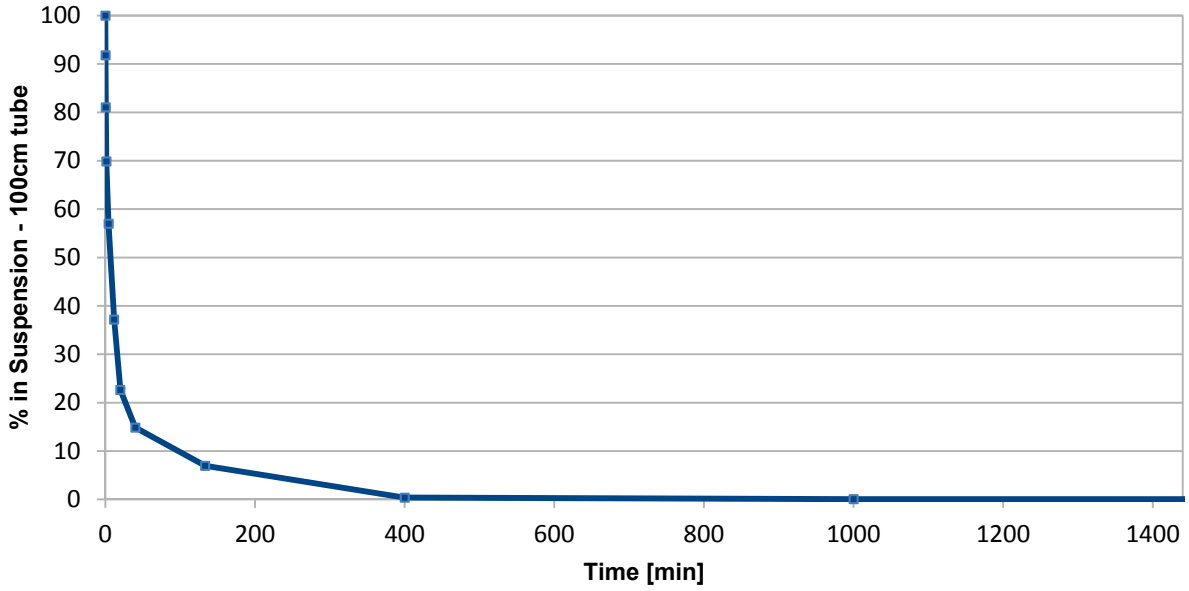
Plot 6a: Sample SD37: % Fraction Range



Plot 6b: Sample SD37: Settling Velocity



Plot 6c: Sample SD37: Oden Curve



Plot 6d: Sample SD37: Oden Curve

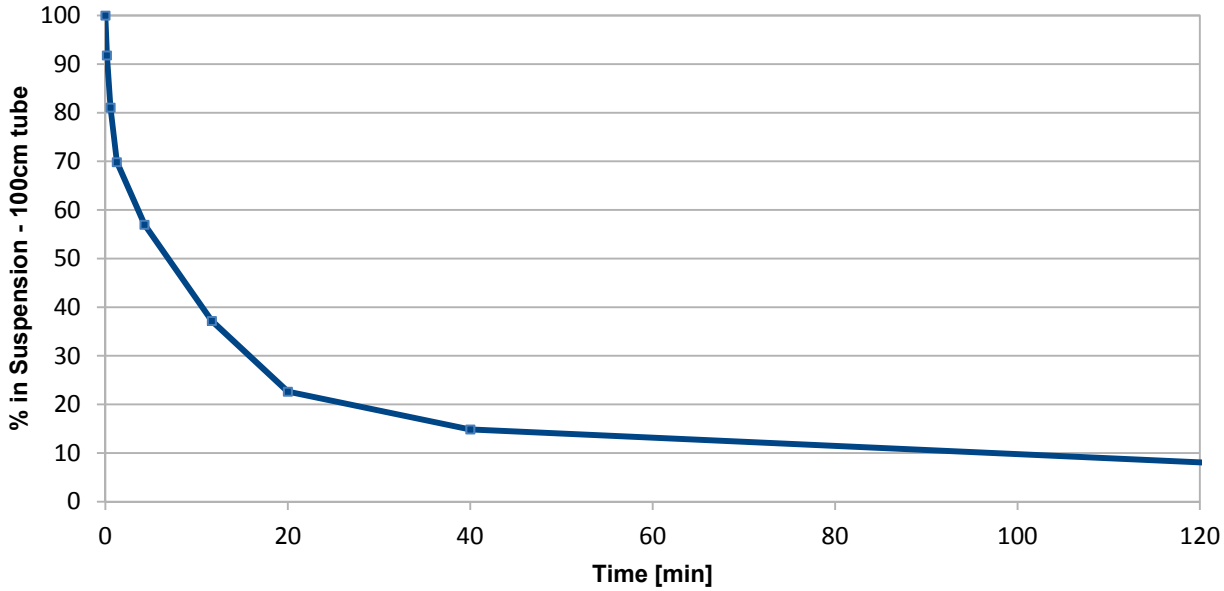


Table 7: Sample SD40

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P040	-7.1	VB18a	2.20	2.40	SD38	Silty fine to medium SAND

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	612.5	0.9	556.8	100.0	0
0.167	100	562.5	1.0	562.6	91.9	0.2
0.5	90	470.3	1.1	522.6	76.8	0.6
1	80	376.2	1.3	470.2	61.4	1.3
3	70	279.8	1.4	399.7	45.7	4.3
7	60	139.3	1.7	232.1	22.7	11.7
10	50	88.5	2.0	177.0	14.5	20.0
16	40	56.9	2.5	142.3	9.29	40.0
40	30	26.0	3.3	86.5	4.24	133.3
80	20	1.1	5.0	5.3	0.17	400
100	10	0.3	10.0	2.5	0.04	1,000
120	1	0.1	100.0	10.8	0.02	12,000

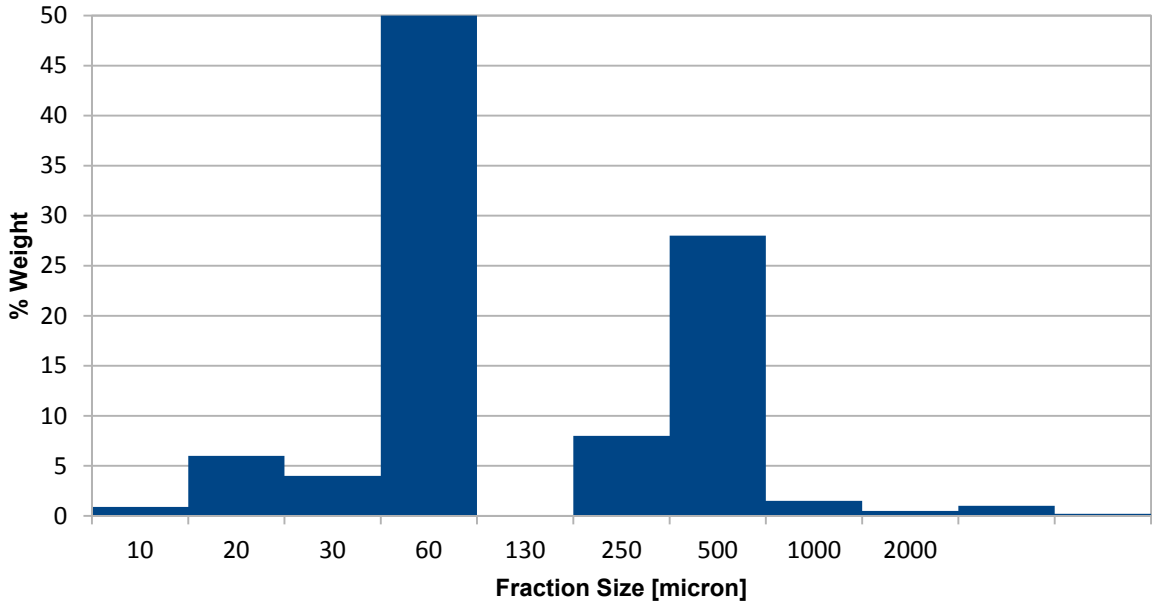
Table 7b: Sample SD38

Particle Faction [micron]	% in Fraction [weight]
2	0.9
4	6
8	4
16	50
31	0
62	8
125	28
250	1.5
500	0.5
1,000	1
2,000	0.2

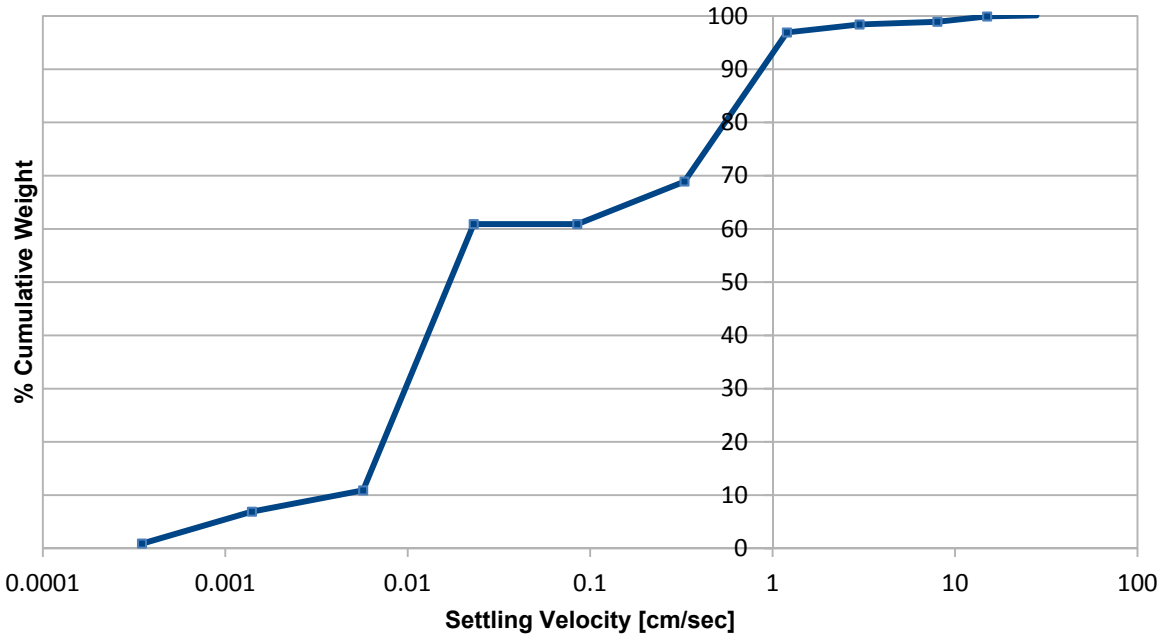
Table 7c: Sample SD38

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.9
0.0014	6.9
0.0057	10.9
0.023	60.9
0.085	60.9
0.329	68.9
1.2	96.9
3	98.4
8	98.9
15	99.9
28	100.0

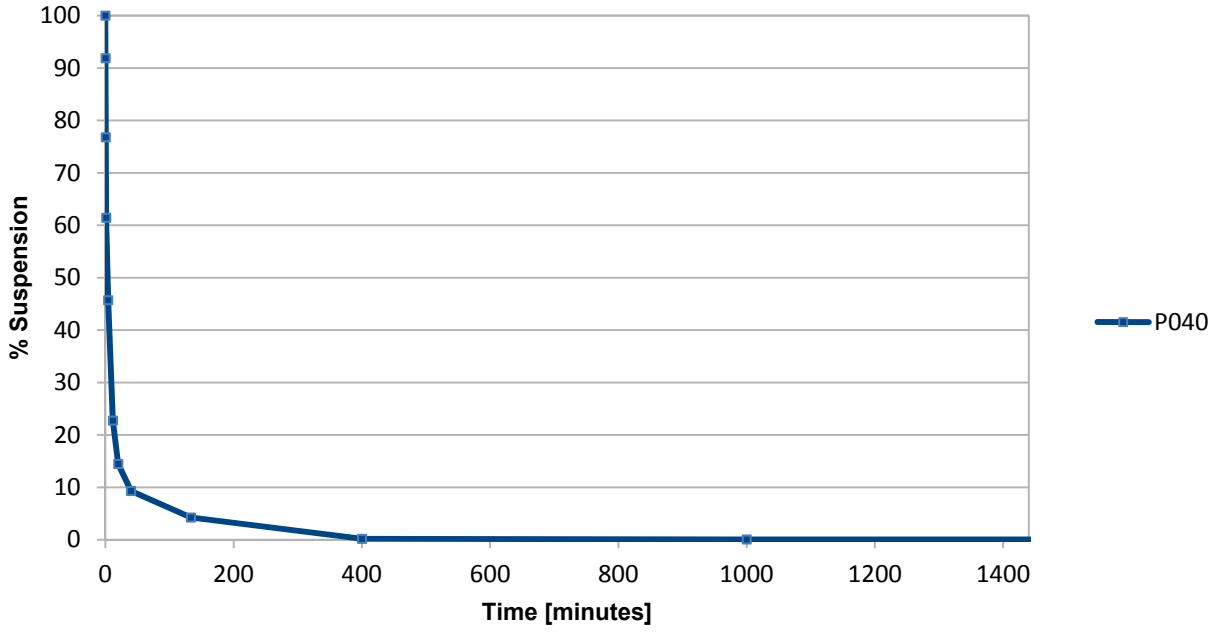
Plot 7a: Sample SD38: % Fraction Range



Plot 7b: Sample SD38: Settling Velocity



Plot 7c: Sample SD38: Oden Curve



Plot 7d: Sample SD38: Oden Curve

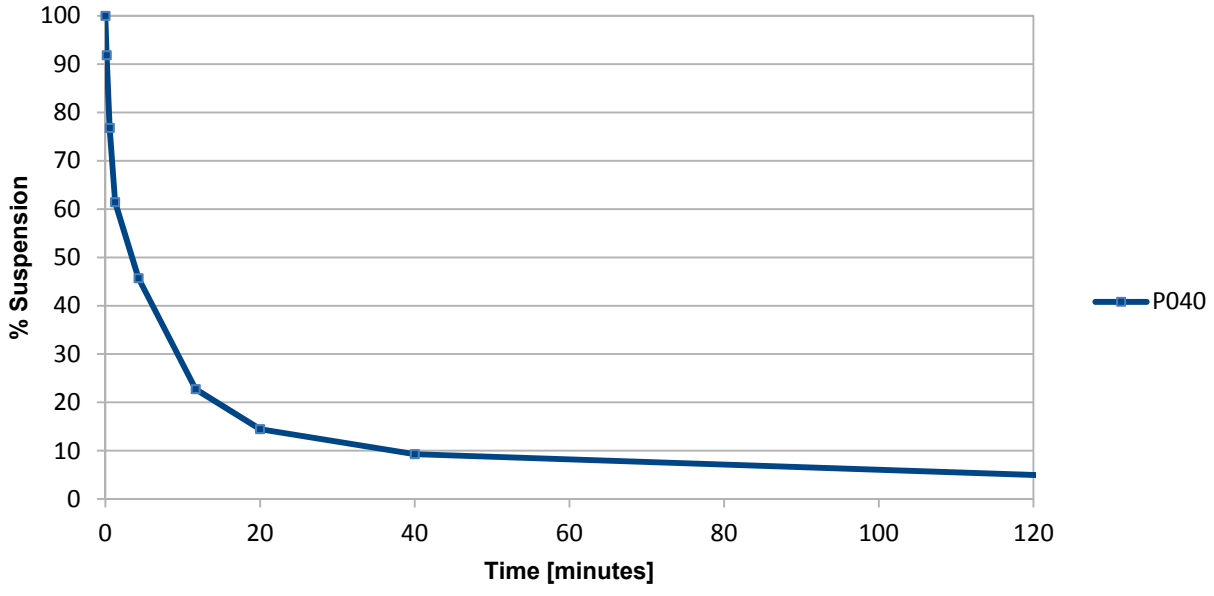


Table 8: Sample SD41

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P041	-7.1	VB18a	2.90	3.10	SD39	SILT, some clay, minor fine sand
Time [min, decimal]	**Fall Height [cm]**	**Cumulative Suspended Sediment (Measured) [mg/L]**	**Depth Factor to 100cm**	**Sediment in Suspension 100cm tube (Corrected) [mg/L]**	**% Sediment in Suspension**	**Time to Settle 100cm [minutes]**
0	110	510.5	0.9	464.1	100.0	0
0.167	100	468.6	1.0	468.6	91.8	0.2
0.5	90	418.8	1.1	465.4	82.1	0.6
1	80	368.1	1.3	460.1	72.1	1.3
3	70	312.9	1.4	447.0	61.3	4.3
7	60	239.5	1.7	399.1	46.9	11.7
10	50	176.2	2.0	352.4	34.5	20.0
16	40	130.2	2.5	325.4	25.5	40.0
40	30	81.8	3.3	272.7	16.0	133.3
80	20	15.0	5.0	75.1	2.94	400
100	10	0.8	10.0	8.4	016	1,000
120	1	0.2	100.0	24.0	0.05	12,000

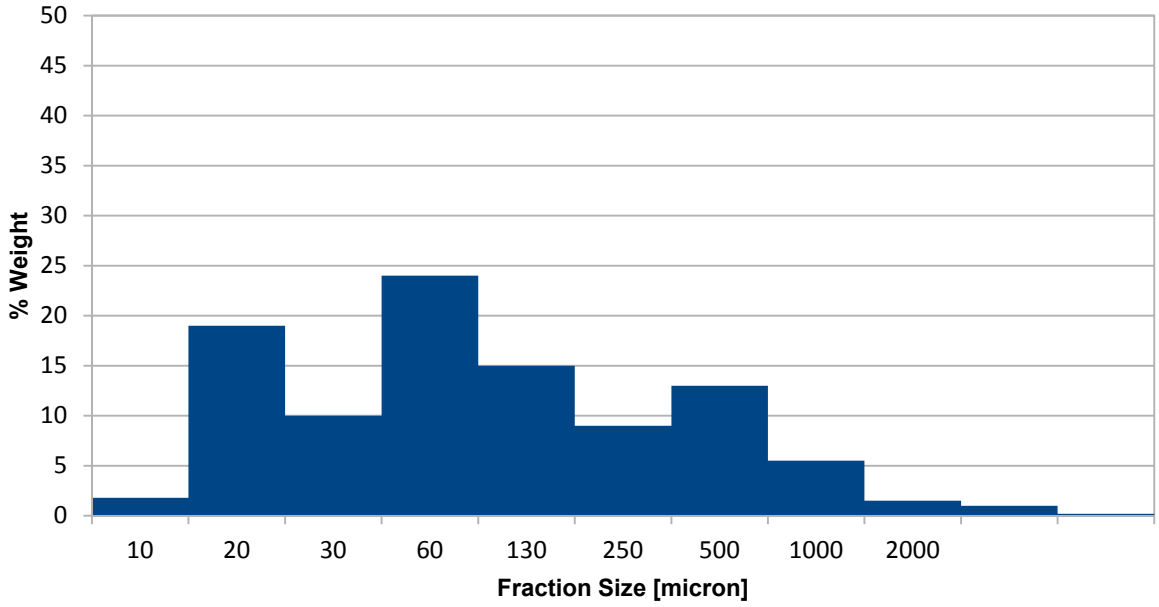
Table 8b: Sample SD41

Particle Faction [micron]	% in Fraction [weight]
2	1.8
4	19
8	10
16	24
31	15
62	9
125	13
250	5.5
500	1.5
1,000	1.0
2,000	0.2

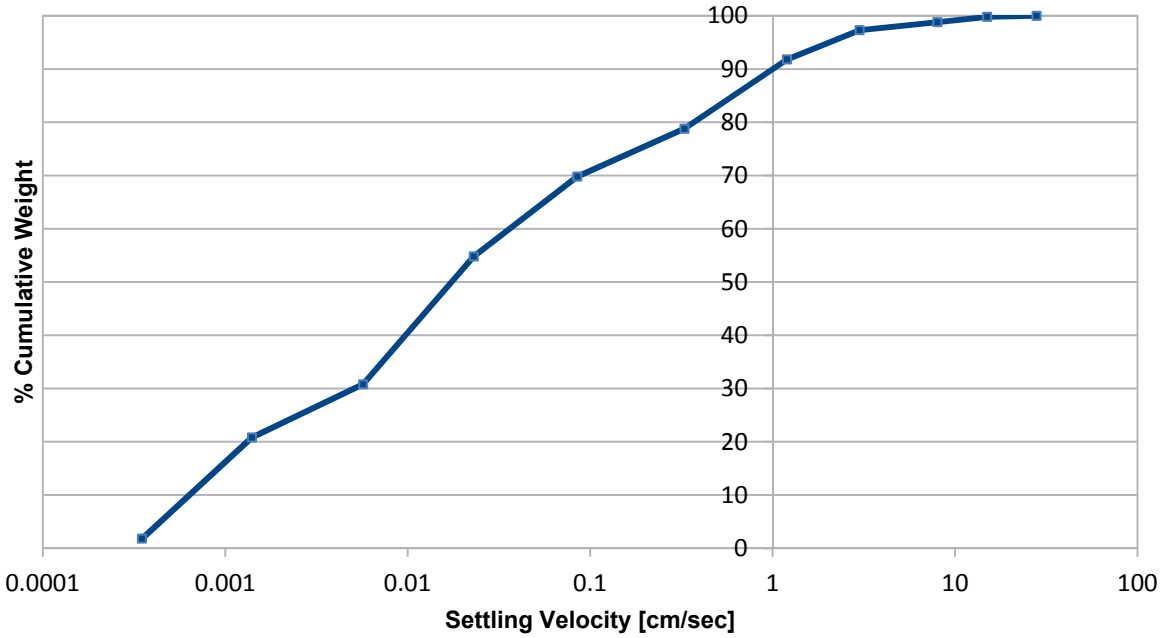
Table 8c: Sample SD41

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	1.8
0.0014	20.8
0.0057	30.8
0.023	54.8
0.085	69.8
0.329	78.8
1.2	91.8
3	97.3
8	98.8
15	99.9
28	100.0

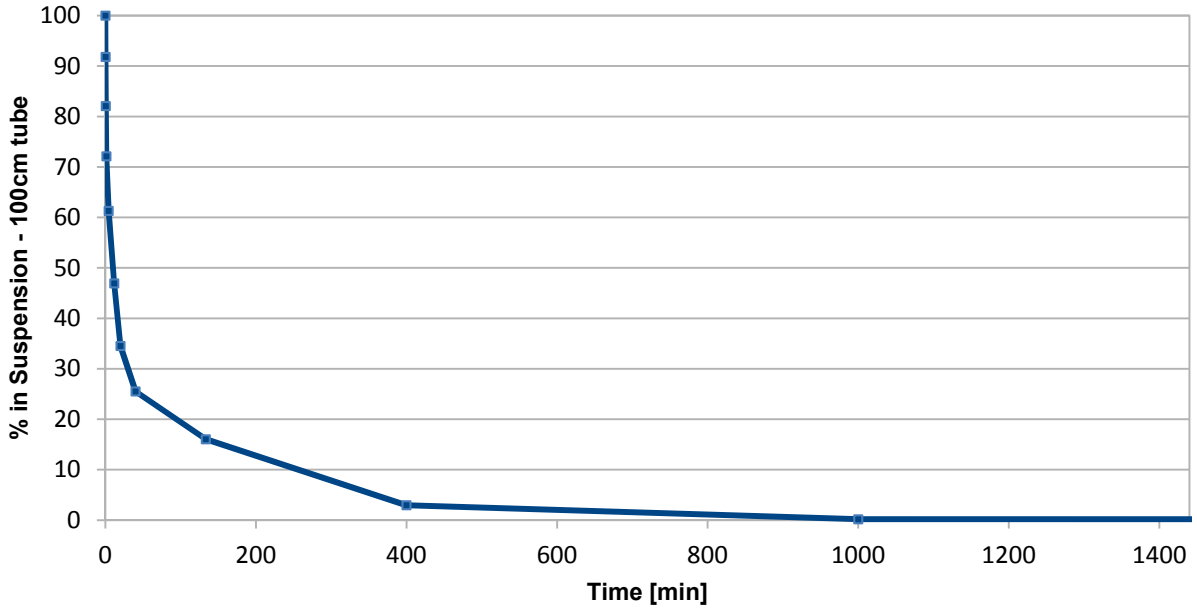
Plot 8a: Sample SD41: % Fraction Range



Plot 8b: Sample SD41: Settling Velocity



Plot 8c: Sample SD41: Oden Curve



Plot 8d: Sample SD41: Oden Curve

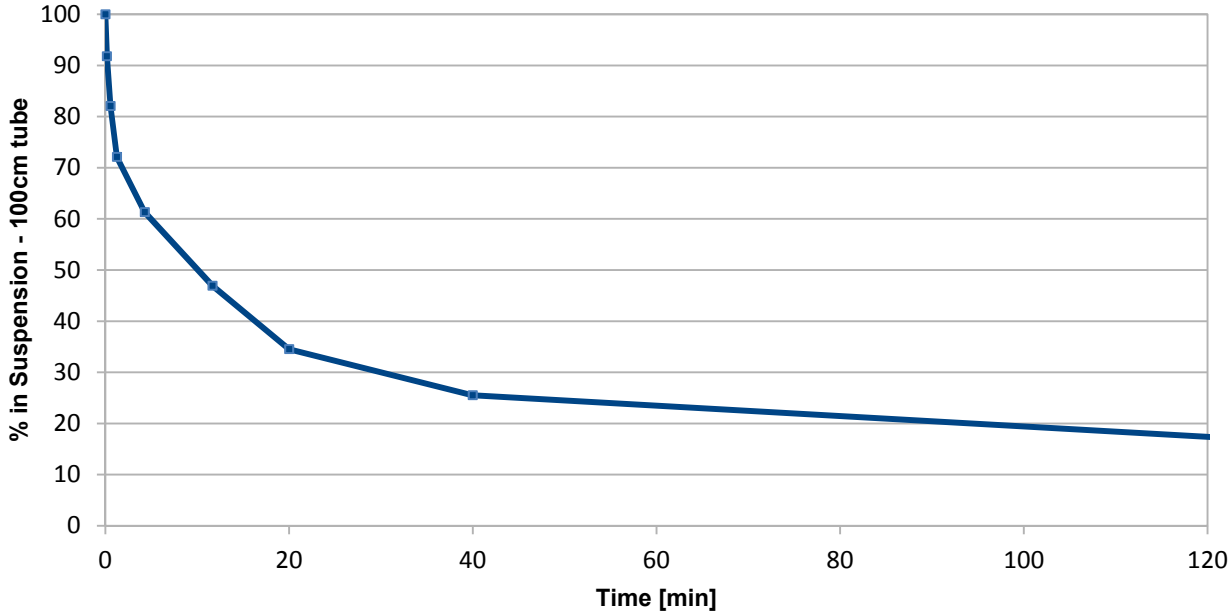


Table 9: Sample SD26

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P044	-13.4	VB20a	0.10	0.40	SD26	Fine sandy SILT, minor clay
Time [min, decimal]	**Fall Height [cm]**	**Cumulative Suspended Sediment (Measured) [mg/L]**	**Depth Factor to 100cm**	**Sediment in Suspension 100cm tube (Corrected) [mg/L]**	**% Sediment in Suspension**	**Time to Settle 100cm [minutes]**
0	110	326.1	0.9	296.5	100.0	0
0.167	100	298.9	1.0	298.9	91.7	0.2
0.5	90	262.2	1.1	291.3	80.4	0.6
1	80	229.0	1.3	286.3	70.2	1.3
3	70	188.9	1.4	269.8	57.9	4.3
7	60	148.6	1.7	247.6	45.6	11.7
10	50	99.8	2.0	199.6	30.6	20.0
16	40	59.6	2.5	149.1	18.3	40.0
40	30	12.3	3.3	41.1	3.78	133.3
80	20	0.9	5.0	4.4	0.27	400
100	10	0.3	10.0	2.6	0.08	1,000
120	1	0.1	100.0	9.3	0.03	12,000

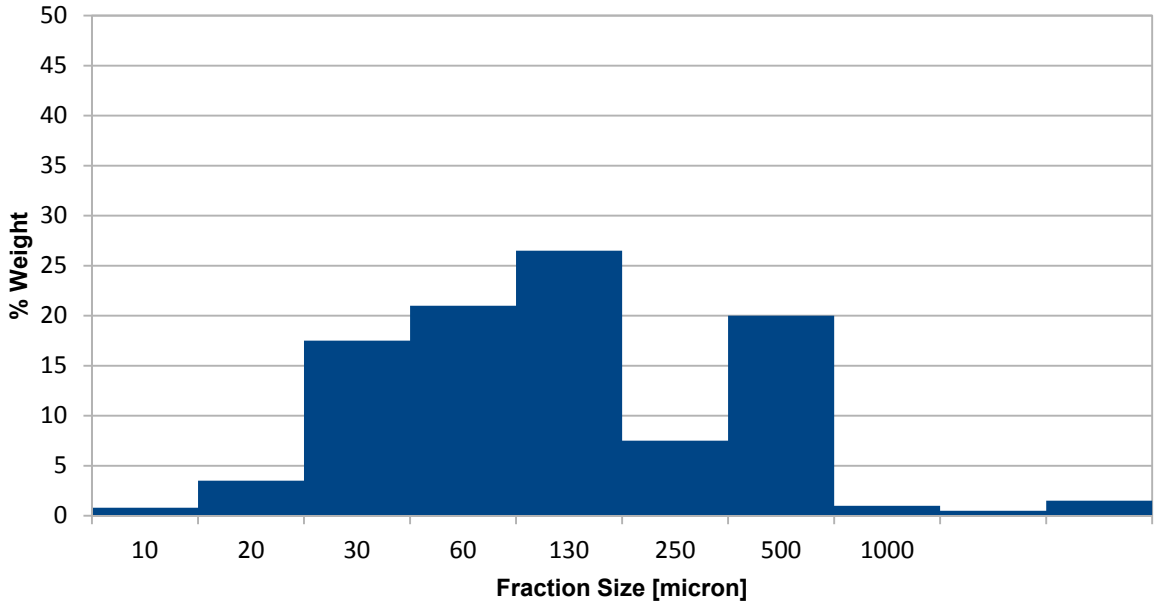
Table 9b: Sample SD26

Particle Faction [micron]	% in Fraction [weight]
2	0.8
4	3.5
8	17.5
16	21.0
31	26.5
62	7.5
125	20.0
250	1.0
500	0.5
1,000	1.5
2,000	0.2

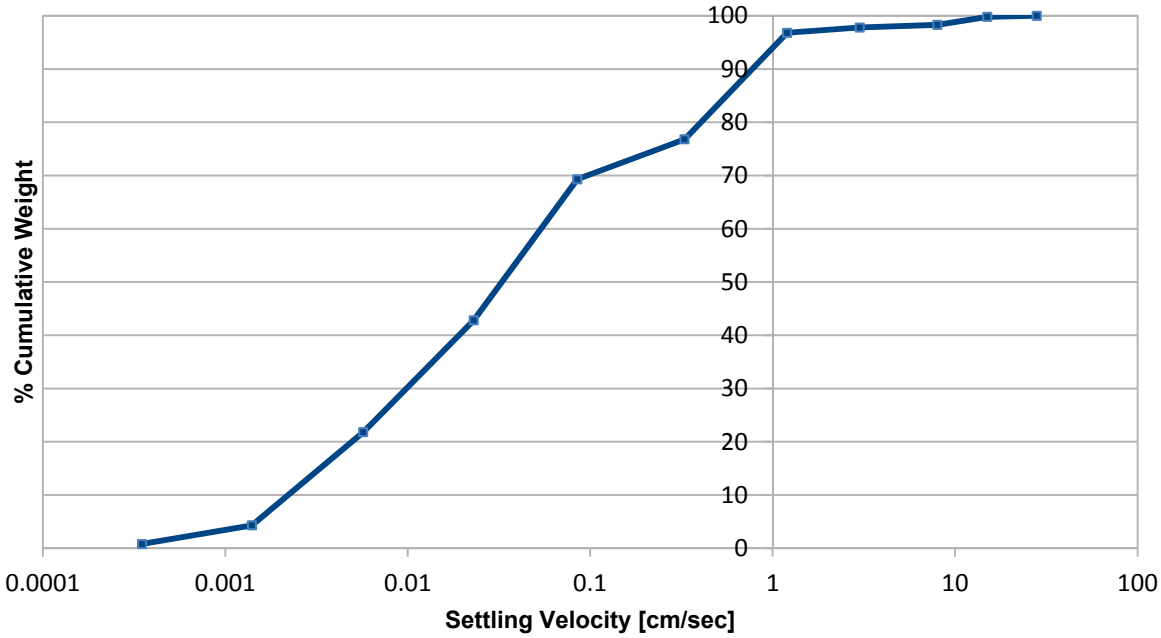
Table 9c: Sample SD26

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	0.8
0.0014	4.3
0.0057	21.8
0.023	42.8
0.085	69.3
0.329	76.8
1.2	96.8
3	97.8
8	98.3
15	99.8
28	100.0

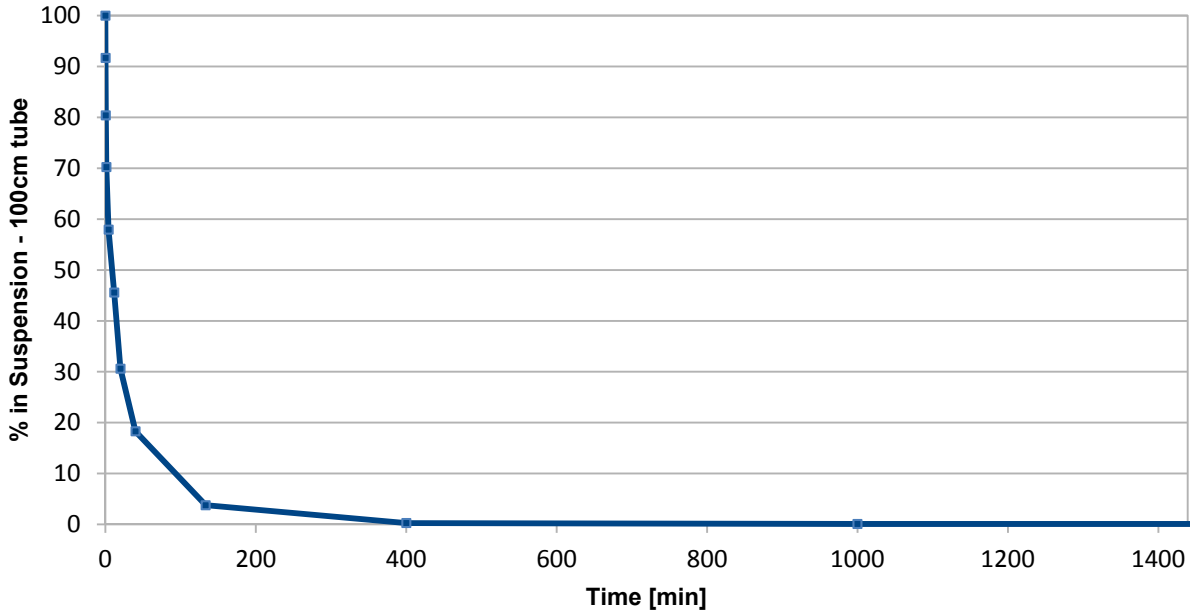
Plot 9a: Sample SD26: % Fraction Range



Plot 9b: Sample SD26: Settling Velocity



Plot 9c: Sample SD26: Oden Curve



Plot 9d: Sample SD26: Oden Curve

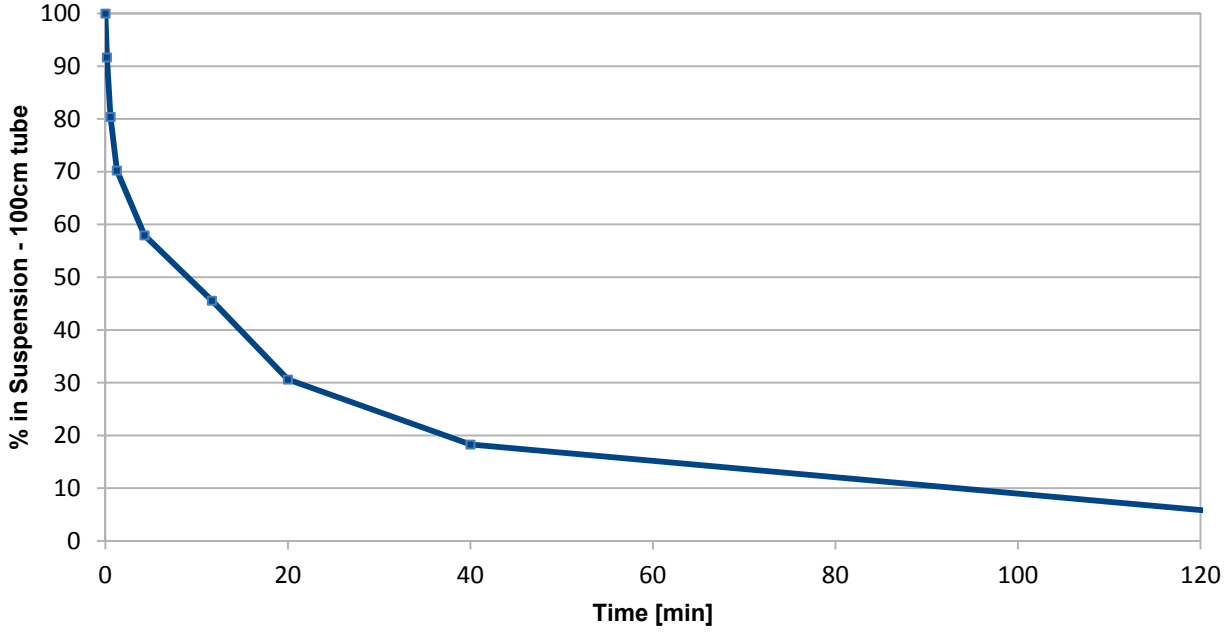


Table 10: Sample SD27

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P045	-13.4	VB20a	0.80	1.10	SD27	SILT, minor fine sand, minor clay
Time [min, decimal]	**Fall Height [cm]**	**Cumulative Suspended Sediment (Measured) [mg/L]**	**Depth Factor to 100cm**	**Sediment in Suspension 100cm tube (Corrected) [mg/L]**	**% Sediment in Suspension**	**Time to Settle 100cm [minutes]**
0	110	600.4	0.9	545.8	100.0	0
0.167	100	551.3	1.0	551.3	91.8	0.2
0.5	90	497.2	1.1	552.4	82.8	0.6
1	80	439.7	1.3	549.6	73.2	1.3
3	70	384.7	1.4	549.6	64.1	4.3
7	60	312.1	1.7	520.2	52.0	11.7
10	50	232.8	2.0	465.6	38.8	20.0
16	40	172.7	2.5	431.7	28.8	40.0
40	30	112.2	3.3	373.9	18.7	133.3
80	20	37.5	5.0	187.7	6.3	400
100	10	2.1	10.0	20.9	0.35	1,000
120	1	0.3	100.0	26.9	0.04	12,000

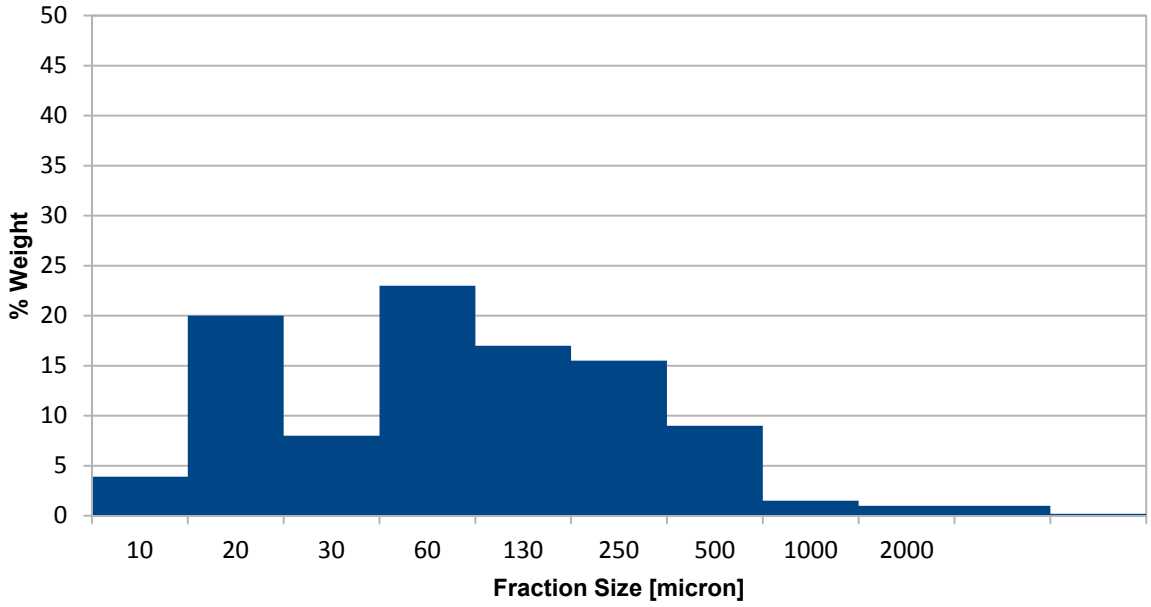
Table 10b: Sample SD27

Particle Faction [micron]	% in Fraction [weight]
2	2.9
4	20
8	8.0
16	23.0
31	17.0
62	15.5
125	9.0
250	1.5
500	1.0
1,000	1.0
2,000	0.2

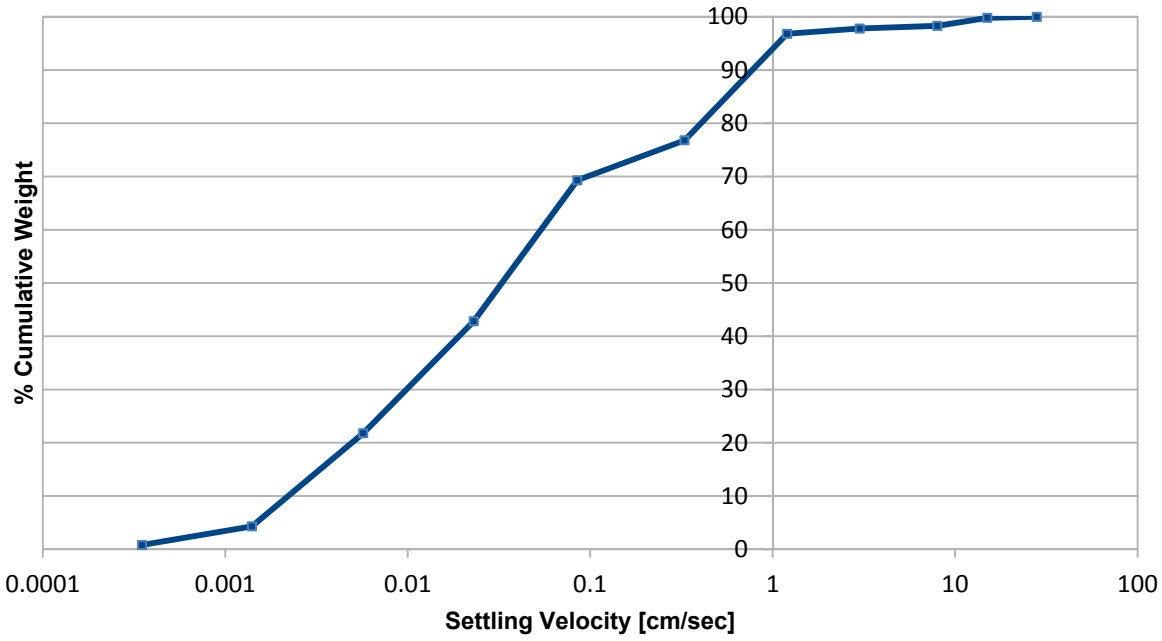
Table 10c: Sample SD27

Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	3.9
0.0014	23.9
0.0057	31.9
0.023	54.9
0.085	71.9
0.329	87.4
1.2	96.4
3	97.9
8	98.9
15	99.9
28	100.1

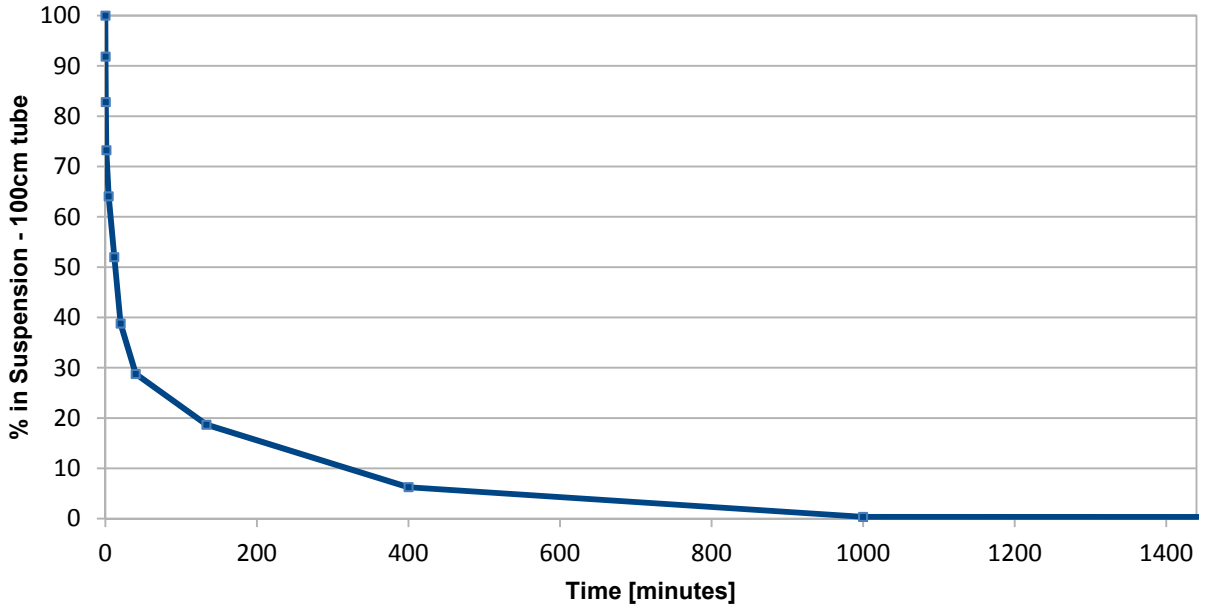
Plot 10a: Sample SD27: % Fraction Range



Plot 10b: Sample SD27: Settling Velocity



Plot 10c: Sample SD27: Oden Curve



Plot 10d: Sample SD27: Oden Curve

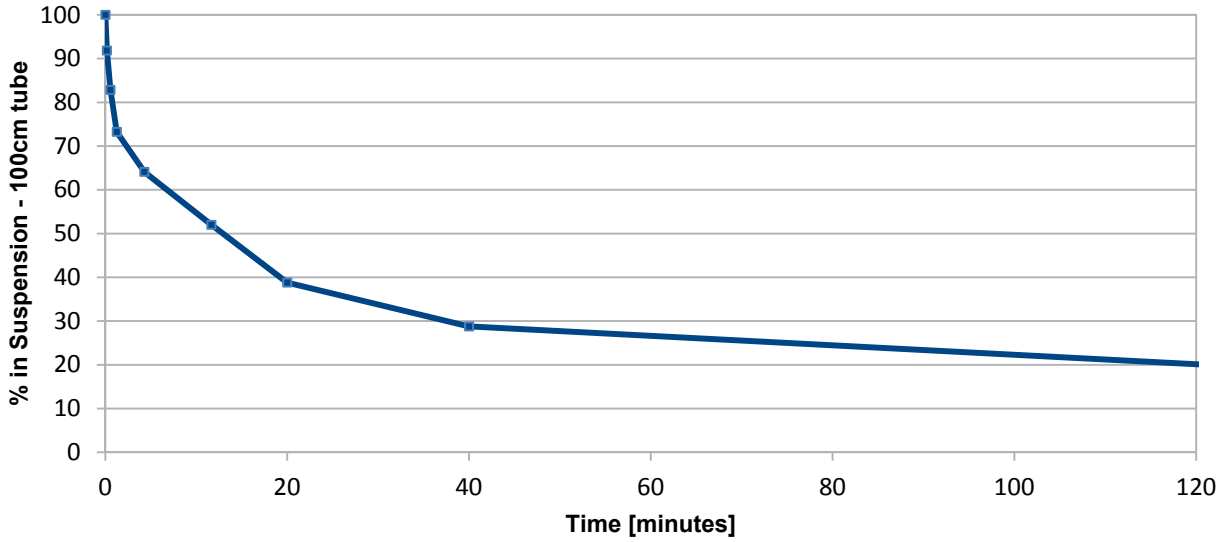


Table 11: Sample SD28

Lab Ref	Bed Depth (m)	Vibrocore	Top	Bottom	Sample Number	Material
P046	-13.4	VB20a	2.20	2.50	SD28	SILT, some clay, minor fine sand

Time [min, decimal]	Fall Height [cm]	Cumulative Suspended Sediment (Measured) [mg/L]	Depth Factor to 100cm	Sediment in Suspension 100cm tube (Corrected) [mg/L]	% Sediment in Suspension	Time to Settle 100cm [minutes]
0	110	632.7	0.9	575.2	100.0	0
0.167	100	580.9	1.0	580.9	91.8	0.2
0.5	90	525.0	1.1	583.3	83.0	0.6
1	80	462.9	1.3	578.6	73.1	1.3
3	70	400.8	1.4	572.5	63.3	4.3
7	60	328.2	1.7	547.0	51.9	11.7
10	50	252.4	2.0	504.8	39.9	20.0
16	40	192.3	2.5	480.8	30.4	40.0
40	30	131.3	3.3	437.8	20.8	133.3
80	20	55.5	5.0	277.3	8.77	400
100	10	3.3	10.0	32.9	0.52	1,000
120	1	0.2	100.0	18.1	0.03	12,000

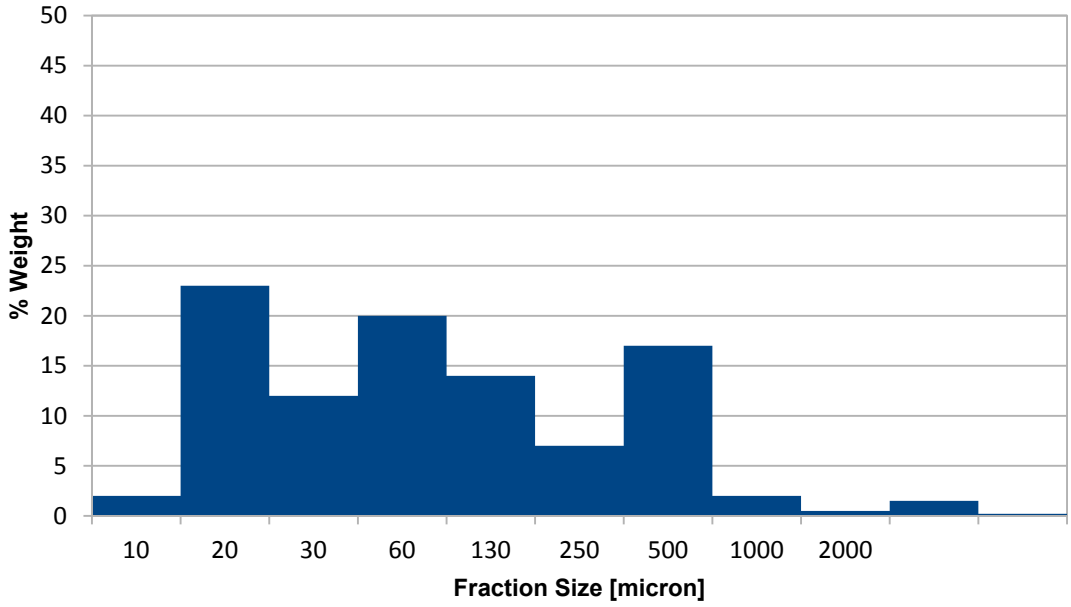
Table 11b: Sample SD28

Particle Faction [micron]	% in Fraction [weight]
2	2.0
4	23
8	12
16	20
31	14
62	7.0
125	17
250	2.0
500	0.5
1,000	1.5
2,000	0.2

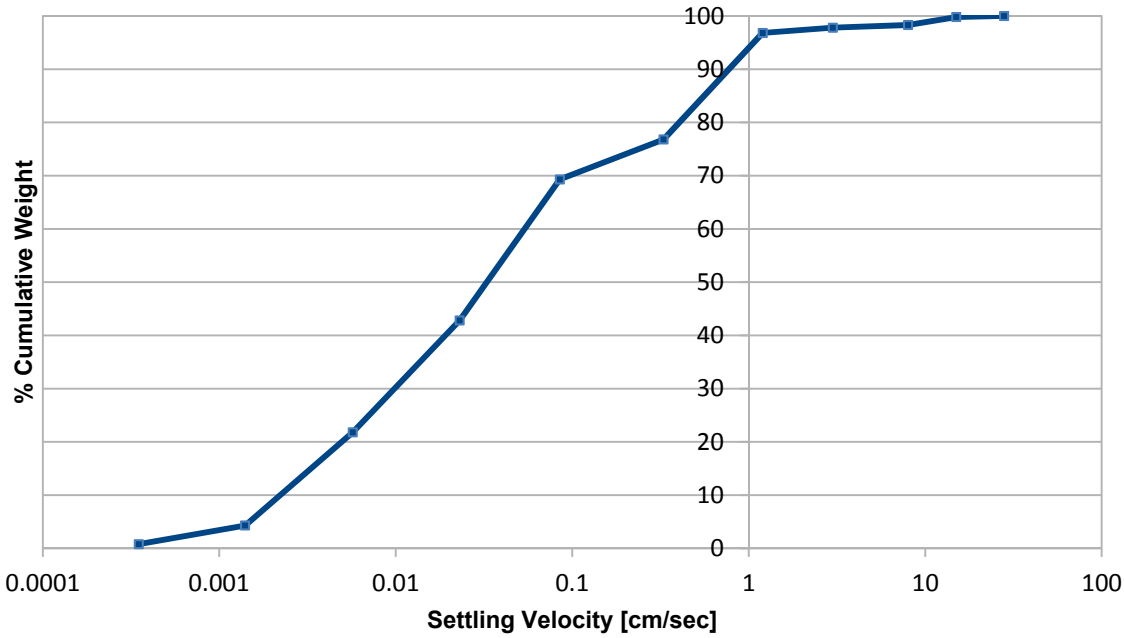
Table 11c: Sample SD28

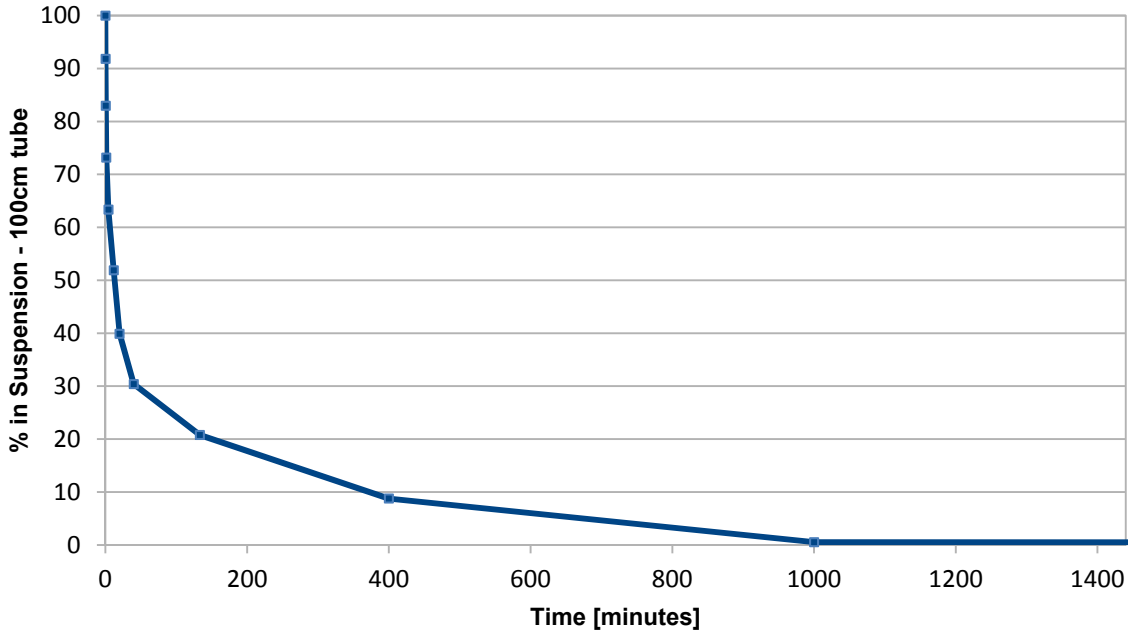
Settling Velocity [cm/sec]	% Cumulative Weight
0.00035	2.0
0.0014	25.0
0.0057	37.0
0.023	57.0
0.085	71.0
0.329	78.0
1.2	95.0
3	97.0
8	97.5
15	99.0
28	99.2

Plot 11a: Sample SD28: % Fraction Range

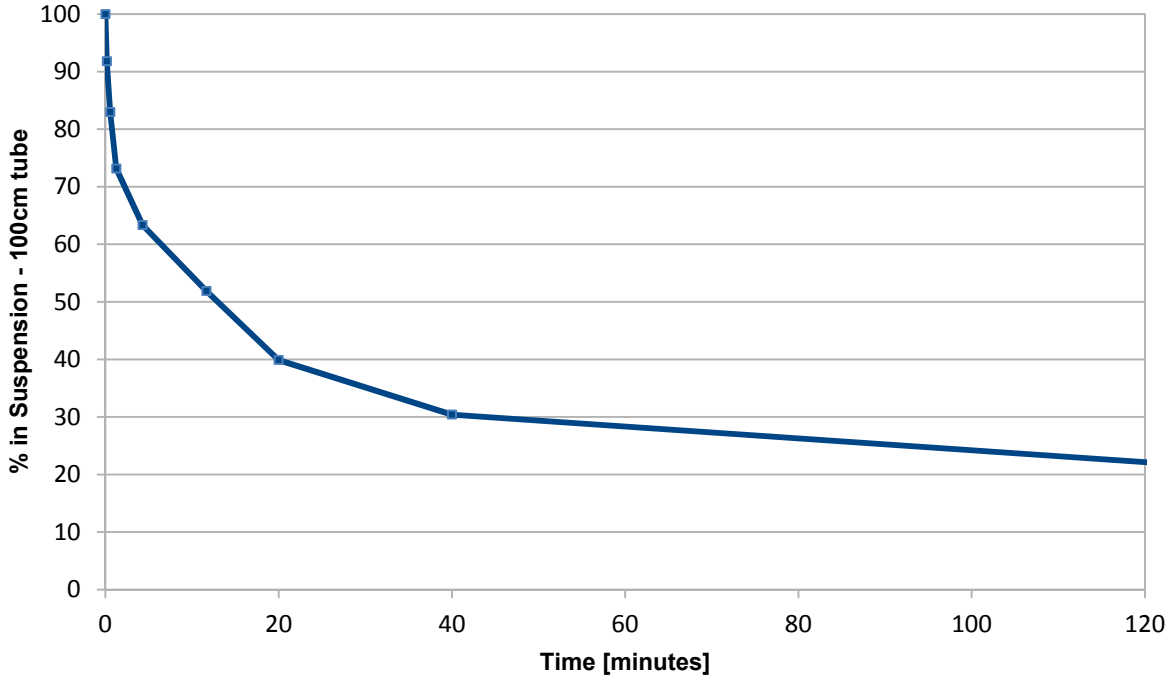


Plot 11b: Sample SD28: Settling Velocity

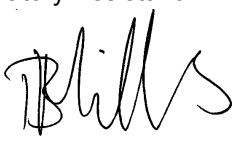




Plot 11d: Sample SD28: Oden Curve



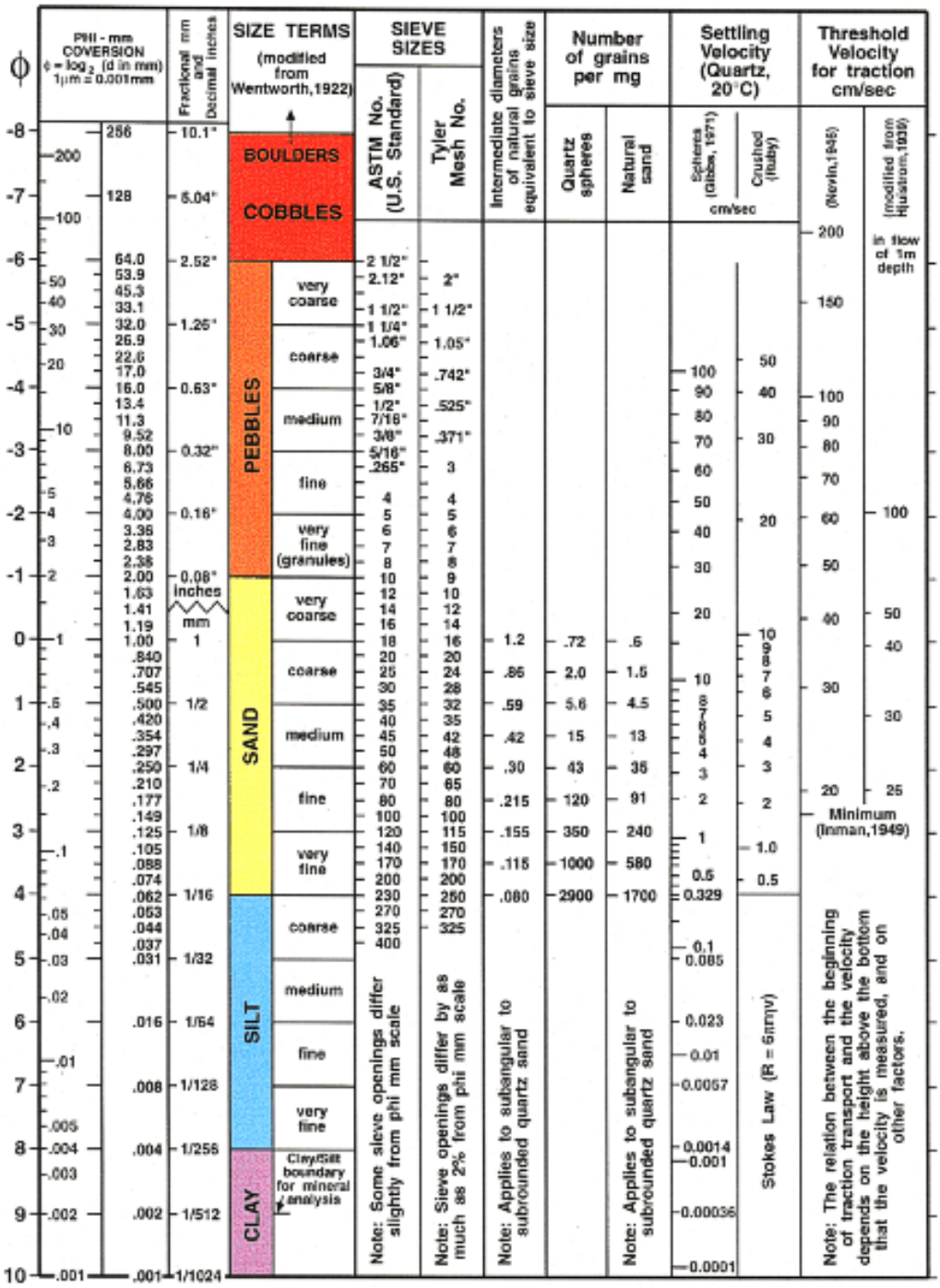
Yours sincerely,
David Steiner
Laboratory Assistant

P.P. 

on behalf of
Beca Ltd
Direct Dial: +64-9-308 4551
Email: david.steiner@beca.com

Copy:
Chris Pohlen, Port of Napier Ltd

Appendix A: Wentworth Scale, 1922



Appendix A: Values used from the Wentworth Scale

Fraction	Size Term	Size [mm] (upper boundary)	Size [micron] (upper boundary)	Settling Velocity [cm/sec]	Time to Fall 100cm [minutes]
Sand	Very Coarse	2	2000	28	0.06
	Coarse	1	1000	15	0.11
	Medium	0.5	500	8	0.21
	Fine	0.25	250	3	0.56
	Very Fine	0.125	125	1.2	1.39
Silt	Coarse	0.062	62	0.329	5.1
	Medium	0.031	31	0.085	19.6
	Fine	0.016	16	0.023	72
	Very Fine	0.008	8	0.0057	292
Clay	Clay	0.004	4	0.0014	1190
	Clay Mineral	0.002	2	0.00035	4762