Stornoway Deepwater Berth

GIR

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Executive Summary

Gavin & Doherty Geosolutions Limited (GDG) has been appointed by Wallace Stone (WS) to produce a Geotechnical Interpretive Report (GIR) to be considered in the design and site development of the proposed Phase 1 Deep-Water Port site in Stornoway.

This GIR includes a proposed ground model for design with associated engineering parameters to be taken forward the development of the proposed site and summarised in the table below.
This assessment is based on:
1. Ground investigation data,
2. Geotechnical laboratory data, and
3. Published and unpublished geological information.

Classification			Upper Granular Strata		Cohesive Strata		Lower Granular Strata	
Geological unit		**Soft Clay**	**Sandy Gravel-upper**	**Sand**	**Silty Sand**	**Clayey Silt**	**Sandy Gravel-lower**	**Bedrock**
Soil Classification	w_N (%)	-	13 to 38	22 to 36	14 to 79	6.1 to 160	6.8 to 14	-
	w_L (%)	-	28 to 68	32 to 44	27 to 81	20 to 130	21 to 37	-
	w_P (%)	-	16 to 31	17 to20	16 to 39	21 to 73	13	-
	Plasticity Index (%)	-	12 to 37	15 to 24	6 to 42	9 to 36	8 to 24	-
	Liquidity Index	-	-0.5 to 0.75	0.3 to 0.6	-0.2 to 2.9	0.07 to 3.6	-0.7 to 0.04	-
	γ (kN/m^3)	1.5	1.78	1.8	1.9	2	1.74	2.8
Consolidation	c_v (m^2/yr)	-	-	-	2 to 25 (range 0.2 to 60)		-	
	m_v (m^2/MN)				0.5 (range 0.2 to 2)			
Soil Strength	Effective Peak Friction Angle ϕ' (°)	<30	40	33	24	24	40	
	Effective Cohesion c' (kN/m^2)	11	10	7	7	7	10	
	Undrained Shear Strength c_u (kN/m^2)	6			30 to 70			
	SPT-N	7	13	18	9	16	30	
Rock Strength	Unconfined compressive strength (MPa)							15 to72

1 Introduction

Gavin and Doherty Geosolutions Ltd. (GDG) was appointed by Wallace Stone (WS) to develop a Ground Investigation Report (GIR) for the Phase-1 development of Stornoway Deep-Water Port.

This GIR and related drawings provide an interpretation and summary of all the ground investigation data, relevant desk study information, in-situ and laboratory soil and rock testing, as well as other published data for the site and presents summary design parameters for use in the development of the short-term and permanent design. This assessment is based on:

1. Ground investigation data, and
2. The completion of a laboratory test programme.

1.1 Description of the Project

Wallace Stone (WS) has been engaged by Stornoway Port Authority (SPA) for the Deep-Water Port Development project as part of the Stornoway Port Masterplan (Figure 1-1) [which may not be fully up to date]. We understand that the Deep-Water Port Phase 1 development works envisaged the following: -

- A new deep-water berth for cruise ships and cargo vessels up to 330m in length
- Potentially 800m of quay (over 400m at 10m below CD)
- Dredging up to -10m CD to provide quay access and alongside berthing in all tides
- Berthing and unloading facilities for renewable energy components.
- Land development for a range of uses, including industrial, storage and decommissioning activities
- A new link road along the foreshore to Arnish fabrication yard

GDG was engaged by Wallace Stone to procure and oversee the geotechnical and environmental ground investigation works and to provide design information for proposed phase-1 development of the deep-water quay construction. The works will compromise of dredging and land reclamation (cut/fill), platform development, access road development to connect the deep-water Port with the existing Arnish Road and other facilities such as storage.

A geotechnical engineer from GDG was present during the recent marine ground investigations which were carried out by Causeway Geotech (CG).

1.2 Geotechnical category

The scheme is considered to be in Geotechnical Category *3* according to EC7 in that it is comprises structures involving abnormal risks, difficulty in ground or loading conditions.

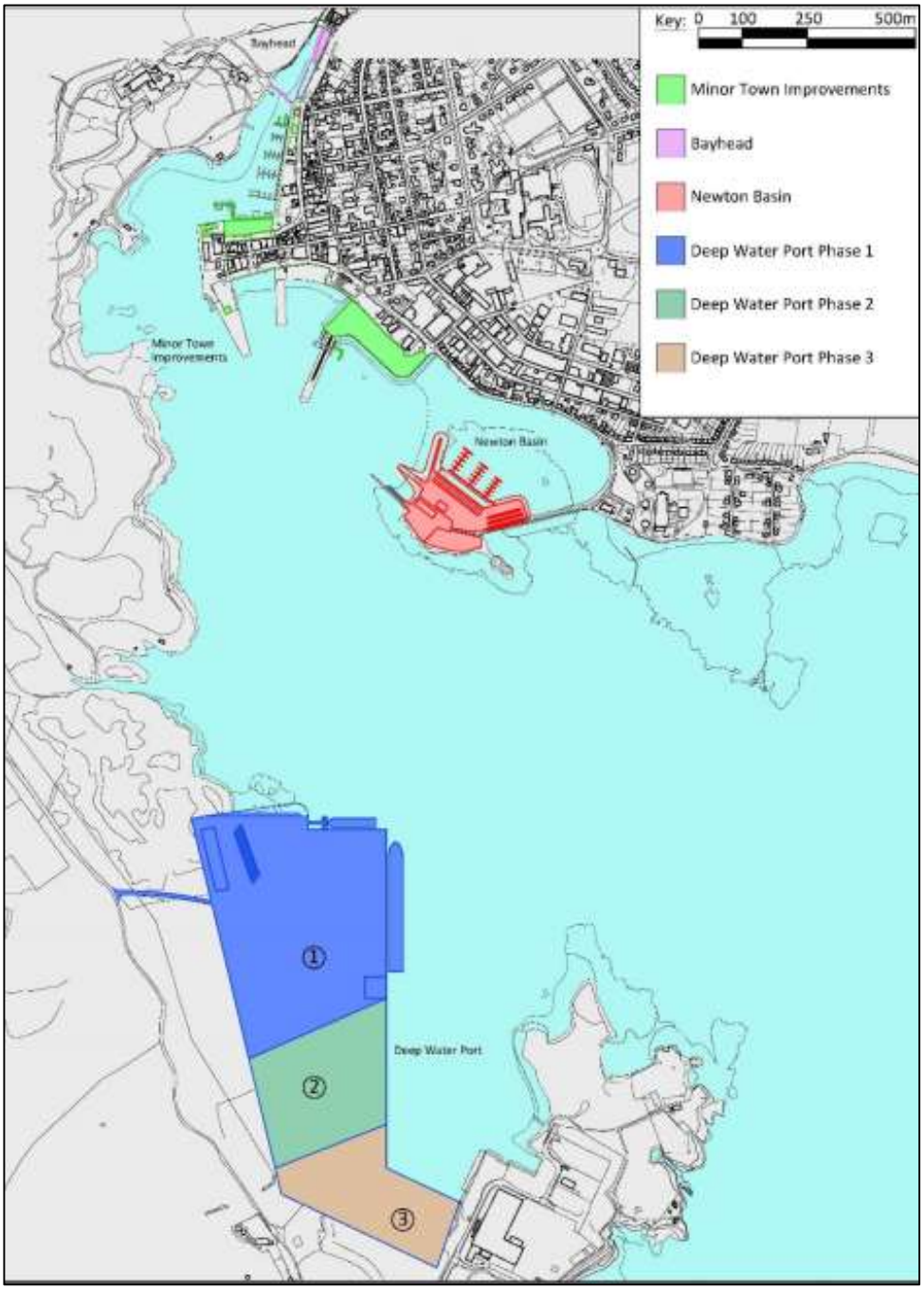


Figure 1-1 The potential locations of the key elements of the future development of Stornoway Harbour (quay walls and reclamation)

1.3 Scope of report

The scope of this GIR includes:

- Review all general and background geological information related to the proposed scheme.
- Summarise details of the ground investigations undertaken and all available geotechnical information.
- Present the interpreted ground conditions and material properties for the main geological units encountered across the scheme.
- Highlight and assess the geotechnical risks associated with the scheme to enable them to be managed through design, construction and operation.

The results were interpreted by following EC7-2, 6.3.

2 Stornoway Deep-Water Berth Site

2.1 Site location

The proposed deep-water port phase 1 site covers approximately 8 hectares and is located at Glumaig Bay approximately 1.2km south of Stornoway, Isle of Lewis. The planned construction site for the deep-water quay is situated across the harbour and to the west of Arnish Point. The site location is illustrated in Figure 2-1.

Stornoway Harbour is one of the primary ports in Scotland. It facilitates activities from aquaculture, construction, ferry services, marine leisure and also houses the Arnish engineering and fabrication yard.

The British national grid coordinate for the approximate centre of the site is 58°12'N 6°23'W.

Vehicle access to the site is via the A858 road followed by restricted usage roads.

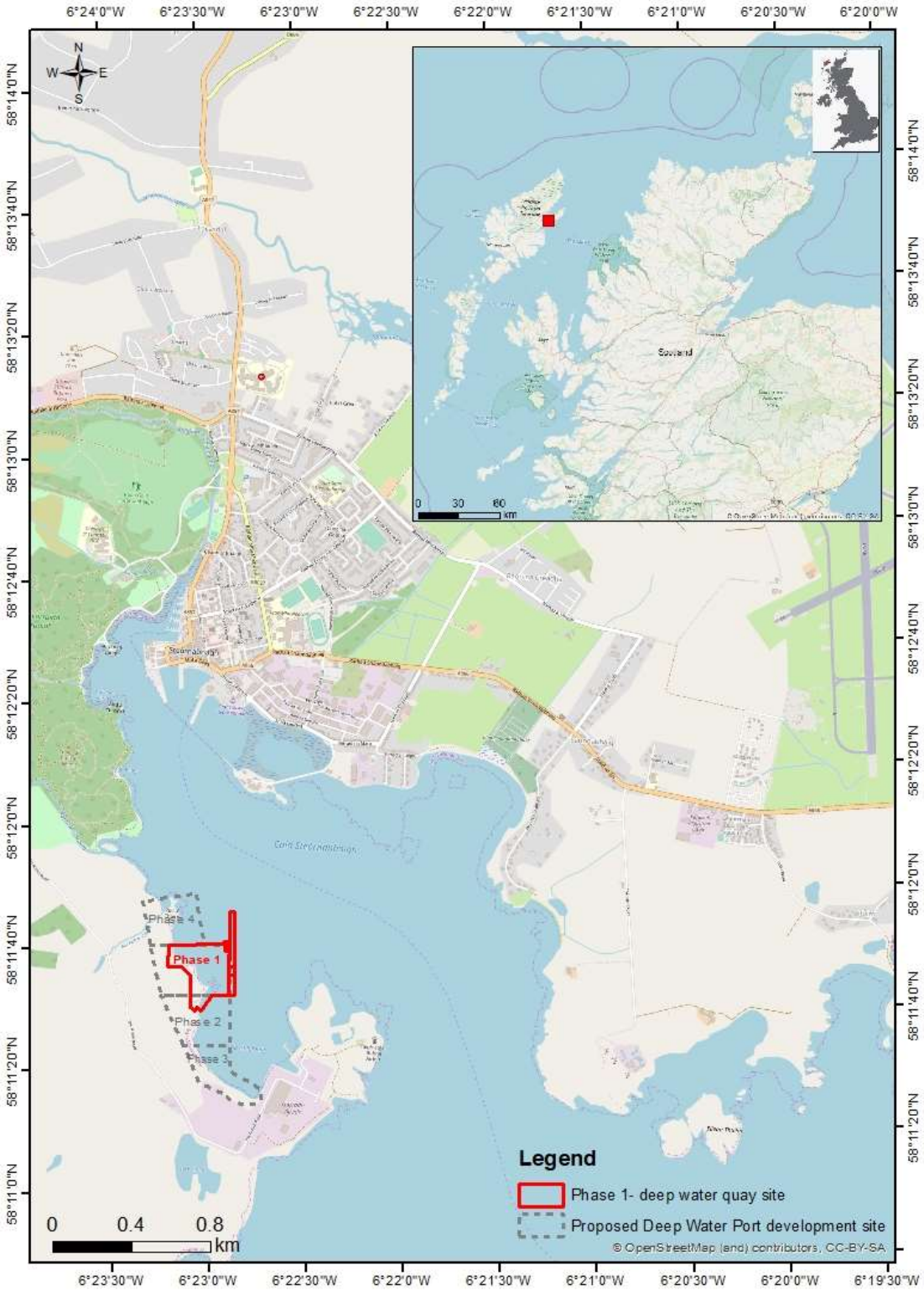


Figure 2-1 Location Map (ArcGIS, 2019)

2.2 Current land use and Surrounding land use

Glumaig Bay is a sheltered inlet, bound by land to the west, south and east, and with aspects towards Stornoway Harbour and the town to the north. The site is comprised of coastal waters and an undeveloped landward portion. Rocky outcrops and undulating moorland slopes characterise the landward portion, western part of the site. The eastern portion of the site is part of the Glumaig bay.

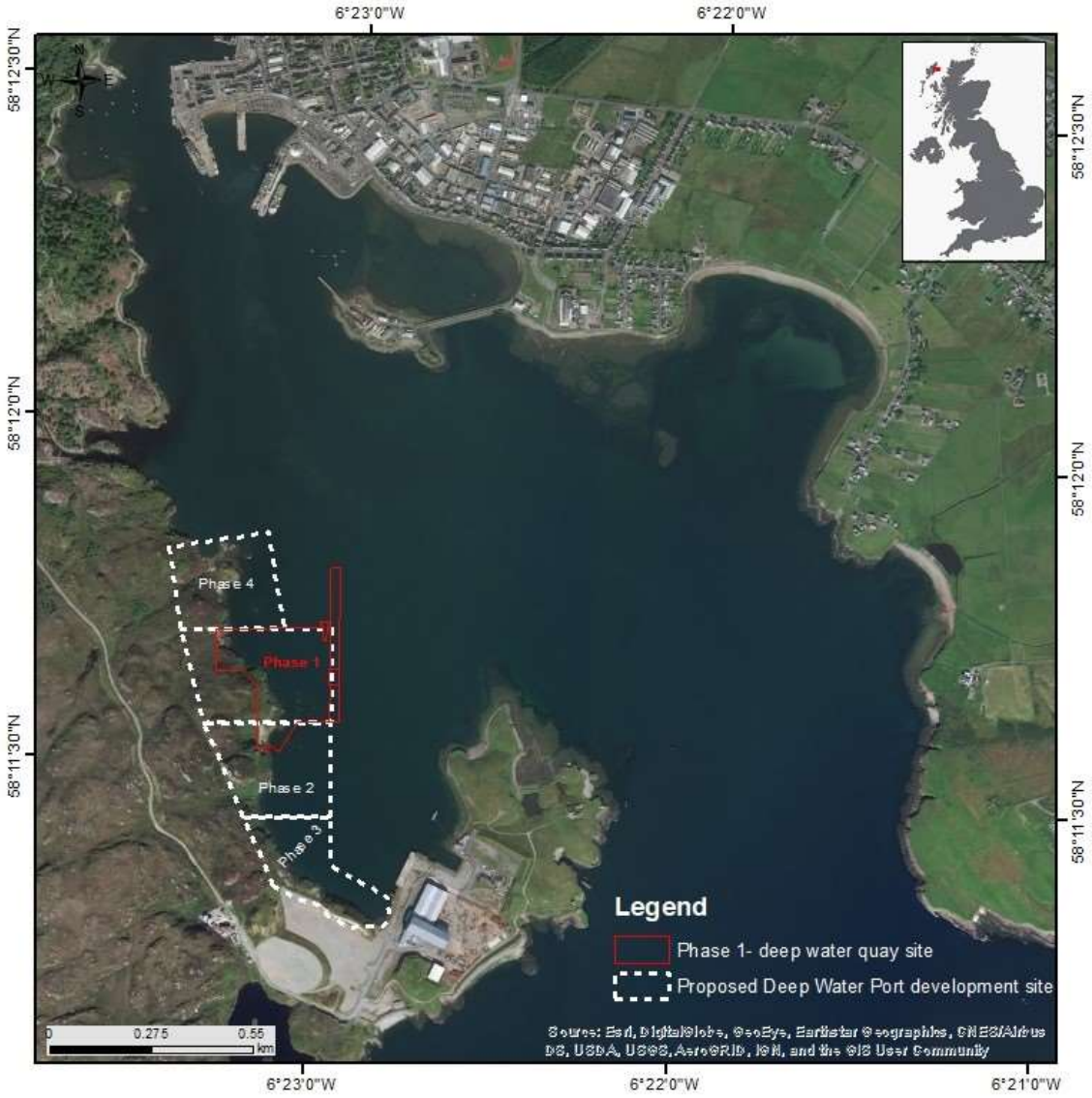


Figure 2-2 Aerial image of the site (ArcGIS, 2019)

An aerial image of the site is shown in Figure 2-2.

Near the project area, there are several existing structures. The most notable of these are as follows:

- The existing asphalt road that leads to the enterprise based at the end of the peninsula,
- The Hebridean Seaweed Company buildings including sheds and depots,
- The Arnish Lighthouse located at Arnish point, and
- Stornoway Harbour across the bay to the east.

2.3 Topography and Land features

The site generally slopes towards seaward. The western part of the site is predominantly coastal edges with rocky outcrops. The eastern part of the site where the quay is planned to be constructed water depth ranges of between -7m to -15m Chart Datum (CD) based on the hydrographic survey data. The hydrographic survey data is presented in Figure 2-3 which was provided by WS.

Chart Datum is 2.71m below Ordnance Datum. Tidal levels for the site are summarised in Table 2-1 which is taken from the UK Hydrographic Office Tide Tables 2019.

Table 2-1 Site Tidal Levels

Tidal Condition	Abbreviation	Chart Datum (m CD)	Local Datum (m LD)
Highest Astronomical Tide	HAT	+5.5	+2.79
Mean High Water Springs	MHWS	+4.8	+2.09
Mean High Water Neaps	MHWN	+3.7	+0.99
Mean Low Water Neaps	MLWN	+2.0	-0.71
Mean Low Water Springs	MLWS	+0.7	-2.01
Lowest Astronomical Tide	LAT	0.0	-2.71

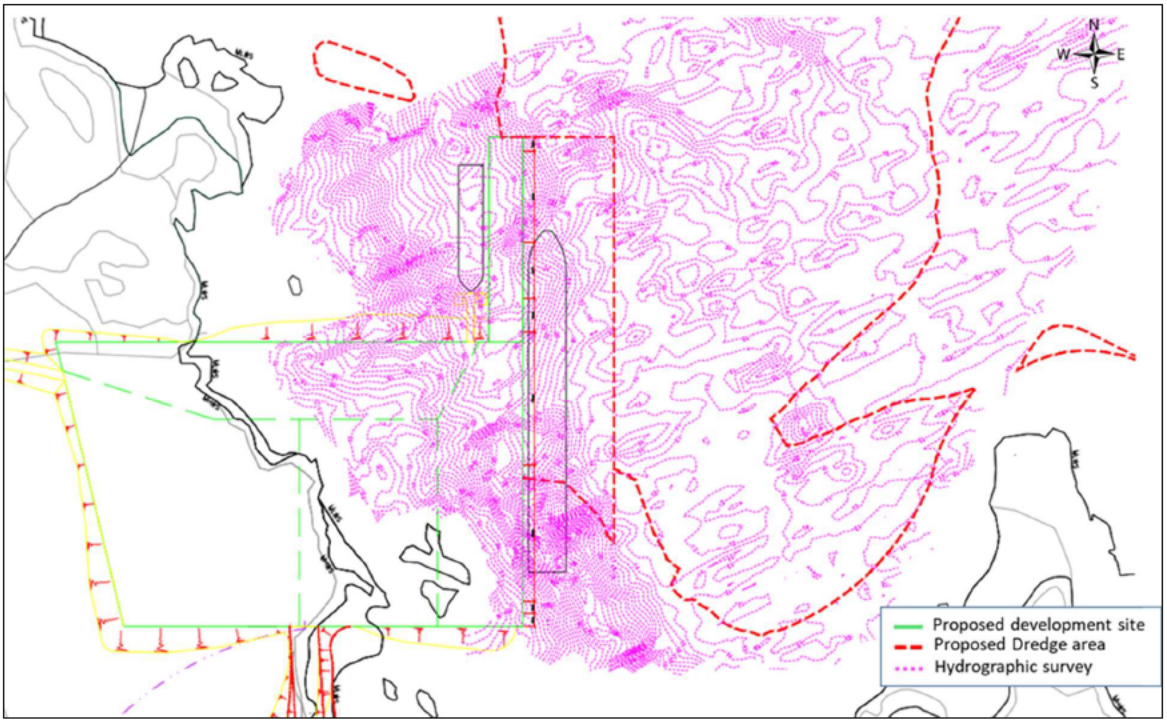


Figure 2-3 Bathymetric survey Map for the Deep water port phase 1 site

2.4 Geology

The bedrock and the superficial geology for the site are described below. The data was made available through the British Geological Survey (BGS) website.

The offshore superficial geology data from the BGS is presented at a 1:625,000 scale and is shown in Figure 2-4. The map shows superficial deposits underlying the site comprising of Quaternary soft mud with thicknesses varying from 5 to 20m across the site.

There were also recordings of the hard substrate underlying the site. The BGS defines hard substrate as cobbles, boulders or bedrock recorded at, or within 0.5 m of the sea-bed. These textural classes are defined in accordance with the Wentworth scale, where particles with a diameter > 64mm (cobble) are considered in the interpretation. The definition includes sediment veneer overlying hard substrate in some areas. This dataset is produced at a 1:250,000 scale.

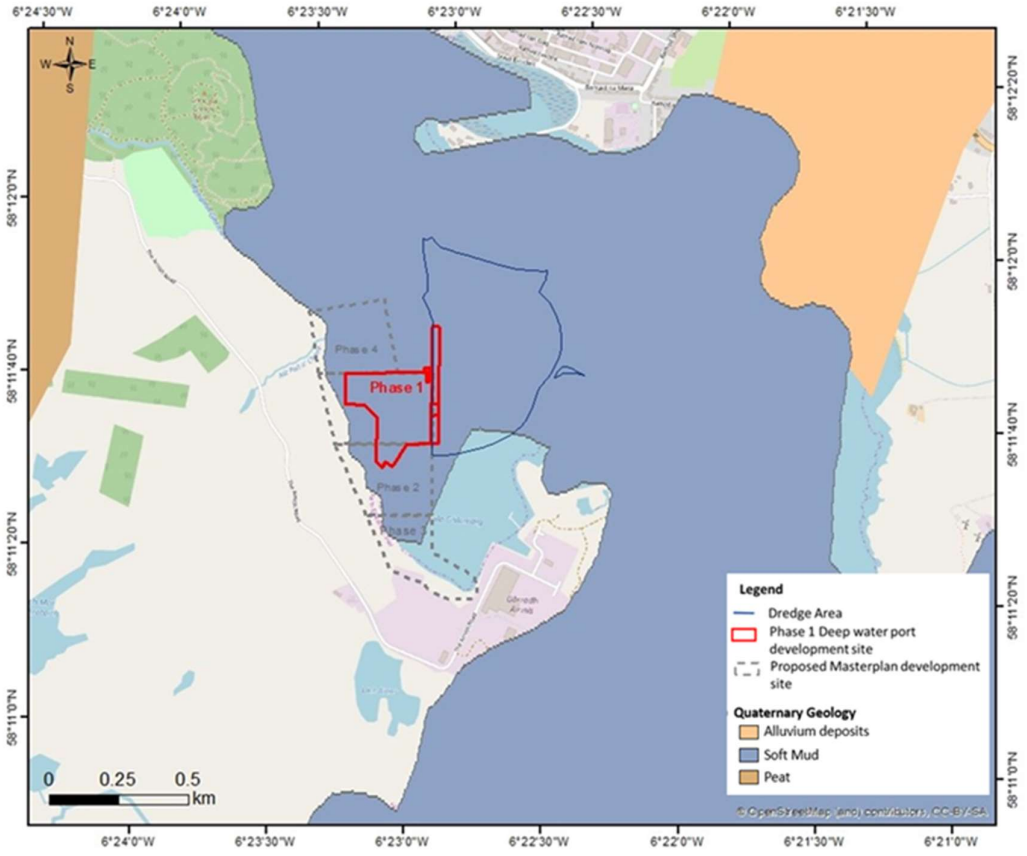


Figure 2-4 BGS superficial deposits 1:625,000 scale geological map (BGS, 2019)

The bedrock geology from both the offshore and onshore portions of the site are presented at a 1:625,000 scale and are seen in Figure 2-5. The site is predominantly underlined by Gneiss, which is part of the Lewisian Complex. Along the coastline to the south and north of the proposed site lies a

thrust zone consisting of the Mylonites Complex. To the east of the site, the bedrock is mainly comprised of the Stornoway Formation.

- Lewisian Complex - Metamorphic bedrock formed approximately 541 to 4000 million years ago. Where this complex is seen offshore and along the coastline it is made up of Gneiss, further northwest it is made up of Amphibolite.
- Outer Hebrides Thrust Zone Mylonites Complex – Metamorphic Bedrock formed approximately 541 to 4000 million years ago. This bedrock is made up of protocataclasite. A cataclastic rock is a type of metamorphic rock that has been formed by the progressive fracturing and comminution of existing rock. A protocataclasite is a type of cataclasite in which the matrix takes up less than 50% of the total volume.
- Stornoway Formation - Sedimentary Bedrock formed approximately 247 to 272 million years ago. This detrital, fine to coarse-grained conglomerate, has a fluvial origin. The beds and lenses of deposits present reflect the channels, floodplains or the levees of a river or estuary of the depositional environment.

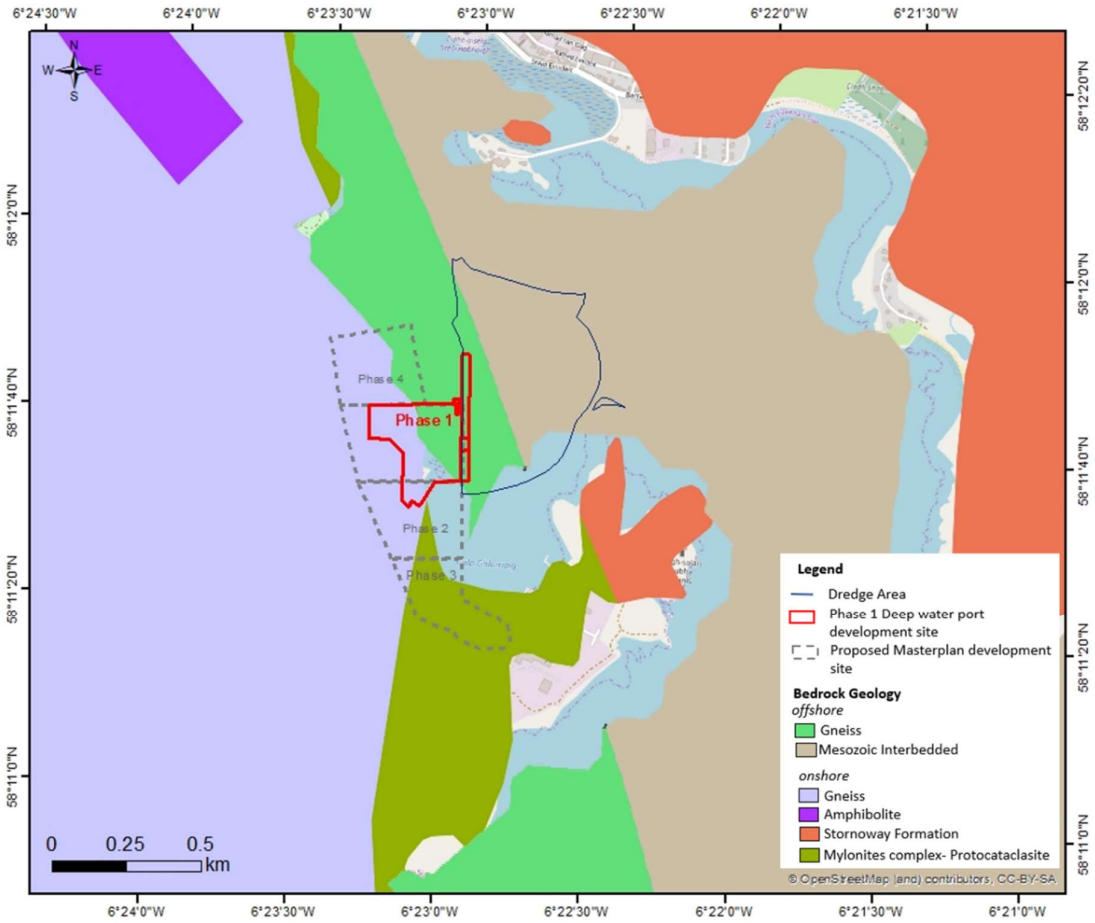


Figure 2-5 BGS Bedrock geology 1:625,000 scale geological map (BGS, 2019)

2.5 Geoheritage

Historic Environment Scotland considers the archaeological potential of the area to be negligible, according to hydrographic (bathymetric) surveys. HES confirmed that there are no other heritage assets there.

The nearby the Sites of Special Scientific Interest (SSSI) and designated natural conservations areas (Special Protection Areas or Special Areas of Conservation) to the site are presented in Figure 2-6. These are controlled by Scottish Natural Heritage (SNH).

- Lewis Peatlands Special Protection Area (SPA), Lewis Peatlands Special Area of Conservation (SAC), and Lewis Peatlands RAMSAR Site are located approximately 6km from the site: no pathways for potential significant effects are expected.
- The nearest Site of Special Scientific Interest (SSSI) protected area is at approximately 2km distance, is the Tong Saltings: no pathways for potential significant effects are expected.

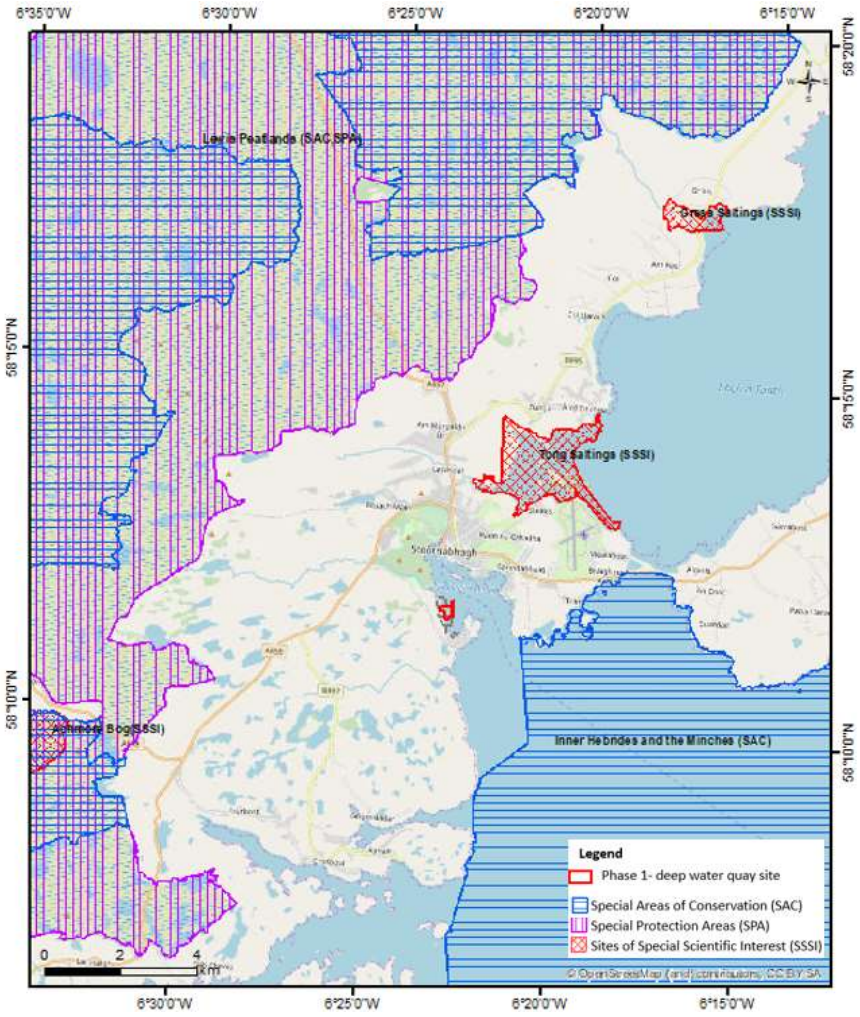


Figure 2-6 Designated Areas near to the site (SNH- ScotGov GIS DATA,2019)

The other notable conservation areas that are close to the development site are: -

- The Shiant Isles SPA is c. 35km from the Harbour: *no pathways for potential significant effects are expected.*
- The Harbour is within proximity to the North-east Lewis proposed Marine Protected Area (pMPA) which is located at Arnish (c. 1.6km at its closest point to the Harbour): *potential interaction with Risso's dolphin.*
- Shiant East Bank pMPA is located c. 20 km from Stornoway Harbour: *no pathways for potential significant effects are expected.*
- Wester Ross Marine Protected Area comprises a diverse range of seabed habitats c. 45km from Stornoway Harbour: *no pathways for potential significant effects are expected.*
- The Harbour is not designated for its landscape character or visual appeal. The closest National Scenic Area (NSA) is the South Lewis, Harris and North Uist NSA, which is approximately 26km south-west of Stornoway: *not likely to impact the NSA.*
- Lews Castle and Lady Lever Park, a prime example of mid-late 19th century ornamental and estate landscape, with distinctive coastal and riverside drives and woodlands. Furthermore, Lady Lever Park is identified as a Historic Garden and Designed Landscape: *potential interaction.*

2.6 Site History and Previous Land Use

Since the 19th century, Stornoway harbour has been developing as a herring port. Currently, the harbour is a place where cargo fleet and fishing fleet are hosted. The area of the Stornoway Deepwater Berth project is undeveloped.

2.7 Underground Features

No utilities service maps or drawings have been made available to GDG.

3 Proposed Development

Together, Fisher Associates, Wallace Stone and EnviroCentre prepared a masterplan which sets out the framework for the physical development of Stornoway Port for the next 20 years. It was envisaged that the Masterplan would be developed in phases (Figure 3-1), with the decision to proceed with the next phase dependent on the success of the previous phase.

The first phase of the masterplan was expected to include:

- 800 metres of quay (over 400 metres at 10m below CD),
- 15 or 29 hectares of laydown area for onshore wind, offshore energy sector and bulk cargo,
- RoRo terminal with space for warehousing,
- Cruise berth for vessels up to 330 metres in length,
- Bus marshalling area for cruise passengers and access into the Castle grounds (via new footbridge),

- Twin track road (straightened) to the main road (A859) and direct road access to existing Arnish development. This would also provide a strong link between the Deep-Water Port and the Creed Enterprise Park,
- Shore-to-ship power connections will be provided along the quay to make use of local renewable energy supplies and
- Space will be planned for LNG storage for supplying vessels, as well as other fuel storage facilities able to make use of renewable energy supplies in and around the Outer Hebrides.

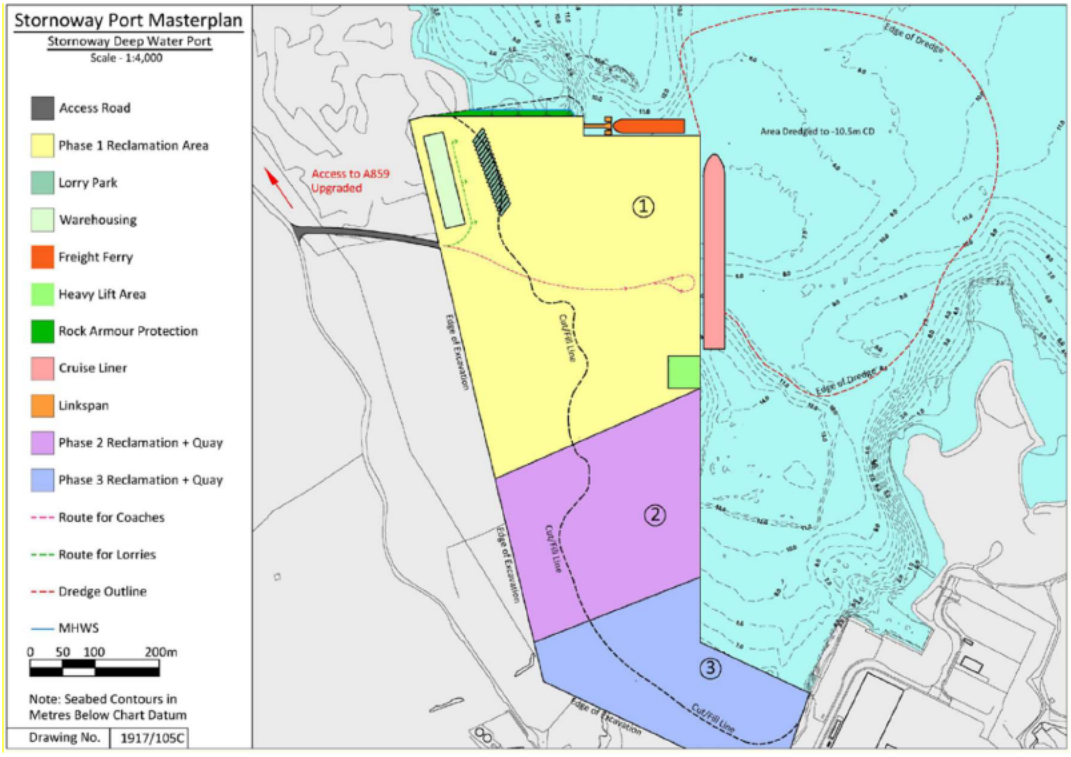


Figure 3-1 Stornoway Masterplan

4 Previous Ground Investigations

A first ground investigation was previously carried out at this site between 28th November 2017 and 12th February 2018. The ground investigation was carried out by Causeway Geotech on behalf of Wallace Stone.

The ground investigation consisted of:

- 33 marine light cable percussion boreholes
  - 16nr light cable percussion boreholes (without follow-on rotary drilling)
  - 17nr combined percussion boring and rotary follow-on drilling
- Geotechnical Laboratory Testing on rock and overburden samples

  a) Soil Testing
  - Soil Classification Tests - moisture content measurements, Atterberg Limit tests and particle size distribution analysis,
  - Shear Strength Tests (total stress) - unconsolidated undrained triaxial tests,
  - Direct Shear Tests - shear box tests,
  - Soil Chemistry Tests - pH, water-soluble sulphate, and organic matter content.

  b) Rock Testing
  - Point load index,
  - Unconfined compressive strength (UCS) tests.

- Pre-Disposal dredge sampling for Marine Scotland Dredge Analysis: following chemical tests carried out on 2 samples taken from 15 locations
  - Metal Content and Particle Size Distribution, and
  - Organic Carbon Content and Organic Chemicals Content.

- Environmental laboratory testing of soils for a range of determinants, including:
  - Metals
  - Tributyl Tin (TBT)
  - Total Petroleum Hydrocarbons (TPH)
  - Speciated Polycyclic Aromatic Hydrocarbons (PAH)
  - Polychlorinated Biphenyls (PCBs)

Boreholes 34 to 40 are not considered for this study as these boreholes are located within the current harbour site, which is outside the proposed GIR development site.

5 Recent Ground investigations

An additional ground investigation was carried out by Causeway Geotech from 6th June to 6th July 2019 as recommended by WS (with commentary from GDG) to supplement the existing ground investigation information for the following reasons:

- Additional boreholes advised on the locations with limited/no information from previous GI,
- Further geotechnical laboratory testing of specific material
- Addition of cone penetration testing in-situ on soft strata encountered in previous GI

The borehole locations of the two site investigation campaigns are presented in Figure 5-1.

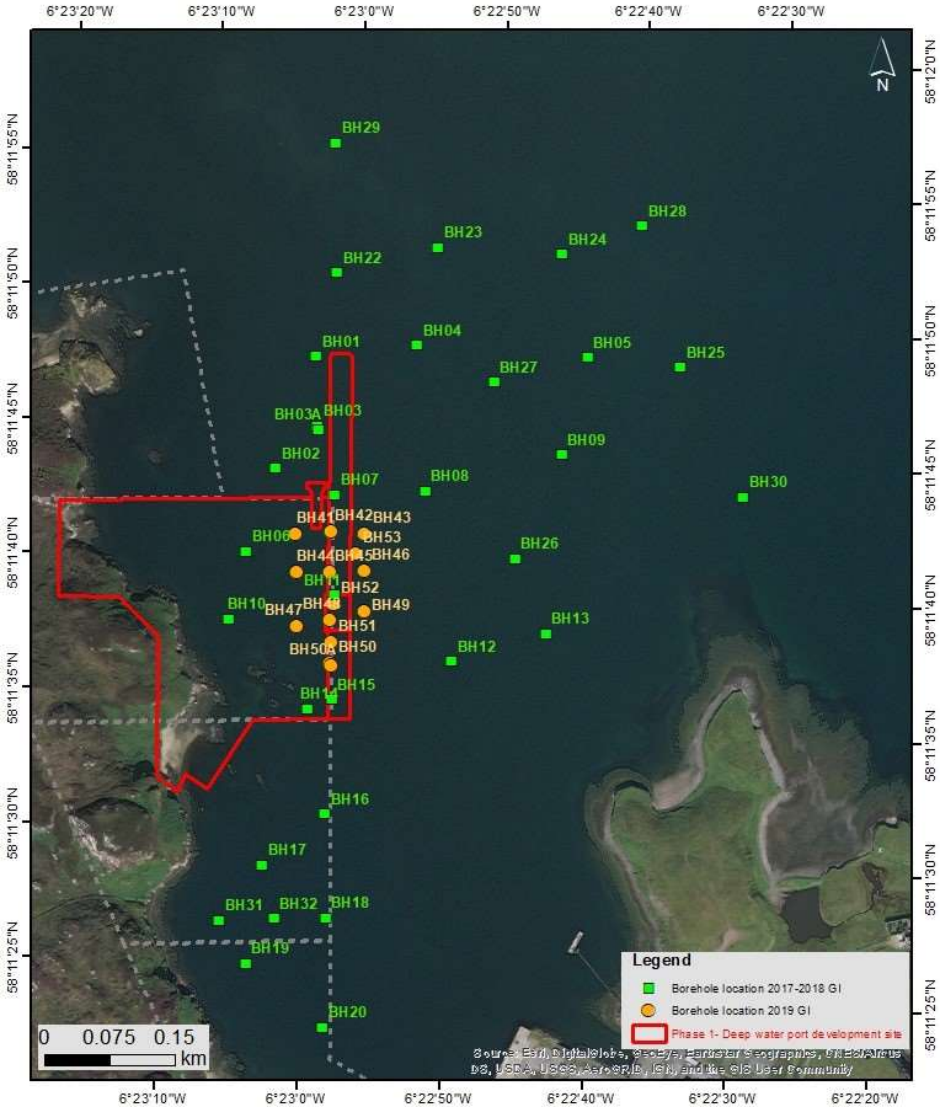


Figure 5-1 Borehole location Map

Table 5-1 Summary of the borehole locations and depth carried out by CG Site investigation

Borehole ID	Drilling Method	Easting	Northing	Ground Level (m CD)	BH Depth (m bgl)
BH01	CP+RC	142499.1	931476.4	-7.17	53.8
BH02	CP+RC	142453.1	931347	-7.05	37.9
BH03	CP	142500.6	931396.7	-6.99	10
BH03A	CP+RC	142501.9	931392.4	-6.99	53
BH04	CP	142615	931489.1	-7.41	4
BH05	CP	142811.4	931474.7	-8.82	2.5
BH06	CP+RC	142418.4	931252	-7.61	12.4
BH07	CP+RC	142520	931317	-7.02	38.3
BH08	CP	142624.2	931321.3	-6.18	5
BH09	CP	142781.6	931363.6	-8.05	3
BH10	CP+RC	142399.4	931174.1	-6.12	9
BH11	CP+RC	142520.3	931201.2	-10.23	25.3
BH12	CP	142655.3	931125.2	-9.14	2
BH13	CP	142762.9	931156.9	-7.49	3.5
BH14	CP+RC	142489.8	931070.3	-5.44	6.3
BH15	CP+RC	142516.5	931080.8	-9.83	6.8
BH16	CP+RC	142509	930949.7	-10.72	8.5
BH17	CP+RC	142437.3	930891.3	-8.07	5.8
BH18	CP+RC	142509.8	930830.4	-9.47	25
BH19	CP+RC	142417.6	930777.6	-6.19	9.5
BH20	CP+RC	142506.4	930703.8	-6.46	10.1
BH21	CP+RC	142620.2	930629.4	-6.76	24.6
BH22	CP	142523.2	931571.8	-8.32	3
BH23	CP	142639.9	931601.2	-8.03	3
BH24	CP	142783	931593.7	-8.9	2
BH25	CP	142917.7	931463.8	-9.81	1.5
BH26	CP	142727.8	931242.6	-9.87	1.5
BH27	CP	142704.4	931446.7	-8.07	3
BH28	CP	142874.2	931626.5	-9.25	2
BH29	CP	142522.9	931722.5	-8.65	2.5
BH30	CP	142991	931314.4	-9.1	2.7
BH31	CP+RC	142386.5	930826.6	-5.5	9.6
BH32	CP+RC	142450.2	930829.2	-7.8	12.5
BH41	CP	142475.3	931271.6	-7.84	30.1
BH42	CP	142516.3	931274.1	-7.69	31.5
BH43	CP	142554.6	931271.7	-6.75	30
BH44	CP	142475.8	931226.9	-8.92	24.2
BH45	CP	142515.4	931227.1	-8.91	24.1
BH46	CP	142554.9	931228.8	-9.13	19.5
BH47	CP	142476.3	931164.8	-11.44	14.1

BH48	CP	142514.9	931171.4	-11.92	22.4
BH49	CP	142554.8	931181.9	-9.9	23.5
BH50	CP	142515.7	931122.3	-13.58	14.2
BH50A	CP	142516	931119.3	-13.22	12.6
BH51	CP	142515.4	931147	-13.63	19.4
BH52	CP	142518	931190.6	-10.95	17.57
BH53	CP	142545	931249.5	-8.59	4.5

5.1 Overview of the fieldwork

CG undertook the second ground investigation, which was conducted between the 6th of June and the 6th of July 2019, under the supervision of GDG Engineer. The site operations undertaken comprised;

- 14 marine light cable percussion boreholes
- In-situ sampling and testing of soil
- Sediment sampling for Marine Scotland Dredge Analysis

In Situ, Investigation Ltd worked with CG during the supplementary ground investigation to carry out the Static Piezocone Penetration Tests (CPTU) test between 20th June to 5th July in 2019, comprising:

- 8 CPTU tests

The procedures used in the site investigations were done in accordance with Eurocode 7 Part 2: Ground
Investigation and Testing BS EN1997 - 2:2007 and BS 5930:2015.

The GI did not encounter any notable difficulties or obstructions that limited the objective of the drilling and sampling campaign.

Site Operations	Previous Ground Investigation	Supplementary Ground Investigations	
	Causeway Geotech 2018	Causeway Geotech 2019	In Situ Site Investigation 2019
Borehole Drilling			
Light Cable Percussion Boreholes	16	14	-
Combined Percussion Boring and Rotary Follow-on Drilling	17	-	-
Total	33	14	-
In-Situ Testing			
Shear Vane Tests	-	2	-
Standard Penetrations Tests	200	114	-
Cone Penetration Tests	-	-	8

5.2 Drilling and Sampling

Fourteen boreholes (BH41-BH50, BH50A, and BH51-BH53) were put down to completion in minimum 200mm diameter using a Dando 3000 light cable percussion boring rig. All boreholes were terminated at their scheduled completion depths, on the instruction of the Engineer, or else on encountering virtual refusal on obstructions, including large boulders and weathered bedrock above scheduled depths.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Undisturbed (UT100 and U100) and piston samples were taken where appropriate and as directed within fine soils. Environmental samples were taken at standard intervals, as directed by the Client's Representative. The CG core samples extracted were up to 1.5m length and 103mm diameter. Core samples were extracted using the SK6L GeoborS core barrel equipment. Where water was added to assist with boring, a note has been added to the log to account for same. Borehole logs are presented in the factual reports provided by CG that is attached in Appendix D.

In-situ Site Investigations conducted 8 CPTU tests in boreholes drilled by CG to a maximum depth of 26.28m. Each test measured Cone Resistance, qc; Sleeve Friction, fs; Porewater Pressure in the shoulder position, u2; and inclination in X and Y axes. CPTU data was obtained using a CPT003 track mounted CPT rig.

5.3 Ground Investigation Reports

The current data used for this GIR came from following factual reports and copies are presented in Appendix D of this report;

- Causeway Geotech ground investigation interpretive report issued on 27th April 2018,
- In-Situ Investigation Ltd CPTU site investigation factual report issued on 29th July 2019, and
- Causeway Geotech factual report - draft issued on 30th September 2019.

AGS data is available for the CG (2018 and 2019) and In-Situ Investigation Ltd GI (2019).

5.4 In situ testing

5.4.1 Shear Vane Tests

Two in-situ shear vane tests were carried out in boreholes BH41 and BH42 at depths of 23.7m bgl and 19.5m bgl respectively. Both tests were carried out in clay units and discussed further in section 7.5. The results are presented in Figure 5-2.

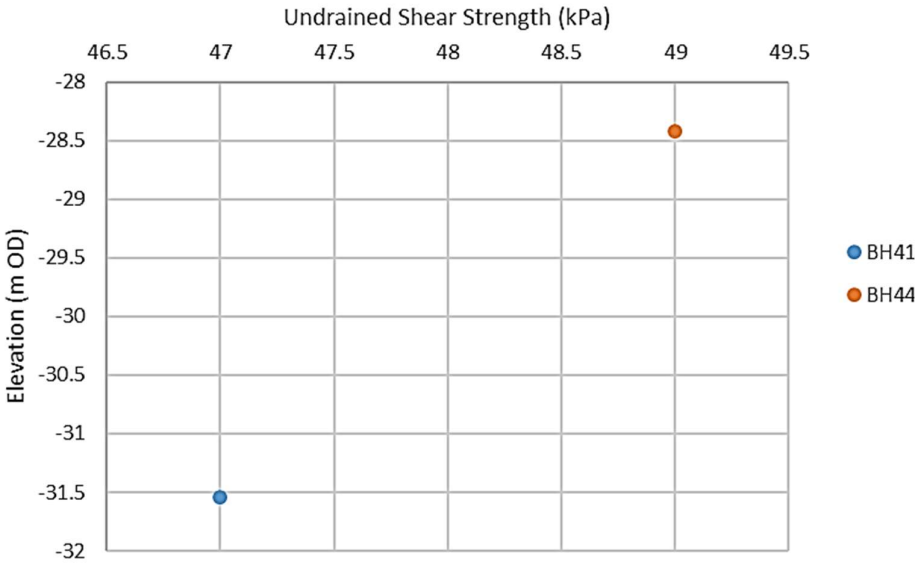


Figure 5-2 Shear vane test summary carried out on site

5.4.2 Standard Penetration Test (SPT)

SPT tests were carried out in accordance with BS EN 22476-3: 2005 at standard depth intervals throughout the overburden using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The test results are deduced through the number of blows needed to drive the cone each 75mm into the ground, to a maximum depth of 450mm. The "standard penetration resistance" or "SPT N value" is calculated by the sum of the number of blows required for the last four 75 mm increments of penetration, to a maximum of 50 blows. The measured number of blows, (SPT N), presented in this report are uncorrected, and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix E in the factual report by CG. A plot of SPT against elevation across the site is shown in Figure 5-3.

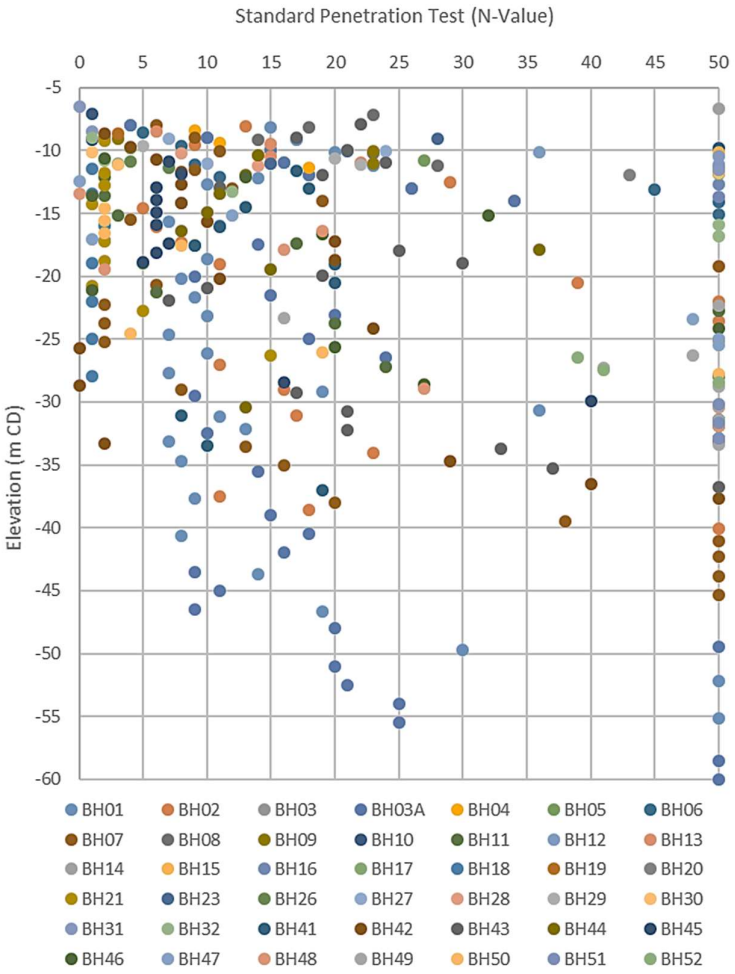


Figure 5-3 SPT -N values vs Elevation

5.4.3 Rock Core

Rock core analysis was carried out on 15 boreholes. The plots presented in Figure 5-4 summarise the main features of the Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) of the rock cores obtained from the site investigation at the proposed key areas.

Total Core Recovery at the site was generally very high for the rock encountered. Figure 5-4(a) presents the TCR results showing TCR is generally greater than 80% for most of the cores. BH14, BH02 and BH20 have the lowest TCR values that range from 48% to 55%.

Solid Core Recovery (SCR) results presented in Figure 5-4(b) shows much wider variability, but show a slight increase in SCR with depth. SCR values vary between 0% and 60% above -20m CD and 0% to 100% SCR values between -20m CD and -60m CD.

Rock Quality Designation (RQD) values generally increase slightly with depth. The results show RQD is generally between 0% to 40% above -20m CD and tending to increase to 0% to 60% extending down to -45m CD. The RQD results are presented in Figure 5-4(c).

Laboratory rock strength tests including UCS (Uniaxial Compressive strength) and Point load index tests (PLT) were carried out on rock cores recovered using the rotary drilling rig. The results are discussed in section 7.10. Detailed summary table provided in Appendix A.

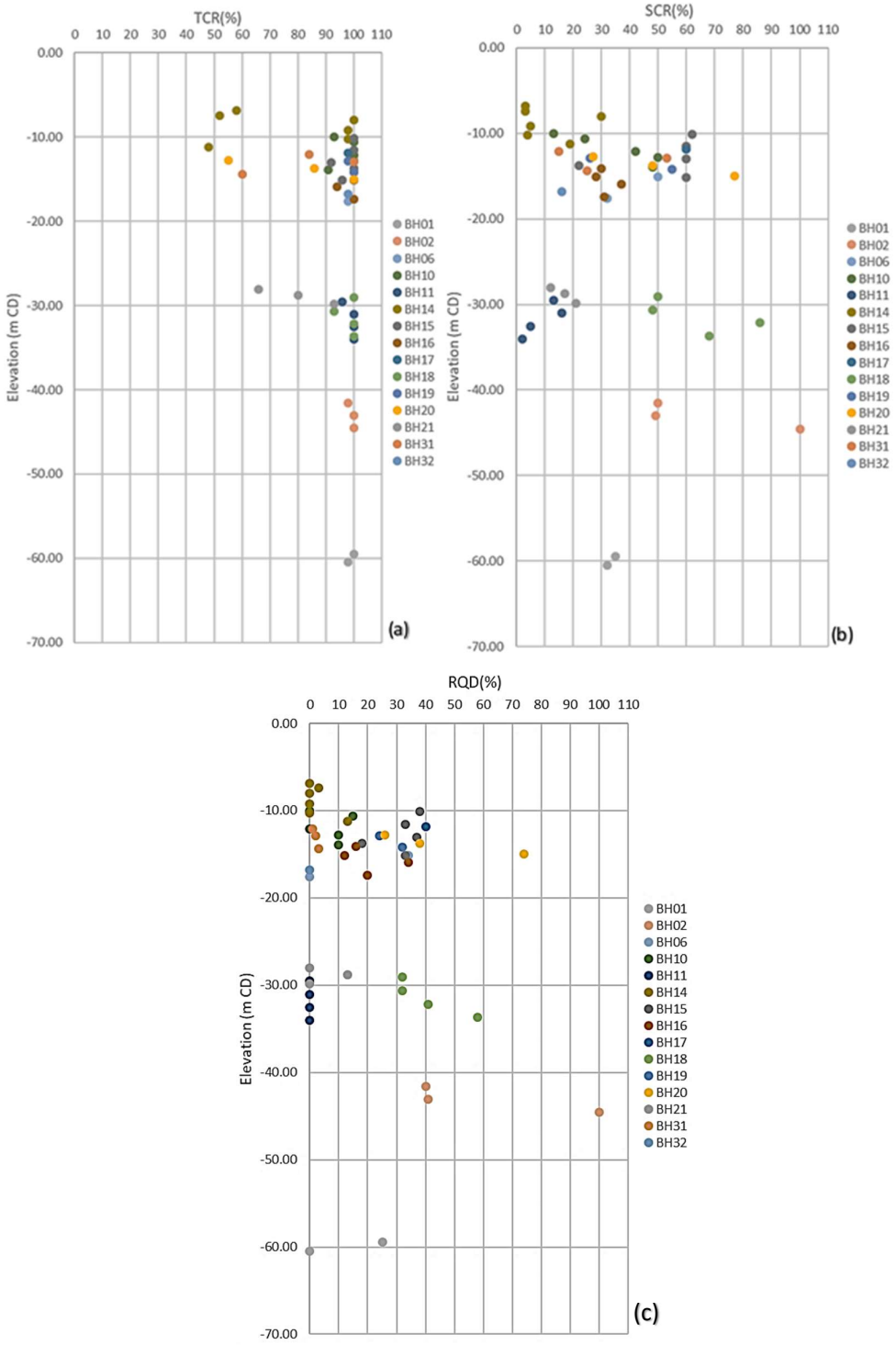


Figure 5-4 Rock core logs: (a) TCR, (b) SCR and (c) RQD with elevation

5.4.4 CPTU

In-Situ completed eight Static Cone Penetration Testing (CPTU's) in the proposed quay construction area on behalf of Causeway Geotech. The testing was carried out on drillholes and reporting was carried out in accordance with BS EN ISO 22475-1:2012. The CPTU testing has been interpreted to determine undrained shear strength, consolidation and compressibility parameters in section 7.

The reported cone resistance, q_t; sleeve friction, fs; and pore water pressure, u_2; have been plotted in Figure 5-5 and Figure 5-6. The measured q_c must be corrected for the unequal area effect due to the influence of pore water pressures acting on the cone geometry, thus obtaining the corrected cone resistance (q_t) using following the expression by Lunne et al., 1997:

$$q_t = q_c + [u_2.(1-a)]$$

Where a is the net area ratio of the CPT cone, which is 0.79 for the cone used on this project.

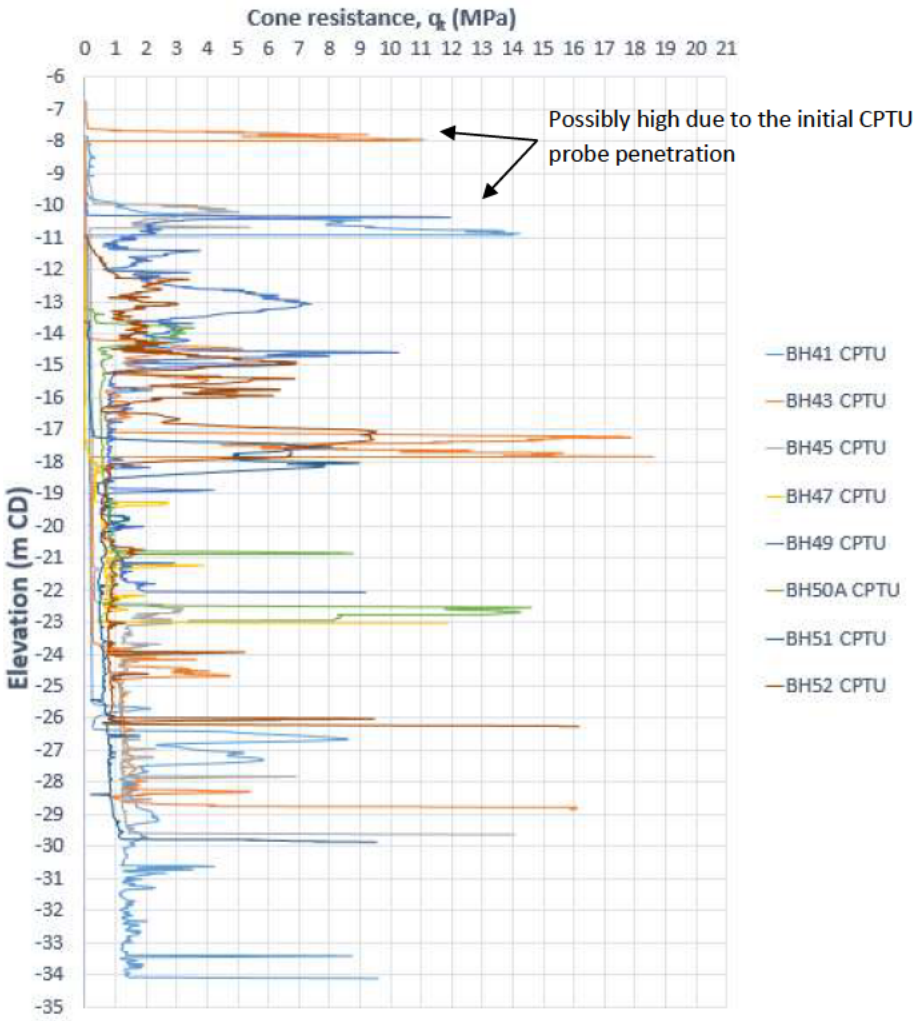


Figure 5-5 Elevation vs cone resistance, q_t

The cone tip resistance in Figure 5-5 can be seen to generally have a small linear increase from the top to -15mCD in the CPTU traces. This linear increase is indicative of normally consolidated material. These values are used in Section 7 in order to determine the undrained shear strength.

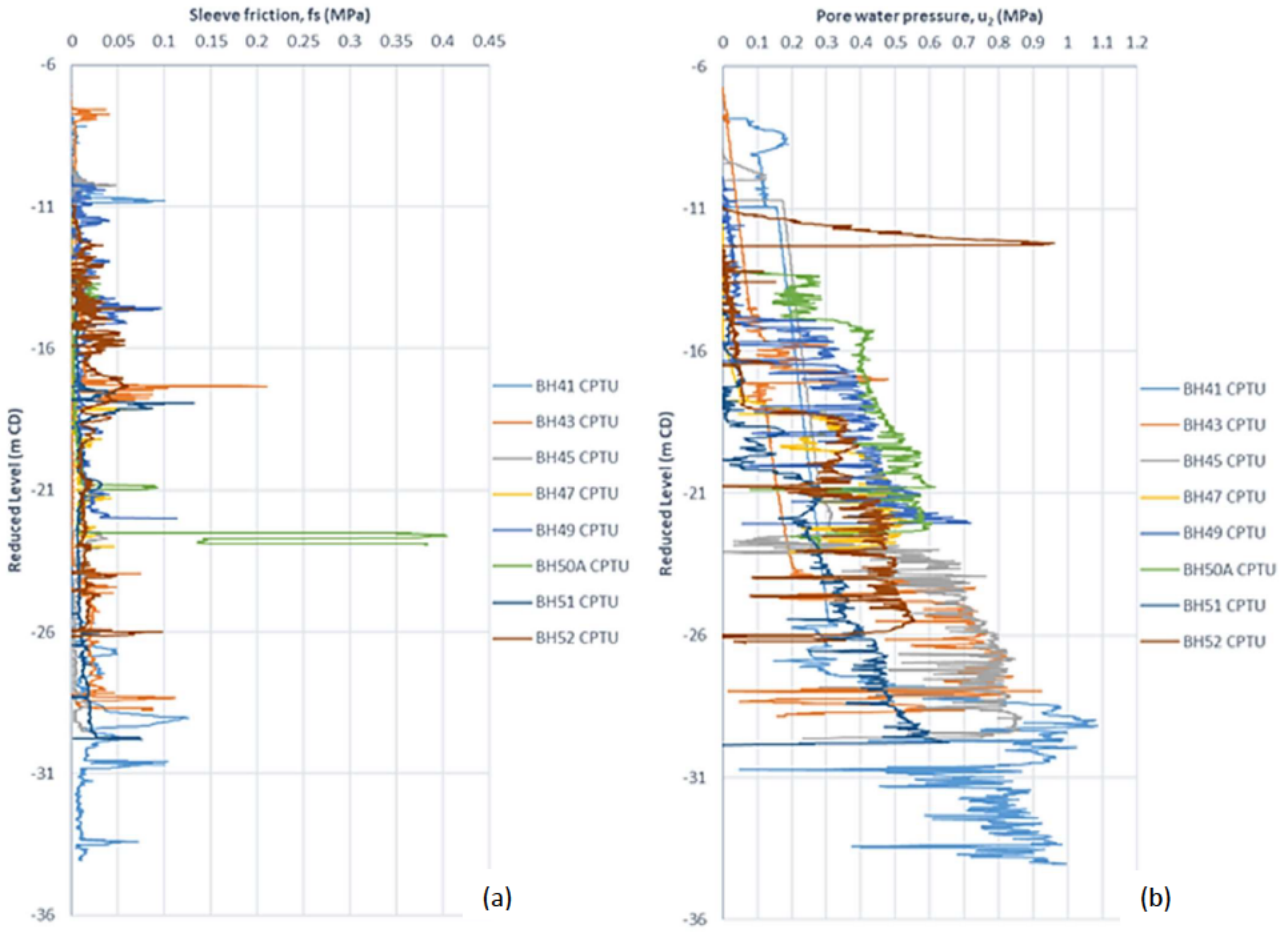


Figure 5-6 Elevation vs sleeve friction (a) and Elevation vs pore water pressure (b)

The generally low values of both cone resistance (Figure 5-5) and sleeve friction (Figure 5-6-a) are near the resolution of the cone accuracy. It indicates that the cohesive material is low to extremely low strength.

5.5 Geotechnical Laboratory testing

Table 5-2 Geotechnical laboratory tests summary table

Geotechnical laboratory testing	Previous GI (CG,2018)	Supplementary GI (CG,2019)
Triaxial tests		
Total Stress	10	48
Effective Stress	-	17
Shear Box test	10	54
Particle Size Distribution tests	102	74
Oedometer test	-	24
Point load test	34	-
Liquid and Plastic Limit tests	39	63
Moisture content test	51	63
Density test	-	73
Geotechnical chemistry testing		
PH	23	-
Water-soluble sulphate 2:1extract (WS)	23	-
Organic matter content(OGM)	6	-

5.5.1 Point load test

Point load index test (PLT) were carried out on 34 samples. Six-point load strength tests were carried out on BH7A from 22.8m to 30.30m bgl. Refer to section 7.10 for analyses.

5.5.2 Uniaxial Compressive Strength (UCS)

The testing was carried out by MATtest Limited on seven samples taken from four boreholes. A summary of the results can be seen in Appendix B. The UCS tests were carried out only on Dolerite and Gneiss. Refer to section 7.10 for analyses.

5.5.3 Density test

Bulk density was measured in undisturbed 73 samples from 12 different boreholes. Refer to section 7.9 for analyses.

5.5.4 Oedometer tests

Oedometer testing was carried out on 24 samples following the site investigation. Consolidation parameters are derived from these test results. All samples were remoulded before the test; results therefore need to be interpreted cautiously. Refer to section 7.7 for analyses.

5.5.5 Triaxial tests

An effective stress triaxial compression on consolidated undrained test was carried out on 17 samples. These test results are used to determine the consolidation settlement parameters and explained in section 7.7.

Unconsolidated undrained triaxial (UU) compression tests were carried out without the measurement of the pore pressure on 8 boreholes across the site. UU single specimen test carried out on samples taken from BH03A, BH07, BH11, BH31 and BH32. UU multi-stage test was tested on samples obtained from BH42, BH44 and BH46. A summary of the results is presented below in Figure 5-7.

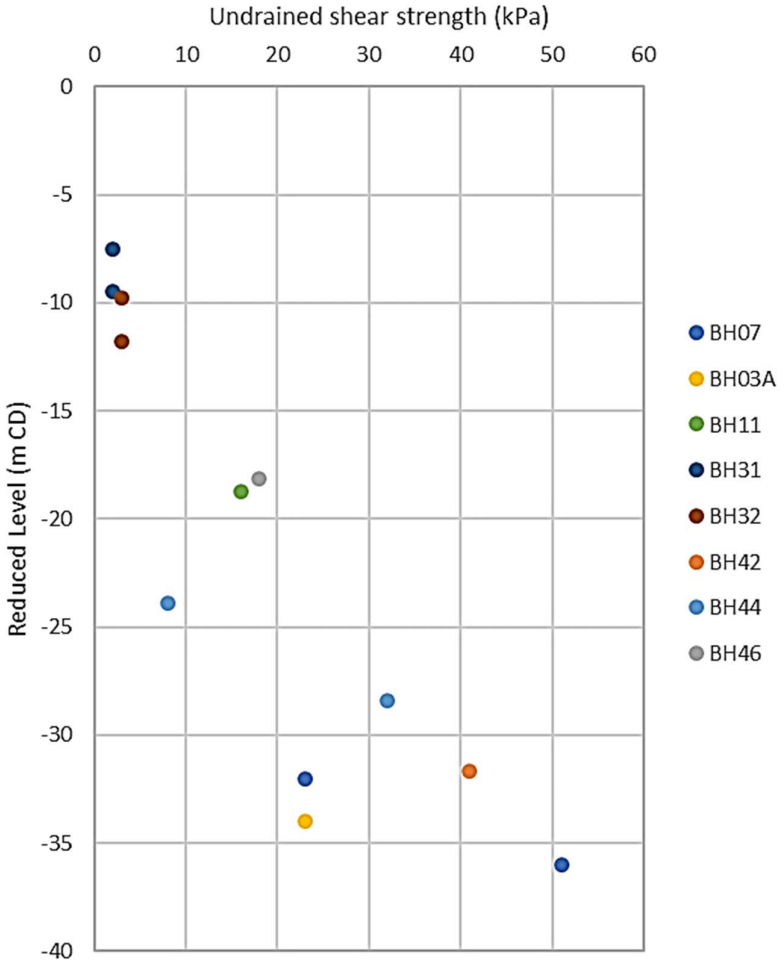


Figure 5-7 Undrained shear strength vs Elevation

5.5.6 Direct Shear

Shear box tests (small and large) were carried out on 64 samples taken from 17 different boreholes relevant to the site. Only large shear box testing was carried out on samples taken from BH49 at 0.5m bgl and BH51 at 3m bgl. In all other samples, a small shear box was used to conduct the analysis. A summary graph is presented in Figure 5-8, and Figure 5-9 shows the test results. Effective Cohesion (C') values for the site range from 0 to 27kPa, and angle of friction varies from 23 to 46 degrees. The

rate of shearing was 0.60mm/min on the samples tested. The shear strength parameters for each stratum are explained further in Section 6.

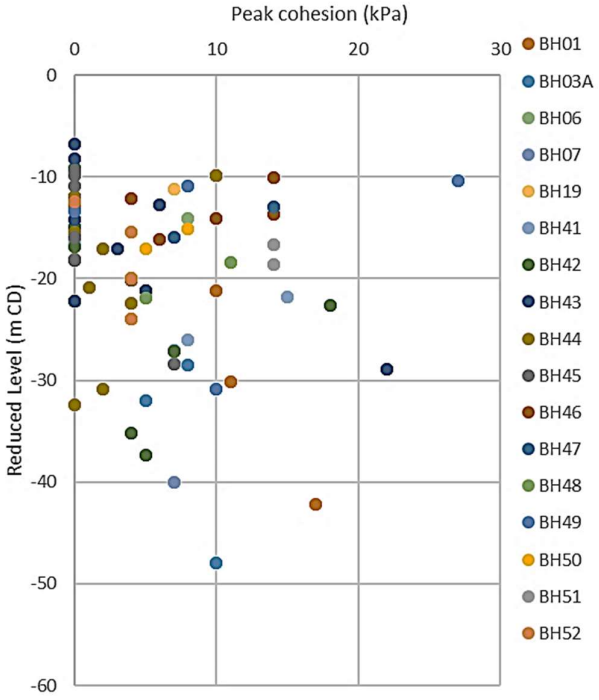


Figure 5-8 Effective Cohesion (c') vs elevation

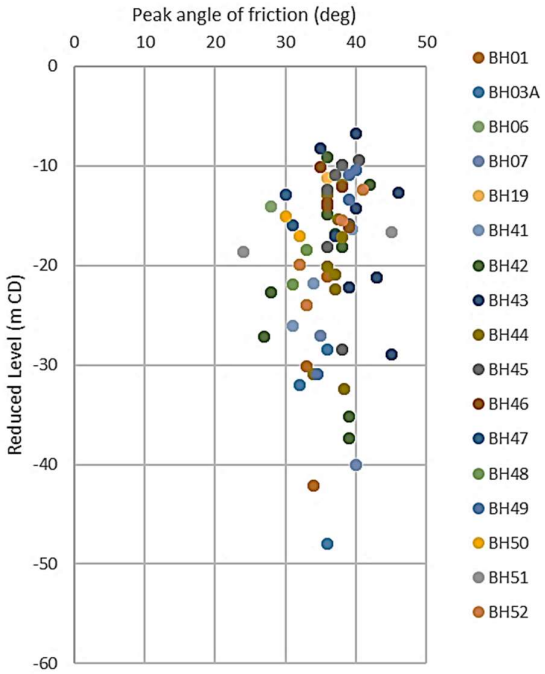


Figure 5-9 Friction angle vs Elevation

5.5.7 Particle Size Distribution (PSD)

PSD analysis was carried out on 261 samples taken from various depths from 28 boreholes from across the quay construction site. A minimum of one sample was taken from all boreholes and in some cases a maximum up to 13 samples were taken from an individual borehole. Samples are analysed using three different methods such as - Pipette analysis for size 0.02mm to 0.002mm, Wet Sieve (WS) on particle size 125mm to 0.063mm and WS+HY (Hydrometer) on particle size 125mm to 0.00153mm. In general, Pipette or hydrometer tests have been carried out on the clay/silt samples while wet sieves down to the 63µm sieve were carried out on sands and gravels.

5.5.8 Index tests

The index tests {Water Content (w_N), Liquid Limit (w_L) and Plastic Limit (w_P)} are tested on 107 samples taken across the site and are presented Figure 5-10.

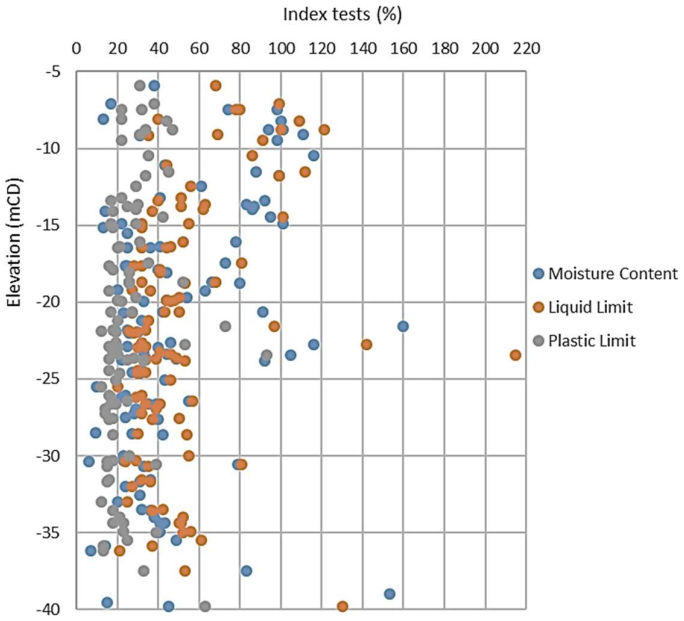


Figure 5-10 Index tests vs elevation

5.5.9 Geotechnical chemistry tests

The Geotechnical Chemistry tests were carried out by Chemtest (for the 1st factual report) on 331 samples taken from 16 boreholes. The plots are presented in Figure 5-11.

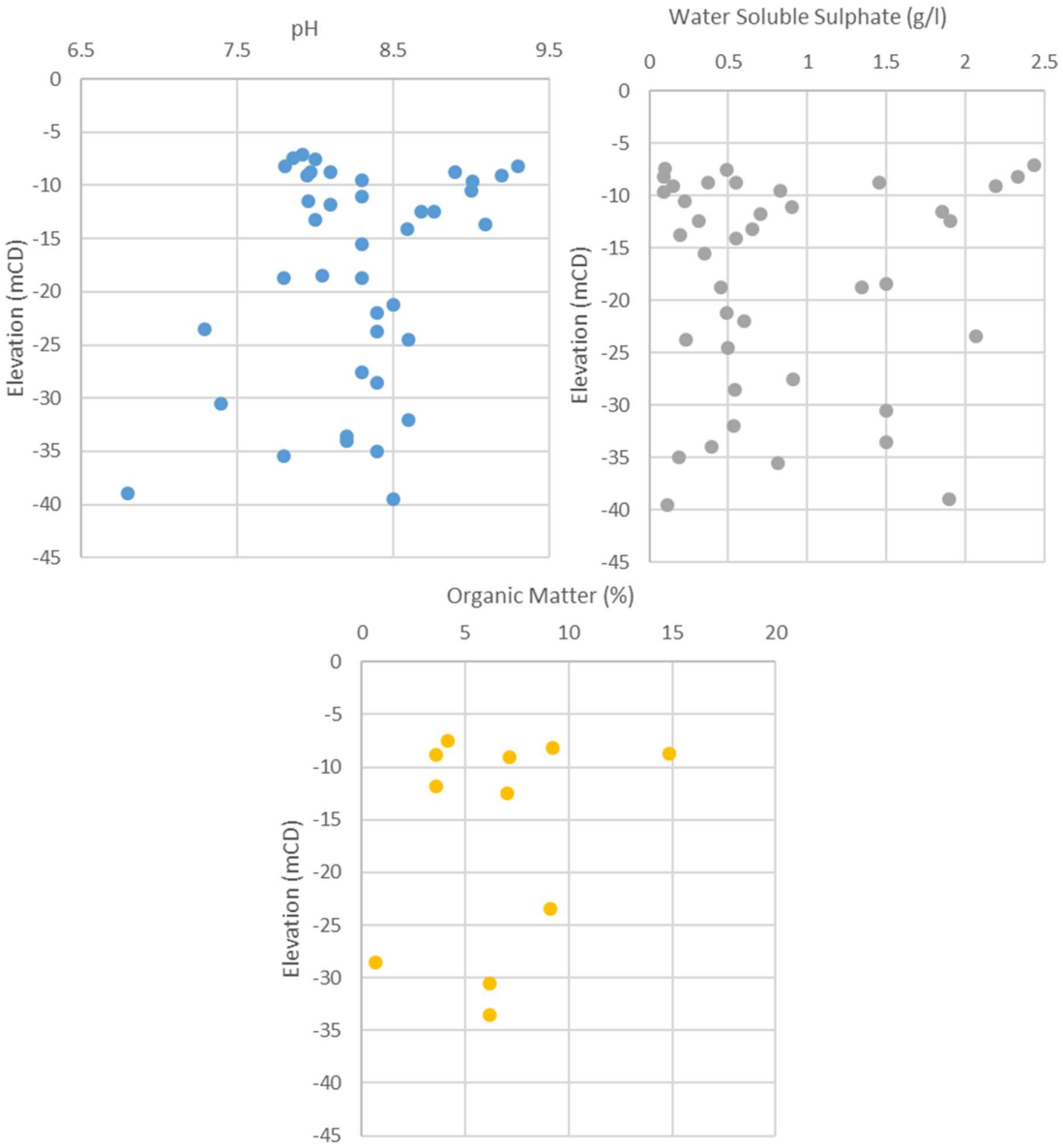


Figure 5-11 Geochemistry test (PH, Water Soluble and Organic matter)results vs elevation

6 Ground summary

The following ground model is focused mainly on the boreholes that are within and nearby to the quay construction site within the new harbour layout. Detailed borehole cross sections across the Quay construction site are provided in Appendix B.

6.1 Superficial Deposits

6.1.1 Soft Clay

This geology unit cannot be traced in all boreholes. It is however noted as the youngest deposit that lies close to the seabed. It can be described as very soft dark grey sandy gravelly silty CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. A very thick sequence of this strata is notable in BH18.

6.1.2 Granular strata

6.1.2.1 Sandy Gravel

In the majority of the boreholes, sandy gravel materials are noted at two different elevation or depths. The upper unit in the next layer is named ‘sandy gravel upper’- which is present at much shallow depth or younger deposits. The second lower unit is named as ‘sandy gravel lower’ which is present at much deeper depths or older deposits in comparison to the sandy gravel upper layer as mentioned above. Loose grey very sandy to dense dark brownish-grey slightly silty slightly sandy subangular to subrounded fine to coarse GRAVEL. Within the overall sandy gravel strata, there are the various size and <1.5m sand or dark grey gravelly clay lenses throughout, occasional pocket-sized deposits of soft sandy clay with shells, or predominately of gneiss with pockets of fine to medium gravel. The presence of boulder and cobbles are higher in sandy gravel lower strata. The sandy gravel lower strata lie just above the weathered bedrock layer or bedrock lithology.

6.1.2.2 Sand

Very dense to loose grey silty slightly gravelly organic fine to coarse SAND. Gravel is subangular to subrounded fine. Sand is fine to coarse.

6.1.3 Cohesive strata

6.1.3.1 Silty Sand

This stratum can be described as loose to medium dense brownish-grey slightly gravelly clayey very silty fine to coarse SAND with cobble to boulder-sized pockets of very sandy silt. Gravel is subangular

to subrounded fine. Firm to stiff thinly laminated brown and black organic silt and grey slightly silty fine sand layer or lenses are noted within this stratum.

6.1.3.2 Clayey Silt

Soft to firm greyish green slightly gravelly or sandy silty CLAY. Gravel is subangular to subrounded fine to coarse. Stiff clay thin bands are present within the strata.

6.2 Solid Geology

Bedrock was noted in 23 boreholes out of the 47 boreholes drilled at specified final borehole depth. Rockhead levels are presented in Figure 6-1. Igneous and metamorphic rocks were identified. The igneous rock Dolerite was recorded in BH02 at 37.9 m bgl which was underlaid by the metamorphic rock Gneiss. In all other boreholes, the bedrock recorded were the metamorphic rocks - Pegmatite, Gneiss, Metagabbro and Amphibolite. The bulk density of the bedrock ranges from 2.6 Mg/m^3 to 2.9 mg/m^3. A detailed description of various metamorphic bedrock present in the site is summarised in Table 6-1.

Table 6-1 Summary of Bedrock lies under the site

Bedrock	Description
Dolerite	Weak massive black DOLERITE. Partially weathered: slightly closer fracture spacing, faint greyish green discolouration on discontinuities. Discontinuities: 1. 20 to 40-degree joints medium spaced (260/280/350) planar, smooth, patchy greenish-grey staining on joint surfaces.
Gnesis	Strong to very strong narrowly foliated grey and pink GNEISS. Largely unweathered: faint greyish green discolouration on discontinuities. Discontinuities: 1. 0 to 30-degree foliation fractures, medium spaced (80/200/340) planar, smooth, faint greyish green staining on fracture surfaces. 2. 50 to 70 degree joints medium spaced (70/420/780) planar, smooth, patchy greenish-grey staining on the joint surface.
Metagabbro	Strong to medium-dark greenish-grey METAGABBRO. Partially weathered: yellowish-green discolouration on occasional joint surfaces. Discontinuities: 1. 0 to 30 degree fractures medium spaced (40/500/880) planar, sooth, with faint grey staining on the fracture surface, 50 to 90 degree joint, occurring in conjugate pairs, closely spaced (60/200/260) planar, smooth, with patchy greyish green staining on joint surfaces.
Pegmatite	Strong greyish red massive PEGMATITE. Largely unweathered: very faint grey discolouration on joint surfaces. Discontinuity Set 1. 0 to 30-degree probable foliation fractures, planar smooth, with faint brown staining on fractures. Very strong massive pink and grey PEGMATITE. Partially weathered with slight grey discolouration. Discontinuities: 1. 0 to 30 degree fractures, closely spaced (80/100/150) stepped, rough with faint greenish-grey staining.

Amphibolite	Medium-strong massive dark grey AMPHIBOLITE with weakly developed foliation. Partially weathered: greenish-grey staining on fractures, some local red staining, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 degree joints, closely spaced (90/130/330), planar, smooth, with greyish green staining. Set 2. 30 to 50 degree joints, closely spaced, (50/160/380), planar smooth, with greyish green staining, some local red staining. Set 3. 70 to 90 degree joints at 4.40m to 5.20m and 5.70m to 6.50m, undulating, rough, with slight grey staining.

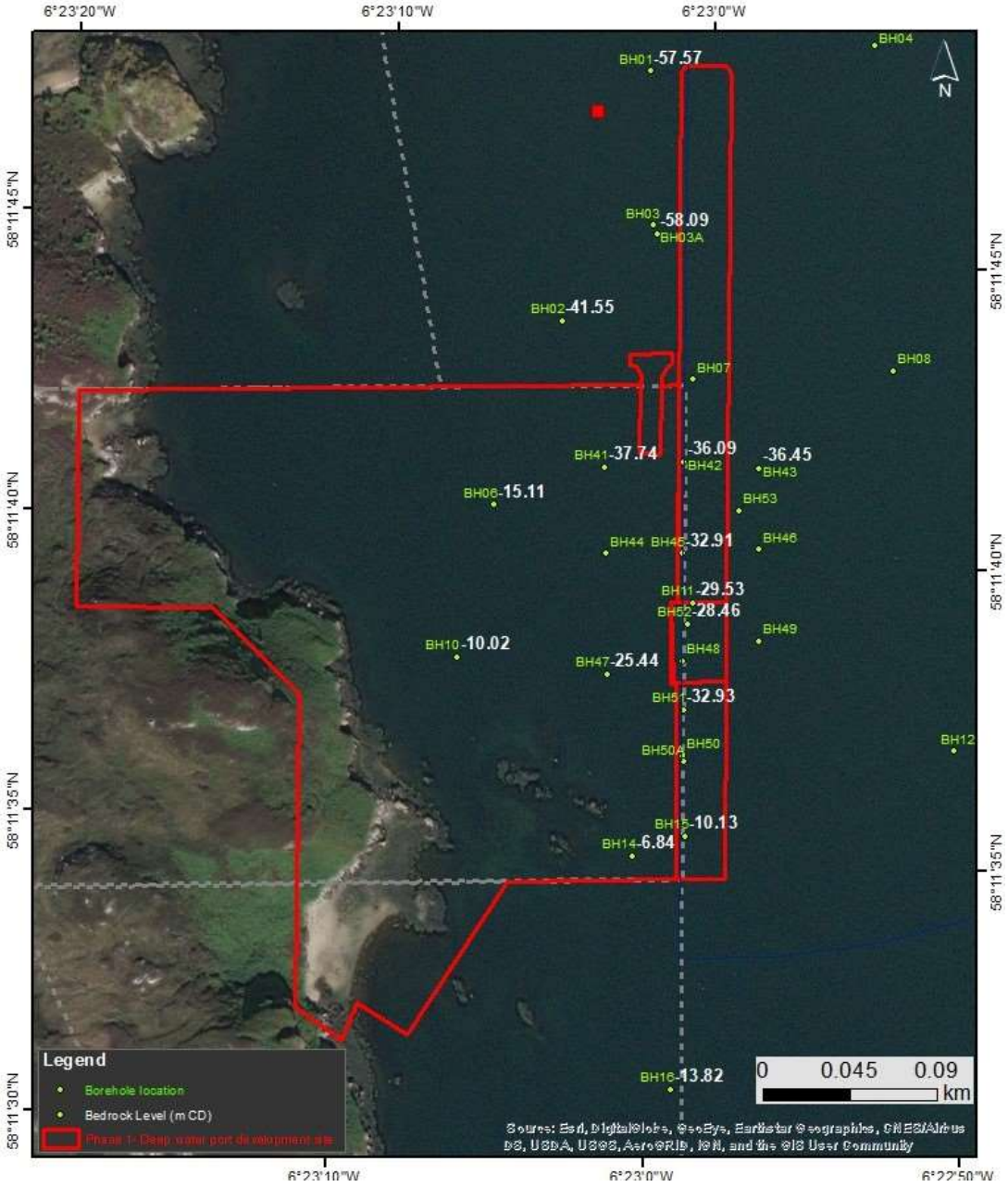


Figure 6-1 Site map showing the rock head levels

6.3 Ground model

A summary of all of the geological units is presented in Table 6-2.

Table 6-2 Geology unit summary ground model

Material Name	Typical Description	Thickness approx. (m)	
		from	to
Superficial Deposits			
Soft Clay	Very soft dark grey sandy gravelly silty CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.	0.5	19
Upper Granular Strata			
Sandy Gravel-upper	Loose grey very sandy to dense dark brownish-grey slightly silty slightly sandy subangular to subrounded fine to coarse GRAVEL. Within the strata lenses of clay, sand is present in varying thickness and material composition.	0.2	9
Sand	Very dense to loose grey silty slightly gravelly organic fine to coarse SAND. Sand is fine to coarse.	0.9	5
Cohesive Strata			
Silty Sand	Loose to medium dense brownish-grey slightly gravelly clayey very silty fine to coarse SAND with cobble to boulder-sized pockets of very sandy silt. Gravel is subangular to subrounded fine. Firm to stiff thinly laminated brown and black organic SILT. Grey slightly silty fine SAND.	1.1	11
Clayey Silt	Soft to firm greyish green slightly gravelly or sandy silty CLAY. Gravel is subangular to subrounded fine to coarse.	4	32
Lower Granular Strata			
Sandy Gravel-lower	Very dense grey slightly silty slightly sandy angular to subangular medium to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular predominantly gneiss.	thickness unproven	
Solid Geology			
Metamorphic Rock	Pegmatite, Gnesis, Metagabbro and Amphibolite	thickness unproven	

6.4 Groundwater

Groundwater elevated above tidal levels was not specifically noted during drilling at any of the borehole locations. However, it should be noted that the casing used to support the borehole walls during drilling may have sealed out any elevated groundwater strikes encountered and the possibility of encountering such groundwater during piling works cannot be ruled out, although they are not expected.

7 Characteristic geotechnical parameters

7.1 SPT Parameters

In Figure 7-1, the left plot shows the SPT- N values obtained during the site investigation and the right plot categorises the data according to the overburden geology unit or strata as classified. The data in Figure 7-1 is focused primarily on the boreholes located around the proposed quay construction area.

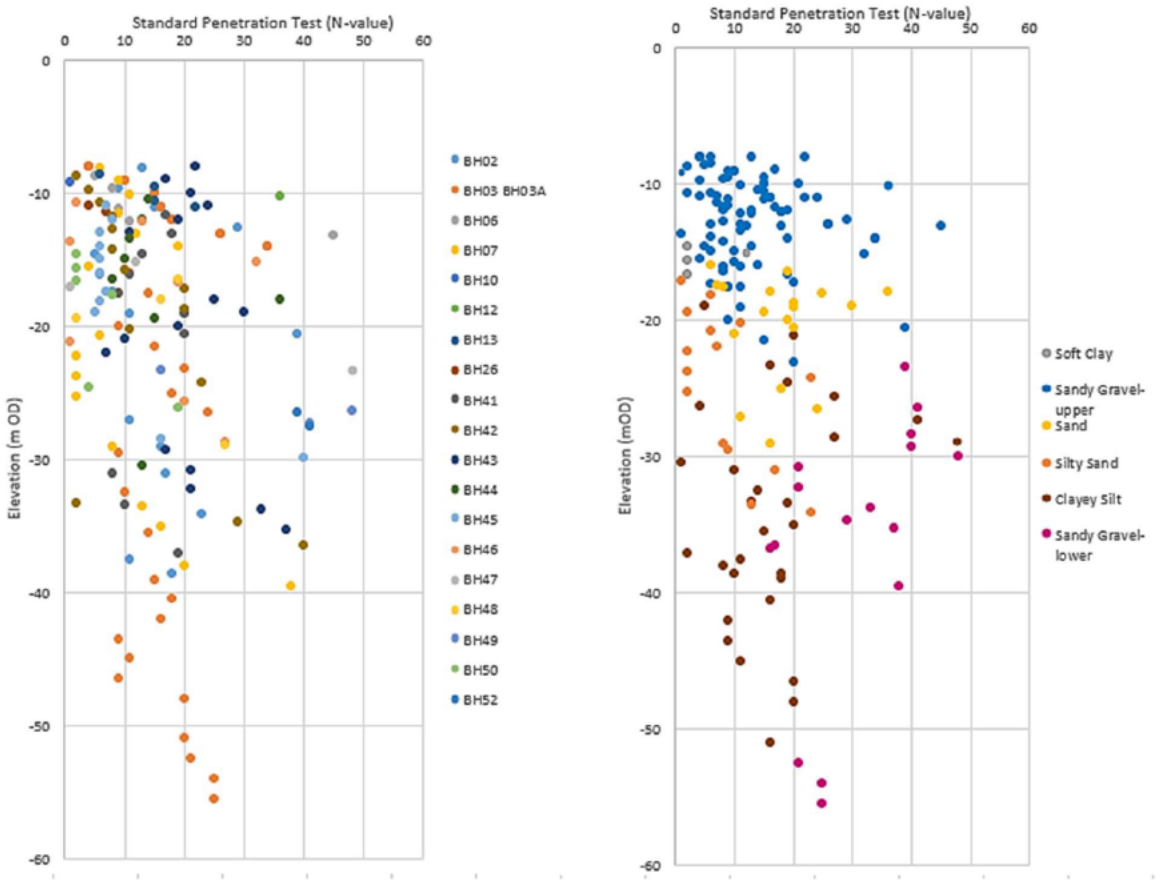


Figure 7-1 SPT-N vs elevation- for borehole Nr.(left) and for geological unit/strata (right)

Table 7-1 Summary of the SPT-N values for the geology units

Geology unit	SPT-N	Average SPT
Soft clay	2 to 15	7
Sandy gravel- upper	2 to 45	13
Sand	6 to 36	18
Silty sand	1 to 23	9
Clayey silt	1 to 48	16
Sandy gravel-lower	15 to 48	30

7.2 Undrained shear strength

7.2.1 Lab tests

The undrained shear strength of the silty sand was determined based on the unconsolidated undrained triaxial (UU) tests carried out three samples taken from BH07, BH11 and BH44; this plot is presented in Figure 7-2.

The undrained shear strength of the clayey silt unit was reviewed based on the in-situ shear vane tests as well as the unconsolidated undrained triaxial (UU) compression tests. A summary of both tests is presented in Figure 7-2 with a general trend of increasing shear strength with increasing depth. Four test results are omitted from this data analysis as their data from the boreholes (BH31 and BH32) are located outside the new harbour layout.

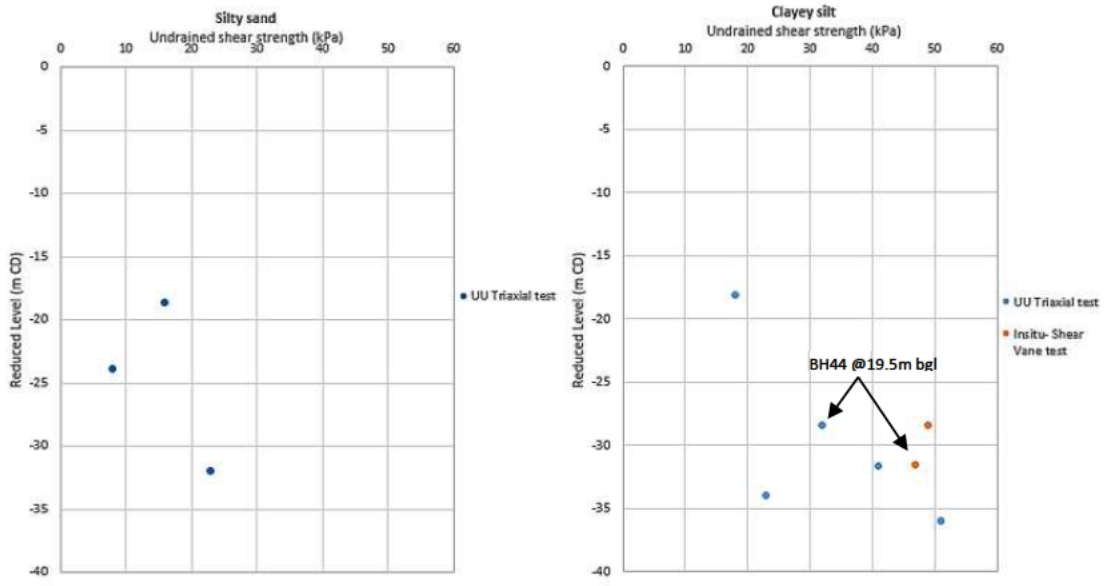


Figure 7-2 Lab tests undrained shear strength parameters vs elevation for geological units: silty sand (left), clayey silt (right)

It is clear that the in-situ test gave higher values compared to the disturbed lab test result. For example, BH44 at 19.5m bgl the in-situ shear vane test gave a value of 47kPa whereas the UU triaxial laboratory test gave a test result of 32kPa for a sample taken from a similar depth in that borehole.

Generally, the c_u values tend to increase with depth. For the cohesive unit between -15 mCD to -25 mCD the 2 values range from 8kPa to 18kPa. Below that, c_u appears to increase up to 51kPa at -36 mCD. However, for design purpose, the reliability to estimate an accurate average c_u from this total of only 10 points in Figure 7-2 should be considered somewhat unpredictable. Fortunately, other methods can provide further reliability for estimation of undrained shear strength as noted below.

7.2.2 In-situ test - CPTU

The undrained shear strength (c_u) can be calculated from the cone penetration testing (CPTU) by the following relationship (Robertson and Cabal, 2015):

$$c_u = \frac{q_t - \sigma_v}{N_{kt}}$$

Where:

q_t = corrected cone resistance (kPa),

σ_v = total vertical stress (kPa) = unit weight * depth, unit weight was taken as 18.3kN/m^3, and

N_{kt} = an empirical factor = 17.5

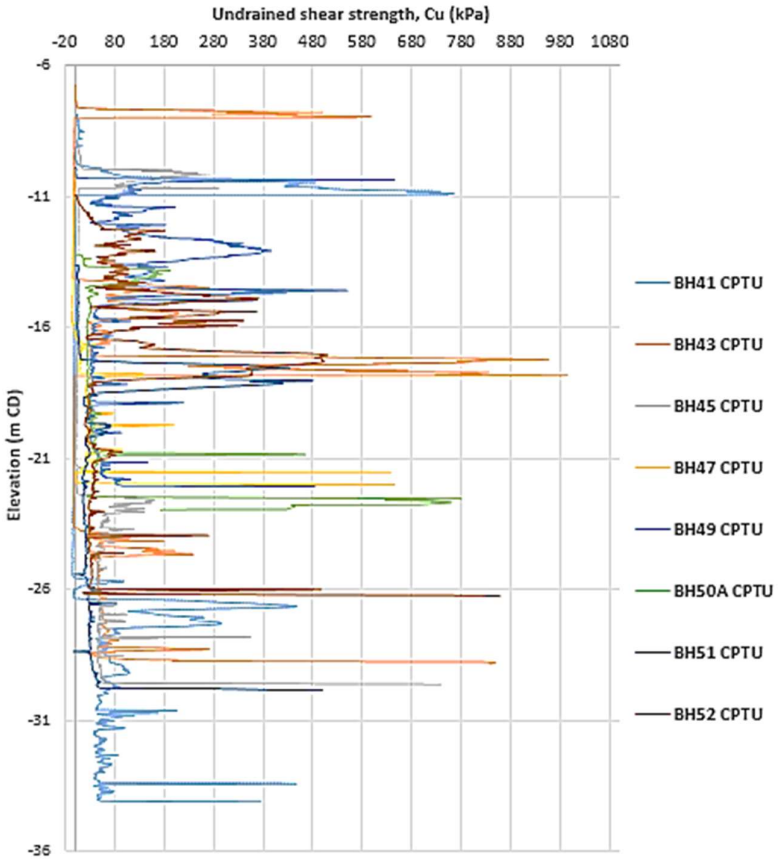


Figure 7-3 "As recorded" Elevation vs undrained shear strength interpretation from CPTU testing

To develop a more accurate and representative c_u vs elevation CPTU plot for the site from the c_u dataset indicated above, values greater than 150kPa and any negative values were eliminated. The revised plot is presented in Figure 7-4 (a). The upper limit of 150kPa was chosen to only exclude a few peak values that are not considered to be representative of the whole strata of clay soil under investigation. They are more likely to represent a localised increased resistance to the cone penetration rather than very stiff clays actually being encountered.

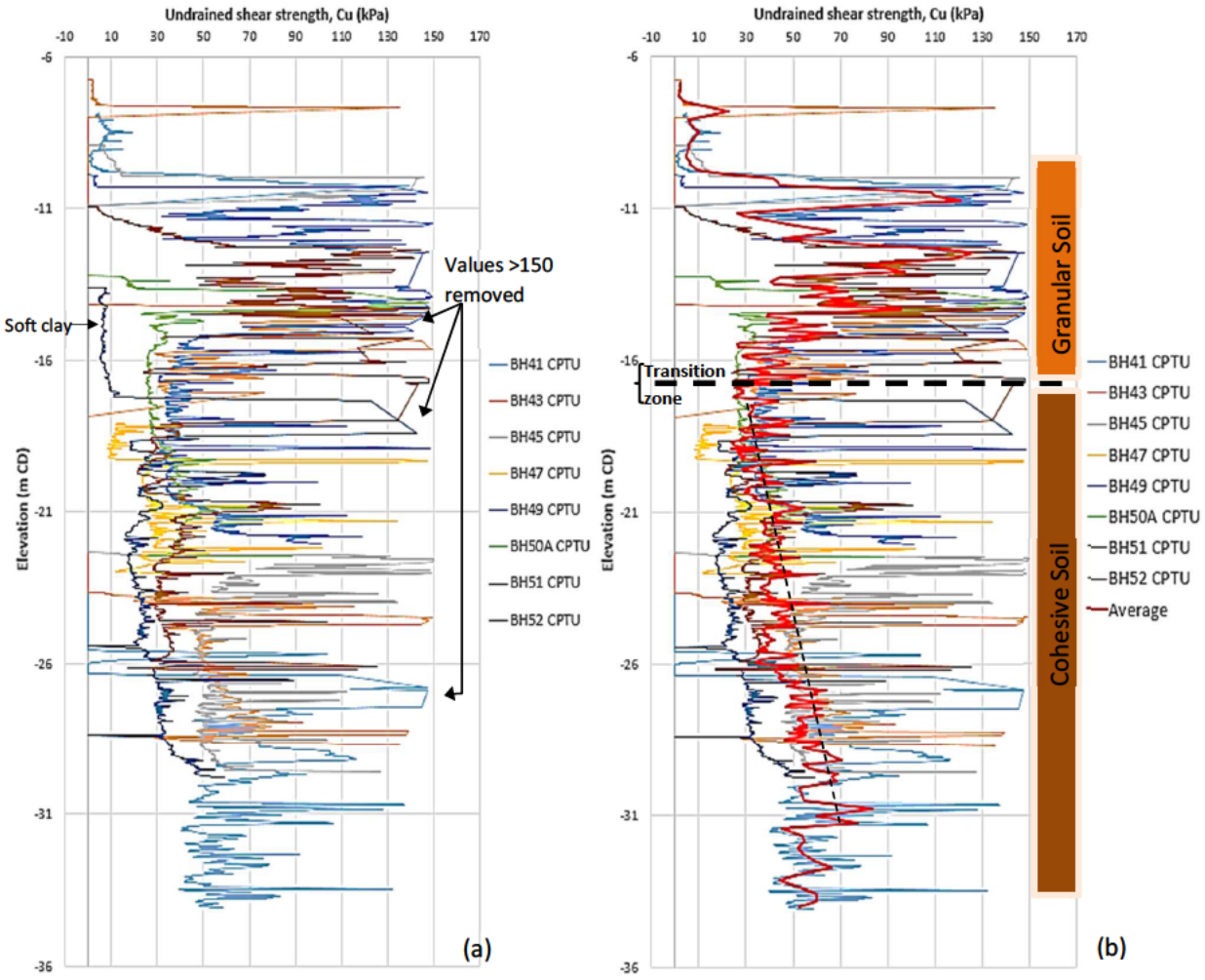


Figure 7-4 Undrained shear strength, c_u against elevation: (a)- cleaned-up data (b)Average c_u for the site

In Figure 7-4 (b) the average undrained shear strength line (in red) is presented as obtained from the remaining dataset. Thus, this interpretation is considered to be conservative. Some of the observations are as follows: -

- At shallow depths, the c_u tends to be greater than with depth. This effect is considered to be as a result of the cone having to break through a crust which is not entirely cohesive, and thus the c_u values are probably artificially elevated to get through the sandier layers (more granular soil).
- The soft clay geology unit recognised from BH51CPTU which is marked in Figure 7-4(a) as "soft clay" was also eliminated from Figure 7-4(b) as it was interpreted as a very different strata of cohesive material since it clearly represents very soft clay with an average c_u value of only circa. 6kPa.
- A change in average trend line is distinguished between -16m CD and -18 m CD, which is marked as a transition zone between the more granular and typically cohesive soils. This transition zone is taken as -17m CD on average, for this report. However, this transition zone needs to be assessed carefully depending upon strata variations across the site and where any

particular analyses are undertaken. The cohesive soil unit presented in Figure 7-4(b) includes both the silty sand and clayey silt geology units identified in Table 6-2.

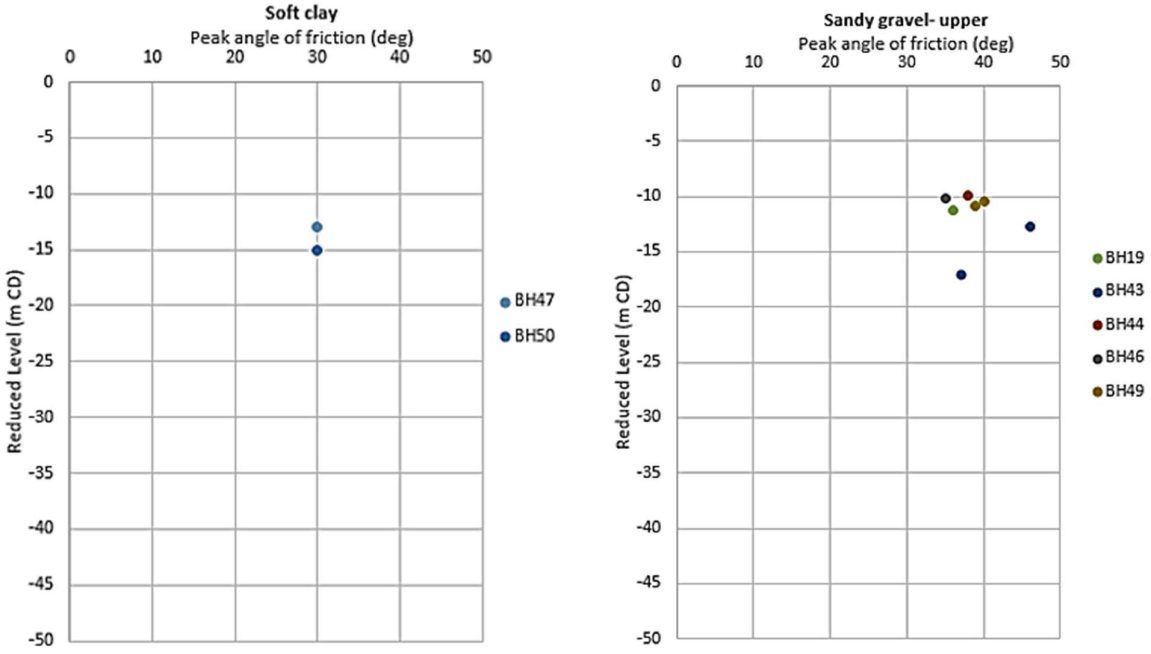
- The c_u is highly variable ranging typically between 15kPa to circa 100kPa for the cohesive soils. However, a representative range of 30kPa at -17m CD improving to 70kPa at-30m CD are taken as the characteristic soil parameters.

Undrained cohesion c_u values obtained from CPTU are considered to be more accurate and representative site data than individual lab test results from unconsolidated undrained triaxial (UU) tests which are disturbed in the process of recovery, during transport to the lab and during preparation for testing. The CPTU testing is also much more extensive and less subject to one individual result not being representative of the whole soil mass as per the UU tests.

7.3 Angle of friction

7.3.1 Lab tests

The angle of friction results across the site range between 28 degrees to 45 degrees which are obtained from the shear box test. The shear box angle of friction test results are presented for each geology unit in Figure 7-5.



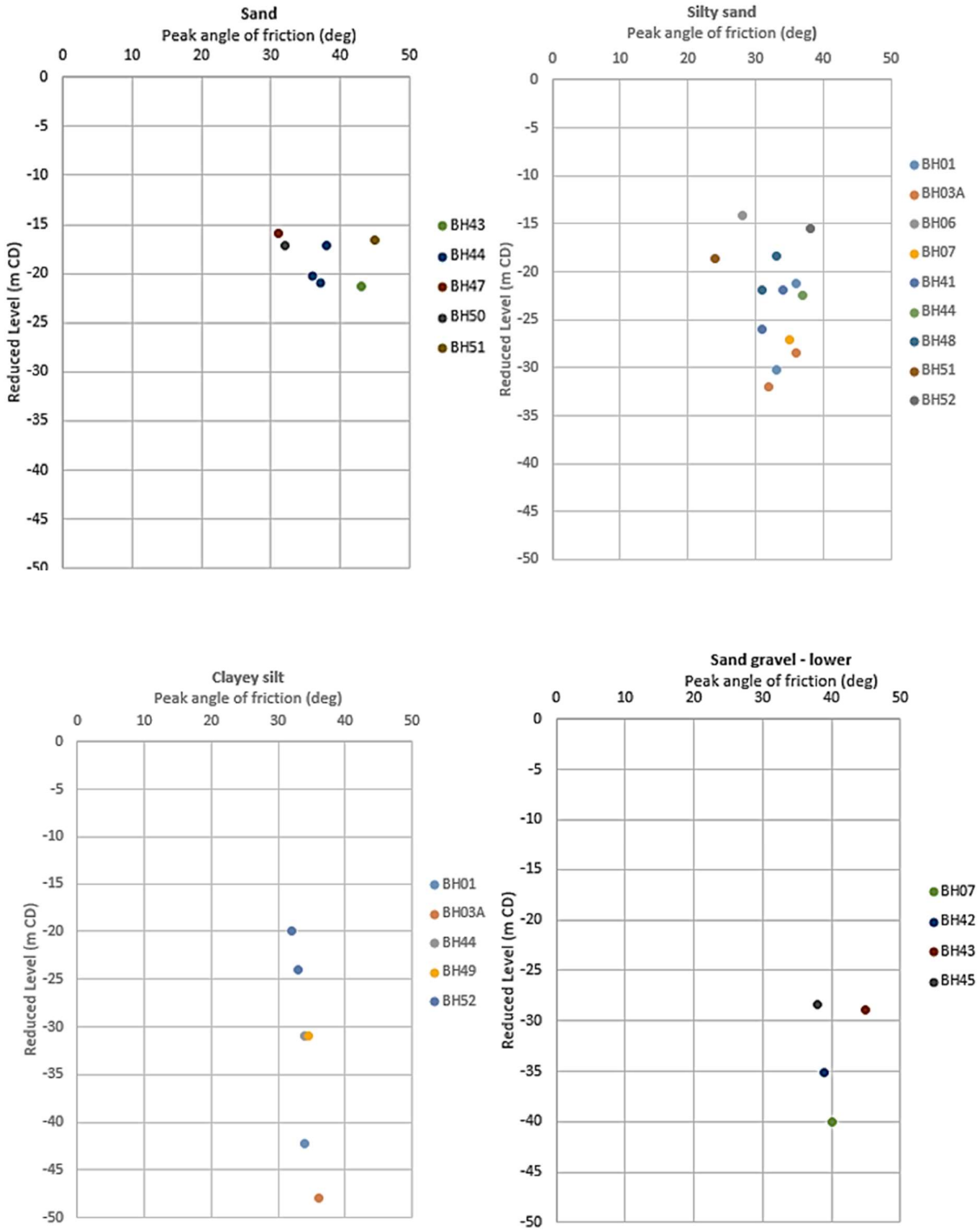


Figure 7-5 Lab tests: friction angle graphs for six geology units

Laboratory test results for angle of friction are summarised in Figure 7-5. The results from the laboratory testing are considered quite conservative for the following reasons: -

- The soft clay friction angle presented in Figure 7-5 may not be considered as a true representative value (these 2 results are considered likely to be too high) for this unit as the material is described as cohesive from borehole logs and sample descriptions.
- The test results presented in Figure 7-5 are based on a few discreet individual samples which limit the validity of the dataset.

Table 7-2 Lab test summary of the angle of friction across the site

Strata	Friction angle, Ø (degrees)
Upper granular strata (Sandy gravel upper & Sand)	31 to 46
Cohesive strata (Silty sand & Clayey silt)	24 to 39
Lower granular strata (Sandy gravel lower)	38 to 45

7.3.2 In situ test - CPTU

The effective friction angle, ϕ', is used to express the shear strength of drained coarse-grained soils. In this report, the friction angle is derived from the correlations of Robertson and Campanella (1983).

$$\emptyset' = tan^{-1}\left(0.1 + 0.38.\log\left(\frac{q_t}{\sigma'_{v0}}\right)\right.$$

Where,
q_t = corrected cone resistance in kPa
σ'_{v0} = effective vertical stress in kPa

In Figure 7-6(a) the as calculated and recorded friction angle against elevation plot is presented for the site. However, to obtain the an average line that is considered more representative and accurate, the data set was truncated at a cut-off value of 10 degrees (i.e. negative values and those values <10deg were removed) as per Figure 7-6(b).

The main observations from Figure 7-6(b) are as follows:-

- CPT could only generally penetrate through relatively soft or loose material, so this graph does not fully represent the full upper strata of "better" gravels and sands,
- Even though the overburden soil is made-up of mixed granular and cohesive materials. A higher proportion of granular material is noted above -17 m CD (transition line). Below this level, the soil is seen to be predominantly made of more cohesive type material,
- The transition line (adopted at -17m CD) can vary in level across the site and along the length of the quay wall, but there is reasonable consistency in properties for each layer as the level changes,
- The CPTU tests could not all fully penetrate through the lower cohesive strata

- For the long term fully drained condition, a characteristic friction angle was assigned to the strata as per the black dashed lines. The upper more granular strata are characterised by the gravel and sand layer which have friction angles of 40° and 33° respectively in the strata shown in Figure 7-6(b). For the lower more cohesive strata, a friction angle of circa 24° is taken to be characteristic across the site. Table 7-3 summarises these results.

Table 7-3 In situ CPTU test summary of the angle of friction across the site

Strata	Friction angle, Ø (degrees)
Upper Sandy gravel strata	40
Sand strata	33
Silty sand and Clayey Silt strata	24

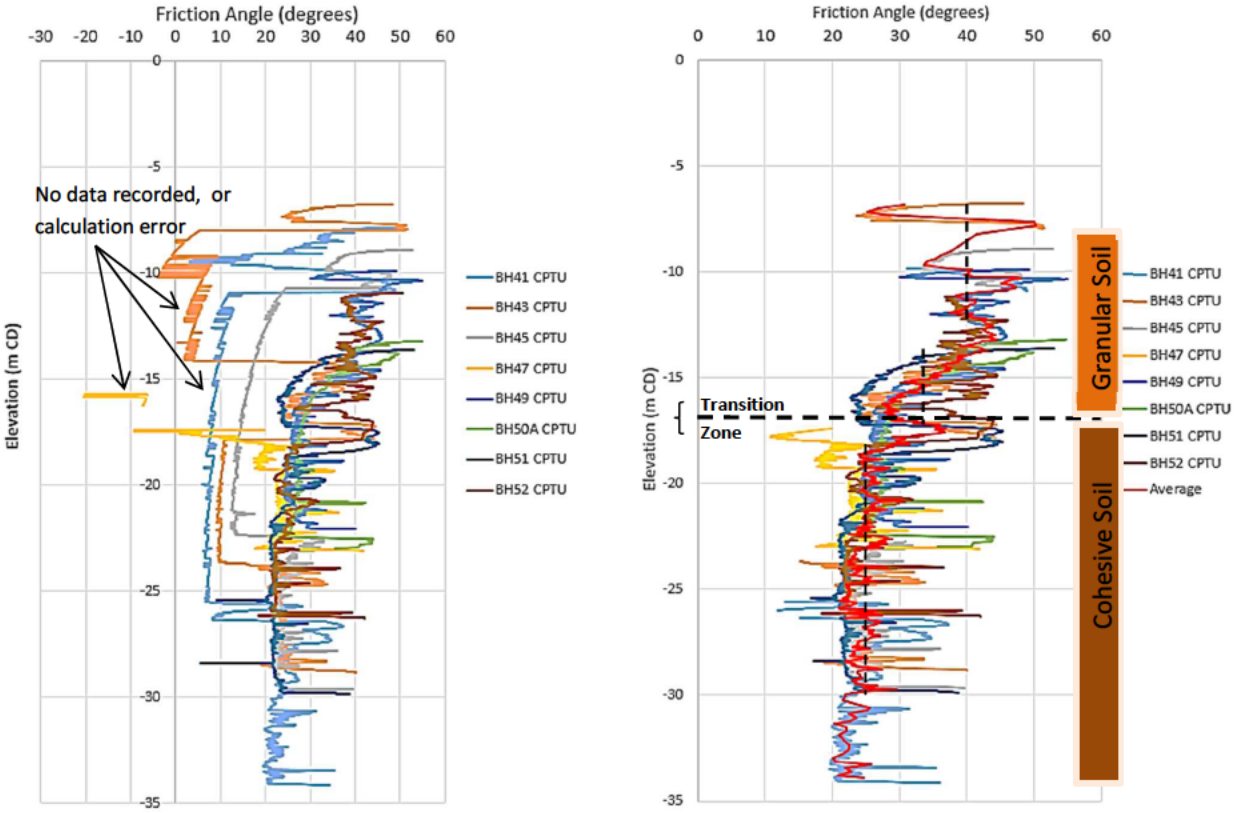


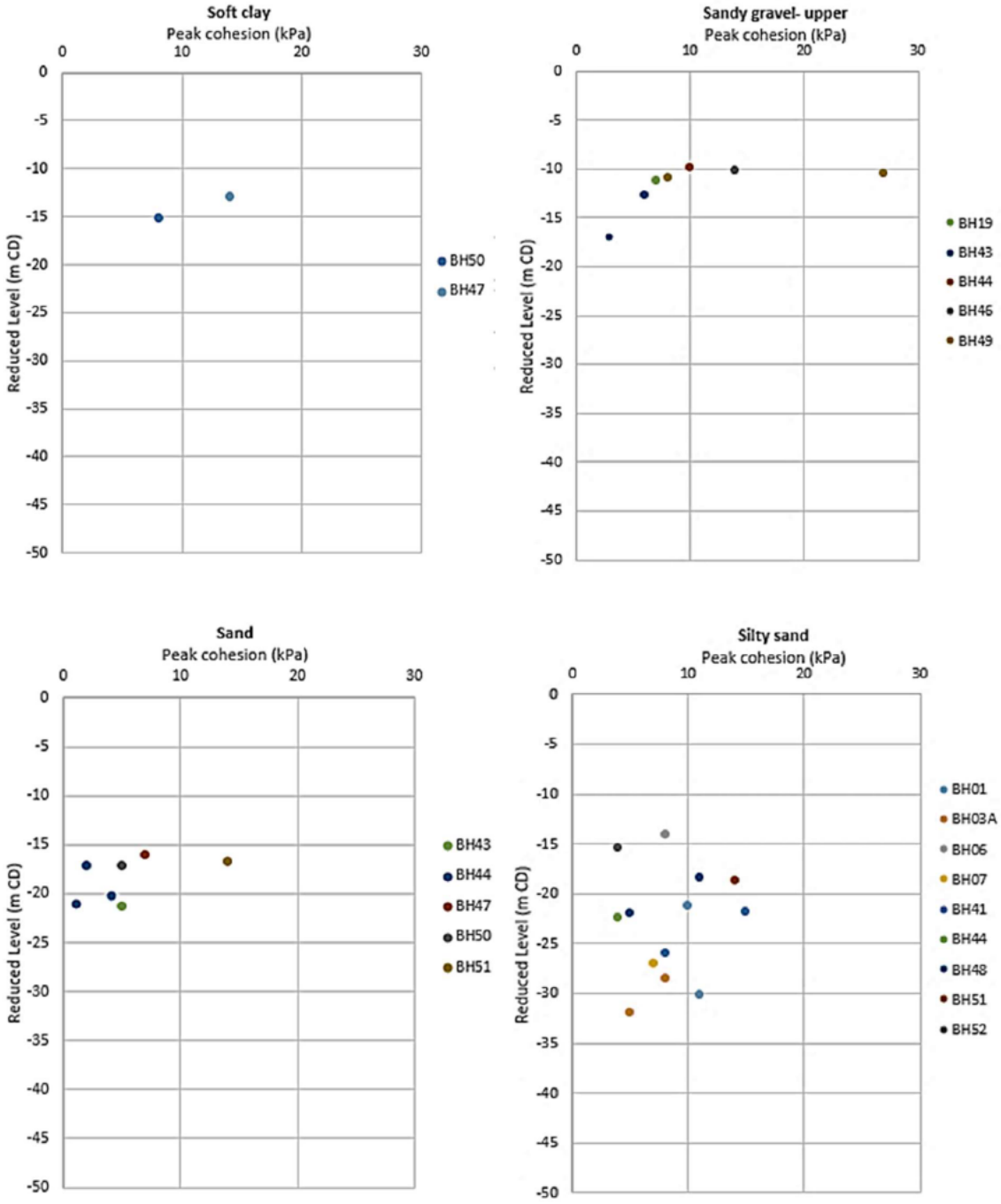
Figure 7-6 Friction angle vs elevation (a) as recorded data (b) "cleaned up" data with average line

7.4 Cohesion

The cohesion for the strata is obtained from the shear box test. In Figure 7-7 presents all of the laboratory test results for each geology units across the site and Table 7-4 summarises the result.

Table 7-4 Peak cohesion, C' across the site

Geology unit	Peak Cohesion, C' (kPa)	Average C' (kPa)
Soft clay	8 to 14	11
Sandy gravel- upper	3 to 27	10
Sand	1 to 14	7
Silty sand	4 to 15	7
Clayey silt	2 to 17	7
Sandy gravel-lower	7 to 22	10



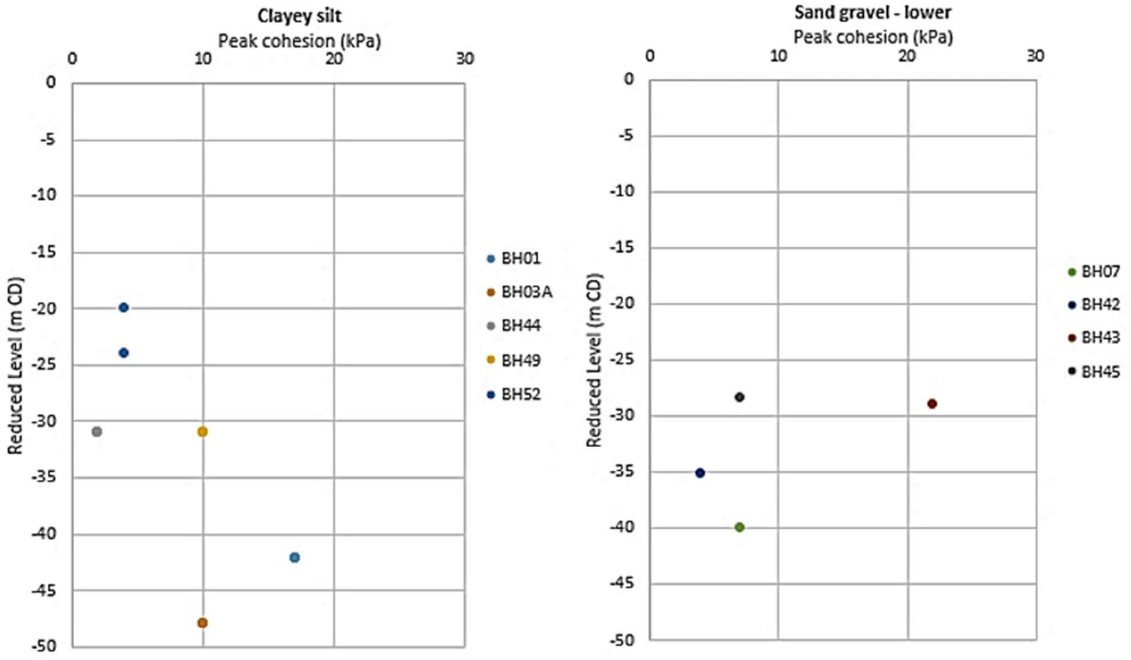


Figure 7-7 Peak Cohesion (C') vs elevation for six geology units

7.5 Particle Size Distribution (PSD)

According to the soil classified in section 6 of this report, all PSD results are presented in Figure 7-8.

Figure 7-9 to Figure 7-12 present the PSD plots for individual geological units, and it can be noted that particle sizes are distributed widely within each geological units.

Figure 7-11 which is a Silty sand and Figure 7-12 of clayey silts show PSD curves where it is noticeable that these two layers are quite similar in terms of their associated particle size distribution curves. Between these two units there is only a small variation in silt content but a similar content of fine sand.

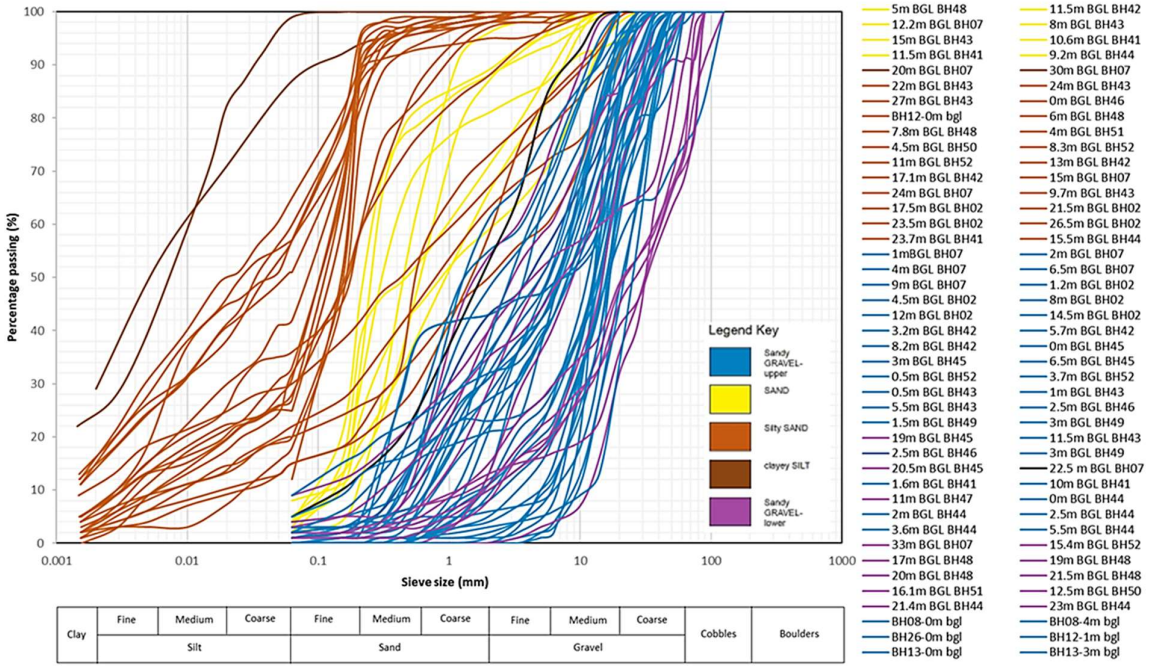


Figure 7-8 PSD results across the quay construction site

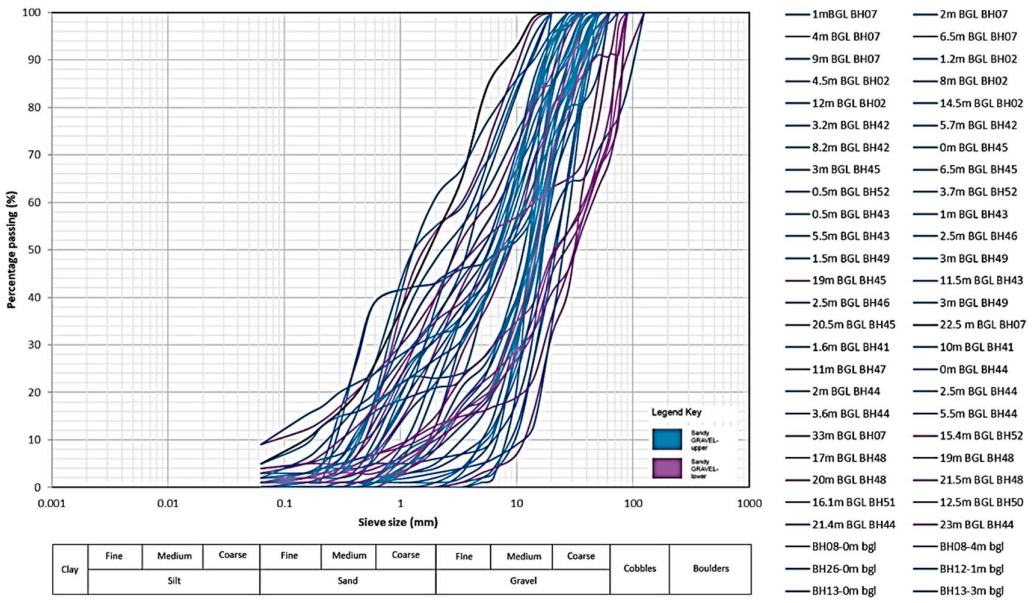


Figure 7-9 PSD plot for gravelly sand upper and lower

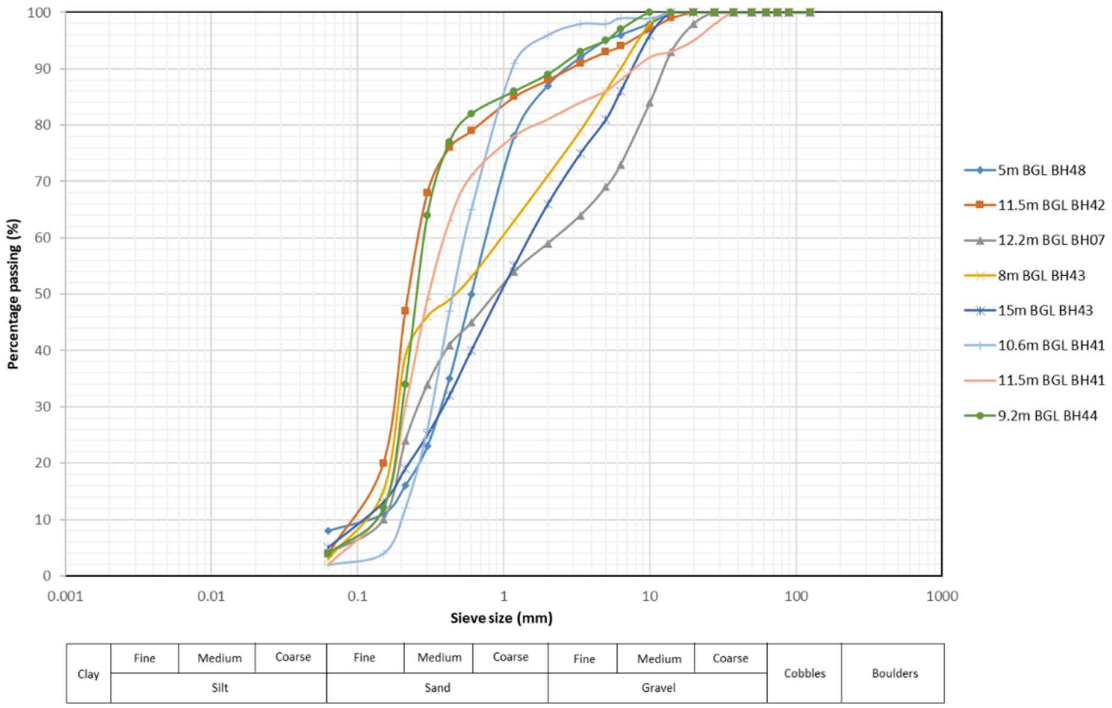


Figure 7-10 PSD plot for sand geology unit

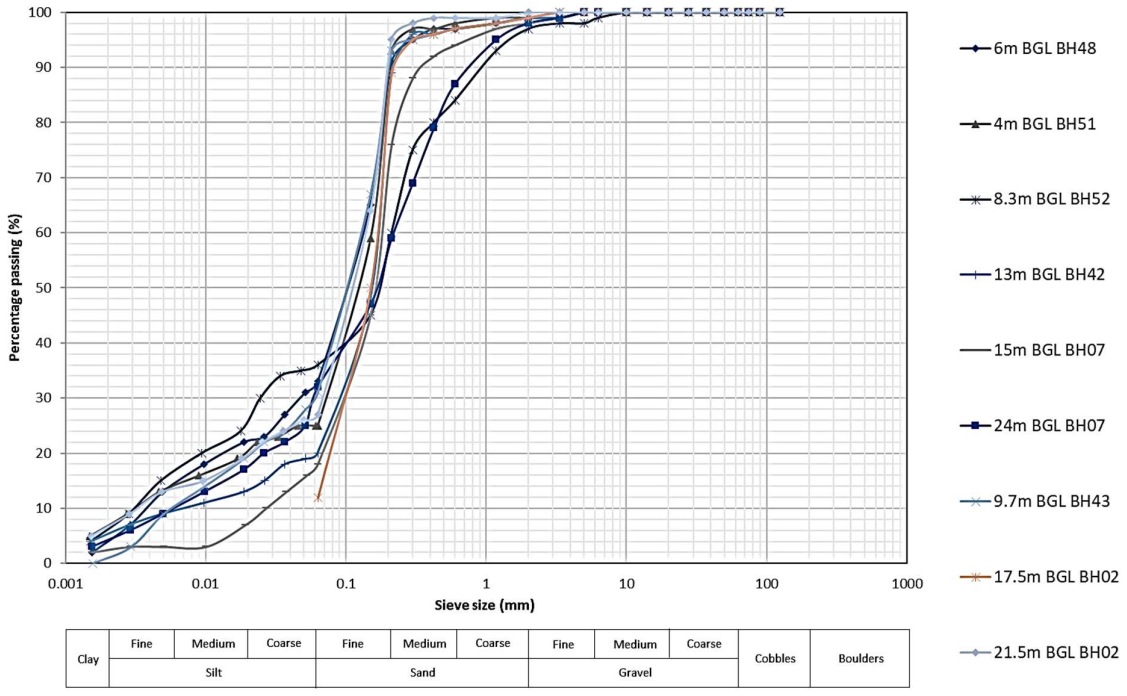


Figure 7-11 PSD plot for Silty sand geology unit

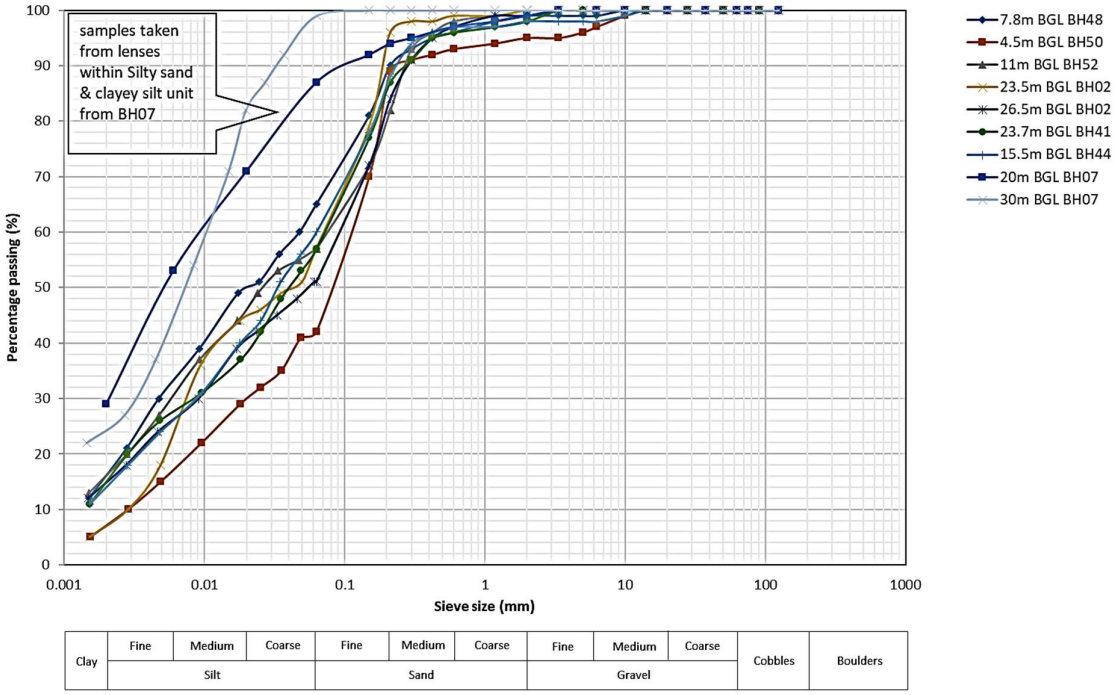


Figure 7-12 PSD plot for clayey silt geology unit

7.6 Atterberg Limits

The index tests {water content (w_N), Liquid Limit (w_L) and Plastic Limit (w_P)} are tested on 107 samples taken across the site and are presented in Figure 7-13.

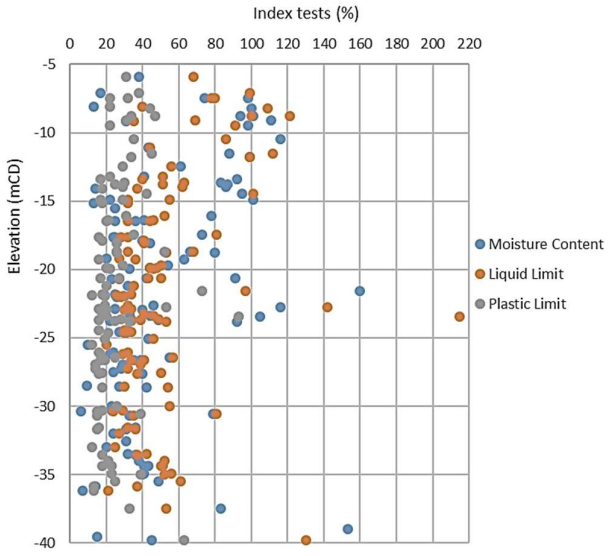


Figure 7-13 Index tests vs Elevation for the samples recovered across the site

Atterberg test results show a variation in the plastic limit from 12% to 93%. Also from these tests, the liquid limit varies from 20 to 215%. The plasticity chart is plotted in Figure 7-14 shows that the plasticity of the materials varies from low (minimum of 9%) to high (up to 38%). The low plasticity indicates that small changes in moisture content could have a significant impact on the mechanical strength of cohesive soil.

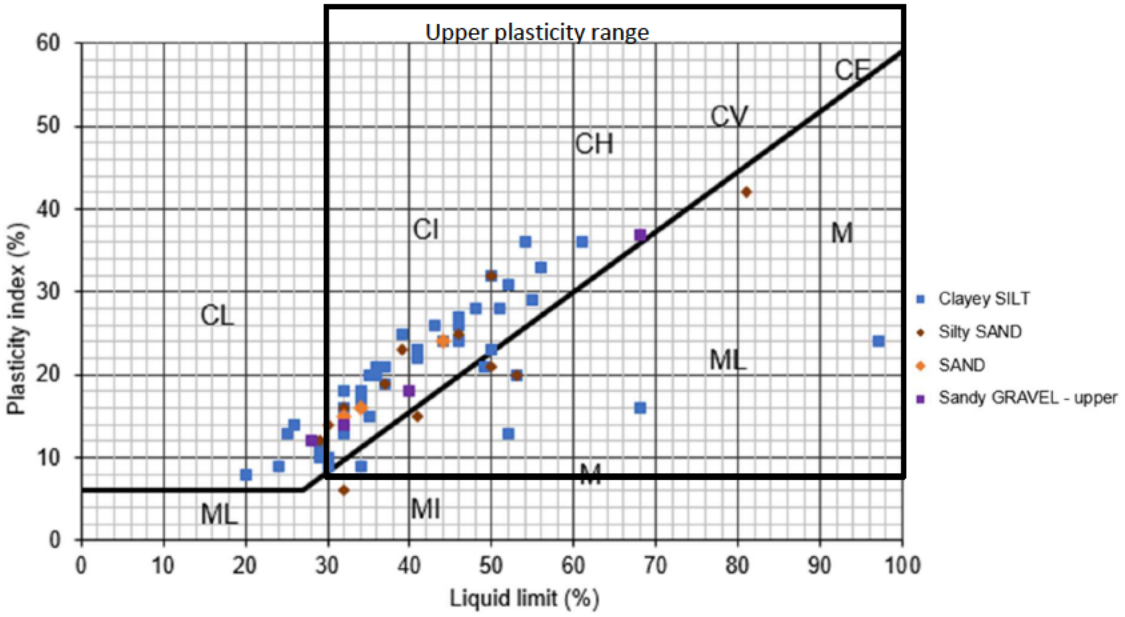


Figure 7-14 Plasticity chart for the samples recovered across the site

The Liquidity Index is defined as:

$$LI = \frac{w_N - w_P}{w_L - w_P}$$

Where,

w_N = Moisture Content as in %

w_P = Plastic Limit as in %

w_L= Liquid Limit as in %

The Liquidity Index serves as a useful parameter for differentiating between soil strata. The Liquidity Index results for the site are presented in Figure 7-15. The results show that the Liquidity Index is generally between -1.0 to 3.6 for indicative of stiff soil to soft soil. A negative liquidity index means that the moisture content is less than the plastic limit.

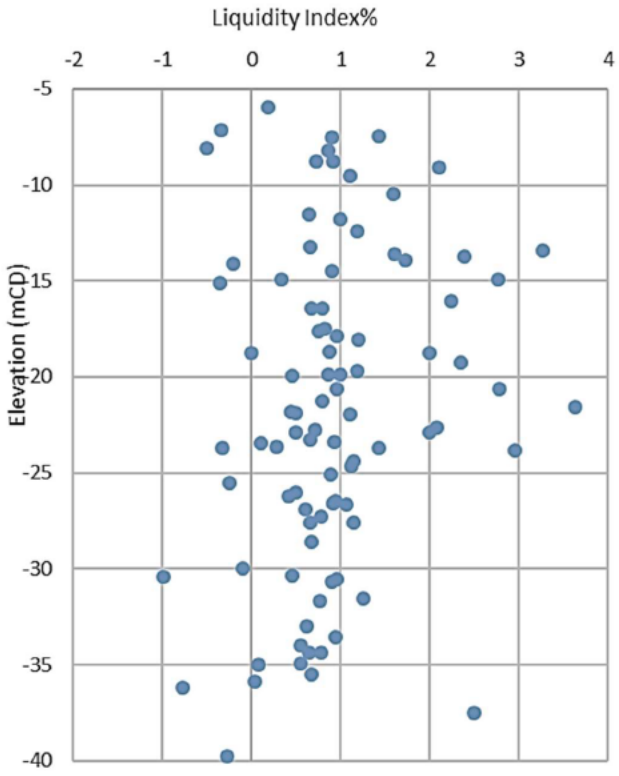


Figure 7-15 Liquidity Index vs Elevation

Table 7-5 Summary of Atterberg limits, liquid and plasticity index for the site

Geology unit	Moisture Content w_N (%)	Liquid Limit w_L (%)	Liquidity Index	Plastic Limit w_P (%)	Plasticity Index
Soft clay	-	-	-	-	-
Sandy gravel- upper	13 to 38	28 to 68	-0.5 to 0.75	16 to 31	12 to 37
Sand	22 to 36	32 to 44	0.3 to 0.6	17 to 20	15 to 24
Silty sand	14 to 79	27 to 81	-0.2 to 2.9	16 to 39	6 to 42
Clayey silt	6.1 to 160	20 to 130	0.07 to 3.6	21 to 73	9 to 36
Sandy gravel-lower	6.8 to 14	21 to 37	-0.7 to 0.04	13	8 to 24

7.7 Consolidation

Consolidation settlement parameters for the site is determined from the oedometer tests, one-dimensional consolidation test (ODCT) and effective stress triaxial compression (ESTC) on consolidated undrained samples taken during the ground investigation.

The void ratio (e), coefficient of compressibility and consolidation coefficient results for the material across the site are presented in Figure 7-16, Figure 7-17 and Figure 7-18. These parameters

determining the consolidation of the material are mainly concerned with cohesive strata (silty sand and clayey silt units).

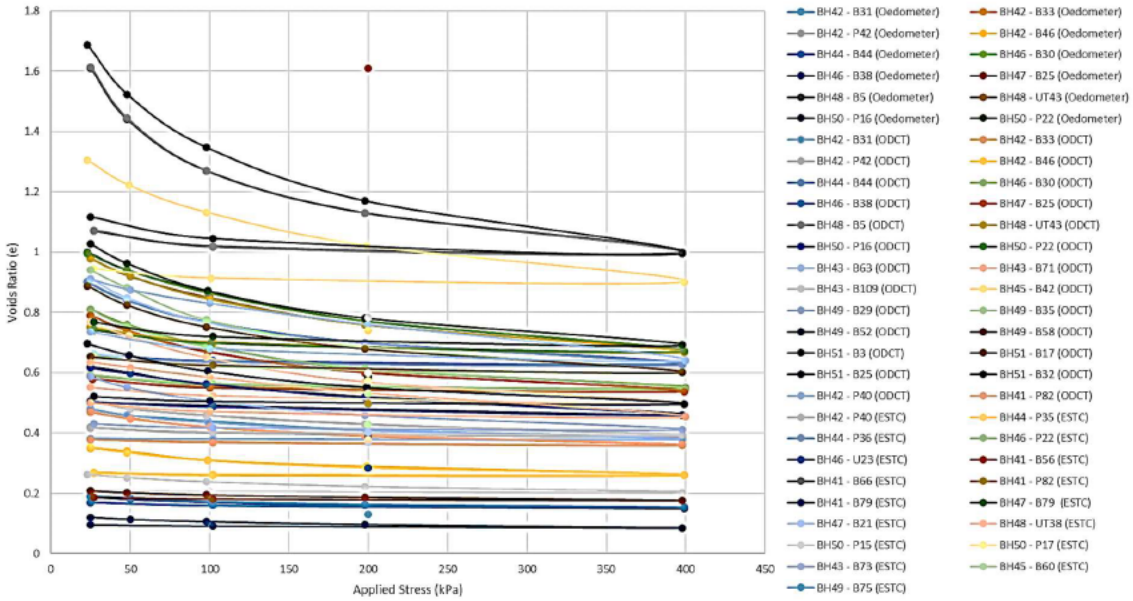


Figure 7-16 void ratio vs applied stress

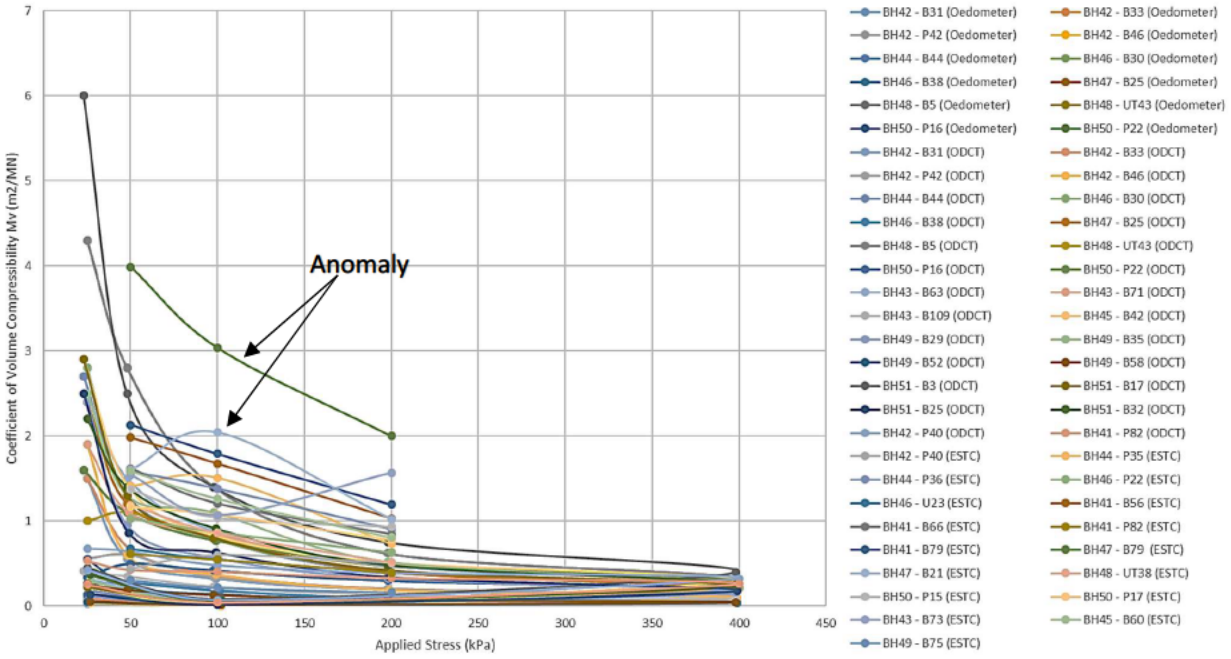


Figure 7-17 Compressibility coefficient, m_v against applied stress

From Figure 7-16, the void ratios from start to finish in the materials can be seen in the graphs. For a 200kPa stress, the void ratio ranges from 0.9 to 1.17 (Figure 7-16). Similarly for a 200kPa stress, the

coefficient of volume compressibility, m_v has values ranging from 0.2 to 2m²/MN (Figure 7-17). The coefficient of consolidation, c_v ranges from 0.2 to 60m²/yr after excluding anomalies (Figure 7-18).

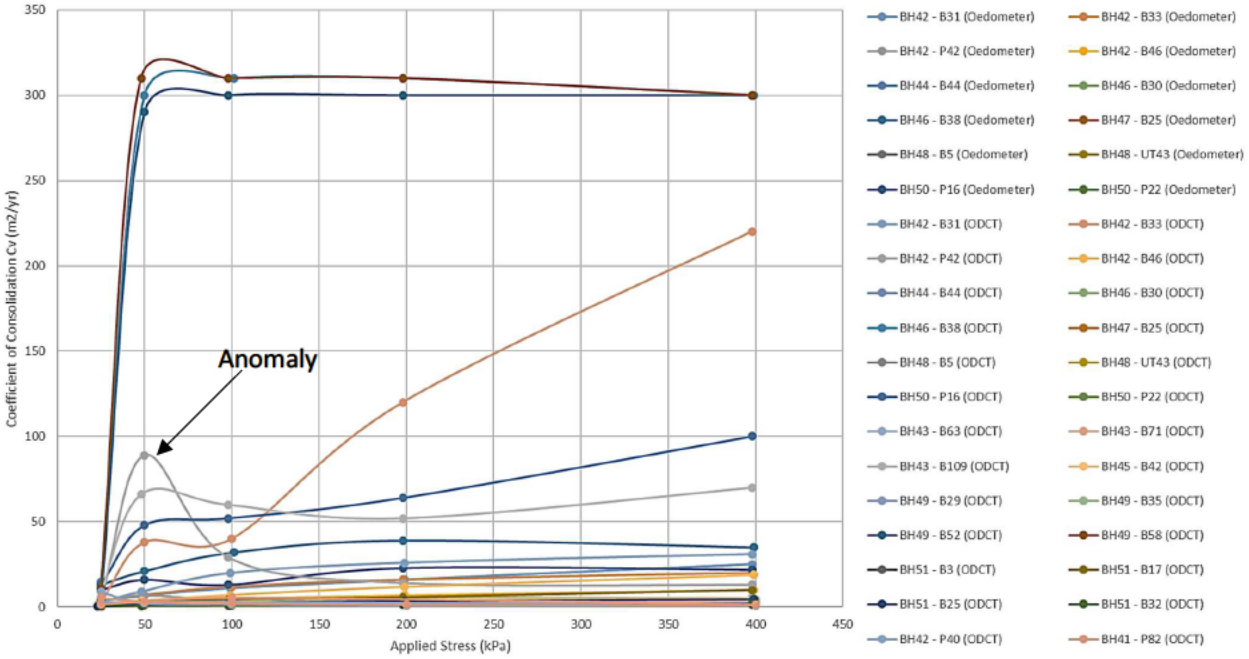


Figure 7-18 Consolidation coefficient, c_v against applied stress

In Figure 7-17 showing mv against applied stress – we note that there are a few anomalies in this plot, but they reflect the data as-received so it was concluded that they should be presented for completeness.

In Figure 7-18 showing c_v against applied stress – the values recorded range from a very high 300 m²/yr to more 'normal' values such as 0.2 to 60m²/yr. As the very high values appear to be unrealistic, we expect that these values would likely be eliminated in any settlement calculation. In addition, there remain some further anomalies in the plotted data in Figure 7-18 as highlighted. We expect that these anomalies have arisen from poor samples perhaps reacting poorly under direct test load and that they may also be treated with caution in any settlement calculation.

7.8 Settlement Analysis

For the settlement analysis, a representative value of m_v =0.5m^2/MN was taken from the dataset for the relative applied loading around 200kPa (which we assume is a reasonable characteristic value for the strata under investigation). It represents a construction bund and filling as per the reclamation area near the front of the quay.

Also, a lower and upper-value range of c_v =2 to 25m^2/yr was chosen from the more realistic data for the relative applied loading around 200kPa (which represents the bund and filling activity).

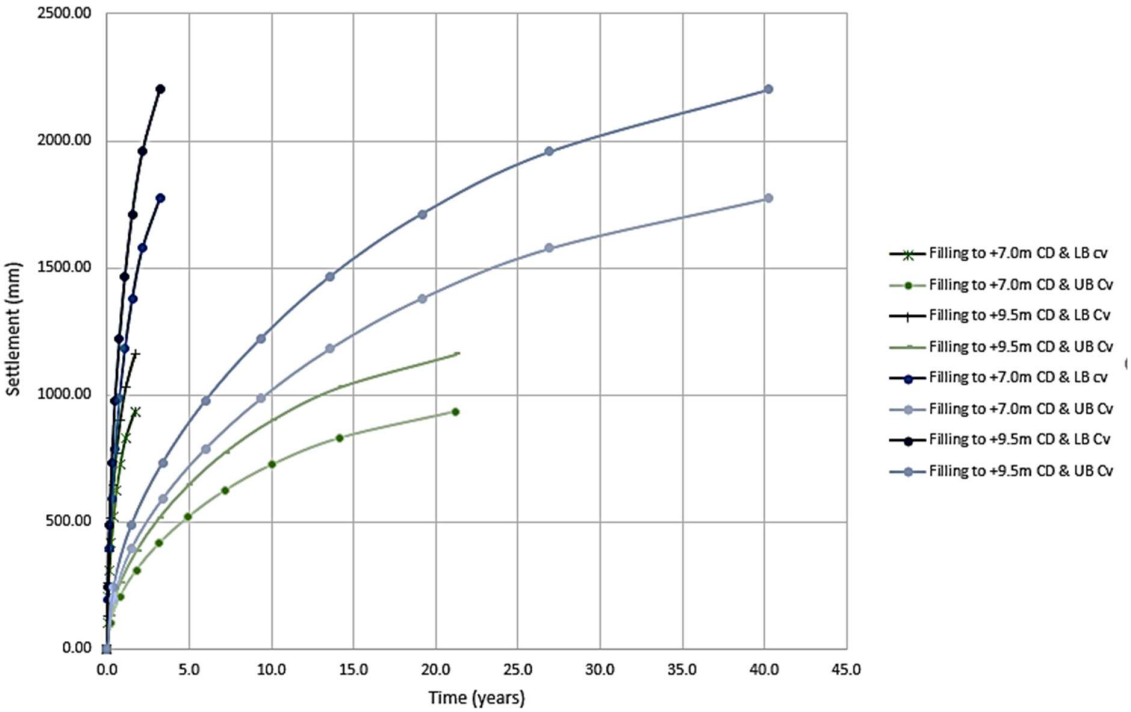


Figure 7-19 Settlement vs time

Figure 7-19 shows the range of calculated values for time for consolidation (T_{90}) and the magnitude of consolidation that might be expected for the following factors

- the varied thickness of strata encountered (taken as 10m and 19m as representative range)
- the range of upper and lower bound c_v adopted (labelled UB and LB)
- the option of filling to +7.0mCD or filling to +9.5mCD representing reclamation and a nominal surcharge respectively

The green lines show predicted consolidation for 10m of silty clay thickness and blue lines for 19m silty clay strata thickness to show the variability that the depth of strata can have on the analysis.

We might summarise this graph by taking a “centroidal” value at circa 1500mm consolidation over 8 years as shorthand for a *typical single value* of expected settlement.

7.9 Bulk Density

The bulk densities of the materials across the site are presented in Figure 7-20, where the values range from 1.47 to 2.45 Mg/m^3. It shows that the typical density of the material increases slightly with depth.

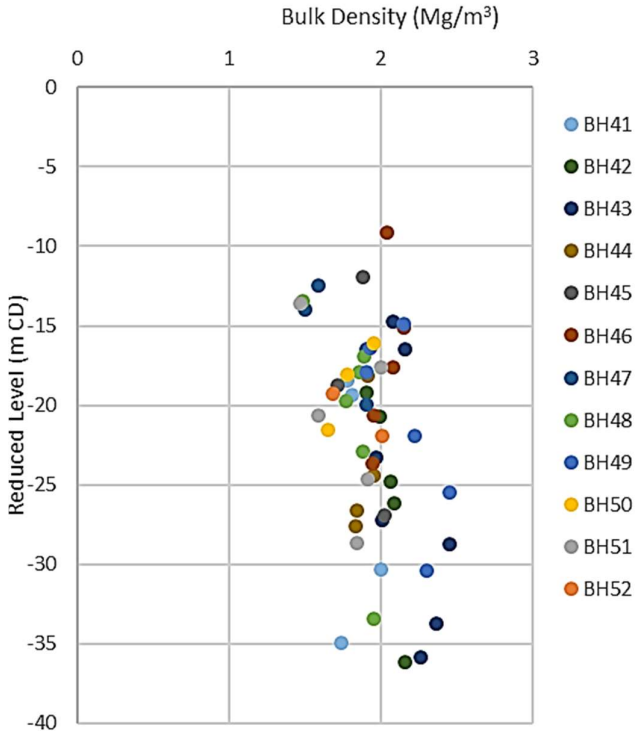


Figure 7-20 Bulk Density vs Elevation

7.10 Rock parameters

Point load and UCS tests were carried out to find the rock strength parameters which are presented in

Figure 7-21 and Figure 7-22. The fractures and discontinuities encountered were discussed in Section 6.2. A summary table of rock strength parameters are provided in Appendix A.

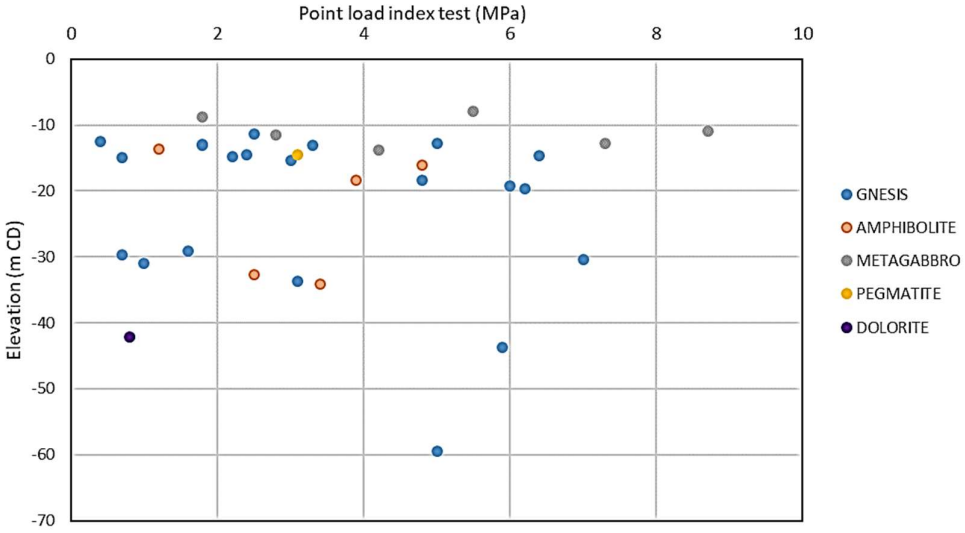


Figure 7-21 Point load index vs elevation

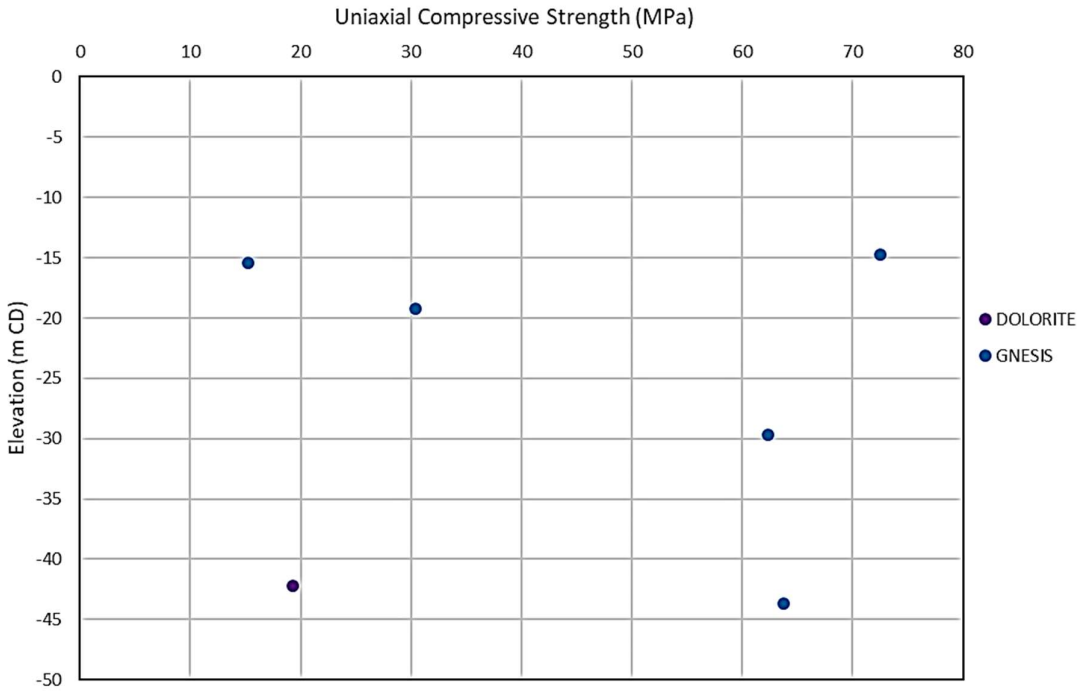


Figure 7-22 UCS vs elevation

A rippability assessment was carried out based on the fracture spacing index, point load and UCS for the site, which is presented in Figure 7-23. Variability in rock strength observed in strength tests reflects on this plot when combined with the fracture spacing index. The assessment shows that results lie in the range of hard digging to hard ripping. However, the majority of the data points suggest a toothed machine operation (hard ripping) is required when dealing with the bedrock. It is noted that

the points in the hard digging and easy digging categories are typically located in the upper layers of rock which reflects where the majority of the testing was carried out.

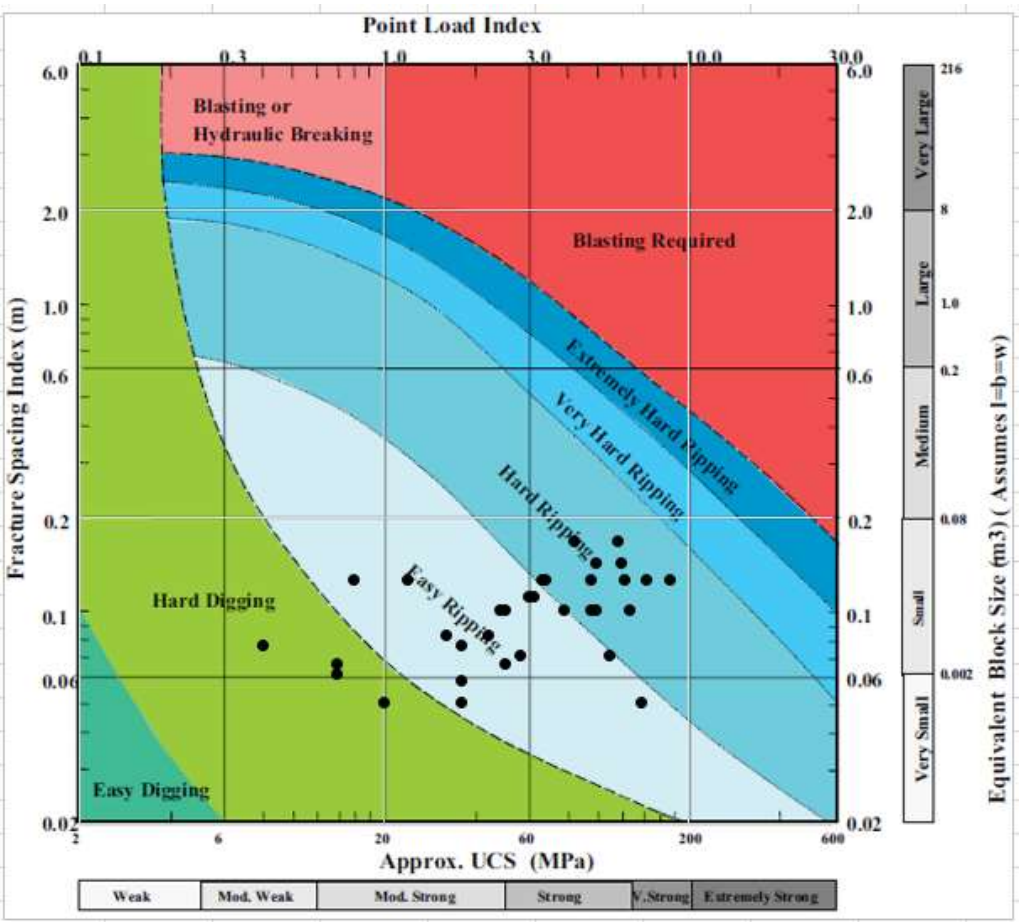


Figure 7-23 Rippability assessment for Bedrock

8 Summary of geotechnical soil parameters

A summary of the characteristic engineering classification, strength, consolidation and deformation parameters are provided in the Executive Summary at the start of this Report.

9 Geotechnical Risk Register

A Geotechnical Risk Register has been developed for the scheme based on the contents of this report and is presented in Table 9-1 Geotechnical Risk RegisterTable 9-1.

Table 9-1 Geotechnical Risk Register

Ref No.	Work element	Identified by:	Risk or opportunity (R or O)	Description	Management and Mitigation of Risk
1	Settlement	GDG	**R**	Fill heights and thickness of compressible material on site are known to vary.	Some initial settlement predictions have been provided in Section 7.8 of this report however a more detailed assessment is required in order to evaluate expected settlement in different areas. We would suggest that a 3-dimensional settlement design is carried out in in conjunction with the main marine civils design work.
2	Unforeseen ground conditions	GDG	**R**	Boreholes and other intrusive sampling provide an indication of ground conditions at precise locations. There is a risk that conditions change between sampling locations.	Account for ground variability in design by looking at sensitivity of both stratigraphy and potential changes to engineering parameters, particularly at critical areas.
3	Shallow obstructions (boulders present in layers)	GDG	**R**	Given that there is a known presence of granular materials on site, there exists a risk that cobbles or boulders may be present on site. The presence of boulders can provide pile drivability risks, including early	Detailed review of geohazards and pile drivability analysis to be completed, inclusive of all buckling checks.

Ref No.	Work element	Identified by:	Risk or opportunity (R or O)	Description	Management and Mitigation of Risk
				refusal and toe buckling.	
4	Variability of chosen engineering parameters	GDG	**R**	Resulting design outputs will be influenced by the choice of representative engineering parameters and as such these should be chosen conservatively.	The design work should be accompanied with appropriate sensitivity analyses in order to ascertain which parameters most heavily influence the design outputs. The parameters concluded upon should be characteristic for each strata.

10 Conclusions and recommendations

An assessment of engineering ground parameters for design has been made throughout this report and as part of a summary of parameters outlined in the Executive Summary. The assessment has been made primarily by the use of soil descriptions and the relationships between engineering parameters, the results of the in-situ SPT testing and also from the CPTU testing that was carried out on site.

We have found there to be no particular limitations in terms of coverage or the depths of boreholes undertaken.

Given the extent of compressible soils on the site there are particular risks relating to settlement that need to be considered in detail. An initial assessment has been provided in this report, but it is meant for guidance in terms of advancing a detailed 3-dimensional assessment at different areas of the site with varying thickness of compressible layers.

General design risks are also raised, in terms of the variability of engineering parameters and the need to carry out sensitivity analyses as part of the detailed design work.

11 References

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Guidance for The Sampling and Analysis of Sediment and Dredge material to be Submitted in Support of Applications for Sea Disposal of Dredged Material (2011)

12 APPENDIX A- Rock Core Analysis

Test Number	Borehole ID	Depth Top	Ground Level	Elevation (mCD)	TCR %	SCR %	RQD %	Unit Description
1	BH01	-49	-7.17	-56.17	63	35	35	BOULDER of GNEISS
2	BH01	-49.95	-7.17	-57.12	47	9		GNIESS
3	BH01	-51	-7.17	-58.17	29			GNEISS
4	BH01	-52.3	-7.17	-59.47	100	35	25	GNEISS
5	BH01	-53.3	-7.17	-60.47	98	32		GNEISS
6	BH02	-34.5	-7.05	-41.55	98	50	40	DOLORITE
7	BH02	-36	-7.05	-43.05	100	49	41	GNEISS
8	BH02	-37.5	-7.05	-44.55	100	100	100	GNEISS
9	BH06	-7.5	-7.61	-15.11	96	50	34	METAGABBRO
10	BH06	-10	-7.61	-17.61	98	32		GNEISS
11	BH06	-10.9	-7.61	-18.51	96	62	56	GNEISS
12	BH10	-3.9	-6.12	-10.02	93	13		METAGABBRO
13	BH10	-4.5	-6.12	-10.62	100	24	15	METAGABBRO
14	BH10	-6	-6.12	-12.12	100	42		GNEISS
15	BH10	-6.7	-6.12	-12.82	100	50	10	GNEISS
16	BH10	-7.8	-6.12	-13.92	91	48	10	GNEISS
17	BH11	-19.3	-10.23	-29.53	96	13		GNEISS
18	BH11	-20.8	-10.23	-31.03	100	16		GNEISS
19	BH11	-22.3	-10.23	-32.53	100	5		GNEISS
20	BH11	-23.8	-10.23	-34.03	100	2		GNEISS
21	BH14	-1.4	-5.44	-6.84	58	3		METAGABBRO
22	BH14	-2	-5.44	-7.44	52	3		METAGABBRO
23	BH14	-2.55	-5.44	-7.99	100	30		METAGABBRO
24	BH14	-3.75	-5.44	-9.19	98	5		METAGABBRO
25	BH14	-4.8	-5.44	-10.24	98	4		METAGABBRO
26	BH14	-5.8	-5.44	-11.24	48	19	13	METAGABBRO
27	BH15	-0.3	-9.83	-10.13	100	62	38	METAGABBRO
28	BH15	-1.7	-9.83	-11.53	100	60	33	METAGABBRO
29	BH15	-3.2	-9.83	-13.03	92	60	37	PEGMATITE
30	BH15	-3.9	-9.83	-13.73	100	22	18	METAGABBRO
31	BH15	-5.3	-9.83	-15.13	96	60	33	METAGABBRO
32	BH16	-3.4	-10.72	-14.12	100	30	16	PEGMATITE

33	BH16	-4.2	-10.72	-14.92	100	28	12	AMPHIBOLITE
34	BH16	-5.2	-10.72	-15.92	94	37	34	AMPHIBOLITE
35	BH16	-6.7	-10.72	-17.42	100	31	20	PEGMATITE
36	BH16	-7	-10.72	-17.72	100			AMPHIBOLITE
37	BH17	-3.8	-8.07	-11.87	98	60	40	GNEISS
38	BH17	-4.8	-8.07	-12.87	100			AMPHIBOLITE
39	BH18	-19.6	-9.47	-29.07	100	50	32	GNEISS
40	BH18	-21.2	-9.47	-30.67	93	48	32	AMPHIBOLITE
41	BH18	-22.7	-9.47	-32.17	100	86	41	AMPHIBOLITE
42	BH18	-24.2	-9.47	-33.67	100	68	58	AMPHIBOLITE/PEGMATITE
43	BH19	-6.7	-6.19	-12.89	98	26	24	GNEISS/METAGABBRO
44	BH19	-8	-6.19	-14.19	100	55	32	GNEISS
45	BH20	-6.3	-6.46	-12.76	55	27	26	GNEISS
46	BH20	-7.3	-6.46	-13.76	86	48	38	GNEISS
47	BH20	-8.55	-6.46	-15.01	100	77	74	GNEISS
48	BH21	-21.3	-6.76	-28.06	66	12		GNEISS
49	BH21	-22	-6.76	-28.76	80	17	13	GNEISS
50	BH21	-23.1	-6.76	-29.86	93	21		GNEISS
51	BH31	-6.6	-5.5	-12.1	84	15		GNEISS
52	BH31	-7.4	-5.5	-12.9	100	53	46	GNEISS
53	BH31	-8.9	-5.5	-14.4	60	25	19	GNEISS
54	BH32	-9	-7.8	-16.8	98	16		GNEISS
55	BH32	-9.9	-7.8	-17.7	100	40	22	GNEISS
56	BH32	-11.5	-7.8	-19.3	100	47	26	GNIESS

Rock strength parameters summary table for the figures provided in section 7.1

							Point Load Strength Index			
Borehole ID	Ground Level (mCD)	Elevation Top (mCD)	Elev Base (mCD)	FI	Fracture Spacing Index (m)	UCS	*Is (Mpa)*	*Is50 (Mpa)*	Test Elevation (mCD)	Unit Description
BH01	-7.17	-59.47	-53.8	10	0.10		3.7	5	-59.47	GNESIS
BH02	-7.05	-42.15	-36.15	8	0.13	19.3	0.6	0.8	-42.2	DOLORITE
BH02	-7.05	-43.2	-37.5	6	0.17	63.7	4.3	5.9	-43.65	GNESIS
BH06	-7.61	-15.11	-8.5	9	0.11	15.2	2.7	3	-15.41	GNESIS
BH06	-7.61	-18.61	-12.4	7	0.14	30.4	4.4	6	-19.26	GNESIS
BH10	-6.12	-10.62	-6	15	0.07		1.9	2.5	-11.32	GNESIS
BH10	-6.12	-12.12	-7.4	13	0.08		0.3	0.4	-12.52	GNESIS
BH10	-6.12	-14.37	-9	10	0.10		1.8	2.4	-14.52	GNESIS
BH11	-10.23	-29.53	-20.8	20	0.05		5.5	7	-30.43	GNESIS
BH11	-10.23	-31.03	-22.3	20	0.05		0.8	1	-31.03	GNESIS
BH14	-5.44	-6.84	-2.55	14	0.07		4.8	5.5	-7.94	METAGABBRO
BH14	-5.44	-8.29	-3.75	17	0.06		1.4	1.8	-8.79	METAGABBRO
BH14	-5.44	-11.24	-6.3	14	0.07		2.2	2.8	-11.54	METAGABBRO
BH15	-9.83	-10.03	-1.7	8	0.13		7.4	8.7	-10.93	METAGABBRO
BH15	-9.83	-11.83	-3.2	8	0.13		6.4	7.3	-12.73	METAGABBRO
BH15	-9.83	-13.73	-6.8	6	0.17		3.3	4.2	-13.73	METAGABBRO
BH16	-10.72	-14.12	-4.4	9	0.11		2.3	3.1	-14.52	AMPHIBOLITE
BH16	-10.72	-15.92	-5.7	10	0.10		3.8	4.8	-16.07	PEGMATITE
BH16	-10.72	-17.92	-8.5	10	0.10		2.8	3.9	-18.42	AMPHIBOLITE
BH17	-8.07	-12.37	-4.8	7	0.14		3.7	5	-12.72	AMPHIBOLITE
BH17	-8.07	-12.87	-5.8	8	0.13		0.9	1.2	-13.67	GNESIS
BH18	-9.47	-29.37	-20.5	15	0.07		0.5	0.7	-29.67	AMPHIBOLITE
BH18	-9.47	-31.67	-23.3	10	0.10	62.3	2	2.5	-32.72	GNESIS
BH18	-9.47	-33.77	-24.7	8	0.13		2.7	3.4	-34.07	AMPHIBOLITE
BH19	-6.19	-13.09	-7.05	20	0.05		1.3	1.8	-13.09	GNESIS
BH19	-6.19	-14.49	-9.1	16	0.06		0.5	0.7	-14.99	GNESIS
BH20	-6.46	-12.76	-7.95	10	0.10		4.7	6.4	-12.96	GNESIS
BH20	-6.46	-14.71	-8.55	13	0.08	72.5	1.4	1.8	-14.71	GNESIS
BH21	-6.76	-28.66	-22.4	12	0.08		1.3	1.6	-29.11	GNESIS
BH31	-5.5	-12.1	-8.3	8	0.13		2.7	3.3	-13.05	GNESIS
BH31	-5.5	-14.3	-9.6	12	0.08	56	1.8	2.2	-14.8	GNESIS
BH32	-7.8	-18.2	-12.5	8	0.13		3.5	4.8	-18.4	GNESIS
BH32	-7.8	-18.2	-12.5	8	0.13		5.1	6.2	-19.6	GNESIS

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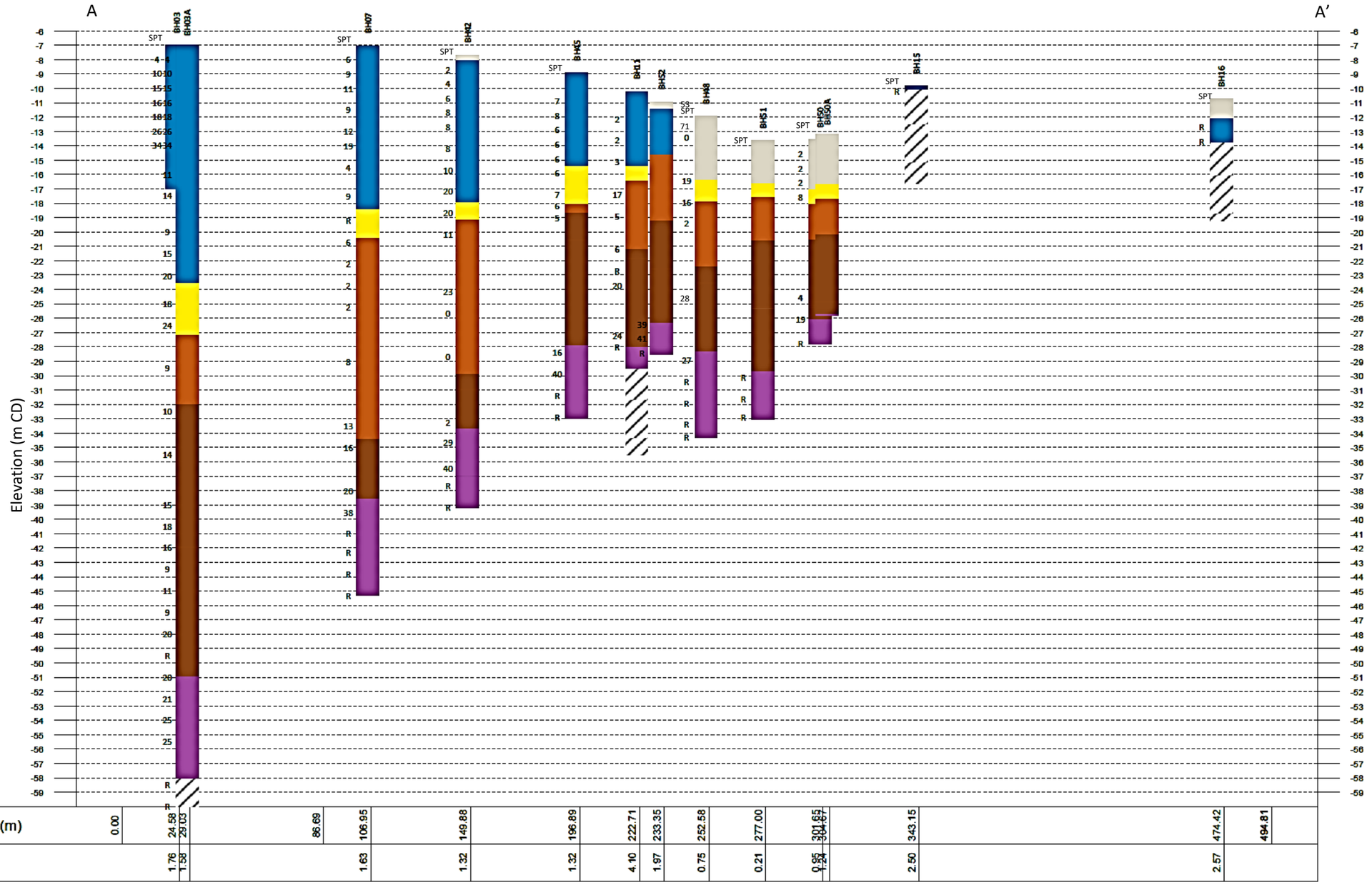
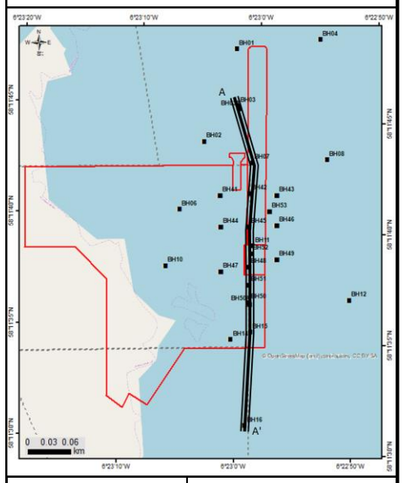
13 APPENDIX B- Geological Cross Sections

Geological Cross Section A - A’



Stornoway Deepwater Berth



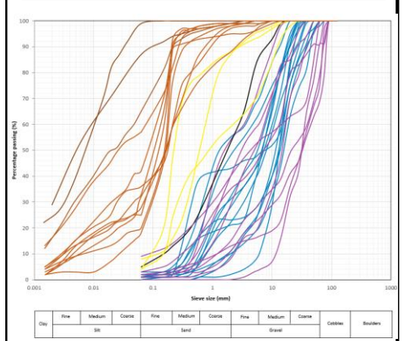
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Soft CLAY
- Sandy GRAVEL-upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL-lower
- Bedrock

SPT - R: => 50

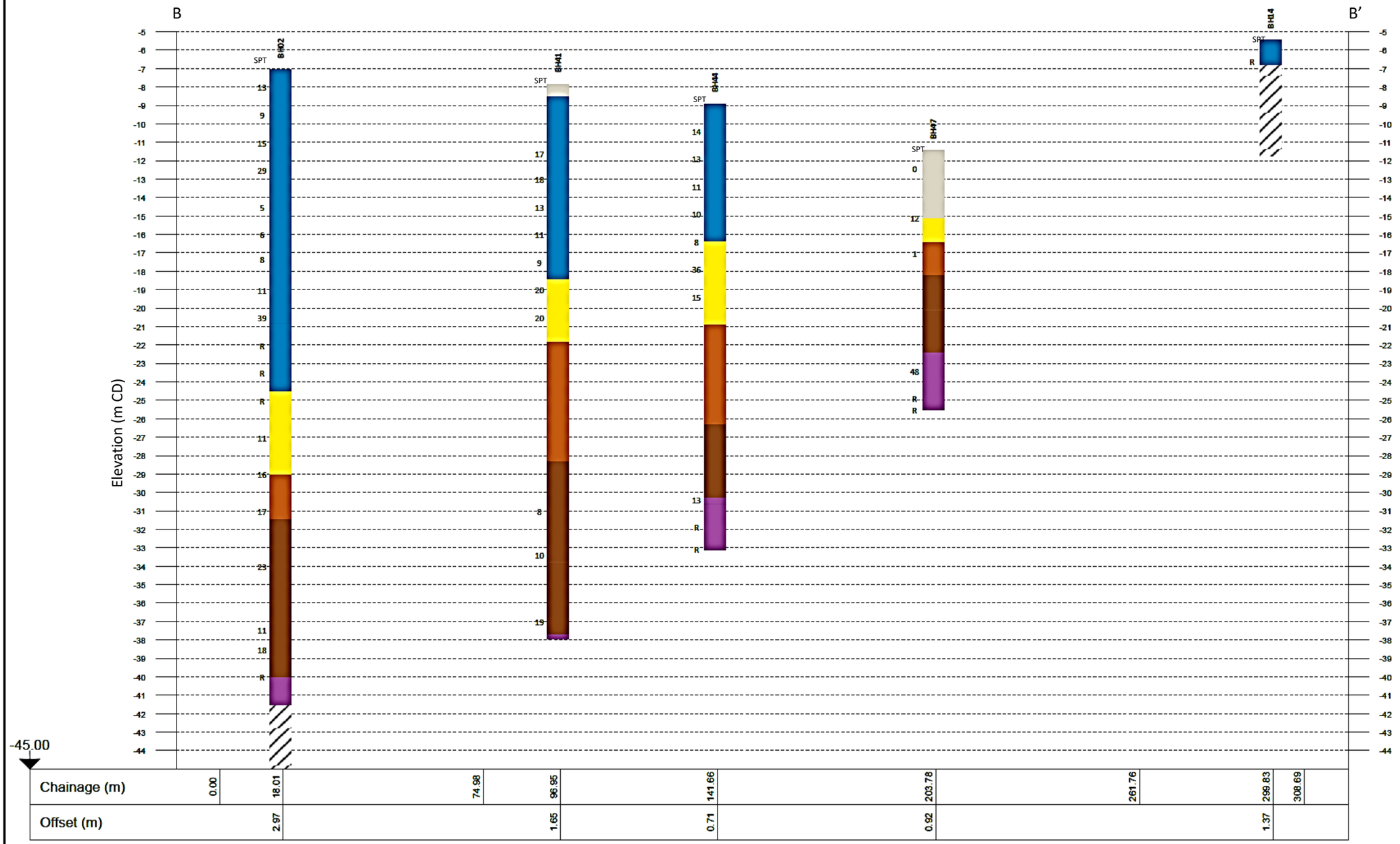
Particle Size Distribution (PSD) graph



GDG GAVIN & DOHERTY GEOSOLUTIONS

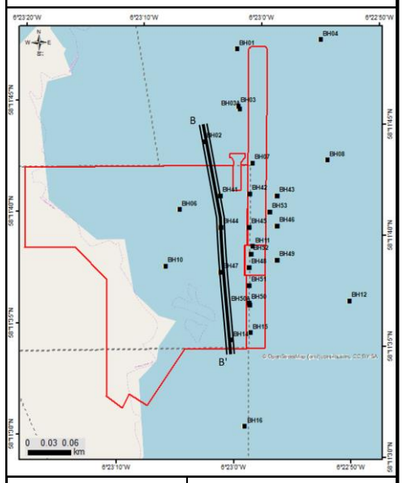
Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Geological Cross Section B - B’



Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Stornoway Deepwater Berth



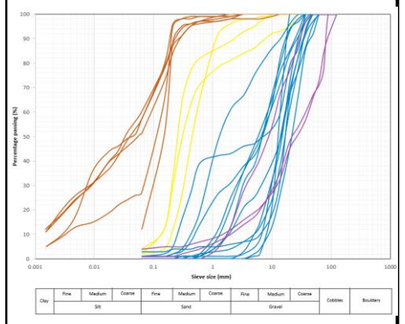
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Soft CLAY
- Sandy GRAVEL- upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL- lower
- Bedrock

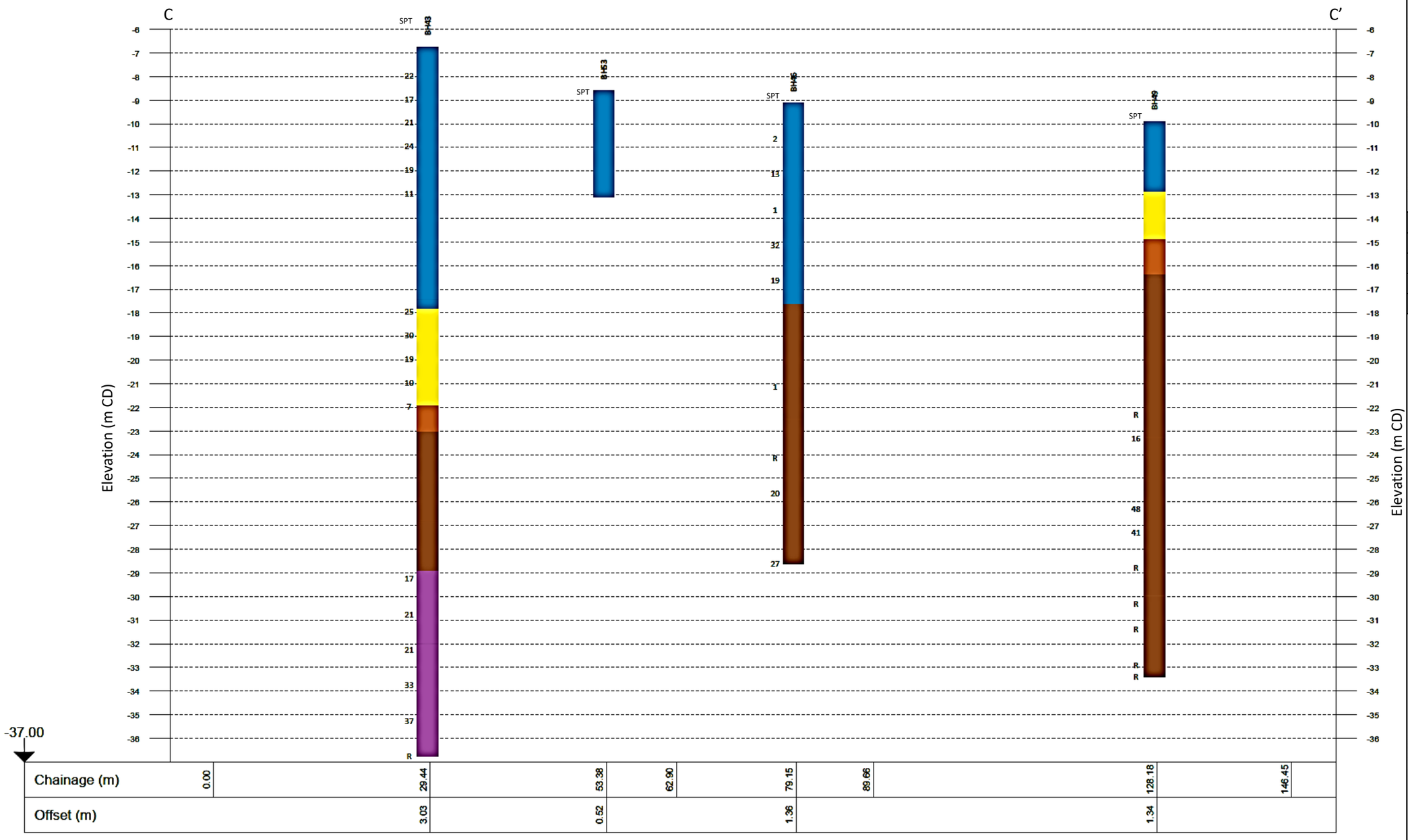
SPT - R: => 50

Particle Size Distribution (PSD) graph

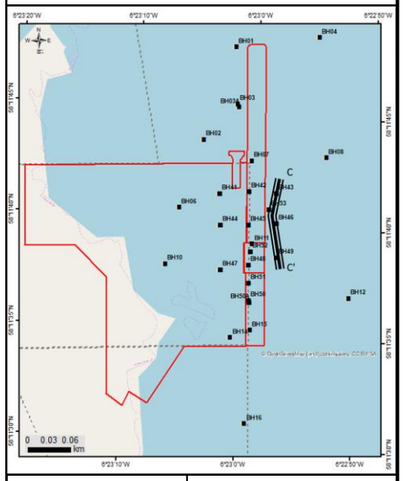


GDG GAVIN & DOHERTY GEOSOLUTIONS

Geological Cross Section C - C’



Stornoway Deepwater Berth



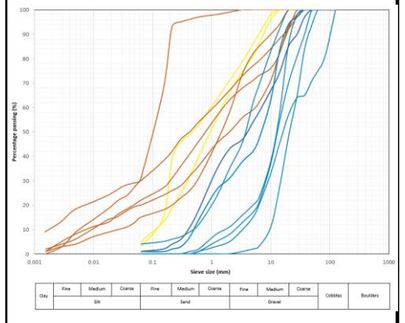
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Sandy GRAVEL- upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL- lower

SPT - R: => 50

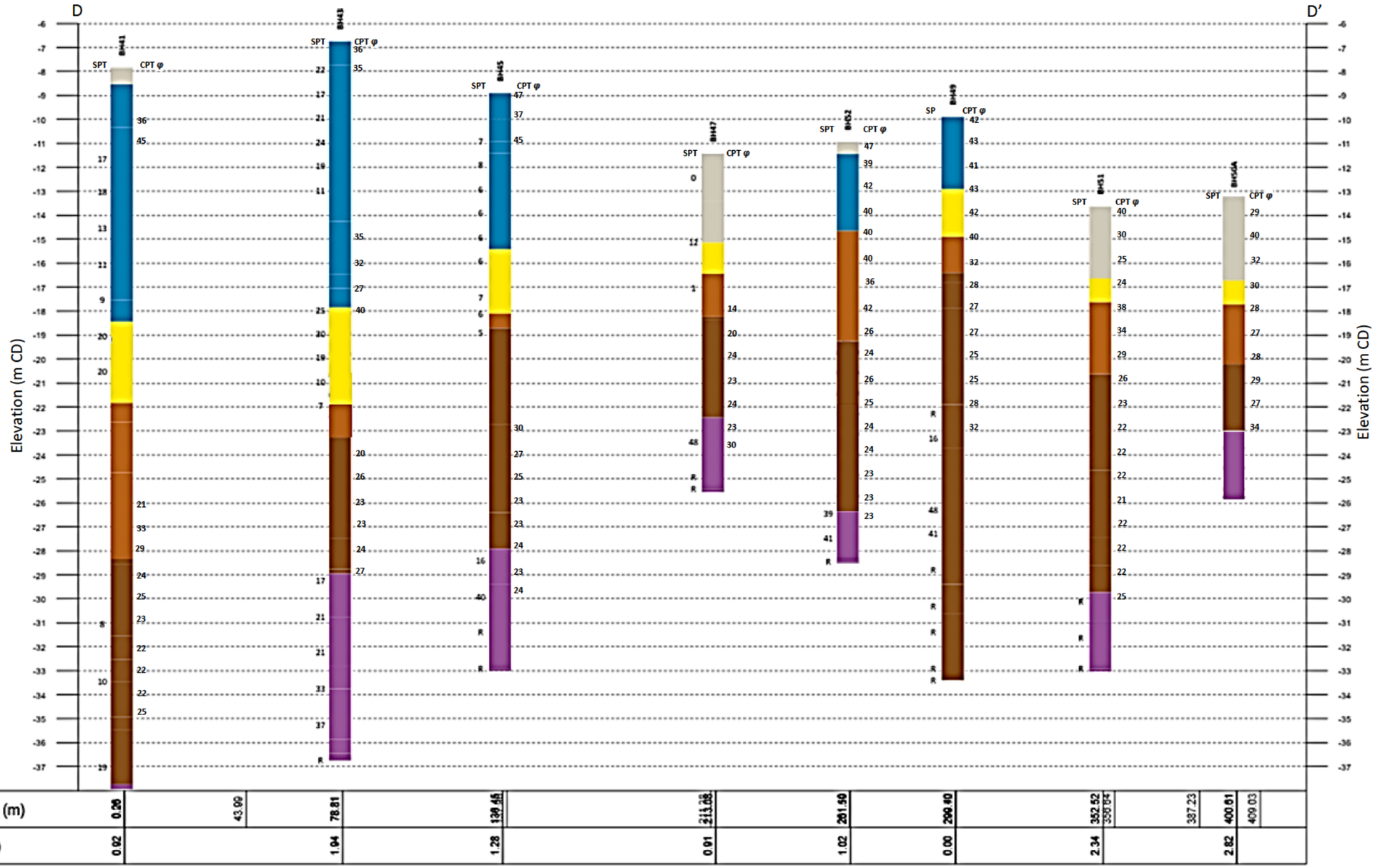
Particle Size Distribution (PSD) graph



GDG GAVIN & DOHERTY GEOSOLUTIONS

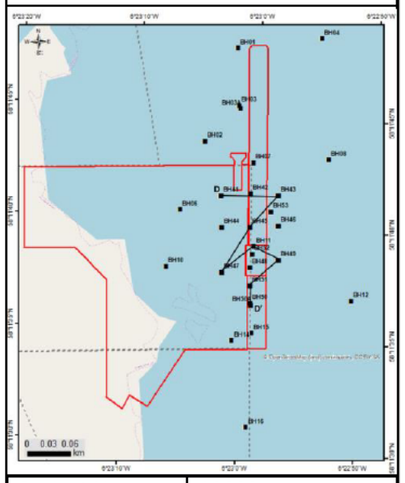
Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Geological Cross Section D - D’



Note: Strata shown indicative only, lenses of mixed & intervening materials are often found. CPT friction angle are true average only.

Stornoway Deepwater Berth



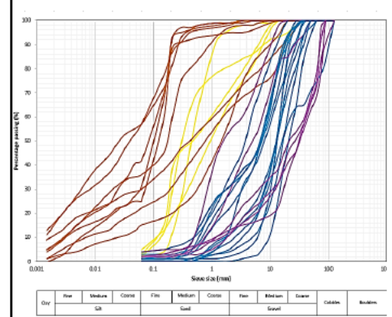
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Soft CLAY
- Sandy GRAVEL- upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL- lower
- Bedrock

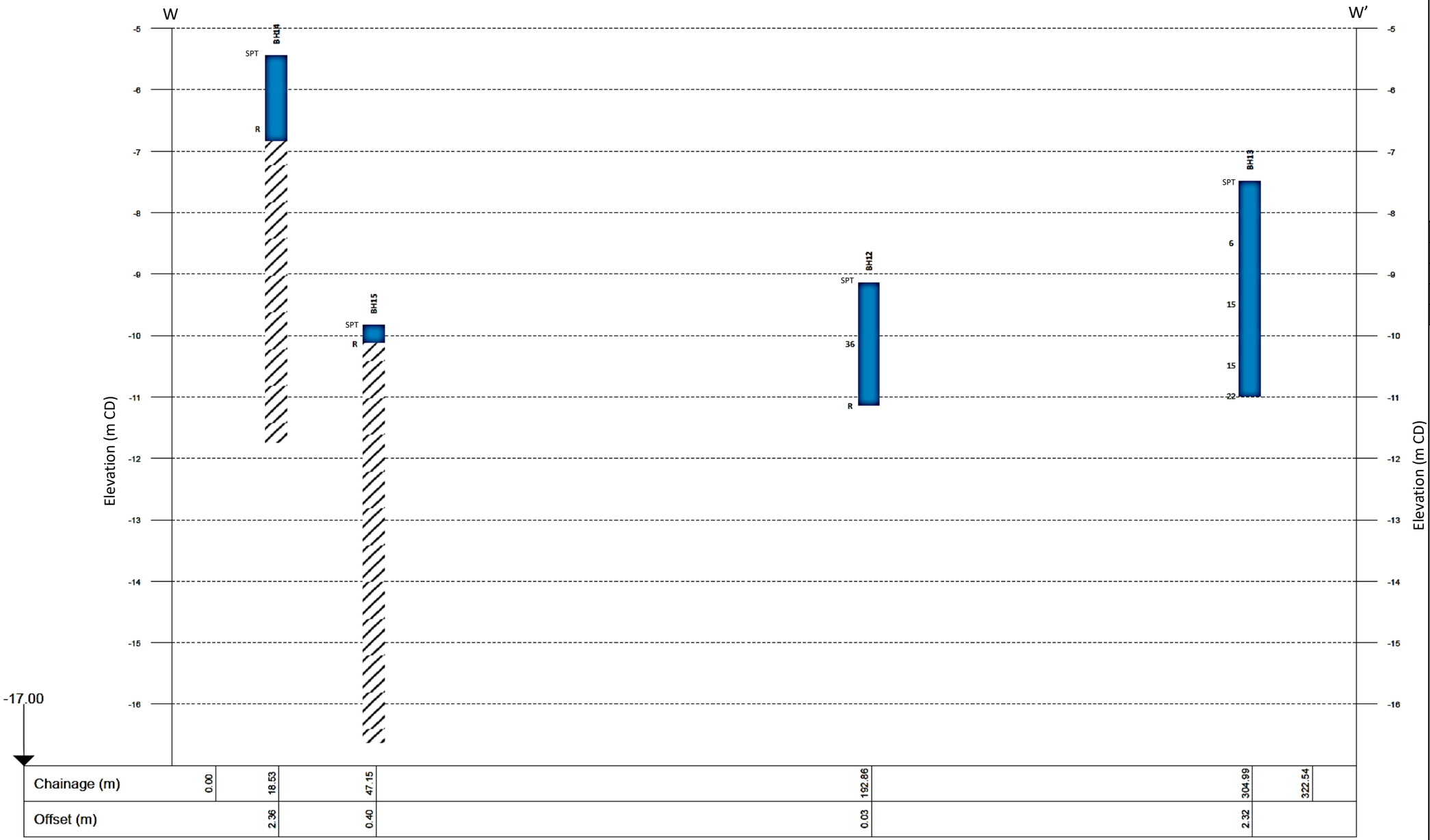
SPT - R: => 50

Particle Size Distribution (PSD) graph



GDG GAVIN & DOHERTY GEOSOLUTIONS

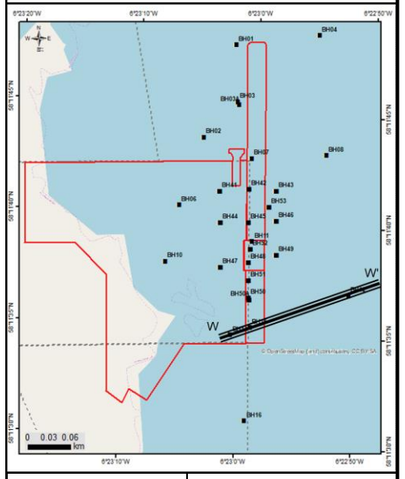
Geological Cross Section W - W'



Chainage (m)	0.00	18.53	47.15	192.86	304.99	322.54
Offset (m)		2.36	0.40	0.03	2.32	

Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Stornoway Deepwater Berth



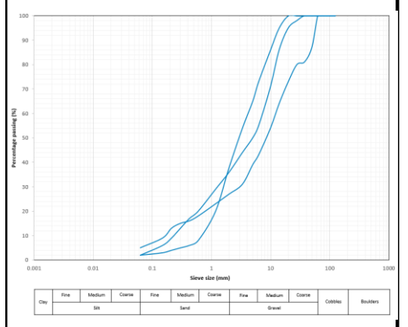
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Sandy GRAVEL-upper
- Bedrock

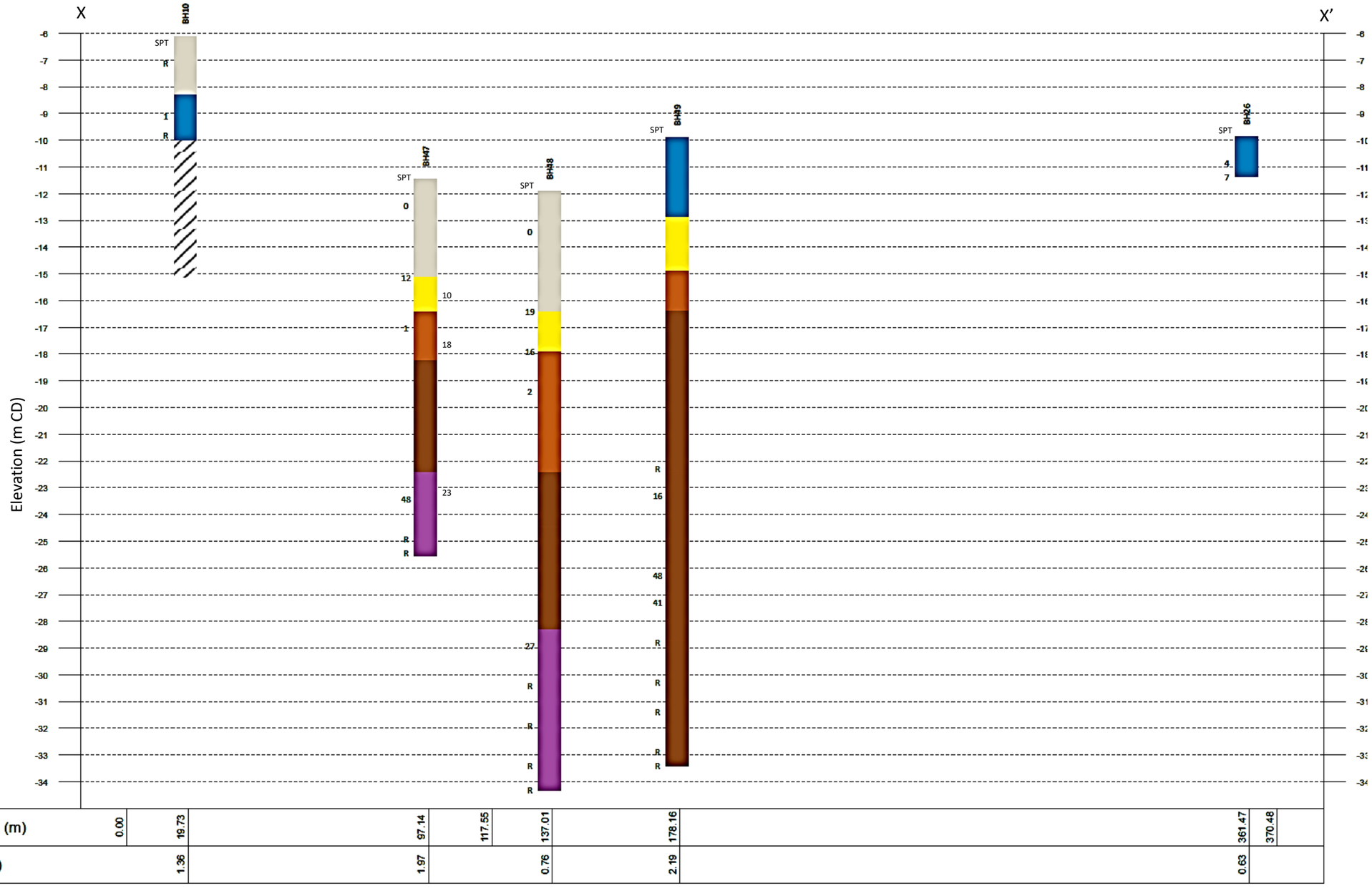
SPT - R: => 50

Particle Size Distribution (PSD) graph



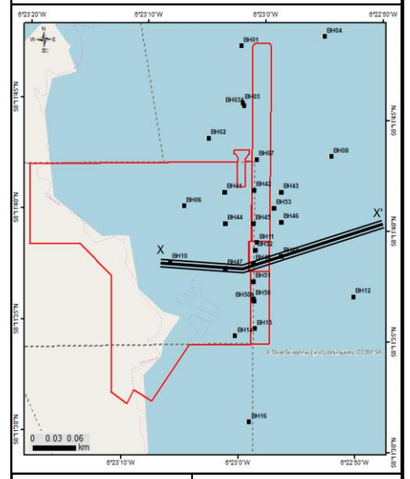
GDG GAVIN & DOHERTY GEOSOLUTIONS

Geological Cross Section X - X’



Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Stornoway Deepwater Berth



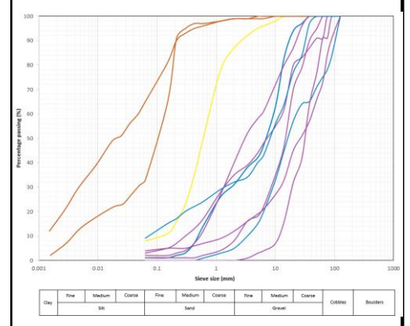
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Soft CLAY
- Sandy GRAVEL- upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL- lower
- Bedrock

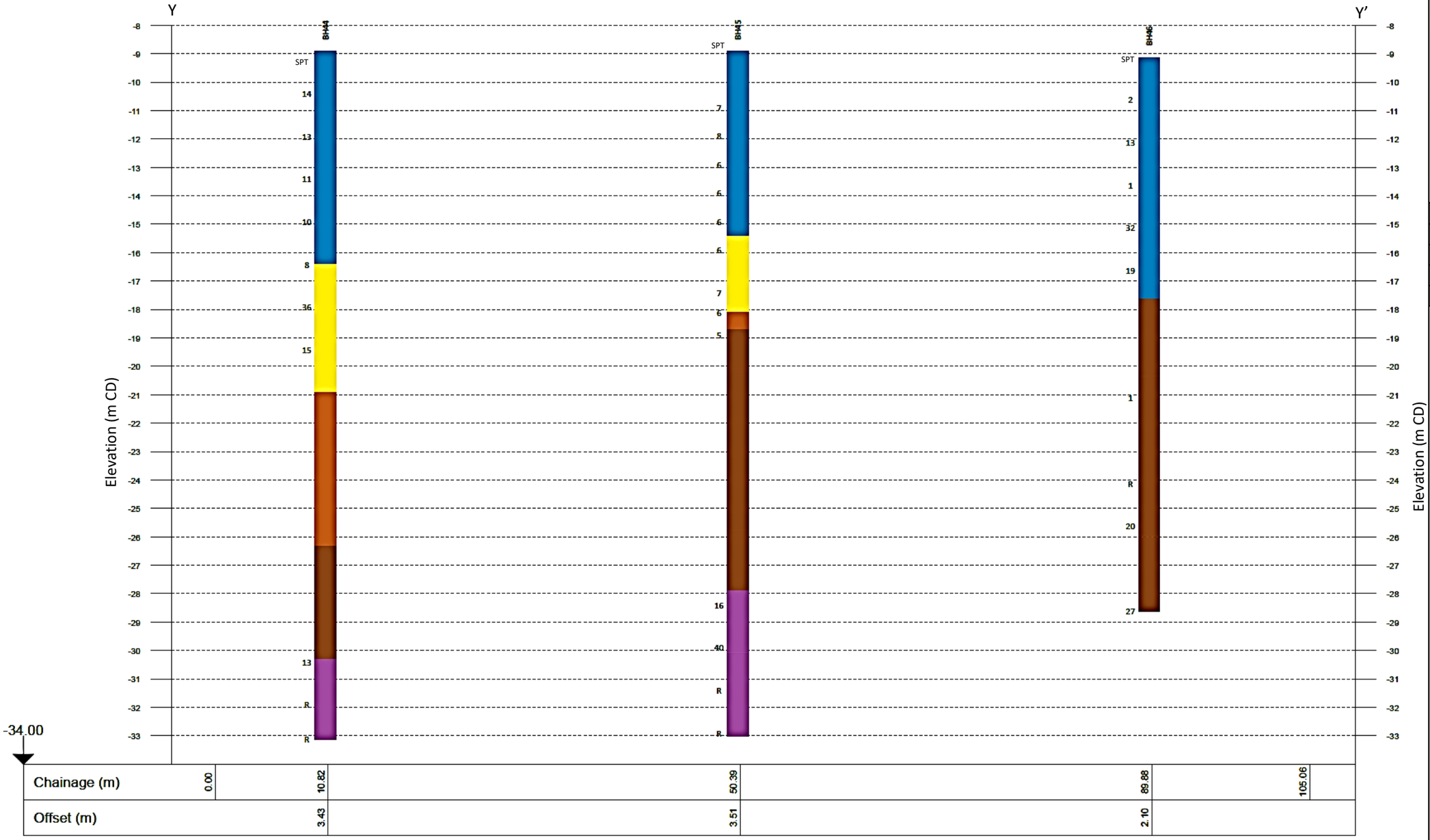
SPT - R: => 50

Particle Size Distribution (PSD) graph



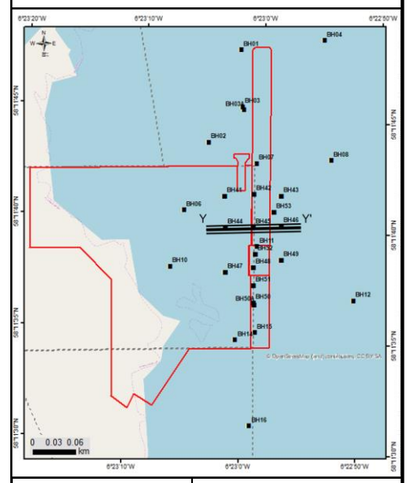
GDG GAVIN & DOHERTY GEOSOLUTIONS

Geological Cross Section Y - Y’



Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Stornoway Deepwater Berth



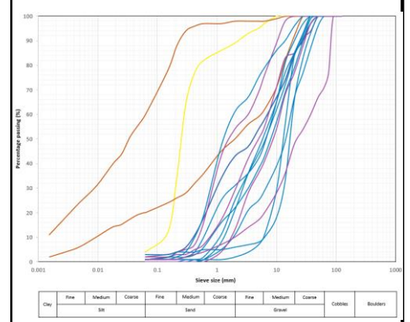
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Sandy GRAVEL-upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL-lower

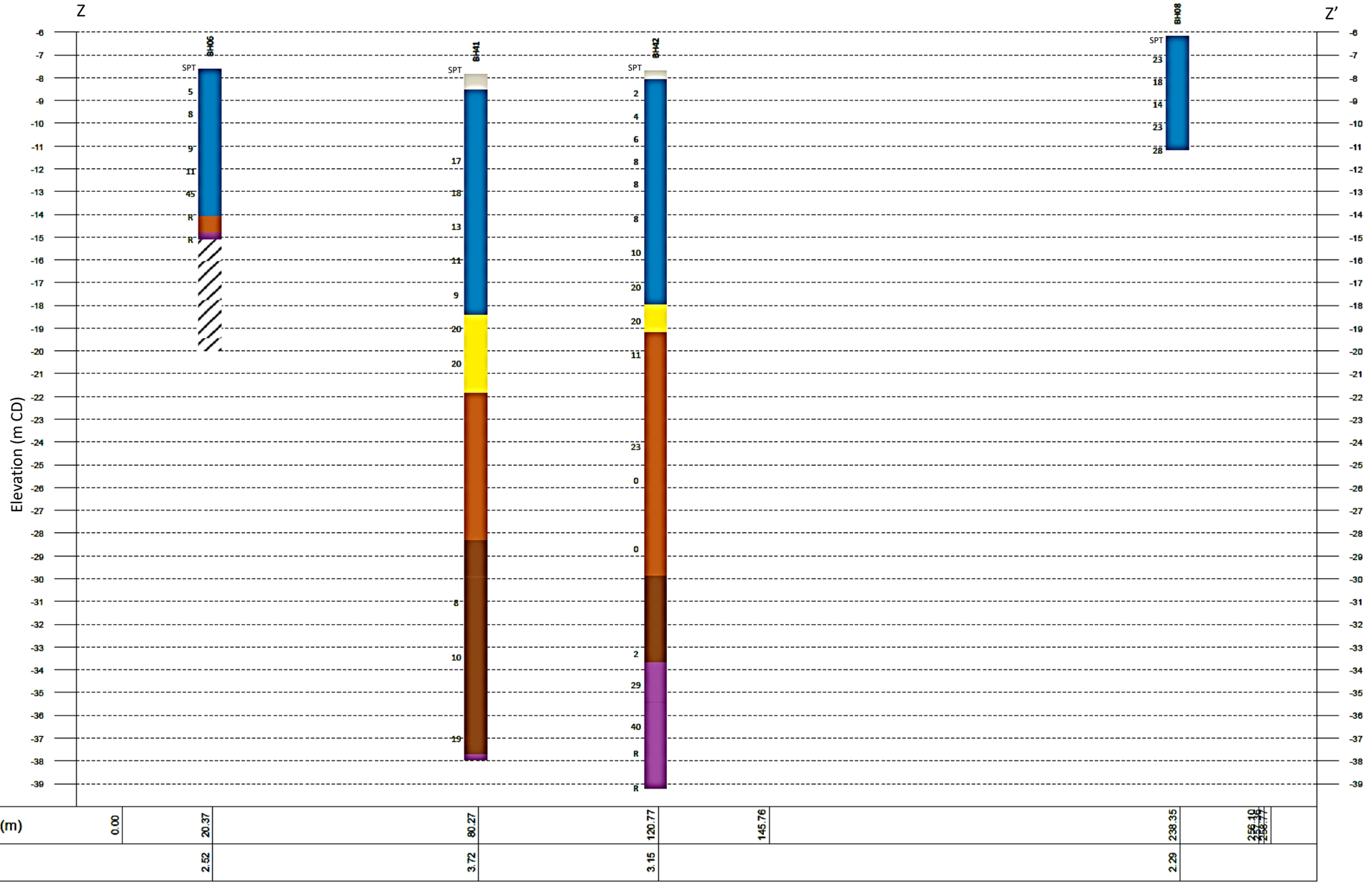
SPT - R: => 50

Particle Size Distribution (PSD) graph



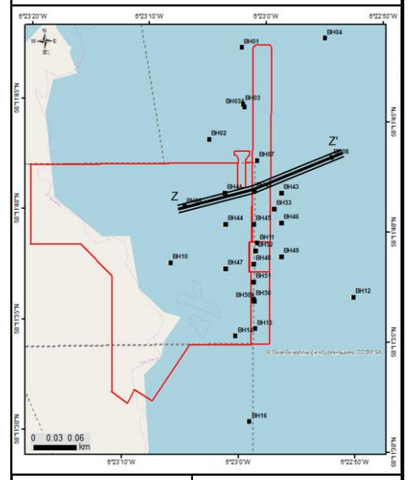
GDG GAVIN & DOHERTY GEOSOLUTIONS

Geological Cross Section Z - Z’



Note: Strata shown indicative only, lenses of mixed & intervening materials are often found.

Stornoway Deepwater Berth



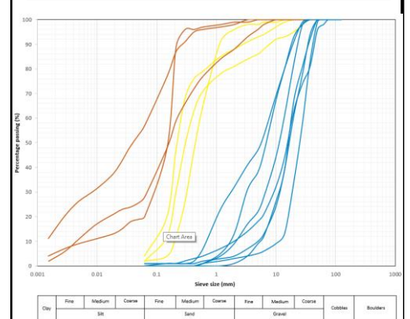
Project No.	19023
Location	Scotland
Client	Wallace Stone
Date	07/11/2019
Status	FINAL

Legend Key

- Soft CLAY
- Sandy GRAVEL- upper
- SAND
- Silty SAND
- clayey SILT
- Sandy GRAVEL- lower
- Bedrock

SPT - R: => 50

Particle Size Distribution (PSD) graph



GDG GAVIN & DOHERTY GEOSOLUTIONS

14 APPENDIX C - Factual Reports

Stornoway Deep Water Berth – Ground Investigation

INTERPRETATIVE REPORT

Client:	Stornoway Port Authority
Client's Representative:	Wallace Stone Consulting Civil Engineers
Report No.:	17-0769a Interpretative
Date:	27 April 2018
Status:	*Final for Issue*

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Appendix C	Core photographs
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Appendix E	Dredge analysis laboratory test results
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Document Control Sheet

Report No.:		17-0769a			
Project Title:		Stornoway Deep Water Berth – Ground Investigation INTERPRETATIVE REPORT			
Client:		Stornoway Port Authority			
Client's Representative:		Wallace Stone Consulting Civil Engineers			
Revision:	A01	**Status:**	Final for issue	**Issue Date:**	27 April 2018
Prepared by:		**Reviewed by:**		**Approved by:**	
[redacted] Lucy Newland BSc (Hons)		[redacted] Neil Haggan BSc(Hons) MSc FGS		[redacted] Darren O'Mahony BSc MSc MIEI	

The works were conducted in accordance with:

UK Specification for Ground Investigation 2nd Edition, published by ICE Publishing (2012)

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377-2:1990, BS EN ISO 17892-1:2014, and BS EN ISO 17892-2:2014

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
Abbreviations relating to rock core – reference Clause 44.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.

Stornoway Deep Water Berth

1 AUTHORITY

On the instructions of Wallace Stone Consulting Civil Engineers, ("the Client's Representative"), acting on the behalf of Stornoway Port Authority ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical information for input to the design and construction of a proposed new Deep Water Berth structure and associated soft sediment dredging programme.

This report details the work carried out both on site and in the geotechnical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included marine boreholes, soil sampling, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted around the location of Arnish Pier across the bay from Stornoway Harbour.

The boreholes were put down at given locations within Glumaig bay to the north west of Arnish point.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 28th November 2017 and 12th February 2018, comprised:

- Thirty-Three marine light cable percussion boreholes
- Seventeen marine boreholes with rotary follow-on
- Soil and rock core sampling
- In-situ testing of soils
- Sediment samples for Marine Scotland Dredge Analysis

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Marine Plant

The OCM80 jack-up barge was deployed for the duration of the site works. OCM80 is a Combi-float C5 modular jack-up barge in a ten-pontoon configuration joined and secured with a simple pinning system. The jack-up barge sits on four 28m spudded legs with associated hydraulic rams and can be operated in both spudded (floating) or jack-up modes.

The barge was contracted and operated through Ocean Crest Marine for the duration of the site works. Boreholes were sunk through an integral moonpool through one of the pontoons which make up the main deck of the jack-up barge.

Ocean Crest Marine also provided the marine support vessels OCM Supporter and OCM Fortess to assist with crew transfers and barge movements respectively.

4.3 Boreholes

4.3.1 Light cable percussion boreholes

Sixteen No boreholes (BH03-BH05, BH08, BH09, and BH22-BH30) were put down to completion in minimum 200mm diameter using one Dando 3000 light cable percussion boring rig. All boreholes were terminated either at their scheduled completion depths, or else on encountering virtual refusal on obstructions, including large boulders and weathered bedrock

Disturbed (bulk and small bag) samples were taken within the encountered strata. Undisturbed (UT100

and U100) samples were taken where appropriate and as directed within cohesive soils. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix H.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.3.2 Boreholes by combined percussion boring and rotary follow-on drilling

Seventeen boreholes (BH01-BH03A, BH06, BH07, BH10, BH11, BH14-BH21, BH31, and BH32) were put down by a combination of light cable percussion boring and rotary follow-on drilling techniques with core recovery in bedrock. Where the cable percussion borehole had not been advanced onto bedrock, rotary coring methods were employed to advance the borehole to completion/bedrock.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals throughout the overburden using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix H.

The core was extracted in up to 1.5m lengths using a SK6L GeoborS core barrel, which produced core of nominal 103mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.4 Surveying

The as-built exploratory hole positions were surveyed throughout the project by the Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R8S GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (UK National Grid) and ground elevation (mCD) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **shear strength** (total stress): unconsolidated undrained triaxial tests
- **direct shear:** shear box tests
- **soil chemistry:** pH, water-soluble sulphate, and organic matter content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.*

The test results are presented in Appendix D.

5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index
- unconfined compressive strength (UCS) tests

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60

Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix D.

5.3 Marine Scotland Analysis – Pre-Disposal Dredge Sampling

In addition to geotechnical testing conducted on soils, environmental samples were selected at standard intervals for chemical testing relating to disposal at sea parameters.

Sampling was carried out in accordance with Marine Scotland's "Guidance for The Sampling and Analysis of Sediment and Dredge material to be Submitted in Support of Applications for Sea Disposal of Dredged Material" 2011.

All 15 sample locations extend to -10.5m CD with sample intervals as required by the above document. Two samples were recovered at each location and depth for separate testing of (a) Metals and particle size and (b) Organic carbon and organic chemicals.

Testing was conducted to determine chemical concentrations to allow assessment of disposal of dredged material at sea.

The dredge analysis test results are included in Appendix E; a summary table showing the Marine Scotland Pre-disposal Sampling Guidance Action Levels has also been included before the RPS lab results.

5.4 Environmental laboratory testing of soils

In addition, environmental testing, was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for a range of determinants, including:

- Metals
- Tributyl Tin (TBT)
- Total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- PCB (7 congeners)

Waste acceptance criteria (WAC) testing was carried out on four samples.

Results of the environmental laboratory testing are presented in Appendix F.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Quaternary soft sediments overlying glacial till and sands and gravels. These deposits are underlain by metamorphic rocks of both the Lewisian Gneiss complex and the Outer Hebrides Thrust Zone Mylonite complex; some intrusive igneous features are also shown in the area associated with the thrust complex.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Recent deposits:** Very soft organic silts and sands were found on the seabed in a large number of the dredge area boreholes; found to a maximum depth of 12.00mbgl in BH18.
- **Marine sands and gravel deposits:** Typically loose to medium dense sands and gravels with low to medium cobble content; occasionally with localised pockets of firm sandy gravelly silts/clays throughout. Where encountered at depth tend to be dense to very dense.
- **Glacial Till:** Sandy gravelly silty clay, frequently with low to medium cobble content, typically firm to stiff in upper horizons, becoming stiff to very stiff with increasing depth.
- **Bedrock (gneiss, metagabbro, amphibolite, dolerite, and pegmatite):** Rockhead was encountered at depths ranging from 0.30mbgl (-10.13mCD) in BH15 to a maximum depth of 51.10mbgl (-58.09mCD) in borehole BH03A.

Representative geological long sections showing the rockhead profile along the line of the proposed new Deep Water Berth Structures are provided in Appendix G.

6.3 Groundwater

Groundwater was not noted during drilling at any of the borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any groundwater strikes encountered and the possibility of encountering groundwater during excavation works should not be ruled out. Seasonal variation in groundwater levels should also be factored into design considerations.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

7 DISCUSSION

7.1 Proposed construction

It is proposed to construct a new Deep Water Berth Facility within Glumaig Bay near Arnish Point.

The works for the Deep Water Facility will include:

- New Quay wall construction - large diameter combi-wall retaining wall (3 Phases)
- Reclamation area to create a laydown area (2 Phases)
- Heavy lift platform - piled reinforced concrete slab
- Linkspan for freight ferry to include dolphins and bankseat – all piled foundations

Limited information has been provided at this stage and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Proposed New Quay Wall

7.2.1.1 Piled Foundations

The ground conditions along the lines of the proposed new quay walls are highly variable; marine beach deposits, with some deep occurrences of glacial till material, and an irregular rockhead level. This will render the implementation of any shallow design solution problematic. Based on the proposals it follows that a piled solution may be used to transfer the loadings to depth.

The ultimate effective angle of shearing resistance, Φ', as determined by the small shear box tests in the geotechnical laboratory on representative samples of soils encountered, was found to be in the order of 35-40 degrees. The effective cohesion, c', unless obtained through shear box testing, should be taken as zero given the prevalence of coarse grained soils interbedded with cohesive strata throughout.

7.2.1.1.1 Phase 1 Quay Wall works

Potential founding strata are as follows; this will be confirmed by the specialist piling contractor:

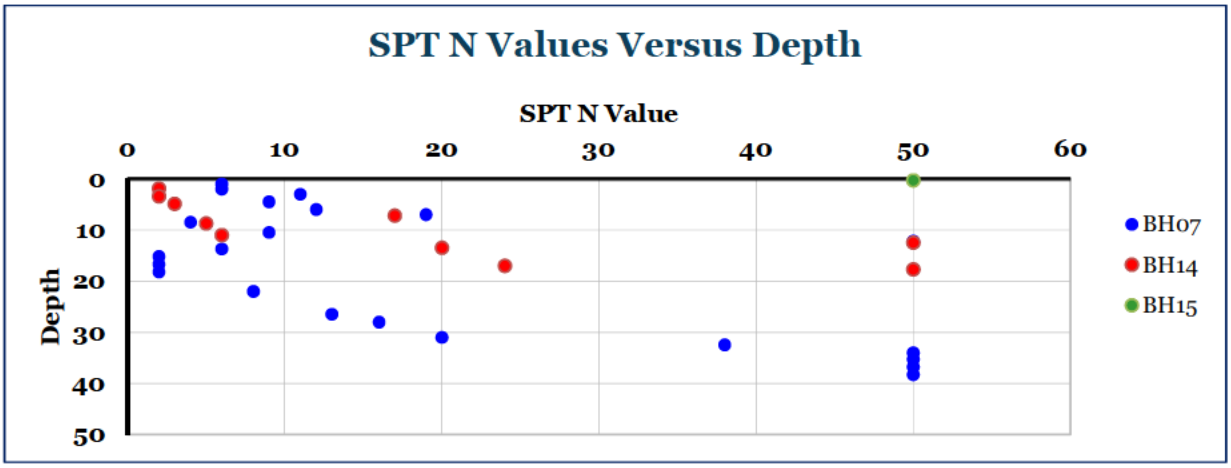
- BH07: Dense to very dense sandy Gravel; encountered at 31.60mbgl (-38.62mCD). No bedrock was encountered in BH07; completion depth was 38.30mbgl (-45.32mCD).
- BH11: Strong to very strong Gneiss encountered at 19.30mbgl (-29.53mCD).
- BH15: Very strong Metagabbro encountered at 0.30mbgl (-10.13mCD).

Table 1a: Ground parameters for bearing piles derived from in-situ testing and laboratory results

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH07 (P1)	5.00	Loose to Med Dense sandy Gravel	90 kPa	-	29.00	-
	10.00	Loose sandy Gravel	40 kPa	-	28.00	-
	15.00	Very loose gravelly Sand	20 kPa	-	-	-
	20.00	Soft to firm sandy gravelly organic SILT	60 kPa	1.33, 1.34, 1.33	35.00	7.00
	25.00	Loose gravelly Sand	23 kPa	2.16	-	-
	26.50	Medium dense gravelly Sand	130 kPa	-	31.00	-
	29.00	Firm sandy Silt	51 kPa	2.10	-	-
	33.00	Dense sandy Gravel	380 kPa	2.23, 2.23, 2.23	40.00	7.00
	38.00	Very dense sandy Gravel	>500 kPa	-	42.00	-
	No rockhead encountered during drilling works at this location					
BH11 (P1)	4.00	Very loose sandy Gravel	20 kPa	-	-	-
	8.00	Medium dense gravelly Sand	50 kPa	-	28	-
	8.50	Very soft sandy gravelly Silt	16 kPa	2.11	-	-
	12.00	Soft sandy gravelly Clay	30 kPa	-	-	-
	16.00	Firm to stiff sandy gravelly Silt	50 kPa	-	-	-
	20.20	Strong to very strong GNEISS	140 MPa	-	-	-
	20.80	Medium strong to strong GNEISS	20 MPa	-	-	-
	23.40	Medium strong to strong GNEISS	62 MPa	-	-	-
BH15 (P1)	1.10	Very strong METAGABBRO	174 MPa	-	-	-
	2.90	Very strong METAGABBRO	146 MPa	-	-	-
	3.90	Strong METAGABBRO	84 MPa	-	-	-

An indication of standard penetration test results against depth has been carried out and is summarised in the graph provided on the following page.

Graph 1: Summary of SPT *N* Values across the areas investigated – Quay Wall Phase 1



The specialist piling contractor may propose either driven piles into medium dense granular/stiff cohesive soils or drilled piles into the underlying metagabbro/gneiss bedrock.

In all instances above, it is recommended that the advice of specialist contractors is sought out at an early stage to ensure the correct methods and pile specifications are selected with regard to the site-specific ground conditions.

Pile driving conditions will vary across the site through local variations in ground conditions, further accentuated by the presence of cobbles and/or boulders. The ultimate load capacity of the piles should be determined by the execution of in-situ dynamic load tests.

7.2.1.1.2 Phase 2 Quay Wall works

Potential founding strata are as follows; this will be confirmed by the specialist piling contractor:

- BH16: Strong Pegmatite encountered at 3.40mbgl (-14.12mCD).
- BH32: Very dense sandy gravelly cobbles; encountered at 6.60mbgl (-14.40mCD). Strong to very strong Gneiss encountered at 9.90mbgl (-17.70mCD).

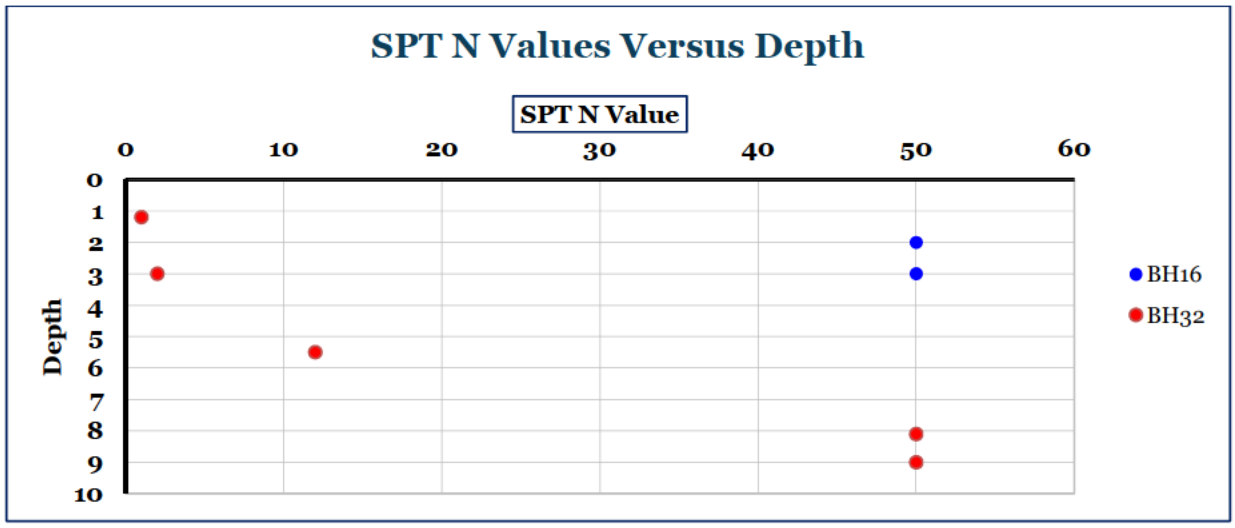
Table 1b: Ground parameters for bearing piles derived from in-situ testing and laboratory results

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH16 (P2)	3.80	Strong PEGMATITE	62 MPa	-	-	-
	5.35	Strong AMPHIBOLITE	96 MPa	-	-	-
	7.70	Strong AMPHIBOLITE	78 MPa	-	-	-

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH32 (P2)	2.00	Very soft sandy gravelly Clay	3 kPa	1.53	-	-
	4.00	Very soft sandy gravelly Clay	3 kPa	1.50	-	-
	8.00	Very dense sandy gravelly Cobble	>500 kPa	-	42.00	-
	10.60	Strong GNEISS	96 MPa	-	-	-
	11.80	Very strong GNEISS	124 MPa	-	-	-

An indication of standard penetration test results against depth has been carried out and is summarised in the graph provided below.

Graph 2: Summary of SPT *N* Values across the areas investigated – Quay Wall Phase 2



The specialist piling contractor may propose either driven piles into very dense granular soils or drilled piles into the underlying pegmatite/amphibolite/gneiss bedrock.

In all instances above, it is recommended that the advice of specialist contractors is sought out at an early stage to ensure the correct methods and pile specifications are selected with regard to the site-specific ground conditions.

Pile driving conditions will vary across the site through local variations in ground conditions, further accentuated by the presence of cobbles and/or boulders. The ultimate load capacity of the piles should be determined by the execution of in-situ dynamic load tests.

7.2.1.1.3 Phase 3 Quay Wall works

Potential founding strata are as follows; this will be confirmed by the specialist piling contractor:

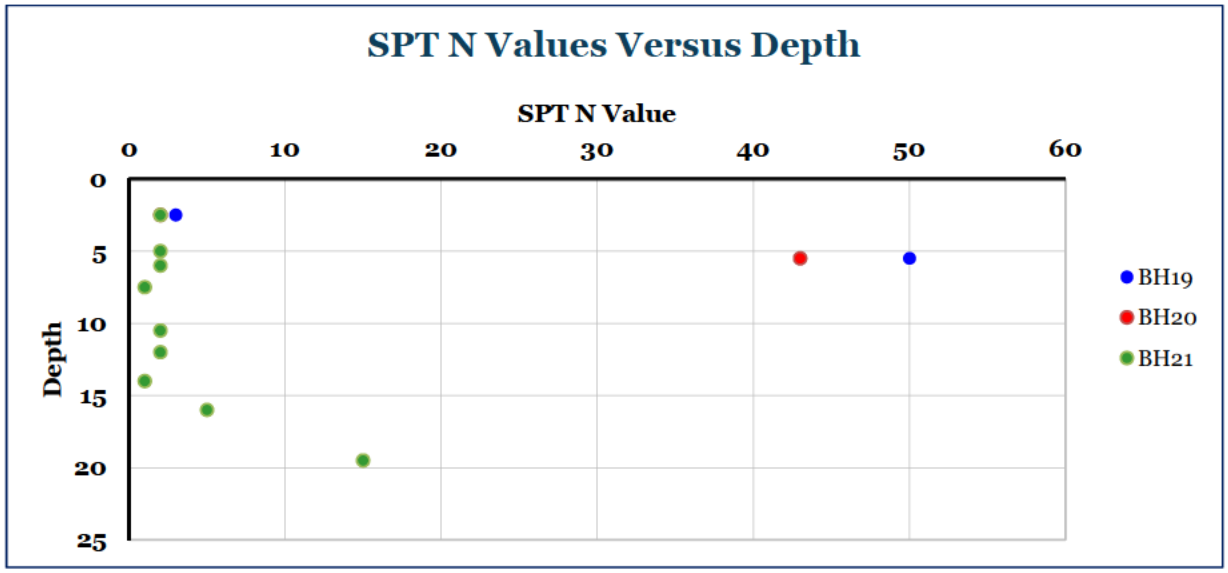
- BH19: Very dense sandy gravel with cobbles; encountered at 4.60mbgl (-10.79mCD). Medium strong Gneiss encountered at 6.70mbgl (-12.89mCD).
- BH20: Dense gravelly sand with cobbles; encountered at 5.20mbgl (-11.66mCD). Medium strong to strong Gneiss encountered at 6.30mbgl (-12.76mCD).
- BH21: Medium dense sandy gravel; encountered at 18.30mbgl (-25.06mCD). Medium strong Gneiss encountered at 21.30mbgl (-28.06mCD).

Table 1c: Ground parameters for bearing piles derived from in-situ testing and laboratory results

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m^3)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH19 (P3)	5.00	Very dense sandy Gravel	310 kPa	2.21, 2.21, 2.21	36.00	7.00
	6.90	Medium strong GNEISS	36 MPa	-	-	-
	8.80	Weak GNEISS	14 MPa	-	-	-
BH20 (P3)	3.00	Very soft sandy gravelly Clay	10 kPa	-	-	-
	6.50	Strong GNEISS	128 MPa	-	-	-
	8.25	Medium strong GNEISS	36 MPa	-	-	-
	9.65	Strong GNEISS	72.5 MPa	-	-	-
BH21 (P3)	5.00	Very soft sandy gravelly Clay	10 kPa	-	-	-
	10.00	Very soft sandy gravelly Clay	10 kPa	-	-	-
	15.00	Very soft sandy gravelly Clay	10 kPa	-	-	-
	20.00	Medium dense sandy Gravel	150 kPa	-	-	-
	22.35	Strong GNEISS	32 MPa	-	-	-

An indication of standard penetration test results against depth has been carried out and is summarised in the graph provided on the following page.

Graph 3: Summary of SPT *N* Values across the areas investigated – Quay Wall Phase 3



The specialist piling contractor may propose either driven piles into medium dense/very dense granular soils or drilled piles into the underlying gneiss bedrock.

In all instances above, it is recommended that the advice of specialist contractors is sought out at an early stage to ensure the correct methods and pile specifications are selected with regard to the site-specific ground conditions.

Pile driving conditions will vary across the site through local variations in ground conditions, further accentuated by the presence of cobbles and/or boulders. The ultimate load capacity of the piles should be determined by the execution of in-situ dynamic load tests.

7.2.2 Proposed Reclamation Area

7.2.2.1 Suitability of overburden sediments for proposed loading

The two areas of proposed reclamation behind the new quay wall structures are composed of very loose to loose granular and very soft to firm cohesive strata overlying a relatively shallow rockhead. The reclamation is proposed in two phases to align with the construction phases of the new quay walls.

7.2.2.1.1 Phase 1 Reclamation works

- BH06: Overburden thickness 7.50m. Depth to rockhead was 7.50mbgl (-15.11mCD).
- BH10: Overburden thickness 3.90m. Depth to rockhead 3.90mbgl (-10.02mCD).

- BH14: Overburden thickness 1.40m. Depth to rockhead 1.40mbgl (-6.84mCD).

Table 2a: Ground parameters for proposed Phase 1 reclamation area

Location	Depth (mbgl)	Strata Description	Estimated bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH06 (P1)	2.00	Loose sandy Gravel	50 kPa	-	28.00	-
	4.00	Loose to Med dense sandy Gravel	90 kPa	-	29.00	-
	6.50	Firm sandy gravelly Clay	225 kPa	2.09, 2.09, 2.10	28.00	8.00
	7.85	Weak METAGABBRO	15.2 MPa	-	-	-
	11.15	Medium strong GNEISS	30.4 MPa	-	-	-
BH10 (P1)	3.00	Loose sandy Gravel	10 kPa	-	-	-
	5.20	Strong GNEISS	50 MPa	-	-	-
	6.40	Weak GNEISS	8 MPa	-	-	-
	8.40	Medium strong GNEISS	48 MPa	-	-	-
BH14 (P1)	2.50	Very strong METAGABBRO	110 MPa	-	-	-
	3.35	Medium strong METAGABBRO	36 MPa	-	-	-
	6.10	Strong METAGABBRO	56 MPa	-	-	-

The area of proposed Phase 1 reclamation works contains a covering of loose sandy gravel and soft sandy gravelly clay to depths of between 1.20mgl (-6.64mCD) in BH14 and 4.00mbgl (-11.61mCD) in BH06. These overlie medium dense gravel in BH06 and relatively shallow bedrock in BH10 and BH14.

The bedrock throughout this area consists of medium strong Metagabbro overlying medium strong Gneiss; occurring at 7.50mgl (-15.11mCD), 3.90mbgl (-10.02mCD), and 1.40mgbl (-6.84mCD) in BH06, BH10, and BH14 respectively.

During reclamation works it is advised the imported granular fill material is placed and compacted in layers as the operation progresses. Upon loading it is anticipated there will be some compaction of the loose granular and soft cohesive marine sediments. The compaction of these layers should be fully observed during the works and any areas of settlement should then receive another layer of compacted granular fill maintaining a level working platform for all plant and machinery.

7.2.2.1.2 Phase 2 Reclamation works

- BH17: Overburden thickness 3.80m. Depth to rockhead was 3.80mbgl (-11.87mCD).
- BH31: Overburden thickness 6.40m. Depth to rockhead 6.40mbgl (-11.90mCD).

Table 2b: Ground parameters for proposed Phase 2 reclamation area

Location	Depth (mbgl)	Strata Description	Estimated bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH17 (P2)	3.00	Very loose sandy Gravel	20 kPa	-	-	-
	4.65	Strong GNEISS	100 MPa	-	-	-
	5.60	Weak AMPHIBOLITE	24 MPa	-	-	-
BH31 (P2)	2.00	Very soft sandy gravelly CLAY	2 kPa	1.50	-	-
	4.00	Very soft sandy gravelly CLAY	2 kPa	1.46	-	-
	7.40	Strong GNEISS	66 MPa	-	-	-
	8.20	Strong GNEISS	56 MPa	-	-	-
	9.30	Medium strong GNEISS	44 MPa	-	-	-

The area of proposed Phase 2 reclamation works contains a covering of very soft sandy gravelly silty organic clay and very loose silty sandy gravel to depths of 3.80mgl (-11.87mCD) in BH17 and 5.00mbgl (-10.50mCD) in BH31. These overlie very dense gravel in BH31 and relatively shallow bedrock in BH17.

The bedrock throughout this area consists of medium strong to strong Gneiss overlying weak to medium strong Amphibolite; occurring at 3.80mgl (-11.87mCD) and 6.40mgbl (-11.90mCD) in BH17 and BH31 respectively.

During reclamation works it is advised the imported granular fill material is placed and compacted in layers as the operation progresses. Upon loading it is anticipated there will be some compaction of the very soft cohesive and very loose granular marine sediments. The compaction of these layers should be fully observed during the works and any areas of settlement should then receive another layer of compacted granular fill maintaining a level working platform for all plant and machinery.

7.2.3 Heavy Lift Area

7.2.3.1 Piled Reinforced Concrete Slab

The ground conditions in the location of the proposed heavy lifting area consist of a thin layer of soft marine sediments onto shallow rockhead. Based on the proposals it follows that a piled solution may be used to transfer the loadings anticipated to be generated from the reinforced slab and heavy lifting operations.

Potential founding strata are as follows; this will be confirmed by the specialist piling contractor:

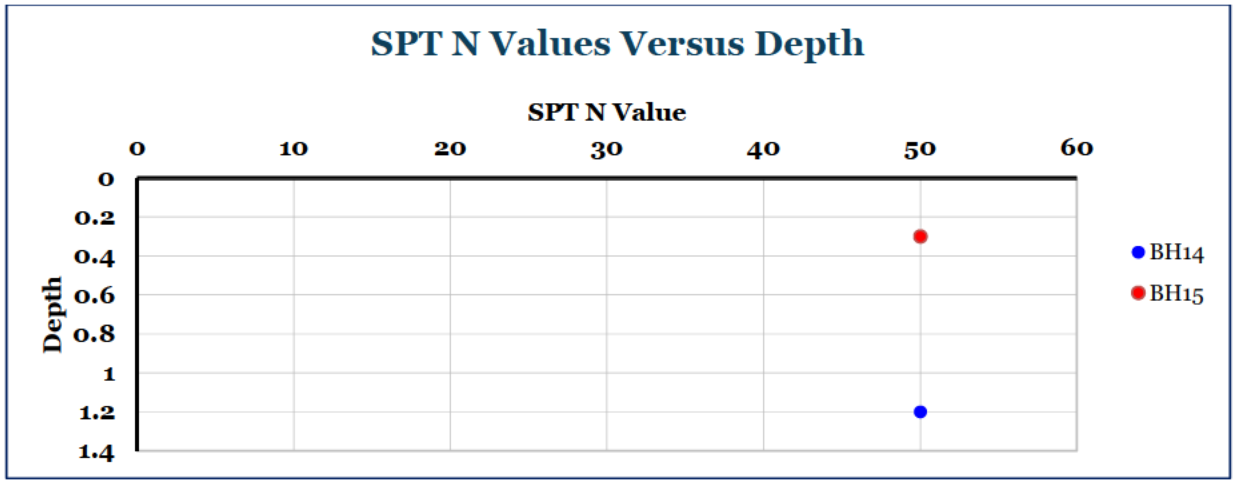
- BH14: Medium strong to very strong Metagabbro encountered at 1.40mbgl (-6.84mCD).
- BH15: Very strong Metagabbro encountered at 0.30mbgl (-10.13mCD).

Table 3: Ground parameters at proposed heavy lift area based on laboratory results

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH14	2.50	Very strong METAGABBRO	110 MPa	-	-	-
	3.35	Medium strong METAGABBRO	36 MPa	-	-	-
	6.10	Strong METAGABBRO	56 MPa	-	-	-
BH15	1.10	Very strong METAGABBRO	174 MPa	-	-	-
	2.90	Very strong METAGABBRO	146 MPa	-	-	-
	3.90	Strong METAGABBRO	84 MPa	-	-	-

An indication of standard penetration test results against depth has been carried out and is summarised in the graph provided below.

Graph 4: Summary of SPT *N* Values across the areas investigated – Heavy Lifting Area



In all instances above, it is recommended that the advice of specialist contractors is sought out at an early stage to ensure the correct methods and pile specifications are selected with regard to the site-specific ground conditions.

Pile driving conditions will vary across the site through local variations in ground conditions, further accentuated by the presence of cobbles and/or boulders. The ultimate load capacity of the piles should be determined by the execution of in-situ dynamic load tests.

7.2.4 Linkspan for Freight Ferry, Linkspan, Finger Pier and Dolphins

7.2.4.1 Piled Foundations

The ground conditions in the area of the proposed linkspan, finger pier, and dolphins are highly variable; marine beach deposits, with some deep occurrences of glacial till material, and a deep rockhead level. This will render the implementation of any shallow design solution problematic. Based on the proposals it follows that a piled solution may be used to transfer the loadings to depth.

The ultimate effective angle of shearing resistance, Φ', as determined by the small shear box tests in the geotechnical laboratory on representative samples of soils encountered, was found to be in the order of 32-36 degrees. The effective cohesion, c', unless obtained through shear box testing, should be taken as zero given the prevalence of coarse grained soils interbedded with cohesive strata throughout.

Potential founding strata are as follows; this will be confirmed by the specialist piling contractor:

- BH01: Dense to very dense sandy gravel with cobbles; encountered at 43.10mbgl (-50.27mCD). Medium strong Gneiss bedrock was encountered at 40.40mbgl (-57.57mCD).
- BH02: Stiff sandy clay encountered at 28.00mbgl (-35.05mCD). Very strong Gneiss bedrock was encountered at 36.20mbgl (-43.25mCD).
- BH03A: Medium dense sandy gravel with cobbles; encountered at 44.00mbgl (-50.99mCD). Weathered Gneiss bedrock was encountered at 51.10mbgl (-58.09mCD).

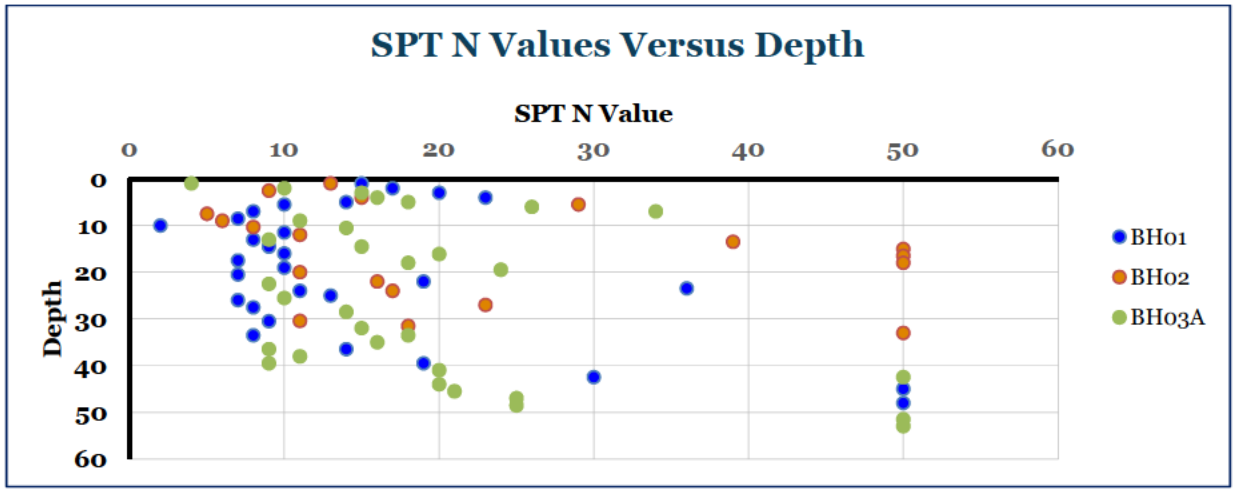
Table 4: Ground parameters at area of proposed linkspan/finger pier/dolphins

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
BH01	4.00	Medium dense gravelly Sand	120 kPa	-	31.00	-
	9.00	Loose sandy Gravel	20 kPa	-	-	-
	14.00	Loose gravelly Sand	80 kPa	1.99, 1.99, 2.00	36.00	10.00
	23.00	Medium dense gravelly Sand	190 kPa	1.95, 1.96, 1.96	33.00	11.00
	29.00	Soft to firm sandy gravelly Clay	40 kPa	-	-	-
	35.00	Loose silty Sand	80 kPa	2.04, 2.04, 2.05	34.00	17.00
	40.00	Medium dense Gravel	190 kPa	-	33.00	-

Location	Depth (mbgl)	Strata Description	Pile base bearing capacity	Bulk Density (Mg/m³)	Angle of Shearing Resistance Φ (Degrees)	Effective Cohesion C' (kPa)
	45.00	Very dense sandy Gravel	500 kPa	-	42.00	-
	50.40	Medium strong GNEISS	100 MPa	-	-	-
BH02	4.00	Medium dense Gravel	90 kPa	-	29.00	-
	8.00	Loose Gravel	50 kPa	-	28.00	-
	12.00	Medium dense sandy Gravel	110 kPa	-	-	-
	16.00	Very dense Gravel	>500 kPa	-	42.00	-
	20.00	Medium dense gravelly Sand	110 kPa	-	30.00	-
	24.00	Firm to stiff sandy Silt	75 kPa	-	-	-
	28.00	Stiff sandy Clay	115 kPa	-	-	-
	32.00	Stiff sandy gravelly Clay	90 kPa	-	-	-
	35.35	Weak DOLERITE	19.3 MPa	-	-	-
	36.60	Very strong GNEISS	118 MPa	-	-	-
	37.50	Strong GNEISS	63.7MPa	-	-	-
BH03A	4.00	Medium dense sandy Gravel	100 kPa	-	30.00	-
	8.00	Dense sandy Gravel	180 kPa	-	32.00	-
	12.50	Loose to Med Dense sandy Gravel	90 kPa	-	-	-
	17.50	Medium dense sandy Gravel	180 kPa	-	-	-
	21.50	Loose gravelly silty Sand	90 kPa	1.87, 1.88, 1.87	36.00	8.00
	25.00	Firm slightly gravelly silty CLAY	100 kPa	1.81, 1.81, 1.81	32.00	5.00
	27.00	Soft sandy Clay	23 kPa	1.83		
	30.50	Stiff sandy Clay	80 kPa	1.39	-	-
	32.80	Firm sandy Clay	47 kPa	1.78	-	-
	35.00	Medium dense Sand	160 kPa	-	32.00	-
	41.00	Medium dense silty Sand	200 kPa	1.95, 1.96, 1.96	36.00	10.00
	46.00	Medium dense sandy Gravel	200 kPa	-	33.00	-
	51.10	Weathered GNEISS	>500 kPa	-	42.00	-

An indication of standard penetration test results against depth has been carried out and is summarised in the graph provided on the following page.

Graph 4: Summary of SPT *N* Values across the areas investigated – Heavy Lifting Area



The specialist piling contractor may propose either driven piles into medium dense/very dense granular or stiff cohesive soils or drilled piles into the underlying dolerite/gneiss bedrock.

In all instances above, it is recommended that the advice of specialist contractors is sought out at an early stage to ensure the correct methods and pile specifications are selected with regard to the site-specific ground conditions.

Pile driving conditions will vary across the site through local variations in ground conditions, further accentuated by the presence of cobbles and/or boulders. The ultimate load capacity of the piles should be determined by the execution of in-situ dynamic load tests.

7.2.5 Proposed Dredge Operation

7.2.5.1 Seabed Material

The proposed dredge area encompasses over half the site area. There are 18 exploratory hole locations within the dredge area; 15 of these were selected for Marine Scotland Analysis to inform the requirements for the disposal of the dredge material.

The table on the following page lists the depth to sea bed at each of the 18 borehole locations within the proposed dredge zone, estimated thickness of the soft marine sediments, and the depth to more competent strata (all depths given in mCD).

Table 5: Summary of marine sediment material encountered at each dredge borehole location

Location	Depth to Soft / Loose Sediment (mCD)	Thickness of soft sediment (m)	Sediment Description	Depth to firm/med. dense material (mCD)	Strata Description
BH04	-7.41	2.10	Loose silty gravelly Sand	-9.51	Medium dense silty sandy Gravel
BH05	-8.82	1.90	Loose sandy Gravel	-10.72	Medium dense sandy Gravel
BH07	-7.02	5.10	Loose silty sandy Gravel	-12.12	Medium dense silty gravelly Sand
BH08	-6.18	0.00	No soft sediment	-6.18	Medium dense silty sandy Gravel
BH09	-8.05	1.50	Very loose silty sandy Gravel	-9.55	Medium dense sandy Gravel
BH11	-10.23	7.20	Very loose silty sandy Gravel/silty gravelly Sand	-15.43	Medium dense silty gravelly Sand
BH12	-9.14	0.70	Silty gravelly Sand	-9.84	Dense silty sandy Gravel
BH13	-7.49	2.00	Loose silty sandy Gravel	-9.49	Medium dense silty dandy Gravel
BH15	-9.83	0.30	Loose silty sandy Gravel	-10.13	Very strong Metagabbro
BH22	-8.32	0.00	No soft sediment	-8.32	Medium dense silty sandy Gravel
BH23	-8.03	0.60	Loose silty gravelly Sand	-8.63	Medium dense silty gravelly Sand
BH24	-8.90	0.00	No soft sediment	-8.90	Medium dense silty sandy Gravel
BH25	-9.81	0.00	No soft sediment	-9.81	Medium dense silty sandy Gravel
BH26	-9.87	1.50	Loose silty sandy Gravel	-	No hard strata encountered
BH27	-8.07	1.50	Loose silty sandy Gravel	-9.57	Medium dense silty sandy Gravel
BH28	-9.25	1.50	Loose silty sandy Gravel	-10.75	Medium dense sandy Gravel
BH29	-8.65	1.90	Loose silty sandy Gravel/silty gravelly Sand	-10.55	Medium dense silty gravelly Sand
BH30	-9.10	2.60	Very loose silty gravelly Sand/ Very soft sandy Silt	-11.70	Very dense silty sandy gravelly Cobbles

The proposed depth of the dredge for the Deep Water Berth Facility will be -10.5mCD as advised in the scope of works. The majority of the dredge area has a blanket covering of either loose granular or very soft cohesive marine sediments ranging from 0.30m to 7.20m in thickness; average around 2.00m thick. These overlie medium dense to dense granular material; predominantly sandy gravels and gravelly sands which would be easily excavatable by any proposed dredging operation.

The only occurrence of rockhead within the dredging area above -10.5mCD is in BH15 where a very strong Metagabbro is encountered at 0.30mbgl (-10.13mCD). As the location of BH15 is at the edge of the proposed dredge area, and adjacent to the Phase 1 Quay Wall construction, this is not considered to pose a significant issue for any dredging contractor.

7.2.6 Leachate and Waste Acceptance Criteria Analysis

7.2.6.1 Material re-use

It is proposed to re-use a proportion of the dredged material to backfill some of the proposed reclamation areas of the Deep Water Berth Development.

Fifty-two selected soil samples were analysed for a range of potential contaminants including:

- Metals
- Tributyl Tin (TBT)
- Total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- PCB (7 congeners)

In the initial examination of the potential risk of site contamination, the laboratory results have been compared to the following available assessment criteria relevant to the proposed land use:

- SEPA Statutory EQS values for Marine Sediments published in 2004. These relate to arsenic (dissolved), cadmium (dissolved), chromium (dissolved), copper (dissolved), mercury (dissolved), nickel (dissolved), lead (dissolved), and zinc (dissolved).

The results from the samples do not identify significantly elevated concentrations for the compounds analysed over the majority of the site area. A few instances of elevated levels of mercury (Hg) were observed in BH04 at 1.00m (-8.41mCD) and 2.00m (-9.41mCD) and in BH30 at 0.50m (-9.60mCD). Elevated levels of Zinc were also noted in the BH04 sample at 1.00m (-8.41mCD).

It should be noted that the above assessment is based on the results of the soil samples against available criteria. No assessment has been made where criteria is not available. Any potential contamination identified during site development by visual or olfactory means should be investigated, including further laboratory testing, and appropriate health & safety, waste disposal and remediation measures adopted.

From the four samples tested for WAC analysis material from the site may potentially be classified as inert/non-hazardous. It is noted however that the recorded concentrations of chloride in three of the four samples falls just above the threshold for inert/non-hazardous and would classify this material as stable non-reactive hazardous waste. Any material excavated for off-site disposal would require further Waste Classification analysis and WAC testing and would have to be classified under the SEPA Guidance on the classification and assessment of waste (1st edition 2015) Technical Guidance WM3.

7.2.7 Soil strength parameters

When estimating the shear strength of cohesive soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of cohesive soils can be estimated using the correlation developed by Stroud & Butler:

$$C_u = f_1 \times N$$

where f_1 is typically in the range 4 to 6. A median f_1 value of 5 is adopted for this report.

For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance, φ, has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the granular soils.

7.2.8 Soil aggressivity

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2005).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous development and not perceived as containing pyrite;
- Sites not subjected to previous development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as not having been subject to previous development and not perceived as containing pyrite.

The results of chemical tests (pH and water-soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-3 and ACEC Class AC-3 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005).

The Special Digest will require measures to protect underground concrete elements; reference should be made to the *Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground* documentation by the nominated Geotechnical Design Engineer.

8 REFERENCES

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

Construction Industry Research and Information Association (CIRIA). 1993. Research Project 369. The Standard Penetration Test (SPT): Methods and Use. CIRIA. London.

BS EN ISO 14688-1: 2002: Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

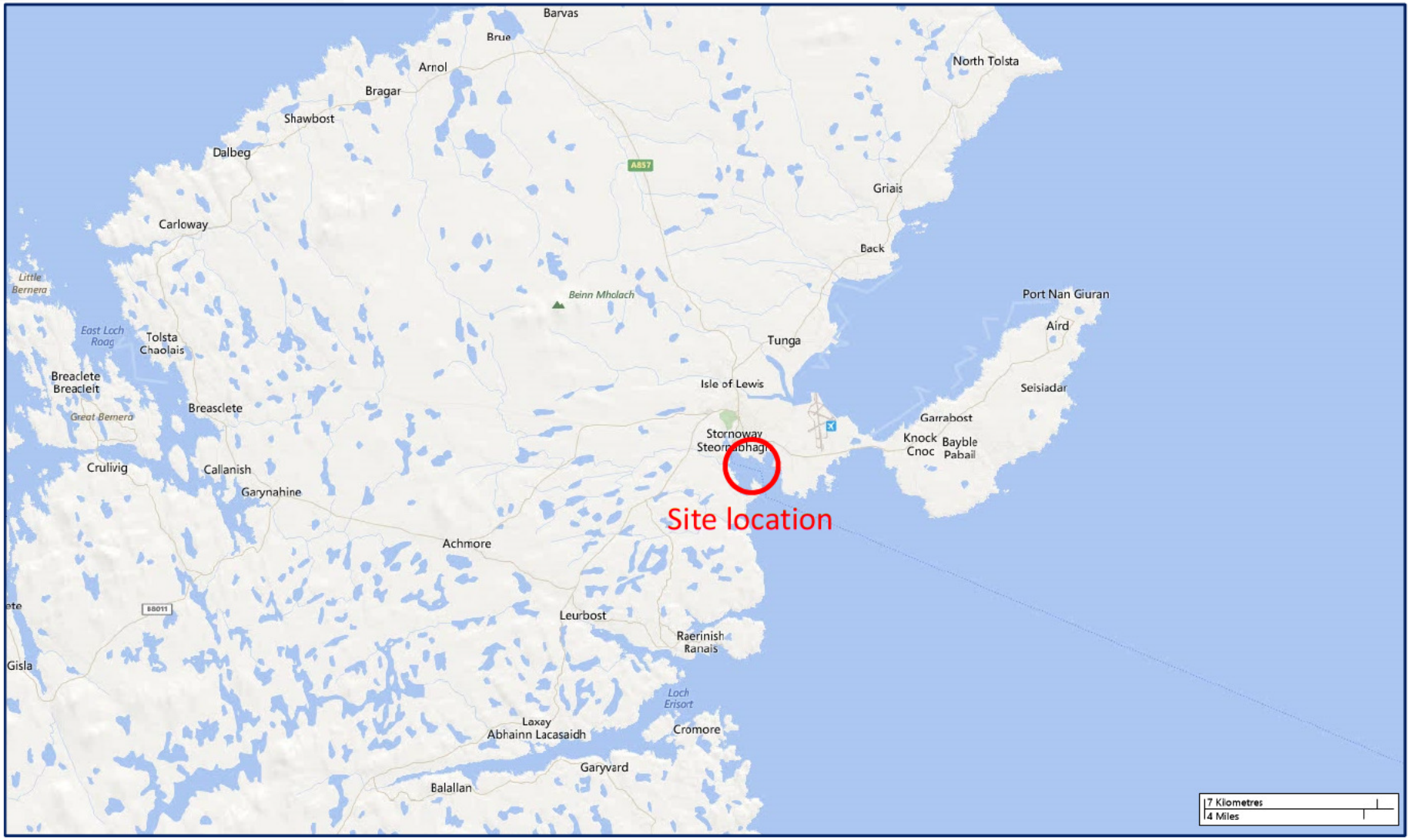
Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground.

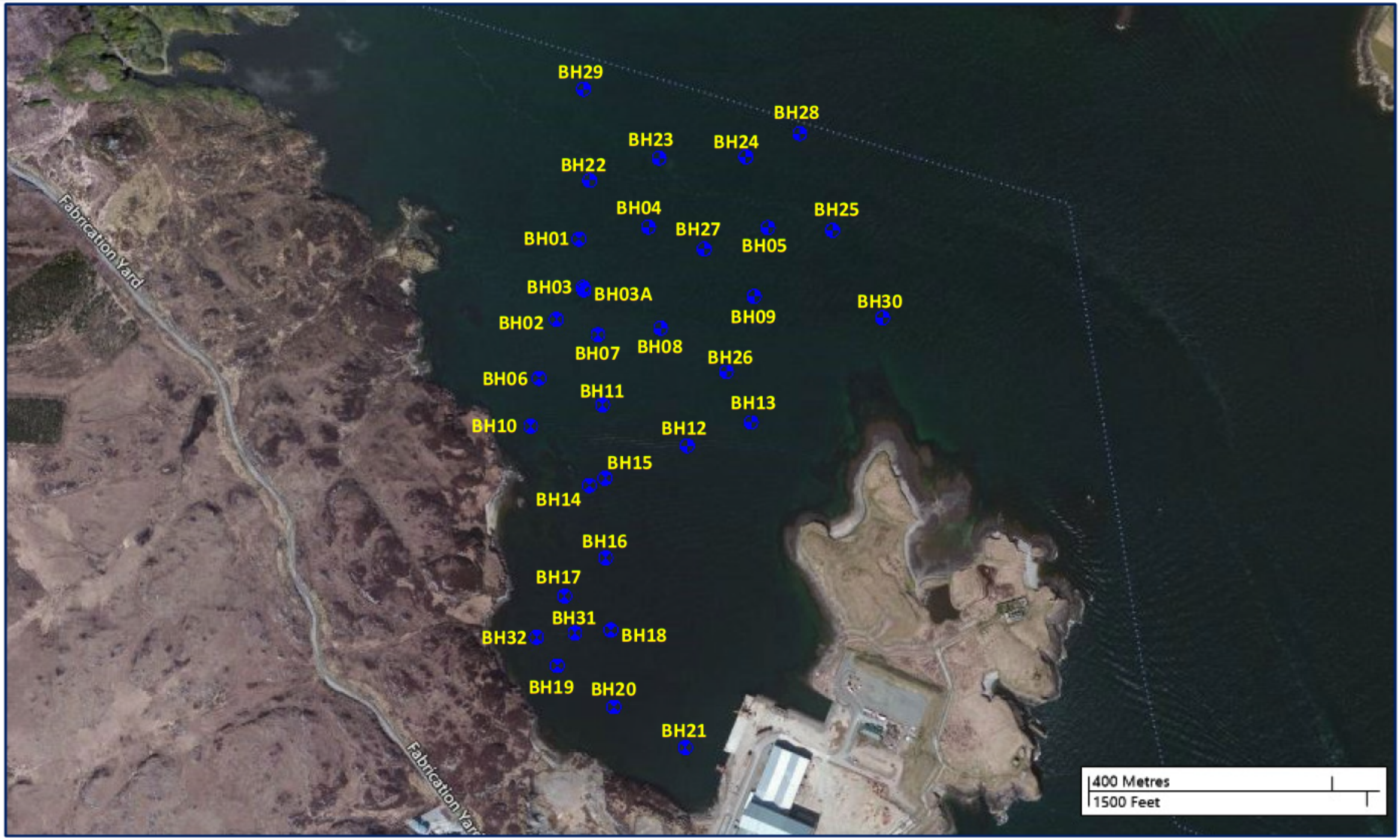
Guidance for The Sampling and Analysis of Sediment and Dredge material to be Submitted in Support of Applications for Sea Disposal of Dredged Material (2011).

CAUSEWAY GEOTECH

APPENDIX A

Site and exploratory hole location plans


Barvas
Brue
Arnol
Bragar
Shawbost
Dalbeg
A857
Carloway
North Tolsta
Griais
Back
Little Bernera
Beinn Mholach
Port Nan Giuran
Aird
East Loch Roag
Tolsta Chaolais
Tunga
Isle of Lewis
Seisiadar
Breaclete Breacleit
Breasclete
Great Bernera
Garrabost
Stornoway
Steornabhagh
Knock Cnoc
Bayble Pabail
Crulivig
Callanish
Garynahine
Site location
Achmore
B8011
Leurbost
Raerinish Ranais
Gisla
Loch Erisort
Laxay Abhainn Lacasaidh
Cromore
Garyvard
Balallan
7 Kilometres
4 Miles


BH29
BH28
BH23
BH24
BH22
BH04
BH25
BH27
BH01
BH05
BH03
BH03A
BH30
BH09
BH02
BH07
BH08
BH26
BH06
BH11
BH13
BH10
BH12
BH15
BH14
BH16
BH17
BH31
BH32
BH18
BH19
BH20
BH21
Fabrication Yard
Fabrication Yard
400 Metres
1500 Feet

CAUSEWAY GEOTECH

APPENDIX B

Borehole logs

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.80)		Greyish brown sandy subangular to subrounded fine to coarse GRAVEL with high cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies.		
0 50	B8 D1									
0 80	B9 D2				-7 97	0.80		Medium dense greyish brown slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies.		
1 00	D3									
1 00 - 1.45	SPT (S) N=15			N=15 (2,3/3,3,4,5)		(0.70)				
1 50	B10				-8.67	1.50		Medium dense greyish brown slightly silty gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to medium. Cobbles are subrounded of mixed lithologies.		
2 00	D4									
2 00 - 2.45	SPT (S) N=17			N=17 (2,2/3,4,5,5)						
2 50	B11									
						(2.80)				
3 00	D5									
3 00 - 3.45	SPT (S) N=20			N=20 (2,3/4,5,5,6)						
3 50	B12									
4 00	D6									
4 00 - 4.45	SPT (S) N=23			N=23 (3,3/5,6,6,6)						
					-11.47	4.30		Medium dense brown slightly sandy subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies.		
4.40 - 5.00	B13									
						(1.20)				
5 00 - 5.45	SPT (S) N=14			N=14 (1,2/2,3,3,6)						

Remarks

Deck to Bed = 14.00m
Attempted to core at 27.50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole
Terminated by Engineer 1.5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Medium dense brown slightly sandy subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies.		
5 50 - 6.00 5 50 - 5.95	B14 SPT (C) N=10			N=10 (1,2/3,2,2,3)	-12.67	5.50		Loose brownish grey slightly silty very sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
6 00 - 7.00	B15									
7 00 - 8.00 7 00 - 7.45	B16 SPT (C) N=8			N=8 (2,2/2,4,1,1)		(4.50)				
8 00 - 9.00	B17									
8 50 - 8.95	SPT (C) N=7			N=7 (1,2/1,2,2,2)						
9 00 - 10.00	B18									
10.00 - 10.45	SPT (C) N=2			N=2 (2,2/0,1,1,0)	-17.17	10.00		Loose brownish grey slightly silty very sandy subrounded fine to coarse GRAVEL with medium cobble content. Sand is medium to coarse. Cobbles are subrounded of mixed lithologies.		

Remarks

Deck to Bed = 14.00m
Attempted to core at 27.50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole
Terminated by Engineer 1.5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Sheet 3 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Driller: CC+SS

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose brownish grey slightly silty very sandy subrounded fine to coarse GRAVEL with medium cobble content. Sand is medium to coarse. Cobbles are subrounded of mixed lithologies.		
11.00 - 11.50	B19									
11.50 - 11.95	SPT (C) N=10			N=10 (2,3/2,3,2,3)						
						(3.40)				
12.00 - 12.50	B20									
13.00 - 13.45	SPT (C) N=8			N=8 (2,2/1,2,2,3)						
					-20.57	13.40		Loose to medium dense brownish grey gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium.		
14.00 - 14.50	B21									
14.50 - 14.95	SPT (C) N=9			N=9 (1,1/2,2,3,2)						

Remarks

Deck to Bed = 14.00m
Attempted to core at 27.50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole
Terminated by Engineer 1.5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose to medium dense brownish grey gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium.		
16.00 - 16.50	B22									
16.00 - 16.45	SPT (C) N=10			N=10 (1,2/2,2,3,3)						
17.00 - 17.50	B23									
17.50 - 17.95	SPT (C) N=7			N=7 (2,2/1,2,2,2)						
18.00 - 18.40	B24					(8.60)				
19.00 - 19.40	B25									
19.00 - 19.45	SPT (C) N=10			N=10 (1,2/2,3,3,2)						
20.00 - 20.40	B26									
20.50 - 20.95	SPT (C) N=7			N=7 (1,1/2,1,2,2)						

15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5

Remarks

Deck to Bed = 14.00m
Attempted to core at 27.50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole
Terminated by Engineer 1.5m into competent bedrock

Core Barrel
SK6L

Flush Type

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
19.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Sheet 5 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
21.00 - 21.40	B27							Loose to medium dense brownish grey gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium.		
22.00 - 22.40	B28				-29.17	22.00				
22.00 - 22.45	SPT (C) N=19			N=19 (3,4/4,6,4,5)				Medium dense brownish grey sightly gravelly silty fine to coarse SAND (predominantly medium). Gravel is subangular to subrounded fine to medium.		
						(1.50)				
23.00 - 23.50	B29									
23.50	D7				-30.67	23.50		Loose to medium dense grey silty fine to coarse SAND.		
23.50 - 23.95	SPT (S) N=36			N=36 (4,6/7,10,10,9)						
24.00	D31									
24.00 - 24.45	SPT (S) N=11			N=11 (2,2/3,3,2,3)						
						(3.50)				
25.00	D33									
25.00 - 25.45	SPT (S) N=13			N=13 (2,3/5,3,3,2)						

Remarks

Deck to Bed = 14.00m

Attempted to core at 27.50 to 29.00m, 25% recovery

Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery

Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery

Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1.5m into competent bedrock

Core Barrel

SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
24.70	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Sheet 6 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose to medium dense grey silty fine to coarse SAND.		
26.00 26.00 - 26.45	D37 SPT (S) N=7			N=7 (2,2/1,2,2,2)						
					-34.17	27.00		Soft to firm brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
27.50 - 27.95	SPT (C) N=8			N=8 (2,2/1,2,3,2) N=8 (2,2/1,2,3,2)						
	25									
29.00						(5.00)				
30.50 - 30.95				N=9 (2,3/1,2,3,3)						
	TCR SCR RQD FI									

Remarks

Deck to Bed = 14.00m

Attempted to core at 27.50 to 29.00m, 25% recovery

Open holed from 29.00 to 38.00m, cored 38.00 to 39.50m, 50% recovery

Open holed from 39.50 to 42.50m, cored 42.50 to 45.00m, 20% recovery

Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1.5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769	**Project Name:** Stornoway Deep Water Berth G.I.
Coordinates: 142499.08 E 931476.38 N	**Client:** Stornoway Port Authority
	Client's Representative: Wallace Stone Consulting Civil Engineers
Ground Level: -7.17 mCD	**Dates:** 28/11/2017 - 02/12/2017

Borehole No.: BH01

Sheet 7 of 11

Scale: 1:25

Driller: CC+SS

Logger: SC+SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						-39.17	32.00		Loose to medium dense greyish brown slightly clayey very silty fine to medium SAND.		
33.50 - 33.95					N=8 (2,2/1,2,3,2)						
34.00					B34		(7.50)				
35.00					B35						
	TCR	SCR	RQD	FI							

31.0 31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0 35.5 36.0

Remarks

Deck to Bed = 14.00m

Attempted to core at 27 50 to 29.00m, 25% recovery

Open holed from 29.00 to 38.00m, cored 38.00 to 39 50m, 50% recovery

Open holed from 39.50 to 42.50m, cored 42.50 to 45 00m, 20% recovery

Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1 5m into competent bedrock

Core Barrel

SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Sheet 8 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Loose to medium dense greyish brown slightly clayey very silty fine to medium SAND.		
36.50 36.50 - 36.95					B36 N=14 (3,4/3,3,4,4)						
	50										
39.50 - 39.95 39.50					N=19 (4,5/4,4,5,6)	-46.67	39.50		Medium dense brownish grey subangular to subrounded fine to coarse GRAVEL of mixed lithologies predominantly gneiss.		
							(1.50)				
						-48.17	41.00		Light grey SILT (recovered as drilling flush returns only).		
	TCR	SCR	RQD	FI							

Remarks

Deck to Bed = 14.00m

Attempted to core at 27 50 to 29.00m, 25% recovery

Open holed from 29.00 to 38.00m, cored 38.00 to 39 50m, 50% recovery

Open holed from 39.50 to 42.50m, cored 42.50 to 45 00m, 20% recovery

Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1 5m into competent bedrock

Core Barrel

SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Sheet 9 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Driller: CC+SS

Logger: SC+SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(1.50)		Light grey SILT (recovered as drilling flush returns only).		
42.50 - 42.95	20				N=30 (5,7/6,7,8,9)	-49.67	42.50 (0.60)		Medium dense to dense grey silty sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
43.10	20					-50.27	43.10 (5.90)		Dense to very dense grey silty sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies predominantly gneiss.		
45.00 - 45.41 45.00					N=50 (8,7/50 for 260mm)						
	TCR	SCR	RQD	FI							

41.5 42.0 42.5 43.0 43.5 44.0 44.5 45.0 45.5 46.0

Remarks

Deck to Bed = 14.00m

Attempted to core at 27 50 to 29.00m, 25% recovery

Open holed from 29.00 to 38.00m, cored 38.00 to 39 50m, 50% recovery

Open holed from 39.50 to 42.50m, cored 42.50 to 45 00m, 20% recovery

Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1 5m into competent bedrock

Core Barrel

SK6L

Flush Type

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH01

Coordinates: 142499.08 E, 931476.38 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -7.17 mCD

Dates: 28/11/2017 - 02/12/2017

Logger: SC+SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Dense to very dense grey silty sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies predominantly gneiss.		
48.00 - 48.38					N=50 (8,9/50 for 230mm)						
						-56.17	49.00 (0.20)		Stiff sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse. Gravels are mostly of gneiss.		
				NA		-56.37	49.20				
	63	35	35	0			(0.50)		Medium strong thinly foliated dark grey BOULDER of gneiss, pink mineral bands, largely unweathered: pervasive, slight greenish grey discoloration. Discontinuities: 1. 0 to 30 degree foliation fractures, medium spaced (50/280/400) planar, smooth, faint greenish grey stain. 2. 0 to 30 degree foliation fractures, medium spaced (20/280/400) planar, smooth, faint greenish grey stain.		
						-56.87	49.70		Stiff sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse.		
49.95											
				10			(0.70)				
	47	9	0	NI		-57.57	50.40		Medium strong to strong thinly foliated greenish grey and pink greenish GNEISS. Partially weathered: faint greenish grey and reddish brown discolouration. Discontinuities: 1. 0 to 30 degree foliation fractures , closely spaced (30/140/200) planar, smooth, faint greenish grey and reddish brown staining on joint surface. 2. 30 to 60 degree joints, closely spaced (90/200/460) planar, smooth, faint greenish grey and reddish brown staining on joint surface. 3. 70 to 90 degree joints at 52 50 to 52 80m, undulating, smooth, patchy greenish grey staining on joint surface.		
51.00											
	TCR	SCR	RQD	FI							

Remarks

Deck to Bed = 14.00m
Attempted to core at 27 50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39 50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45 00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1 5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH01
Coordinates:	**Client:**	Sheet 11 of 11
142499.08 E	Stornoway Port Authority	
931476.38 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.17 mCD	**Dates:** 28/11/2017 - 02/12/2017	**Driller:** CC+SS
		Logger: SC+SG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	23.50
Rotary Drilling	Comacchio 405	23.50	27.50
Rotary Coring	Comacchio 405	27.50	53.80

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	29	0	0	NI					Medium strong to strong thinly foliated greenish grey and pink greenish GNEISS. Partially weathered: faint greenish grey and reddish brown discolouration. Discontinuities: 1. 0 to 30 degree foliation fractures , closely spaced (30/140/200) planar, smooth, faint greenish grey and reddish brown staining on joint surface. 2. 30 to 60 degree joints, closely spaced (90/200/460) planar, smooth, faint greenish grey and reddish brown staining on joint surface. 3. 70 to 90 degree joints at 52 50 to 52 80m, undulating, smooth, patchy greenish grey staining on joint surface.		
52.30											
	100	35	25	10			(3.40)				
53.30											
	98	32	0								
53.80						-60.97	53.80		End of Borehole at 53.80m		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 14.00m
Attempted to core at 27 50 to 29.00m, 25% recovery
Open holed from 29.00 to 38.00m, cored 38.00 to 39 50m, 50% recovery
Open holed from 39.50 to 42.50m, cored 42.50 to 45 00m, 20% recovery
Open holed from 45.00 to 49.00m, cored 49.00m to end of borehole

Terminated by Engineer 1 5m into competent bedrock

Core Barrel
SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH02

Coordinates: 142453.09 E, 931347.03 N

Client: Stornoway Port Authority

Sheet 1 of 8

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.05 mCD

Dates: 26/01/2018 - 29/01/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.70	B1							Medium dense grey very sandy slightly silty angular to subrounded fine to coarse GRAVEL with some shells and shell fragments and very low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
1 00 - 1.45	SPT (C) N=13	1.00		N=13 (3,2/3,3,4,3)						
1 20 - 1.50	B2					(2.50)				
2 50 - 3.00	B3				-9 55	2.50				
2 50 - 2.95	SPT (C) N=9	2.50		N=9 (2,2/2,3,2,2)				Loose grey slightly sandy rounded to subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
						(0.80)				
					-10.35	3.30		Medium dense rounded to subrounded fine to coarse GRAVEL.		
3 50 - 4.00	B4									
4 00 - 4.45	SPT (C) N=15	4.00		N=15 (5,4/4,3,4,4)						
						(2.70)				
4 50 - 5.00	B5									

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH02
Coordinates:	**Client:**	Sheet 2 of 8
142453.09 E	Stornoway Port Authority	
931347.03 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+MJ
-7.05 mCD	26/01/2018 - 29/01/2018	**Logger:** FG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Medium dense rounded to subrounded fine to coarse GRAVEL.		
5 50 - 6.00	B6									
5 50 - 5.95	SPT (C) N=29	5.50		N=29 (7,6/7,7,8,7)						
6 00 - 7.00	B8				-13.05	6.00		Loose reddish brown and grey subrounded fine to medium GRAVEL.		
7 00 - 8.00	B7									
7 50 - 7.95	SPT (C) N=5	7.50		N=5 (1,1/1,1,2,1)						
8 00 - 9.00	B9					(4.50)				
9 00 - 10.00	B10									
9 00 - 9.45	SPT (C) N=6	9.00		N=6 (1,1/1,2,1,2)						
10.00 - 12.00	B11									
~~10.30 - 10.75~~	~~SPT (C) N=8~~	~~10.30~~		~~N=8 (2,2/2,3,1,2)~~						

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
8.00	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH02

Coordinates: 142453.09 E 931347.03 N

Client: Stornoway Port Authority

Sheet 3 of 8

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.05 mCD

Dates: 26/01/2018 - 29/01/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose reddish brown and grey subrounded fine to medium GRAVEL.		
					-17.55	10.50		Medium dense reddish brown slightly sandy subrounded fine to coarse GRAVEL. Sand is medium to coarse.		
						(2.50)				
12.00 - 13.00 12.00 - 12.45	B12 SPT (C) N=11	12.00		N=11 (3,2/2,4,2,3)						
					-20.05	13.00		Dense reddish brown rounded to subrounded fine to coarse GRAVEL.		
13.50 - 14.00 13.50 - 13.95	B13 SPT (C) N=39	13.50		N=39 (5,7/9,8,9,13)						
						(2.00)				
14.50 - 15.00	B14									
15.00 - 15.40	SPT (C)	15.00		N=50 (9,10/50 for 245mm)	-22.05	15.00		Very dense reddish brown and grey rounded and subrounded coarse GRAVEL.		

Remarks

Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH02
Coordinates:	**Client:**	Sheet 4 of 8
142453.09 E	Stornoway Port Authority	
931347.03 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.05 mCD	**Dates:** 26/01/2018 - 29/01/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
15.50 - 16.00	B15					(1.50)		Very dense reddish brown and grey rounded and subrounded coarse GRAVEL.		
16.50 - 17.00	B16				-23.55	16.50				
16.50 - 16.88	SPT (C)	16.50		N=50 (12,10/50 for 230mm)		(0.50)		Very dense reddish brown sandy rounded to subrounded fine to coarse GRAVEL. Sand is coarse.		
					-24.05	17.00				
						(0.50)		Reddish grey sandy rounded to subrounded fine to coarse GRAVEL. Sand is coarse.		
17.50 - 18.00	B17				-24.55	17.50				
						(0.70)		Very dense grey slightly silty slightly gravelly organic fine to coarse SAND. Gravel is subangular to subrounded fine. (Strong organic odour noted)		
18.00 - 18.39	SPT (C)	18.00		N=50 (12,10/50 for 235mm)						
					-25.25	18.20		Medium dense grey slightly gravelly silty organic fine to medium SAND. Gravel is subangular to subrounded fine. (Strong organic odour noted)		
18.50 - 19.00	B18									
						(3.80)				
19.50 - 20.00	B19									
19.60 - 20.05	U27			Ublow=3 0%						
20.00 - 20.45	SPT (C) N=11	20.00		N=11 (3,2/3,2,3,3)						
20.50 - 21.00	B20									

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH02
Coordinates:	**Client:**	Sheet 5 of 8
142453.09 E	Stornoway Port Authority	
931347.03 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.05 mCD	**Dates:** 26/01/2018 - 29/01/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Medium dense grey slightly gravelly silty organic fine to medium SAND. Gravel is subangular to subrounded fine. (Strong organic odour noted)		
21.50 - 22.00	B21									
22.00 - 22.45	SPT (C) N=16	22.00		N=16 (3,4/4,4,4,4)	-29.05	22.00		Stiff greenish grey heavily fissured slightly sandy clayey SILT. Sand is fine.		
						(0.40)				
					-29.45	22.40		Firm to stiff dark brown and black thinly laminated very sandy clayey organic SILT. Sand is fine to coarse.		
22.50 - 23.00	B22									
						(2.00)				
23.50 - 23.95	U28			Ublow=6 0%						
23.50 - 24.00	B23									
24.00 - 24.45	SPT (S) N=17	24.00		N=17 (4,5/4,4,5,4)						
					-31.45	24.40		Very soft grey slightly gravelly very sandy silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
24.50 - 25.00	B24									
						(2.60)				
25.50 - 25.95	U29			Ublow=8 0%						
25.50 - 26.00	B25									

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH02

Coordinates: 142453.09 E 931347.03 N

Client: Stornoway Port Authority

Sheet 6 of 8

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.05 mCD

Dates: 26/01/2018 - 29/01/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
26.50 - 27.00	B26							Very soft grey slightly gravelly very sandy silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
27.00 - 27.45	SPT (C) N=23	27.00		N=23 (5,6/6,6,5,6)	-34.05	27.00		Stiff sandy silty CLAY. Sand is fine to coarse. (No Recovery)		
28.50 - 30.00				B30		(3.00)				
30.45 - 30.90				N=11 (2,1/2,3,3,3)	-37.05	30.00 (1.50)		Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 15.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		27.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH02
Coordinates:	**Client:**	Sheet 7 of 8
142453.09 E	Stornoway Port Authority	
931347.03 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.05 mCD	**Dates:** 26/01/2018 - 29/01/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	27.00
Rotary Coring	Comacchio 405	27.00	37.90

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		
31.50 - 31.95					N=18 (3,3/4,3,5,6)	-38.55	31.50				
									Stiff slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse.		
							(1.50)				
33.00 - 33.43					N=50 (6,4/50 for 280mm)	-40.05	33.00				
							(0.30)		Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mixed lithologies.		
	73					-40.35	33.30		Very dense slightly sandy clayey angular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Gravels are predominately of gneiss. Cobbles are angular predominately of gneiss.		
							(1.20)				
34.50						-41.55	34.50		Weak massive black DOLORITE. Partially weathered: slightly closer fracture spacing, faint greyish green discolouration on discontinuities. Discontinuities: 1. 20 to 40 degree joints medium spaced (260/280/350) planar, smooth, patchy greenish grey staining on joint surfaces.		
				20							
	98	50	40				(1.70)				
				8							
36.00											
	TCR	SCR	RQD	FI							

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3 5m into competent bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH02
Coordinates:	**Client:**	Sheet 8 of 8
142453.09 E	Stornoway Port Authority	
931347.03 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.05 mCD	**Dates:** 26/01/2018 - 29/01/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 27.00	27.00 37.90

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	49	41	6		-43.25	36.20	+ + + + + + + +	Weak massive black DOLORITE. Partially weathered: slightly closer fracture spacing, faint greyish green discolouration on discontinuities. Discontinuities: 1. 20 to 40 degree joints medium spaced (260/280/350) planar, smooth, patchy greenish grey staining on joint surfaces. Strong to very strong narrowly foliated grey and pink GNEISS. Largely unweathered: faint greyish green discolouration on discontinuities. Discontinuities: 1. 0 to 30 degree foliation fractures, medium spaced (80/200/340) planar, smooth, faint greyish green staining on fracture surfaces. 2. 50 to 70 degree joints medium spaced (70/420/780) planar, smooth, patchy greenish grey staining on joint surface.		
37.50	100	100	100	0			(1.70)				
37.90						-44.95	37.90		End of Borehole at 37.90m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 15.00m

Terminated by Engineer 3 5m into competent bedrock

Core Barrel

Flush Type

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH03
Coordinates:	**Client:**	Sheet 1 of 2
142500.58 E	Stornoway Port Authority	
931396.69 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC
-6.99 mCD	05/01/2018 - 06/01/2018	**Logger:** SC

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	10.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 1.00	B1					(1.00)		Black slightly silty sandy subrounded fine to coarse GRAVEL with high volume of shell fragments. Sand is fine to coarse.		
1 00	D2				-7 99	1.00				
1 00 - 2.00	B3							Very loose to medium dense reddish grey slightly silty sandy subrounded fine to coarse GRAVEL with shells. Sand is fine to coarse.		
1 00 - 1.45	SPT (S) N=4	15.00		N=4 (1,0/1,1,1,1)						
2 00	D4					(3.50)				
2 00 - 3.00	B5									
2 00 - 2.45	SPT (S) N=10	16.00		N=10 (1,2/2,3,3,2)						
3 00	D6									
3 00 - 4.00	B7									
3 00 - 3.45	SPT (S) N=15	17.00		N=15 (2,3/3,4,4,4)						
4 00	D8									
4 00 - 4.50	B9									
4 00 - 4.45	SPT (S) N=16	18.00		N=16 (1,2/3,4,4,5)						
4 50 - 5.00	B10				-11.49	4.50		Medium dense reddish brown slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse		
5 00 - 6.00	B11									
5 00 - 5.45	SPT (S) N=18	19.00		N=18 (2,3/3,4,5,6)						

Remarks

Deck to Bed = 14.00m

Terminated due to obstruction in borehole preventing progress of the CP drill string

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	10.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03

Coordinates: 142500.58 E, 931396.69 N

Client: Stornoway Port Authority

Sheet 2 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC

Ground Level: -6.99 mCD

Dates: 05/01/2018 - 06/01/2018

Logger: SC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Medium dense reddish brown slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse		
6.00 6.00 - 7.00 6.00 - 6.45	D12 B13 SPT (S) N=26	20.00		N=26 (3,4/5,7,7,7)		(2.50)				
7.00 7.00 - 7.45	D14 SPT (S) N=34	21.00 7.00 7.00		N=34 (4,5/6,8,9,11) 05-01-2018 06-01-2018	-13.99	7.00		Dense reddish brown slightly sandy rounded and subrounded fine to coarse GRAVEL with very low cobble content. Sand is coarse (Blowing sandy gravel)		
8.00	B15 D16					(1.80)		*Reddish brown GRAVEL with boulders (blowing)*		
					-15.79	8.80		Loose to medium dense reddish brown and grey slightly sandy rounded and subrounded fine to coarse GRAVEL. Sand is coarse (Blowing sandy gravel)		
9.00	B17 D18					(1.20)				
10.00	B19 D20				-16.99	10.00		End of Borehole at 10.00m		

Remarks

Deck to Bed = 14.00m

Terminated due to obstruction in borehole preventing progress of the CP drill string

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
8.00	250
10.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH03A
Coordinates:	**Client:**	Sheet 1 of 11
142501.94 E	Stornoway Port Authority	
931392.44 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-6.99 mCD	06/01/2018 - 16/01/2018	**Logger:** SG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00
Rotary Coring	Comacchio 405	30.00	53.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 1.00	B53					(1.00)		Black slightly silty sandy subrounded fine to coarse GRAVEL with high volume of shell fragments. Sand is fine to coarse.		
1 00	D54				-7 99	1.00				
1 00 - 2.00	B55							Very loose reddish grey slightly silty sandy subrounded fine to coarse GRAVEL with shells. Sand is fine to coarse.		
1 00 - 1.45	SPT (S) N=4	1.00		N=4 (1,0/1,1,1,1)		(1.00)				
2 00	D56				-8 99	2.00				
2 00 - 3.00	B57							Medium dense reddish grey slightly sandy subrounded fine to coarse GRAVEL. Sand is coarse.		
2 00 - 2.45	SPT (S) N=10	2.00		N=10 (1,2/2,3,3,2)						
3 00	D58									
3 00 - 4.00	B59									
3 00 - 3.45	SPT (S) N=15	3.00		N=15 (2,3/3,4,4,4)		(2.50)				
4 00	D60									
4 00 - 4.50	B61									
4 00 - 4.45	SPT (S) N=16	4.00		N=16 (1,2/3,4,4,5)						
4 50 - 5.00	B62				-11.49	4.50		Medium dense reddish brown slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
5 00	D63									
5 00 - 6.00	B64									
5 00 - 5.45	SPT (S) N=18	5.00		N=18 (2,3/3,4,5,6)						

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH03A
Coordinates:	**Client:**	Sheet 2 of 11
142501.94 E	Stornoway Port Authority	
931392.44 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -6.99 mCD	**Dates:** 06/01/2018 - 16/01/2018	**Driller:** CC+SS
		Logger: SG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00
Rotary Coring	Comacchio 405	30.00	53.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
6.00 6.00 - 7.00 6.00 - 6.45	D65 B66 SPT (S) N=26	6.00		N=26 (3,4/5,7,7,7)		(2.50)		Medium dense reddish brown slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
7.00 7.00 - 7.45	D67 SPT (S) N=34	7.00		N=34 (4,5/6,8,9,11)	-13.99	7.00		Dense reddish brown slightly sandy rounded and subrounded fine to coarse GRAVEL with very low cobble content. Sand is coarse. (Blowing)		
8.00 8.00 - 9.00	D68 B69					(1.80)				
9.00 9.00 - 10.00 9.00 - 9.45	D70 B71 SPT (S) N=11	9.00		N=11 (1,2/2,3,3,3)	-15.79	8.80		Loose to medium dense reddish brown slightly sandy subrounded fine to coarse GRAVEL. Sand is medium to coarse. (Blowing)		
10.00 10.00 - 11.00	D72 B73									

Remarks
Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)
6.00	16.00

Casing Details

To (m)	Diam (mm)
7.50	250

Chiselling Details

From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E 931392.44 N

Client: Stornoway Port Authority

Sheet 3 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Driller: CC+SS

Logger: SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50 - 10.95	SPT (S) N=14	10.50		N=14 (2,3/3,3,4,4)				Loose to medium dense reddish brown slightly sandy subrounded fine to coarse GRAVEL. Sand is medium to coarse. (Blowing)		
11.50	B6 D30					(5.20)				
12.50	B7 D31									
13.00 - 13.45	SPT (C) N=9	13.00		N=9 (2,2/2,2,3,2)						
13.50	B8 D32									
					-20.99	14.00		Medium dense reddish brown subrounded to rounded medium to coarse GRAVEL with low to medium cobble content. Cobbles are subrounded to rounded. (Blowing)		
14.50	B9 D33									
14.50 - 14.95	SPT (C) N=15	14.50		N=15 (4,3/4,4,3,4)		(2.00)				

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E, 931392.44 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Logger: SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
15.50	B10 D34							Medium dense reddish brown subrounded to rounded medium to coarse GRAVEL with low to medium cobble content. Cobbles are subrounded to rounded. (Blowing)		
					-22.99	16.00				
16.10 - 16.55	SPT (C) N=20	16.10		N=20 (4,4/5,4,5,6)				Medium dense grey gravelly fine to coarse SAND. Gravel is subrounded to rounded fine.		
						(0.60)				
16.40	B11 D35									
					-23.59	16.60		Medium dense grey and reddish brown slightly silty sandy subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
16.70	B12 D36									
17.00 - 18.00	B14									
17.50	B13 D37									
						(2.10)				
18.00	D38									
18.00 - 18.45	SPT (S) N=18	18.00		N=18 (2,3/4,4,5,5)						
18.70 - 19.50	B15				-25.69	18.70		Medium dense blackish grey slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
						(1.50)				
19.50	D39									
19.50 - 19.95	SPT (S) N=24	19.50		N=24 (1,4/5,6,6,7)						
					-27.19	20.20		Dark grey clayey very silty slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine.		
						(0.40)				
~~20.60 - 21.00~~	~~B16~~				~~-27.59~~	~~20.60~~				

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00
Rotary Coring	Comacchio 405	30.00	53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E, 931392.44 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Logger: SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.40)		Soft to firm brownish grey slightly gravelly sandy silty CLAY. Gravel is subrounded fine to medium. Sand is fine to coarse.		
21.00 - 21.45	U49			Ublow=6 0%	-27.99	21.00				
21.00 - 21.50	B17							Loose brownish grey slightly gravelly clayey very silty fine to coarse SAND with cobble to boulder sized pockets of very sandy silt. Gravel is subangular to subrounded fine.		
21.50 - 22.50	B18									
22.50	D40									
22.50 - 22.95	SPT (S) N=9	22.50		N=9 (1,1/2,2,2,3)						
23.00 - 24.00	B19					(4.00)				
24.00 - 24.45	U50			Ublow=16 100%						
24.00 - 25.00	B20									
25.00 - 26.00	B21				-31.99	25.00		Soft to firm brownish grey slightly sandy silty CLAY. Sand is fine to coarse.		
25.50	D41									
25.50 - 25.95	SPT (S) N=10	25.50		N=10 (2,2/2,2,3,3)						

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Coordinates: 142501.94 E, 931392.44 N

Ground Level: -6.99 mCD

Project Name: Stornoway Deep Water Berth G.I.

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Dates: 06/01/2018 - 16/01/2018

Borehole No.: BH03A

Sheet 6 of 11

Scale: 1:25

Driller: CC+SS

Logger: SG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Soft to firm brownish grey slightly sandy silty CLAY. Sand is fine to coarse.		
26.40 - 27.00	B22					(2.00)				
27.00 - 27.45	U51			Ublow=22 100%	-33.99	27.00				
27.00 - 28.00	B1							Soft brownish grey sandy silty CLAY. Sand is fine to coarse.		
						(1.10)				
					-35.09	28.10				
28.20 - 29.00	B2							Firm blackish grey sandy silty CLAY. Sand is fine to coarse.		
28.50	D4									
28.50 - 28.95	SPT (S) N=14	28.50		N=14 (1,2/3,3,4,4)						
29.00 - 30.00	B3					(1.90)				
30.00 - 30.45	U52			Ublow=24 0%		30.00				
30.00 - 30.45	U52				-36.99			Firm to stiff brownish grey slightly sandy clayey organic SILT. Sand is fine to coarse.		
						(0.50)				
					-37.49	30.50		Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mixed lithologies.		
	TCR SCR RQD FI									

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
30.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E, 931392.44 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Logger: SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100								Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mixed lithologies.		
32.00 32.00 - 32.45 32.00	98				D42 N=15 (2,3/3,4,4,4)		(2.80)				
						-40.29	33.30				
							(0.20)		Dark grey and pink BOULDER of medium strong narrowly foliated gneiss. Largely unweathered.		
33.50 33.50 - 33.95 33.50	0				D43 N=18 (3,3/4,4,5,5)	-40.49	33.50		Medium dense grey very silty fine to coarse SAND.		
							(2.50)				
35.00 - 35.45 35.00	0				N=16 (2,3/4,4,4,4)						
						-42.99	36.00				
	TCR	SCR	RQD	FI							

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
				8.00	8.50	03 00
				16.60	17.00	01 00

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00
Rotary Coring	Comacchio 405	30.00	53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E, 931392.44 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Logger: SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Loose to medium dense greyish brown clayey very silty fine to coarse SAND.		
36.50 - 36.95					N=9 (1,2/2,2,2,3)						
36.50	0										
38.00					D44						
38.00 - 40.00					B23						
38.00 - 38.45					N=11 (1,1/2,3,3,3)						
38.00	0						(8.00)				
39.50					D45						
39.50 - 39.95					N=9 (1,2/2,2,2,3)						
39.50	0										
41.00					D46						
41.00 - 43.00					B24						
41.00 - 41.45					N=20 (3,3/4,5,5,6)						
41.00	TCR	SCR	RQD	FI							

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel: SK6L

Flush Type: Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Coordinates: 142501.94 E, 931392.44 N

Ground Level: -6.99 mCD

Project Name: Stornoway Deep Water Berth G.I.

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Dates: 06/01/2018 - 16/01/2018

Borehole No.: BH03A

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Scale: 1:25

Driller: CC+SS

Logger: SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	0								Loose to medium dense greyish brown clayey very silty fine to coarse SAND.		
42.50 42.50 - 42.58 42.50	0				D47 50 (25 for 70mm/50 for 5mm)						
44.00 44.00 - 44.45 44.00	0				D48 N=20 (2,3/4,4,6,6)	-50.99	44.00		Medium dense grey silty sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. with areas of pocket-sized stiff grey silty CLAY. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies predominantly gneiss.		
45.50 45.50 - 45.95 45.50	0				D5 N=21 (5,4/4,6,5,6)						
	TCR	SCR	RQD	FI							

41.5 42.0 42.5 43.0 43.5 44.0 44.5 45.0 45.5 46.0

Remarks
Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH03A

Coordinates: 142501.94 E 931392.44 N

Client: Stornoway Port Authority

Sheet 10 of 11

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -6.99 mCD

Dates: 06/01/2018 - 16/01/2018

Driller: CC+SS

Logger: SG+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Medium dense grey silty sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. with areas of pocket-sized stiff grey silty CLAY. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies predominantly gneiss.		
47.00					D74						
47.00 - 47.45					N=25 (5,6/5,7,6,7)						
47.00	0						(5.00)				
48.50 - 48.95					N=25 (5,5/5,7,6,7)						
48.50	0										
49.00						-55.99	49.00		Dark grey subrounded to rounded cobbles and BOULDERS of gneiss and metagabbro.		
	55										
50.00							(2.10)				
	40										
						-58.09	51.10		Weathered bedrock - Recovered as pink and grey sandy silty angular to subangular fine to coarse GRAVEL with low cobble content. Gravels are of gneiss. Sand is fine to coarse. Cobbles are angular of gneiss. (weathered bedrock)		
~~51.50 - 51.55~~ 51.50	TCR	SCR	RQD	FI	~~50 (25 for 35mm/50 for 15mm)~~						

Remarks

Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel SK6L

Flush Type Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
8.00	8.50	03 00
16.60	17.00	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH03A
Coordinates:	**Client:**	Sheet 11 of 11
142501.94 E	Stornoway Port Authority	
931392.44 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-6.99 mCD	06/01/2018 - 16/01/2018	**Logger:** SG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 30.00	30.00 53.00

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	20						(1.90)		Weathered bedrock - Recovered as pink and grey sandy silty angular to subangular fine to coarse GRAVEL with low cobble content. Gravels are of gneiss. Sand is fine to coarse. Cobbles are angular of gneiss. (weathered bedrock)		
53.00 - 53.01 53.00					50 (25 for 5mm/50 for 5mm)	-59.99	53.00		End of Borehole at 53.00m		
	TCR	SCR	RQD	FI							

52.0 52.5 53.0 53.5 54.0 54.5 55.0 55.5 56.0 56.5

Remarks
Deck to Bed = 13.50m

Terminated due to Geobore casing sheared above lead length

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					8.00 16.60	8.50 17.00	03 00 01 00

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
Polymer				

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH04
Coordinates:	**Client:**	Sheet 1 of 1
142614.97 E	Stornoway Port Authority	
931489.09 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.41 mCD	**Dates:** 17/01/2018	**Driller:** CC
		Logger: SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	4.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 1.00	B8							Loose blackish grey slightly silty very gravelly fine to coarse SAND with shell fragments. Gravel is subrounded fine to medium.		
0 50	ES9									
1 00	D4					(2.10)				
	ES10									
	ES15									
1 00 - 2.00	B7									
1 00 - 1.45	SPT (S) N=9	1.00		N=9 (1,1/2,2,2,3)						
1 50	ES11									
2 00	D3									
	ES12				-9 51	2.10				
	ES16							Medium dense reddish brown and grey slightly silty very sandy subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
2 00 - 2.45	SPT (S) N=11	2.00		N=11 (1,2/2,3,3,3)						
2.10 - 3.00	B6									
2 50	ES13									
3 00	D2					(1.90)				
	ES14									
	ES17									
3 00 - 4.00	B5									
3 00 - 3.45	SPT (S) N=14	3.00		N=14 (2,2/3,3,4,4)						
4 00	D1				-11.41	4.00				
4 00 - 4.45	SPT (S) N=18	4.00		N=18 (2,3/3,4,5,6)				End of Borehole at 4 00m		

Remarks
Deck to Bed = 13.80m

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
4.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH05
Coordinates:	**Client:**	Sheet 1 of 1
142811.43 E	Stornoway Port Authority	
931474.71 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC
-8.82 mCD	08/02/2018	**Logger:** FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.50

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B9					(0.70)		Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is medium to coarse.		
0 50	ES1 ES2				-9 52	0.70		Loose reddish brown and grey very sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
1 00	ES3 ES4									
1 00 - 1.50	B10									
1 00 - 1.45	SPT (C) N=4	1.00		N=4 (1,1/0,1,1,2)		(1.20)				
1 50	ES5 ES6									
2 00	ES7 ES8				-10.72	1.90		Medium dense reddish brown slightly sandy subrounded to rounded fine to coarse GRAVEL with medium cobble content. Sand is coarse. Cobbles are subrounded to rounded.		
2 00 - 2.50	B11									
2 00 - 2.45	SPT (C) N=27	2.00		N=27 (5,6/6,7,6,8)		(0.60)				
2 50 - 2.83	SPT (C)	2.50		50 (7,14/50 for 180mm)	-11.32	2.50		End of Borehole at 2 50m		

Remarks
Deck to Bed = 14.80m

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.50	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 7.60	7.60 12.40

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH06

Coordinates: 142418.35 E, 931251.97 N

Client: Stornoway Port Authority

Sheet 1 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.61 mCD

Dates: 04/12/2017 - 05/12/2017

Driller: CC+SS

Logger: SC+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
1 00 - 1.40 1 00 - 1.45	B6 SPT (S) N=5			N=5 (1,0/1,1,1,2)				Loose grey slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is medium to coarse. Cobbles are subangular to subrounded of mixed lithologies.		
2 00 - 2.80 2 00 - 2.45	B5 SPT (S) N=8			N=8 (1,2/2,2,2,2)		(4.00)				
3 00 - 3.40	B4									
3 50 - 3.95	SPT (C) N=9			N=9 (1,1/2,2,2,3)						
4 00 - 4.40	B3				-11.61	4.00		Loose to medium dense grey slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is medium to coarse. Cobbles are subrounded of mixed lithologies.		
4 50 - 4.95	SPT (C) N=11			N=11 (2,2/3,3,2,3)						
5 00 - 5.40	B2									

Remarks
Deck to Bed = 14.50m

Terminated at scheduled depth

Core Barrel: SK6L

Flush Type:

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH06
Coordinates:	**Client:**	Sheet 2 of 3
142418.35 E	Stornoway Port Authority	
931251.97 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-7.61 mCD	04/12/2017 - 05/12/2017	**Logger:** SC+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	7.60
Rotary Coring	Comacchio 405	7.60	12.40

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 50 - 5.95	SPT (C) N=45			N=45 (5,6/14,10,10,11)		(2.50)		Loose to medium dense grey slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is medium to coarse. Cobbles are subrounded of mixed lithologies.		
6 00 - 6.40	B1									
6 50 - 7.00	B9				-14.11	6.50				
6 50 - 6.82	SPT (S)			50 (6,14/50 for 175mm)		(0.70)		Firm grey slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of mixed lithologies.		
7 20 - 7.60	B8				-14.81	7.20		Brownish grey slightly silty sandy subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular.		
7 50	D7				-15.11	(0.30) 7.50				
7 50 - 7.72	SPT (S)		9	50 (25 for 100mm/50 for 120mm)				Weak to medium strong massive black METAGRABBRO. Largely unweathered: pervasive faint greenish grey discolouration. Discontinuities: 1. 0 to 30 degree joints, closely spaced (30/180/200) planar, smooth, faint grey staining surfaces. 2. 50 to 70 degree joints medium spaced (200/300/430) planar, smooth, faint greenish grey staining on joints. 3. Probable 90 degree joint at 8.50m to 9.0m.		
	96 50	34	>20			(1.50)				
9 00					-16.61	9.00		No core recovery - assumed zone of core loss due to weak rock		
	0 0	0	13			(1.00)				
10.00					-17.61	10.00		Medium strong to strong very narrowly foliated pink and grey GNEISS. largely unweathered: slightly closer fracture spacing, faint orangish red and grey discolouration on fracture surfaces.		
	TCR SCR	RQD	FI							

Remarks
Deck to Bed = 14.50m

Terminated at scheduled depth

Core Barrel	Water Strikes				Chiselling Details		
SK6L	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			7.60	250

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 7.60	7.60 12.40

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH06

Coordinates: 142418.35 E 931251.97 N

Client: Stornoway Port Authority

Sheet 3 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.61 mCD

Dates: 04/12/2017 - 05/12/2017

Driller: CC+SS

Logger: SC+TH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	98	32	0						Medium strong to strong very narrowly foliated pink and grey GNEISS. largely unweathered: slightly closer fracture spacing, faint orangish red and grey discolouration on fracture surfaces. Discontinuities: 1. 0 to 30 degree foliation fractures, closely spaced (30/100/150) planar, smooth. 2. 50 to 70 degree joints medium spaced (170/300/380) planar, smooth, patchy greenish grey staining. 3. 80 degree joint at 11 85m to 12.20m, undulating, rough, faint grey staining.		
10.90											
	96	62	56	7			(2.40)				
12.40						-20.01	12.40		End of Borehole at 12.40m		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 14.50m

Terminated at scheduled depth

Core Barrel SK6L

Flush Type

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.40	150

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	35.30
Rotary Coring	Comacchio 405	35.30	38.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH07

Coordinates: 142520.03 E, 931316.99 N

Client: Stornoway Port Authority

Sheet 1 of 8

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.02 mCD

Dates: 23/01/2018 - 25/01/2018

Driller: CC+MJ

Logger: FG+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 50	ES47					(1.60)		Loose grey slightly silty very sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse.		
1 00	D33 ES48 ES55									
1 00 - 2.00	B1									
1 00 - 1.45	SPT (S) N=6	1.00		N=6 (1,1/1,1,2,2)						
1 50	ES49				-8.62	1.60		Loose grey slightly silty very sandy subrounded to rounded fine to coarse GRAVEL with low cobble content. Sand is medium to coarse. Cobbles are subrounded to rounded.		
2 00	D34 ES50 ES56									
2 00 - 3.00	B2									
2 00 - 2.45	SPT (S) N=9	2.00		N=9 (1,2/2,2,2,3)						
2 50	ES51					(1.80)				
3 00	D35 ES52 ES57									
3 00 - 4.00	B3									
3 00 - 3.45	SPT (S) N=11	3.00		N=11 (2,2/3,3,3,2)						
3 50	ES53				-10.42	3.40		Loose to medium dense grey slightly silty very sandy subrounded to rounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
4 00	D36 ES54									
4 00 - 5.00	B4					(1.70)				
4 50 - 4.95	SPT (C) N=9	4.50		N=9 (4,3/2,3,2,2)						
5 00	D37									
5 00 - 5.30	B5				-12.12	5.10				

Remarks

Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

Flush Type

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	35.30
Rotary Coring	Comacchio 405	35.30	38.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH07

Coordinates: 142520.03 E, 931316.99 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -7.02 mCD

Dates: 23/01/2018 - 25/01/2018

Logger: FG+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 30 - 6.00	B6							Medium dense grey slightly silty very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		
6 00 - 6.45	SPT (C) N=12	6.00		N=12 (3,4/3,3,3,3)						
6 50 - 7.00	B7					(2.90)				
7 00 - 8.00	B8									
7 00 - 7.45	SPT (C) N=19	7.00		N=19 (4,3/4,4,5,6)						
8 00 - 9.00	B9				-15.02	8.00		Loose grey very sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
8 50	D38									
8 50 - 8.95	SPT (S) N=4	8.50		N=4 (2,1/1,1,1,1)						
9 00 - 10.00	B10					(3.40)				
10.00 - 11.00	B11									

Remarks

Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

Flush Type

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 35.30	35.30 38.30

Project No.: 17-0769	**Project Name:** Stornoway Deep Water Berth G.I.	**Borehole No.:** BH07
Coordinates: 142520.03 E 931316.99 N	**Client:** Stornoway Port Authority	Sheet 3 of 8
	Client's Representative: Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.02 mCD	**Dates:** 23/01/2018 - 25/01/2018	**Driller:** CC+MJ **Logger:** FG+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50 10.50 - 10.95	D39 SPT (C) N=9	10.50		N=9 (3,3/3,2,2,2)				Loose grey very sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
11.40 - 12.00	B12				-18.42	11.40		Very dense brownish grey very gravelly slightly silty fine to coarse SAND with low cobble content and shell fragments. Gravel is subrounded to rounded fine to coarse. Cobbles are subrounded to rounded.		
12.20 - 13.00 12.20 - 12.63	B13 SPT (C)	12.20		N=50 (2,4/50 for 280mm)		(2.00)				
					-20.42	13.40		Very loose to loose greyish brown slightly clayey slightly gravelly silty fine to coarse SAND with organic material and odour throughout. Gravel is subangular to subrounded fine.		
13.70 - 14.15	SPT (C) N=6	13.70		N=6 (1,1/1,1,2,2)						
14.00 - 14.40	B14									
15.00 - 15.40	B15									
15.20 - 15.65	SPT (C) N=2	15.20		N=2 (1,1/1,0,1,0)						

Remarks
Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		10.50	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	35.30
Rotary Coring	Comacchio 405	35.30	38.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH07

Coordinates: 142520.03 E, 931316.99 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -7.02 mCD

Dates: 23/01/2018 - 25/01/2018

Logger: FG+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very loose to loose greyish brown slightly clayey slightly gravelly silty fine to coarse SAND with organic material and odour throughout. Gravel is subangular to subrounded fine.		
16.00 - 16.40	B16									
16.70 - 17.15	SPT (C) N=2	16.70		N=2 (1,0/1,0,1,0)						
17.00 - 17.40	B17									
						(6.60)				
18.00 - 18.40	B18									
18.20 - 18.65	SPT (C) N=2	18.20		N=2 (0,1/0,0,2,0)						
18.50 - 19.00	B19									
20.00 - 20.50	B20				-27.02	20.00		Dark grey/black slightly sandy slightly gravelly slightly clayey organic SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
20.50 - 20.95	U44			Ublow=15 100%						

Remarks

Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH07
Coordinates:	**Client:**	Sheet 5 of 8
142520.03 E	Stornoway Port Authority	
931316.99 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.02 mCD	**Dates:** 23/01/2018 - 25/01/2018	**Driller:** CC+MJ
		Logger: FG+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	35.30
Rotary Coring	Comacchio 405	35.30	38.30

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(2.00)		Dark grey/black slightly sandy slightly gravelly slightly clayey organic SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
22.00 - 22.45	SPT (C) N=8	22.00		N=8 (2,2/1,2,3,2)	-29.02	22.00				
22.50 - 23.00	B21					(1.50)		Loose grey silty SAND and GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.		
23.00 - 24.00	B22									
					-30.52	23.50		Loose to medium dense brownish grey slightly gravelly slightly clayey very silty fine to coarse SAND. Gravel is subangular to subrounded fine.		
24.00 - 25.00	B23					(3.90)				
25.00 - 25.45	U45			Ublow=32 100%						
25.50 - 26.00	B24									

Remarks
Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH07
Coordinates:	**Client:**	Sheet 6 of 8
142520.03 E	Stornoway Port Authority	
931316.99 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+MJ
-7.02 mCD	23/01/2018 - 25/01/2018	**Logger:** FG+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	35.30
Rotary Coring	Comacchio 405	35.30	38.30

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose to medium dense brownish grey slightly gravelly slightly clayey very silty fine to coarse SAND. Gravel is subangular to subrounded fine.		
26.00 - 27.00	B25									
26.50	D40									
26.50 - 26.95	SPT (S) N=13	26.50		N=13 (3,2/2,3,4,4)						
27.00 - 28.00	B26									
					-34.42	27.40		Firm to stiff grey slightly sandy clayey SILT. Sand is fine.		
28.00	D41									
28.00 - 29.00	B27									
28.00 - 28.45	SPT (S) N=16	28.00		N=16 (5,4/4,3,5,4)						
29.00 - 29.45	U46			Ublow=37 100%						
						(4.20)				
30.00 - 31.00	B28									

Remarks
Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 35.30	35.30 38.30

Project No.: 17-0769
Coordinates: 142520.03 E 931316.99 N
Ground Level: -7.02 mCD
Project Name: Stornoway Deep Water Berth G.I.
Client: Stornoway Port Authority
Client's Representative: Wallace Stone Consulting Civil Engineers
Dates: 23/01/2018 - 25/01/2018
Borehole No.: BH07
Sheet 7 of 8
Scale: 1:25
Driller: CC+MJ
Logger: FG+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
31.00 - 31.50	B29							Firm to stiff grey slightly sandy clayey SILT. Sand is fine.		
31.00 - 31.45	SPT (S) N=20	31.00		N=20 (6,4/4,5,5,6)						
31.60 - 32.50	B30				-38.62	31.60		Dense to very dense greenish grey silty very sandy subangular to subrounded fine to coarse GRAVEL predominantly gneiss. Sand is fine to coarse.		
32.50	D43									
32.50 - 32.95	SPT (S) N=38	32.50		N=38 (5,7/7,9,10,12)						
33.00 - 34.00	B31					(3.70)				
34.00	D42									
34.00 - 34.40	SPT (S)	34.00		N=50 (10,11/50 for 250mm)						
35.00 - 35.30	B32									
35.30 - 35.35	SPT (C)	35.30		50 (25 for 25mm/50 for 25mm)	-42.32	35.30		Very dense grey slightly silty slightly sandy angular to subangular medium to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular predominantly gneiss.		
35.30 - 35.35				50 (25 for 25mm/50 for 25mm)						

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		35.30	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 35.30	35.30 38.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH07

Coordinates: 142520.03 E 931316.99 N

Client: Stornoway Port Authority

Sheet 8 of 8

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.02 mCD

Dates: 23/01/2018 - 25/01/2018

Driller: CC+MJ

Logger: FG+SG

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	0								Very dense grey slightly silty slightly sandy angular to subangular medium to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular predominantly gneiss.		
36.80 - 36.99 36.80					50 (25 for 85mm/50 for 105mm)		(3.00)				
	0										
38.30 - 38.38 38.30					50 (25 for 30mm/50 for 45mm)	-45.32	38.30		End of Borehole at 38.30m		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 14.60m

Terminated after 2 runs of GeoborS - casing seized at base of borehole

Core Barrel

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.40	4.60	01 00
32.00	33.00	02 00
34.50	35.30	02 00

Flush Type

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH08
Coordinates:	**Client:**	Sheet 1 of 1
142624.18 E	Stornoway Port Authority	
931321.27 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -6.18 mCD	**Dates:** 18/01/2018	**Driller:** CC
		Logger: SC

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	5.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 1.00	B10							Medium dense reddish brown grey slightly sandy subrounded fine to coarse GRAVEL with shells. Sand is medium to coarse.		
0 50	ES1									
						(1.70)				
1 00	D16									
	ES2									
	ES21									
1 00 - 1.50	B11									
1 00 - 1.45	SPT (S) N=23	1.00		N=23 (2,3/4,6,6,7)						
1 50	ES3									
1.70 - 2.50	B12				-7 88	1.70		Medium dense reddish brown slightly silty gravelly fine to coarse SAND with shells. Gravel is subrounded fine to medium.		
2 00	D17									
	ES22									
	ES4					(0.80)				
2 00 - 2.45	SPT (S) N=18	2.00		N=18 (1,2/3,5,5,5)						
2 50	ES5				-8.68	2.50				
2 50 - 3.00	B13							Medium dense reddish brown grey slightly sandy subrounded fine to coarse GRAVEL with shells. Sand is coarse.		
3 00	D18									
	ES23									
	ES6									
3 00 - 4.00	B14									
3 00 - 3.45	SPT (S) N=14	3.00		N=14 (2,3/3,3,4,4)						
3 50	ES7									
						(2.50)				
4 00	D19									
	ES24									
	ES8									
4 00 - 5.00	B15									
4 00 - 4.45	SPT (S) N=23	4.00		N=23 (3,4/4,6,7,6)						
4 50	ES9									
5 00	D20				-11.18	5.00				
5 00 - 5.45	SPT (S) N=28	5.00		N=28 (4,4/6,7,7,8)				End of Borehole at 5 00m		

Remarks
Deck to Bed = 14.00m

Terminated at scheduled depth

Core Barrel

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

Flush Type

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		5.00	200

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH09
Coordinates:	**Client:**	Sheet 1 of 1
142781.59 E	Stornoway Port Authority	
931363.59 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC
-8.05 mCD	07/02/2018	**Logger:** FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B11					(0.60)		Grey and reddish brown slightly silty sandy subrounded to rounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
0 50	ES1									
	ES2				-8.65	0.60				
0 50 - 1.00	B12							Very loose brownish grey subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded to rounded.		
1 00	ES3					(0.90)				
	ES4									
1 00 - 1.50	B13									
1 00 - 1.45	SPT (C) N=3	1.00		N=3 (1,0/1,1,0,1)						
1 50	ES5				-9 55	1.50				
	ES6							Medium dense greyish brown slightly sandy subrounded to rounded fine to coarse GRAVEL with medium cobble content. Sand is medium to coarse. Cobbles are subrounded to rounded.		
1 50 - 2.00	B14									
2 00	ES7									
	ES8									
2 00 - 2.50	B15									
2 00 - 2.45	SPT (C) N=23	2.00		N=23 (1,3/4,5,6,8)		(1.50)				
2 50	ES10									
	ES9									
2 50 - 3.00	B16									
3 00 - 3.45	SPT (C) N=23	3.00		N=23 (1,3/3,4,7,9)	-11.05	3.00		End of Borehole at 3 00m		

Remarks
Deck to Bed = 14.00m

Terminated at scheduled depth

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			3.00	250

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando Terrier Comacchio 405	0.00 3.90	3.90 9.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH10

Coordinates: 142399.41 E, 931174.14 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -6.12 mCD

Dates: 05/12/2017 - 06/12/2017

Driller: CC+MJ

Logger: SC+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
1 00 - 1.40 1 00 - 1.45	B2 SPT (S)			1 (1,0/0,1,0,)		(2.20)		Soft grey gravelly slightly sandy silty CLAY with fragments of shell. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
2 00 - 2.40 2 00 - 2.45	B3 U1			Ublow=6 100%						
					-8 32	2.20		Loose grey slightly clayey silty sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobles are subangular to subrounded.		
3 00 - 3.40 3 00 - 3.45	B5 SPT (C) N=1			N=1 (1,0/0,1,0,0)		(1.70)				
3.70 - 3.76	SPT (C)			50 (25 for 25mm/50 for 35mm)						
3 90	B4					3.90				
3 90 4 50	B4 93 13 0 >20			B4	-10.02	(2.10)		Medium strong to strong massive dark greenish grey METAGABBRO. Partially weathered: reddish brown discolouration on some joint surfaces, slightly reduced strength. Discontinuities: 1. 50 to 70 degree joints, closely spaced (60/100/150) planar, smooth, patchy reddish brown stain on joint surfaces. 2. 80 to 90 degree joint at 3.90m to 4.30m, undulating, smooth, with reddish brown staining.		
	TCR SCR RQD FI									

Remarks
Deck to Bed = 12.60m

Terminated by Engineer 5m into bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		3.90	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.50	3.90	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH10
Coordinates:	**Client:**	Sheet 2 of 2
142399.41 E	Stornoway Port Authority	
931174.14 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -6.12 mCD	**Dates:** 05/12/2017 - 06/12/2017	**Driller:** CC+MJ
		Logger: SC+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando Terrier Comacchio 405	0.00 3.90	3.90 9.00

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	24	15	15					Medium strong to strong massive dark greenish grey METAGABBRO. Partially weathered: reddish brown discolouration on some joint surfaces, slightly reduced strength. Discontinuities: 1. 50 to 70 degree joints, closely spaced (60/100/150) planar, smooth, patchy reddish brown stain on joint surfaces. 2. 80 to 90 degree joint at 3.90m to 4.30m, undulating, smooth, with reddish brown staining.		
6 00						-12.12	6.00				
	100	42	0				(0.70)		Weak thinly foliated dark grey and pink GNEISS. Highly weathered, faint greenish grey discolouration.		
6.70				13		-12.82	6.70				
	100	50	10	20					Medium strong thinly foliated dark grey and pink GNEISS. Partially weathered slightly closer fracture spacing, faint greenish grey discolouration. Discontinuities: 1. 0 to 30 degree foliation fractures, closely spaced (50/80/170) planar, smooth, occurring on mafic mineral bonds, faint greyish green staining, fault gauge at 8 20m to 8.25m and 8.50m to 8.55m, greyish green clayey angular fine to medium gravel. 2. 30 to 50 degree joints closely spaced (100/120/160) planar, smooth, faint greyish green staining on surface.		
				20							
7 80							(2.30)				
				13							
				NI							
	91	48	10	10							
9 00						-15.12	9.00		End of Borehole at 9 00m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 12.60m

Terminated by Engineer 5m into bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					3.50	3.90	01 00

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			9.00	150

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH11
Coordinates:	**Client:**	Sheet 1 of 5
142520.34 E	Stornoway Port Authority	
931201.20 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -10.23 mCD	**Dates:** 31/01/2018 - 06/02/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	17.80
Rotary Coring	Comacchio 405	17.80	25.30

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Grey slightly silty sandy angular to subangular fine to coarse GRAVEL with low cobble content and shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded.		
0 50	B3 ES1					(1.10)				
1 00	ES2 ES29				-11.33	1.10		Very loose reddish brown sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content and shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded.		
1 50	B4									
1 90 - 2.35	SPT (C) N=2	1.90		N=2 (1,0/0,1,1,0)						
2 50	B5									
						(4.10)				
3.40 - 3.85	SPT (C) N=2	3.40		N=2 (1,0/0,1,0,1)						
3 50	B6									
4 50	B7									
4 90 - 5.35	SPT (C) N=3	4.90		N=3 (1,1/1,0,1,1)						

Remarks
Deck to Bed = 19.00m

Terminated by Engineer 5m into bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
12.75	13.00	01 00
17.00	17.10	02 00
17.80	17.80	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 17.80	17.80 25.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH11

Coordinates: 142520.34 E, 931201.20 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -10.23 mCD

Dates: 31/01/2018 - 06/02/2018

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					-15.43	5.20		Very loose reddish brown sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content and shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded.		
5 50	B8							Grey silty very gravelly fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to medium. Cobbles are subangular to subrounded.		
						(1.00)				
					-16.43	6.20		Soft grey silty organic CLAY.		
						(0.20)				
6 35	B9									
6.40 - 6.85	U25			Ublow=8 100%	-16.63	6.40		Grey slightly silty fine SAND.		
6.45	B10									
						(0.80)				
7 00 - 8.00	B11									
7 20	D21				-17.43	7.20		Medium dense brownish grey clayey gravelly very silty fine to coarse SAND. Gravel is subangular fine to medium.		
7 20 - 7.65	SPT (S) N=17	7.65		N=17 (1,2/3,4,4,4,6)						
						(1.20)				
8.40 - 9.00	B12				-18.63	8.40		Very soft to soft brownish grey slightly gravelly slightly clayey sandy SILT. Sand is fine to coarse. Gravel is subangular fine.		
8 50 - 8.95	U26			Ublow=31 100%						
8.70 - 9.15	SPT (C) N=5	8.70		N=5 (0,1/1,1,1,2)						
9 00 - 10 00	B13									
						(2.60)				
10.00 - 11.00	B14									

Remarks

Deck to Bed = 19.00m

Terminated by Engineer 5m into bedrock

Core Barrel

Flush Type

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
7.20	250

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.75	13.00	01 00
17.00	17.10	02 00
17.80	17.80	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	17.80
Rotary Coring	Comacchio 405	17.80	25.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH11

Coordinates: 142520.34 E, 931201.20 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -10.23 mCD

Dates: 31/01/2018 - 06/02/2018

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft to soft brownish grey slightly gravelly slightly clayey sandy SILT. Sand is fine to coarse. Gravel is subangular fine.		
11.00	D22				-21.23	11.00				
11.00 - 11.50	B15							Soft brownish grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
11.00 - 11.45	SPT (S) N=6	11.00		N=6 (1,1/1,1,2,2)						
						(1.75)				
12.00 - 12.50	B16									
12.50 - 13.00	B17									
12.50 - 12.75	SPT (S)	12.50		50 (0,0/50 for 100mm)						
					-22.98	12.75		BOULDER		
						(0.25)				
					-23.23	13.00		Firm to stiff greenish grey slightly sandy slightly gravelly clayey SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium. Cobbles are subangular to subrounded.		
13.50	D23									
13.50 - 14.00	B18									
13.50 - 13.95	SPT (S) N=20	13.50		N=20 (4,4/4,5,6,5)						
						(4.40)				
15.00 - 15.45	U27			Ublow=43 0%						

Remarks

Deck to Bed = 19.00m

Terminated by Engineer 5m into bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
12.75	13.00	01 00
17.00	17.10	02 00
17.80	17.80	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 17.80	17.80 25.30

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH11

Coordinates: 142520.34 E 931201.20 N

Client: Stornoway Port Authority

Sheet 4 of 5

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -10.23 mCD

Dates: 31/01/2018 - 06/02/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Firm to stiff greenish grey slightly sandy slightly gravelly clayey SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium. Cobbles are subangular to subrounded.		
17.00	D24									
17.00 - 17.40	B19									
17.00 - 17.45	SPT (S) N=24	17.00		N=24 (4,5/5,5,7,7)						
17.40 - 17.60	B20				-27.63	17.40 (0.40)		Grey and reddish brown sandy silty angular fine to coarse GRAVEL predominantly gneiss with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of gneiss.		
17.70 - 17.80	B28									
17.70 - 17.79	SPT (C)	17.70		50 (23 for 80mm/50 for 10mm)	-28.03	17.80 (0.20)		BOULDER of gneiss		
	50				-28.23	18.00 (1.30)		Grey sandy gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse , predominately of gneiss. Cobbles are subangular of gneiss.		
19.30	96	13	0 >20		-29.53	19.30 (1.50)		Strong to very strong narrowly foliated grey and reddish brown GNEISS. Partially weathered: faint greyish green discolouration on joint surfaces. Discontinuities: 1. 0 to 30 degree foliation fractures, closely spaced (20/60/80) planar, smooth, faint greyish green staining on fracture surfaces. 2. 30 to 50 degree joints closely spaced (50/90/40) planar, smooth, faint greenish grey staining.		
	TCR	SCR	RQD FI							

Remarks

Deck to Bed = 19.00m

Terminated by Engineer 5m into bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		17.80	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
12.75	13.00	01 00
17.00	17.10	02 00
17.80	17.80	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH11
Coordinates:	**Client:**	Sheet 5 of 5
142520.34 E	Stornoway Port Authority	
931201.20 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -10.23 mCD	**Dates:** 31/01/2018 - 06/02/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	17.80
Rotary Coring	Comacchio 405	17.80	25.30

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Strong to very strong narrowly foliated grey and reddish brown GNEISS. Partially weathered: faint greyish green discolouration on joint surfaces. Discontinuities: 1. 0 to 30 degree foliation fractures, closely spaced (20/60/80) planar, smooth, faint greyish green staining on fracture surfaces. 2. 30 to 50 degree joints closely spaced (50/90/40) planar, smooth, faint greenish grey staining.		
20.80						-31.03	20.80				
	100	16	0	>20					Medium strong to strong narrowly foliated greenish grey and red GNEISS. Distinctly weathered, much closer fracture spacing, reduced strength, pervasive greyish green discolouration, grey sand and clay infill between discontinuities. Discontinuities: 1.0 0 to 30 degree foliation fractures, closely spaced (20/40/60) planar, smooth, strong greyish green discolouration on fracture surfaces, penetrating up to 5mm.		
									20.80m to 21.80m: Possible sleeper joints.		
22.30									*22.30m to 23.30m: Possible sleeper joints.*		
	100	5	0				(4.50)				
23.80				NI					*23.80m to 25.30m: Difficulty to distinguish due to NI nature of core.*		
	100	2	0								
25.30						-35.53	25.30		End of Borehole at 25.30m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 19.00m

Terminated by Engineer 5m into bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
12.75	13.00	01 00
17.00	17.10	02 00
17.80	17.80	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH12
Coordinates:	**Client:**	Sheet 1 of 1
142655.27 E	Stornoway Port Authority	
931125.23 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -9.14 mCD	**Dates:** 09/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B7					(0.70)		Grey slightly clayey silty very gravelly fine to coarse SAND with low cobble content.. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
0 50	ES1 ES2				-9 84	0.70		Dense to very dense grey and reddish brown silty very sandy angular to subangular fine to coarse GRAVEL. Sand is fine to coarse.		
1 00	ES3 ES4									
1 00 - 1.50	B8									
1 00 - 1.45	SPT (C) N=36	1.00		N=36 (3,7/8,7,9,12)		(1.30)				
1 50	ES5 ES6									
2 00 - 2.32	SPT (C)	2.00		50 (12,12/50 for 165mm)	-11.14	2.00		End of Borehole at 2 00m		

Remarks
Deck to Bed = 13.00m
Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.00	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH13

Coordinates: 142762.87 E, 931156.86 N

Client: Stornoway Port Authority

Sheet 1 of 1

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC

Ground Level: -7.49 mCD

Dates: 13/02/2018

Logger: FG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.90	B13							Grey and reddish brown slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with occasional pocket-sized deposits of soft sandy CLAY with shells and shell fragments. Sand is fine to coarse.		
0 50	ES1 ES2					(1.10)				
1 00	ES3 ES4				-8 59	1.10				
1 00 - 1.45	SPT (C) N=6	1.00		N=6 (1,1/1,2,1,2)				Loose to medium dense grey and reddish brown sandy subangular fine to coarse GRAVEL.		
1 20 - 2.70	B14									
1 50	ES5 ES6									
2 00	ES7 ES8					(1.70)				
2 00 - 2.45	SPT (C) N=15	2.00		N=15 (1,3/3,4,3,5)						
2 50	ES10 ES9									
					-10.29	2.80		Medium dense grey slightly silty very sandy subangular to subrounded fine to medium GRAVEL with shells and shell fragments. Sand is fine to coarse.		
3 00	ES11 ES12									
3 00 - 3.30	B15					(0.70)				
3 00 - 3.45	SPT (C) N=15	3.00		N=15 (2,4/4,4,3,4)						
3 50 - 3.95	SPT (C) N=22	3.50		N=22 (4,4/5,5,6,6)	-10.99	3.50		End of Borehole at 3 50m		

Remarks

Deck to Bed = 10.20m

Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
3.50	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	**BH14**
Coordinates:	**Client:**	Sheet 1 of 2
142489.81 E	Stornoway Port Authority	
931070.30 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-5.44 mCD	13/12/2017 - 14/12/2017	**Logger:** SC+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	1.40
Rotary Coring	Comacchio 405	1.40	6.30

Depth (m)	Sample / Tests	TCR	SCR	RQD	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 50	B1								(1.20)		Soft light grey slightly silty slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
1 00	B2												
1 20 - 1.22	SPT (C)						50 (25 for 10mm/50 for 5mm)	-6.64	1.20				
									(0.20)		Very dense angular to subangular COBBLES of Gneiss (suspected bedrock).		
								-6 84	1.40				
		58	3	0							Medium strong to very strong massive dark greenish grey METAGABBRO. Partially weathered: pervasive reddish brown and green discolouration. Distinctly weathered at 2.55m to 2.85m, significantly reduced strength, strong reddish brown discolouration. Discontinuities: 1. 0 to 30 degree joints closely spaced (60/100/300) planar, smooth, faint greyish green stain on joint surface. 2. 50 to 70 degree joints closely spaced (170/200/250) planar, smooth, strong reddish brown staining on most joint surfaces. 3. 70 to 90 degree joints 4 80m to 5.80m and 3.75m to 4 80m.		
2 00		52	3	0		14							
2 55						NI							
		100	30	0		17			(4.90)				
3.75													
		98	5	0		>20							
4 80													

Remarks
Deck to Bed = 11.70m

Terminated by Engineer 5m into competent bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					1.20	1.40	00 30

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			1.40	250

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH14
Coordinates:	**Client:**	Sheet 2 of 2
142489.81 E	Stornoway Port Authority	
931070.30 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -5.44 mCD	**Dates:** 13/12/2017 - 14/12/2017	**Driller:** CC+SS
		Logger: SC+TH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	1.40
Rotary Coring	Comacchio 405	1.40	6.30

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	98	4	0						Medium strong to very strong massive dark greenish grey METAGABBRO. Partially weathered: pervasive reddish brown and green discolouration. Distinctly weathered at 2.55m to 2.85m, significantly reduced strength, strong reddish brown discolouration. Discontinuities: 1. 0 to 30 degree joints closely spaced (60/100/300) planar, smooth, faint greyish green stain on joint surface. 2. 50 to 70 degree joints closely spaced (170/200/250) planar, smooth, strong reddish brown staining on most joint surfaces. 3. 70 to 90 degree joints 4 80m to 5.80m and 3.75m to 4 80m.		
5 80	48	19	13	14							
6 30						-11.74	6.30		End of Borehole at 6 30m		
	TCR	SCR	RQD	FI							

Remarks
Deck to Bed = 11.70m

Terminated by Engineer 5m into competent bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					1.20	1.40	00 30

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			6.30	150

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 3000 Comacchio 405	0.00 0.30	0.30 6.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH15

Coordinates: 142516.50 E 931080.81 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -9.83 mCD

Dates: 11/12/2017 - 12/12/2017

Driller: CC+MJ

Logger: SC+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.20	B1					(0.30)		Loose grey slightly silty sandy subangular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of mixed lithologies.		
0 30 - 0.31	SPT (C)			50 (25 for 10mm/50 for 0mm)	-10.13	0.30		Very strong massive dark greenish grey METAGABBRO with gneissic bands at 1.70m to 2.10m and 2.70m to 2 90m. Gneissic bands are medium spaced, largely unweathered: slight greenish red discolouration on most joint surfaces. Discontinuities: 1. 0 to 30 degree joints, medium spaced (130/250/330) planar, smooth with patchy reddish green staining on joint surfaces, 2. 50 to 70 degree joints closely spaced (90/180/150) planar, smooth, patchy red staining on some joint surfaces.		
0 30 - 0.31	100 62	38	8	50 (25 for 10mm/50 for 0mm)						
1.70			10			(2.90)				
	100 60	33	8							
3 20					-13.03	3.20		Very strong massive pink and grey PEGMATITE. Partially weathered with slight grey discolouration. Discontinuities: 1. 0 to 30 degree fractures, closely spaced (80/100/150) stepped, rough with faint greenish grey staining.		
	92 60	37	8			(0.70)				
3 90					-13.73	3.90		Strong massive dark greenish grey METAGABBRO. Largely unweathered, greenish grey discolouration on occasional joint surfaces. Discontinuities: 1. 0 to 30 degree fractures medium spaced (40/500/880) planar, sooth, with faint grey staining on fracture surface. 2. 50 to 70 degree joint, occurring in conjugate pairs, closely spaced (60/200/260) planar, smooth, with patchy greyish green staining on joint surfaces.		
	100 22	18								
	TCR SCR	RQD	FI							

Remarks
Deck to Bed = 16.50m

Terminated by Engineer 5m into competent rock

Core Barrel SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
0.60	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
0.30	0.30	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH15
Coordinates:	**Client:**	Sheet 2 of 2
142516.50 E	Stornoway Port Authority	
931080.81 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -9.83 mCD	**Dates:** 11/12/2017 - 12/12/2017	**Driller:** CC+MJ
		Logger: SC+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 3000	0.00	0.30
	Comacchio 405	0.30	6.80

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 30	96	60	33	6			(2.90)		Strong massive dark greenish grey METAGABBRO. Largely unweathered, greenish grey discolouration on occasional joint surfaces. Discontinuities: 1. 0 to 30 degree fractures medium spaced (40/500/880) planar, sooth, with faint grey staining on fracture surface. 2. 50 to 70 degree joint, occurring in conjugate pairs, closely spaced (60/200/260) planar, smooth, with patchy greyish green staining on joint surfaces.		
6 80						-16.63	6.80		End of Borehole at 6 80m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 16.50m

Terminated by Engineer 5m into competent rock

Core Barrel
SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
6.80	150

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
0.30	0.30	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussive Rotary Coring	Dando 3000 Comacchio 405	0.00 3.40	3.40 8.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH16

Coordinates: 142508.98 E 930949.66 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -10.72 mCD

Dates: 14/12/2017 - 15/12/2017

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 80 - 1.00	B1					(1.40)		Soft dark grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.45	U4			Ublow=7 100%	-12.12	1.40		Dense dark brownish grey slightly silty slightly sandy subangular to subrounded fine to coarse GRAVEL with occasional dark grey gravelly CLAY lenses throughout. Sand is fine to coarse.		
2 00 - 2.20	B2									
2 00 - 2.37	SPT (C)			50 (8,10/50 for 220mm)		(1.70)				
3 00 - 3.10	B3									
3 00 - 3.05	SPT (C)			50 (25 for 50mm/50 for 0mm)	-13.82	3.10		Weathered GNEISS bedrock. Recovered as angular to subangular coarse GRAVEL and COBBLES of Gneiss.		
						(0.30)				
					-14.12	3.40		Strong thinly foliated orangish red and grey PEGMATITE. Partially weathered: faint greyish green discolouration on some fractures. Discontinuities: Set 1. o to 30 degree foliation fractures (80/160/380), planar, rough, fractures typically occurring on mafic bands, grey staining on surfaces. Set 2. 60 to 70 degree joints, closely spaced (60/150/190), planar, rough, light grey staining.		
4 20	100 30 16		9			(1.00)				
	100 28 12		14		-15.12	4.40		Medium strong massive dark grey AMPHIBOLITE. Partially weathered: greenish grey staining on fractures, some local red staining, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 degree joints, closely spaced (90/130/330), planar, smooth, with greyish green staining. Set 2. 30 to 50 degree joints, closely spaced, (50/160/380), planar smooth, with greyish green staining, some local red staining. Set 3. 70 to 90 degree joints at 4.40m to 5.20m and 5.70m to 6.50m, undulating, rough, with slight grey staining.		
	TCR SCR RQD FI									

Remarks
Deck to Bed = 17.00m

Terminated by Engineer 5m into competent bedrock

Core Barrel SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		3.40	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.10	3.40	00 45

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussive Rotary Coring	Dando 3000 Comacchio 405	0.00 3.40	3.40 8.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH16

Coordinates: 142508.98 E 930949.66 N

Client: Stornoway Port Authority

Sheet 2 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -10.72 mCD

Dates: 14/12/2017 - 15/12/2017

Logger: SC+SG

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 20									Medium strong massive dark grey AMPHIBOLITE. Partially weathered: greenish grey staining on fractures, some local red staining, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 degree joints, closely spaced (90/130/330), planar, smooth, with greyish green staining. Set 2. 30 to 50 degree joints, closely spaced, (50/160/380), planar smooth, with greyish green staining, some local red staining. Set 3. 70 to 90 degree joints at 4.40m to 5.20m and 5.70m to 6.50m, undulating, rough, with slight grey staining.		
	94	37	34	10			(2.10)				
				>20							
						-17.22	6.50		Strong thinly foliated reddish grey PEGMATITE. Partially weathered: faint grey staining on fractures. Discontinuities: Set 1. 0 to 40 degree foliation fractures, closely spaced (18/120/150), planar, rough, faint grey staining.		
6.70											
	100	31	20	70			(0.70)				
7 00											
						-17.92	7.20		Medium strong massive dark grey AMPHIBOLITE. Largely unweathered: faint patchy orangish grey discolouration on some fracture surfaces. Discontinuities: Set 1. 0 to 30 degree joints, medium spaced (80/300/500), planar, rough, with slight grey staining. Set 2. 30 to 60 degree joints, closely spaced (60/160/380), planar, rough, with faint grey staining. Set 3. 60 to 90 degree joint at 7.65m to 8.10m, undulating, smooth, faint greyish green staining.		
	100			10			(1.30)				
8 50						-19.22	8.50		End of Borehole at 8 50m		
	TCR	SCR	RQD	FI							

Remarks
Deck to Bed = 17.00m

Terminated by Engineer 5m into competent bedrock

Core Barrel SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
8.50	150

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.10	3.40	00 45

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.80
Rotary Coring	Comacchio 405	3.80	5.80

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH17

Coordinates: 142437.28 E 930891.30 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -8.07 mCD

Dates: 16/12/2017

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy slightly gravelly silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.20	B1									
						(2.80)				
1 50 - 1.95	U5			Ublow=4 100%						
2 00 - 2.20	B2									
					-10.87	2.80		Very loose dark grey slightly clayey very silty very sandy subangular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular predominantly gneiss.		
3 00 - 3.20	B3									
3 00 - 3.45	SPT (C) N=3	3.00		N=3 (1,0/1,1,0,1)						
						(1.00)				
3.60 - 3.80	B4									
3 80 - 3.80	SPT (C)	3.80		50 (25 for 0mm/50 for 0mm)		3.80				
3 80 - 3.80				50 (25 for 0mm/50 for 0mm)	-11.87			Strong narrowly foliated dark grey GNEISS with red mineral banding. Partially weathered: pervasive greenish grey discolouration with slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 degrees foliation fractures, closely spaced (50/140/300), planar, smooth, grey staining on fractures. Set 2. 30 to 60 degree joints, medium spaced (90/160/340), planar, smooth, faint orangish grey staining on joints.		
			15							
	98 60 40					(1.00)				
			7							
4 80					-12.87	4.80		Weak to medium strong massive dark grey to black AMPHIBOLITE with weakly developed foliation. Partially weathered: green discolouration, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 joints, medium spaced (200/330/400),		
	TCR SCR RQD FI									

Remarks

Deck to Bed = 14.50m

Terminated by Engineer 2m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
3.80	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.70	3.80	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH17
Coordinates:	**Client:**	Sheet 2 of 2
142437.28 E	Stornoway Port Authority	
930891.30 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-8.07 mCD	16/12/2017	**Logger:** SC+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.80
Rotary Coring	Comacchio 405	3.80	5.80

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100			8			(1.00)		Weak to medium strong massive dark grey to black AMPHIBOLITE with weakly developed foliation. Partially weathered: green discolouration, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 joints, medium spaced (200/330/400), planar, rough, faint greenish grey staining on fractures surfaces. Set 2. 30 to 60 degree joints, medium spaced (150/300/350), planar, rough, greenish grey staining on joint surfaces with localized red oxidation spots. Set 3. 90 degree joint at 5m, planar, smooth, faint greyish green staining.		
5 80						-13.87	5.80		End of Borehole at 5 80m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 14.50m

Terminated by Engineer 2m into competent bedrock

Core Barrel
SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		5.80	150

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.70	3.80	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	**BH18**
Coordinates:	**Client:**	Sheet 1 of 5
142509.81 E	Stornoway Port Authority	
930830.39 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-9.47 mCD	15/12/2017 - 16/12/2017	**Logger:** SC+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	19.60
Rotary Coring	Comacchio 405	19.60	25.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy very silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse.		
1 00 - 1.20	B1									
1 00 - 1.45	U16			Ublow=4 100%						
2 00 - 2.45	SPT (C) N=1			N=1 (1,0/0,1,0,0)						
3 00 - 3.20	B2									
3 00 - 3.45	U17			Ublow=5 100%						
4 00 - 4.45	SPT (C) N=1			N=1 (1,0/0,0,1,0)						
5 00 - 5.20	B3									
5 00 - 5.45	U18			Ublow=4 100%						

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks
Deck to Bed = 11.80m
Drilled from floating (spudded) platform

Terminated by Engineer 5m into competent bedrock

Core Barrel
SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
19.50	19.60	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 19.60	19.60 25.00

Project No.: 17-0769
Project Name: Stornoway Deep Water Berth G.I.
Borehole No.: BH18
Coordinates: 142509.81 E 930830.39 N
Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers
Scale: 1:25
Driller: CC+SS
Ground Level: -9.47 mCD
Dates: 15/12/2017 - 16/12/2017
Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy very silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse.		
6 00 - 6.20	B4									
6 50 - 6.95	SPT (C) N=2			N=2 (1,0/1,0,0,1)						
7 00 - 7.20	B5									
						(12.00)				
8 00 - 8.20	B6									
8 00 - 8.45	U19			Ublow=6 100%						
9 00 - 9.20	B7									
9 50 - 9.95	SPT (C) N=1			N=1 (1,0/0,0,1,0)						
10.00 - 10.20	B8									

5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0

Remarks
Deck to Bed = 11.80m
Drilled from floating (spudded) platform

Terminated by Engineer 5m into competent bedrock

Core Barrel SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
19.50	19.60	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH18
Coordinates:	**Client:**	Sheet 3 of 5
142509.81 E	Stornoway Port Authority	
930830.39 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-9.47 mCD	15/12/2017 - 16/12/2017	**Logger:** SC+SG

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 19.60	19.60 25.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy very silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse.		
11.00 - 11.20	B9									
11.00 - 11.45	U20			Ublow=5 100%						
12.00 - 12.20	B10				-21.47	12.00				
								Very soft dark grey slightly sandy slightly gravelly very silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
12.50 - 12.95	SPT (C) N=1			N=1 (1,0/0,1,0,0)						
13.00 - 13.20	B11									
						(4.70)				
14.00 - 14.20	B12									
14.00 - 14.45	U21			Ublow=3 0%						

Remarks
Deck to Bed = 11.80m
Drilled from floating (spudded) platform

Terminated by Engineer 5m into competent bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					19.50	19.60	00 30

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)
			13.70	250

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 19.60	19.60 25.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH18

Coordinates: 142509.81 E, 930830.39 N

Client: Stornoway Port Authority

Sheet 4 of 5

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -9.47 mCD

Dates: 15/12/2017 - 16/12/2017

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
15.50 - 15.95	SPT (C) N=1			N=1 (1,0/0,0,1,0)				Very soft dark grey slightly sandy slightly gravelly very silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
16.00 - 16.20	B13									
					-26.17	16.70		Very soft dark grey slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
17.00 - 17.20	B14									
17.00 - 17.45	U22			Ublow=5 0%		(2.10)				
18.50 - 18.95	SPT (C) N=1			N=1 (1,0/1,0,0,0)						
					-28.27	18.80		Dark grey slightly sandy silty subangular fine to coarse GRAVEL. Sand is fine to coarse.		
19.00 - 19.20	B15					(0.80)				
			NI		-29.07	19.60		Weak to medium strong narrowly foliated greyish red GNEISS. Partially weathered: slightly closer spacing of fractures. Faint orangish grey discolouration on most joints, with faint greenish grey staining locally penetrating in up to 10mm. Discontinuities: Set 1. 0 to 30 degree foliation fractures, closely spaced (30/130/520), planar smooth, faint greyish brown staining. Set 2. 30 to 60 degree joints, closely spaced (50/180/360), planar, smooth, faint greyish brown staining. Set 3. 70 degree joint at 22m and 23m, planar, smooth, with faint brown grey staining.		
	100 50 32		15			(1.60)				
	TCR SCR RQD		FI							

Remarks
Deck to Bed = 11.80m
Drilled from floating (spudded) platform

Terminated by Engineer 5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
19.60	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
19.50	19.60	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 19.60	19.60 25.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH18

Coordinates: 142509.81 E 930830.39 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -9.47 mCD

Dates: 15/12/2017 - 16/12/2017

Logger: SC+SG

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
				>20					Weak to medium strong narrowly foliated greyish red GNEISS. Partially weathered: slightly closer spacing of fractures. Faint orangish grey discolouration on most joints, with faint greenish grey staining locally penetrating in up to 10mm. Discontinuities: Set 1. 0 to 30 degree foliation fractures, closely spaced (30/130/520), planar smooth, faint greyish brown staining. Set 2. 30 to 60 degree joints, closely spaced (50/180/360), planar, smooth, faint greyish brown staining. Set 3. 70 degree joint at 22m and 23m, planar, smooth, with faint brown grey staining.		
21.20						-30.67	21.20				
				6					Strong dark grey and black massive AMPHIBOLITE with weakly developed foliation. Partially weathered: faint green discolouration, slightly reduced strength, slightly closer fracture spacing. Discontinuities: Set 1. 0 to 30 degree foliation fractures, closely spaced (80/150/200), planar, smooth, fractures occurring along mineral bands, faint green staining on fracture surfaces. Set 2. 30 to 60 degree joints, closely spaced (40/160/300), planar, smooth, faint green staining on joints. Set 3. 70 degree joint at 24.5m, planar smooth, with faint green staining.		
	93	48	32	8							
				10							
22.70							(3.50)				
	100	86	41	17							
24.20											
	100	68	58	8							
				10		-34.17	24.70	+ + + + + + + + + + + + + + + +	Strong greyish red massive PEGMATITE. Largely unweathered: very faint grey discolouration on joint surfaces. Discontinuity Set 1. 0 to 30 degree probable foliation fractures, planar smooth, with faint brown staining on fractures.		
25.00						-34.47	(0.30) 25.00		End of Borehole at 25.00m		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 11.80m

Drilled from floating (spudded) platform

Terminated by Engineer 5m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
25.00	150

Chiselling Details

From (m)	To (m)	Time (hh:mm)
19.50	19.60	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 6.70	6.70 9.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH19

Coordinates: 142417.60 E 930777.64 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -6.19 mCD

Dates: 18/12/2017

Driller: CC+SS

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy slightly gravelly silty CLAY with abundant shell fragments and organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.20	B1									
1 00 - 1.45	U6			Ublow=4 100%						
2 00 - 2.20	B2									
						(4.60)				
2 50 - 2.95	SPT (C) N=3			N=3 (1,0/1,1,0,1)						
4 00 - 4.20	B3									
4 00 - 4.45	U7			Ublow=4 100%						
					-10.79	4.60		Very dense dark grey clayey silty very sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subrounded predominantly gneiss.		
5 00 - 5.20	B4									

Remarks

Deck to Bed = 12.00m

Terminated by Engineer 2m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)
0.00	6.70

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.40	6.70	00 45

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 6.70	6.70 9.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH19

Coordinates: 142417.60 E 930777.64 N

Client: Stornoway Port Authority

Sheet 2 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -6.19 mCD

Dates: 18/12/2017

Driller: CC+SS

Logger: SC+SG

Depth (m)	Sample / Tests		Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 50 - 5.66	SPT (C)				50 (25 for 85mm/50 for 70mm)		(1.60)		Very dense dark grey clayey silty very sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subrounded predominantly gneiss.		
6 00 - 6.20	B5					-12.39	6.20		Dark grey gravelly subangular cobbles of GNEISS (weathered bedrock). Gravel is angular to subangular medium to coarse predominantly gneiss.		
						-12.89	(0.50) 6.70		Medium strong narrowly foliated light grey GNEISS. Partially weathered: faint yellowish grey discolouration on fracture and joint surfaces. Discontinuity set 1. 0 to 20 degree foliation fractures, closely spaced (60/100/160), planar, smooth, faint yellow grey staining.		
	98	26	24	15 20 8		-13.24	(0.35) 7.05		Medium strong massive dark grey and black METAGABBRO. Partially weathered: yellowish green discolouration. Discontinuity set 1. 0 to 20 degree fractures, closely spaced (80/140/160), planar, stepped, faint yellow discolouration. Discontinuity set 2. 30 to 40 degree joints, medium spaced (90/140/170), planar, rough,, faint grey green staining. Discontinuity set 3. 70 to 90 degree joints, widely spaced (180/275/360), planar, rough, faint orange yellow staining .		
8 00						-14.19	(0.95) 8.00		Weak to medium strong thinly foliated light grey GNEISS. Partially weathered: slightly reduced strength, faint yellow grey discolouration on fractures. Discontinuity set 1. 0 to 30 degree foliation fractures, closely spaced (20/115/180), planar, smooth, faint grey staining. Discontinuity set 2. joints, medium spaced (40/375/430), planar, smooth, faint yellow grey stain.		
	100	55	32	16 >20 >20			(1.50)				
9 50						-15.69	9.50		End of Borehole at 9 50m		
	TCR	SCR	RQD	FI							

Remarks

Deck to Bed = 12.00m

Terminated by Engineer 2m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
6.70	250
9.50	150

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.40	6.70	00 45

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH20
Coordinates:	**Client:**	Sheet 1 of 2
142506.37 E	Stornoway Port Authority	
930703.76 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-6.46 mCD	19/12/2017 - 20/12/2017	**Logger:** SC+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	6.30
Rotary Coring	Comacchio 405	6.30	10.10

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy slightly gravelly very silty CLAY with strong organic odour. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.20	B1									
1 00 - 1.45	U8			Ublow=4 100%						
						(3.90)				
2 50	D6									
2 50 - 2.95	SPT (S) N=2			N=2 (1,0/1,0,0,1)						
3 00 - 3.20	B2									
					-10.36	3.90				
4 00 - 4.20	B3							Very soft dark grey sandy gravelly silty CLAY with abundant shell fragments, low cobble content, and organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
4 00 - 4.45	U9			Ublow=3 100%						
						(1.30)				
5 00 - 5.20	B4									

Remarks
Deck to Bed = 13.00m

Terminated by Engineer 3m into competent bedrock

Core Barrel	Water Strikes				Chiselling Details		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
SK6L					6.20	6.30	00 45

Flush Type	Water Added		Casing Details	
	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 6.30	6.30 10.10

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH20

Coordinates: 142506.37 E, 930703.76 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.46 mCD

Dates: 19/12/2017 - 20/12/2017

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 50 5 50 - 5.95 6 00 - 6.20	D7 SPT (S) N=43 B5			N=43 (7,7/9,11,12,11)	-11.66	5.20 (1.10)		Very soft dark grey sandy gravelly silty CLAY with abundant shell fragments, low cobble content, and organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded. Dense grey clayey silty very gravelly fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded predominantly gneiss.		
7 30	55 27 26 86 48 38		10 4 13		-12.76	6.30 (3.80)		Medium strong to strong very narrowly foliated light grey and pink GNEISS. Largely unweathered: faint grey discoloration on fracture and joint surfaces. Discontinuities: Set 1. 0 to 20 degree foliation fractures, medium spaced (50/225/370), planar, smooth, unstained. Set 2. 30 to 40 degree joints, medium spaced (14/315/406), planar, smooth, faint greenish grey staining. Set 3. 70 to 90 degree joints (28/475/940), planar smooth, faint yellowish grey stain.		
8 55	100 77 74		3 13 8 4 20							
10.10					-16.56	10.10		End of Borehole at 10.10m		
	TCR SCR RQD		FI							

Remarks
Deck to Bed = 13.00m

Terminated by Engineer 3m into competent bedrock

Core Barrel: SK6L

Flush Type:

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
6.30	250
10.10	150

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.20	6.30	00 45

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH21
Coordinates:	**Client:**	Sheet 1 of 5
142620.17 E	Stornoway Port Authority	
930629.35 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level:	**Dates:**	**Driller:** CC+SS
-6.76 mCD	20/12/2017 - 21/12/2017	**Logger:** SC+SG

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 16.60	16.60 24.60

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft dark grey slightly sandy slightly gravelly very silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.20	B1									
1 00 - 1.45	U19			Ublow=3 100%						
2 00 - 2.20	B2									
2 50	D16									
2 50 - 2.95	SPT (S) N=2			N=2 (1,0/1,0,1,0)		(9.80)				
3 00 - 3.20	B3									
4 00 - 4.20	B4									
4 00 - 4.45	U20			Ublow=3 100%						
5 00 - 5.20	B5									
5 00 - 5.45	SPT (S) N=2			N=2 (1,1/0,0,1,1)						

Remarks

Deck to Bed = 10.60m Drilled from floating (spudded) platform
Attempted to core at 16.60 to 17.00m, 100% recovery (boulder)
Attempted to core at 17.00 to 19.50m, 25% recovery (gravels)
Open holed from 19.50 to 21.30m, cored 21.30m to end of borehole

Terminated by Engineer 3m into competent bedrock

Core Barrel: SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
16.50	16.60	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 16.60	16.60 24.60

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH21

Coordinates: 142620.17 E 930629.35 N

Client: Stornoway Port Authority

Sheet 2 of 5

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.76 mCD

Dates: 20/12/2017 - 21/12/2017

Logger: SC+SG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
5 50 - 5.95	U21			Ublow=4 100%				Very soft dark grey slightly sandy slightly gravelly very silty CLAY with abundant shell fragments and strong organic odour throughout. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
6 00 - 6.20	B6									
6 00 - 6.45	SPT (S) N=2			N=2 (1,0/1,0,0,1)						
7 00 - 7.20	B7									
7 00 - 7.45	U22			Ublow=2 0%						
7 50 - 7.95	SPT (S) N=1			N=1 (1,0/0,1,0,0)						
8 00 - 8.20	B8									
9 00 - 9.20	B9									
9 00 - 9.45	23			Ublow=2 0%						
					-16.56	9.80		Very soft dark greenish grey slightly sandy slightly gravelly very silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium. Cobbles are angular to subangular of mixed lithologies.		
10.00 - 10.20	B10									

5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0

Remarks

Deck to Bed = 10.60m Drilled from floating (spudded) platform
Attempted to core at 16.60 to 17.00m, 100% recovery (boulder)
Attempted to core at 17.00 to 19.50m, 25% recovery (gravels)
Open holed from 19.50 to 21.30m, cored 21.30m to end of borehole

Terminated by Engineer 3m into competent bedrock

Core Barrel SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
16.50	16.60	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH21
Coordinates:	**Client:**	Sheet 3 of 5
142620.17 E	Stornoway Port Authority	
930629.35 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -6.76 mCD	**Dates:** 20/12/2017 - 21/12/2017	**Driller:** CC+SS
		Logger: SC+SG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	16.60
Rotary Coring	Comacchio 405	16.60	24.60

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50 - 10.95	SPT (S) N=2			N=2 (1,0/1,0,1,0)				Very soft dark greenish grey slightly sandy slightly gravelly very silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium. Cobbles are angular to subangular of mixed lithologies.		
11.00 - 11.20	B11									
12.00	D17									
12.00 - 12.20	B12									
12.00 - 12.45	SPT (S) N=2			N=2 (1,0/0,1,1,0)						
						(5.20)				
13.00 - 13.20	B13									
13.50 - 13.95	U24			Ublow=2 0%						
14.00 - 14.45	SPT (S) N=1			N=1 (1,0/0,1,0,0)						
15.00 - 15.20	B14				-21.76	15.00		Soft dark greenish grey slightly sandy slightly gravelly very silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine. Cobbles are angular of mixed lithologies.		

Remarks

Deck to Bed = 10.60m Drilled from floating (spudded) platform
Attempted to core at 16.60 to 17.00m, 100% recovery (boulder)
Attempted to core at 17.00 to 19.50m, 25% recovery (gravels)
Open holed from 19.50 to 21.30m, cored 21.30m to end of borehole

Terminated by Engineer 3m into competent bedrock

Core Barrel: SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
16.50	16.60	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH21
Coordinates: 142620.17 E 930629.35 N	**Client:** Stornoway Port Authority	Sheet 4 of 5
	Client's Representative: Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -6.76 mCD	**Dates:** 20/12/2017 - 21/12/2017	**Driller:** CC+SS
		Logger: SC+SG

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 16.60	16.60 24.60

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
15.50 - 15.95	U25			Ublow=2 0%				Soft dark greenish grey slightly sandy slightly gravelly very silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine. Cobbles are angular of mixed lithologies.		
16.00	D18					(1.60)				
16.00 - 16.20	B15									
16.00 - 16.45	SPT (S) N=5			N=5 (1,0/1,0,2,2)						
	44				-23.36	(0.40)		Medium strong thinly foliated dark grey BOULDER of GNEISS. Partially weathered. Discontinuity set 1 0 to 20 degree fractures, closely spaced, planar, smooth.		
17.00					-23.76	17.00		Stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.		
	50					(1.30)				
18.30					-25.06	18.30		Medium dense grey silty sandy subangular to subrounded fine to coarse GRAVEL of mixed lithologies predominantly gneiss. Sand is fine to coarse.		
	0									
19.50 - 19.95				N=15 (3,2/4,3,5,3)		(3.00)				
19.50	0									
	TCR	SCR	RQD	FI						

Remarks

Deck to Bed = 10.60m Drilled from floating (spudded) platform
Attempted to core at 16.60 to 17.00m, 100% recovery (boulder)
Attempted to core at 17.00 to 19.50m, 25% recovery (gravels)
Open holed from 19.50 to 21.30m, cored 21.30m to end of borehole

Terminated by Engineer 3m into competent bedrock

Core Barrel: SK6L

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		16.60	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
16.50	16.60	00 30

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 16.60	16.60 24.60

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH21

Coordinates: 142620.17 E 930629.35 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+SS

Ground Level: -6.76 mCD

Dates: 20/12/2017 - 21/12/2017

Logger: SC+SG

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Medium dense grey silty sandy subangular to subrounded fine to coarse GRAVEL of mixed lithologies predominantly gneiss. Sand is fine to coarse.		
21.30						-28.06	21.30				
	66	12	0	>20					Medium strong very narrowly foliated reddish grey GNEISS. Distinctly weathered: much closer fracture spacing, slightly reduced strength, reddish brown oxidation stain on some joint surfaces. Discontinuities: Set 1. 0 to 30 degree foliation fractures, closely spaced (20/50/250), planar, smooth, faint grey discolouration on fracture surfaces, strong red discolouration at 23.50 to 24.60m. Set 2. 30 to 60 degree joints probably closely spaced, planar smooth, with yellowish stain on joint surfaces. Set 3. 70 to 90 degree joints at 21.30 to 21.90m, 22.40 to 23.10m, and 23.65 to 24.50m, undulating, smooth with patchy reddish brown and grey staining.		
22.00				12							
	80	17	13	NI			(3.30)				
23.10											
				18							
	93	21	0	NI							
24.60						-31.36	24.60		End of Borehole at 24.60m		

TCR	SCR	RQD	FI

Remarks

Deck to Bed = 10.60m Drilled from floating (spudded) platform
Attempted to core at 16.60 to 17.00m, 100% recovery (boulder)
Attempted to core at 17.00 to 19.50m, 25% recovery (gravels)
Open holed from 19.50 to 21.30m, cored 21.30m to end of borehole

Terminated by Engineer 3m into competent bedrock

Core Barrel SK6L

Flush Type

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
24.60	150

Chiselling Details

From (m)	To (m)	Time (hh:mm)
16.50	16.60	00 30

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH22
Coordinates:	**Client:**	Sheet 1 of 1
142523.24 E	Stornoway Port Authority	
931571.79 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -8.32 mCD	**Dates:** 06/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 50	ES1 ES2							Grey slightly silty sandy subrounded to rounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
1 00	ES3 ES4									
1 50	ES5 ES6					(3.00)				
2 00	ES7 ES8									
					-11.32	3.00		End of Borehole at 3 00m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks
Deck to Bed = 13.20m
Drilled from floating (spudded) platform
Environmental Sampling only

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		3.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	**BH23**
Coordinates:	**Client:**	Sheet 1 of 1
142639.87 E	Stornoway Port Authority	
931601.16 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -8.03 mCD	**Dates:** 26/01/2018	**Driller:** CC
		Logger: NH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 1.50	B1					(0.60)		Grey slightly silty gravelly fine to coarse SAND with some shells and shell fragments. Gravel is subrounded to rounded fine to coarse.		
					-8.63	0.60				
0.70 - 1.00	B2							Medium dense grey and dark grey slightly silty very gravelly fine to coarse SAND with very low cobble content and some shells and shell fragments. Gravel is subrounded to rounded fine to coarse. Cobbles are subrounded to rounded.		
1 00 - 1.40	B3					(0.85)				
1 00 - 1.45	SPT (C) N=28			N=28 (4,5/5,7,8,8)						
					-9.48	1.45				
1 50 - 2.00	B4					(0.55)		Grey and dark grey slightly silty very gravelly fine to coarse SAND with some shells and shell fragments and low cobble content. Gravel is subangular to subrounded fine to medium. Cobbles are subrounded to rounded.		
2 00 - 2.50	B5				-10.03	2.00				
2 00 - 2.45	SPT (C) N=21			N=21 (3,3/4,5,6,6)				Medium dense grey gravelly fine to coarse SAND with occasional shell fragments. Gravel is angular to subrounded fine.		
						(0.50)				
2 50 - 3.00	B6				-10.53	2.50		Medium dense grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to subangular fine to medium.		
						(0.50)				
3 00 - 3.45	SPT (C) N=15			N=15 (2,2/2,3,5,5)	-11.03	3.00		End of Borehole at 3 00m		

Remarks
Deck to Bed = 11.50m
Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
3.00	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH24
Coordinates:	**Client:**	Sheet 1 of 1
142782.95 E	Stornoway Port Authority	
931593.65 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -8.90 mCD	**Dates:** 08/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 50	ES1 ES2					(1.40)		Grey slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
1 00	ES3 ES4				-10.30	1.40				
1 50	ES5 ES6					(0.60)		Grey and reddish brown sandy subangular fine to coarse GRAVEL. with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
2 00	ES7 ES8				-10.90	2.00		End of Borehole at 2 00m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks
Deck to Bed = 12.50m
Drilled from floating (spudded) platform
Environmental Sampling only

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.00	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH25
Coordinates:	**Client:**	Sheet 1 of 1
142917.67 E	Stornoway Port Authority	
931463.80 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -9.81 mCD	**Dates:** 08/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	1.50

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 50	ES1 ES2					(1.50)		Grey and reddish brown slightly silty very sandy subangular to subrounded fine to coarse GRAVEL with occasional shells and shell fragments. Sand is fine to coarse.		
1 00	ES3 ES4									
1 50	ES5 ES6				-11.31	1.50		End of Borehole at 1 50m		

Remarks
Deck to Bed = 13.30m
Drilled from floating (spudded) platform
Environmental Sampling only

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
1.50	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH26
Coordinates:	**Client:**	Sheet 1 of 1
142727.82 E	Stornoway Port Authority	
931242.58 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -9.87 mCD	**Dates:** 09/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	1.50

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B5					(0.80)		Grey silty very sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
0 50	ES1 ES2				-10.67	0.80		Loose reddish brown and grey sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
1 00	ES3 ES4									
1 00 - 1.50	B6					(0.70)				
1 00 - 1.45	SPT (C) N=4	1.00		N=4 (1,1/1,1,1,1)						
1 50 - 1.95	SPT (C) N=7	1.50		N=7 (1,1/1,2,2,2)	-11.37	1.50		End of Borehole at 1 50m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks
Deck to Bed = 13.30m
Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		1.50	250

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH27
Coordinates:	**Client:**	Sheet 1 of 1
142704.40 E	Stornoway Port Authority	
931446.70 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -8.07 mCD	**Dates:** 06/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	3.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Loose grey very sandy slightly silty subrounded to rounded fine to coarse GRAVEL with low cobble content and some shell fragments. Sand is fine to coarse. Cobbles are subrounded to rounded.		
0 50 - 1.00	B1					(1.50)				
1 00 - 1.50	B2									
1 00 - 1.45	SPT (C) N=7	1.00		N=7 (2,1/2,2,1,2)						
1 50 - 2.00	B3				-9 57	1.50		Medium dense grey and reddish brown sandy silty subrounded to rounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
2 00 - 2.45	SPT (C) N=24	2.00		N=24 (11,12/8,6,6,4)		(0.80)				
2.40 - 2.70	B4				-10.37	2.30		Medium dense grey slightly silty sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
2.70 - 3.00	B5					(0.70)				
3 00 - 3.45	SPT (C) N=10	3.00		N=10 (4,4/4,3,2,1)	-11.07	3.00		End of Borehole at 3 00m		

Remarks
Deck to Bed = 11.40m

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		3.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.00

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH28

Coordinates: 142874.16 E, 931626.48 N

Client: Stornoway Port Authority

Sheet 1 of 1

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC

Ground Level: -9.25 mCD

Dates: 08/02/2018

Logger: FG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B7							Grey silty sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
0 50	ES1 ES2					(1.00)				
0 50 - 1.00	B8									
1 00	ES3 ES4				-10.25	1.00		Loose to medium dense reddish brown and grey very sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is medium to coarse. Cobbles are subrounded to rounded.		
1 00 - 1.50	B9									
1 00 - 1.45	SPT (C) N=8	1.00		N=8 (1,1/2,2,2,2)						
1 50	ES5 ES6					(1.00)				
1 50 - 2.00	B10									
2 00 - 2.45	SPT (C) N=14	2.00		N=14 (1,2/4,3,3,4)	-11.25	2.00		End of Borehole at 2 00m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks

Deck to Bed = 13.30m

Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.00	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH29

Coordinates: 142522.86 E, 931722.46 N

Client: Stornoway Port Authority

Sheet 1 of 1

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC

Ground Level: -8.65 mCD

Dates: 07/02/2018

Logger: FG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description
0 00 - 0.50	B9					(0.50)		Grey very sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.
0 50	ES1				-9.15	0.50		
	ES2							Loose grey and reddish brown slightly silty sandy subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.
0 50 - 1.00	B10							
1 00	ES3					(1.00)		
	ES4							
1 00 - 1.50	B11							
1 00 - 1.45	SPT (C) N=5	1.00		N=5 (1,1/1,2,1,1)				
1 50	ES5				-10.15	1.50		
	ES6							Grey gravelly fine to coarse SAND with shell fragments. Gravel is subangular to subrounded fine to coarse.
1 50 - 2.00	B12					(0.40)		
					-10.55	1.90		Medium dense grey slightly silty very gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to medium. Cobbles are subrounded to rounded.
2 00	ES7							
	ES8							
2 00 - 2.50	B13					(0.60)		
2 00 - 2.45	SPT (C) N=20	2.00		N=20 (4,4/3,5,6,6)				
2 50 - 2.95	SPT (C) N=22	2.50		N=22 (4,4/4,5,6,7)	-11.15	2.50		End of Borehole at 2 50m

Water: Backfill

Remarks
Deck to Bed = 12.80m
Drilled from floating (spudded) platform

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.50	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH30
Coordinates:	**Client:**	Sheet 1 of 1
142991.00 E	Stornoway Port Authority	
931314.43 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -9.10 mCD	**Dates:** 13/02/2018	**Driller:** CC
		Logger: FG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	2.70

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B7							Grey slightly silty slightly gravelly fine to coarse SAND with shells and shell fragments. Gravel is subangular to subrounded fine to coarse.		
0 50	ES1 ES2					(1.20)				
1 00	ES3 ES4									
1 00 - 1.20	B8									
1 00 - 1.45	SPT (C) N=1	1.00		N=1 (1,0/0,0,1,0)	-10.30	1.20		Very soft grey slightly sandy clayey SILT with occasional shells and shell fragments. Sand is fine to coarse.		
1 50	ES5 ES6					(1.40)				
2 00 - 2.45	D11									
2 00 - 2.50	B9									
2 00 - 2.45	SPT (S) N=3	2.00		N=3 (1,1/1,0,1,1)						
2.65	B10				-11.70	2.60 (0.10)		Very dense grey slightly silty very sandy gravelly subangular to subrounded COBBLES. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
2.70 - 2.72	SPT (C)	2.70		50 (25 for 15mm/50 for 10mm)	-11.80	2.70		End of Borehole at 2.70m		

Remarks
Deck to Bed = 12.30m

Terminated at scheduled depth

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		2.70	250

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 6.60	6.60 9.60

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH31

Coordinates: 142386.51 E, 930826.63 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -5.50 mCD

Dates: 09/02/2018 - 10/02/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B1					(0.60)		Very soft dark grey slightly sandy slightly gravelly silty organic CLAY with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
					-6.10	0.60		Very soft grey slightly sandy slightly gravelly silty organic CLAY with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.45	SPT (S)	1.00		N=0 (0,1/0,0,0,0)						
1 50 - 2.00	B2									
2 00 - 2.45	U7			Ublow=2 100%						
2 50 - 3.00	B3					(4.40)				
3 00 - 3.45	SPT (S) N=1	3.00		N=1 (0,2/0,0,1,0)						
3 50 - 4.00	B4									
4 00 - 4.45	U8			Ublow=3 100%						
5 00 - 5.50	B5				-10.50	5.00		Very dense slightly silty sandy angular to subangular fine to coarse GRAVEL		
5 00 - 5.45	SPT (C) N=50	5.00		N=50 ~~(4,6/7,17,12,14)~~						

Remarks

Deck to Bed = 11.50m

Terminated by Engineer 3m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.40	6.60	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 6.60	6.60 9.60

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH31

Coordinates: 142386.51 E, 930826.63 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -5.50 mCD

Dates: 09/02/2018 - 10/02/2018

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
6 00 - 6.33	SPT (C)	6.00		50 (12,12/50 for 180mm)		(1.40)		Very dense slightly silty sandy angular to subangular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded.		
6.40 - 6.50	B6				-11.90	6.40				
						(0.20)		Grey largely weathered GNEISS.		
					-12.10	6.60				
	84 15 0							Medium strong to strong narrowly foliated dark grey and pink GNEISS. Largely unweathered: faint patchy greenish grey discolouration on most discontinuity surfaces. Discontinuities: 1. 0 to 20 degree foliation fractures, closely spaced (70/200/530) planar, rough, with faint patchy greenish grey staining on fracture surfaces. 2. 70 to 90 degree joints at 9.20 to 9.60m, undulating, rough, mottled greyish green and orange discolouration.		
7.40			8							
	100 53 46					(3.00)				
			0							
8 90			NI							
	60 25 19		12							
9.60					-15.10	9.60		End of Borehole at 9.60m		
	TCR SCR RQD		FI							

Remarks
Deck to Bed = 11.50m

Terminated by Engineer 3m into competent bedrock

Core Barrel

Flush Type

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)
				6.40	6.60	01 00

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		6.60	250

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	9.00
Rotary Coring	Comacchio 405	9.00	12.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH32

Coordinates: 142450.21 E, 930829.17 N

Client: Stornoway Port Authority

Sheet 1 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Ground Level: -7.80 mCD

Dates: 10/02/2018 - 12/02/2018

Driller: CC+MJ

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0 00 - 0.50	B1							Very soft grey slightly sandy slightly gravelly silty organic CLAY with fragments of shell. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
1 00 - 1.45	D8									
1 00 - 1.50	B2									
1 20 - 1.65	SPT (S) N=1	1.20		N=1 (1,0/0,0,1,0)						
2 00 - 2.45	U11			Ublow=3 100%						
						(5.30)				
3 00 - 3.45	D9									
3 00 - 4.00	B3									
3 00 - 3.45	SPT (S) N=2	3.00		N=2 (1,1/0,0,1,1)						
4 00 - 4.45	U12			Ublow=4 100%						

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Remarks

Deck to Bed = 14.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.60	6.60	00 30
8.90	9.00	01 00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 9.00	9.00 12.50

Project No.: 17-0769

Project Name: Stornoway Deep Water Berth G.I.

Borehole No.: BH32

Coordinates: 142450.21 E, 930829.17 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:25

Driller: CC+MJ

Ground Level: -7.80 mCD

Dates: 10/02/2018 - 12/02/2018

Logger: FG+TH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					-13.10	5.30		Very soft grey slightly sandy slightly gravelly silty organic CLAY with fragments of shell. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
5.40 - 5.80	B4							Firm dark grey slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to medium.		
5 50 - 5.95	D10									
	SPT (S) N=12	5.50		N=12 (1,2/2,3,3,4)						
6 00 - 6.50	B5					(1.30)				
6.60 - 7.00	U13			Ublow=20 0%	-14.40	6.60		Very dense greyish brown slightly silty slightly sandy very gravelly subangular to subrounded COBBLES. Sand is fine to coarse. Gravel is subangular fine to coarse.		
7 00 - 7.50	B6									
						(2.30)				
8.10 - 8.60	B7									
8.10 - 8.28	SPT (C)	8.10		50 (9,15/50 for 35mm)						
					-16.70	8.90 (0.10)		Weathered GNEISS bedrock.		
9 00 - 9.01	SPT (C)	9.00		50 (25 for 5mm/50 for 5mm)	-16.80	9.00		Weathered GNEISS bedrock recovered as slightly sandy slightly gravelly subangular COBBLES of medium strong gneiss. Sand is fine to coarse. Gravel is fine to coarse of gneiss.		
9 00 - 9.01	98 16 0		NA	50 (25 for 5mm/50 for 5mm)		(0.90)				
9 90			10		-17.70	9.90		Strong to very strong narrowly foliated dark grey and red GNEISS. Partially weathered: greyish green mottled discolouration on most discontinuities surfaces.		
			>20					Discontinuities: 1. 0 to 30 degree fractures, closely spaced (30/200/270) planar, smooth,		
	TCR SCR	RQD	FI							

Remarks

Deck to Bed = 14.00m

Terminated by Engineer 3.5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
6.60	250
9.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.60	6.60	00 30
8.90	9.00	01 00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
17-0769	Stornoway Deep Water Berth G.I.	BH32
Coordinates:	**Client:**	Sheet 3 of 3
142450.21 E	Stornoway Port Authority	
930829.17 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:25
Ground Level: -7.80 mCD	**Dates:** 10/02/2018 - 12/02/2018	**Driller:** CC+MJ
		Logger: FG+TH

Method	Plant Used	Top	Base
Cable Percussion Rotary Coring	Dando 3000 Comacchio 405	0.00 9.00	9.00 12.50

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mCD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	40	22	8			(2.60)		Strong to very strong narrowly foliated dark grey and red GNEISS. Partially weathered: greyish green mottled discolouration on most discontinuities surfaces. Discontinuities: 1. 0 to 30 degree fractures, closely spaced (30/200/270) planar, smooth, greenish grey mottled discolouration on fracture surfaces, mud infill between foliation fractures at 10 50m. Discontinuities: 1. 70 to 90 degree joints at 9.90m to 10 20m and 11.20m to 11.50m , undulating, rough, with faint grey staining on joint surface.		
11.50											
	100	47	26								
12.50						-20.30	12.50		End of Borehole at 12.50m		

TCR	SCR	RQD	FI

Remarks
Deck to Bed = 14.00m

Terminated by Engineer 3 5m into competent bedrock

Core Barrel

Flush Type

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

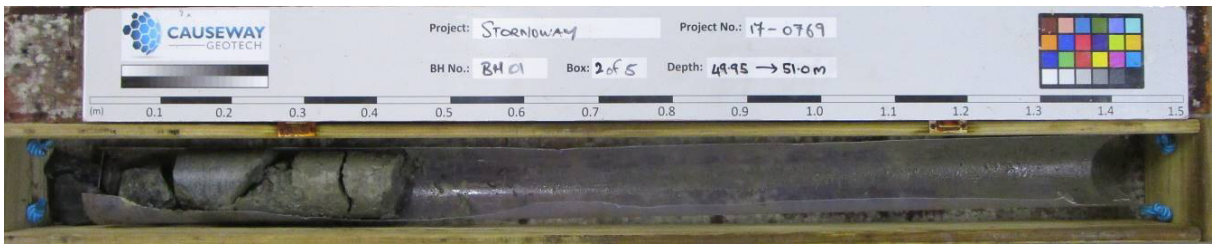
Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.60	6.60	00 30
8.90	9.00	01 00

CAUSEWAY GEOTECH

APPENDIX C

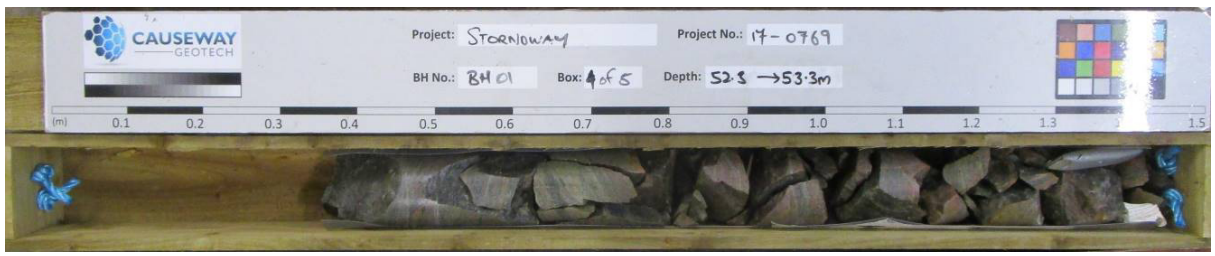
Core photographs

BH01 49.00m to 49.95m

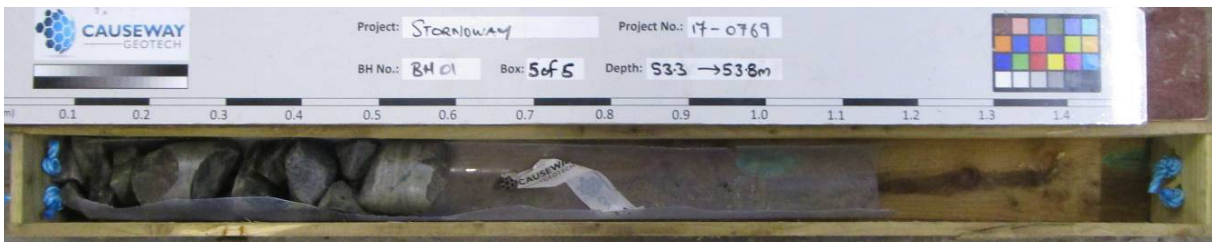


BH01 49.95m to 51.00m

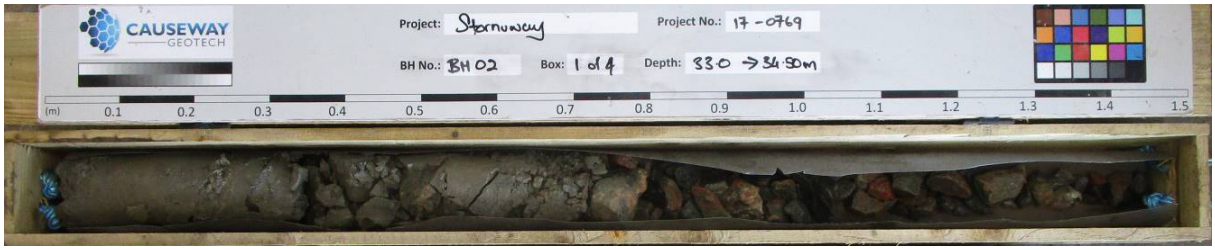
BH01 51.00m to 52.30m



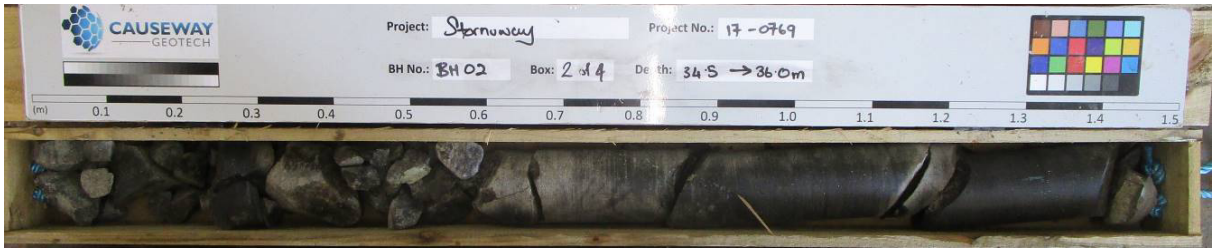
BH01 52.30m to 53.30m



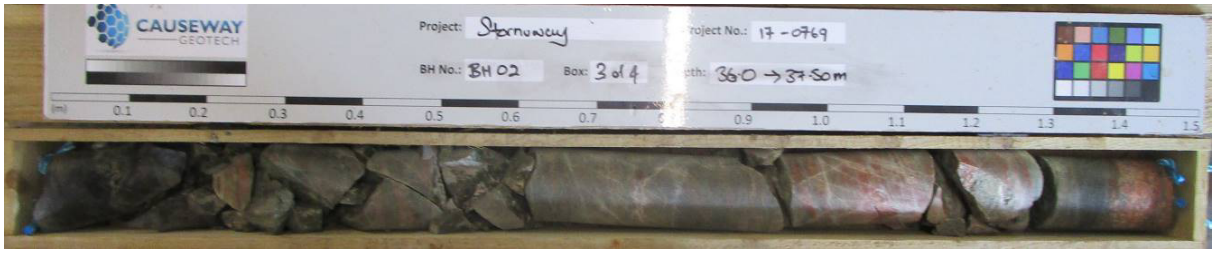
BH01 53.30m to 53.80m



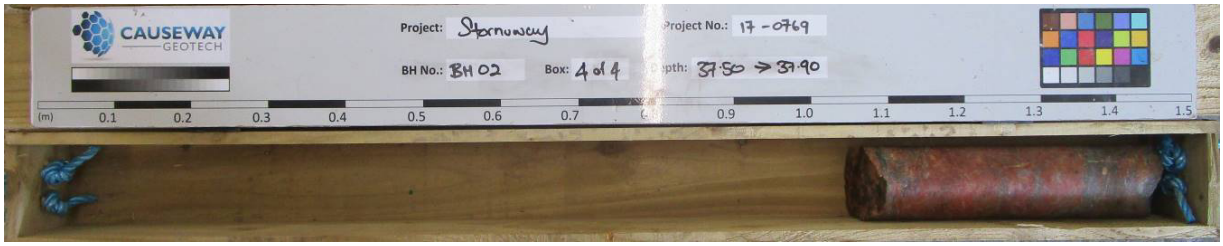
BH02 33.00m to 34.50m



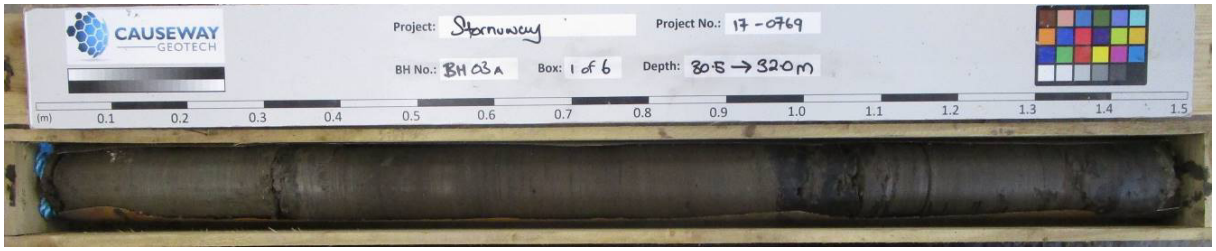
BH02 34.50m to 36.00m



BH02 36.00m to 37.50m



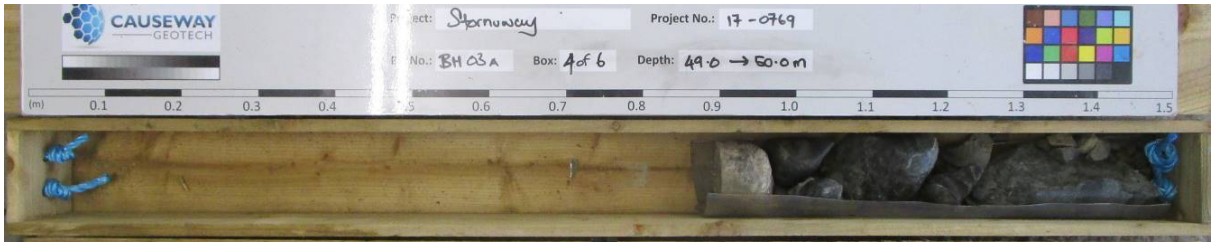
BH02 37.50m to 37.90m



BH03A 30.50 to 32.00m

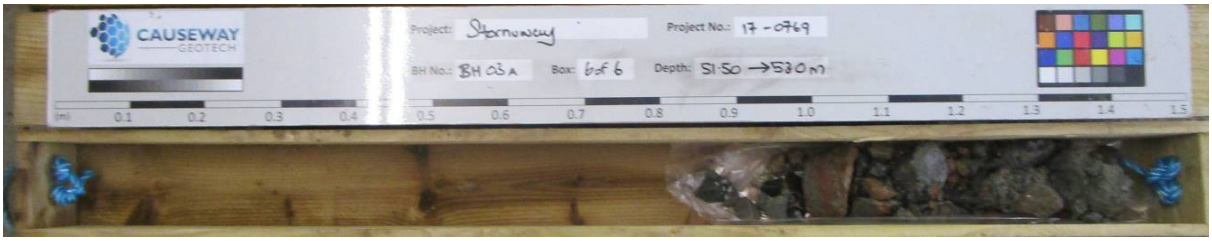
BH03A 32.00m to 33.50m

BH03A 33.50m to 35.00m

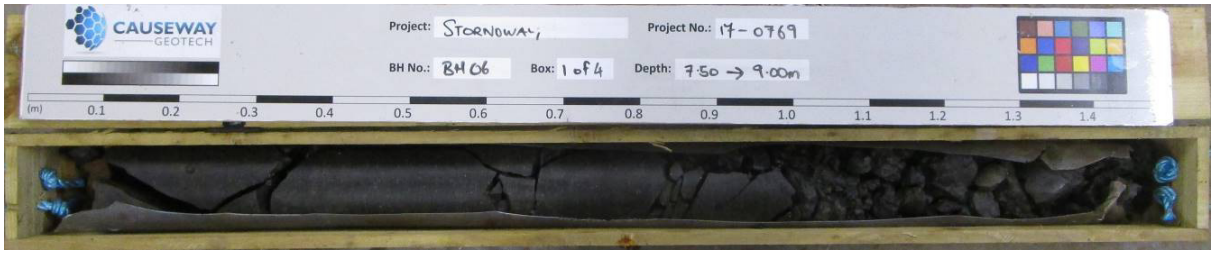


BH03A 49.00m to 50.00m

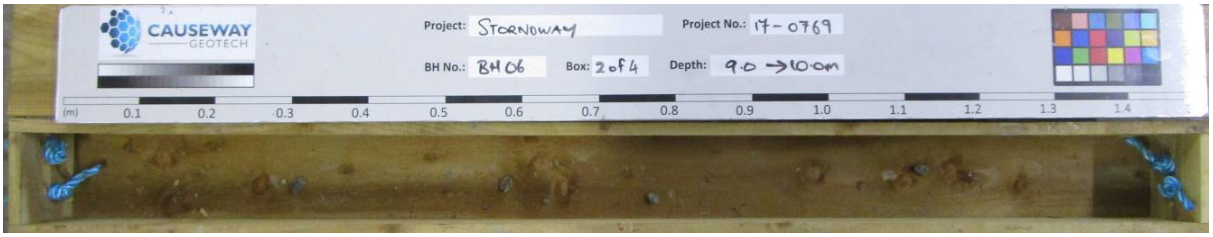
BH03A 50.00m to 51.00m



BH03A 51.50m to 53.0m

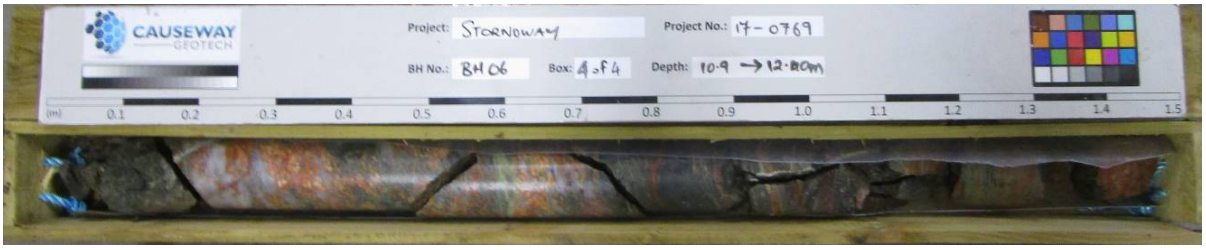


BH06 7.50m to 9.00m



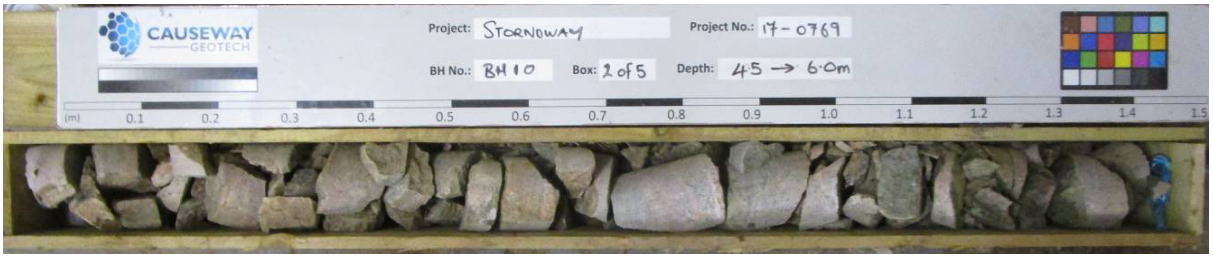
(NO RECOVERY) BH06 9.00m to 10.00m

BH06 10.00m to 10.90m



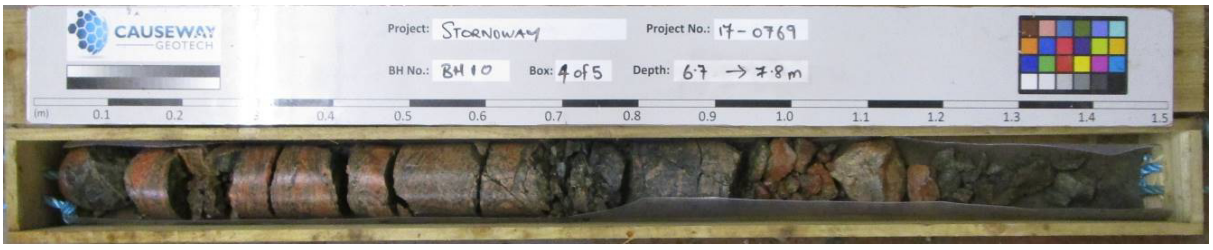
BH06 10.90 to 12.40m

BH10 3.90m to 4.50m

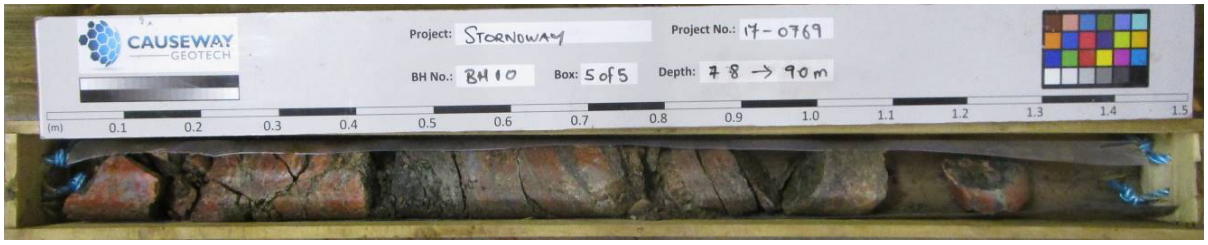


BH10 4.50m to 6.00m

BH10 6.00m to 6.70m



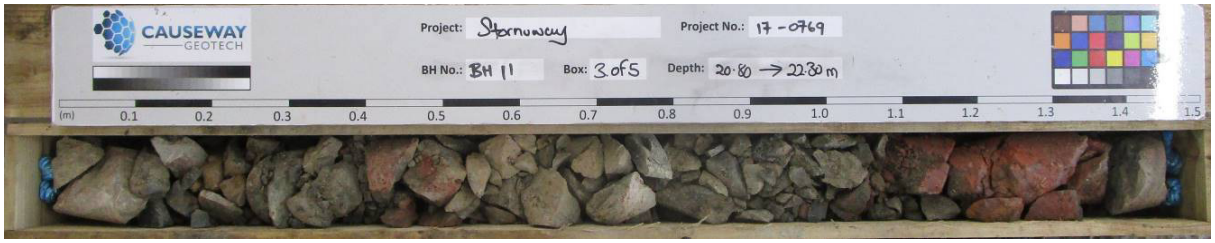
BH10 6.70m to 7.80m



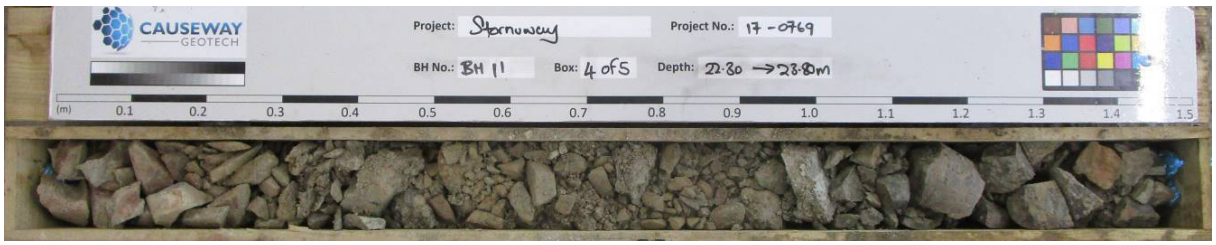
BH10 7.80m to 9.00m

BH11 17.80m to 19.30m

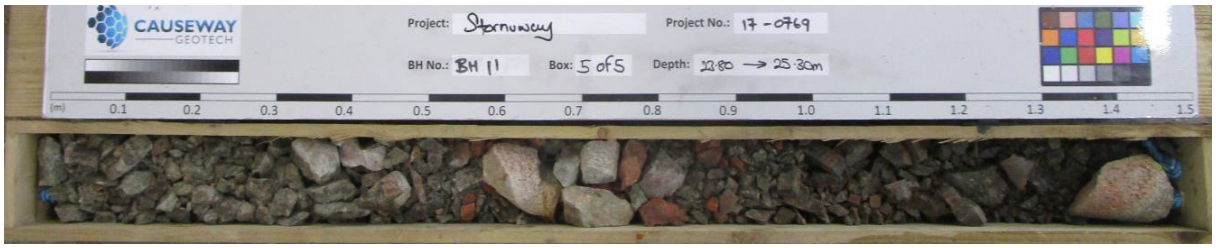
BH11 19.30 to 20.80m



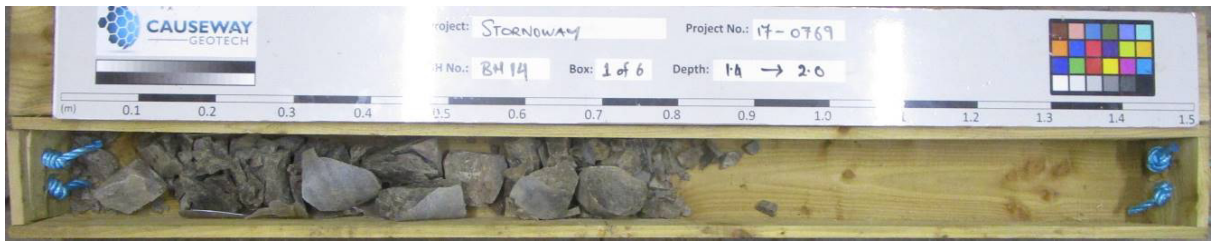
BH11 20.80m to 22.30m



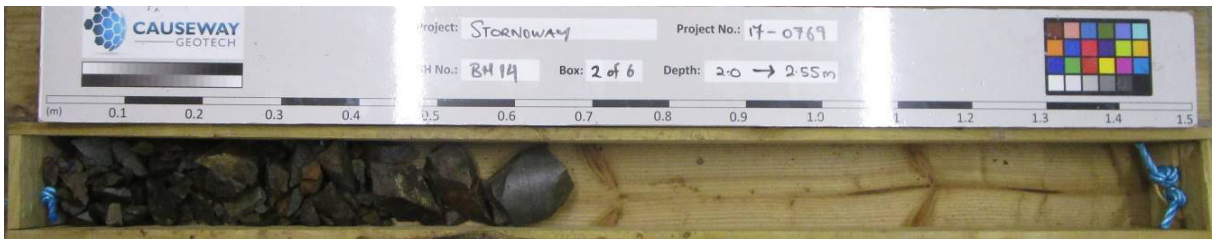
BH11 22.30m to 23.80m



BH11 23.80m to 25.30m

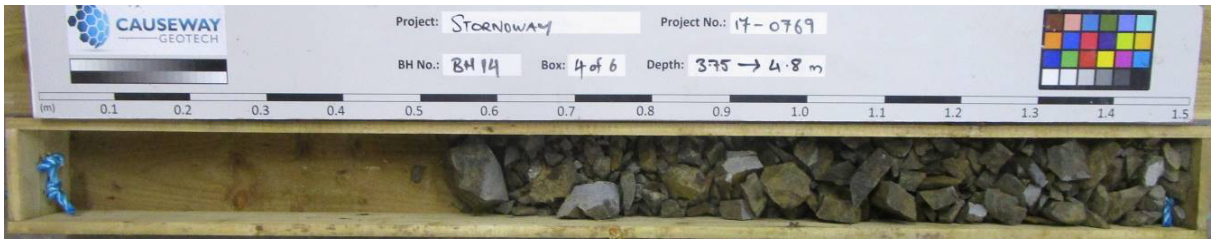


BH14 1.40m to 2.00m

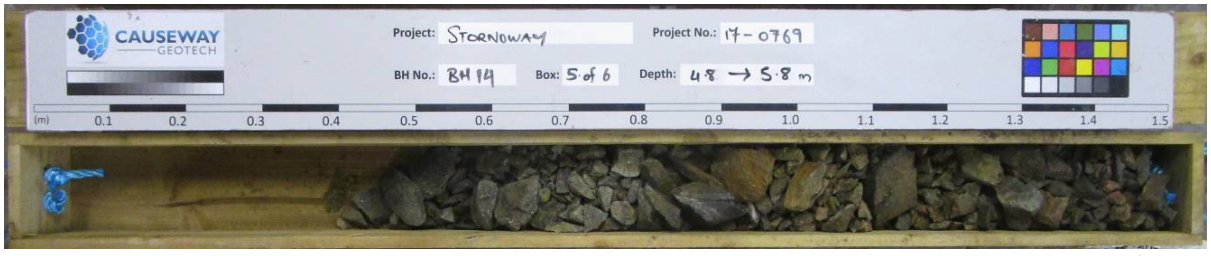


BH14 2.00m to 2.55m

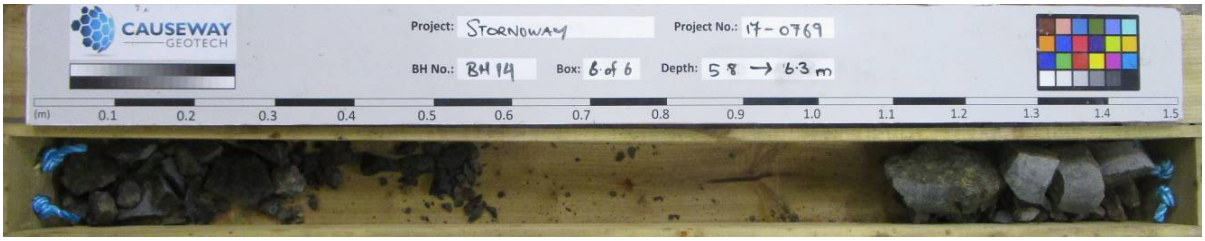
BH14 2.55m to 3.75m



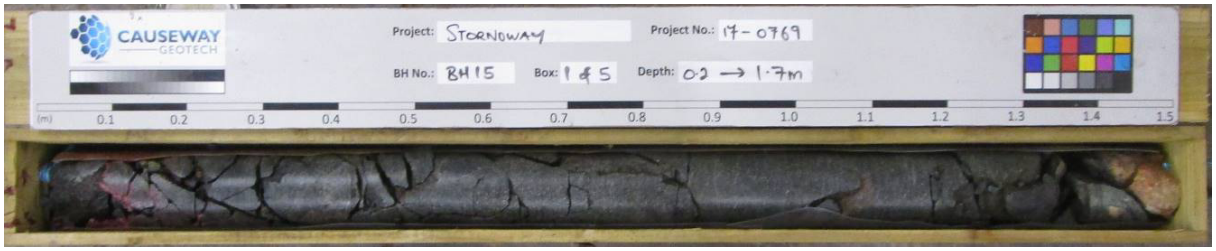
BH14 3.75m to 4.80m



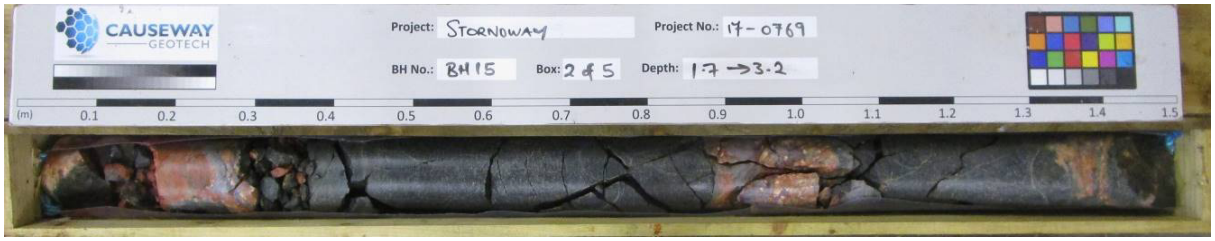
BH14 4.80m to 5.80m



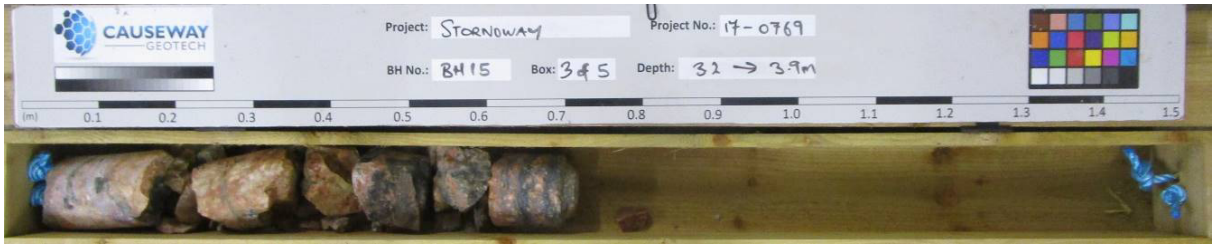
BH14 5.80m to 6.30m



BH15 0.20m to 1.70m



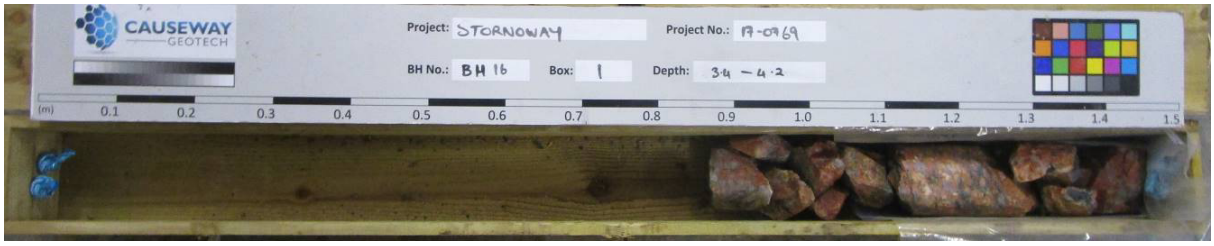
BH15 1.70m to 3.20m



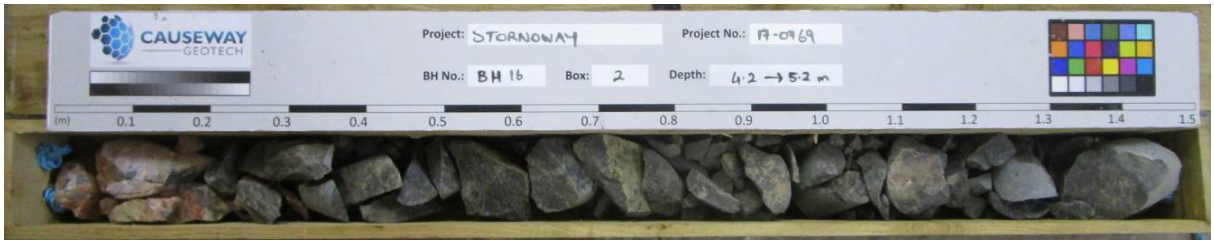
BH15 3.20m to 3.90m

BH14 3.90m to 5.30m

BH15 5.30m to 6.80m

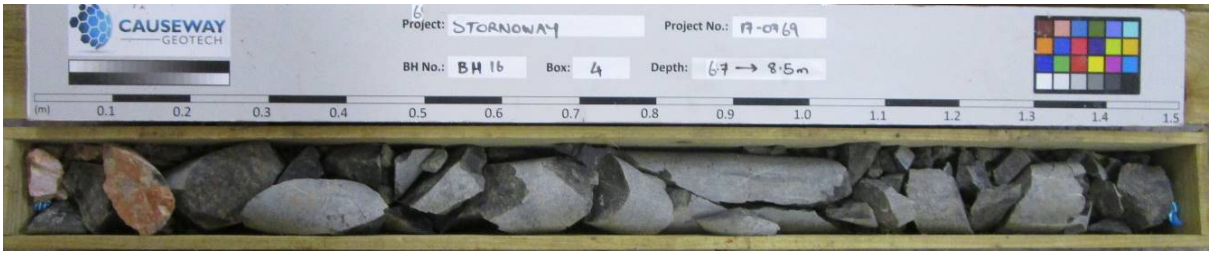


BH16 3.40m to 4.20m



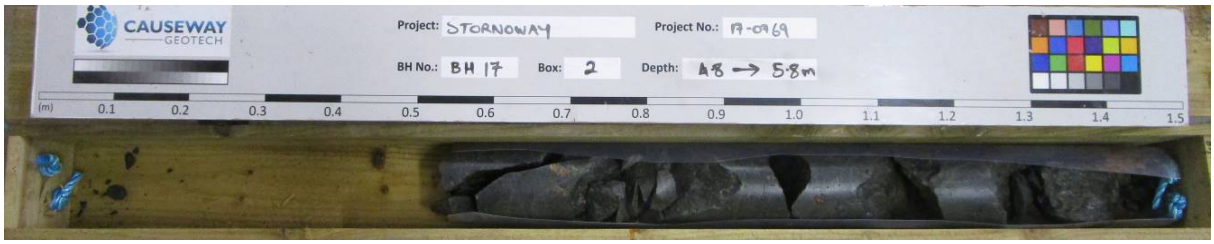
BH16 4.20m to 5.20m

BH16 5.20m to 6.70m

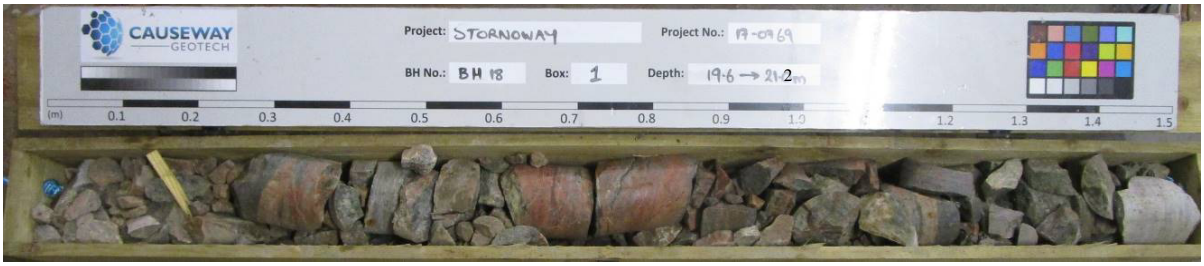


BH16 6.70m to 8.50m

BH17 3.80m to 4.80m



BH17 4.80m to 5.80m



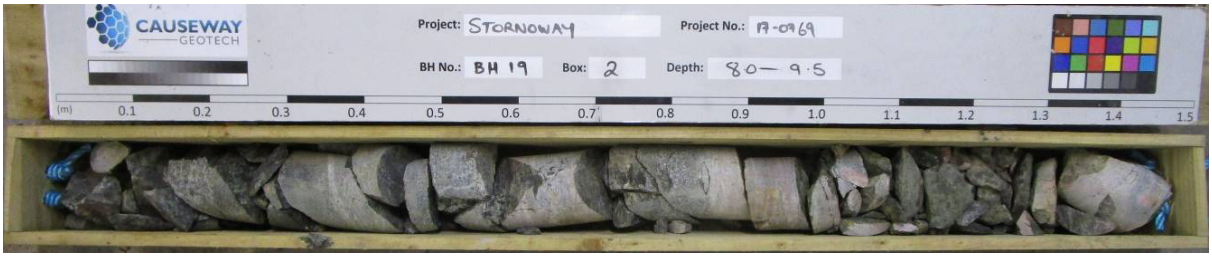
BH18 19.60m to 21.20m

BH18 21.20m to 22.70m

BH18 22.70m to 24.30m

BH18 24.30m to 25.00m

BH19 6.70m to 8.00m

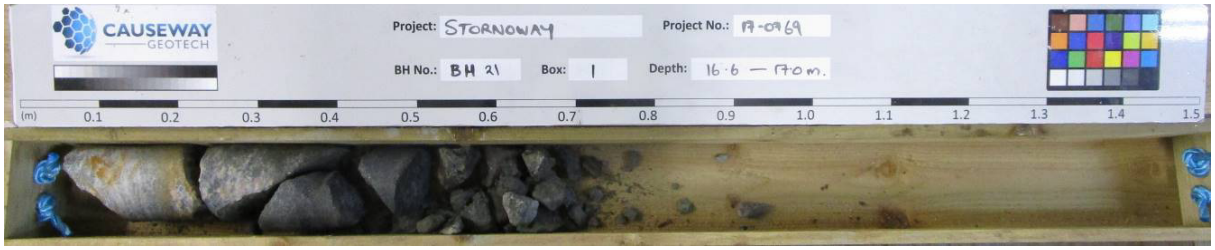


BH19 8.00m to 9.50m

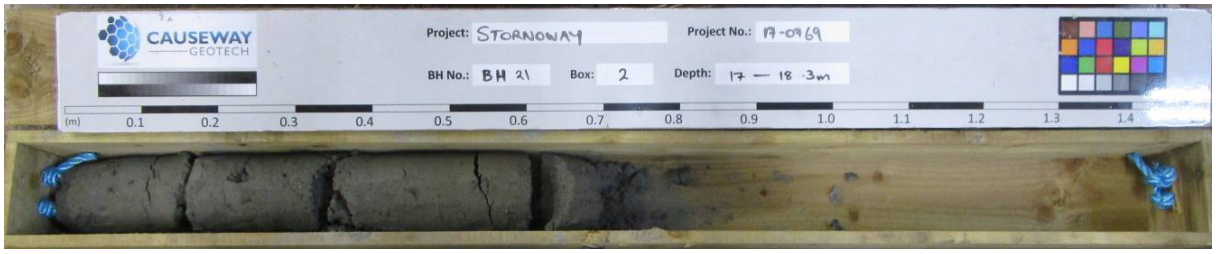
BH20 6.30m to 7.30m

BH20 7.30m to 8.55m

BH20 8.55m to 10.10m

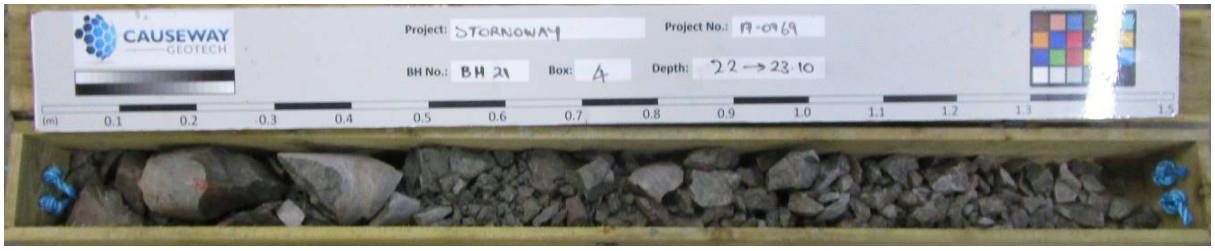


BH21 16.60m to 17.00m

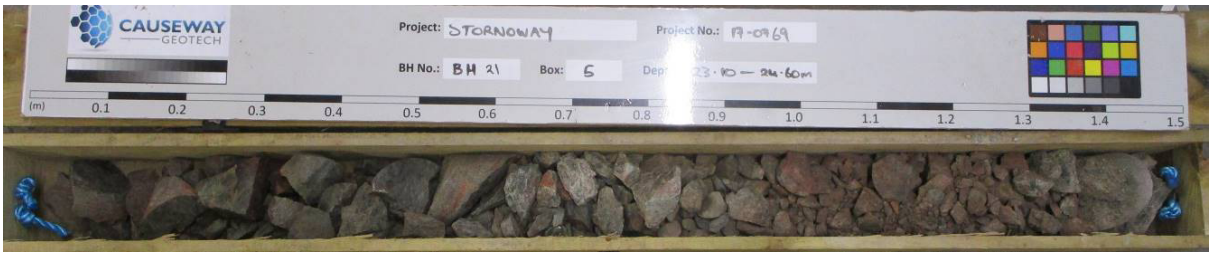


BH21 17.00m to 18.30m

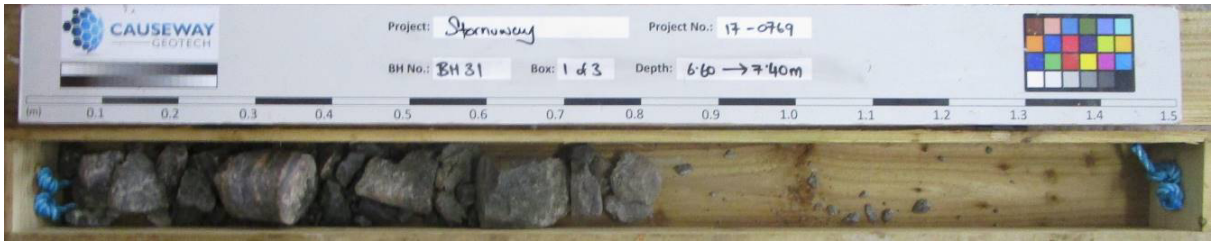
BH21 21.30m to 22.00m



BH21 22.00m to 23.10m



BH21 23.10m to 24.60m



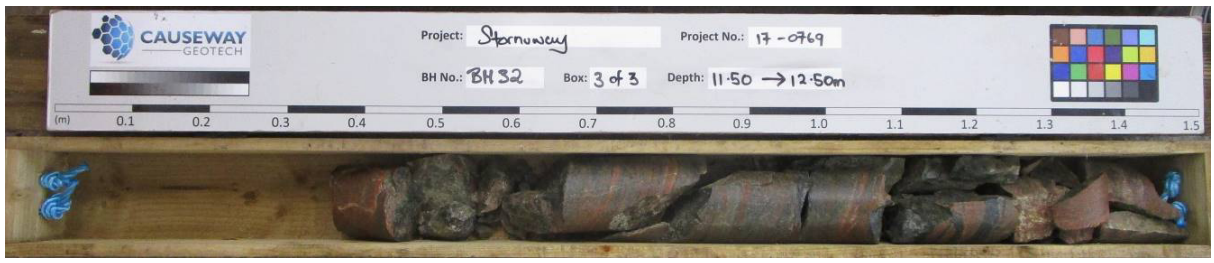
BH31 6.60m to 7.40m

BH31 7.40m to 8.90m

BH31 8.90m to 9.60m

BH32 9.00m to 9.90m

BH32 9.90m to 11.50m



BH32 11.50m to 12.50m

CAUSEWAY GEOTECH

APPENDIX D

Geotechnical laboratory test results

LABORATORY REPORT

4043

Contract Number: PSL18/0272

Report Date: 06 February 2018

Client's Reference: 17-0769

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water G.I

Date Received: 18/1/2018
Date Commenced: 18/1/2018
Date Completed: 6/2/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	A Fry (Senior Technician)

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fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01	8	B	0.50		Grey sandy GRAVEL.
BH01	11	B	2.50		Brown slightly gravelly slightly silty SAND.
BH01	15	B	6.00	7.00	Brown very sandy slightly silty GRAVEL.
BH01	19	B	11.00	11.50	Brown very sandy slightly silty GRAVEL with cobbles.
BH01	21	B	14.00	14.50	Brown slightly gravelly silty SAND.
BH01	29	B	23.00	23.50	Brown slightly gravelly silty SAND.
BH01	35	B	35.00		Brown very silty SAND.
BH06	5	B	2.00	2.80	Brown very sandy slightly silty GRAVEL.
BH06	2	B	5.00	5.40	Brown very sandy slightly silty GRAVEL.
BH06	9	B	6.50	7.00	Brown mottled grey sandy very clayey GRAVEL of cobbles.
BH10	2	B	1.00	1.40	Brown mottled grey very gravelly sandy organic CLAY.
BH10	5	B	3.00	3.40	Grey sandy slightly clayey silty GRAVEL.
BH14	1	B	0.50		Grey very gravelly sandy CLAY with some organic material.
BH15	1	B	0.00	0.20	Grey & brown sandy slightly silty GRAVEL.
BH16	1	B	0.80	1.00	Grey mottled brown slightly gravelly slightly sandy organic CLAY.
BH16	3	B	3.00	3.10	Grey slightly sandy slightly silty GRAVEL.
BH17	1	B	1.00	1.20	Brown mottled grey slightly gravelly slightly sandy silty CLAY.
BH17	3	B	3.00	3.20	Brown mottled grey very gravelly very sandy CLAY.
BH18	2	B	3.00	3.20	Brown slightly sandy very silty CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Stornoway Deep Water Berth G.I.	Contract No: PSL18/0272 Client Ref: 17-0769

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH18	18	U	5.00	5.45	Brownish grey slightly gravelly slightly sandy CLAY with some organic material.
BH18	19	U	8.00	8.45	Brownish grey slightly sandy very silty CLAY.
BH18	7	B	9.00	9.20	Grey slightly sandy very silty CLAY.
BH18	12	B	14.00	14.20	Grey slightly gravelly slightly sandy very clayey PEAT.
BH18	14	B	17.00	17.20	Grey mottled brown slightly sandy very clayey GRAVEL.
BH18	15	B	19.00	19.20	Grey slightly sandy slightly clayey silty GRAVEL.
BH19	2	B	2.00	2.20	Brown slightly gravelly slightly sandy CLAY with some organic material.
BH19	4	B	5.00	5.20	Grey very sandy very clayey GRAVEL.
BH20	1	B	1.00	1.20	Brown mottled grey slightly gravelly slightly sandy CLAY with some organic material.
BH20	3	B	4.00	4.20	Grey very gravelly very sandy CLAY with some organic material.
BH20	5	B	6.00	6.20	Grey very clayey silty SAND & GRAVEL.
BH21	2	B	2.00	2.20	Brown slightly gravelly slightly sandy CLAY with some organic material.
BH21	7	B	7.00	7.20	Grey mottled brown slightly gravelly slightly sandy very silty CLAY.
BH21	11	B	11.00	11.20	Grey mottled brown slightly gravelly slightly sandy very silty CLAY.
BH21	17	D	12.00		Grey mottled brown slightly gravelly slightly sandy very silty CLAY.
BH21	15	B	16.00	16.20	Grey mottled brown slightly gravelly slightly sandy organic CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Stornoway Deep Water Berth G.I.	Contract No: PSL18/0272 Client Ref: 17-0769

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH06	9	B	6.50	7.00	14			37	18	19	38	Intermediate plasticity CI.
BH10	2	B	1.00	1.40	71			99	38	61	51	Extremely high plasticity CE.
BH14	1	B	0.50		38			68	31	37	42	High plasticity CH.
BH16	1	B	0.80	1.00	88			112	45	67	93	Extremely high plasticity CE.
BH17	1	B	1.00	1.20	111			69	31	38	96	High plasticity CH.
BH18	18	U	5.00	5.45	95			101	42	59	94	Extremely high plasticity CE.
BH18	19	U	8.00	8.45	73			81	35	46	98	Very high plasticity CV.
BH18	12	B	14.00	14.20	105			215	93	122	97	Extremely high plasticity CE.
BH18	14	B	17.00	17.20	55			57	25	32	39	High plasticity CH.
BH18	15	B	19.00	19.20	9.2				NP			
BH19	2	B	2.00	2.20	100			109	44	65	97	Extremely high plasticity CE.
BH20	1	B	1.00	1.20	98			78	32	46	98	Very high plasticity CV.
BH20	3	B	4.00	4.20	116			86	35	51	54	Very high plasticity CV.
BH21	2	B	2.00	2.20	101			121	47	74	96	Extremely high plasticity CE.
BH21	7	B	7.00	7.20	87			51	25	26	96	High plasticity CH.
BH21	17	D	12.00		80			53	26	27	90	High plasticity CH.
BH21	15	B	16.00	16.20	116			142	53	89	96	Extremely high plasticity CE.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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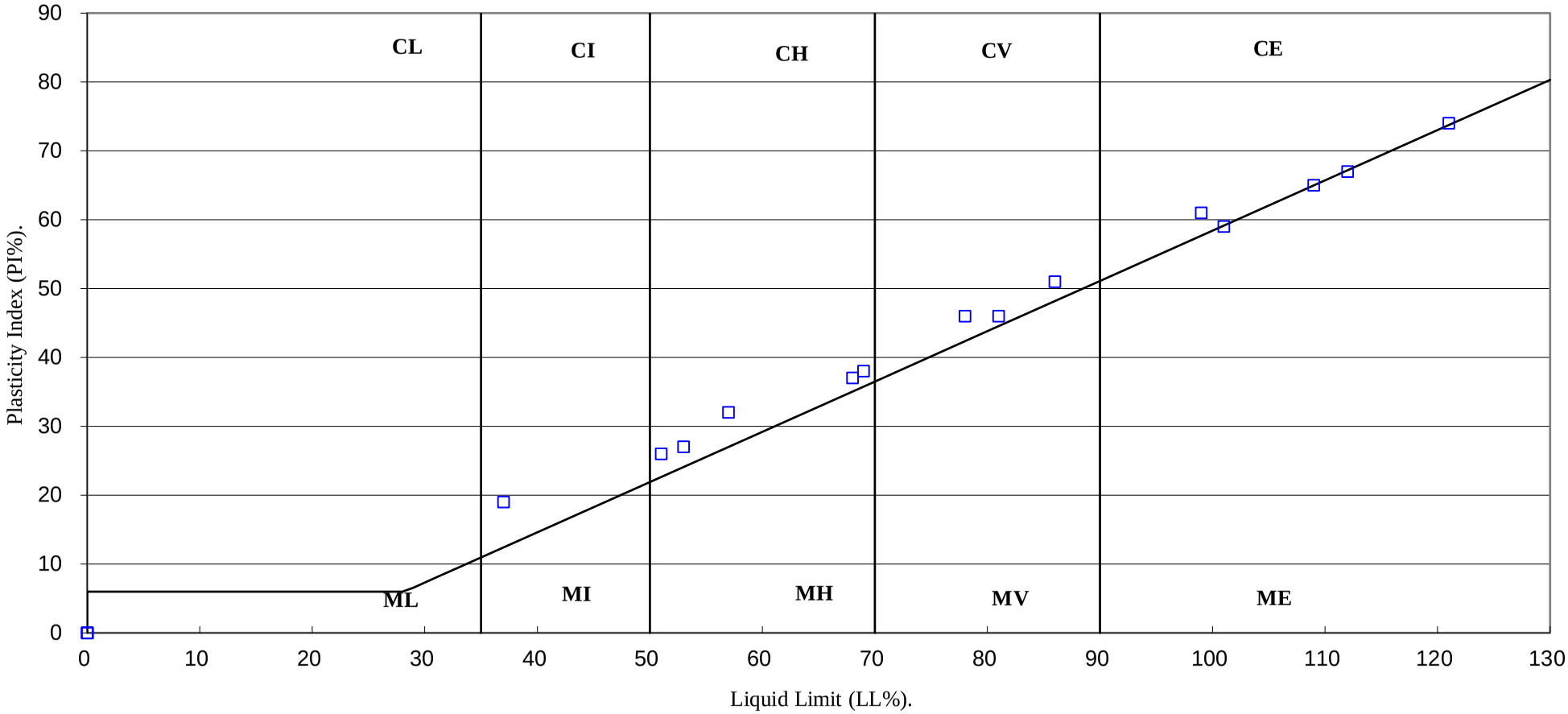
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**

Contract No:
PSL18/0272
Client Ref:
17-0769

PARTICLE SIZE DISTRIBUTION TEST

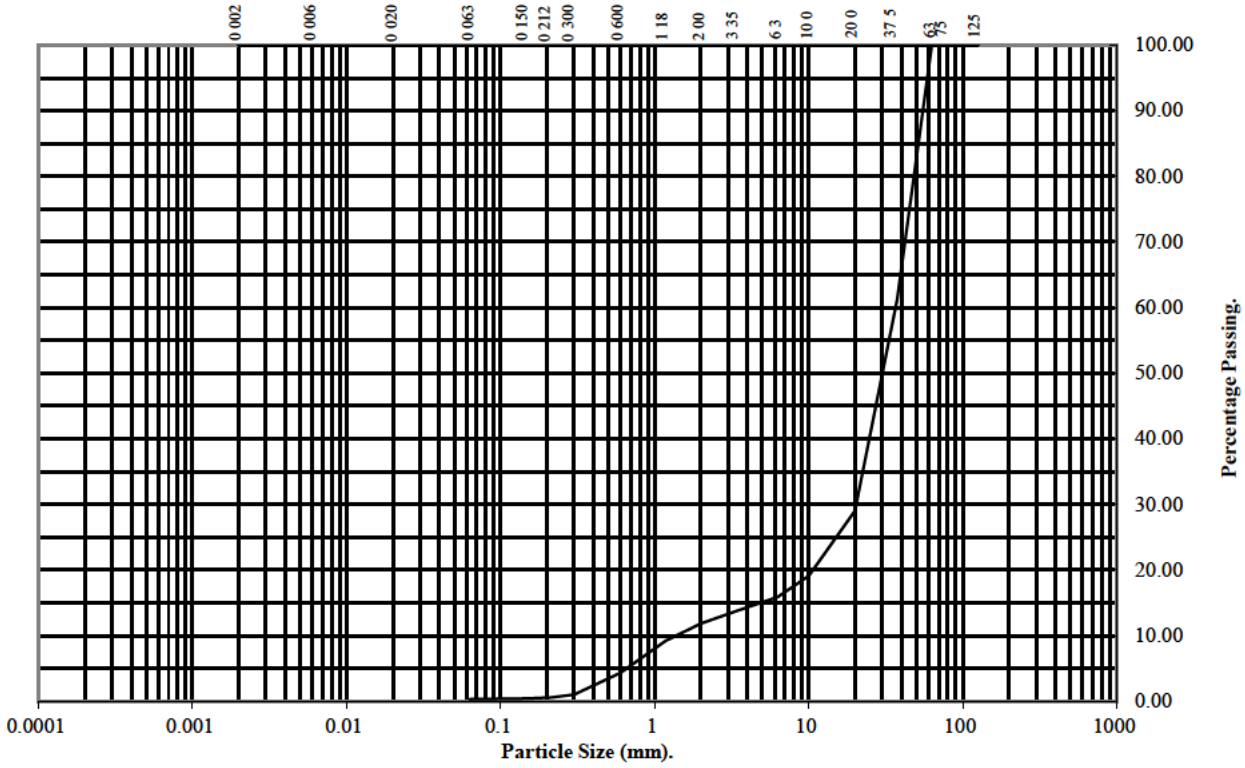
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH01 **Top Depth (m):** 0.50

Sample Number: 8 **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	61
20	29
10	19
6.3	16
3.35	14
2	12
1.18	9
0.6	4
0.3	1
0.212	1
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	88
Sand	12
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions

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Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No: PSL18/0272

Client Ref: 17-0769

PARTICLE SIZE DISTRIBUTION TEST

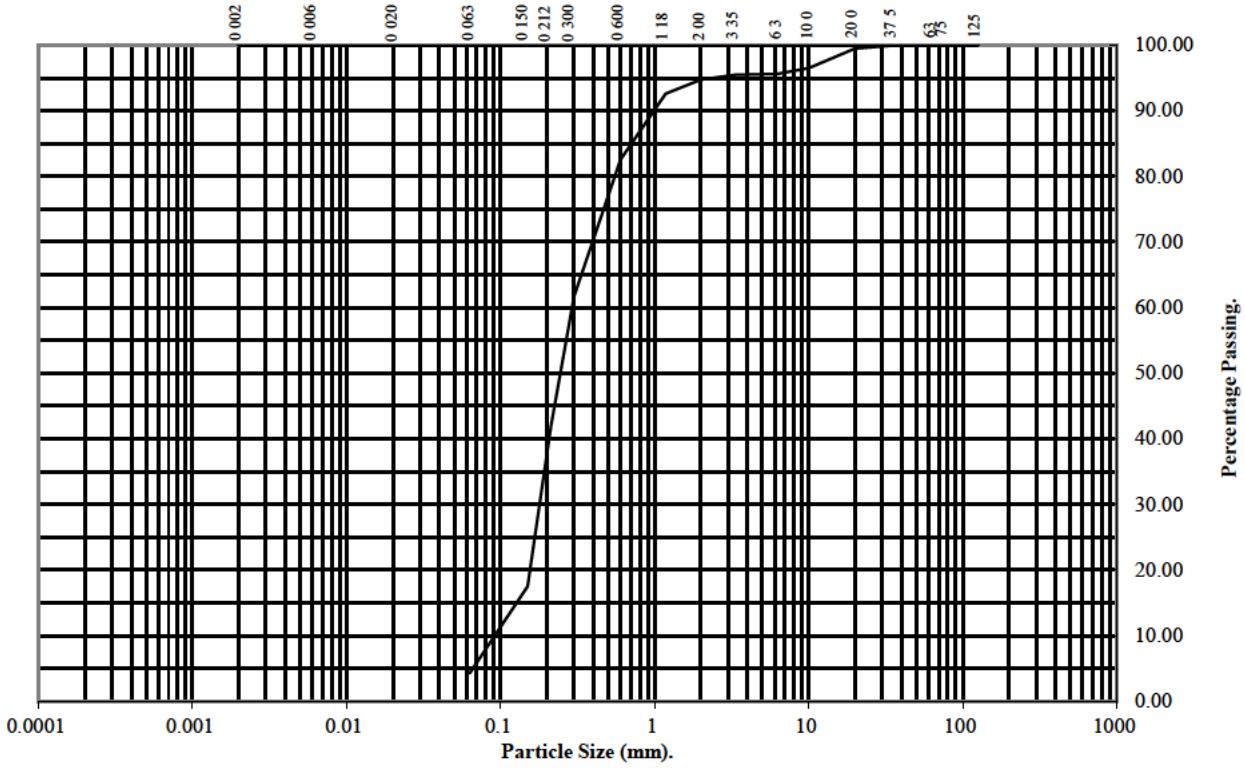
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH01 **Top Depth (m):** 2.50

Sample Number: 11 **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	99
10	97
6.3	96
3.35	95
2	95
1.18	93
0.6	83
0.3	62
0.212	42
0.15	18
0.063	4

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	91
Silt/Clay	4

Remarks:

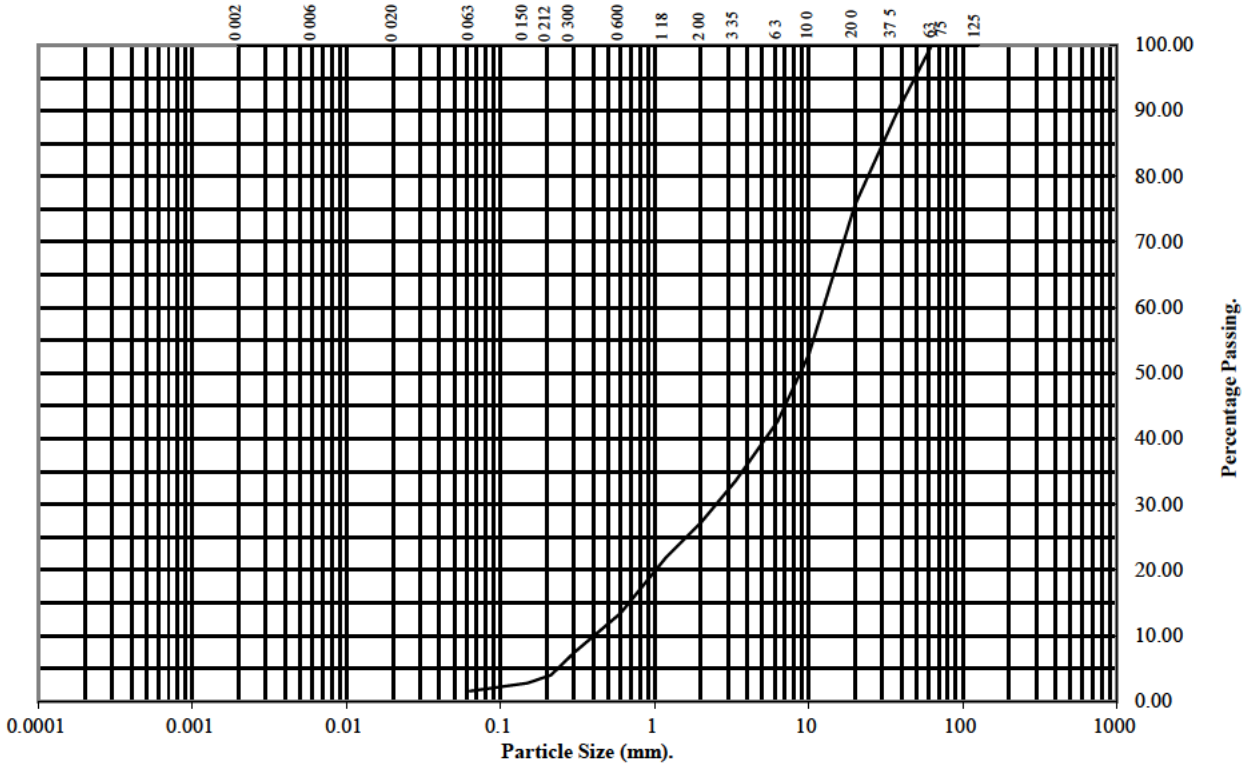
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH01**	**Top Depth (m):**	**6.00**
Sample Number:	**15**	**Base Depth(m):**	**7.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	90
20	76
10	53
6.3	43
3.35	34
2	27
1.18	22
0.6	13
0.3	7
0.212	4
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	73
Sand	25
Silt/Clay	2

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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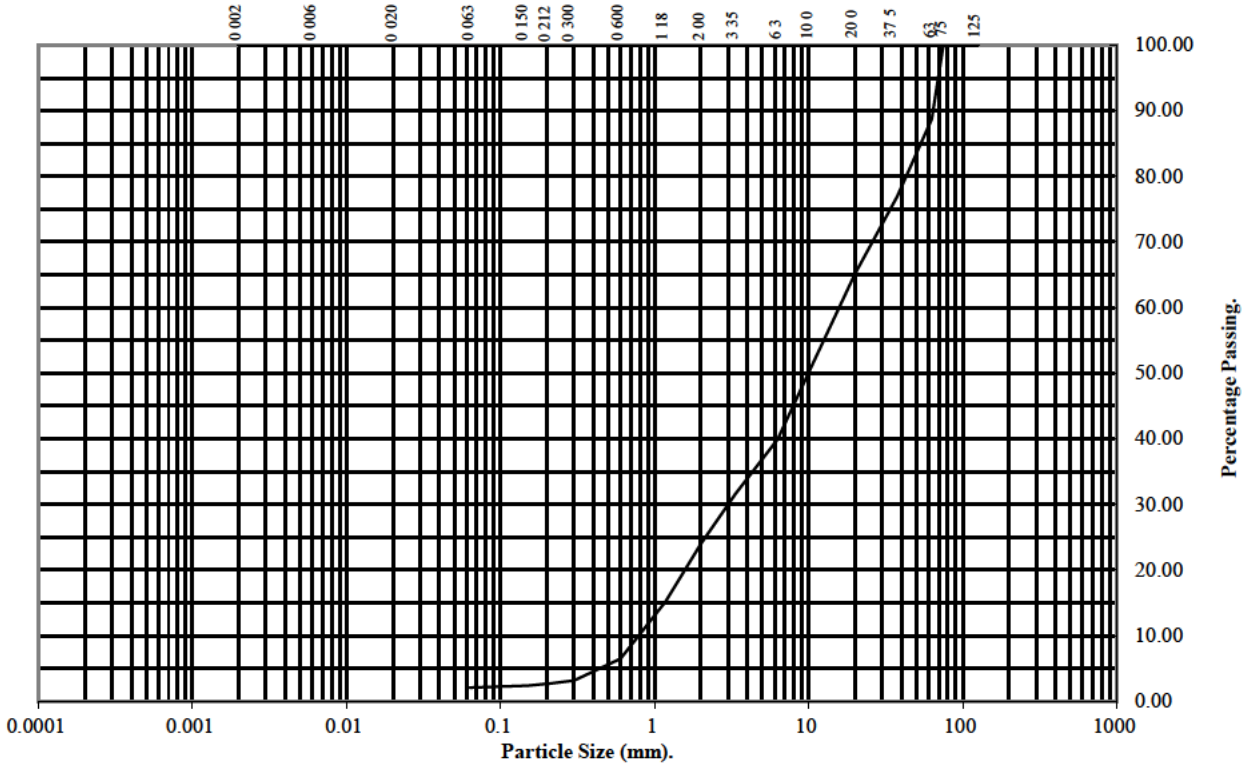
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH01**	**Top Depth (m):**	**11.00**
Sample Number:	**19**	**Base Depth(m):**	**11.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	89
37.5	77
20	65
10	50
6.3	40
3.35	32
2	24
1.18	15
0.6	6
0.3	3
0.212	3
0.15	2
0.063	2

Soil Fraction	Total Percentage
Cobbles	11
Gravel	65
Sand	22
Silt/Clay	2

Remarks:

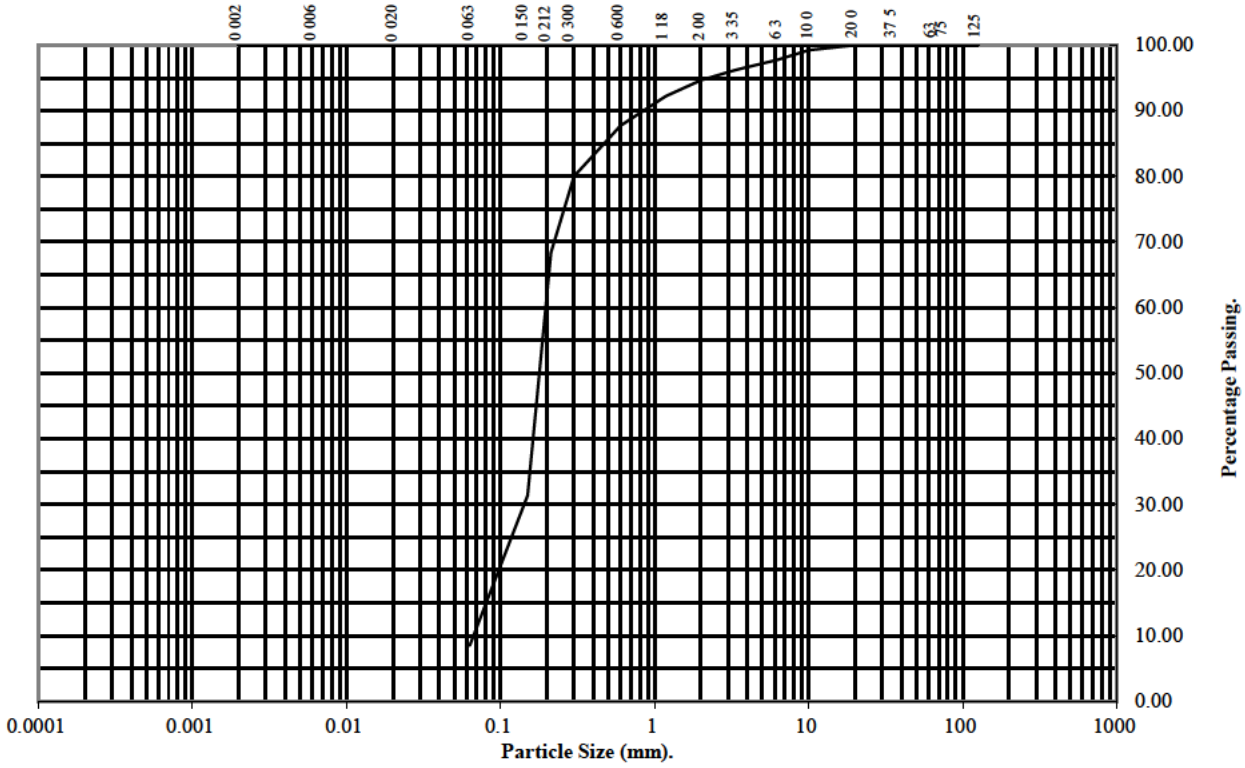
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH01**	**Top Depth (m):**	**14.00**
Sample Number:	**21**	**Base Depth(m):**	**14.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	98
3.35	96
2	95
1.18	92
0.6	88
0.3	80
0.212	68
0.15	31
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	87
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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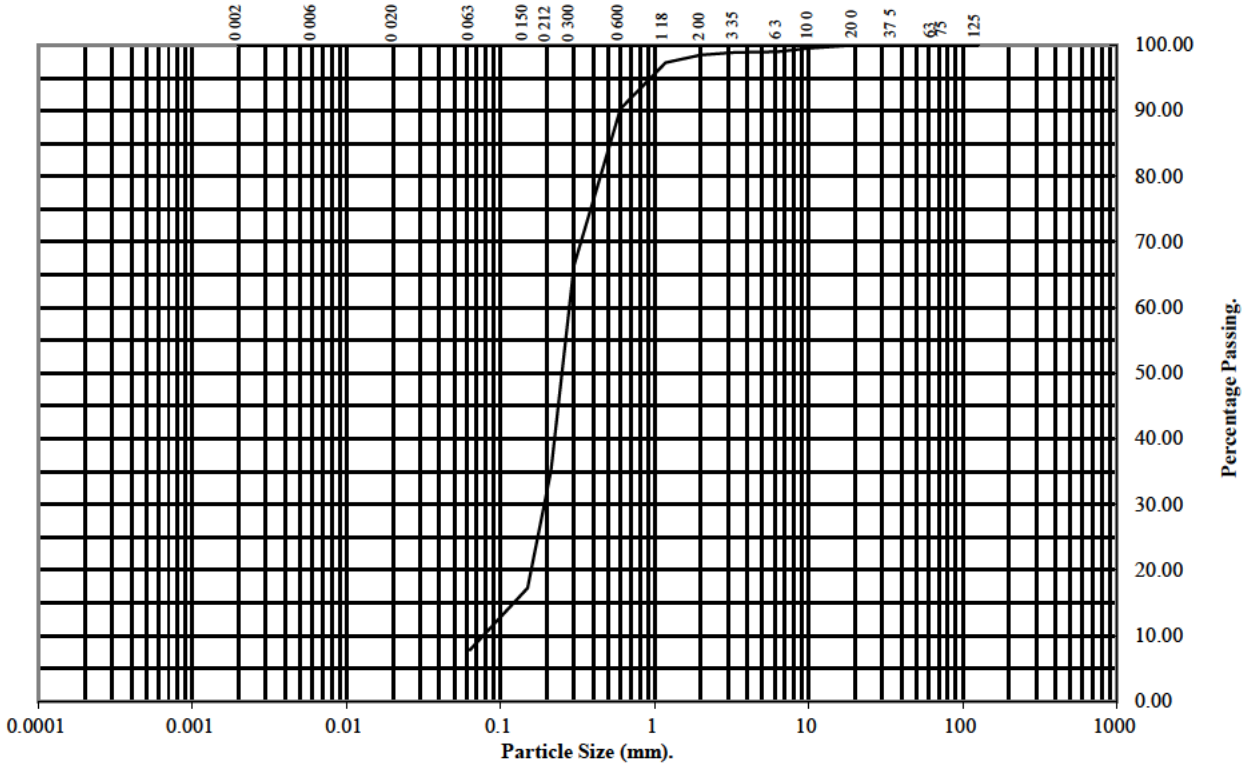
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH01**	**Top Depth (m):**	**23.00**
Sample Number:	**29**	**Base Depth(m):**	**23.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	99
2	99
1.18	97
0.6	90
0.3	66
0.212	35
0.15	17
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	91
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

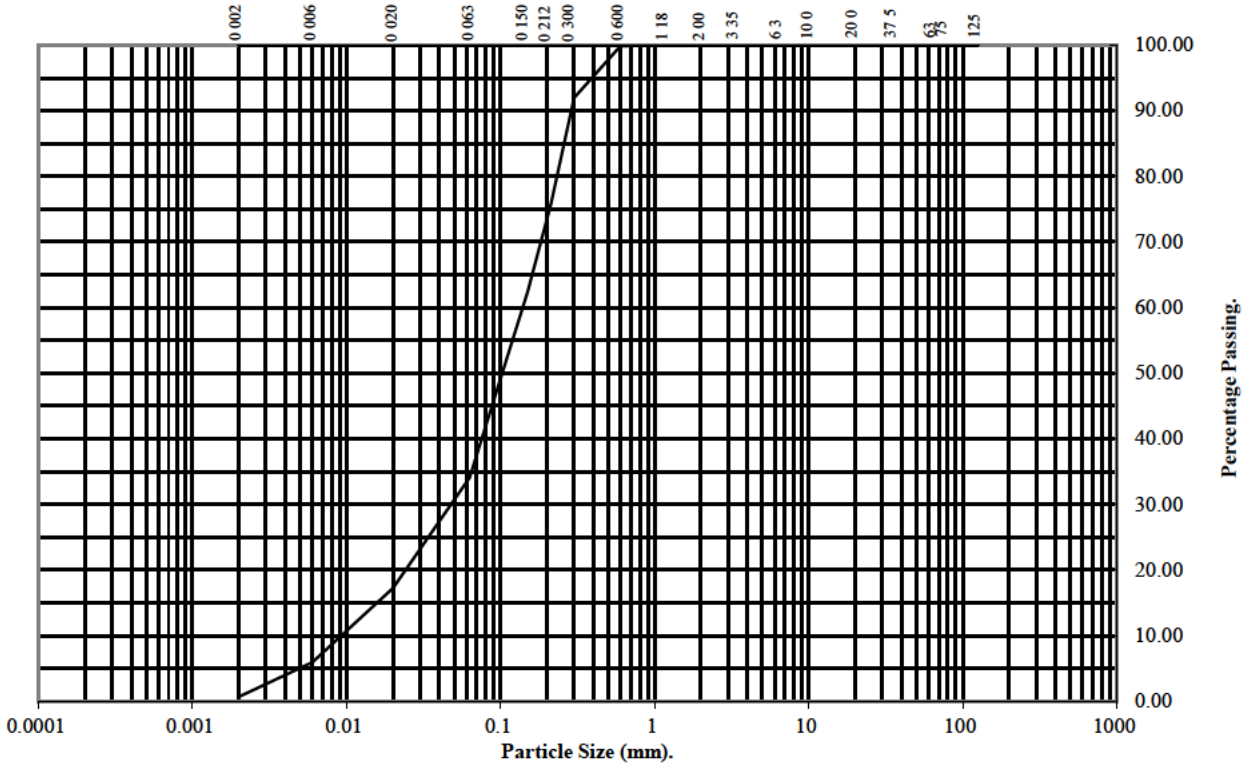
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BH01 **Top Depth (m):** 35.00

Sample Number: 35 **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	92
0.212	76
0.15	62
0.063	34

Particle Diameter	Percentage Passing
0.02	17
0.006	6
0.002	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	66
Silt	33
Clay	1

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No: PSL18/0272

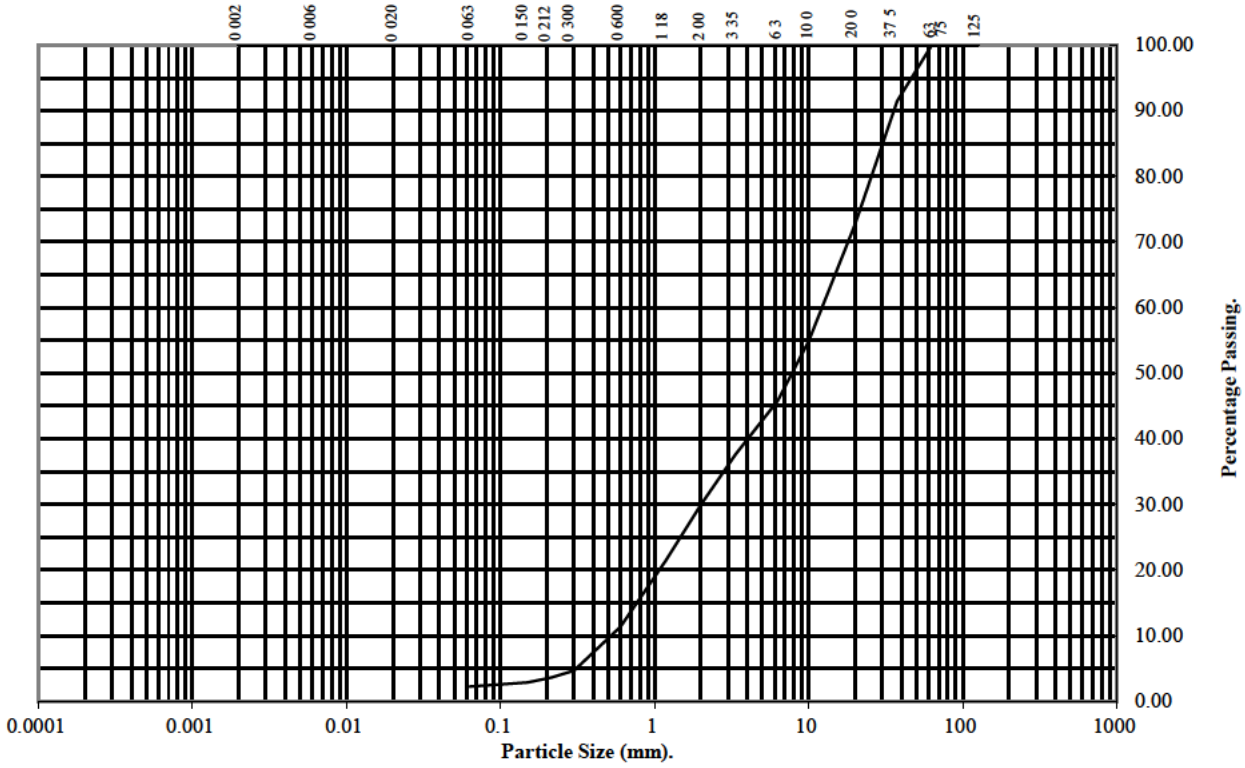
Client Ref: 17-0769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH06**	**Top Depth (m):**	**2.00**
Sample Number:	**5**	**Base Depth(m):**	**2.80**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	73
10	55
6.3	46
3.35	38
2	30
1.18	21
0.6	11
0.3	5
0.212	4
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	70
Sand	28
Silt/Clay	2

Remarks:

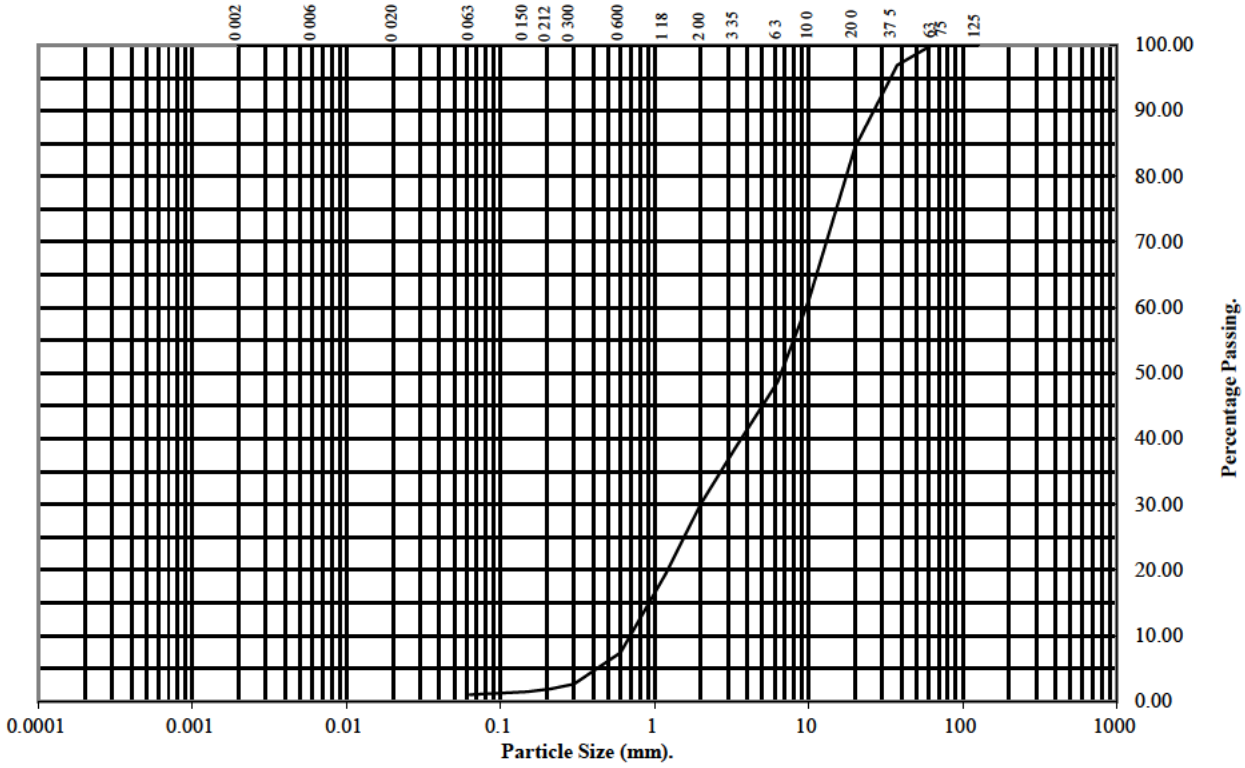
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH06**	**Top Depth (m):**	**5.00**
Sample Number:	**2**	**Base Depth(m):**	**5.40**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	84
10	61
6.3	49
3.35	39
2	30
1.18	19
0.6	7
0.3	3
0.212	2
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	70
Sand	29
Silt/Clay	1

Remarks:

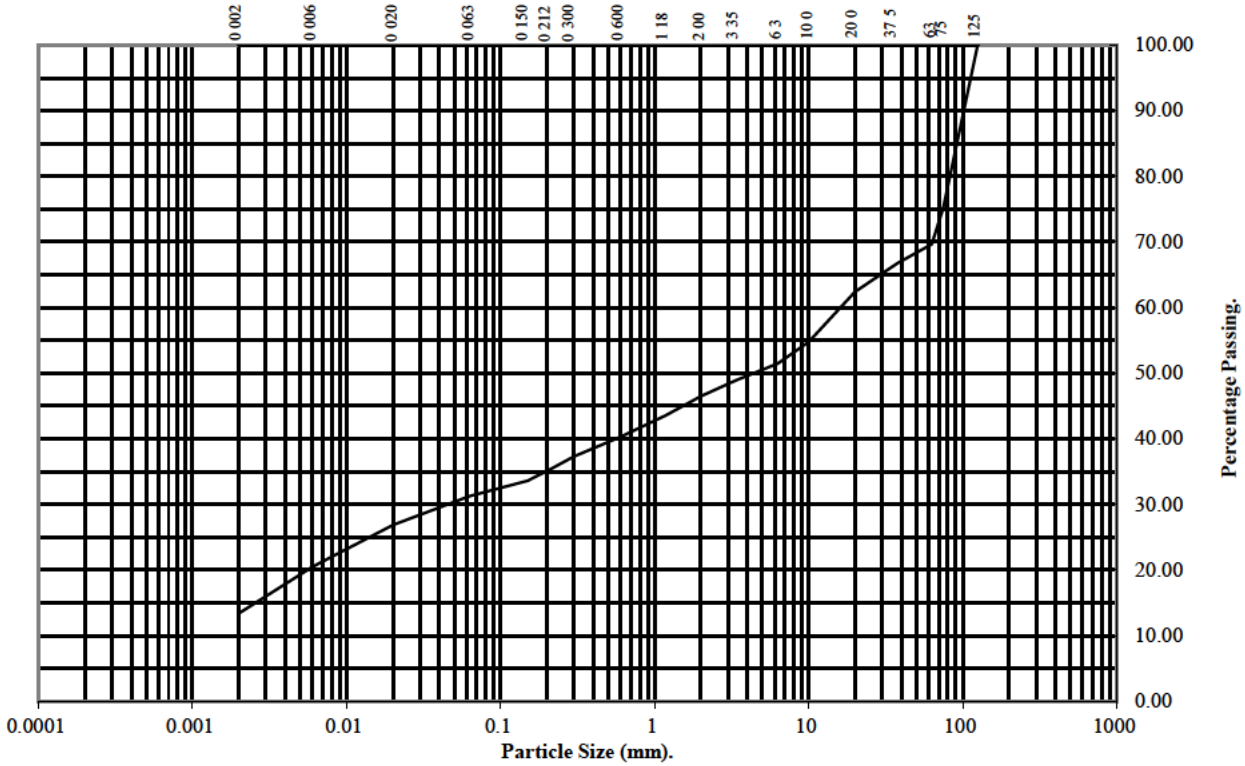
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH06**	**Top Depth (m):**	**6.50**
Sample Number:	**9**	**Base Depth(m):**	**7.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	75
63	70
37.5	67
20	62
10	55
6.3	51
3.35	49
2	46
1.18	44
0.6	40
0.3	37
0.212	35
0.15	34
0.063	31

Particle Diameter	Percentage Passing
0.02	27
0.006	20
0.002	13

Soil Fraction	Total Percentage
Cobbles	30
Gravel	24
Sand	15
Silt	18
Clay	13

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
PSL18/0272
Client Ref:
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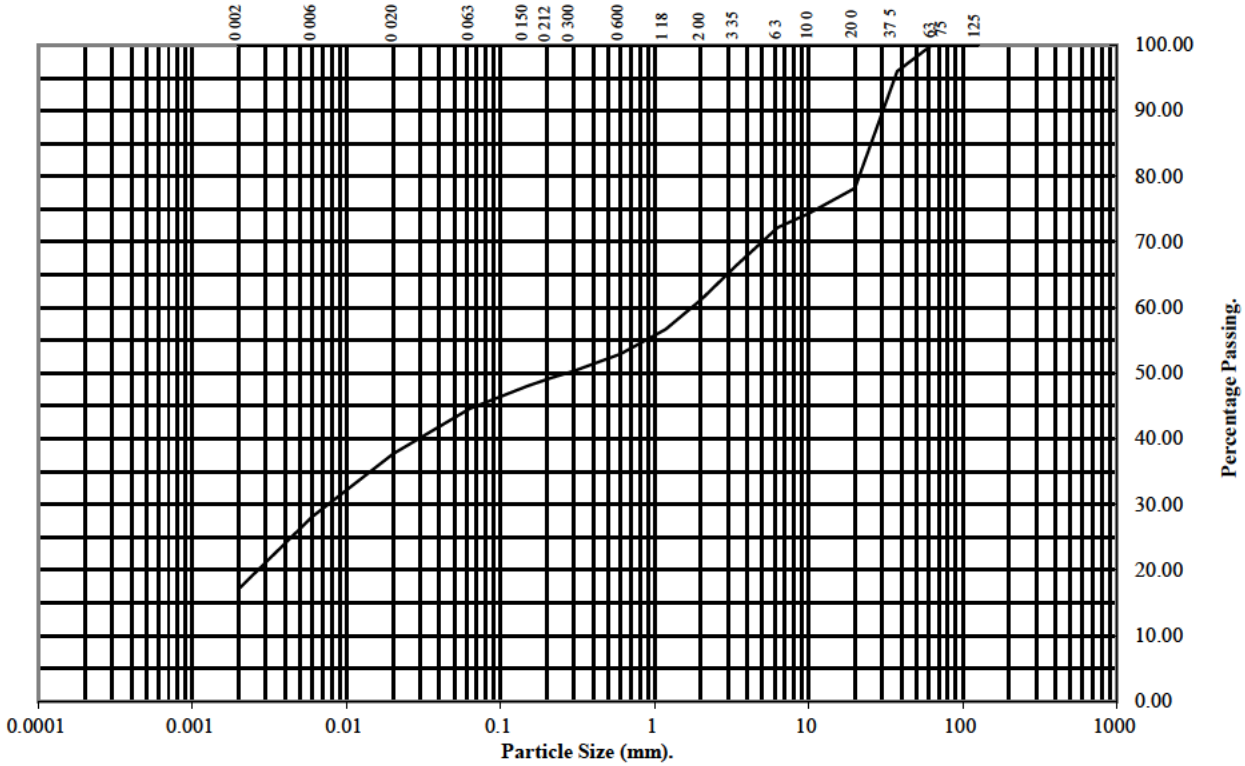
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH10**	**Top Depth (m):**	**1.00**
Sample Number:	**2**	**Base Depth(m):**	**1.40**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	78
10	74
6.3	72
3.35	66
2	61
1.18	57
0.6	53
0.3	50
0.212	49
0.15	48
0.063	45

Particle Diameter	Percentage Passing
0.02	38
0.006	28
0.002	17

Soil Fraction	Total Percentage
Cobbles	0
Gravel	39
Sand	16
Silt	28
Clay	17

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

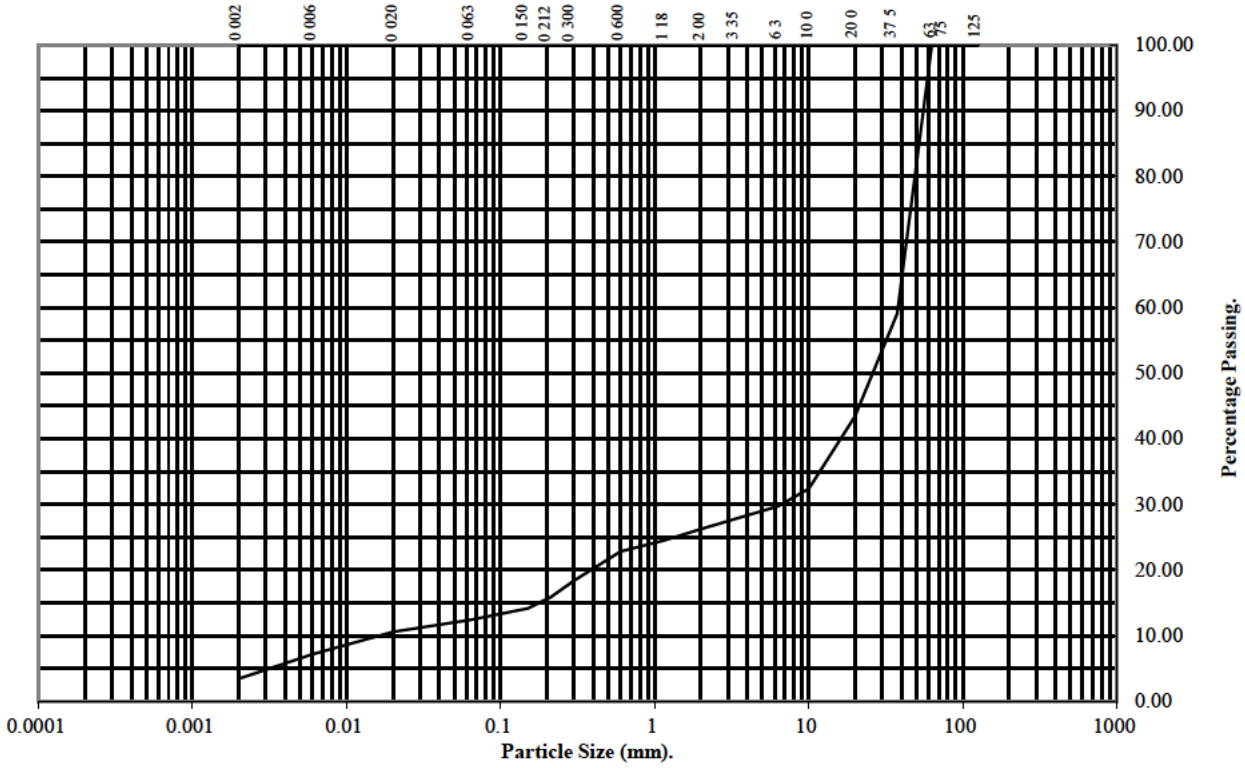
Contract No:
PSL18/0272
Client Ref:
17-0769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH10**	**Top Depth (m):**	**3.00**
Sample Number:	**5**	**Base Depth(m):**	**3.40**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	59
20	43
10	32
6.3	30
3.35	28
2	26
1.18	25
0.6	23
0.3	18
0.212	16
0.15	14
0.063	12

Particle Diameter	Percentage Passing
0.02	11
0.006	7
0.002	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	74
Sand	14
Silt	9
Clay	3

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
PSL18/0272
Client Ref:
17-0769

PARTICLE SIZE DISTRIBUTION TEST

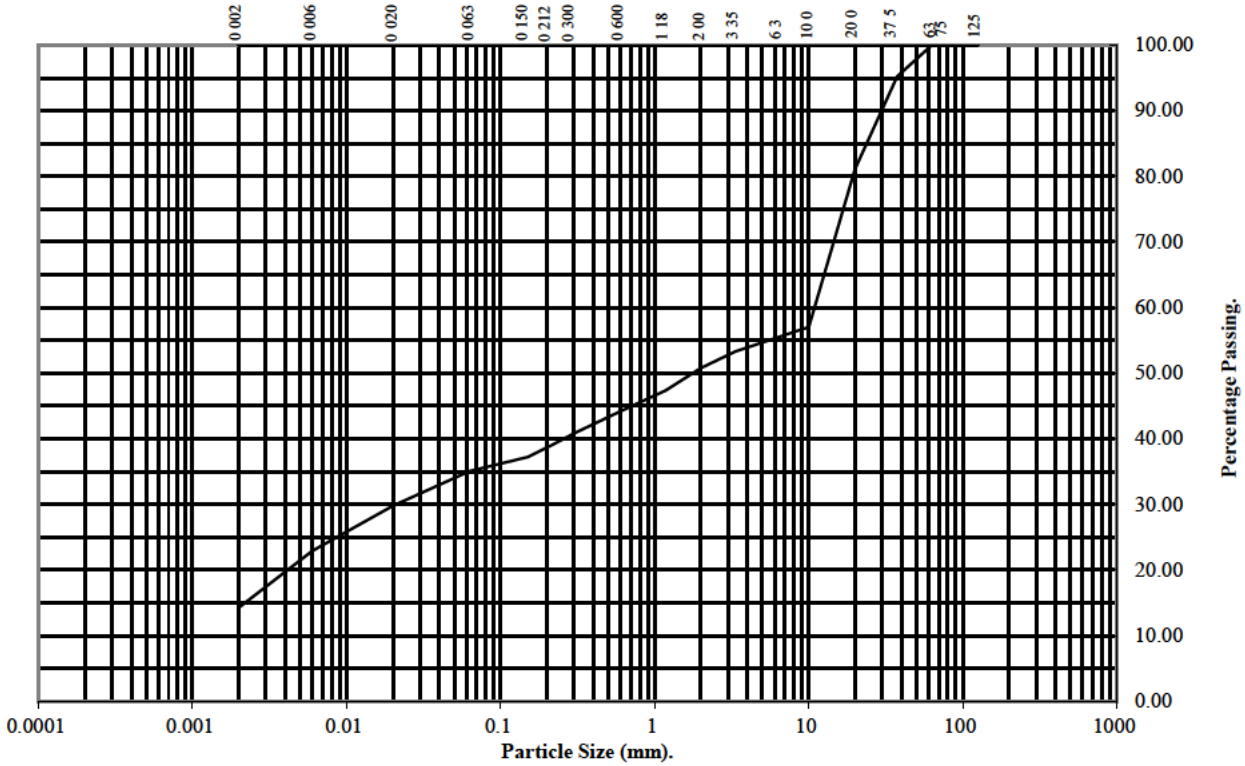
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BH14 **Top Depth (m):** 0.50

Sample Number: 1 **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	81
10	57
6.3	55
3.35	53
2	51
1.18	47
0.6	44
0.3	41
0.212	39
0.15	37
0.063	35

Particle Diameter	Percentage Passing
0.02	30
0.006	23
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	49
Sand	16
Silt	21
Clay	14

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No: PSL18/0272

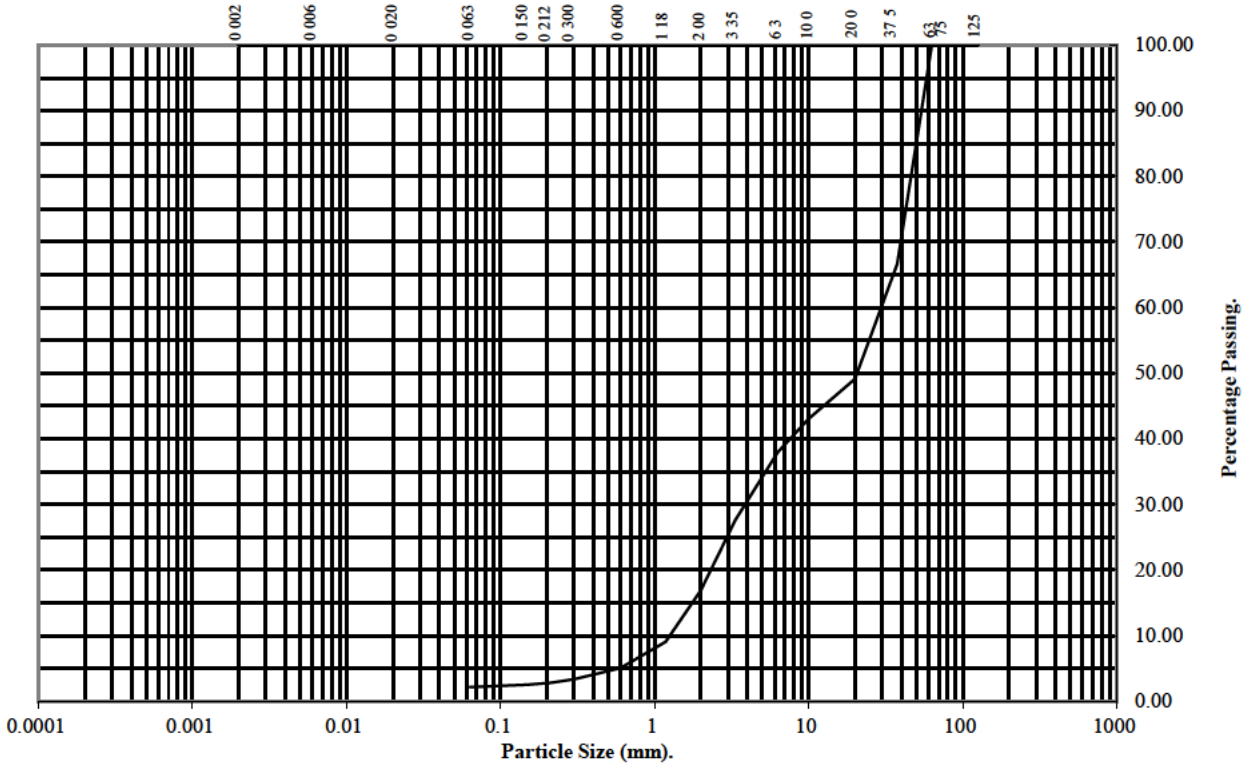
Client Ref: 17-0769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH15**	**Top Depth (m):**	**0.00**
Sample Number:	**1**	**Base Depth(m):**	**0.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	67
20	49
10	43
6.3	38
3.35	28
2	17
1.18	9
0.6	5
0.3	3
0.212	3
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	83
Sand	15
Silt/Clay	2

Remarks:

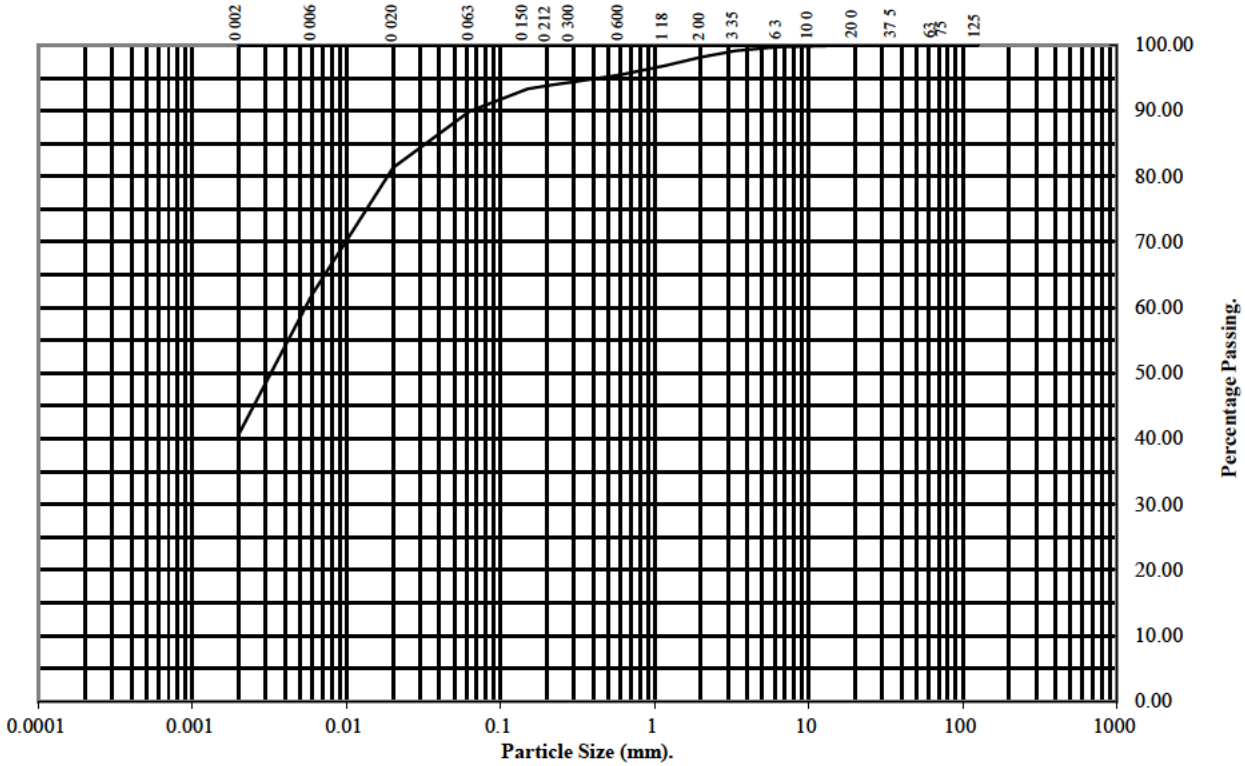
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH16**	**Top Depth (m):**	**0.80**
Sample Number:	**1**	**Base Depth(m):**	**1.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	97
0.6	95
0.3	94
0.212	94
0.15	93
0.063	90

Particle Diameter	Percentage Passing
0.02	81
0.006	62
0.002	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	8
Silt	49
Clay	41

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

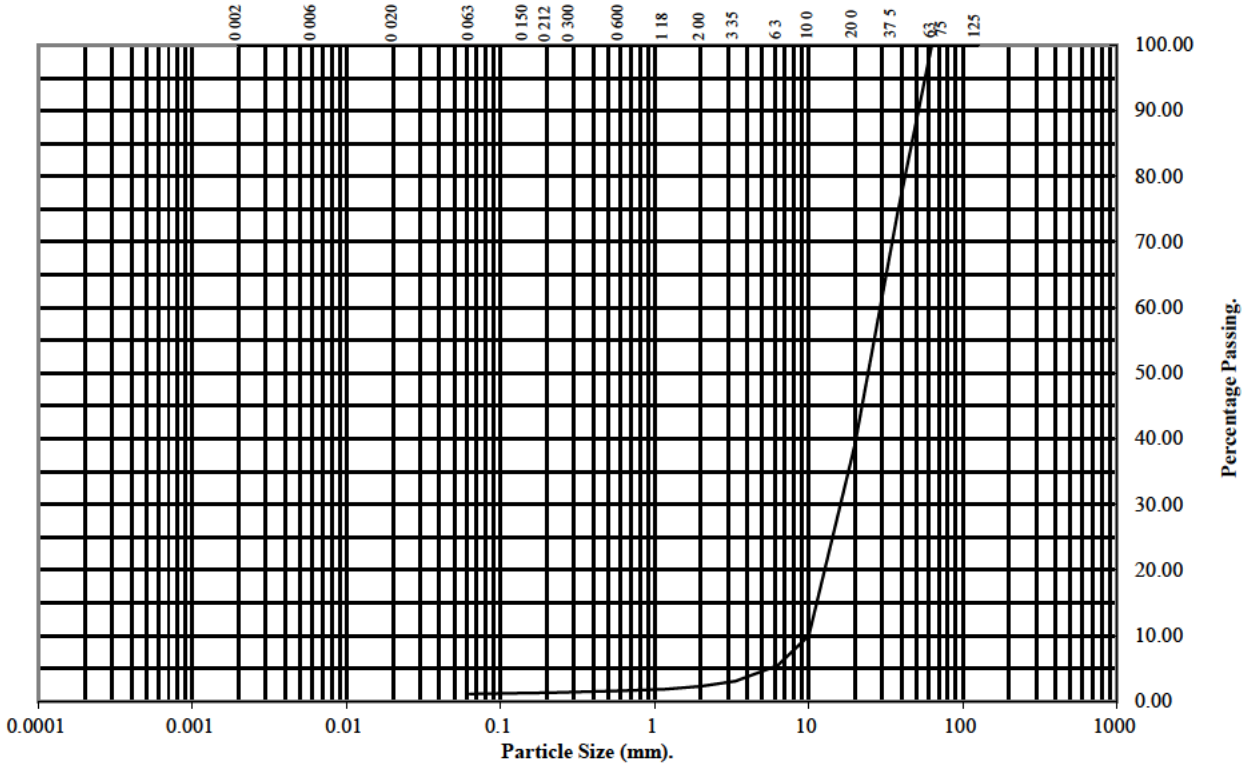
Contract No:
PSL18/0272
Client Ref:
17-0769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH16**	**Top Depth (m):**	**3.00**
Sample Number:	**3**	**Base Depth(m):**	**3.10**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	74
20	39
10	10
6.3	5
3.35	3
2	2
1.18	2
0.6	2
0.3	1
0.212	1
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	98
Sand	1
Silt/Clay	1

Remarks:

See Summary of Soil Descriptions

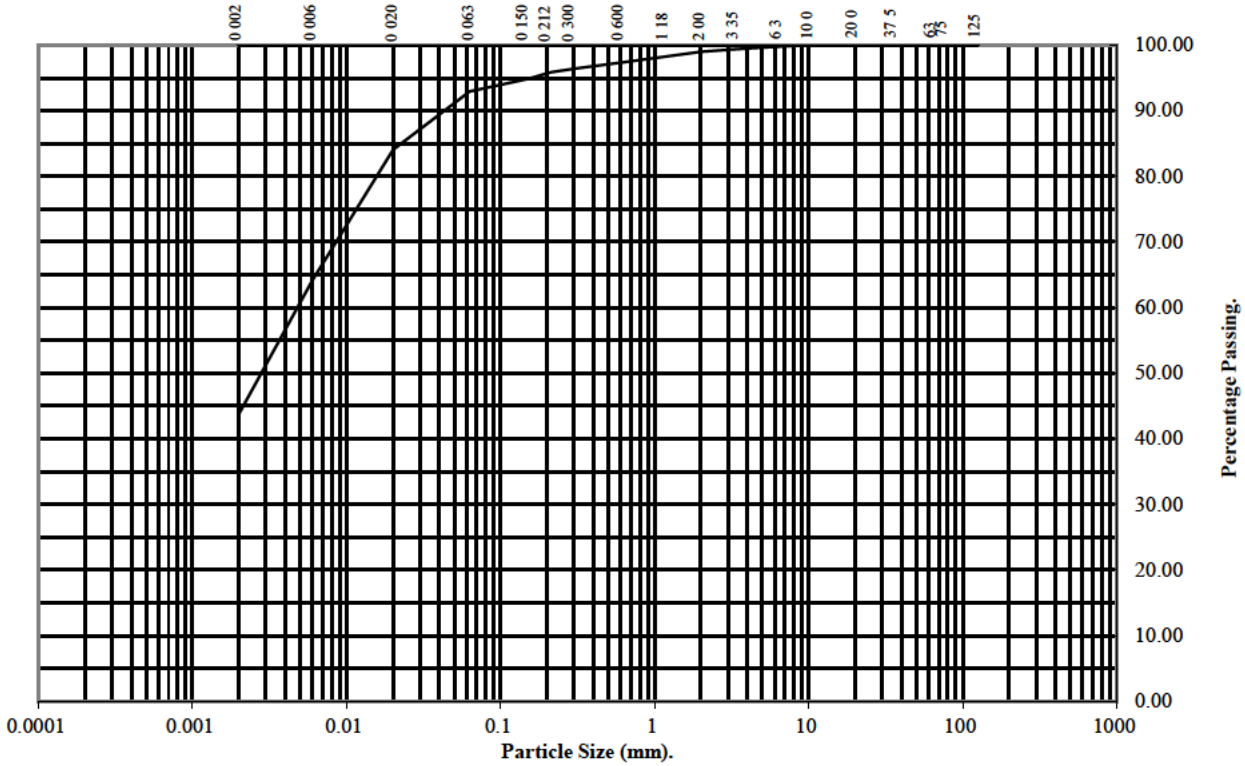
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/0272 **Client Ref:** 17-0769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH17**	**Top Depth (m):**	**1.00**
Sample Number:	**1**	**Base Depth(m):**	**1.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	96
0.212	96
0.15	95
0.063	93

Particle Diameter	Percentage Passing
0.02	84
0.006	64
0.002	44

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	6
Silt	49
Clay	44

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
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Client Ref:
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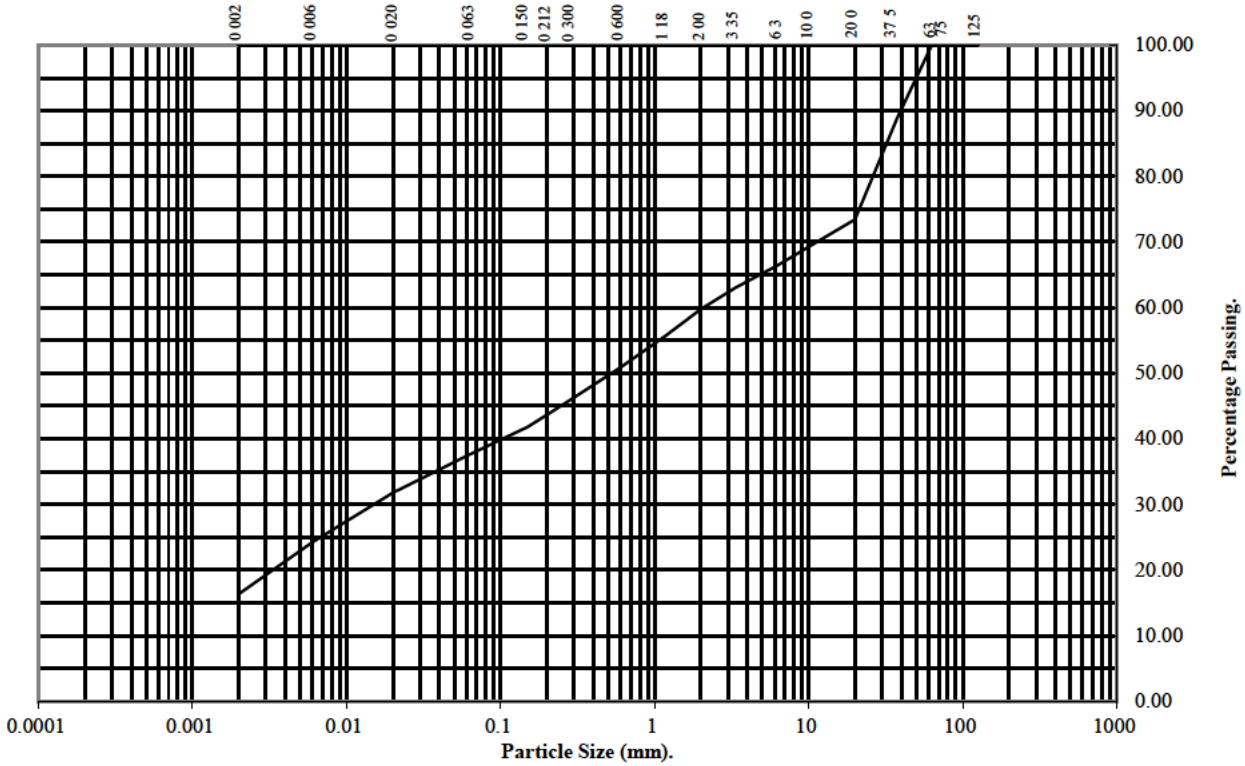
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH17**	**Top Depth (m):**	**3.00**
Sample Number:	**3**	**Base Depth(m):**	**3.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	89
20	73
10	69
6.3	66
3.35	63
2	60
1.18	56
0.6	51
0.3	46
0.212	44
0.15	42
0.063	38

Particle Diameter	Percentage Passing
0.02	32
0.006	24
0.002	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	40
Sand	22
Silt	22
Clay	16

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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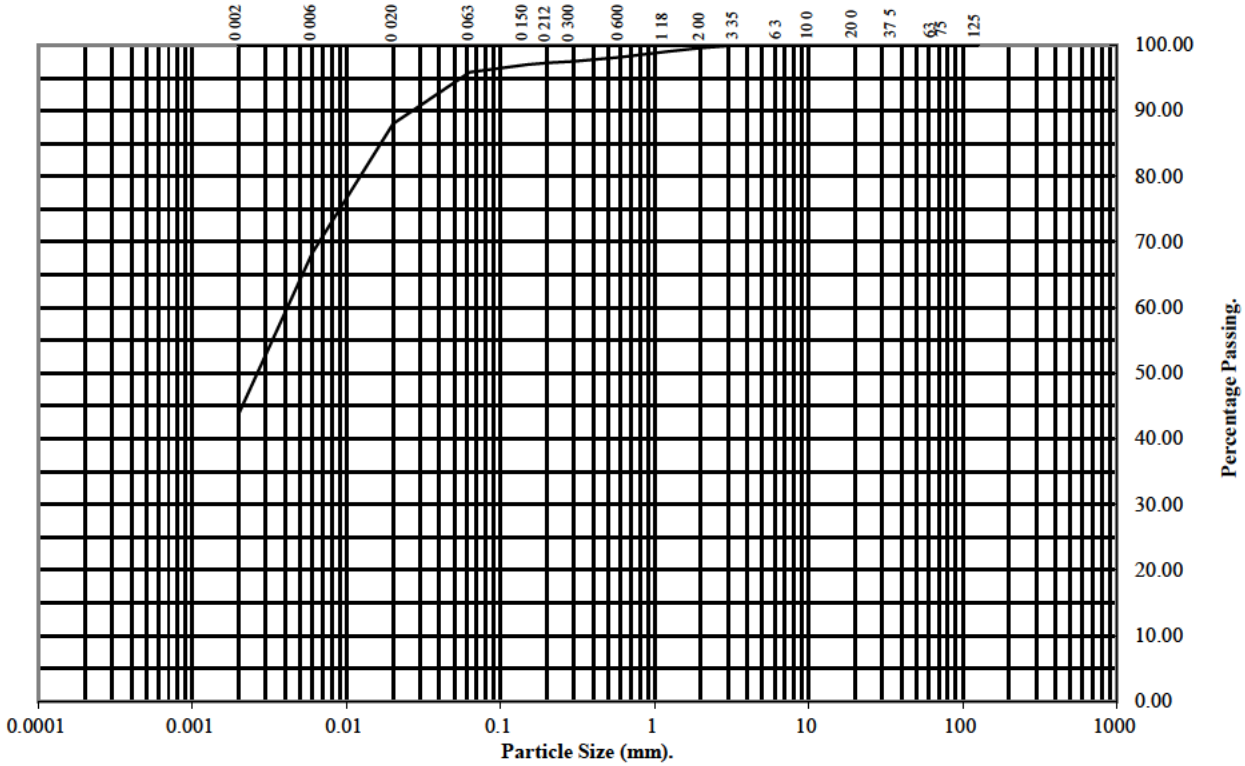
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH18**	**Top Depth (m):**	**3.00**
Sample Number:	**2**	**Base Depth(m):**	**3.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	98
0.3	98
0.212	97
0.15	97
0.063	96

Particle Diameter	Percentage Passing
0.02	88
0.006	68
0.002	44

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	4
Silt	52
Clay	44

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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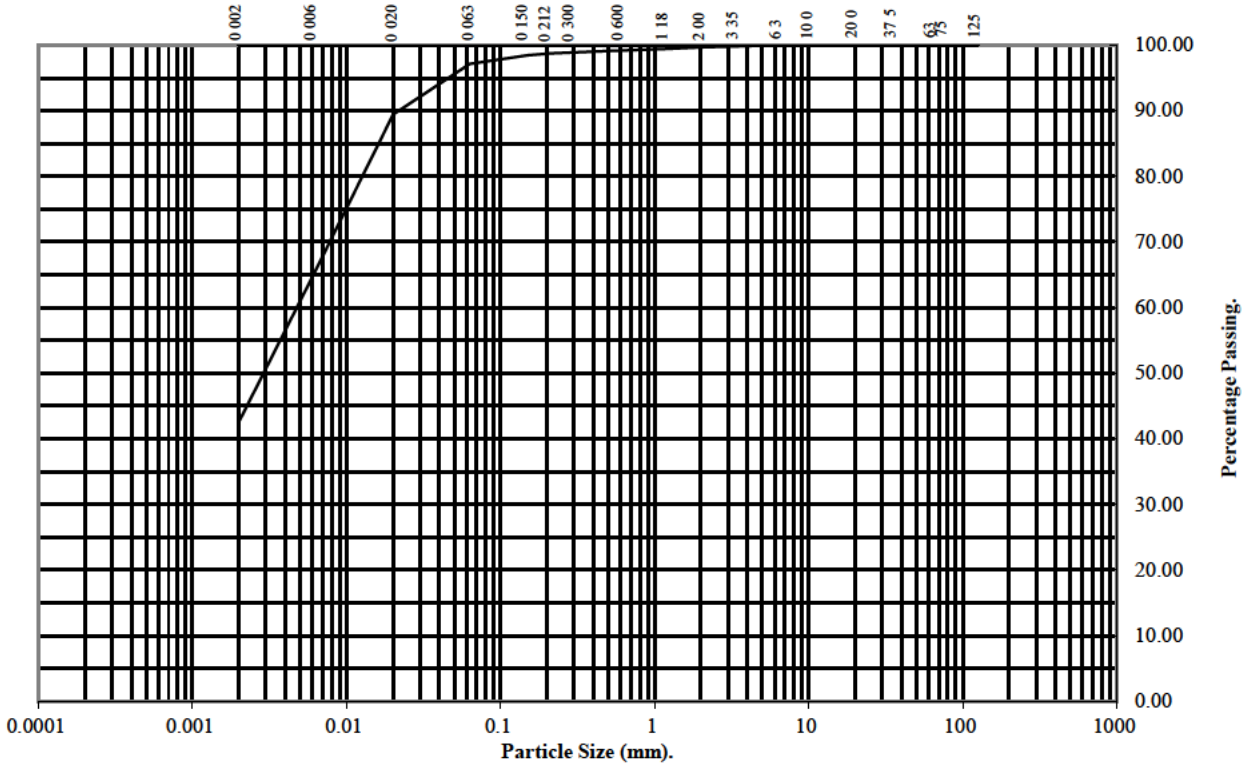
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH18**	**Top Depth (m):**	**9.00**
Sample Number:	**7**	**Base Depth(m):**	**9.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	99
0.3	99
0.212	99
0.15	98
0.063	97

Particle Diameter	Percentage Passing
0.02	89
0.006	65
0.002	43

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	3
Silt	54
Clay	43

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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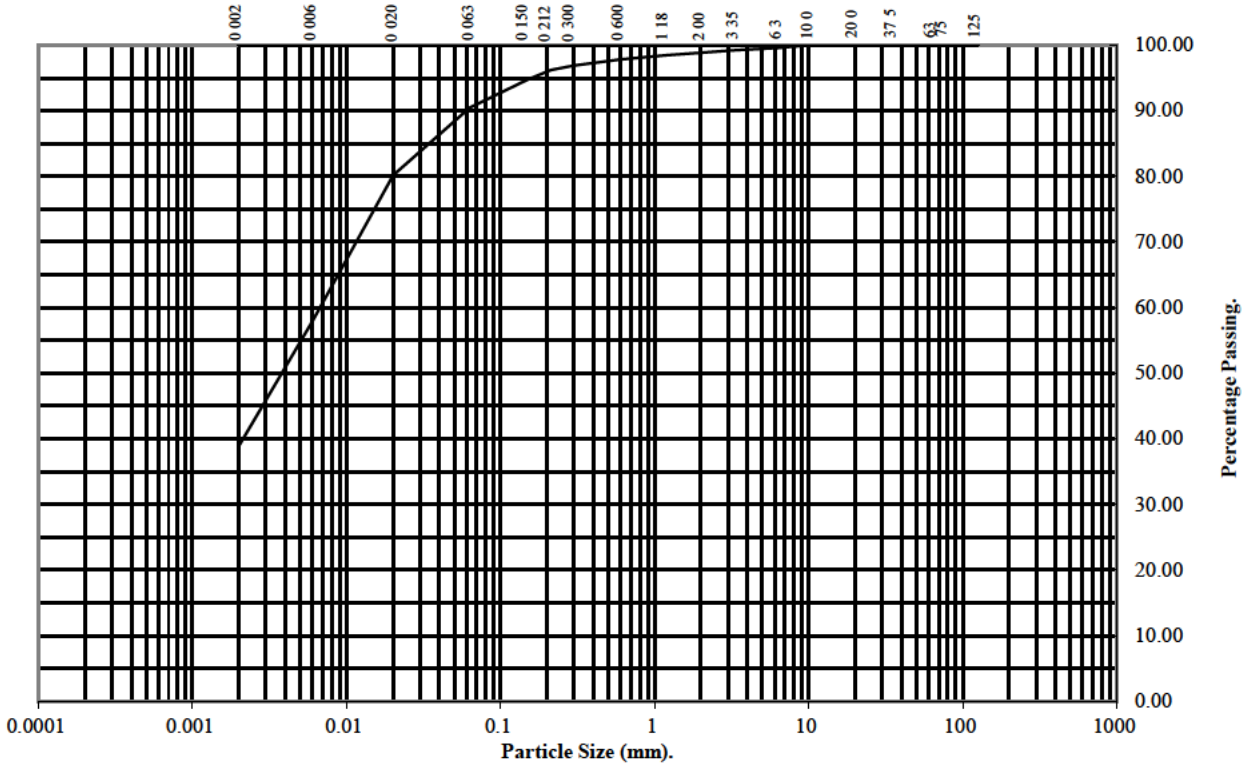
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH18**	**Top Depth (m):**	**14.00**
Sample Number:	**12**	**Base Depth(m):**	**14.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	98
0.3	97
0.212	96
0.15	95
0.063	90

Particle Diameter	Percentage Passing
0.02	80
0.006	58
0.002	39

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	9
Silt	51
Clay	39

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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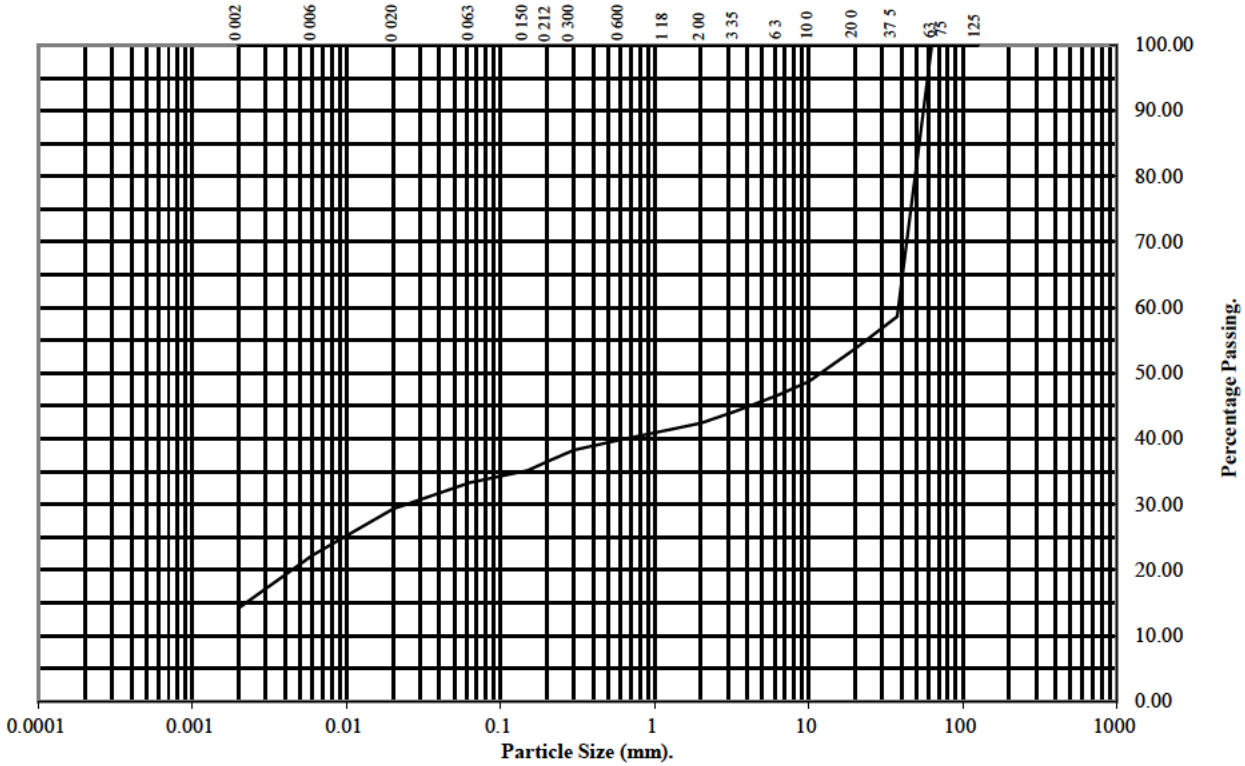
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH18**	**Top Depth (m):**	**17.00**
Sample Number:	**14**	**Base Depth(m):**	**17.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	59
20	54
10	49
6.3	47
3.35	44
2	42
1.18	41
0.6	40
0.3	38
0.212	37
0.15	35
0.063	33

Particle Diameter	Percentage Passing
0.02	29
0.006	22
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	58
Sand	9
Silt	19
Clay	14

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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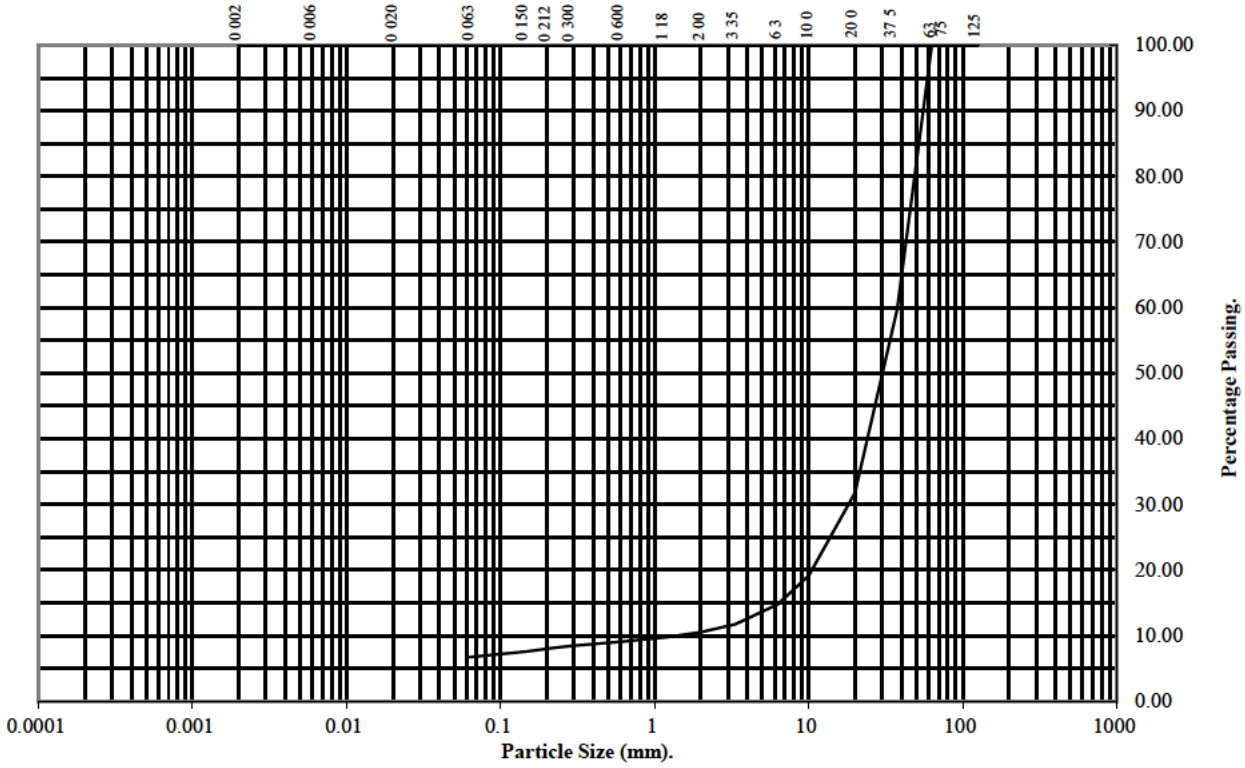
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH18**	**Top Depth (m):**	**19.00**
Sample Number:	**15**	**Base Depth(m):**	**19.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	60
20	32
10	19
6.3	15
3.35	12
2	11
1.18	10
0.6	9
0.3	8
0.212	8
0.15	8
0.063	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	89
Sand	4
Silt/Clay	7

Remarks:

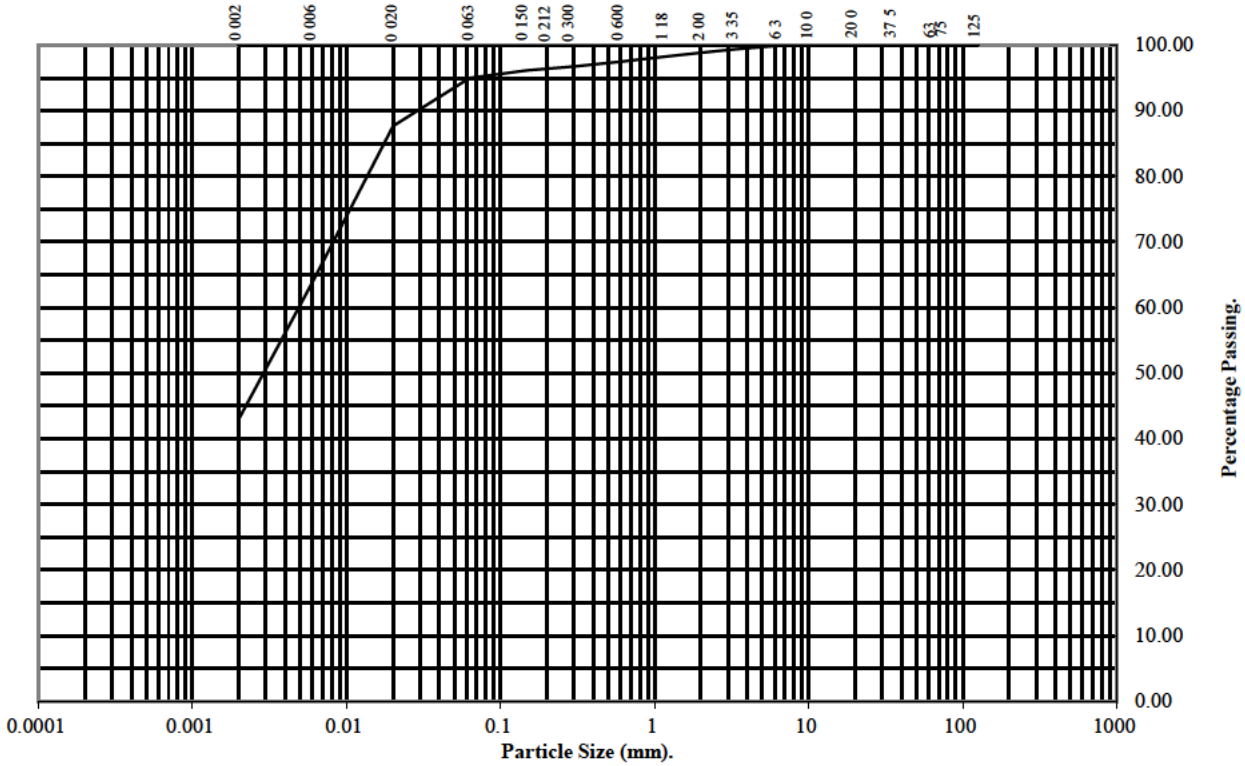
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH19**	**Top Depth (m):**	**2.00**
Sample Number:	**2**	**Base Depth(m):**	**2.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	97
0.212	96
0.15	96
0.063	95

Particle Diameter	Percentage Passing
0.02	88
0.006	64
0.002	43

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	4
Silt	52
Clay	43

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
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Client Ref:
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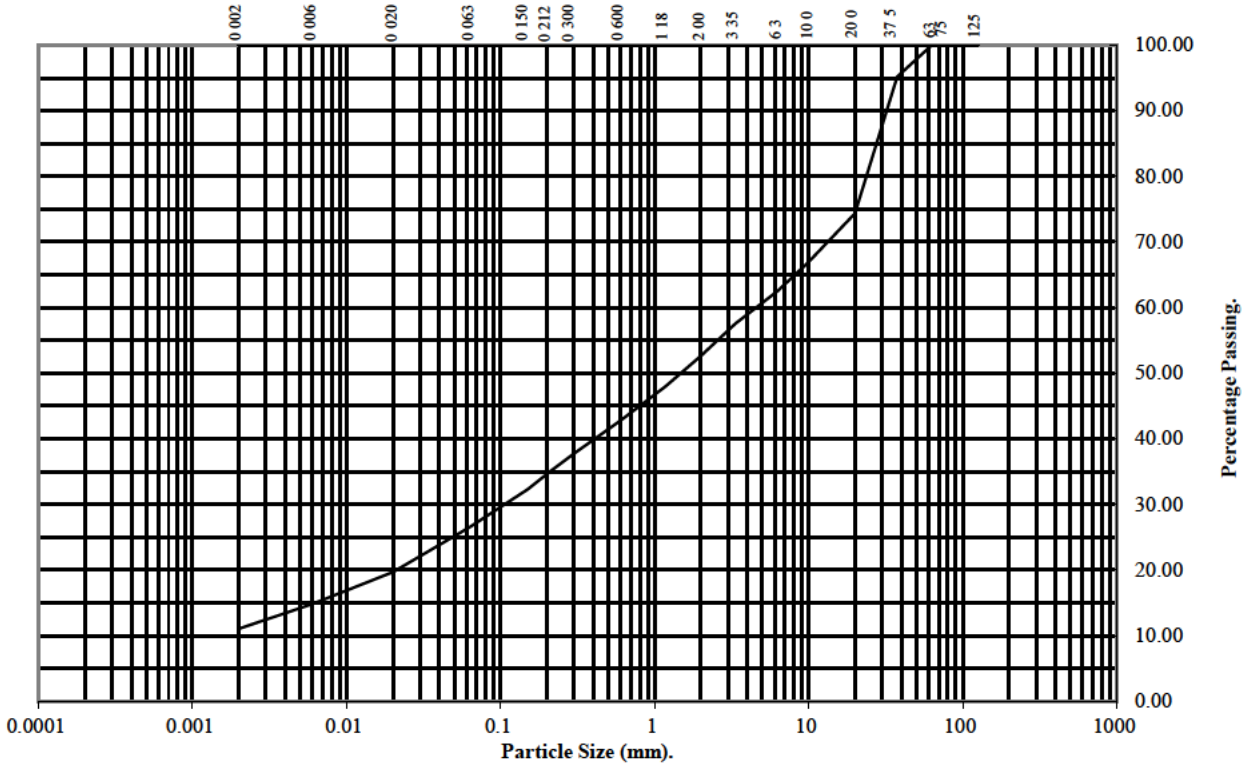
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH19**	**Top Depth (m):**	**5.00**
Sample Number:	**4**	**Base Depth(m):**	**5.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	74
10	67
6.3	63
3.35	58
2	53
1.18	48
0.6	43
0.3	38
0.212	35
0.15	32
0.063	27

Particle Diameter	Percentage Passing
0.02	20
0.006	15
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	47
Sand	26
Silt	16
Clay	11

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
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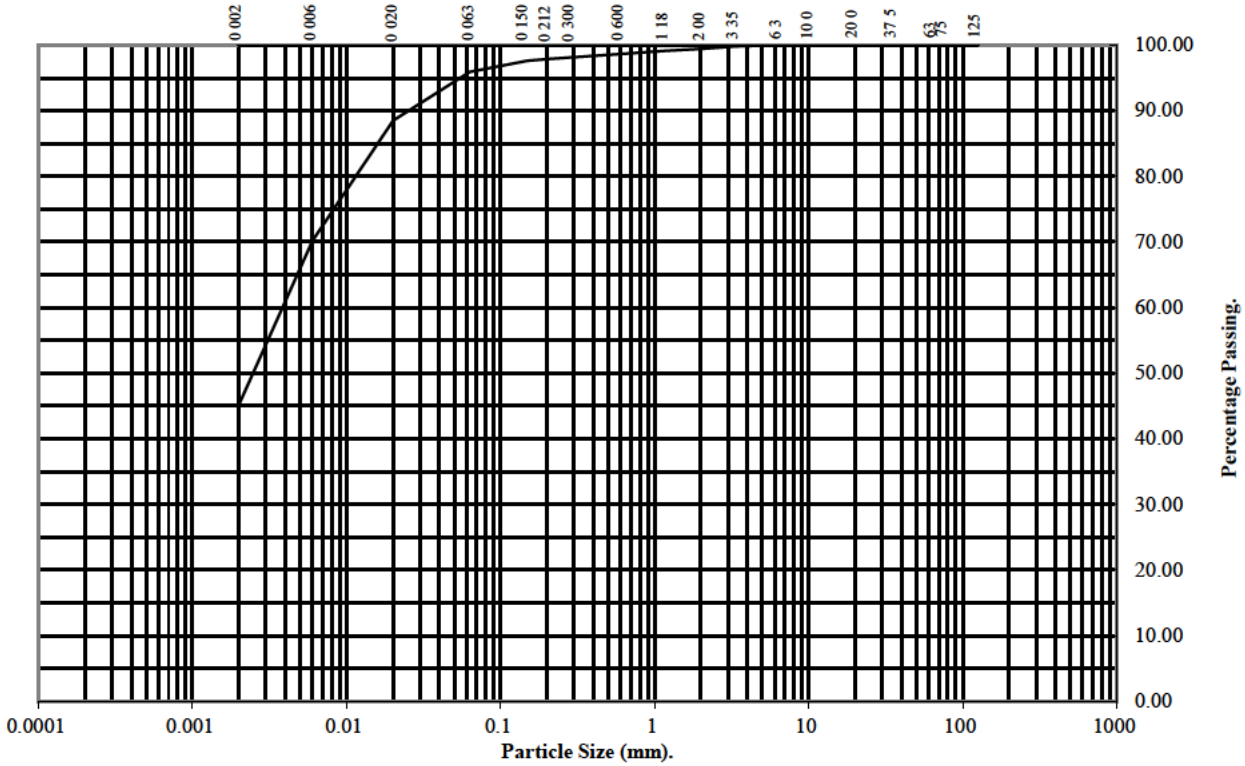
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH20**	**Top Depth (m):**	**1.00**
Sample Number:	**1**	**Base Depth(m):**	**1.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	99
0.6	99
0.3	98
0.212	98
0.15	98
0.063	96

Particle Diameter	Percentage Passing
0.02	88
0.006	70
0.002	45

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	3
Silt	51
Clay	45

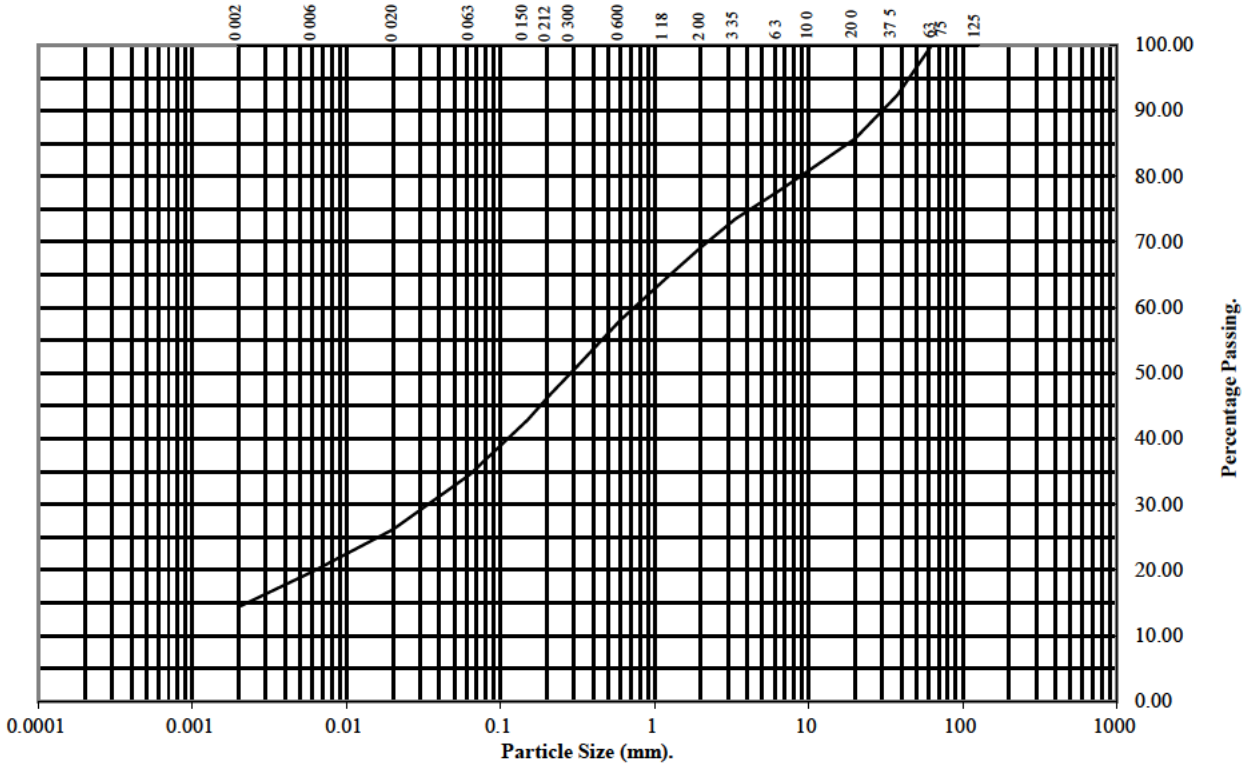
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH20**	**Top Depth (m):**	**4.00**
Sample Number:	**3**	**Base Depth(m):**	**4.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	86
10	81
6.3	78
3.35	73
2	69
1.18	64
0.6	58
0.3	51
0.212	47
0.15	43
0.063	35

Particle Diameter	Percentage Passing
0.02	26
0.006	20
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	31
Sand	34
Silt	21
Clay	14

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
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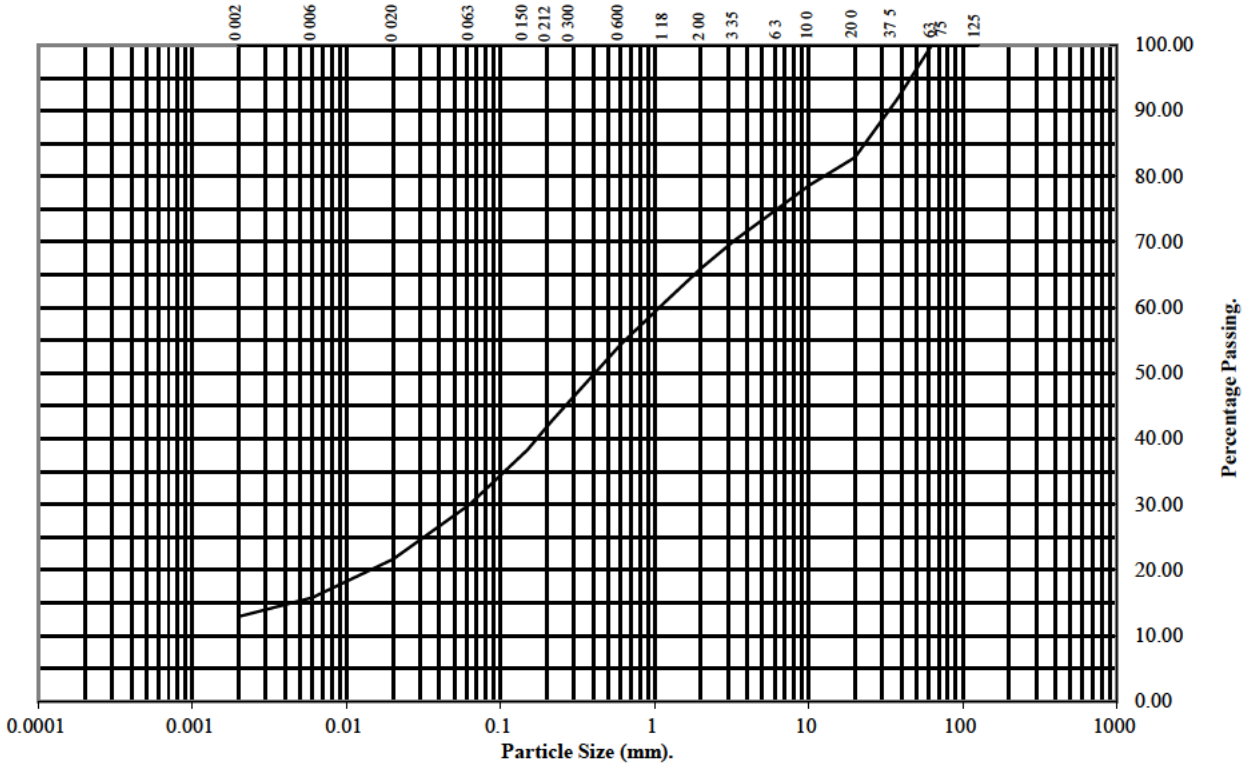
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH20**	**Top Depth (m):**	**6.00**
Sample Number:	**5**	**Base Depth(m):**	**6.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	83
10	79
6.3	75
3.35	70
2	66
1.18	61
0.6	54
0.3	46
0.212	43
0.15	38
0.063	30

Particle Diameter	Percentage Passing
0.02	22
0.006	16
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	34
Sand	36
Silt	17
Clay	13

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

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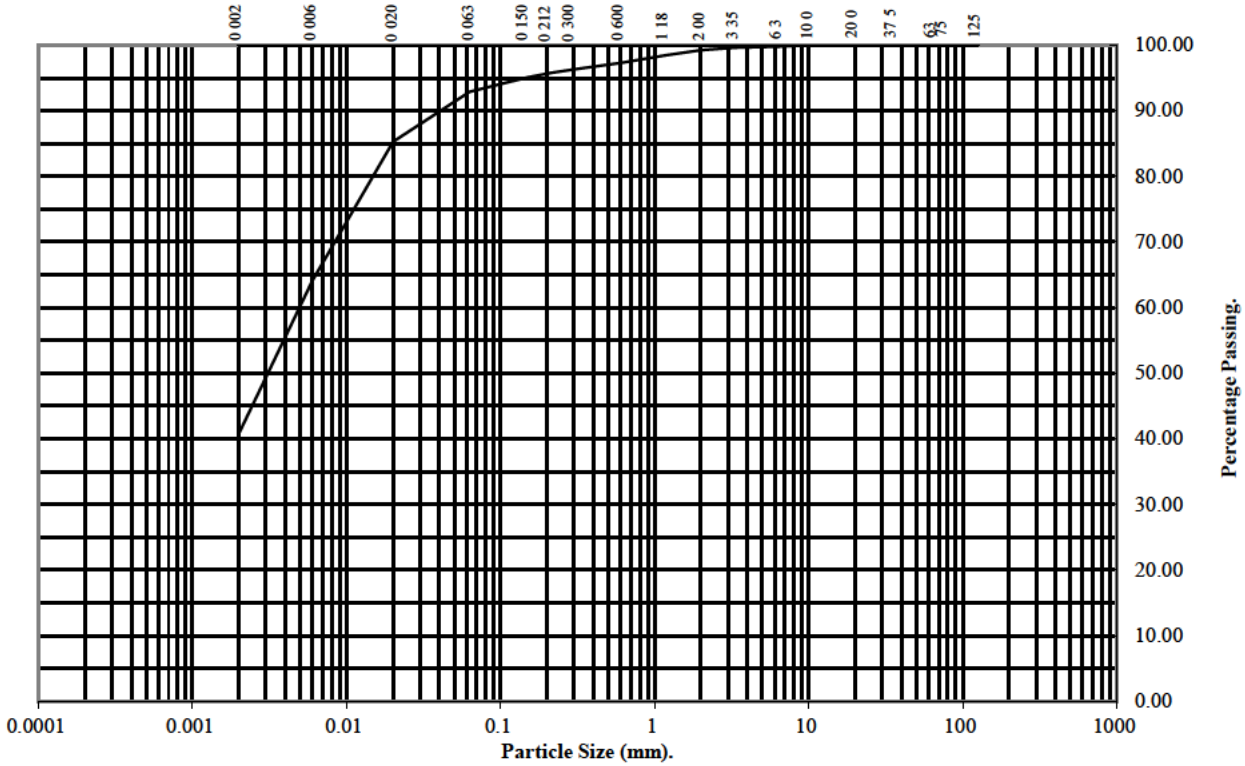
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH21**	**Top Depth (m):**	**2.00**
Sample Number:	**2**	**Base Depth(m):**	**2.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	98
0.6	97
0.3	96
0.212	96
0.15	95
0.063	93

Particle Diameter	Percentage Passing
0.02	85
0.006	64
0.002	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	6
Silt	52
Clay	41

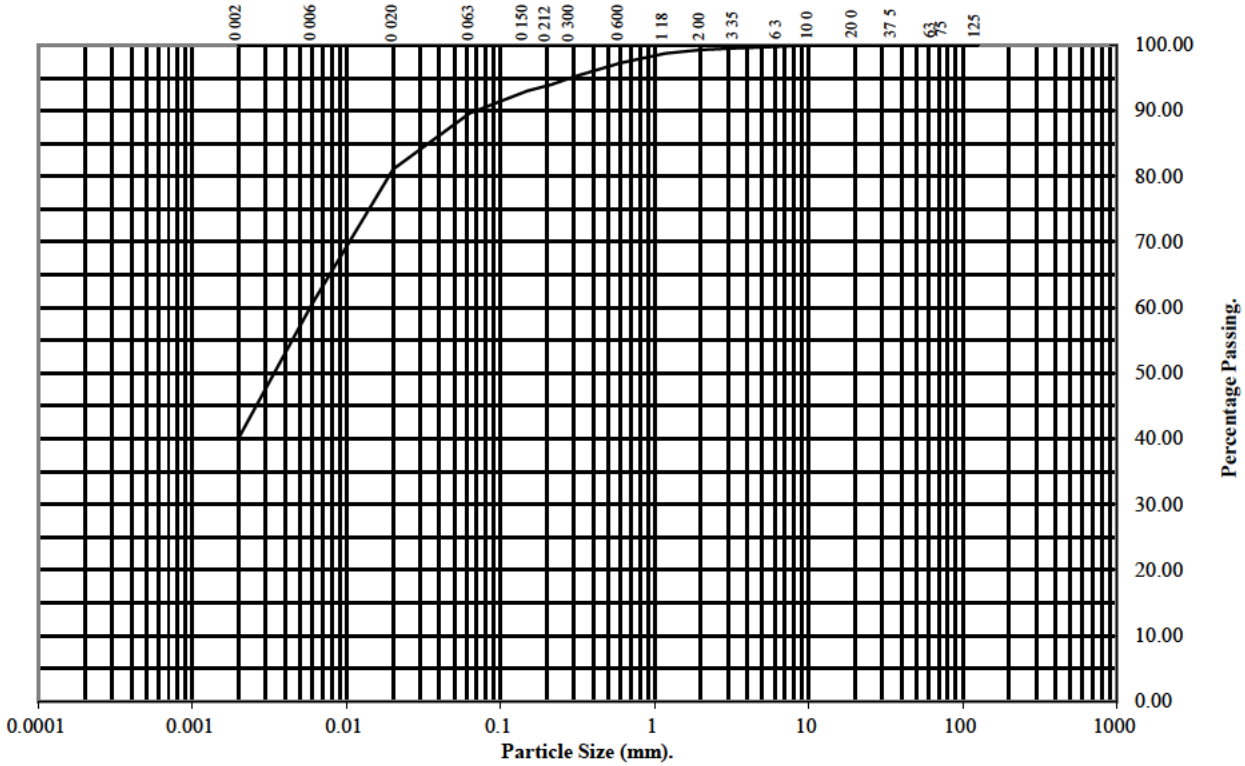
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH21**	**Top Depth (m):**	**7.00**
Sample Number:	**7**	**Base Depth(m):**	**7.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	99
0.6	97
0.3	95
0.212	94
0.15	93
0.063	90

Particle Diameter	Percentage Passing
0.02	81
0.006	61
0.002	40

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	9
Silt	50
Clay	40

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

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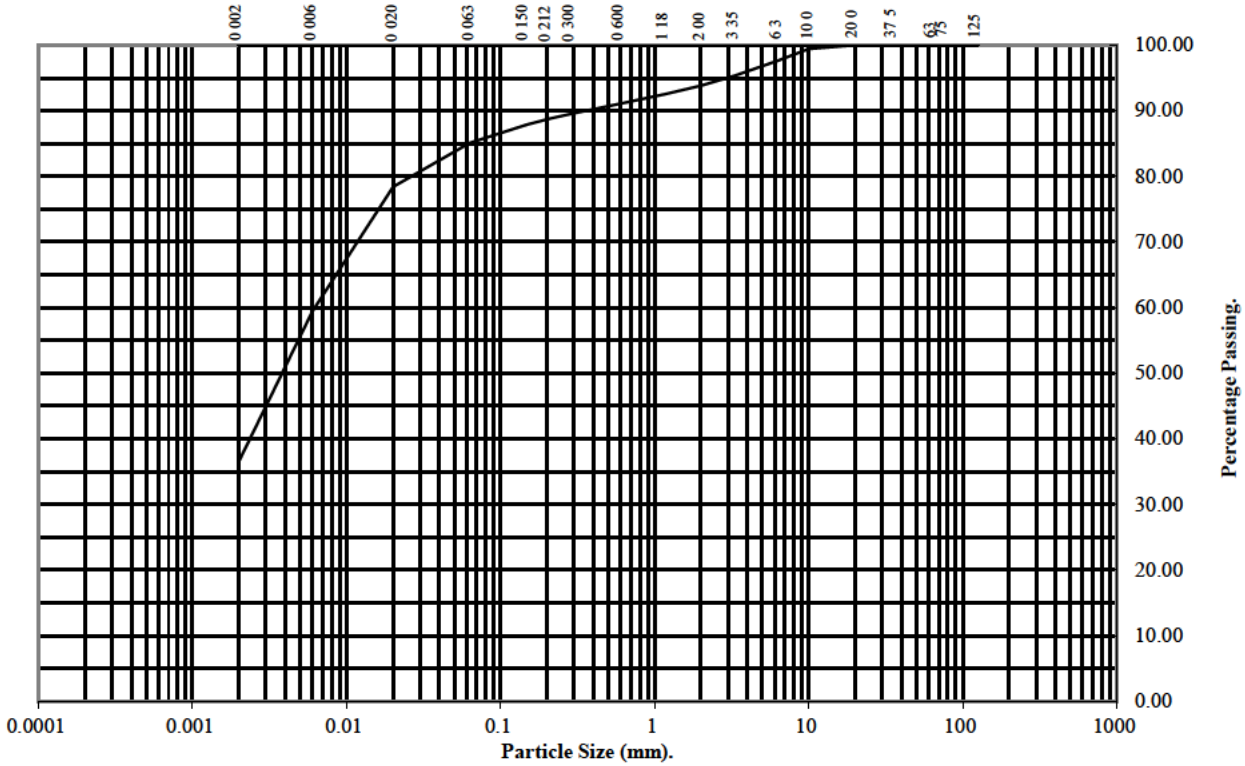
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH21**	**Top Depth (m):**	**11.00**
Sample Number:	**11**	**Base Depth(m):**	**11.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	98
3.35	95
2	94
1.18	93
0.6	91
0.3	90
0.212	89
0.15	88
0.063	85

Particle Diameter	Percentage Passing
0.02	78
0.006	59
0.002	37

Soil Fraction	Total Percentage
Cobbles	0
Gravel	6
Sand	9
Silt	48
Clay	37

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

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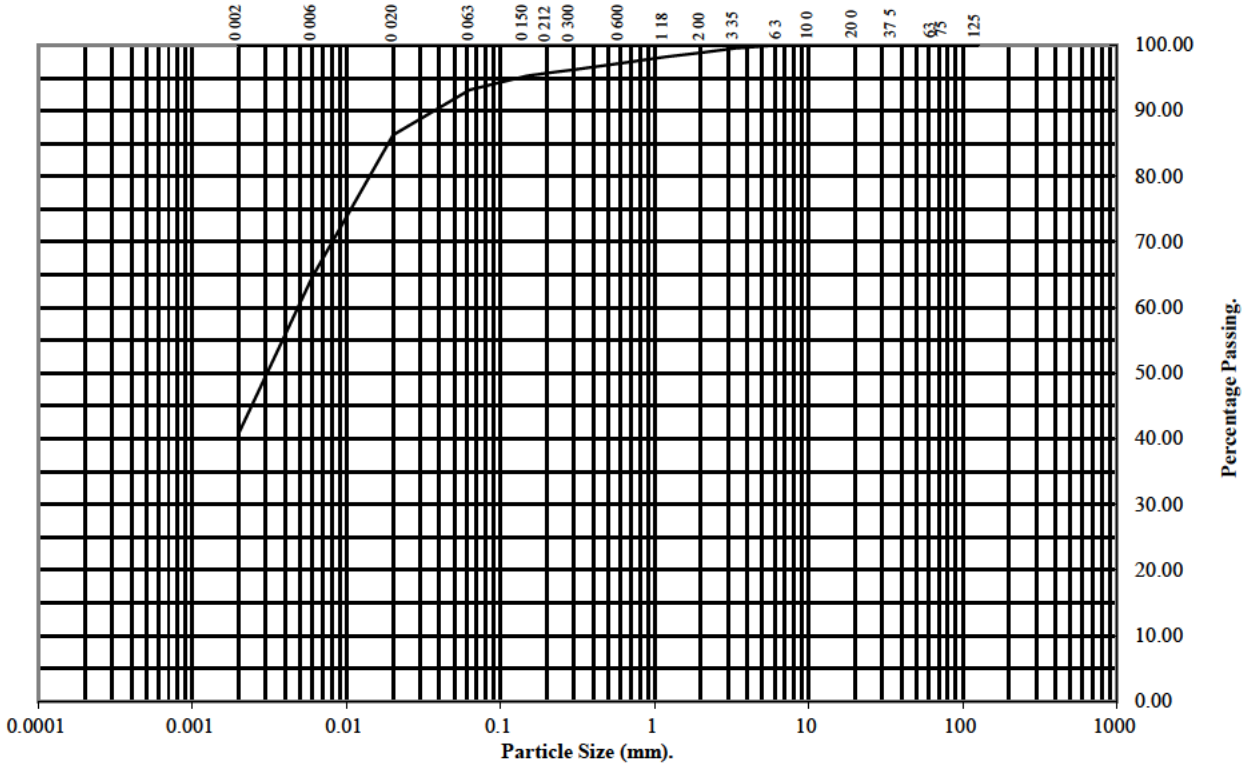
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH21**	**Top Depth (m):**	**16.00**
Sample Number:	**15**	**Base Depth(m):**	**16.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	98
0.6	97
0.3	96
0.212	96
0.15	95
0.063	93

Particle Diameter	Percentage Passing
0.02	86
0.006	65
0.002	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	6
Silt	52
Clay	41

Remarks:

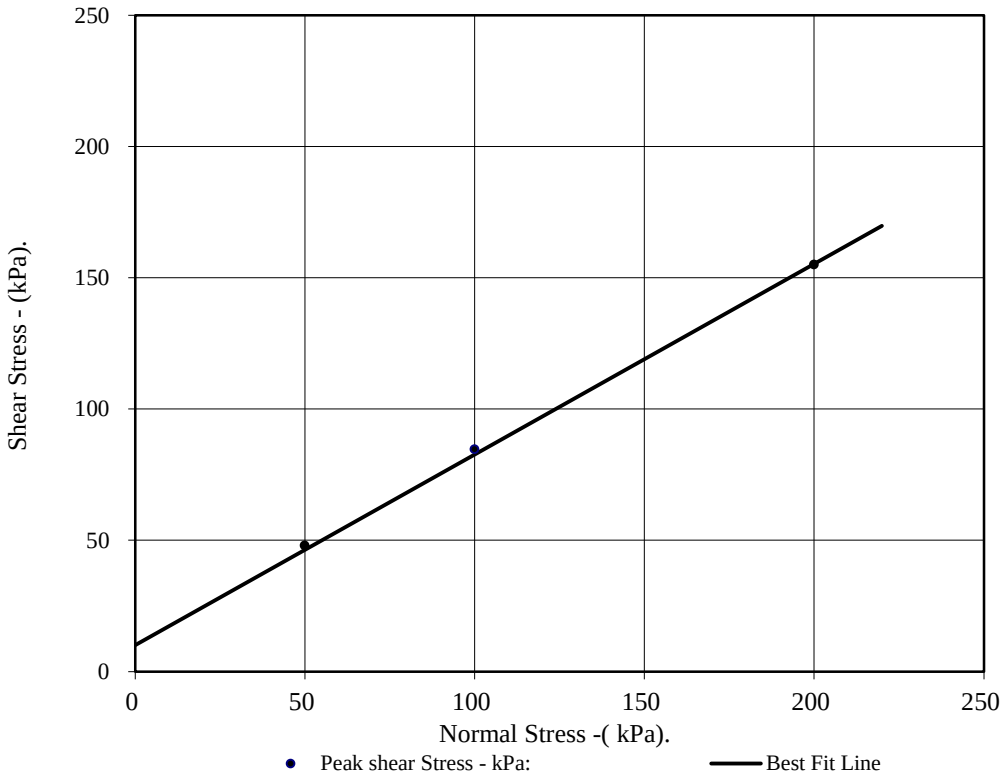
See Summary of Soil Descriptions

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**		Top Depth:	**14.00**	
Sample Number:	**21**		Base Depth:	**14.50**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Remoulded using hand tamped effort. Material tested passing 2mm sieve				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.98	19.98	19.98
Length - mm:	60.01	60.01	60.01
Moisture Content - %:	20	20	20
Bulk Density - Mg/m3:	1.99	1.99	2.00
Dry Density - Mg/m3:	1.66	1.66	1.66
Voids Ratio:	0.599	0.597	0.592
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.29	19.12	19.16
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	4.00	4.00	4.00
Peak shear Stress - kPa:	48	85	155
Final Consolidated Conditions			
Moisture Content - %:	22	22	22
Bulk Density - Mg/m3:	2.06	2.08	2.09
Dry Density - Mg/m3:	1.69	1.70	1.71
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**10**		

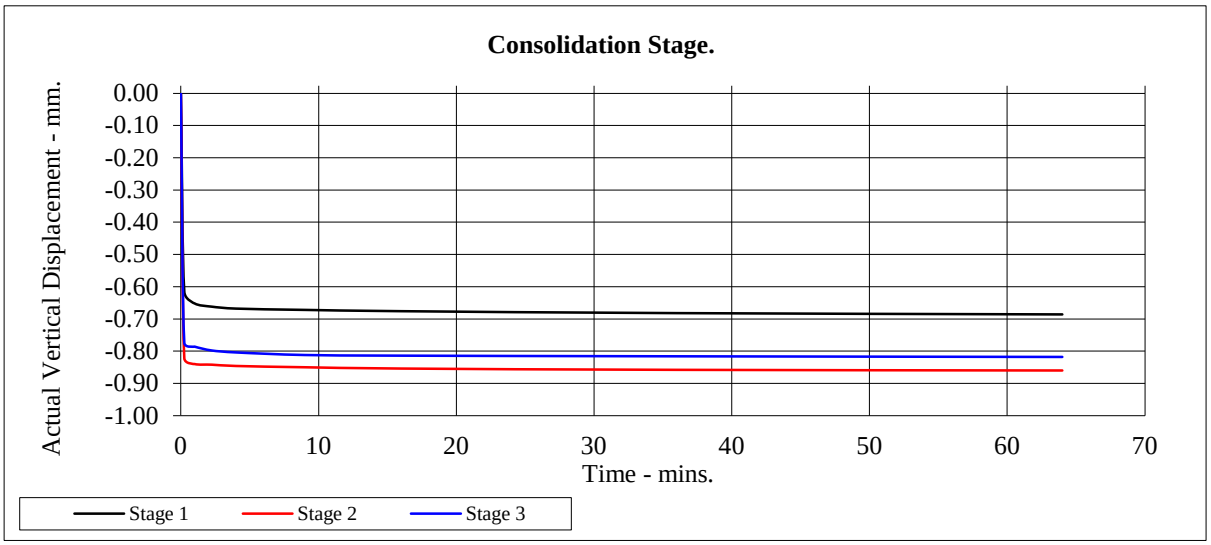


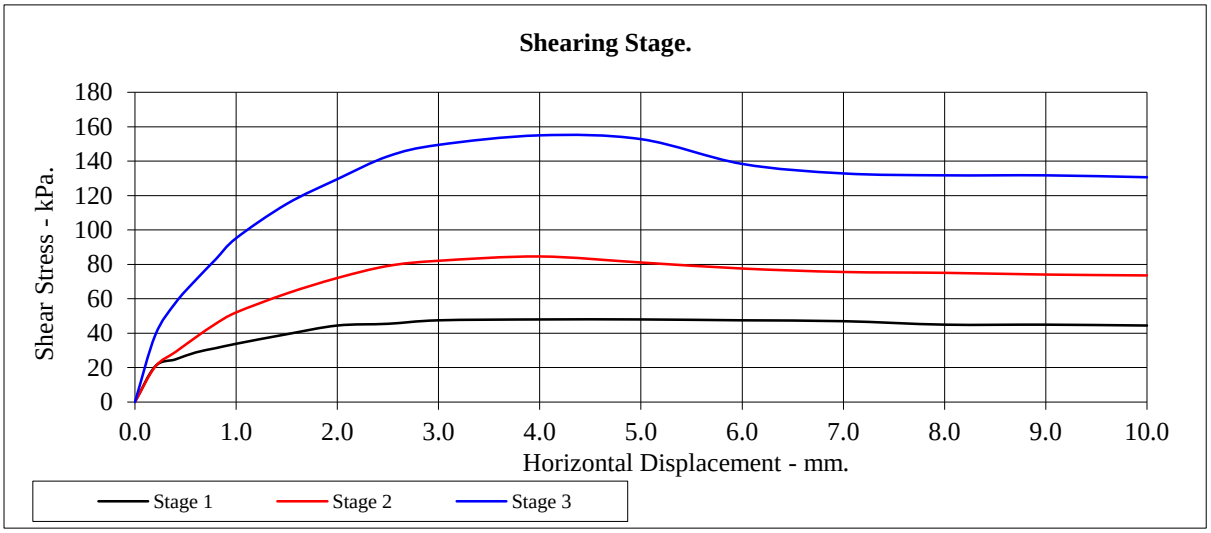
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No:** **PSL18/0272** **Client Ref:** **17-0769**

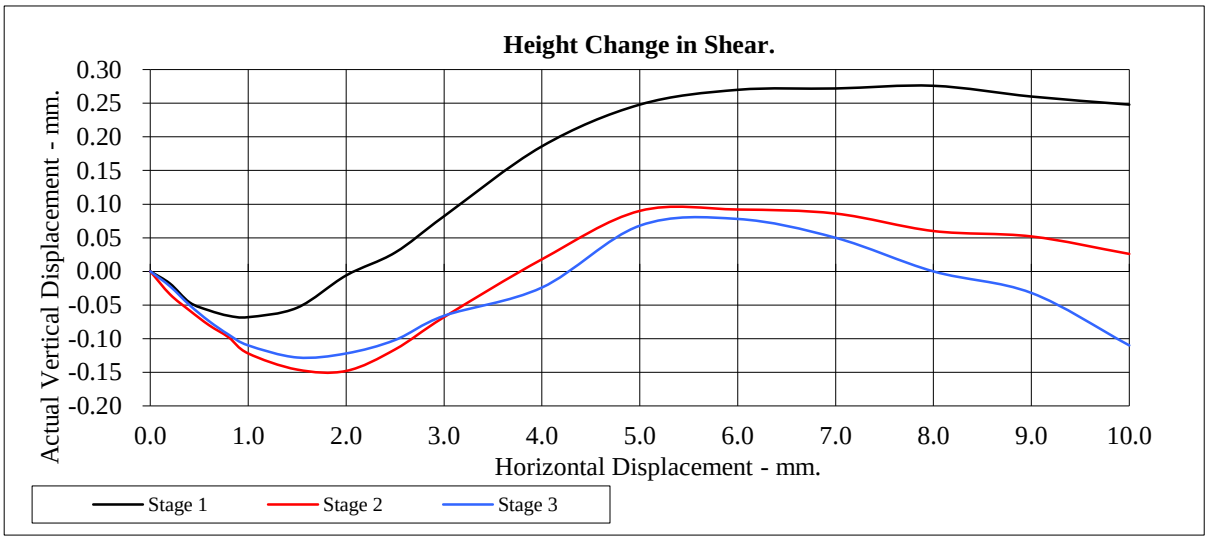
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**	Top Depth:	**14.00**
Sample Number:	**21**	Base Depth:	**14.50**







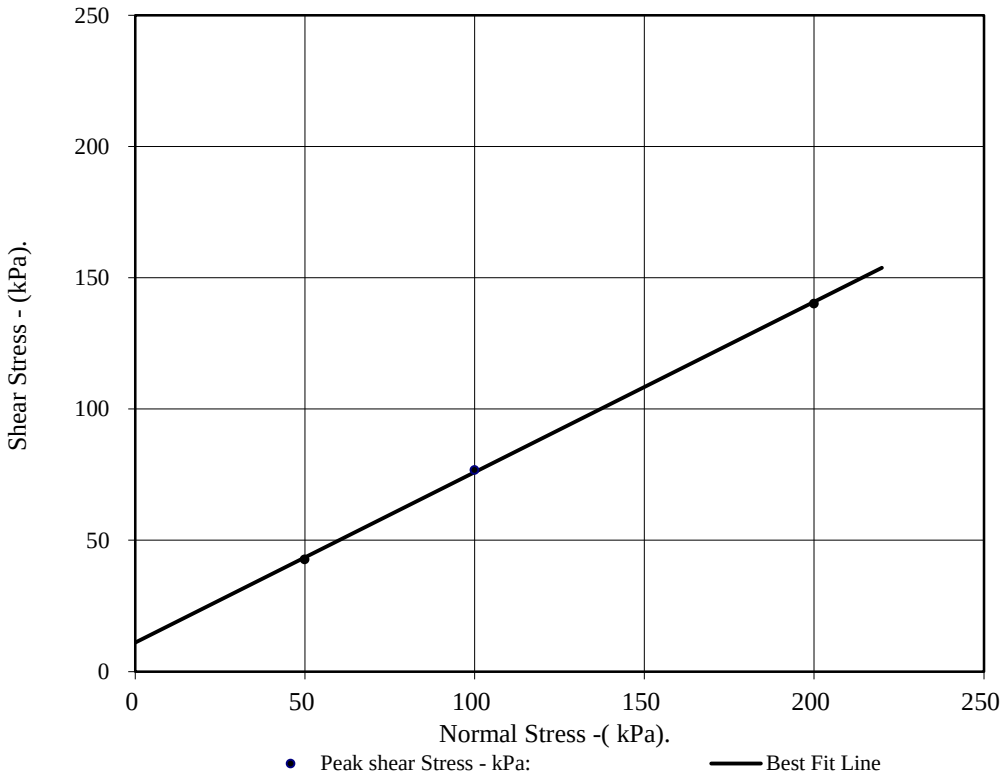
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No: PSL18/0272** / **Client Ref: 17-0769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**		Top Depth:	**23.00**
Sample Number:	**29**		Base Depth:	**23.50**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using hand tamped effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.98	19.98	19.98
Length - mm:	60.01	60.01	60.01
Moisture Content - %:	21	21	21
Bulk Density - Mg/m3:	1.95	1.96	1.96
Dry Density - Mg/m3:	1.62	1.63	1.63
Voids Ratio:	0.636	0.630	0.630
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.72	19.59	19.30
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	3.00	4.00	4.00
Peak shear Stress - kPa:	43	77	140
Final Consolidated Conditions			
Moisture Content - %:	21	21	22
Bulk Density - Mg/m3:	1.98	2.00	2.03
Dry Density - Mg/m3:	1.63	1.66	1.67
Peak			
Angle of Shearing Resistance:(~~θ~~)	**33**		
Effective Cohesion - kPa:	**11**		

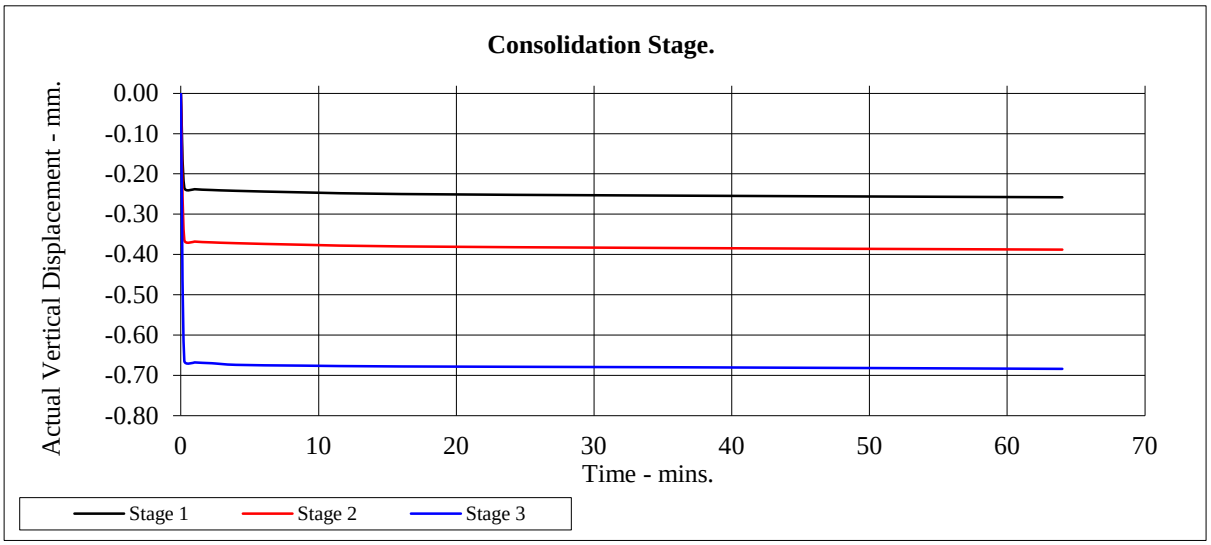


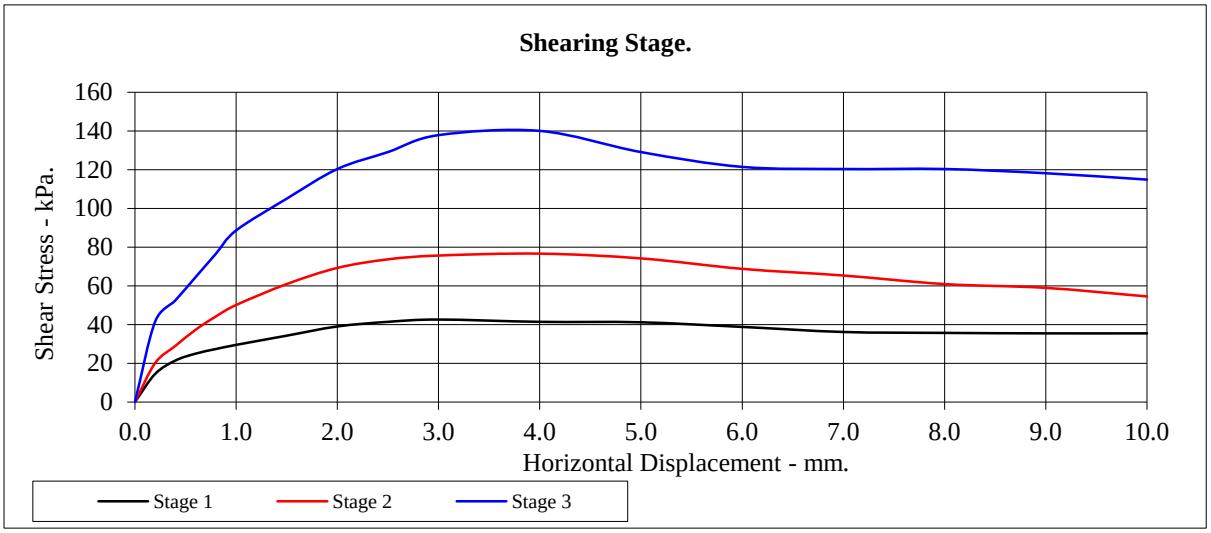
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No:** **PSL18/0272** **Client Ref:** **17-0769**

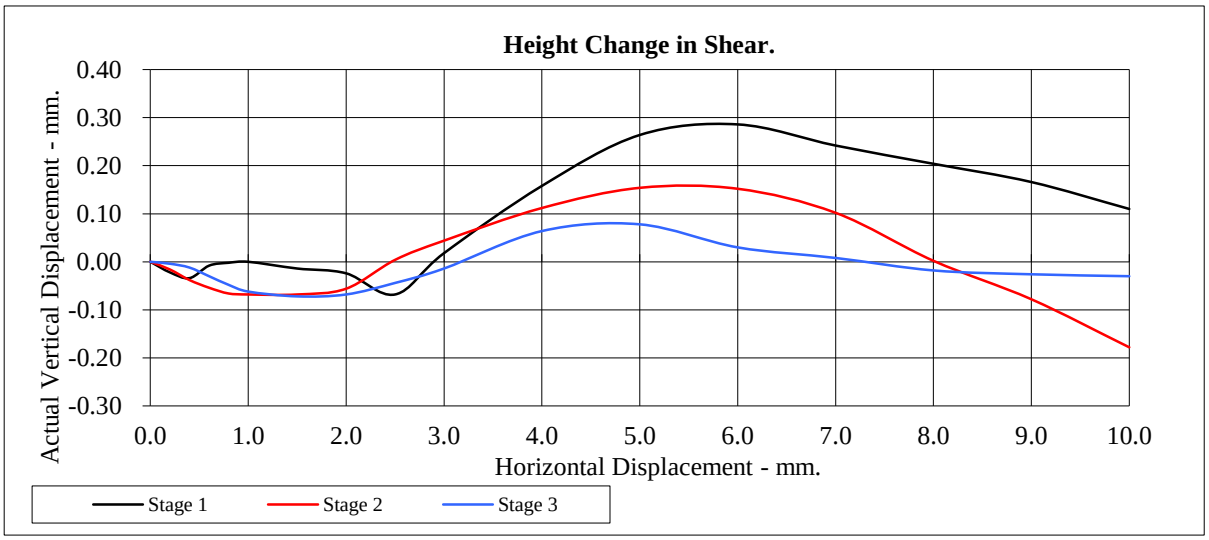
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**	Top Depth:	**23.00**
Sample Number:	**29**	Base Depth:	**23.50**







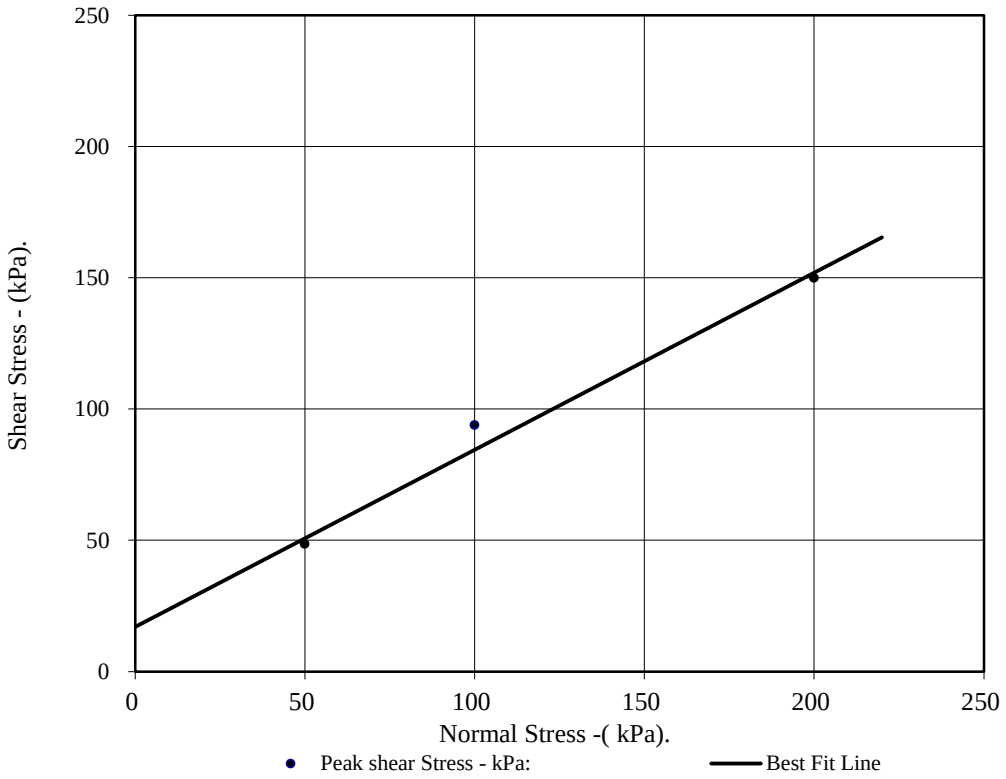
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No:** PSL18/0272 **Client Ref:** 17-0769

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**		Top Depth:	**35.00**	
Sample Number:	**35**		Base Depth:		
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Remoulded using hand tamped effort. Material tested passing 2mm sieve				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.98	19.98	19.98
Length - mm:	60.01	60.01	60.01
Moisture Content - %:	19	19	19
Bulk Density - Mg/m3:	2.04	2.04	2.05
Dry Density - Mg/m3:	1.71	1.71	1.72
Voids Ratio:	0.553	0.546	0.542
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.44	19.23	18.81
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	3.00	3.00	3.00
Peak shear Stress - kPa:	49	94	150
Final Consolidated Conditions			
Moisture Content - %:	21	20	20
Bulk Density - Mg/m3:	2.09	2.12	2.18
Dry Density - Mg/m3:	1.73	1.77	1.82
Peak			
Angle of Shearing Resistance:(~~θ~~)	**34**		
Effective Cohesion - kPa:	**17**		

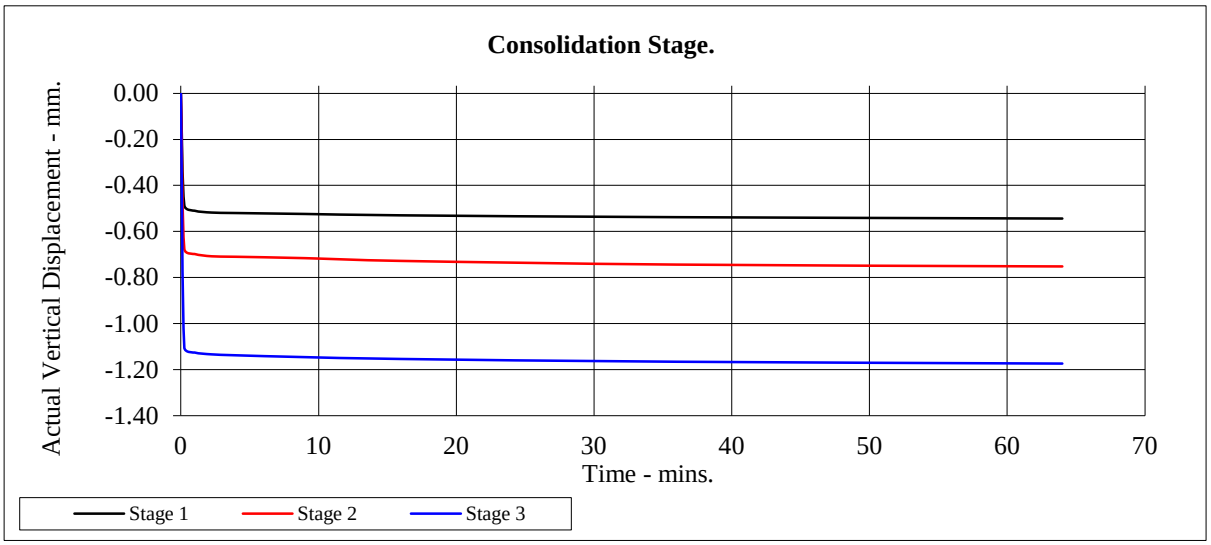


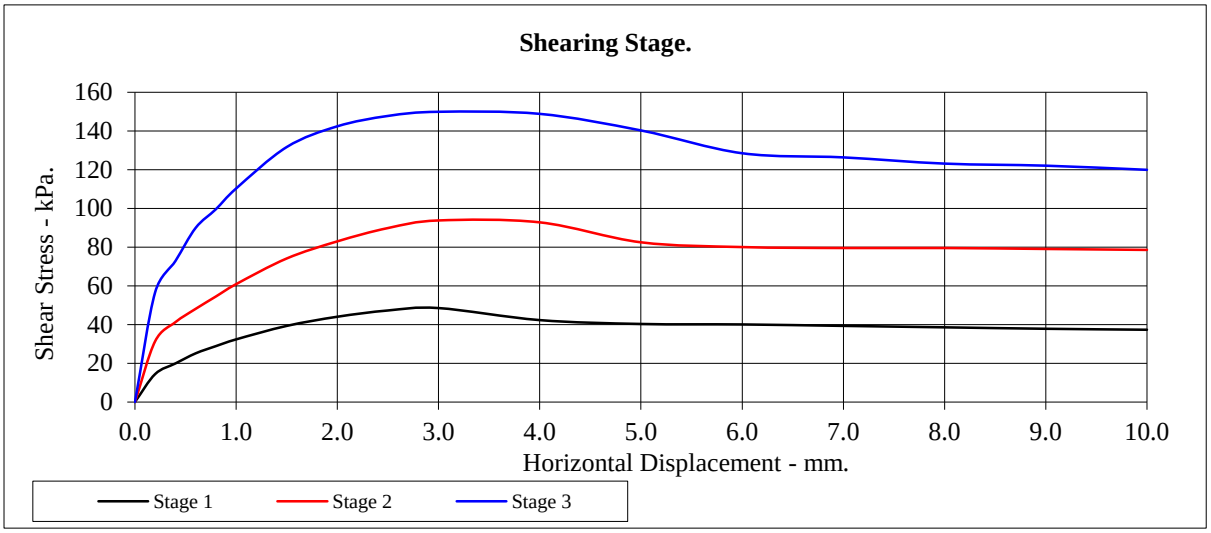
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No:** **PSL18/0272** **Client Ref:** **17-0769**

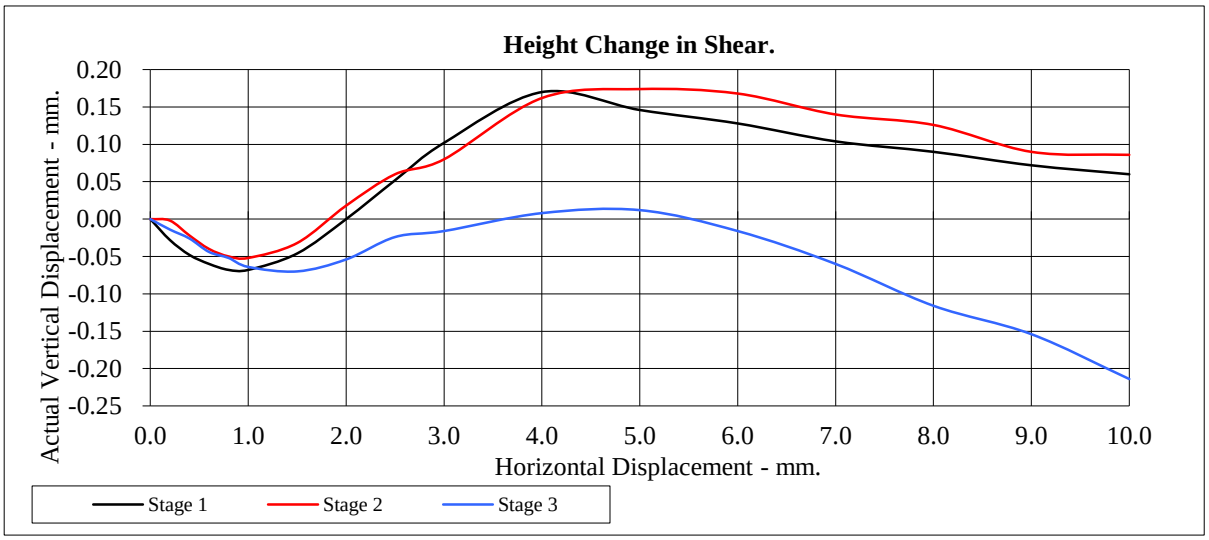
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH01**	Top Depth:	**35.00**
Sample Number:	**35**	Base Depth:	







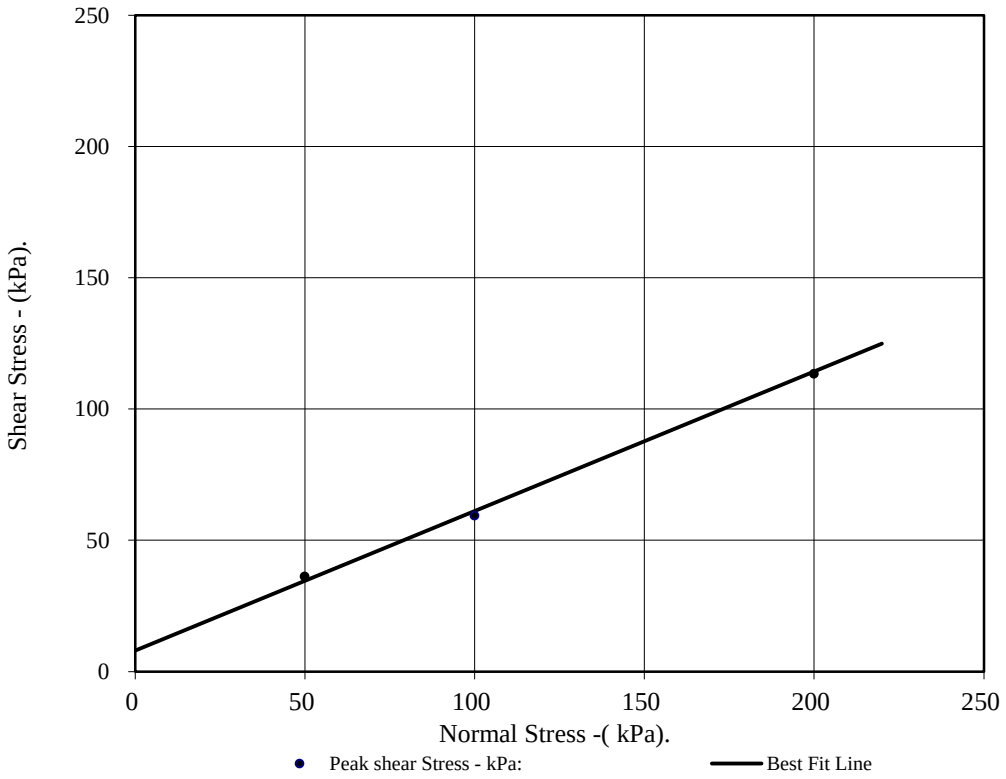
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I**	**Contract No: PSL18/0272** **Client Ref: 17-0769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH06**		Top Depth:	**6.50**
Sample Number:	**9**		Base Depth:	**7.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	24.51	24.51	24.51
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	25	25	25
Bulk Density - Mg/m3:	2.09	2.09	2.10
Dry Density - Mg/m3:	1.66	1.67	1.67
Voids Ratio:	0.594	0.588	0.586
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	23.84	23.52	22.66
Shearing Stage			
Rate of Strain - mm/min	0.04	0.04	0.04
Displacement at peak shear stress - mm	3.60	3.90	4.20
Peak shear Stress - kPa:	36	59	113
Final Consolidated Conditions			
Moisture Content - %:	19	21	21
Bulk Density - Mg/m3:	2.14	2.18	2.27
Dry Density - Mg/m3:	1.80	1.80	1.88
Peak			
Angle of Shearing Resistance:(~~θ~~)	**28**		
Effective Cohesion - kPa:	**8**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

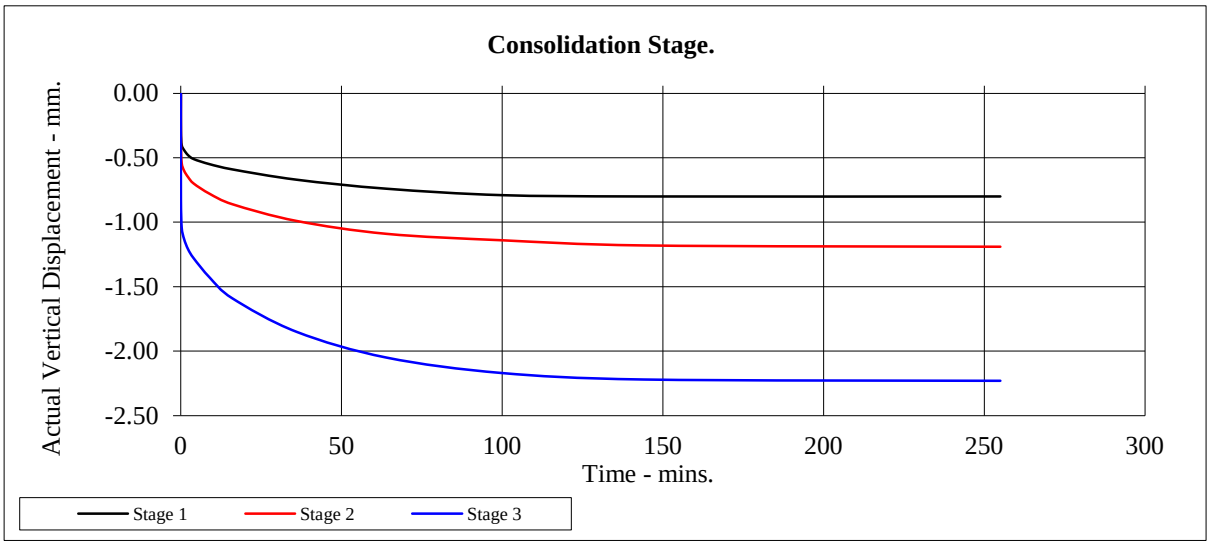
Stornoway Deep Water Berth G.I.

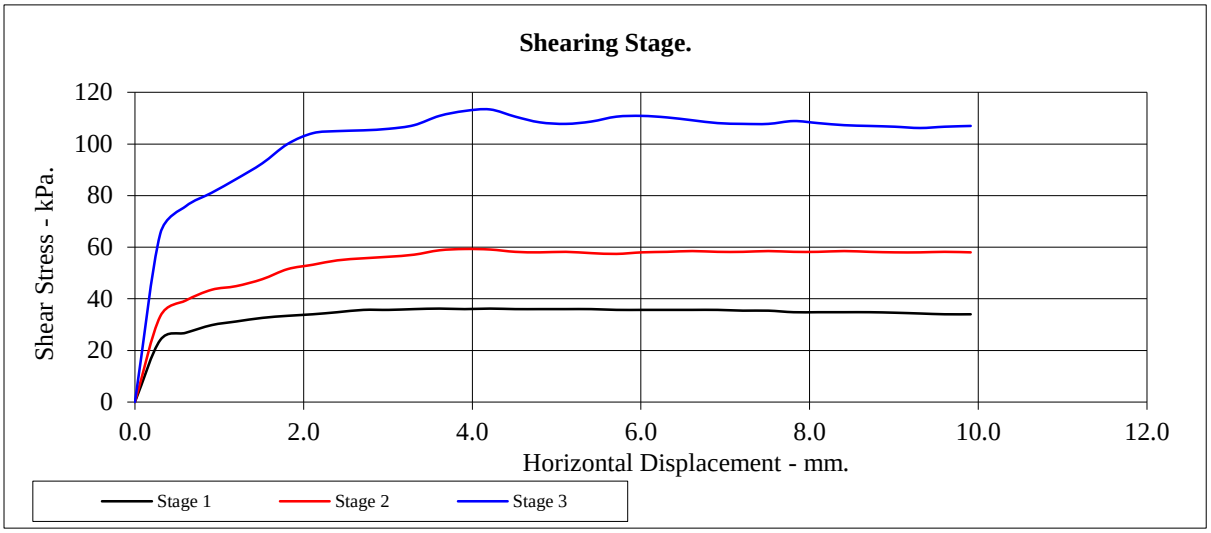
Contract No:
PSL18/0272
Client Ref:
17-0769

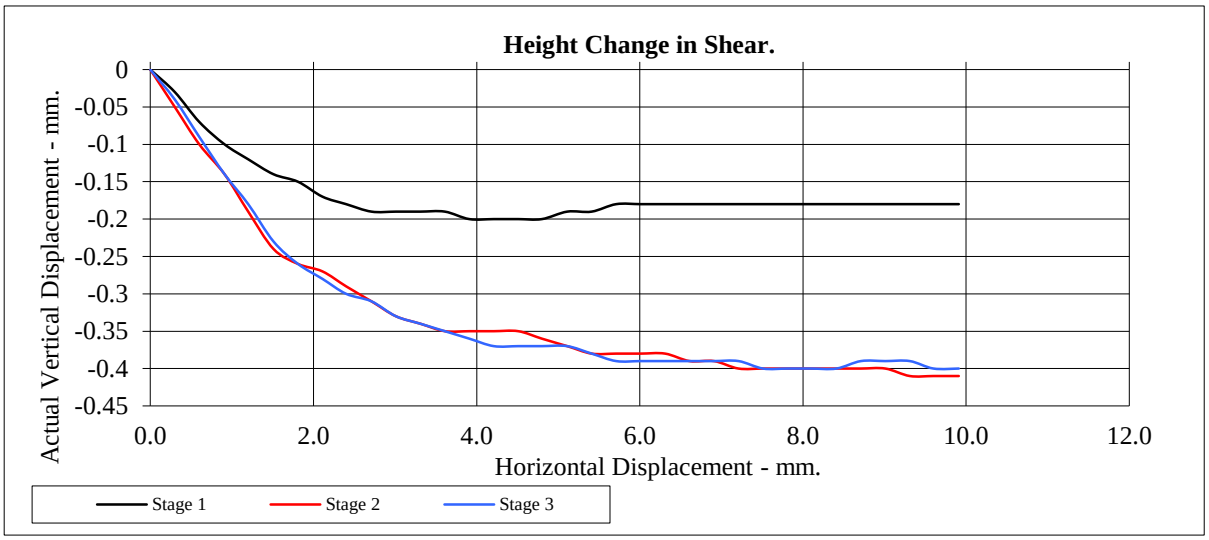
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH06**	Top Depth:	**6.50**
Sample Number:	**9**	Base Depth:	**7.00**







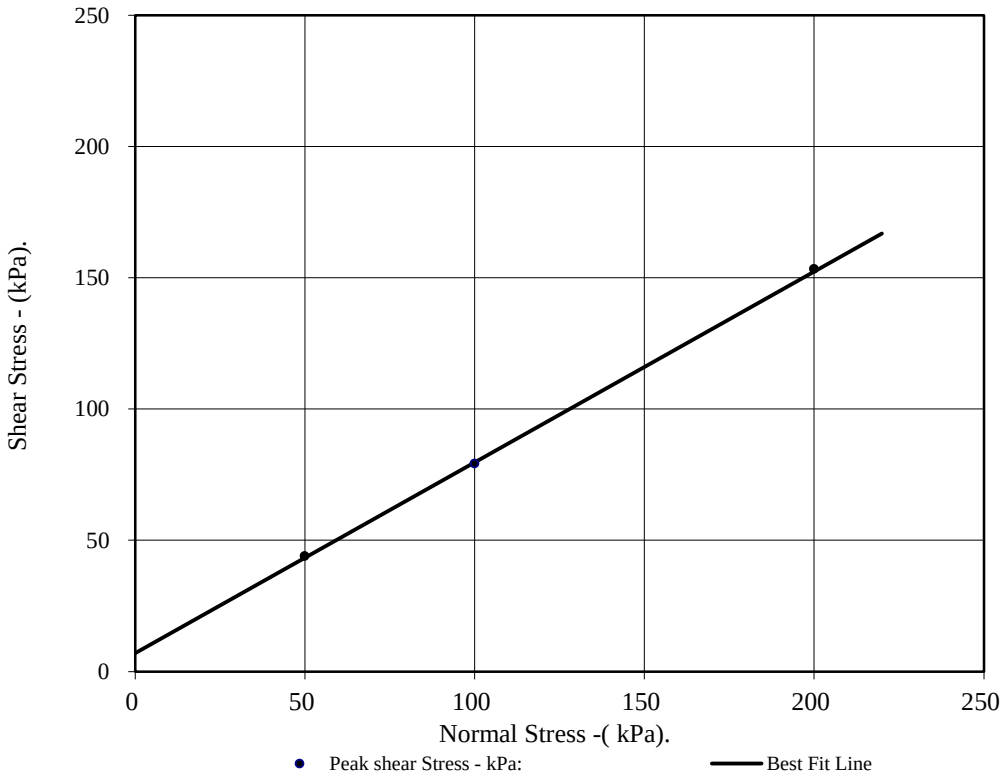
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/0272 / **Client Ref:** 17-0769

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH19**		Top Depth:	**5.00**
Sample Number:	**4**		Base Depth:	**5.20**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	24.51	24.51	24.51
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	14	14	14
Bulk Density - Mg/m3:	2.21	2.21	2.21
Dry Density - Mg/m3:	1.94	1.93	1.94
Voids Ratio:	0.367	0.370	0.366
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	23.25	22.51	22.15
Shearing Stage			
Rate of Strain - mm/min	0.04	0.04	0.04
Displacement at peak shear stress - mm	3.60	3.60	4.20
Peak shear Stress - kPa:	44	79	153
Final Consolidated Conditions			
Moisture Content - %:	13	12	12
Bulk Density - Mg/m3:	2.33	2.40	2.45
Dry Density - Mg/m3:	2.07	2.14	2.19
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**7**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

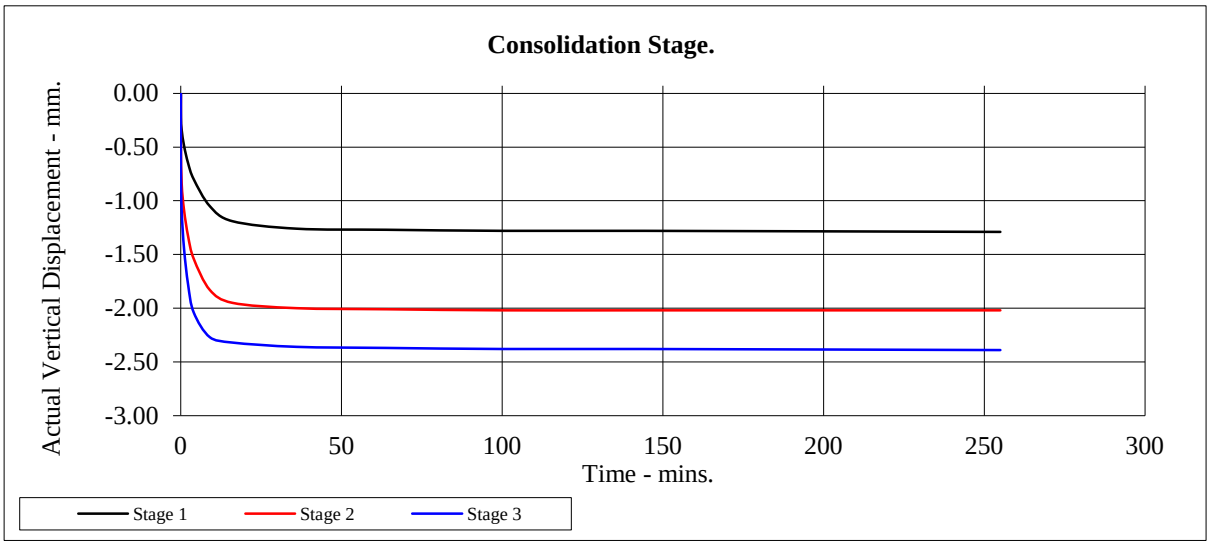
Stornoway Deep Water Berth G.I.

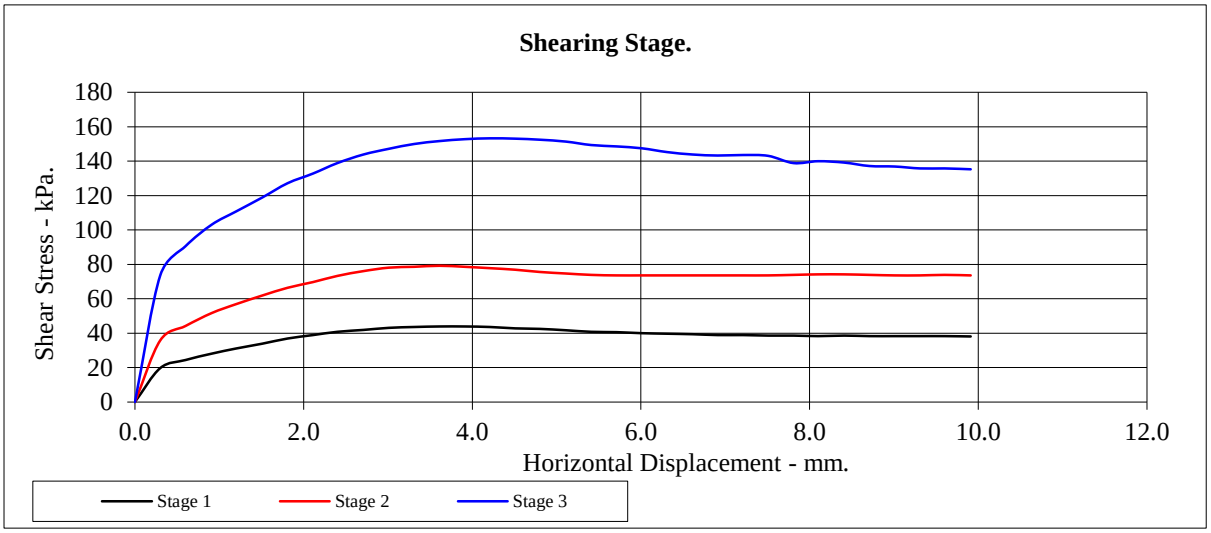
Contract No:
PSL18/0272
Client Ref:
17-0769

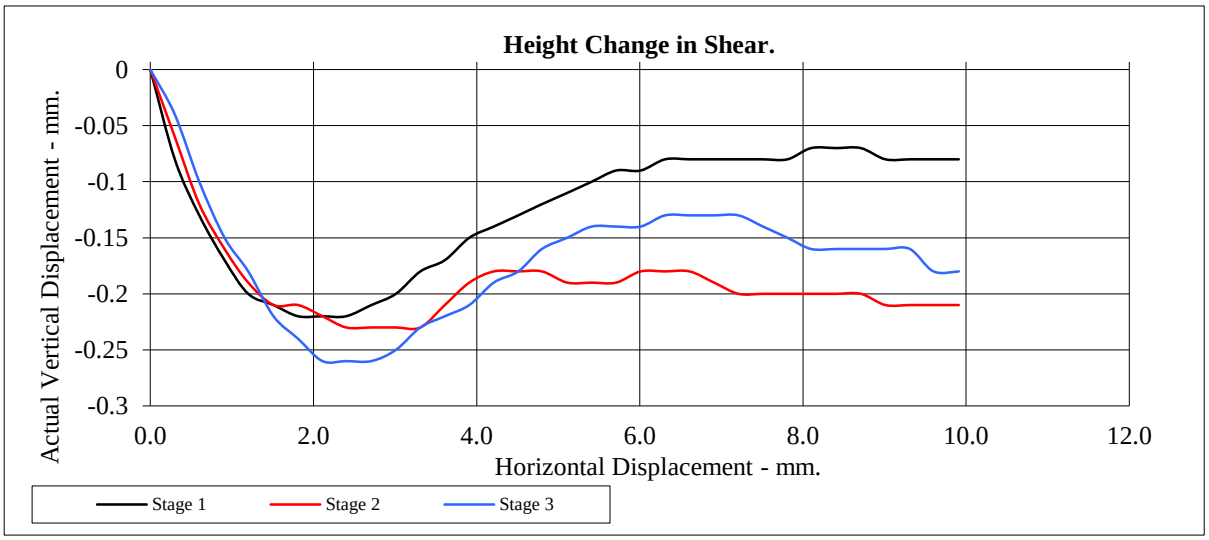
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH19**	Top Depth:	**5.00**
Sample Number:	**4**	Base Depth:	**5.20**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

Contract No:
PSL18/0272
Client Ref:
17-0769

Certificate of Analysis

Certificate Number 18-01774

29-Jan-18

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 18-01774

Client Reference PSL18/0272

Order No (not supplied)

Contract Title STONEWAY DEEP WATER BERTH G.I

Description 14 Soil samples.

Date Received 24-Jan-18

Date Started 24-Jan-18

Date Completed 29-Jan-18

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By [redacted]

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 18-01774
Client Ref PSL18/0272
Contract Title STONEWAY DEEP WATER BERTH G.I

			Lab No	1288326	1288327	1288328	1288329	1288330	1288331	1288332	1288333	1288334	1288335	1288336
			Sample ID	BH06	BH06	BH10	BH16	BH16	BH17	BH18	BH18	BH18	BH19	BH20
			Depth	2.00-2.80	6.50-7.00	1.00-1.40	0.80-1.00	3.00-3.10	1.00-1.20	3.00-3.20	9.00-9.20	14.00-14.20	2.00-2.20	1.00-1.20
			Other ID	5	9	2	1	3	1	2	7	12	2	1
			Sample Type	B	B	B	B	B	B	B	B	B	B	B
			Sampling Date	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**											
Inorganics														
pH	DETSC 2008#			9.0	8.6	7.9	8.0	9.1	8.0	8.7	8.1	7.3	7.8	7.9
Organic matter	DETSC 2002#	0.1	%						7.2	7.0		9.1	9.2	4.1
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	91	550	2400	1900	190	2200	1900	1500	2100	2300	97

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-01774
Client Ref PSL18/0272
Contract Title STONEWAY DEEP WATER BERTH G.I

			Lab No	1288337	1288338	1288339
			Sample ID	BH20	BH21	BH21
			Depth	6.00-6.20	2.00-2.20	12.00
			Other ID	5	2	17
			Sample Type	B	B	D
			Sampling Date	18/01/18	18/01/18	18/01/18
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Inorganics						
pH	DETSC 2008#			8.8	8.0	7.8
Organic matter	DETSC 2002#	0.1	%		15	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	310	1500	1300

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 18-01774
Client Ref PSL18/0272
Contract STONEWAY DEEP WATER BERTH G.I

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1288326	BH06 2.00-2.80 SOIL	18/01/18	PT 500ml		
1288327	BH06 6.50-7.00 SOIL	18/01/18	PT 500ml		
1288328	BH10 1.00-1.40 SOIL	18/01/18	PT 500ml		
1288329	BH16 0.80-1.00 SOIL	18/01/18	PT 500ml		
1288330	BH16 3.00-3.10 SOIL	18/01/18	PT 500ml		
1288331	BH17 1.00-1.20 SOIL	18/01/18	PT 500ml		
1288332	BH18 3.00-3.20 SOIL	18/01/18	PT 500ml		
1288333	BH18 9.00-9.20 SOIL	18/01/18	PT 500ml		
1288334	BH18 14.00-14.20 SOIL	18/01/18	PT 500ml		
1288335	BH19 2.00-2.20 SOIL	18/01/18	PT 500ml		
1288336	BH20 1.00-1.20 SOIL	18/01/18	PT 500ml		
1288337	BH20 6.00-6.20 SOIL	18/01/18	PT 500ml		
1288338	BH21 2.00-2.20 SOIL	18/01/18	PT 500ml		
1288339	BH21 12.00 SOIL	18/01/18	PT 500ml		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Client:	**Stornoway Port Authority**
Engineer:	**Wallace Stone Consulting Civil Engineers**
From:	**Stephen Watson** **Laboratory Manager** **Causeway Geotech Ltd**
Tel:	**+44(0)2827666640**
E-mail:	**stephen.watson@causewaygeotech.com**
Date:	**17/04/18**
Ref:	**17-0769 – Soils Schedule 2 – Issue 2**

Stornoway Deep Water Berth G.I.

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the *Contents page(s)*.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory

[redacted]

Stephen Watson
Laboratory Manager

CAUSEWAY GEOTECH

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Project Name **Stornoway Deep Water Berth G.I.**

Report Reference. **17-0769 – Soils Schedule 2 – Issue 2**

The table below details the tests carried out, the specifications used, and the number of tests included in this report:

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	Number of test results included in the report
SOIL	Moisture Content of Soil	BS1377: Part 2: Clause 3.2: 1990	25
SOIL	Liquid and Plastic Limits of soil -1-point cone penetrometer method	BS1377: Part 2: Clauses 4.4, 5.3 & 5.4 1990	21
SOIL	Particle size distribution - wet sieving	BS1377: Part 2: Clause 9.2: 1990	70
SOIL	Particle size distribution -sedimentation hydrometer method	BS1377: Part 2: Clause 9.5: 1990	21
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS1377: Part 7: Clause 8: 1990	8
SOIL – Subcontracted to Pro Soils Ltd	Direct Shear Strength using 60mm Small Shear box (up to 4 days)	BS1377: Part 7: Clause 4: 1990	5
SOIL – Subcontracted to Chemtest Ltd	pH Value of Soil		26
SOIL - Subcontracted to Chemtest Ltd	Sulphate Content water extract		26
SOIL SOIL – Subcontracted to Chemtest Ltd	Organic Matter Content		6

[redacted]

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.	Project Name
17-0769	Stornoway Deep Water Berth G.I.

Hole No.	Sample				Soil Description	Density bulk / dry Mg/m3		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH02	17	17.50		B	Grey slightly silty fine to medium SAND.			27.0	100	34 -1pt	NP			
BH02	21	21.50		B	Grey slightly silty fine to medium SAND.			27.0	99	30 -1pt	NP			
BH02	23	23.50		B	Dark brown sandy organic clayey S LT.			79.0	100	81 -1pt	39	42		MV
BH02	26	26.50		B	Grey sandy silty CLAY.			36.0	100	37 -1pt	18	19		CI
BH03A	16	20.60		B	Brownish grey sandy silty CLAY.			39.0	100	50 -1pt	18	32		CI/CH
BH03A	51	27.00		U	Brownish grey sandy silty CLAY.			38.0	100	52 -1pt	21	31		CH
BH03A	4	28.50		D	Blackish grey sandy silty CLAY.			49.0	100	61 -1pt	25	36		CH
BH03A	42	32.00		D	Brown slightly sandy slightly gravelly organic silty CLAY.			153.0						
BH07	38	8.50		D	Grey slightly gravelly fine to coarse SAND with shells and shell fragments.			25.0						
BH07	15	15.00		B	Greyish brown silty fine to coarse SAND.			26.0	100	28 -1pt	NP			
BH07	44	20.50		U	Greyish black thinly laminated slightly organic S LT.			24.0						
BH07	45	25.00		U	Brownish grey sandy slightly gravelly clayey SILT.			24.0	100	27 -1pt	NP			
BH07	40	26.50		D	Brownish grey sandy slightly gravelly SILT.			32.0	100	42 -1pt	NP			

All tests performed in accordance with BS1377:1990 unless specified otherwise

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

Date Printed: 04/02/2018 00:00

Approved By: Stephen.Watson

Table 1

sheet 1

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.	Project Name
17-0769	Stornoway Deep Water Berth G.I.

Hole No.	Sample				Soil Description	Density bulk / dry Mg/m3		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH07	41	28.00		D	Grey slightly sandy clayey SILT.			40.0	100	52 -1pt	39	13		MH
BH07	43	32.50		D	Greenish grey slightly gravelly fine to coarse SAND.			15.0						
BH11	26	8.50		U	Brownish grey slightly sandy slightly gravelly clayey S LT.			26.0	98	32 -1pt	26	6		ML
BH11	22	11.00		D	Brownish grey slightly sandy silty CLAY.			32.0	100	35 -1pt	20	15		CL/CI
BH11	18	13.50		B	Greenish grey slightly sandy slightly gravelly clayey S LT.			22.0	73	34 -1pt	25	9		ML
BH12	7	0.00		B	Grey sandy slightly gravelly SILT.			31.0	77	35 -1pt	NP			
BH30	9	2.00		B	Grey sandy clayey SILT with occasional shells and shell fragments.			43.0	100	44 -1pt	NP			
BH31	7	2.00		U	Grey slightly sandy organic silty CLAY with occasional shell fragments.			74.0	100	80 -1pt	22	58		CV
BH31	8	4.00		U	Grey slightly sandy organic silty CLAY with occasional shell fragments.			98.0	100	91 -1pt	22	69		CE
BH32	2	1.00		B	Grey organic silty CLAY with shells and shell fragments.			94.0	100	100 -1pt	34	66		CE
BH32	12	4.00		U	Grey organic silty CLAY with shells and shell fragments.			99.0	100	99 -1pt	34	65		CE
BH32	4	5.40		B	Dark grey sandy silty CLAY.			41.0	100	51 -1pt	22	29		CH

All tests performed in accordance with BS1377:1990 unless specified otherwise

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

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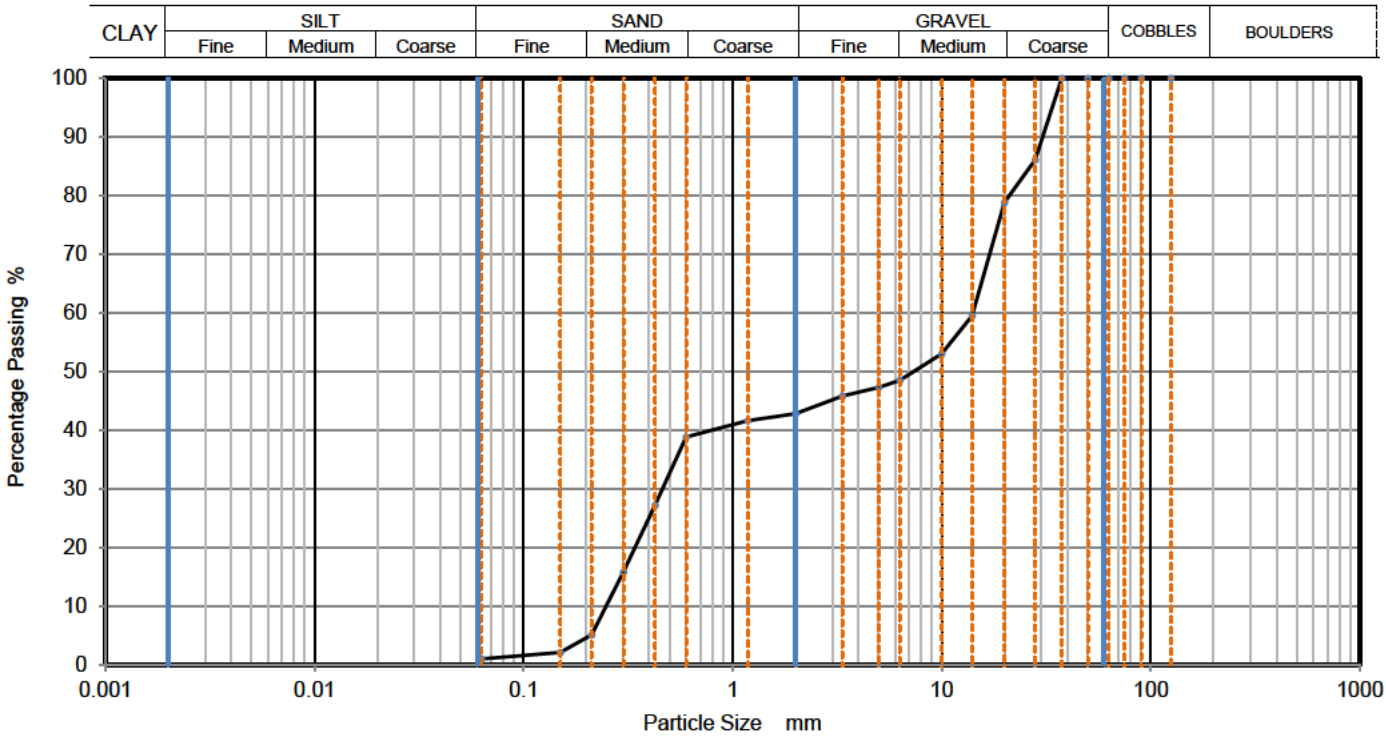
Table 1

sheet 2

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	2
Soil Description	Grey sandy angular to subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	1.20
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803080



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	86		
20	79		
14	60		
10	53		
6.3	49		
5	47		
3.35	46		
2	43		
1.18	42		
0.6	39		
0.425	27		
0.3	16		
0.212	5		
0.15	2		
0.063	1		

Dry Mass of sample, g	2436

Sample Proportions	% dry mass
Cobbles	0
Gravel	57
Sand	42
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	14.1
D30	mm	0.461
D10	mm	0.249
Uniformity Coefficient		57
Curvature Coefficient		0.061

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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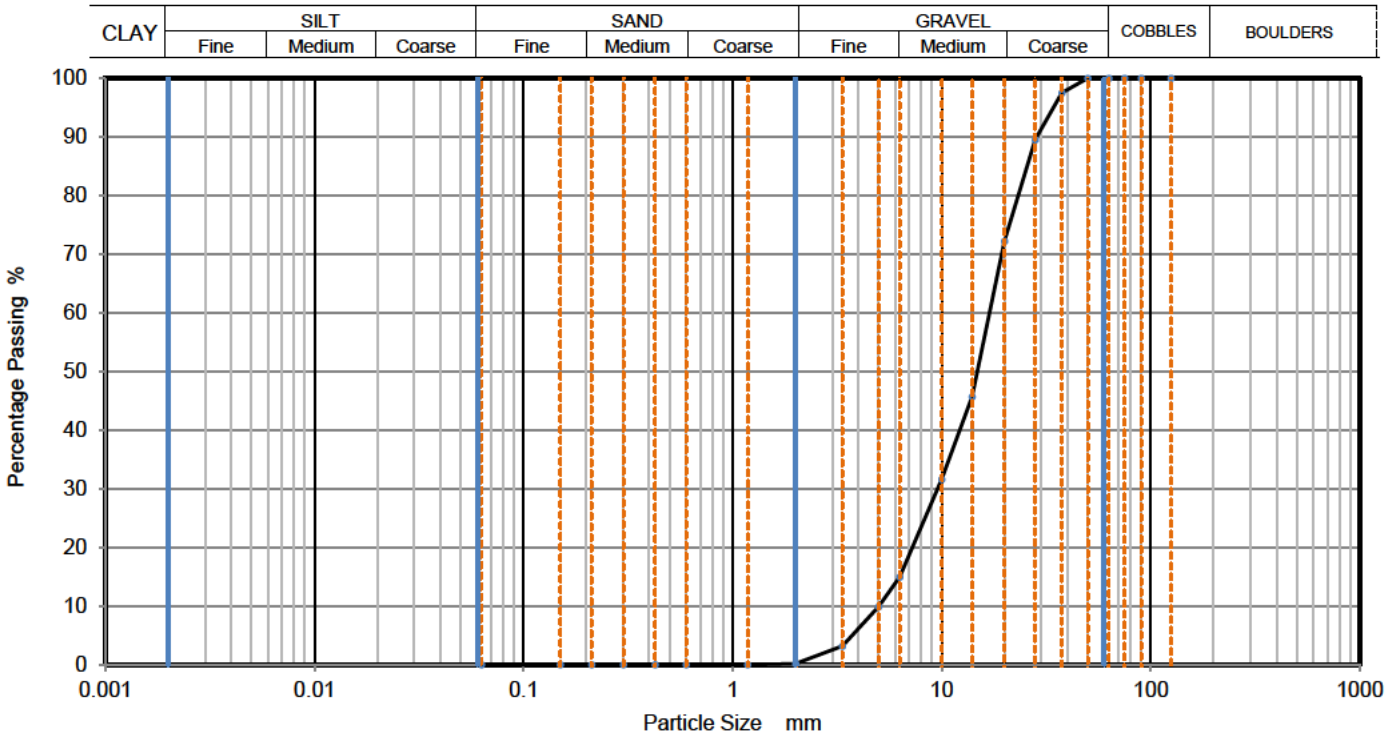
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Greyish brown rounded to subrounded fine to coarse GRAVEL.			Depth, m	4.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803081



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	90		
20	72		
14	46		
10	32		
6.3	15		
5	10		
3.35	3		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7780

Sample Proportions	% dry mass
Cobbles	0
Gravel	100
Sand	0
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	17
D30	mm	9.58
D10	mm	5.01
Uniformity Coefficient		3.4
Curvature Coefficient		1.1

Remarks

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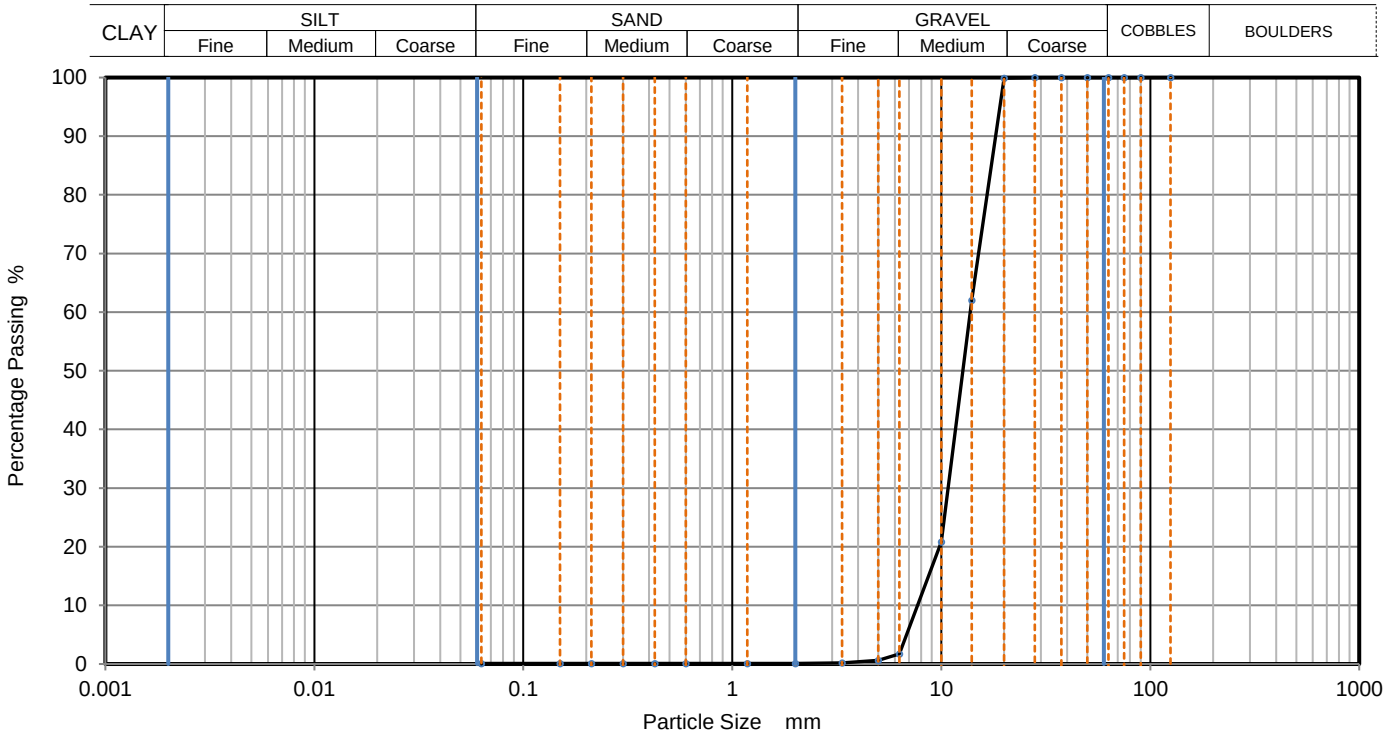
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	9
Soil Description	Reddish brown and grey subrounded fine to medium GRAVEL.			Depth, m	8.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803082



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	62		
10	21		
6.3	2		
5	1		
3.35	0		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	2873

Sample Proportions	% dry mass
Cobbles	0
Gravel	100
Sand	0
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	13.8
D30	mm	10.8
D10	mm	7.7
Uniformity Coefficient		1.8
Curvature Coefficient		1.1

Remarks

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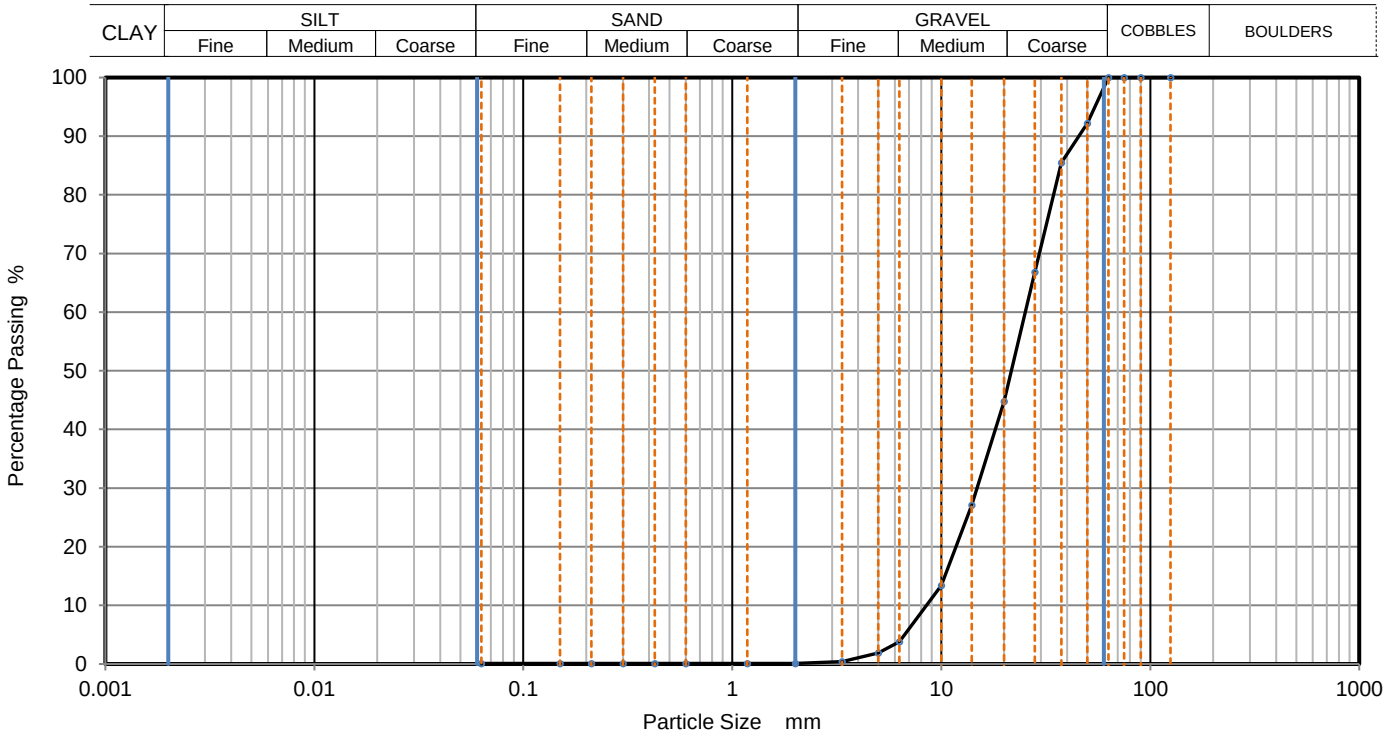
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	14
Soil Description	Reddish brown rounded to subrounded fine to coarse GRAVEL.			Depth, m	14.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803084



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	92		
37.5	86		
28	67		
20	45		
14	27		
10	13		
6.3	4		
5	2		
3.35	0		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	15674

Sample Proportions	% dry mass
Cobbles	0
Gravel	100
Sand	0
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	25.2
D30	mm	14.8
D10	mm	8.48
Uniformity Coefficient		3
Curvature Coefficient		1

Remarks

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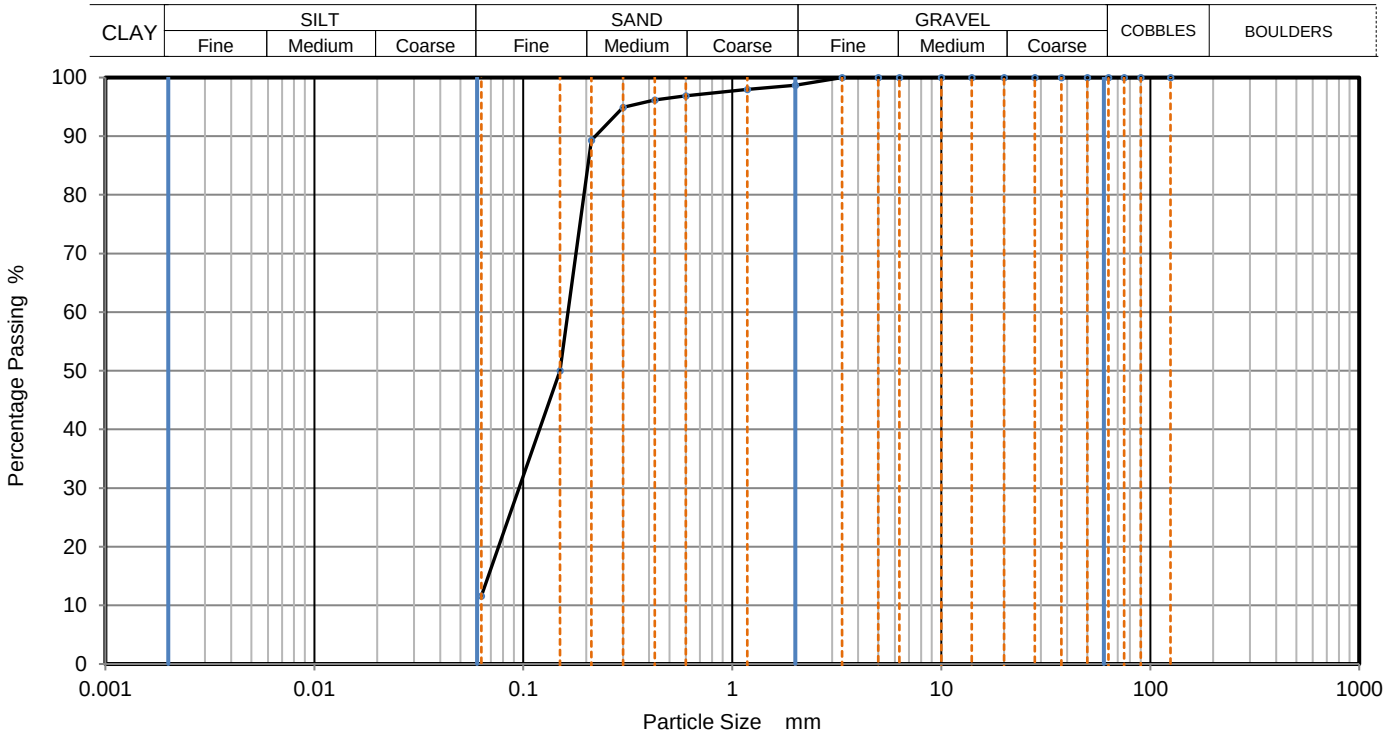
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**17-0769**
		Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.	Sample No.	17
Soil Description	Grey slightly silty fine to medium SAND.	Depth, m	17.50
Specimen Reference	7 / Specimen Depth / m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2	KeyLAB ID	Caus201803085



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	98		
0.6	97		
0.425	96		
0.3	95		
0.212	89		
0.15	50		
0.063	12		

Dry Mass of sample, g	204

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	87
Fines <0.063mm	12

Grading Analysis		
D100	mm	
D60	mm	0.164
D30	mm	0.0955
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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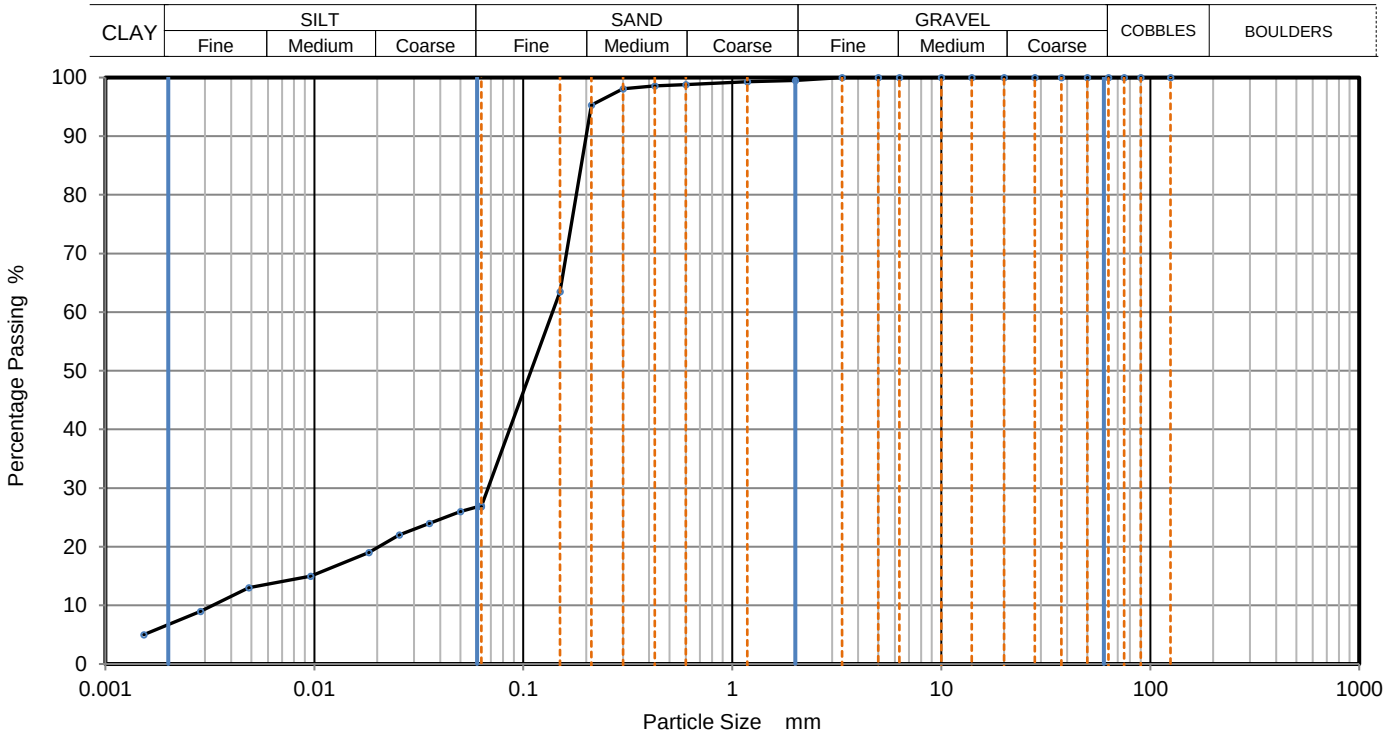
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	21
Soil Description	Grey slightly silty fine to medium SAND.			Depth, m	21.50
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201803086



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	27
90	100	0.0500	26
75	100	0.0356	24
63	100	0.0255	22
50	100	0.0182	19
37.5	100	0.0096	15
28	100	0.0049	13
20	100	0.0029	9
14	100	0.0015	5
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	95		
0.15	64		
0.063	27		

Dry Mass of sample, g	356

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	73
Silt	20
Clay	7

Grading Analysis		
D100	mm	
D60	mm	0.138
D30	mm	0.0679
D10	mm	0.00331
Uniformity Coefficient		42
Curvature Coefficient		10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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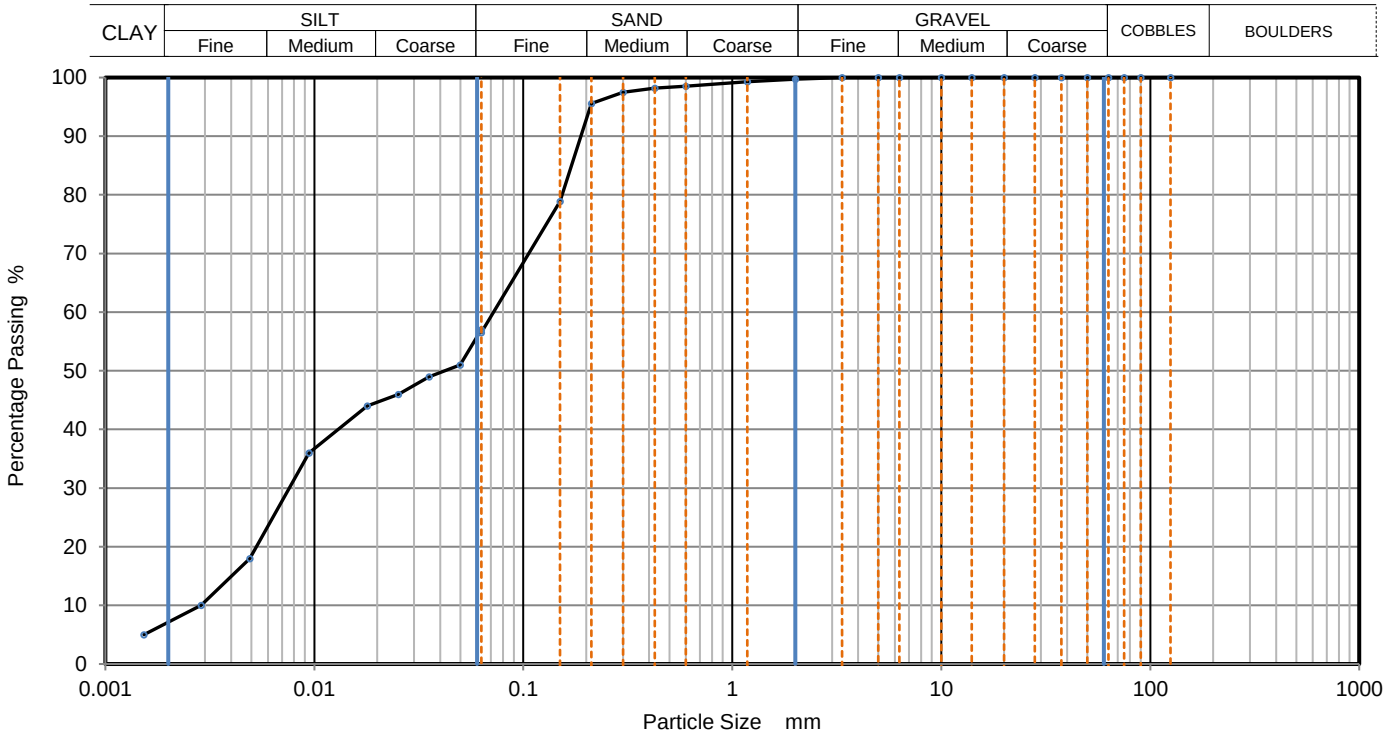
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	23
Soil Description	Dark brown sandy organic clayey SILT.			Depth, m	23.50
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201803087



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	57
90	100	0.0498	51
75	100	0.0354	49
63	100	0.0252	46
50	100	0.0179	44
37.5	100	0.0094	36
28	100	0.0049	18
20	100	0.0029	10
14	100	0.0015	5
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	98	2.65	Mg/m3
0.3	98		
0.212	96		
0.15	79		
0.063	57		

Dry Mass of sample, g	184

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	43
Silt	49
Clay	7

Grading Analysis		
D100	mm	
D60	mm	0.0722
D30	mm	0.00759
D10	mm	0.00278
Uniformity Coefficient		26
Curvature Coefficient		0.29

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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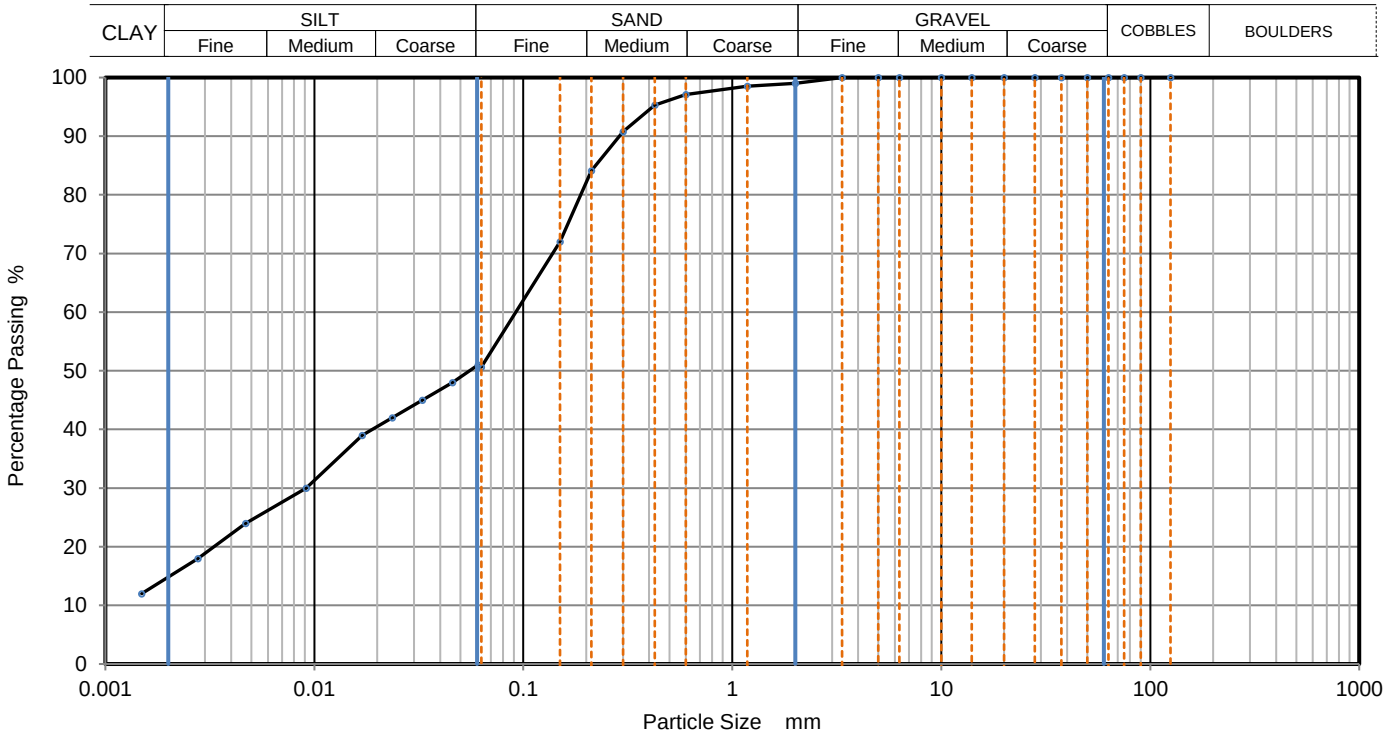
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH02
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	26
Soil Description	Grey sandy silty CLAY.			Depth, m	26.50
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201803088



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0607	51
90	100	0.0458	48
75	100	0.0329	45
63	100	0.0236	42
50	100	0.0170	39
37.5	100	0.0091	30
28	100	0.0047	24
20	100	0.0028	18
14	100	0.0015	12
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	97	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	91		
0.212	84		
0.15	72		
0.063	51		

Dry Mass of sample, g	252

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	48
Silt	36
Clay	15

Grading Analysis		
D100	mm	
D60	mm	0.0922
D30	mm	0.00928
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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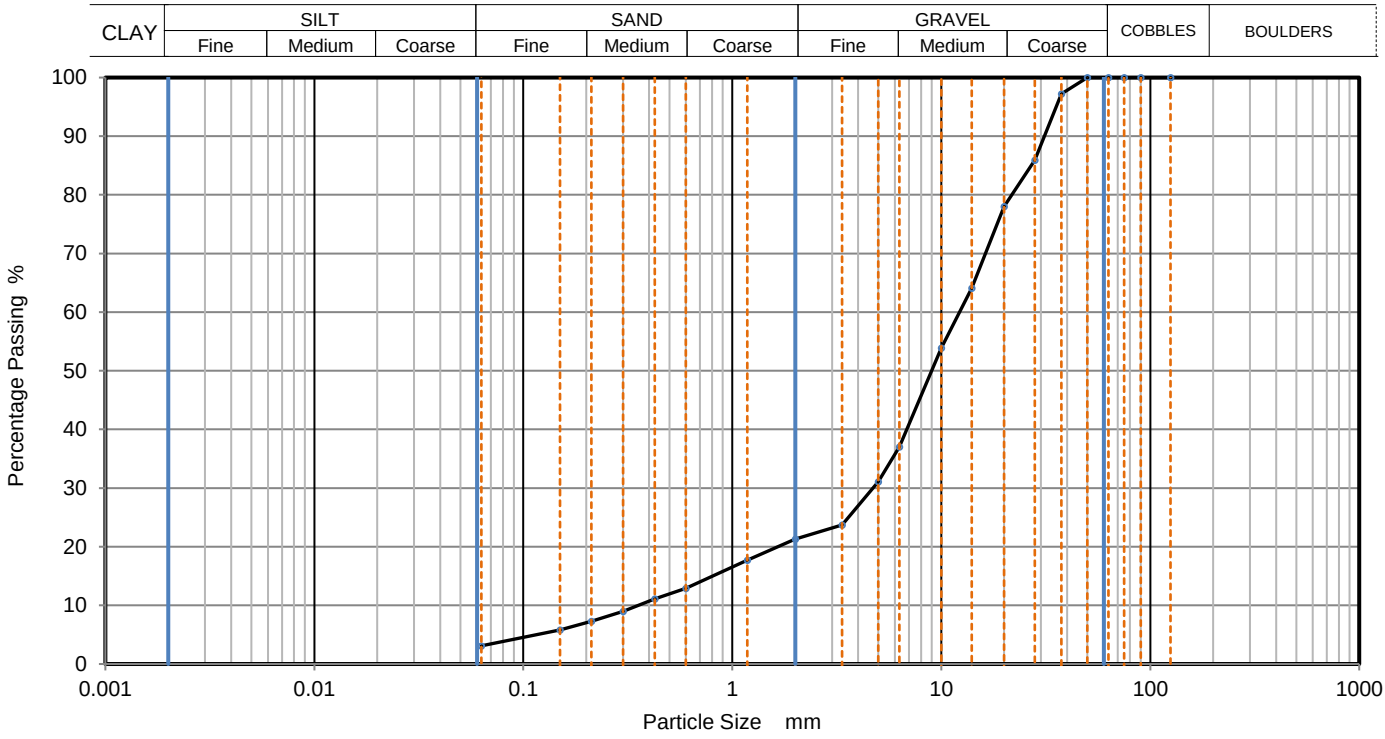
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	53
Soil Description	Black slightly sandy subangular fine to coarse GRAVEL with some shell and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803089



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	86		
20	78		
14	64		
10	54		
6.3	37		
5	31		
3.35	24		
2	21		
1.18	18		
0.6	13		
0.425	11		
0.3	9		
0.212	7		
0.15	6		
0.063	3		

Dry Mass of sample, g	5898

Sample Proportions	% dry mass
Cobbles	0
Gravel	79
Sand	18
Fines <0.063mm	3

Grading Analysis		
D100	mm	
D60	mm	12.2
D30	mm	4.71
D10	mm	0.352
Uniformity Coefficient		35
Curvature Coefficient		5.2

Remarks

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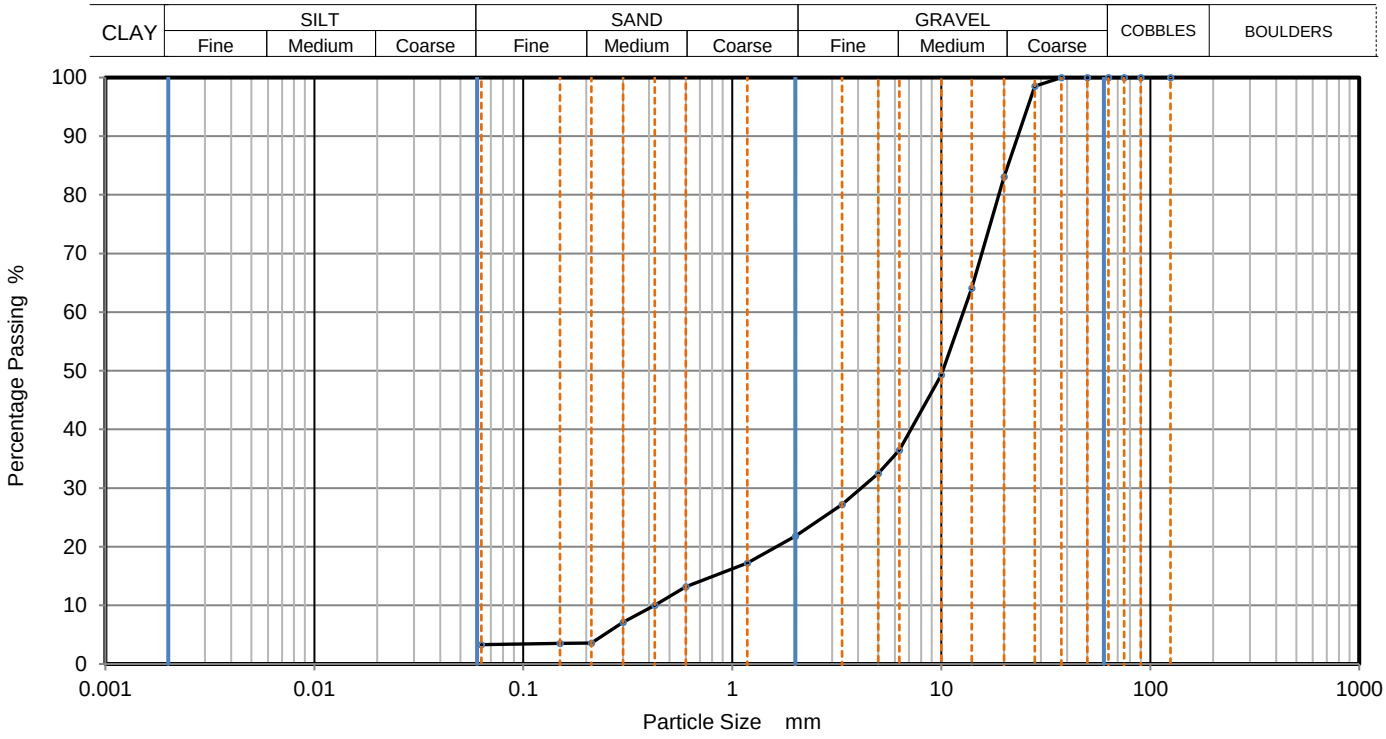
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	55
Soil Description	Reddish grey slightly sandy subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	1.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030810



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	83		
14	64		
10	49		
6.3	37		
5	33		
3.35	27		
2	22		
1.18	17		
0.6	13		
0.425	10		
0.3	7		
0.212	4		
0.15	4		
0.063	3		

Dry Mass of sample, g	2636

Sample Proportions	% dry mass
Cobbles	0
Gravel	78
Sand	18
Fines <0.063mm	3

Grading Analysis		
D100	mm	
D60	mm	12.8
D30	mm	4.15
D10	mm	0.423
Uniformity Coefficient		30
Curvature Coefficient		3.2

Remarks

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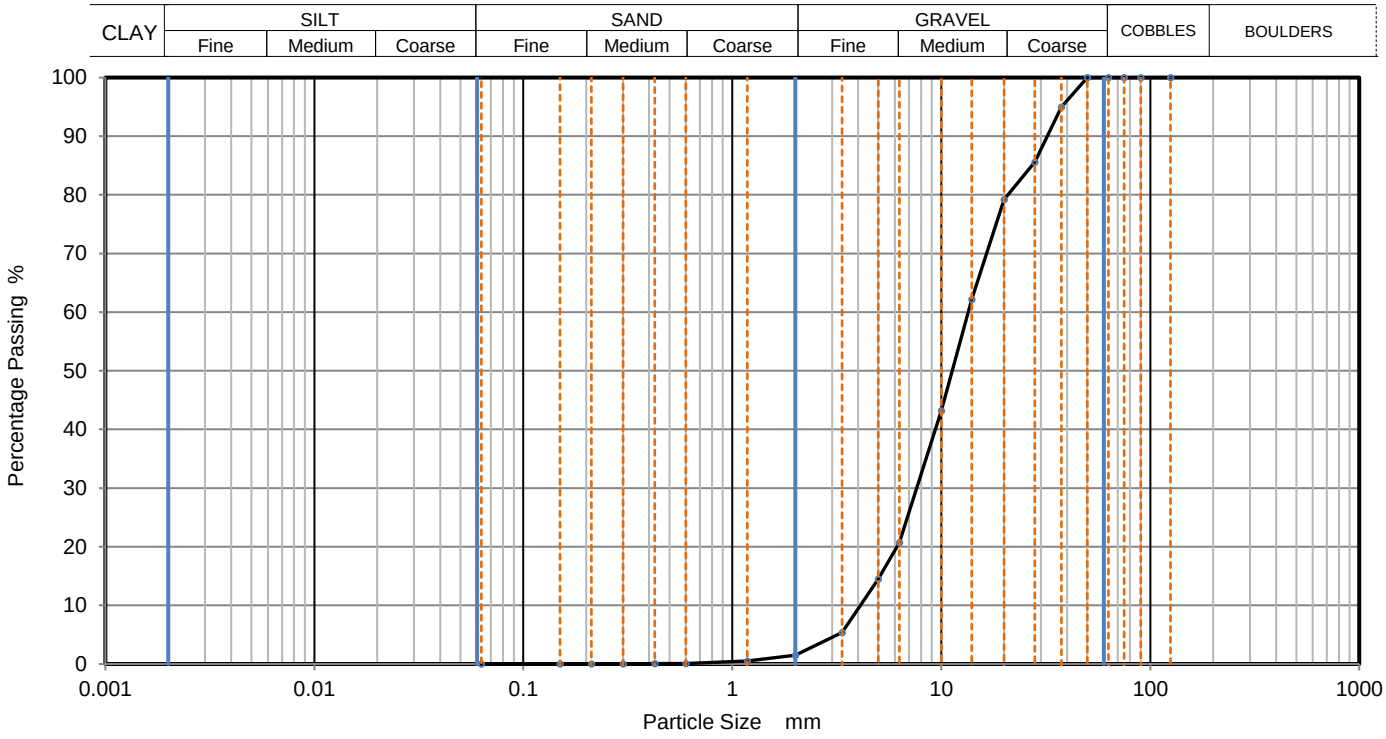
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	59
Soil Description	Reddish grey subrounded fine to coarse GRAVEL.			Depth, m	3.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030811



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	86		
20	79		
14	62		
10	43		
6.3	21		
5	15		
3.35	5		
2	2		
1.18	1		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7052

Sample Proportions	% dry mass
Cobbles	0
Gravel	99
Sand	2
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	13.5
D30	mm	7.63
D10	mm	4.09
Uniformity Coefficient		3.3
Curvature Coefficient		1.1

Remarks

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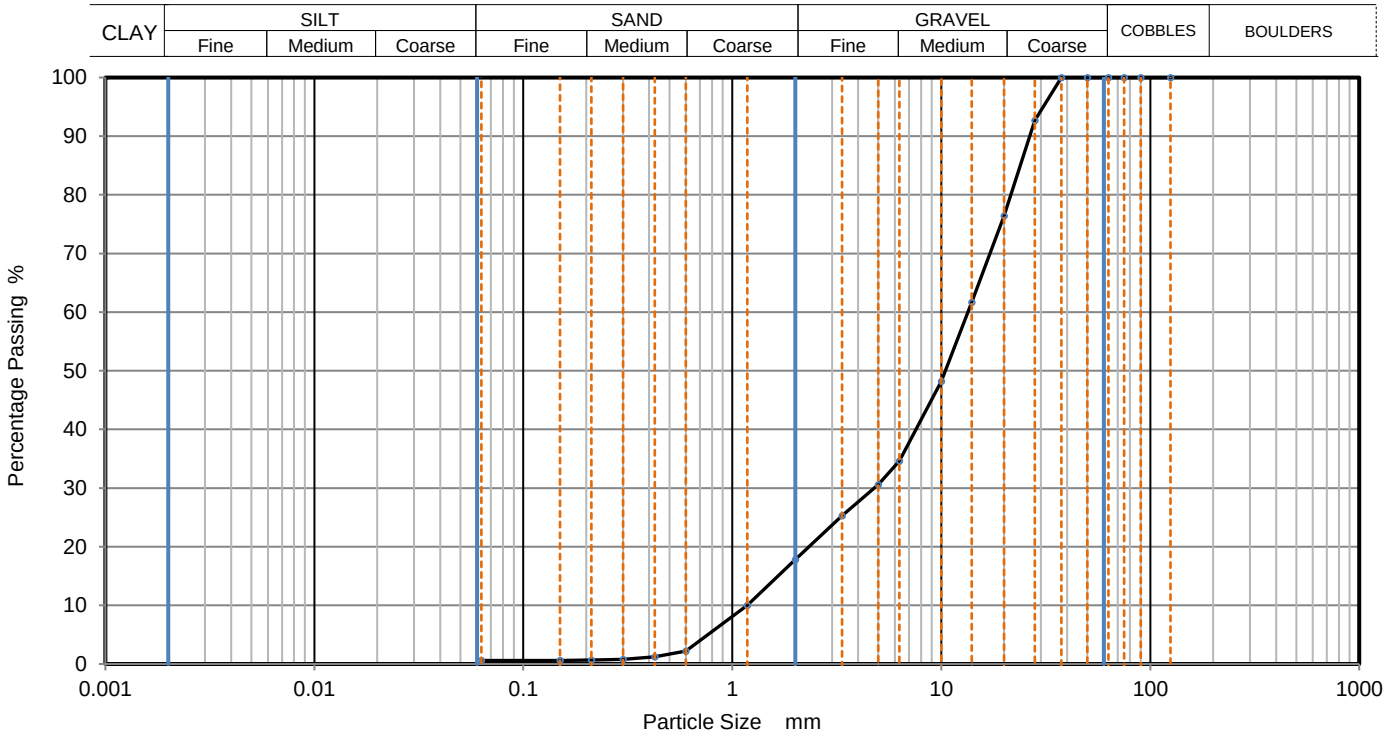
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	66
Soil Description	Reddish brown slightly sandy subrounded fine to coarse GRAVEL.			Depth, m	6.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030812



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	76		
14	62		
10	48		
6.3	35		
5	31		
3.35	25		
2	18		
1.18	10		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	2949

Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	17
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	13.4
D30	mm	4.79
D10	mm	1.18
Uniformity Coefficient		11
Curvature Coefficient		1.4

Remarks

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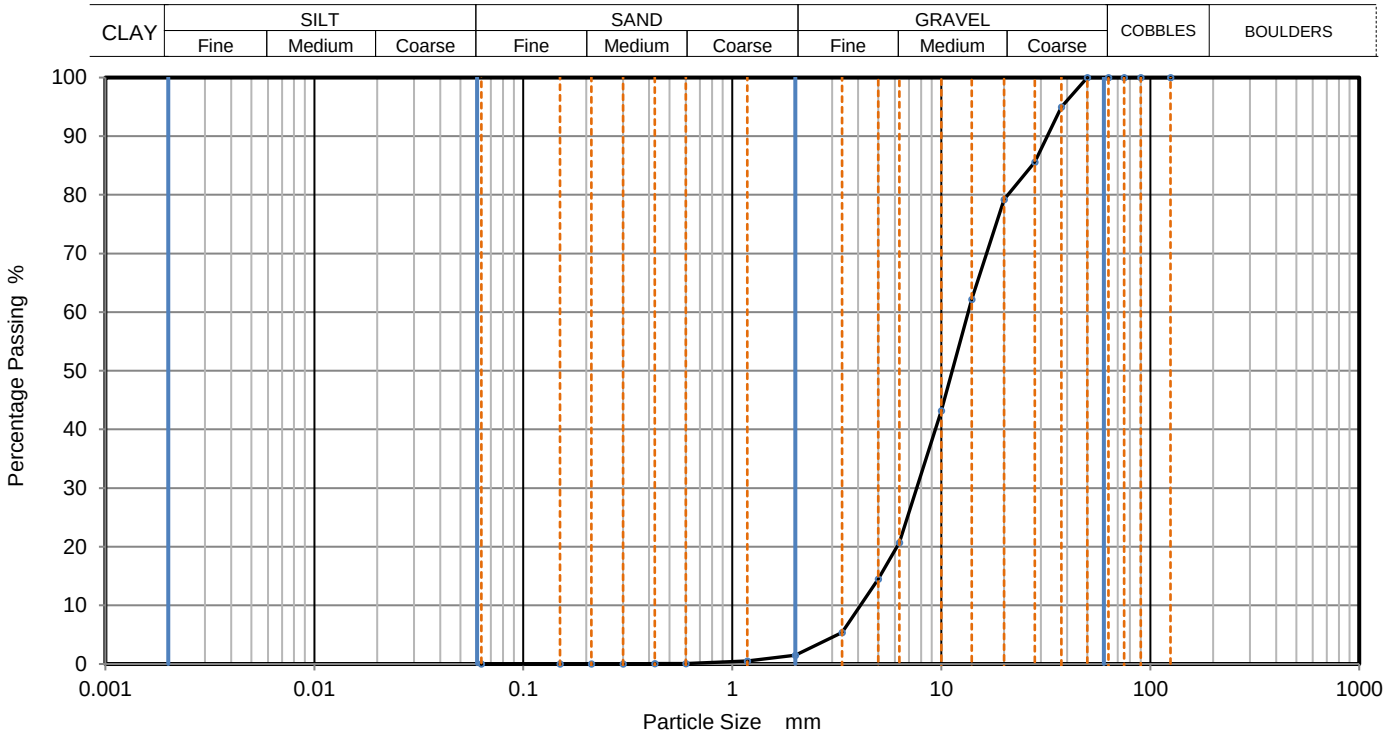
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	69
Soil Description	Reddish brown subrounded fine to coarse GRAVEL.			Depth, m	8.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030813



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	86		
20	79		
14	62		
10	43		
6.3	21		
5	15		
3.35	5		
2	2		
1.18	1		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7052

Sample Proportions	% dry mass
Cobbles	0
Gravel	99
Sand	2
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	13.5
D30	mm	7.63
D10	mm	4.09
Uniformity Coefficient		3.3
Curvature Coefficient		1.1

Remarks

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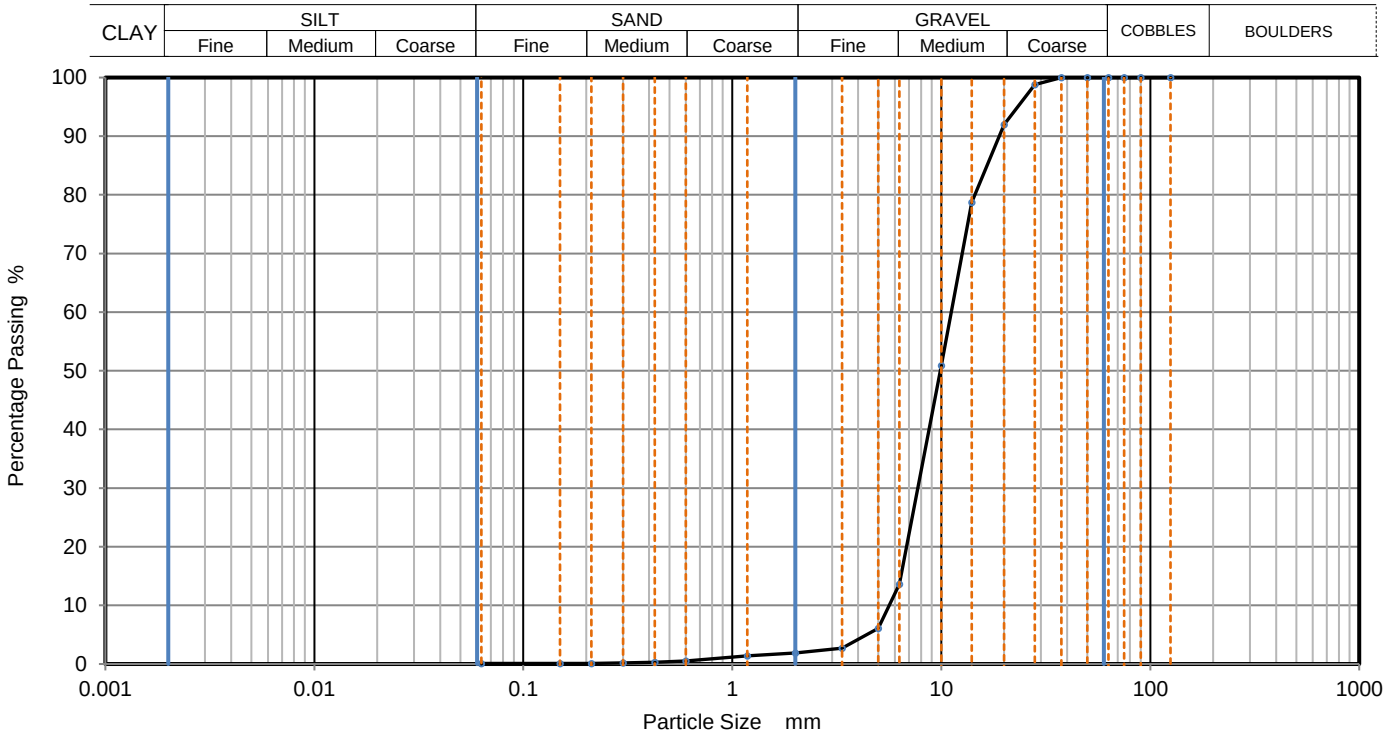
PARTICLE SIZE DISTRIBUTION

				Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	71
Soil Description	Reddish brown subrounded fine to coarse GRAVEL.			Depth, m	9.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030814



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	92		
14	79		
10	51		
6.3	14		
5	6		
3.35	3		
2	2		
1.18	1		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	2930

Sample Proportions	% dry mass
Cobbles	0
Gravel	98
Sand	2
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	11.2
D30	mm	7.72
D10	mm	5.64
Uniformity Coefficient		2
Curvature Coefficient		0.95

Remarks

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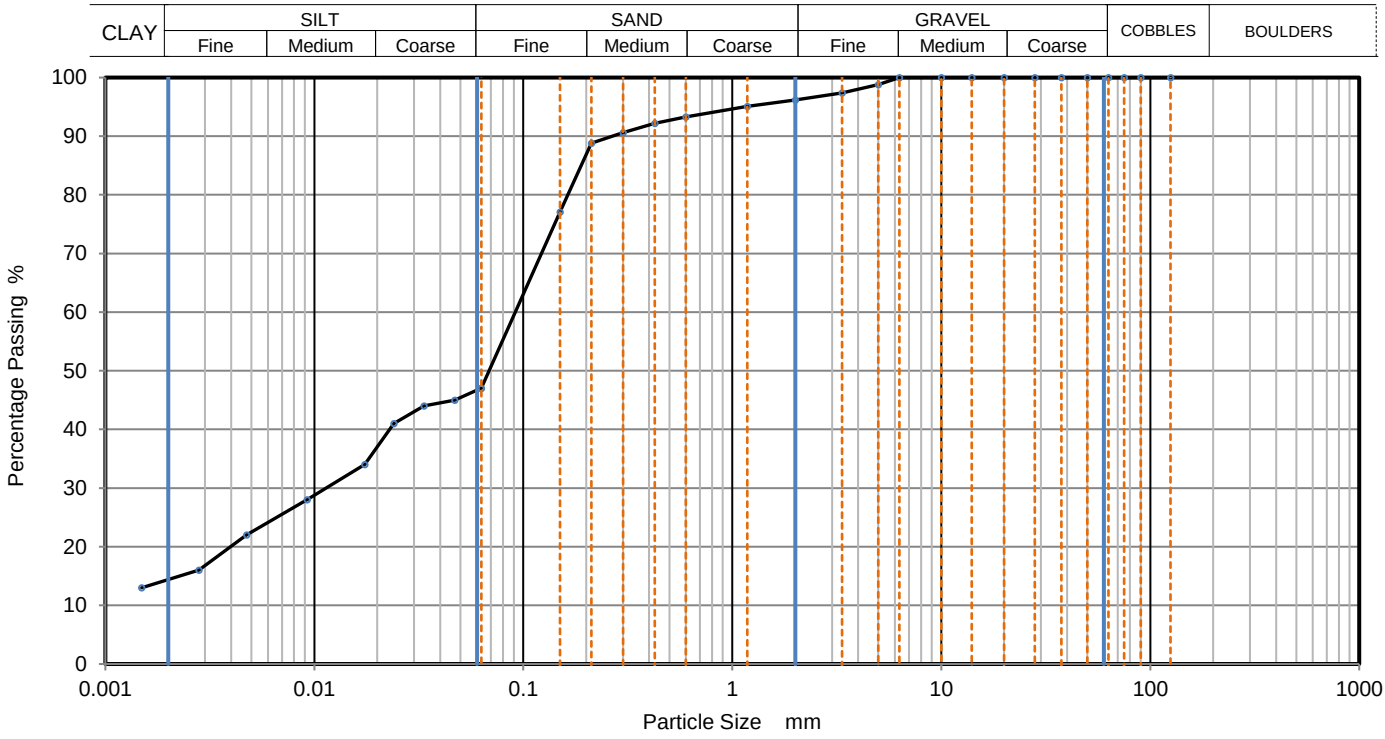
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	16
Soil Description	Brownish grey sandy silty CLAY.			Depth, m	20.60
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030818



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0626	47
90	100	0.0469	45
75	100	0.0334	44
63	100	0.0240	41
50	100	0.0174	34
37.5	100	0.0092	28
28	100	0.0047	22
20	100	0.0028	16
14	100	0.0015	13
10	100		
6.3	100		
5	99		
3.35	97		
2	96		
1.18	95		
0.6	93	Particle density	(assumed)
0.425	92	2.65	Mg/m3
0.3	91		
0.212	89		
0.15	77		
0.063	47		

Dry Mass of sample, g	197

Sample Proportions	% dry mass
Cobbles	0
Gravel	4
Sand	49
Silt	33
Clay	14

Grading Analysis		
D100	mm	
D60	mm	0.0915
D30	mm	0.0111
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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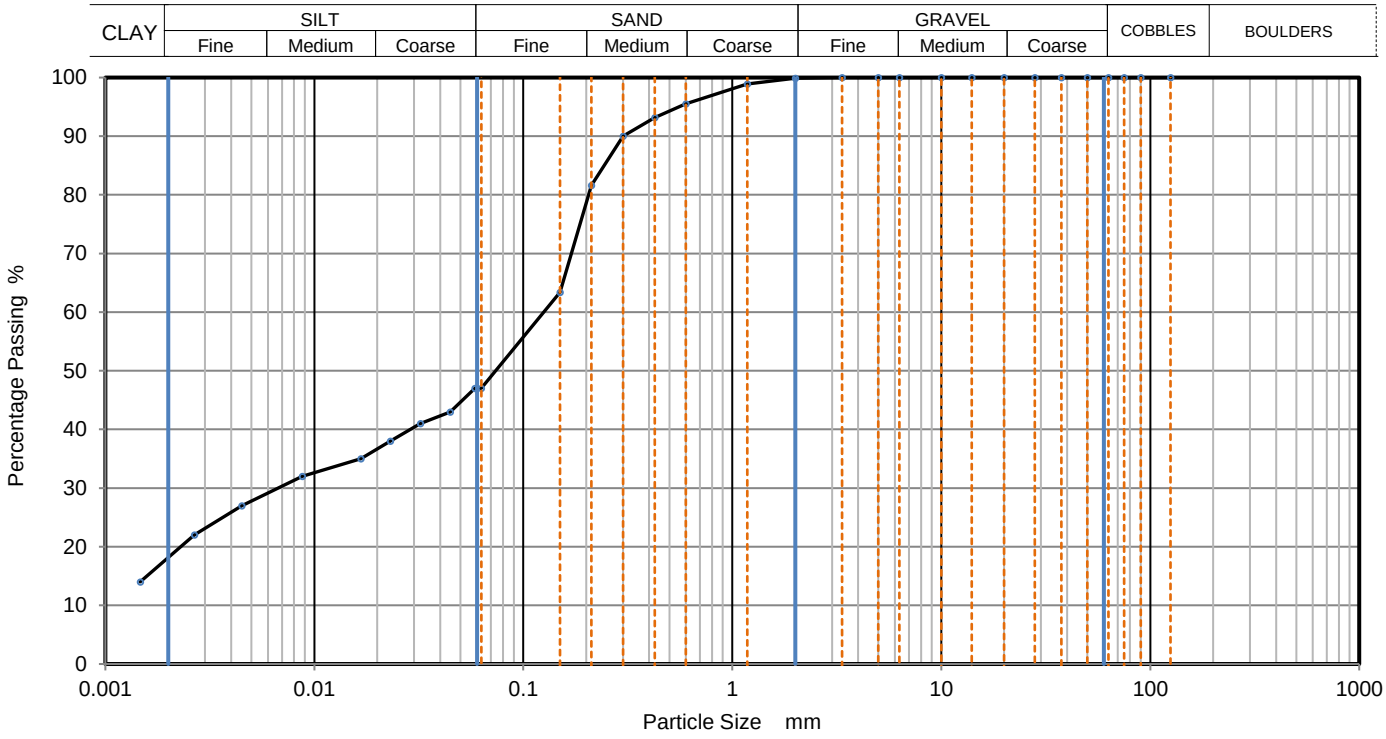
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	3
Soil Description	Blackish grey sandy silty CLAY.			Depth, m	29.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030823



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0586	47
90	100	0.0447	43
75	100	0.0322	41
63	100	0.0231	38
50	100	0.0167	35
37.5	100	0.0088	32
28	100	0.0045	27
20	100	0.0027	22
14	100	0.0015	14
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	96	Particle density	(assumed)
0.425	93	2.65	Mg/m3
0.3	90		
0.212	82		
0.15	63		
0.063	47		

Dry Mass of sample, g	198

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	53
Silt	29
Clay	18

Grading Analysis		
D100	mm	
D60	mm	0.125
D30	mm	0.00655
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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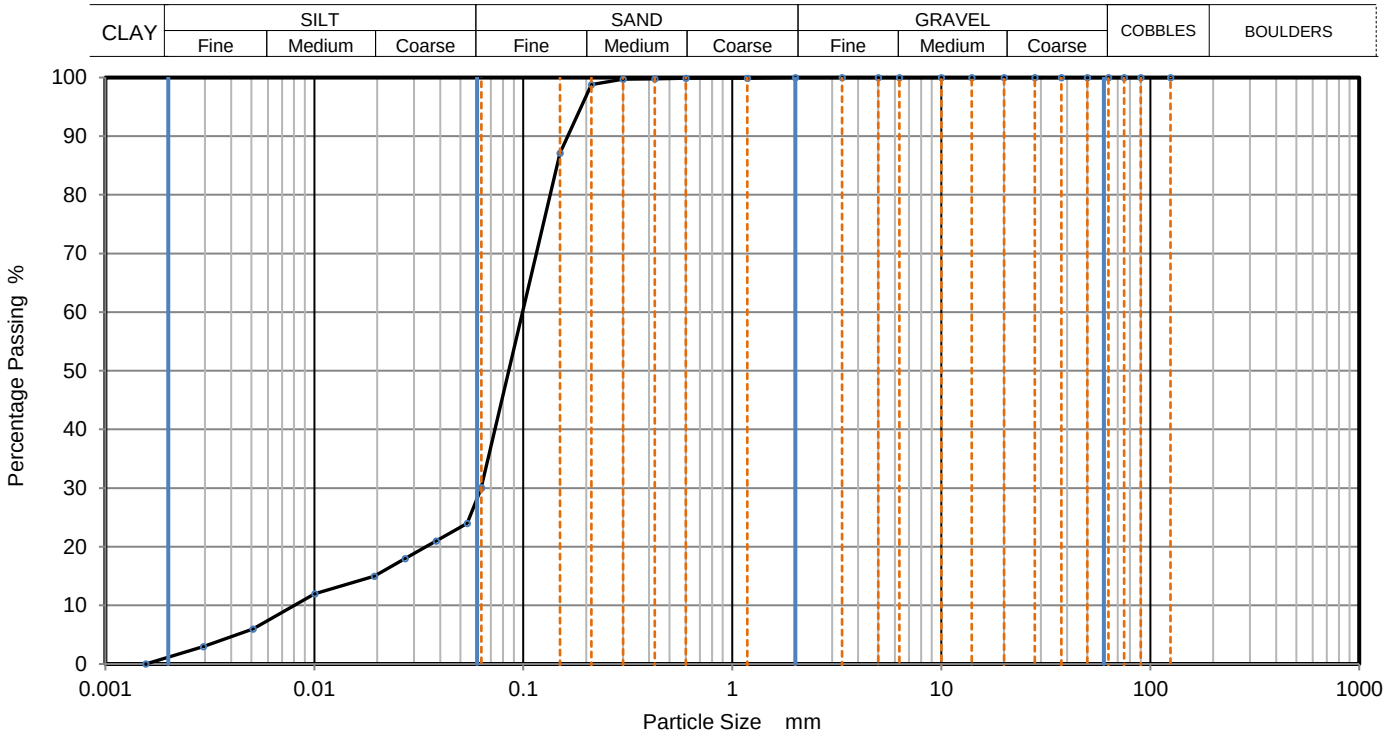
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	23
Soil Description	Grey silty fine to medium SAND.			Depth, m	38.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030825



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0538	24
75	100	0.0383	21
63	100	0.0272	18
50	100	0.0193	15
37.5	100	0.0100	12
28	100	0.0051	6
20	100	0.0029	3
14	100	0.0016	0
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	100		
0.212	99		
0.15	87		
0.063	30		

Dry Mass of sample, g: 255

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	70
Silt	29
Clay	1

Grading Analysis		
D100	mm	
D60	mm	0.0993
D30	mm	0.0629
D10	mm	0.00797
Uniformity Coefficient		12
Curvature Coefficient		5

Remarks

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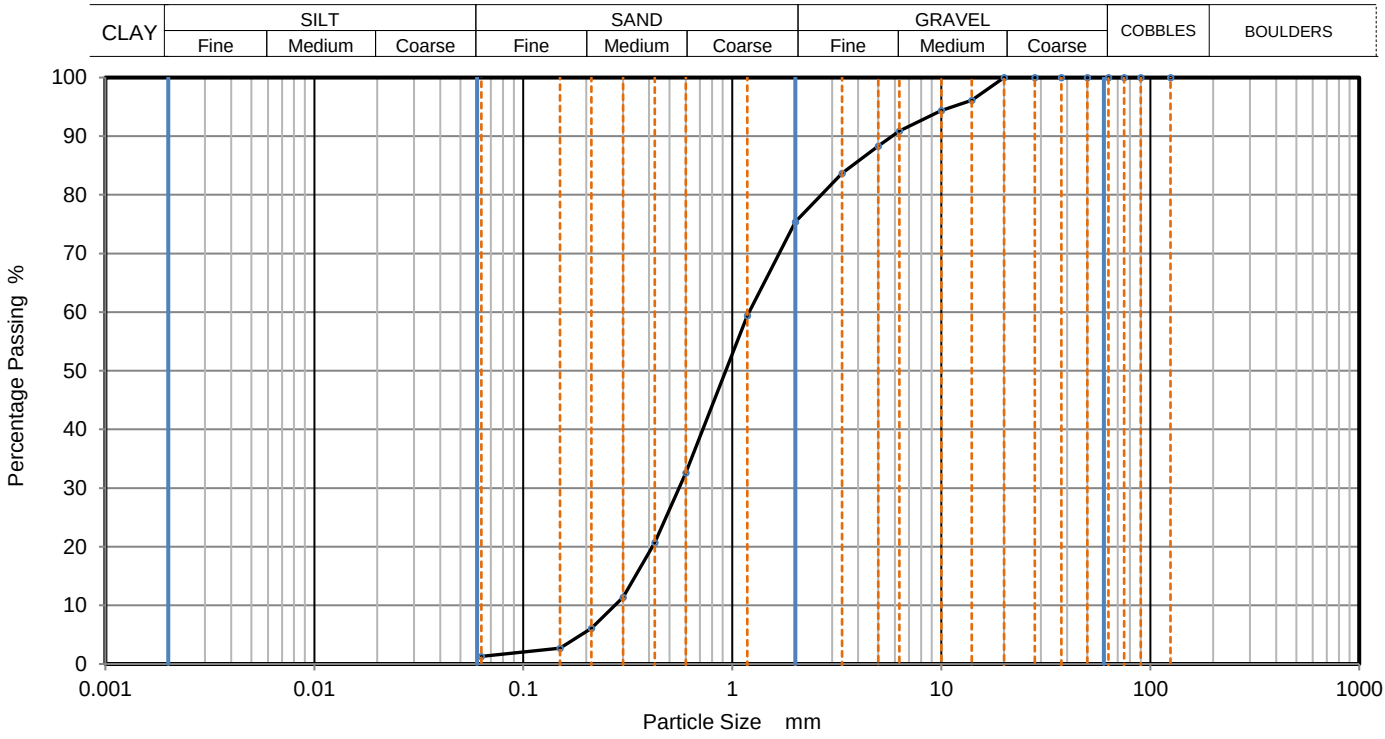
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH04
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	8
Soil Description	Blackish grey slightly gravelly fine to coarse SAND with shells and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030827



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	96		
10	94		
6.3	91		
5	88		
3.35	84		
2	75		
1.18	59		
0.6	33		
0.425	21		
0.3	11		
0.212	6		
0.15	3		
0.063	1		

Dry Mass of sample, g	356

Sample Proportions	% dry mass
Cobbles	0
Gravel	25
Sand	74
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	1.21
D30	mm	0.556
D10	mm	0.273
Uniformity Coefficient		4.4
Curvature Coefficient		0.94

Remarks

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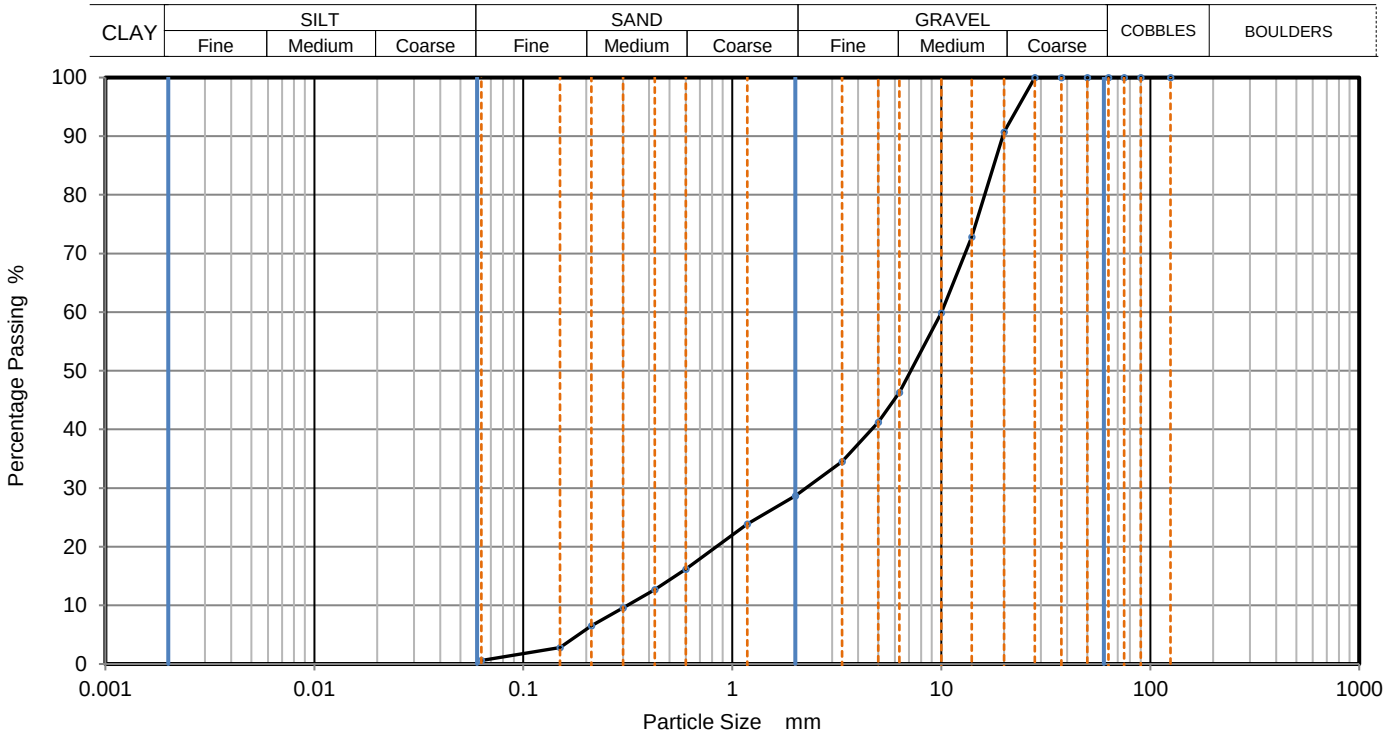
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH04
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	6
Soil Description	Reddish brown and grey sandy subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	2.10
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030828



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	91		
14	73		
10	60		
6.3	46		
5	41		
3.35	35		
2	29		
1.18	24		
0.6	16		
0.425	13		
0.3	10		
0.212	7		
0.15	3		
0.063	1		

Dry Mass of sample, g	3459

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	28
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	10
D30	mm	2.24
D10	mm	0.313
Uniformity Coefficient		32
Curvature Coefficient		1.6

Remarks

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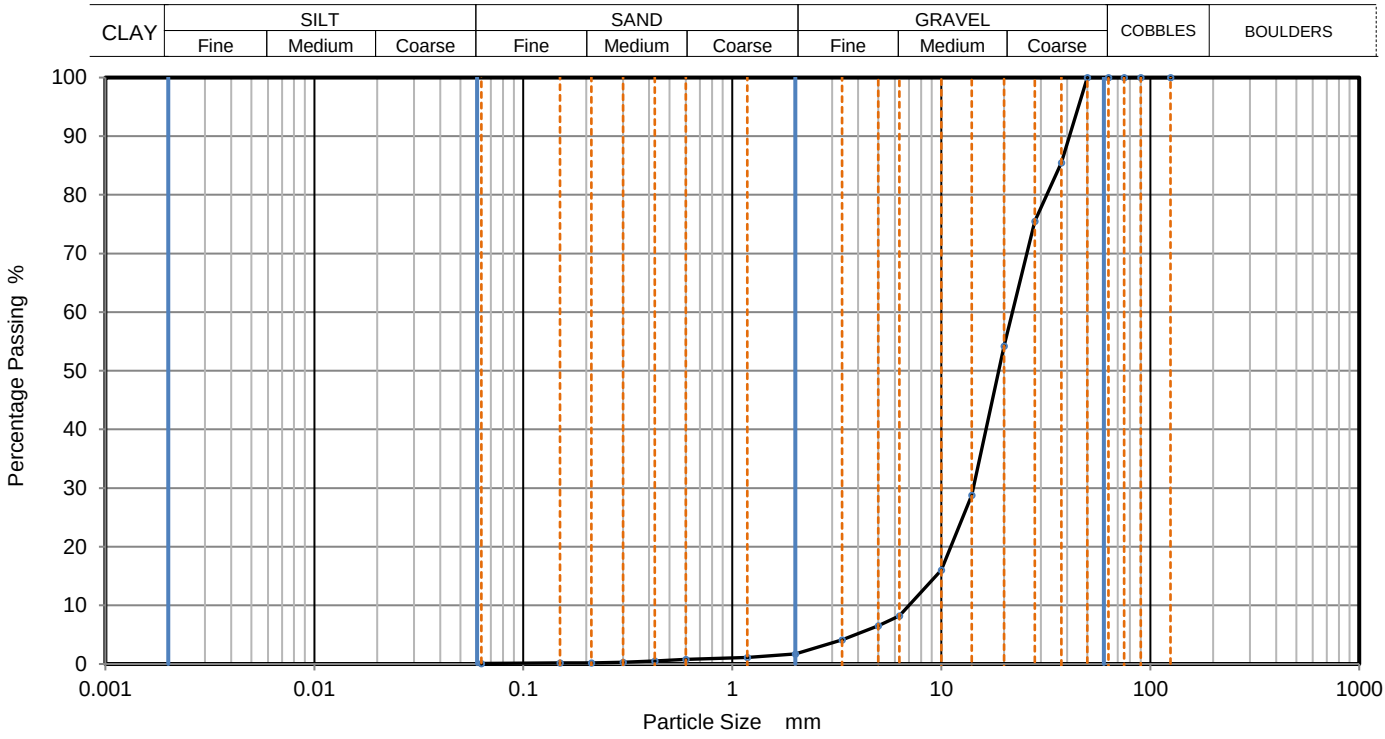
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH05
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	9
Soil Description	Grey subangular to subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030829



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	86		
28	76		
20	54		
14	29		
10	16		
6.3	8		
5	7		
3.35	4		
2	2		
1.18	1		
0.6	1		
0.425	1		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	11385

Sample Proportions	% dry mass
Cobbles	0
Gravel	98
Sand	2
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	21.9
D30	mm	14.2
D10	mm	7
Uniformity Coefficient		3.1
Curvature Coefficient		1.3

Remarks

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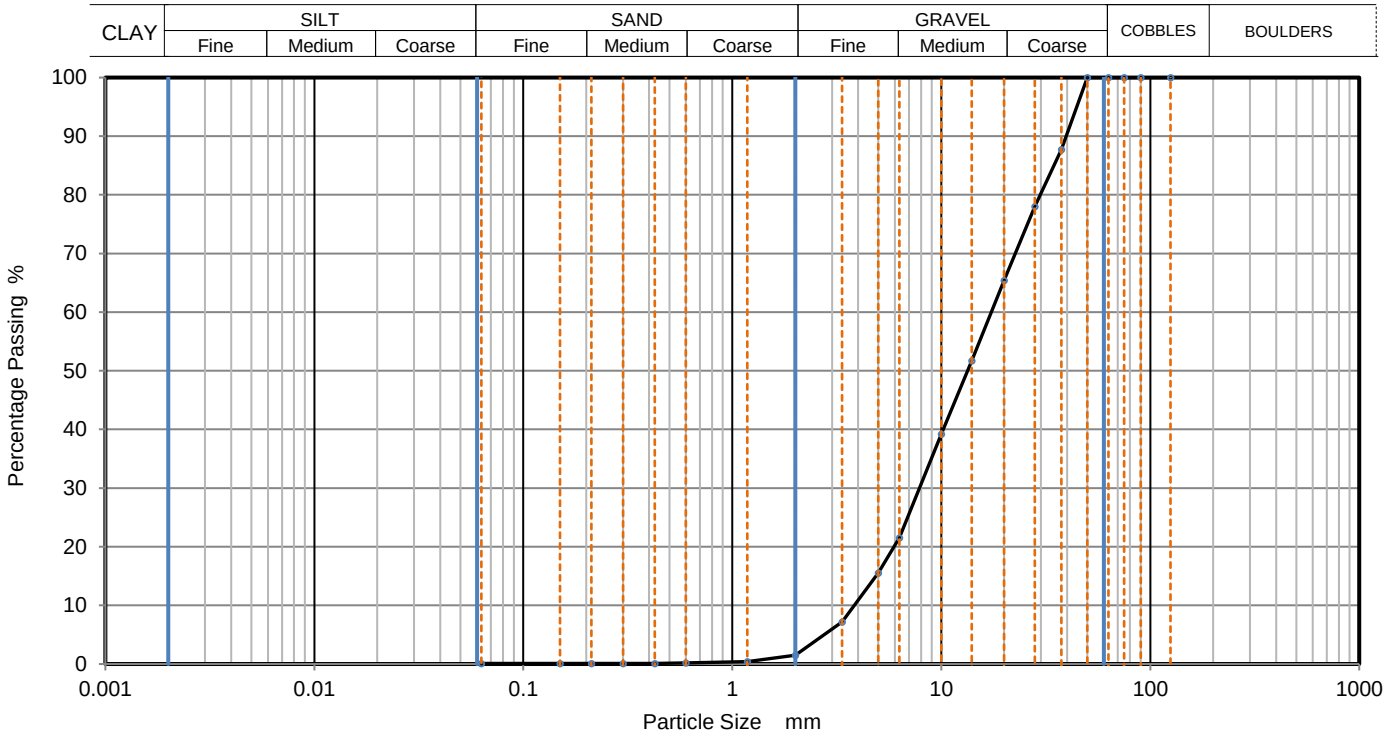
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH05
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	11
Soil Description	Reddish brown subrounded to rounded fine to coarse GRAVEL.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030830



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	88		
28	78		
20	65		
14	52		
10	39		
6.3	22		
5	16		
3.35	7		
2	2		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7807

Sample Proportions	% dry mass
Cobbles	0
Gravel	99
Sand	2
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	17.4
D30	mm	7.86
D10	mm	3.84
Uniformity Coefficient		4.5
Curvature Coefficient		0.93

Remarks

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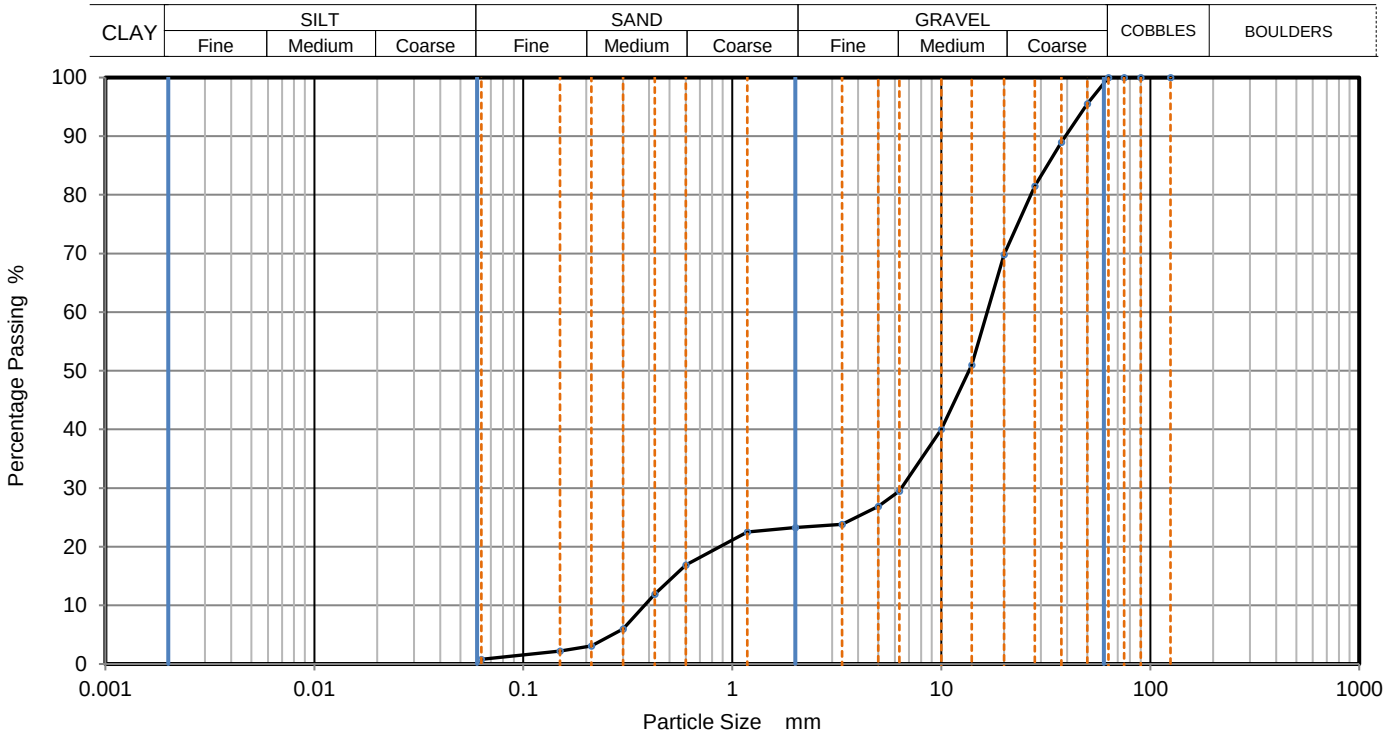
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	1
Soil Description	Grey slightly sandy subrounded fine to coarse GRAVEL.			Depth, m	1.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030831



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	89		
28	82		
20	70		
14	51		
10	40		
6.3	30		
5	27		
3.35	24		
2	23		
1.18	23		
0.6	17		
0.425	12		
0.3	6		
0.212	3		
0.15	2		
0.063	1		

Dry Mass of sample, g	6088

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	23
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	16.6
D30	mm	6.43
D10	mm	0.379
Uniformity Coefficient		44
Curvature Coefficient		6.6

Remarks

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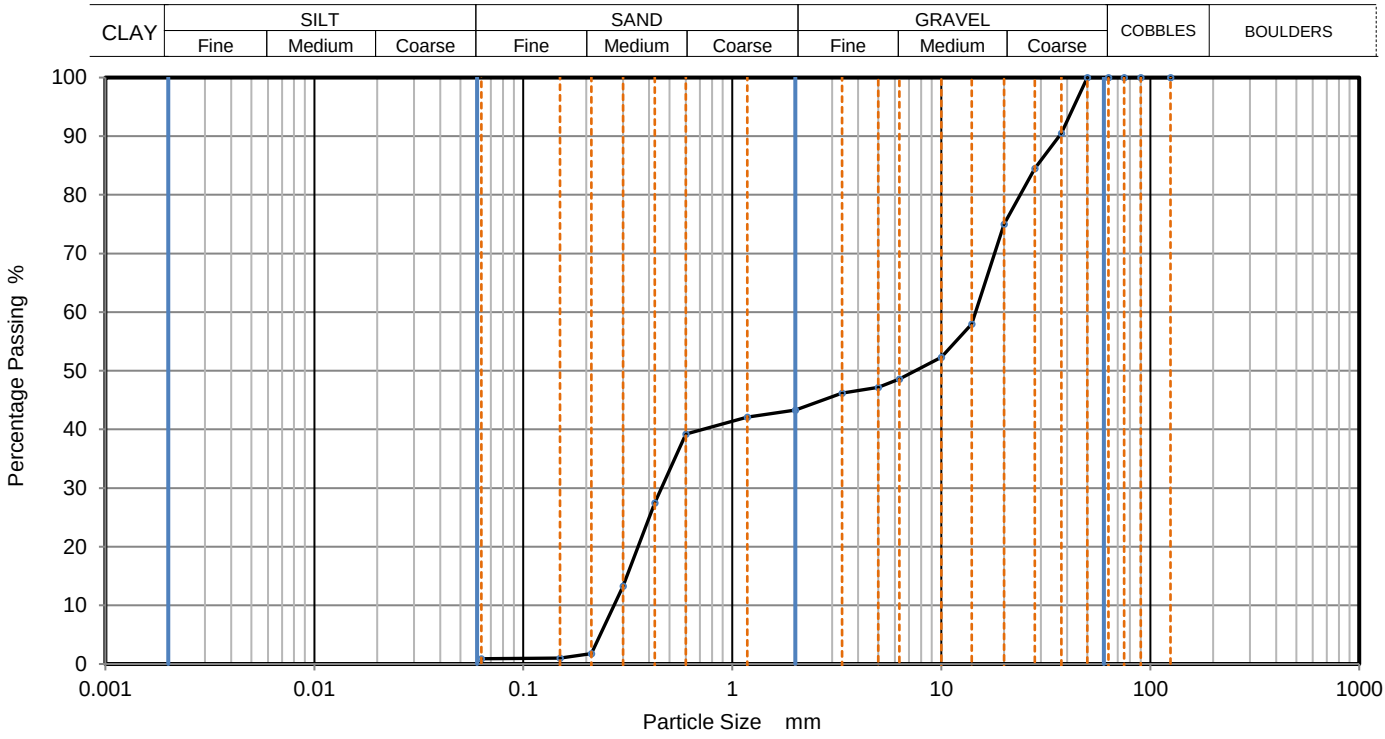
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	2
Soil Description	Grey sandy subrounded fine to coarse GRAVEL.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030832



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	91		
28	85		
20	75		
14	58		
10	52		
6.3	49		
5	47		
3.35	46		
2	43		
1.18	42		
0.6	39		
0.425	28		
0.3	13		
0.212	2		
0.15	1		
0.063	1		

Dry Mass of sample, g	2841

Sample Proportions	% dry mass
Cobbles	0
Gravel	57
Sand	42
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	14.6
D30	mm	0.458
D10	mm	0.272
Uniformity Coefficient		54
Curvature Coefficient		0.053

Remarks

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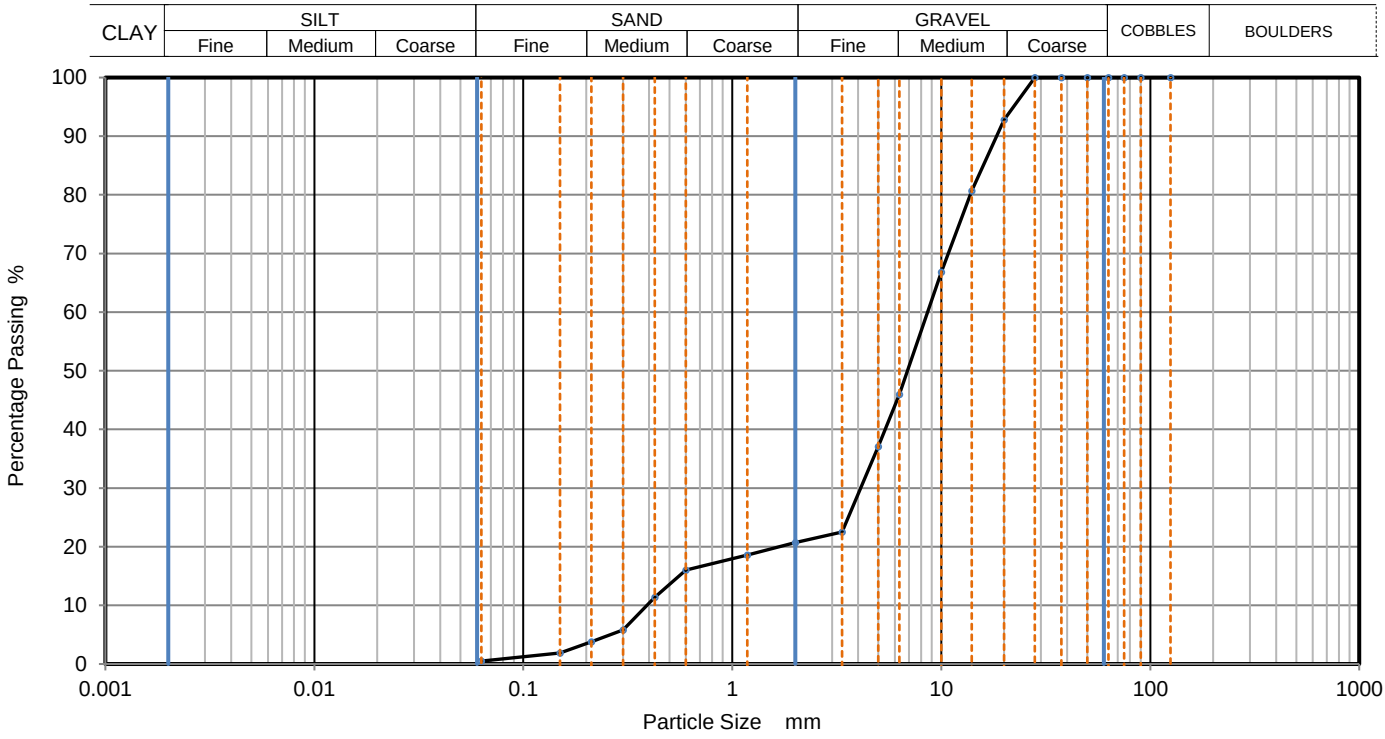
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	4
Soil Description	Grey slightly sandy subrounded fine to coarse GRAVEL.			Depth, m	4.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030833



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	81		
10	67		
6.3	46		
5	37		
3.35	23		
2	21		
1.18	19		
0.6	16		
0.425	11		
0.3	6		
0.212	4		
0.15	2		
0.063	1		

Dry Mass of sample, g	2419

Sample Proportions	% dry mass
Cobbles	0
Gravel	79
Sand	20
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	8.6
D30	mm	4.12
D10	mm	0.39
Uniformity Coefficient		22
Curvature Coefficient		5.1

Remarks

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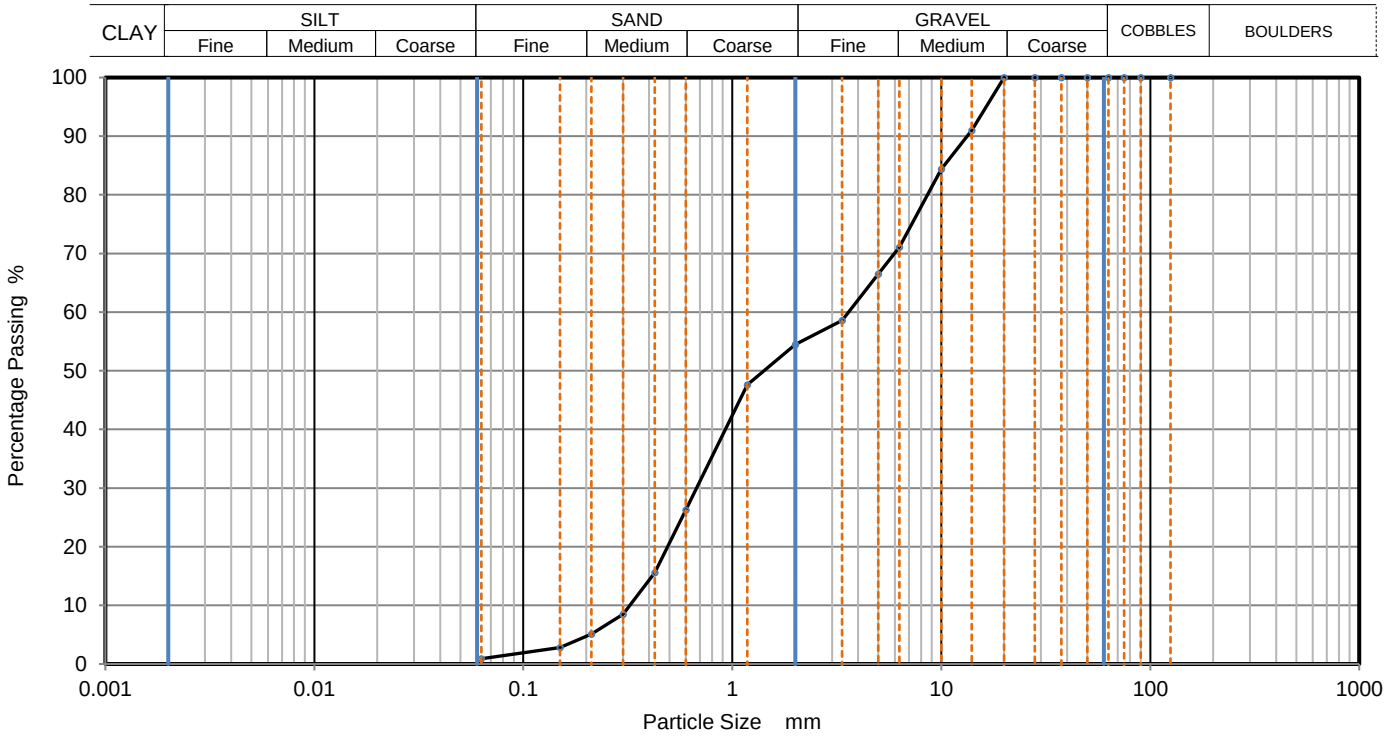
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	7
Soil Description	Grey gravelly fine to coarse SAND.			Depth, m	6.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030834



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	91		
10	84		
6.3	71		
5	67		
3.35	59		
2	55		
1.18	48		
0.6	26		
0.425	16		
0.3	9		
0.212	5		
0.15	3		
0.063	1		

Dry Mass of sample, g	731

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	54
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	3.6
D30	mm	0.676
D10	mm	0.322
Uniformity Coefficient		11
Curvature Coefficient		0.39

Remarks

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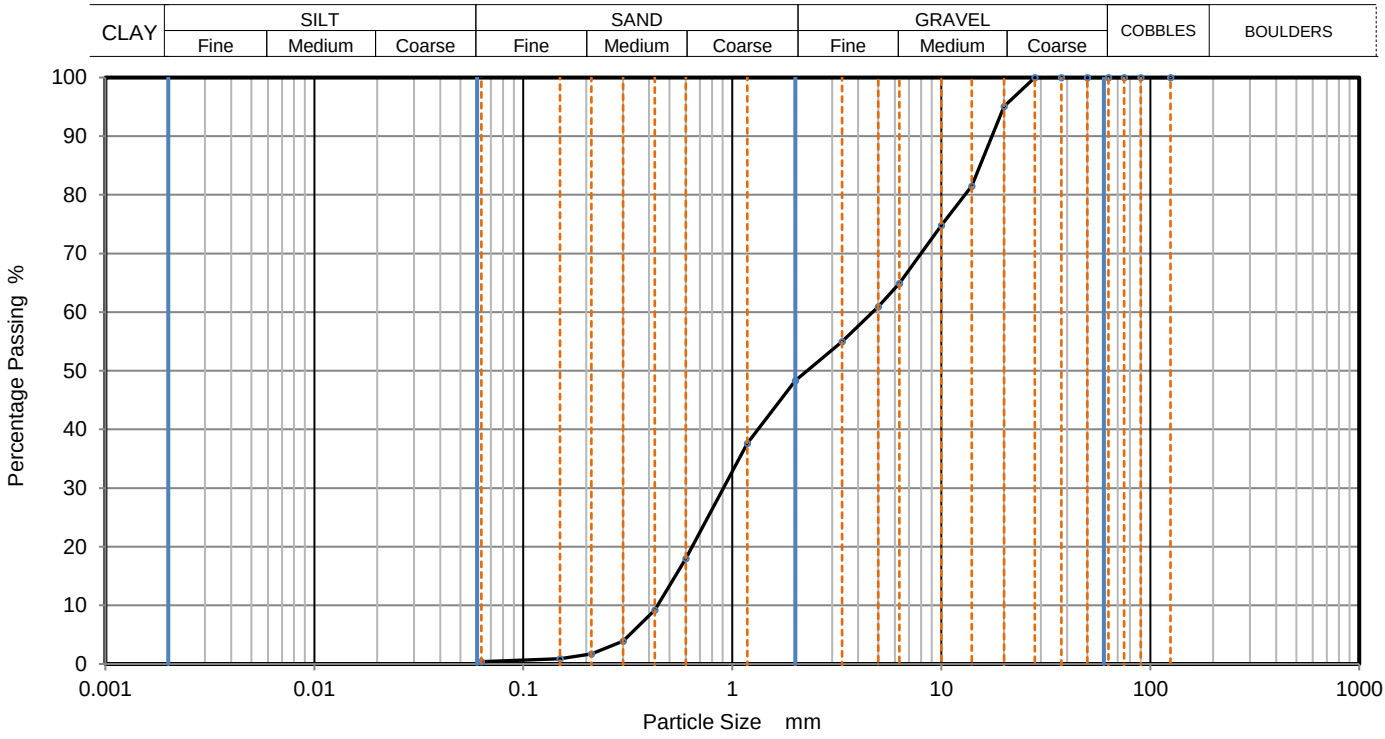
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	10
Soil Description	Grey sandy fine to coarse subangular GRAVEL.			Depth, m	9.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030836



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	95		
14	82		
10	75		
6.3	65		
5	61		
3.35	55		
2	48		
1.18	38		
0.6	18		
0.425	9		
0.3	4		
0.212	2		
0.15	1		
0.063	0		

Dry Mass of sample, g	2769

Sample Proportions	% dry mass
Cobbles	0
Gravel	52
Sand	48
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	4.7
D30	mm	0.909
D10	mm	0.439
Uniformity Coefficient		11
Curvature Coefficient		0.4

Remarks

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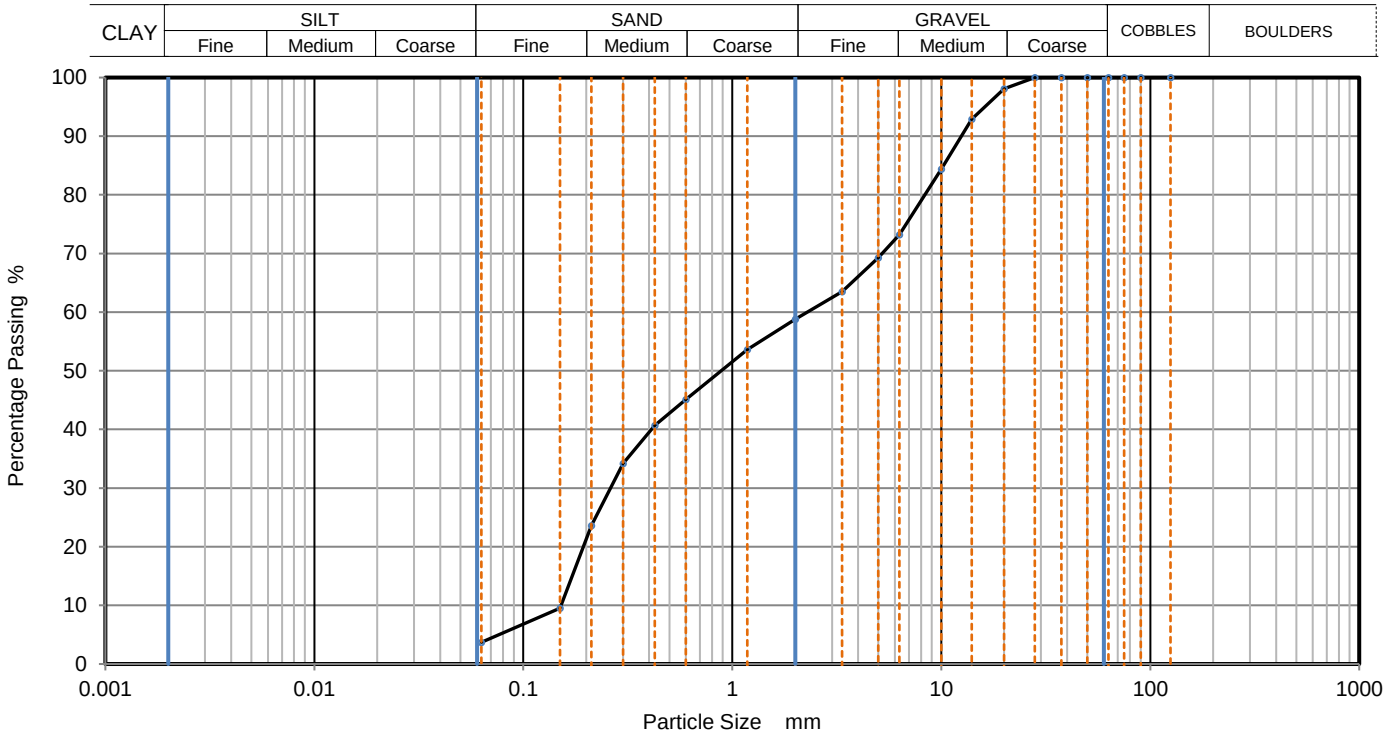
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	13
Soil Description	Brownish grey gravelly fine to coarse SAND.			Depth, m	12.20
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030837



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	93		
10	84		
6.3	73		
5	69		
3.35	64		
2	59		
1.18	54		
0.6	45		
0.425	41		
0.3	34		
0.212	24		
0.15	10		
0.063	4		

Dry Mass of sample, g	1925

Sample Proportions	% dry mass
Cobbles	0
Gravel	41
Sand	55
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	2.28
D30	mm	0.261
D10	mm	0.152
Uniformity Coefficient		15
Curvature Coefficient		0.2

Remarks

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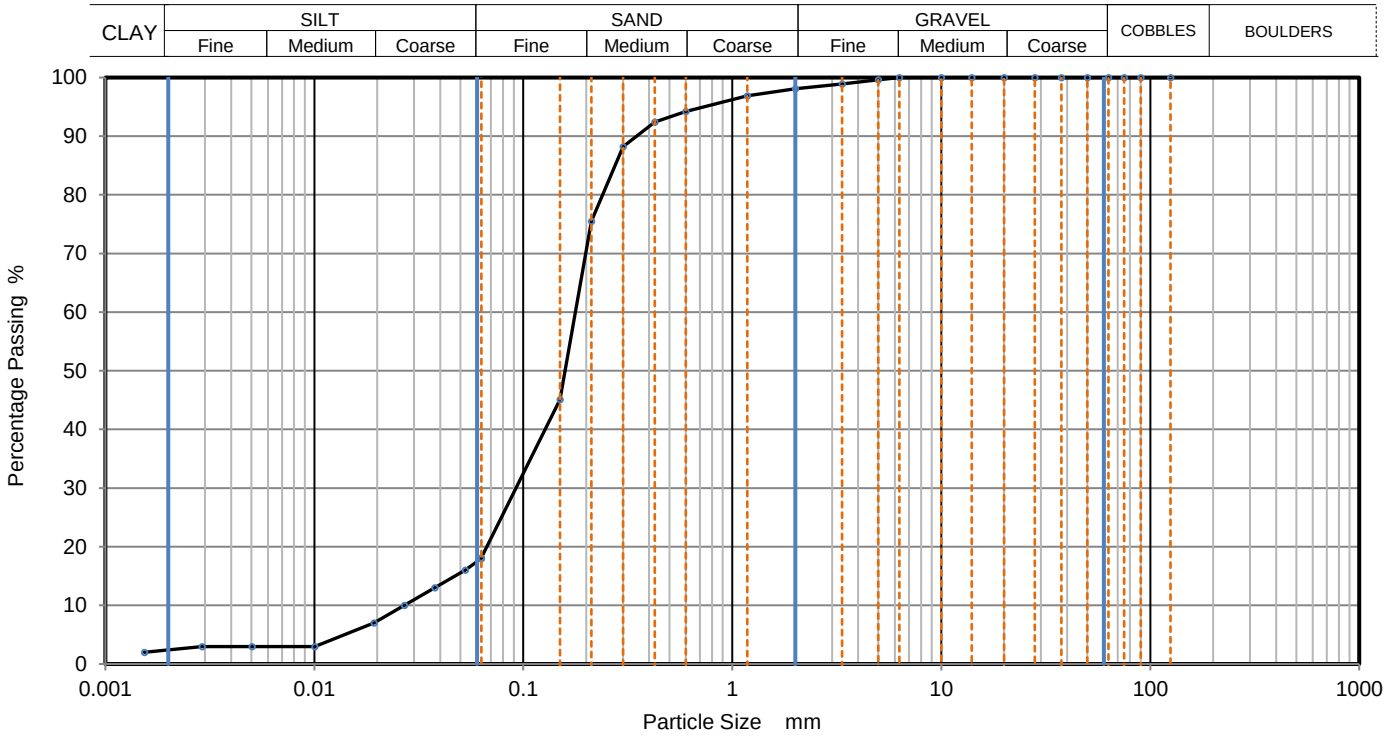
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	15
Soil Description	Greyish brown silty fine to coarse SAND.			Depth, m	15.00
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030838



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	18
90	100	0.0528	16
75	100	0.0377	13
63	100	0.0270	10
50	100	0.0193	7
37.5	100	0.0101	3
28	100	0.0050	3
20	100	0.0029	3
14	100	0.0015	2
10	100		
6.3	100		
5	100		
3.35	99		
2	98		
1.18	97		
0.6	94	Particle density	(assumed)
0.425	92	2.65	Mg/m3
0.3	88		
0.212	76		
0.15	45		
0.063	18		

Dry Mass of sample, g	331

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	80
Silt	16
Clay	2

Grading Analysis		
D100	mm	
D60	mm	0.178
D30	mm	0.0924
D10	mm	0.0273
Uniformity Coefficient		6.5
Curvature Coefficient		1.8

Remarks

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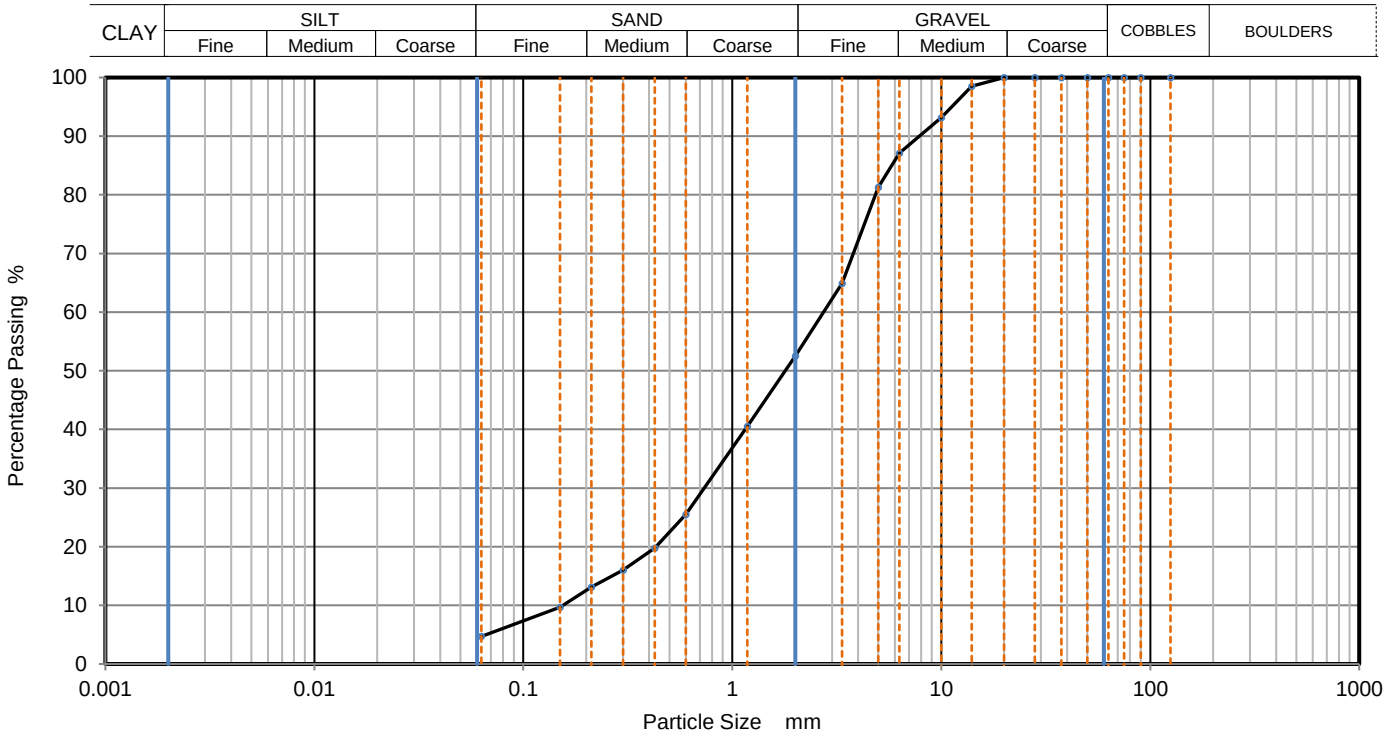
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	21
Soil Description	Grey sandy subrounded fine to coarse GRAVEL.			Depth, m	22.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030841



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	93		
6.3	87		
5	81		
3.35	65		
2	53		
1.18	41		
0.6	26		
0.425	20		
0.3	16		
0.212	13		
0.15	10		
0.063	5		

Dry Mass of sample, g	613

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	48
Fines <0.063mm	5

Grading Analysis		
D100	mm	
D60	mm	2.73
D30	mm	0.734
D10	mm	0.154
Uniformity Coefficient		18
Curvature Coefficient		1.3

Remarks

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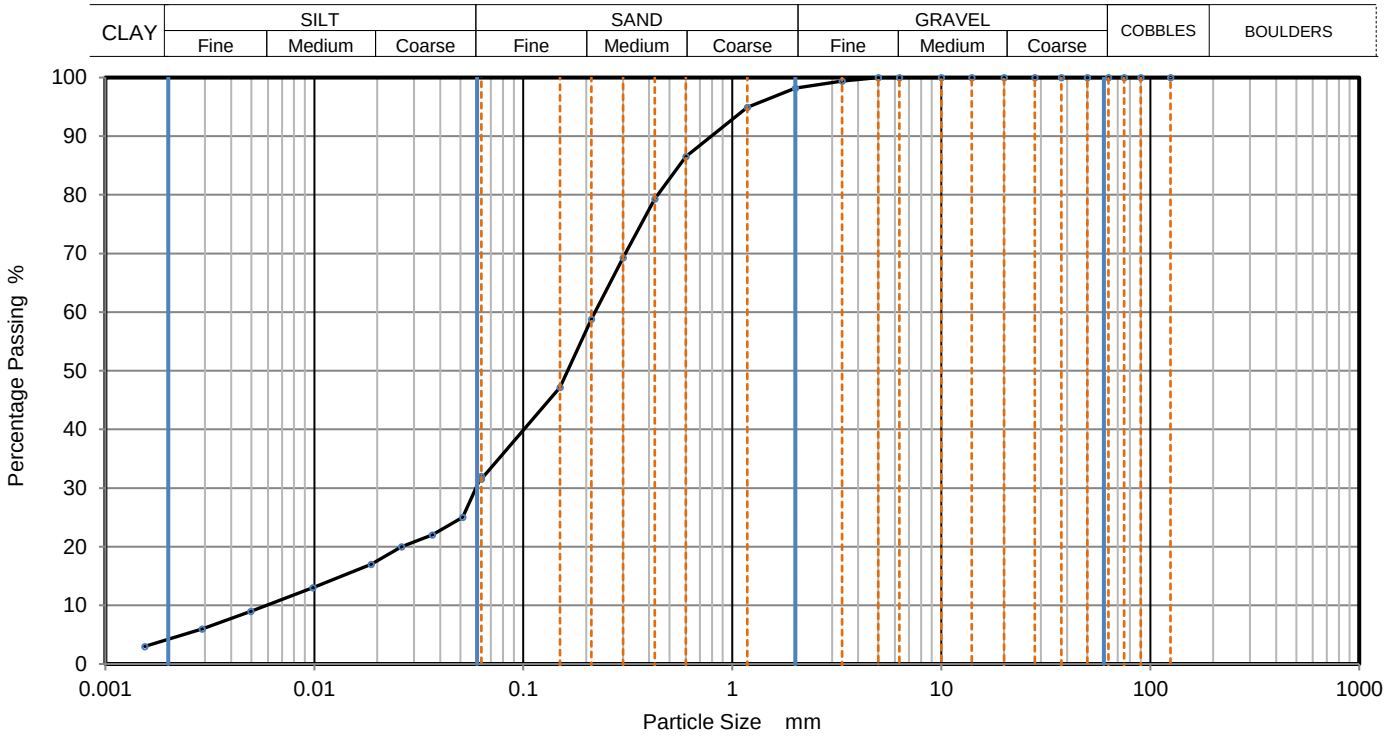
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	23
Soil Description	Brownish grey sandy subangular fine to coarse GRAVEL.			Depth, m	24.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030842



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	32
90	100	0.0513	25
75	100	0.0367	22
63	100	0.0261	20
50	100	0.0187	17
37.5	100	0.0098	13
28	100	0.0050	9
20	100	0.0029	6
14	100	0.0015	3
10	100		
6.3	100		
5	100		
3.35	99		
2	98		
1.18	95		
0.6	87	Particle density	(assumed)
0.425	79	2.65	Mg/m3
0.3	69		
0.212	59		
0.15	47		
0.063	32		

Dry Mass of sample, g	364

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	67
Silt	27
Clay	4

Grading Analysis		
D100	mm	
D60	mm	0.221
D30	mm	0.06
D10	mm	0.0056
Uniformity Coefficient		39
Curvature Coefficient		2.9

Remarks

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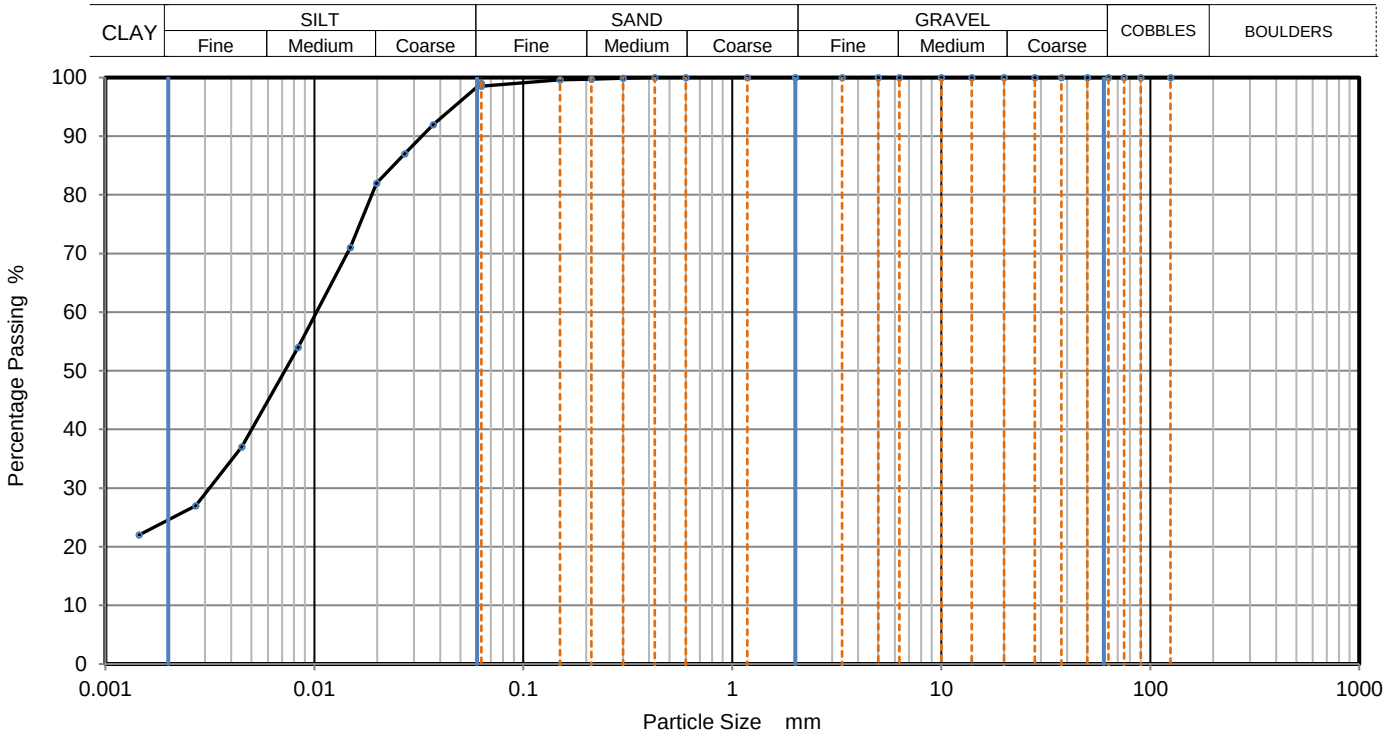
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	28
Soil Description	Grey slightly sandy clayey SILT.			Depth, m	30.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030847



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	99
90	100	0.0370	92
75	100	0.0271	87
63	100	0.0198	82
50	100	0.0149	71
37.5	100	0.0084	54
28	100	0.0045	37
20	100	0.0027	27
14	100	0.0014	22
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	100		
0.212	100		
0.15	100		
0.063	99		

Dry Mass of sample, g	258

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	2
Silt	74
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.0101
D30	mm	0.00311
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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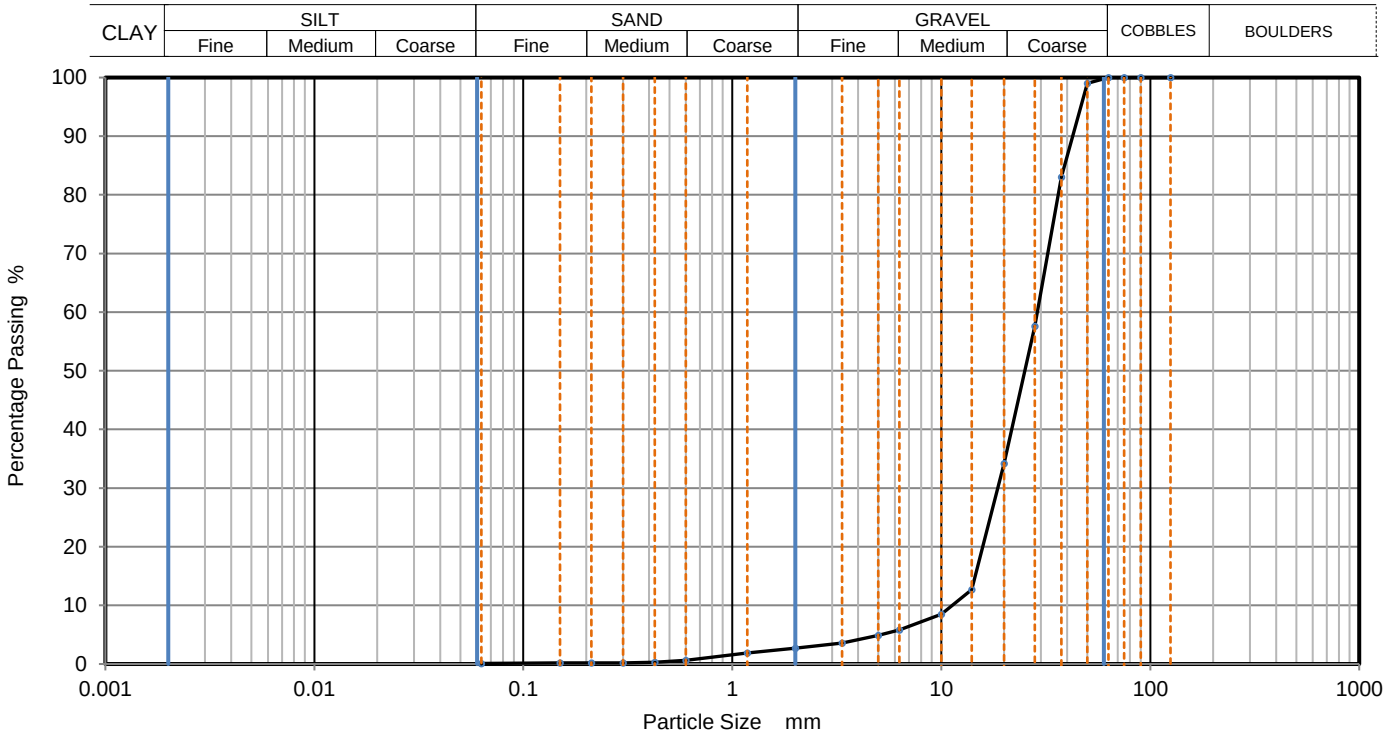
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH08
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	10
Soil Description	Reddish brown slightly sandy subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030850



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	99		
37.5	83		
28	58		
20	34		
14	13		
10	9		
6.3	6		
5	5		
3.35	4		
2	3		
1.18	2		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	15733

Sample Proportions	% dry mass
Cobbles	0
Gravel	97
Sand	3
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	28.8
D30	mm	18.6
D10	mm	11.2
Uniformity Coefficient		2.6
Curvature Coefficient		1.1

Remarks

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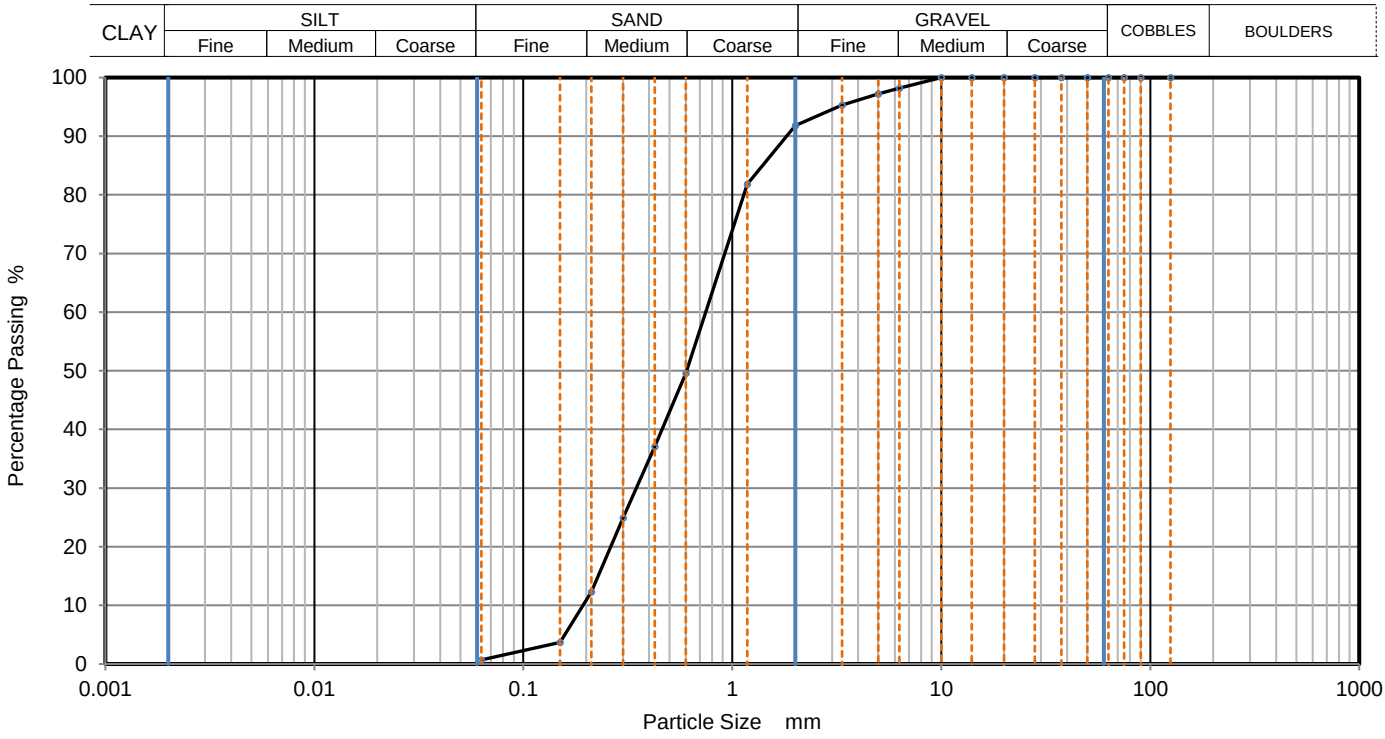
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH08
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	12
Soil Description	Reddish brown slightly gravelly fine to coarse SAND with shells and shell fragments.			Depth, m	1.70
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030851



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	98		
5	97		
3.35	95		
2	92		
1.18	82		
0.6	50		
0.425	37		
0.3	25		
0.212	12		
0.15	4		
0.063	1		

Dry Mass of sample, g	247

Sample Proportions	% dry mass
Cobbles	0
Gravel	8
Sand	91
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	0.747
D30	mm	0.347
D10	mm	0.193
Uniformity Coefficient		3.9
Curvature Coefficient		0.83

Remarks

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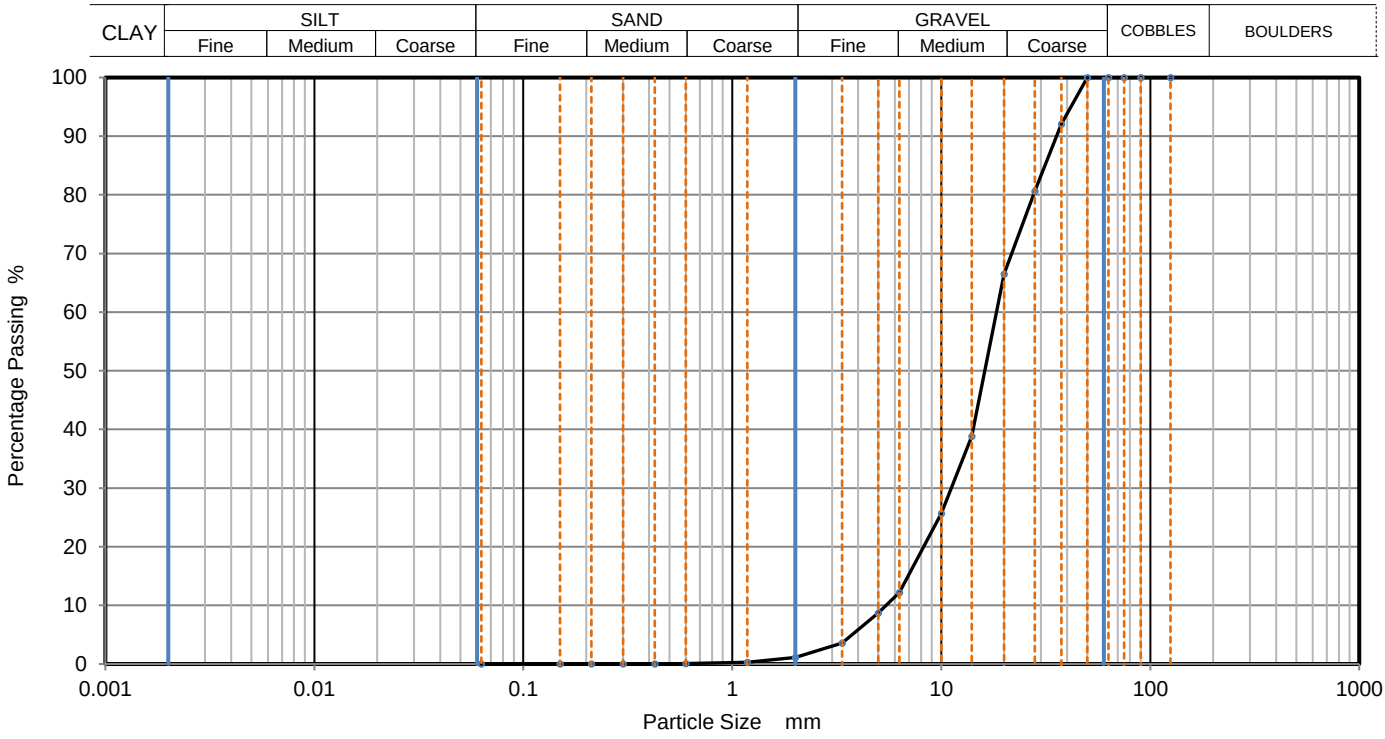
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH08
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	15
Soil Description	Reddish brown subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	4.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030852



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	92		
28	81		
20	67		
14	39		
10	26		
6.3	12		
5	9		
3.35	4		
2	1		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	15294

Sample Proportions	% dry mass
Cobbles	0
Gravel	99
Sand	1
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	18.4
D30	mm	11.2
D10	mm	5.45
Uniformity Coefficient		3.4
Curvature Coefficient		1.2

Remarks

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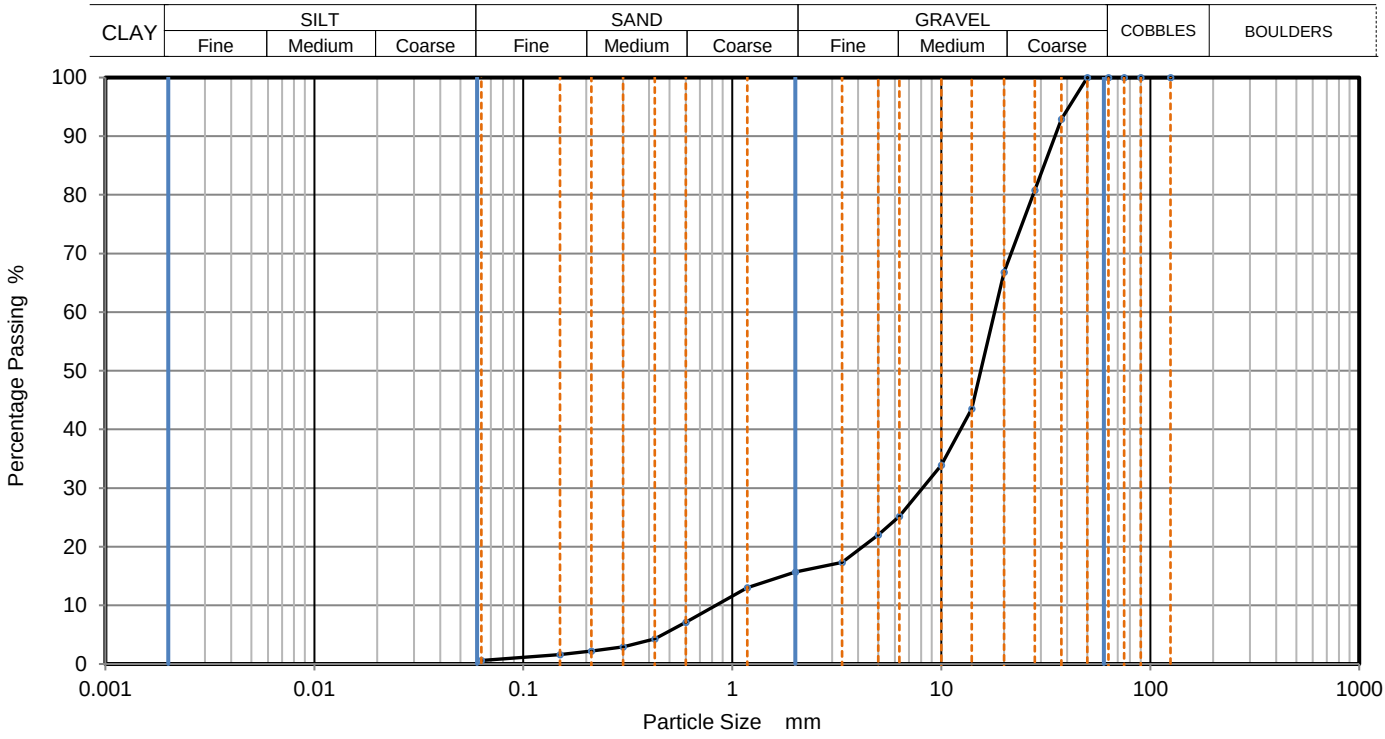
PARTICLE SIZE DISTRIBUTION

				Job Ref	**17-0769**
				Borehole/Pit No.	BH09
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	11
Soil Description	Reddish brown slightly sandy subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030853



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	93		
28	81		
20	67		
14	44		
10	34		
6.3	25		
5	22		
3.35	17		
2	16		
1.18	13		
0.6	7		
0.425	4		
0.3	3		
0.212	2		
0.15	2		
0.063	1		

Dry Mass of sample, g	6492

Sample Proportions	% dry mass
Cobbles	0
Gravel	84
Sand	15
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	18
D30	mm	8.13
D10	mm	0.835
Uniformity Coefficient		22
Curvature Coefficient		4.4

Remarks

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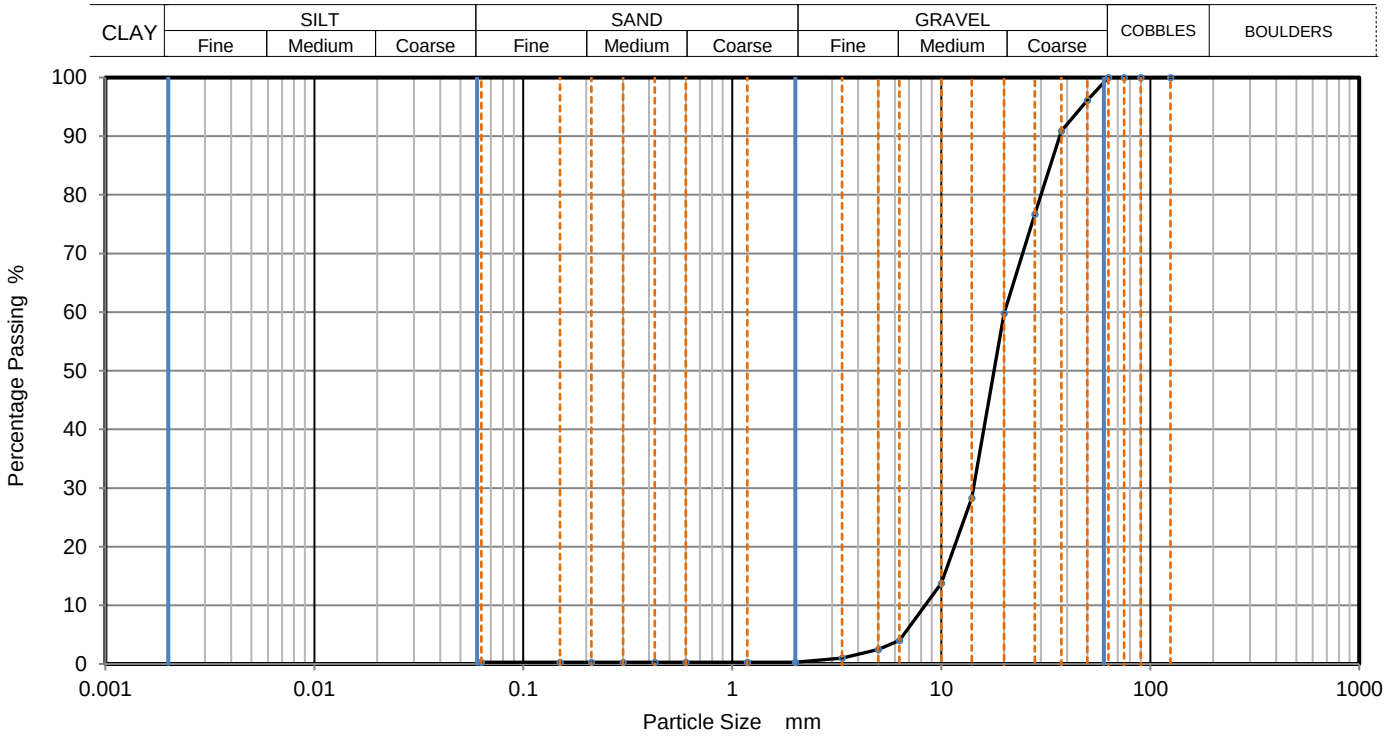
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH09
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	12
Soil Description	Reddish brown subrounded fine to coarse GRAVEL with shells and shell fragments.			Depth, m	0.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030854



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	91		
28	77		
20	60		
14	28		
10	14		
6.3	4		
5	3		
3.35	1		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	9669

Sample Proportions	% dry mass
Cobbles	0
Gravel	100
Sand	0
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	20.1
D30	mm	14.3
D10	mm	8.37
Uniformity Coefficient		2.4
Curvature Coefficient		1.2

Remarks

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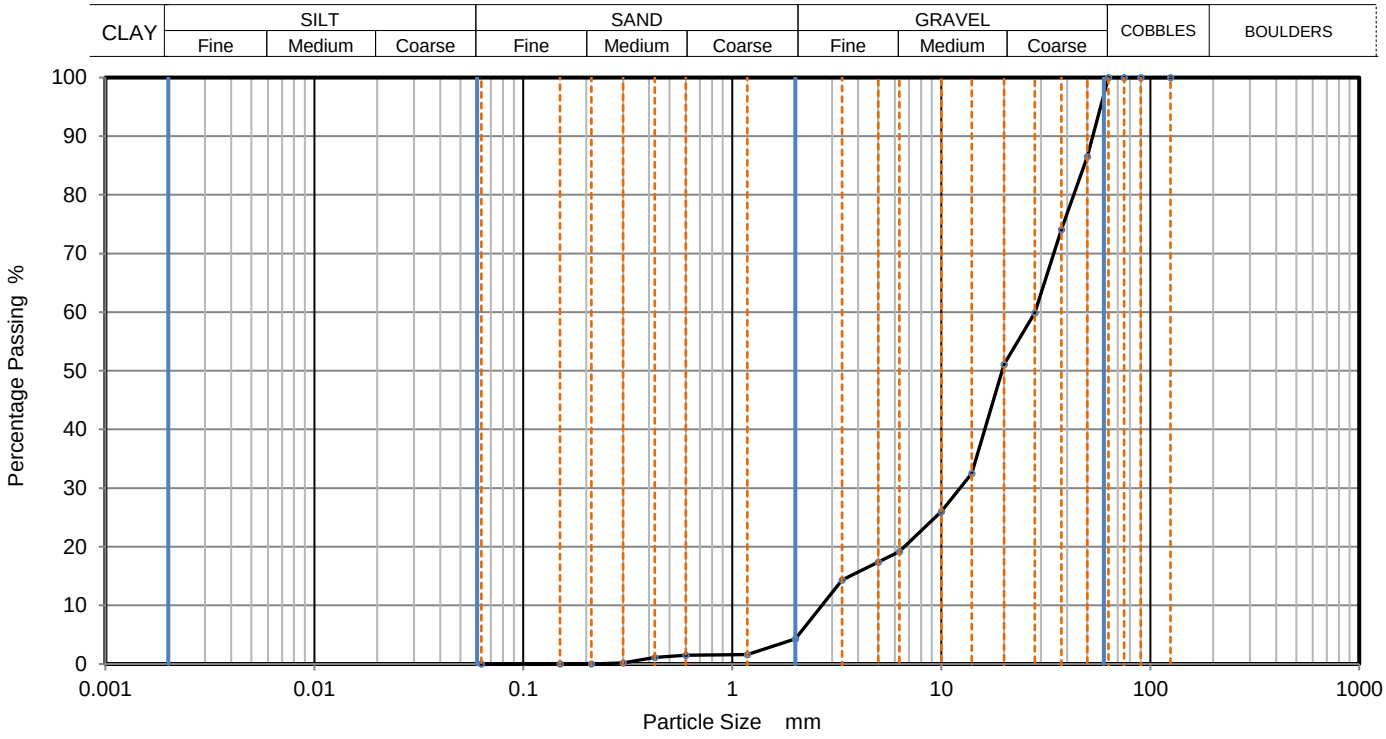
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH09
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	15
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030855



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	87		
37.5	74		
28	60		
20	51		
14	33		
10	26		
6.3	19		
5	17		
3.35	14		
2	4		
1.18	2		
0.6	2		
0.425	1		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	12969

Sample Proportions	% dry mass
Cobbles	0
Gravel	96
Sand	4
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	28.1
D30	mm	12.3
D10	mm	2.69
Uniformity Coefficient		10
Curvature Coefficient		2

Remarks

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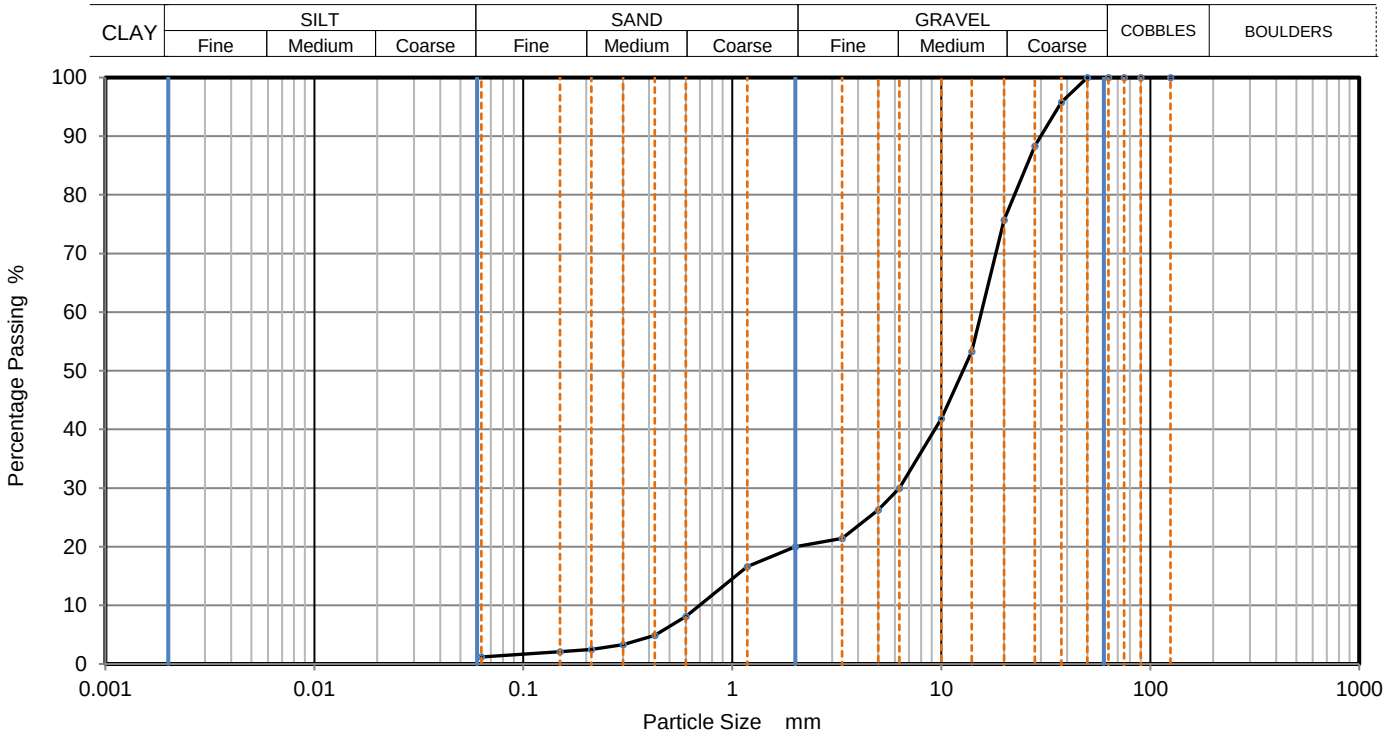
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	3
Soil Description	Grey slightly sandy subangular fine to coarse GRAVEL.			Depth, m	0.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030856



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	88		
20	76		
14	53		
10	42		
6.3	30		
5	26		
3.35	21		
2	20		
1.18	17		
0.6	8		
0.425	5		
0.3	3		
0.212	3		
0.15	2		
0.063	1		

Dry Mass of sample, g	6339

Sample Proportions	% dry mass
Cobbles	0
Gravel	80
Sand	19
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	15.6
D30	mm	6.31
D10	mm	0.697
Uniformity Coefficient		22
Curvature Coefficient		3.7

Remarks

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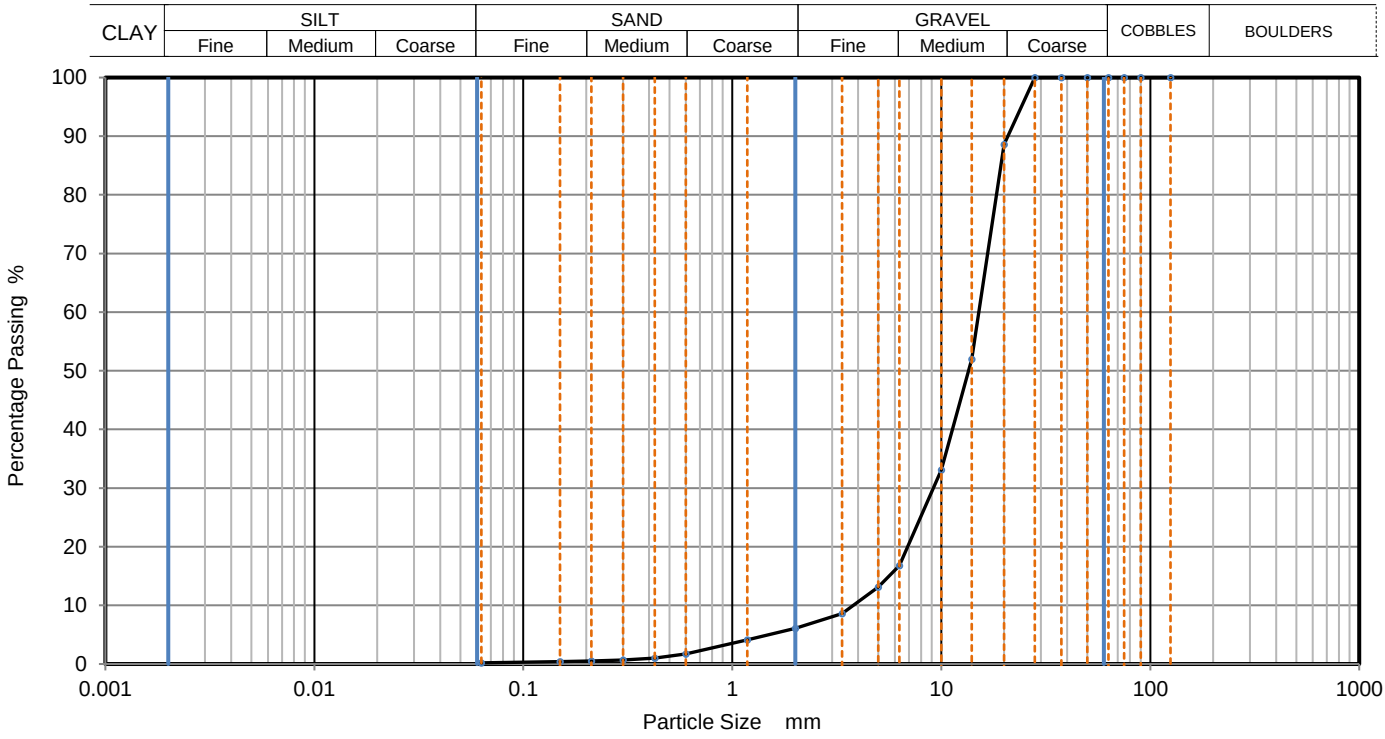
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Reddish brown slightly sandy subangular to subrounded fine to coarse GRAVEL.			Depth, m	2.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030857



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	89		
14	52		
10	33		
6.3	17		
5	13		
3.35	9		
2	6		
1.18	4		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	0		
0.063	0		

Dry Mass of sample, g	2474

Sample Proportions	% dry mass
Cobbles	0
Gravel	94
Sand	6
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	15.1
D30	mm	9.16
D10	mm	3.8
Uniformity Coefficient		4
Curvature Coefficient		1.5

Remarks

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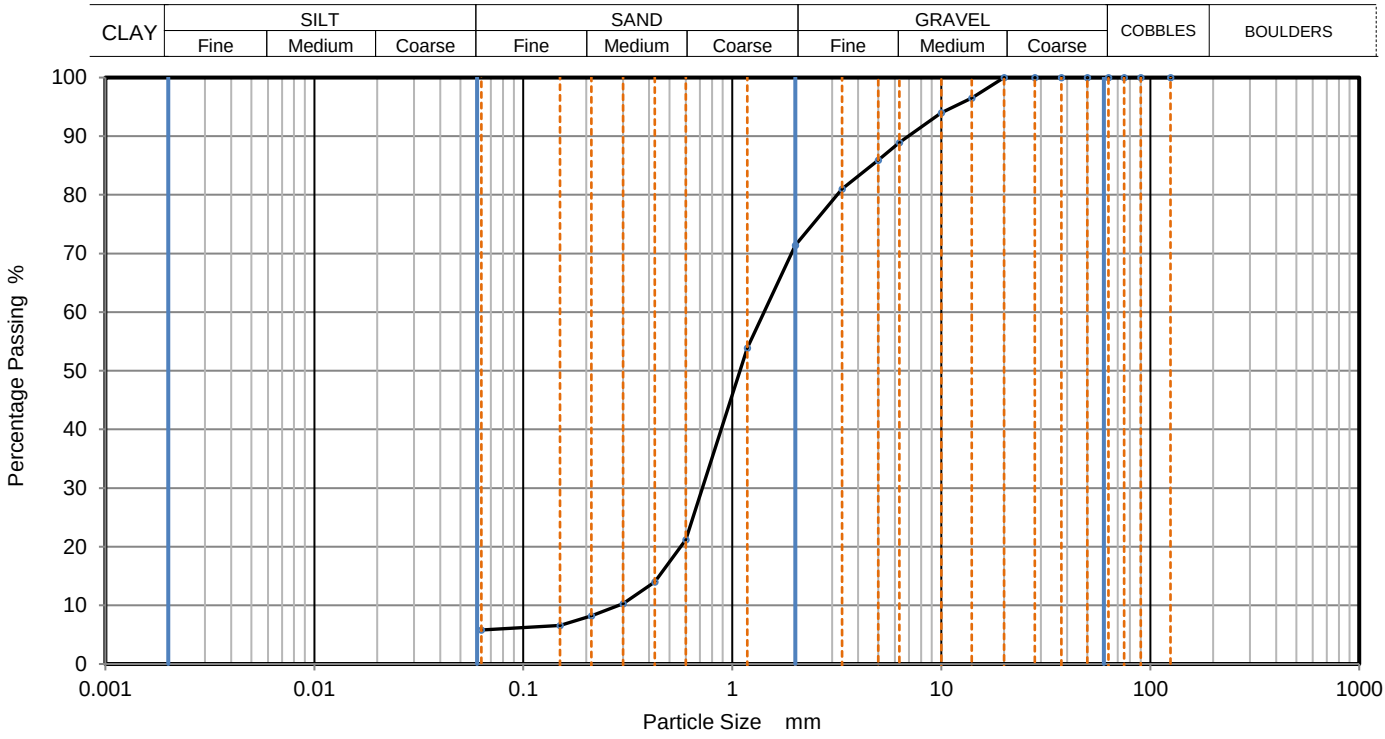
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	8
Soil Description	Grey slightly gravelly fine to coarse SAND with shells and shell fragments.			Depth, m	5.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030858



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	97		
10	94		
6.3	89		
5	86		
3.35	81		
2	71		
1.18	54		
0.6	21		
0.425	14		
0.3	10		
0.212	8		
0.15	7		
0.063	6		

Dry Mass of sample, g	356

Sample Proportions	% dry mass
Cobbles	0
Gravel	29
Sand	66
Fines <0.063mm	6

Grading Analysis		
D100	mm	
D60	mm	1.42
D30	mm	0.72
D10	mm	0.286
Uniformity Coefficient		4.9
Curvature Coefficient		1.3

Remarks

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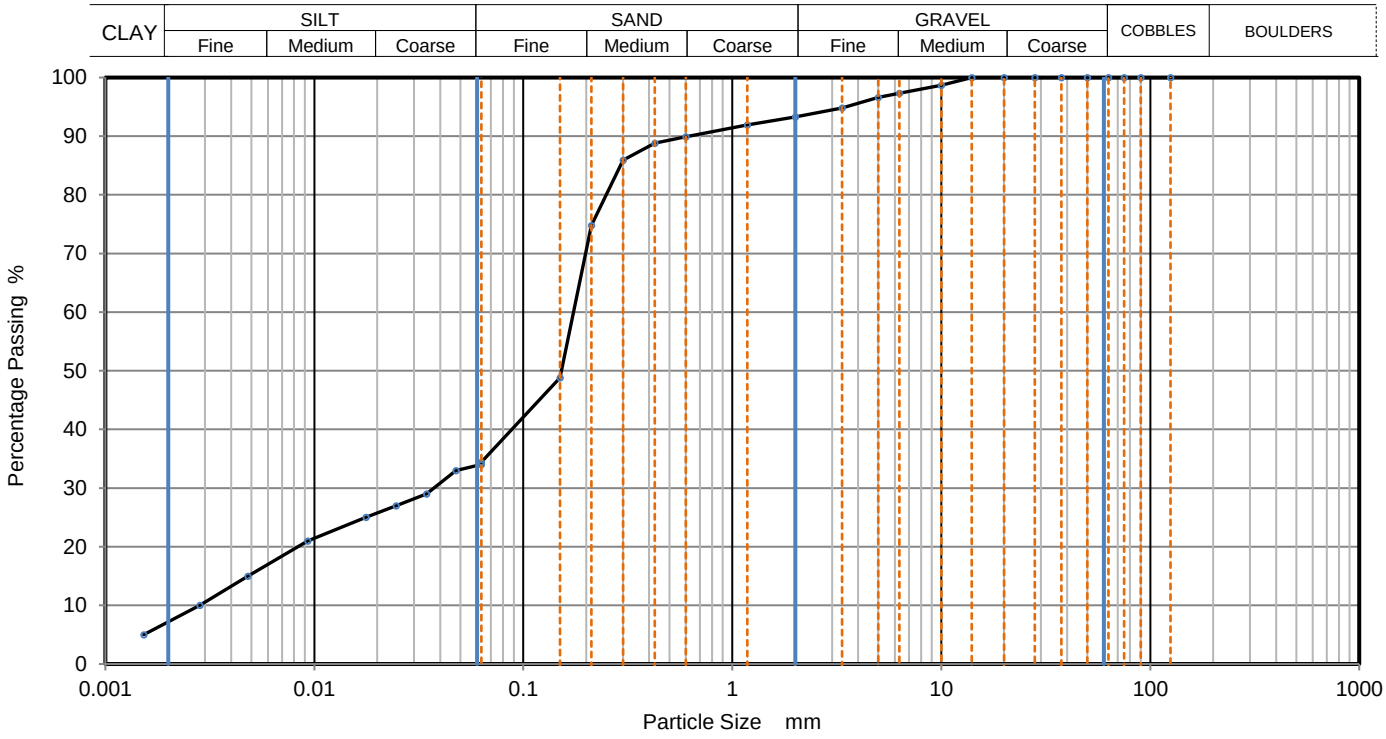
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	11
Soil Description	Grey slightly silty fine to medium SAND.			Depth, m	7.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030859



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	34
90	100	0.0476	33
75	100	0.0344	29
63	100	0.0247	27
50	100	0.0177	25
37.5	100	0.0093	21
28	100	0.0048	15
20	100	0.0028	10
14	100	0.0015	5
10	99		
6.3	97		
5	97		
3.35	95		
2	93		
1.18	92		
0.6	90	Particle density	(assumed)
0.425	89	2.65	Mg/m3
0.3	86		
0.212	75		
0.15	49		
0.063	34		

Dry Mass of sample, g	235

Sample Proportions	% dry mass
Cobbles	0
Gravel	7
Sand	59
Silt	27
Clay	7

Grading Analysis		
D100	mm	
D60	mm	0.174
D30	mm	0.036
D10	mm	0.00289
Uniformity Coefficient		60
Curvature Coefficient		2.6

Remarks

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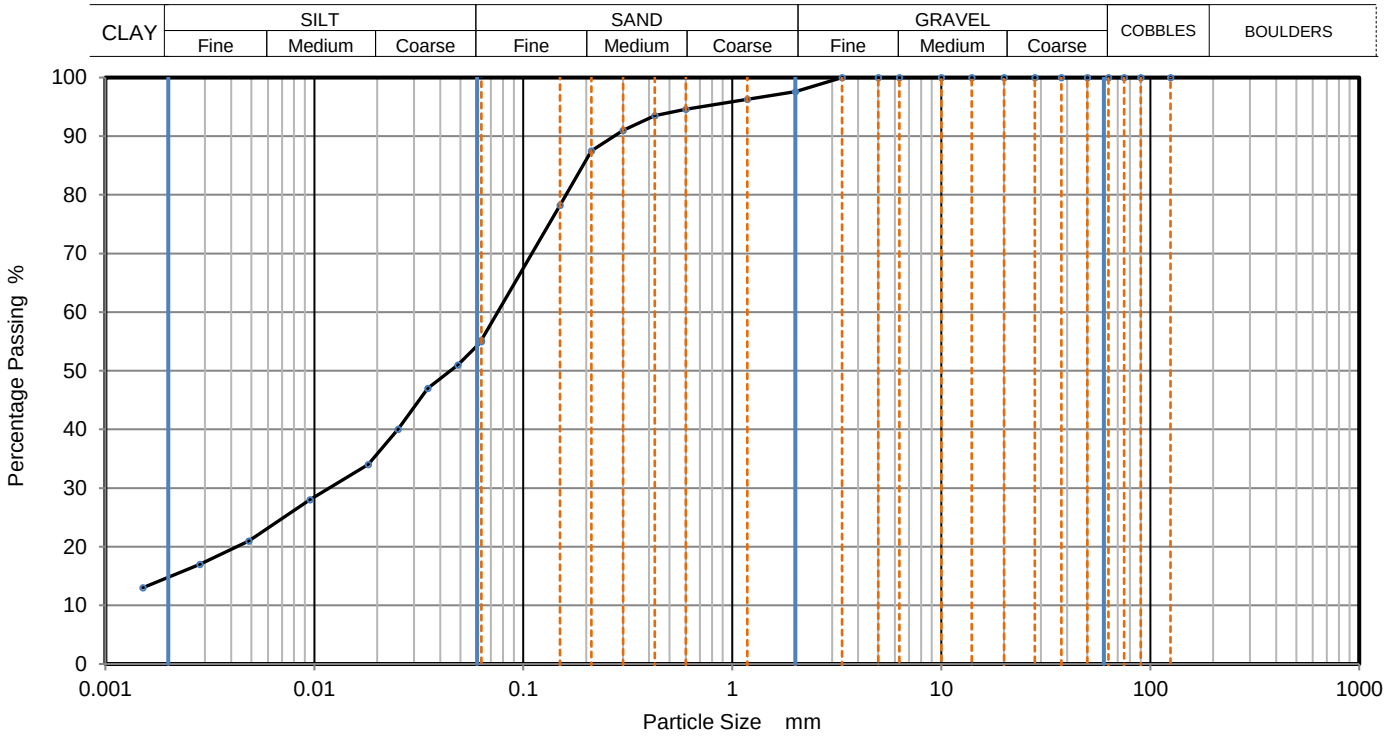
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	13
Soil Description	Brownish grey sandy slightly gravelly clayey SILT.			Depth, m	9.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030861



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	55
90	100	0.0486	51
75	100	0.0349	47
63	100	0.0252	40
50	100	0.0181	34
37.5	100	0.0095	28
28	100	0.0049	21
20	100	0.0028	17
14	100	0.0015	13
10	100		
6.3	100		
5	100		
3.35	100		
2	98		
1.18	96		
0.6	95	Particle density	(assumed)
0.425	94	2.65	Mg/m3
0.3	91		
0.212	88		
0.15	78		
0.063	55		

Dry Mass of sample, g	176

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	42
Silt	41
Clay	15

Grading Analysis		
D100	mm	
D60	mm	0.0755
D30	mm	0.0122
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

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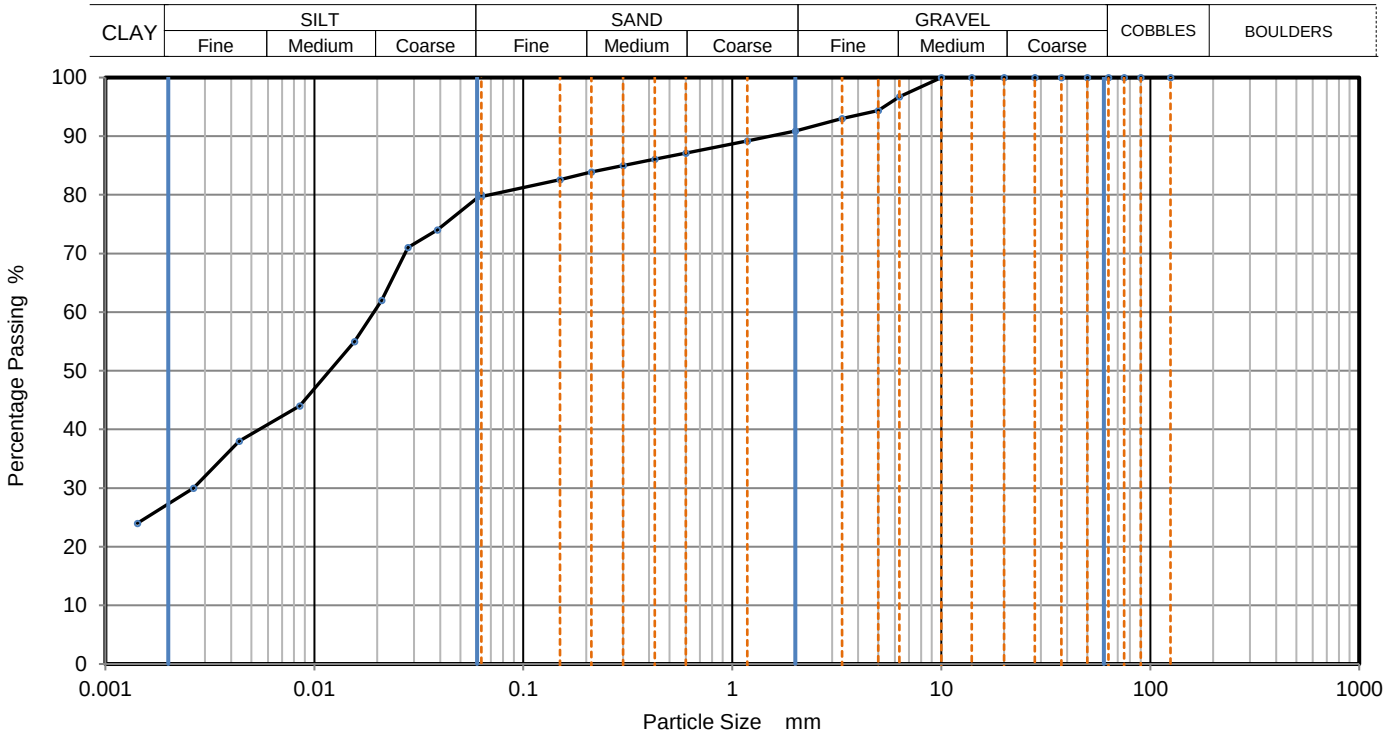
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	18
Soil Description	Greenish grey slightly sandy slightly gravelly clayey SILT.			Depth, m	13.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030863



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	80
90	100	0.0388	74
75	100	0.0280	71
63	100	0.0210	62
50	100	0.0156	55
37.5	100	0.0085	44
28	100	0.0044	38
20	100	0.0026	30
14	100	0.0014	24
10	100		
6.3	97		
5	94		
3.35	93		
2	91		
1.18	89		
0.6	87	Particle density	(assumed)
0.425	86	2.65	Mg/m3
0.3	85		
0.212	84		
0.15	83		
0.063	80		

Dry Mass of sample, g	172

Sample Proportions	% dry mass
Cobbles	0
Gravel	9
Sand	11
Silt	53
Clay	27

Grading Analysis		
D100	mm	
D60	mm	0.0194
D30	mm	0.00271
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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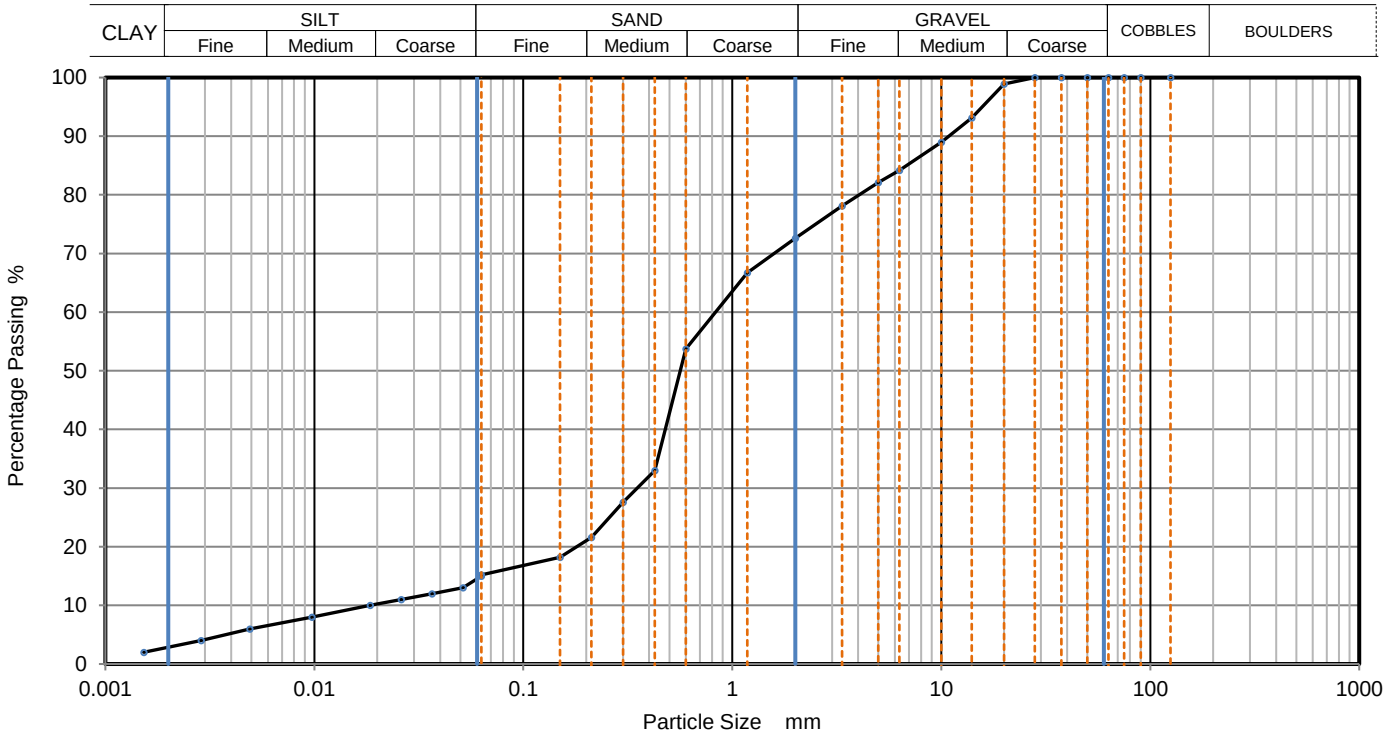
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH12
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	7
Soil Description	Grey sandy slightly gravelly SILT.			Depth, m	0.00
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030867



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	15
90	100	0.0514	13
75	100	0.0366	12
63	100	0.0260	11
50	100	0.0185	10
37.5	100	0.0097	8
28	100	0.0049	6
20	99	0.0029	4
14	93	0.0015	2
10	89		
6.3	84		
5	82		
3.35	78		
2	73		
1.18	67		
0.6	54	Particle density	(assumed)
0.425	33	2.65	Mg/m3
0.3	28		
0.212	22		
0.15	18		
0.063	15		

Dry Mass of sample, g	1181

Sample Proportions	% dry mass
Cobbles	0
Gravel	27
Sand	57
Silt	13
Clay	3

Grading Analysis		
D100	mm	
D60	mm	0.831
D30	mm	0.35
D10	mm	0.0167
Uniformity Coefficient		50
Curvature Coefficient		8.8

Remarks

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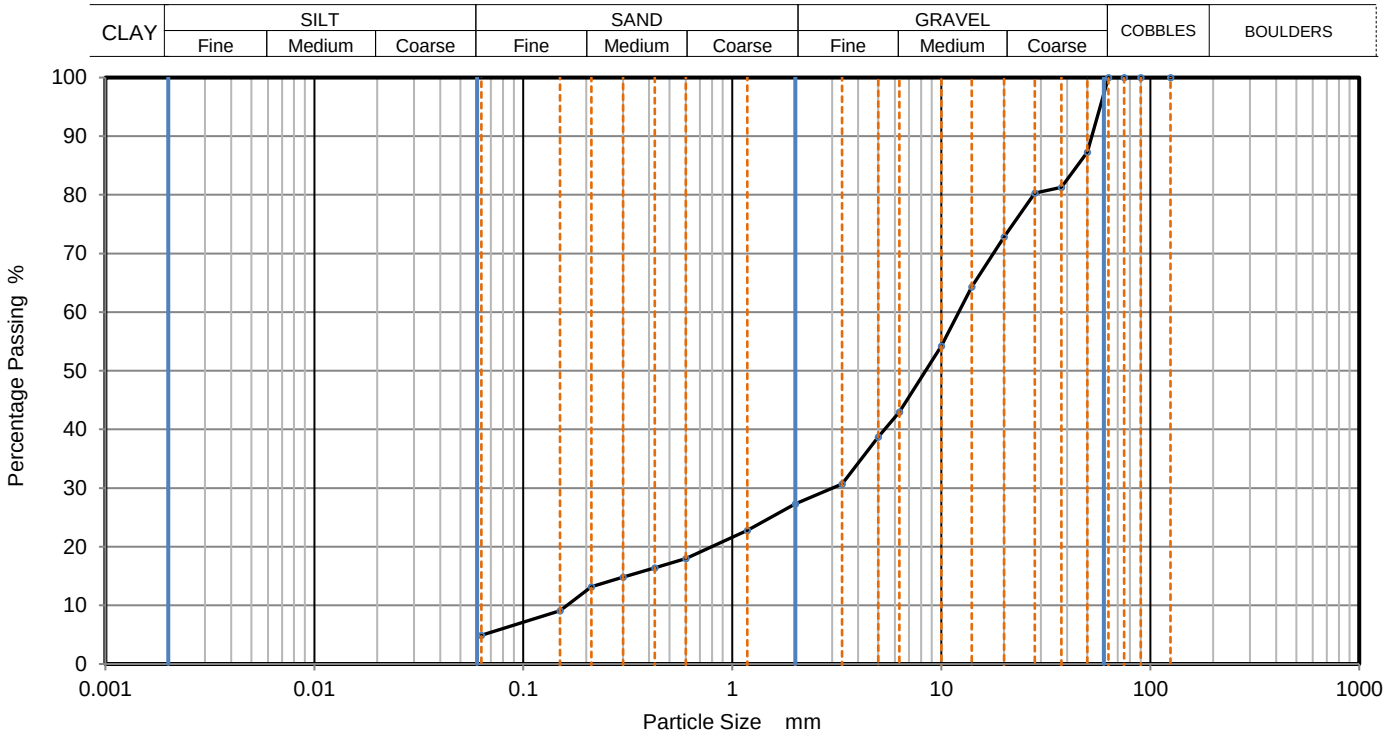
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH12
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	8
Soil Description	Reddish brown slightly sandy angular to subangular fine to coarse GRAVEL.			Depth, m	1.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030868



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	87		
37.5	81		
28	80		
20	73		
14	64		
10	54		
6.3	43		
5	39		
3.35	31		
2	27		
1.18	23		
0.6	18		
0.425	16		
0.3	15		
0.212	13		
0.15	9		
0.063	5		

Dry Mass of sample, g	7445

Sample Proportions	% dry mass
Cobbles	0
Gravel	73
Sand	22
Fines <0.063mm	5

Grading Analysis		
D100	mm	
D60	mm	12.1
D30	mm	3
D10	mm	0.161
Uniformity Coefficient		75
Curvature Coefficient		4.6

Remarks

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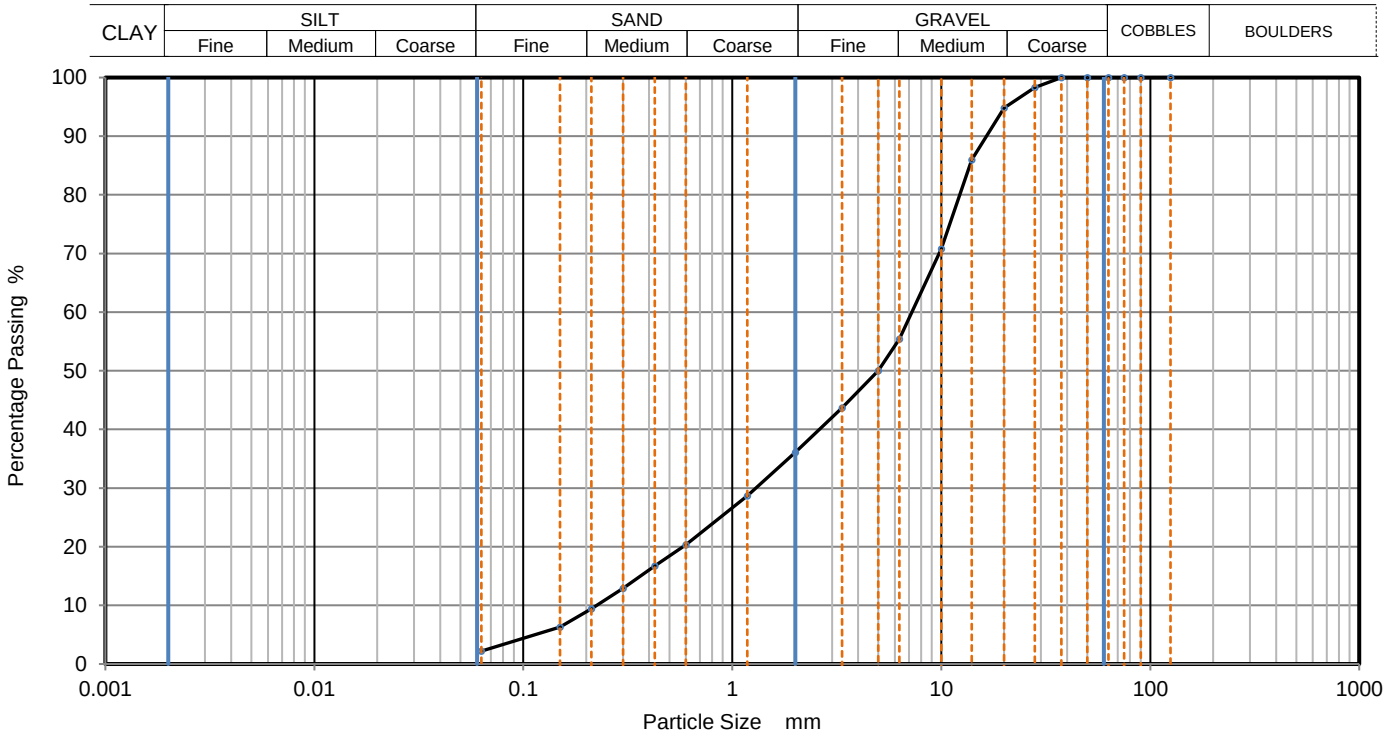
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**17-0769**
		Borehole/Pit No.	BH13
Site Name	Stornoway Deep Water Berth G.I.	Sample No.	13
Soil Description	Reddish brown sandy subangular to subrounded fine to coarse GRAVEL.	Depth, m	0.00
Specimen Reference	3 / Specimen Depth / m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2	KeyLAB ID	Caus2018030869



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	95		
14	86		
10	71		
6.3	55		
5	50		
3.35	44		
2	36		
1.18	29		
0.6	20		
0.425	17		
0.3	13		
0.212	9		
0.15	6		
0.063	2		

Dry Mass of sample, g	2263

Sample Proportions	% dry mass
Cobbles	0
Gravel	64
Sand	34
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	7.23
D30	mm	1.29
D10	mm	0.224
Uniformity Coefficient		32
Curvature Coefficient		1

Remarks

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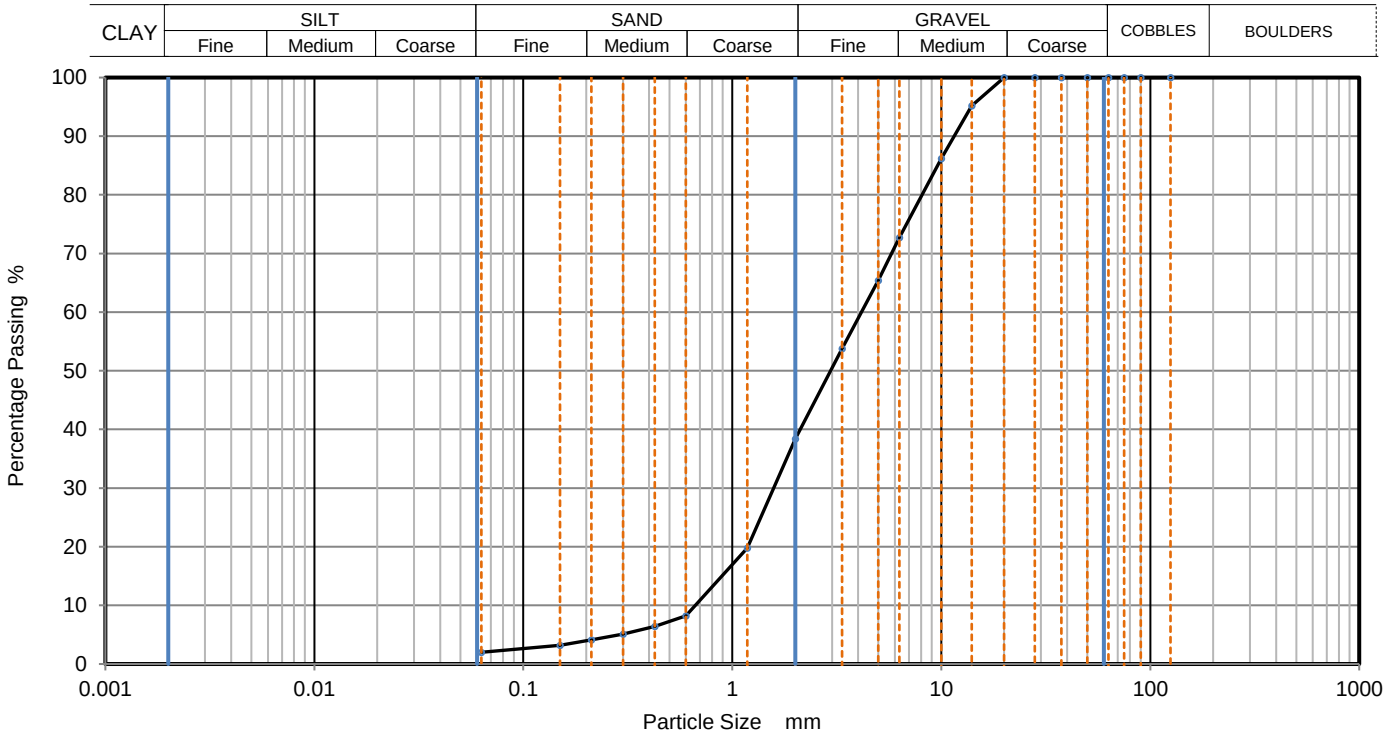
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH13
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	15
Soil Description	Grey sandy subangular fine to coarse SAND with shells and shell fragments.			Depth, m	3.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030870



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	95		
10	86		
6.3	73		
5	65		
3.35	54		
2	38		
1.18	20		
0.6	8		
0.425	6		
0.3	5		
0.212	4		
0.15	3		
0.063	2		

Dry Mass of sample, g	670

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	37
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	4.15
D30	mm	1.58
D10	mm	0.667
Uniformity Coefficient		6.2
Curvature Coefficient		0.9

Remarks

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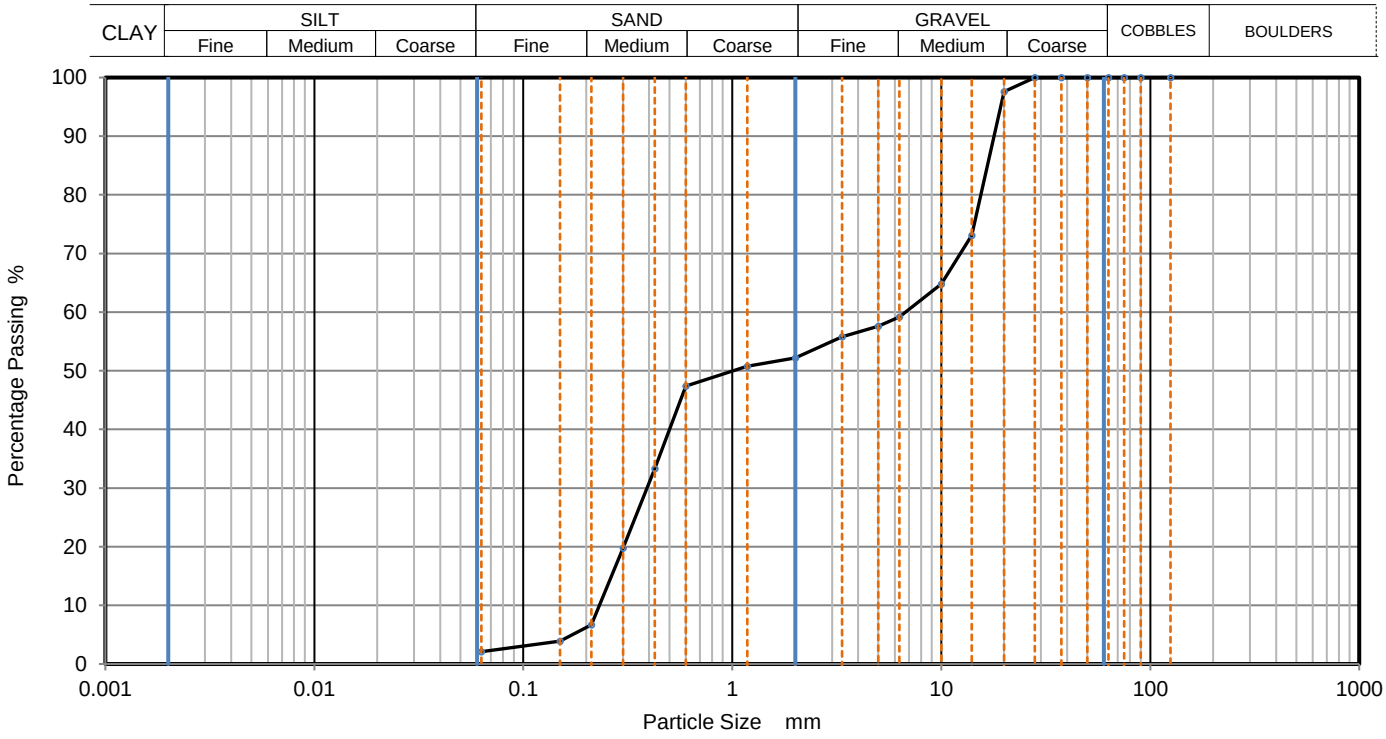
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH23
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	2
Soil Description	Grey gravelly fine to coarse SAND with shells and shell fragments.			Depth, m	0.70
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030871



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	73		
10	65		
6.3	59		
5	58		
3.35	56		
2	52		
1.18	51		
0.6	47		
0.425	33		
0.3	20		
0.212	7		
0.15	4		
0.063	2		

Dry Mass of sample, g	1927

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	50
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	6.74
D30	mm	0.39
D10	mm	0.231
Uniformity Coefficient		29
Curvature Coefficient		0.098

Remarks

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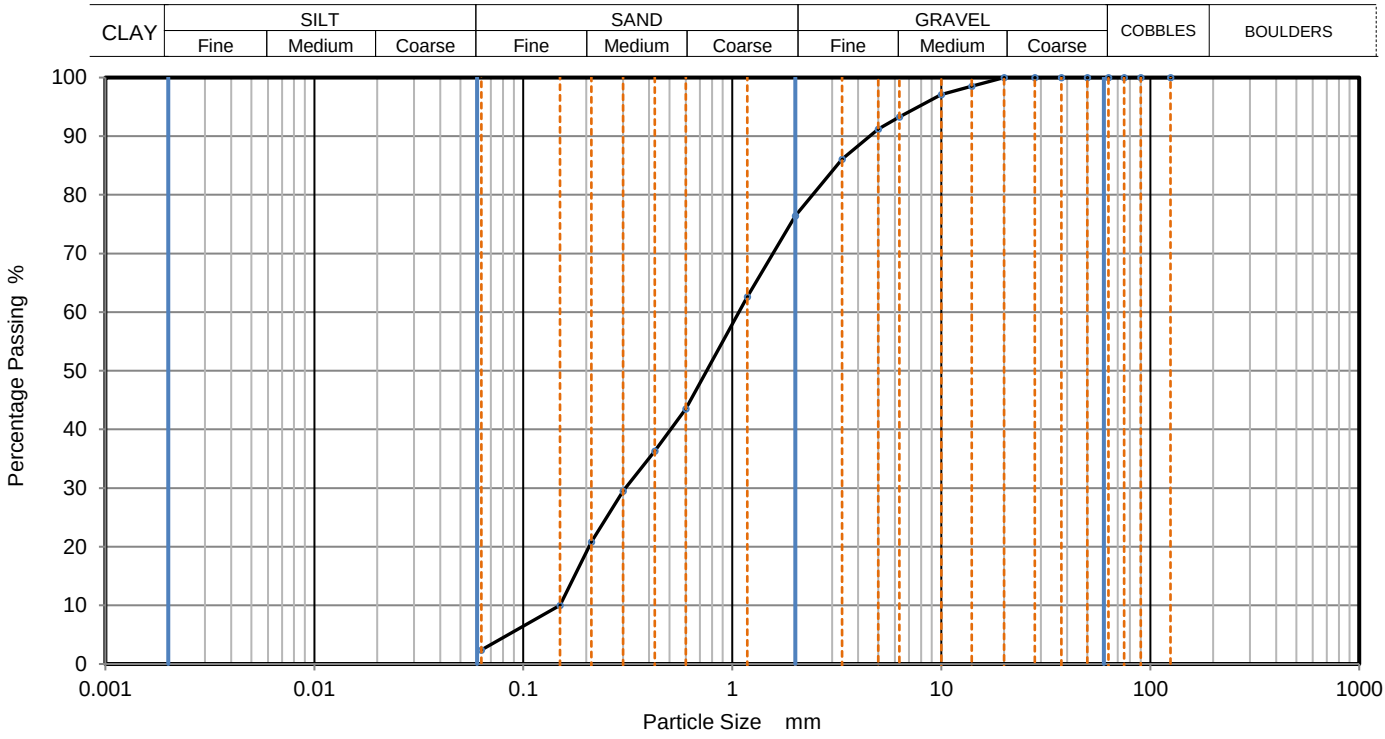
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH23
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	6
Soil Description	Grey gravelly fine to coarse SAND.			Depth, m	2.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030872



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	93		
5	91		
3.35	86		
2	76		
1.18	63		
0.6	44		
0.425	36		
0.3	30		
0.212	21		
0.15	10		
0.063	2		

Dry Mass of sample, g	506

Sample Proportions	% dry mass
Cobbles	0
Gravel	24
Sand	74
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	1.08
D30	mm	0.307
D10	mm	0.15
Uniformity Coefficient		7.2
Curvature Coefficient		0.58

Remarks

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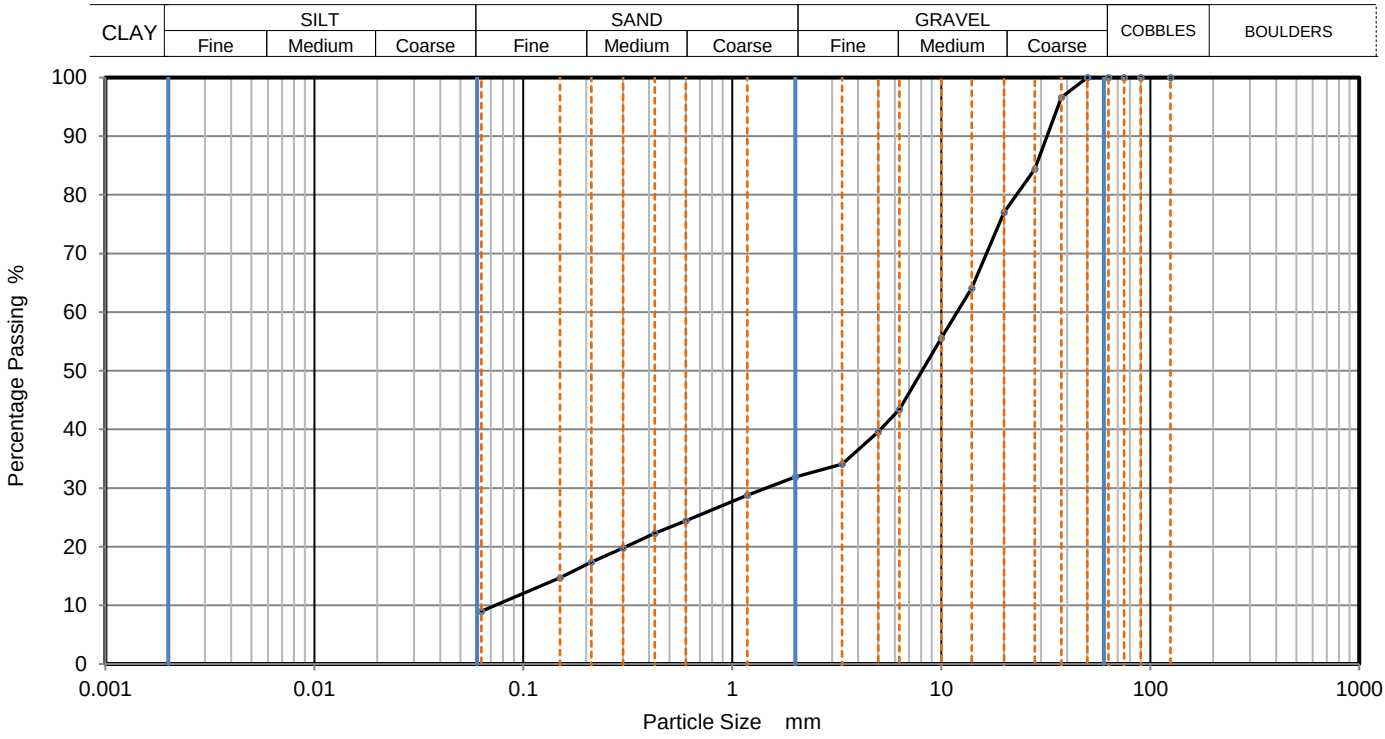
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH26
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030873



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	84		
20	77		
14	64		
10	56		
6.3	43		
5	40		
3.35	34		
2	32		
1.18	29		
0.6	24		
0.425	22		
0.3	20		
0.212	17		
0.15	15		
0.063	9		

Dry Mass of sample, g	6558

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	23
Fines <0.063mm	9

Grading Analysis		
D100	mm	
D60	mm	11.9
D30	mm	1.44
D10	mm	0.0738
Uniformity Coefficient		160
Curvature Coefficient		2.4

Remarks

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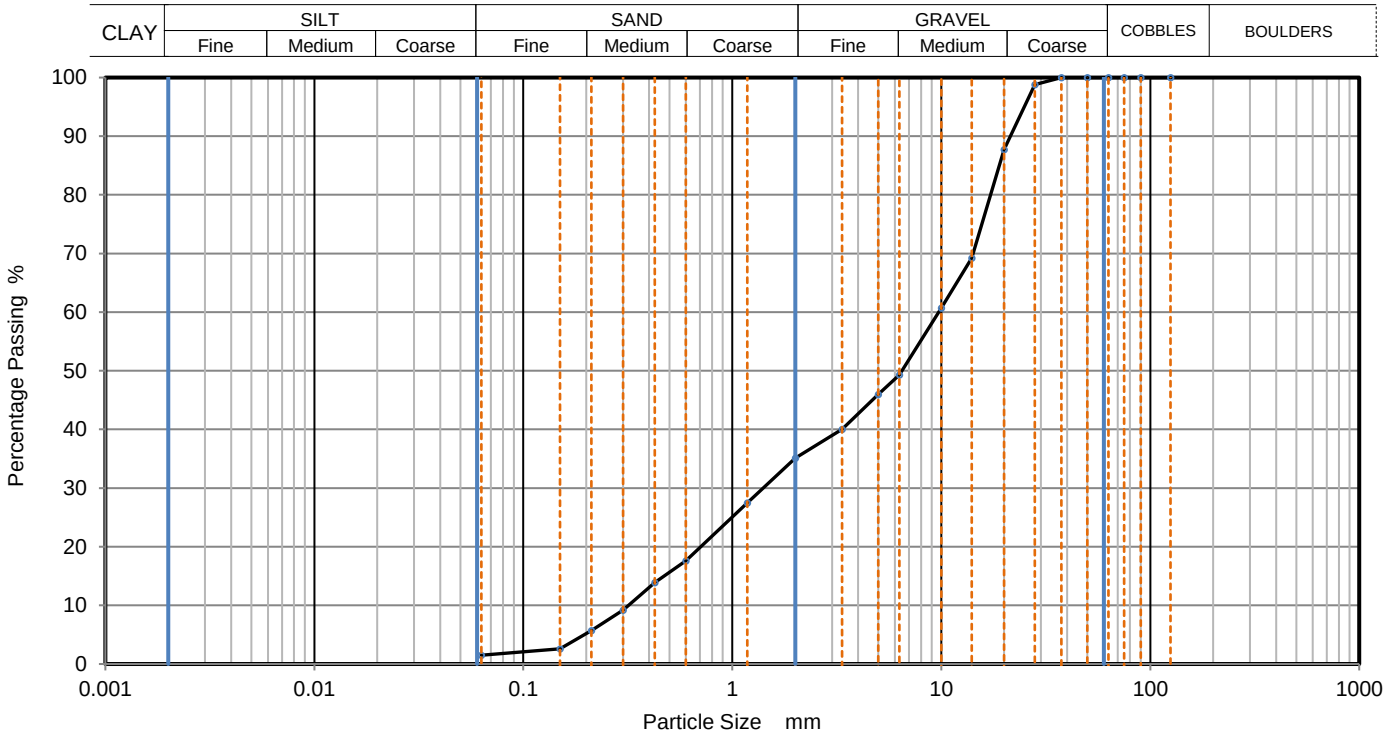
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH27
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	2
Soil Description	Grey sandy subrounded to rounded fine to coarse GRAVEL.			Depth, m	1.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030874



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	88		
14	69		
10	61		
6.3	49		
5	46		
3.35	40		
2	35		
1.18	28		
0.6	18		
0.425	14		
0.3	9		
0.212	6		
0.15	3		
0.063	2		

Dry Mass of sample, g	2919

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	34
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	9.72
D30	mm	1.4
D10	mm	0.319
Uniformity Coefficient		30
Curvature Coefficient		0.64

Remarks

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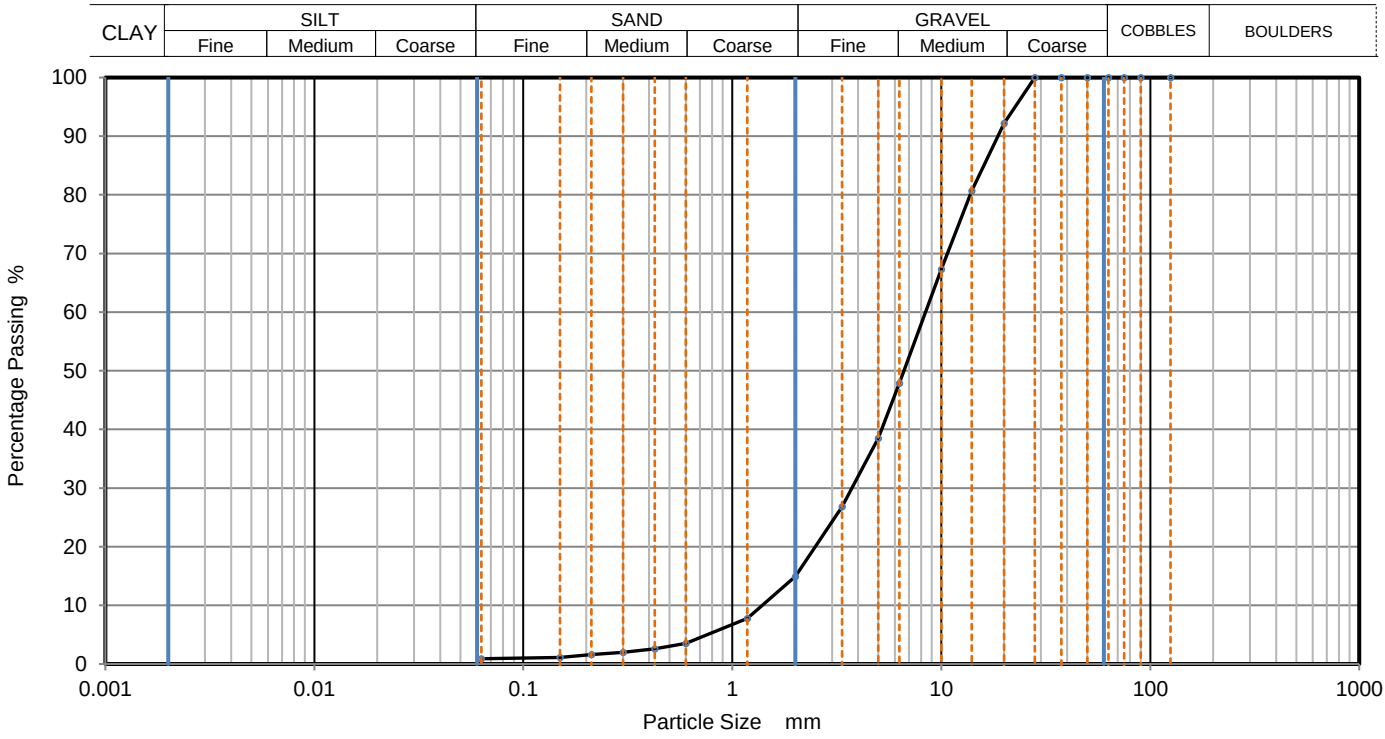
PARTICLE SIZE DISTRIBUTION

				Job Ref	**17-0769**
				Borehole/Pit No.	BH27
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Grey slightly sandy subangular fine to coarse GRAVEL.			Depth, m	2.70
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030875



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	92		
14	81		
10	67		
6.3	48		
5	39		
3.35	27		
2	15		
1.18	8		
0.6	4		
0.425	3		
0.3	2		
0.212	2		
0.15	1		
0.063	1		

Dry Mass of sample, g: 2565

Sample Proportions	% dry mass
Cobbles	0
Gravel	85
Sand	14
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	8.4
D30	mm	3.74
D10	mm	1.39
Uniformity Coefficient		6.1
Curvature Coefficient		1.2

Remarks

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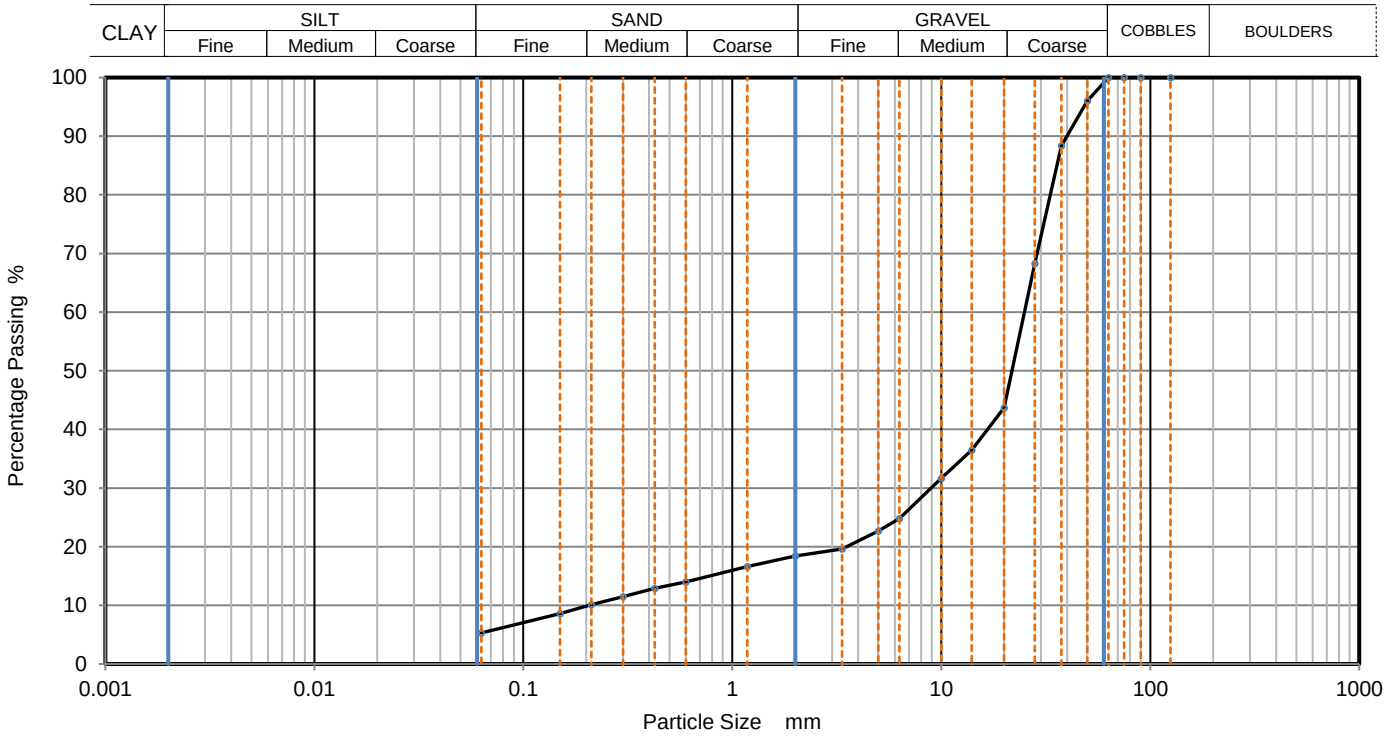
PARTICLE SIZE DISTRIBUTION

				Job Ref	**17-0769**
				Borehole/Pit No.	BH28
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	7
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030876



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	88		
28	68		
20	44		
14	37		
10	32		
6.3	25		
5	23		
3.35	20		
2	18		
1.18	17		
0.6	14		
0.425	13		
0.3	12		
0.212	10		
0.15	9		
0.063	5		

Dry Mass of sample, g	7573

Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	13
Fines <0.063mm	5

Grading Analysis		
D100	mm	
D60	mm	25
D30	mm	8.92
D10	mm	0.207
Uniformity Coefficient		120
Curvature Coefficient		15

Remarks

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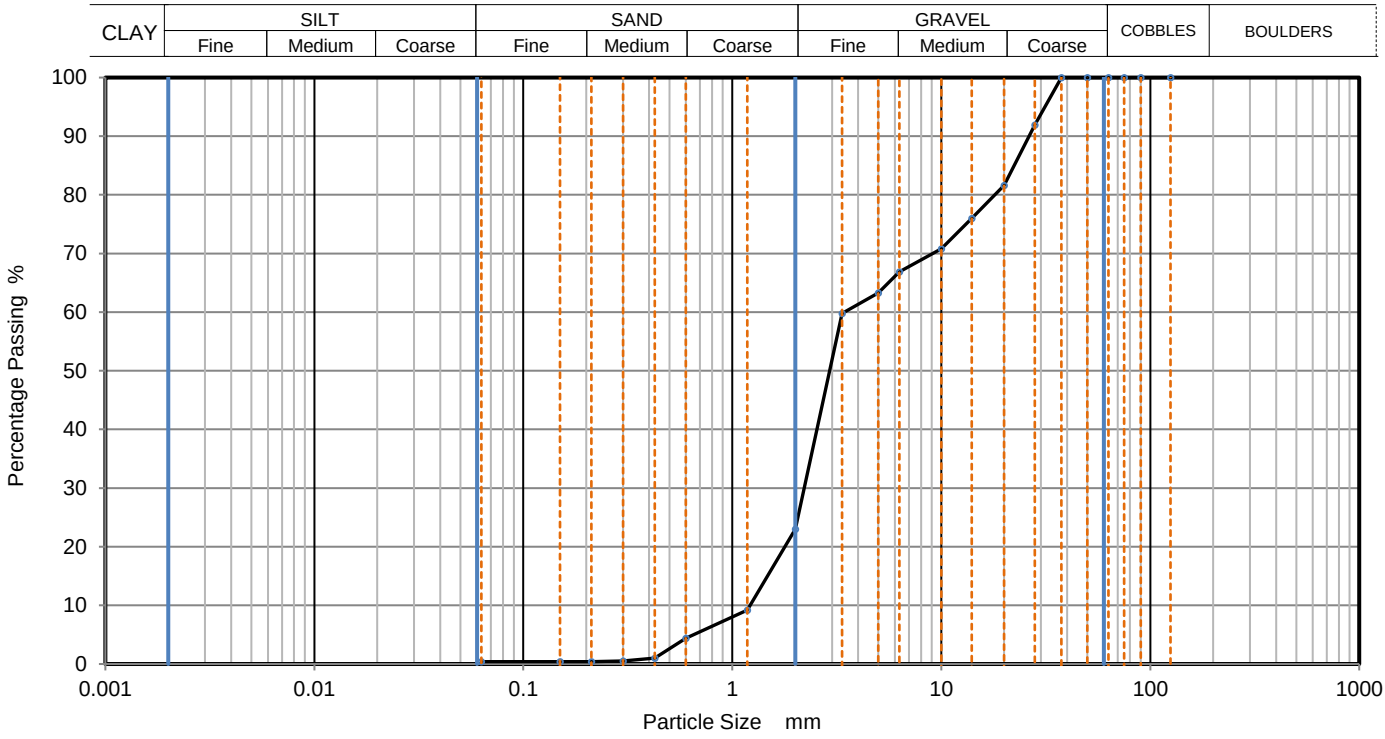
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH28
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	10
Soil Description	Reddish brown slightly sandy subangular to subrounded fine to coarse GRAVEL.			Depth, m	1.50
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201803261



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	92		
20	82		
14	76		
10	71		
6.3	67		
5	63		
3.35	60		
2	23		
1.18	9		
0.6	4		
0.425	1		
0.3	1		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	2846

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	23
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	3.42
D30	mm	2.21
D10	mm	1.21
Uniformity Coefficient		2.8
Curvature Coefficient		1.2

Remarks

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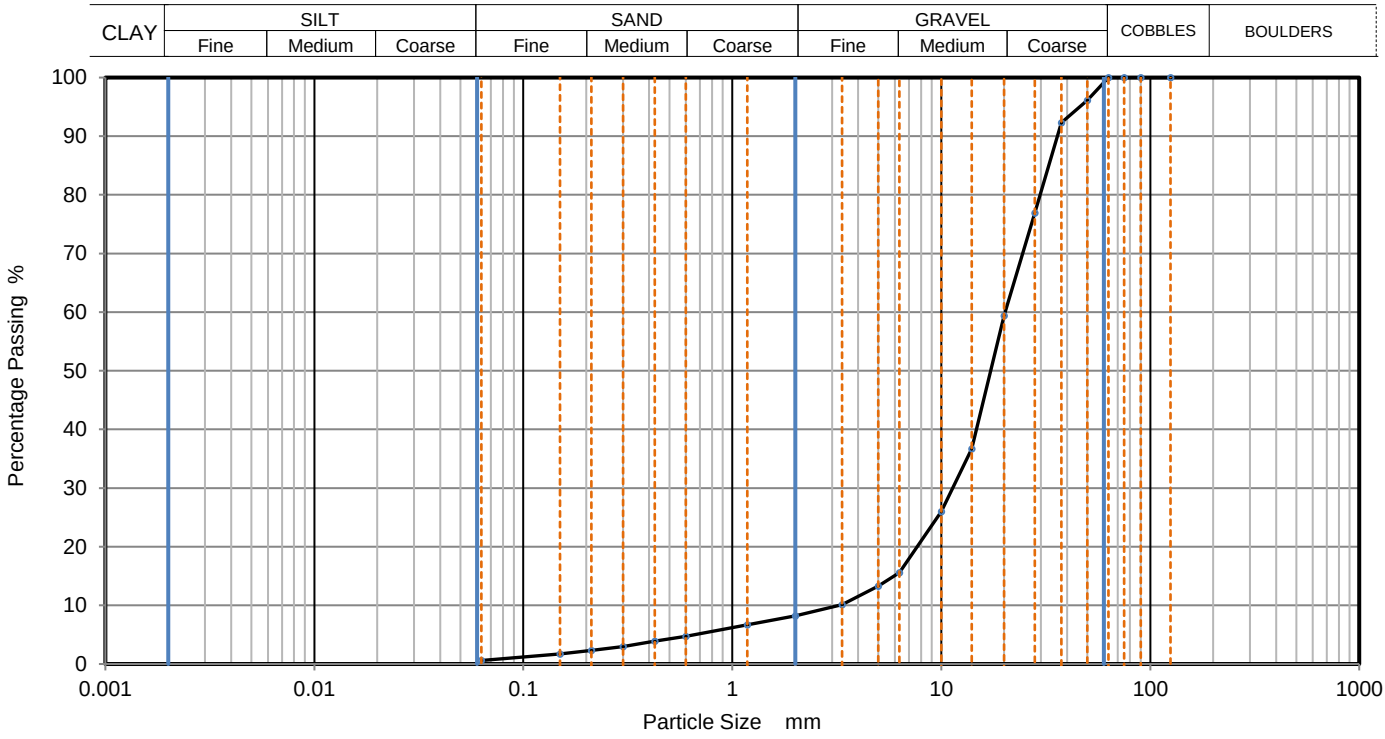
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH29
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	10
Soil Description	Reddish brown slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	0.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030877



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	92		
28	77		
20	59		
14	37		
10	26		
6.3	16		
5	13		
3.35	10		
2	8		
1.18	7		
0.6	5		
0.425	4		
0.3	3		
0.212	2		
0.15	2		
0.063	1		

Dry Mass of sample, g	6465

Sample Proportions	% dry mass
Cobbles	0
Gravel	92
Sand	8
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	20.3
D30	mm	11.3
D10	mm	3.28
Uniformity Coefficient		6.2
Curvature Coefficient		1.9

Remarks

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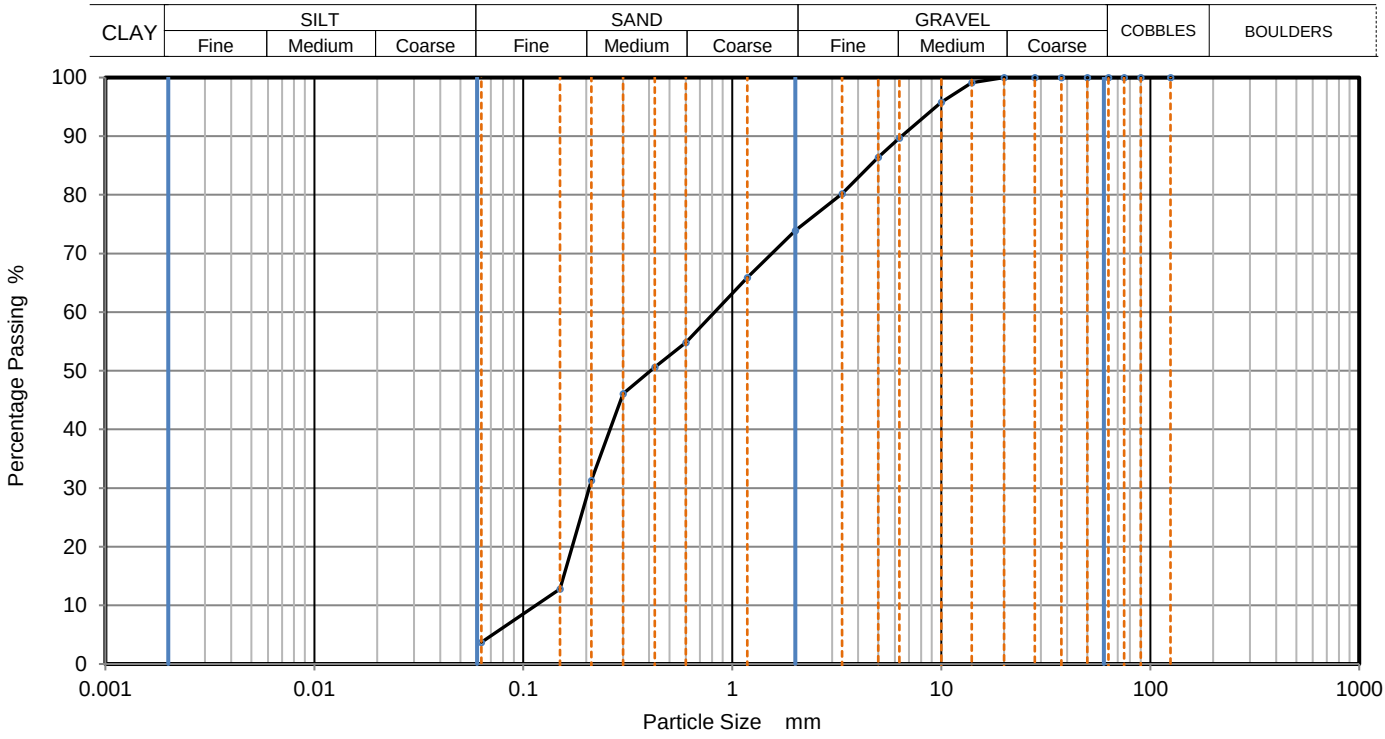
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH29
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	13
Soil Description	Grey slightly gravelly fine to coarse SAND.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030878



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	96		
6.3	90		
5	86		
3.35	80		
2	74		
1.18	66		
0.6	55		
0.425	51		
0.3	46		
0.212	31		
0.15	13		
0.063	4		

Dry Mass of sample, g	672

Sample Proportions	% dry mass
Cobbles	0
Gravel	26
Sand	70
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	0.822
D30	mm	0.207
D10	mm	0.114
Uniformity Coefficient		7.2
Curvature Coefficient		0.45

Remarks

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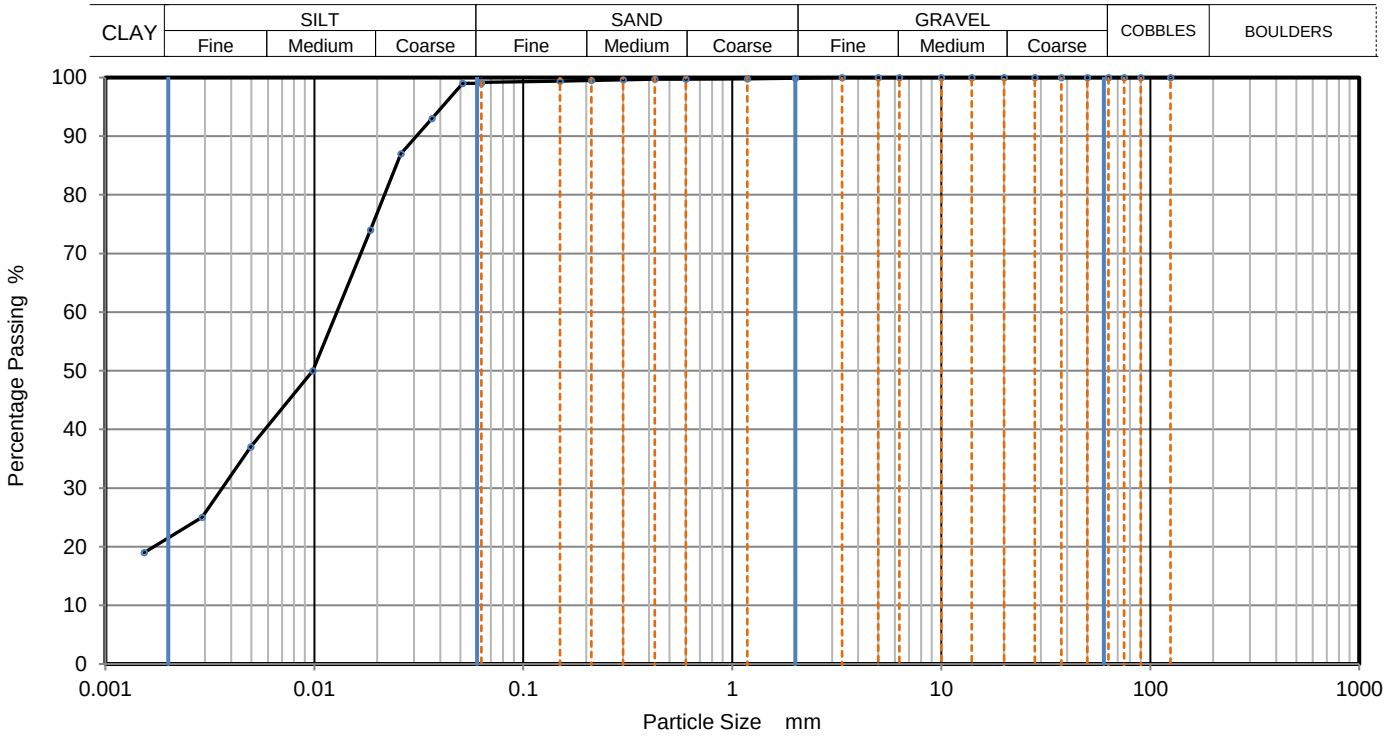
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH30
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	9
Soil Description	Grey sandy clayey SILT with occasional shells and shell fragments.			Depth, m	2.00
Specimen Reference	2	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030880



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	99
90	100	0.0513	99
75	100	0.0365	93
63	100	0.0260	87
50	100	0.0186	74
37.5	100	0.0098	50
28	100	0.0050	37
20	100	0.0029	25
14	100	0.0015	19
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	100		
0.212	100		
0.15	99		
0.063	99		

Dry Mass of sample, g	512

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	1
Silt	78
Clay	21

Grading Analysis		
D100	mm	
D60	mm	0.0128
D30	mm	0.00363
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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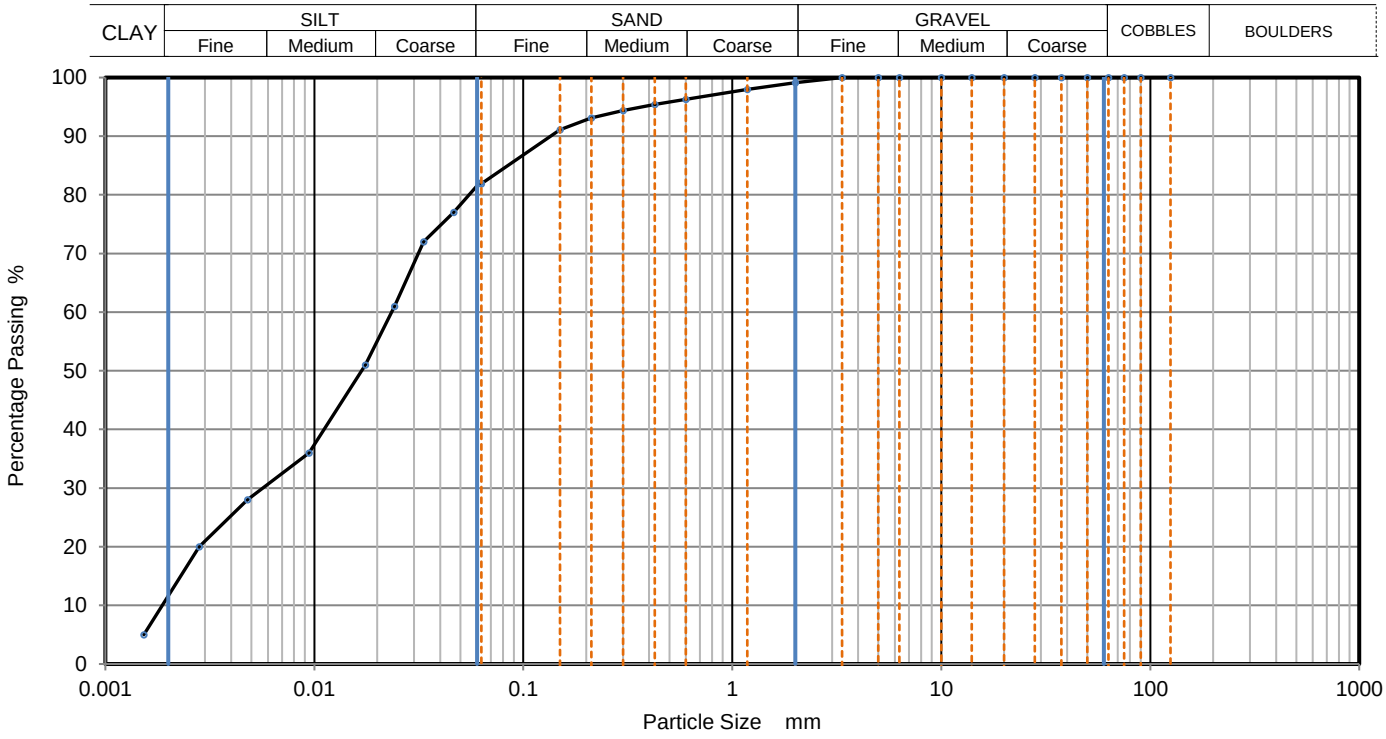
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH31
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	1
Soil Description	Grey slightly sandy organic clayey SILT with occasional shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030882



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0615	82
90	100	0.0464	77
75	100	0.0333	72
63	100	0.0242	61
50	100	0.0176	51
37.5	100	0.0094	36
28	100	0.0048	28
20	100	0.0028	20
14	100	0.0015	5
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	98		
0.6	96	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	94		
0.212	93		
0.15	91		
0.063	82		

Dry Mass of sample, g	180

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	17
Silt	70
Clay	12

Grading Analysis		
D100	mm	
D60	mm	0.0231
D30	mm	0.00563
D10	mm	0.00186
Uniformity Coefficient		12
Curvature Coefficient		0.74

Remarks

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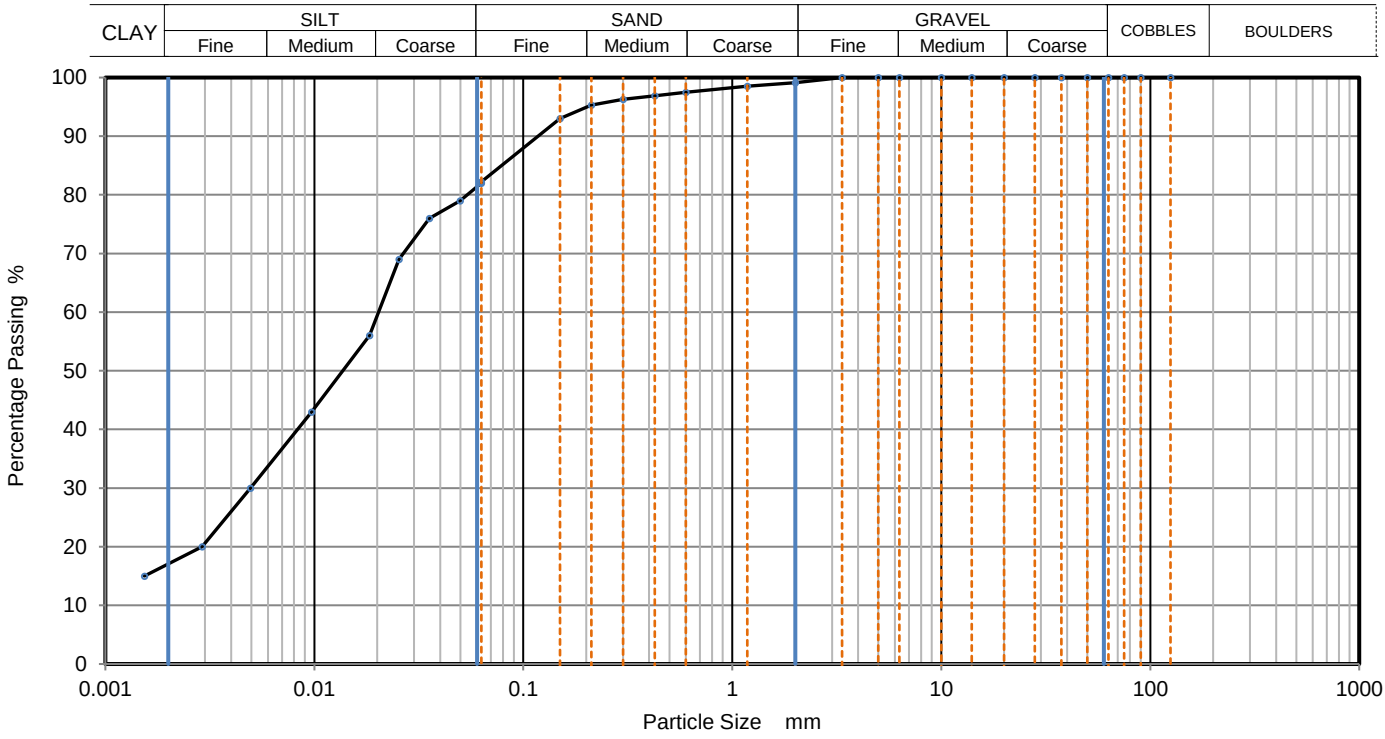
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH31
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	2
Soil Description	Grey slightly sandy organic clayey SILT with occasional shell fragments.			Depth, m	1.50
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030883



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	82
90	100	0.0499	79
75	100	0.0355	76
63	100	0.0254	69
50	100	0.0184	56
37.5	100	0.0097	43
28	100	0.0049	30
20	100	0.0029	20
14	100	0.0015	15
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	97	2.65	Mg/m3
0.3	96		
0.212	95		
0.15	93		
0.063	82		

Dry Mass of sample, g: 107

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	17
Silt	65
Clay	17

Grading Analysis		
D100	mm	
D60	mm	0.0203
D30	mm	0.00505
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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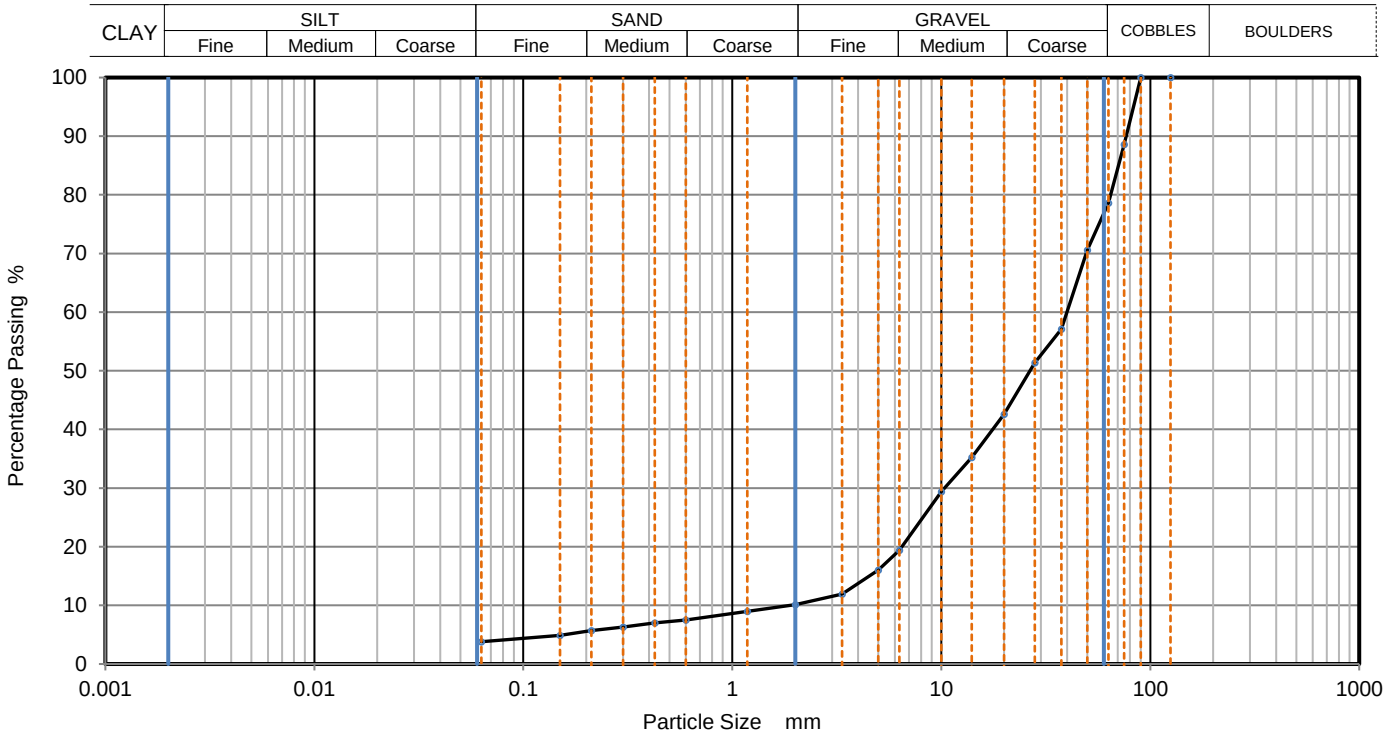
CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	17-0769
				Borehole/Pit No.	BH31
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Grey slightly sandy fine to coarse subangular GRAVEL.			Depth, m	5.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030886



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	79		
50	71		
37.5	57		
28	51		
20	43		
14	35		
10	29		
6.3	19		
5	16		
3.35	12		
2	10		
1.18	9		
0.6	8		
0.425	7		
0.3	6		
0.212	6		
0.15	5		
0.063	4		

Dry Mass of sample, g	13532

Sample Proportions	% dry mass
Cobbles	21
Gravel	69
Sand	6
Fines <0.063mm	4

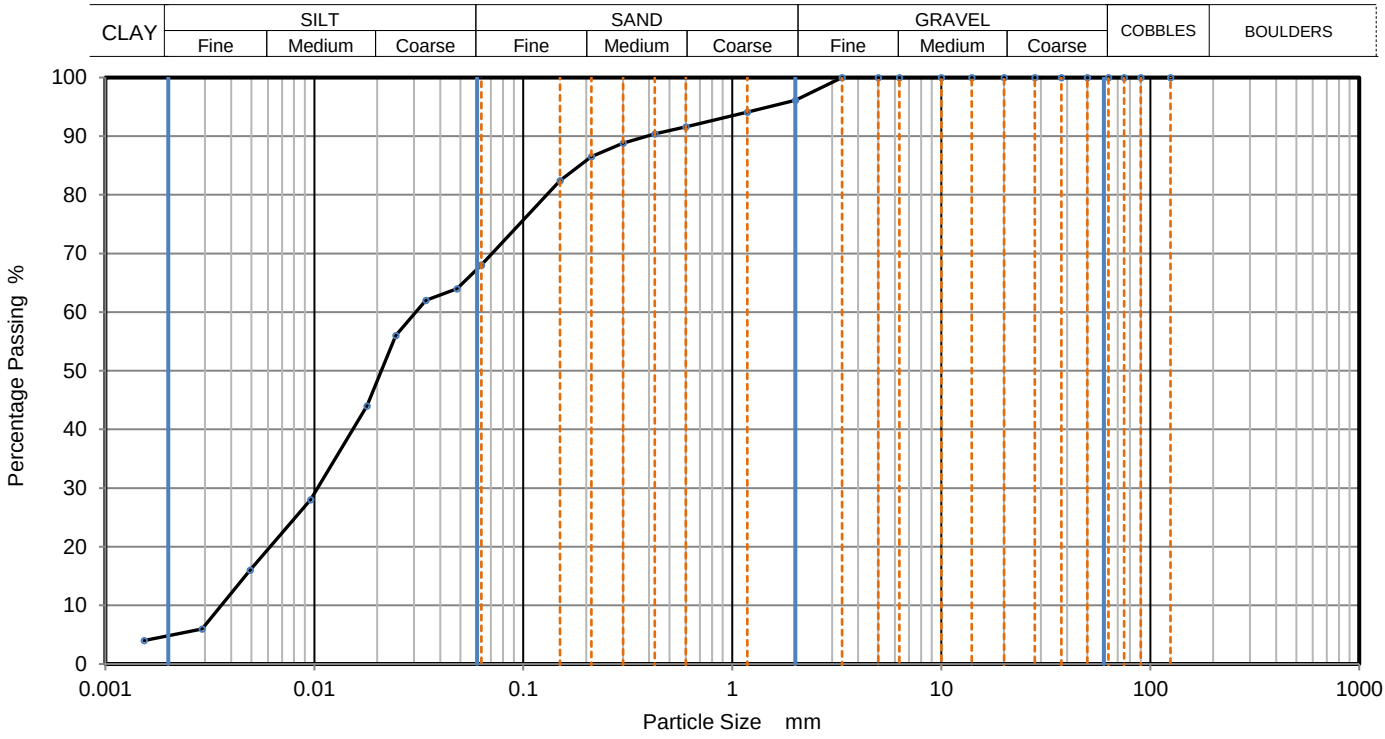
Grading Analysis		
D100	mm	
D60	mm	39.9
D30	mm	10.3
D10	mm	1.87
Uniformity Coefficient		21
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	Fig 1
Stephen.Watson	02/04/2018 16:43	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH32
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	1
Soil Description	Grey organic silty CLAY with shells and shell fragments.			Depth, m	0.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030887



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	68
90	100	0.0481	64
75	100	0.0342	62
63	100	0.0245	56
50	100	0.0179	44
37.5	100	0.0096	28
28	100	0.0049	16
20	100	0.0029	6
14	100	0.0015	4
10	100		
6.3	100		
5	100		
3.35	100		
2	96		
1.18	94		
0.6	92	Particle density	(assumed)
0.425	90	2.65	Mg/m3
0.3	89		
0.212	87		
0.15	82		
0.063	68		

Dry Mass of sample, g	116

Sample Proportions	% dry mass
Cobbles	0
Gravel	4
Sand	28
Silt	63
Clay	5

Grading Analysis		
D100	mm	
D60	mm	0.0306
D30	mm	0.0104
D10	mm	0.00358
Uniformity Coefficient		8.5
Curvature Coefficient		0.98

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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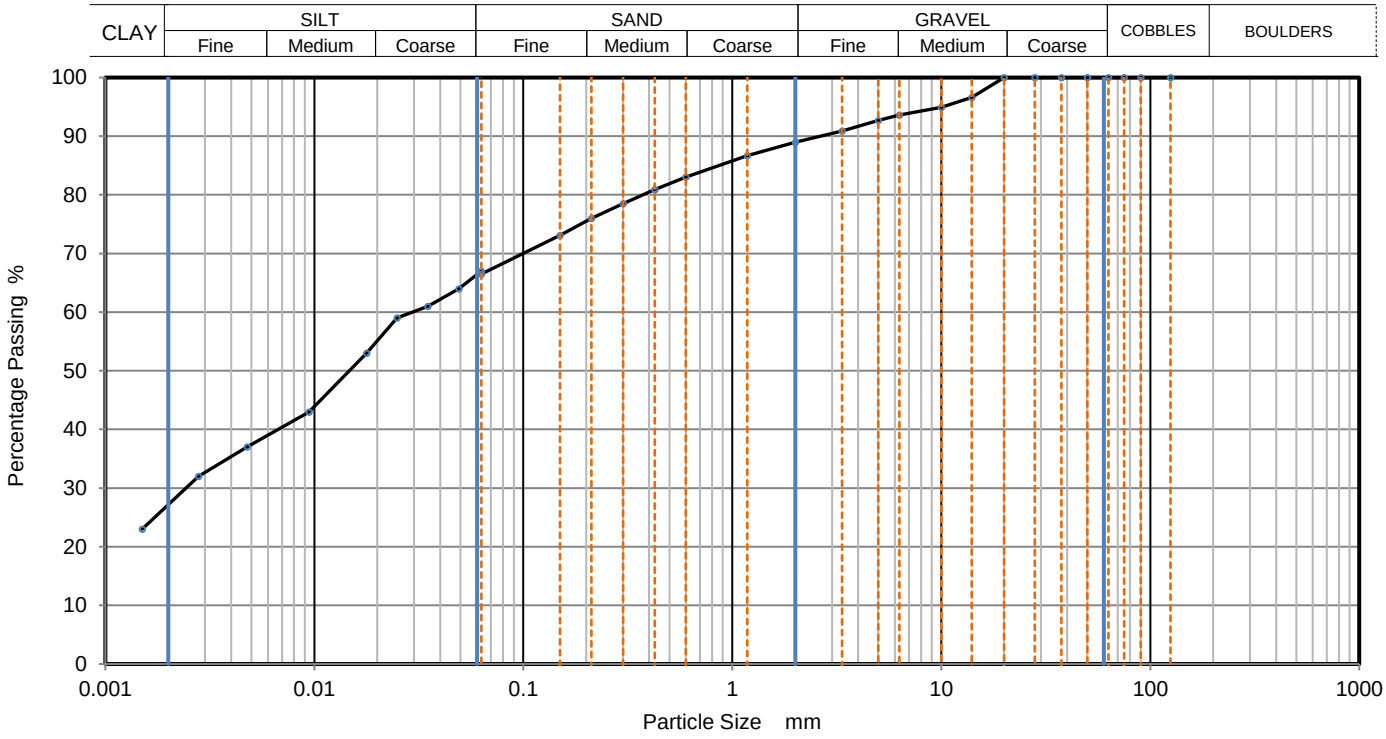
CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**17-0769**
				Borehole/Pit No.	BH32
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	5
Soil Description	Dark grey sandy slightly gravelly silty CLAY.			Depth, m	6.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2018030892



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	67
90	100	0.0491	64
75	100	0.0349	61
63	100	0.0249	59
50	100	0.0178	53
37.5	100	0.0094	43
28	100	0.0048	37
20	100	0.0028	32
14	97	0.0015	23
10	95		
6.3	94		
5	93		
3.35	91		
2	89		
1.18	87		
0.6	83	Particle density	(assumed)
0.425	81	2.65	Mg/m3
0.3	79		
0.212	76		
0.15	73		
0.063	67		

Dry Mass of sample, g	163

Sample Proportions	% dry mass
Cobbles	0
Gravel	11
Sand	22
Silt	40
Clay	27

Grading Analysis		
D100	mm	
D60	mm	0.0301
D30	mm	0.00246
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

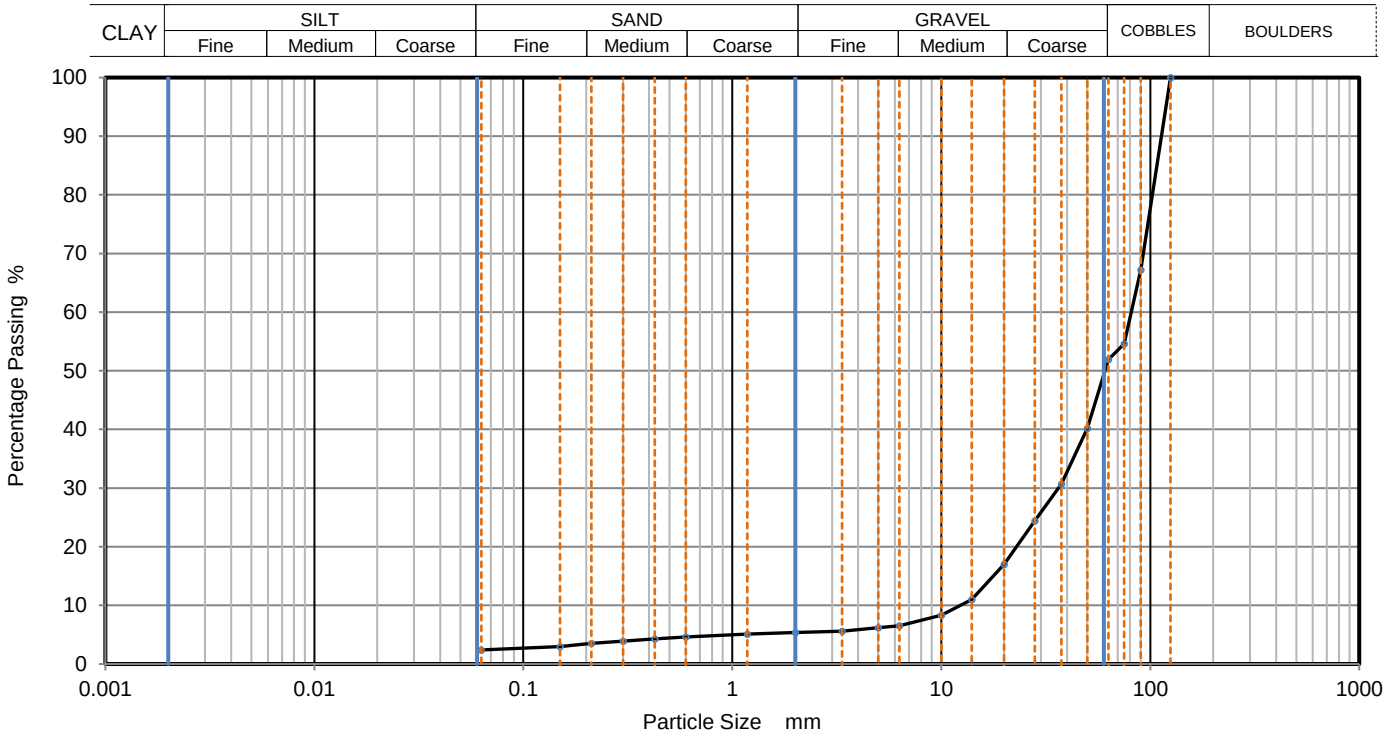
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	02/04/2018 16:43	Sheet

PARTICLE SIZE DISTRIBUTION

				Job Ref	**17-0769**
				Borehole/Pit No.	BH32
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	6
Soil Description	Greyish brown subangular to subrounded GRAVEL with high cobble content.			Depth, m	7.00
Specimen Reference	3	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2018030893



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	67		
75	55		
63	52		
50	40		
37.5	31		
28	24		
20	17		
14	11		
10	8		
6.3	7		
5	6		
3.35	6		
2	5		
1.18	5		
0.6	5		
0.425	4		
0.3	4		
0.212	4		
0.15	3		
0.063	2		

Dry Mass of sample, g	15240

Sample Proportions	% dry mass
Cobbles	48
Gravel	47
Sand	3
Fines <0.063mm	2

Grading Analysis		
D100	mm	125
D60	mm	81.1
D30	mm	36.3
D10	mm	12.3
Uniformity Coefficient		6.6
Curvature Coefficient		1.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
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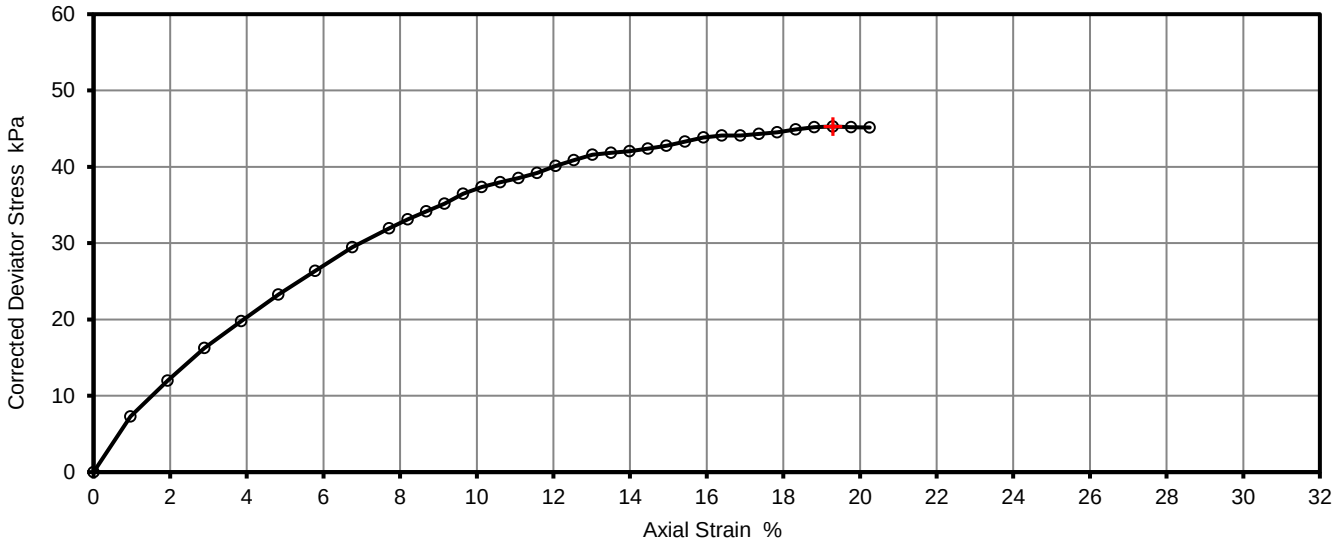
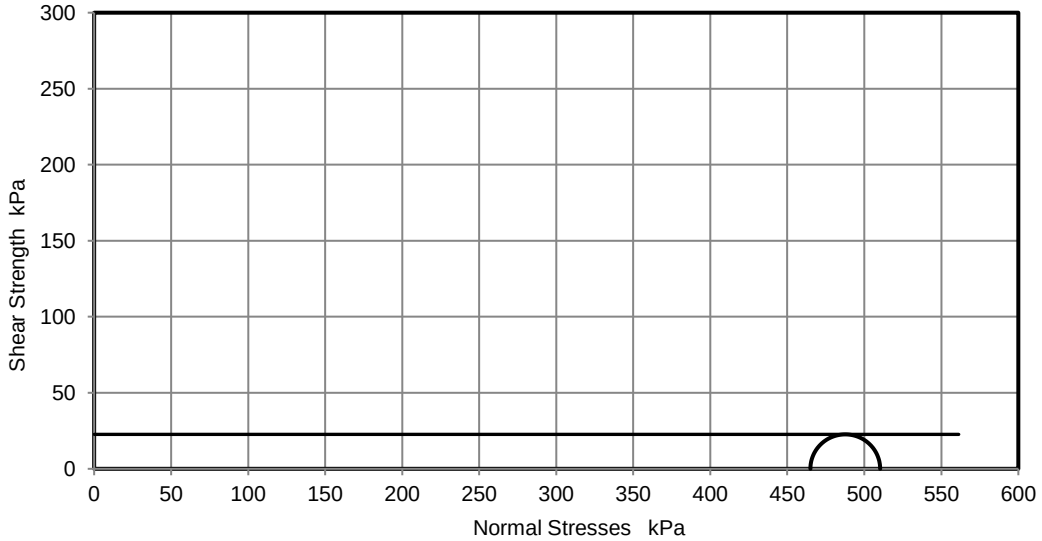
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	
Soil Description	Brownish grey sandy silty CLAY.			Depth	27.00
Specimen Reference	A	Specimen Depth	27.00-27.21 m	Sample Type	U
Specimen Description	Very soft to soft brownish grey sandy silty CLAY.			KeyLAB ID	Caus201803260
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	26/03/2018

Test Number		1	
Length		207.4	mm
Diameter		103.2	mm
Bulk Density		1.83	Mg/m3
Moisture Content		37.8	%
Dry Density		1.33	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		465	kPa
At failure	Axial Strain	19.3	%
	Deviator Stress, (σ1 - σ3)f	45	kPa
	Undrained Shear Strength, cu	23	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

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Fig. No. 1

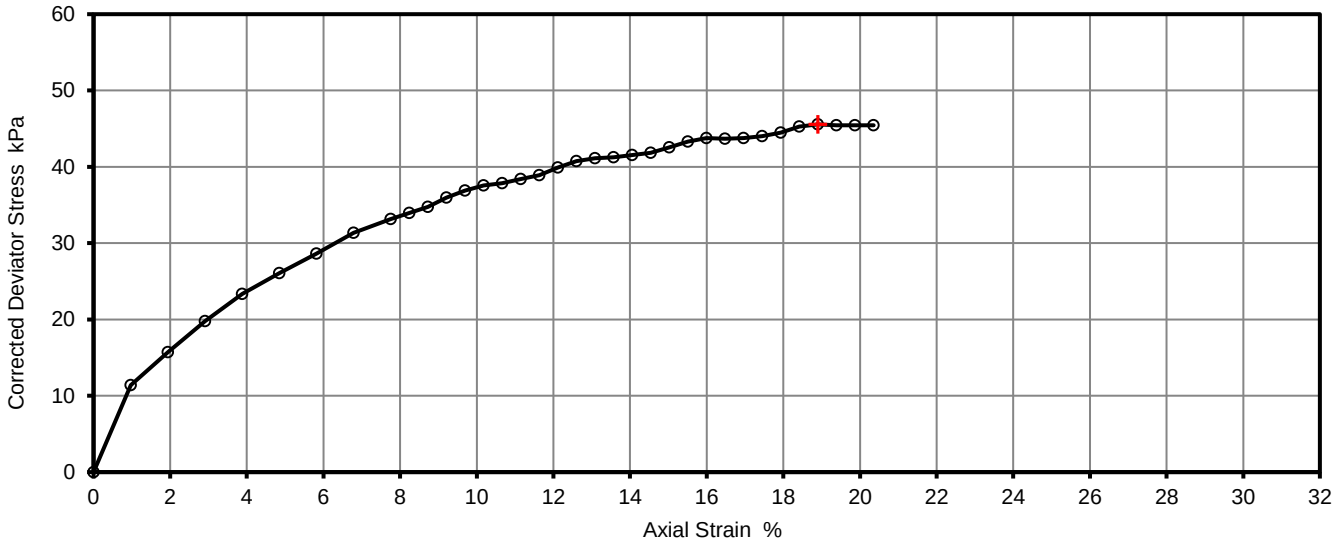
Sheet 1

Lab Sheet Reference :

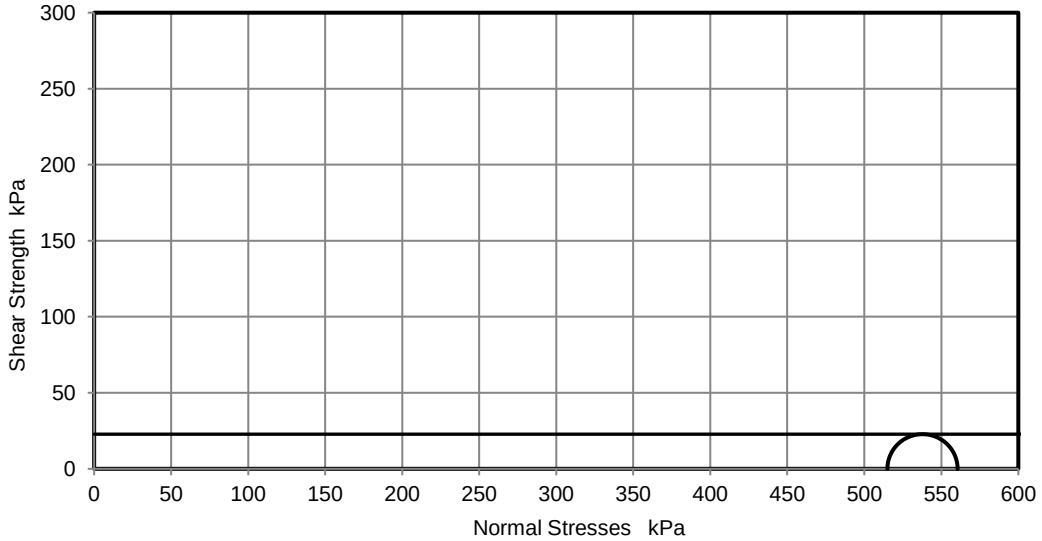
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	45
Soil Description	Brownish grey sandy slightly gravelly clayey SILT.			Depth	25.00
Specimen Reference	B	Specimen Depth	25.00-25.21 m	Sample Type	U
Specimen Description	Very soft to soft brownish grey sandy slightly gravelly clayey SILT.			KeyLAB ID	Caus2018030843
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	26/03/2018

Test Number		1	
Length		206.3	mm
Diameter		103.4	mm
Bulk Density		2.16	Mg/m3
Moisture Content		24.3	%
Dry Density		1.74	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		515	kPa
At failure	Axial Strain	18.9	%
	Deviator Stress, (σ1 - σ3)f	46	kPa
	Undrained Shear Strength, cu	23	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

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Lab Sheet Reference :

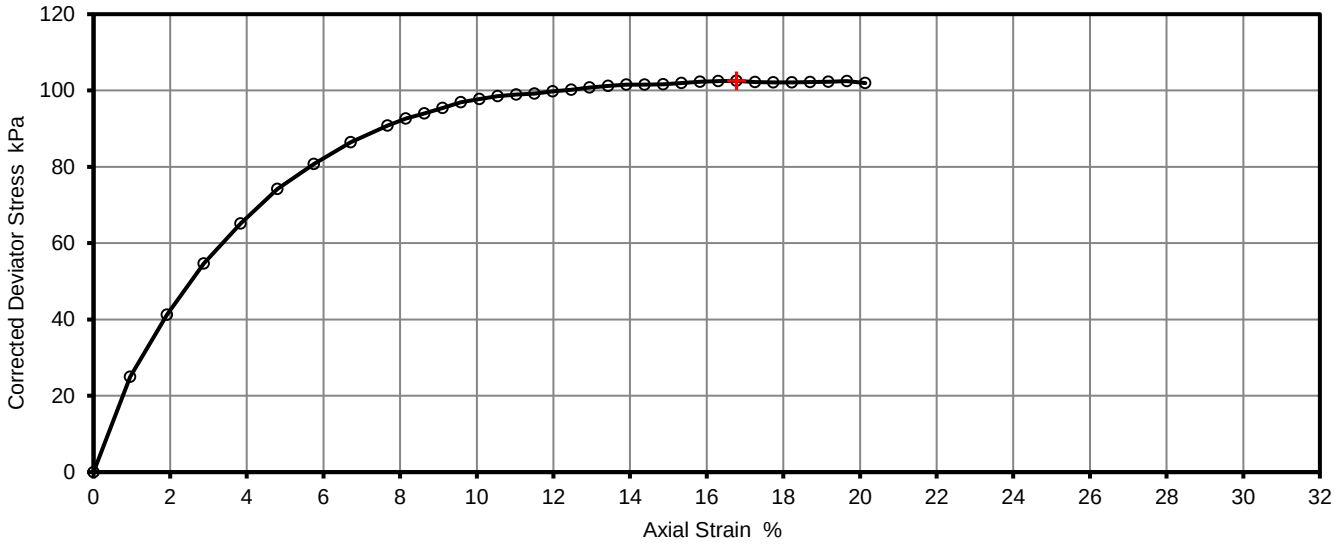
Fig. No. 1

Sheet 2

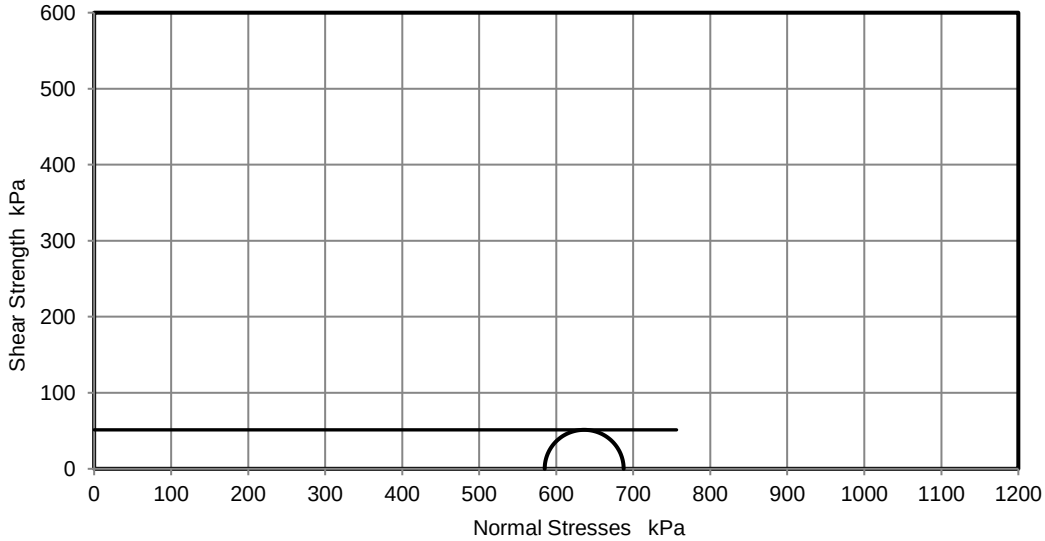
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH07
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	46
Soil Description	Grey slightly sandy clayey SILT.			Depth	29.00
Specimen Reference	C	Specimen Depth	29.00-29.21 m	Sample Type	U
Specimen Description	Firm grey slightly sandy clayey SILT.			KeyLAB ID	Caus2018030846
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	26/03/2018

Test Number		1	
Length		208.6	mm
Diameter		104.0	mm
Bulk Density		2.10	Mg/m3
Moisture Content		24.0	%
Dry Density		1.69	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		585	kPa
At failure	Axial Strain	16.8	%
	Deviator Stress, (σ1 - σ3)f	103	kPa
	Undrained Shear Strength, cu	51	kPa ½(σ1 - σ3)f
	Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

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Lab Sheet Reference :

Fig. No. 1

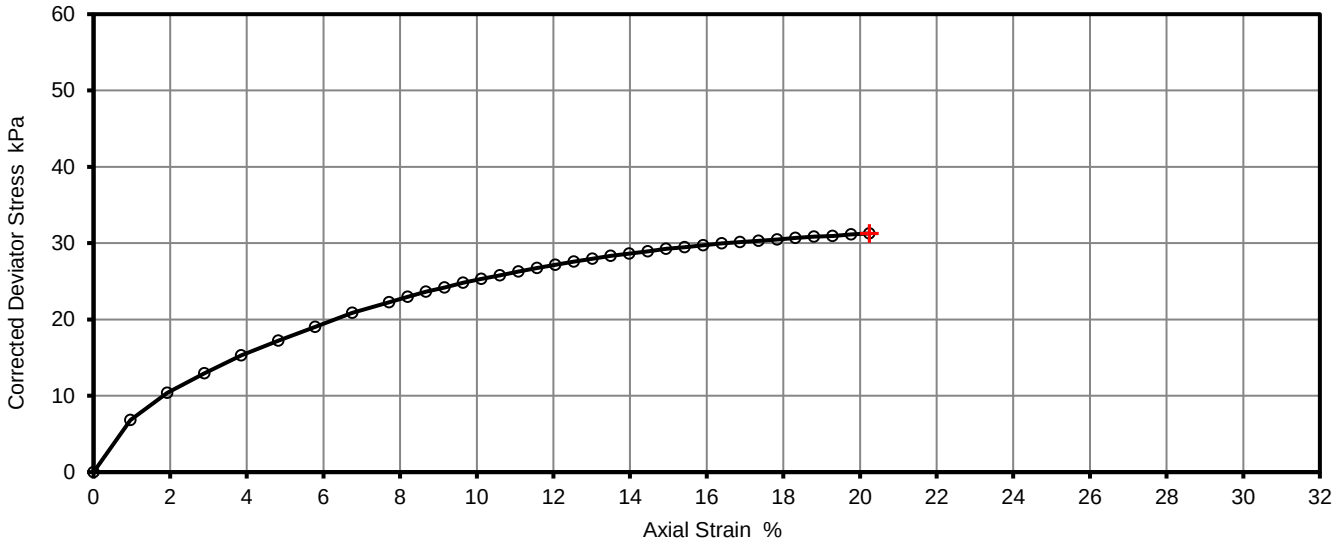
Sheet 3

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH11
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	26
Soil Description	Brownish grey slightly sandy slightly gravelly clayey SILT.			Depth	8.50
Specimen Reference	D	Specimen Depth	8.50-8.71 m	Sample Type	U
Specimen Description	Very soft brownish grey slightly sandy slightly gravelly clayey SILT.			KeyLAB ID	Caus2018030860
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	27/03/2018

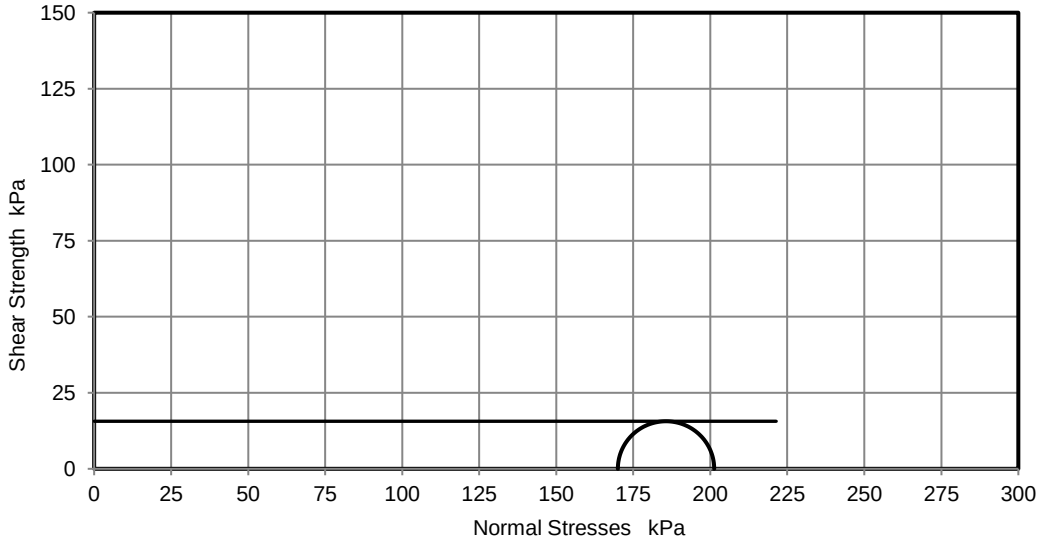
Test Number	1	
Length	207.4	mm
Diameter	103.3	mm
Bulk Density	2.11	Mg/m3
Moisture Content	26.0	%
Dry Density	1.67	Mg/m3

Rate of Strain		2.0	%/min
Cell Pressure		170	kPa
At failure	Axial Strain	20.2	%
	Deviator Stress, (σ1 - σ3)f	31	kPa
	Undrained Shear Strength, cu	16	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Testing terminated at 20% strain

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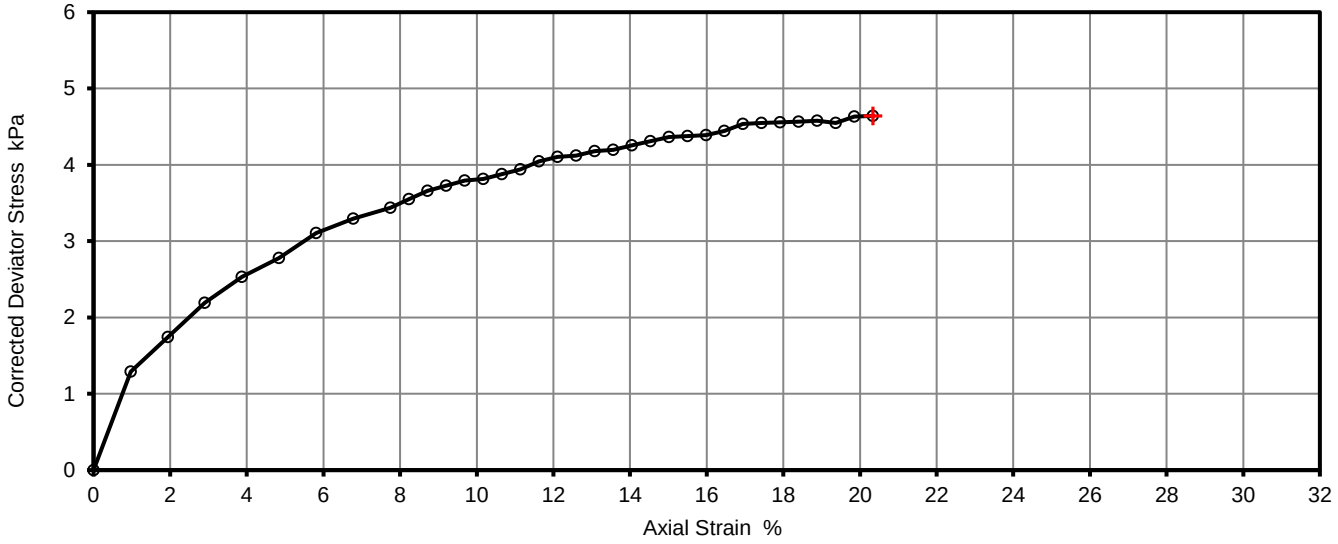
Lab Sheet Reference :

Fig. No. 1

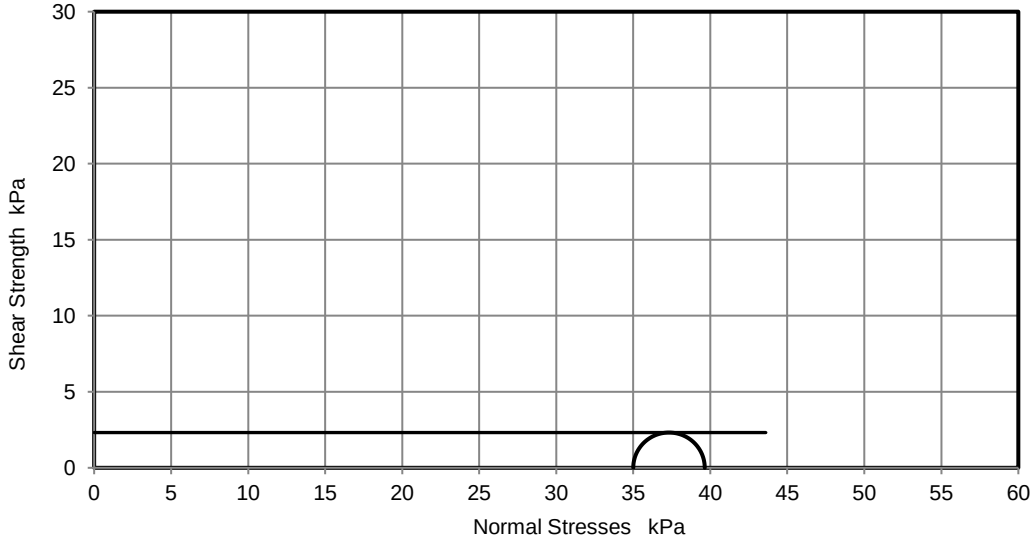
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH31
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	7
Soil Description	Grey slightly sandy organic silty CLAY with occasional shell fragments.			Depth	2.00
Specimen Reference	E	Specimen Depth	2.00-2.21 m	Sample Type	U
Specimen Description	Very soft grey slightly sandy organic silty CLAY with occasional shell fragments.			KeyLAB ID	Caus2018030884
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	27/03/2018

Test Number		1	
Length		206.5	mm
Diameter		106.5	mm
Bulk Density		1.50	Mg/m3
Moisture Content		74.4	%
Dry Density		0.86	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		35	kPa
At failure	Axial Strain	20.3	%
	Deviator Stress, (σ1 - σ3)f	5	kPa
	Undrained Shear Strength, cu	2	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Testing terminated at 20% strain

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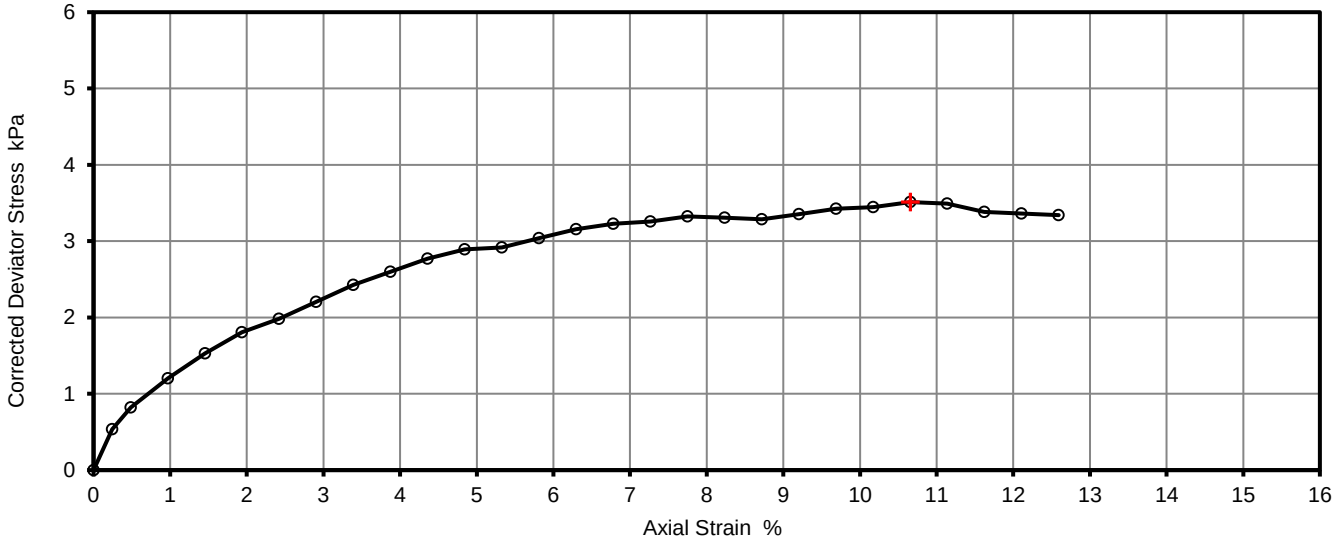
Lab Sheet Reference :

Fig. No. 1

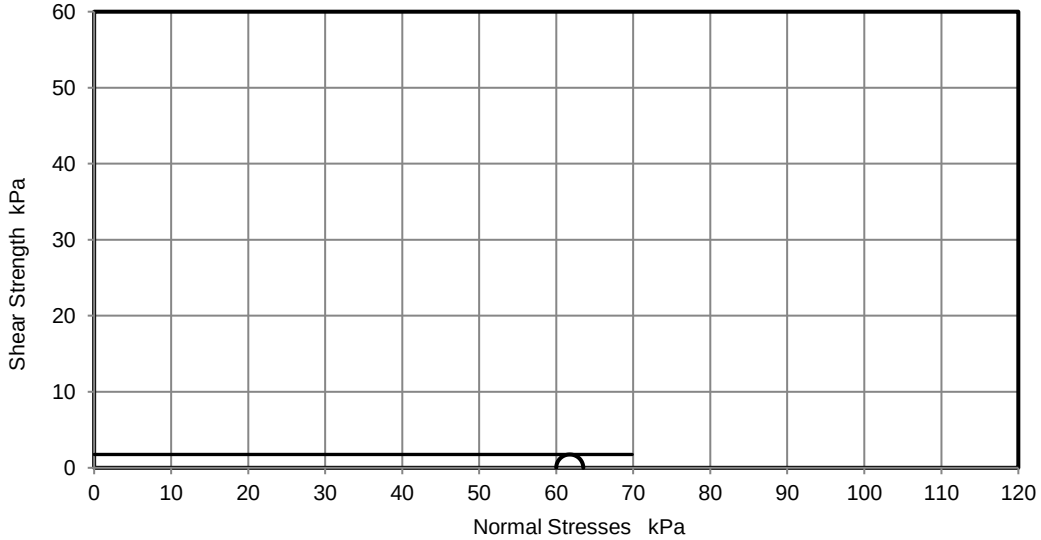
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH31
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	8
Soil Description	Grey slightly sandy organic silty CLAY with occasional shell fragments.			Depth	4.00
Specimen Reference	F	Specimen Depth	4.00-4.21 m	Sample Type	U
Specimen Description	Very soft grey slightly sandy organic silty CLAY with occasional shell fragments.			KeyLAB ID	Caus2018030885
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	28/03/2018

Test Number		1	
Length		206.5	mm
Diameter		106.1	mm
Bulk Density		1.46	Mg/m3
Moisture Content		97.9	%
Dry Density		0.74	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		60	kPa
At failure	Axial Strain	10.7	%
	Deviator Stress, (σ1 - σ3)f	4	kPa
	Undrained Shear Strength, cu	2	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

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Fig. No. 1

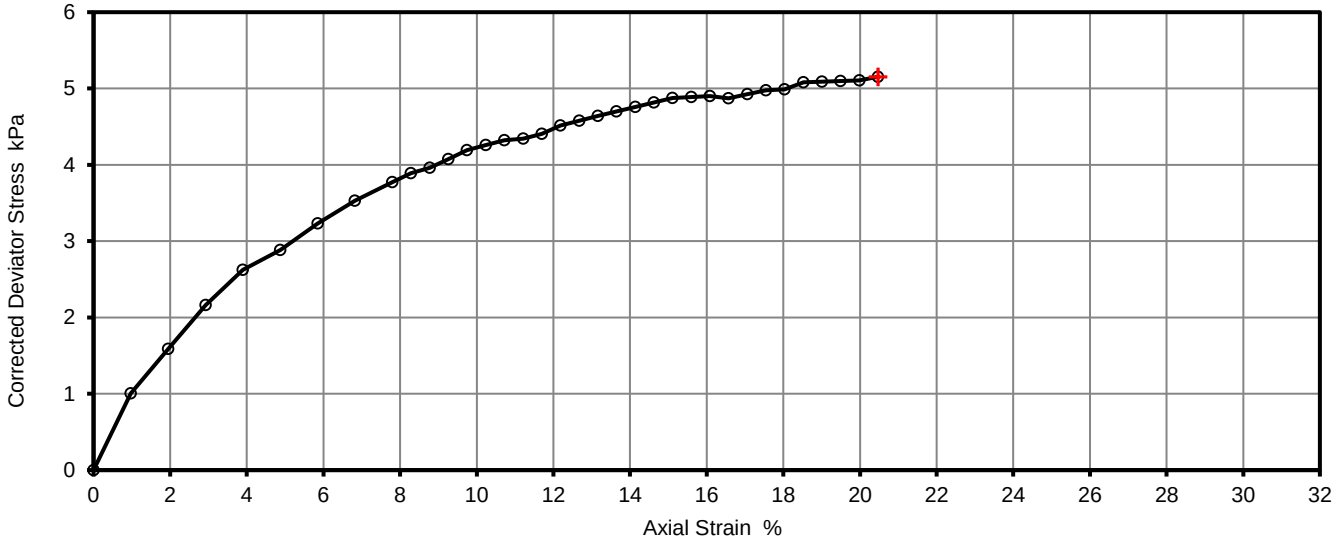
Sheet 6

Lab Sheet Reference :

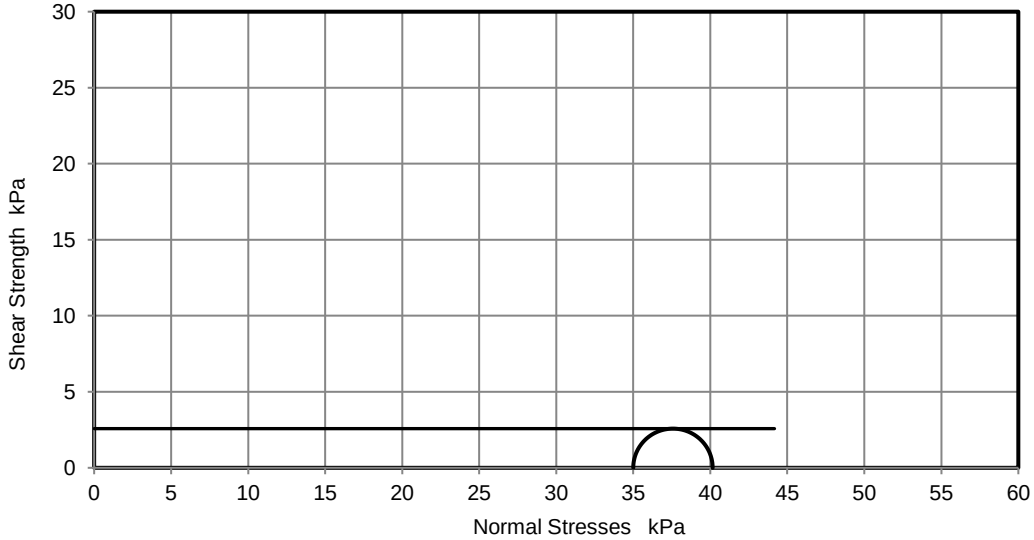
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH32
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	11
Soil Description	Grey organic silty CLAY with shells and shell fragments.			Depth	2.00
Specimen Reference	G	Specimen Depth	2.00-2.21 m	Sample Type	U
Specimen Description	Very soft grey organic silty CLAY with shells and shell fragments.			KeyLAB ID	Caus2018030889
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	27/03/2018

Test Number		1	
Length		205.2	mm
Diameter		103.9	mm
Bulk Density		1.53	Mg/m3
Moisture Content		94.2	%
Dry Density		0.79	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		35	kPa
At failure	Axial Strain	20.5	%
	Deviator Stress, (σ1 - σ3)f	5	kPa
	Undrained Shear Strength, cu	3	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Testing terminated at 20% strain

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Lab Sheet Reference :

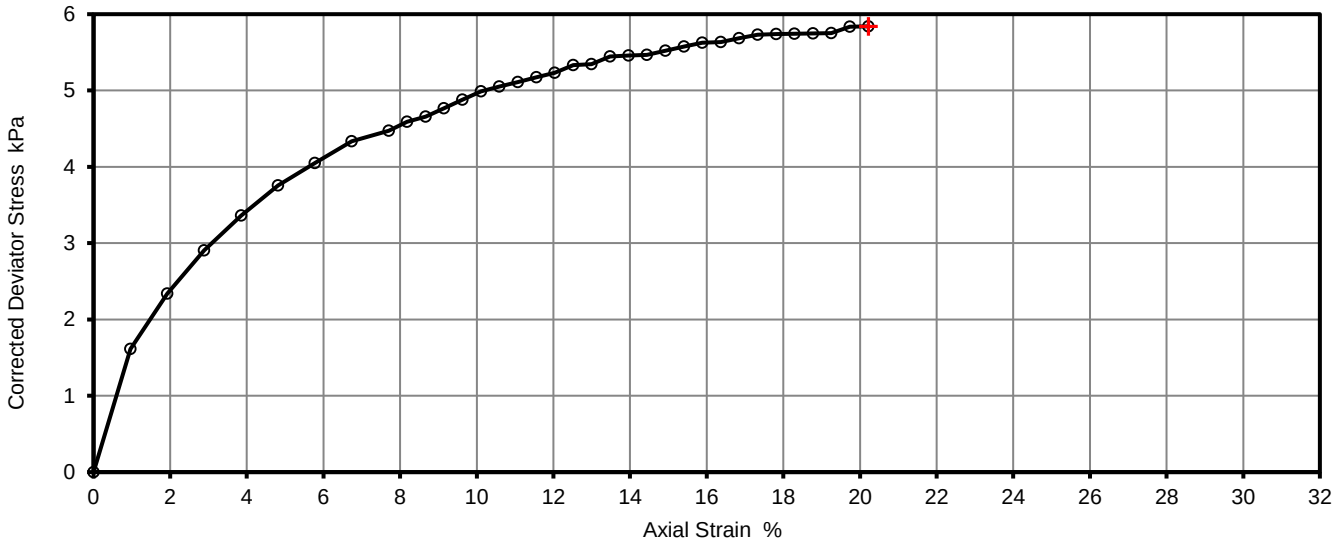
Fig. No. 1

Sheet 7

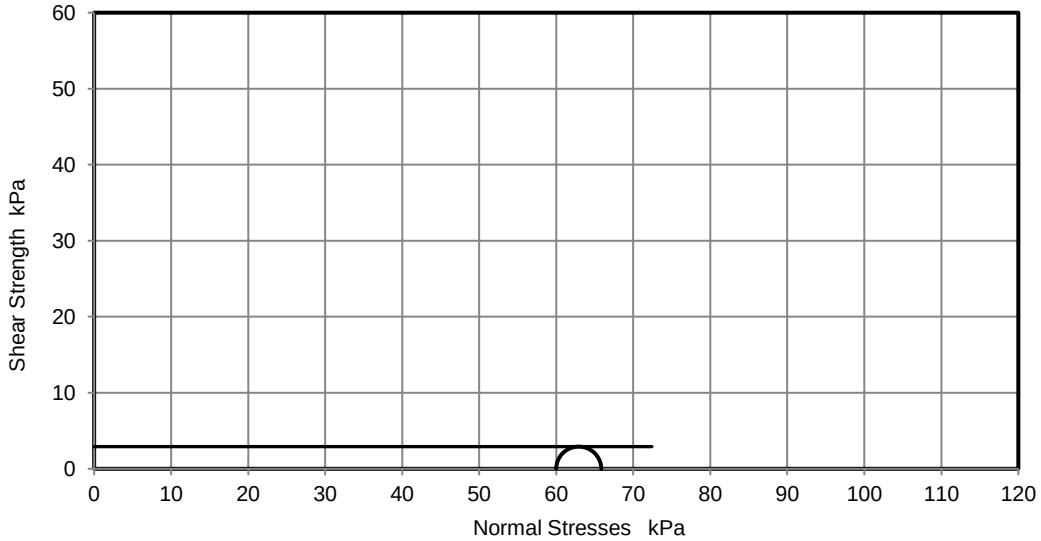
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH32
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	12
Soil Description	Grey organic silty CLAY with shells and shell fragments.			Depth	4.00
Specimen Reference	H	Specimen Depth	4.00-4.21 m	Sample Type	U
Specimen Description	Very soft grey organic silty CLAY with shells and shell fragments.			KeyLAB ID	Caus2018030890
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	29/03/2018

Test Number		1	
Length		207.7	mm
Diameter		103.7	mm
Bulk Density		1.50	Mg/m3
Moisture Content		98.5	%
Dry Density		0.76	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		60	kPa
At failure	Axial Strain	20.2	%
	Deviator Stress, (σ1 - σ3)f	6	kPa
	Undrained Shear Strength, cu	3	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Testing terminated at 20% strain

Approved: Stephen.Watson

Printed: 02/04/2018 16:50

Lab Sheet Reference :

Fig. No. 1

LABORATORY REPORT

4043

Contract Number: PSL18/1308

Report Date: 17 April 2018

Client's Reference: 17-0769

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Berth G.I.

Date Received: 21/3/2018
Date Commenced: 21/3/2018
Date Completed: 17/4/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	[redacted] S Eyre (Senior Technician)	A Fry (Senior Technician)

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Doncaster DN4 0AR
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e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH02	12	B	12.00	13.00	Reddish brown slightly sandy GRAVEL.
BH03A	7	B	12.50		Reddish brown slightly sandy GRAVEL.
BH03A	18	B	21.50	22.50	Grey slightly gravelly very sandy very silty CLAY.
BH03A	21	B	25.00	26.00	Brown mottled grey very sandy very silty CLAY.
BH03A	24	B	41.00	43.00	Brown very sandy clayey SILT.
BH07	20	B	20.00	20.50	Dark brown slightly gravelly sandy very silty peaty CLAY.
BH07	31	B	33.00	34.00	Grey very sandy slightly clayey silty GRAVEL.

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Stornoway Deep Water Berth G.I.

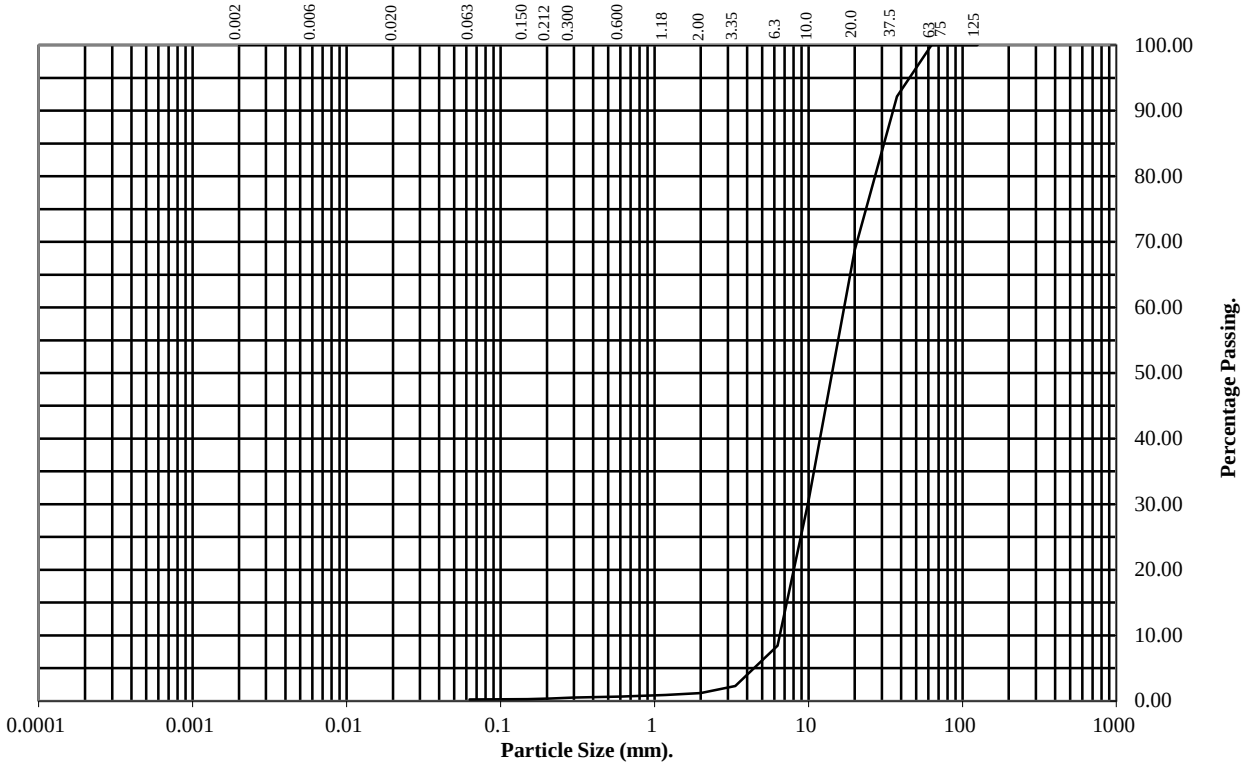
Contract No:
PSL18/1308
Client Ref:
17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH02**	**Top Depth (m):**	**12.00**
Sample Number:	**12**	**Base Depth(m):**	**13.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	69
10	31
6.3	8
3.35	2
2	1
1.18	1
0.6	1
0.3	1
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	99
Sand	1
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

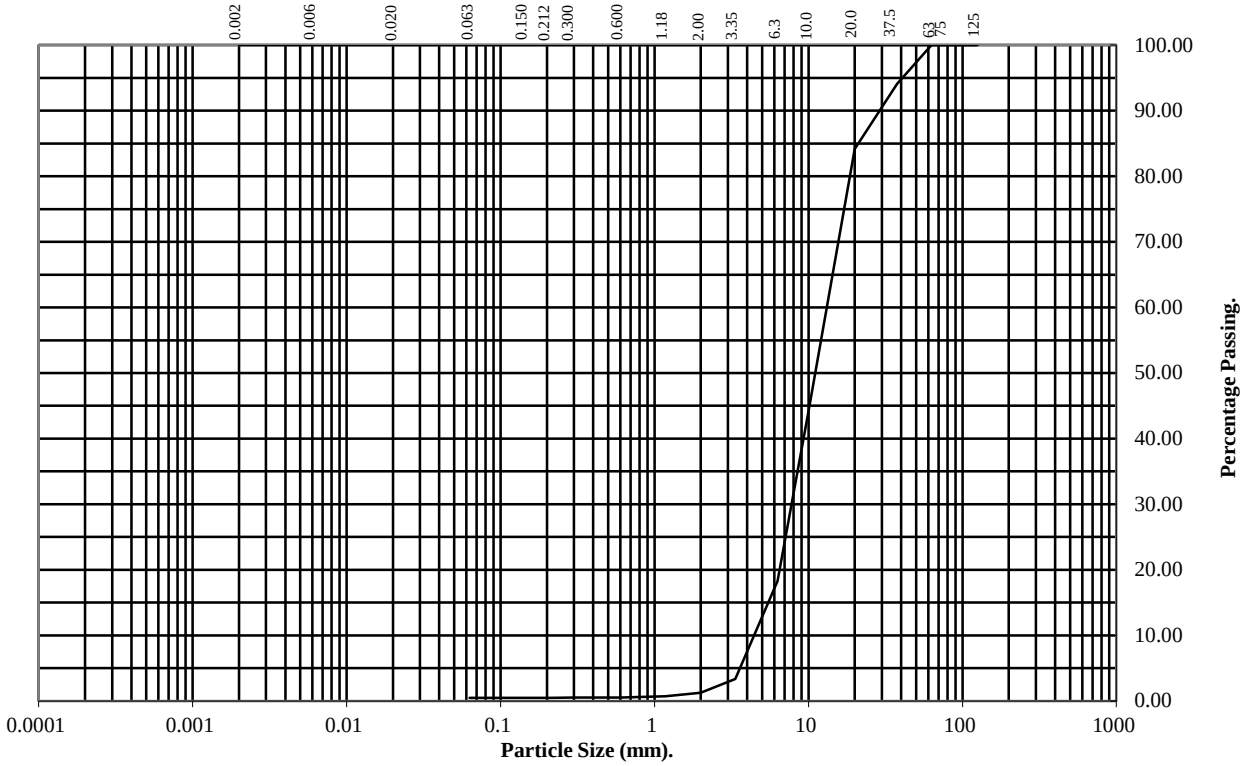
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH03A** **Top Depth (m):** **12.50**

Sample Number: **7** **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	94
20	84
10	44
6.3	18
3.35	3
2	1
1.18	1
0.6	1
0.3	1
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	99
Sand	1
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions

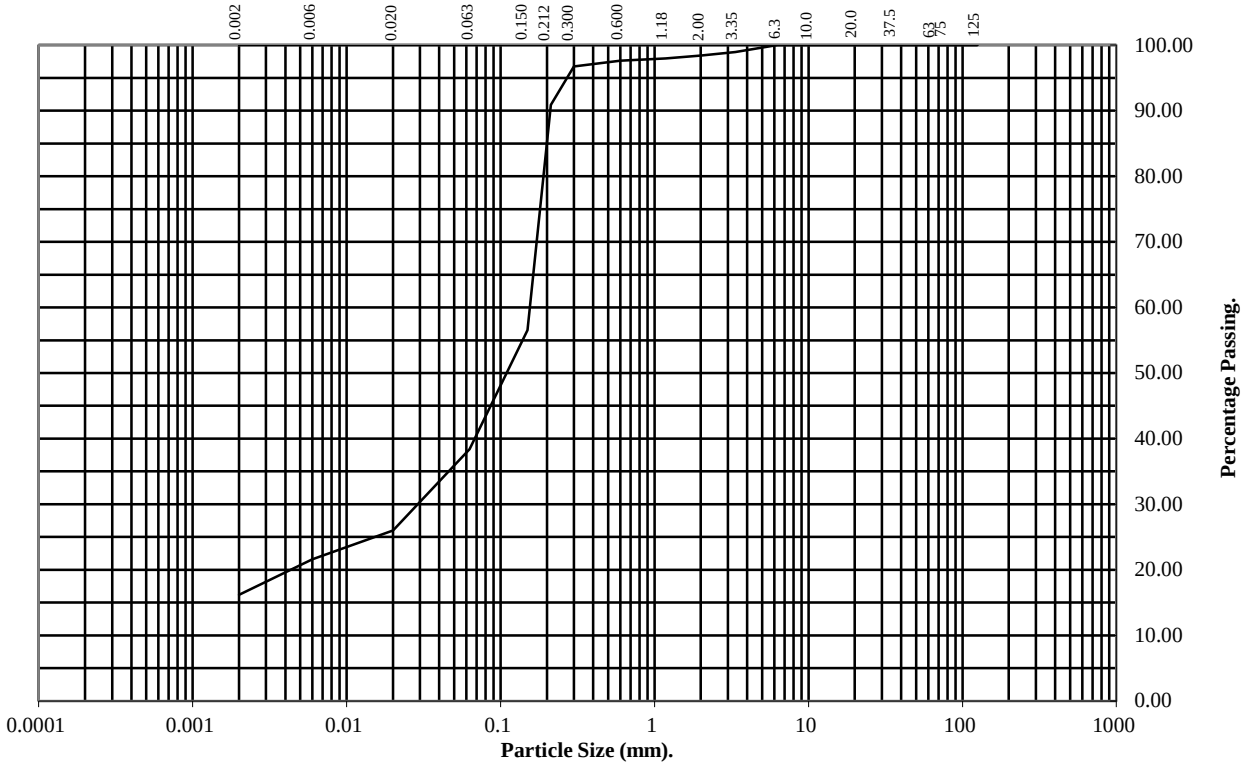
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH03A**	**Top Depth (m):**	**21.50**
Sample Number:	**18**	**Base Depth(m):**	**22.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	98
0.6	98
0.3	97
0.212	91
0.15	57
0.063	38

Particle Diameter	Percentage Passing
0.02	26
0.006	22
0.002	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	60
Silt	22
Clay	16

Remarks:

See Summary of Soil Descriptions

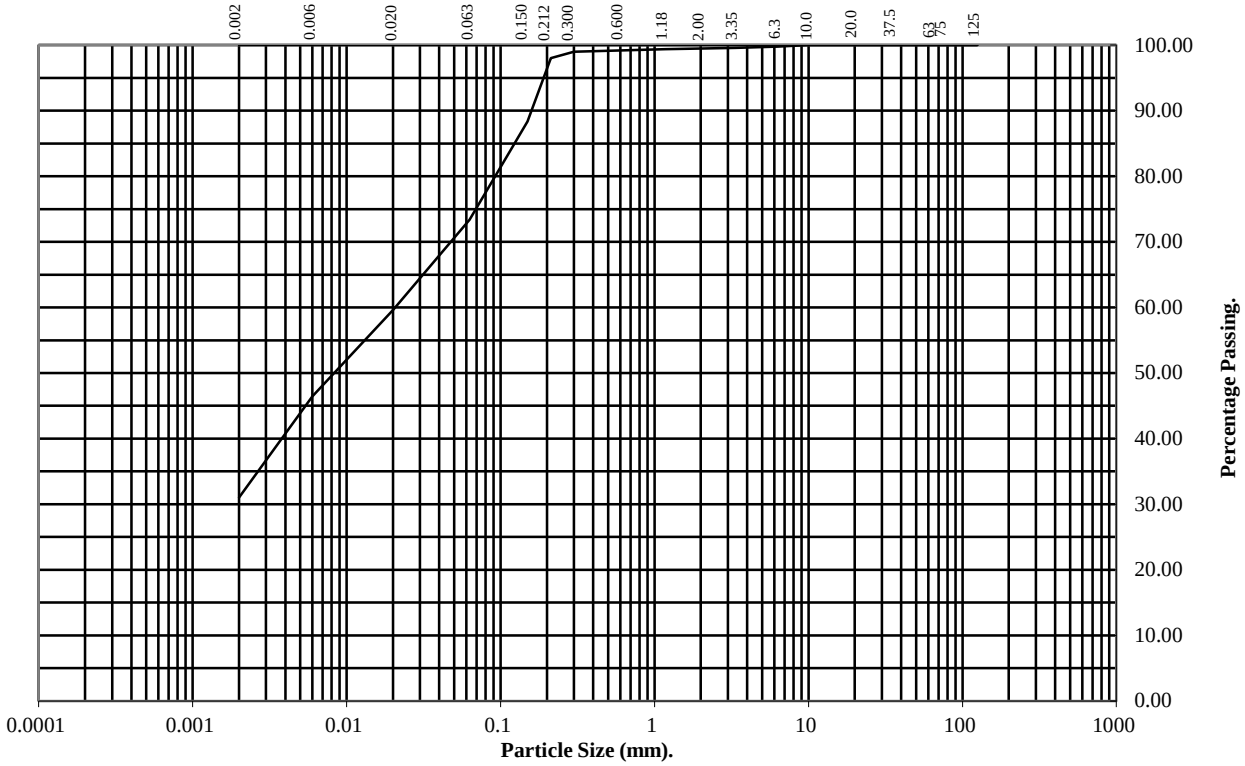
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH03A**	**Top Depth (m):**	**25.00**
Sample Number:	**21**	**Base Depth(m):**	**26.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	99
0.3	99
0.212	98
0.15	88
0.063	73

Particle Diameter	Percentage Passing
0.02	60
0.006	46
0.002	31

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	27
Silt	42
Clay	31

Remarks:
See Summary of Soil Descriptions

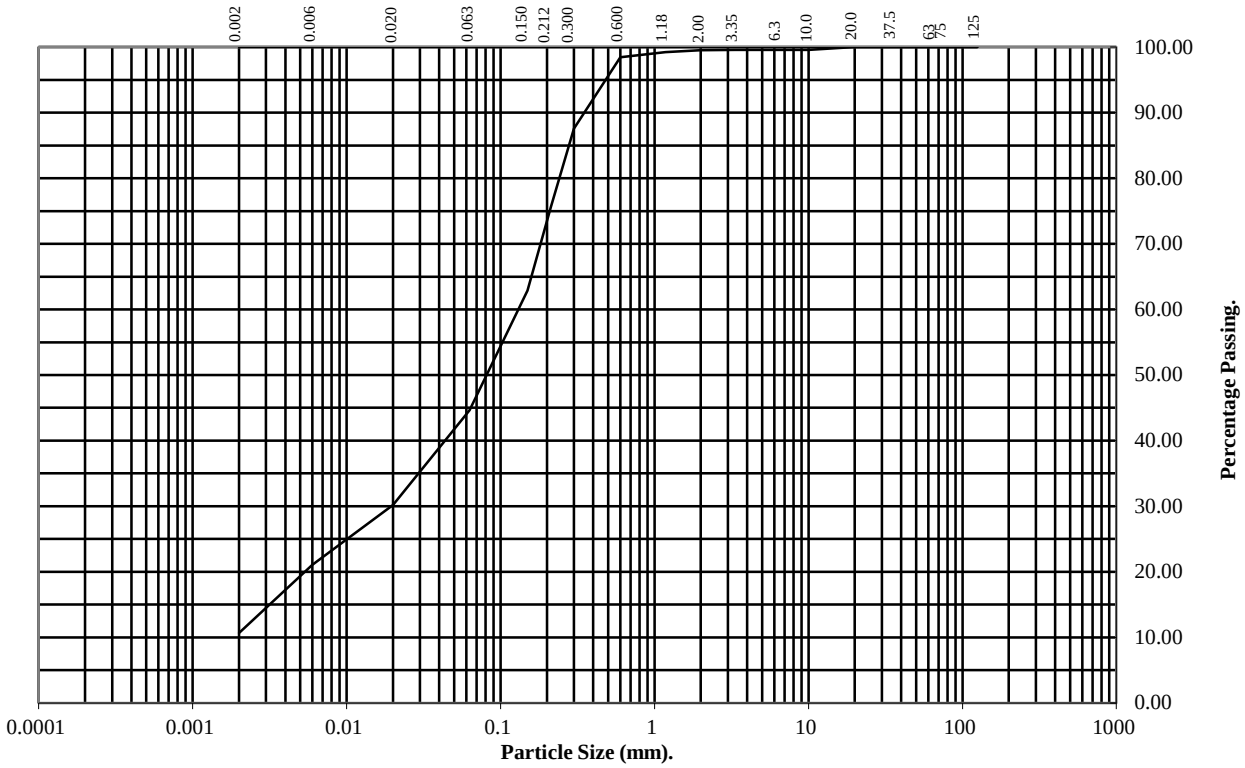
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH03A**	**Top Depth (m):**	**41.00**
Sample Number:	**24**	**Base Depth(m):**	**43.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	98
0.3	88
0.212	76
0.15	63
0.063	45

Particle Diameter	Percentage Passing
0.02	30
0.006	21
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	55
Silt	34
Clay	11

Remarks:
See Summary of Soil Descriptions

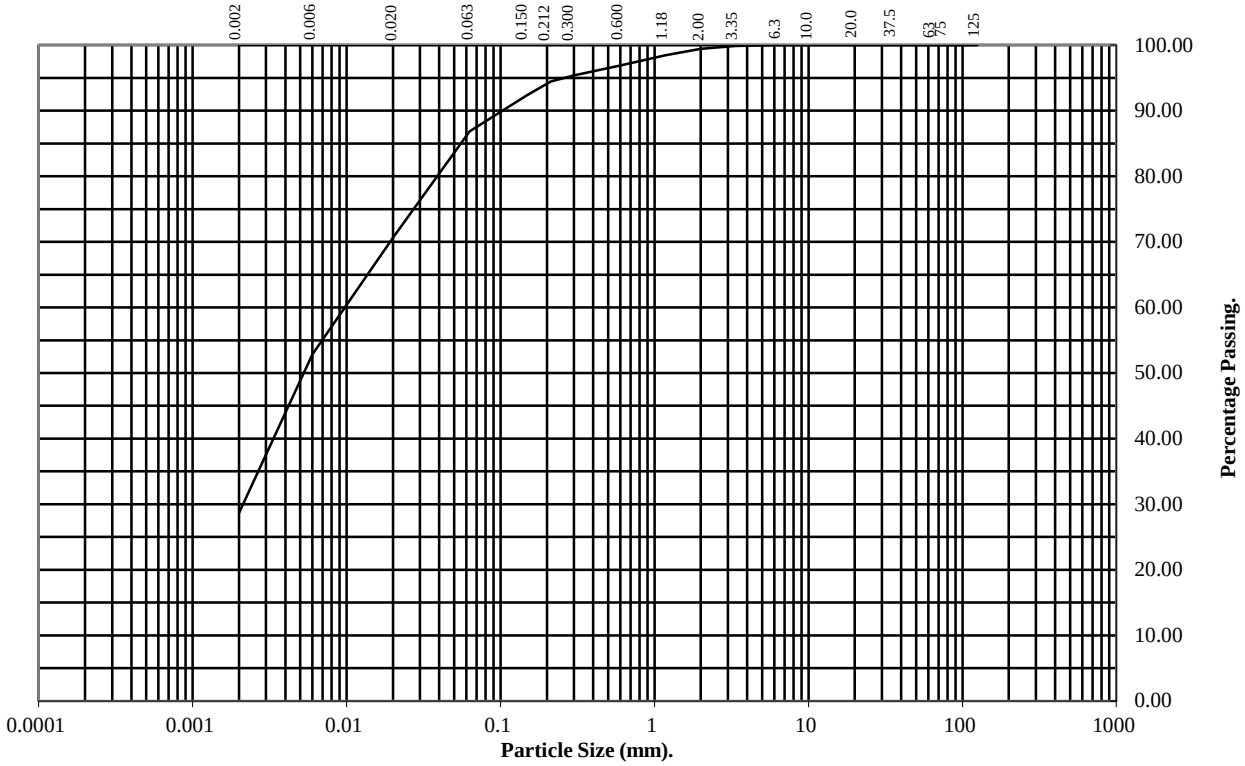
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH07**	**Top Depth (m):**	**20.00**
Sample Number:	**20**	**Base Depth(m):**	**20.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	98
0.6	97
0.3	95
0.212	94
0.15	92
0.063	87

Particle Diameter	Percentage Passing
0.02	71
0.006	53
0.002	29

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	12
Silt	58
Clay	29

Remarks:
See Summary of Soil Descriptions

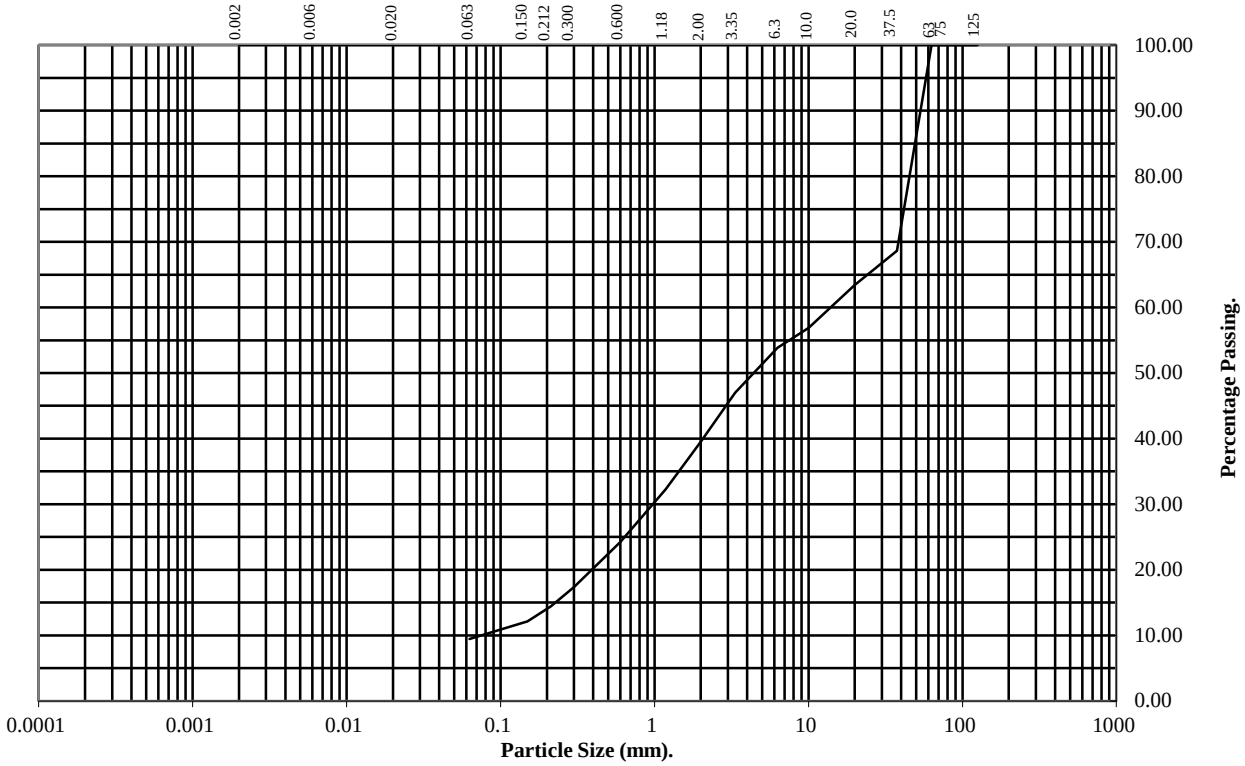
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-1769

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH07**	**Top Depth (m):**	**33.00**
Sample Number:	**31**	**Base Depth(m):**	**34.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	69
20	63
10	57
6.3	54
3.35	47
2	40
1.18	32
0.6	24
0.3	17
0.212	14
0.15	12
0.063	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	60
Sand	31
Silt/Clay	9

Remarks:

See Summary of Soil Descriptions

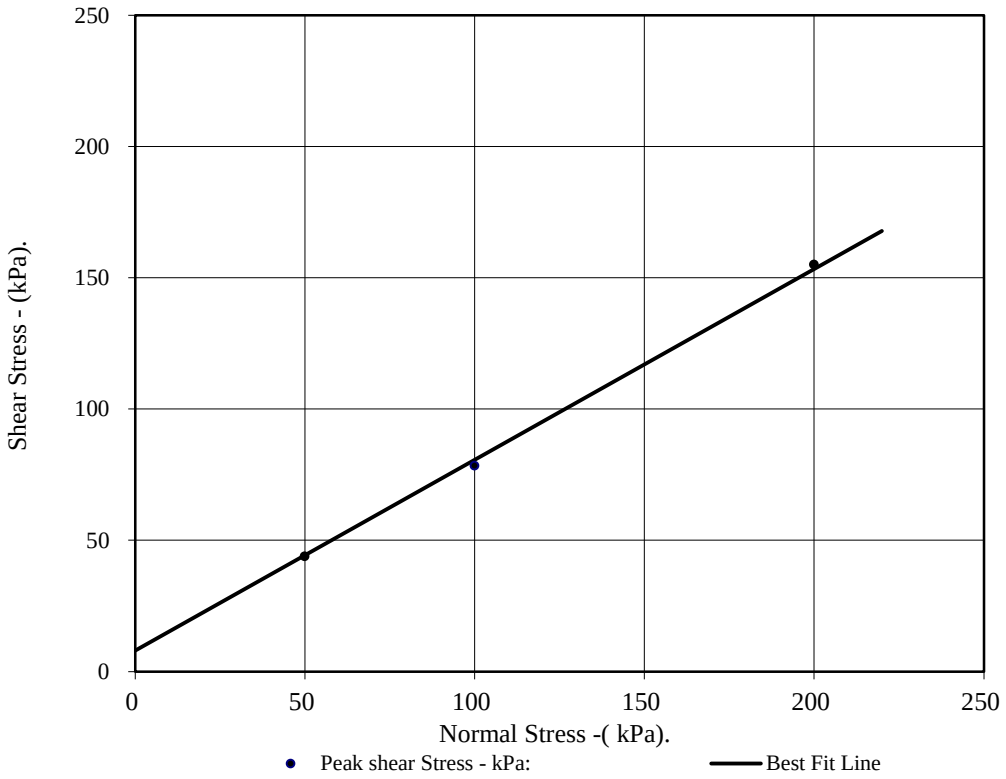
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No: PSL18/1308** **Client Ref: 17-1769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**		Top Depth:	**21.50**
Sample Number:	**18**		Base Depth:	**22.50**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.54	19.54	19.54
Length - mm:	60.03	60.03	60.03
Moisture Content - %:	38	38	38
Bulk Density - Mg/m3:	1.87	1.88	1.87
Dry Density - Mg/m3:	1.36	1.37	1.36
Voids Ratio:	0.950	0.941	0.945
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	16.95	16.18	15.74
Shearing Stage			
Rate of Strain (mm/min)	0.013	0.013	0.013
Displacement at peak shear stress (mm)	10.00	10.00	10.00
Peak shear Stress - kPa:	44	78	155
Final Consolidated Conditions			
Moisture Content - %:	31	29	26
Bulk Density - Mg/m3:	2.15	2.27	2.33
Dry Density - Mg/m3:	1.64	1.76	1.85
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**8**		

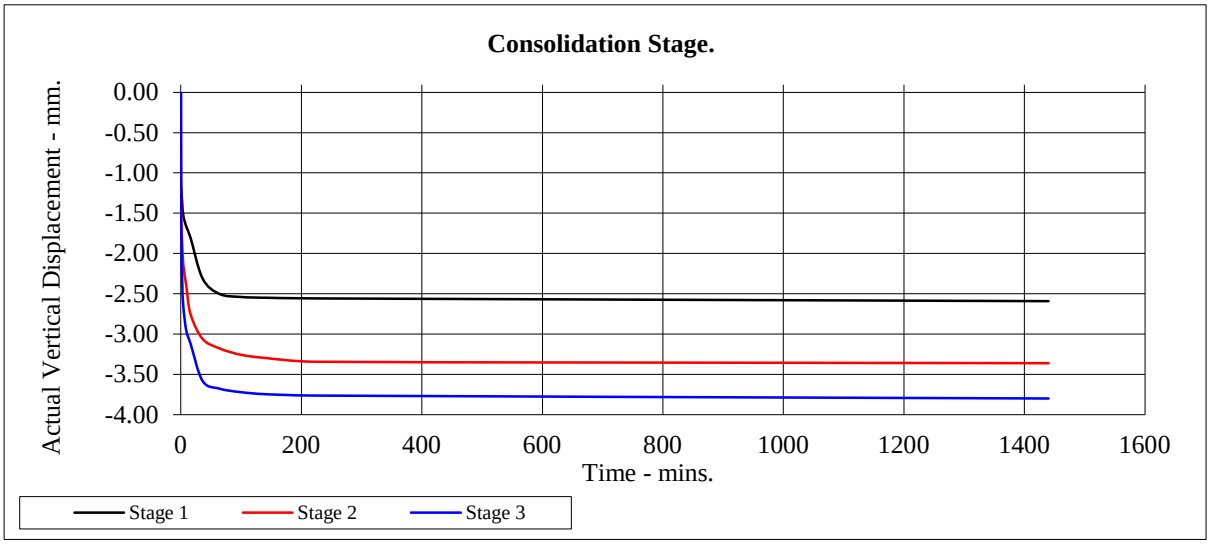


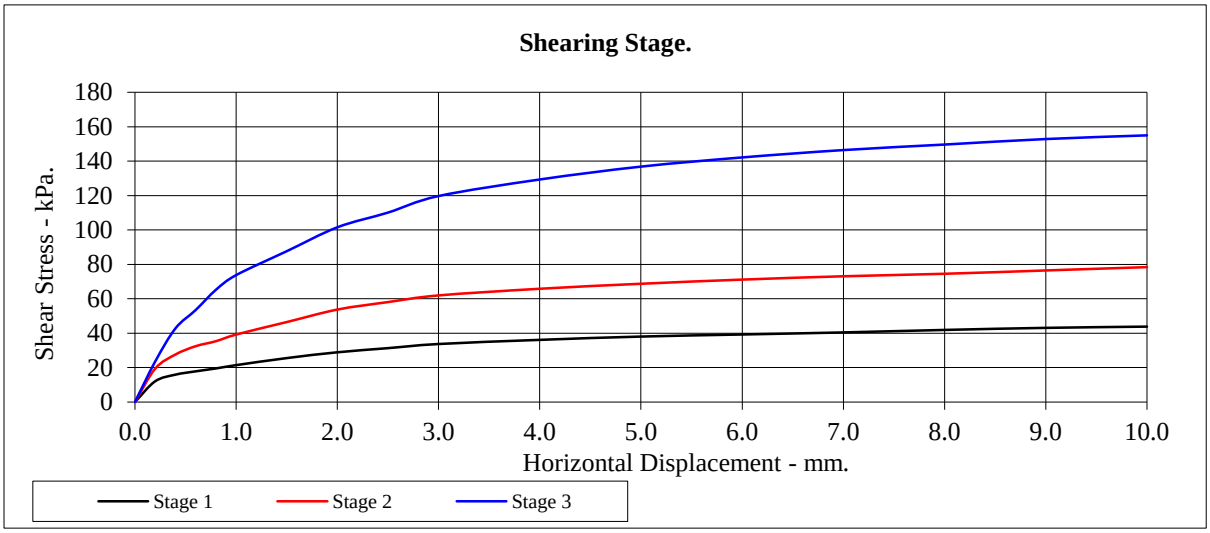
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** **PSL18/1308** **Client Ref:** **17-0769**

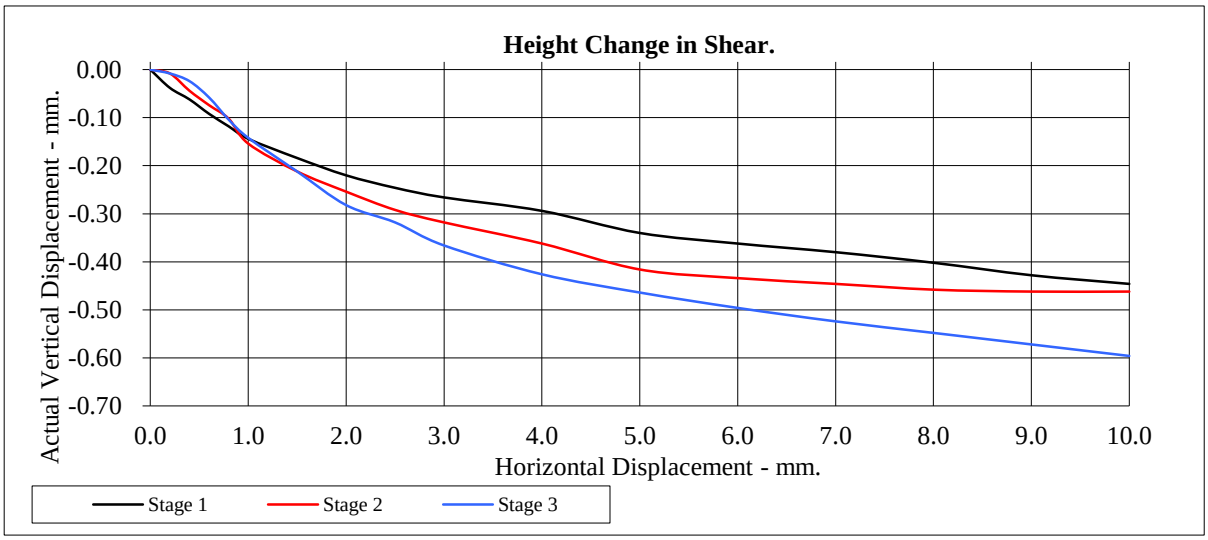
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**	Top Depth:	**21.50**
Sample Number:	**18**	Base Depth:	**22.50**







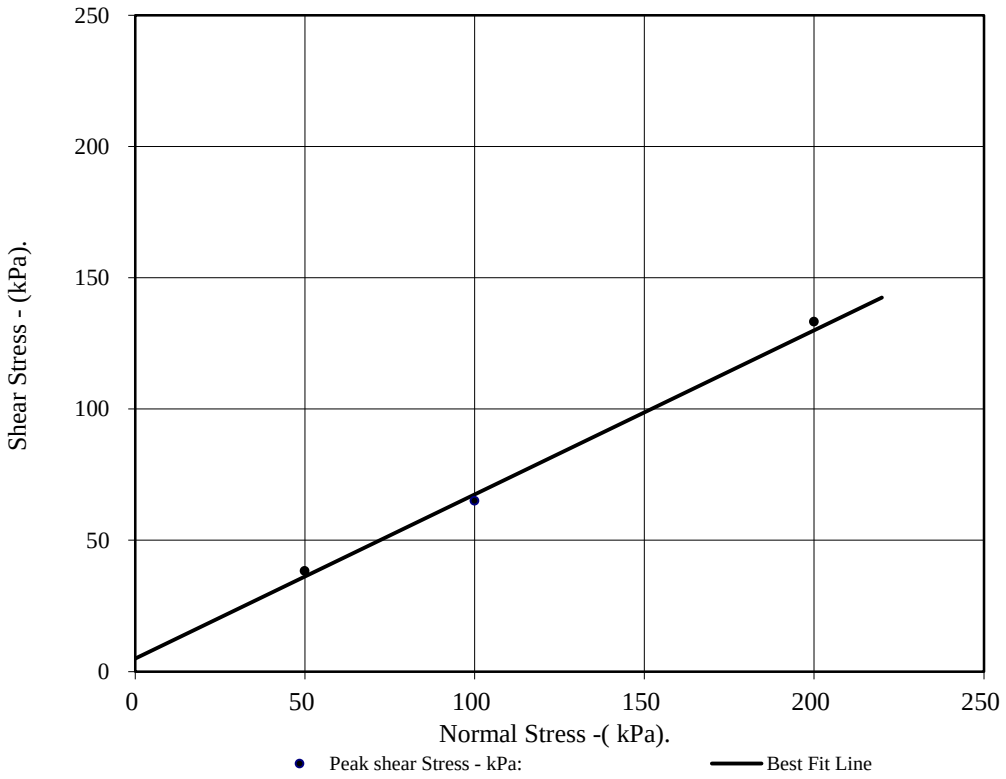
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** **PSL18/1308** **Client Ref:** **17-0769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**		Top Depth:	**25.00**
Sample Number:	**21**		Base Depth:	**26.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	24.51	24.51	24.51
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	39	39	39
Bulk Density - Mg/m3:	1.81	1.81	1.81
Dry Density - Mg/m3:	1.30	1.31	1.30
Voids Ratio:	1.034	1.029	1.033
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	22.43	21.96	21.45
Shearing Stage			
Rate of Strain - mm/min	0.01	0.01	0.01
Displacement at peak shear stress - mm	5.70	5.10	6.60
Peak shear Stress - kPa:	38	65	133
Final Consolidated Conditions			
Moisture Content - %:	32	30	27
Bulk Density - Mg/m3:	1.98	2.03	2.07
Dry Density - Mg/m3:	1.50	1.56	1.63
Peak			
Angle of Shearing Resistance:(~~θ~~)	**32**		
Effective Cohesion - kPa:	**5**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

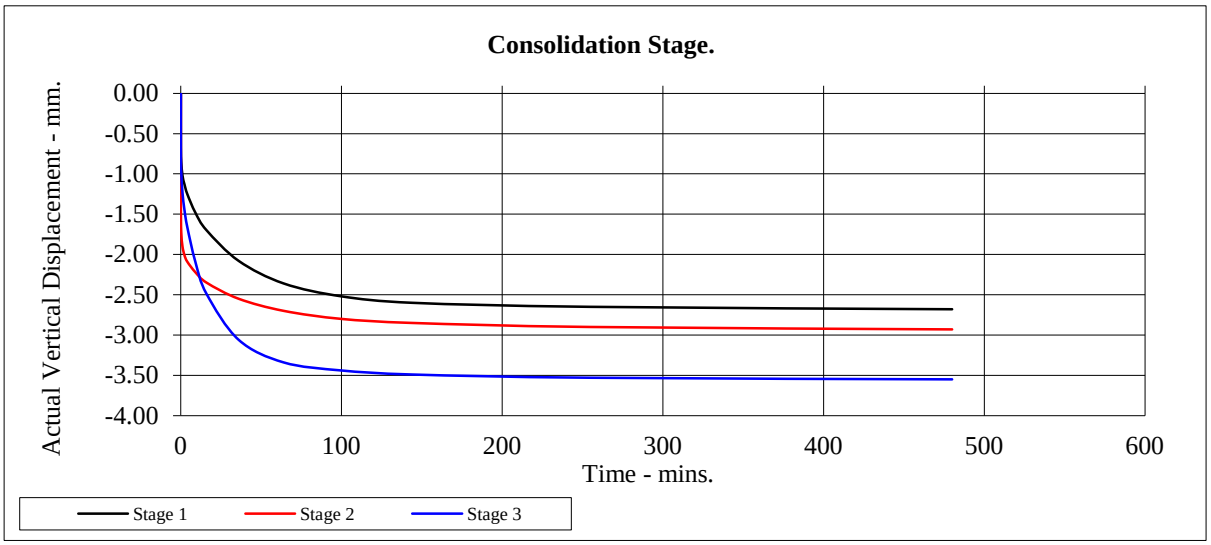
Stornoway Deep Water Berth G.I.

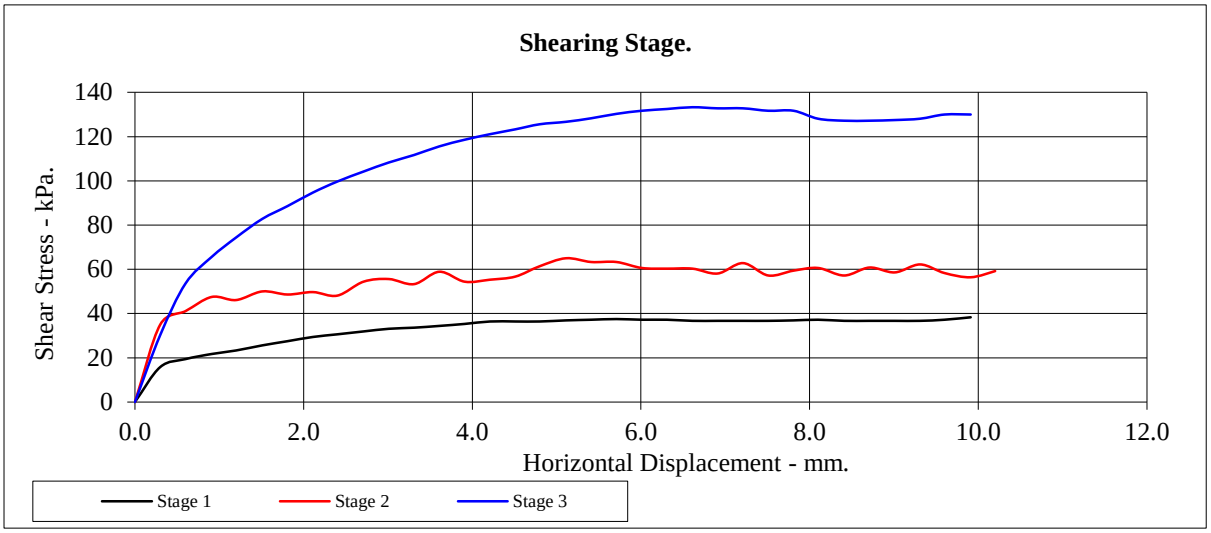
Contract No:
PSL18/1308
Client Ref:
17-0769

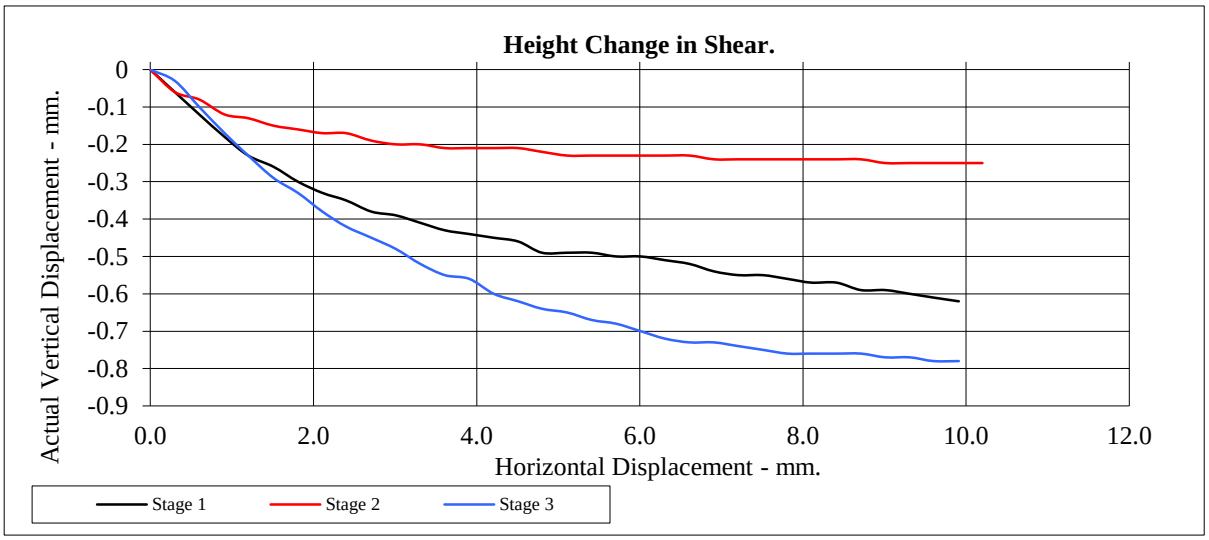
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**	Top Depth:	**25.00**
Sample Number:	**21**	Base Depth:	**26.00**







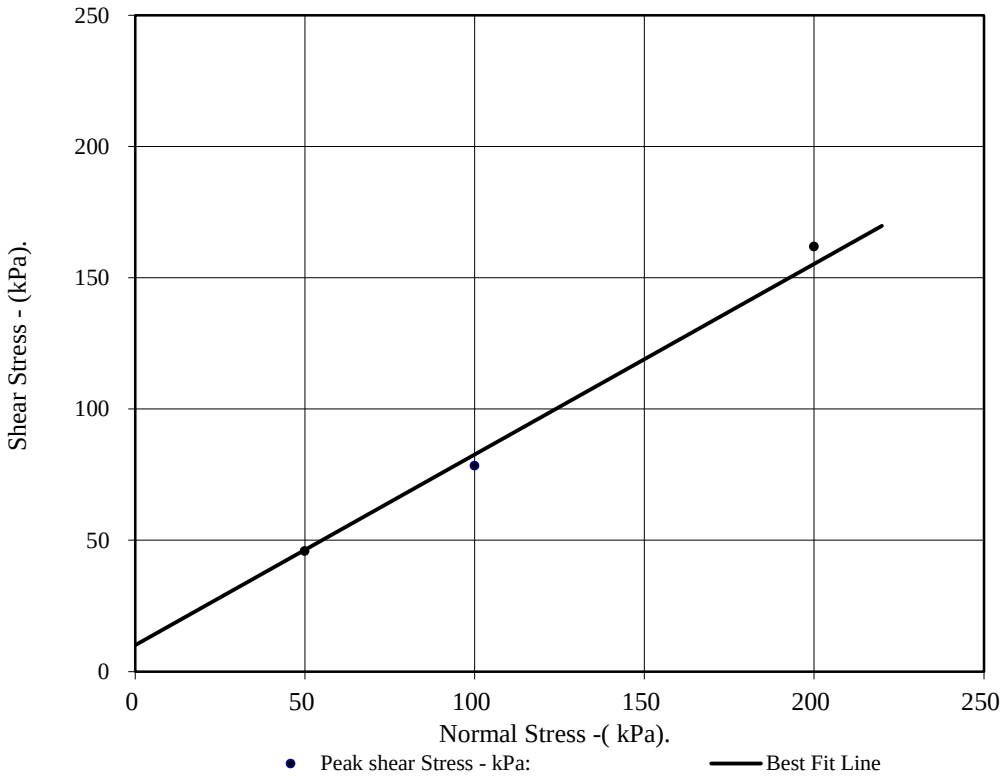
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water Berth G.I.**	**Contract No: PSL18/1308** **Client Ref: 17-0769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**		Top Depth:	**41.00**	
Sample Number:	**24**		Base Depth:	**43.00**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.54	19.54	19.54
Length - mm:	60.03	60.03	60.03
Moisture Content - %:	28	28	28
Bulk Density - Mg/m3:	1.95	1.96	1.96
Dry Density - Mg/m3:	1.52	1.53	1.53
Voids Ratio:	0.741	0.731	0.735
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.38	16.43	16.21
Shearing Stage			
Rate of Strain (mm/min)	0.086	0.086	0.086
Displacement at peak shear stress (mm)	6.00	7.00	7.00
Peak shear Stress - kPa:	46	78	162
Final Consolidated Conditions			
Moisture Content - %:	23	22	20
Bulk Density - Mg/m3:	2.20	2.33	2.36
Dry Density - Mg/m3:	1.79	1.92	1.96
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**10**		

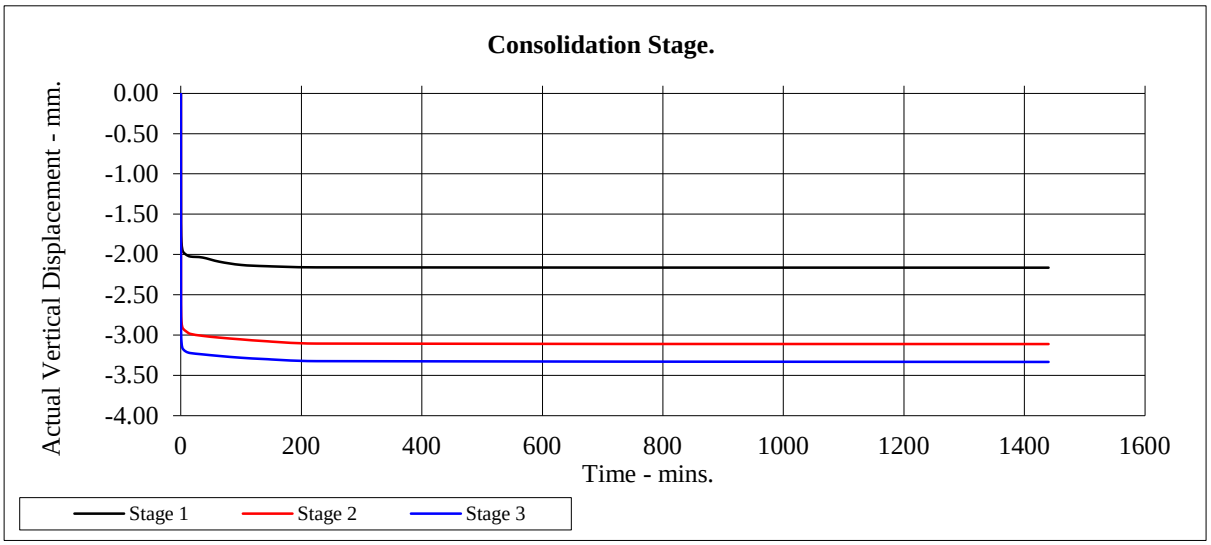


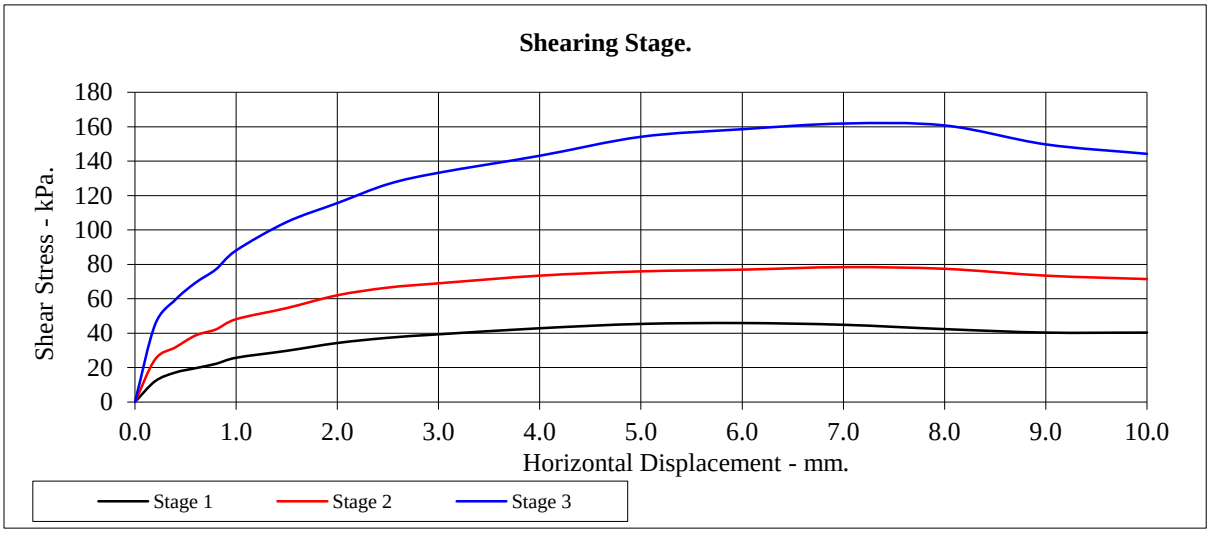
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-0769

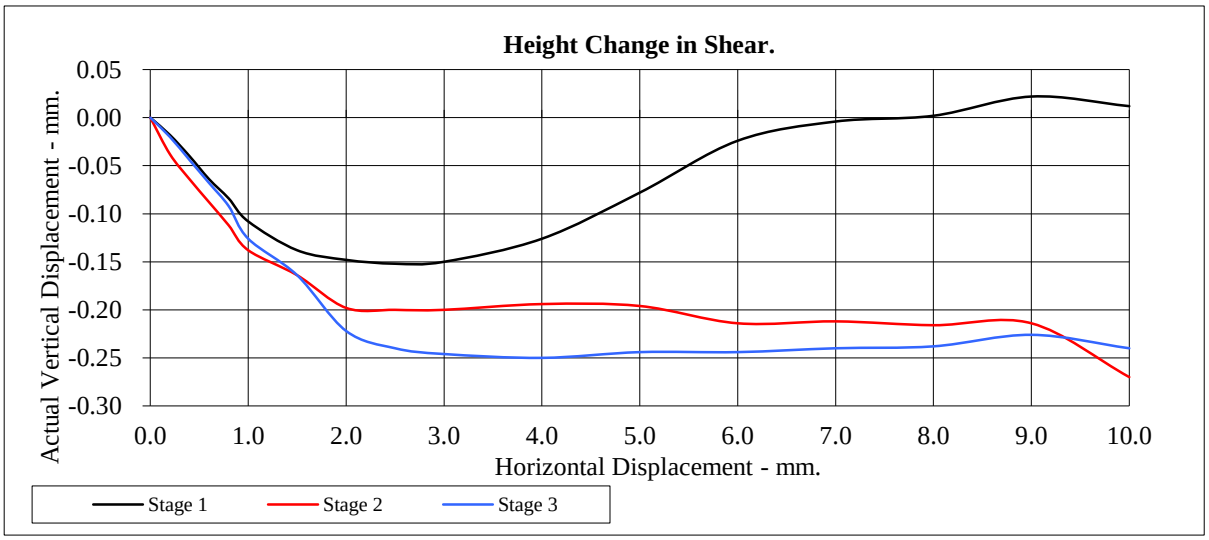
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH03A**	Top Depth:	**41.00**
Sample Number:	**24**	Base Depth:	**43.00**







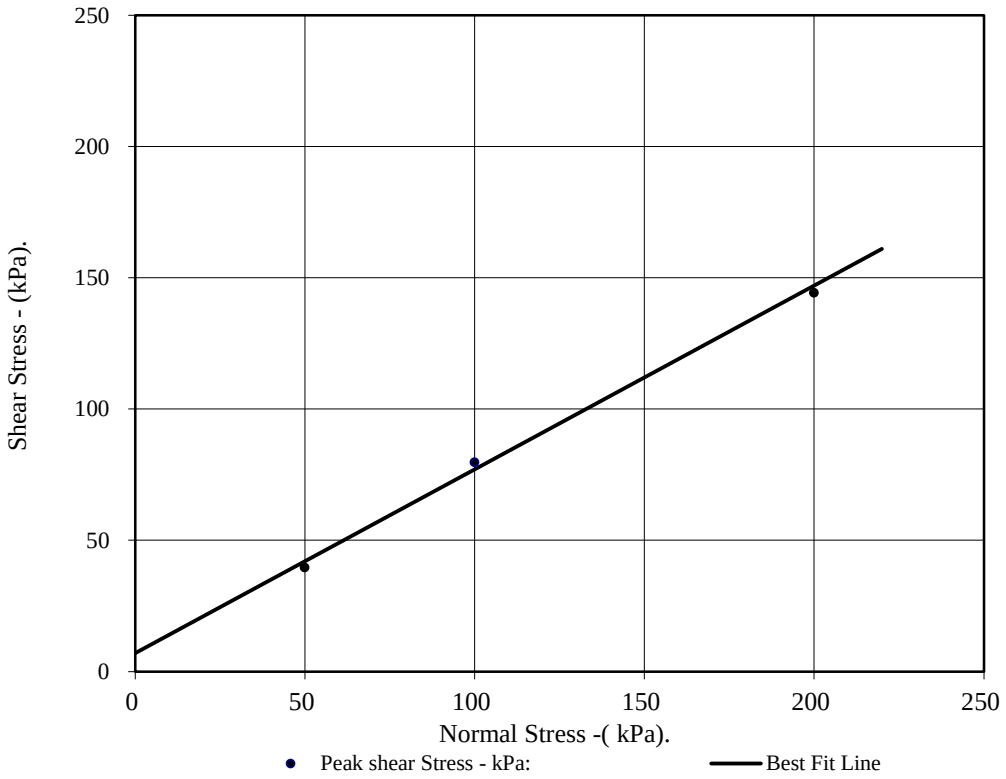
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** **PSL18/1308** **Client Ref:** **17-0769**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH07**		Top Depth:	**20.00**
Sample Number:	**20**		Base Depth:	**20.50**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.54	19.54	19.54
Length - mm:	60.03	60.03	60.03
Moisture Content - %:	179	179	179
Bulk Density - Mg/m3:	1.33	1.34	1.33
Dry Density - Mg/m3:	0.48	0.48	0.48
Voids Ratio:	4.557	4.503	4.554
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	15.49	14.20	12.15
Shearing Stage			
Rate of Strain (mm/min)	0.013	0.013	0.013
Displacement at peak shear stress (mm)	10.00	10.00	10.00
Peak shear Stress - kPa:	40	80	144
Final Consolidated Conditions			
Moisture Content - %:	99	89	84
Bulk Density - Mg/m3:	1.68	1.85	2.14
Dry Density - Mg/m3:	0.84	0.97	1.16
Peak			
Angle of Shearing Resistance:(~~θ~~)	**35**		
Effective Cohesion - kPa:	**7**		

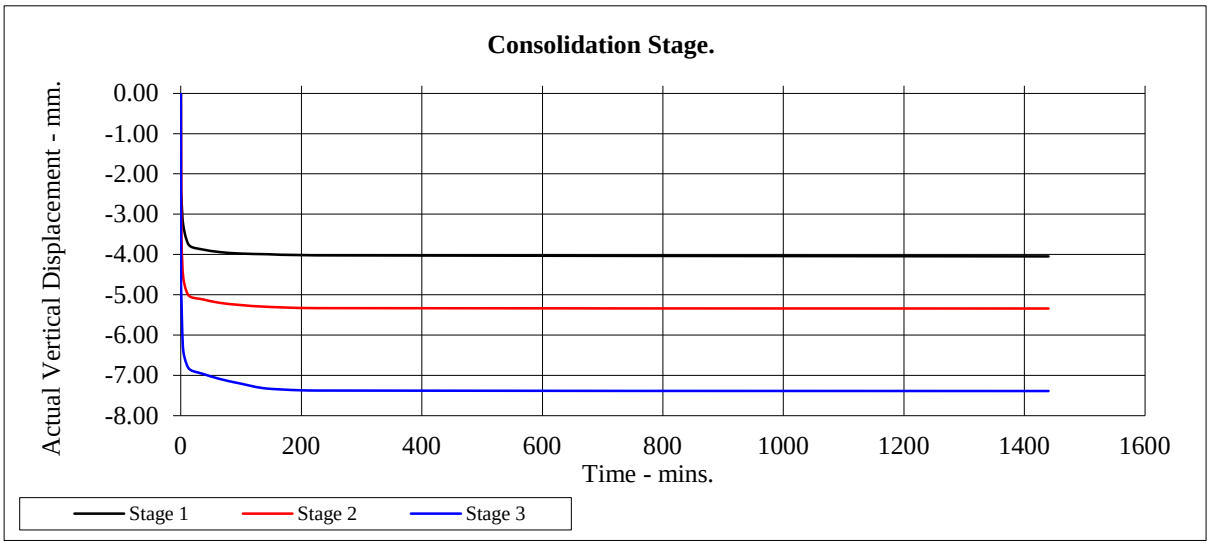


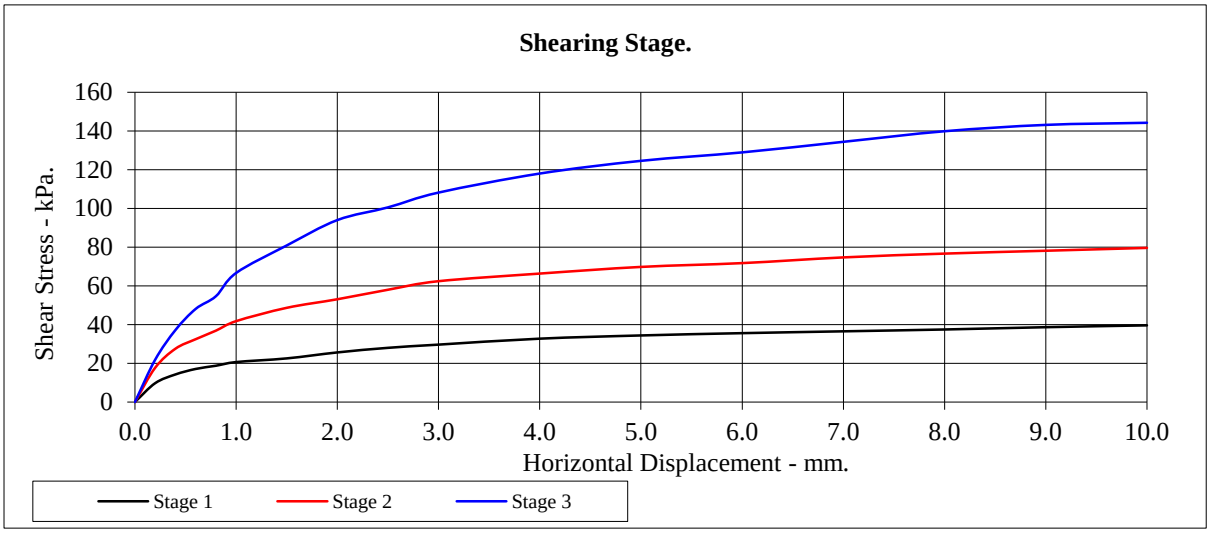
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-0769

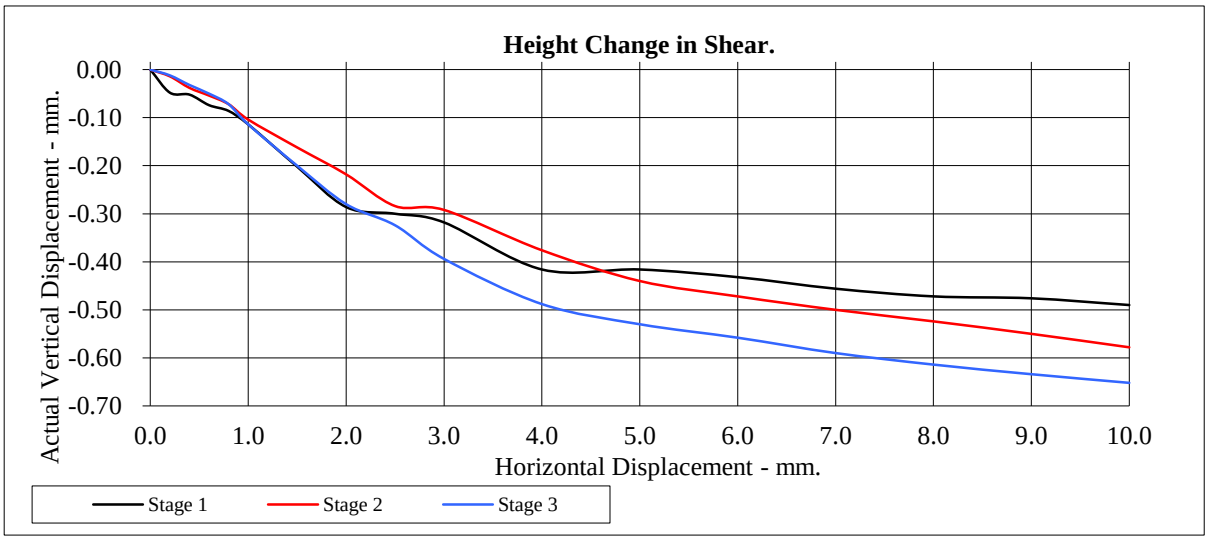
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH07**	Top Depth:	**20.00**
Sample Number:	**20**	Base Depth:	**20.50**







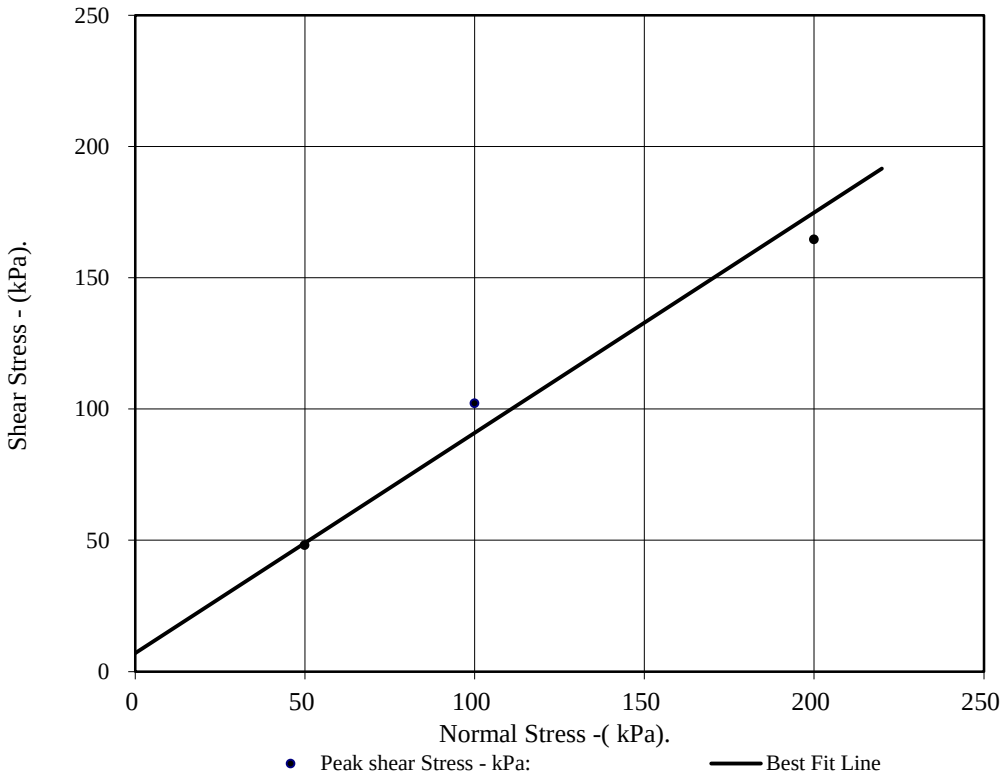
UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** PSL18/1308 / **Client Ref:** 17-0769

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH07**		Top Depth:	**33.00**
Sample Number:	**31**		Base Depth:	**34.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 2mm sieve			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	19.54	19.54	19.54
Length - mm:	60.03	60.03	60.03
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	2.23	2.23	2.23
Dry Density - Mg/m3:	1.99	1.99	1.99
Voids Ratio:	0.329	0.330	0.332
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	18.78	18.65	18.04
Shearing Stage			
Rate of Strain (mm/min)	1.090	1.090	1.090
Displacement at peak shear stress (mm)	3.00	4.00	4.00
Peak shear Stress - kPa:	48	102	165
Final Consolidated Conditions			
Moisture Content - %:	14	13	13
Bulk Density - Mg/m3:	2.32	2.34	2.41
Dry Density - Mg/m3:	2.04	2.07	2.14
Peak			
Angle of Shearing Resistance:(~~θ~~)	**40**		
Effective Cohesion - kPa:	**7**		

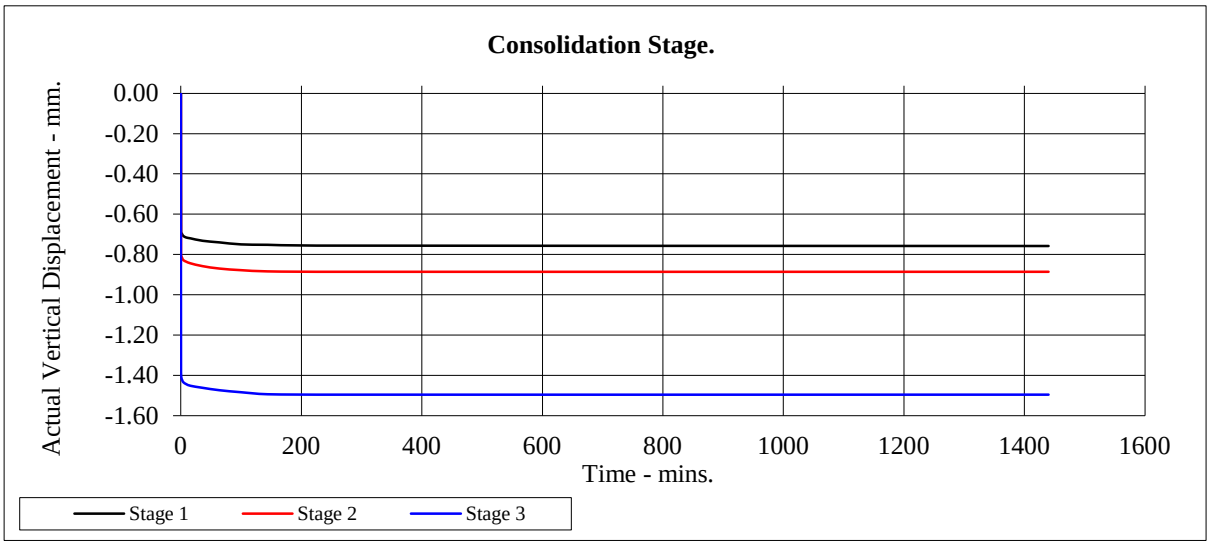


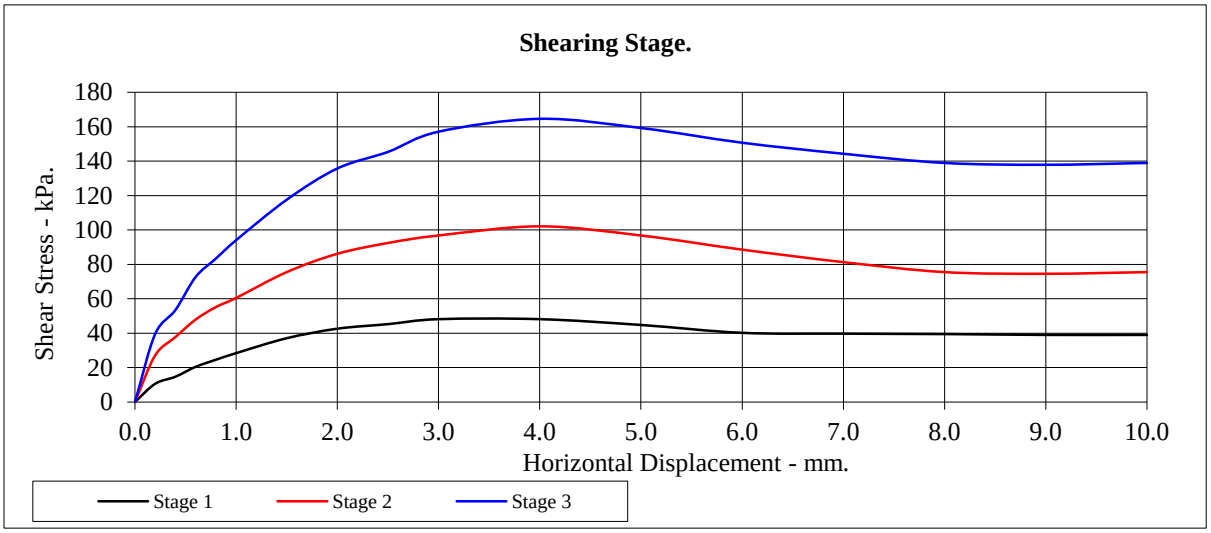
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No:** PSL18/1308 **Client Ref:** 17-0769

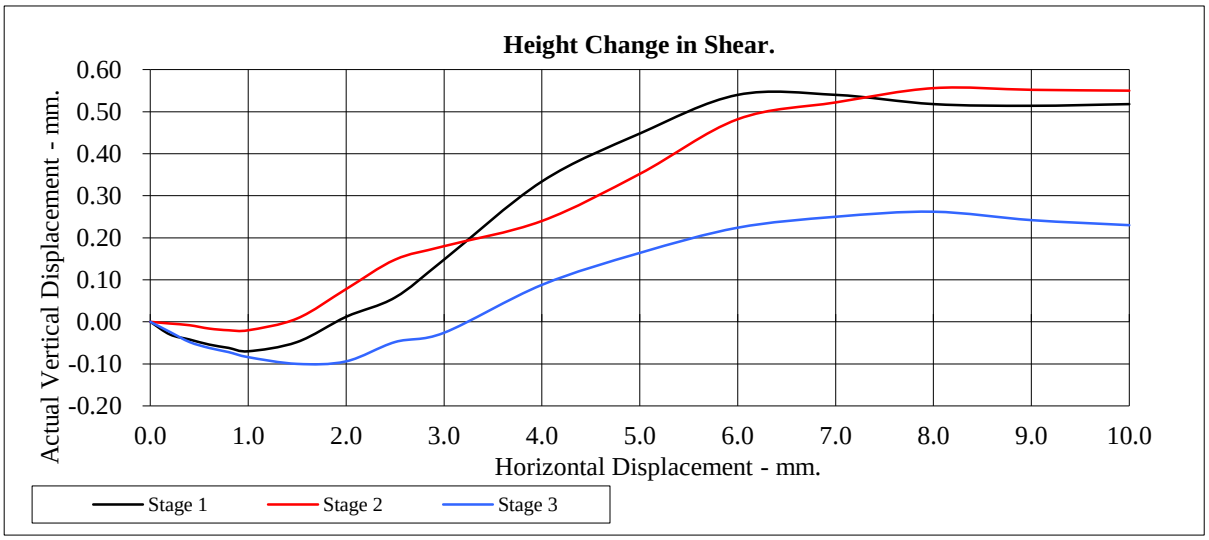
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4.5.4

Hole Number:	**BH07**	Top Depth:	**33.00**
Sample Number:	**31**	Base Depth:	**34.00**







UKAS TESTING 4043 / PSL Professional Soils Laboratory	**Stornoway Deep Water G.I.**	**Contract No: PSL18/1308** **Client Ref: 17-0769**

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.: 18-07837-1

Initial Date of Issue: 23-Mar-2018

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): [redacted]

Project 17-0769 Stornoway Deep Water Berth
G.I

Quotation No.:

Order No.:

No. of Samples: 26

Turnaround (Wkdays): 3

Date Approved: 23-Mar-2018

Approved By:

[redacted]

Details: Robert Monk, Technical Manager

Date Received: 21-Mar-2018

Date Instructed: 21-Mar-2018

Results Due: 23-Mar-2018

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 17-0769 Stornoway Deep Water Berth G.I

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837
Quotation No.:				**Chemtest Sample ID.:**	595364	595365	595366	595367	595368	595369	595370	595371	595372
Order No.:				Client Location ID.:	BH02	BH02	BH02	BH02	BH02	BH03A	BH03A	BH03A	BH03A
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	1.20	17.50	21.50	23.50	26.50	20.60	27.00	28.50	32.00
				Bottom Depth (m):	1.50	18.00	22.00	24.00	27.00	21.00	27.45		
				Date Sampled:	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	3.2	22	24	47	28	25	30	34	58
pH	U	2010		N/A	9.3	8.6	8.4	7.4	8.2	8.3	8.2	7.8	6.8
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.092	0.50	0.54	1.5	0.52	0.91	0.39	0.81	1.9
Organic Matter	U	2625	%	0.40			0.67	6.2	1.2				

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 17-0769 Stornoway Deep Water Berth G.I

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837
Quotation No.:				**Chemtest Sample ID.:**	595373	595374	595375	595376	595377	595378	595379	595380	595381
Order No.:				Client Location ID.:	BH07	BH07	BH07	BH07	BH07	BH11	BH11	BH11	BH23
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	8.50	15.00	25.00	28.00	32.50	8.50	11.00	13.50	0.70
				Bottom Depth (m):		15.40	25.45			8.95		14.00	1.00
				Date Sampled:	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	20	21	28	42	12	31	32	18	8.8
pH	U	2010		N/A	8.3	8.4	8.6	8.4	8.5	8.3	8.5	8.4	8.9
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.35	0.60	0.53	0.19	0.11	0.45	0.49	0.23	0.37
Organic Matter	U	2625	%	0.40		0.69							

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 17-0769 Stornoway Deep Water Berth G.I

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837	18-07837
Quotation No.:				**Chemtest Sample ID.:**	595382	595383	595384	595385	595386	595387	595388	595389
Order No.:				Client Location ID.:	BH23	BH27	BH30	BH31	BH31	BH32	BH32	BH32
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	2.50	1.00	2.00	2.00	4.00	1.00	4.00	5.40
				Bottom Depth (m):	3.00	1.50	2.50	2.45	4.45	1.50	4.45	5.80
				Date Sampled:	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018	20-Mar-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Moisture	N	2030	%	0.020	11	2.6	29	40	42	43	43	25
pH	U	2010		N/A	9.0	9.2	8.3	8.0	8.3	8.1	8.1	8.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.22	0.15	0.90	0.49	0.83	0.55	0.70	0.65
Organic Matter	U	2625	%	0.40						3.6	3.6	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Client:	**Stornoway Port Authority**
Engineer:	**Wallace Stone Consulting Civil Engineers**
From:	**Stephen Watson** **Laboratory Manager** **Causeway Geotech Ltd**
Tel:	**+44(0)2827666640**
E-mail:	**stephen.watson@causewaygeotech.com**
Date:	**04/04/18**
Ref:	**17-0769 – Rock Schedule 1**

Stornoway Deep Water Berth G.I.

We are pleased to attach the results of laboratory testing carried out for the above project**.** This memo and its attachments constitute a report of the results of tests as detailed in the *Contents page(s)*.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory

[redacted]

Stephen Watson
Laboratory Manager

+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

Project Name **Stornoway Deep Water Berth G.I.**

Report Reference. **17-0769 – Rock Schedule 1**

The table below details the tests carried out, the specifications used, and the number of tests included in this report:

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	Number of test results included in the report
SOIL	Moisture Content of Soil	BS1377: Part 2: Clause 3.2: 1990	2
SOIL	Liquid and Plastic Limits of soil -1-point cone penetrometer method	BS1377: Part 2: Clauses 4.4, 5.3 & 5.4 1990	2
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS1377: Part 7: Clause 8: 1990	2
SOIL – Subcontracted to Chemtest Ltd	pH Value of Soil		2
SOIL - Subcontracted to Chemtest Ltd	Sulphate Content water extract		2
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	34
ROCK – Subcontracted to MATtest Limited	Uniaxial Compressive Strength (UCS)	ISRM Suggested Methods - Rock Characterization Testing and Monitoring, Ed. E T Brown - 1981	7

[redacted]

Summary of Classification Test Results

Project No.	Project Name
17-0769	Stornoway Deep Water Berth G.I.

Hole No.	Sample				Soil Description	Density bulk Mg/m^3	Density dry Mg/m^3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m^3	Casagrande Classification
	Ref	Top	Base	Type										
BH03A		30.50		C	Brown slightly sandy organic clayey SILT.			83	100	53 -1pt	33	20		MH
BH03A		32.80		C	Brown slightly sandy clayey SILT.			45	97	133 -1pt	63	70		ME

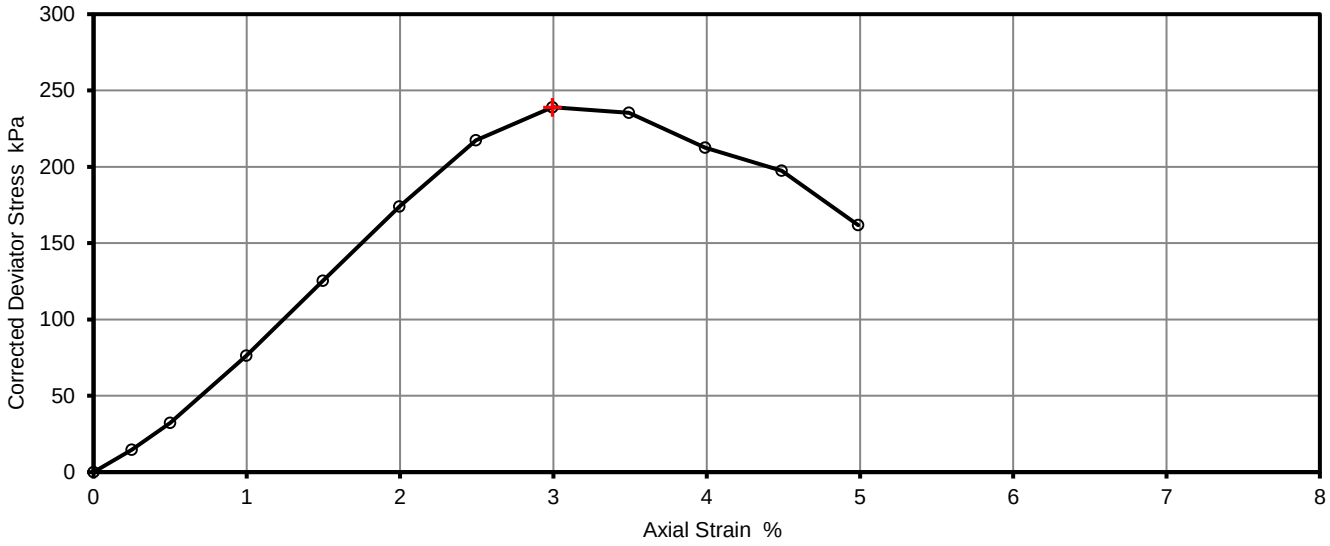
All tests performed in accordance with BS1377:1990 unless specified otherwise

Key			Date Printed	Approved By	Table
Density test	Liquid Limit	Particle density			1
Linear measurement unless :	4pt cone unless :	sp - small pyknometer	29/03/2018		
wd - water displacement	cas - Casagrande method	gj - gas jar			sheet
wi - immersion in water	1pt - single point test			Stephen.Watson	1

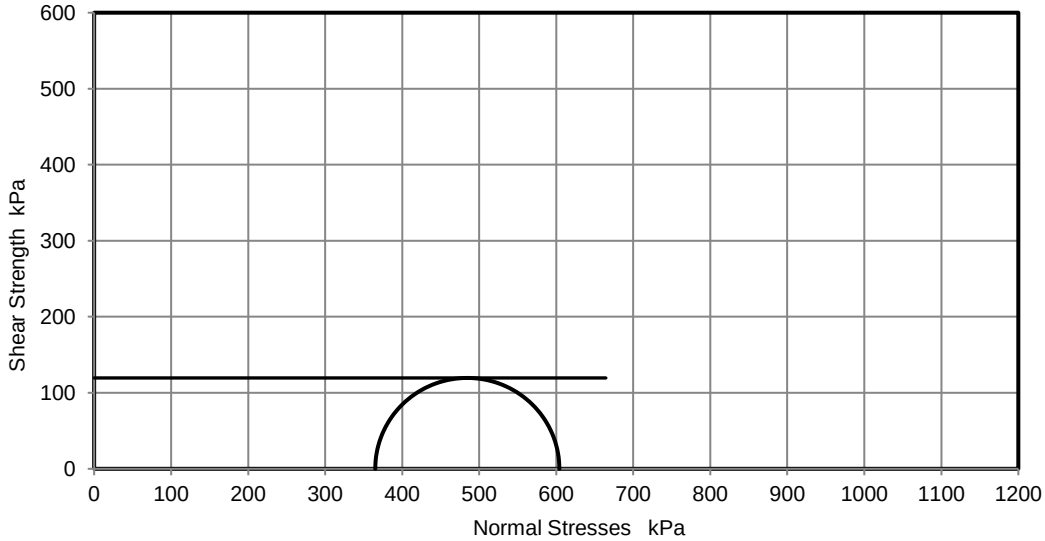
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	
Soil Description	Brown slightly sandy organic clayey SILT.			Depth	30.50
Specimen Reference	2	Specimen Depth	m	Sample Type	C
Specimen Description	Stiff brown slightly sandy organic clayey SILT.			KeyLAB ID	Caus201803213
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	28/03/2018

Test Number		1	
Length		200.5	mm
Diameter		98.8	mm
Bulk Density		1.39	Mg/m3
Moisture Content		83.2	%
Dry Density		0.76	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		365	kPa
At failure	Axial Strain	3.0	%
	Deviator Stress, (σ1 - σ3)f	239	kPa
	Undrained Shear Strength, cu	120	kPa ½(σ1 - σ3)f
	Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

Approved: Stephen.Watson

Printed: 29/03/2018 17:41

Fig. No. 1

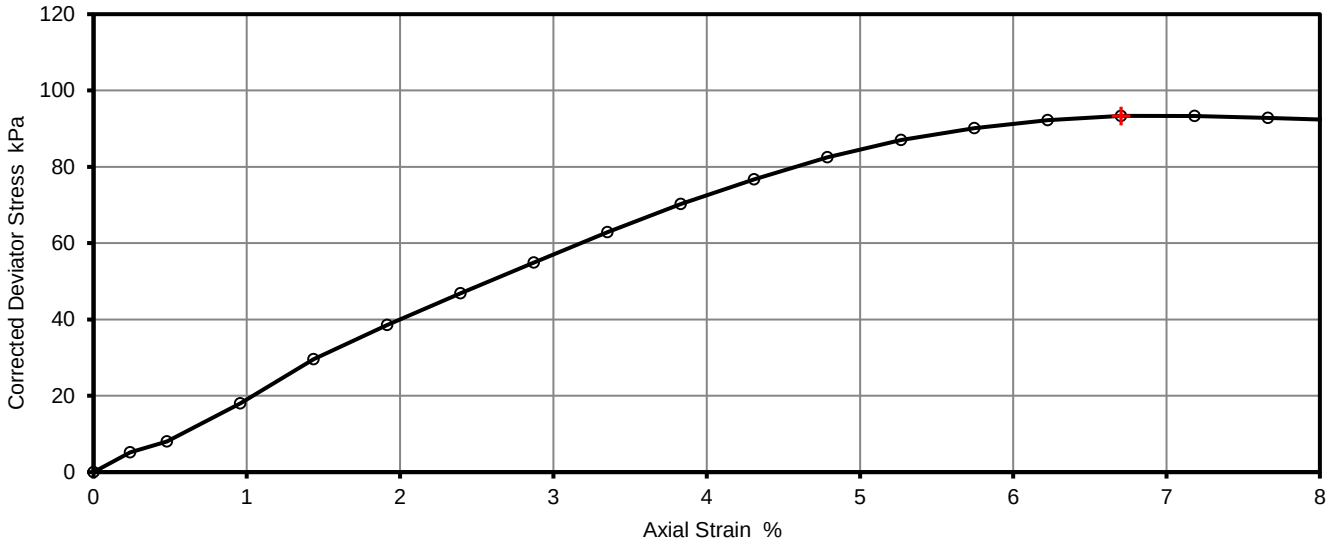
Sheet 1

Lab Sheet Reference :

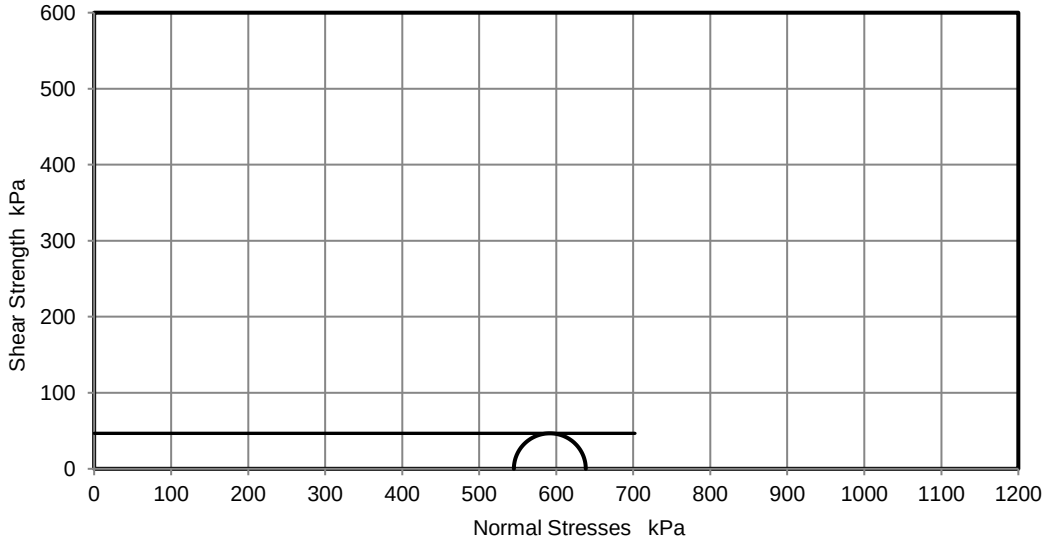
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	17-0769
				Borehole/Pit No.	BH03A
Site Name	Stornoway Deep Water Berth G.I.			Sample No.	
Soil Description	Brown slightly sandy clayey SILT.			Depth	32.80
Specimen Reference	2	Specimen Depth	m	Sample Type	C
Specimen Description	Firm brown slightly sandy clayey SILT.			KeyLAB ID	Caus201803214
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	28/03/2018

Test Number		1	
Length		208.8	mm
Diameter		102.9	mm
Bulk Density		1.78	Mg/m3
Moisture Content		45.1	%
Dry Density		1.23	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		545	kPa
At failure	Axial Strain	6.7	%
	Deviator Stress, (σ1 - σ3)f	93	kPa
	Undrained Shear Strength, cu	47	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



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Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

Approved: Stephen.Watson

Printed: 29/03/2018 17:41

Fig. No. 1

Sheet 2

Lab Sheet Reference :

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.: 18-07994-1

Initial Date of Issue: 26-Mar-2018

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): [redacted]

Project 17-0769 Stornoway Deep Water Berth
GI

Quotation No.:

Order No.:

No. of Samples: 2

Turnaround (Wkdays): 3

Date Approved: 26-Mar-2018

Approved By:

[redacted]

Details: Robert Monk, Technical Manager

Date Received: 22-Mar-2018

Date Instructed: 22-Mar-2018

Results Due: 26-Mar-2018

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 17-0769 Stornoway Deep Water Berth GI

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		18-07994	18-07994
Quotation No.:			**Chemtest Sample ID.:**		596149	596150
Order No.:			Client Location ID.:		BH03A	BH03A
			Client Sample Ref.:		1	2
			Sample Type:		SOIL	SOIL
			Top Depth (m):		30.50	32.80
			Bottom Depth (m):		30.80	33.20
			Date Sampled:		21-Mar-2018	21-Mar-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	39	24
pH	U	2010		N/A	8.0	8.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.30	0.26

Report Information

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U	UKAS accredited
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customerservices@chemtest.co.uk

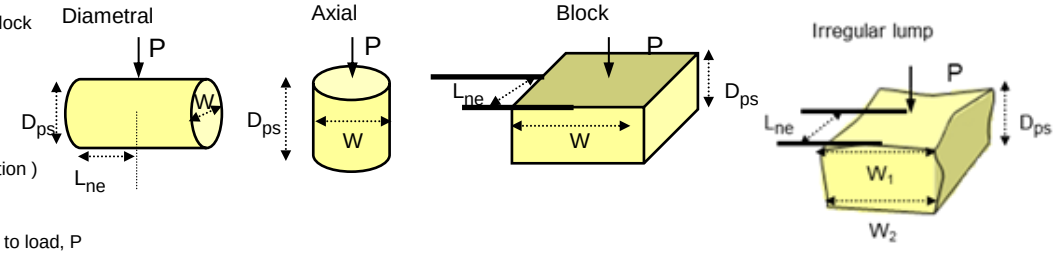
CAUSEWAY GEOTECH

Point Load Strength Index Tests
Summary of Results

Project No.	Project Name
17-0769	Stornoway Deep Water Berth G.I.

Borehole No.	Sample			Specimen		Rock Type	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth m	Ref.	Type	Ref.	Depth m		Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN	mm	Is MPa	Is(50) MPa	
BH01	52.30		C	1	52.30	GNEISS	D	U	YES	72.1	101.6	101.6	96.0	36.0	98.8	3.7	5.0	
BH02	35.15		C	1	35.15	DOLORITE	D	U	YES	76.1	102.0	102.0	98.0	6.2	100.0	0.6	0.8	
BH02	36.60		C	1	36.60	GNEISS	D	U	YES	58.4	101.9	101.9	96.0	42.5	98.9	4.3	5.9	
BH06	7.80		C	1	7.80	GNEISS	I	U	YES	52.9	97.1	42.0	36.0	11.9	66.7	2.7	3.0	
BH06	11.65		C	1	11.65	GNEISS	D	U	YES	54.0	101.5	101.5	94.0	42.1	97.7	4.4	6.0	
BH10	5.20		C	1	5.20	GNEISS	D	U	YES	69.0	101.6	101.6	96.0	18.3	98.8	1.9	2.5	
BH10	6.40		C	1	6.40	GNEISS	D	U	YES	34.2	100.8	100.8	98.0	3.2	99.4	0.3	0.4	
BH10	8.40		C	1	8.40	GNEISS	I	U	YES	64.8	80.7	81.0	76.0	14.2	88.3	1.8	2.4	
BH11	20.20		C	1	20.20	GNEISS	I	U	YES	68.5	73.9	80.0	74.0	38.5	83.4	5.5	7.0	
BH11	20.80		C	1	20.80	GNEISS	I	U	NO	68.1	76.7	66.0	63.0	5.0	78.4	0.8	1.0	
BH11	23.40		C	1	23.40	GNEISS	I	U	NO	61.5	75.6	90.0	86.0	19.6	91.0	2.4	3.1	
BH14	2.50		C	1	2.50	METAGABBRO	I	U	YES	51.9	80.4	50.0	46.0	22.6	68.6	4.8	5.5	
BH14	3.35		C	1	3.35	METAGABBRO	A	U	YES		102.5	52.0	49.0	9.2	80.0	1.4	1.8	
BH14	6.10		C	1	6.10	METAGABBRO	I	U	YES	60.5	76.8	76.0	71.0	15.6	83.3	2.2	2.8	
BH15	1.10		C	1	1.10	METAGABBRO	I	U	YES	74.0	83.6	55.0	48.0	38.0	71.5	7.4	8.7	
BH15	2.90		C	1	2.90	METAGABBRO	I	U	YES	58.4	81.1	49.0	42.0	27.9	65.8	6.4	7.3	
BH15	3.90		C	1	3.90	METAGABBRO	I	U	NO	76.1	75.2	82.0	79.0	24.6	87.0	3.3	4.2	
BH16	3.80		C	1	3.80	PEGMATITE	D	U	YES	68.0	100.7	100.7	96.0	21.8	98.3	2.3	3.1	
BH16	5.35		C	1	5.35	AMPHIBOLITE	I	U	YES	76.8	73.6	86.0	81.0	28.5	87.1	3.8	4.8	
BH16	7.70		C	1	7.70	AMPHIBOLITE	D	U	NO	54.1	100.6	100.6	98.0	28.0	99.3	2.8	3.9	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

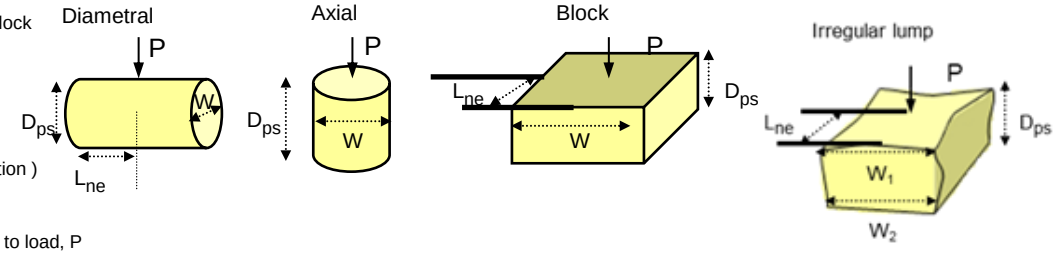
Date Printed	Approved By	Table
26/03/2018	Stephen.Watson	1 sheet 1

Point Load Strength Index Tests
Summary of Results

Project No.	Project Name
17-0769	Stornoway Deep Water Berth G.I.

Borehole No.	Sample			Specimen		Rock Type	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth	Ref.	Type	Ref.	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m				m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH17	4.65		C	1	4.65	GNEISS	D	U	NO	73.4	101.2	101.2	97.0	36.2	99.1	3.7	5.0	
BH17	5.60		C	1	5.60	AMPHIBOLITE	D	U	YES	39.8	101.6	101.6	98.0	8.8	99.8	0.9	1.2	
BH18	20.20		C	1	20.20	GNEISS	D	U	YES	48.2	100.2	100.2	97.0	5.2	98.6	0.5	0.7	
BH18	23.25		C	1	23.25	AMPHIBOLITE	I	U	NO	42.4	74.7	80.0	76.0	14.2	85.0	2.0	2.5	
BH18	24.60		C	1	24.60	AMPHIBOLITE	I	U	YES	76.4	80.6	72.0	69.0	19.1	84.1	2.7	3.4	
BH19	6.90		C	1	6.90	GNEISS	D	U	NO	69.6	101.4	101.4	98.0	13.0	99.7	1.3	1.8	
BH19	8.80		C	1	8.80	GNEISS	D	U	YES	63.5	101.3	101.3	99.0	4.9	100.1	0.5	0.7	
BH20	6.50		C	1	6.50	GNEISS	D	U	NO	62.6	101.4	101.4	96.0	46.0	98.7	4.7	6.4	
BH20	8.25		C	1	8.25	GNEISS	I	U	YES	62.1	79.5	73.0	64.0	9.3	80.5	1.4	1.8	
BH21	22.35		C	1	22.35	GNEISS	I	U	YES	44.4	73.6	69.0	66.0	8.2	78.6	1.3	1.6	
BH31	7.55		C	1	7.55	GNEISS	I	U	NO	50.7	73.9	92.7	58.0	15.0	73.9	2.7	3.3	
BH31	9.30		C	1	9.00	GNEISS	I	U	NO	81.7	82.8	79.2	63.0	11.7	81.5	1.8	2.2	
BH32	10.60		C	1	10.60	GNEISS	D	U	NO	61.9	101.9	101.9	97.0	34.6	99.4	3.5	4.8	
BH32	11.80		C	1	11.80	GNEISS	I	U	YES	62.9	82.2	64.6	58.0	31.0	77.9	5.1	6.2	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed	Approved By	Table
26/03/2018	Stephen.Watson	1 sheet 2

LABORATORY TEST CERTIFICATE

10 Queenslie Point
Queenslie Industrial Estate
120 Stepps Road
Glasgow
G33 3NQ

Tel: 0141 774 4032
Fax: 0141 774 3552

email: info@mattest.org
Website: www.mattest.org

Certificate No : **18/337 - 01**

To : **Stephen Watson**

Client : **Causeway Geotech Limited**
8 Drumahiskey Road
Ballymoney
Co. Antrim
BT53 7QL

Dear Sirs,

LABORATORY TESTING OF ROCK

Introduction

We refer to samples taken from Stornoway Deep Water Berth GI and delivered to our laboratory on 26th March 2018.

Material & Source

Sample Reference	:	See Report Plates
Sampled By	:	Client
Sampling Certificate	:	Not Supplied
Location	:	See Report Plates
Description	:	Rock Cores
Date Sampled	:	Not Supplied
Date Tested	:	26th March 2018 Onwards
Source	:	17-0769 - Stornoway Deep Water Berth GI

Test Results;

As Detailed On Page 2 to Page 6 inclusive

Comments;

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate

Remarks;

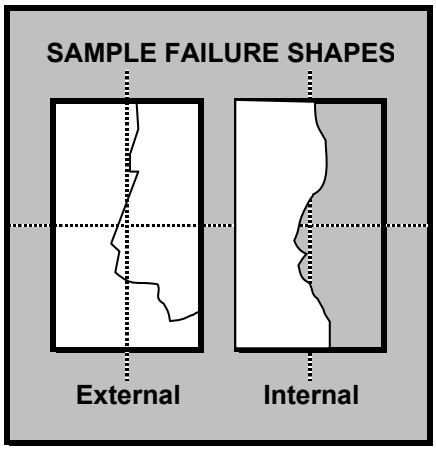
Approved for Issue

Date 04/04/2018

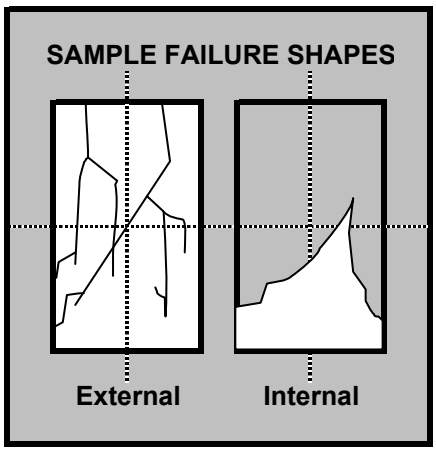
T McLelland (Director)

2643

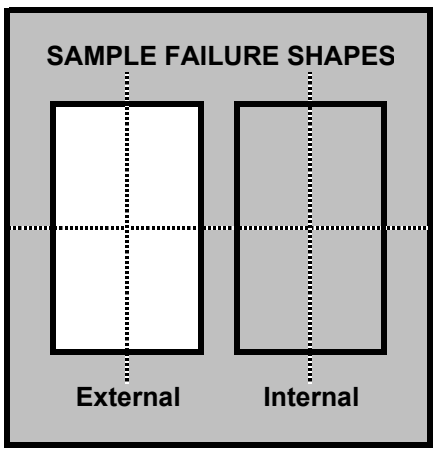
BOREHOLE		**BH02**
SAMPLE		**CS2**
DEPTH	m	**35.35-35.65**
SAMPLE DIAMETER	mm	**101.72**
SAMPLE HEIGHT	mm	**205.87**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.6**
TEST DURATION	min.sec	**4.36**
DATE OF TESTING		**31/03/2018**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**157.2**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**19.3**
WATER CONTENT (ISRM Suggested Methods)	%	**0.3**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.93**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.92**



BOREHOLE		**BH02**
SAMPLE		**CS4**
DEPTH	m	**37.50-37.90**
SAMPLE DIAMETER	mm	**101.95**
SAMPLE HEIGHT	mm	**219.44**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.9**
TEST DURATION	min.sec	**9.44**
DATE OF TESTING		**31/03/2018**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**519.7**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**63.7**
WATER CONTENT (ISRM Suggested Methods)	%	**0.2**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.63**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.63**



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

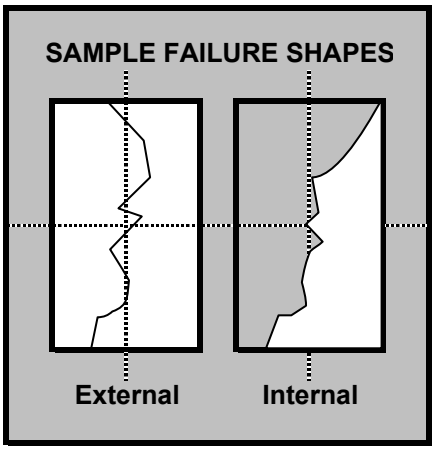


Tested in accordance with ASTM D7012 - 14

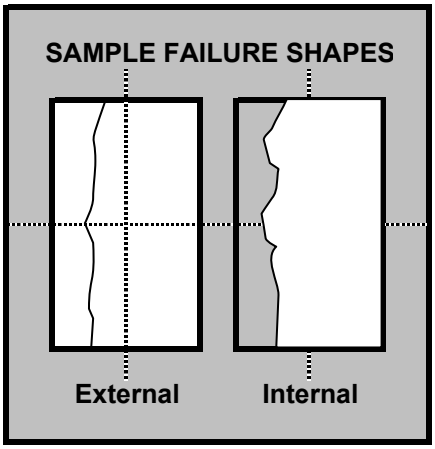
SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

MATtest Limited
materials testing & consultancy

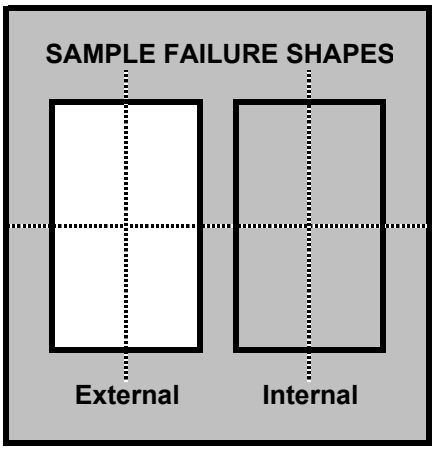
BOREHOLE		BH06
SAMPLE		CS1
DEPTH	m	7.85-8.10
SAMPLE DIAMETER	mm	101.76
SAMPLE HEIGHT	mm	209.02
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.9
TEST DURATION	min.sec	2.37
DATE OF TESTING		31/03/2018
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	124.0
UNCONFINED COMPRESSIVE STRENGTH	MPa	15.2
WATER CONTENT (ISRM Suggested Methods)	%	1.7
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	2.76
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	2.72



BOREHOLE		BH06
SAMPLE		CS2
DEPTH	m	11.15-11.50
SAMPLE DIAMETER	mm	101.24
SAMPLE HEIGHT	mm	203.47
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.9
TEST DURATION	min.sec	4.34
DATE OF TESTING		31/03/2018
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Unknown
FAILURE LOAD	kN	244.4
UNCONFINED COMPRESSIVE STRENGTH	MPa	30.4
WATER CONTENT (ISRM Suggested Methods)	%	0.2
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	2.81
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	2.80



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

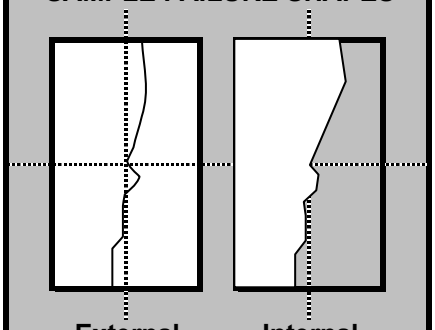


Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

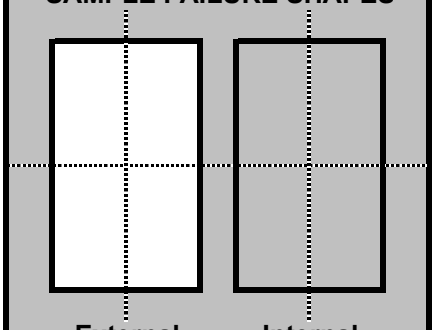
BOREHOLE		**BH18**
SAMPLE		**CS2**
DEPTH	m	**21.20-21.50**
SAMPLE DIAMETER	mm	**101.38**
SAMPLE HEIGHT	mm	**215.82**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.9**
TEST DURATION	min.sec	**9.59**
DATE OF TESTING		**31/03/2018**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**502.8**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**62.3**
WATER CONTENT (ISRM Suggested Methods)	%	**0.1**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.67**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.67**

SAMPLE FAILURE SHAPES



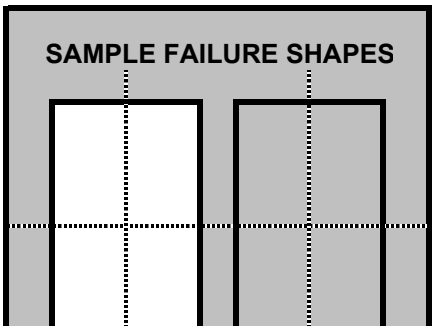
BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

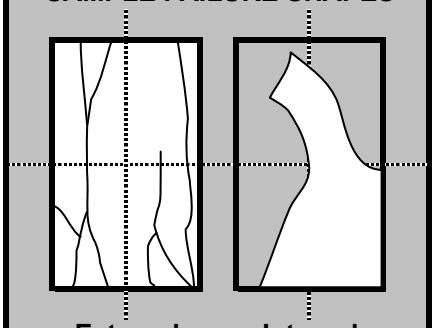


Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

BOREHOLE		**BH20**
SAMPLE		**CS3**
DEPTH	m	**9.65-9.90**
SAMPLE DIAMETER	mm	**100.29**
SAMPLE HEIGHT	mm	**168.63**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.9**
TEST DURATION	min.sec	**11.15**
DATE OF TESTING		**03/04/2018**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Perpendicular**
FAILURE LOAD	kN	**572.5**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**72.5**
WATER CONTENT (ISRM Suggested Methods)	%	**0.2**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.93**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.93**

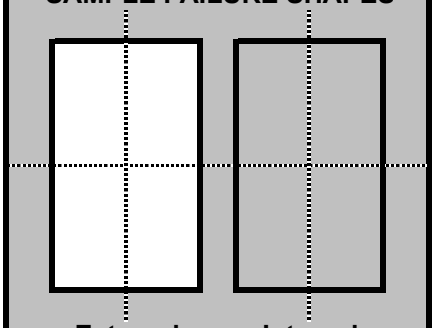
SAMPLE FAILURE SHAPES



Test specimen does not meet specified length / diameter ratio requirements

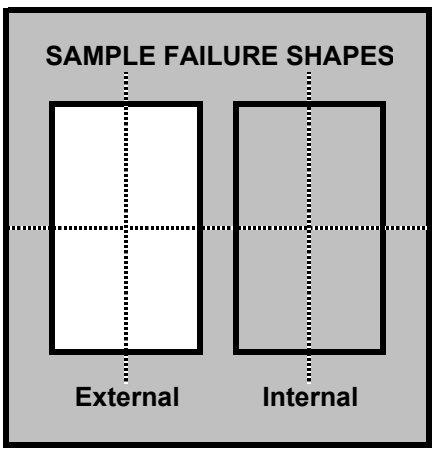
BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

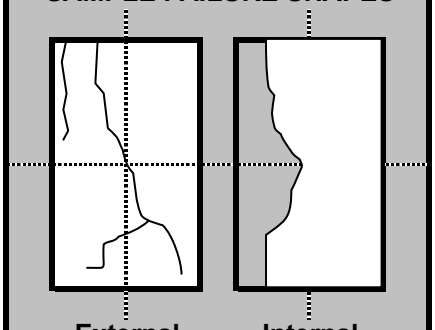


Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

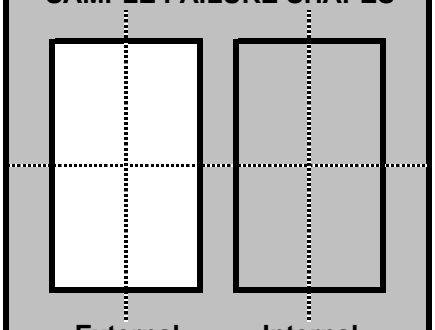
BOREHOLE		**BH31**
SAMPLE		**CS2**
DEPTH	m	**8.20-8.70**
SAMPLE DIAMETER	mm	**101.55**
SAMPLE HEIGHT	mm	**222.12**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.9**
TEST DURATION	min.sec	**8.05**
DATE OF TESTING		**31/03/2018**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**453.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**56.0**
WATER CONTENT (ISRM Suggested Methods)	%	**0.1**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.73**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.73**

SAMPLE FAILURE SHAPES



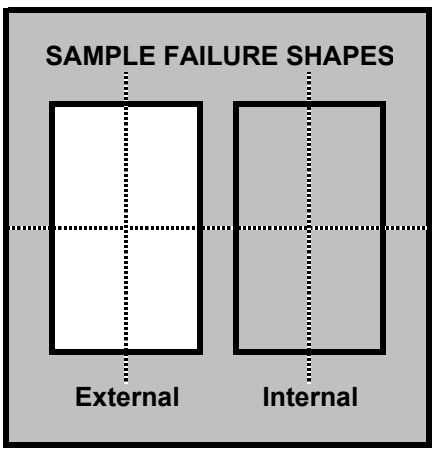
BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES



Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

CAUSEWAY GEOTECH

APPENDIX E

Dredge analysis laboratory test results

Marine Scotland
Pre-disposal Sampling Guidance
Version 2 - November 2017

Table 2 Action Levels

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Arsenic	20	70
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Mercury	0.25	1.5
Nickel	30	150
Lead	50	400
Zinc	130	600
Tributyltin	0.1	0.5
Polychlorinated Biphenyls	0.02	0.18
Polyaromatic Hydrocarbons		
Acenaphthene	0.1	
Acenaphthylene	0.1	
Anthracene	0.1	
Fluorene	0.1	
Naphthalene	0.1	
Phenanthrene	0.1	
Benzo[a]anthracene	0.1	
Benzo[b]flouranthene	0.1	
Benzo[k]fluoranthene	0.1	
Benzo[a]pyrene	0.1	
Benzo[g,h,i]perylene	0.1	
Dibenzo[a,h]anthracene	0.01	
Chrysene	0.1	
Fluoranthene	0.1	
Pyrene	0.1	
Indeno(1,2,3cd)pyrene	0.1	
Total Hydrocarbons	100	
Booster Biocide and		
Brominated Flame Retardents*		

*Provisional Action Levels for these compounds are subject to further investigation.

Results which exceed the Contaminant Action Levels are highlighted in blue or red, as appropriate, on the following pages

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Certificate of Analysis

Report No.: 18-69352-2

Issue No.: **2**
Date of Issue **04/04/2018**

Customer Details:	Causeway Geotech Ltd, 8 Drumahiskey Road, Ballymoney, Co. Antrim, BT53 7QL
Customer Contact:	Darren O'Mahony
Customer Order No.:	1711-360
Customer Reference:	Stornoway Deep Water Berth
Quotation Reference:	171120/02
Description:	66 sediment samples
Date Received:	23/02/2018
Date Started:	05/03/2018
Date Completed:	26/03/2018
Test Methods:	Details available on request (refer to SOP code against relevant result/s)
Notes:	This replaces Issue 1 in its entirety

Approved By: **Matthew Hickson, Laboratory Manager**

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Results reported herein relate only to the items supplied to the laboratory for testing.

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Customer Sample ID						ES9	ES10	ES11	ES12	ES13	ES14
						RPS Sample No						355364	355365	355366	355367	355368	355369
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Sample Depth (m)						0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	79.9	72.1	80.6	81.9	88.5	88.5
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	2.5	1.7	0.5	0.4	< 0.3	< 0.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Customer Sample ID						ES1	ES3	ES5	ES7	ES47	ES48
						RPS Sample No						355370	355371	355372	355373	355374	355375
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Sample Depth (m)						0.50	1.00	1.50	2.00	0.50	1.00
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	82.0	93.3	90.3	94.9	82.1	81.5
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	0.4	0.8	0.4	< 0.3	3.1	2.0
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	37.9	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	32.4	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Customer Sample ID						ES49	ES50	ES51	ES52	ES53	ES54
						RPS Sample No						355376	355377	355378	355379	355380	355956
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Sample Depth (m)						1.50	2.00	2.50	3.00	3.50	4.00
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	74.7	76.7	84.2	85.0	86.9	93.3
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	0.4	0.4	0.4	< 0.3	< 0.3	< 0.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Customer Sample ID						ES1	ES2	ES3	ES4	ES5	ES6
						RPS Sample No						355381	355382	355383	355384	355385	355386
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Sample Depth (m)						0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	89.7	90.6	94.0	79.6	82.4	83.8
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	4.8	0.3	< 0.3	< 0.3	< 0.3	< 0.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Customer Sample ID						ES7	ES8	ES9	ES1	ES3	ES5
						RPS Sample No						355387	355388	355389	355390	355391	355392
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Sample Depth (m)						3.50	4.00	4.50	0.50	1.00	1.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	93.8	99.5	94.4	93.2	89.8	85.8
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	< 0.3	< 0.3	< 0.3	< 0.3	1.3	0.6
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Customer Sample ID						ES7	ES9	ES1	ES2	ES1	ES3
						RPS Sample No						355393	355394	355395	355396	355397	355398
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Sample Depth (m)						2.00	2.50	0.50	1.00	0.50	1.00
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	90.9	96.5	91.7	93.1	70.6	73.8
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	0.3	< 0.3	1.1	1.3	1.3	0.4
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Customer Sample ID						ES5	ES1	ES3	ES5	ES7	ES9
						RPS Sample No						355399	355400	355401	355402	355403	355404
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Sample Depth (m)						1.50	0.50	1.00	1.50	2.00	2.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	88.5	80.3	96.2	96.5	95.7	94.9
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	< 0.3	0.9	< 0.3	< 0.3	< 0.3	< 0.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Customer Sample ID						ES11	ES1	ES3	ES5	ES7	ES1
						RPS Sample No						355405	355406	355407	355408	355409	355410
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Sample Depth (m)						3.00	0.50	1.00	1.50	2.00	0.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	97.3	76.7	92.3	92.0	89.0	72.7
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	< 0.3	1.8	0.6	1.0	0.5	3.4
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Customer Sample ID						ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No						355411	355412	355413	355414	355415	355416
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Sample Depth (m)						1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	94.6	99.0	93.4	92.5	96.1	93.2
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	0.6	< 0.3	0.4	< 0.3	0.7	1.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Customer Sample ID						ES1	ES3	ES1	ES3	ES5	ES1
						RPS Sample No						355417	355418	355419	355420	355421	355422
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Sample Depth (m)						0.50	1.00	0.50	1.00	1.50	0.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	69.0	87.7	96.9	90.1	94.8	93.4
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	5.4	1.0	0.8	1.2	1.0	2.3
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Dry Weights, Moisture, Total Organic Carbon, TPH, Organotins & Density

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Customer Sample ID						ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No						355423	355424	355425	355426	355427	355428
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Sample Depth (m)						1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**CRM BCR-646**		**Spike on clean sediment**			07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
dry solids (at 105°C)		N	397	%		n/a	n/a	n/a	n/a	n/a	n/a	88.1	95.4	81.5	68.4	71.2	66.8
total organic carbon		U	404	%	0.3	n/a	n/a	n/a	n/a	n/a	n/a	1.6	1.3	0.7	3.9	4.4	3.6
dibutyltin (DBT)	1002-53-5	U	395	ug/kg DW	5	770	598.8	77.8%	40	40.6	101.5%	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	395	ug/kg DW	2	480	415.1	86.5%	40	41.47	103.7%	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Customer Sample ID			ES9	ES10	ES11	ES12	ES13	ES14
						RPS Sample No			355364	355365	355366	355367	355368	355369
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Sample Depth (m)			0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**SRM-2702**		17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	8.22	8.54	3.80	3.64	1.90	1.74
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	0.11	< 0.10	0.14	< 0.10	0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	31.4	38.3	40.3	28.9	30.7	36.3
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	12.2	18.6	10.1	9.49	11.4	10.3
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	12.7	20.2	10.9	13.0	11.6	9.35
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.02	0.07	< 0.01	< 0.01	0.02	< 0.01
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	22.2	22.1	19.9	17.1	17.6	17.0
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	30.8	53.8	31.6	28.6	31.6	28.0

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Customer Sample ID			ES1	ES3	ES5	ES7	ES47	ES48
						RPS Sample No			355370	355371	355372	355373	355374	355375
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Sample Depth (m)			0.50	1.00	1.50	2.00	0.50	1.00
						Sampling Date	**SRM-2702**		08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	2.65	5.28	2.33	2.24	6.15	3.88
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.11
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	29.5	32.4	23.5	22.5	27.4	24.5
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	11.0	11.4	12.0	9.42	11.9	9.06
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	9.96	13.0	9.26	8.96	13.2	9.15
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.01	0.01	0.02	< 0.01	0.05	0.02
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	19.8	20.8	16.7	15.4	18.1	13.8
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	40.8	32.5	62.3	37.2	29.2	24.3

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Customer Sample ID			ES49	ES50	ES51	ES52	ES53	ES54
						RPS Sample No			355376	355377	355378	355379	355380	355956
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Sample Depth (m)			1.50	2.00	2.50	3.00	3.50	4.00
						Sampling Date	**SRM-2702**		23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	2.79	2.26	1.52	16.7	1.60	1.89
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	0.11	< 0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	26.4	23.9	26.1	23.4	24.3	24.8
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	8.41	8.82	8.48	7.93	10.6	11.4
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	9.63	8.28	8.00	7.99	8.76	7.58
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.02	0.10	< 0.01	< 0.01	< 0.01	0.01
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	13.8	12.9	15.1	15.3	17.4	17.6
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	28.6	22.3	23.4	25.6	28.5	32.2

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Customer Sample ID			ES1	ES2	ES3	ES4	ES5	ES6
						RPS Sample No			355381	355382	355383	355384	355385	355386
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Sample Depth (m)			0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**SRM-2702**		18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	4.82	2.42	2.74	1.34	1.20	1.29
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	0.11	< 0.10	0.12	< 0.10	< 0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	30.9	22.5	21.9	22.5	26.4	25.8
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	26.1	9.35	9.63	8.28	8.57	11.9
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	11.6	8.63	7.65	7.60	7.73	9.46
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	36.4	16.5	15.6	13.4	14.5	18.4
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	34.8	27.8	25.5	23.3	25.8	29.1

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Results Summary - Metals

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Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Customer Sample ID			ES7	ES8	ES9	ES1	ES3	ES5
						RPS Sample No			355387	355388	355389	355390	355391	355392
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Sample Depth (m)			3.50	4.00	4.50	0.50	1.00	1.50
						Sampling Date	**SRM-2702**		18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	0.92	1.15	1.20	4.33	2.73	1.16
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	22.4	28.7	43.5	24.3	25.1	26.7
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	9.60	15.3	16.6	17.2	13.4	10.8
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	7.68	11.7	9.78	9.66	11.0	7.97
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.01	< 0.01	< 0.01	0.01	0.02	< 0.01
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	14.8	19.4	25.3	24.6	19.9	14.9
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	26.2	34.9	41.6	27.9	28.1	29.8

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Customer Sample ID			ES7	ES9	ES1	ES2	ES1	ES3
						RPS Sample No			355393	355394	355395	355396	355397	355398
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Sample Depth (m)			2.00	2.50	0.50	1.00	0.50	1.00
						Sampling Date	**SRM-2702**		07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	1.22	0.93	4.36	5.39	8.96	6.20
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	0.12	< 0.10	0.11	0.11	0.14	0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	26.8	30.2	32.3	37.9	58.4	82.5
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	12.2	12.1	12.7	15.5	14.4	17.7
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	8.82	7.97	10.1	11.2	18.5	11.7
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	< 0.01	0.01	0.03	0.04	0.09	0.01
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	15.7	18.8	20.9	23.5	27.3	37.4
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	28.2	31.9	38.4	43.9	48.3	55.0

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Customer Sample ID			ES5	ES1	ES3	ES5	ES7	ES9
						RPS Sample No			355399	355400	355401	355402	355403	355404
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Sample Depth (m)			1.50	0.50	1.00	1.50	2.00	2.50
						Sampling Date	**SRM-2702**		18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	3.04	6.30	1.78	1.75	1.95	2.54
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	78.2	56.7	38.9	45.7	59.1	53.1
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	23.6	18.0	17.8	19.2	20.2	20.5
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	13.0	13.8	8.23	8.99	9.52	9.31
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.14	0.05	0.01	0.01	0.01	0.02
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	37.6	31.2	25.6	29.4	30.0	31.7
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	59.6	54.2	37.6	43.4	44.7	44.1

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Customer Sample ID			ES11	ES1	ES3	ES5	ES7	ES1
						RPS Sample No			355405	355406	355407	355408	355409	355410
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Sample Depth (m)			3.00	0.50	1.00	1.50	2.00	0.50
						Sampling Date	**SRM-2702**		13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	2.51	8.76	3.11	2.64	2.69	11.9
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	0.12	< 0.10	< 0.10	< 0.10	0.22
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	56.8	49.3	25.4	21.5	26.7	36.2
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	21.1	21.0	11.2	11.2	13.2	11.9
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	10.8	34.6	9.72	8.59	13.4	16.1
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.02	0.41	0.01	0.02	0.02	0.04
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	32.9	25.6	15.8	15.7	18.3	20.3
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	45.0	67.8	28.5	25.8	38.7	31.8

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Customer Sample ID			ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No			355411	355412	355413	355414	355415	355416
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Sample Depth (m)			1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**SRM-2702**		08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	4.54	2.80	2.10	2.33	3.54	5.15
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	35.4	36.1	40.8	38.6	30.9	44.4
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	14.5	16.1	15.2	20.3	14.4	17.7
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	8.05	9.27	9.18	8.92	10.6	11.6
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.01	0.03	0.01	0.01	0.02	0.02
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	22.3	21.8	23.2	25.8	21.1	26.6
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	33.2	37.8	33.7	40.7	32.4	41.7

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Customer Sample ID			ES1	ES3	ES1	ES3	ES5	ES1
						RPS Sample No			355417	355418	355419	355420	355421	355422
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Sample Depth (m)			0.50	1.00	0.50	1.00	1.50	0.50
						Sampling Date	**SRM-2702**		09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	12.7	2.63	3.90	2.90	2.62	6.62
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	0.35	< 0.10	< 0.10	< 0.10	< 0.10	0.10
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	81.7	31.4	33.6	39.8	33.3	24.7
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	33.8	16.2	17.8	17.5	17.6	8.45
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	43.3	9.50	12.9	10.5	14.5	9.22
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.40	0.02	0.02	< 0.01	0.03	0.02
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	40.0	22.0	27.6	22.5	21.6	15.8
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	109	42.2	48.5	35.7	35.1	23.1

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Results Summary - Metals

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Standard Reference Material**		**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Customer Sample ID			ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No			355423	355424	355425	355426	355427	355428
						Sample Type	**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location			**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Sample Depth (m)			1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**SRM-2702**		07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**						
arsenic	7440-38-2	USI	M-129	mg/kg DW	0.5	45.3	42.9	94.7%	4.24	3.36	3.29	6.21	6.75	12.0
cadmium	7440-43-9	USI	M-129	mg/kg DW	0.1	0.817	0.91	111.4%	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.19
chromium	7440-47-3	USI	M-129	mg/kg DW	0.5	352	309	87.8%	24.9	27.9	40.4	38.8	41.1	56.3
copper	7440-50-8	USI	M-129	mg/kg DW	0.5	Not certified	n/a	n/a	9.89	10.6	13.9	8.90	8.92	10.3
lead	7439-92-1	USI	M-129	mg/kg DW	0.5	132.8	134	100.9%	8.35	7.84	8.22	7.21	7.17	7.79
mercury	7439-97-6	USI	M-129	mg/kg DW	0.01	0.4474	0.45	100.6%	0.02	0.02	0.01	0.02	0.02	0.02
nickel	7440-02-0	USI	M-129	mg/kg DW	0.5	75.4	66.8	88.6%	16.6	16.8	19.1	16.9	17.9	26.0
zinc	7440-66-6	USI	M-129	mg/kg DW	2	485.3	457	94.2%	26.2	25.8	29.9	31.3	32.3	41.0

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
				Customer Sample ID								ES9	ES10	ES11	ES12	ES13	ES14
				RPS Sample No								355364	355365	355366	355367	355368	355369
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
				Sample Depth (m)								0.50	1.00	1.50	2.00	2.50	3.00
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	142	10.9	< 2.6	< 2.6	< 2.6	< 2.6
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	51.8	11.9	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	20.8	2.90	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	166	7.25	< 1.6	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	1050	45.5	5.27	6.12	< 3.9	5.85
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	687	22.4	< 2.4	< 2.4	< 2.4	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	1920	181	4.70	10.1	5.32	< 2.4
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	165	245	5.74	10.0	< 2.8	< 2.8
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	1190	162	2.22	5.12	2.10	< 1.6
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	515	96.5	< 1.7	3.85	2.93	< 1.7
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	975	260	4.67	9.49	6.15	2.39
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	751	207	< 2.0	3.52	< 2.0	< 2.0
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	997	321	1.80	5.22	1.07	1.28
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	311	103	< 2.2	2.88	< 2.2	< 2.2
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	95.1	31.2	< 1.6	< 1.6	< 1.6	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	350	143	2.41	4.31	2.77	< 1.4

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
				Customer Sample ID								ES1	ES3	ES5	ES7	ES47	ES48
				RPS Sample No								355370	355371	355372	355373	355374	355375
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
				Sample Depth (m)								0.50	1.00	1.50	2.00	0.50	1.00
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	8.79	< 2.6	< 2.6	< 2.6	27.4	7.54
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	4.41	< 2.0	< 2.0	< 2.0	6.42	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	2.94	< 1.7	< 1.7	< 1.7	82.9	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	4.87	< 1.6	< 1.6	< 1.6	118	2.46
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	28.9	< 3.9	8.76	< 3.9	240	11.3
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	7.52	< 2.4	< 2.4	< 2.4	79.0	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	57.9	< 2.4	9.16	< 2.4	160	15.1
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	68.8	< 2.8	6.34	< 2.8	177	19.9
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	29.9	< 1.6	1.78	< 1.6	159	6.19
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	15.6	< 1.7	2.35	< 1.7	94.6	4.81
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	58.8	2.22	3.83	2.39	120	21.2
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	31.5	< 2.0	< 2.0	< 2.0	55.4	8.95
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	52.3	< 0.9	1.69	< 0.9	119	10.6
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	17.9	< 2.2	< 2.2	< 2.2	32.0	6.00
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	5.72	< 1.6	< 1.6	< 1.6	13.5	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	21.2	< 1.4	1.79	< 1.4	63.3	7.55

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
				Customer Sample ID								ES49	ES50	ES51	ES52	ES53	ES54
				RPS Sample No								355376	355377	355378	355379	355380	355956
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
				Sample Depth (m)								1.50	2.00	2.50	3.00	3.50	4.00
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	9.15	< 2.6	< 2.6	< 2.6	< 2.6	3.62
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	3.81	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	17.9	< 3.9	< 3.9	< 3.9	< 3.9	< 3.9
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	4.62	< 2.4	< 2.4	< 2.4	< 2.4	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	23.7	9.37	9.48	< 2.4	11.8	5.44
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	32.4	12.9	10.3	< 2.8	9.29	11.3
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	16.0	6.51	5.38	< 1.6	3.79	4.49
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	9.38	4.26	3.84	< 1.7	2.94	3.21
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	38.3	16.2	9.66	< 1.6	6.25	9.75
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	19.1	7.60	3.78	< 2.0	3.11	3.73
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	29.1	13.4	6.39	< 0.9	2.73	7.19
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	13.0	6.44	3.46	< 2.2	< 2.2	3.13
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	4.09	2.27	< 1.6	< 1.6	< 1.6	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	15.8	8.46	5.18	< 1.4	1.80	4.02

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
				Customer Sample ID								ES1	ES2	ES3	ES4	ES5	ES6
				RPS Sample No								355381	355382	355383	355384	355385	355386
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
				Sample Depth (m)								0.50	1.00	1.50	2.00	2.50	3.00
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	6.68	4.55	6.28	< 2.6	< 2.6	< 2.6
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	3.23	12.5	4.13	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	13.1	46.9	13.6	< 3.9	< 3.9	< 3.9
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	3.31	2.88	< 2.4	< 2.4	< 2.4	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	10.1	15.0	7.32	< 2.4	3.43	< 2.4
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	13.8	9.02	8.16	< 2.8	3.60	< 2.8
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	6.34	5.87	3.14	< 1.6	< 1.6	< 1.6
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	3.47	4.41	2.63	< 1.7	< 1.7	< 1.7
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	9.28	7.82	4.56	2.27	3.47	3.74
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	2.32	2.33	< 2.0	< 2.0	< 2.0	< 2.0
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	5.05	4.06	1.79	< 0.9	< 0.9	< 0.9
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	< 2.2	< 2.2	< 2.2	< 2.2	< 2.2	< 2.2
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	4.81	3.99	2.37	< 1.4	< 1.4	< 1.4

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
				Customer Sample ID								ES7	ES8	ES9	ES1	ES3	ES5
				RPS Sample No								355387	355388	355389	355390	355391	355392
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
				Sample Depth (m)								3.50	4.00	4.50	0.50	1.00	1.50
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	3.07	< 2.6	< 2.6	35.4	9.96	< 2.6
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	< 2.0	48.2	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	< 1.7	< 1.7	8.55	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	3.66	< 1.6	< 1.6	66.2	2.97	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	8.93	< 3.9	< 3.9	347	17.0	< 3.9
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	< 2.4	< 2.4	< 2.4	203	4.42	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	5.19	< 2.4	< 2.4	405	21.7	4.77
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	5.37	< 2.8	< 2.8	280	27.1	5.14
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	3.51	< 1.6	< 1.6	150	7.88	< 1.6
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	2.82	< 1.7	< 1.7	101	6.62	< 1.7
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	3.04	< 1.6	< 1.6	160	20.1	3.97
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	< 2.0	< 2.0	< 2.0	60.0	7.27	< 2.0
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	1.60	< 0.9	< 0.9	161	9.41	< 0.9
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	< 2.2	< 2.2	< 2.2	51.6	5.32	< 2.2
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	< 1.6	< 1.6	12.2	1.89	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	1.74	< 1.4	< 1.4	78.0	7.76	1.77

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
				Customer Sample ID								ES7	ES9	ES1	ES2	ES1	ES3
				RPS Sample No								355393	355394	355395	355396	355397	355398
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
				Sample Depth (m)								2.00	2.50	0.50	1.00	0.50	1.00
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	2.96	< 2.6	4.94	6.11	122	4.26
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	3.26	2.86	43.2	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	< 1.7	< 1.7	< 1.7	14.0	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	< 1.6	< 1.6	2.01	2.66	54.3	2.18
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	4.63	< 3.9	9.83	9.02	128	7.82
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	< 2.4	< 2.4	4.16	3.62	48.6	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	5.90	2.87	37.0	26.1	320	14.7
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	5.42	< 2.8	47.0	44.9	424	17.9
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	< 1.6	< 1.6	14.9	11.9	76.9	8.52
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	< 1.7	< 1.7	11.8	6.87	111	5.49
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	5.14	1.66	60.8	49.6	364	20.1
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	< 2.0	< 2.0	37.9	22.8	146	8.26
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	1.50	< 0.9	46.4	40.4	314	17.1
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	< 2.2	< 2.2	27.4	19.8	208	7.88
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	< 1.6	7.76	6.08	68.2	2.52
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	1.70	< 1.4	31.2	21.6	344	11.0

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
				Customer Sample ID								ES5	ES1	ES3	ES5	ES7	ES9
				RPS Sample No								355399	355400	355401	355402	355403	355404
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
				Sample Depth (m)								1.50	0.50	1.00	1.50	2.00	2.50
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	< 2.6	15.7	< 2.6	< 2.6	< 2.6	2.75
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	10.1	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	4.16	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	< 1.6	11.4	< 1.6	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	< 3.9	57.1	< 3.9	< 3.9	< 3.9	7.90
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	< 2.4	21.3	< 2.4	< 2.4	< 2.4	3.38
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	6.55	124	3.27	4.24	4.11	15.8
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	8.11	109	< 2.8	4.02	2.98	16.2
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	2.23	49.1	< 1.6	< 1.6	< 1.6	8.69
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	1.96	45.5	< 1.7	< 1.7	< 1.7	5.02
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	7.09	129	1.84	4.42	3.21	18.2
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	2.68	44.6	< 2.0	2.08	< 2.0	9.15
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	2.75	63.9	< 0.9	1.60	0.972	16.0
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	2.70	56.5	< 2.2	< 2.2	< 2.2	8.23
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	13.3	< 1.6	< 1.6	< 1.6	2.73
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	3.69	61.2	< 1.4	2.14	1.62	10.5

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
				Customer Sample ID								ES11	ES1	ES3	ES5	ES7	ES1
				RPS Sample No								355405	355406	355407	355408	355409	355410
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
				Sample Depth (m)								3.00	0.50	1.00	1.50	2.00	0.50
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	< 2.6	47.1	7.18	390	4.32	8.68
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	29.7	2.76	21.8	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	12.4	2.18	11.9	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	< 1.6	28.7	4.36	43.6	2.19	3.80
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	4.31	111	24.5	136	7.20	22.2
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	< 2.4	45.7	5.73	24.4	2.79	6.06
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	7.29	293	51.9	43.9	16.4	23.5
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	6.91	353	50.0	54.3	22.0	33.3
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	3.21	138	30.6	27.9	7.89	11.9
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	3.19	79.7	16.1	16.9	6.14	7.00
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	10.5	437	45.6	45.6	19.1	29.3
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	3.39	154	29.0	12.6	6.86	11.3
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	4.37	475	42.2	39.3	11.7	25.8
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	3.45	205	22.8	12.4	5.81	9.53
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	57.7	6.73	4.66	1.98	3.36
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	4.10	222	25.5	19.6	6.91	12.4

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Customer Sample ID						ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No						355411	355412	355413	355414	355415	355416
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Sample Depth (m)						1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**NMIJ CRM-7307a**		**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	8.92	< 2.6	< 2.6	< 2.6	10.8	2.97
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	< 2.0	< 2.0	9.38	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	< 1.7	2.08	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	1.75	2.92	< 1.6	< 1.6	3.40	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	8.74	35.9	< 3.9	< 3.9	45.8	12.1
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	< 2.4	4.71	< 2.4	< 2.4	9.11	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	15.5	45.1	< 2.4	4.86	88.8	8.54
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	25.3	36.1	< 2.8	4.15	84.5	13.2
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	6.89	18.7	< 1.6	< 1.6	42.3	5.18
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	5.40	14.7	< 1.7	< 1.7	36.6	3.72
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	15.4	27.2	< 1.6	4.49	55.5	19.2
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	5.55	9.83	< 2.0	< 2.0	23.5	7.02
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	8.13	24.7	< 0.9	< 0.9	33.2	10.3
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	5.67	9.11	< 2.2	< 2.2	20.5	5.13
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	1.77	3.47	< 1.6	< 1.6	5.92	1.83
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	7.71	11.0	< 1.4	1.96	26.6	6.57

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
				Customer Sample ID								ES1	ES3	ES1	ES3	ES5	ES1
				RPS Sample No								355417	355418	355419	355420	355421	355422
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
				Sample Depth (m)								0.50	1.00	0.50	1.00	1.50	0.50
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	38.2	52.5	< 2.6	< 2.6	5.26	3.37
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	24.6	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	14.8	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	23.0	2.50	< 1.6	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	98.0	7.11	< 3.9	< 3.9	< 3.9	5.61
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	51.1	3.72	< 2.4	< 2.4	< 2.4	< 2.4
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	237	8.26	5.13	< 2.4	< 2.4	11.1
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	326	13.9	6.51	< 2.8	3.77	15.8
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	118	6.48	2.40	< 1.6	< 1.6	5.92
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	70.2	3.29	2.04	< 1.7	< 1.7	4.48
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	376	28.2	7.07	2.59	2.94	19.8
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	151	10.2	2.65	< 2.0	< 2.0	8.01
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	321	29.8	3.11	< 0.9	< 0.9	13.2
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	156	17.4	2.37	< 2.2	< 2.2	6.12
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	58.9	4.49	< 1.6	< 1.6	< 1.6	1.95
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	196	17.8	2.93	< 1.4	< 1.4	7.80

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No		**Certified Reference Material**			**AQC spike**			**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
				Customer Sample ID								ES3	ES5	ES7	ES1	ES3	ES5
				RPS Sample No								355423	355424	355425	355426	355427	355428
				Sample Type		**SEDIMENT**			**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
				Sample Depth (m)								1.00	1.50	2.00	0.50	1.00	1.50
				Sampling Date		**NMIJ CRM-7307a**			**Spike on clean sediment**			07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
				Sampling Time													
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
naphthalene	91-20-3	U	396	ug/kg DW	3	Not certified	n/a	n/a	50	56.73	113.5%	7.97	3.06	< 2.6	5.82	7.44	7.61
acenaphthylene	208-96-8	U	396	ug/kg DW	2	Not certified	n/a	n/a	50	45.79	91.6%	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
acenaphthene	83-32-9	U	396	ug/kg DW	1.7	Not certified	n/a	n/a	50	53.21	106.4%	2.28	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7
fluorene	86-73-7	U	396	ug/kg DW	1.7	Not certified	7.25	n/a	50	54.02	108.0%	2.93	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
phenanthrene	85-01-8	U	396	ug/kg DW	4	24.5	32.41	132.3%	50	55.82	111.6%	9.22	< 3.9	< 3.9	8.03	8.07	9.54
anthracene	120-12-7	U	396	ug/kg DW	2.5	3.59	3.73	103.9%	50	48.08	96.2%	4.46	< 2.4	< 2.4	< 2.4	4.68	12.1
fluoranthene	206-44-0	U	396	ug/kg DW	2.5	25.1	30.81	122.7%	50	52.5	105.0%	12.4	< 2.4	4.22	16.5	17.4	7.85
pyrene	129-00-0	U	396	ug/kg DW	2.8	22.2	20.8	93.7%	50	48.09	96.2%	32.0	< 2.8	4.21	21.2	18.9	6.32
benzo(a)anthracene	56-55-3	U	396	ug/kg DW	1.6	7.15	8.51	119.0%	50	51.47	102.9%	5.99	< 1.6	< 1.6	9.39	9.28	< 1.6
chrysene	218-01-9	U	396	ug/kg DW	1.7	8.39	8.34	99.4%	50	53.79	107.6%	3.68	< 1.7	< 1.7	6.10	6.61	3.16
benzo(b+j)fluoranthene	205-99-2	U	396	ug/kg DW	1.6	31.9	32.23	101.0%	50	54.31	108.6%	17.0	1.81	3.46	25.7	25.7	8.98
benzo(k)fluoranthene	207-08-9	U	396	ug/kg DW	2	5.28	5.44	103.0%	50	54.36	108.7%	6.69	< 2.0	< 2.0	14.5	10.6	< 2.0
benzo(a)pyrene	50-32-8	U	396	ug/kg DW	0.9	4.57	4.09	89.5%	50	48.06	96.1%	7.84	< 0.9	3.67	23.0	17.3	1.92
indeno(1,2,3-c,d)pyrene	193-39-5	U	396	ug/kg DW	2.2	5.6	5.54	98.9%	50	45.25	90.5%	3.79	< 2.2	< 2.2	12.9	11.2	< 2.2
dibenzo(a,h)anthracene	53-70-3	U	396	ug/kg DW	1.6	Not certified	n/a	n/a	50	43.75	87.5%	< 1.6	< 1.6	< 1.6	3.32	3.09	< 1.6
benzo(g,h,i)perylene	191-24-2	U	396	ug/kg DW	1.4	6.76	6.35	93.9%	50	47.59	95.2%	6.79	< 1.4	< 1.4	15.1	12.1	4.51

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Customer Sample ID						ES9	ES10	ES11	ES12	ES13	ES14
						RPS Sample No						355364	355365	355366	355367	355368	355369
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
						Sample Depth (m)						0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Customer Sample ID						ES1	ES3	ES5	ES7	ES47	ES48
						RPS Sample No						355370	355371	355372	355373	355374	355375
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
						Sample Depth (m)						0.50	1.00	1.50	2.00	0.50	1.00
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Customer Sample ID						ES49	ES50	ES51	ES52	ES53	ES54
						RPS Sample No						355376	355377	355378	355379	355380	355956
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
						Sample Depth (m)						1.50	2.00	2.50	3.00	3.50	4.00
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Customer Sample ID						ES1	ES2	ES3	ES4	ES5	ES6
						RPS Sample No						355381	355382	355383	355384	355385	355386
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
						Sample Depth (m)						0.50	1.00	1.50	2.00	2.50	3.00
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Customer Sample ID						ES7	ES8	ES9	ES1	ES3	ES5
						RPS Sample No						355387	355388	355389	355390	355391	355392
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
						Sample Depth (m)						3.50	4.00	4.50	0.50	1.00	1.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Customer Sample ID						ES7	ES9	ES1	ES2	ES1	ES3
						RPS Sample No						355393	355394	355395	355396	355397	355398
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
						Sample Depth (m)						2.00	2.50	0.50	1.00	0.50	1.00
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Customer Sample ID						ES5	ES1	ES3	ES5	ES7	ES9
						RPS Sample No						355399	355400	355401	355402	355403	355404
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
						Sample Depth (m)						1.50	0.50	1.00	1.50	2.00	2.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Customer Sample ID						ES11	ES1	ES3	ES5	ES7	ES1
						RPS Sample No						355405	355406	355407	355408	355409	355410
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
						Sample Depth (m)						3.00	0.50	1.00	1.50	2.00	0.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	0.35	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Customer Sample ID						ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No						355411	355412	355413	355414	355415	355416
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
						Sample Depth (m)						1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Customer Sample ID						ES1	ES3	ES1	ES3	ES5	ES1
						RPS Sample No						355417	355418	355419	355420	355421	355422
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
						Sample Depth (m)						0.50	1.00	0.50	1.00	1.50	0.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

						Customer Sample No	**Certified Reference Material**		**AQC spike**			**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Customer Sample ID						ES3	ES5	ES7	ES1	ES3	ES5
						RPS Sample No						355423	355424	355425	355426	355427	355428
						Sample Type	**SEDIMENT**		**SEDIMENT**			**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
						Sample Location						**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
						Sample Depth (m)						1.00	1.50	2.00	0.50	1.00	1.50
						Sampling Date	**CRM BCR-536**		**Spike on clean sediment**			07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
						Sampling Time											
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**RL**	**Assigned Value**	**Measured Value**	**Recovery %**	**Assigned Value**	**Measured Value**	**Recovery %**						
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5	U	396	ug/kg DW	0.1	44	33.3	75.7%	25	29.29	117.2%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3	U	396	ug/kg DW	0.2	38	31.92	84.0%	25	27.85	111.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2	U	396	ug/kg DW	0.2	44	37.82	86.0%	25	26.88	107.5%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6	U	396	ug/kg DW	0.2	27.5	30.93	112.5%	25	26.09	104.4%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2	U	396	ug/kg DW	0.2	44.2	49.31	111.6%	25	25.17	100.7%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1	U	396	ug/kg DW	0.2	50	51.43	102.9%	25	25.24	101.0%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3	U	396	ug/kg DW	0.2	22.4	31.72	141.6%	25	26.08	104.3%	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Customer Sample No					**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
Customer Sample ID					ES9	ES10	ES11	ES12	ES13	ES14
RPS Sample No					355364	355365	355366	355367	355368	355369
Sample Type					**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location					**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**
Sample Depth (m)					0.50	1.00	1.50	2.00	2.50	3.00
Sampling Date					17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018
Sampling Time										
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Polymodal, Very Poorly Sorted	Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Muddy Sandy Gravel	Gravelly Muddy Sand	Gravelly Sand	Gravelly Sand	Gravel	Sandy Gravel
sediment name		S	In-house		Medium Silty Sandy Coarse Gravel	Very Fine Gravelly Medium Silty Coarse Sand	Very Fine Gravelly Very Coarse Sand	Very Fine Gravelly Coarse Sand	Medium Gravel	Sandy Medium Gravel
arithmetic mean (method of moments)		S	In-house	um	6090	2880	1350	1170	13700	7580
arithmetic sorting (method of moments)		S	In-house	um	9520	5450	1430	1340	8780	5390
arithmetic skewness (method of moments)		S	In-house	um	1.75	3.44	2.69	3.58	0.204	0.331
arithmetic kurtosis (method of moments)		S	In-house	um	4.83	14.9	12.7	19.5	1.91	2.14
geometic mean (method of moments)		S	In-house	um	1050	751	854	705	8680	4490
geometic sorting (method of moments)		S	In-house	um	11.4	7.62	2.66	3.28	3.81	3.68
geometic skewness (method of moments)		S	In-house	um	-0.760	-1.07	-0.160	-2.00	-2.58	-1.29
geometic kurtosis (method of moments)		S	In-house	um	3.36	4.61	2.72	11.3	12.8	3.80
logarithmic mean (method of moments)		S	In-house	phi	-0.075	0.411	0.227	0.504	-3.12	-2.17
logarithmic sorting (method of moments)		S	In-house	phi	3.52	2.93	1.41	1.72	1.93	1.88
logarithmic skewness (method of moments)		S	In-house	phi	0.762	1.07	0.160	2.00	2.58	1.29
logarithmic kurtosis (method of moments)		S	In-house	phi	3.36	4.62	2.72	11.3	12.8	3.80
mean (Folk and Ward method - um)		S	In-house	um	1280	911	846	768	10300	4850
sorting (Folk and Ward method - um)		S	In-house	um	11.4	6.75	2.72	2.47	2.97	3.53
skewness (Folk and Ward method - um)		S	In-house	um	-0.103	-0.195	-0.113	-0.070	-0.459	-0.538
kurtosis (Folk and Ward method - um)		S	In-house	um	1.10	1.57	1.02	1.26	1.35	1.20
mean (Folk and Ward method - phi)		S	In-house	phi	-0.359	0.135	0.242	0.381	-3.36	-2.28
sorting (Folk and Ward method - phi)		S	In-house	phi	3.51	2.76	1.44	1.31	1.57	1.82
skewness (Folk and Ward method - phi)		S	In-house	phi	0.103	0.195	0.113	0.070	0.459	0.538
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.10	1.57	1.02	1.26	1.35	1.20
mean description (Folk and Ward method)		S	In-house		Very Coarse Sand	Coarse Sand	Coarse Sand	Coarse Sand	Medium Gravel	Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Fine Skewed	Fine Skewed	Fine Skewed	Symmetrical	Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Mesokurtic	Very Leptokurtic	Mesokurtic	Leptokurtic	Leptokurtic	Leptokurtic
MODE 1 - um		S	In-house	um	27000	1200	1200	854	13600	13600
MODE 2 - um		S	In-house	um	1200	6800	604		27000	1200
MODE 3 - um		S	In-house	um	604	27000				
MODE 1 - phi		S	In-house	phi	-4.73	-0.243	-0.243	0.250	-3.74	-3.74
MODE 2 - phi		S	In-house	phi	-0.243	-2.74	0.750		-4.73	-0.243
MODE 3 - phi		S	In-house	phi	0.750	-4.73				
D10 - um		S	In-house	um	23.7	38.6	213	231	1500	505
D50 - um		S	In-house	um	1230	980	923	793	12800	7060
D90 - um		S	In-house	um	24400	7040	2920	2280	26900	14800
(D90/D10) - um		S	In-house	um	1030	182	13.7	9.89	18.0	29.4
(D90 - D10) - um		S	In-house	um	24400	7000	2700	2050	25400	14300
(D75/D25) - um		S	In-house	um	20.8	6.37	3.71	2.86	3.30	4.37
(D75 - D25) - um		S	In-house	um	6790	2130	1220	856	14200	8980
D10 - phi		S	In-house	phi	-4.61	-2.82	-1.54	-1.19	-4.75	-3.89
D50 - phi		S	In-house	phi	-0.299	0.030	0.116	0.335	-3.68	-2.82
D90 - phi		S	In-house	phi	5.40	4.69	2.23	2.12	-0.582	0.987
(D90/D10) - phi		S	In-house	phi	-1.17	-1.67	-1.45	-1.78	0.123	-0.254
(D90 - D10) - phi		S	In-house	phi	10.0	7.51	3.78	3.31	4.17	4.88
(D75/D25) - phi		S	In-house	phi	-0.546	-1.00	-1.57	-2.82	0.604	0.399
(D75 - D25) - phi		S	In-house	phi	4.38	2.67	1.89	1.52	1.72	2.13
% gravel		S	In-house	%	40.2	29.0	18.4	12.1	88.7	78.8
% sand		S	In-house	%	46.8	59.9	81.3	84.7	10.4	21.1
% mud		S	In-house	%	13.0	11.1	0.36	3.25	0.99	0.16
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	1.54	0.00	0.00	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	12.7	4.25	0.00	0.00	33.4	5.37
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	9.72	3.70	0.75	0.94	37.0	39.8
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	6.95	9.99	4.34	2.83	12.0	22.2
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	9.30	11.0	13.3	8.28	6.22	11.5
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	15.5	20.4	28.7	25.1	4.60	7.17
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	14.1	21.3	25.4	35.5	2.15	4.10
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	8.33	10.2	14.8	16.3	1.90	3.85
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	5.73	4.99	10.6	6.67	1.42	5.19
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	3.18	3.10	1.74	1.15	0.28	0.74
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	2.04	1.66	0.36	0.47	0.13	0.16
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	2.72	2.23	0.00	0.54	0.15	0.00
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	3.35	2.76	0.00	0.71	0.21	0.00
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	2.48	2.17	0.00	0.67	0.20	0.00
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	1.17	1.07	0.00	0.36	0.13	0.00
% clay (<0.001953mm or >9phi)		S	In-house	%	1.28	1.25	0.00	0.49	0.17	0.00

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
				Customer Sample ID	ES1	ES3	ES5	ES7	ES47	ES48
				RPS Sample No	355370	355371	355372	355373	355374	355375
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
				Sample Depth (m)	0.50	1.00	1.50	2.00	0.50	1.00
				Sampling Date	08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Bimodal, Poorly Sorted	Trimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Gravel	Gravel	Sandy Gravel	Gravel	Gravel
sediment name		S	In-house		Coarse Gravel	Coarse Gravel	Fine Gravel	Sandy Fine Gravel	Coarse Gravel	Coarse Gravel
arithmetic mean (method of moments)		S	In-house	um	9890	15600	8380	5460	21400	19200
arithmetic sorting (method of moments)		S	In-house	um	8350	10700	7880	4040	11900	7860
arithmetic skewness (method of moments)		S	In-house	um	0.698	0.419	1.35	0.864	-0.251	-0.737
arithmetic kurtosis (method of moments)		S	In-house	um	2.19	2.28	3.81	3.31	2.23	2.78
geometic mean (method of moments)		S	In-house	um	5810	10300	5000	3660	12600	14100
geometic sorting (method of moments)		S	In-house	um	3.31	3.04	3.12	2.84	4.88	3.63
geometic skewness (method of moments)		S	In-house	um	-0.859	-1.42	-0.807	-1.21	-2.57	-4.28
geometic kurtosis (method of moments)		S	In-house	um	3.63	5.24	4.06	4.82	10.5	24.3
logarithmic mean (method of moments)		S	In-house	phi	-2.54	-3.36	-2.32	-1.87	-3.66	-3.82
logarithmic sorting (method of moments)		S	In-house	phi	1.73	1.61	1.64	1.50	2.29	1.86
logarithmic skewness (method of moments)		S	In-house	phi	0.859	1.42	0.807	1.21	2.57	4.28
logarithmic kurtosis (method of moments)		S	In-house	phi	3.63	5.24	4.06	4.82	10.5	24.3
mean (Folk and Ward method - um)		S	In-house	um	6040	10800	5230	3940	16700	18500
sorting (Folk and Ward method - um)		S	In-house	um	3.17	2.83	2.96	2.63	3.01	2.04
skewness (Folk and Ward method - um)		S	In-house	um	-0.180	-0.424	-0.152	-0.283	-0.572	-0.475
kurtosis (Folk and Ward method - um)		S	In-house	um	0.778	0.997	1.01	0.975	2.59	2.13
mean (Folk and Ward method - phi)		S	In-house	phi	-2.60	-3.43	-2.39	-1.98	-4.06	-4.21
sorting (Folk and Ward method - phi)		S	In-house	phi	1.67	1.50	1.57	1.40	1.59	1.03
skewness (Folk and Ward method - phi)		S	In-house	phi	0.180	0.424	0.152	0.283	0.572	0.475
kurtosis (Folk and Ward method - phi)		S	In-house	phi	0.778	0.997	1.01	0.975	2.59	2.13
mean description (Folk and Ward method)		S	In-house		Fine Gravel	Medium Gravel	Fine Gravel	Very Fine Gravel	Coarse Gravel	Coarse Gravel
sorting description (Folk and Ward method)		S	In-house		Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Fine Skewed	Very Fine Skewed	Fine Skewed	Fine Skewed	Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Very Leptokurtic	Very Leptokurtic
MODE 1 - um		S	In-house	um	19200	27000	6800	6800	19200	27000
MODE 2 - um		S	In-house	um	6800	13600	27000			
MODE 3 - um		S	In-house	um		6800				
MODE 1 - phi		S	In-house	phi	-4.24	-4.73	-2.74	-2.74	-4.24	-4.73
MODE 2 - phi		S	In-house	phi	-2.74	-3.74	-4.73			
MODE 3 - phi		S	In-house	phi		-2.74				
D10 - um		S	In-house	um	1190	2030	1210	1050	945	9070
D50 - um		S	In-house	um	6720	14100	5860	4590	21300	19600
D90 - um		S	In-house	um	22000	29900	23400	11000	37700	29000
(D90/D10) - um		S	In-house	um	18.5	14.7	19.3	10.5	39.9	3.19
(D90 - D10) - um		S	In-house	um	20800	27900	22200	9950	36800	19900
(D75/D25) - um		S	In-house	um	6.39	4.00	4.27	3.86	2.05	1.89
(D75 - D25) - um		S	In-house	um	14300	17600	8240	5790	15100	12000
D10 - phi		S	In-house	phi	-4.46	-4.90	-4.55	-3.46	-5.24	-4.86
D50 - phi		S	In-house	phi	-2.75	-3.82	-2.55	-2.20	-4.41	-4.30
D90 - phi		S	In-house	phi	-0.249	-1.03	-0.279	-0.064	0.082	-3.18
(D90/D10) - phi		S	In-house	phi	0.056	0.209	0.061	0.018	-0.016	0.655
(D90 - D10) - phi		S	In-house	phi	4.21	3.88	4.27	3.40	5.32	1.67
(D75/D25) - phi		S	In-house	phi	0.345	0.561	0.389	0.343	0.788	0.804
(D75 - D25) - phi		S	In-house	phi	2.68	2.00	2.10	1.95	1.03	0.915
% gravel		S	In-house	%	80.5	90.2	80.4	75.3	86.2	93.4
% sand		S	In-house	%	19.3	9.71	19.4	24.5	12.1	4.79
% mud		S	In-house	%	0.19	0.09	0.14	0.24	1.71	1.84
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	6.50	0.00	0.00	19.4	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	28.4	36.5	13.4	1.04	53.2	64.8
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	16.2	25.9	22.8	22.7	11.0	27.3
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	21.4	12.2	26.0	31.4	1.38	0.89
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	14.5	9.15	18.2	20.1	1.24	0.44
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	12.5	6.35	12.8	15.6	3.44	2.25
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	3.82	1.59	3.22	4.42	4.77	1.33
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	1.09	0.62	1.23	1.51	2.60	0.89
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	1.23	0.75	1.47	1.86	0.82	0.18
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.62	0.41	0.66	1.05	0.44	0.15
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.19	0.09	0.14	0.24	0.32	0.22
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.39	0.39
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.44	0.53
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.30	0.37
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.00	0.00	0.13	0.15
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.15	0.16

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Customer Sample No					**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
Customer Sample ID					ES49	ES50	ES51	ES52	ES53	ES54
RPS Sample No					355376	355377	355378	355379	355380	355956
Sample Type					**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location					**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**
Sample Depth (m)					1.50	2.00	2.50	3.00	3.50	4.00
Sampling Date					23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018
Sampling Time										
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Unimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Slightly Gravelly Muddy Sand	Sandy Gravel	Sandy Gravel	Gravel	Gravel	Gravel
sediment name		S	In-house		Slightly Very Fine Gravelly Medium Silty Medium Sand	Sandy Coarse Gravel	Sandy Medium Gravel	Medium Gravel	Medium Gravel	Medium Gravel
arithmetic mean (method of moments)		S	In-house	um	667	10500	7590	9340	9310	8860
arithmetic sorting (method of moments)		S	In-house	um	1220	11000	7350	5460	5090	4640
arithmetic skewness (method of moments)		S	In-house	um	7.38	0.466	0.487	0.208	0.298	0.197
arithmetic kurtosis (method of moments)		S	In-house	um	69.5	1.48	1.67	2.19	2.25	2.54
geometic mean (method of moments)		S	In-house	um	328	2950	2620	6770	7370	6810
geometic sorting (method of moments)		S	In-house	um	4.35	7.55	7.02	2.71	2.19	2.50
geometic skewness (method of moments)		S	In-house	um	-1.87	-0.626	-1.10	-1.79	-1.70	-2.30
geometic kurtosis (method of moments)		S	In-house	um	8.17	3.16	4.41	6.37	7.65	9.34
logarithmic mean (method of moments)		S	In-house	phi	1.61	-1.56	-1.39	-2.76	-2.88	-2.77
logarithmic sorting (method of moments)		S	In-house	phi	2.12	2.92	2.81	1.44	1.13	1.32
logarithmic skewness (method of moments)		S	In-house	phi	1.88	0.626	1.10	1.79	1.70	2.30
logarithmic kurtosis (method of moments)		S	In-house	phi	8.18	3.16	4.41	6.37	7.65	9.34
mean (Folk and Ward method - um)		S	In-house	um	409	3310	3300	7610	7800	7830
sorting (Folk and Ward method - um)		S	In-house	um	3.09	5.78	5.50	2.45	2.01	2.12
skewness (Folk and Ward method - um)		S	In-house	um	-0.320	-0.092	-0.415	-0.423	-0.283	-0.394
kurtosis (Folk and Ward method - um)		S	In-house	um	2.34	0.548	0.648	1.44	1.04	1.46
mean (Folk and Ward method - phi)		S	In-house	phi	1.29	-1.73	-1.72	-2.93	-2.96	-2.97
sorting (Folk and Ward method - phi)		S	In-house	phi	1.63	2.53	2.46	1.30	1.00	1.08
skewness (Folk and Ward method - phi)		S	In-house	phi	0.320	0.092	0.415	0.423	0.283	0.394
kurtosis (Folk and Ward method - phi)		S	In-house	phi	2.34	0.548	0.648	1.44	1.04	1.46
mean description (Folk and Ward method)		S	In-house		Medium Sand	Very Fine Gravel	Very Fine Gravel	Fine Gravel	Fine Gravel	Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Symmetrical	Very Fine Skewed	Very Fine Skewed	Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Very Leptokurtic	Very Platykurtic	Very Platykurtic	Leptokurtic	Mesokurtic	Leptokurtic
MODE 1 - um		S	In-house	um	427	27000	19200	13600	13600	9600
MODE 2 - um		S	In-house	um		604	427			
MODE 3 - um		S	In-house	um						
MODE 1 - phi		S	In-house	phi	1.25	-4.73	-4.24	-3.74	-3.74	-3.24
MODE 2 - phi		S	In-house	phi		0.750	1.25			
MODE 3 - phi		S	In-house	phi						
D10 - um		S	In-house	um	54.8	330	293	1930	2830	2780
D50 - um		S	In-house	um	435	3550	5250	8870	8650	8560
D90 - um		S	In-house	um	987	27000	18900	16800	15900	14900
(D90/D10) - um		S	In-house	um	18.0	81.9	64.6	8.72	5.62	5.38
(D90 - D10) - um		S	In-house	um	932	26700	18600	14900	13100	12200
(D75/D25) - um		S	In-house	um	2.40	37.7	24.3	2.65	2.53	2.29
(D75 - D25) - um		S	In-house	um	387	20500	13400	8200	7830	6790
D10 - phi		S	In-house	phi	0.019	-4.76	-4.24	-4.08	-3.99	-3.90
D50 - phi		S	In-house	phi	1.20	-1.83	-2.39	-3.15	-3.11	-3.10
D90 - phi		S	In-house	phi	4.19	1.60	1.77	-0.950	-1.50	-1.47
(D90/D10) - phi		S	In-house	phi	225	-0.337	-0.417	0.233	0.376	0.377
(D90 - D10) - phi		S	In-house	phi	4.17	6.36	6.01	3.12	2.49	2.43
(D75/D25) - phi		S	In-house	phi	3.14	-0.190	-0.210	0.621	0.638	0.667
(D75 - D25) - phi		S	In-house	phi	1.26	5.24	4.60	1.41	1.34	1.20
% gravel		S	In-house	%	3.71	52.5	58.6	89.9	94.6	93.4
% sand		S	In-house	%	86.0	44.8	37.4	10.1	5.33	6.49
% mud		S	In-house	%	10.3	2.66	3.98	0.06	0.04	0.08
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	0.00	38.0	20.0	11.8	9.54	5.21
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	0.50	6.70	22.8	44.4	44.8	49.8
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	1.57	4.89	10.5	24.5	28.2	29.9
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	1.63	2.97	5.35	9.10	12.0	8.60
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	5.85	6.26	6.96	3.68	3.16	1.42
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	31.3	19.7	12.6	2.17	0.82	0.89
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	38.9	16.1	14.4	2.98	0.82	2.38
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	7.30	2.28	2.60	0.99	0.38	1.27
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	2.69	0.51	0.90	0.27	0.15	0.54
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	1.62	0.40	0.69	0.06	0.04	0.08
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	2.00	0.54	0.78	0.00	0.00	0.00
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	2.51	0.67	0.96	0.00	0.00	0.00
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	1.98	0.51	0.75	0.00	0.00	0.00
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	1.01	0.24	0.37	0.00	0.00	0.00
% clay (<0.001953mm or >9phi)		S	In-house	%	1.17	0.31	0.43	0.00	0.00	0.00

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Customer Sample No				**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
Customer Sample ID				ES1	ES2	ES3	ES4	ES5	ES6
RPS Sample No				355381	355382	355383	355384	355385	355386
Sample Type				**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location				**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
Sample Depth (m)				0.50	1.00	1.50	2.00	2.50	3.00
Sampling Date				18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
Sampling Time									
Determinand	**CAS No**	**Codes**	**SOP**	**Units**					
sample type		S	In-house		Unimodal, Well Sorted	Bimodal, Well Sorted	Unimodal, Moderately Sorted	Trimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Gravel	Gravel	Gravelly Sand	Sandy Gravel	Sandy Gravel
sediment name		S	In-house		Coarse Gravel	Coarse Gravel	Coarse Gravel	Coarse Gravelly Coarse Sand	Sandy Coarse Gravel	Sandy Medium Gravel
arithmetic mean (method of moments)		S	In-house	um	26800	27400	18900	3970	12400	4370
arithmetic sorting (method of moments)		S	In-house	um	7930	9460	8000	7060	9280	4460
arithmetic skewness (method of moments)		S	In-house	um	-0.790	-0.448	0.107	2.22	0.023	0.903
arithmetic kurtosis (method of moments)		S	In-house	um	5.03	2.92	4.40	6.79	1.70	2.45
geometic mean (method of moments)		S	In-house	um	23600	23800	15200	1140	5780	2020
geometic sorting (method of moments)		S	In-house	um	1.98	2.02	2.41	4.87	5.25	4.34
geometic skewness (method of moments)		S	In-house	um	-4.54	-4.01	-2.90	-0.050	-1.15	-0.951
geometic kurtosis (method of moments)		S	In-house	um	26.1	21.9	11.7	4.80	3.73	5.41
logarithmic mean (method of moments)		S	In-house	phi	-4.56	-4.57	-3.93	-0.188	-2.53	-1.02
logarithmic sorting (method of moments)		S	In-house	phi	0.982	1.01	1.27	2.29	2.39	2.12
logarithmic skewness (method of moments)		S	In-house	phi	4.54	4.01	2.90	0.050	1.15	0.951
logarithmic kurtosis (method of moments)		S	In-house	phi	26.1	21.9	11.7	4.80	3.73	5.41
mean (Folk and Ward method - um)		S	In-house	um	26100	26300	18000	1330	5720	2160
sorting (Folk and Ward method - um)		S	In-house	um	1.32	1.40	1.93	4.74	4.87	3.86
skewness (Folk and Ward method - um)		S	In-house	um	-0.053	0.013	-0.390	0.380	-0.698	0.016
kurtosis (Folk and Ward method - um)		S	In-house	um	1.27	0.691	4.55	1.21	0.686	0.722
mean (Folk and Ward method - phi)		S	In-house	phi	-4.71	-4.72	-4.17	-0.407	-2.52	-1.11
sorting (Folk and Ward method - phi)		S	In-house	phi	0.404	0.483	0.947	2.24	2.29	1.95
skewness (Folk and Ward method - phi)		S	In-house	phi	0.053	-0.013	0.390	-0.380	0.698	-0.016
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.27	0.691	4.55	1.21	0.686	0.722
mean description (Folk and Ward method)		S	In-house		Coarse Gravel	Coarse Gravel	Coarse Gravel	Very Coarse Sand	Fine Gravel	Very Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Well Sorted	Well Sorted	Moderately Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Symmetrical	Symmetrical	Very Fine Skewed	Very Coarse Skewed	Very Fine Skewed	Symmetrical
kurtosis description (Folk and Ward method)		S	In-house		Leptokurtic	Platykurtic	Extremely Leptokurtic	Leptokurtic	Platykurtic	Platykurtic
MODE 1 - um		S	In-house	um	27000	19200	19200	854	19200	9600
MODE 2 - um		S	In-house	um		38300		27000	854	854
MODE 3 - um		S	In-house	um				13600		
MODE 1 - phi		S	In-house	phi	-4.73	-4.24	-4.24	0.250	-4.24	-3.24
MODE 2 - phi		S	In-house	phi		-5.24		-4.73	0.250	0.250
MODE 3 - phi		S	In-house	phi				-3.74		
D10 - um		S	In-house	um	17700	17100	11300	245	425	363
D50 - um		S	In-house	um	26400	26200	18600	850	13200	1980
D90 - um		S	In-house	um	37900	40700	28700	15100	24700	11500
(D90/D10) - um		S	In-house	um	2.15	2.39	2.54	61.8	58.2	31.8
(D90 - D10) - um		S	In-house	um	20200	23700	17400	14900	24300	11200
(D75/D25) - um		S	In-house	um	1.35	1.78	1.35	5.13	16.0	10.1
(D75 - D25) - um		S	In-house	um	8020	15300	5560	1870	18300	6750
D10 - phi		S	In-house	phi	-5.24	-5.35	-4.84	-3.92	-4.63	-3.53
D50 - phi		S	In-house	phi	-4.72	-4.71	-4.22	0.235	-3.73	-0.986
D90 - phi		S	In-house	phi	-4.14	-4.09	-3.49	2.03	1.24	1.46
(D90/D10) - phi		S	In-house	phi	0.790	0.765	0.722	-0.518	-0.267	-0.415
(D90 - D10) - phi		S	In-house	phi	1.10	1.26	1.35	5.95	5.86	4.99
(D75/D25) - phi		S	In-house	phi	0.912	0.838	0.903	-0.936	0.066	-0.150
(D75 - D25) - phi		S	In-house	phi	0.437	0.829	0.430	2.36	4.00	3.34
% gravel		S	In-house	%	96.7	96.6	93.5	26.4	71.8	49.8
% sand		S	In-house	%	3.29	3.37	6.52	71.8	27.8	48.7
% mud		S	In-house	%	0.03	0.02	0.02	1.82	0.49	1.47
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	19.9	34.3	6.37	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	75.5	62.3	68.8	9.26	40.4	0.00
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	1.15	0.00	15.9	7.30	23.5	23.1
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	0.00	0.00	1.14	4.05	5.06	17.1
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	0.16	0.07	1.25	5.75	2.85	9.66
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	1.85	1.88	3.20	15.6	5.32	15.5
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	0.89	0.95	1.90	30.4	11.0	19.6
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	0.33	0.36	1.09	17.3	7.71	9.38
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	0.12	0.11	0.24	7.57	3.41	3.58
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.10	0.07	0.10	0.95	0.34	0.57
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.03	0.02	0.02	0.31	0.09	0.24
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.00	0.29	0.07	0.24
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	0.00	0.34	0.08	0.30
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	0.00	0.33	0.08	0.28
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.00	0.20	0.06	0.16
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	0.00	0.35	0.11	0.25

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No	**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
				Customer Sample ID	ES7	ES8	ES9	ES1	ES3	ES5
				RPS Sample No	355387	355388	355389	355390	355391	355392
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location	**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**
				Sample Depth (m)	3.50	4.00	4.50	0.50	1.00	1.50
				Sampling Date	18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Trimodal, Poorly Sorted	Unimodal, Well Sorted	Trimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Sandy Gravel
sediment name		S	In-house		Coarse Gravel	Coarse Gravel	Sandy Medium Gravel	Coarse Gravel	Coarse Gravel	Sandy Medium Gravel
arithmetic mean (method of moments)		S	In-house	um	13400	27200	9990	17700	21800	4370
arithmetic sorting (method of moments)		S	In-house	um	8770	8640	7350	7660	12500	5420
arithmetic skewness (method of moments)		S	In-house	um	-0.004	-0.608	-0.058	-0.546	-0.061	1.48
arithmetic kurtosis (method of moments)		S	In-house	um	1.89	3.77	1.41	2.62	1.91	4.06
geometic mean (method of moments)		S	In-house	um	8120	24000	5430	13900	14500	1960
geometic sorting (method of moments)		S	In-house	um	3.65	1.87	3.89	2.49	3.38	3.63
geometic skewness (method of moments)		S	In-house	um	-1.36	-4.06	-0.795	-2.67	-1.96	0.248
geometic kurtosis (method of moments)		S	In-house	um	3.89	22.9	2.19	10.6	6.27	1.95
logarithmic mean (method of moments)		S	In-house	phi	-3.02	-4.59	-2.44	-3.80	-3.86	-0.971
logarithmic sorting (method of moments)		S	In-house	phi	1.87	0.904	1.96	1.32	1.76	1.86
logarithmic skewness (method of moments)		S	In-house	phi	1.36	4.06	0.795	2.67	1.96	-0.248
logarithmic kurtosis (method of moments)		S	In-house	phi	3.89	22.9	2.19	10.6	6.27	1.95
mean (Folk and Ward method - um)		S	In-house	um	7930	26300	5770	16700	18300	2000
sorting (Folk and Ward method - um)		S	In-house	um	3.55	1.40	3.80	2.06	2.72	3.80
skewness (Folk and Ward method - um)		S	In-house	um	-0.627	-0.116	-0.689	-0.467	-0.413	0.273
kurtosis (Folk and Ward method - um)		S	In-house	um	1.12	1.16	0.670	2.16	1.85	0.716
mean (Folk and Ward method - phi)		S	In-house	phi	-2.99	-4.72	-2.53	-4.06	-4.19	-0.998
sorting (Folk and Ward method - phi)		S	In-house	phi	1.83	0.487	1.93	1.04	1.44	1.93
skewness (Folk and Ward method - phi)		S	In-house	phi	0.627	0.116	0.689	0.467	0.413	-0.273
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.12	1.16	0.670	2.16	1.85	0.716
mean description (Folk and Ward method)		S	In-house		Fine Gravel	Coarse Gravel	Fine Gravel	Coarse Gravel	Coarse Gravel	Very Coarse Sand
sorting description (Folk and Ward method)		S	In-house		Poorly Sorted	Well Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Coarse Skewed
kurtosis description (Folk and Ward method)		S	In-house		Leptokurtic	Leptokurtic	Very Platykurtic	Very Leptokurtic	Very Leptokurtic	Platykurtic
MODE 1 - um		S	In-house	um	13600	27000	19200	19200	38300	1200
MODE 2 - um		S	In-house	um	1200		1200		19200	604
MODE 3 - um		S	In-house	um	6800		604			13600
MODE 1 - phi		S	In-house	phi	-3.74	-4.73	-4.24	-4.24	-5.24	-0.243
MODE 2 - phi		S	In-house	phi	-0.243		-0.243		-4.24	0.750
MODE 3 - phi		S	In-house	phi	-2.74		0.750			-3.74
D10 - um		S	In-house	um	1030	17000	618	6450	1530	422
D50 - um		S	In-house	um	13700	26600	11500	18000	20000	1470
D90 - um		S	In-house	um	25600	39500	19700	27800	39600	13300
(D90/D10) - um		S	In-house	um	24.9	2.32	32.0	4.32	25.9	31.4
(D90 - D10) - um		S	In-house	um	24600	22400	19100	21400	38100	12800
(D75/D25) - um		S	In-house	um	4.32	1.49	10.6	1.83	2.50	9.45
(D75 - D25) - um		S	In-house	um	15100	10700	14800	10500	19600	5770
D10 - phi		S	In-house	phi	-4.68	-5.30	-4.30	-4.80	-5.31	-3.73
D50 - phi		S	In-house	phi	-3.78	-4.73	-3.52	-4.17	-4.33	-0.556
D90 - phi		S	In-house	phi	-0.044	-4.09	0.694	-2.69	-0.611	1.25
(D90/D10) - phi		S	In-house	phi	0.009	0.771	-0.161	0.560	0.115	-0.334
(D90 - D10) - phi		S	In-house	phi	4.64	1.21	5.00	2.11	4.70	4.98
(D75/D25) - phi		S	In-house	phi	0.509	0.885	0.154	0.807	0.737	-0.205
(D75 - D25) - phi		S	In-house	phi	2.11	0.579	3.41	0.875	1.32	3.24
% gravel		S	In-house	%	81.7	97.4	71.8	93.1	89.3	42.5
% sand		S	In-house	%	18.3	2.57	28.2	6.87	10.7	57.5
% mud		S	In-house	%	0.08	0.01	0.04	0.04	0.06	0.08
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	26.0	0.00	0.00	26.6	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	38.4	67.9	26.7	62.2	39.9	5.65
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	30.5	2.42	30.8	26.6	17.8	16.0
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	7.29	0.50	7.54	2.94	3.25	10.4
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	5.52	0.59	6.74	1.30	1.65	10.4
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	8.80	1.85	10.9	3.40	3.76	21.0
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	4.79	0.49	10.9	2.01	3.54	22.6
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	2.55	0.11	5.61	0.90	2.56	12.2
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	1.89	0.07	0.60	0.32	0.54	1.36
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.23	0.06	0.12	0.23	0.28	0.33
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.08	0.01	0.04	0.04	0.06	0.08
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No	**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
				Customer Sample ID	ES7	ES9	ES1	ES2	ES1	ES3
				RPS Sample No	355393	355394	355395	355396	355397	355398
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location	**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
				Sample Depth (m)	2.00	2.50	0.50	1.00	0.50	1.00
				Sampling Date	07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Extremely Poorly Sorted	Polymodal, Very Poorly Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Gravel	Gravel	Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel
sediment name		S	In-house		Coarse Gravel	Coarse Gravel	Coarse Gravel	Medium Gravel	Medium Silty Sandy Coarse Gravel	Very Coarse Silty Sandy Coarse Gravel
arithmetic mean (method of moments)		S	In-house	um	24800	18100	19000	11600	7460	7290
arithmetic sorting (method of moments)		S	In-house	um	19900	10200	8360	7330	11000	9740
arithmetic skewness (method of moments)		S	In-house	um	0.504	0.474	-0.697	0.298	1.07	1.21
arithmetic kurtosis (method of moments)		S	In-house	um	1.76	2.93	2.37	2.45	2.29	2.92
geometic mean (method of moments)		S	In-house	um	12800	13100	15000	7940	686	1070
geometic sorting (method of moments)		S	In-house	um	4.50	2.85	2.43	2.91	16.9	14.8
geometic skewness (method of moments)		S	In-house	um	-1.21	-2.09	-2.45	-1.46	-0.258	-0.638
geometic kurtosis (method of moments)		S	In-house	um	3.47	7.27	9.60	4.96	2.28	2.63
logarithmic mean (method of moments)		S	In-house	phi	-3.68	-3.71	-3.90	-2.99	0.542	-0.104
logarithmic sorting (method of moments)		S	In-house	phi	2.17	1.51	1.28	1.54	4.08	3.89
logarithmic skewness (method of moments)		S	In-house	phi	1.21	2.09	2.45	1.46	0.259	0.639
logarithmic kurtosis (method of moments)		S	In-house	phi	3.47	7.27	9.60	4.96	2.28	2.63
mean (Folk and Ward method - um)		S	In-house	um	11000	16300	17600	8180	798	1560
sorting (Folk and Ward method - um)		S	In-house	um	5.07	2.33	2.06	2.76	18.1	14.4
skewness (Folk and Ward method - um)		S	In-house	um	-0.462	-0.321	-0.550	-0.539	0.079	-0.252
kurtosis (Folk and Ward method - um)		S	In-house	um	1.35	2.62	1.86	1.24	0.728	0.794
mean (Folk and Ward method - phi)		S	In-house	phi	-3.46	-4.03	-4.14	-3.03	0.326	-0.641
sorting (Folk and Ward method - phi)		S	In-house	phi	2.34	1.22	1.04	1.46	4.18	3.85
skewness (Folk and Ward method - phi)		S	In-house	phi	0.462	0.321	0.550	0.539	-0.079	0.252
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.35	2.62	1.86	1.24	0.728	0.794
mean description (Folk and Ward method)		S	In-house		Medium Gravel	Coarse Gravel	Coarse Gravel	Medium Gravel	Coarse Sand	Very Coarse Sand
sorting description (Folk and Ward method)		S	In-house		Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Symmetrical	Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Leptokurtic	Very Leptokurtic	Very Leptokurtic	Leptokurtic	Platykurtic	Platykurtic
MODE 1 - um		S	In-house	um	54000	19200	27000	13600	27000	27000
MODE 2 - um		S	In-house	um	19200	38300		1200	214	13600
MODE 3 - um		S	In-house	um	1200				1200	151
MODE 1 - phi		S	In-house	phi	-5.74	-4.24	-4.73	-3.74	-4.73	-4.73
MODE 2 - phi		S	In-house	phi	-4.24	-5.24		-0.243	2.25	-3.74
MODE 3 - phi		S	In-house	phi	-0.243				-0.243	2.75
D10 - um		S	In-house	um	922	2530	5170	1360	13.6	25.9
D50 - um		S	In-house	um	18300	16900	20000	11700	508	2020
D90 - um		S	In-house	um	56000	34400	29100	21300	26900	25600
(D90/D10) - um		S	In-house	um	60.8	13.6	5.63	15.7	1990	991
(D90 - D10) - um		S	In-house	um	55100	31800	23900	20000	26900	25600
(D75/D25) - um		S	In-house	um	4.23	1.79	1.97	3.02	124	74.2
(D75 - D25) - um		S	In-house	um	35900	9570	12700	10500	15700	11200
D10 - phi		S	In-house	phi	-5.81	-5.10	-4.86	-4.42	-4.75	-4.68
D50 - phi		S	In-house	phi	-4.19	-4.08	-4.32	-3.55	0.977	-1.01
D90 - phi		S	In-house	phi	0.117	-1.34	-2.37	-0.439	6.21	5.27
(D90/D10) - phi		S	In-house	phi	-0.020	0.263	0.487	0.099	-1.31	-1.13
(D90 - D10) - phi		S	In-house	phi	5.93	3.76	2.49	3.98	11.0	9.95
(D75/D25) - phi		S	In-house	phi	0.626	0.810	0.791	0.599	-0.745	-0.775
(D75 - D25) - phi		S	In-house	phi	2.08	0.842	0.978	1.60	6.95	6.21
% gravel		S	In-house	%	82.3	90.4	94.0	86.2	35.9	50.1
% sand		S	In-house	%	17.7	9.61	5.97	13.6	45.8	35.9
% mud		S	In-house	%	0.04	0.02	0.07	0.20	18.3	14.0
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	28.7	12.6	0.00	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	29.3	42.9	65.0	23.7	24.9	17.4
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	21.4	30.9	21.1	43.6	2.98	13.9
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	1.27	2.83	5.35	11.6	4.51	9.94
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	1.61	1.05	2.48	7.27	3.47	8.90
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	7.09	4.34	3.51	8.07	8.55	6.91
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	5.99	3.25	1.75	4.03	5.70	3.45
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	3.64	1.42	0.41	0.92	8.00	3.98
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	0.78	0.46	0.17	0.38	17.3	14.9
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.19	0.15	0.13	0.25	6.25	6.72
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.04	0.02	0.07	0.20	3.64	3.27
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.00	0.00	3.78	2.56
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	0.00	0.00	4.09	2.63
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	0.00	0.00	3.19	2.27
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.00	0.00	1.65	1.42
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	0.00	0.00	1.92	1.82

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

	Customer Sample No	**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
	Customer Sample ID	ES5	ES1	ES3	ES5	ES7	ES9
	RPS Sample No	355399	355400	355401	355402	355403	355404
	Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
	Sample Location	**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**
	Sample Depth (m)	1.50	0.50	1.00	1.50	2.00	2.50
	Sampling Date	18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018
	Sampling Time						

Determinand	CAS No	Codes	SOP	Units						
sample type		S	In-house		Polymodal, Very Poorly Sorted	Polymodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Trimodal, Moderately Well Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Muddy Sandy Gravel	Sandy Gravel	Sandy Gravel	Sandy Gravel	Gravel
sediment name		S	In-house		Coarse Gravel	Coarse Silty Sandy Coarse Gravel	Sandy Very Fine Gravel	Sandy Very Fine Gravel	Sandy Very Fine Gravel	Very Coarse Gravel
arithmetic mean (method of moments)		S	In-house	um	14100	8440	3150	3820	2860	5640
arithmetic sorting (method of moments)		S	In-house	um	12900	8250	3150	3710	2730	6570
arithmetic skewness (method of moments)		S	In-house	um	0.836	0.761	1.82	1.75	1.61	0.908
arithmetic kurtosis (method of moments)		S	In-house	um	2.46	2.24	5.90	6.45	5.04	2.49
geometic mean (method of moments)		S	In-house	um	7240	3050	1950	2340	1810	270
geometic sorting (method of moments)		S	In-house	um	3.98	7.72	2.83	2.91	2.74	66.9
geometic skewness (method of moments)		S	In-house	um	-0.818	-1.55	-0.536	-0.587	-0.517	-0.496
geometic kurtosis (method of moments)		S	In-house	um	3.13	5.54	3.73	3.62	3.73	1.39
logarithmic mean (method of moments)		S	In-house	phi	-2.86	-1.61	-0.964	-1.23	-0.859	-1.59
logarithmic sorting (method of moments)		S	In-house	phi	1.99	2.95	1.50	1.54	1.46	1.79
logarithmic skewness (method of moments)		S	In-house	phi	0.818	1.55	0.536	0.587	0.517	-0.056
logarithmic kurtosis (method of moments)		S	In-house	phi	3.13	5.54	3.73	3.62	3.73	1.78
mean (Folk and Ward method - um)		S	In-house	um	8180	3930	2070	2570	1970	6330
sorting (Folk and Ward method - um)		S	In-house	um	4.05	6.52	2.78	2.85	2.73	1.43
skewness (Folk and Ward method - um)		S	In-house	um	-0.333	-0.392	0.021	-0.007	0.072	-4.12
kurtosis (Folk and Ward method - um)		S	In-house	um	0.858	1.11	1.21	1.00	1.17	0.277
mean (Folk and Ward method - phi)		S	In-house	phi	-3.03	-1.98	-1.05	-1.36	-0.975	-2.66
sorting (Folk and Ward method - phi)		S	In-house	phi	2.02	2.71	1.48	1.51	1.45	0.515
skewness (Folk and Ward method - phi)		S	In-house	phi	0.333	0.392	-0.021	0.007	-0.072	4.12
kurtosis (Folk and Ward method - phi)		S	In-house	phi	0.858	1.11	1.21	1.00	1.17	0.277
mean description (Folk and Ward method)		S	In-house		Medium Gravel	Very Fine Gravel	Very Fine Gravel	Very Fine Gravel	Very Coarse Sand	Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Moderately Well Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Very Fine Skewed	Symmetrical	Symmetrical	Symmetrical	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Platykurtic	Leptokurtic	Leptokurtic	Mesokurtic	Leptokurtic	Very Platykurtic
MODE 1 - um		S	In-house	um	19200	19200	1700	1700	1200	19200
MODE 2 - um		S	In-house	um	38300	6800		9600		9600
MODE 3 - um		S	In-house	um	4800	1200				1200
MODE 1 - phi		S	In-house	phi	-4.24	-4.24	-0.743	-0.743	-0.243	-4.24
MODE 2 - phi		S	In-house	phi	-5.24	-2.74		-3.24		-3.24
MODE 3 - phi		S	In-house	phi	-2.24	-0.243				-0.243
D10 - um		S	In-house	um	1080	230	571	650	575	1400
D50 - um		S	In-house	um	11000	5090	1930	2370	1740	13900
D90 - um		S	In-house	um	36700	20700	7690	9250	7190	366000
(D90/D10) - um		S	In-house	um	33.8	90.3	13.5	14.2	12.5	262
(D90 - D10) - um		S	In-house	um	35600	20500	7120	8600	6610	364000
(D75/D25) - um		S	In-house	um	7.41	12.3	3.45	4.12	3.40	3.69
(D75 - D25) - um		S	In-house	um	17200	14900	2760	3900	2570	14200
D10 - phi		S	In-house	phi	-5.20	-4.38	-2.94	-3.21	-2.85	-8.51
D50 - phi		S	In-house	phi	-3.46	-2.35	-0.947	-1.25	-0.800	-3.79
D90 - phi		S	In-house	phi	-0.116	2.12	0.808	0.622	0.798	-0.482
(D90/D10) - phi		S	In-house	phi	0.022	-0.485	-0.275	-0.194	-0.280	0.057
(D90 - D10) - phi		S	In-house	phi	5.08	6.50	3.75	3.83	3.64	8.03
(D75/D25) - phi		S	In-house	phi	0.330	0.100	0.088	0.135	0.051	0.560
(D75 - D25) - phi		S	In-house	phi	2.89	3.62	1.78	2.04	1.77	1.88
% gravel		S	In-house	%	80.0	67.7	48.3	56.5	43.3	87.0
% sand		S	In-house	%	19.8	25.4	51.3	43.0	56.2	12.9
% mud		S	In-house	%	0.24	6.93	0.42	0.49	0.47	0.10
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	16.7	0.00	0.00	0.00	0.00	34.9
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	21.9	25.8	0.00	1.57	0.00	11.2
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	17.7	13.0	9.33	13.3	7.74	20.9
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	12.0	15.9	14.8	17.2	14.7	12.7
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	11.8	13.1	24.2	24.5	20.8	7.27
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	11.4	12.8	32.2	26.5	35.2	6.55
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	4.73	5.31	11.1	9.86	13.4	3.42
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	1.58	3.89	3.85	3.50	3.74	2.00
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	1.46	1.97	2.97	2.30	2.81	0.75
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.54	1.38	1.13	0.86	1.13	0.22
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.24	1.45	0.42	0.49	0.47	0.10
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	1.71	0.00	0.00	0.00	0.00
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	1.66	0.00	0.00	0.00	0.00
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	1.10	0.00	0.00	0.00	0.00
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.48	0.00	0.00	0.00	0.00
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.53	0.00	0.00	0.00	0.00

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Determinand	CAS No	Codes	SOP	Units	Customer Sample No	BH13	BH22	BH22	BH22	BH22	BH24
					Customer Sample ID	ES11	ES1	ES3	ES5	ES7	ES1
					RPS Sample No	355405	355406	355407	355408	355409	355410
					Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
					Sample Location	**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
					Sample Depth (m)	3.00	0.50	1.00	1.50	2.00	0.50
					Sampling Date	13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
					Sampling Time						
sample type		S	In-house		Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Trimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted
textural group (GRADISTAT)		S	In-house		Sandy Gravel	Gravel	Gravel	Gravel	Gravel	Muddy Sandy Gravel
sediment name		S	In-house		Sandy Fine Gravel	Coarse Gravel	Medium Gravel	Coarse Gravel	Medium Gravel	Medium Silty Sandy Fine Gravel
arithmetic mean (method of moments)		S	In-house	um	3700	15100	15800	20700	12600	4720
arithmetic sorting (method of moments)		S	In-house	um	3450	9680	12100	11900	8210	4150
arithmetic skewness (method of moments)		S	In-house	um	1.28	-0.313	0.792	0.036	0.269	0.649
arithmetic kurtosis (method of moments)		S	In-house	um	3.90	1.75	2.59	1.86	2.10	2.39
geometic mean (method of moments)		S	In-house	um	2230	6470	9600	15000	8330	1570
geometic sorting (method of moments)		S	In-house	um	2.98	8.73	3.44	2.71	3.05	10.1
geometic skewness (method of moments)		S	In-house	um	-0.470	-2.10	-1.33	-1.84	-1.37	-1.60
geometic kurtosis (method of moments)		S	In-house	um	2.92	6.87	4.53	6.87	4.40	4.87
logarithmic mean (method of moments)		S	In-house	phi	-1.16	-2.70	-3.26	-3.91	-3.06	-0.650
logarithmic sorting (method of moments)		S	In-house	phi	1.57	3.13	1.78	1.44	1.61	3.34
logarithmic skewness (method of moments)		S	In-house	phi	0.470	2.10	1.33	1.84	1.37	1.60
logarithmic kurtosis (method of moments)		S	In-house	phi	2.92	6.88	4.53	6.87	4.40	4.87
mean (Folk and Ward method - um)		S	In-house	um	2330	8090	10500	17000	8770	1820
sorting (Folk and Ward method - um)		S	In-house	um	3.00	6.11	3.47	2.47	2.92	8.52
skewness (Folk and Ward method - um)		S	In-house	um	-0.066	-0.778	-0.366	-0.475	-0.495	-0.626
kurtosis (Folk and Ward method - um)		S	In-house	um	0.905	1.90	1.50	1.36	1.23	1.57
mean (Folk and Ward method - phi)		S	In-house	phi	-1.22	-3.02	-3.39	-4.09	-3.13	-0.865
sorting (Folk and Ward method - phi)		S	In-house	phi	1.59	2.61	1.80	1.30	1.55	3.09
skewness (Folk and Ward method - phi)		S	In-house	phi	0.066	0.778	0.366	0.475	0.495	0.626
kurtosis (Folk and Ward method - phi)		S	In-house	phi	0.905	1.90	1.50	1.36	1.23	1.57
mean description (Folk and Ward method)		S	In-house		Very Fine Gravel	Medium Gravel	Medium Gravel	Coarse Gravel	Medium Gravel	Very Coarse Sand
sorting description (Folk and Ward method)		S	In-house		Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Symmetrical	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Mesokurtic	Very Leptokurtic	Leptokurtic	Leptokurtic	Leptokurtic	Very Leptokurtic
MODE 1 - um		S	In-house	um	1200	19200	13600	27000	13600	6800
MODE 2 - um		S	In-house	um	4800	1200	38300	13600	1200	1200
MODE 3 - um		S	In-house	um			1200			214
MODE 1 - phi		S	In-house	phi	-0.243	-4.24	-3.74	-4.73	-3.74	-2.74
MODE 2 - phi		S	In-house	phi	-2.24	-0.243	-5.24	-3.74	-0.243	-0.243
MODE 3 - phi		S	In-house	phi			-0.243			2.25
D10 - um		S	In-house	um	536	202	1280	4410	1320	35.6
D50 - um		S	In-house	um	2340	16700	13300	20500	12100	3900
D90 - um		S	In-house	um	9010	27600	37000	37600	24600	10700
(D90/D10) - um		S	In-house	um	16.8	137	29.0	8.53	18.6	301
(D90 - D10) - um		S	In-house	um	8470	27400	35800	33200	23300	10700
(D75/D25) - um		S	In-house	um	4.90	4.48	3.01	2.79	3.32	7.11
(D75 - D25) - um		S	In-house	um	4220	17600	13200	18900	12600	6450
D10 - phi		S	In-house	phi	-3.17	-4.79	-5.21	-5.23	-4.62	-3.42
D50 - phi		S	In-house	phi	-1.23	-4.06	-3.74	-4.36	-3.59	-1.97
D90 - phi		S	In-house	phi	0.899	2.31	-0.351	-2.14	-0.404	4.81
(D90/D10) - phi		S	In-house	phi	-0.283	-0.482	0.067	0.409	0.087	-1.41
(D90 - D10) - phi		S	In-house	phi	4.07	7.09	4.86	3.09	4.22	8.23
(D75/D25) - phi		S	In-house	phi	0.048	0.520	0.630	0.697	0.585	0.027
(D75 - D25) - phi		S	In-house	phi	2.29	2.16	1.59	1.48	1.73	2.83
% gravel		S	In-house	%	54.9	80.3	85.9	93.7	86.4	63.5
% sand		S	In-house	%	44.7	13.2	13.9	6.29	13.5	25.1
% mud		S	In-house	%	0.38	6.53	0.15	0.03	0.06	11.4
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	0.00	17.5	19.0	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	0.00	53.6	18.6	40.2	31.2	0.00
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	13.1	18.5	36.3	22.6	36.7	22.1
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	21.1	4.29	7.92	8.81	11.2	27.3
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	20.7	3.92	5.63	3.10	7.39	14.1
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	22.8	6.58	7.09	3.53	6.82	12.6
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	13.5	1.27	4.06	1.63	4.09	1.85
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	5.87	1.12	1.65	0.74	1.85	3.19
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	1.91	2.34	0.68	0.27	0.56	4.84
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.62	1.83	0.44	0.12	0.20	2.70
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.38	1.32	0.15	0.03	0.06	1.70
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	1.43	0.00	0.00	0.00	1.95
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	1.55	0.00	0.00	0.00	2.38
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	1.12	0.00	0.00	0.00	2.16
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.55	0.00	0.00	0.00	1.29
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.56	0.00	0.00	0.00	1.90

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No	**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
				Customer Sample ID	ES3	ES5	ES7	ES1	ES3	ES5
				RPS Sample No	355411	355412	355413	355414	355415	355416
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location	**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**
				Sample Depth (m)	1.00	1.50	2.00	0.50	1.00	1.50
				Sampling Date	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Trimodal, Poorly Sorted	Unimodal, Moderately Well Sorted	Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Moderately Sorted	Bimodal, Poorly Sorted
textural group (GRADISTAT)		S	In-house		Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Gravel
sediment name		S	In-house		Fine Gravel	Coarse Gravel	Sandy Medium Gravel	Very Coarse Gravel	Coarse Gravel	Very Coarse Gravel
arithmetic mean (method of moments)		S	In-house	um	8130	26300	12900	31600	19900	7710
arithmetic sorting (method of moments)		S	In-house	um	8230	8220	14100	19000	6580	7620
arithmetic skewness (method of moments)		S	In-house	um	2.13	-0.939	1.02	0.130	-0.963	0.384
arithmetic kurtosis (method of moments)		S	In-house	um	7.89	5.15	2.43	1.33	4.08	1.52
geometic mean (method of moments)		S	In-house	um	4960	22700	5530	23400	17000	654
geometic sorting (method of moments)		S	In-house	um	2.99	2.11	4.44	2.55	2.11	51.4
geometic skewness (method of moments)		S	In-house	um	-0.891	-4.01	-0.404	-1.98	-3.76	-0.873
geometic kurtosis (method of moments)		S	In-house	um	4.92	20.4	2.33	9.20	18.8	2.03
logarithmic mean (method of moments)		S	In-house	phi	-2.31	-4.50	-2.47	-4.55	-4.09	-1.88
logarithmic sorting (method of moments)		S	In-house	phi	1.58	1.07	2.15	1.35	1.08	2.08
logarithmic skewness (method of moments)		S	In-house	phi	0.891	4.01	0.404	1.98	3.76	0.360
logarithmic kurtosis (method of moments)		S	In-house	phi	4.92	20.4	2.33	9.20	18.8	1.87
mean (Folk and Ward method - um)		S	In-house	um	5340	25600	6370	24500	19400	7040
sorting (Folk and Ward method - um)		S	In-house	um	2.77	1.55	4.72	2.03	1.67	2.28
skewness (Folk and Ward method - um)		S	In-house	um	-0.124	-0.334	-0.160	0.107	-0.359	-1.98
kurtosis (Folk and Ward method - um)		S	In-house	um	1.07	2.79	0.807	0.770	2.30	0.318
mean (Folk and Ward method - phi)		S	In-house	phi	-2.42	-4.68	-2.67	-4.61	-4.28	-2.82
sorting (Folk and Ward method - phi)		S	In-house	phi	1.47	0.636	2.24	1.02	0.740	1.19
skewness (Folk and Ward method - phi)		S	In-house	phi	0.124	0.334	0.160	-0.107	0.359	1.98
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.07	2.79	0.807	0.770	2.30	0.318
mean description (Folk and Ward method)		S	In-house		Fine Gravel	Coarse Gravel	Fine Gravel	Coarse Gravel	Coarse Gravel	Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Poorly Sorted	Moderately Well Sorted	Very Poorly Sorted	Poorly Sorted	Moderately Sorted	Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Fine Skewed	Very Fine Skewed	Fine Skewed	Coarse Skewed	Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Mesokurtic	Very Leptokurtic	Platykurtic	Platykurtic	Very Leptokurtic	Very Platykurtic
MODE 1 - um		S	In-house	um	6800	27000	38300	54000	19200	19200
MODE 2 - um		S	In-house	um	19200		9600	19200		1200
MODE 3 - um		S	In-house	um	38300		1200			
MODE 1 - phi		S	In-house	phi	-2.74	-4.73	-5.24	-5.74	-4.24	-4.24
MODE 2 - phi		S	In-house	phi	-4.24		-3.24	-4.24		-0.243
MODE 3 - phi		S	In-house	phi	-5.24		-0.243			
D10 - um		S	In-house	um	1330	17500	710	10600	12100	834
D50 - um		S	In-house	um	5620	26200	7190	21300	19800	14600
D90 - um		S	In-house	um	18600	37200	38200	57600	28500	192000
(D90/D10) - um		S	In-house	um	14.1	2.13	53.7	5.42	2.35	231
(D90 - D10) - um		S	In-house	um	17300	19700	37400	47000	16400	192000
(D75/D25) - um		S	In-house	um	3.51	1.35	9.65	3.28	1.51	12.0
(D75 - D25) - um		S	In-house	um	6930	7820	14300	35100	8220	57700
D10 - phi		S	In-house	phi	-4.22	-5.22	-5.25	-5.85	-4.83	-7.59
D50 - phi		S	In-house	phi	-2.49	-4.71	-2.85	-4.41	-4.31	-3.87
D90 - phi		S	In-house	phi	-0.406	-4.13	0.494	-3.41	-3.60	0.261
(D90/D10) - phi		S	In-house	phi	0.096	0.791	-0.094	0.583	0.745	-0.034
(D90 - D10) - phi		S	In-house	phi	3.81	1.09	5.75	2.44	1.23	7.85
(D75/D25) - phi		S	In-house	phi	0.447	0.913	0.180	0.697	0.872	0.399
(D75 - D25) - phi		S	In-house	phi	1.81	0.430	3.27	1.72	0.590	3.59
% gravel		S	In-house	%	82.4	96.0	71.6	96.3	95.6	82.9
% sand		S	In-house	%	17.2	4.01	28.1	3.64	4.35	17.0
% mud		S	In-house	%	0.37	0.03	0.22	0.01	0.02	0.12
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	3.95	17.9	20.7	45.6	0.00	25.0
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	10.9	77.0	4.16	27.6	77.2	20.7
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	16.9	0.00	23.2	20.9	17.4	23.8
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	32.5	0.52	12.4	1.89	0.10	8.10
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	18.3	0.50	11.3	0.42	0.95	5.24
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	11.7	2.44	13.2	2.22	2.51	6.21
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	2.60	1.00	9.86	0.49	0.85	3.90
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	1.21	0.27	3.16	0.63	0.48	3.64
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	1.01	0.18	1.39	0.22	0.39	2.69
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	0.71	0.12	0.52	0.08	0.13	0.59
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.37	0.03	0.22	0.01	0.02	0.12
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

				Customer Sample No	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
				Customer Sample ID	ES1	ES3	ES1	ES3	ES5	ES1
				RPS Sample No	355417	355418	355419	355420	355421	355422
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
				Sample Depth (m)	0.50	1.00	0.50	1.00	1.50	0.50
				Sampling Date	09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Trimodal, Very Poorly Sorted	Trimodal, Poorly Sorted	Polymodal, Poorly Sorted	Polymodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted
textural group (GRADISTAT)		S	In-house		Muddy Sandy Gravel	Gravel	Sandy Gravel	Sandy Gravel	Sandy Gravel	Gravel
sediment name		S	In-house		Medium Silty Sandy Coarse Gravel	Medium Gravel	Sandy Coarse Gravel	Sandy Medium Gravel	Sandy Coarse Gravel	Medium Gravel
arithmetic mean (method of moments)		S	In-house	um	11600	18400	9830	6460	8730	12200
arithmetic sorting (method of moments)		S	In-house	um	9710	15600	7520	5980	8320	8360
arithmetic skewness (method of moments)		S	In-house	um	0.335	1.20	0.151	0.887	0.766	0.266
arithmetic kurtosis (method of moments)		S	In-house	um	1.69	3.30	1.36	2.60	2.34	2.26
geometic mean (method of moments)		S	In-house	um	3920	12000	5670	3350	4260	6200
geometic sorting (method of moments)		S	In-house	um	9.95	2.86	3.48	3.90	4.01	6.09
geometic skewness (method of moments)		S	In-house	um	-1.62	-1.18	-0.811	-0.798	-0.528	-2.35
geometic kurtosis (method of moments)		S	In-house	um	5.03	5.62	2.77	3.06	2.42	9.15
logarithmic mean (method of moments)		S	In-house	phi	-1.97	-3.59	-2.50	-1.74	-2.09	-2.63
logarithmic sorting (method of moments)		S	In-house	phi	3.31	1.52	1.80	1.96	2.00	2.61
logarithmic skewness (method of moments)		S	In-house	phi	1.62	1.18	0.811	0.798	0.528	2.35
logarithmic kurtosis (method of moments)		S	In-house	phi	5.03	5.62	2.77	3.06	2.42	9.16
mean (Folk and Ward method - um)		S	In-house	um	4800	13900	5940	3710	4520	6970
sorting (Folk and Ward method - um)		S	In-house	um	7.99	2.69	3.35	4.02	3.88	4.52
skewness (Folk and Ward method - um)		S	In-house	um	-0.614	0.139	-0.449	-0.267	-0.166	-0.644
kurtosis (Folk and Ward method - um)		S	In-house	um	1.16	1.61	0.680	0.962	0.725	1.85
mean (Folk and Ward method - phi)		S	In-house	phi	-2.26	-3.80	-2.57	-1.89	-2.18	-2.80
sorting (Folk and Ward method - phi)		S	In-house	phi	3.00	1.43	1.74	2.01	1.96	2.18
skewness (Folk and Ward method - phi)		S	In-house	phi	0.614	-0.139	0.449	0.267	0.166	0.644
kurtosis (Folk and Ward method - phi)		S	In-house	phi	1.16	1.61	0.680	0.962	0.725	1.85
mean description (Folk and Ward method)		S	In-house		Fine Gravel	Medium Gravel	Fine Gravel	Very Fine Gravel	Fine Gravel	Fine Gravel
sorting description (Folk and Ward method)		S	In-house		Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Coarse Skewed	Very Fine Skewed	Fine Skewed	Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)		S	In-house		Leptokurtic	Very Leptokurtic	Platykurtic	Mesokurtic	Platykurtic	Very Leptokurtic
MODE 1 - um		S	In-house	um	19200	9600	19200	6800	19200	13600
MODE 2 - um		S	In-house	um	9600	19200	9600	13600	1200	27000
MODE 3 - um		S	In-house	um	1200	54000	1200	3400		1200
MODE 1 - phi		S	In-house	phi	-4.24	-3.24	-4.24	-2.74	-4.24	-3.74
MODE 2 - phi		S	In-house	phi	-3.24	-4.24	-3.24	-3.74	-0.243	-4.73
MODE 3 - phi		S	In-house	phi	-0.243	-5.74	-0.243	-1.74		-0.243
D10 - um		S	In-house	um	106	3550	957	549	659	723
D50 - um		S	In-house	um	9380	10900	8620	4320	5000	12200
D90 - um		S	In-house	um	25900	45500	20200	16000	21000	25000
(D90/D10) - um		S	In-house	um	244	12.8	21.1	29.1	31.9	34.5
(D90 - D10) - um		S	In-house	um	25800	41900	19300	15500	20400	24200
(D75/D25) - um		S	In-house	um	13.7	2.59	8.30	7.34	10.5	3.25
(D75 - D25) - um		S	In-house	um	18300	13500	15300	8780	13600	11000
D10 - phi		S	In-house	phi	-4.70	-5.51	-4.34	-4.00	-4.40	-4.64
D50 - phi		S	In-house	phi	-3.23	-3.45	-3.11	-2.11	-2.32	-3.61
D90 - phi		S	In-house	phi	3.24	-1.83	0.063	0.864	0.601	0.467
(D90/D10) - phi		S	In-house	phi	-0.689	0.332	-0.014	-0.216	-0.137	-0.101
(D90 - D10) - phi		S	In-house	phi	7.93	3.68	4.40	4.87	5.00	5.11
(D75/D25) - phi		S	In-house	phi	0.123	0.692	0.259	0.140	0.132	0.574
(D75 - D25) - phi		S	In-house	phi	3.78	1.37	3.05	2.88	3.39	1.70
% gravel		S	In-house	%	73.3	92.6	75.8	67.4	67.3	80.5
% sand		S	In-house	%	18.3	7.35	24.1	32.5	32.5	15.7
% mud		S	In-house	%	8.42	0.07	0.09	0.14	0.18	3.86
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	19.6	0.00	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	37.4	21.0	33.1	10.0	22.3	24.4
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	18.9	40.6	19.3	21.7	20.0	45.6
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	11.5	8.32	11.5	20.1	11.7	6.31
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	5.54	3.13	12.0	15.6	13.3	4.11
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	6.93	4.32	13.6	14.9	16.8	7.87
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	3.88	1.79	7.43	8.85	9.50	3.56
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	2.62	0.72	1.66	2.94	3.31	1.85
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	2.71	0.33	1.00	1.91	2.21	1.40
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	2.13	0.19	0.42	3.88	0.73	0.99
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	1.77	0.07	0.09	0.14	0.18	0.59
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	1.88	0.00	0.00	0.00	0.00	0.74
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	1.99	0.00	0.00	0.00	0.00	0.97
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	1.44	0.00	0.00	0.00	0.00	0.77
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.66	0.00	0.00	0.00	0.00	0.37
% clay (<0.001953mm or >9phi)		S	In-house	%	0.68	0.00	0.00	0.00	0.00	0.43

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Results Summary - PSA Results

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Customer Sample No					**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
Customer Sample ID					ES3	ES5	ES7	ES1	ES3	ES5
RPS Sample No					355423	355424	355425	355426	355427	355428
Sample Type					**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location					**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
Sample Depth (m)					1.00	1.50	2.00	0.50	1.00	1.50
Sampling Date					07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
Sampling Time										
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
sample type		S	In-house		Bimodal, Very Poorly Sorted	Trimodal, Poorly Sorted	Trimodal, Very Poorly Sorted	Polymodal, Very Poorly Sorted	Polymodal, Very Poorly Sorted	Trimodal, Very Poorly Sorted
textural group (GRADISTAT)		S	In-house		Sandy Gravel	Sandy Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel	Gravelly Muddy Sand
sediment name		S	In-house		Sandy Coarse Gravel	Sandy Medium Gravel	Fine Silty Sandy Coarse Gravel	Medium Silty Sandy Very Fine Gravel	Medium Silty Sandy Very Fine Gravel	Very Fine Gravelly Medium Silty Fine Sand
arithmetic mean (method of moments)		S	In-house	um	11600	10600	9830	2540	2370	524
arithmetic sorting (method of moments)		S	In-house	um	8890	6920	12100	3490	3240	1120
arithmetic skewness (method of moments)		S	In-house	um	0.084	-0.247	0.679	1.96	2.22	4.05
arithmetic kurtosis (method of moments)		S	In-house	um	1.66	1.60	1.53	6.19	8.42	24.2
geometic mean (method of moments)		S	In-house	um	5800	6140	1790	756	688	70.5
geometic sorting (method of moments)		S	In-house	um	4.56	3.98	11.3	7.53	8.00	10.2
geometic skewness (method of moments)		S	In-house	um	-0.961	-1.36	-0.614	-1.09	-1.10	-0.122
geometic kurtosis (method of moments)		S	In-house	um	2.73	3.88	3.08	4.41	4.16	2.30
logarithmic mean (method of moments)		S	In-house	phi	-2.54	-2.62	-0.842	0.402	0.538	3.82
logarithmic sorting (method of moments)		S	In-house	phi	2.19	1.99	3.49	2.91	3.00	3.35
logarithmic skewness (method of moments)		S	In-house	phi	0.961	1.36	0.616	1.09	1.11	0.127
logarithmic kurtosis (method of moments)		S	In-house	phi	2.73	3.88	3.08	4.41	4.17	2.30
mean (Folk and Ward method - um)		S	In-house	um	6310	6510	2030	968	867	84.9
sorting (Folk and Ward method - um)		S	In-house	um	4.27	3.74	9.81	7.06	7.22	11.1
skewness (Folk and Ward method - um)		S	In-house	um	-0.675	-0.729	-0.029	-0.235	-0.290	-0.051
kurtosis (Folk and Ward method - um)		S	In-house	um	0.761	1.06	0.616	1.21	1.19	0.863
mean (Folk and Ward method - phi)		S	In-house	phi	-2.66	-2.70	-1.02	0.047	0.207	3.56
sorting (Folk and Ward method - phi)		S	In-house	phi	2.09	1.90	3.29	2.82	2.85	3.48
skewness (Folk and Ward method - phi)		S	In-house	phi	0.675	0.729	0.029	0.235	0.290	0.051
kurtosis (Folk and Ward method - phi)		S	In-house	phi	0.761	1.06	0.616	1.21	1.19	0.863
mean description (Folk and Ward method)		S	In-house		Fine Gravel	Fine Gravel	Very Fine Gravel	Coarse Sand	Coarse Sand	Very Fine Sand
sorting description (Folk and Ward method)		S	In-house		Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)		S	In-house		Very Fine Skewed	Very Fine Skewed	Symmetrical	Fine Skewed	Fine Skewed	Symmetrical
kurtosis description (Folk and Ward method)		S	In-house		Platykurtic	Mesokurtic	Very Platykurtic	Leptokurtic	Leptokurtic	Platykurtic
MODE 1 - um		S	In-house	um	19200	13600	27000	1700	1200	1200
MODE 2 - um		S	In-house	um	1200	1200	214	427	427	214
MODE 3 - um		S	In-house	um		4800	1200	6800	6800	9.41
MODE 1 - phi		S	In-house	phi	-4.24	-3.74	-4.73	-0.743	-0.243	-0.243
MODE 2 - phi		S	In-house	phi	-0.243	-0.243	2.25	1.25	1.25	2.25
MODE 3 - phi		S	In-house	phi		-2.24	-0.243	-2.74	-2.74	6.75
D10 - um		S	In-house	um	550	698	136	54.3	28.6	3.6
D50 - um		S	In-house	um	12600	12200	1700	1130	1100	87.5
D90 - um		S	In-house	um	22200	19500	28400	7300	6760	1480
(D90/D10) - um		S	In-house	um	40.4	28.0	208	134	237	405
(D90 - D10) - um		S	In-house	um	21700	18800	28200	7240	6730	1480
(D75/D25) - um		S	In-house	um	11.3	5.32	96.0	11.0	11.4	31.6
(D75 - D25) - um		S	In-house	um	17100	12900	24000	2770	2720	342
D10 - phi		S	In-house	phi	-4.48	-4.29	-4.83	-2.87	-2.76	-0.565
D50 - phi		S	In-house	phi	-3.66	-3.61	-0.769	-0.172	-0.131	3.52
D90 - phi		S	In-house	phi	0.863	0.520	2.88	4.20	5.13	8.10
(D90/D10) - phi		S	In-house	phi	-0.193	-0.121	-0.596	-1.47	-1.86	-14.3
(D90 - D10) - phi		S	In-house	phi	5.34	4.81	7.70	7.07	7.89	8.66
(D75/D25) - phi		S	In-house	phi	0.174	0.396	-0.431	-1.15	-1.23	4.32
(D75 - D25) - phi		S	In-house	phi	3.50	2.41	6.59	3.46	3.52	4.98
% gravel		S	In-house	%	72.8	79.0	48.1	34.6	34.0	6.66
% sand		S	In-house	%	27.0	20.8	46.2	55.1	53.6	47.3
% mud		S	In-house	%	0.24	0.25	5.76	10.4	12.4	46.1
% very coarse gravel (>32<64mm or <-5>-6phi)		S	In-house	%	0.00	0.00	0.00	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)		S	In-house	%	39.2	24.6	32.7	0.00	0.48	0.00
% medium gravel (>8<16mm or <-3>-4phi)		S	In-house	%	20.1	38.5	1.24	8.24	6.65	0.29
% fine gravel (>4<8mm or <-2>-3phi)		S	In-house	%	6.89	8.61	7.44	11.9	11.8	1.84
% very fine gravel (>2<4mm or <-1>-2phi)		S	In-house	%	6.63	7.26	6.71	14.4	15.0	4.52
% very coarse sand (>1<2mm or <0>-1phi)		S	In-house	%	10.7	8.55	11.8	18.6	18.5	12.9
% coarse sand (>0.5<1mm or <1>0phi)		S	In-house	%	7.46	4.78	6.66	10.5	11.4	3.52
% medium sand (>0.25<0.5mm or <2>1phi)		S	In-house	%	5.04	3.17	8.66	13.1	11.8	5.35
% fine sand (>0.125<0.25mm or <3>2phi)		S	In-house	%	2.66	3.15	16.4	9.43	8.32	15.5
% very fine sand (>0.0625<0.125mm or <4>3phi)		S	In-house	%	1.07	1.10	2.69	3.36	3.61	9.99
% very coarse silt (>0.03125<0.0625mm or <5>4phi		S	In-house	%	0.24	0.25	0.76	1.73	2.09	7.27
% coarse silt (>0.015625<0.03125mm or <6>5phi)		S	In-house	%	0.00	0.00	0.84	1.98	2.50	8.79
% medium silt (>0.007813<0.015625mm or <7>6phi)		S	In-house	%	0.00	0.00	1.12	2.51	3.06	10.6
% fine silt (>0.003906<0.007813mm or <8>7phi)		S	In-house	%	0.00	0.00	1.16	1.98	2.32	8.90
% very fine silt (>0.001953<0.003906mm or <9>8phi		S	In-house	%	0.00	0.00	0.82	1.01	1.12	4.97
% clay (<0.001953mm or >9phi)		S	In-house	%	0.00	0.00	1.06	1.15	1.30	5.60

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
			Customer Sample ID	ES9	ES10	ES11	ES12	ES13	ES14	ES1	ES3	ES5	ES7	ES47	ES48
			RPS Sample No	355364	355365	355366	355367	355368	355369	355370	355371	355372	355373	355374	355375
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
			Sample Depth (m)	0.50	1.00	1.50	2.00	2.50	3.00	0.50	1.00	1.50	2.00	0.50	1.00
			Sampling Date	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
			Sampling Time												
Sediment	**mm**	**phi ϕ**	**Units**												
Very coarse gravel	>32<64	<-5>-6	%	1.54	0.00	0.00	0.00	0.00	0.00	0.00	6.50	0.00	0.00	19.40	0.00
Coarse gravel	>16<32	<-4>-5	%	12.70	4.25	0.00	0.00	33.40	5.37	28.40	36.50	13.40	1.04	53.20	64.80
Medium gravel	>8<16	<-3>-4	%	9.72	3.70	0.75	0.94	37.00	39.80	16.20	25.90	22.80	22.70	11.00	27.30
Fine gravel	>4<8	<-2>-3	%	6.95	9.99	4.34	2.83	12.00	22.20	21.40	12.20	26.00	31.40	1.38	0.89
Very fine gravel	>2<4	<-1>-2	%	9.30	11.00	13.30	8.28	6.22	11.50	14.50	9.15	18.20	20.10	1.24	0.44
Very coarse sand	>1<2	<0>-1	%	15.50	20.40	28.70	25.10	4.60	7.17	12.50	6.35	12.80	15.60	3.44	2.25
Coarse sand	>0.5<1	<1>0	%	14.10	21.30	25.40	35.50	2.15	4.10	3.82	1.59	3.22	4.42	4.77	1.33
Medium sand	>0.25<0.5	<2>1	%	8.33	10.20	14.80	16.30	1.90	3.85	1.09	0.62	1.23	1.51	2.60	0.89
Fine sand	>0.125<0.25	<3>2	%	5.73	4.99	10.60	6.67	1.42	5.19	1.23	0.75	1.47	1.86	0.82	0.18
Very fine sand	>0.0625<0.125	<4>3	%	3.18	3.10	1.74	1.15	0.28	0.74	0.62	0.41	0.66	1.05	0.44	0.15
Very coarse silt	>0.03125<0.0625	<5>4	%	2.04	1.66	0.36	0.47	0.13	0.16	0.19	0.09	0.14	0.24	0.32	0.22
Coarse silt	>0.015625<0.03125	<6>5	%	2.72	2.23	0.00	0.54	0.15	0.00	0.00	0.00	0.00	0.00	0.39	0.39
Medium silt	>0.007813<0.015625	<7>6	%	3.35	2.76	0.00	0.71	0.21	0.00	0.00	0.00	0.00	0.00	0.44	0.53
Fine silt	>0.003906<0.007813	<8>7	%	2.48	2.17	0.00	0.67	0.20	0.00	0.00	0.00	0.00	0.00	0.30	0.37
Very fine silt	>0.001953<0.003906	<9>8	%	1.17	1.07	0.00	0.36	0.13	0.00	0.00	0.00	0.00	0.00	0.13	0.15
Clay	<0.001953	>9	%	1.28	1.25	0.00	0.49	0.17	0.00	0.00	0.00	0.00	0.00	0.15	0.16
Statistics*	Mean (phi)			-0.359	0.135	0.242	0.381	-3.36	-2.28	-2.60	-3.43	-2.39	-1.98	-4.06	-4.21
	Sorting			3.51	2.76	1.44	1.31	1.57	1.82	1.67	1.50	1.57	1.40	1.59	1.03
	Skewness			0.103	0.195	0.113	0.070	0.459	0.538	0.180	0.424	0.152	0.283	0.572	0.475
	Kurtosis			1.10	1.57	1.02	1.26	1.35	1.20	0.778	0.997	1.01	0.975	2.59	2.13
	% Silt/Clay		%	13.04	11.14	0.36	3.24	0.99	0.16	0.19	0.09	0.14	0.24	1.73	1.82
	Textural Group**			Muddy Sandy Gravel	Gravelly Muddy Sand	Gravelly Sand	Gravelly Sand	Gravel	Sandy Gravel	Gravel	Gravel	Gravel	Sandy Gravel	Gravel	Gravel

* Folk & Ward

** GRADISTAT classification system (Blott, S. J. & Pye, K., 2001)

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
			Customer Sample ID	ES49	ES50	ES51	ES52	ES53	ES54	ES1	ES2	ES3	ES4	ES5	ES6
			RPS Sample No	355376	355377	355378	355379	355380	355956	355381	355382	355383	355384	355385	355386
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
			Sample Depth (m)	1.50	2.00	2.50	3.00	3.50	4.00	0.50	1.00	1.50	2.00	2.50	3.00
			Sampling Date	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
			Sampling Time												
Sediment	**mm**	**phi ϕ**	**Units**												
Very coarse gravel	>32<64	<-5>-6	%	0.00	0.00	0.00	0.00	0.00	0.00	19.90	34.30	6.37	0.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	0.00	38.00	20.00	11.80	9.54	5.21	75.50	62.30	68.80	9.26	40.40	0.00
Medium gravel	>8<16	<-3>-4	%	0.50	6.70	22.80	44.40	44.80	49.80	1.15	0.00	15.90	7.30	23.50	23.10
Fine gravel	>4<8	<-2>-3	%	1.57	4.89	10.50	24.50	28.20	29.90	0.00	0.00	1.14	4.05	5.06	17.10
Very fine gravel	>2<4	<-1>-2	%	1.63	2.97	5.35	9.10	12.00	8.60	0.16	0.07	1.25	5.75	2.85	9.66
Very coarse sand	>1<2	<0>-1	%	5.85	6.26	6.96	3.68	3.16	1.42	1.85	1.88	3.20	15.60	5.32	15.50
Coarse sand	>0.5<1	<1>0	%	31.30	19.70	12.60	2.17	0.82	0.89	0.89	0.95	1.90	30.40	11.00	19.60
Medium sand	>0.25<0.5	<2>1	%	38.90	16.10	14.40	2.98	0.82	2.38	0.33	0.36	1.09	17.30	7.71	9.38
Fine sand	>0.125<0.25	<3>2	%	7.30	2.28	2.60	0.99	0.38	1.27	0.12	0.11	0.24	7.57	3.41	3.58
Very fine sand	>0.0625<0.125	<4>3	%	2.69	0.51	0.90	0.27	0.15	0.54	0.10	0.07	0.10	0.95	0.34	0.57
Very coarse silt	>0.03125<0.0625	<5>4	%	1.62	0.40	0.69	0.06	0.04	0.08	0.03	0.02	0.02	0.31	0.09	0.24
Coarse silt	>0.015625<0.03125	<6>5	%	2.00	0.54	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.07	0.24
Medium silt	>0.007813<0.015625	<7>6	%	2.51	0.67	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.08	0.30
Fine silt	>0.003906<0.007813	<8>7	%	1.98	0.51	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.08	0.28
Very fine silt	>0.001953<0.003906	<9>8	%	1.01	0.24	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.06	0.16
Clay	<0.001953	>9	%	1.17	0.31	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.11	0.25
Statistics*	Mean (phi)			1.29	-1.73	-1.72	-2.93	-2.96	-2.97	-4.71	-4.72	-4.17	-0.407	-2.52	-1.11
	Sorting			1.63	2.53	2.46	1.30	1.00	1.08	0.404	0.483	0.947	2.24	2.29	1.95
	Skewness			0.320	0.092	0.415	0.423	0.283	0.394	0.053	-0.013	0.390	-0.380	0.698	-0.016
	Kurtosis			2.34	0.548	0.648	1.44	1.04	1.46	1.27	0.691	4.55	1.21	0.686	0.722
	% Silt/Clay		%	10.29	2.67	3.98	0.06	0.04	0.08	0.03	0.02	0.02	1.82	0.49	1.47
	Textural Group**			Slightly Gravelly Muddy Sand	Sandy Gravel	Sandy Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravelly Sand	Sandy Gravel	Sandy Gravel

* Folk & Ward

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**	**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
			Customer Sample ID	ES7	ES8	ES9	ES1	ES3	ES5	ES7	ES9	ES1	ES2	ES1	ES3
			RPS Sample No	355387	355388	355389	355390	355391	355392	355393	355394	355395	355396	355397	355398
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**	**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
			Sample Depth (m)	3.50	4.00	4.50	0.50	1.00	1.50	2.00	2.50	0.50	1.00	0.50	1.00
			Sampling Date	18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
			Sampling Time												
Sediment	**mm**	**phi ϕ**	**Units**												
Very coarse gravel	>32<64	<-5>-6	%	0.00	26.00	0.00	0.00	26.60	0.00	28.70	12.60	0.00	0.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	38.40	67.90	26.70	62.20	39.90	5.65	29.30	42.90	65.00	23.70	24.90	17.40
Medium gravel	>8<16	<-3>-4	%	30.50	2.42	30.80	26.60	17.80	16.00	21.40	30.90	21.10	43.60	2.98	13.90
Fine gravel	>4<8	<-2>-3	%	7.29	0.50	7.54	2.94	3.25	10.40	1.27	2.83	5.35	11.60	4.51	9.94
Very fine gravel	>2<4	<-1>-2	%	5.52	0.59	6.74	1.30	1.65	10.40	1.61	1.05	2.48	7.27	3.47	8.90
Very coarse sand	>1<2	<0>-1	%	8.80	1.85	10.90	3.40	3.76	21.00	7.09	4.34	3.51	8.07	8.55	6.91
Coarse sand	>0.5<1	<1>0	%	4.79	0.49	10.90	2.01	3.54	22.60	5.99	3.25	1.75	4.03	5.70	3.45
Medium sand	>0.25<0.5	<2>1	%	2.55	0.11	5.61	0.90	2.56	12.20	3.64	1.42	0.41	0.92	8.00	3.98
Fine sand	>0.125<0.25	<3>2	%	1.89	0.07	0.60	0.32	0.54	1.36	0.78	0.46	0.17	0.38	17.30	14.90
Very fine sand	>0.0625<0.125	<4>3	%	0.23	0.06	0.12	0.23	0.28	0.33	0.19	0.15	0.13	0.25	6.25	6.72
Very coarse silt	>0.03125<0.0625	<5>4	%	0.08	0.01	0.04	0.04	0.06	0.08	0.04	0.02	0.07	0.20	3.64	3.27
Coarse silt	>0.015625<0.03125	<6>5	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.78	2.56
Medium silt	>0.007813<0.015625	<7>6	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.09	2.63
Fine silt	>0.003906<0.007813	<8>7	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.19	2.27
Very fine silt	>0.001953<0.003906	<9>8	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.65	1.42
Clay	<0.001953	>9	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.92	1.82
Statistics*	Mean (phi)			-2.99	-4.72	-2.53	-4.06	-4.19	-0.998	-3.46	-4.03	-4.14	-3.03	0.326	-0.641
	Sorting			1.83	0.487	1.93	1.04	1.44	1.93	2.34	1.22	1.04	1.46	4.18	3.85
	Skewness			0.627	0.116	0.689	0.467	0.413	-0.273	0.462	0.321	0.550	0.539	-0.079	0.252
	Kurtosis			1.12	1.16	0.670	2.16	1.85	0.716	1.35	2.62	1.86	1.24	0.728	0.794
	% Silt/Clay		%	0.08	0.01	0.04	0.04	0.06	0.08	0.04	0.02	0.07	0.20	18.27	13.97
	Textural Group**			Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Gravel	Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
			Customer Sample ID	ES5	ES1	ES3	ES5	ES7	ES9	ES11	ES1	ES3	ES5	ES7	ES1
			RPS Sample No	355399	355400	355401	355402	355403	355404	355405	355406	355407	355408	355409	355410
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
			Sample Depth (m)	1.50	0.50	1.00	1.50	2.00	2.50	3.00	0.50	1.00	1.50	2.00	0.50
			Sampling Date	18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
			Sampling Time												
Sediment	**mm**	**phi ϕ**	**Units**												
Very coarse gravel	>32<64	<-5>-6	%	16.70	0.00	0.00	0.00	0.00	34.90	0.00	0.00	17.50	19.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	21.90	25.80	0.00	1.57	0.00	11.20	0.00	53.60	18.60	40.20	31.20	0.00
Medium gravel	>8<16	<-3>-4	%	17.70	13.00	9.33	13.30	7.74	20.90	13.10	18.50	36.30	22.60	36.70	22.10
Fine gravel	>4<8	<-2>-3	%	12.00	15.90	14.80	17.20	14.70	12.70	21.10	4.29	7.92	8.81	11.20	27.30
Very fine gravel	>2<4	<-1>-2	%	11.80	13.10	24.20	24.50	20.80	7.27	20.70	3.92	5.63	3.10	7.39	14.10
Very coarse sand	>1<2	<0>-1	%	11.40	12.80	32.20	26.50	35.20	6.55	22.80	6.58	7.09	3.53	6.82	12.60
Coarse sand	>0.5<1	<1>0	%	4.73	5.31	11.10	9.86	13.40	3.42	13.50	1.27	4.06	1.63	4.09	1.85
Medium sand	>0.25<0.5	<2>1	%	1.58	3.89	3.85	3.50	3.74	2.00	5.87	1.12	1.65	0.74	1.85	3.19
Fine sand	>0.125<0.25	<3>2	%	1.46	1.97	2.97	2.30	2.81	0.75	1.91	2.34	0.68	0.27	0.56	4.84
Very fine sand	>0.0625<0.125	<4>3	%	0.54	1.38	1.13	0.86	1.13	0.22	0.62	1.83	0.44	0.12	0.20	2.70
Very coarse silt	>0.03125<0.0625	<5>4	%	0.24	1.45	0.42	0.49	0.47	0.10	0.38	1.32	0.15	0.03	0.06	1.70
Coarse silt	>0.015625<0.03125	<6>5	%	0.00	1.71	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00	0.00	1.95
Medium silt	>0.007813<0.015625	<7>6	%	0.00	1.66	0.00	0.00	0.00	0.00	0.00	1.55	0.00	0.00	0.00	2.38
Fine silt	>0.003906<0.007813	<8>7	%	0.00	1.10	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	2.16
Very fine silt	>0.001953<0.003906	<9>8	%	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	1.29
Clay	<0.001953	>9	%	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	1.90
Statistics*	Mean (phi)			-3.03	-1.98	-1.05	-1.36	-0.975	-2.66	-1.22	-3.02	-3.39	-4.09	-3.13	-0.865
	Sorting			2.02	2.71	1.48	1.51	1.45	0.515	1.59	2.61	1.80	1.30	1.55	3.09
	Skewness			0.333	0.392	-0.021	0.007	-0.072	4.12	0.066	0.778	0.366	0.475	0.495	0.626
	Kurtosis			0.858	1.11	1.21	1.00	1.17	0.277	0.905	1.90	1.50	1.36	1.23	1.57
	% Silt/Clay		%	0.24	6.93	0.42	0.49	0.47	0.10	0.38	6.53	0.15	0.03	0.06	11.38
	Textural Group**			Gravel	Muddy Sandy Gravel	Sandy Gravel	Sandy Gravel	Sandy Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Gravel	Gravel	Muddy Sandy Gravel

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
			Customer Sample ID	ES3	ES5	ES7	ES1	ES3	ES5	ES1	ES3	ES1	ES3	ES5	ES1
			RPS Sample No	355411	355412	355413	355414	355415	355416	355417	355418	355419	355420	355421	355422
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
			Sample Depth (m)	1.00	1.50	2.00	0.50	1.00	1.50	0.50	1.00	0.50	1.00	1.50	0.50
			Sampling Date	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
			Sampling Time												
Sediment	**mm**	**phi ϕ**	**Units**												
Very coarse gravel	>32<64	<-5>-6	%	3.95	17.90	20.70	45.60	0.00	25.00	0.00	19.60	0.00	0.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	10.90	77.00	4.16	27.60	77.20	20.70	37.40	21.00	33.10	10.00	22.30	24.40
Medium gravel	>8<16	<-3>-4	%	16.90	0.00	23.20	20.90	17.40	23.80	18.90	40.60	19.30	21.70	20.00	45.60
Fine gravel	>4<8	<-2>-3	%	32.50	0.52	12.40	1.89	0.10	8.10	11.50	8.32	11.50	20.10	11.70	6.31
Very fine gravel	>2<4	<-1>-2	%	18.30	0.50	11.30	0.42	0.95	5.24	5.54	3.13	12.00	15.60	13.30	4.11
Very coarse sand	>1<2	<0>-1	%	11.70	2.44	13.20	2.22	2.51	6.21	6.93	4.32	13.60	14.90	16.80	7.87
Coarse sand	>0.5<1	<1>0	%	2.60	1.00	9.86	0.49	0.85	3.90	3.88	1.79	7.43	8.85	9.50	3.56
Medium sand	>0.25<0.5	<2>1	%	1.21	0.27	3.16	0.63	0.48	3.64	2.62	0.72	1.66	2.94	3.31	1.85
Fine sand	>0.125<0.25	<3>2	%	1.01	0.18	1.39	0.22	0.39	2.69	2.71	0.33	1.00	1.91	2.21	1.40
Very fine sand	>0.0625<0.125	<4>3	%	0.71	0.12	0.52	0.08	0.13	0.59	2.13	0.19	0.42	3.88	0.73	0.99
Very coarse silt	>0.03125<0.0625	<5>4	%	0.37	0.03	0.22	0.01	0.02	0.12	1.77	0.07	0.09	0.14	0.18	0.59
Coarse silt	>0.015625<0.03125	<6>5	%	0.00	0.00	0.00	0.00	0.00	0.00	1.88	0.00	0.00	0.00	0.00	0.74
Medium silt	>0.007813<0.015625	<7>6	%	0.00	0.00	0.00	0.00	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.97
Fine silt	>0.003906<0.007813	<8>7	%	0.00	0.00	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.77
Very fine silt	>0.001953<0.003906	<9>8	%	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.37
Clay	<0.001953	>9	%	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.43
Statistics*	Mean (phi)			-2.42	-4.68	-2.67	-4.61	-4.28	-2.82	-2.26	-3.80	-2.57	-1.89	-2.18	-2.80
	Sorting			1.47	0.636	2.24	1.02	0.740	1.19	3.00	1.43	1.74	2.01	1.96	2.18
	Skewness			0.124	0.334	0.160	-0.107	0.359	1.98	0.614	-0.139	0.449	0.267	0.166	0.644
	Kurtosis			1.07	2.79	0.807	0.770	2.30	0.318	1.16	1.61	0.680	0.962	0.725	1.85
	% Silt/Clay		%	0.37	0.03	0.22	0.01	0.02	0.12	8.42	0.07	0.09	0.14	0.18	3.87
	Textural Group**			Gravel	Gravel	Sandy Gravel	Gravel	Gravel	Gravel	Muddy Sandy Gravel	Gravel	Sandy Gravel	Sandy Gravel	Sandy Gravel	Gravel

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Results Summary - PSA Size Class & Statistics

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

			Customer Sample No	**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
			Customer Sample ID	ES3	ES5	ES7	ES1	ES3	ES5
			RPS Sample No	355423	355424	355425	355426	355427	355428
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location	**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
			Sample Depth (m)	1.00	1.50	2.00	0.50	1.00	1.50
			Sampling Date	07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
			Sampling Time						
Sediment	**mm**	**phi ϕ**	**Units**						
Very coarse gravel	>32<64	<-5>-6	%	0.00	0.00	0.00	0.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	39.20	24.60	32.70	0.00	0.48	0.00
Medium gravel	>8<16	<-3>-4	%	20.10	38.50	1.24	8.24	6.65	0.29
Fine gravel	>4<8	<-2>-3	%	6.89	8.61	7.44	11.90	11.80	1.84
Very fine gravel	>2<4	<-1>-2	%	6.63	7.26	6.71	14.40	15.00	4.52
Very coarse sand	>1<2	<0>-1	%	10.70	8.55	11.80	18.60	18.50	12.90
Coarse sand	>0.5<1	<1>0	%	7.46	4.78	6.66	10.50	11.40	3.52
Medium sand	>0.25<0.5	<2>1	%	5.04	3.17	8.66	13.10	11.80	5.35
Fine sand	>0.125<0.25	<3>2	%	2.66	3.15	16.40	9.43	8.32	15.50
Very fine sand	>0.0625<0.125	<4>3	%	1.07	1.10	2.69	3.36	3.61	9.99
Very coarse silt	>0.03125<0.0625	<5>4	%	0.24	0.25	0.76	1.73	2.09	7.27
Coarse silt	>0.015625<0.03125	<6>5	%	0.00	0.00	0.84	1.98	2.50	8.79
Medium silt	>0.007813<0.015625	<7>6	%	0.00	0.00	1.12	2.51	3.06	10.60
Fine silt	>0.003906<0.007813	<8>7	%	0.00	0.00	1.16	1.98	2.32	8.90
Very fine silt	>0.001953<0.003906	<9>8	%	0.00	0.00	0.82	1.01	1.12	4.97
Clay	<0.001953	>9	%	0.00	0.00	1.06	1.15	1.30	5.60
Statistics*	Mean (phi)			-2.66	-2.70	-1.02	0.047	0.207	3.56
	Sorting			2.09	1.90	3.29	2.82	2.85	3.48
	Skewness			0.675	0.729	0.029	0.235	0.290	0.051
	Kurtosis			0.761	1.06	0.616	1.21	1.19	0.863
	% Silt/Clay		%	0.24	0.25	5.76	10.36	12.39	46.13
	Textural Group**			Sandy Gravel	Sandy Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel	Muddy Sandy Gravel	Gravelly Muddy Sand

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Results Summary - PSA Wentworth Scale

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Customer Sample No		**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
Customer Sample ID		ES9	ES10	ES11	ES12	ES13	ES14	ES1	ES3	ES5	ES7	ES47	ES48
RPS Sample No		355364	355365	355366	355367	355368	355369	355370	355371	355372	355373	355374	355375
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH04**	**BH05**	**BH05**	**BH05**	**BH05**	**BH07**	**BH07**
Sample Depth (m)		0.50	1.00	1.50	2.00	2.50	3.00	0.50	1.00	1.50	2.00	0.50	1.00
Sampling Date		17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	17/01/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	23/01/2018	23/01/2018
Sampling Time													
Parameter	**Units**												
Pebble	%	30.91	17.94	5.09	3.77	82.40	67.37	66.00	81.10	62.20	55.14	84.98	92.99
Granule	%	9.30	11.00	13.30	8.28	6.22	11.50	14.50	9.15	18.20	20.10	1.24	0.44
Very coarse sand	%	15.50	20.40	28.70	25.10	4.60	7.17	12.50	6.35	12.80	15.60	3.44	2.25
Coarse sand	%	14.10	21.30	25.40	35.50	2.15	4.10	3.82	1.59	3.22	4.42	4.77	1.33
Medium sand	%	8.33	10.20	14.80	16.30	1.90	3.85	1.09	0.62	1.23	1.51	2.60	0.89
Fine sand	%	5.73	4.99	10.60	6.67	1.42	5.19	1.23	0.75	1.47	1.86	0.82	0.18
Very fine sand	%	3.18	3.10	1.74	1.15	0.28	0.74	0.62	0.41	0.66	1.05	0.44	0.15
Silt Clay	%	13.04	11.14	0.36	3.24	0.99	0.16	0.19	0.09	0.14	0.24	1.73	1.82
Total	%	100.1	100.1	100.0	100.0	100.0	100.1	100.0	100.1	99.9	99.9	100.0	100.1

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Results Summary - PSA Wentw

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water I
Customer Order No: 1711-360

Customer Sample No		**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
Customer Sample ID		ES49	ES50	ES51	ES52	ES53	ES54	ES1	ES2	ES3	ES4	ES5	ES6
RPS Sample No		355376	355377	355378	355379	355380	355956	355381	355382	355383	355384	355385	355386
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH07**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**	**BH08**
Sample Depth (m)		1.50	2.00	2.50	3.00	3.50	4.00	0.50	1.00	1.50	2.00	2.50	3.00
Sampling Date		23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	23/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018	18/01/2018
Sampling Time													
Parameter	**Units**												
Pebble	%	2.07	49.59	53.30	80.70	82.54	84.91	96.55	96.60	92.21	20.61	68.96	40.20
Granule	%	1.63	2.97	5.35	9.10	12.00	8.60	0.16	0.07	1.25	5.75	2.85	9.66
Very coarse sand	%	5.85	6.26	6.96	3.68	3.16	1.42	1.85	1.88	3.20	15.60	5.32	15.50
Coarse sand	%	31.30	19.70	12.60	2.17	0.82	0.89	0.89	0.95	1.90	30.40	11.00	19.60
Medium sand	%	38.90	16.10	14.40	2.98	0.82	2.38	0.33	0.36	1.09	17.30	7.71	9.38
Fine sand	%	7.30	2.28	2.60	0.99	0.38	1.27	0.12	0.11	0.24	7.57	3.41	3.58
Very fine sand	%	2.69	0.51	0.90	0.27	0.15	0.54	0.10	0.07	0.10	0.95	0.34	0.57
Silt Clay	%	10.29	2.67	3.98	0.06	0.04	0.08	0.03	0.02	0.02	1.82	0.49	1.47
Total	%	100.0	100.1	100.1	100.0	99.9	100.1	100.0	100.1	100.0	100.0	100.1	100.0

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Results Summary - PSA Wentw

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water I
Customer Order No: 1711-360

Customer Sample No		BH08	BH08	BH08	BH09	BH09	BH09	BH09	BH09	BH11	BH11	BH12	BH12
Customer Sample ID		ES7	ES8	ES9	ES1	ES3	ES5	ES7	ES9	ES1	ES2	ES1	ES3
RPS Sample No		355387	355388	355389	355390	355391	355392	355393	355394	355395	355396	355397	355398
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH08**	**BH08**	**BH08**	**BH09**	**BH09**	**BH09**	**BH09**	**BH09**	**BH11**	**BH11**	**BH12**	**BH12**
Sample Depth (m)		3.50	4.00	4.50	0.50	1.00	1.50	2.00	2.50	0.50	1.00	0.50	1.00
Sampling Date		18/01/2018	18/01/2018	18/01/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018	31/01/2018	31/01/2018	18/01/2018	18/01/2018
Sampling Time													
Parameter	**Units**												
Pebble	%	76.19	96.82	65.04	91.74	87.55	32.05	80.67	89.23	91.45	78.90	32.39	41.24
Granule	%	5.52	0.59	6.74	1.30	1.65	10.40	1.61	1.05	2.48	7.27	3.47	8.90
Very coarse sand	%	8.80	1.85	10.90	3.40	3.76	21.00	7.09	4.34	3.51	8.07	8.55	6.91
Coarse sand	%	4.79	0.49	10.90	2.01	3.54	22.60	5.99	3.25	1.75	4.03	5.70	3.45
Medium sand	%	2.55	0.11	5.61	0.90	2.56	12.20	3.64	1.42	0.41	0.92	8.00	3.98
Fine sand	%	1.89	0.07	0.60	0.32	0.54	1.36	0.78	0.46	0.17	0.38	17.30	14.90
Very fine sand	%	0.23	0.06	0.12	0.23	0.28	0.33	0.19	0.15	0.13	0.25	6.25	6.72
Silt Clay	%	0.08	0.01	0.04	0.04	0.06	0.08	0.04	0.02	0.07	0.20	18.27	13.97
Total	%	100.1	100.0	100.0	99.9	99.9	100.0	100.0	99.9	100.0	100.0	99.9	100.1

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Results Summary - PSA Wentw

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water I
Customer Order No: 1711-360

Customer Sample No		BH12	BH13	BH13	BH13	BH13	BH13	BH13	BH22	BH22	BH22	BH22	BH24
Customer Sample ID		ES5	ES1	ES3	ES5	ES7	ES9	ES11	ES1	ES3	ES5	ES7	ES1
RPS Sample No		355399	355400	355401	355402	355403	355404	355405	355406	355407	355408	355409	355410
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH12**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH13**	**BH22**	**BH22**	**BH22**	**BH22**	**BH24**
Sample Depth (m)		1.50	0.50	1.00	1.50	2.00	2.50	3.00	0.50	1.00	1.50	2.00	0.50
Sampling Date		18/01/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	13/02/2018	06/02/2018	06/02/2018	06/02/2018	06/02/2018	08/02/2018
Sampling Time													
Parameter	**Units**												
Pebble	%	68.30	54.70	24.13	32.07	22.44	79.70	34.20	76.39	80.32	90.61	79.10	49.40
Granule	%	11.80	13.10	24.20	24.50	20.80	7.27	20.70	3.92	5.63	3.10	7.39	14.10
Very coarse sand	%	11.40	12.80	32.20	26.50	35.20	6.55	22.80	6.58	7.09	3.53	6.82	12.60
Coarse sand	%	4.73	5.31	11.10	9.86	13.40	3.42	13.50	1.27	4.06	1.63	4.09	1.85
Medium sand	%	1.58	3.89	3.85	3.50	3.74	2.00	5.87	1.12	1.65	0.74	1.85	3.19
Fine sand	%	1.46	1.97	2.97	2.30	2.81	0.75	1.91	2.34	0.68	0.27	0.56	4.84
Very fine sand	%	0.54	1.38	1.13	0.86	1.13	0.22	0.62	1.83	0.44	0.12	0.20	2.70
Silt Clay	%	0.24	6.93	0.42	0.49	0.47	0.10	0.38	6.53	0.15	0.03	0.06	11.38
Total	%	100.1	100.1	100.0	100.1	100.0	100.0	100.0	100.0	100.0	100.0	100.1	100.1

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Results Summary - PSA Wentw

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water I
Customer Order No: 1711-360

Customer Sample No		**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
Customer Sample ID		ES3	ES5	ES7	ES1	ES3	ES5	ES1	ES3	ES1	ES3	ES5	ES1
RPS Sample No		355411	355412	355413	355414	355415	355416	355417	355418	355419	355420	355421	355422
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH24**	**BH24**	**BH24**	**BH25**	**BH25**	**BH25**	**BH26**	**BH26**	**BH28**	**BH28**	**BH28**	**BH29**
Sample Depth (m)		1.00	1.50	2.00	0.50	1.00	1.50	0.50	1.00	0.50	1.00	1.50	0.50
Sampling Date		08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018	09/02/2018	09/02/2018	08/02/2018	08/02/2018	08/02/2018	07/02/2018
Sampling Time													
Parameter	**Units**												
Pebble	%	64.25	95.42	60.46	95.99	94.70	77.60	67.80	89.52	63.90	51.80	54.00	76.31
Granule	%	18.30	0.50	11.30	0.42	0.95	5.24	5.54	3.13	12.00	15.60	13.30	4.11
Very coarse sand	%	11.70	2.44	13.20	2.22	2.51	6.21	6.93	4.32	13.60	14.90	16.80	7.87
Coarse sand	%	2.60	1.00	9.86	0.49	0.85	3.90	3.88	1.79	7.43	8.85	9.50	3.56
Medium sand	%	1.21	0.27	3.16	0.63	0.48	3.64	2.62	0.72	1.66	2.94	3.31	1.85
Fine sand	%	1.01	0.18	1.39	0.22	0.39	2.69	2.71	0.33	1.00	1.91	2.21	1.40
Very fine sand	%	0.71	0.12	0.52	0.08	0.13	0.59	2.13	0.19	0.42	3.88	0.73	0.99
Silt Clay	%	0.37	0.03	0.22	0.01	0.02	0.12	8.42	0.07	0.09	0.14	0.18	3.87
Total	%	100.2	100.0	100.1	100.1	100.0	100.0	100.0	100.1	100.1	100.0	100.0	100.0

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Results Summary - PSA Wentw

Report No.: **18-69352**
Customer Reference: Stornoway Deep Water I
Customer Order No: 1711-360

Customer Sample No		BH29	BH29	BH29	BH30	BH30	BH30
Customer Sample ID		ES3	ES5	ES7	ES1	ES3	ES5
RPS Sample No		355423	355424	355425	355426	355427	355428
Sample Type		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location		**BH29**	**BH29**	**BH29**	**BH30**	**BH30**	**BH30**
Sample Depth (m)		1.00	1.50	2.00	0.50	1.00	1.50
Sampling Date		07/02/2018	07/02/2018	07/02/2018	13/02/2018	13/02/2018	13/02/2018
Sampling Time							
Parameter	**Units**						
Pebble	%	66.19	71.71	41.38	20.14	18.93	2.13
Granule	%	6.63	7.26	6.71	14.40	15.00	4.52
Very coarse sand	%	10.70	8.55	11.80	18.60	18.50	12.90
Coarse sand	%	7.46	4.78	6.66	10.50	11.40	3.52
Medium sand	%	5.04	3.17	8.66	13.10	11.80	5.35
Fine sand	%	2.66	3.15	16.40	9.43	8.32	15.50
Very fine sand	%	1.07	1.10	2.69	3.36	3.61	9.99
Silt Clay	%	0.24	0.25	5.76	10.36	12.39	46.13
Total	%	100.0	100.0	100.1	99.9	100.0	100.0

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355364	BH04	Visual Inspection: Colour - dark brown Texture - sandy Odour - None Biota - None Anthropogenic Inputs - None The responses for Anthracene, Benz(ghi)Perylene, Benz(k)Flouranthene, Chrysene, Dibenzo(ah)Anthracene, Flourene, Indeno(123-cd)Pyrene, Naphthalene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range. The responses for Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Fluoranthene and Phenantharene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:100 in order to bring the response within the calibrated range.
355365	BH04	Visual Inspection: Colour - Gray Texture - Broken shell, Sand Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Flouranthene, Benz(ghi)Perylene, Benz(k)Flouranthene, Chrysene, Fluoranthene, Indeno(123-cd)Pyrene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355366	BH04	Visual Inspection: Colour - dark brown Texture - Sand/stone Odour - None Biota - None Anthropogenic Inputs - None
355367	BH04	Visual Inspection: Colour - dark brown Texture - sand/ stones Odour - None Biota - None Anthropogenic Inputs - None
355368	BH04	Visual Inspection: Colour - dark brown Texture - stony Odour - None Biota - None Anthropogenic Inputs - None
355369	BH04	Visual Inspection: Colour - mixed colours, stones Texture - stones Odour - None Biota - None Anthropogenic Inputs - None

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355370	BH05	Visual Inspection: Colour - mixed stones Texture - stones Odour - None Biota - None Anthropogenic Inputs - None The responses for Fluoranthene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355371	BH05	Visual Inspection: Colour - mixed Texture - stones Odour - None Biota - None Anthropogenic Inputs - None
355372	BH05	Visual Inspection: Colour - mixed Texture - stones Odour - None Biota - None Anthropogenic Inputs - None
355373	BH05	Visual Inspection: Colour - mixed stones Texture - stones Odour - None Biota - None Anthropogenic Inputs - None
355374	BH07	Visual Inspection: Colour - dark Gray Texture - stones Odour - None Biota - None Anthropogenic Inputs - None The responses for Acenaphthalene, Anthracene, Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Chrysene, Fluoranthene, Fluorene, Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355375	BH07	Visual Inspection: Colour - dark grey Texture - stones Odour - None Biota - None Anthropogenic Inputs - None
355376	BH07	Visual Inspection: Colour - dark grey Texture - sandy shell Odour - None Biota - None Anthropogenic Inputs - None

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Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355377	BH07	Visual Inspection: Colour - dark grey Texture - sand stone shell Odour - None Biota - None Anthropogenic Inputs - None
355378	BH07	Visual Inspection: Colour - dark grey Texture - sand stone shell Odour - None Biota - None Anthropogenic Inputs - None
355379	BH07	Visual Inspection: Colour - red brown Texture - stone Odour - None Biota - None Anthropogenic Inputs - None
355380	BH07	Visual Inspection: Colour - red brown Texture - stone Odour - None Biota - None Anthropogenic Inputs - None
355956	BH07	Visual Inspection: Colour - Red and Brown Texture - Stones Odour - None Biota - None Anthropogenic Inputs - None
355381	BH08	Visual Inspection: Colour - red brown Texture - large stone/ shell Odour - None Biota - None Anthropogenic Inputs - None
355382	BH08	Visual Inspection: Colour - red brown Texture - large stone/ shell Odour - None Biota - None Anthropogenic Inputs - None
355383	BH08	Visual Inspection: Colour - red brown Texture - coarse sand stone Odour - None Biota - None Anthropogenic Inputs - None

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355384	BH08	Visual Inspection: Colour - red brown Texture - coarse sand stone Odour - None Biota - None Anthropogenic Inputs - None
355385	BH08	Visual Inspection: Colour - red brown Texture - coarse sand stone Odour - None Biota - None Anthropogenic Inputs - None
355386	BH08	Visual Inspection: Colour - red brown Texture - coarse sand stone Odour - None Biota - None Anthropogenic Inputs - None
355387	BH08	Visual Inspection: Colour - multi red Texture - sand stone Odour - None Biota - None Anthropogenic Inputs - None
355388	BH08	Visual Inspection: Colour - multi red Texture - large stone Odour - None Biota - None Anthropogenic Inputs - None
355389	BH08	Visual Inspection: Colour - multi red Texture - large stone Odour - None Biota - None Anthropogenic Inputs - None
355390	BH09	Visual Inspection: Colour - mixed multi Texture - sand stone Odour - None Biota - None Anthropogenic Inputs - None The responses for Anthracene, Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Benz(k)Fluoranthene, Chrysene, Fluoranthene, Fluorene, Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355391	BH09	Visual Inspection: Colour - multi red Texture - coarse sand/ stone Odour - None Biota - None Anthropogenic Inputs - None
355392	BH09	Visual Inspection: Colour - red brown Texture - sand stones Odour - None Biota - None Anthropogenic Inputs - None
355393	BH09	Visual Inspection: Colour - red brown Texture - coarse sand Odour - None Biota - None Anthropogenic Inputs - None
355394	BH09	Visual Inspection: Colour - red brown Texture - coarse sand & shingle Odour - None Biota - None Anthropogenic Inputs - None
355395	BH11	Visual Inspection: Colour - grey Texture - sand stones Odour - None Biota - None Anthropogenic Inputs - None
355396	BH11	Visual Inspection: Colour - grey Texture - gravel Odour - None Biota - None Anthropogenic Inputs - None
355397	BH12	Visual Inspection: Colour - grey Texture - muddy Odour - None Biota - None Anthropogenic Inputs - None The responses for Anthracene, Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Benz(k)Fluoranthene, Chrysene, Dibenzo(a,h) Anthracene, Fluoranthene, Naphthalene, Indeno(c,d)Pyrene Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355398	BH12	Visual Inspection: Colour - grey Texture - muddy Odour - None Biota - None Anthropogenic Inputs - None
355399	BH12	Visual Inspection: Colour - multi coloured Texture - small stones Odour - None Biota - None Anthropogenic Inputs - None
355400	BH13	Visual Inspection: Colour - grey Texture - shingle sandy Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Benz(k)Fluoranthene, Fluoranthene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355401	BH13	Visual Inspection: Colour - grey Texture - coarse sand/stone Odour - None Biota - None Anthropogenic Inputs - None
355402	BH13	Visual Inspection: Colour - red brown Texture - small shingle Odour - None Biota - None Anthropogenic Inputs - None
355403	BH13	Visual Inspection: Colour - brown Texture - small shingle/sand Odour - None Biota - None Anthropogenic Inputs - None
355404	BH13	Visual Inspection: Colour - red brown Texture - shingle sand Odour - None Biota - None Anthropogenic Inputs - None

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Comments

RPS Sample Number	Customer Number	Sample Comments
355405	BH13	Visual Inspection: Colour - red brown Texture - shingle sand Odour - None Biota - None Anthropogenic Inputs - None
355406	BH22	Visual Inspection: Colour - grey Texture - shell stones Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Benz(k)Fluoranthene, Chrysene, Fluoranthene, Indeno(c,d)Pyrene, Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355407	BH22	Visual Inspection: Colour - mixed Texture - stones sand Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(a)Pyrene, Benz(b)Fluoranthene, Fluoranthene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355408	BH22	Visual Inspection: Colour - multi Texture - stone broken shell Odour - None Biota - None Anthropogenic Inputs - None The responses for Naphthalene, Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355409	BH22	Visual Inspection: Colour - multi (grey brown red) Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None
355410	BH24	Visual Inspection: Colour - grey Texture - tiny shell Odour - None Biota - None Anthropogenic Inputs - None

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355411	BH24	Visual Inspection: Colour - grey Texture - stone shell Odour - None Biota - None Anthropogenic Inputs - None
355412	BH24	Visual Inspection: Colour - mixed multi coloured Texture - large stone Odour - None Biota - None Anthropogenic Inputs - None
355413	BH24	Visual Inspection: Colour - multi Texture - sand stone Odour - None Biota - None Anthropogenic Inputs - None
355414	BH25	Visual Inspection: Colour - multi coloured Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None
355415	BH25	Visual Inspection: Colour - red brown mixed Texture - shingle sand Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(b)Fluoranthene, Fluoranthene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355416	BH25	Visual Inspection: Colour - red brown mixed Texture - shingle sand Odour - None Biota - None Anthropogenic Inputs - None
355417	BH26	Visual Inspection: Colour - dark grey Texture - silty Odour - None Biota - None Anthropogenic Inputs - None The responses for Benz(a)Anthracene, Benz(a)Pyrene, Benz(b)Fluoranthene, Benz(ghi)Perylene, Benz(k)Fluoranthene, Fluoranthene, Indeno(c,d)Pyrene, Phenantharene and Pyrene were outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355418	BH26	Visual Inspection: Colour - multi Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None The response for Naphthalene was outside the normal dynamic range of the method and it was necessary to dilute the extract 1:10 in order to bring the response within the calibrated range.
355419	BH28	Visual Inspection: Colour - multi Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None
355420	BH28	Visual Inspection: Colour - red Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None
355421	BH28	Visual Inspection: Colour - red brown Texture - shingle sand Odour - None Biota - None Anthropogenic Inputs - None
355422	BH29	Visual Inspection: Colour - grey Texture - shingle stone Odour - None Biota - None Anthropogenic Inputs - None
355423	BH29	Visual Inspection: Colour - multi Texture - stone sand Odour - None Biota - None Anthropogenic Inputs - None
355424	BH29	Visual Inspection: Colour - multi Texture - sand stone Odour - None Biota - None Anthropogenic Inputs - None
355425	BH29	Visual Inspection: Colour - grey Texture - shell sand Odour - None Biota - None Anthropogenic Inputs - None

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Report No.: 18-69352-1
Customer Reference: Stornoway Deep Water Berth
Customer Order No: 1711-360

Comments

RPS Sample Number	Customer Number	Sample Comments
355426	BH30	Visual Inspection: Colour - grey Texture - sandy stone Odour - None Biota - None Anthropogenic Inputs - None
355427	BH30	Visual Inspection: Colour - grey Texture - shell sand Odour - None Biota - None Anthropogenic Inputs - None
355428	BH30	Visual Inspection: Colour - grey Texture - sand Odour - None Biota - None Anthropogenic Inputs - None

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Report Information

Key to Report Codes

U	UKAS Accredited
M	MCERTS Accredited
N	Not Accredited
S	Subcontracted to approved laboratory
US	Subcontracted to approved laboratory UKAS Accredited for the test
MS	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SI	Subcontracted to internal RPS Group Laboratory
USI	Subcontracted to internal RPS Group Laboratory UKAS Accredited for the test
MSI	Subcontracted to internal RPS Group Laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
DW (in units)	Results are expressed on a dry weight basis

Sample Retention and Disposal

Samples will generally* be retained for the following times prior to disposal:

Perishables, e.g. foodstuffs	1 month (if frozen) from the issue date of this report
Waters	2 weeks from the issue date of this report
Other Liquids	1 months from the issue date of this report
Solids (including Soils)	1 months from the issue date of this report

*Sample retention may be subject to agreement with the customer for particular projects

Analytical Methods

PAH's and PCB's	GCMS analysis following extraction of the wet sediment with DCM:acetone by ASE 350 extraction. Extract cleaned-up with silica and activated copper.
Metals	ICP-MS analysis following microwave assisted digestion in hydrofluoric acid of the dried (<30°C) and ground sediment.
TOC	Combustion and infrared analysis following carbonate removal with hydrochloric acid.
PSA	Wet and dry sieving followed by laser diffraction analysis.
Density	Determination of density from the dry sediment by gravimetric analysis of a known volume of sediment.
Dry solids at 105°C	A portion of the wet sediment is dried at 105°C to constant weight.
TBT and DBT	GCMS analysis following the extraction of the wet sediment and subsequent derivatisation.
Please note:	All testing carried out using the <2mm fraction

Laboratories

RPS Letchworth	UKAS Accreditation Laboratory No. 1663
RPS Manchester (Metals only)	UKAS Accreditation Laboratory No. 0605
Ocean Ecology PSA only	NMBAQC

RPS Letchworth and Manchester Laboratories participate in the QUASIMEME Proficiency Testing Scheme

CAUSEWAY GEOTECH

APPENDIX F

Environmental laboratory test results

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.: 18-05734-1

Initial Date of Issue: 05-Mar-2018

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): [redacted]

Project 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Quotation No.: Q18-11997

Date Received: 26-Feb-2018

Order No.:

Date Instructed: 27-Feb-2018

No. of Samples: 52

Turnaround (Wkdays): 5

Results Due: 05-Mar-2018

Date Approved: 05-Mar-2018

Approved By:

[redacted]

Details: Robert Monk, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997					**Chemtest Sample ID.:**	585241	585242	585243	585244	585245	585246	585247	585248	585249
Order No.:					Client Location ID.:	BH04	BH04	BH04	BH05	BH05	BH05	BH05	BH07	BH07
					Client Sample Ref.:	ES01	ES02	ES03	ES01	ES02	ES03	ES04	ES01	ES02
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	2.00	3.00	0.50	1.00	1.50	2.00	1.00	2.00
					Date Sampled:	13-Feb-2018	13-Feb-2018	13-Feb-2018	08-Feb-2018	08-Feb-2018	08-Feb-2018	08-Feb-2018	13-Feb-2018	13-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Arsenic (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1450	µg/l	0.080		< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	1.6	3.2	< 1.0	2.4	< 1.0	< 1.0	3.3
Copper (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0	1.0
Mercury (Dissolved)	U	1450	µg/l	0.50		0.69	0.58	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0		430	2.7	< 1.0	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	U	1670	µg/l	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997					**Chemtest Sample ID.:**	585250	585251	585252	585253	585254	585255	585256	585257	585258
Order No.:					Client Location ID.:	BH07	BH08	BH08	BH08	BH08	BH09	BH09	BH09	BH09
					Client Sample Ref.:	ES03	ES01	ES02	ES03	ES04	ES01	ES02	ES03	ES04
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	3.00	1.00	2.00	3.00	4.00	0.50	1.00	1.50	2.00
					Date Sampled:	13-Feb-2018	13-Feb-2018	13-Feb-2018	13-Feb-2018	13-Feb-2018	07-Feb-2018	07-Feb-2018	07-Feb-2018	07-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Arsenic (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	1.3	1.2	< 1.0	< 1.0	1.3	< 1.0
Cadmium (Dissolved)	U	1450	µg/l	0.080		< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0		3.7	2.0	3.2	4.8	4.4	2.8	2.3	5.0	3.7
Copper (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	1.3	1.4	1.0	< 1.0	1.1	1.1
Mercury (Dissolved)	U	1450	µg/l	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	U	1670	µg/l	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997					**Chemtest Sample ID.:**	585259	585260	585261	585262	585263	585264	585265	585266	585267
Order No.:					Client Location ID.:	BH09	BH11	BH12	BH12	BH12	BH13	BH13	BH13	BH13
					Client Sample Ref.:	ES05	ES01	ES01	ES02	ES03	ES01	ES02	ES03	ES04
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	2.50	1.00	0.50	1.00	1.50	0.50	1.00	1.50	2.00
					Date Sampled:	07-Feb-2018	13-Feb-2018	09-Feb-2018	09-Feb-2018	09-Feb-2018	13-Feb-2018	13-Feb-2018	13-Feb-2018	13-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Arsenic (Dissolved)	U	1450	µg/l	1.0		< 1.0	2.8	15	13	4.6	1.0	< 1.0	1.1	1.4
Cadmium (Dissolved)	U	1450	µg/l	0.080		< 0.080	< 0.080	0.096	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	2.2	2.5	2.1	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	2.0	1.8	1.5	< 1.0	< 1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	3.6	11	7.8	1.9	2.1	1.4	< 1.0
Total TPH >C6-C40	U	1670	µg/l	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997					**Chemtest Sample ID.:**	585268	585269	585270	585271	585272	585273	585274	585275	585276
Order No.:					Client Location ID.:	BH13	BH13	BH22	BH22	BH22	BH22	BH24	BH24	BH24
					Client Sample Ref.:	ES05	ES06	ES01	ES02	ES03	ES04	ES01	ES02	ES03
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	2.50	3.00	0.50	1.00	1.50	2.00	0.50	1.00	1.50
					Date Sampled:	13-Feb-2018	13-Feb-2018	06-Feb-2018	06-Feb-2018	06-Feb-2018	06-Feb-2018	08-Feb-2018	08-Feb-2018	08-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Arsenic (Dissolved)	U	1450	µg/l	1.0		3.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0
Cadmium (Dissolved)	U	1450	µg/l	0.080		< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0		6.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0		1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0		8.6	1.3	< 1.0	< 1.0	< 1.0	< 1.0	18	< 1.0	< 1.0
Total TPH >C6-C40	U	1670	µg/l	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997				**Chemtest Sample ID.:**	585277	585278	585279	585280	585281	585282	585283	585284	585285
Order No.:				Client Location ID.:	BH24	BH25	BH25	BH25	BH26	BH26	BH28	BH28	BH28
				Client Sample Ref.:	ES04	ES01	ES02	ES03	ES02	ES04	ES02	ES04	ES06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	2.00	0.50	1.00	1.50	0.50	1.00	0.50	1.00	1.50
				Date Sampled:	08-Feb-2018	08-Feb-2018	08-Feb-2018	08-Feb-2018	09-Feb-2018	09-Feb-2018	08-Feb-2018	08-Feb-2018	08-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	1.3	< 1.0	6.9	6.2	1.0	1.2	< 1.0
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	0.12
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	3.2	< 1.0	< 1.0	5.6	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	1.3	1.2	1.1	< 1.0	1.2	4.5	< 1.0	1.3	1.7
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	0.96	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7.1	1.3	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	2.3	< 1.0	1.4	< 1.0	3.7	21	14	5.6	3.4
Total TPH >C6-C40	U	1670	µg/l	10	< 10	< 10	< 10	< 10	23	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734	18-05734
Quotation No.: Q18-11997				**Chemtest Sample ID.:**	585286	585287	585288	585289	585290	585291	585292
Order No.:				Client Location ID.:	BH29	BH29	BH29	BH29	BH30	BH30	BH30
				Client Sample Ref.:	ES02	ES04	ES06	ES08	ES02	ES04	ES06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	1.00	1.50	2.00	0.50	1.00	1.50
				Date Sampled:	07-Feb-2018	07-Feb-2018	07-Feb-2018	07-Feb-2018	13-Feb-2018	13-Feb-2018	13-Feb-2018
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
Arsenic (Dissolved)	U	1450	µg/l	1.0	3.2	3.1	6.1	9.7	7.2	7.9	6.4
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	0.097	1.1	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	1.5	< 1.0	4.3	4.5	3.9	4.5	3.2
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	1.5	1.7	1.3	1.4	1.9
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	3.3
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	1.6	1.1	3.6	5.0	3.4	3.1	4.3
Total TPH >C6-C40	U	1670	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tributyl Tin	N	1730	µg/l	0.0500	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
PCB 28	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 congeners)	N	1815	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Report Information

Key

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M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.: 18-05740-1

Initial Date of Issue: 07-Mar-2018

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): [redacted]

Project 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

Quotation No.: Q18-11997

Date Received: 26-Feb-2018

Order No.:

Date Instructed: 26-Feb-2018

No. of Samples: 4

Turnaround (Wkdays): 8

Results Due: 07-Mar-2018

Date Approved: 07-Mar-2018

Approved By:

[redacted]

Details: Robert Monk, Technical Manager

Results - 2 Stage WAC

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-05740						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:	585304								
Sample Location ID:	BH07								
Sample Ref:	ES01								
Top Depth(m):	1.00								
Bottom Depth(m):									
Sampling Date:	13-Feb-2018								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	U	%			< 0.20	3	5	6
Loss On Ignition	2610	U	%			0.82	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				8.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.032	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0022	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0081	0.0022	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0096	0.0020	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0035	0.0011	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0040	0.0010	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0053	< 0.0010	0.011	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0027	< 0.0010	< 0.50	< 0.50	4	50	200
Chloride	1220	U	480	35	960	1200	800	15000	25000
Fluoride	1220	U	0.27	0.12	< 1.0	1.5	10	150	500
Sulphate	1220	U	77	6.7	150	200	1000	20000	50000
Total Dissolved Solids	1020	N	1000	99	2000	2600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	17	15	< 50	150	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	8.6

Leachate Test Information	
Leachant volume 1st extract/l	0.334
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.321

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-05740						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:	585305								
Sample Location ID:	BH13								
Sample Ref:	ES03								
Top Depth(m):	1.50								
Bottom Depth(m):									
Sampling Date:	13-Feb-2018								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	U	%			< 0.20	3	5	6
Loss On Ignition	2610	U	%			0.71	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				9.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0040	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	0.0018	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.010	0.0070	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0022	0.0025	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0014	0.0021	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	0.0075	< 0.050	0.061	0.5	10	30
Nickel	1450	U	< 0.0010	0.0012	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0023	< 0.010	0.019	0.5	10	50
Antimony	1450	U	< 0.0010	0.0011	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	0.0020	< 0.50	< 0.50	4	50	200
Chloride	1220	U	22	1.1	44	49	800	15000	25000
Fluoride	1220	U	0.084	0.083	< 1.0	< 1.0	10	150	500
Sulphate	1220	U	5.3	< 1.0	11	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	60	21	120	280	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	10	7.3	< 50	78	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	3.7

Leachate Test Information	
Leachant volume 1st extract/l	0.343
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.316

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-05740						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:	585306								
Sample Location ID:	BH25								
Sample Ref:	ES01								
Top Depth(m):	0.50								
Bottom Depth(m):									
Sampling Date:	08-Feb-2018								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	U	%			< 0.20	3	5	6
Loss On Ignition	2610	U	%			0.76	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				10.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0090	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0019	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0073	0.0014	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0043	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0019	< 0.0010	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0016	0.0022	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0023	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.0010	< 0.50	< 0.50	4	50	200
Chloride	1220	U	250	57	510	870	800	15000	25000
Fluoride	1220	U	0.20	0.11	< 1.0	1.2	10	150	500
Sulphate	1220	U	41	14	82	180	1000	20000	50000
Total Dissolved Solids	1020	N	560	89	1100	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	14	10	< 50	110	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	5.2

Leachate Test Information	
Leachant volume 1st extract/l	0.340
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.270

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17-0769 - No1 Pier, King Edward Wharf, Stornoway, HS1 2XT

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-05740						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:	585994								
Sample Location ID:	BH29								
Sample Ref:	ES02								
Top Depth(m):	0.50								
Bottom Depth(m):									
Sampling Date:	07-Feb-2018								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	U	%			0.41	3	5	6
Loss On Ignition	2610	U	%			1.2	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			14	100	--	--
pH	2010	U				8.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.023	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0021	0.0013	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0083	0.0044	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0032	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0030	0.0017	< 0.050	< 0.050	2	50	100
Mercury	1450	U	0.00063	< 0.00050	0.0013	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.035	0.0021	0.070	0.081	0.5	10	30
Nickel	1450	U	< 0.0010	0.0016	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0012	< 0.010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0042	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0072	0.0018	< 0.50	< 0.50	4	50	200
Chloride	1220	U	640	9.6	1300	1200	800	15000	25000
Fluoride	1220	U	0.36	0.58	< 1.0	5.4	10	150	500
Sulphate	1220	U	140	5.7	280	300	1000	20000	50000
Total Dissolved Solids	1020	N	1300	120	2600	3400	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	12	11	< 50	110	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	4.2

Leachate Test Information	
Leachant volume 1st extract/l	0.342
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.320

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Report Information

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U	UKAS accredited
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C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

CAUSEWAY GEOTECH

APPENDIX G

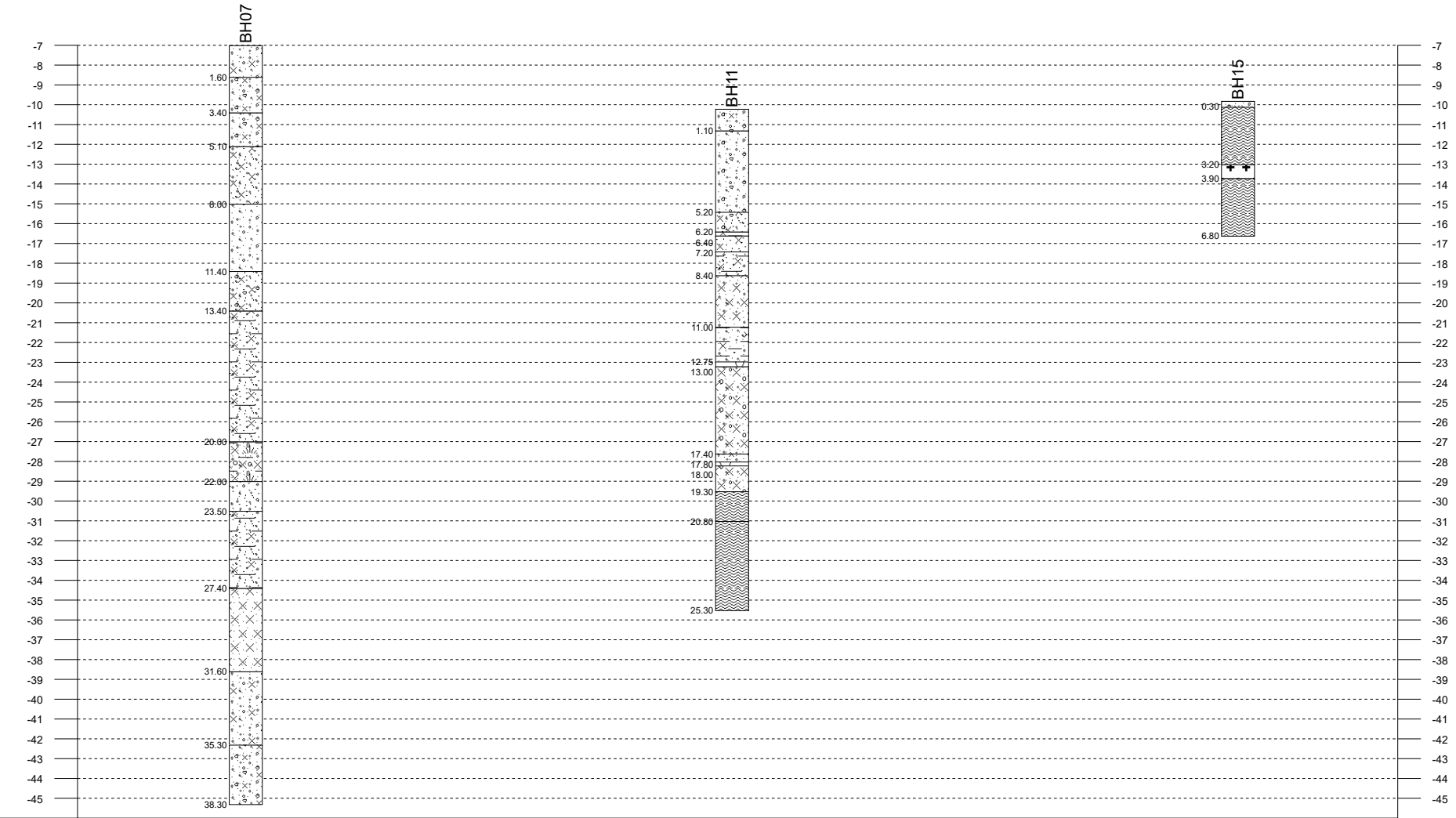
Geological long sections

Project Id: 17-0769a	Title: Section 1 - Quay Wall Phase 1
Project Title: Stornoway Deep Water Berth G.I.	Vertical Scale: 1:299
Location: Deep Water Berth	Horizontal Scale: 1:1411
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

Legend Key

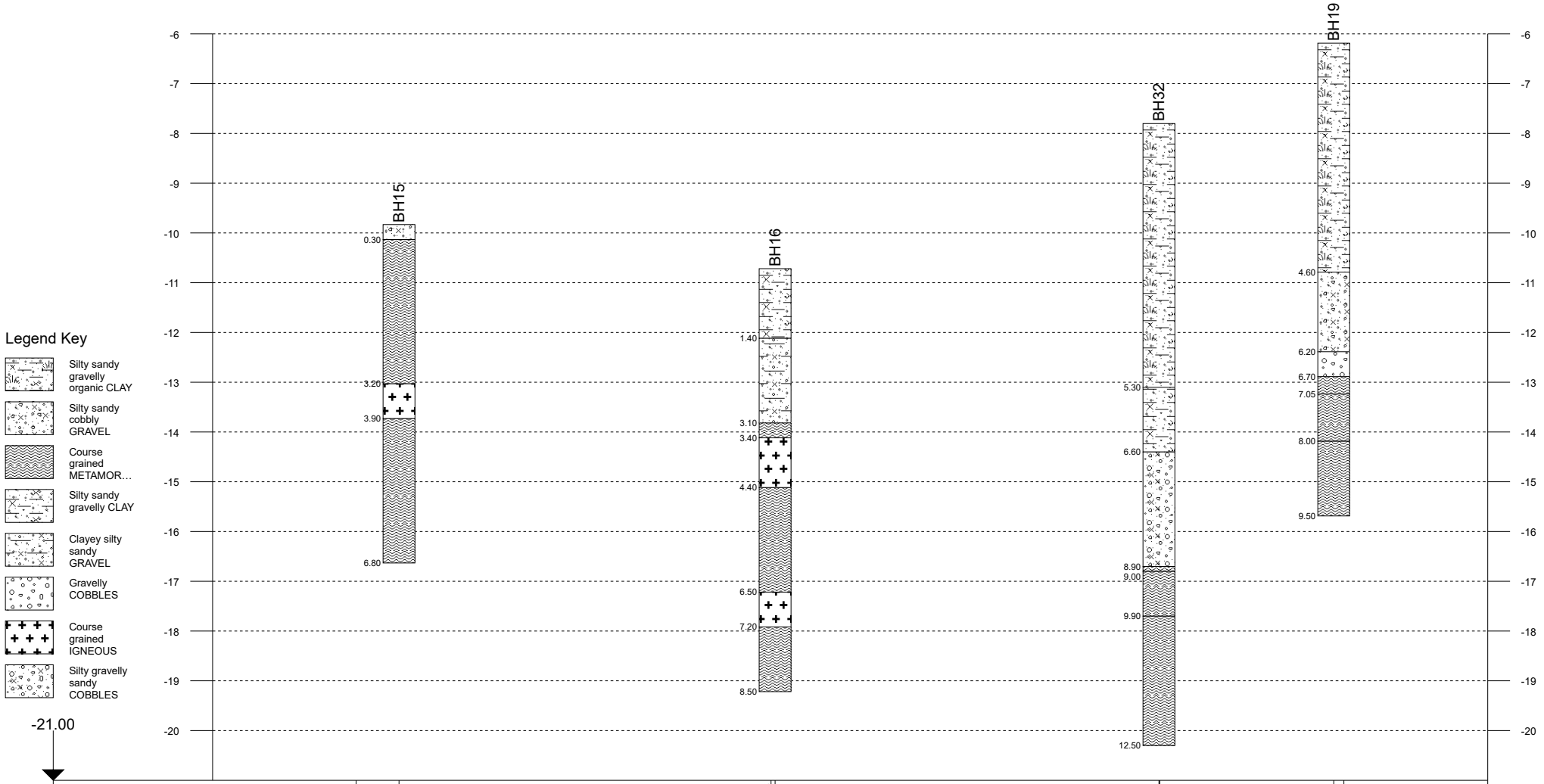
- Silty sandy GRAVEL
- Silty sandy cobbly GRAVEL
- Course grained METAMOR…
- Sandy cobbly GRAVEL
- Silty gravelly SAND
- Course grained IGNEOUS
- Sandy GRAVEL
- Silty gravelly cobbly SAND
- Silty organic CLAY
- Silty SAND
- Clayey silty gravelly SAND
- Sandy gravelly SILT
- Silty sandy gravelly CLAY
- BOULDERS
- Sandy gravelly cobbly SILT
- Clayey sandy gravelly organic cob…
- SAND and GRAVEL



-46.00

Chainage (m)	0.00	4.71		120.50	122.55		240.95	243.59
Offset (m)	0.47			0.04			0.10	
Elevation (mCD)	-7.02			-10.23			-9.83	

Project Id: 17-0769a	Title: Section 2 - Quay Wall Phase 2
Project Title: Stornoway Deep Water Berth G.I.	Vertical Scale: 1:115
Location: Deep Water Berth	Horizontal Scale: 1:1999
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

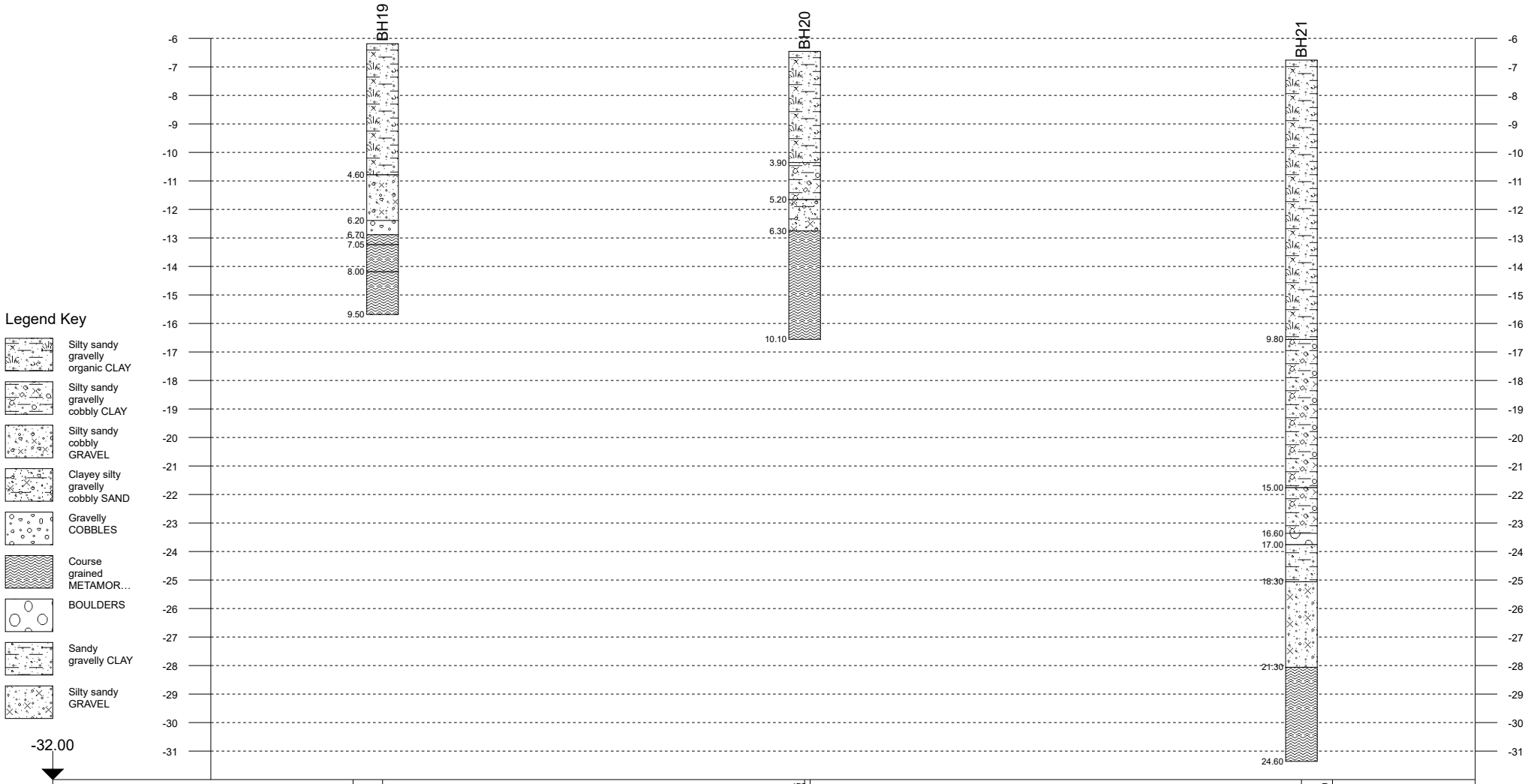


| | | |

Project Id: 17-0769a
Project Title: Stornoway Deep Water Berth G.I.
Location: Deep Water Berth
Client: Stornoway Port Authority

Title: Section 3 - Quay Wall Phase 3
Vertical Scale: 1:199
Horizontal Scale: 1:1553
Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

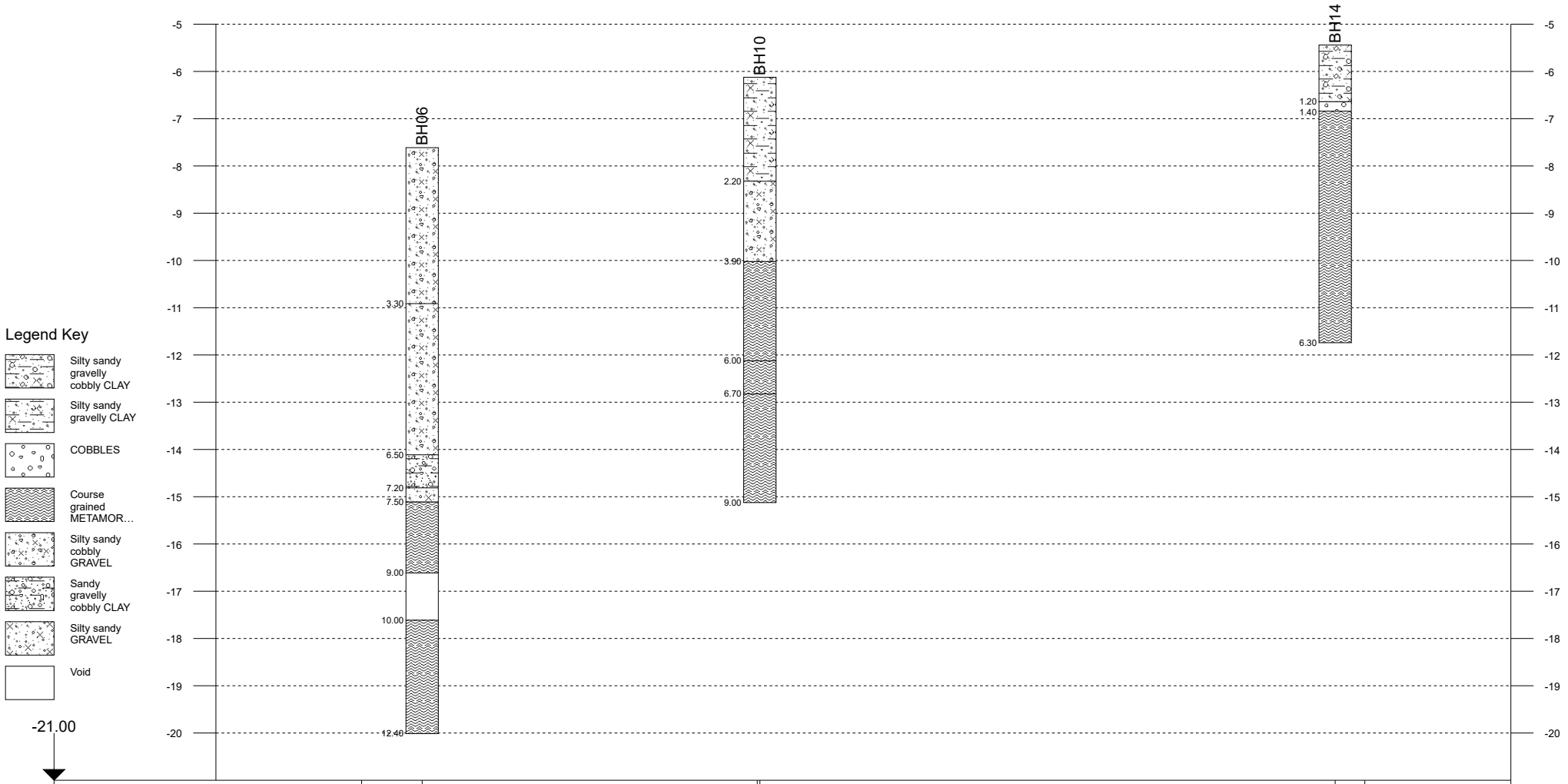


Chainage (m)	0.00	8.07	123.56	123.58	259.51	268.00			
Offset (m)	0.44		0.27		1.14				
Elevation (mCD)	-6.19		-6.46		-6.76				

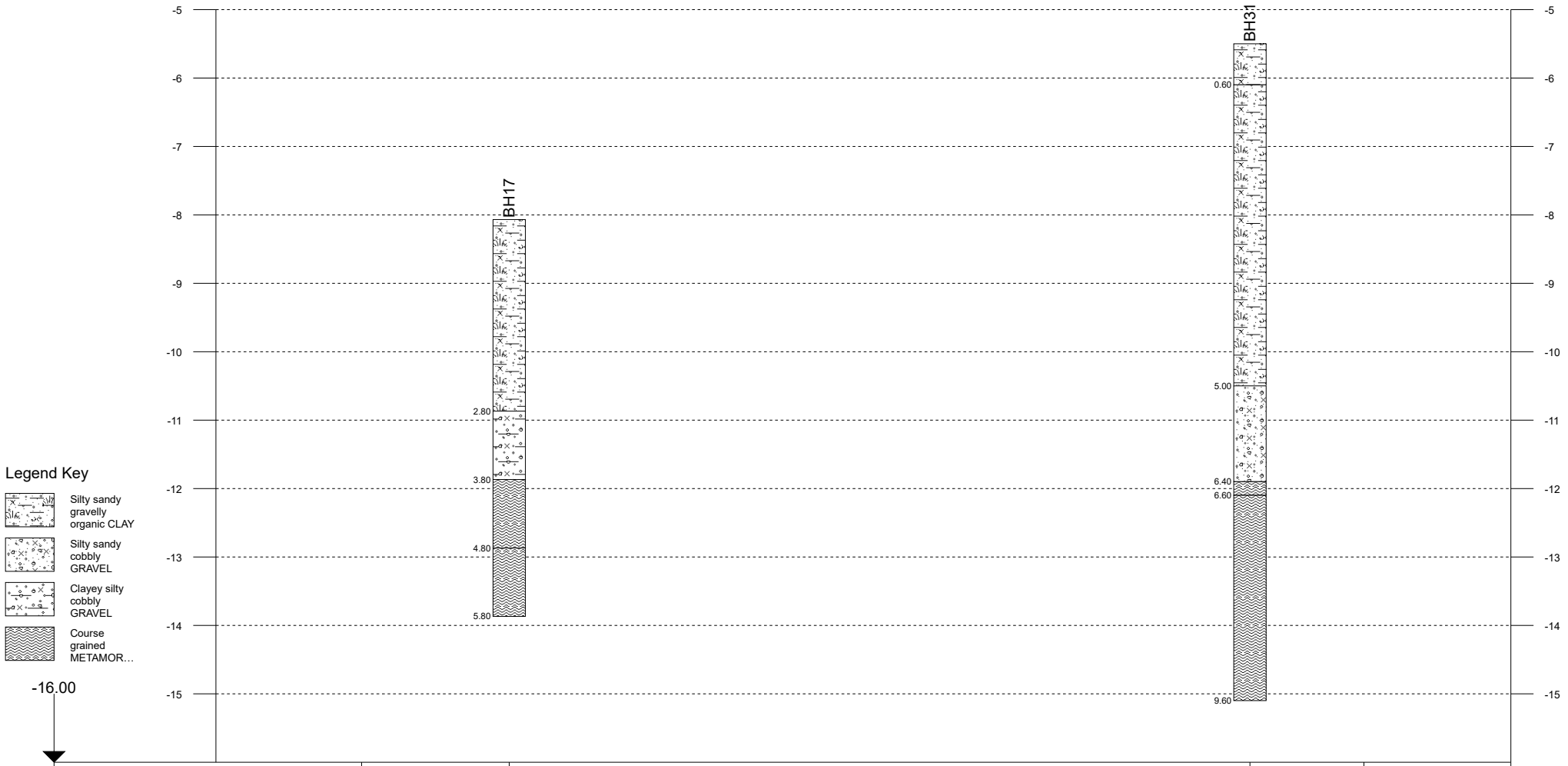
Project Id: 17-0769a
Project Title: Stornoway Deep Water Berth G.I.
Location: Deep Water Berth
Client: Stornoway Port Authority

Title: Section 4 - Reclamation Area Phase 1
Vertical Scale: 1:123
Horizontal Scale: 1:1391
Engineer: Wallace Stone Consulting Civil Engineers

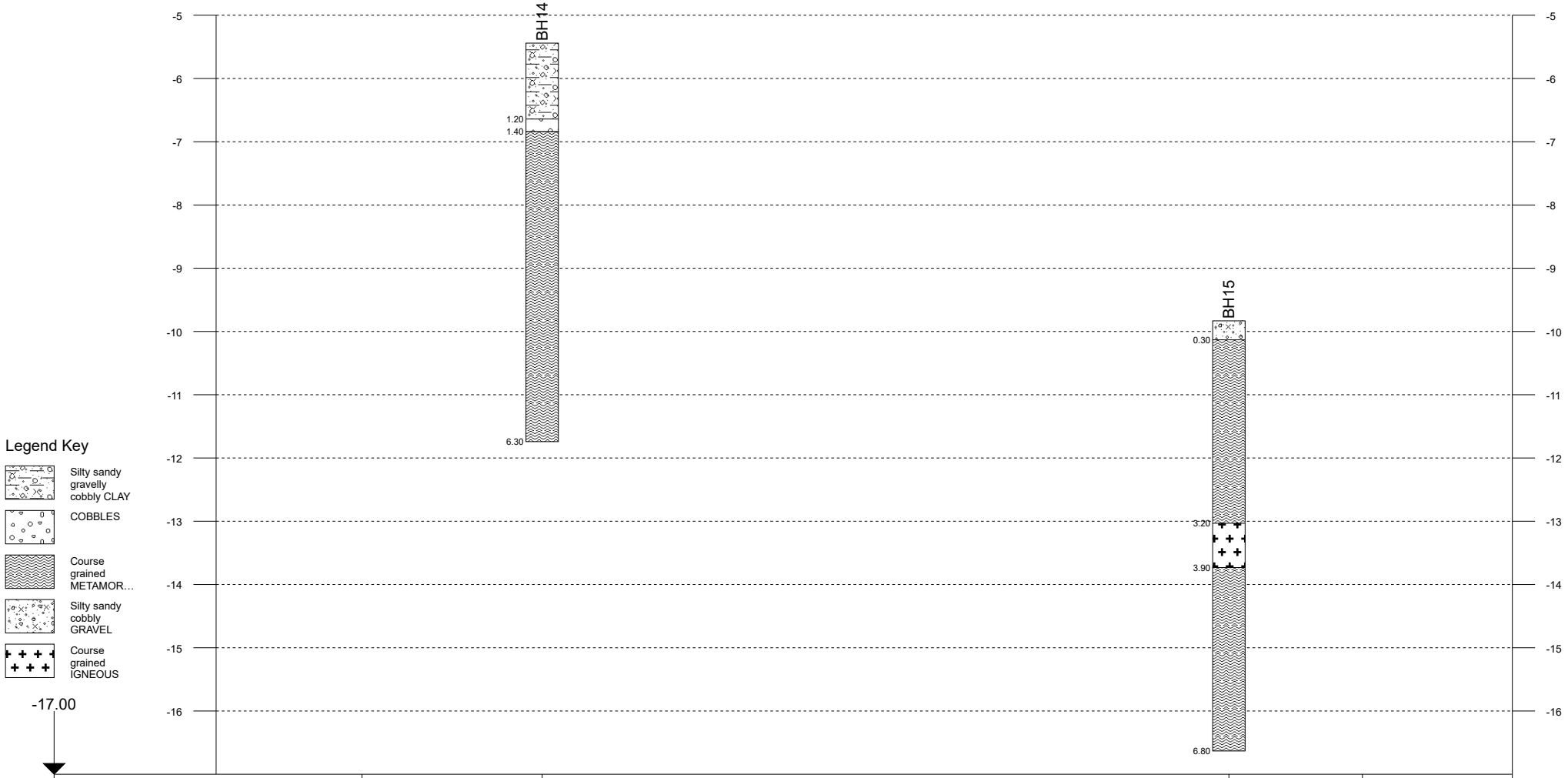
CAUSEWAY GEOTECH



Project Id: 17-0769a	Title: Section 5 - Reclamation Area Phase 2
Project Title: Stornoway Deep Water Berth G.I.	Vertical Scale: 1:85
Location: Deep Water Berth	Horizontal Scale: 1:645
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers



Project Id: 17-0769a	Title: Section 6 - Heavy Lift Area
Project Title: Stornoway Deep Water Berth G.I.	Vertical Scale: 1:92
Location: Deep Water Berth	Horizontal Scale: 1:243
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

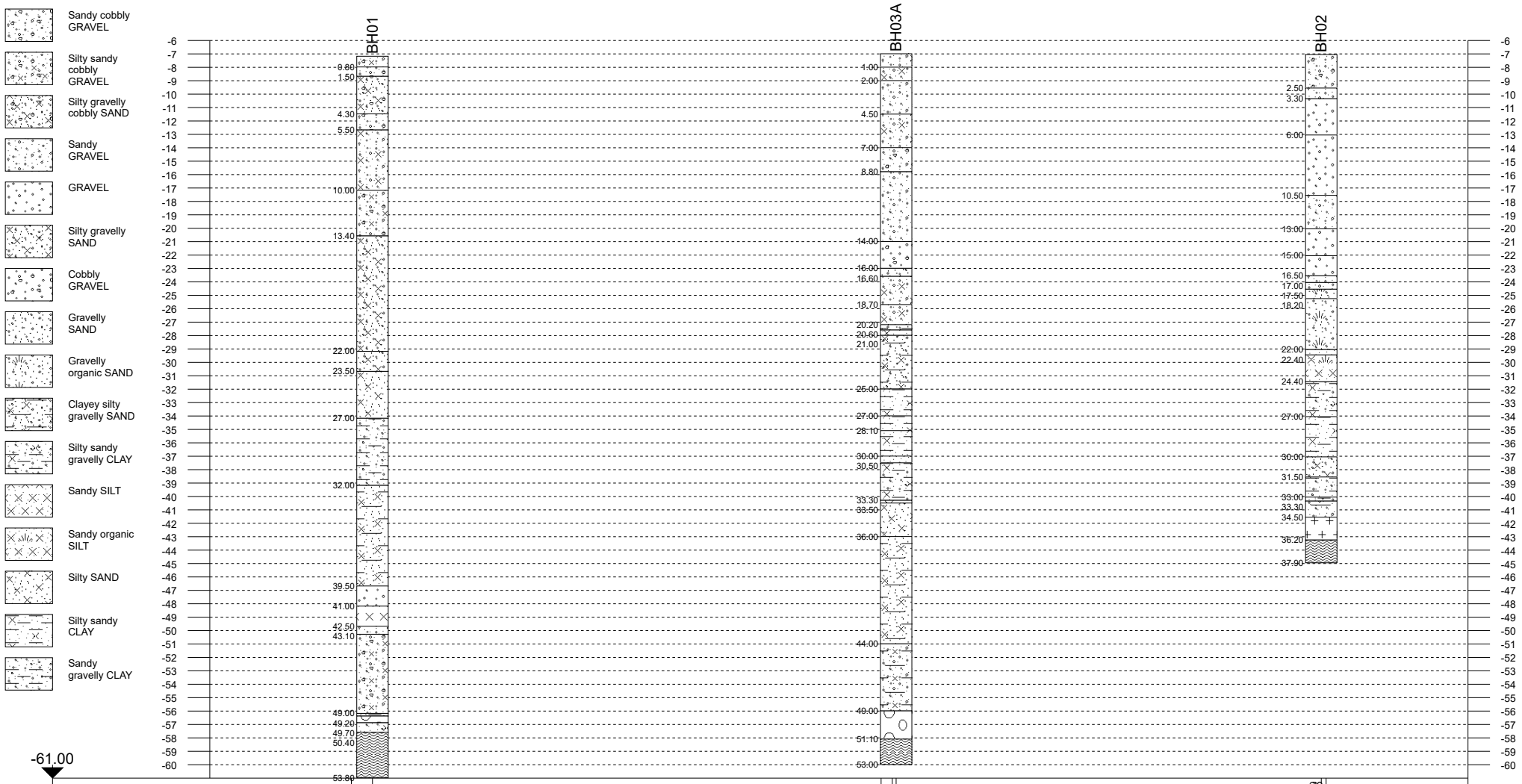


Project Id: 17-0769a	Title: Section 7 - Linkspan, Finger Pier, Dolphins
Project Title: Stornoway Deep Water Berth G.I.	Area Vertical Scale: 1:421
Location: Deep Water Berth	Horizontal Scale: 1:885
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

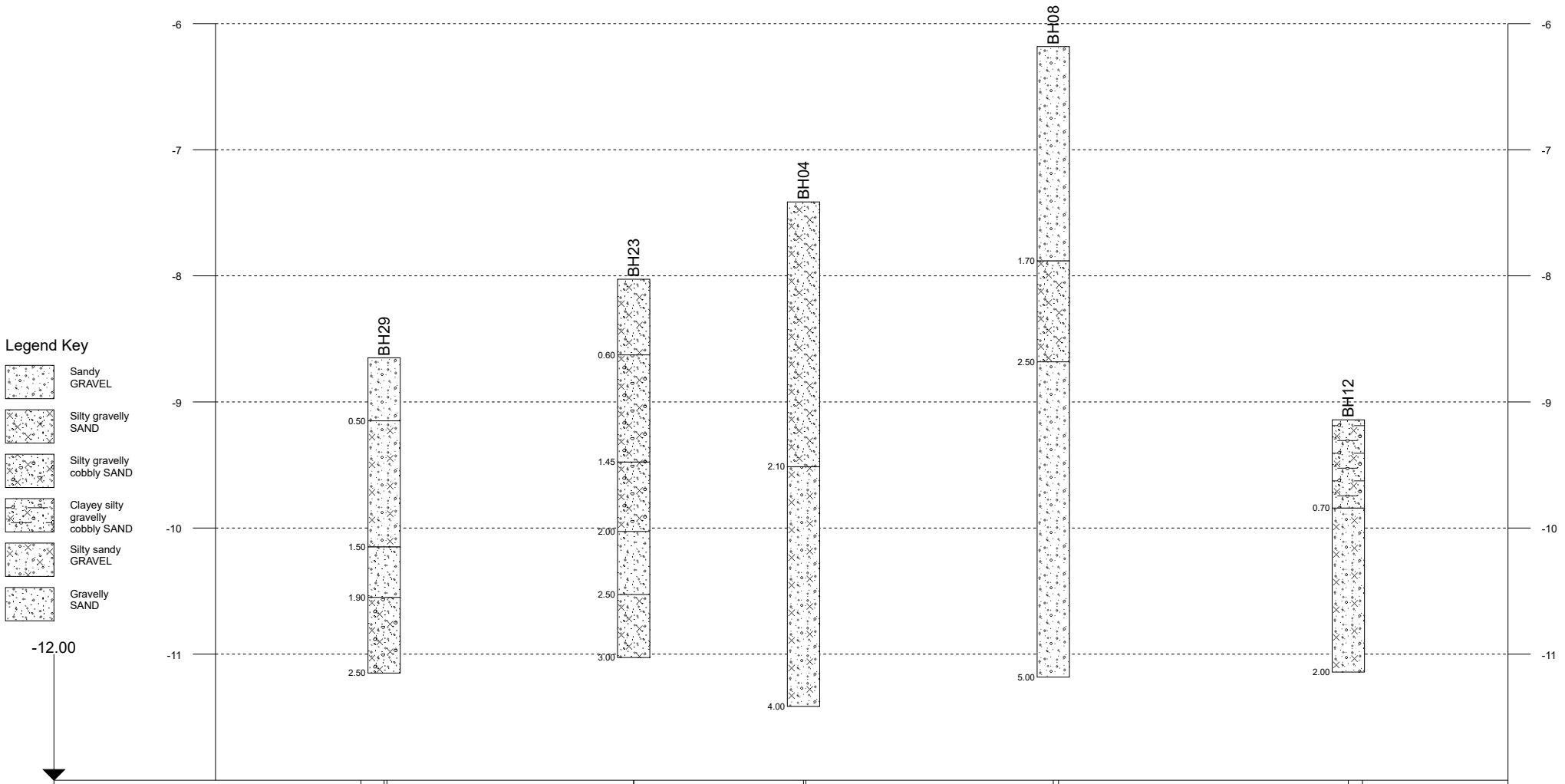
Legend Key

- Silty sandy GRAVEL
- Sandy cobbly GRAVEL
- Silty sandy cobbly GRAVEL
- Silty gravelly cobbly SAND
- Sandy GRAVEL
- GRAVEL
- Silty gravelly SAND
- Cobbly GRAVEL
- Gravelly SAND
- Gravelly organic SAND
- Clayey silty gravelly SAND
- Silty sandy gravelly CLAY
- Sandy SILT
- Sandy organic SILT
- Silty SAND
- Silty sandy CLAY
- Sandy gravelly CLAY



Chainage (m)	0.00	3.31	83.02	84.37	151.98	151.98					
Offset (m)	0.81		0.37	2.94	0.34						
Elevation (mCD)	-7.17		-6.99	-6.99	-7.05						

Project Id: 17-0769a	Title: Section 8 - Dredge Area North to South
Project Title: Stornoway Deep Water Berth G.I.	Vertical Scale: 1:46
Location: Deep Water Berth	Horizontal Scale: 1:3904
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers



Chainage (m)	0.00	15.63	183.56	289.84	465.93	489.45	664.48	673.96	
Offset (m)	0.01		1.29	0.13	0.41		0.82		
Elevation (mCD)	-8.65		-8.03	-7.41	-6.18		-9.14		

Project Id: 17-0769a
Project Title: Stornoway Deep Water Berth G.I.
Location: Deep Water Berth
Client: Stornoway Port Authority

Title: Section 9 - Dredge Area West to East
Vertical Scale: 1:39
Horizontal Scale: 1:3316
Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

APPENDIX H

SPT hammer energy measurement report

SPT Calibration Report

EQUIPE GROUP
www.equipegroup.com

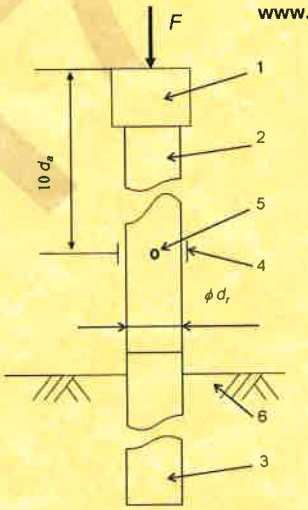
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	CAUSEWAY GEOTECH
Test No	EQU1763
Test Depth (m)	7.50
Date of Test	18 February 2017
Valid until	18 February 2018
Hammer ID	EQU1763

Mass of the hammer	m = 63.5kg
Falling height	h = 0.76m
E_{theor} =	$m \times g \times h$ = 473J

Characteristics of the instrumented rod

Diameter	d_r = 0.052 m
Length of the instrumented rod	0.558 m
Area	A = 11.61 cm^2
Modulus	E_a = 206843 MPa

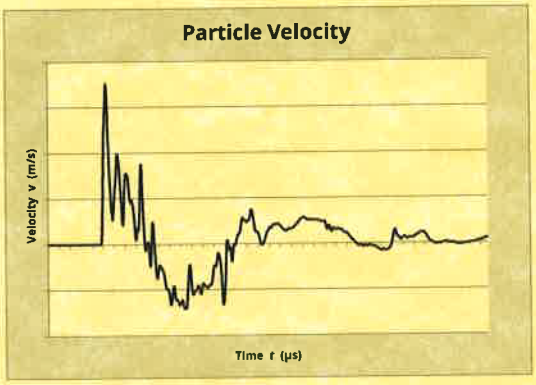


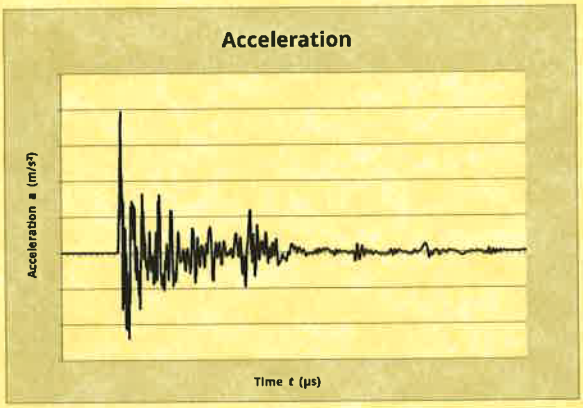
Key

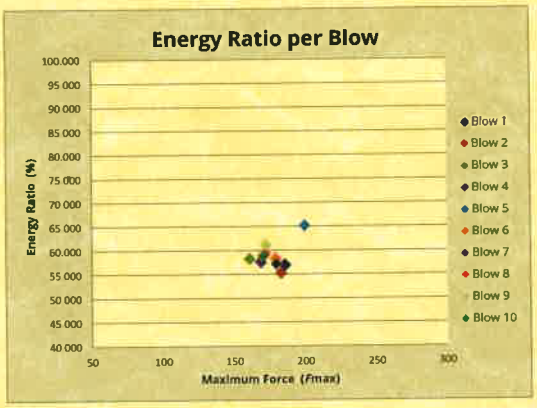
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011







Observations:
1.

E_{meas} = **0.277** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_r) $= \frac{E_{meas}}{E_{theor}}$ **58.61%**

Equipe SPT Analyzer Operators: AF

Prepared by: [redacted] **Checked by** [redacted] **Date** 02/03/2017

© Copyright 2016 **Equipe Group**, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: +44 (0)1295 670990 Fax: +44 (0)1295 678232 Email: info@equipegroup.com

Stornoway Deep Water Port – Ground Investigation

Client:	Stornoway Port Authority
Client's Representative:	Wallace Stone Consulting Civil Engineers
Report No.:	19-0382
Date:	September 2019
Status:	Draft for Review

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Approved: ISO 9001 • ISO 14001 • OHSAS 18001

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APPENDICES

Appendix A Site and exploratory hole location plans

Appendix B Borehole logs

Appendix C Geotechnical laboratory test results

Appendix D Dredge analysis laboratory test results

Appendix E Geological long sections

Appendix F Cone Penetration Test report

Appendix G SPT hammer energy measurement report

Document Control Sheet

Report No.:		19-0382			
Project Title:		Stornoway Deep Water Port – Ground Investigation			
Client:		Stornoway Port Authority			
Client's Representative:		Wallace Stone Consulting Civil Engineers			
Revision:	A00	**Status:**	Draft for Review	**Issue Date:**	30 September 2019
Prepared by:		**Reviewed by:**		**Approved by:**	
[redacted] Carin Cornwall BSc MSc PhD		[redacted] Neil Haggan BSc (Hons) MSc FGS		[redacted] Darren O'Mahony BSc MSc MIEI EurGeol PGeo	

The works were conducted in accordance with:

UK Specification for Ground Investigation 2nd Edition, published by ICE Publishing (2012)

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
▽	Water strike: initial depth of strike
▼	Water strike: depth water rose to
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum).

Stornoway Deep Water Port

1 AUTHORITY

On the instructions of Wallace Stone Consulting Engineers, ("the Client's Representative"), acting on the behalf of Stornoway Port Authority ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a new Deep Water Berth and associated soft sediment dredging programme.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included marine boreholes, soil sampling, in-situ and laboratory testing, and the preparation of a Factual Report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted overwater around the location of Arnish Pier across the bay from Stornoway Harbour.

The boreholes were put down off a jack-up barge at given locations within Glumaig bay to the north west of Arnish point.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 6th June and 6th July 2019, comprised:

- Fourteen marine light cable percussion boreholes
- Eight cone penetration tests
- In-situ testing of soils
- Sediment sampling for Marine Scotland Dredge Analysis

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Marine Plant

The OCM80 jack-up barge was deployed for the duration of the site works. OCM80 is a Combi-float C5 modular jack-up barge in a ten-pontoon configuration joined and secured with a simple pinning system. The jack-up barge sits on four 28m spudded legs with associated hydraulic rams and can be operated in both spudded (floating) or jack-up modes.

The barge was contracted and operated through Ocean Crest Marine for the duration of the site works. Boreholes were sunk through an integral moonpool through one of the pontoons which make up the main deck of the jack-up barge.

Ocean Crest Marine also provided the marine support vessels OCM Supporter and OCM Fortess to assist with crew transfers and barge movements respectively.

4.3 Boreholes

Fourteen boreholes (BH41-BH50, BH50A, and BH51-BH53) were put down to completion in minimum 200mm diameter using a Dando 3000 light cable percussion boring rig. All boreholes were terminated at their scheduled completion depths, on instruction of the Engineer, or else on encountering virtual refusal on obstructions, including large boulders and weathered bedrock above scheduled depths.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Undisturbed (UT100 and U100) and piston samples were taken where appropriate and as directed within fine soils. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Standard penetration tests were carried out in accordance with BS EN 22476-3: 2005 at standard depth

intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix G.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.4 Cone Penetration Test

Eight cone penetration tests were carried out by In-Situ Site Investigation at pre-agreed locations across the works area.

Details of the tests and the methods used are provided in the report in Appendix F.

4.5 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R10S GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (UK National Grid) and ground elevation (mCD) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **compressibility:** one dimensional consolidation (oedometer)
- **shear strength** (total stress): unconsolidated undrained triaxial tests
- **direct shear:** shear box tests (small and large)

- **soil chemistry:** pH and water-soluble sulphate content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix C.

5.2 Marine Scotland Analysis – Pre-Disposal Dredge Sampling

In addition to geotechnical testing conducted on soils, environmental samples were taken at two locations at standard intervals for chemical testing relating to disposal at sea parameters.

Sampling was carried out in accordance with Marine Scotland's "Guidance for The Sampling and Analysis of Sediment and Dredge material to be Submitted in Support of Applications for Sea Disposal of Dredged Material" 2011.

At both sample locations, samples were taken extending to -13.0m CD with sample intervals as required by the above document. Two samples were recovered at each location and depth for separate testing of (a) Metals and particle size and (b) Organic carbon and organic chemicals.

Testing was conducted to determine chemical concentrations to allow assessment of disposal of dredged material at sea.

The dredge analysis test results are included in Appendix D; a summary table showing the Marine Scotland Pre-disposal Sampling Guidance Action Levels has also been included before the SOCOTEC lab results.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Quaternary soft sediments overlying glacial till and sands and gravels. These deposits are underlain by metamorphic rocks of both the Lewisian Gneiss complex and the Outer Hebrides Thrust Zone Mylonite complex; some intrusive igneous features are also shown in the area associated with the thrust complex.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Recent deposits:** Very soft silty clay and sands with occasional gravel and shell fragments were

found on the seabed; found to a maximum depth of 16.10mbgl in BH51.

- **Marine sands and gravel deposits:** Typically, loose to medium dense sands and gravels with low to medium cobble content; occasionally with localised pockets of firm sandy gravelly silts/clays throughout. Where encountered at depth tend to be dense to very dense.

- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

Representative geological long sections showing the geologic profile along the line of the proposed new Deep Water Berth Structures are provided in Appendix E.

7 REFERENCES

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

CAUSEWAY GEOTECH

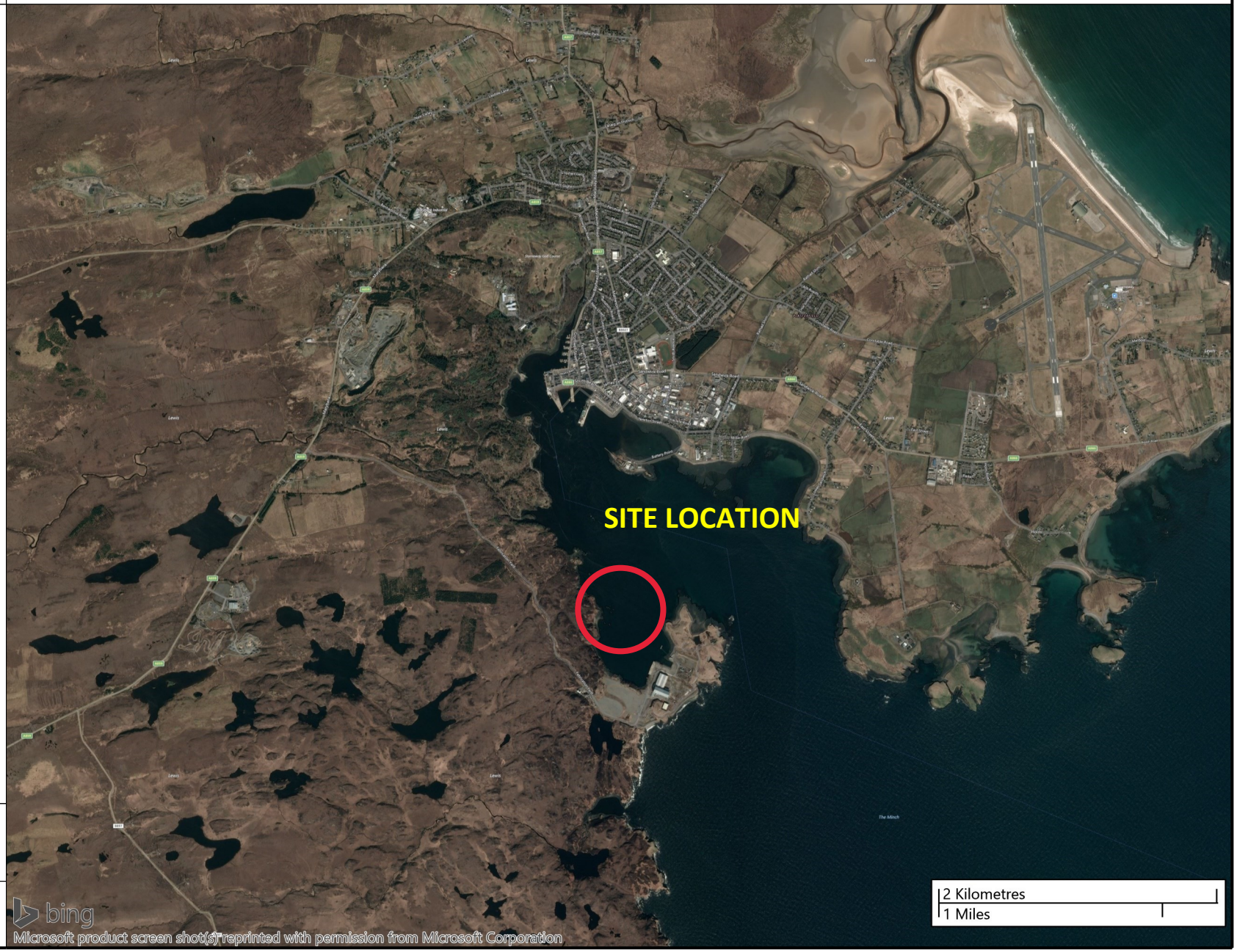
APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY GEOTECH

Project No.:	19-0382	**Client:**	Stornoway Port Authority
Project Name:	Stornoway Deep Water Port	**Client's Representative:**	Wallace Stone Consulting Civil Engineers

Legend Key



Title:

Site Location Plan

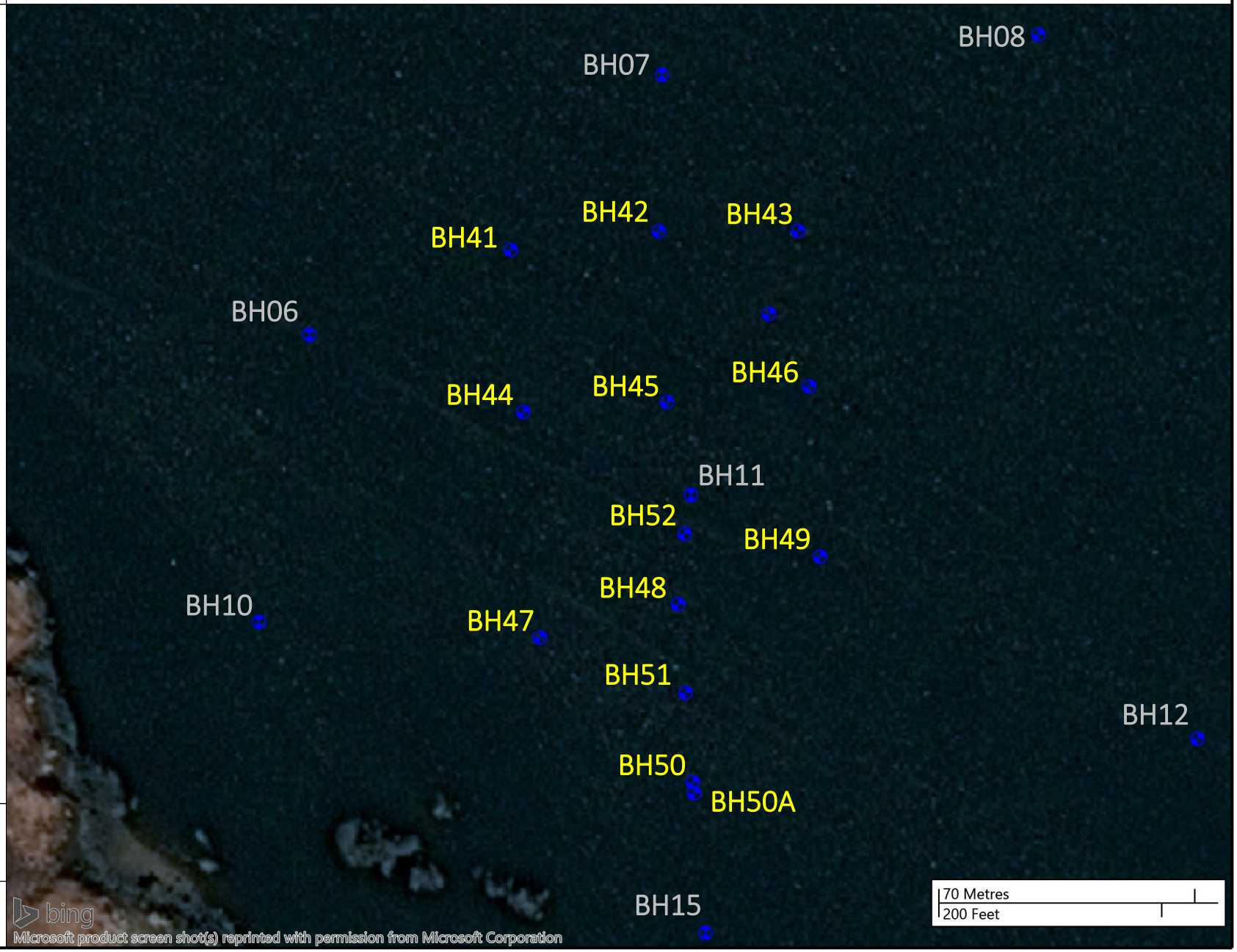
Last Revised:	**Scale:**
30/09/2019	1:40000

CAUSEWAY GEOTECH

Project No.:	19-0382	**Client:**	Stornoway Port Authority
Project Name:	Stornoway Deep Water Port	**Client's Representative:**	Wallace Stone Consulting Civil Engineers

Legend Key

- Locations By Type - CP
- Locations By Type - CP+RC



Title:

Site Location Plan

Last Revised:	**Scale:**
08/07/2019	1:1520

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	29.90

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH41

Coordinates: 142475.28 E 931271.63 N

Client: Stornoway Port Authority

Sheet 1 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Driller: CC/DA

Ground Level: -7.84 mCD

Dates: 22/06/2019 - 24/06/2019

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1					(0.70)		Very soft grey sandy silty CLAY with shell fragments. Sand is fine to medium.		
					-8.54	0.70				
0.80 - 1.20	B2							Grey slightly sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
1.50	D3									
1.60 - 2.50	B4					(1.80)				
2.50	D5				-10.34	2.50				
2.50 - 3.00	B6							Medium dense grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
3.00	D7									
3.00 - 3.50	B8									
3.50	D9									
3.80 - 4.25	SPT (C) N=17	3.80		N=17 (4,4/4,5,4,4) Hammer SN = 1118						
4.25	D10									
4.25 - 4.50	B11									
4.50	D12									
4.50 - 5.00	B13									
5.00	D14									
5.00 - 5.50	B15									
5.20 - 5.65	SPT (C) N=18	5.20		N=18 (5,5/5,4,6,3) Hammer SN = 1118						
5.50	D16									
5.50 - 6.00	B17									
6.00	D18									
6.00 - 6.50	B19					(7.20)				
6.50	D20									
6.50 - 7.00	B21									
6.70 - 7.15	SPT (C) N=13	6.70		N=13 (2,3/3,3,3,4) Hammer SN = 1118						
7.00	D22									
7.00 - 7.50	B23									
7.50	D24									
7.50 - 8.00	B25									
8.00	D26									
8.00 - 8.50	B27									
8.20 - 8.65	SPT (C) N=11	8.20		N=11 (2,2/2,4,3,2) Hammer SN = 1118						
8.50	D28									
8.50 - 9.00	B29									
9.00	D30									
9.00 - 9.50	B31									
9.50	D32									
9.50 - 10.00	B33									
9.70 - 10.15	SPT (C) N=9	9.70		N=9 (1,1/2,2,2,3) Hammer SN = 1118	-17.54	9.70		Loose grey sandy subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is coarse. Cobbles are		

Remarks

Deck to Bed = 15.80m

CPT push 1 from 0.70m to 2.50m (below bed)

CPT push 2 from 14.20m to 22.70m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250
29.90	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.90	30.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	29.90

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH41

Coordinates: 142475.28 E 931271.63 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -7.84 mCD

Dates: 22/06/2019 - 24/06/2019

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00	D34									
10.00 - 10.60	B35					(0.90)		Loose grey sandy subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is coarse. Cobbles are subangular to subrounded of gneiss.		
10.60	D36				-18.44	10.60				
10.60 - 11.00	B37					(0.60)		Grey slightly gravelly slightly silty fine to coarse SAND with shell fragments. Gravel is subangular to subrounded fine to medium.		
11.00	D38									
11.00 - 11.50	B39				-19.04	11.20				
11.20 - 11.65	D40							Medium dense grey gravelly slightly silty fine to coarse SAND with shell fragments. Gravel is subangular to subrounded fine to coarse.		
	SPT (S)	11.2		N=20 (2,3/3,4,6,7)						
	N=20	0		Hammer SN = 1118						
11.50	D41									
11.50 - 12.00	D42									
12.00	D43									
12.00 - 12.50	B44									
12.50	D45									
12.50 - 13.00	B46					(2.80)				
12.70 - 13.15	D47									
	SPT (S)	12.7		N=20 (3,4/4,5,5,6)						
	N=20	0		Hammer SN = 1118						
13.00	D48									
13.00 - 13.50	B49									
13.50	D50									
13.50 - 14.00	B51									
14.00	D52				-21.84	14.00				
14.00 - 14.20	B53							Very soft to soft grey sandy slightly clayey SILT with occasional shell fragments. Sand is fine.		
14.20 - 14.70	B54					(0.80)				
					-22.64	14.80				
15.00	D55							Soft grey slightly sandy SILT with occasional pockets of soft black SILT. Sand is fine.		
15.20 - 15.70	B56									
						(2.10)				
16.00	D57									
16.20 - 16.70	B58									
					-24.74	16.90				
17.00	D59							Firm to stiff thinly laminated brown and black organic SILT.		
17.20 - 17.70	B60									
18.00	D61									
18.20 - 18.70	B62					(3.60)				
19.00	D63									
19.20 - 19.70	B64									
~~20.00~~	~~D65~~									

Remarks

Deck to Bed = 15.80m

CPT push 1 from 0.70m to 2.50m (below bed)

CPT push 2 from 14.20m to 22.70m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250
29.90	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.90	30.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	29.90

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH41

Coordinates: 142475.28 E 931271.63 N

Client: Stornoway Port Authority

Sheet 3 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -7.84 mCD

Dates: 22/06/2019 - 24/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Firm to stiff thinly laminated brown and black organic SILT.		
					-28.34	20.50				
20.60 - 21.00	B66							Soft purplish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
21.20	D67									
21.50 - 22.00	B68									
						(3.20)				
22.20	D69									
22.50 - 22.70	B70									
23.00	D71									
23.20 - 23.70	B72									
23.20 - 23.65	SPT (S) N=8	23.20		N=8 (2,2/2,2,2,2) Hammer SN = 1118						
23.70 - 24.55	P82			Piston Sample (100%)	-31.54	23.70		Firm grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
23.70 - 24.60	LB73									
23.70				HVP=47, HVR=20		(1.00)				
24.70	D74				-32.54	24.70				
24.70 - 25.50	LB75							Soft to very soft grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
24.70 - 25.55	P83	24.70		Piston Sample (100%)		(0.80)				
					-33.34	25.50				
25.60 - 26.05	B77 D76				-33.44	25.60 (0.10)		Soft to firm grey slighty sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
	SPT (S) N=10	25.60		N=10 (5,4/2,2,3,3) Hammer SN = 1118				Firm grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
26.05	D78									
						(1.50)				
26.50 - 27.00	B79									
27.00 - 27.10	B81									
27.00 - 27.45	UT80			Ublow=40 20%	-34.94	27.10		Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
27.10 - 27.50	B84									
27.50	D85									
27.50 - 28.00	B86									
28.00	D87									
28.00 - 28.50	B88									
						(2.80)				
28.50	D89									
28.50 - 29.00	B90									
29.00 - 29.50	B91									
29.20 - 29.65	D92									
	SPT (S) N=19	29.20		N=19 (3,4/5,5,4,5) Hammer SN = 1118						
29.50	D93									
29.50 - 29.90	B94									
29.90	D95				-37.74	29.90 (0.20)				
29.90 - 30.10	B96									

Remarks

Deck to Bed = 15.80m

CPT push 1 from 0.70m to 2.50m (below bed)

CPT push 2 from 14.20m to 22.70m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250
29.90	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.90	30.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	29.90

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH41

Coordinates: 142475.28 E 931271.63 N

Client: Stornoway Port Authority

Sheet 4 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -7.84 mCD

Dates: 22/06/2019 - 24/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					-37.94	30.10		Large BOULDER / possible bedrock. End of Borehole at 30.10m		

Remarks

Deck to Bed = 15.80m

CPT push 1 from 0.70m to 2.50m (below bed)

CPT push 2 from 14.20m to 22.70m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250
29.90	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.90	30.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	31.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH42

Coordinates: 142516.28 E, 931274.12 N

Client: Stornoway Port Authority

Sheet 1 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -7.69 mCD

Dates: 06/06/2019 - 09/06/2019

Driller: CC/DA

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.00 - 0.40	B1					(0.40)		Very soft dark grey slightly sandy slightly gravelly silty CLAY with shells and shell fragments. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse predominantly of gneiss.
0.40 - 1.50	B2				-8.09	0.40		Very soft grey slightly sandy slightly gravelly CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of gneiss.
1.00	D3					(1.10)		
1.00 - 1.45	SPT (C) N=2	1.00		N=2 (1,0/1,0,1,0) Hammer SN = 1118				
1.50 - 2.50	B5				-9.19	1.50		Very loose becoming loose grey very gravelly slightly silty fine to coarse SAND with low cobble content, shells and shell fragments. Gravel is subangular to subrounded fine to coarse predominately of gneiss.
2.00	D4					(1.50)		
2.00 - 2.45	SPT (C) N=4	2.00		N=4 (1,0/1,1,1,1) Hammer SN = 1118				
3.00	D6				-10.69	3.00		Loose grey sandy subangular to rounded fine to coarse GRAVEL predominantly of gneiss with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.
3.00 - 3.45	SPT (C) N=6	3.00		N=6 (1,1/1,1,2,2) Hammer SN = 1118				
3.20 - 3.30	B7							
4.00	D8					(2.60)		
4.00 - 4.45	SPT (C) N=8	4.00		N=8 (1,2/3,2,1,2) Hammer SN = 1118				
4.20 - 4.30	B9							
5.00	D10							
5.00 - 5.45	SPT (C) N=8	5.00		N=8 (1,1/2,2,2,2) Hammer SN = 1118				
5.70 - 6.00	B11				-13.29	5.60		Loose brownish grey very sandy subangular to rounded fine to coarse GRAVEL predominately of gneiss with shells and shell fragments.
6.50 - 6.95	SPT (C) N=8	6.50		N=8 (1,2/2,1,2,3) Hammer SN = 1118				
6.80	D12					(2.40)		
7.20 - 7.50	B13							
8.00	D14				-15.69	8.00		Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL predominately of gneiss with low cobble content, shells and pockets pockets of fine to medium GRAVEL. Cobbles are subangular to subrounded of gneiss.
8.00 - 8.45	SPT (C) N=10	8.00		N=10 (2,2/2,3,2,3) Hammer SN = 1118				
8.20 - 8.50	B15							
9.20 - 9.50	B16					(2.30)		
9.50	D17							
9.50 - 9.95	SPT (C) N=20	9.50		N=20 (2,2/4,4,5,7) Hammer SN = 1118				

Water: Backfill

Remarks

Deck to Bed = 15.00m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.00	250
31.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
19-0382	Stornoway Deep Water Port	BH42
Coordinates:	**Client:**	Sheet 2 of 4
142516.28 E	Stornoway Port Authority	
931274.12 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:50
Ground Level: -7.69 mCD	**Dates:** 06/06/2019 - 09/06/2019	**Driller:** CC/DA
		Logger: MK

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	31.50

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					-17.99	10.30		Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL predominately of gneiss with low cobble content, shells and pockets pockets of fine to medium GRAVEL. Cobbles are subangular to subrounded of gneiss.		
10.50 - 10.70	B18							Medium dense brownish grey very gravelly slightly silty fine to coarse SAND with shells and shell fragments. Gravel is subangular to subrounded fine to medium.		
11.00	D19					(1.20)				
11.00 - 11.45	SPT (C) N=20	11.00		N=20 (3,3/3,5,6,6) Hammer SN = 1118				*11.35m to 11.50m: Slightly sandy fine to medium GRAVEL*		
11.50 - 11.70	B20				-19.19	11.50		Firm brown gravelly slightly silty fine to coarse SAND with shell fragments. Gravel is subangular to rounded fine to medium predominantly of gneiss.		
						(1.50)				
12.50	D21									
12.50 - 12.95	SPT (S) N=11	12.50		N=11 (1,2/2,3,3,3) Hammer SN = 1118						
13.00 - 13.30	B22				-20.69	13.00		Stiff dark grey very sandy SILT with shell fragments. Sand is fine to coarse.		
14.00	D23					(2.00)				
14.00 - 14.50	B24									
14.50	D25									
15.00 - 15.45	UT26			Ublow=40 100%	-22.69	15.00		Firm heavily fissured dark grey CLAY.		
						(0.50)				
15.45	D27				-23.19	15.50		Soft slightly fissured dark grey CLAY.		
16.00	D28					(1.00)				
16.50	D29				-24.19	16.50		Medium dense brown slightly gravelly slightly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		
16.50 - 16.95	SPT (S) N=23	16.50		N=23 (3,4/5,6,6,6) Hammer SN = 1118		(0.50)				
16.90	D30				-24.69	17.00		Brownish grey gravelly very silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium.		
17.10 - 17.50	B31					(1.00)				
18.00 - 18.45	D32				-25.69	18.00		Very soft dark brownish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded to rounded of gneiss.		
	SPT (S)	18.00		N=0 (0,0/0,0,0,0) Hammer SN = 1118						
18.50 - 19.00	B33									
19.50 - 19.95	UT34			Ublow=35 100%						
19.95	D35									

Remarks
Deck to Bed = 15.00m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.00	250
31.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	31.50

Project No.: 19-0382
Project Name: Stornoway Deep Water Port
Borehole No.: BH42
Coordinates: 142516.28 E, 931274.12 N
Client: Stornoway Port Authority
Sheet 3 of 4
Client's Representative: Wallace Stone Consulting Civil Engineers
Scale: 1:50
Ground Level: -7.69 mCD
Dates: 06/06/2019 - 09/06/2019
Driller: CC/DA
Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
20.50	D36							Very soft dark brownish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded to rounded of gneiss.		
21.00	D37									
21.00 - 21.50	B38					(4.20)				
21.00 - 21.45	SPT (S)	21.00		N=0 (1,0/0,0,0,0) Hammer SN = 1118						
22.30	D39				-29.89	22.20				
22.50 - 23.35	P40			Piston Sample (80%)	-29.99	22.30		Soft dark brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Firm greyish brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
23.00 - 23.30	D43					(1.70)				
24.00	D44				-31.69	24.00		Soft greyish green slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
24.00 - 24.50	B41									
24.00 - 24.85	P42			Piston Sample (100%)		(0.85)				
25.00	D45				-32.54	24.85		Very soft light grey slightly gravelly CLAY. Gravel is angular fine to medium.		
25.30 - 25.50	B46					(1.15)				
25.60 - 26.05	SPT (S) N=2	25.60		N=2 (1,0/1,0,1,0) Hammer SN = 1118						
27.00	D47				-33.69	26.00		Medium dense grey very gravelly silty fine to coarse SAND with low cobble content. Gravel is subangular fine to coarse. Cobbles are subrounded of gneiss.		
27.00 - 27.45	SPT (S) N=29	27.00		N=29 (6,7/9,6,6,8) Hammer SN = 1118		(2.40)				
27.50 - 27.80	B48									
28.00	D49									
28.50 - 28.60	U55			Ublow=70 0%	-36.09	28.40		Very stiff grey slightly gravelly sandy CLAY with low cobble and boulder content and widely spaced thin beds of fine SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse predominantly of gneiss. Cobbles and boulders are subrounded of gneiss.		
28.50 - 28.80	B50									
28.80	D51									
28.80 - 29.25	SPT (S) N=40	28.80		N=40 (5,9/9,8,11,12) Hammer SN = 1118		(3.10)				
29.70 - 30.00	B52									

Remarks
Deck to Bed = 15.00m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.00	250
31.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	31.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH42

Coordinates: 142516.28 E 931274.12 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -7.69 mCD

Dates: 06/06/2019 - 09/06/2019

Sheet 4 of 4

Scale: 1:50

Driller: CC/DA

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
30.00 - 30.15	SPT (S)	30.00		N=50 (25 for 75mm/50 for 75mm) Hammer SN = 1118				Very stiff grey slightly gravelly sandy CLAY with low cobble and boulder content and widely spaced thin beds of fine SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse predominantly of gneiss. Cobbles and boulders are subrounded of gneiss.		
30.50	D53									
31.00 - 31.30	B54									
31.50 - 31.80	SPT (S)	31.50		N=50 (9,13/50 for 150mm) Hammer SN = 1118	-39.19	31.50		End of Borehole at 31.50m		

30.5 31.0 31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0 35.5 36.0 36.5 37.0 37.5 38.0 38.5 39.0 39.5

Remarks

Deck to Bed = 15.00m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.00	250
31.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH43

Coordinates: 142554.56 E 931271.70 N

Client: Stornoway Port Authority

Sheet 1 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -6.75 mCD

Dates: 28/06/2019 - 03/07/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							Loose grey sandy subangular to subrounded fine to medium GRAVEL with shell fragments. Sand is medium to coarse.		
0.50	D2					(1.00)				
0.50 - 1.00	B3									
1.00	D4				-7.75	1.00		Medium dense grey slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is medium to coarse. Cobbles are subangular to subrounded of gneiss.		
1.00 - 1.50	B5									
1.20 - 1.65	SPT (C) N=22	1.20		N=22 (5,4/5,6,6,5) Hammer SN = 1118						
1.50	D6									
1.50 - 2.00	B7									
2.00	D8									
2.00 - 2.50	B9									
2.20 - 2.65	SPT (C) N=17	2.20		N=17 (4,5/4,4,5,4) Hammer SN = 1118						
2.50	D10									
2.50 - 3.00	B11									
3.00	D12									
3.00 - 3.50	B13									
3.20 - 3.65	SPT (C) N=21	3.20		N=21 (3,4/5,5,5,6) Hammer SN = 1118						
3.50	D14									
3.50 - 4.00	B15									
4.00	D16									
4.00 - 4.50	B17									
4.20 - 4.65	SPT (C) N=24	4.20		N=24 (6,5/6,7,5,6) Hammer SN = 1118		(6.50)				
4.50	D18									
4.50 - 5.00	B19									
5.00	D20									
5.00 - 5.50	B21									
5.20 - 5.65	SPT (C) N=19	5.20		N=19 (4,5/5,4,4,6) Hammer SN = 1118						
5.50	D22									
5.50 - 6.00	B23									
6.00	D24									
6.00 - 6.50	B25									
6.20 - 6.65	SPT (C) N=11	6.20		N=11 (1,1/2,2,3,4) Hammer SN = 1118						
6.50	D26									
6.50 - 7.00	B27									
7.00	D28									
7.00 - 7.50	B29									
7.50 - 8.00	B30				-14.25	7.50		Grey very gravelly slightly silty fine to coarse SAND with shell fragments. Gravel is subrounded fine to medium.		
8.00	D31									
8.00 - 9.00	B32					(2.20)				
9.00	D33									
9.70	D34				-16.45	9.70				
9.70 - 10.20	B35					(0.60)		Soft grey slightly gravelly very silty fine to coarse SAND. Gravel is subangular to subrounded fine.		

Remarks

Deck to Bed = 15.00m

CPT push 1 from approximately 0.10m to 1.36m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 7.50m to 11.20m (depths TBC on receipt of IN-Situ SI data)

CPT push 3 from approximately 18.10m to 22.60m (depths TBC on receipt of IN-Situ SI data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.20	250
30.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.80	30.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH43

Coordinates: 142554.56 E, 931271.70 N

Client: Stornoway Port Authority

Sheet 2 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -6.75 mCD

Dates: 28/06/2019 - 03/07/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.20	D36							Soft grey slightly gravelly very silty fine to coarse SAND. Gravel is subangular to subrounded fine.		
10.30 - 10.70	B37				-17.05	10.30		Greyish brown sandy silty subangular to subrounded fine to medium GRAVEL. Sand is fine to coarse.		
10.70	D38					(0.80)				
10.70 - 11.10	B39									
11.20	D40				-17.85	11.10		Medium dense greyish brown very sandy slightly silty subangular to subrounded fine to medium GRAVEL. Sand is fine to coarse.		
11.20 - 11.65	SPT (C)	11.2		N=25 (2,4/5,5,7,8)						
	N=25	0		Hammer SN = 1118						
11.50	D41									
11.50 - 12.00	B42									
12.00	D43									
12.00 - 12.50	B44									
12.20 - 12.65	SPT (C)	12.2		N=30 (3,5/7,9,7,7)						
	N=30	0		Hammer SN = 1118						
12.50	D45					(2.90)				
13.00	D46									
13.00 - 13.50	B47									
13.20 - 13.65	SPT (C)	13.2		N=19 (1,2/4,4,5,6)						
	N=19	0		Hammer SN = 1118						
13.50	D48									
13.50 - 14.00	B49									
14.00 - 14.50	B51				-20.75	14.00		Loose greyish brown very gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium.		
14.20	D50									
14.20 - 14.65	SPT (C)	14.2		N=10 (1,2/2,3,2,3)						
	N=10	0		Hammer SN = 1118						
14.50 - 15.00	B53					(1.50)				
15.00 - 15.50	B55									
15.20	D54									
15.20 - 15.65	SPT (C)	15.2		N=7 (2,2/1,2,2,2)						
	N=7	0		Hammer SN = 1118	-22.25	15.50		Loose greyish brown very gravelly slightly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		
15.50	D56									
15.50 - 16.00	B57					(0.80)				
16.00	D58									
16.30	D52				-23.05	16.30 (0.20)		Soft greyish brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
16.30 - 16.50	B59				-23.25	16.50		Very soft grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
16.50	D60									
16.50 - 17.00	B61									
17.00	D62									
17.00 - 17.50	B63									
17.50	D64									
17.50 - 18.00	B65									
18.00	D66									
18.00 - 18.50	B67					(5.50)				
18.50	D68									
18.50 - 19.00	B69									
19.00	D70									
19.00 - 19.50	B71									
19.50	D72									
19.50 - 20.00	B73									
20.00	D74									

Remarks

Deck to Bed = 15.00m

CPT push 1 from approximately 0.10m to 1.36m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 7.50m to 11.20m (depths TBC on receipt of IN-Situ SI data)

CPT push 3 from approximately 18.10m to 22.60m (depths TBC on receipt of IN-Situ SI data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.20	250
30.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.80	30.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH43

Coordinates: 142554.56 E, 931271.70 N

Client: Stornoway Port Authority

Sheet 3 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -6.75 mCD

Dates: 28/06/2019 - 03/07/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
20.00 - 20.50	B75							Very soft grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
20.50	D76									
20.50 - 21.00	B77									
21.00	D78									
21.00 - 21.50	B79									
21.50	D80									
21.50 - 22.00	B81									
22.00	D82				-28.75	22.00 (0.20)				
22.00 - 22.20	B83				-28.95	22.20		Soft to firm light grey slightly gravelly sandy clayey SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
22.20	D84									
22.20 - 22.50	B85							Medium dense grey sandy silty subangular to subrounded fine to coarse GRAVEL with medium cobble content and pockets of light grey SILT. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
22.50	D86									
22.50 - 23.00	B87									
22.50 - 22.95	SPT (C)	22.5		N=17 (2,3/4,4,4,5)						
	N=17	0		Hammer SN = 1118						
23.00	D88					(1.80)				
23.00 - 23.50	B89									
23.50	D90									
23.50 - 24.00	B91									
24.00	D92				-30.75	24.00				
24.00 - 24.50	B93							Medium dense grey silty SAND and GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
24.00 - 24.45	SPT (C)	24.0		N=21 (2,3/4,5,6,6)						
	N=21	0		Hammer SN = 1118						
24.50	D94									
24.50 - 25.00	B95									
25.00 - 25.50	B96									
25.50 - 25.95	D97					(3.00)				
25.50 - 26.00	B98									
25.50 - 25.95	SPT (S)	25.5		N=21 (3,4/4,5,5,7)						
	N=21	0		Hammer SN = 1118						
26.00	D99									
26.00 - 26.50	B100									
26.50 - 27.00	B101									
27.00 - 27.45	D102				-33.75	27.00				
27.00 - 27.50	B103							Dense grey very gravelly very silty fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
27.00 - 27.45	SPT (S)	27.0		N=33 (2,5/6,9,10,8)						
	N=33	0		Hammer SN = 1118						
27.50	D104									
27.50 - 28.00	B105									
28.00 - 28.50	B106					(2.10)				
28.50 - 28.95	D107									
	SPT (S)	28.5		N=37 (3,4/7,8,11,11)						
	N=37	0		Hammer SN = 1118						
29.10	D108				-35.85	29.10				
29.10 - 29.70	B109					(0.60)		Very stiff grey slightly sandy slightly gravelly CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
29.70 - 30.00	B110				-36.45	29.70 (0.30)		Large BOULDER / possible bedrock.		
30.00	D111				-36.75	30.00				

Remarks

Deck to Bed = 15.00m

CPT push 1 from approximately 0.10m to 1.36m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 7.50m to 11.20m (depths TBC on receipt of IN-Situ SI data)

CPT push 3 from approximately 18.10m to 22.60m (depths TBC on receipt of IN-Situ SI data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.20	250
30.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.80	30.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	30.00

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH43

Coordinates: 142554.56 E 931271.70 N

Client: Stornoway Port Authority

Sheet 4 of 4

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Driller: CC/DA

Ground Level: -6.75 mCD

Dates: 28/06/2019 - 03/07/2019

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
30.00 - 30.02	SPT (C)	30.00		N=50 (25 for 10mm/50 for 15mm) Hammer SN = 1118				End of Borehole at 30.00m		

30.5
31.0
31.5
32.0
32.5
33.0
33.5
34.0
34.5
35.0
35.5
36.0
36.5
37.0
37.5
38.0
38.5
39.0
39.5

Remarks

Deck to Bed = 15.00m

CPT push 1 from approximately 0.10m to 1.36m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 7.50m to 11.20m (depths TBC on receipt of IN-Situ SI data)

CPT push 3 from approximately 18.10m to 22.60m (depths TBC on receipt of IN-Situ SI data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.20	250
30.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
29.80	30.00	02:00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
19-0382	Stornoway Deep Water Port	BH44
Coordinates:	**Client:**	Sheet 1 of 3
142475.83 E	Stornoway Port Authority	
931226.92 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:50
Ground Level: -8.92 mCD	**Dates:** 10/06/2019 - 11/06/2019	**Driller:** CC/DA
		Logger: MK

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.20

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							Medium dense grey slightly sandy slightly silty subrounded to rounded fine to coarse GRAVEL with medium cobble content and shell fragments. Sand is fine to coarse. Cobbles are subrounded to rounded of gneiss.		
1.00	D2					(2.00)				
1.00 - 1.50	B3									
1.50 - 2.00	B4									
1.50 - 1.95	SPT (C) N=14	1.50		N=14 (3,4/4,4,3,3) Hammer SN = 1118						
2.00	D5				-10.92	2.00		Grey sandy slightly silty subrounded to rounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is fine to coarse. Cobbles are subrounded to rounded of gneiss.		
2.00 - 2.50	B6					(0.50)				
2.50	D7				-11.42	2.50		Medium dense grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
2.50 - 3.00	B8									
3.00	D9					(1.00)				
3.00 - 3.50	B10									
3.00 - 3.45	SPT (C) N=13	3.00		N=13 (1,2/3,3,3,4) Hammer SN = 1118						
3.50	D11				-12.42	3.50		Medium dense grey very gravelly slightly silty fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
3.60 - 4.00	B12									
4.00	D14									
4.00 - 4.50	B13					(1.50)				
4.50 - 5.00	B15									
4.50 - 4.95	SPT (C) N=11	4.50		N=11 (1,2/2,3,3,3) Hammer SN = 1118						
5.00	D16				-13.92	5.00		Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. and shell fragments. Sand is fine to coarse. Cobbles are subrounded of gneiss.		
5.50 - 5.80	B17									
6.00	D18									
6.00 - 6.45	SPT (C) N=10	6.00		N=10 (1,2/2,2,3,3) Hammer SN = 1118		(2.50)				
6.50 - 6.80	B19									
7.00	D20									
7.20 - 7.50	B21									
7.50	D22				-16.42	7.50		Loose grey gravelly slightly silty fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of gneiss.		
7.50 - 7.95	SPT (C) N=8	7.50		N=8 (1,1/1,2,2,3) Hammer SN = 1118						
8.00	D23									
8.20 - 8.50	B24					(1.50)				
9.00	D25				-17.92	9.00		Dense grey gravelly slightly silty fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of gneiss.		
9.00 - 9.45	SPT (S) N=36	9.00		N=36 (6,8/10,10,7,9) Hammer SN = 1118						
9.20 - 9.50	B26					(1.50)				
~~10.00~~	~~D27~~									

Remarks

Deck to Bed = 16.50m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.00	250
24.20	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.20

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH44

Coordinates: 142475.83 E, 931226.92 N

Client: Stornoway Port Authority

Sheet 2 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -8.92 mCD

Dates: 10/06/2019 - 11/06/2019

Driller: CC/DA

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
10.20 - 10.50	D28						Dense grey gravelly slightly silty fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of gneiss.
10.50	D64				-19.42	10.50	
10.50 - 10.95	SPT (S) N=15	10.50		N=15 (3,3/4,4,3,4) Hammer SN = 1118			Medium dense grey sightly gravelly silty fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of gneiss.
11.20 - 11.50	B29					(1.50)	
12.00	D30				-20.92	12.00	
12.00 - 13.00	P32			Piston Sample (100%)			Very soft grey sandy slightly gravelly CLAY with shell fragments. Sand is fine to coarse. Gravel is angular to subangular fine to medium.
12.20 - 12.50	B31						
13.00	D37						
13.20 - 13.50	B38						
13.50 - 14.50	P33			Piston Sample (100%)			
14.00	D39						
14.20 - 14.50	B40					(5.40)	
15.00	D41						
15.00 - 16.00	P34			Piston Sample (80%)			
15.50 - 16.00	B42						
16.50 - 17.50	P35			Piston Sample (100%)			
17.50	D43				-26.32	17.40	
17.70 - 18.00	B44					(0.60)	Very soft grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.
18.00 - 19.00	P36			Piston Sample (50%)	-26.92	18.00	Soft grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.
18.70 - 19.00	B45						
19.00	D46					(3.40)	
19.00 - 19.60	B48						
19.50	D49						
19.50 - 20.00	B50						
19.50 - 20.50	P47			Piston Sample (100%)			

Water | Backfill

Remarks

Deck to Bed = 16.50m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.00	250
24.20	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.20

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH44

Coordinates: 142475.83 E, 931226.92 N

Client: Stornoway Port Authority

Sheet 3 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -8.92 mCD

Dates: 10/06/2019 - 11/06/2019

Driller: CC/DA

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
19.50				HVP=49, HVR=20						
20.00	D51							Soft grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
20.50 - 21.00	B52									
21.00	D65									
21.00 - 21.85	P53			Piston Sample (No Recovery)						
21.40 - 21.90	B54				-30.32	21.40				
21.50 - 21.95	SPT (S) N=13	21.50		N=13 (2,2/3,3,3,4) Hammer SN = 1118				Medium dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
22.00	D55									
22.00 - 22.50	B56					(1.60)				
22.50	D57									
22.50 - 23.00	B58									
23.00	D59				-31.92	23.00				
23.00 - 23.50	B60									
23.00 - 23.00	SPT (C)	23.00		N=50 (25 for 0mm/50 for 0mm) Hammer SN = 1118				Very dense grey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
23.50	D61					(1.20)				
23.50 - 24.00	B62									
24.20	D63				-33.12	24.20				
24.20 - 24.38	SPT (C)	24.20		N=50 (25 for 80mm/50 for 100mm) Hammer SN = 1118				End of Borehole at 24.20m		

Remarks

Deck to Bed = 16.50m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.00	250
24.20	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.10

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH45

Coordinates: 142515.40 E 931227.12 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -8.91 mCD

Dates: 24/06/2019 - 25/06/2019

Sheet 1 of 3

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							Grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
0.50	D2					(1.10)				
0.50 - 1.00	B3									
1.00	D4									
1.00 - 1.50	B5				-10.01	1.10		Grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments and medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
1.50	D6				-10.41	(0.40) 1.50		Grey fine to coarse SAND with shell fragments.		
1.50 - 2.00	B7					(0.50)				
2.00	D8				-10.91	2.00		Loose grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with high cobble content and occasional shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
2.00 - 2.50	B9									
2.00 - 2.45	SPT (S)	2.00		N=7 (2,2/1,2,2,2)		(0.50)				
	N=7			Hammer SN = 1118	-11.41	2.50		Loose grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content and occasional shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
2.50	D10									
2.50 - 3.00	B11									
3.00 - 3.50	B12									
3.00 - 3.45	SPT (S)	3.00		N=8 (2,2/1,3,2,2)						
	N=8			Hammer SN = 1118						
3.50	D13									
3.50 - 4.00	B14									
4.00	D15									
4.00 - 4.50	B16									
4.00 - 4.45	SPT (C)	4.00		N=6 (2,1/1,2,1,2)						
	N=6			Hammer SN = 1118		(4.00)				
4.50	D17									
4.50 - 5.00	B18									
5.00	D19									
5.00 - 5.50	B20									
5.00 - 5.45	SPT (C)	5.00		N=6 (1,2/1,1,2,2)						
	N=6			Hammer SN = 1118						
5.50	D21									
5.50 - 6.00	B22									
6.00	D23									
6.00 - 6.50	B24									
6.00 - 6.45	SPT (C)	6.00		N=6 (2,2/2,1,1,2)						
	N=6			Hammer SN = 1118	-15.41	6.50		Loose grey slightly sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content and occasional shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
6.50	D25									
6.50 - 7.00	B26									
7.00	D27									
7.00 - 7.50	B28									
7.00 - 7.45	SPT (C)	7.00		N=6 (1,1/2,1,1,2)						
	N=6			Hammer SN = 1118						
7.50	D29									
7.50 - 8.00	B30					(2.70)				
8.00	D31									
8.00 - 8.50	B32									
8.50	D33									
8.50 - 9.00	B34									
8.50 - 8.95	SPT (C)	8.50		N=7 (2,2/2,1,2,2)						
	N=7			Hammer SN = 1118						
9.00	D35									
9.00 - 9.20	B36				-18.11	9.20		Loose grey very gravelly slightly silty fine to coarse SAND with shell fragments. Gravel is subangular to subrounded fine to medium.		
9.20	D37									
9.20 - 9.80	B38					(0.60)				
9.20 - 9.65	SPT (C)	9.20		N=6 (2,1/2,1,1,2)						
	N=6			Hammer SN = 1118	-18.71	9.80		Soft to firm grey slightly sandy slightly gravelly silty CLAY. Sand is fine to		
9.80	D39									

Remarks

Deck to Bed = 16.70m

CPT push 1 from approximately 0.00m to 2.02m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 10.30m to 19.30m (depths TBC on receipt of IN-Situ SI data)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
10.50	250
24.10	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
24.00	24.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.10

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH45

Coordinates: 142515.40 E, 931227.12 N

Client: Stornoway Port Authority

Sheet 2 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -8.91 mCD

Dates: 24/06/2019 - 25/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
9.80 - 10.00	B40							Soft to firm grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
10.00 - 10.45	D41									
10.00 - 10.50	B42									
10.00 - 10.45	SPT (S)	10.0		N=5 (2,2/3,1,0,1)						
	N=5	0		Hammer SN = 1118						
10.50	D43									
10.50 - 11.00	B44									
11.00	D45									
11.00 - 11.50	B46									
11.50	D47									
11.50 - 12.00	B48									
12.00	D49									
12.00 - 12.50	B50									
12.50	D51									
12.50 - 13.00	B52									
13.00	D53									
13.00 - 13.50	B54									
13.50	D55									
13.50 - 14.00	B56					(7.70)				
14.00	D57									
14.00 - 14.50	B58									
14.50	D59									
14.50 - 15.00	B60									
15.00	D61									
15.00 - 15.50	B62									
15.50	D63									
15.50 - 16.00	B64									
16.00	D65									
16.00 - 16.50	B66									
16.50	D67									
16.50 - 17.00	B68									
17.00	D69									
17.00 - 17.50	B70									
17.50 - 18.00	B71				-26.41	17.50		Soft to firm grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
18.00	D72									
18.00 - 18.50	B73					(1.50)				
18.50	D74									
18.50 - 19.00	B75									
19.00	D76				-27.91	19.00		Medium dense grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
19.00 - 19.50	B77									
19.50 - 19.95	D78					(1.50)				
19.50 - 20.00	B79									
19.50 - 19.95	SPT (S)	19.5		N=16 (2,3/4,4,4,4)						
	N=16	0		Hammer SN = 1118						

Remarks

Deck to Bed = 16.70m

CPT push 1 from approximately 0.00m to 2.02m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 10.30m to 19.30m (depths TBC on receipt of IN-Situ SI data)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
10.50	250
24.10	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
24.00	24.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	24.10

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH45

Coordinates: 142515.40 E, 931227.12 N

Client: Stornoway Port Authority

Sheet 3 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -8.91 mCD

Dates: 24/06/2019 - 25/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
20.00 20.00 - 20.50	D80 B81							Medium dense grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
20.50 20.50 - 21.00	D82 B83				-29.41	20.50		Dense becoming very dense grey very gravelly slightly silty fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
21.00 - 21.50 21.00 - 21.45	B84 SPT (C) N=40	21.00		N=40 (9,9/9,9,10,12) Hammer SN = 1118						
21.50 21.50 - 22.00	D85 B86									
22.00 22.00 - 22.50	D87 B88					(3.50)				
22.50 - 23.00 22.50 - 22.70	B89 SPT (C)	22.50		N=50 (25 for 140mm/50 for 55mm) Hammer SN = 1118						
23.00 23.00 - 23.50 23.50 23.50 - 24.00	D90 B91 D92 B93									
24.00 - 24.10	SPT (C)	24.00		N=50 (25 for 50mm/50 for 50mm) Hammer SN = 1118	-32.91 -33.01	24.00 24.10		Large BOULDER / possible bedrock. End of Borehole at 24.10m		

Remarks

Deck to Bed = 16.70m

CPT push 1 from approximately 0.00m to 2.02m (depths TBC on receipt of IN-Situ SI data)

CPT push 2 from approximately 10.30m to 19.30m (depths TBC on receipt of IN-Situ SI data)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
10.50	250
24.10	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
24.00	24.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	19.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH46

Coordinates: 142554.88 E, 931228.80 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Driller: CC/DA

Ground Level: -9.13 mCD

Dates: 09/06/2019 - 10/06/2019

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
0.00 - 0.50	B1						Very loose grey very sandy silty subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.
0.50 - 1.00	B3						
1.00	D2					(2.00)	
1.00 - 1.50	B4						
1.50 - 1.95	SPT (S) N=2	1.50		N=2 (1,1/0,1,0,1) Hammer SN = 1118			
2.00	D5				-11.13	2.00	Grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with occasional shell fragments. Sand is fine to coarse.
2.00 - 2.50	B6					(0.60)	
2.50 - 3.00	B7						
	B8				-11.73	2.60	Medium dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments and low cobble content. Sand is fine to coarse. Cobbles are angular of gneiss.
3.00	D9						
3.00 - 3.50	B10						
3.00 - 3.45	SPT (C) N=13	3.00		N=13 (2,3/4,3,3,3) Hammer SN = 1118		(1.90)	
4.00	D11						
4.00 - 4.50	B12						
4.50 - 4.95	SPT (C) N=1	4.50		N=1 (1,0/0,0,0,1) Hammer SN = 1118	-13.63	4.50	Very loose grey very gravelly fine to coarse SAND with low cobble content and shell fragments. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular of gneiss.
4.60 - 5.00	B13					(0.50)	
5.00	D14				-14.13	5.00	Grey and brownish red slightly clayey subangular to subrounded fine to coarse GRAVEL with occasional shell fragments. Sand is fine to coarse.
5.00 - 6.60	B15					(1.10)	
6.00	D16						
6.00 - 6.45	D17				-15.23	6.10 (0.25)	Soft greenish grey sandy CLAY with occasional shell fragments. Sand is fine to coarse.
6.00 - 6.50	B18				-15.48	6.35	
6.00 - 6.45	SPT (S) N=32	6.00		N=32 (3,4/6,8,12,6) Hammer SN = 1118			Medium dense grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.
7.00	D19						
7.00 - 7.50	B20					(1.60)	
7.50 - 7.95	SPT (C) N=19	7.50		N=19 (4,4/4,5,5,5) Hammer SN = 1118			
8.00	D25				-17.08	7.95	Grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of gneiss.
8.50 - 8.80	B26				-17.63	(0.55) 8.50	Very soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.
9.00 - 10.00	P21			Piston Sample (100%)			
~~10.00 - 10.30~~	B27						

Water: Backfill

Remarks

Deck to Bed = 16.50m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
19.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	19.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH46

Coordinates: 142554.88 E 931228.80 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -9.13 mCD

Dates: 09/06/2019 - 10/06/2019

Sheet 2 of 2

Scale: 1:50

Driller: CC/DA

Logger: MK

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
10.50 - 11.50	P22			Piston Sample (100%)						
11.50 - 11.80	B29					(4.70)				
12.00	D28									
12.00 - 12.45	SPT (S) N=1	12.00		N=1 (1,0/0,1,0,0) Hammer SN = 1118						
12.50 - 12.80	B30									
13.00	D31									
13.20 - 13.50	B32				-22.33	13.20		Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and widely spaced beds of sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of gneiss. Cobbles and boulders are subrounded of gneiss.		
13.50 - 13.95	U23			Ublow=39 100%						
14.00	D33									
14.50 - 14.80	B34									
15.00	D35									
15.00 - 15.22	SPT (S)	15.00		N=50 (9,11/50 for 65mm) Hammer SN = 1118						
15.50 - 15.80	B36									
16.00	D37									
16.50 - 16.80	B38					(6.30)				
16.50 - 16.95	SPT (S) N=20	16.50		N=20 (4,3/4,5,5,6) Hammer SN = 1118						
17.00	D39									
17.50 - 17.80	B40									
18.00	D41									
18.00 - 18.45	U24			Ublow=72 0%						
18.50 - 18.80	B42									
19.50	D43				-28.63	19.50				
19.50 - 19.95	SPT (S) N=27	19.50		N=27 (3,4/5,6,7,9) Hammer SN = 1118				End of Borehole at 19.50m		

Remarks

Deck to Bed = 16.50m

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
19.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	14.10

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH47

Coordinates: 142476.25 E 931164.78 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -11.44 mCD

Dates: 21/06/2019 - 22/06/2019

Sheet 1 of 2

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
0.00 - 1.00	B1						Very soft greenish grey CLAY with shell fragments.
1.00	D2					(2.00)	
1.00 - 1.45	D14						
1.00 - 1.50	B3						
1.00 - 1.45	SPT (S)	1.00		N=0 (0,0/0,0,0,0) Hammer SN = 1118			
1.50	D4						
1.50 - 2.00	B5						
2.00	D6				-13.44	2.00	Very soft greenish grey slightly sandy slightly gravelly CLAY with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.
2.00 - 2.50	B7						
2.50 - 3.00	B8					(1.70)	
3.00	D9						
3.00 - 3.70	B10						
3.70 - 4.15	SPT (C) N=12	3.70		N=12 (1,1/2,3,3,4) Hammer SN = 1118	-15.14	3.70	Medium dense grey slightly gravelly slightly silty fine to medium SAND with occasional shell fragments. Gravel is subangular to subrounded fine to coarse.
3.90 - 4.20	B11						
4.50 - 5.00	B12					(1.30)	
5.00	D13				-16.44	5.00	Very soft greenish grey slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravels are subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.
5.00 - 5.50	B15						
5.50	D16						
5.60 - 6.05	D17						
	SPT (S) N=1	5.60		N=1 (1,0/0,1,0,0) Hammer SN = 1118		(1.80)	
6.80	D18				-18.24	6.80	Very soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.
6.80 - 7.30	B19						
7.30	D20						
7.30 - 8.00	B21						
8.00	D22						
8.00 - 8.50	B23						
8.50	D24					(4.20)	
8.50 - 9.00	B25						
9.00	D26						
9.00 - 9.50	B27						
9.50	D28						
9.50 - 10.00	B29						
~~10.00~~	D30						

Water

Backfill

Remarks

Deck to Bed = 15.80m at start of borehole

Drilled from floating (spudded) platform

CPT push from 7.50m to 11.63m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
14.10	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
14.00	14.10	02:00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
19-0382	Stornoway Deep Water Port	BH47
Coordinates:	**Client:**	Sheet 2 of 2
142476.25 E	Stornoway Port Authority	
931164.78 N	**Client's Representative:** Wallace Stone Consulting Civil Engineers	**Scale:** 1:50
Ground Level: -11.44 mCD	**Dates:** 21/06/2019 - 22/06/2019	**Driller:** CC/DA
		Logger: JG

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	14.10

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 10.50	B31							Very soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
10.50	D32									
10.50 - 11.00	B33									
11.00	D34				-22.44	11.00				
11.00 - 11.50	B35							Dense grey to dark grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
11.50	D36									
11.50 - 12.00	B37									
12.00 - 12.45	D38									
12.00 - 12.50	B39									
12.00 - 12.45	SPT (S) N=48	12.00		N=48 (8,8/9,8,11,20) Hammer SN = 1118						
12.50	D40					(3.00)				
12.50 - 13.00	B41									
13.00	D42									
13.00 - 13.50	B43									
13.50 - 13.80	D44									
13.50 - 14.00	B45									
13.50 - 13.80	SPT (S)	13.50		N=50 (7,11/50 for 150mm) Hammer SN = 1118	-25.44	14.00				
					-25.54	14.10		Large BOULDER / possible bedrock.		
14.00	D46							End of Borehole at 14.10m		
14.00 - 14.06	SPT (S)	14.00		N=50 (25 for 25mm/50 for 40mm) Hammer SN = 1118						

Remarks

Deck to Bed = 15.80m at start of borehole
Drilled from floating (spudded) platform
CPT push from 7.50m to 11.63m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
14.10	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
14.00	14.10	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	22.40

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Coordinates: 142514.93 E 931171.43 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -11.92 mCD

Dates: 17/06/2019 - 18/06/2019

Borehole No.: BH48

Sheet 1 of 3

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.00 - 0.50	B1							Very soft greenish grey CLAY with shell fragments.
0.50	D2							
0.50 - 1.00	B3							
1.00	D4							
1.00 - 1.50	B5							
1.50 - 1.95	D6							
1.50 - 2.00	B7							
1.50 - 1.95	SPT (S)	1.50		N=0 (0,0/0,0,0,0) Hammer SN = 1118				
2.00	D8							
2.00 - 3.00	B9					(4.50)		
3.00	D10							
3.00 - 4.00	B11							
4.00	D12							
4.00 - 4.80	B13							
4.50 - 4.95	D14				-16.42	4.50		Medium dense grey gravelly clayey fine to medium SAND with occasional shell fragments. Gravel is subangular to subrounded fine to medium.
	SPT (S) N=19	4.50		N=19 (2,2/3,4,6,6) Hammer SN = 1118				
5.00	D15							
5.00 - 5.50	B16					(1.50)		
6.00 - 6.45	D17				-17.92	6.00		Medium dense grey slightly gravelly very clayey fine to coarse SAND with occasional shell fragments. Gravel is subangular to subrounded fine.
6.00 - 6.50	B18							
6.00 - 6.45	SPT (S) N=16	6.00		N=16 (1,2/3,3,5,5) Hammer SN = 1118				
6.50 - 7.00	B19							
	D20					(1.50)		
7.00	D21							
7.00 - 7.50	B22							
7.50 - 7.95	D23				-19.42	7.50		Very soft thinly laminated blackish grey organic slightly sandy slightly gravelly clayey SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine.
	SPT (S) N=2	7.50		N=2 (2,3/1,0,1,0) Hammer SN = 1118				
7.80	D24							
7.80 - 8.50	B25							
8.50 - 9.00	B26							
	D27					(3.00)		
9.00 - 10.00	P28			Piston Sample (No Recovery)				
~~10.00 - 10.45~~	~~UT29~~			~~Ublow=18 100%~~				

Water: Backfill

Remarks

Deck to Bed = 16.30m at start of borehole

Drilled from floating (spudded) platform

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
22.40	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
18.90	19.10	01:30
20.40	20.60	01:30
22.30	22.40	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	22.40

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH48

Coordinates: 142514.93 E, 931171.43 N

Client: Stornoway Port Authority

Sheet 2 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -11.92 mCD

Dates: 17/06/2019 - 18/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Very soft thinly laminated blackish grey organic slightly sandy slightly gravelly clayey SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
					-22.42	10.50		Very soft grey slightly sandy slightly gravelly CLAY with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
11.00	D30									
11.00 - 11.50	B31									
11.50 - 11.95	UT32	11.50		Ublow=15 100%						
12.00	D33									
12.00 - 12.50	B34									
12.50	D35									
12.50 - 13.00	B36									
13.00 - 14.00	P37			Piston Sample (No Recovery)		(5.90)				
14.00 - 14.45	UT38			Ublow=7 100%						
14.50	D39									
14.50 - 15.00	B40									
15.00	D41									
15.00 - 15.50	B42									
15.50 - 15.95	UT43	15.50		Ublow=12 100%						
16.00	D44									
16.40 - 17.00	B45				-28.32	16.40		Medium dense grey slightly sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
17.00	D46									
17.00 - 17.50	B47									
17.00 - 17.45	SPT (S) N=27	17.00		N=27 (6,9/7,7,6,7) Hammer SN = 1118		(2.10)				
17.50	D48									
17.50 - 18.00	B49									
18.00	D50									
18.00 - 18.50	B51									
18.50 - 19.00	B52				-30.42	18.50		Very dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
18.50 - 18.77	SPT (C)	18.50		N=50 (6,18/50 for 120mm) Hammer SN = 1118						
19.00	D53									
19.00 - 19.50	B54					(1.50)				
19.50	D55									
19.50 - 20.00	B56									
20.00	D57				-31.92	20.00				

Remarks

Deck to Bed = 16.30m at start of borehole

Drilled from floating (spudded) platform

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
22.40	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
18.90	19.10	01:30
20.40	20.60	01:30
22.30	22.40	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	22.40

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH48

Coordinates: 142514.93 E, 931171.43 N

Client: Stornoway Port Authority

Sheet 3 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -11.92 mCD

Dates: 17/06/2019 - 18/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
20.00 - 20.50	B58									
20.00 - 20.26	SPT (C)	20.00		N=50 (4,19/50 for 110mm) Hammer SN = 1118				Very dense grey silty gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.		
20.50	D59									
20.50 - 21.00	B60					(1.50)				
21.00	D61									
21.00 - 21.50	B62									
21.50	D63				-33.42	21.50				
21.50 - 22.00	B64							Very dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
21.50 - 21.62	SPT (C)	21.50		N=50 (25 for 70mm/50 for 55mm) Hammer SN = 1118		(0.90)				
22.00	D65				-34.32	22.40				
22.00 - 22.30	B66							End of Borehole at 22.40m		
22.30	D67									
22.40 - 22.40	SPT (C)	22.40		N=50 (25 for 0mm/50 for 5mm) Hammer SN = 1118						

Remarks

Deck to Bed = 16.30m at start of borehole

Drilled from floating (spudded) platform

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
11.50	250
22.40	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
18.90	19.10	01:30
20.40	20.60	01:30
22.30	22.40	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	23.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH49

Coordinates: 142554.83 E, 931181.93 N

Client: Stornoway Port Authority

Sheet 1 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -9.90 mCD

Dates: 26/06/2019 - 27/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							Grey sandy subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
0.50	D2									
0.50 - 1.00	B3									
1.00	D4									
1.00 - 1.50	B5									
1.50	D6					(3.00)				
1.50 - 2.00	B7									
2.00	D8									
2.00 - 2.50	B9									
2.50	D10									
2.50 - 3.00	B11									
3.00	D12				-12.90	3.00		Dark grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
3.00 - 3.50	B13									
3.50	D14									
3.50 - 4.00	B15									
4.00	D16					(2.00)				
4.00 - 4.50	B17									
4.50	D18									
4.50 - 5.00	B19									
5.00	D20				-14.90	5.00		Very soft dark brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
5.00 - 5.50	B21									
5.50	D22									
5.50 - 6.00	B23					(1.50)				
6.00	D24									
6.00 - 6.50	B25									
6.50	D26				-16.40	6.50		Soft to firm dark grey slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
6.50 - 7.00	B27									
7.00	D28									
7.00 - 7.50	B29					(1.50)				
7.50	D30									
7.50 - 8.00	B31									
8.00	D32				-17.90	8.00		Very soft grey slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
8.00 - 8.50	B33									
8.50	D34									
8.50 - 9.00	B35									
9.00	D36					(4.00)				
9.00 - 9.50	B37									
9.50	D38									
9.50 - 10.00	B39									
~~10.00~~	~~D40~~									

Remarks

Deck to Bed = 16.40m

CPT push 1 from 0.00m to 12.40m (below bed) (TBC based on IN-Situ data)

No recovery 14.20-15.60m due to pushing boulder ahead of casing

No UT100's in lower stiff to very stiff clays due to cobble content

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
9.00	250
23.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.00	13.20	01:00
14.20	15.60	01:00
18.10	18.70	01:00
20.50	21.00	01:00
22.50	23.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	23.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH49

Coordinates: 142554.83 E, 931181.93 N

Client: Stornoway Port Authority

Sheet 2 of 3

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -9.90 mCD

Dates: 26/06/2019 - 27/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 10.50	B41							Very soft grey slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
10.50	D42									
10.50 - 11.00	B43									
11.00	D44									
11.00 - 11.50	B45									
11.50	D46									
11.50 - 12.00	B47									
12.00	D48				-21.90	12.00				
12.00 - 12.40	B49							Stiff grey slightly sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
12.40	D50									
12.40 - 12.41	SPT (S)	12.40		N=50 (25 for 5mm/50 for 5mm) Hammer SN = 1118						
13.20	D51									
13.20 - 13.50	B52									
13.40 - 13.85	D53									
	SPT (S)	13.40		N=16 (3,4/4,4,3,5)						
	N=16	0		Hammer SN = 1118		(3.60)				
13.50 - 14.00	B54									
14.00	D55									
15.60	D56				-25.50	15.60				
15.60 - 16.00	B57							Stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
16.00 - 16.50	B58									
16.40 - 16.85	D59									
	SPT (S)	16.40		N=48 (8,8/20,15,7,6)						
	N=48	0		Hammer SN = 1118						
16.50	D60									
16.50 - 17.00	B61									
17.40 - 17.85	D62									
	SPT (S)	17.40		N=41		(3.90)				
	N=41	0		(9,8/8,12,10,11) Hammer SN = 1118						
18.70	D63									
18.90 - 19.30	D64									
	SPT (S)	18.40		N=50 (8,12/50 for 255mm) Hammer SN = 1118						
19.00	D65				-29.40	19.50				
19.00 - 19.50	B66							Very stiff grey very sandy gravelly CLAY with medium to high cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to		
19.50	D67									
19.80 - 20.40	B68									

Remarks

Deck to Bed = 16.40m

CPT push 1 from 0.00m to 12.40m (below bed) (TBC based on IN-Situ data)

No recovery 14.20-15.60m due to pushing boulder ahead of casing

No UT100's in lower stiff to very stiff clays due to cobble content

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
9.00	250
23.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.00	13.20	01:00
14.20	15.60	01:00
18.10	18.70	01:00
20.50	21.00	01:00
22.50	23.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	23.50

Project No.: 19-0382	**Project Name:** Stornoway Deep Water Port
Coordinates: 142554.83 E 931181.93 N	**Client:** Stornoway Port Authority
	Client's Representative: Wallace Stone Consulting Civil Engineers
Ground Level: -9.90 mCD	**Dates:** 26/06/2019 - 27/06/2019

Borehole No.: BH49

Sheet 3 of 3

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
20.40 - 20.76	SPT (C)	20.40		N=50 (5,10/50 for 210mm) Hammer SN = 1118				Very stiff grey very sandy gravelly CLAY with medium to high cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
20.50 - 21.00	B69									
21.00	D70									
21.00 - 21.50	B71									
21.50	D72									
21.50 - 22.00	B73									
21.50 - 21.78	SPT (C)	21.50		N=50 (6,11/50 for 135mm) Hammer SN = 1118		(4.00)				
22.00	D74									
22.00 - 22.50	B75									
22.50	D76									
22.50 - 23.00	B77									
23.00 - 23.50	B78									
23.00 - 23.08	SPT (C)	23.00		N=50 (25 for 45mm/50 for 35mm) Hammer SN = 1118	-33.40	23.50		End of Borehole at 23.50m		
23.50 - 23.62	SPT (C)	23.50		N=50 (25 for 75mm/50 for 50mm) Hammer SN = 1118						

Remarks

Deck to Bed = 16.40m

CPT push 1 from 0.00m to 12.40m (below bed) (TBC based on IN-Situ data)

No recovery 14.20-15.60m due to pushing boulder ahead of casing

No UT100's in lower stiff to very stiff clays due to cobble content

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
9.00	250
23.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.00	13.20	01:00
14.20	15.60	01:00
18.10	18.70	01:00
20.50	21.00	01:00
22.50	23.00	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	14.20

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH50

Coordinates: 142515.72 E 931122.33 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -13.58 mCD

Dates: 18/06/2019 - 19/06/2019

Sheet 1 of 2

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							Very soft grey slightly sandy SILT with occasional shell fragments. Sand is fine to medium.		
0.50 - 1.00	B2									
1.00 - 1.45	D3									
1.00 - 1.50	B4									
1.00 - 1.45	SPT (S) N=2	1.00		N=2 (0,0/1,0,1,0) Hammer SN = 1118						
1.50 - 2.00	B5					(3.50)				
2.00 - 2.45	D6									
2.00 - 2.50	B7									
2.00 - 2.45	SPT (S) N=2	2.00		N=2 (1,0/0,0,1,1) Hammer SN = 1118						
2.50 - 3.00	B8									
3.00 - 3.45	D9									
3.00 - 3.50	B10									
3.00 - 3.45	SPT (S) N=2	3.00		N=2 (0,0/1,0,0,1) Hammer SN = 1118						
3.50 - 4.00	B11				-17.08	3.50		Loose grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL with occasional shell fragments. Sand is fine to coarse.		
4.00 - 4.45	D12					(1.00)				
	SPT (S) N=8	4.00		N=8 (1,3/3,2,1,2) Hammer SN = 1118						
4.50	D13				-18.08	4.50		Very soft grey slightly gravelly sandy clayey SILT with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.		
4.50 - 5.00	B14									
5.00 - 6.00	P15			Piston Sample (100%)						
						(2.50)				
6.00 - 7.00	P16	6.00		Piston Sample (100%)						
7.00 - 8.00	P17			Piston Sample (100%)	-20.58	7.00		Very soft grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
8.00	D18									
8.00 - 8.50	B19									
8.50	D20					(5.50)				
8.50 - 9.00	B21									
9.00 - 10.00	P22			Piston Sample (100%)						

Remarks

Deck to Bed = 19.00m at start of borehole

Drilled from floating (spudded) platform

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	14.20

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH50

Coordinates: 142515.72 E 931122.33 N

Client: Stornoway Port Authority

Sheet 2 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -13.58 mCD

Dates: 18/06/2019 - 19/06/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 11.00	P23			Piston Sample (No Recovery)				Very soft grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
11.00	D24									
11.00 - 11.45	D25									
11.00 - 11.50	B26									
11.00 - 11.45	SPT (S) N=4	11.00		N=4 (2,1/0,1,2,1) Hammer SN = 1118						
11.50 - 12.00	B27									
12.00	D28									
12.00 - 12.50	B29									
12.50 - 12.95	D30				-26.08	12.50		Medium dense to very dense grey very sandy slightly clayey subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
12.50 - 13.00	B31									
12.50 - 12.95	SPT (S) N=19	12.50		N=19 (3,3/5,5,4,5) Hammer SN = 1118						
13.00	D32									
13.00 - 13.50	B33					(1.70)				
13.50	D34									
13.50 - 14.00	B35									
14.20 - 14.57	SPT (S)	14.20		N=50 (6,10/50 for 220mm) Hammer SN = 1118	-27.78	14.20		End of Borehole at 14.20m		

Remarks

Deck to Bed = 19.00m at start of borehole

Drilled from floating (spudded) platform

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
14.20	250

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	0.70
Cone Penetration Test	CPT mini-rig	0.70	12.60

Project No.: 19-0382	**Project Name:** Stornoway Deep Water Port
Coordinates: 142515.95 E 931119.31 N	**Client:** Stornoway Port Authority
	Client's Representative: Wallace Stone Consulting Civil Engineers
Ground Level: -13.22 mCD	**Dates:** 20/06/2019 - 21/06/2019

Borehole No.: BH50A

Sheet 1 of 2

Scale: 1:50

Driller: DA+DM

Logger: JFG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(3.50)		Very soft grey slightly sandy SILT with occasional shell fragments. Sand is fine to medium.
					-16.72	3.50		Loose grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL with occasional shell fragments. Sand is fine to coarse.
						(1.00)		
					-17.72	4.50		Very soft grey slightly gravelly sandy clayey SILT with occasional shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.
						(2.50)		
					-20.22	7.00		Very soft grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.
						(2.77)		
					-22.99	9.77		Medium dense to very dense very sandy slightly clayey subangular to

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Deck to Bed = 15.40m at start of borehole

Drilled from floating (spudded) platform

CPT push from approximately 0.00m to 9.77m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
0.70	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	0.70
Cone Penetration Test	CPT mini-rig	0.70	12.60

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH50A

Coordinates: 142515.95 E 931119.31 N

Client: Stornoway Port Authority

Sheet 2 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Driller: DA+DM

Ground Level: -13.22 mCD

Dates: 20/06/2019 - 21/06/2019

Logger: JFG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(2.83)		Medium dense to very dense very sandy slightly clayey subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
					-25.82	12.60		End of Borehole at 12.60m		

Remarks

Deck to Bed = 15.40m at start of borehole

Drilled from floating (spudded) platform

CPT push from approximately 0.00m to 9.77m (below bed)

Terminated on instruction of Engineer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
0.70	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	19.40

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH51

Coordinates: 142515.44 E, 931146.99 N

Client: Stornoway Port Authority

Sheet 1 of 2

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -13.63 mCD

Dates: 04/07/2019 - 06/07/2019

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 1.00	B1							Very soft grey slightly sandy slightly gravelly CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
1.00	D2									
1.00 - 2.00	B3					(3.00)				
2.00	D4									
2.00 - 3.00	B5									
3.00	D6				-16.63	3.00		Grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with shell fragments. Sand is fine to coarse.		
3.00 - 4.00	B7					(1.00)				
4.00	D8				-17.63	4.00		Very soft grey slightly gravelly very silty fine to coarse SAND with shell fragments. Gravel is subangular to subrounded fine.		
4.00 - 5.00	B9									
5.00	D10									
5.00 - 6.00	B11					(3.00)				
6.00	D12									
6.00 - 7.00	B13									
7.00	D14				-20.63	7.00		Very soft grey and dark grey thinly laminated slightly sandy slightly gravelly CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
7.00 - 8.00	B15									
8.00	D16									
8.00 - 9.00	B17					(4.00)				
9.00	D18									
9.00 - 10.00	B19									
~~10.00~~	~~D20~~									

Remarks

Deck to Bed = 17.50m at start of borehole

Drilled from floating (spudded) platform

CPT push from approximately 0.00m to 15.96m (TBC based on IN-Situ data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.50	250
19.40	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
19.30	19.40	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	19.40

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Coordinates: 142515.44 E 931146.99 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -13.63 mCD

Dates: 04/07/2019 - 06/07/2019

Borehole No.: BH51

Sheet 2 of 2

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 11.00	B21							Very soft grey and dark grey thinly laminated slightly sandy slightly gravelly CLAY with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
11.00	D22				-24.63	11.00				
11.00 - 12.00	B23							Very soft grey slightly sandy slightly gravelly CLAY with low cobble content and shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded of gneiss.		
12.00	D24									
12.00 - 13.00	B25									
13.00	D26					(4.00)				
13.00 - 14.00	B27									
14.00	D28									
14.00 - 15.00	B29									
15.00	D30				-28.63	15.00				
15.00 - 15.50	B31							Very soft to soft light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
15.50 - 16.10	B32					(1.10)				
16.00	D33									
16.10 - 17.00	B34				-29.73	16.10		Very dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of gneiss.		
16.50	D35									
16.50 - 16.88	SPT (C)	16.50		N=50 (7,9/50 for 230mm) Hammer SN = 1118						
17.00 - 18.00	B36									
18.00	D37					(3.20)				
18.00 - 19.00	B38									
18.00 - 18.44	SPT (C)	18.00		N=50 (5,7/50 for 295mm) Hammer SN = 1118						
19.30	D39				-32.93	19.30				
19.30 - 19.34	SPT (C)	19.30		N=50 (25 for 10mm/50 for 25mm) Hammer SN = 1118	-33.03	19.40		Large BOULDER / possible bedrock. End of Borehole at 19.40m		

Remarks

Deck to Bed = 17.50m at start of borehole

Drilled from floating (spudded) platform

CPT push from approximately 0.00m to 15.96m (TBC based on IN-Situ data)

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
15.50	250
19.40	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
19.30	19.40	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	17.57

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH52

Coordinates: 142518.01 E 931190.60 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -10.95 mCD

Dates: 03/07/2019 - 04/07/2019

Sheet 1 of 2

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00	D6									
0.00 - 0.50	B5					(0.50)		Soft grey SILT with shell fragments.		
	ES1									
0.50 - 1.00	ES2				-11.45	0.50				
0.50 - 1.50	B7							Grey very sandy slightly silty subrounded to rounded fine to coarse GRAVEL. Sand is fine to coarse.		
1.00	D8									
1.00 - 1.50	ES3									
1.50 - 2.00	B9									
	ES4									
2.00	D10					(3.20)				
2.50 - 3.50	B11									
3.00	D12									
3.70 - 4.50	B13				-14.65	3.70				
4.00	D14							Grey sandy slightly silty subrounded to rounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded of gneiss.		
4.50 - 5.50	B15									
5.00	D16									
5.50 - 6.50	B17									
6.00	D18					(4.60)				
6.50 - 7.50	B19									
7.00	D20									
8.30 - 9.00	B21				-19.25	8.30				
8.50	D22							Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.		
9.00 - 10.00	B23					(2.70)				
9.50	D24									
~~10.00 - 11.00~~	B25									

Remarks

Deck to Bed = 17.80m

CPT push from approximately 0.00m to 15.60m (below bed)

Dredge Analysis samples recovered

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
9.20	250
17.57	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
17.51	17.57	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	17.57

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH52

Coordinates: 142518.01 E 931190.60 N

Client: Stornoway Port Authority

Client's Representative: Wallace Stone Consulting Civil Engineers

Ground Level: -10.95 mCD

Dates: 03/07/2019 - 04/07/2019

Sheet 2 of 2

Scale: 1:50

Driller: CC/DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50	D26							Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.		
11.00 - 12.00	B27				-21.95	11.00				
11.50	D28							Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine.		
12.00 - 13.00	B29									
12.50	D31									
13.00 - 14.00	B30					(4.40)				
13.50	D32									
14.00 - 15.00	B33									
14.50	D34									
15.40 - 16.00	B35				-26.35	15.40				
15.50	D36							Dense grey sandy slightly silty subangular to subrounded fine to coarse GRAVEL with low cobble and boulder content. Sand is fine to coarse. Cobbles and boulders are subangular to subrounded of gneiss.		
15.50 - 15.95	SPT (C) N=39	15.50		N=39 (4,6/9,9,11,10) Hammer SN = 1118						
16.00	D38									
16.00 - 16.70	B37									
16.50	D39					(2.11)				
16.50 - 16.95	SPT (C) N=41	16.50		N=41 (8,10/10,9,10,12) Hammer SN = 1118						
17.50 - 17.58	SPT (C)	17.50		N=50 (25 for 60mm/50 for 25mm) Hammer SN = 1118	-28.46 -28.52	(17.51) (17.57)		Large BOULDER / possible bedrock. End of Borehole at 17.57m		

Remarks

Deck to Bed = 17.80m

CPT push from approximately 0.00m to 15.60m (below bed)

Dredge Analysis samples recovered

Terminated on large boulder/bedrock

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
9.20	250
17.57	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
17.51	17.57	02:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 3000	0.00	4.50

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Borehole No.: BH53

Coordinates: 142545.04 E 931249.45 N

Client: Stornoway Port Authority

Sheet 1 of 1

Client's Representative: Wallace Stone Consulting Civil Engineers

Scale: 1:50

Ground Level: -8.59 mCD

Dates: 06/07/2019 - 06/07/2019

Driller: DA

Logger: JG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.50	ES1							Very soft grey slightly sandy slightly gravelly clayey SILT with shell fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
0.50 - 1.00	ES2									
						(1.50)				
1.00 - 1.50	ES3									
1.50 - 2.00	ES4				-10.09	1.50		Grey sandy silty subangular to subrounded fine to coarse GRAVEL with low cobble content and shell fragments. Sand is fine to coarse. Cobbles are subrounded of gneiss.		
2.00 - 2.50	ES5									
2.50 - 3.00	ES6									
3.00 - 3.50	ES7					(3.00)				
3.50 - 4.00	ES8									
4.00 - 4.50	ES9									
					-13.09	4.50		End of Borehole at 4.50m		

Remarks

Deck to Bed = 12.50m at start of borehole

Drilled from floating (spudded)

Borehole carried out for Dredge Analysis samples only

Terminated at scheduled depth

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
4.50	250

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

APPENDIX C

GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

1 October 2019

Project Name:	Stornoway Deep Water Port
Project No.:	19-0382
Client:	Stornoway Port Authority
Engineer:	Wallace Stone Consulting Civil Engineers

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

[redacted]

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

SCS ISO 9001 CERTIFIED
SCS ISO 14001 CERTIFIED
SCS ISO 45001 CERTIFIED
UKAS MANAGEMENT SYSTEMS 9235
UKAS TESTING 10122
AGS
BRITISH DRILLING ASSOCIATION

Project Name: Stornoway Deep Water Port

Report Reference: G01 - FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	17
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	17
SOIL	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	14
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	17
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	4
SOIL	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	7
	Extra over days (more than initial 5 days)		14
SOIL	Undrained shear strength – triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 9	4

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	9
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	9
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Direct Shear Strength using 60mm Small Shearbox (up to 3 days)	BS 1377-7: 1990: Cl 4	24
	Extra over days (more than initial 3 days)		9
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Effective shear strength consolidated undrained triaxial compression test with measurement of volume change (up to 4 days)	BS 1377-8:1990	5
	Extra over days (more than initial 4 days)		22
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	1
	Extra over days (more than initial 5 days)		2

Summary of Classification Test Results

CAUSEWAY GEOTECH

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH42	2	0.40		B	Grey sandy gravelly silty CLAY with shell fragments.			13.0	23	40 -1pt	22	18		CI
BH42	20	11.50		B	Brown slightly gravelly slightly silty fine to coarse SAND.	1.90	1.62	20.0	71	27 -1pt	NP			
BH42	22	13.00		B	Brown slightly gravelly slightly silty fine to coarse SAND.	1.99	1.62	23.0	97	27 -1pt	NP			
BH42	28	16.00		D	Brownish grey sandy slightly gravelly silty CLAY.			49.0	94	39 -1pt	16	23		CI
BH42	33	18.50		B	Brownish grey sandy slightly gravelly silty CLAY.	2.09	1.72	22.0	67	29 -1pt	17	12		CL
BH42	39	22.30		D	Brownish grey sandy slightly gravelly silty CLAY.			23.0	95	55 -1pt	26	29		CH
BH42	43	23.00		D	Brownish grey sandy slightly gravelly silty CLAY.			33.0	97	35 -1pt	15	20		CL/CI
BH42	41	24.00		B	Brownish grey sandy slightly gravelly silty CLAY.			31.0	97	36 -1pt	15	21		CI
BH42	46	25.30		B	Brownish grey sandy slightly gravelly silty CLAY.			20.0	71	25 -1pt	12	13		CL
BH42	50	28.50		B	Grey sandy slightly gravelly CLAY.	2.16	2.04	6.8	37	21 -1pt	13	8		CL
BH44	42	15.50		B	Brownish grey slightly gravelly silty CLAY.	1.95	1.50	32.0	96	30 -1pt	16	14		CL
BH44	44	17.70		B	Brownish grey slightly gravelly silty CLAY.	1.84	1.35	39.0	94	41 -1pt	19	22		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

19/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

CAUSEWAY GEOTECH

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH44	45	18.70		B	Brownish grey slightly gravelly silty CLAY.	1.83	1.32	40.0	89	37 -1pt	16	21		CI
BH46	18	6.00		B	Greenish grey sandy gravelly silty CLAY with occasional shell fragments.	2.15	1.81	13.0	43	32 -1pt	18	14		CL
BH46	26	8.50		B	Greenish grey sandy slightly gravelly silty CLAY with occasional shell fragments.	2.08	1.72	25.0	92	28 -1pt	16	12		CL
BH46	29	11.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.95	1.43	42.0	85	43 -1pt	17	26		CI
BH46	34	14.50		B	Greyish brown sandy slightly gravelly SILT/ CLAY.	1.94	1.55	34.0	82	49 -1pt	28	21		MI/CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

19/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

Density Tests - Summary of Results

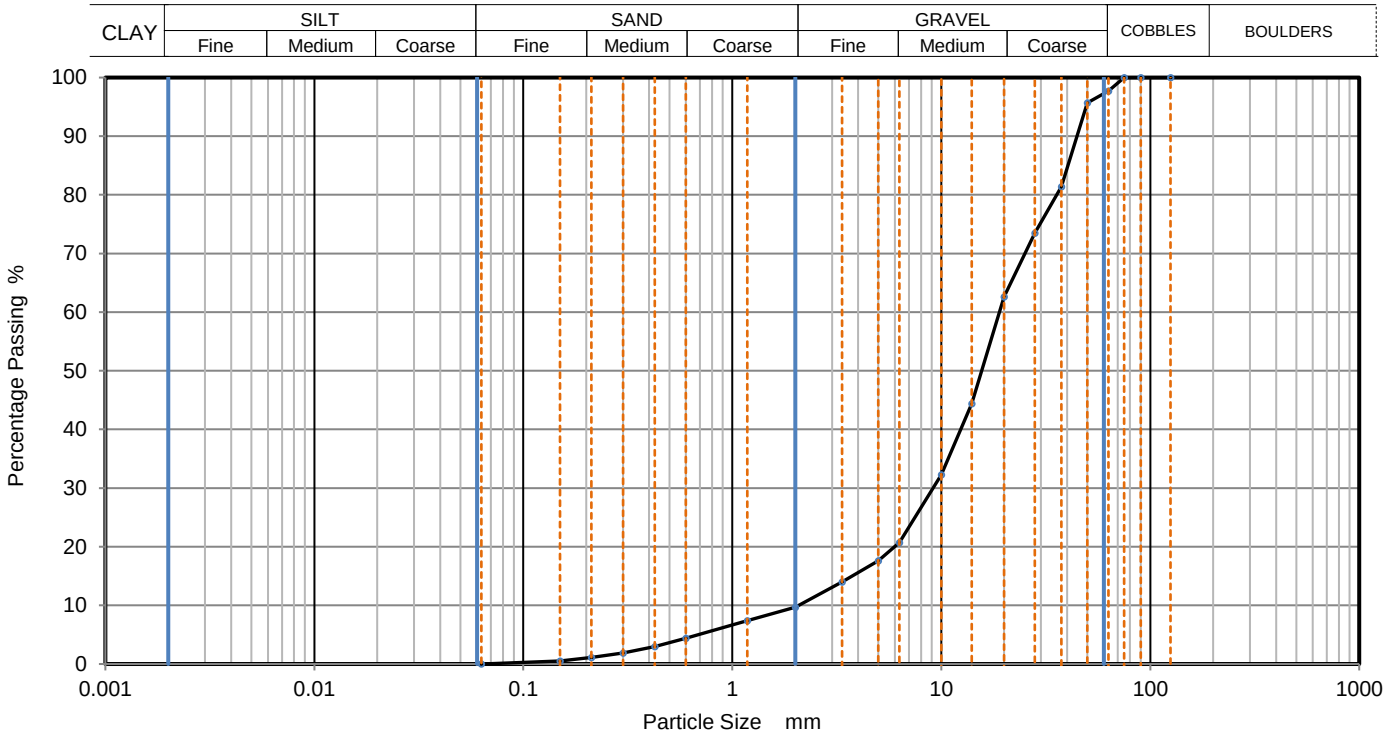
Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Linear Measurement			Immersion in water			Water displacement			Remarks
	Ref	Top	Base	Type		Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	
BH42	20	11.50		B	Brown slightly gravelly slightly silty fine to coarse SAND.	1.90	1.62	17.7							
BH42	22	13.00		B	Brown slightly gravelly slightly silty fine to coarse SAND.	1.99	1.62	22.8							
BH42	31	17.10		B	Brownish grey sandy slightly gravelly silty CLAY.	2.06	1.69	22.3							
BH42	33	18.50		B	Brownish grey sandy slightly gravelly silty CLAY.	2.09	1.72	21.0							
BH42	50	28.50		B	Grey sandy slightly gravelly CLAY.	2.16	2.04	5.7							
BH44	26	9.20		B	Brownish grey slightly gravelly silty fine to coarse SAND.	1.91	1.59	20.5							
BH44	42	15.50		B	Brownish grey slightly gravelly silty CLAY.	1.95	1.50	29.5							
BH44	44	17.70		B	Brownish grey slightly gravelly silty CLAY.	1.84	1.35	36.7							
BH44	45	18.70		B	Brownish grey slightly gravelly silty CLAY.	1.83	1.32	38.3							
BH46	1	0.00		B	Blackish grey sandy gravelly SILT.	2.04	1.66	22.9							
BH46	18	6.00		B	Greenish grey sandy gravelly silty CLAY with occasional shell fragments.	2.15	1.81	18.9							
BH46	26	8.50		B	Greenish grey sandy slightly gravelly silty CLAY with occasional shell fragments.	2.08	1.72	21.5							
BH46	29	11.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.95	1.43	36.2							
BH46	34	14.50		B	Greyish brown sandy slightly gravelly SILT/ CLAY.	1.94	1.55	25.0							

Legend w moisture content of the density test specimen

Notes			Date Printed	Approved By	Table
Tests carried out in accordance with BS1377:Part2:1990 and the following clauses unless annotated otherwise	Linear measurement	clause 7.2	19/08/2019		1
	Immersion in water	clause 7.3			sheet
	Water displacement	clause 7.4		Stephen.Watson	1

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port			Sample No.	7
Soil Description	Brown slightly sandy subangular fine to coarse GRAVEL containing shells and shell fragments.			Depth, m	3.20
Specimen Reference	4	Specimen Depth	3.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201908016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	98		
50	96		
37.5	81		
28	74		
20	63		
14	44		
10	32		
6.3	21		
5	18		
3.35	14		
2	10		
1.18	7		
0.6	4		
0.425	3		
0.3	2		
0.212	1		
0.15	1		
0.063	0		

Dry Mass of sample, g	16422

Sample Proportions	% dry mass
Cobbles	2
Gravel	88
Sand	10
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	19
D30	mm	9.13
D10	mm	2.07
Uniformity Coefficient		9.2
Curvature Coefficient		2.1

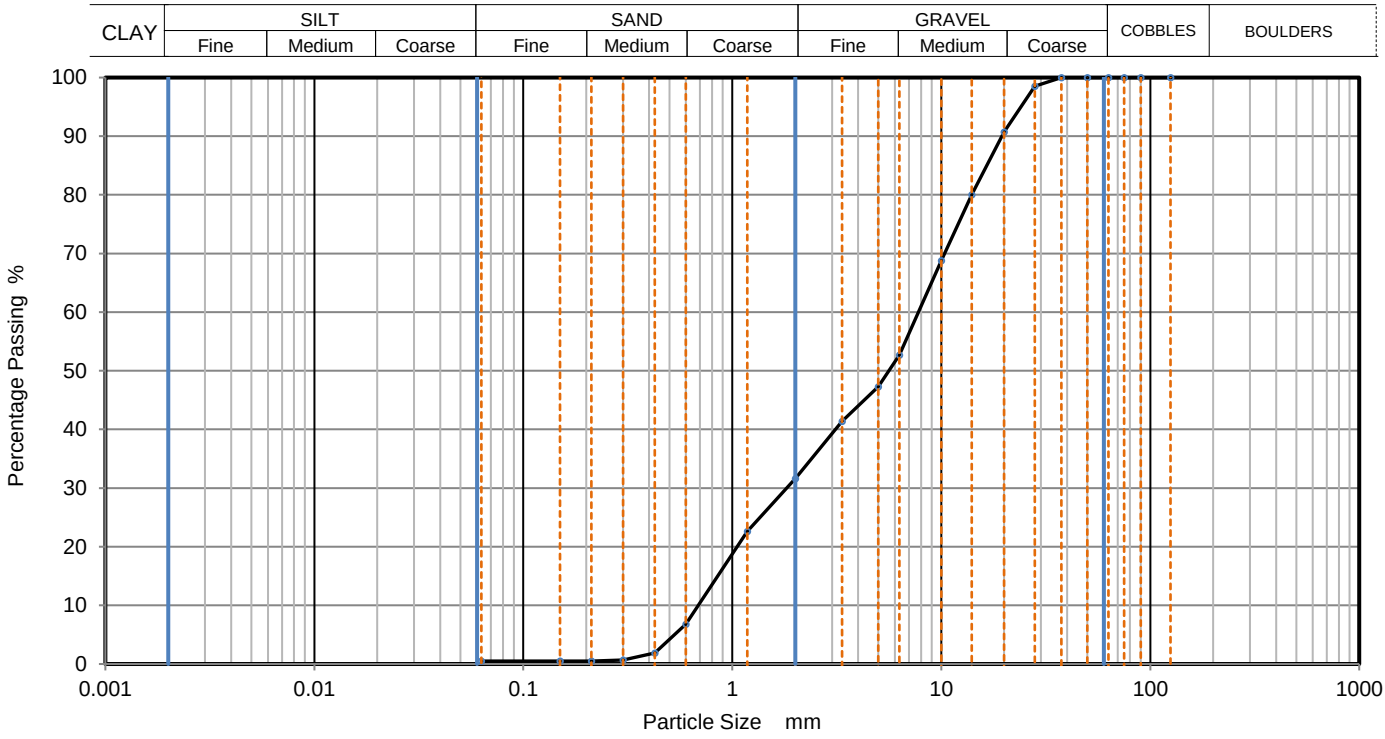
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port			Sample No.	11
Soil Description	Brown slightly sandy subangular fine to coarse GRAVEL containing shells and shell fragments.			Depth, m	5.70
Specimen Reference	2	Specimen Depth	5.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201908017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	91		
14	80		
10	69		
6.3	53		
5	47		
3.35	41		
2	32		
1.18	23		
0.6	7		
0.425	2		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	3823

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	31
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	7.77
D30	mm	1.82
D10	mm	0.689
Uniformity Coefficient		11
Curvature Coefficient		0.62

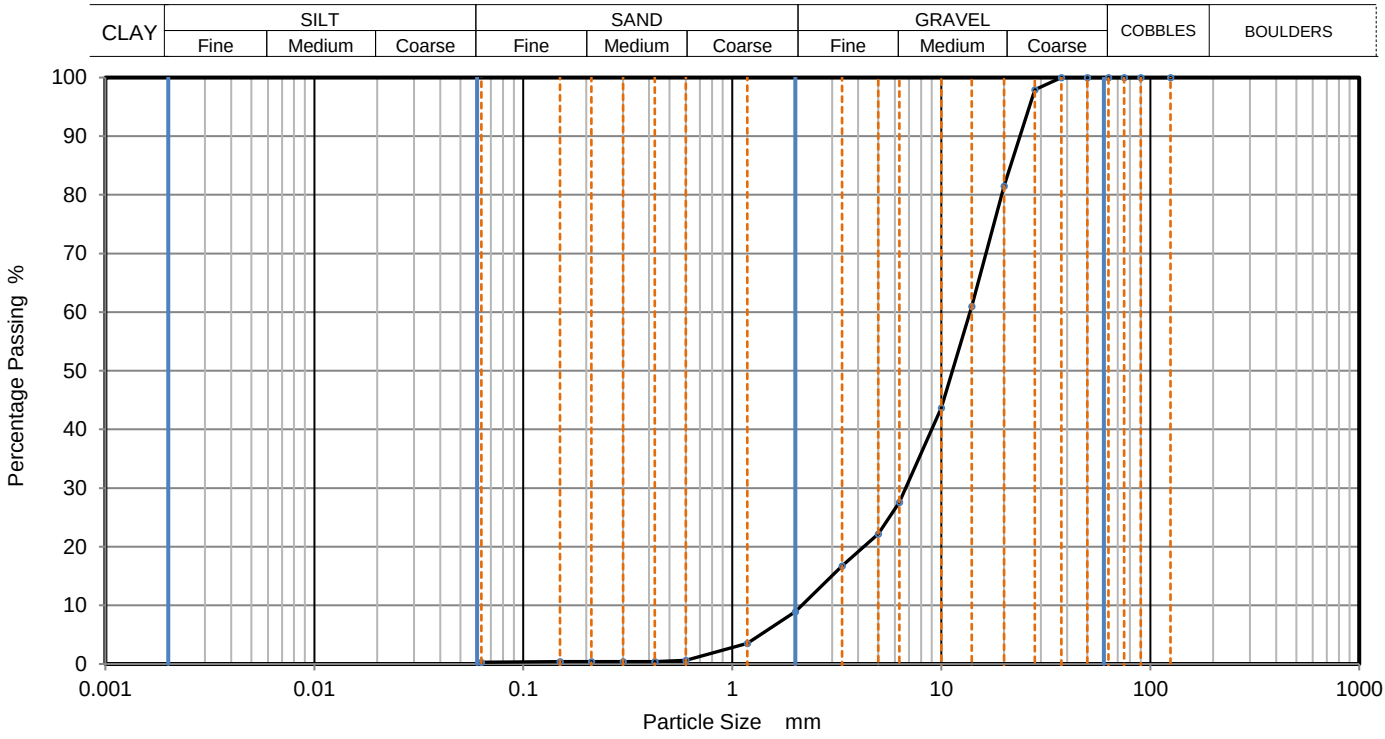
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**19-0382**
				Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port			Sample No.	15
Soil Description	Brown slightly sandy subangular fine to coarse GRAVEL containing shells and shell fragments.			Depth, m	8.20
Specimen Reference	4	Specimen Depth	8.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201908018



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	82		
14	61		
10	44		
6.3	28		
5	22		
3.35	17		
2	9		
1.18	4		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	4031

Sample Proportions	% dry mass
Cobbles	0
Gravel	91
Sand	9
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	13.7
D30	mm	6.74
D10	mm	2.15
Uniformity Coefficient		6.4
Curvature Coefficient		1.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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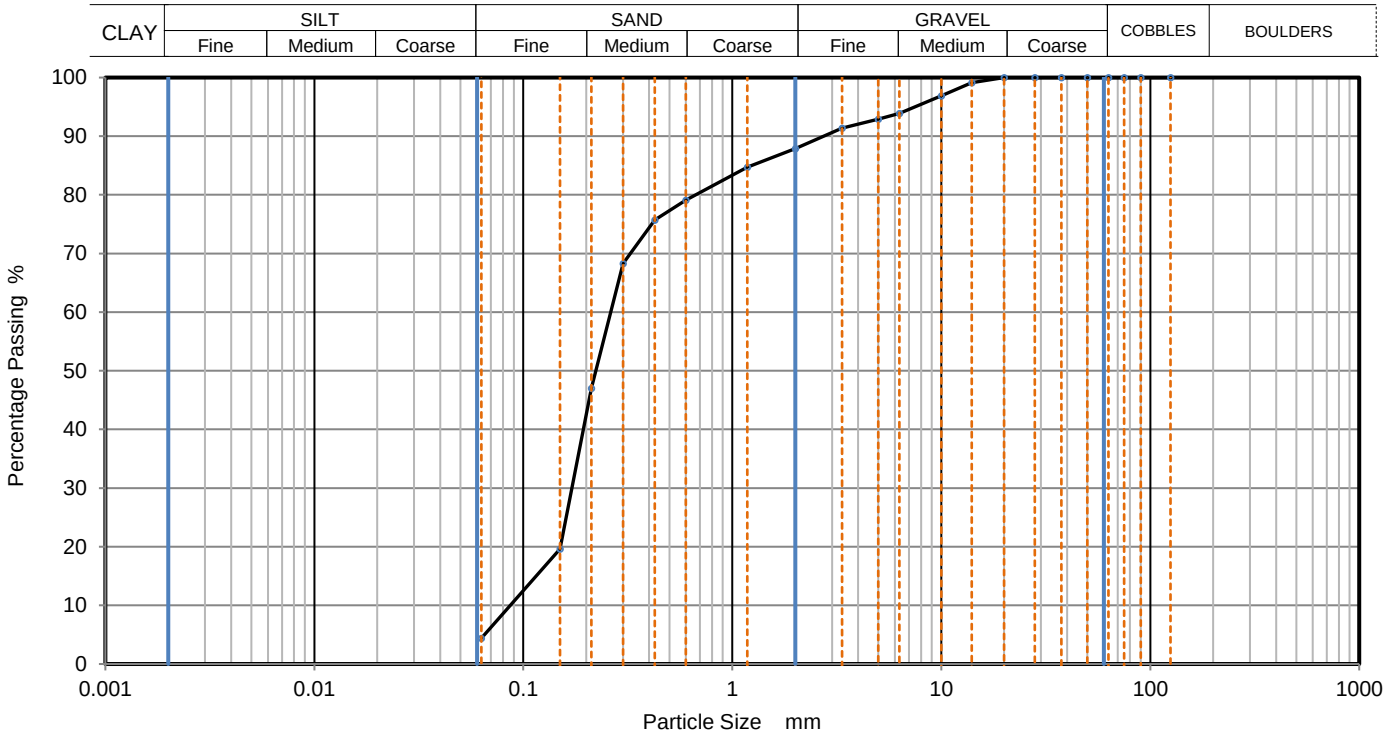
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port			Sample No.	20
Soil Description	Brown slightly gravelly slightly silty fine to coarse SAND.			Depth, m	11.50
Specimen Reference	8	Specimen Depth	11.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201908019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	94		
5	93		
3.35	91		
2	88		
1.18	85		
0.6	79		
0.425	76		
0.3	68		
0.212	47		
0.15	20		
0.063	4		

Dry Mass of sample, g	547

Sample Proportions	% dry mass
Cobbles	0
Gravel	12
Sand	84
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	0.262
D30	mm	0.171
D10	mm	0.0869
Uniformity Coefficient		3
Curvature Coefficient		1.3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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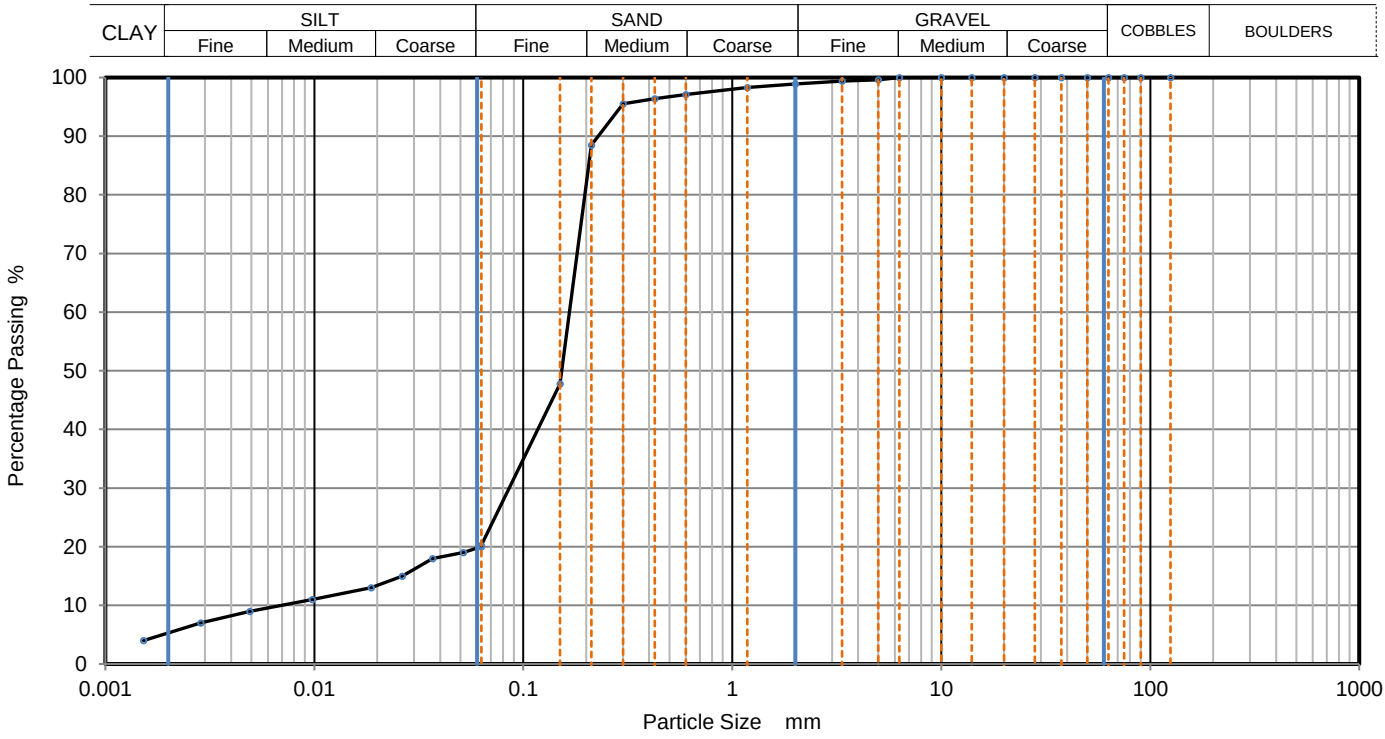
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port			Sample No.	22
Soil Description	Brown slightly gravelly slightly silty fine to coarse SAND.			Depth, m	13.00
Specimen Reference	8	Specimen Depth	13 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080110



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	20
90	100	0.0517	19
75	100	0.0368	18
63	100	0.0263	15
50	100	0.0187	13
37.5	100	0.0098	11
28	100	0.0049	9
20	100	0.0029	7
14	100	0.0015	4
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	96		
0.212	89		
0.15	48		
0.063	20		

Dry Mass of sample, g	325

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	79
Silt	15
Clay	5

Grading Analysis		
D100	mm	
D60	mm	0.166
D30	mm	0.0856
D10	mm	0.00658
Uniformity Coefficient		25
Curvature Coefficient		6.7

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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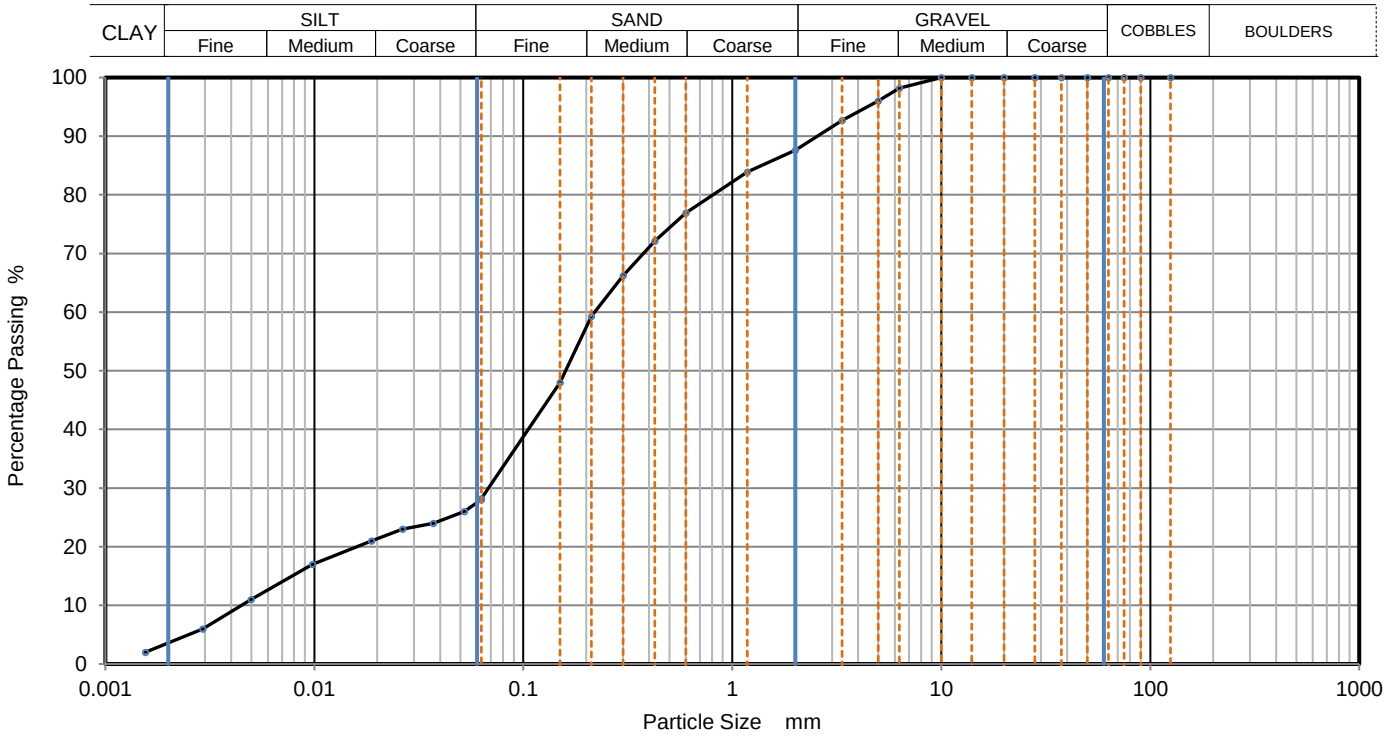
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	31
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth, m	17.10
Specimen Reference	5	Specimen Depth	17.1	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus2019080113



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	28
90	100	0.0522	26
75	100	0.0371	24
63	100	0.0264	23
50	100	0.0188	21
37.5	100	0.0098	17
28	100	0.0050	11
20	100	0.0029	6
14	100	0.0016	2
10	100		
6.3	98		
5	96		
3.35	93		
2	88		
1.18	84		
0.6	77	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	66		
0.212	59		
0.15	48		
0.063	28		

Dry Mass of sample, g	375

Sample Proportions	% dry mass
Cobbles	0
Gravel	12
Sand	59
Silt	25
Clay	3

Grading Analysis		
D100	mm	
D60	mm	0.22
D30	mm	0.0681
D10	mm	0.00441
Uniformity Coefficient		50
Curvature Coefficient		4.8

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
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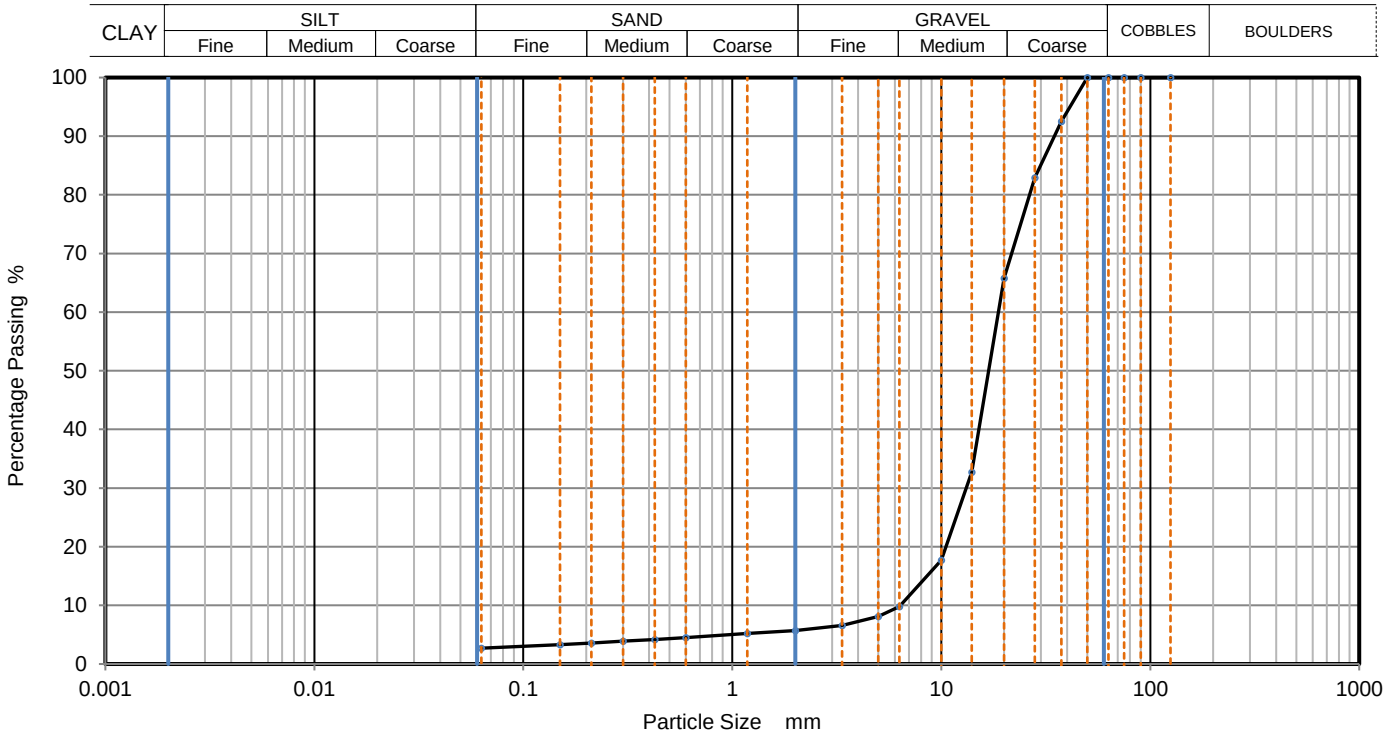
PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	1
Soil Description	Grey slightly silty slightly sandy rounded to subrounded fine to coarse GRAVEL.			Depth, m	0.00
Specimen Reference	4	Specimen Depth	0 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080123



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	93		
28	83		
20	66		
14	33		
10	18		
6.3	10		
5	8		
3.35	7		
2	6		
1.18	5		
0.6	5		
0.425	4		
0.3	4		
0.212	4		
0.15	3		
0.063	3		

Dry Mass of sample, g	13941

Sample Proportions	% dry mass
Cobbles	0
Gravel	94
Sand	3
Fines <0.063mm	3

Grading Analysis		
D100	mm	
D60	mm	18.8
D30	mm	13.2
D10	mm	6.39
Uniformity Coefficient		2.9
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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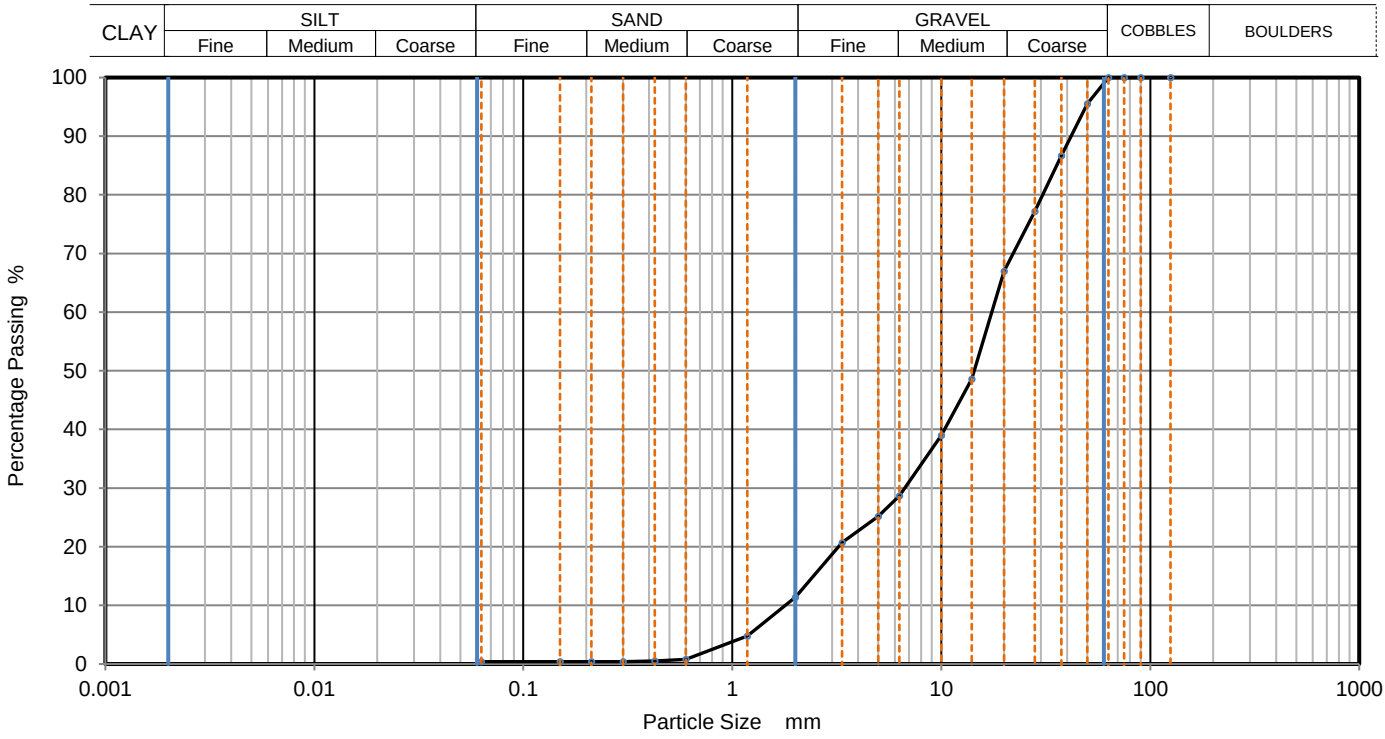
PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	6
Soil Description	Grey slightly silty slightly sandy rounded to subrounded fine to coarse GRAVEL.			Depth, m	2.00
Specimen Reference	2	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080124



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	87		
28	77		
20	67		
14	49		
10	39		
6.3	29		
5	25		
3.35	21		
2	11		
1.18	5		
0.6	1		
0.425	1		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	13763

Sample Proportions	% dry mass
Cobbles	0
Gravel	89
Sand	11
Fines <0.063mm	0

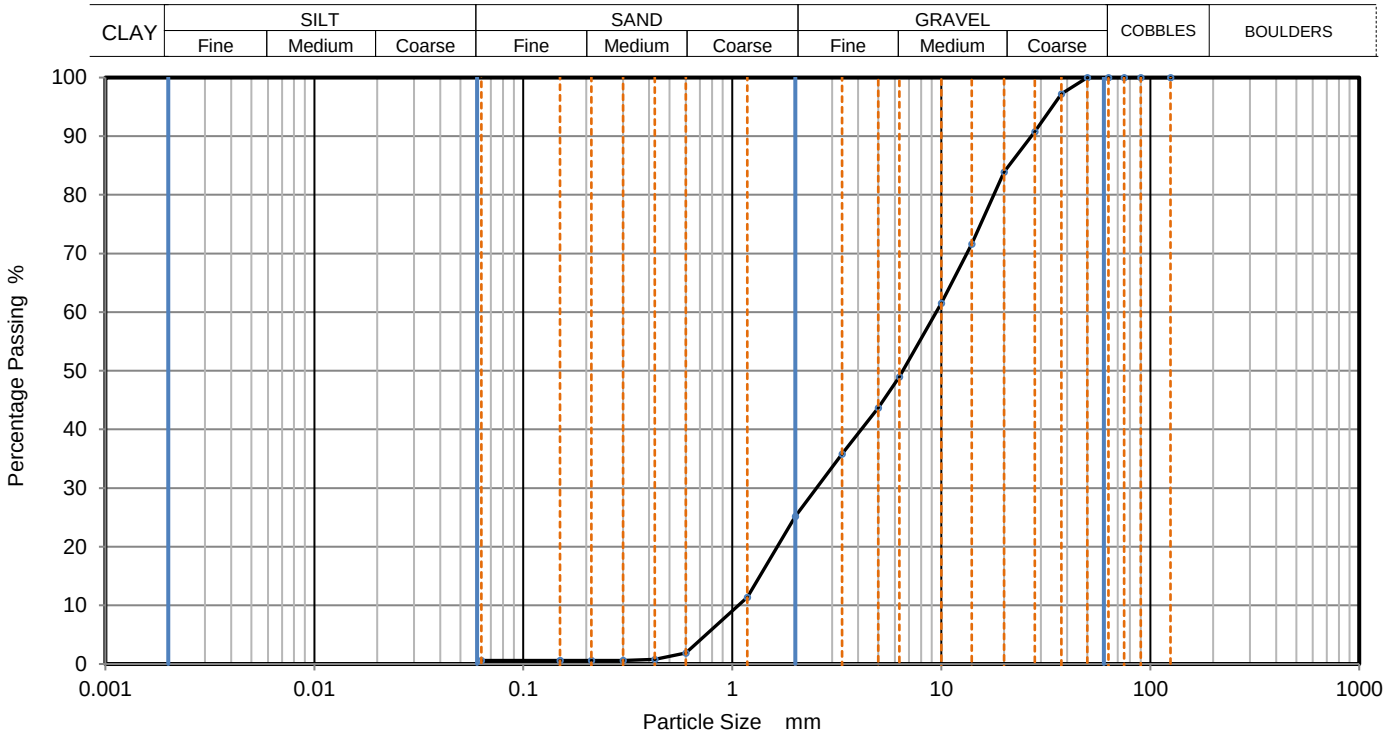
Grading Analysis		
D100	mm	
D60	mm	17.5
D30	mm	6.68
D10	mm	1.79
Uniformity Coefficient		9.8
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	8
Soil Description	Grey slightly silty slightly sandy rounded to subrounded fine to coarse GRAVEL.			Depth, m	2.50
Specimen Reference	4	Specimen Depth	2.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080125



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	91		
20	84		
14	72		
10	62		
6.3	49		
5	44		
3.35	36		
2	25		
1.18	11		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	3536

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	25
Fines <0.063mm	1

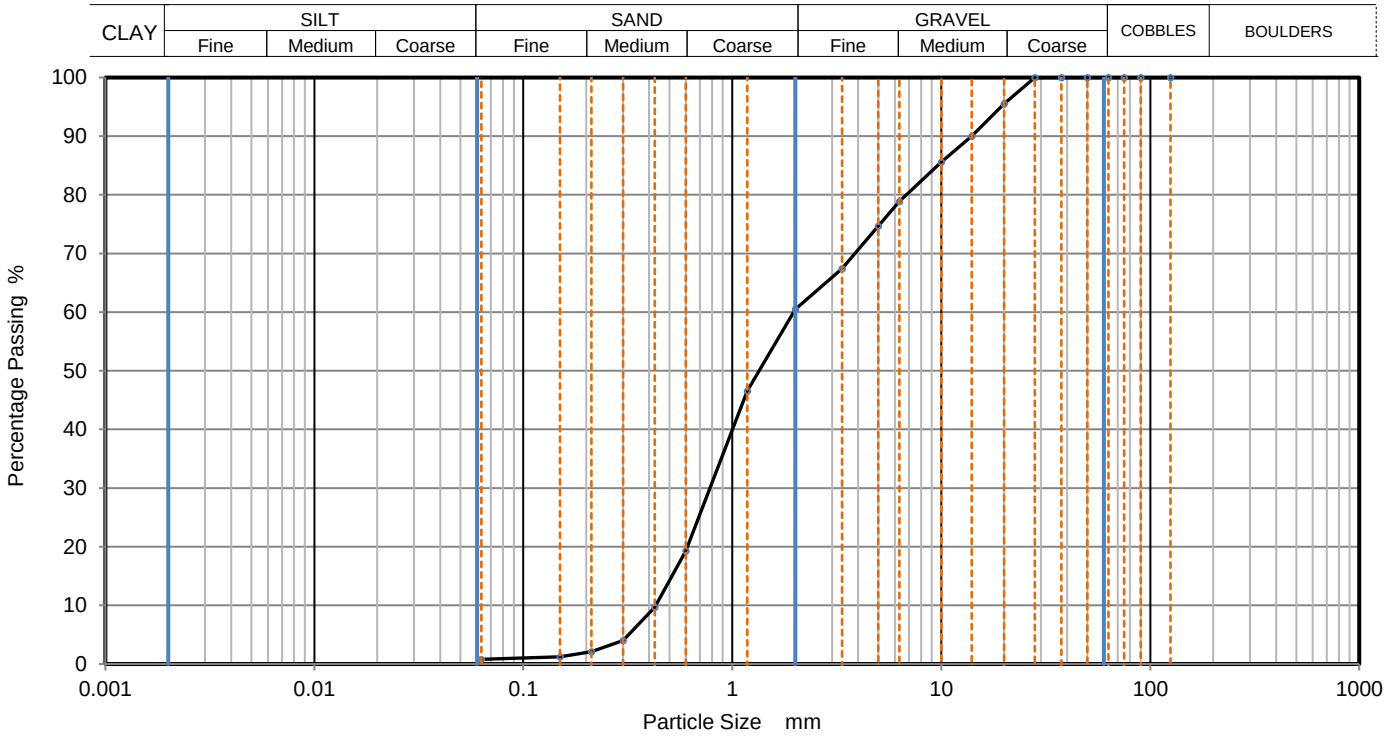
Grading Analysis		
D100	mm	
D60	mm	9.47
D30	mm	2.53
D10	mm	1.07
Uniformity Coefficient		8.9
Curvature Coefficient		0.63

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port				Sample No.	12
Soil Description	Brownish grey gravelly silty fine to coarse SAND.				Depth, m	3.60
Specimen Reference	2	Specimen Depth	3.6	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2019080126



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	96		
14	90		
10	86		
6.3	79		
5	75		
3.35	67		
2	61		
1.18	47		
0.6	19		
0.425	10		
0.3	4		
0.212	2		
0.15	1		
0.063	1		

Dry Mass of sample, g	3107

Sample Proportions	% dry mass
Cobbles	0
Gravel	40
Sand	60
Fines <0.063mm	1

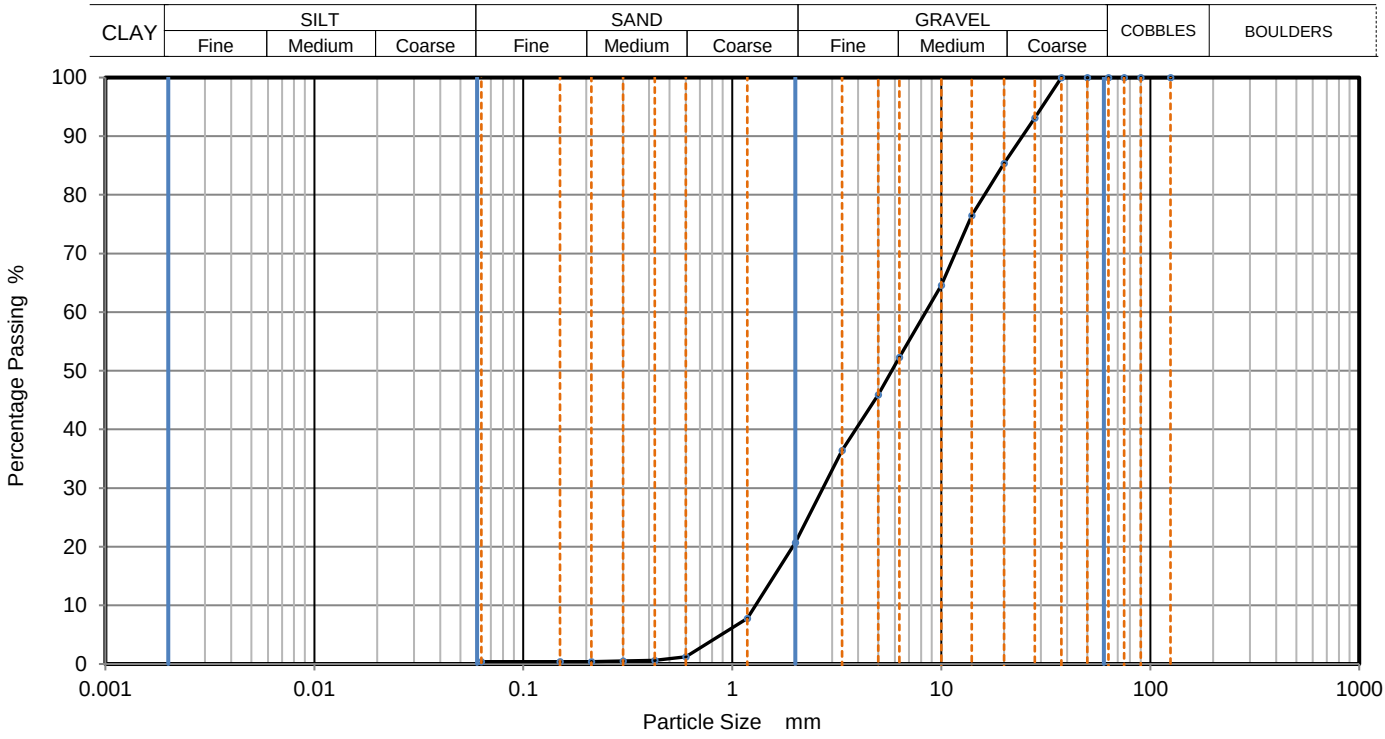
Grading Analysis		
D100	mm	
D60	mm	1.96
D30	mm	0.782
D10	mm	0.43
Uniformity Coefficient		4.6
Curvature Coefficient		0.73

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	17
Soil Description	Brownish grey slightly sandy subangular fine to coarse GRAVEL.			Depth, m	5.50
Specimen Reference	4	Specimen Depth	5.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080127



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	85		
14	77		
10	65		
6.3	52		
5	46		
3.35	36		
2	21		
1.18	8		
0.6	1		
0.425	1		
0.3	1		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	3109

Sample Proportions	% dry mass
Cobbles	0
Gravel	79
Sand	20
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	8.42
D30	mm	2.71
D10	mm	1.29
Uniformity Coefficient		6.5
Curvature Coefficient		0.68

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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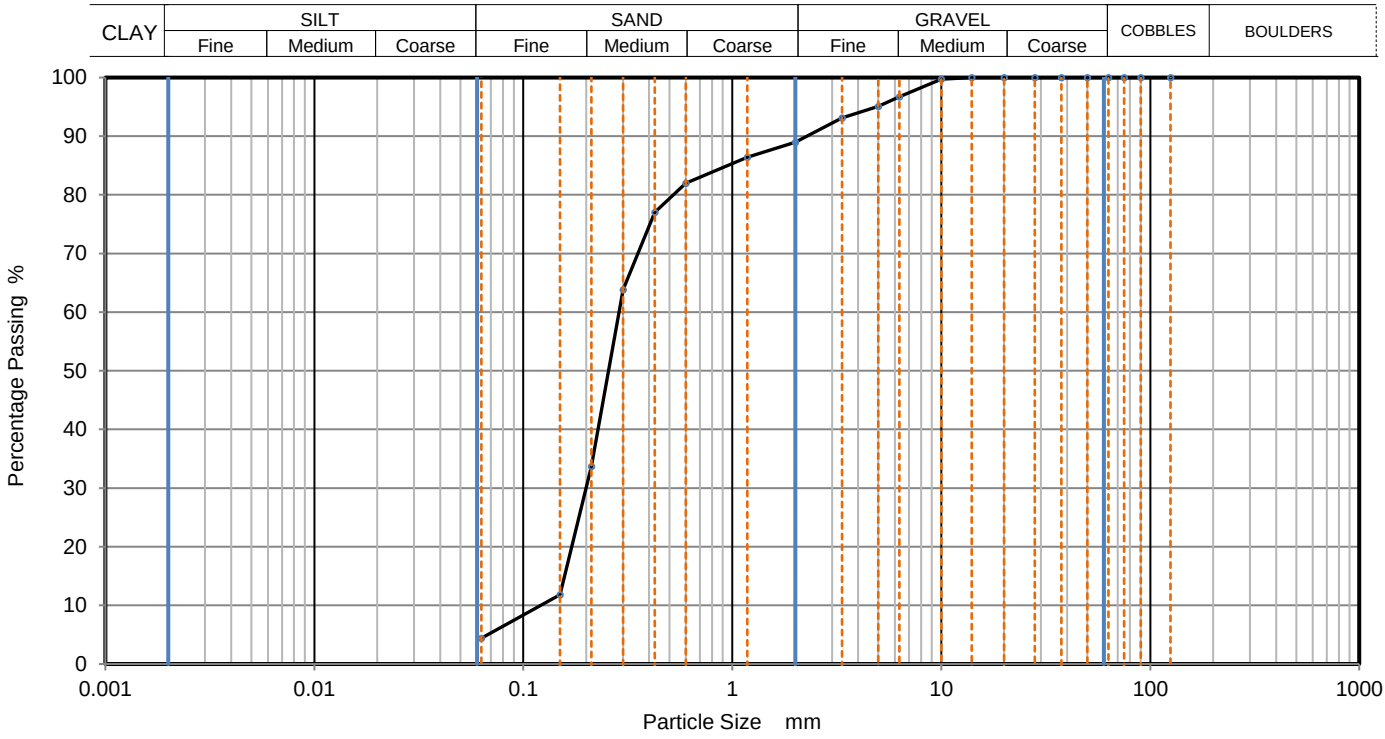
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	26
Soil Description	Brownish grey slightly gravelly silty fine to coarse SAND.			Depth, m	9.20
Specimen Reference	4	Specimen Depth	9.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080128



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	97		
5	95		
3.35	93		
2	89		
1.18	86		
0.6	82		
0.425	77		
0.3	64		
0.212	34		
0.15	12		
0.063	4		

Dry Mass of sample, g	571

Sample Proportions	% dry mass
Cobbles	0
Gravel	11
Sand	85
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	0.287
D30	mm	0.2
D10	mm	0.122
Uniformity Coefficient		2.4
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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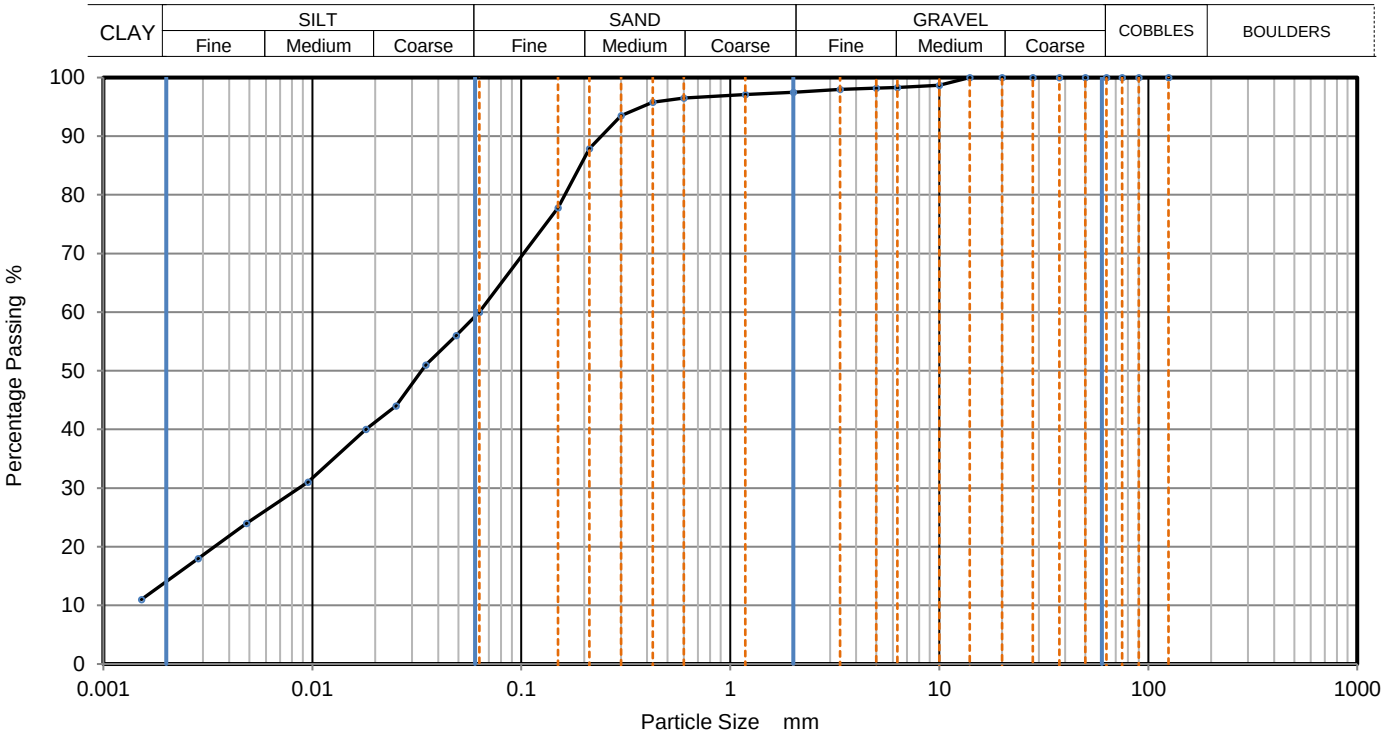
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	42
Soil Description	Brownish grey slightly gravelly silty CLAY.			Depth, m	15.50
Specimen Reference	8	Specimen Depth	15.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080130



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	60
90	100	0.0487	56
75	100	0.0349	51
63	100	0.0252	44
50	100	0.0180	40
37.5	100	0.0095	31
28	100	0.0048	24
20	100	0.0028	18
14	100	0.0015	11
10	99		
6.3	98		
5	98		
3.35	98		
2	98		
1.18	97		
0.6	97	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	94		
0.212	88		
0.15	78		
0.063	60		

Dry Mass of sample, g	563

Sample Proportions	% dry mass
Cobbles	0
Gravel	3
Sand	38
Silt	46
Clay	14

Grading Analysis		
D100	mm	
D60	mm	
D30	mm	0.00851
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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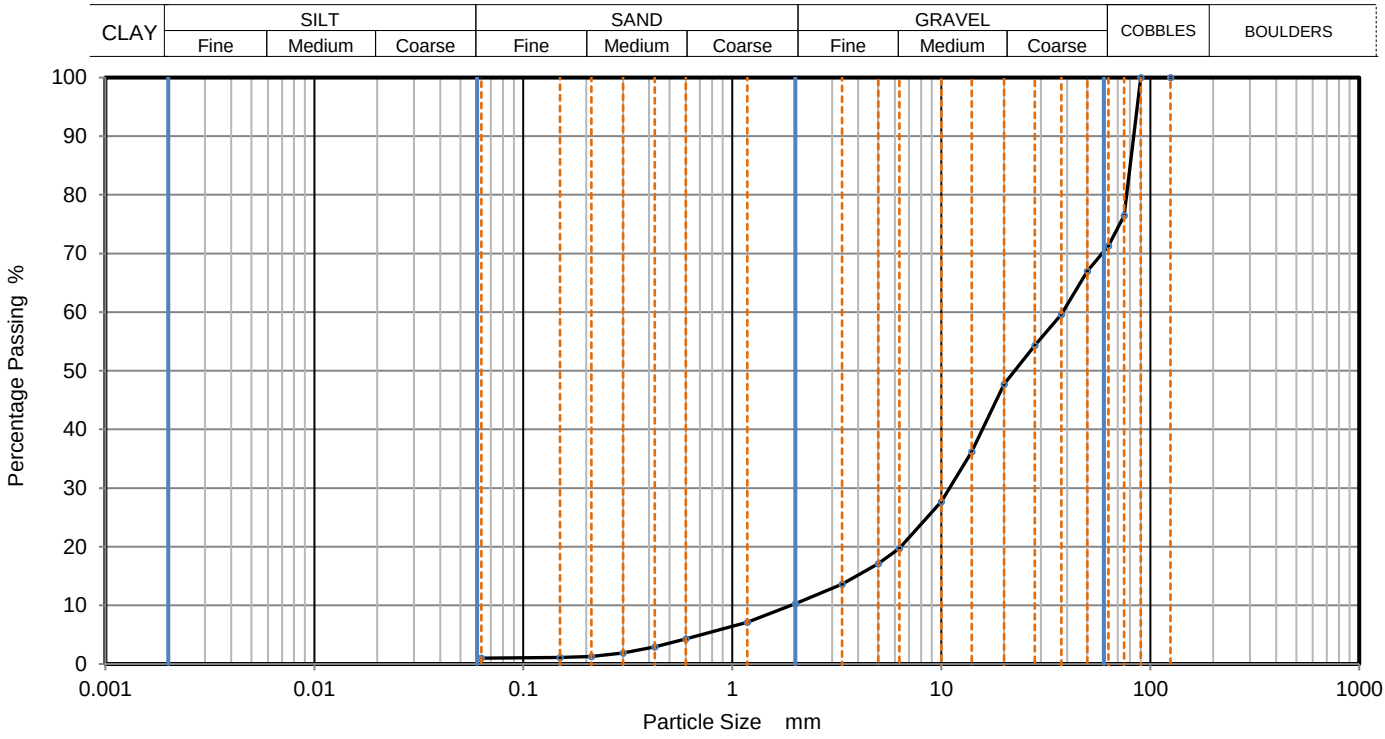
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**19-0382**
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	54
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL.			Depth, m	21.40
Specimen Reference	4	Specimen Depth	21.4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080134



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	77		
63	71		
50	67		
37.5	60		
28	54		
20	48		
14	36		
10	28		
6.3	20		
5	17		
3.35	14		
2	10		
1.18	7		
0.6	4		
0.425	3		
0.3	2		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g: 13270

Sample Proportions	% dry mass
Cobbles	29
Gravel	61
Sand	9
Fines <0.063mm	1

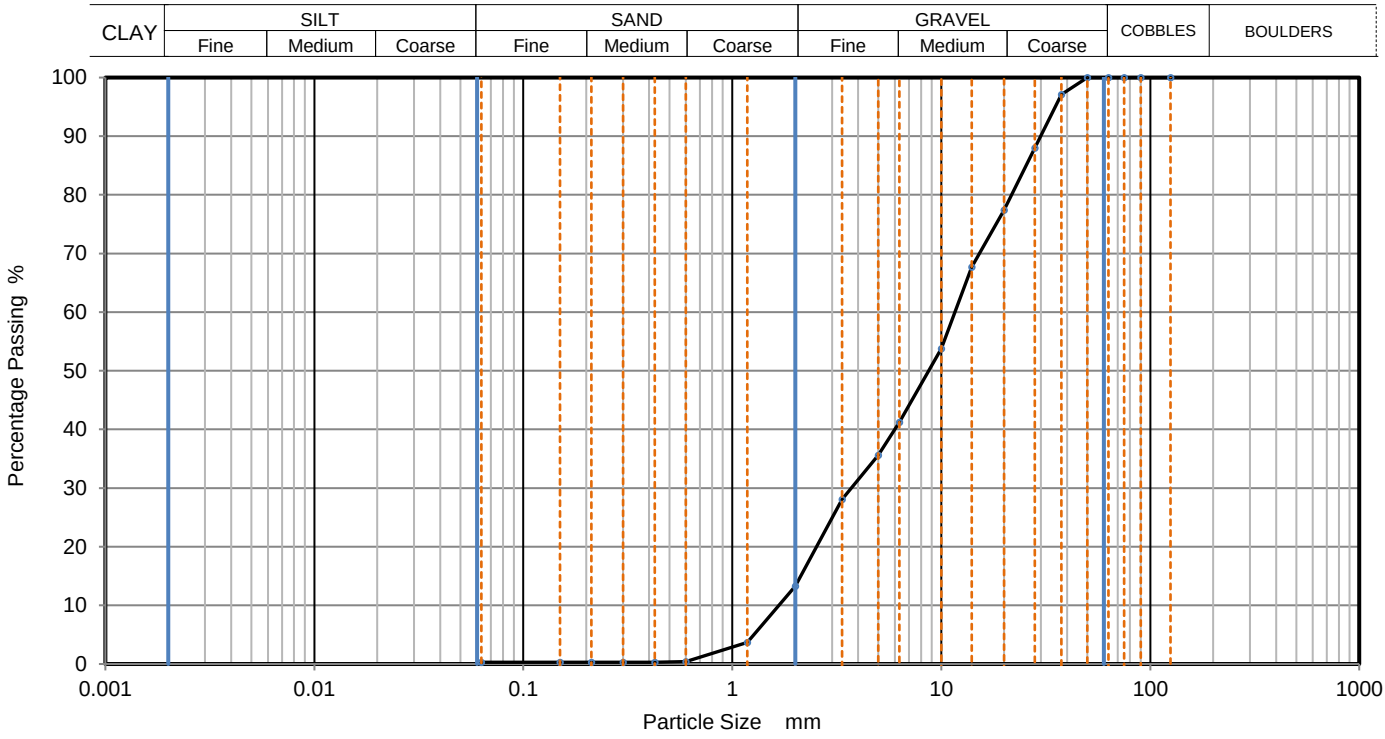
Grading Analysis		
D100	mm	
D60	mm	38.1
D30	mm	10.9
D10	mm	1.89
Uniformity Coefficient		20
Curvature Coefficient		1.7

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port			Sample No.	60
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL.			Depth, m	23.00
Specimen Reference	4	Specimen Depth	23 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080135



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	88		
20	77		
14	68		
10	54		
6.3	41		
5	36		
3.35	28		
2	13		
1.18	4		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	6712

Sample Proportions	% dry mass
Cobbles	0
Gravel	87
Sand	13
Fines <0.063mm	0

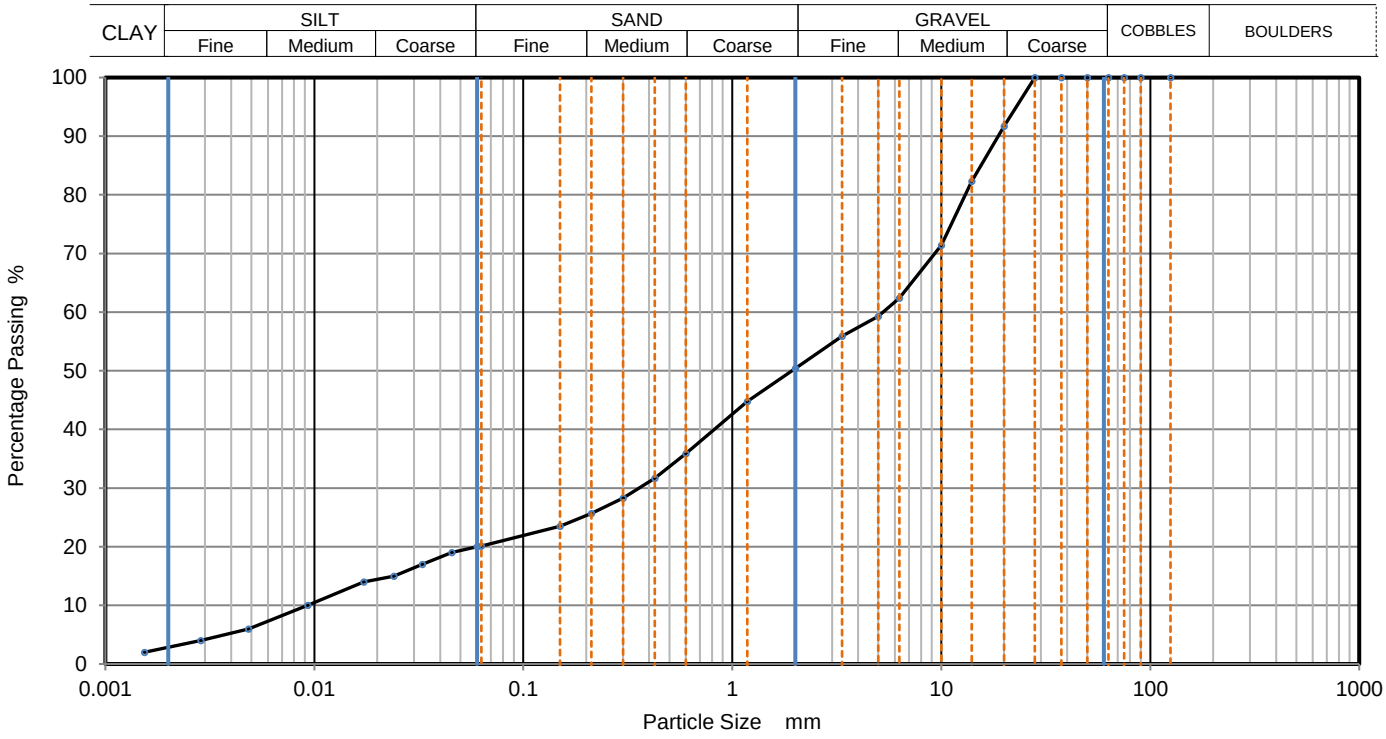
Grading Analysis		
D100	mm	
D60	mm	11.6
D30	mm	3.7
D10	mm	1.67
Uniformity Coefficient		7
Curvature Coefficient		0.71

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH46
Site Name	Stornoway Deep Water Port			Sample No.	1
Soil Description	Blackish grey sandy gravelly SILT.			Depth, m	0.00
Specimen Reference	4	Specimen Depth	0 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080136



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0601	20
90	100	0.0454	19
75	100	0.0328	17
63	100	0.0240	15
50	100	0.0172	14
37.5	100	0.0093	10
28	100	0.0048	6
20	92	0.0029	4
14	82	0.0015	2
10	71		
6.3	62		
5	59		
3.35	56		
2	50		
1.18	45		
0.6	36	Particle density	(assumed)
0.425	32	2.65	Mg/m3
0.3	28		
0.212	26		
0.15	24		
0.063	20		

Dry Mass of sample, g: 1345

Sample Proportions	% dry mass
Cobbles	0
Gravel	50
Sand	30
Silt	17
Clay	3

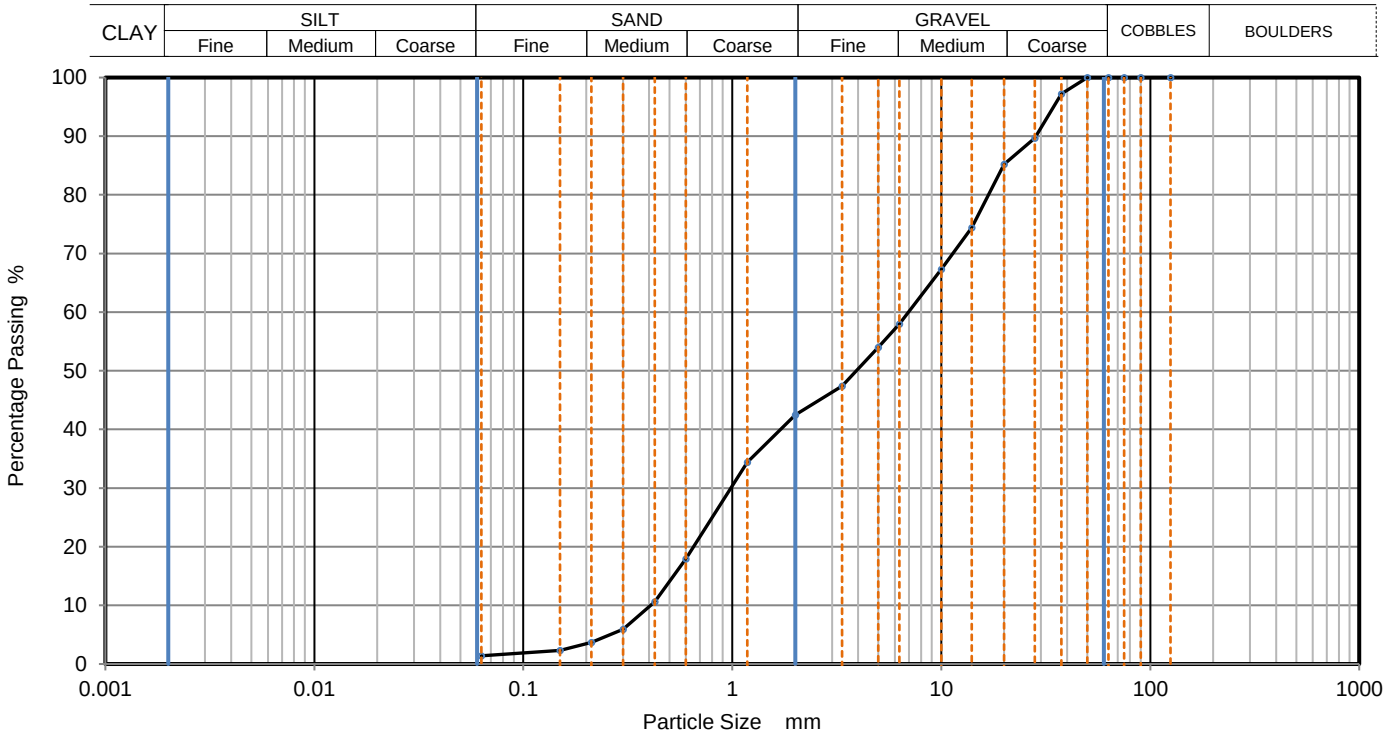
Grading Analysis		
D100	mm	
D60	mm	5.28
D30	mm	0.356
D10	mm	0.00964
Uniformity Coefficient		550
Curvature Coefficient		2.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH46
Site Name	Stornoway Deep Water Port				Sample No.	7
Soil Description	Grey sandy subangular fine to coarse GRAVEL.				Depth, m	2.50
Specimen Reference	4	Specimen Depth	2.5	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2019080137



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	90		
20	85		
14	74		
10	67		
6.3	58		
5	54		
3.35	47		
2	43		
1.18	34		
0.6	18		
0.425	11		
0.3	6		
0.212	4		
0.15	2		
0.063	1		

Dry Mass of sample, g	3635

Sample Proportions	% dry mass
Cobbles	0
Gravel	58
Sand	41
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	6.97
D30	mm	0.985
D10	mm	0.406
Uniformity Coefficient		17
Curvature Coefficient		0.34

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

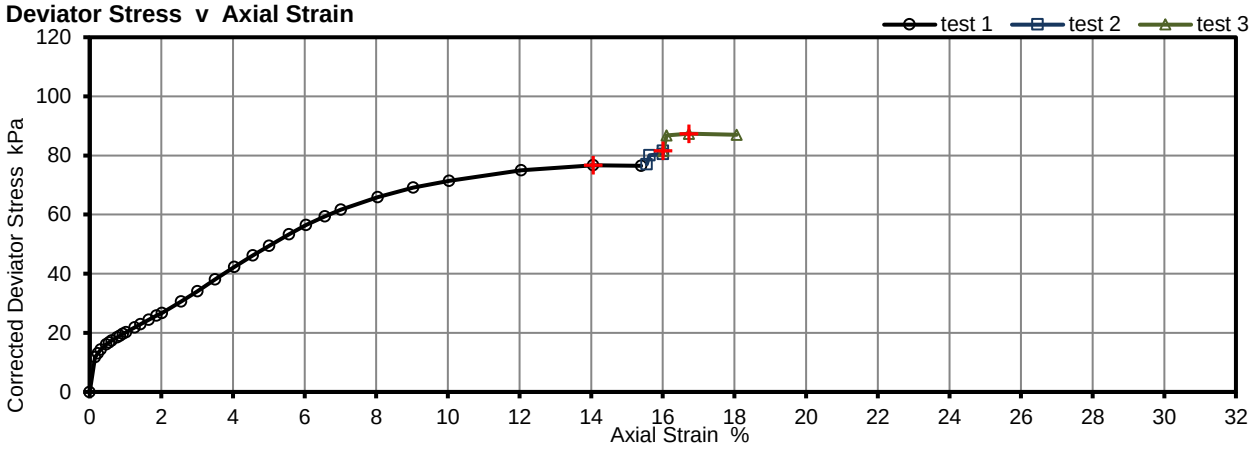
Approved
Stephen.Watson

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	42
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth	24.00
Specimen Reference	3	Specimen Depth	24.00	m	Sample Type	P
Specimen Description	Soft brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080119
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	06/08/2019

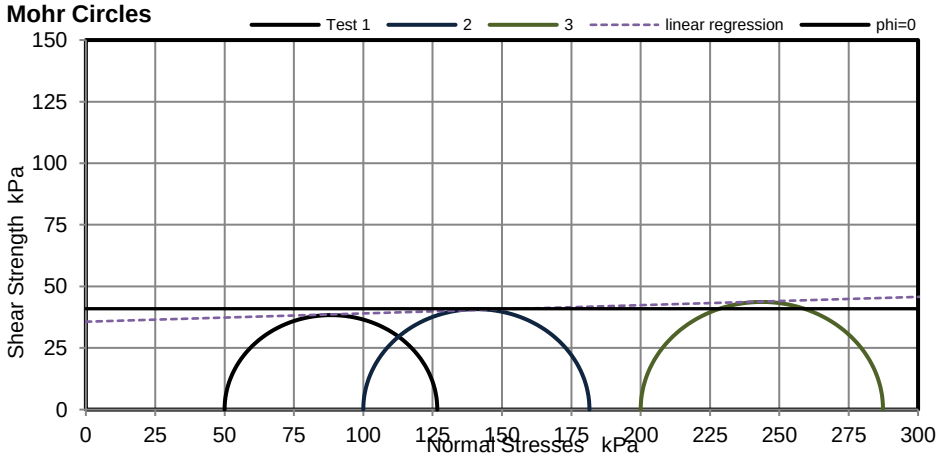
Length	mm	210.9
Diameter	mm	101.3
Bulk Density	Mg/m3	2.09
Moisture Content	%	28.4
Dry Density	Mg/m3	1.63

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	14.1	16.0	16.7
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	76.7	81.5	87.4
	Shear strength, cu	kPa	38.3	40.8	43.7
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 41 kPa

Linear Regression

ϕu 1.9 °

cu 36 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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Stephen.Watson	19/08/2019 12:34

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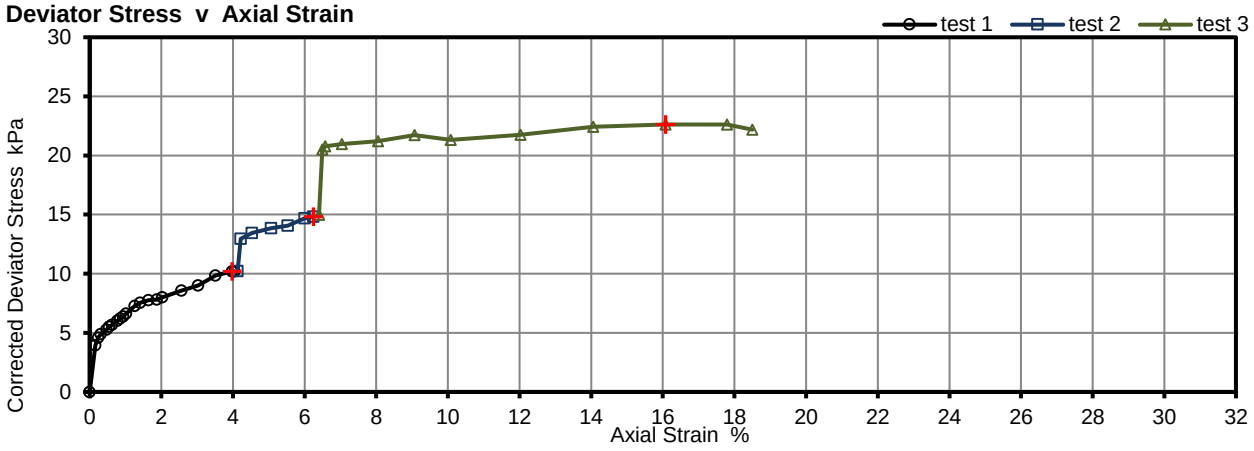
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port				Sample No.	34
Soil Description	Brownish grey slightly gravelly silty CLAY.				Depth	15.00
Specimen Reference	2	Specimen Depth	15.00	m	Sample Type	P
Specimen Description	Very soft brownish grey slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080129
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	06/08/2019

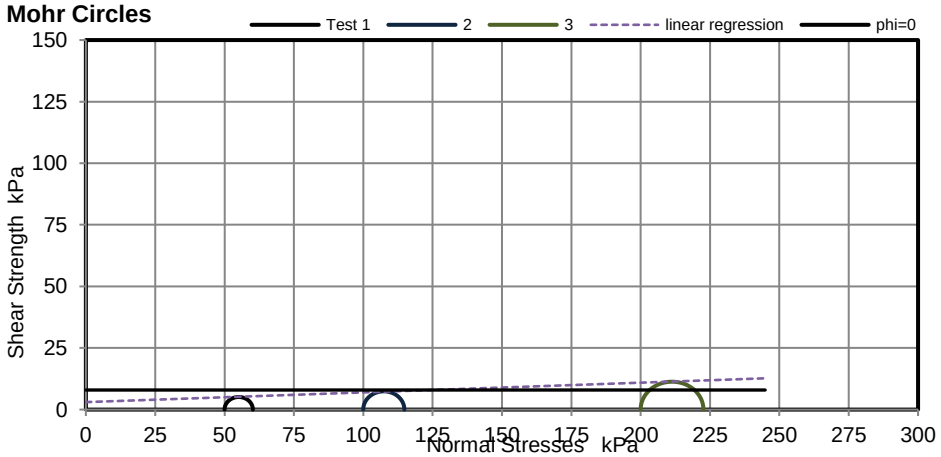
Length	mm	209.6
Diameter	mm	106.9
Bulk Density	Mg/m3	1.93
Moisture Content	%	28.1
Dry Density	Mg/m3	1.51

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	4.0	6.2	16.1
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	10.2	14.8	22.6
	Shear strength, cu	kPa	5.1	7.4	11.3
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 8 kPa

Linear Regression
ϕu 2.3 °
cu 3 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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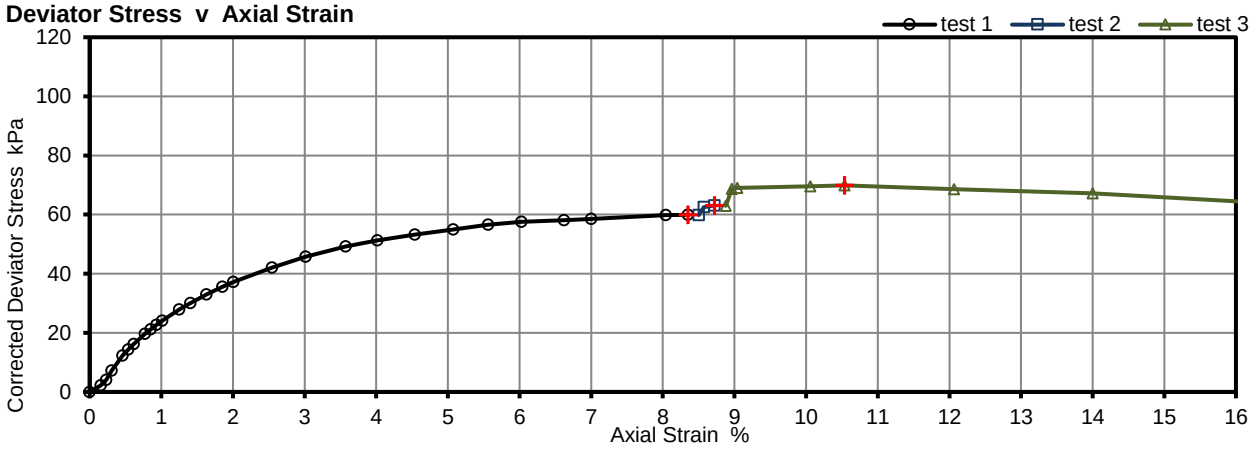
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port				Sample No.	47
Soil Description	Brownish grey slightly gravelly silty CLAY.				Depth	19.50
Specimen Reference	2	Specimen Depth	19.50	m	Sample Type	P
Specimen Description	Soft brownish grey slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080133
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	06/08/2019

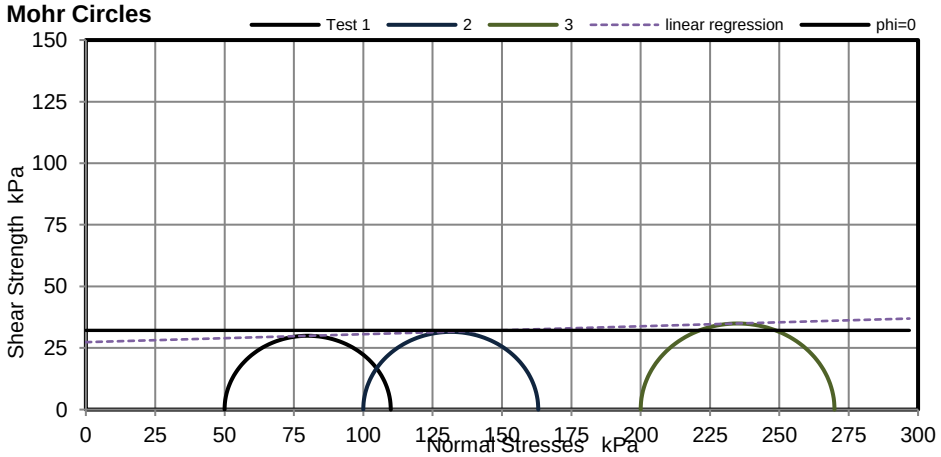
Length	mm	210.8
Diameter	mm	103.6
Bulk Density	Mg/m3	1.86
Moisture Content	%	26.7
Dry Density	Mg/m3	1.46

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	8.3	8.7	10.5
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	59.9	63.1	69.9
	Shear strength, cu	kPa	30.0	31.5	34.9
	Mode of failure		Compound		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 32 kPa

Linear Regression
ϕu 1.8 °
cu 27 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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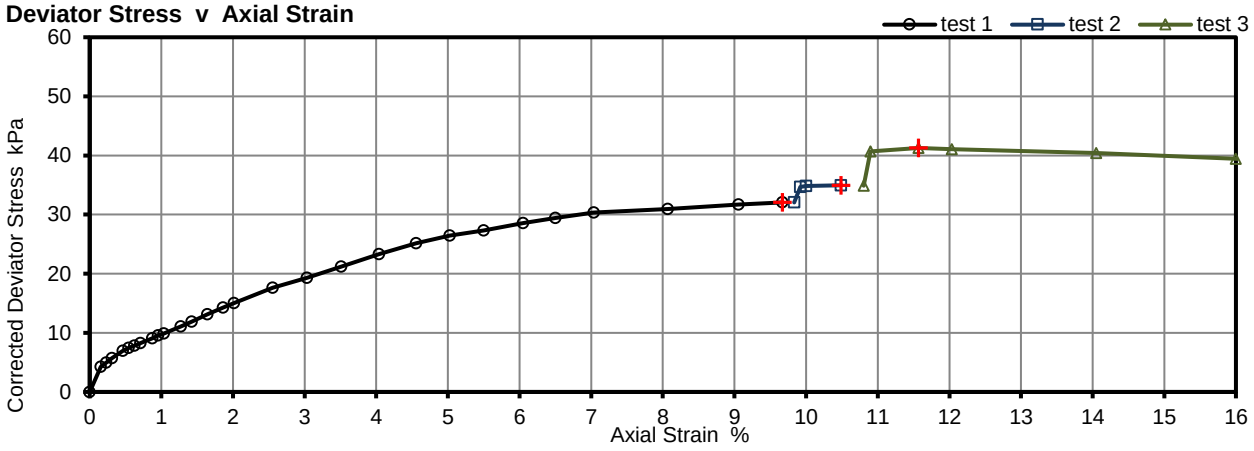
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH46
Site Name	Stornoway Deep Water Port				Sample No.	21
Soil Description	Greyish brown sandy gravelly silty CLAY.				Depth	9.00
Specimen Reference	2	Specimen Depth	9.00	m	Sample Type	P
Specimen Description	Very soft greyish brown sandy gravelly silty CLAY.				KeyLAB ID	Caus2019080140
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	06/08/2019

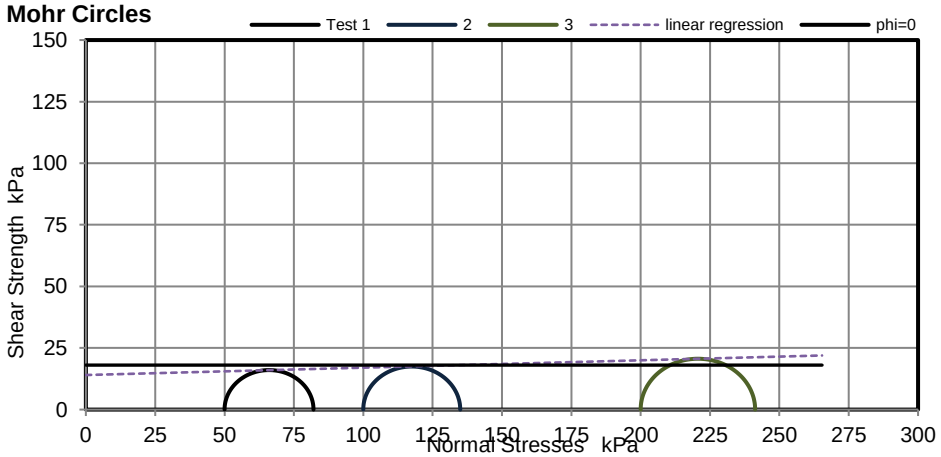
Length	mm	210.4
Diameter	mm	105.6
Bulk Density	Mg/m3	1.76
Moisture Content	%	31.3
Dry Density	Mg/m3	1.34

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	9.7	10.5	11.6
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	32.1	35.0	41.3
	Shear strength, cu	kPa	16.0	17.5	20.6
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 18 kPa

Linear Regression
ϕu 1.7 °
cu 14 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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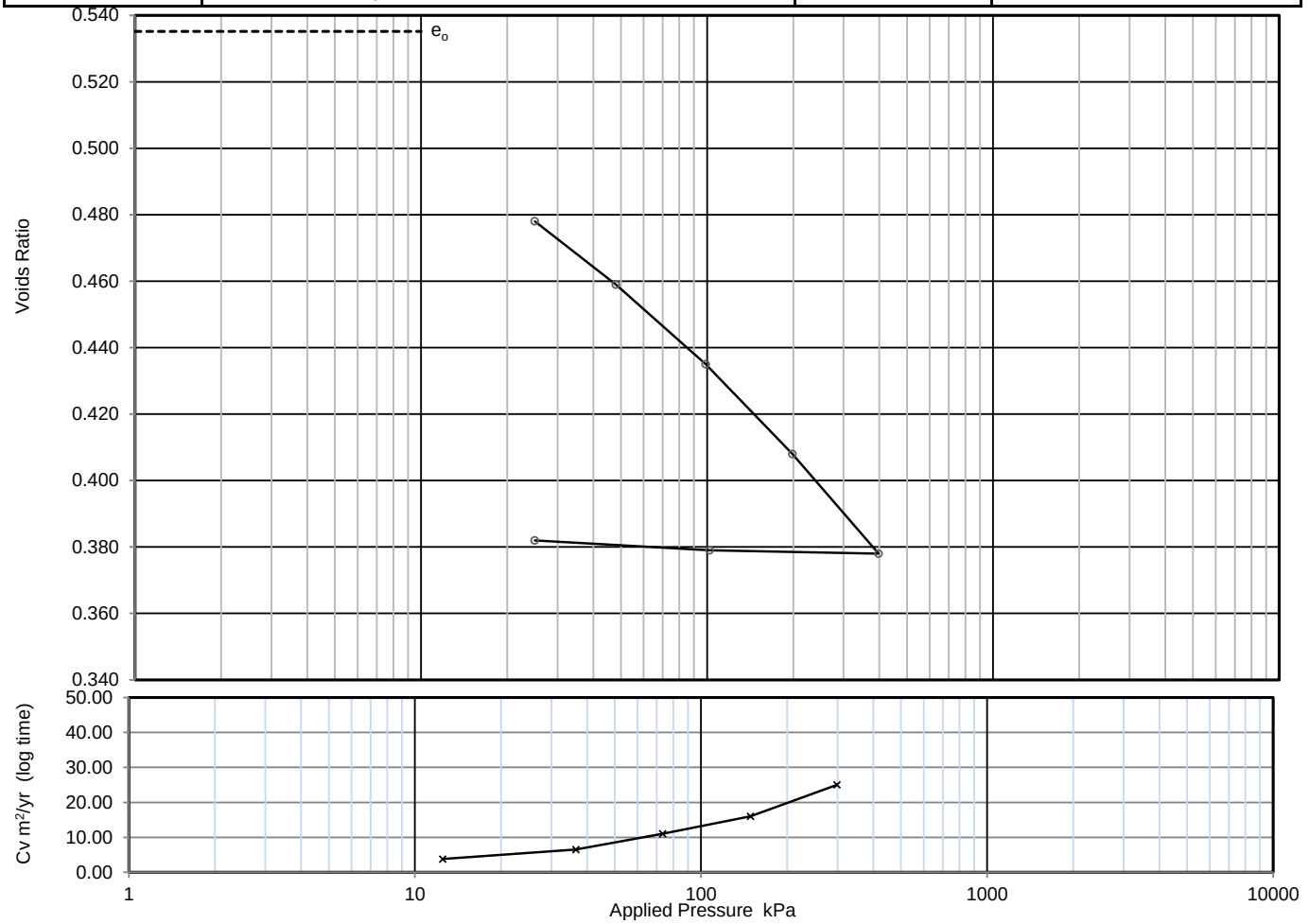
CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	31
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth	17.1
Specimen Reference	6	Specimen Depth	17.1	m	Sample Type	B
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080113
Test Method	BS1377:Part 5:1990, clause 3				Date started	05/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.535	-	-	-	-
25	0.478	1.5	3.8	3	0.0012
48	0.459	0.56	6.5	9.1	0.0014
99	0.435	0.32	11	20	0.0015
199	0.408	0.19	16	26	0.0019
398	0.378	0.11	25	31	0.0033
102	0.379	0.0035			
25	0.382	0.026			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.55	17.60	mm
Moisture Content	24.5	18.1	%
Bulk density	2.15	2.27	Mg/m3
Dry density	1.73	1.92	Mg/m3
Voids Ratio	0.535	0.382	
Saturation	121	126	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

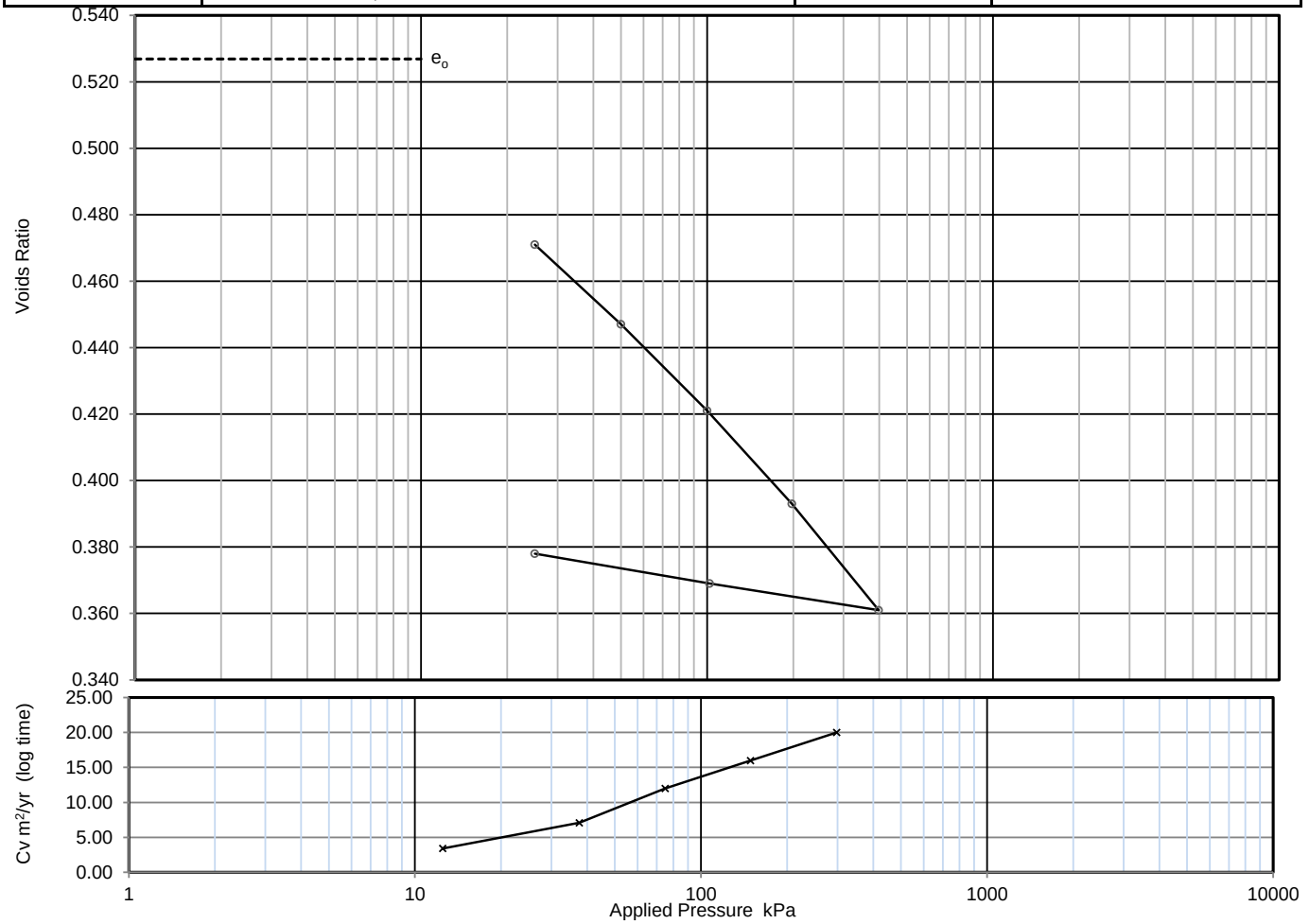
Approved: Stephen.Watson

Printed : 01/10/2019 16:13

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	33
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth	18.5
Specimen Reference	8	Specimen Depth	18.5	m	Sample Type	B
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080114
Test Method	BS1377:Part 5:1990, clause 3				Date started	06/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.527	-	-	-	-
25	0.471	1.5	3.4	2.8	0.0012
50	0.447	0.66	7.1	38	0.0011
100	0.421	0.36	12	40	0.0014
198	0.393	0.2	16	120	0.0013
398	0.361	0.11	20	220	0.0015
102	0.369	0.022			
25	0.378	0.083			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.65	17.74	mm
Moisture Content	23.3	17.3	%
Bulk density	2.14	2.25	Mg/m3
Dry density	1.74	1.92	Mg/m3
Voids Ratio	0.527	0.378	
Saturation	117	121	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks: Sample remoulded using the 2.5kg rammer

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

Printed : 01/10/2019 16:14

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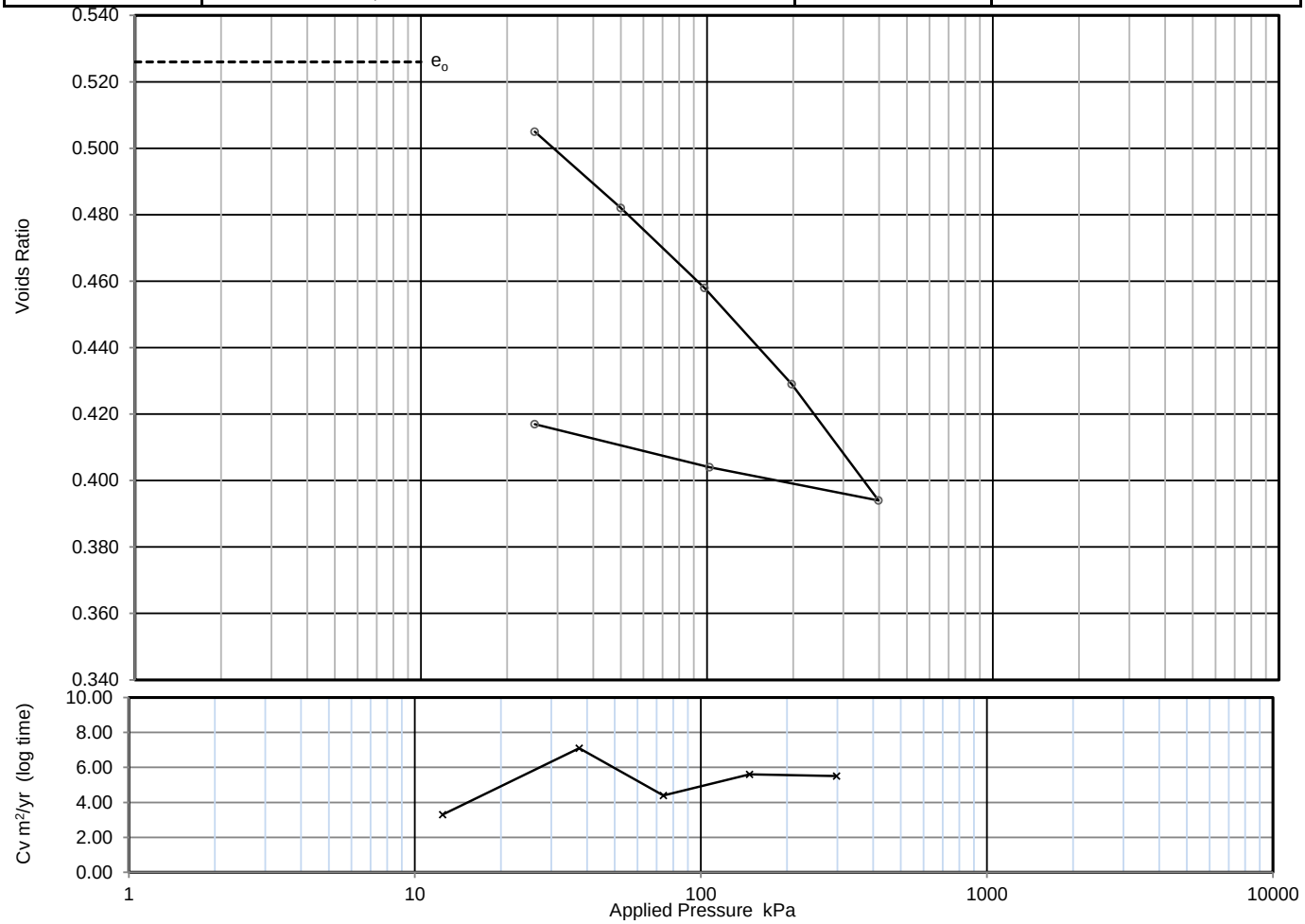
UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	42
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth	24
Specimen Reference	4	Specimen Depth	24	m	Sample Type	P
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080119
Test Method	BS1377:Part 5:1990, clause 3				Date started	08/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.526	-	-	-	-
25	0.505	0.56	3.3	4	0.0013
50	0.482	0.6	7.1	89	0.0011
98	0.458	0.34	4.4	29	0.0012
198	0.429	0.2	5.6	14	0.0018
398	0.394	0.12	5.5	13	0.0019
102	0.404	0.024			
25	0.417	0.12			

Preparation

Index tests Liquid limit % Plastic limit %

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.80	-	mm
Height	19.68	18.28	mm
Moisture Content	23.3	20.4	%
Bulk density	2.14	2.25	Mg/m3
Dry density	1.74	1.87	Mg/m3
Voids Ratio	0.526	0.417	
Saturation	117	130	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved

Stephen.Watson

Printed :

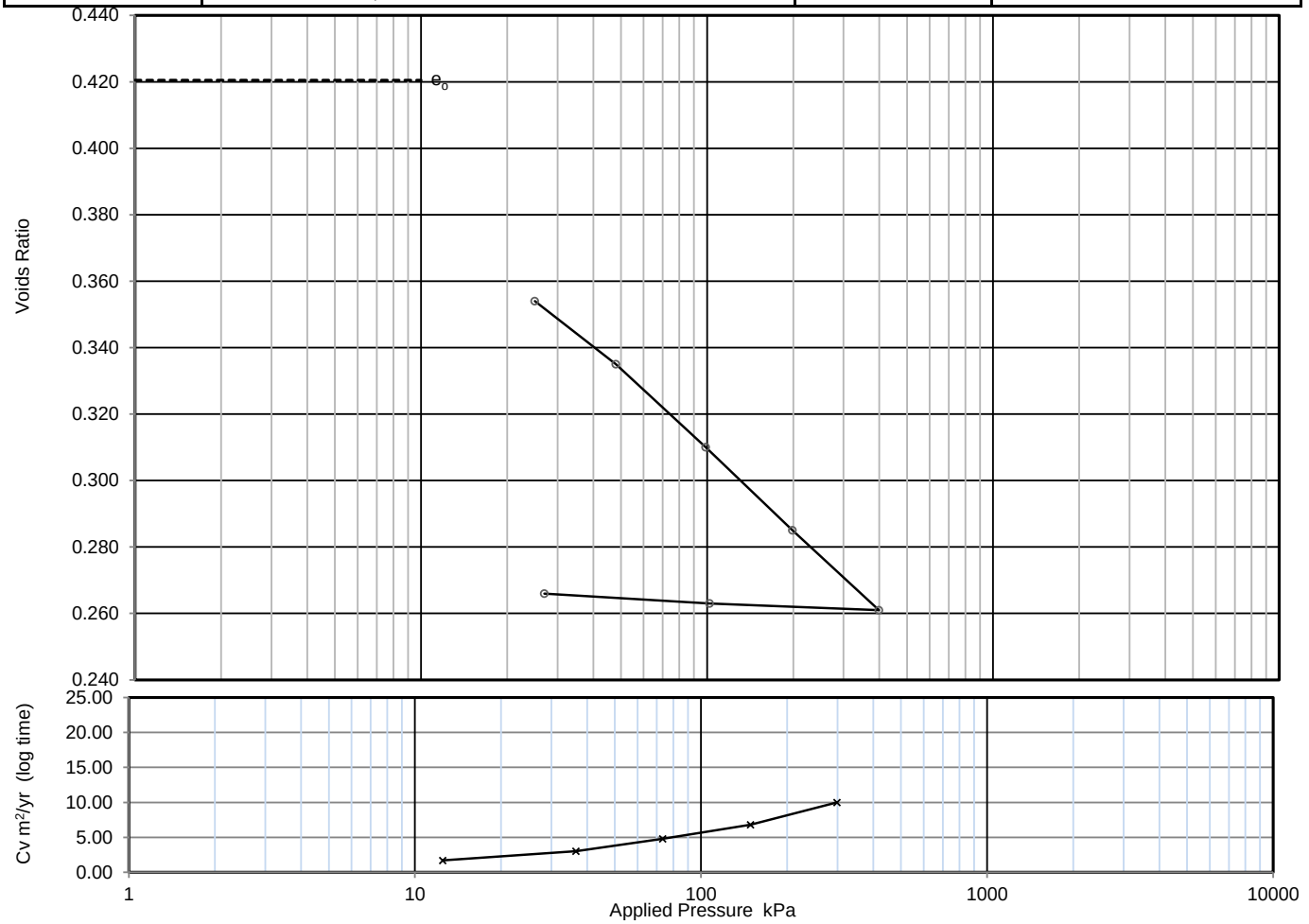
01/10/2019 16:14

LAB 13R Version 4

UKAS TESTING

10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH42
Site Name	Stornoway Deep Water Port				Sample No.	46
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Depth	25.3
Specimen Reference	6	Specimen Depth	25.3	m	Sample Type	B
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080120
Test Method	BS1377:Part 5:1990, clause 3				Date started	08/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.420	-	-	-	-
25	0.354	1.9	1.7	1.3	0.00097
48	0.335	0.6	3	3.8	0.00096
99	0.310	0.37	4.8	7.1	0.00095
199	0.285	0.19	6.8	12	0.0011
399	0.261	0.094	10	19	0.0011
102	0.263	0.0047			
27	0.266	0.035			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.76	17.61	mm
Moisture Content	19.4	12.8	%
Bulk density	2.23	2.36	Mg/m3
Dry density	1.87	2.09	Mg/m3
Voids Ratio	0.420	0.266	
Saturation	122	127	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks: Sample remoulded using the 2.5kg rammer

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

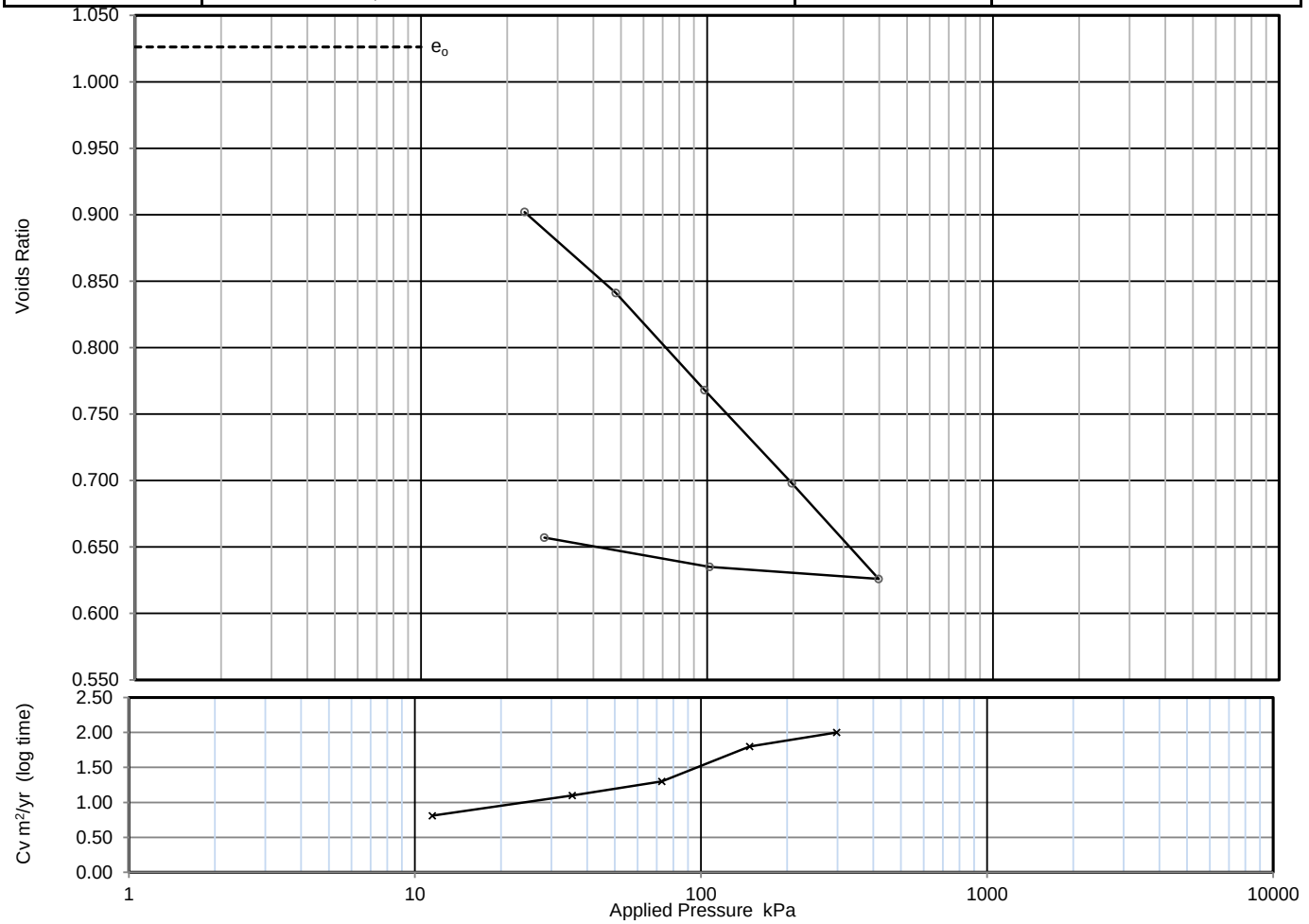
Approved: Stephen.Watson

Printed : 01/10/2019 16:14

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH44
Site Name	Stornoway Deep Water Port				Sample No.	44
Soil Description	Brownish grey slightly gravelly silty CLAY.				Depth	17.7
Specimen Reference	8	Specimen Depth	17.7	m	Sample Type	B
Specimen Description	Brownish grey slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080131
Test Method	BS1377:Part 5:1990, clause 3				Date started	08/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.026	-	-	-	-
23	0.902	2.7	0.81	0.76	0.0031
48	0.841	1.3	1.1	1.2	0.0023
98	0.768	0.79	1.3	1.7	0.0032
198	0.698	0.4	1.8	2	0.0036
398	0.626	0.21	2	2.3	0.0032
102	0.635	0.018			
27	0.657	0.18			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.80	16.19	mm
Moisture Content	41.7	26.7	%
Bulk density	1.85	2.03	Mg/m3
Dry density	1.31	1.60	Mg/m3
Voids Ratio	1.026	0.657	
Saturation	108	107	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks: Sample remoulded using the 2.5kg rammer

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

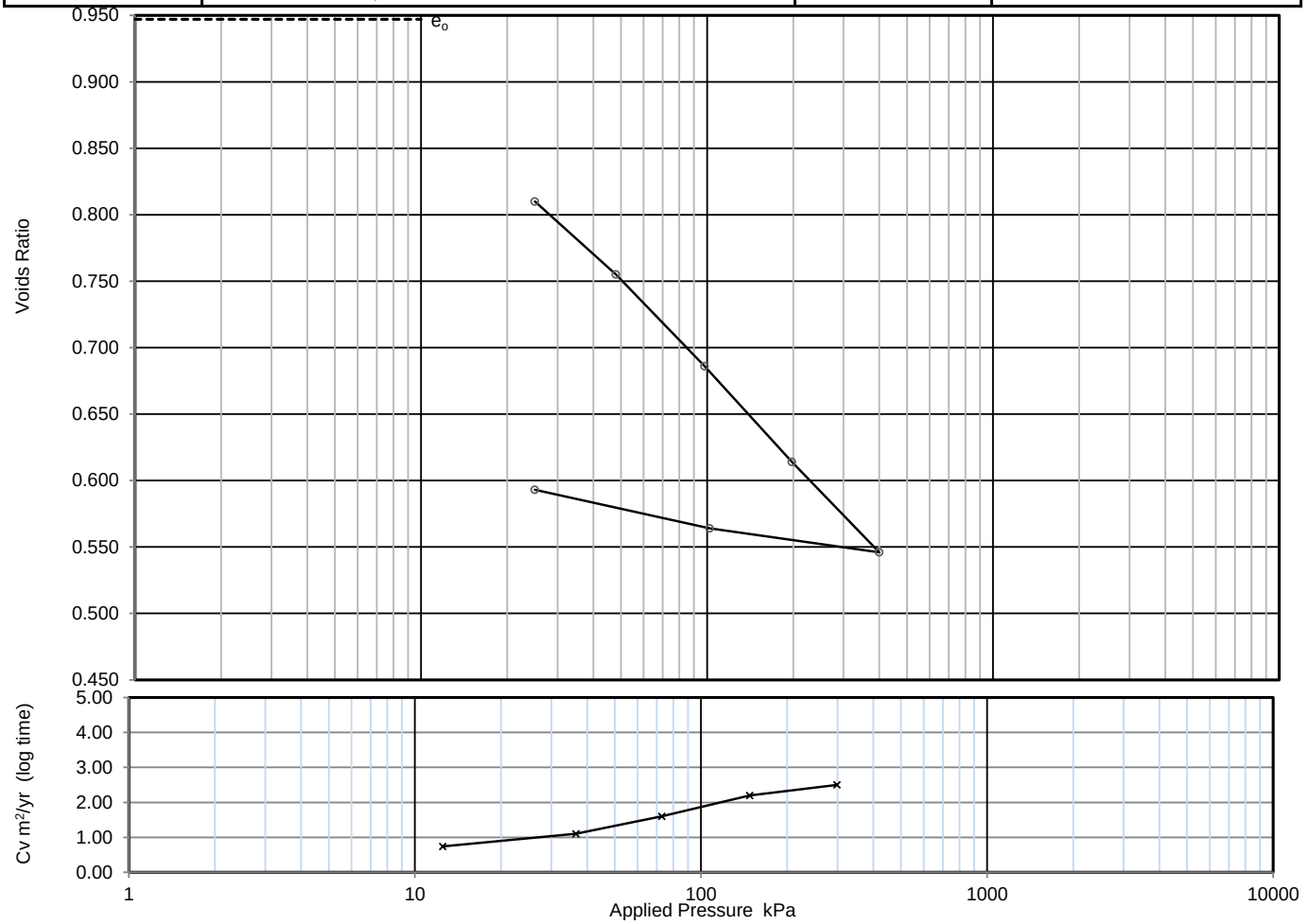
Approved: Stephen.Watson

Printed : 01/10/2019 16:14

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH46
Site Name	Stornoway Deep Water Port				Sample No.	30
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.				Depth	12.5
Specimen Reference	2	Specimen Depth	12.5	m	Sample Type	B
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080142
Test Method	BS1377:Part 5:1990, clause 3				Date started	09/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.947	-	-	-	-
25	0.810	2.8	0.74	0.62	0.0023
48	0.755	1.3	1.1	1.9	0.0028
98	0.686	0.79	1.6	2.1	0.0026
198	0.614	0.42	2.2	3.6	0.0027
400	0.546	0.21	2.5	4.2	0.002
102	0.564	0.04			
25	0.593	0.24			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.20	-	mm
Height	19.98	16.35	mm
Moisture Content	-73.4	24.7	%
Bulk density	0.36	2.07	Mg/m3
Dry density	1.36	1.66	Mg/m3
Voids Ratio	0.947	0.593	
Saturation	-205	110	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks: Sample remoulded using the 2.5kg rammer

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

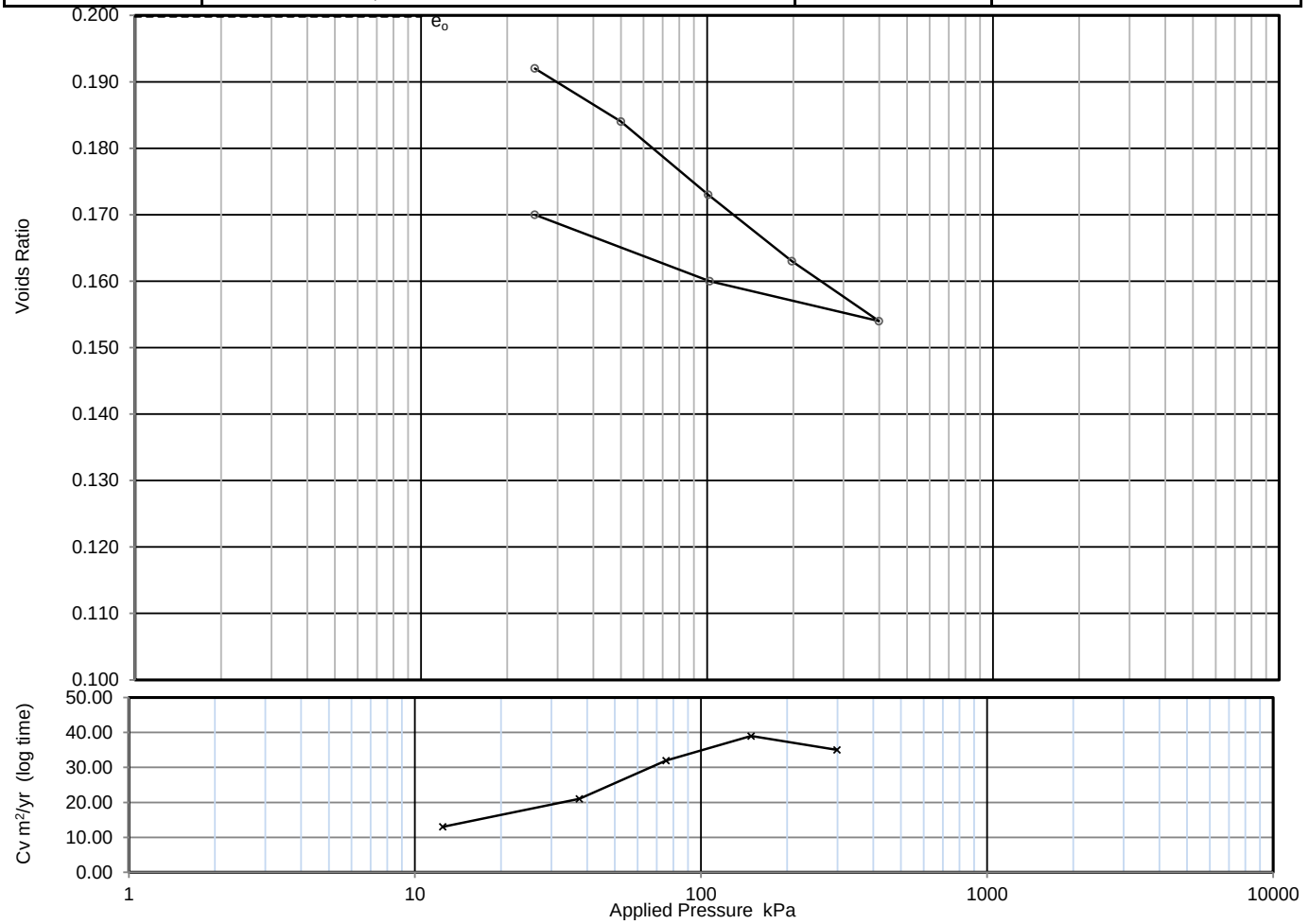
Approved: Stephen.Watson

Printed : 01/10/2019 16:14

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH46
Site Name	Stornoway Deep Water Port				Sample No.	38
Soil Description	Greyish brown sandy slightly gravelly SILT/ CLAY.				Depth	16.5
Specimen Reference	2	Specimen Depth	16.5	m	Sample Type	B
Specimen Description	Greyish brown sandy slightly gravelly SILT/ CLAY.				KeyLAB ID	Caus2019080144
Test Method	BS1377:Part 5:1990, clause 3				Date started	12/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.200	-	-	-	-
25	0.192	0.26	13	15	0.00013
50	0.184	0.27	21	300	0.0003
101	0.173	0.18	32	310	0.00025
198	0.163	0.088	39	310	0.00037
399	0.154	0.039	35	300	0.00035
102	0.160	0.016			
25	0.170	0.12			

Preparation: Remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.85	19.36	mm
Moisture Content	8.6	8.0	%
Bulk density	2.40	2.44	Mg/m3
Dry density	2.21	2.26	Mg/m3
Voids Ratio	0.200	0.170	
Saturation	114	124	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks: Sample remoulded using the 2.5kg rammer

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

Printed : 01/10/2019 16:14

LAB 13R Version 4

UKAS TESTING 10122

LABORATORY REPORT

4043

Contract Number: PSL19/4788

Report Date: 18 September 2019

Client's Reference: 19-0382-1

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 7/8/2019
Date Commenced: 7/8/2019
Date Completed: 18/9/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)

A Watkins (Director)

R Berriman (Quality Manager)

[redacted]

(Laboratory Manager)

S Eyre (Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH42	5	B	1.50	2.50	Brown very gravelly SAND.
BH42	9	B	4.20	4.30	Brown very gravelly SAND.
BH42	13	B	7.20	7.50	Brown very gravelly SAND.
BH42	16	B	9.20	9.50	Brown very gravelly SAND.
BH42	18	B	10.50	10.70	Dark brown very gravelly slightly silty SAND.
BH42	40	P	22.50	23.35	Brown slightly gravelly slightly sandy CLAY.
BH42	48	B	27.50	27.80	Brown very gravelly silty SAND.
BH44	3	B	1.00	1.50	Brown silty SAND & GRAVEL.
BH44	10	B	3.00	3.50	Brown very gravelly SAND.
BH44	13	B	4.00	4.45	Brown gravelly SAND.
BH44	19	B	6.50	6.80	Brown gravelly SAND.
BH44	24	B	8.20	8.50	Brown gravelly slightly silty SAND.
BH44	29	B	11.20	11.50	Brown slightly gravelly silty SAND.
BH44	32	P	12.00	13.00	Brown gravelly SAND.
BH44	33	P	13.50	14.50	Brown gravelly SAND.
BH44	35	P	16.50	17.50	Brown slightly gravelly slightly sandy CLAY.
BH44	36	P	18.00	19.00	Brown slightly gravelly slightly sandy CLAY.
BH44	56	B	22.00	22.50	Brown gravelly SAND.
BH44	62	B	23.50	24.00	Brown gravelly SAND.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH46	4	B	1.00	1.50	Brown gravelly very sandy CLAY.
BH46	10	B	3.00	3.50	Brown very sandy slightly silty GRAVEL.
BH46	13	B	4.60	5.00	Brown very sandy GRAVEL.
BH46	15	B	5.00	6.60	Brown very sandy slightly silty GRAVEL.
BH46	20	B	7.00	7.50	Brown very sandy slightly silty GRAVEL.
BH46	22	P	10.50	11.50	Brown slightly gravelly slightly sandy CLAY.
BH46	23	U	13.50	13.95	Brown slightly gravelly slightly sandy CLAY.

SUMMARY OF SOIL DENSITY RELATED TESTS

(BS1377 : PART 2 & 4 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Retained 20mm %	Retained 37.5mm %	Method of compaction kg	Maximum Dry Density Mg/m^3	Minimum Dry Density Mg/m^3	Remarks
BH42	5	B	1.50	2.50	7.4	1.80	1.68						
BH42	18	B	10.50	10.70	8.7	1.87	1.72						
BH42	48	B	27.50	27.80	4.9	1.82	1.73						
BH44	24	B	8.20	8.50	16	2.00	1.72						
BH44	29	B	11.20	11.50	22	2.10	1.72						
BH46	10	B	3.00	3.50	2.4	1.90	1.86						
BH46	13	B	4.60	5.00	2.4	1.91	1.87						
BH46	15	B	5.00	6.60	4.0	1.94	1.87						
BH46	20	B	7.00	7.50	3.2	1.88	1.82						

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Stornoway Deep Water Port

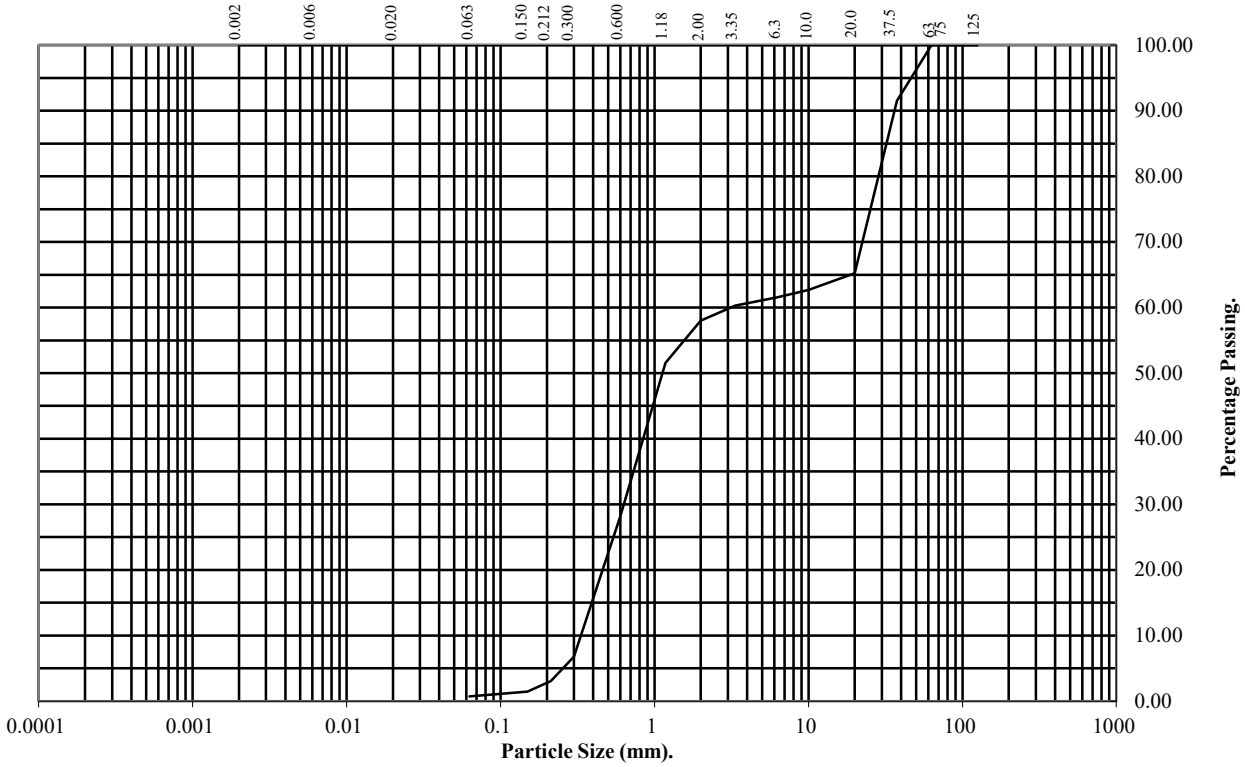
Contract No:
PSL19/4788
Client Ref:
19-0382

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH42**	**Top Depth (m):**	**1.50**
Sample Number:	**5**	**Base Depth(m):**	**2.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	65
10	63
6.3	62
3.35	60
2	58
1.18	52
0.6	28
0.3	7
0.212	3
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	42
Sand	57
Silt/Clay	1

Remarks:

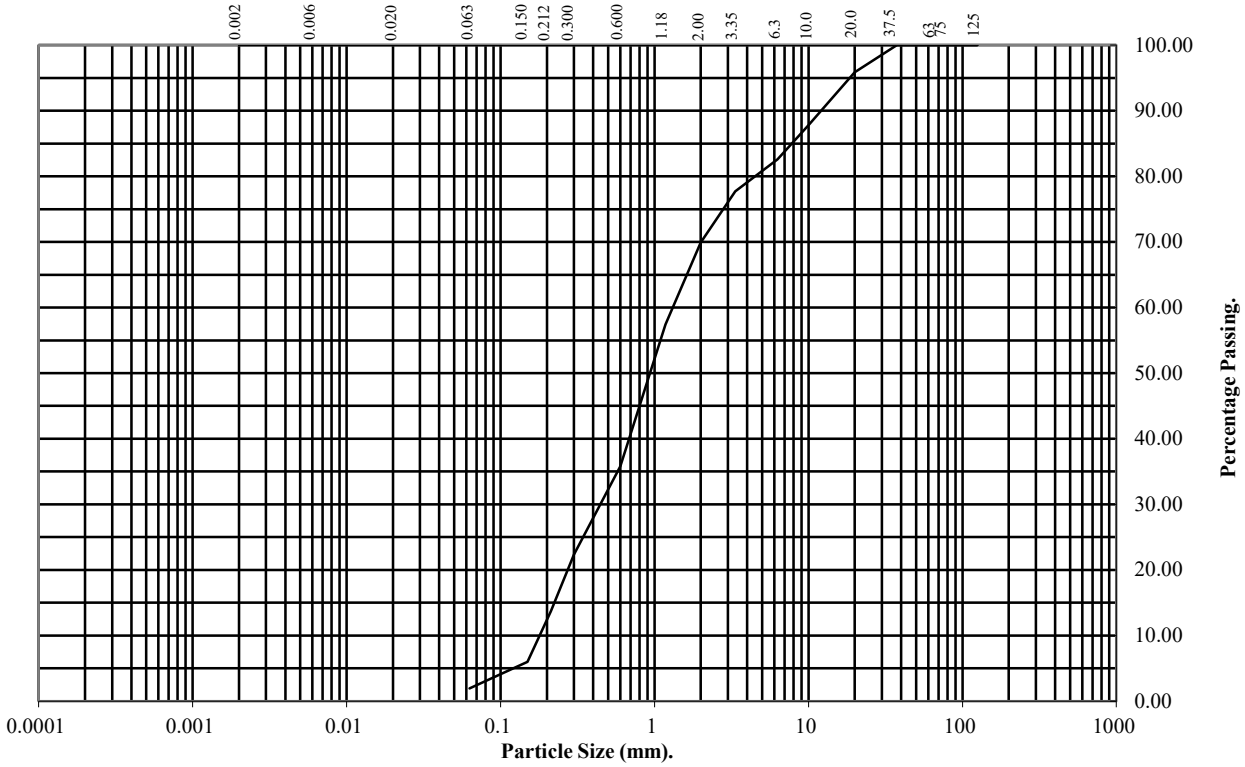
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH42**	**Top Depth (m):**	**10.50**
Sample Number:	**18**	**Base Depth(m):**	**10.70**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	88
6.3	83
3.35	78
2	70
1.18	57
0.6	36
0.3	22
0.212	14
0.15	6
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	30
Sand	68
Silt/Clay	2

Remarks:

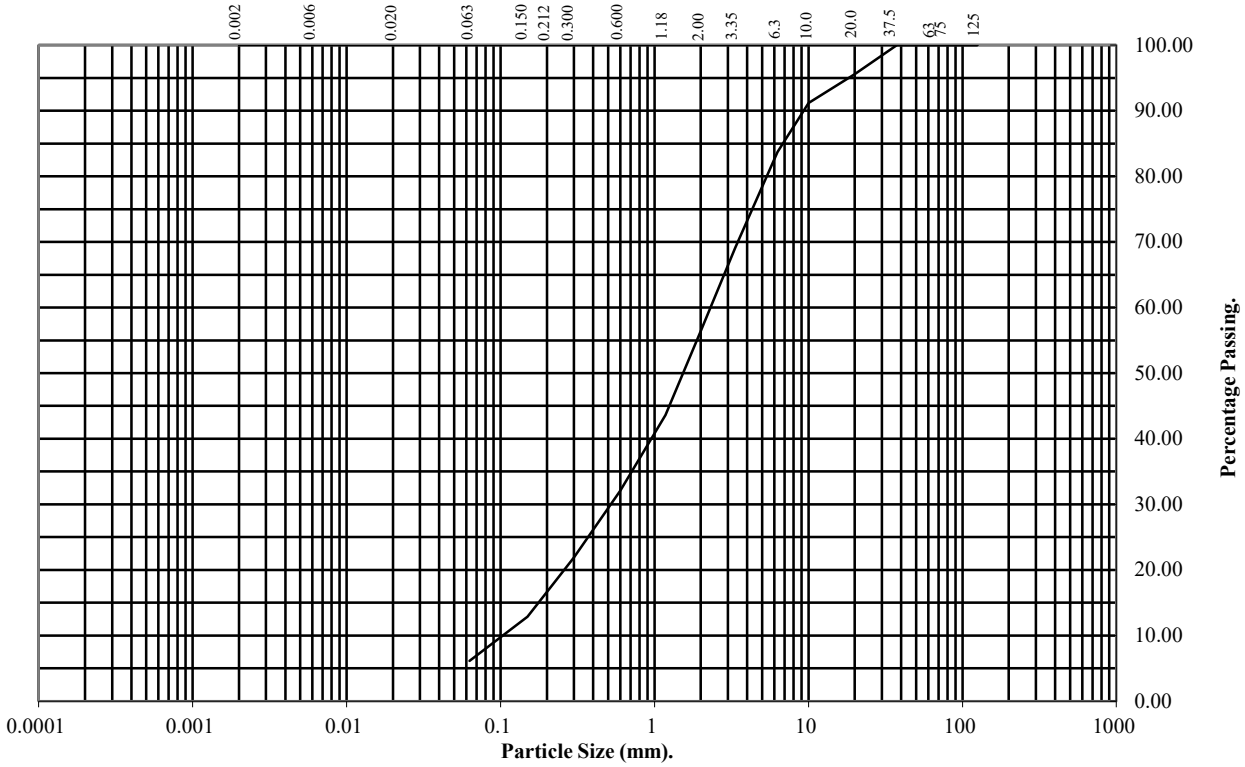
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH42**	**Top Depth (m):**	**27.50**
Sample Number:	**48**	**Base Depth(m):**	**27.80**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	91
6.3	84
3.35	69
2	56
1.18	44
0.6	32
0.3	22
0.212	17
0.15	13
0.063	6

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	50
Silt/Clay	6

Remarks:

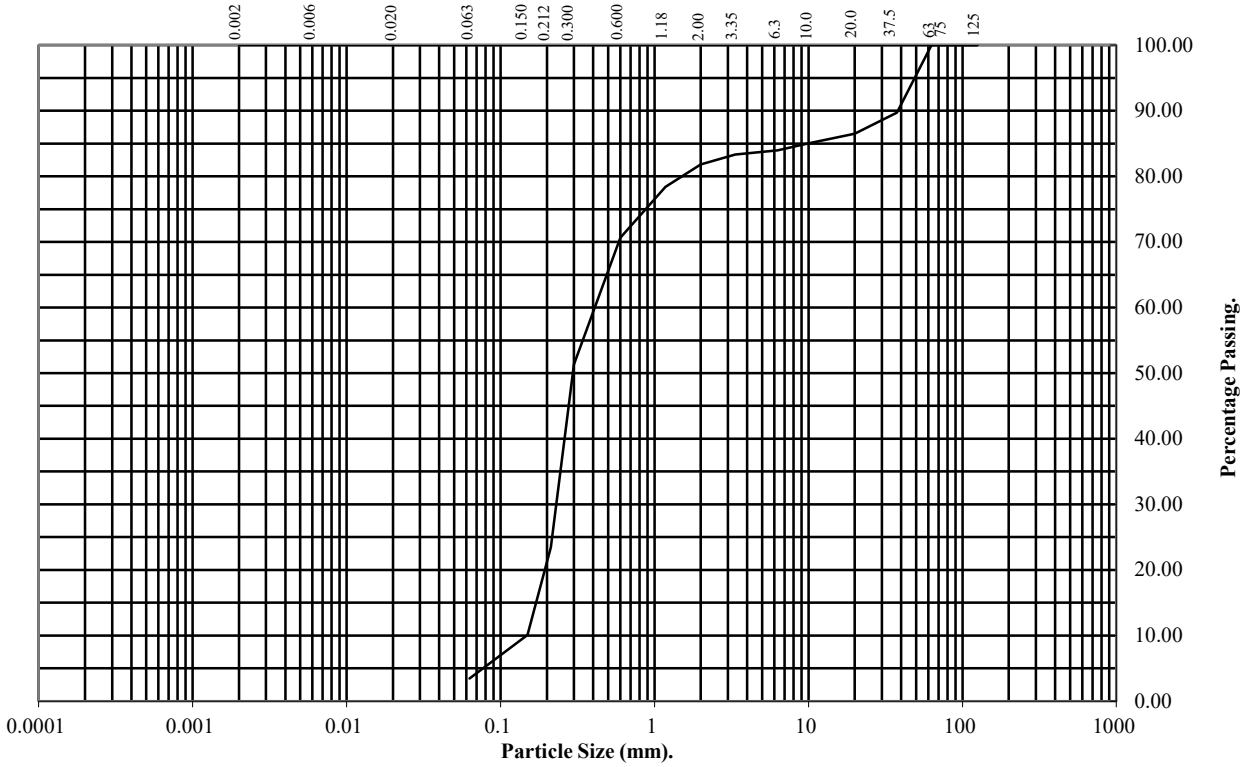
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH44**	**Top Depth (m):**	**8.20**
Sample Number:	**24**	**Base Depth(m):**	**8.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	90
20	87
10	85
6.3	84
3.35	83
2	82
1.18	78
0.6	71
0.3	51
0.212	23
0.15	10
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	18
Sand	79
Silt/Clay	3

Remarks:

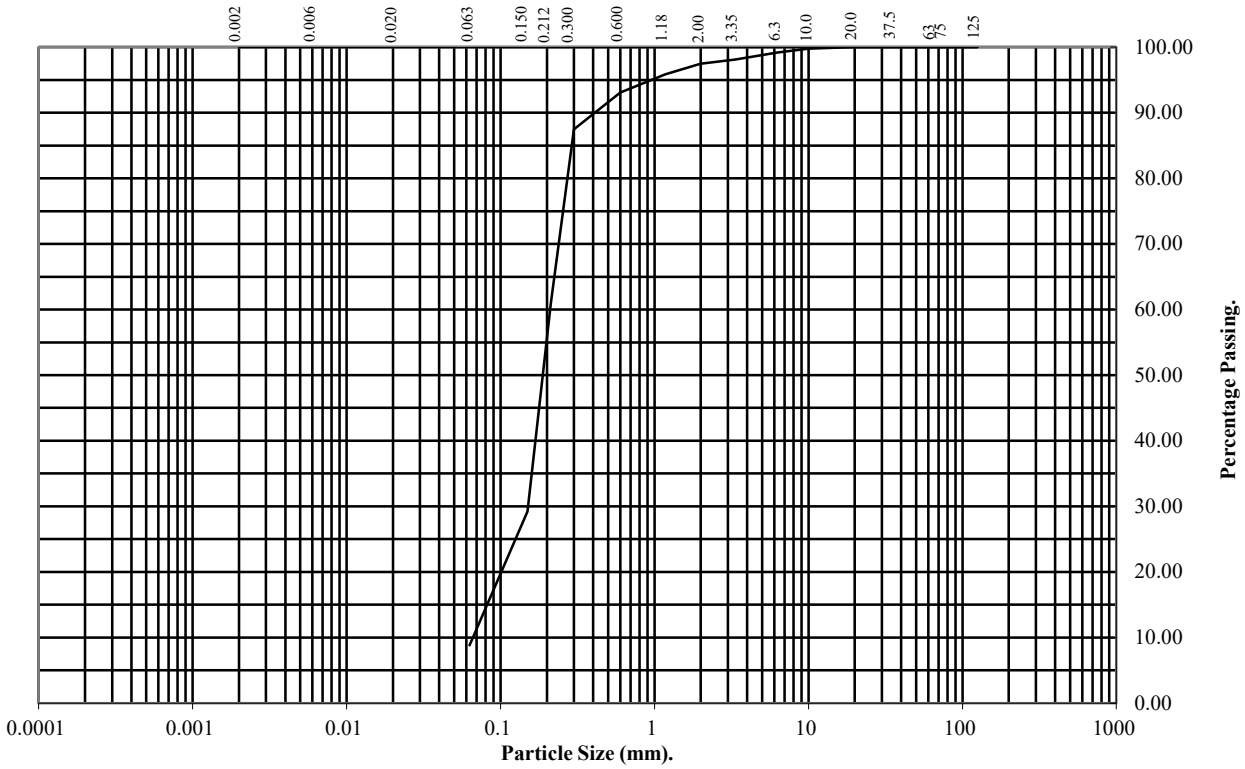
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH44**	**Top Depth (m):**	**11.20**
Sample Number:	**29**	**Base Depth(m):**	**11.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	98
2	97
1.18	96
0.6	93
0.3	87
0.212	61
0.15	29
0.063	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	88
Silt/Clay	9

Remarks:

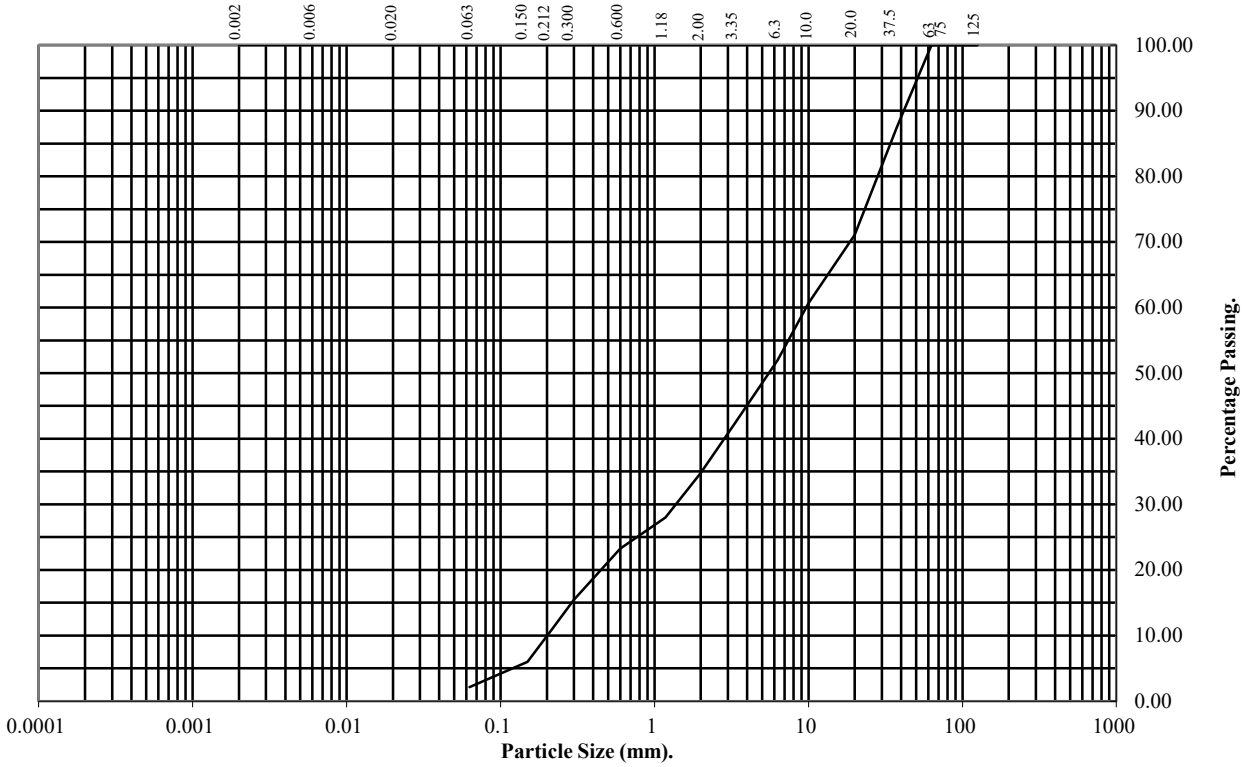
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH46**	**Top Depth (m):**	**3.00**
Sample Number:	**10**	**Base Depth(m):**	**3.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	88
20	71
10	61
6.3	52
3.35	42
2	35
1.18	28
0.6	23
0.3	15
0.212	11
0.15	6
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	65
Sand	33
Silt/Clay	2

Remarks:

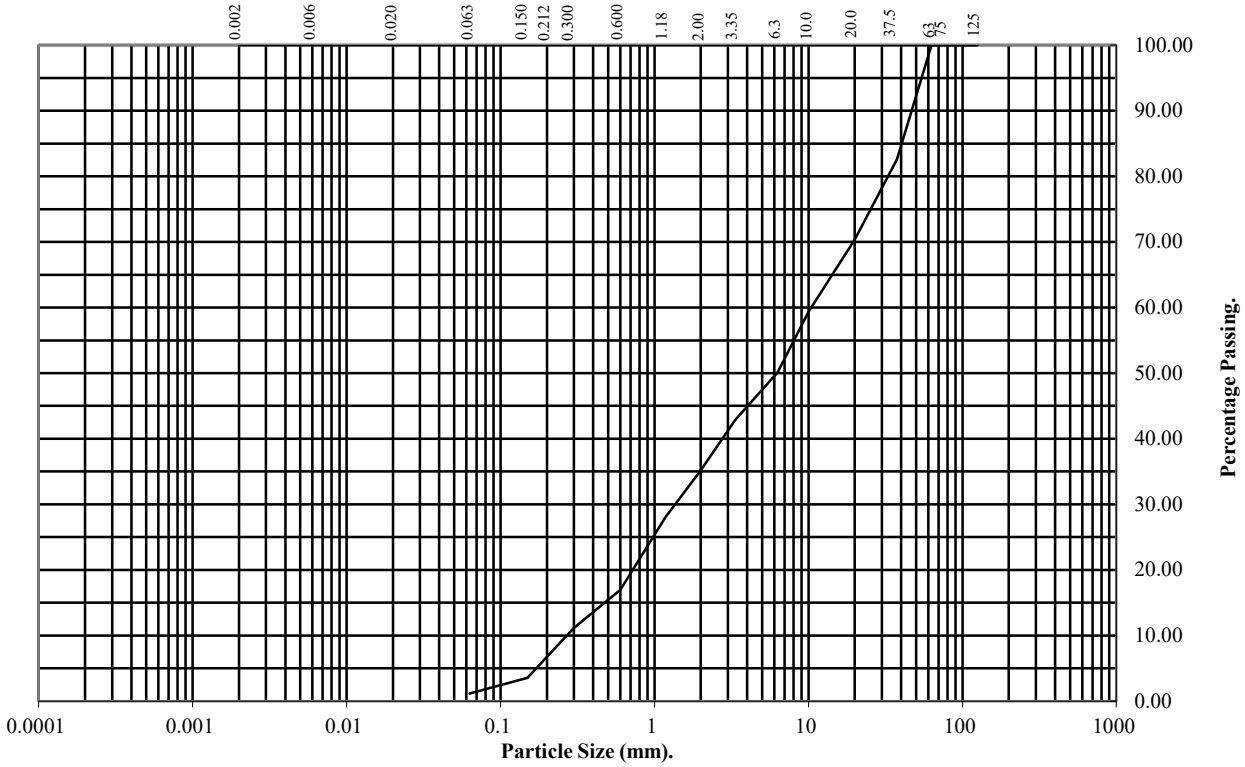
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH46**	**Top Depth (m):**	**4.60**
Sample Number:	**13**	**Base Depth(m):**	**5.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	83
20	70
10	59
6.3	50
3.35	43
2	35
1.18	28
0.6	17
0.3	11
0.212	7
0.15	4
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	65
Sand	34
Silt/Clay	1

Remarks:

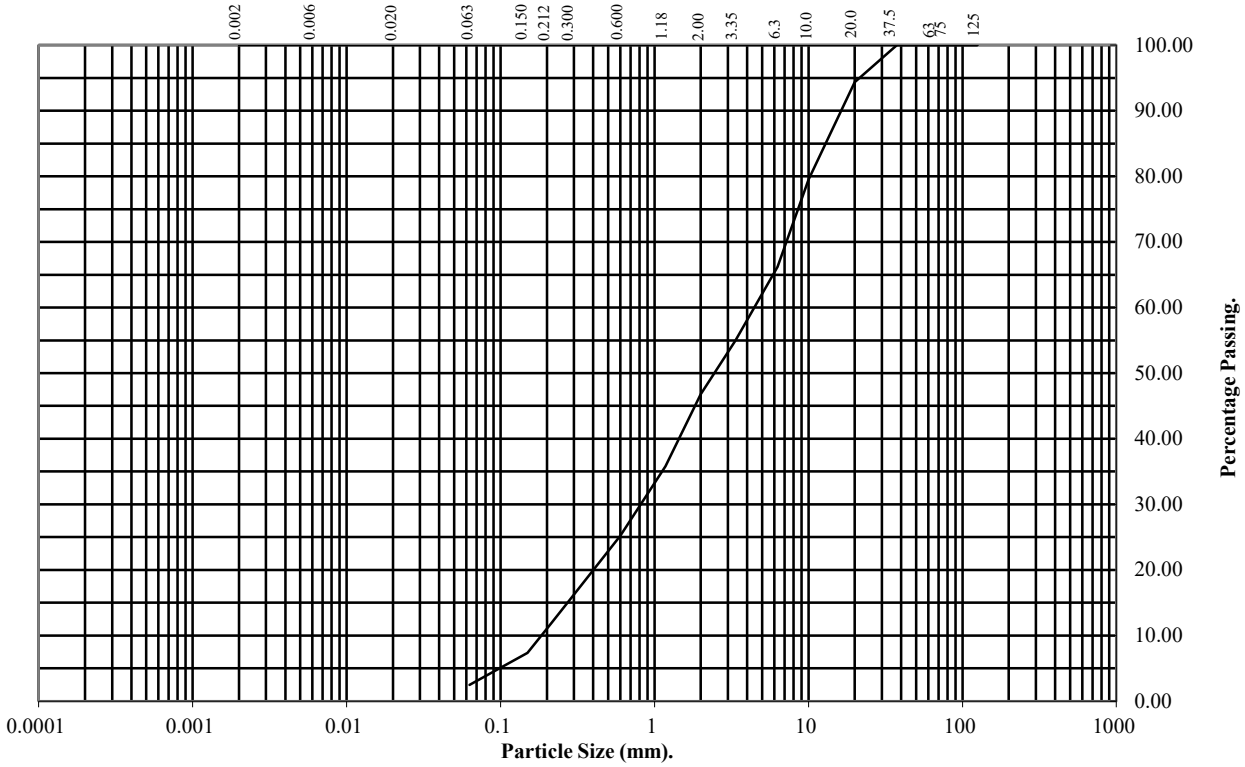
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH46**	**Top Depth (m):**	**5.00**
Sample Number:	**15**	**Base Depth(m):**	**6.60**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	80
6.3	66
3.35	55
2	47
1.18	36
0.6	25
0.3	16
0.212	12
0.15	7
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	53
Sand	45
Silt/Clay	2

Remarks:

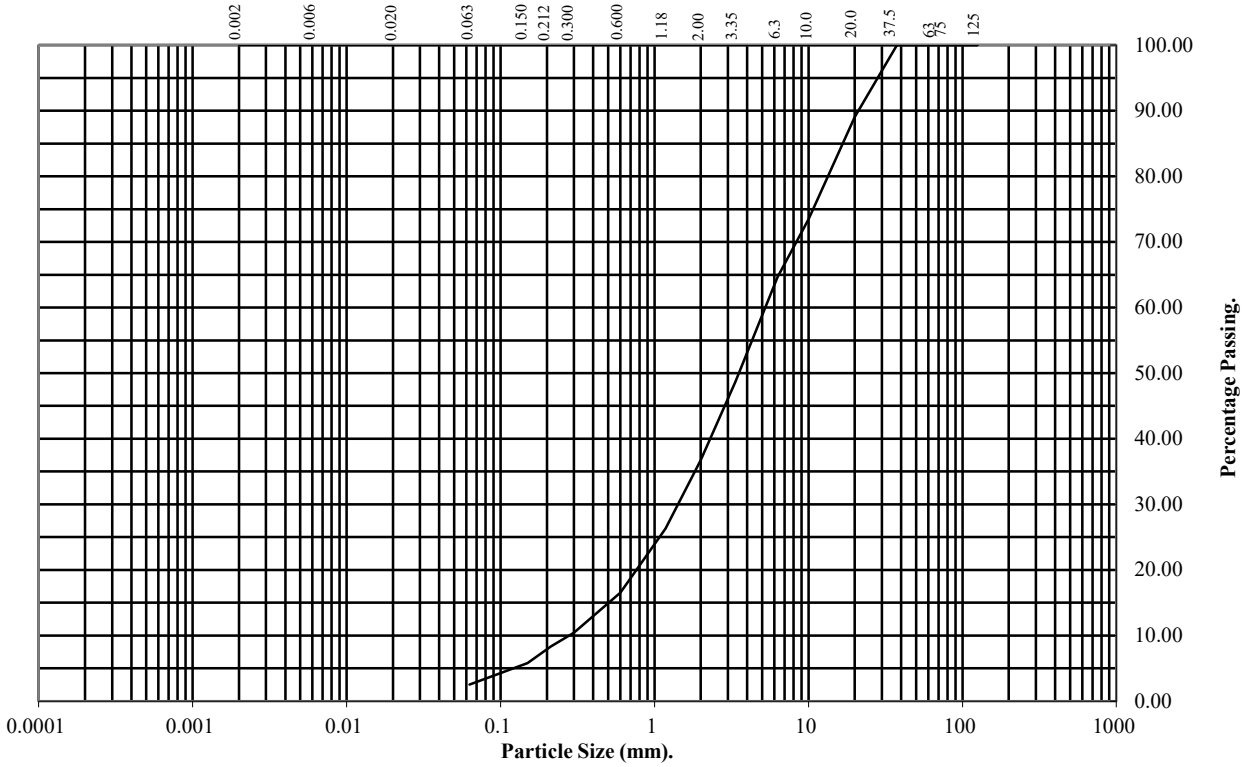
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH46**	**Top Depth (m):**	**7.00**
Sample Number:	**20**	**Base Depth(m):**	**7.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	89
10	73
6.3	65
3.35	49
2	37
1.18	26
0.6	17
0.3	10
0.212	8
0.15	6
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	63
Sand	34
Silt/Clay	3

Remarks:

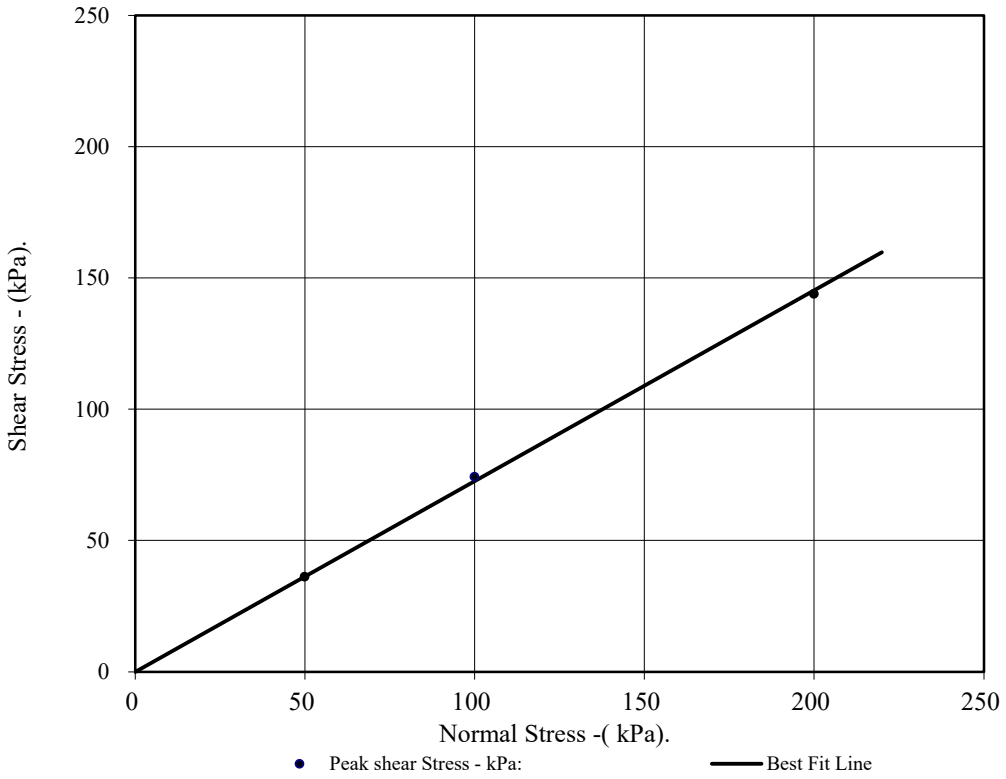
See Summary of Soil Descriptions

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**1.50**	
Sample Number:	**5**		Base Depth:	**2.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	8.4	8.4	8.4
Bulk Density - Mg/m3:	1.70	1.70	1.70
Dry Density - Mg/m3:	1.57	1.57	1.57
Voids Ratio:	0.690	0.686	0.686
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.89	19.71	19.23
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	5.11	3.01	5.71
Peak shear Stress - kPa:	36	74	144
Final Consolidated Conditions			
Moisture Content - %:	7.0	7.0	8.4
Bulk Density - Mg/m3:	1.71	1.73	1.78
Dry Density - Mg/m3:	1.60	1.62	1.64
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**0**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

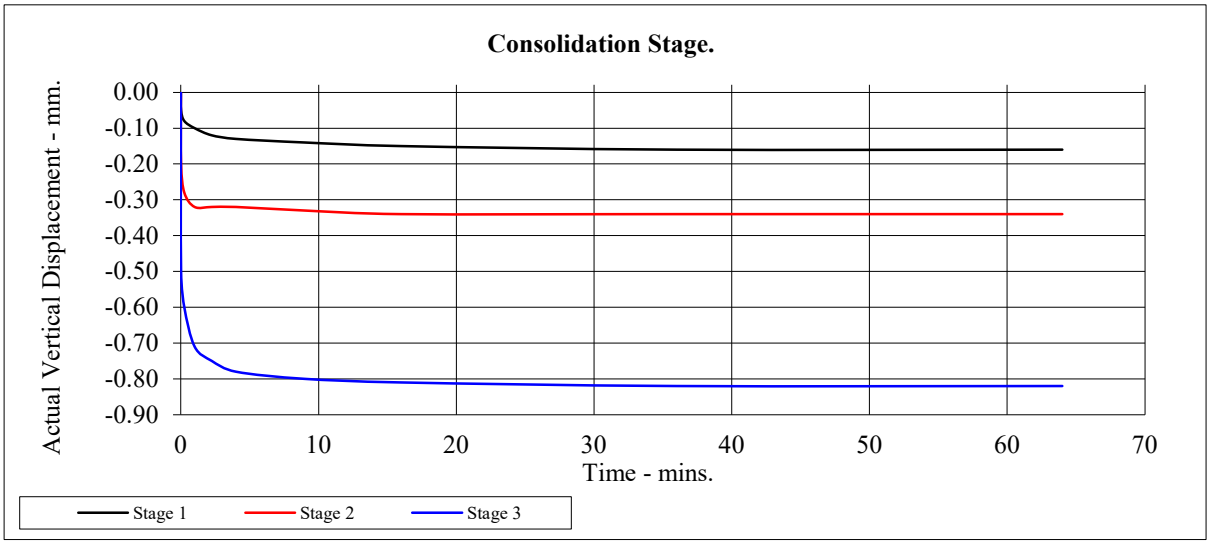
Contract No: PSL19/4788

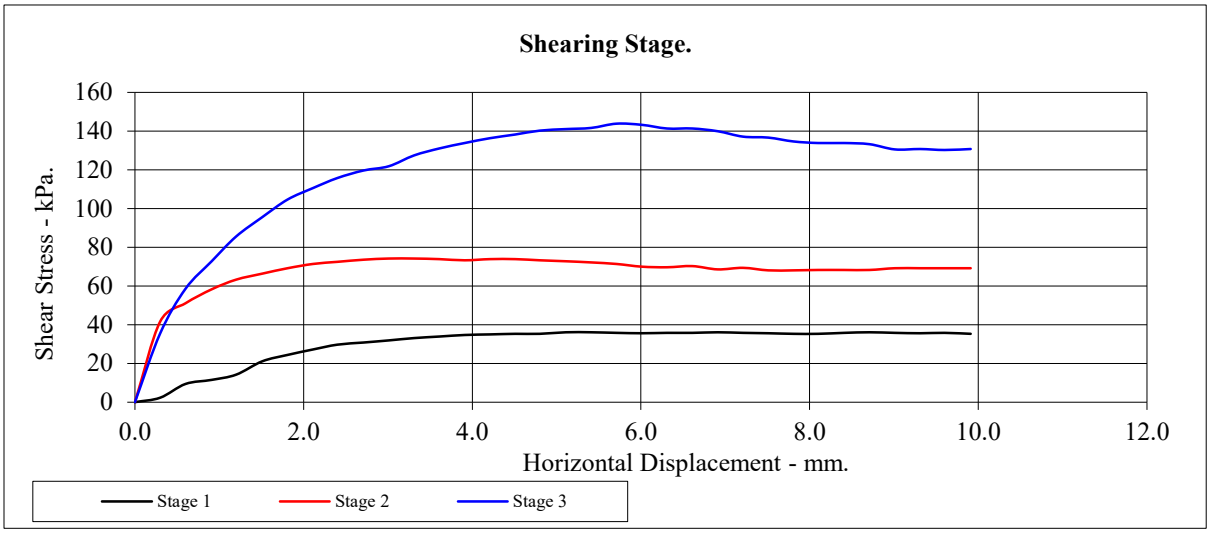
Client Ref: 19-0382

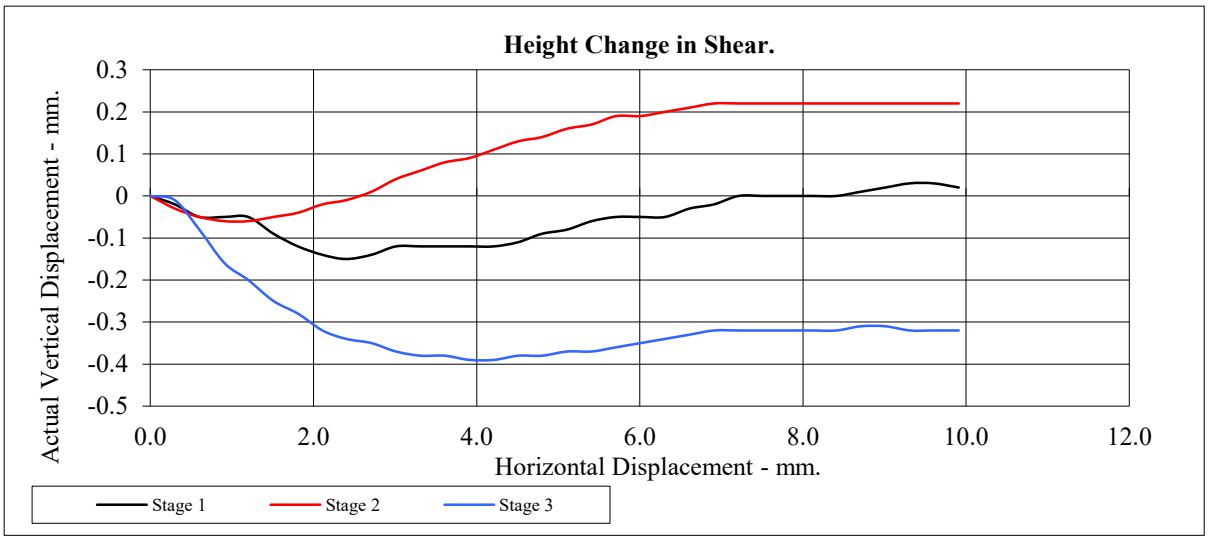
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**1.50**
Sample Number:	**5**	Base Depth:	**2.50**







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PSL Professional Soils Laboratory

Stornoway Deep Water Port

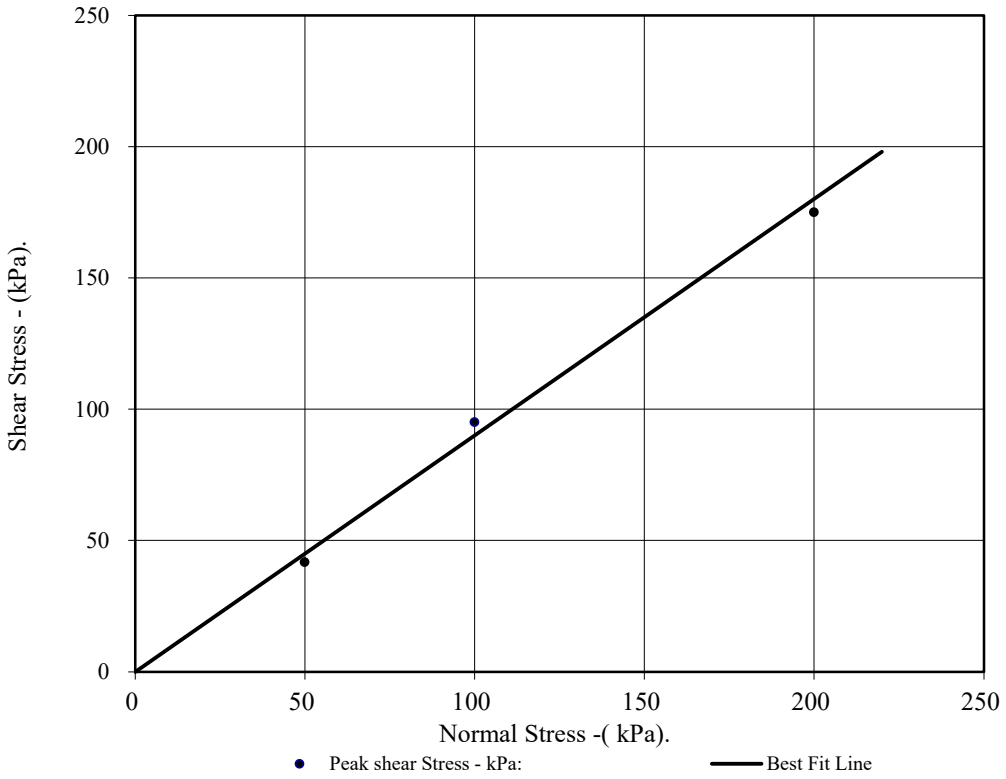
Contract No:
PSL19/4788
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**4.20**
Sample Number:	**9**		Base Depth:	**4.30**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	3.9	3.9	3.9
Bulk Density - Mg/m3:	1.75	1.75	1.75
Dry Density - Mg/m3:	1.68	1.68	1.68
Voids Ratio:	0.576	0.573	0.575
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.90	19.59	19.30
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.61	6.01	7.81
Peak shear Stress - kPa:	42	95	175
Final Consolidated Conditions			
Moisture Content - %:	3.3	3.1	3.2
Bulk Density - Mg/m3:	1.76	1.79	1.82
Dry Density - Mg/m3:	1.70	1.74	1.76
Peak			
Angle of Shearing Resistance:(~~θ~~)	**42**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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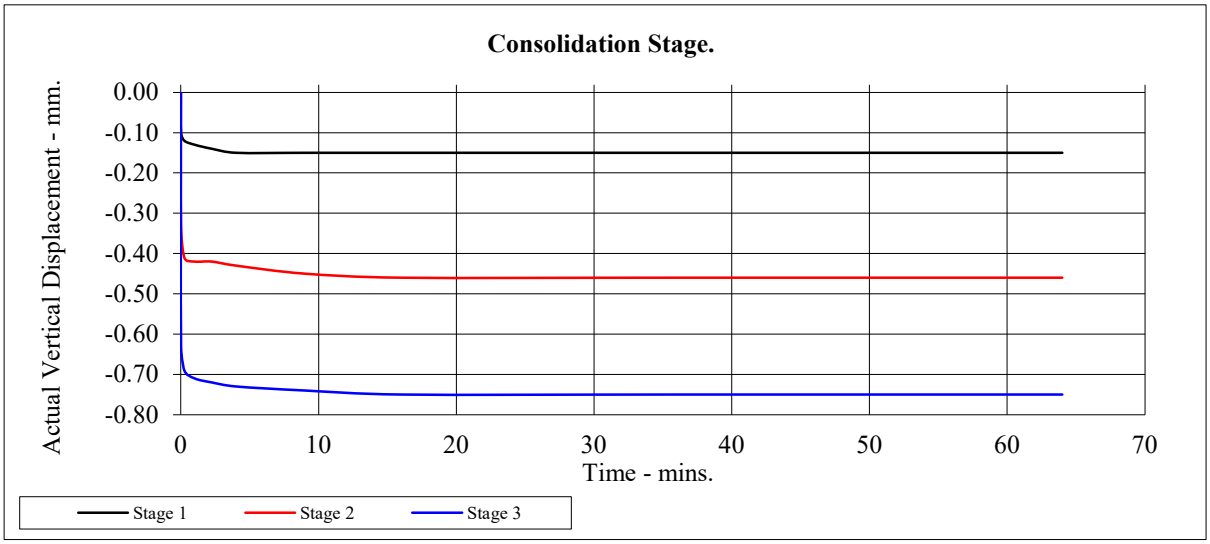
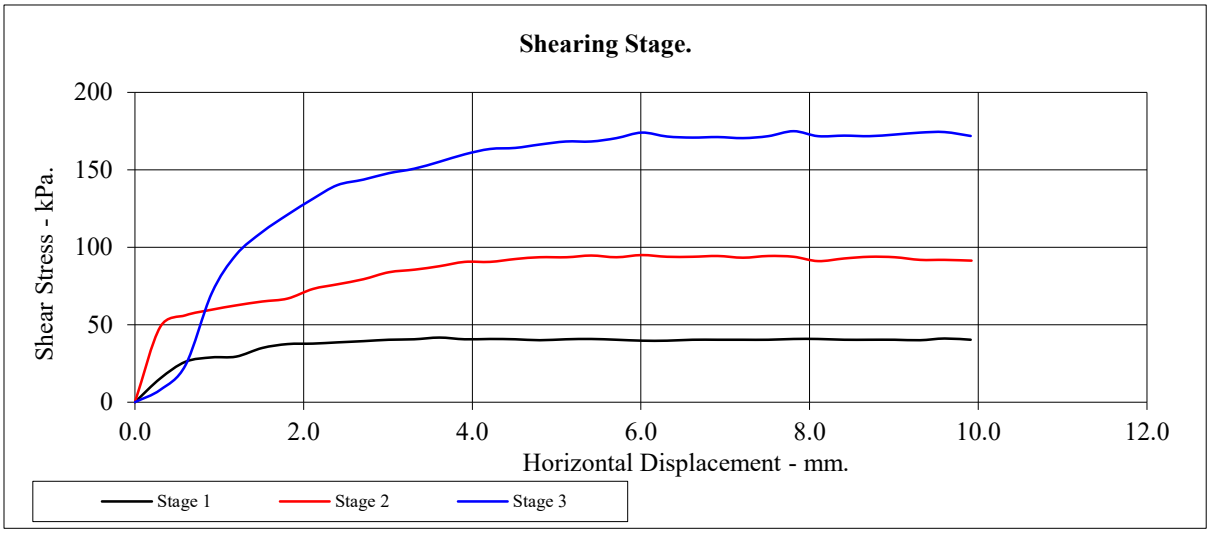
Client Ref: 19-0382

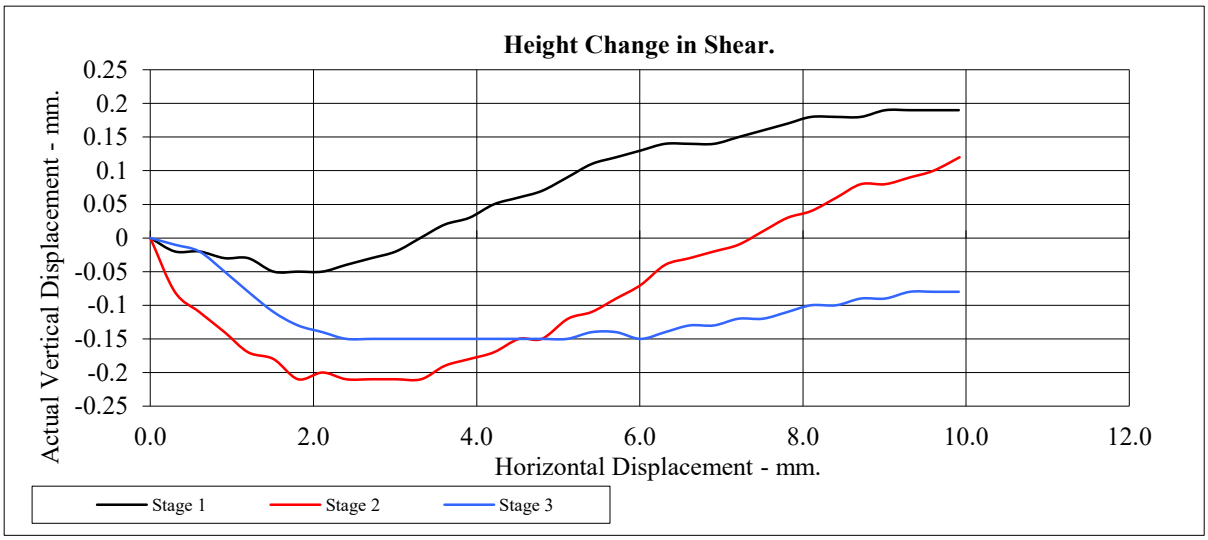
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**4.20**
Sample Number:	**9**	Base Depth:	**4.30**







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Stornoway Deep Water Port

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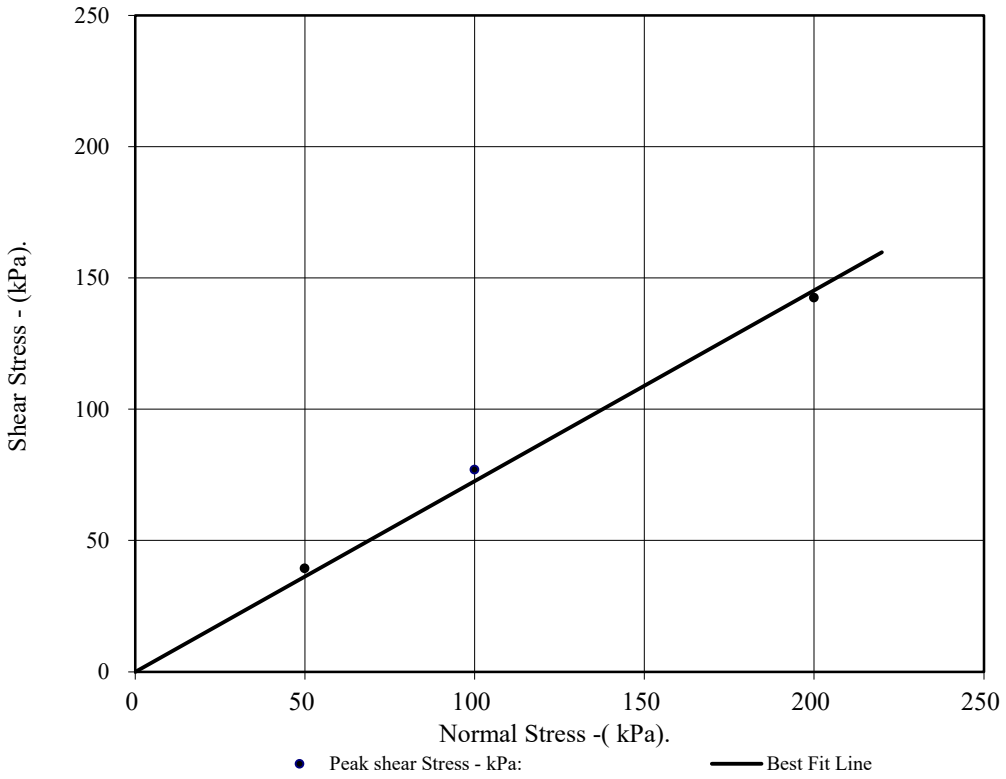
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**7.20**
Sample Number:	**13**		Base Depth:	**7.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.2	5.2	5.2
Bulk Density - Mg/m3:	1.61	1.62	1.62
Dry Density - Mg/m3:	1.53	1.54	1.54
Voids Ratio:	0.727	0.725	0.721
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.85	19.15	18.77
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	5.41	8.41	8.10
Peak shear Stress - kPa:	39	77	143
Final Consolidated Conditions			
Moisture Content - %:	4.1	3.9	3.4
Bulk Density - Mg/m3:	1.63	1.69	1.73
Dry Density - Mg/m3:	1.57	1.63	1.67
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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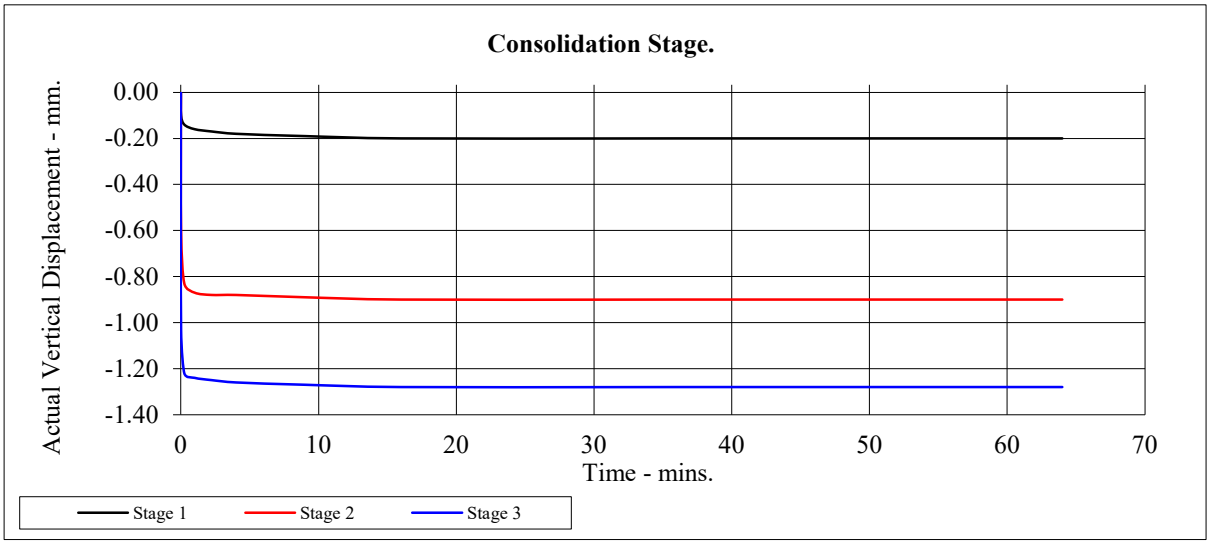
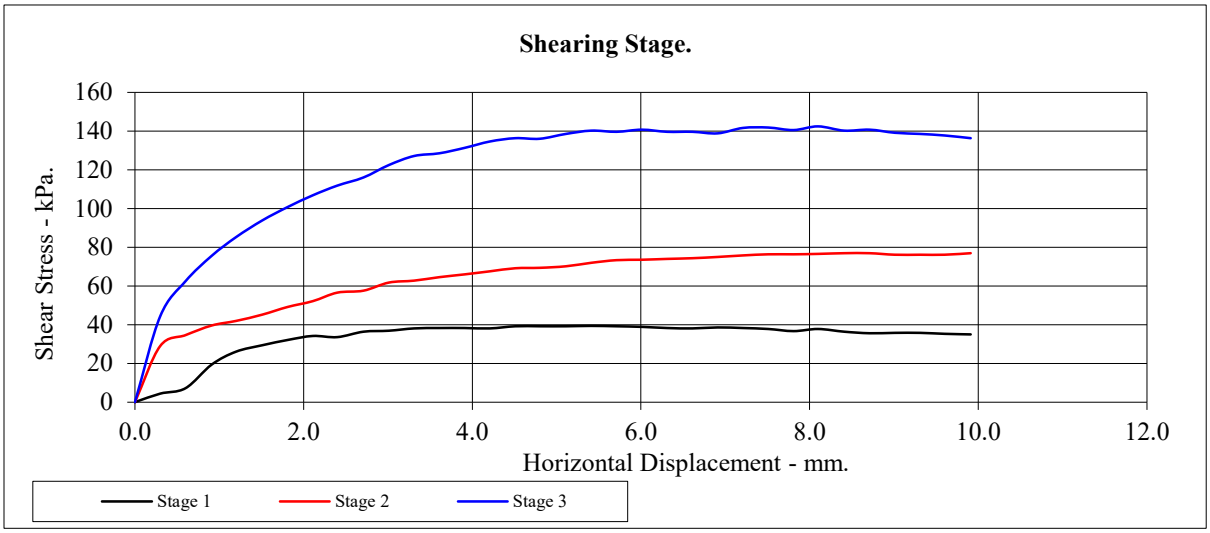
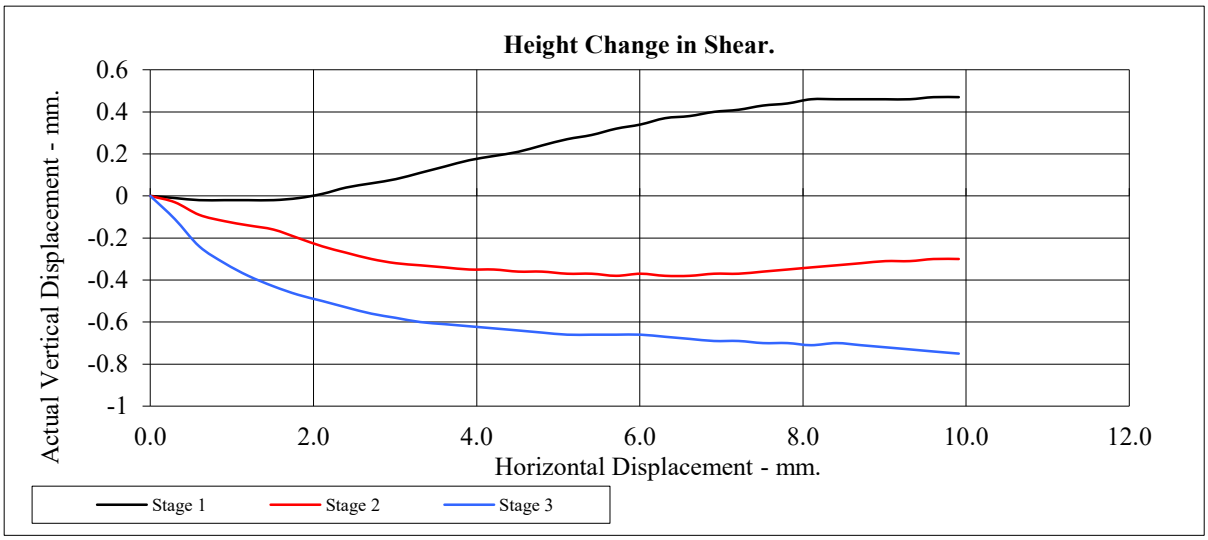
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**7.20**
Sample Number:	**13**	Base Depth:	**7.50**







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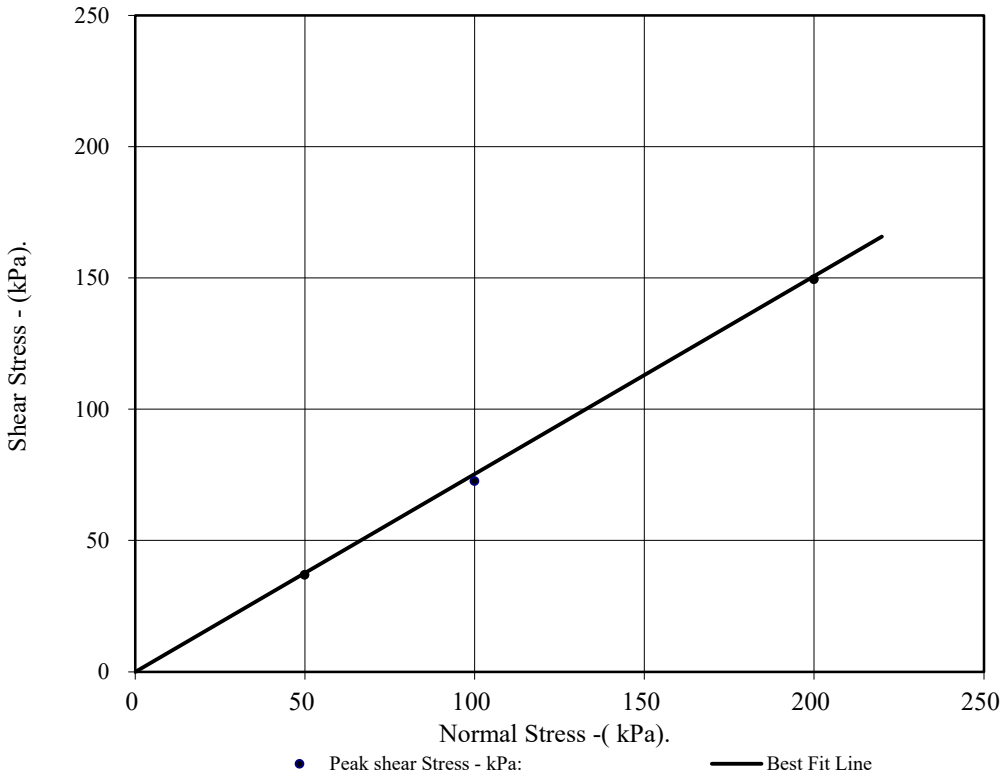
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**9.20**	
Sample Number:	**16**		Base Depth:	**9.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	3.9	3.9	3.9
Bulk Density - Mg/m3:	1.59	1.60	1.60
Dry Density - Mg/m3:	1.53	1.54	1.54
Voids Ratio:	0.733	0.724	0.721
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.81	19.47	18.24
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	6.01	6.31	5.71
Peak shear Stress - kPa:	37	73	149
Final Consolidated Conditions			
Moisture Content - %:	3.8	3.2	3.6
Bulk Density - Mg/m3:	1.61	1.65	1.76
Dry Density - Mg/m3:	1.55	1.59	1.70
Peak			
Angle of Shearing Resistance:(~~θ~~)	**37**		
Effective Cohesion - kPa:	**0**		



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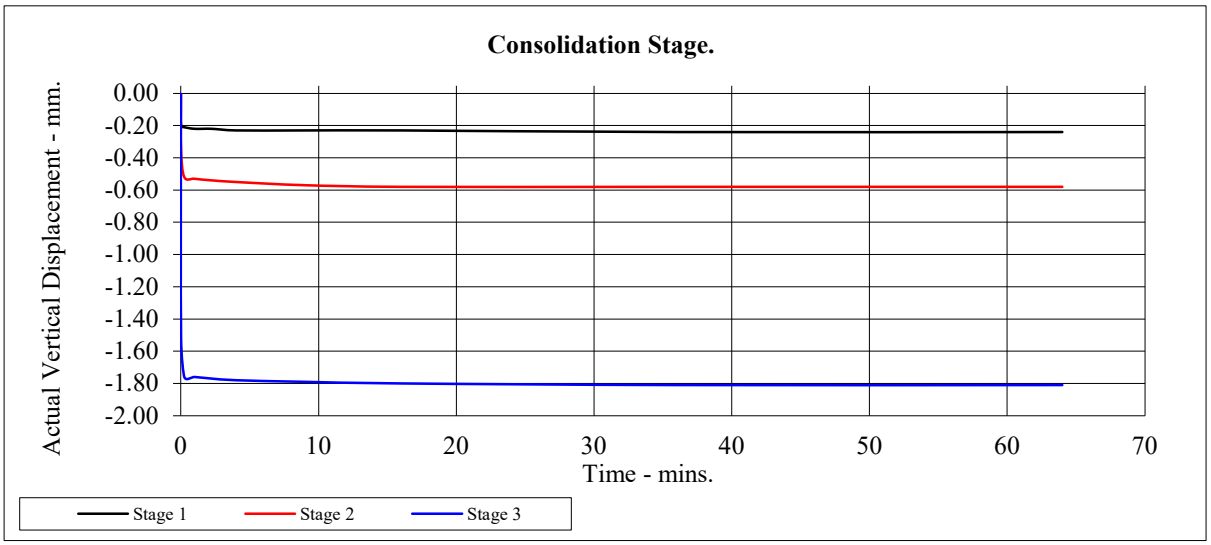
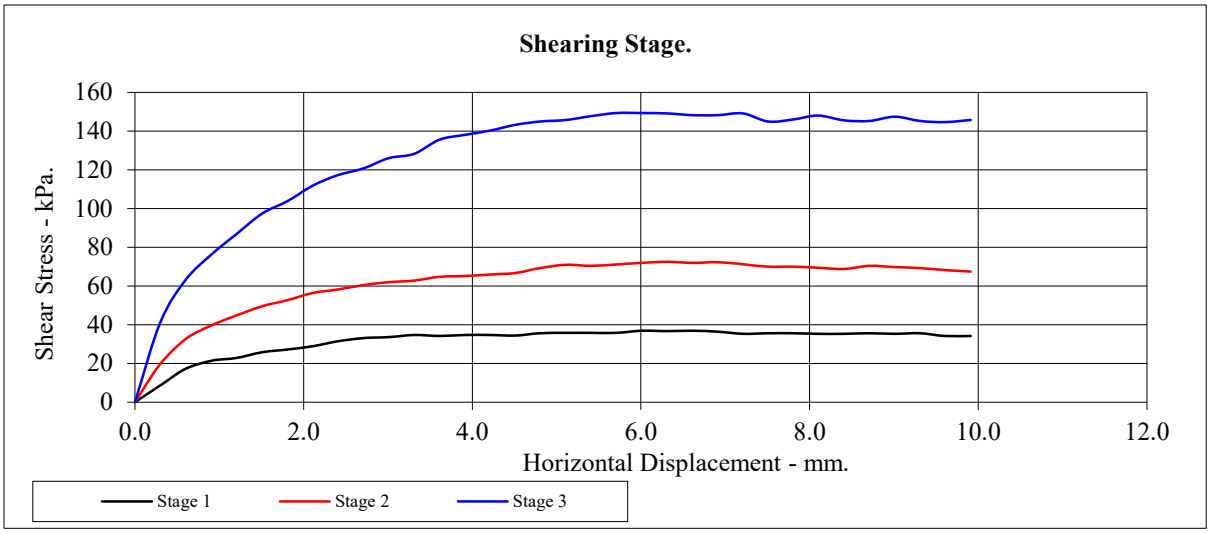
Client Ref: 19-0382

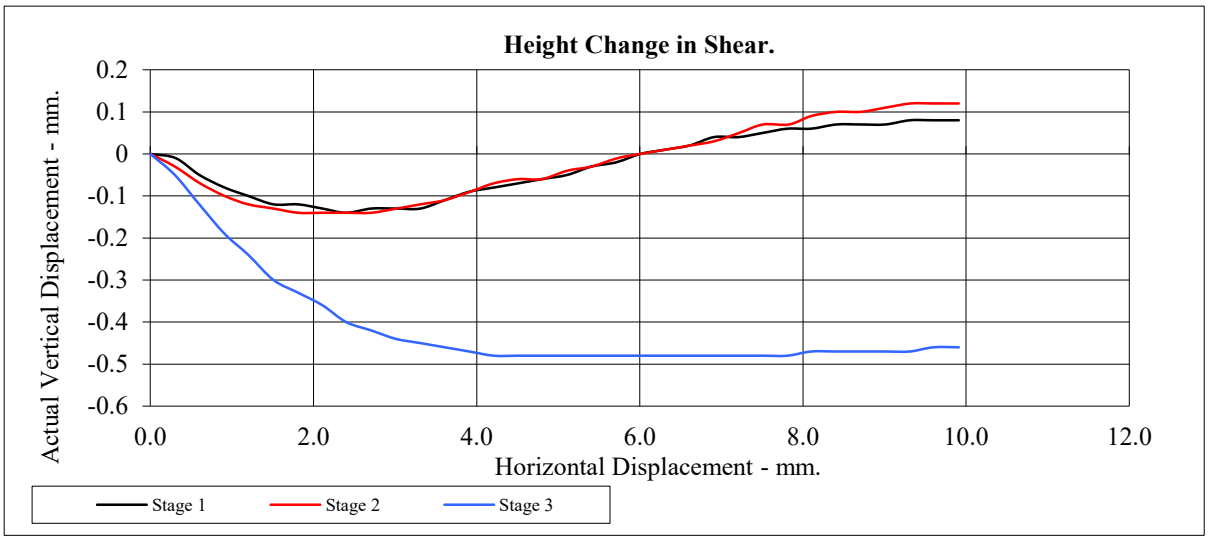
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**9.20**
Sample Number:	**16**	Base Depth:	**9.50**





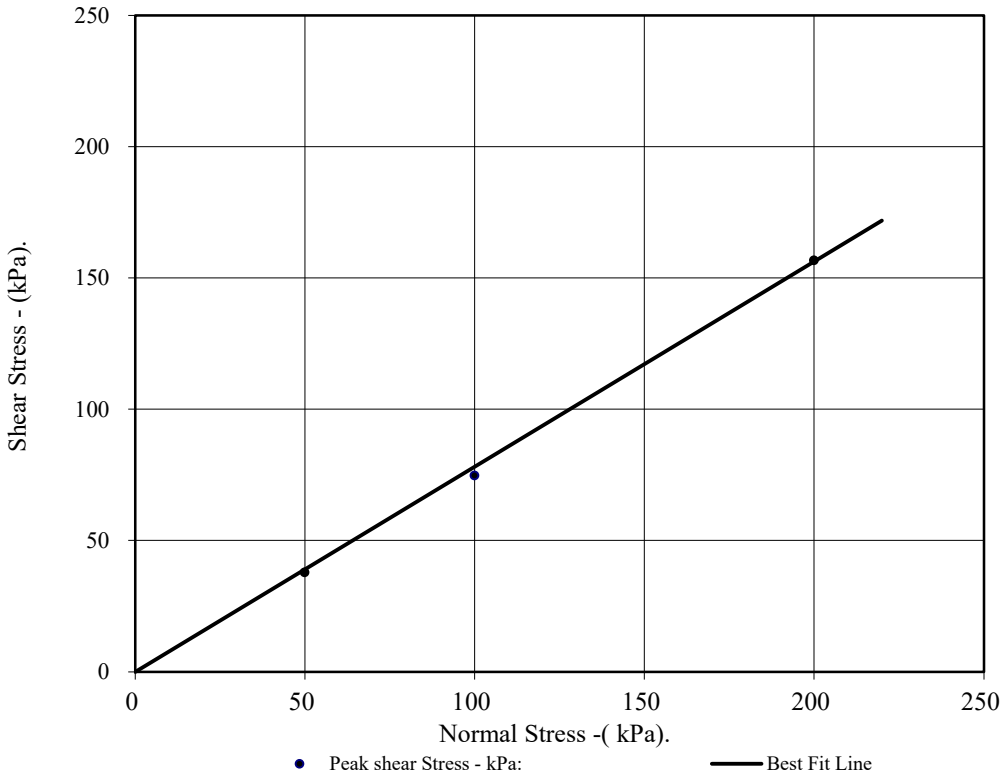


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**10.50**
Sample Number:	**18**		Base Depth:	**10.70**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	11	11	11
Bulk Density - Mg/m3:	1.84	1.84	1.84
Dry Density - Mg/m3:	1.65	1.65	1.65
Voids Ratio:	0.606	0.604	0.603
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.79	19.10	18.78
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.91	5.71	4.51
Peak shear Stress - kPa:	38	75	157
Final Consolidated Conditions			
Moisture Content - %:	11	10	10
Bulk Density - Mg/m3:	1.86	1.93	1.97
Dry Density - Mg/m3:	1.67	1.75	1.79
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**0**		



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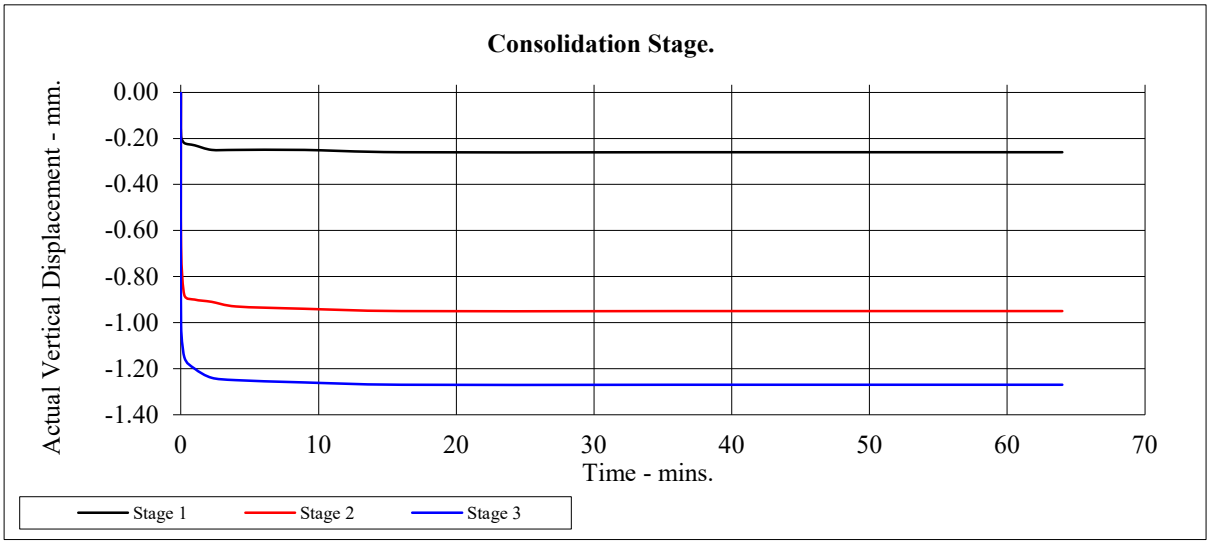
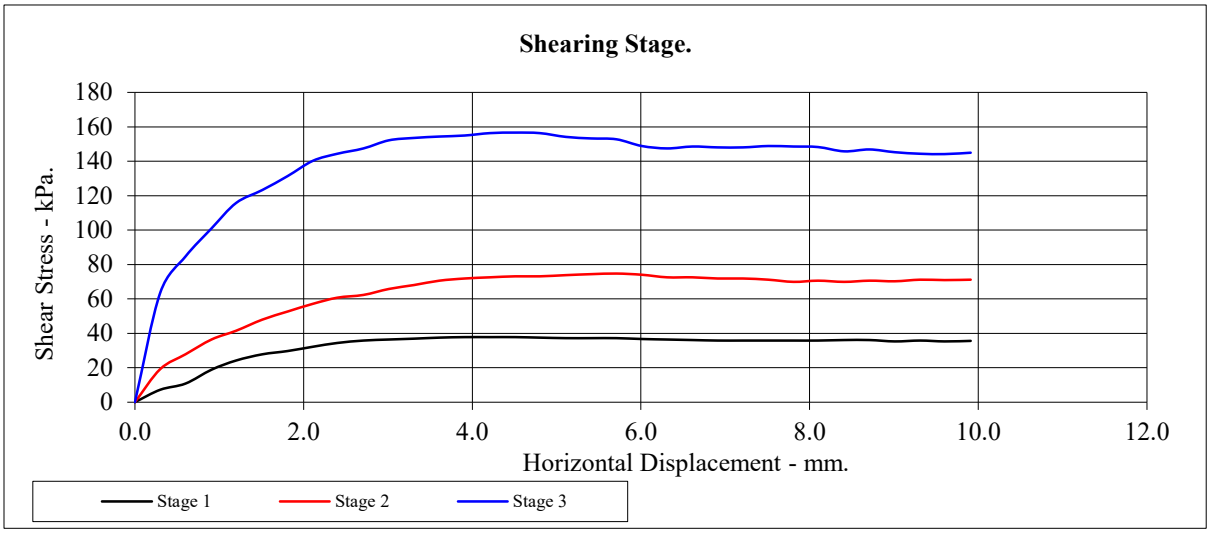
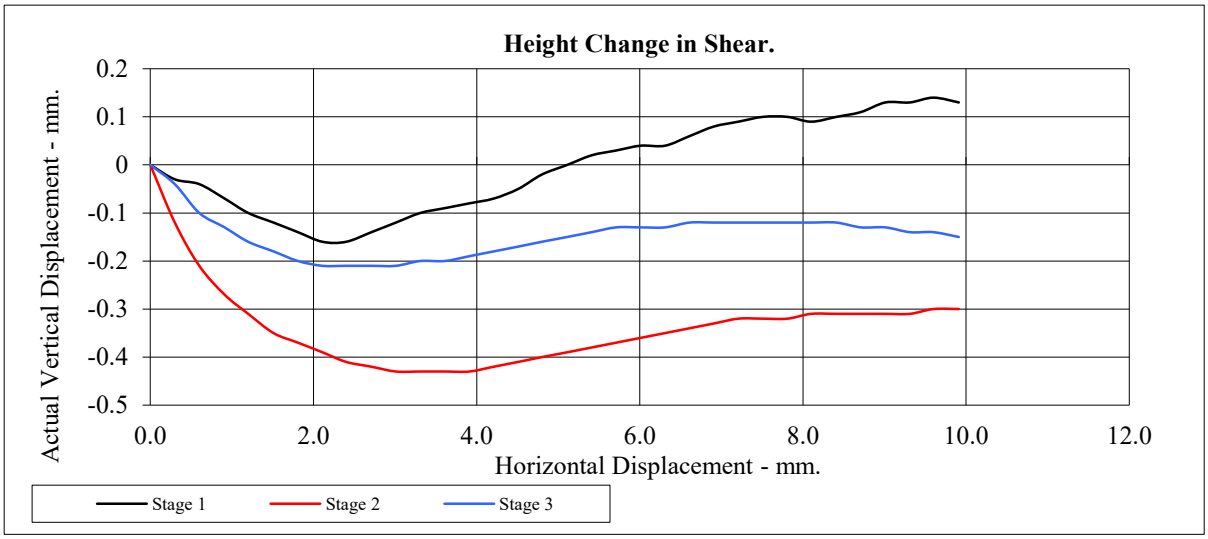
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**10.50**
Sample Number:	**18**	Base Depth:	**10.70**







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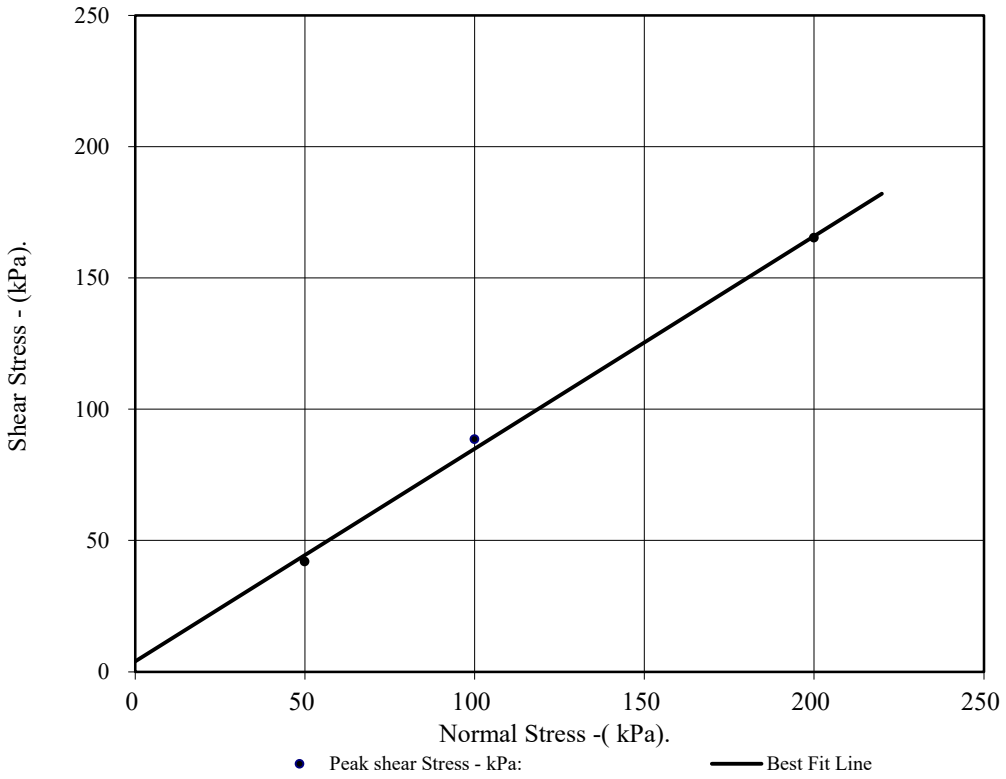
Client Ref:	
19-0382	

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**27.50**	
Sample Number:	**48**		Base Depth:	**27.80**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	6.7	6.7	6.7
Bulk Density - Mg/m3:	1.76	1.76	1.76
Dry Density - Mg/m3:	1.65	1.65	1.65
Voids Ratio:	0.604	0.605	0.603
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.91	19.69	19.38
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	4.21	5.72	7.21
Peak shear Stress - kPa:	42	89	165
Final Consolidated Conditions			
Moisture Content - %:	5.3	4.2	4.9
Bulk Density - Mg/m3:	1.77	1.79	1.83
Dry Density - Mg/m3:	1.69	1.72	1.74
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**4**		



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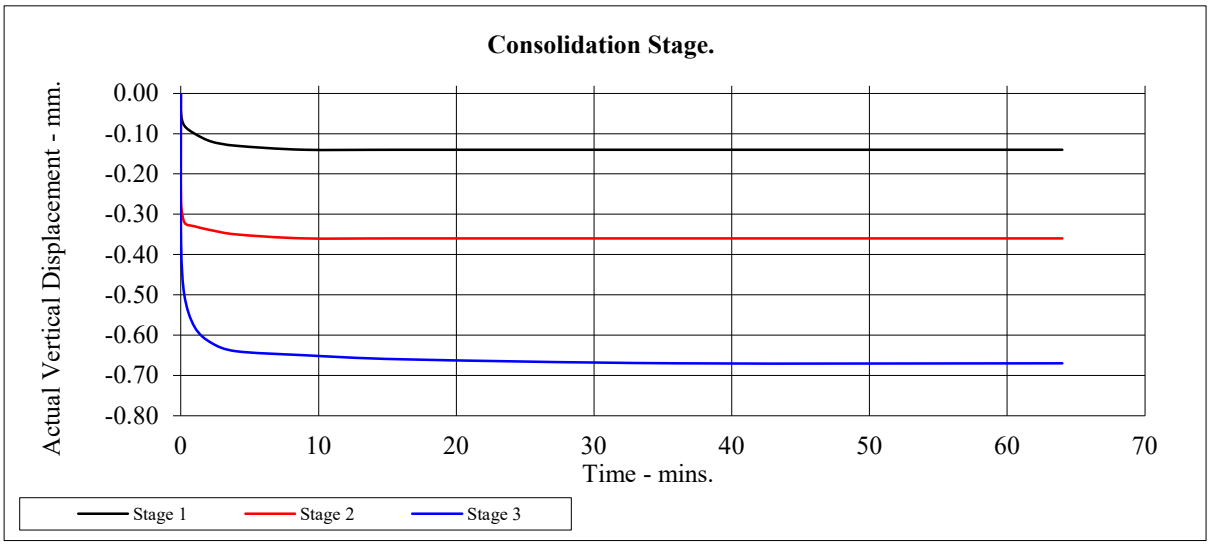
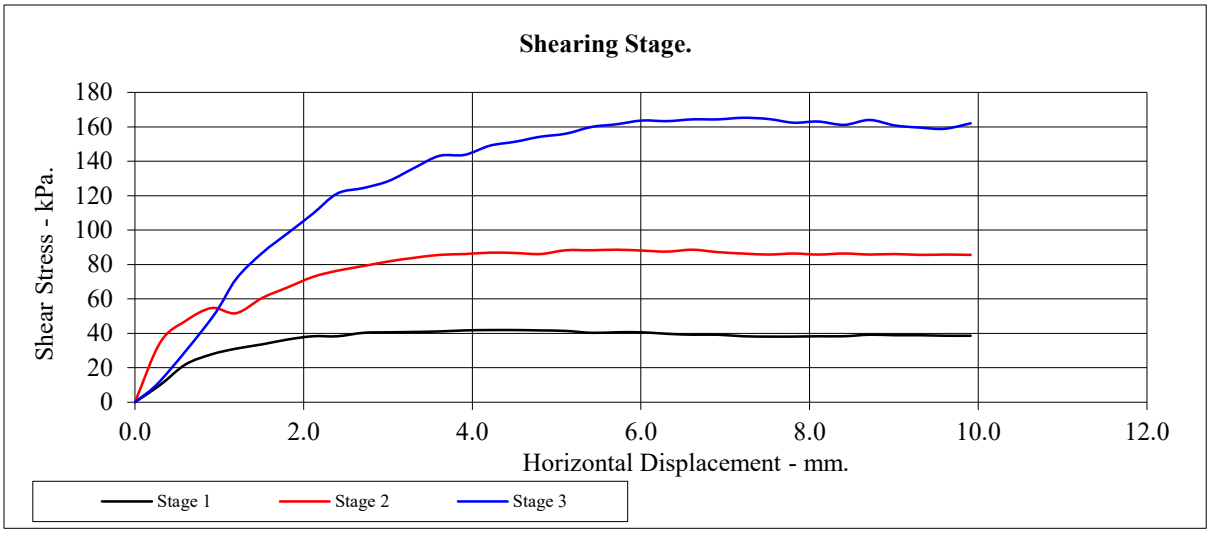
Client Ref: 19-0382

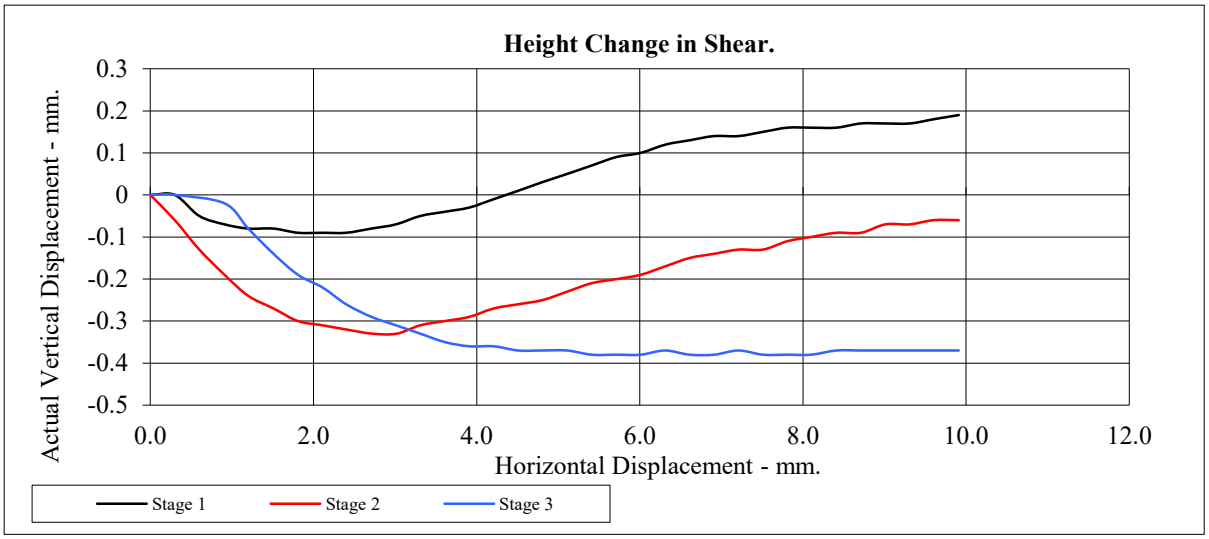
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**27.50**
Sample Number:	**48**	Base Depth:	**27.80**





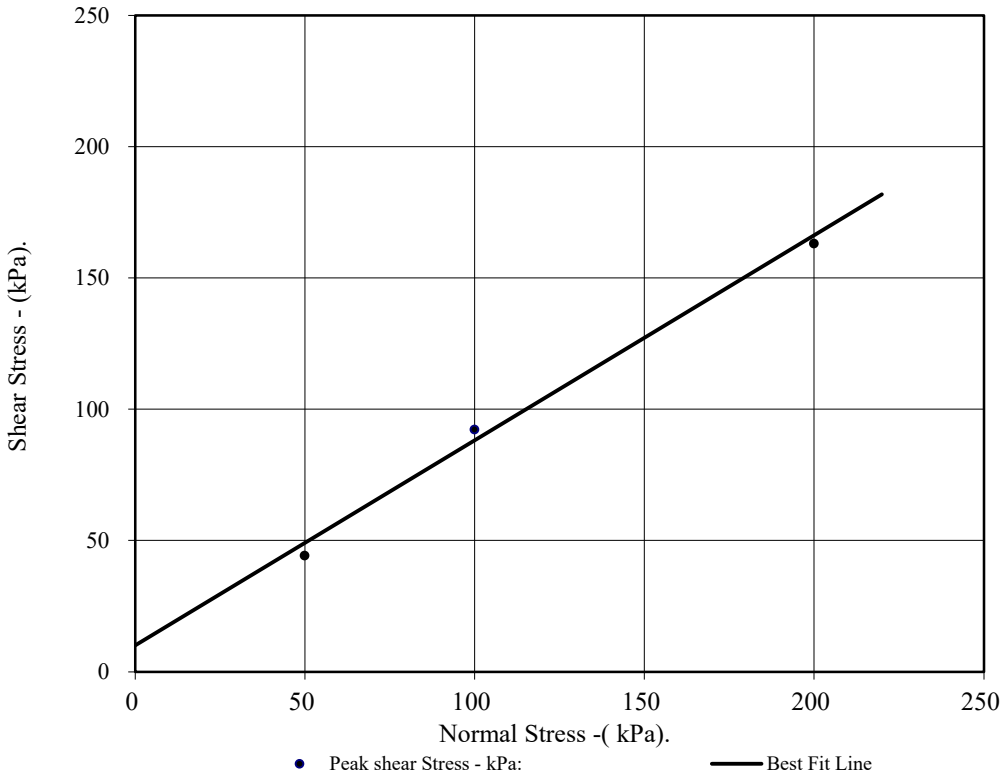


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**1.00**
Sample Number:	**3**		Base Depth:	**1.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.7	4.7	4.7
Bulk Density - Mg/m3:	1.72	1.72	1.72
Dry Density - Mg/m3:	1.64	1.64	1.64
Voids Ratio:	0.615	0.614	0.613
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.67	19.40	18.85
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	7.21	9.60	7.21
Peak shear Stress - kPa:	44	92	163
Final Consolidated Conditions			
Moisture Content - %:	4.0	4.2	4.1
Bulk Density - Mg/m3:	1.75	1.78	1.83
Dry Density - Mg/m3:	1.68	1.71	1.76
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**10**		



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Client Ref: 19-0382

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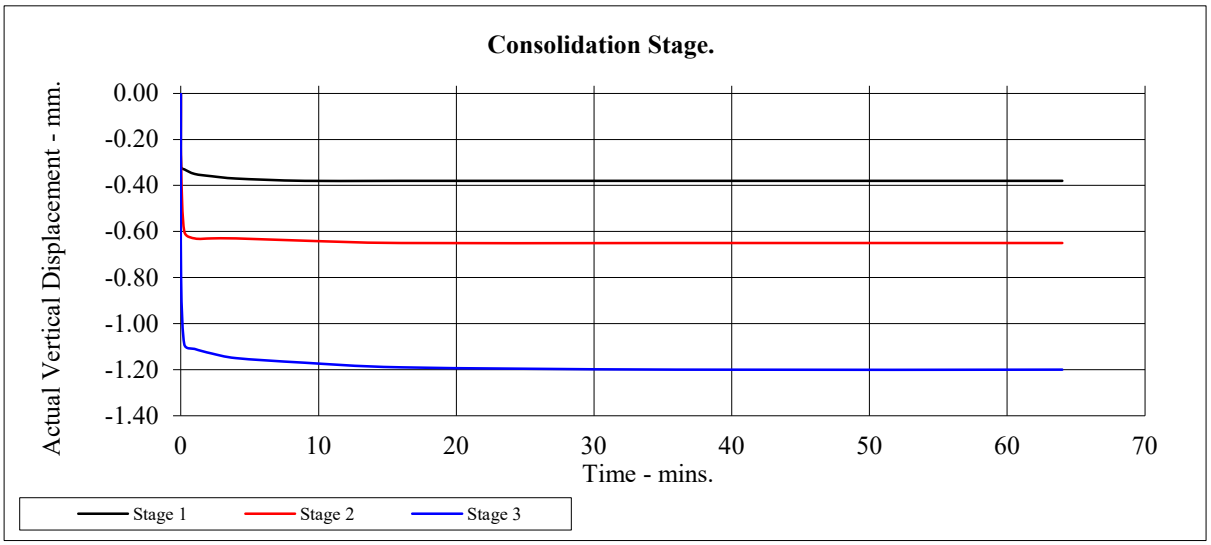
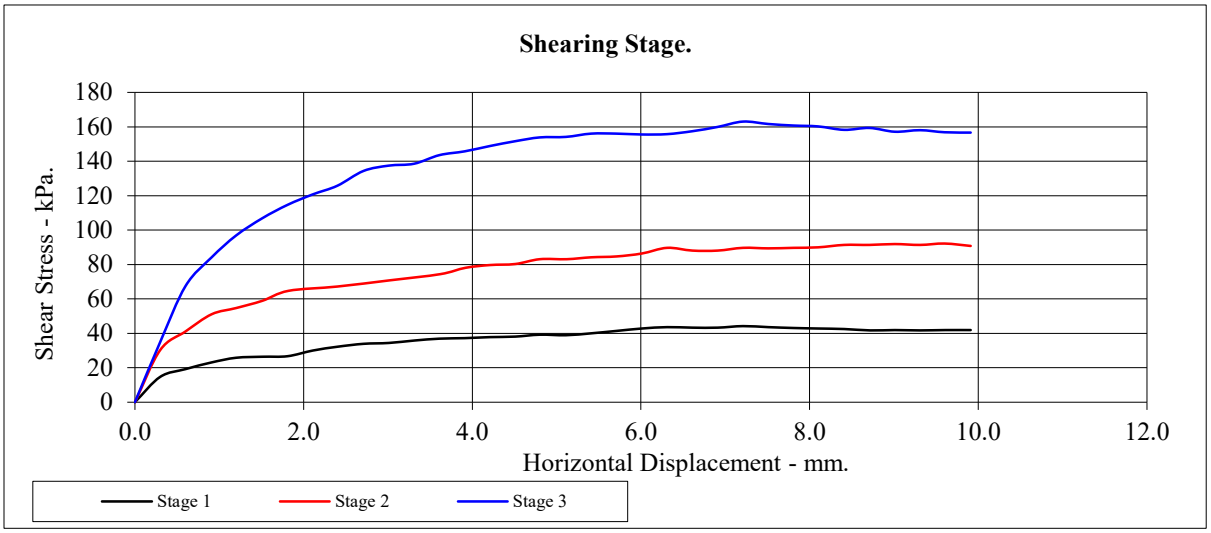
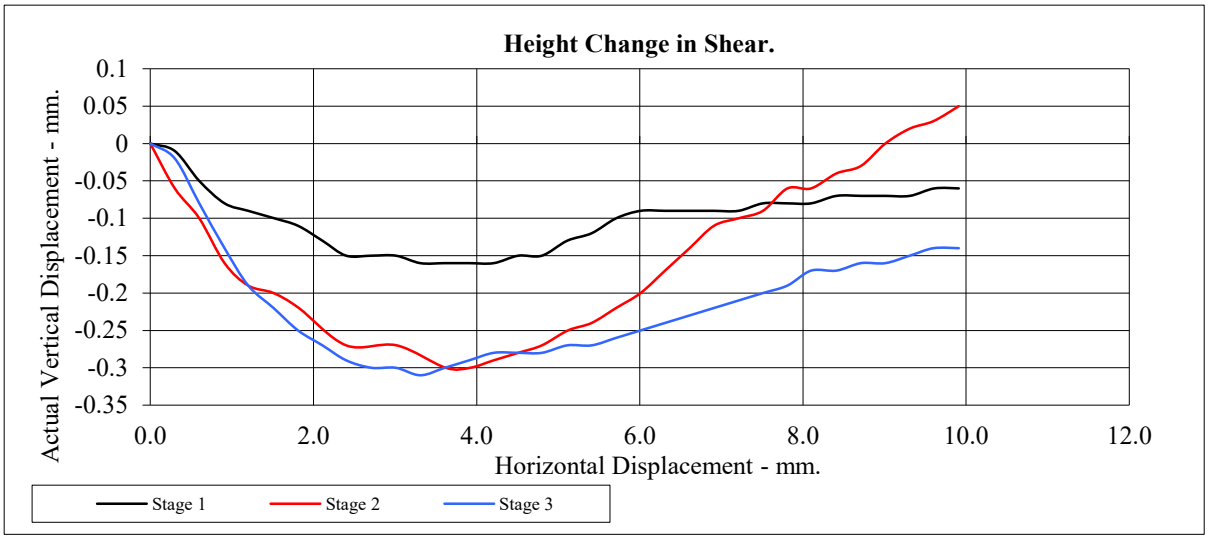
BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**1.00**
Sample Number:	**3**	Base Depth:	**1.50**





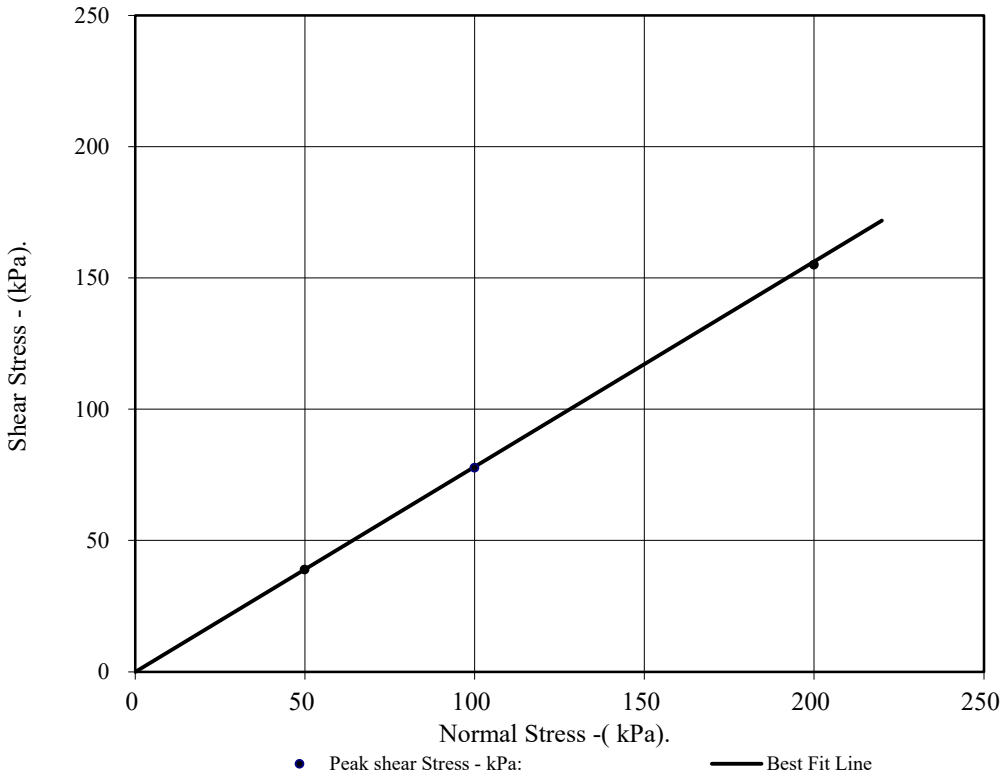


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**3.00**
Sample Number:	**10**		Base Depth:	**3.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.8	5.8	5.8
Bulk Density - Mg/m3:	1.64	1.64	1.64
Dry Density - Mg/m3:	1.55	1.55	1.55
Voids Ratio:	0.714	0.711	0.711
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.61	19.01	18.51
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	6.91	5.11	4.80
Peak shear Stress - kPa:	39	78	155
Final Consolidated Conditions			
Moisture Content - %:	4.8	4.9	5.1
Bulk Density - Mg/m3:	1.67	1.73	1.78
Dry Density - Mg/m3:	1.60	1.65	1.69
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**0**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

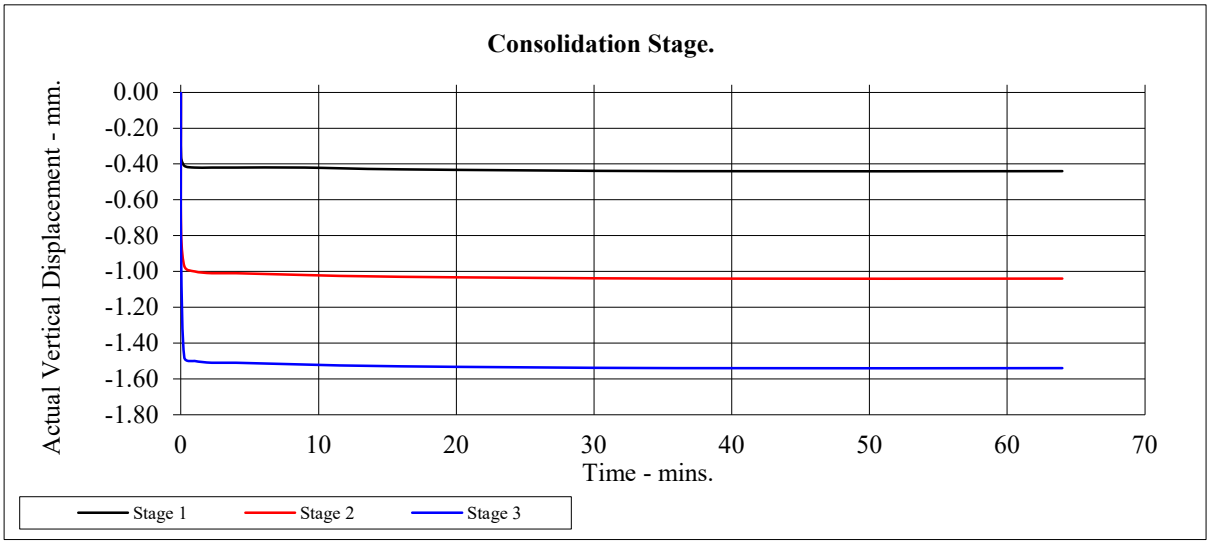
Contract No: PSL19/4788

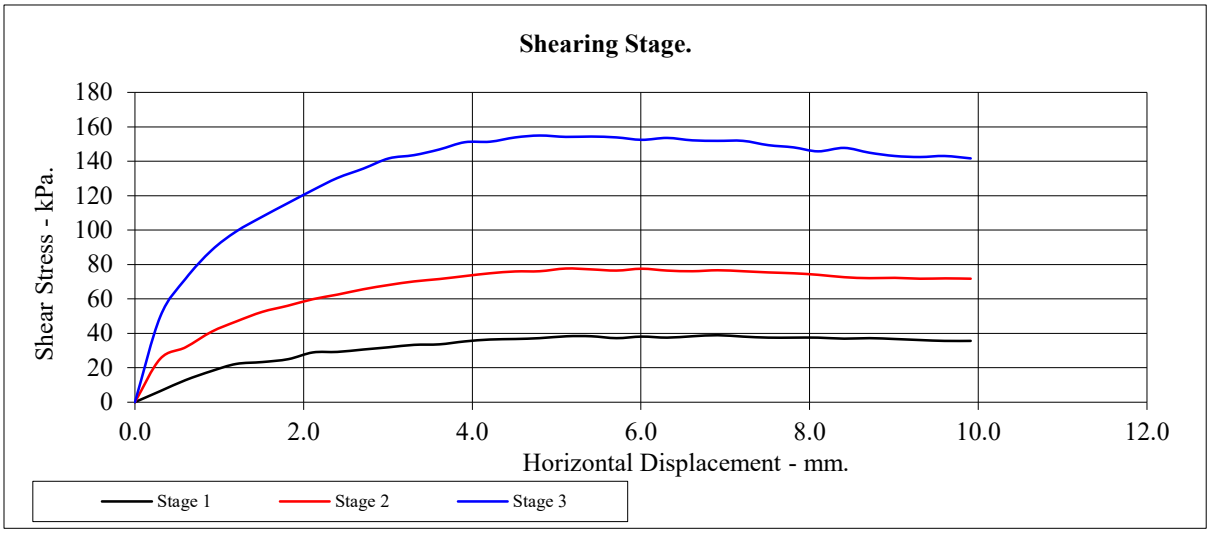
Client Ref: 19-0382

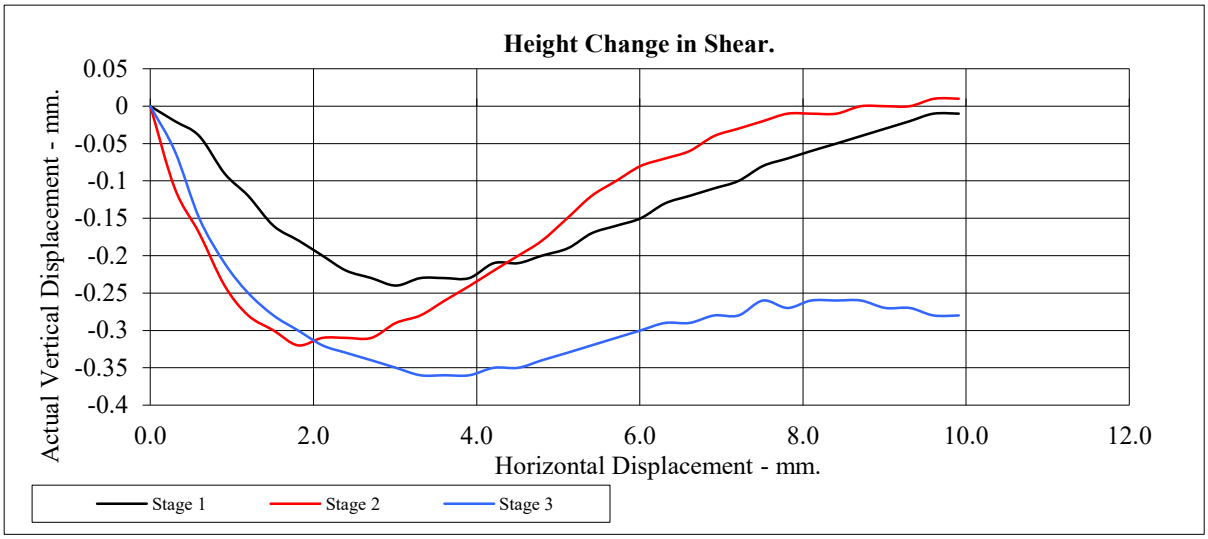
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**3.00**
Sample Number:	**10**	Base Depth:	**3.50**







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PSL Professional Soils Laboratory

Stornoway Deep Water Port

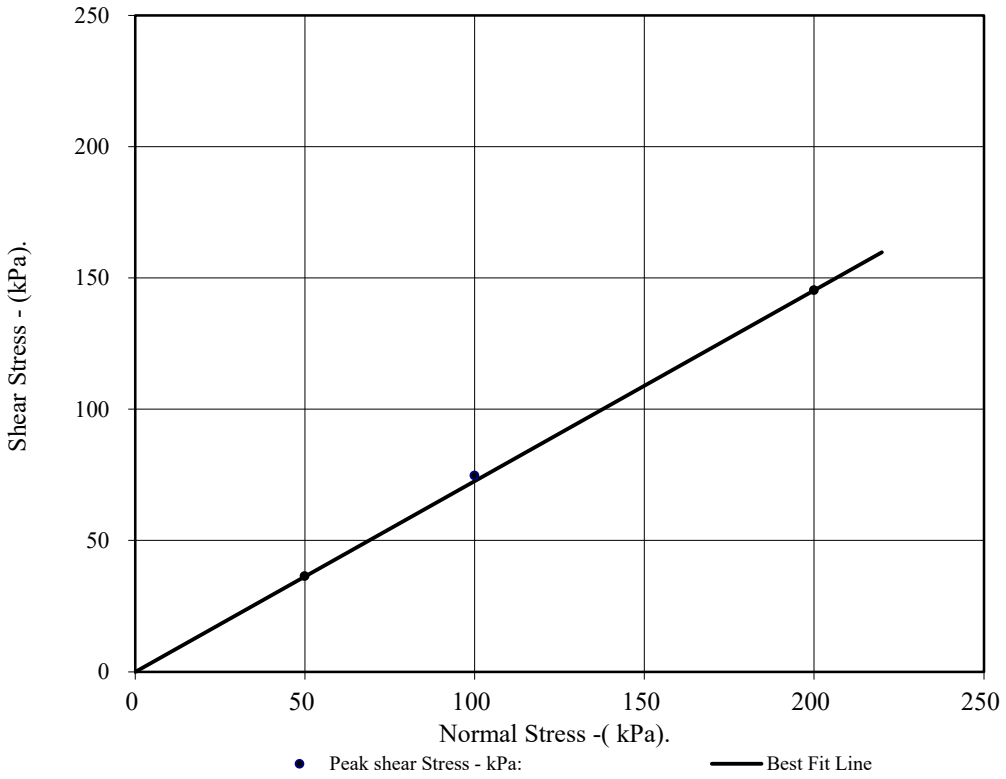
Contract No:
PSL19/4788
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**4.00**	
Sample Number:	**13**		Base Depth:	**4.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	3.9	3.9	3.9
Bulk Density - Mg/m3:	1.68	1.68	1.68
Dry Density - Mg/m3:	1.61	1.62	1.62
Voids Ratio:	0.641	0.637	0.639
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.85	18.63	18.15
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	6.61	5.71	5.71
Peak shear Stress - kPa:	36	75	145
Final Consolidated Conditions			
Moisture Content - %:	3.6	3.7	3.5
Bulk Density - Mg/m3:	1.70	1.81	1.86
Dry Density - Mg/m3:	1.64	1.75	1.79
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

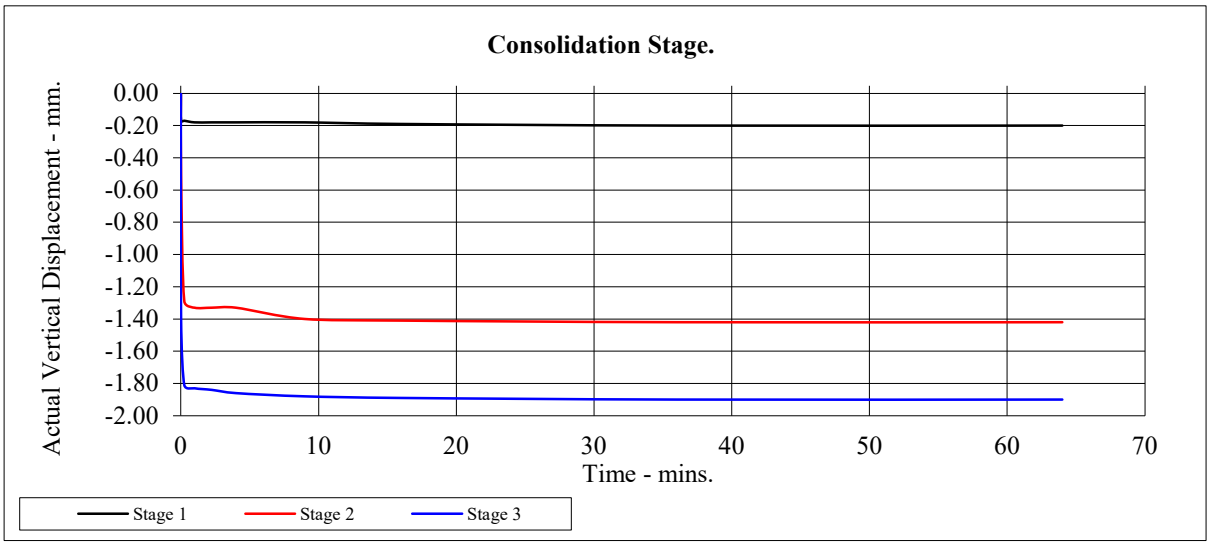
Contract No: PSL19/4788

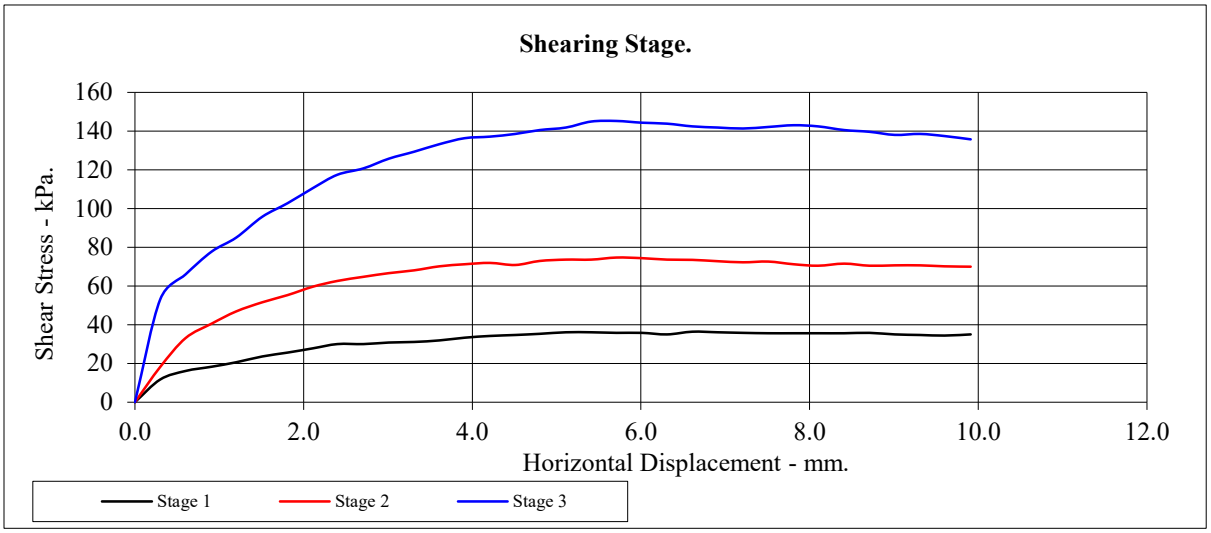
Client Ref: 19-0382

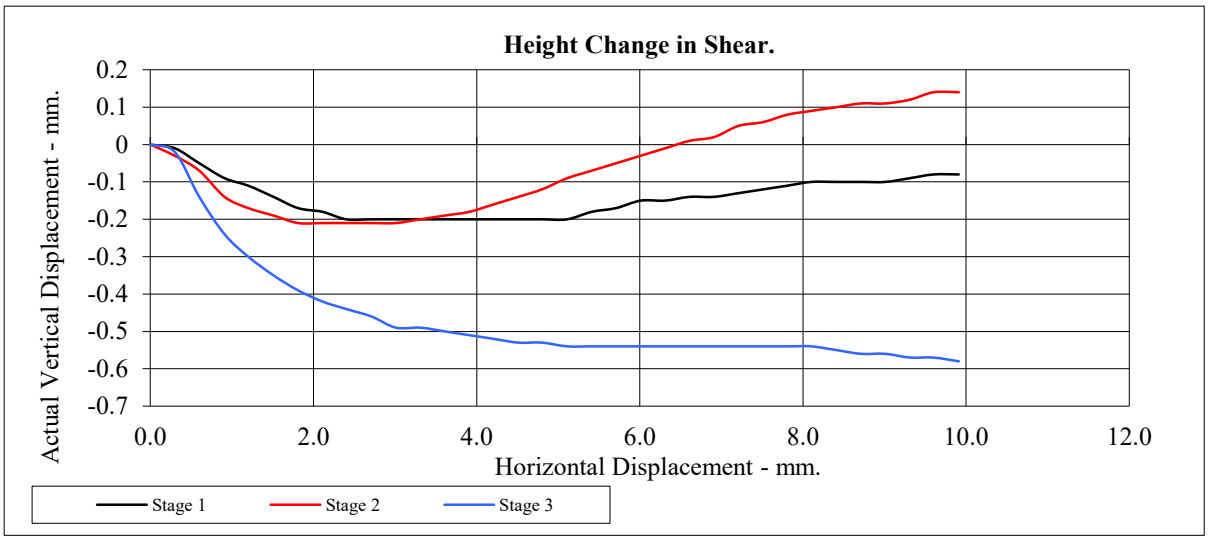
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**4.00**
Sample Number:	**13**	Base Depth:	**4.50**





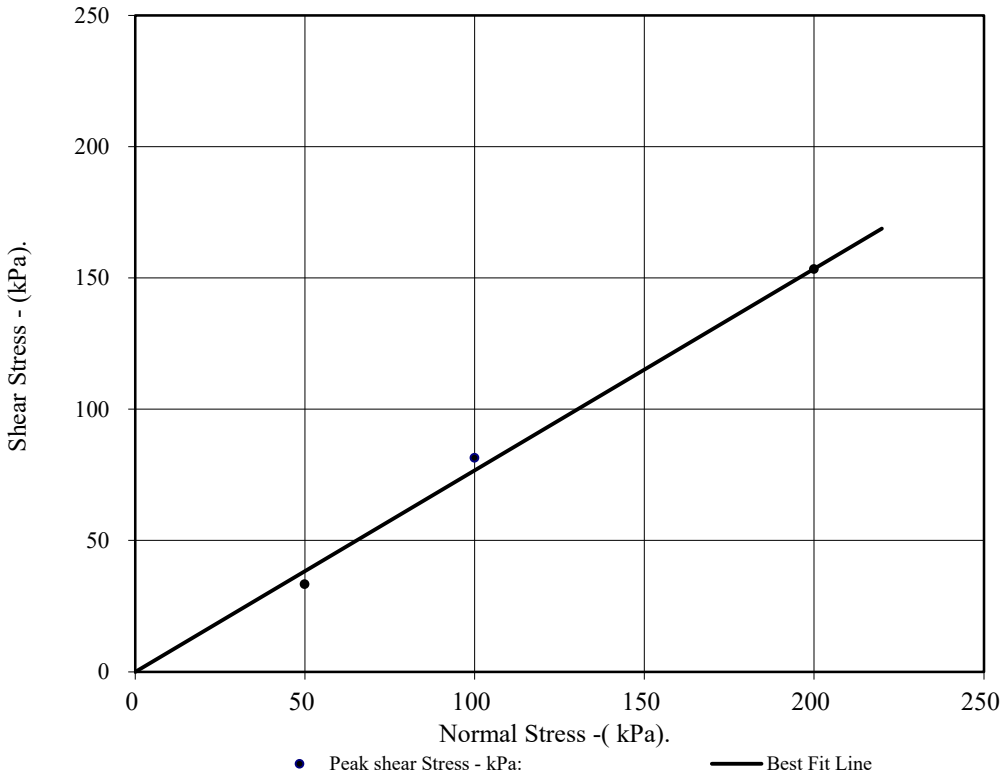


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**6.50**
Sample Number:	**19**		Base Depth:	**6.80**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.3	4.3	4.3
Bulk Density - Mg/m3:	1.46	1.46	1.46
Dry Density - Mg/m3:	1.40	1.40	1.40
Voids Ratio:	0.898	0.895	0.893
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.24	19.20	19.07
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.01	9.91	8.41
Peak shear Stress - kPa:	33	81	153
Final Consolidated Conditions			
Moisture Content - %:	3.9	3.7	3.9
Bulk Density - Mg/m3:	1.52	1.52	1.54
Dry Density - Mg/m3:	1.46	1.47	1.48
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**0**		



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PSL Professional Soils Laboratory

Stornoway Deep Water Port

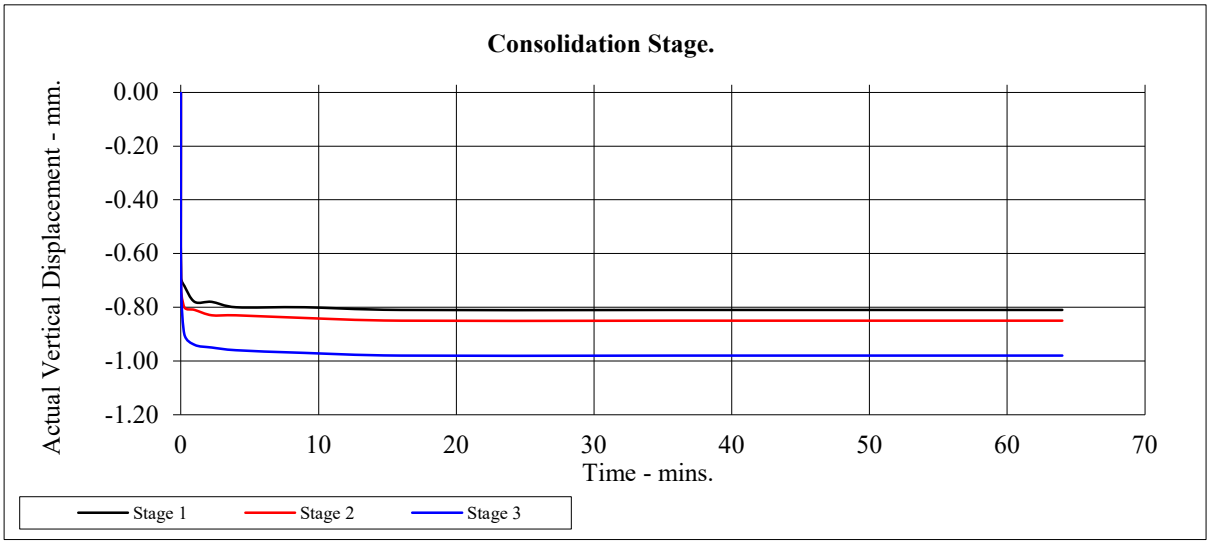
Contract No: PSL19/4788

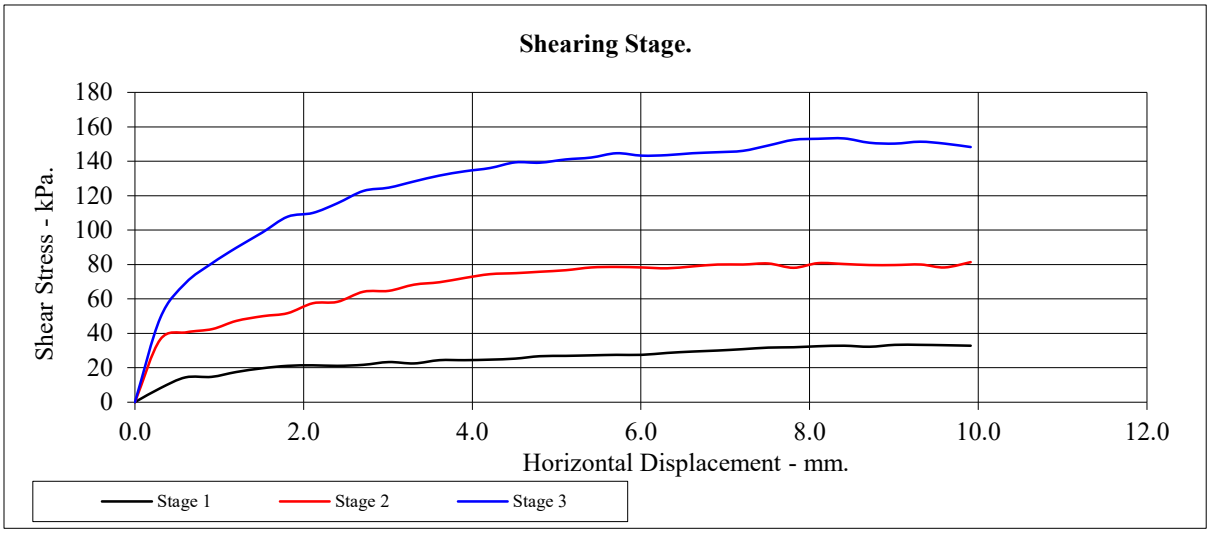
Client Ref: 19-0382

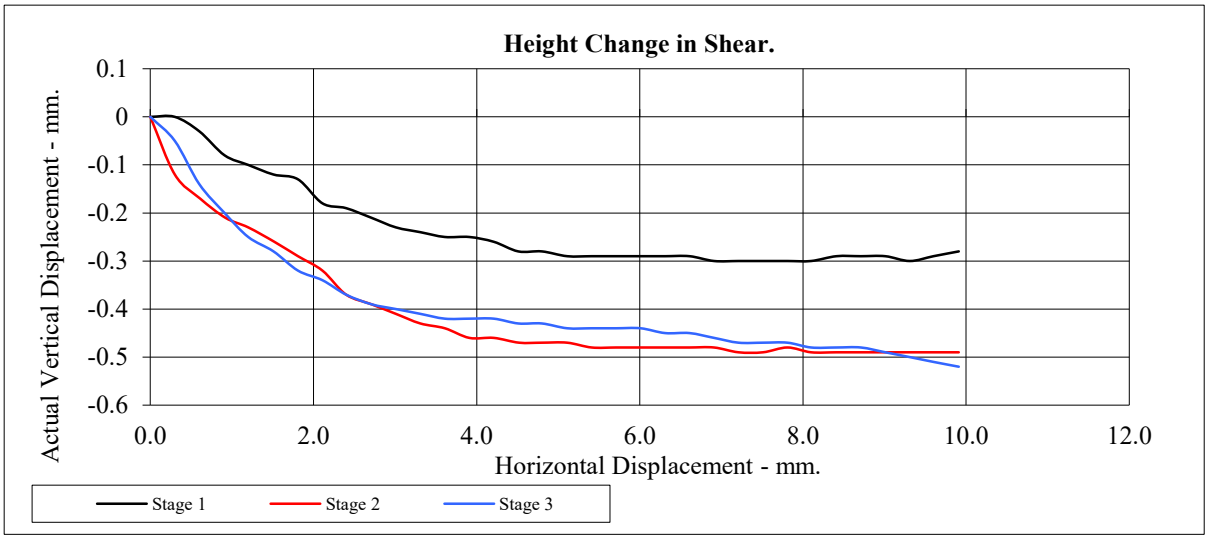
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**6.50**
Sample Number:	**19**	Base Depth:	**6.80**







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Stornoway Deep Water Port

Contract No:
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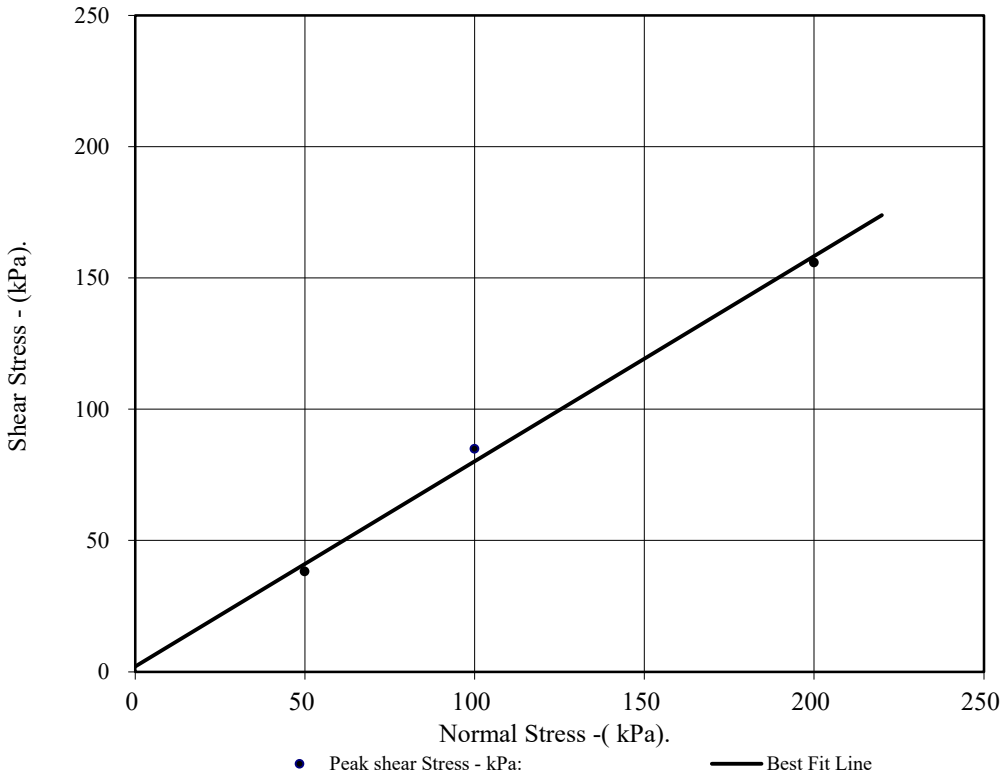
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**8.20**
Sample Number:	**24**		Base Depth:	**8.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	17	17	17
Bulk Density - Mg/m3:	1.96	1.96	1.97
Dry Density - Mg/m3:	1.68	1.68	1.68
Voids Ratio:	0.577	0.576	0.573
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.62	19.10	18.72
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	5.11	4.21	3.91
Peak shear Stress - kPa:	38	85	156
Final Consolidated Conditions			
Moisture Content - %:	17	17	17
Bulk Density - Mg/m3:	2.00	2.06	2.11
Dry Density - Mg/m3:	1.72	1.77	1.80
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**2**		



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Stornoway Deep Water Port

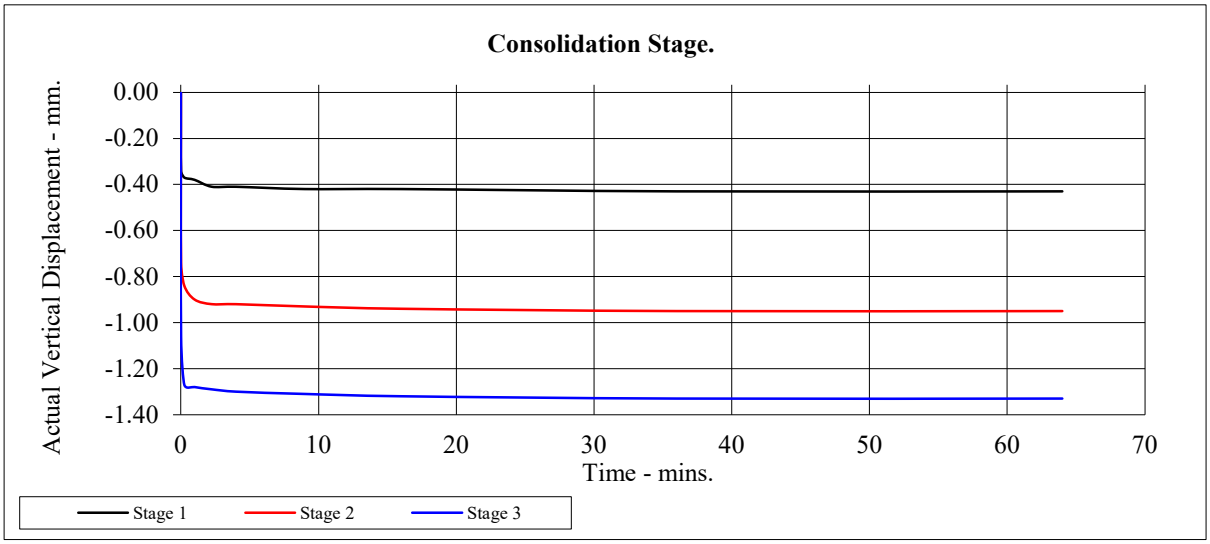
Contract No: PSL19/4788

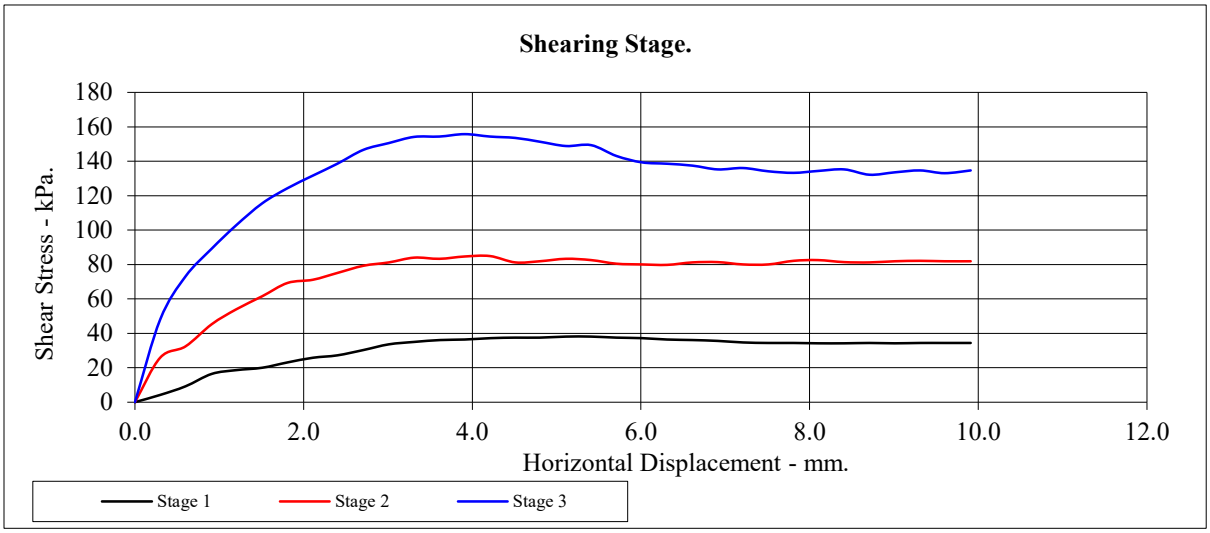
Client Ref: 19-0382

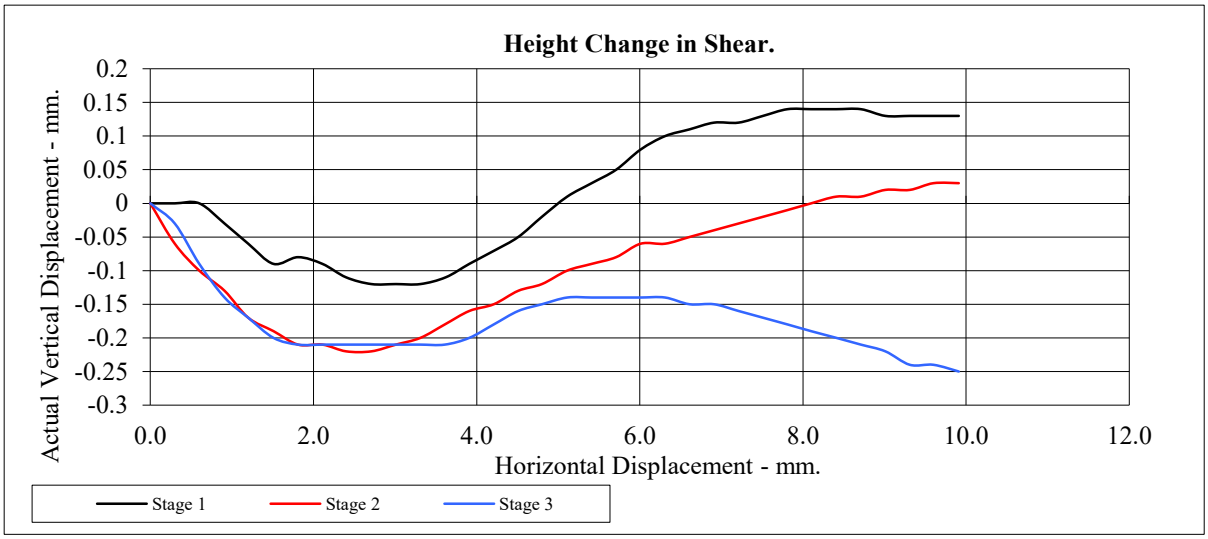
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**8.20**
Sample Number:	**24**	Base Depth:	**8.50**







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PSL Professional Soils Laboratory

Stornoway Deep Water Port

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PSL19/4788
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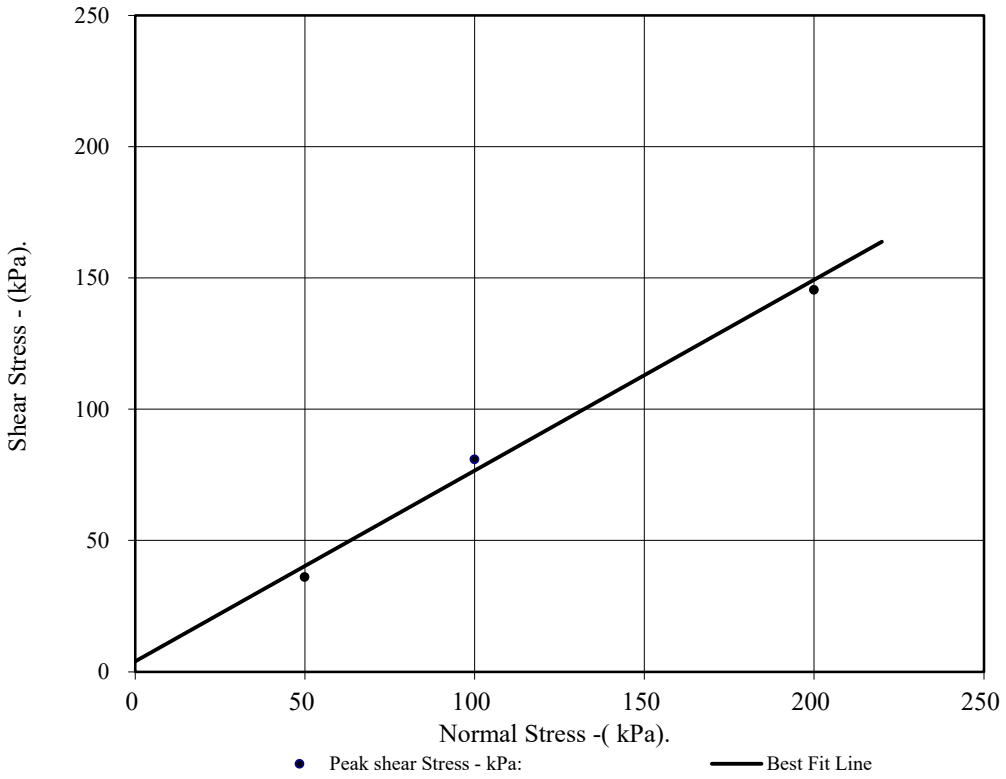
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**11.20**	
Sample Number:	**29**		Base Depth:	**11.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	23	23	23
Bulk Density - Mg/m3:	2.09	2.11	2.09
Dry Density - Mg/m3:	1.70	1.71	1.69
Voids Ratio:	0.561	0.546	0.565
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.62	19.29	18.93
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	7.50	6.90	6.60
Peak shear Stress - kPa:	36	81	145
Final Consolidated Conditions			
Moisture Content - %:	22	22	21
Bulk Density - Mg/m3:	2.14	2.20	2.21
Dry Density - Mg/m3:	1.76	1.81	1.82
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**4**		



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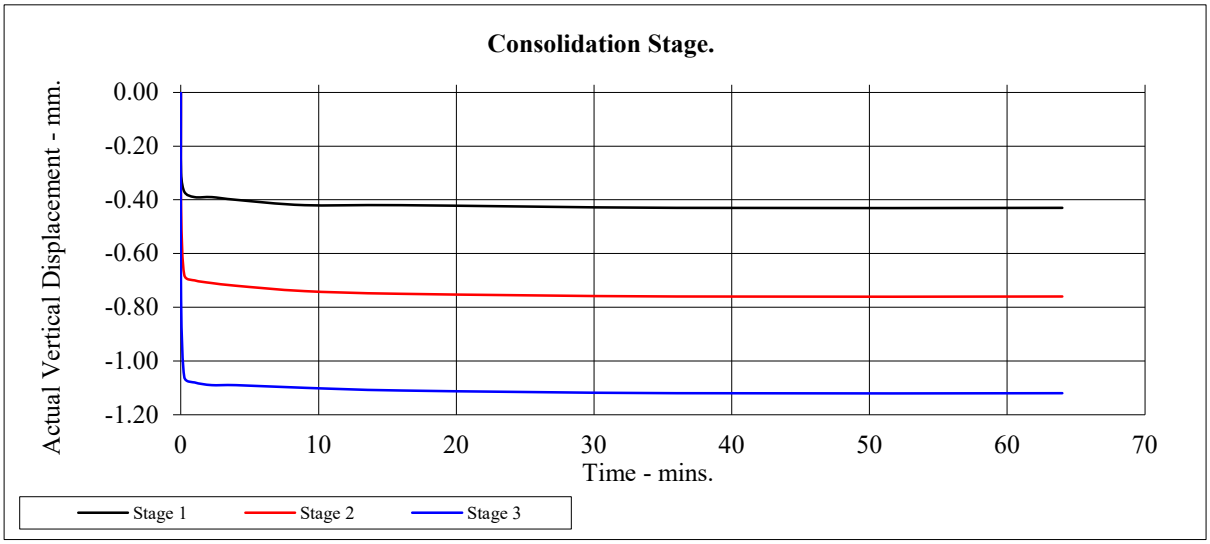
Stornoway Deep Water Port

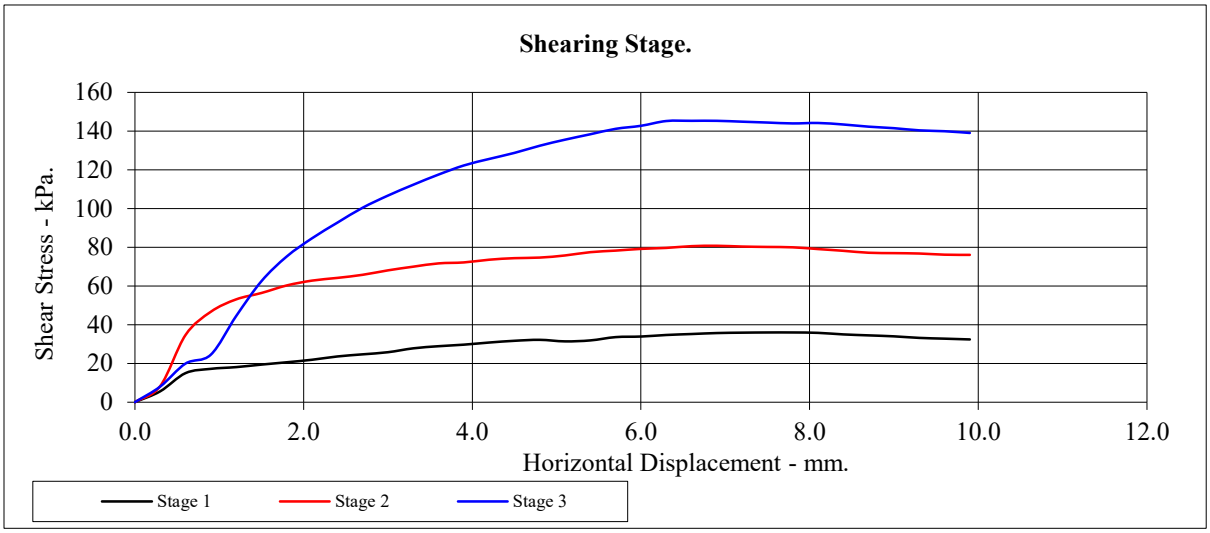
Contract No:
PSL19/4788
Client Ref:
19-0382

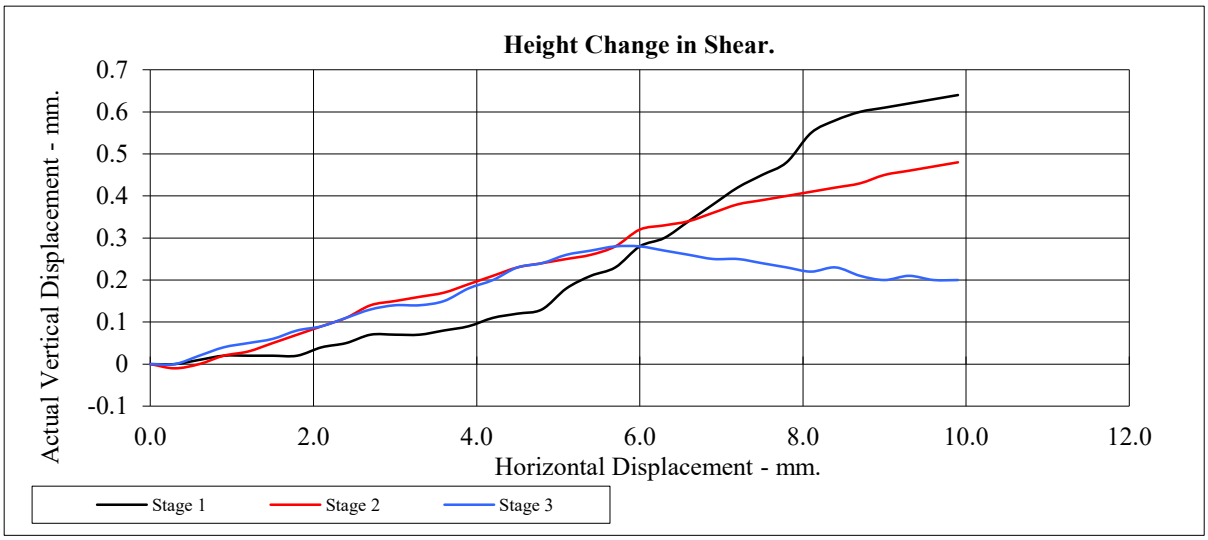
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**11.20**
Sample Number:	**29**	Base Depth:	**11.50**





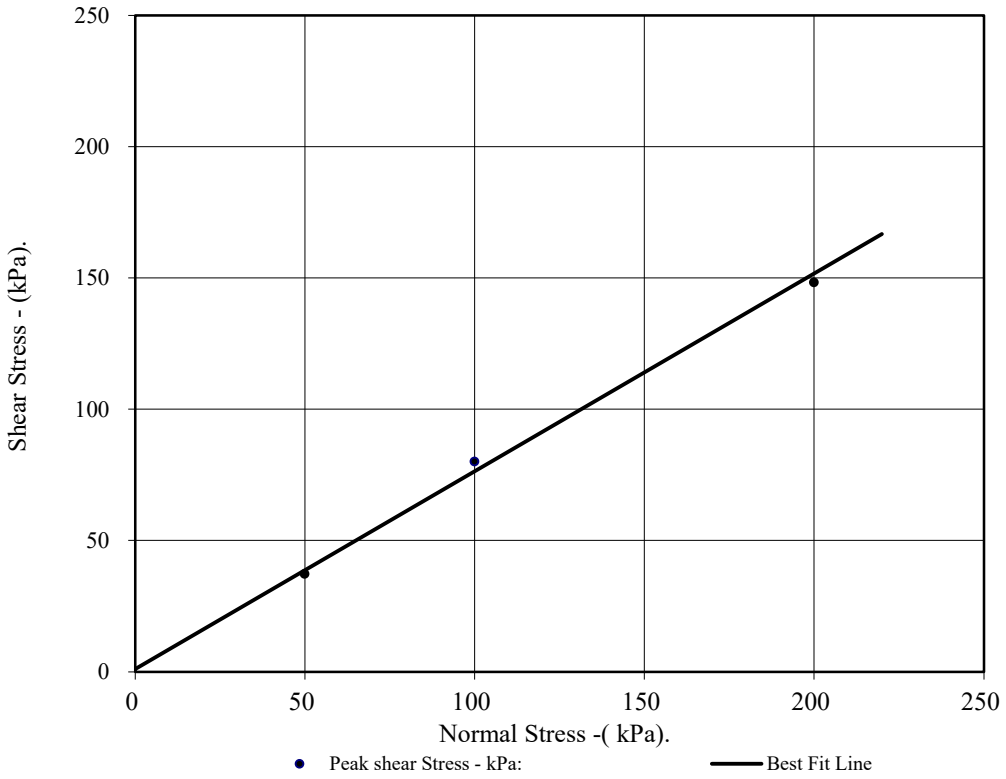


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**12.00**	
Sample Number:	**32**		Base Depth:	**13.00**	
Sample Conditions:	Dry		Sample Type	**P**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	6.3	6.3	6.3
Bulk Density - Mg/m3:	1.83	1.83	1.83
Dry Density - Mg/m3:	1.72	1.72	1.72
Voids Ratio:	0.544	0.539	0.542
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.48	19.06	18.09
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	8.10	8.71	8.71
Peak shear Stress - kPa:	37	80	148
Final Consolidated Conditions			
Moisture Content - %:	4.9	4.8	4.5
Bulk Density - Mg/m3:	1.88	1.93	2.03
Dry Density - Mg/m3:	1.79	1.84	1.94
Peak			
Angle of Shearing Resistance:(~~θ~~)	**37**		
Effective Cohesion - kPa:	**1**		



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Stornoway Deep Water Port

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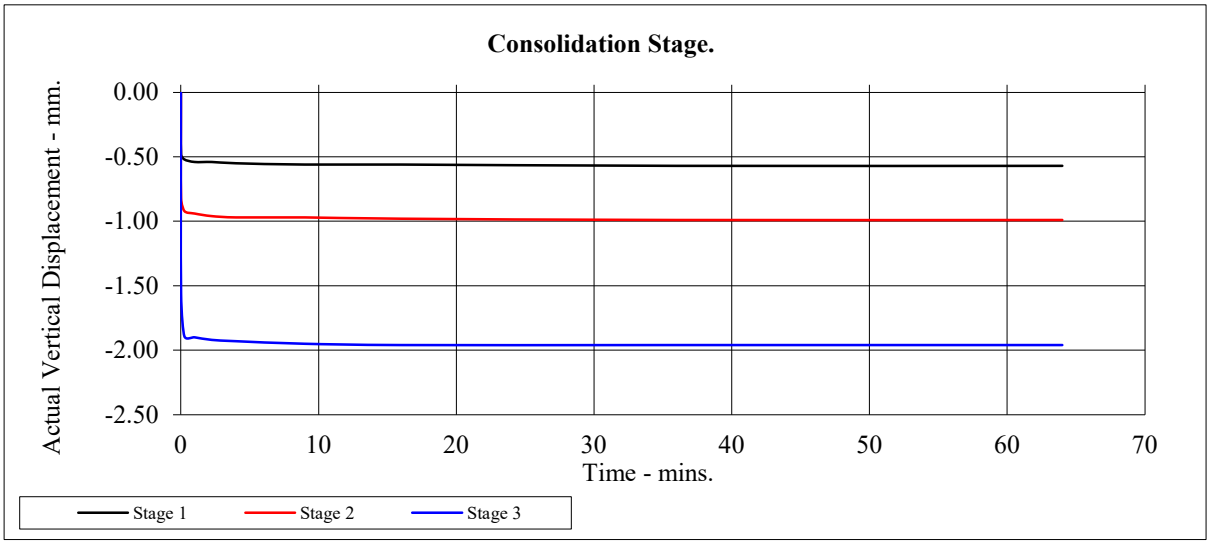
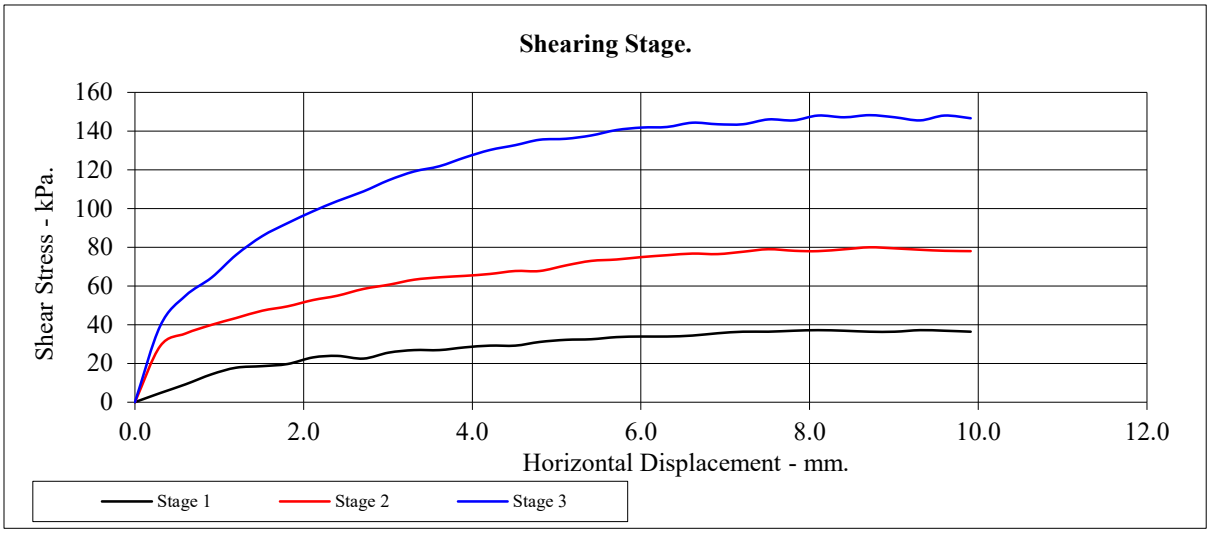
Client Ref: 19-0382

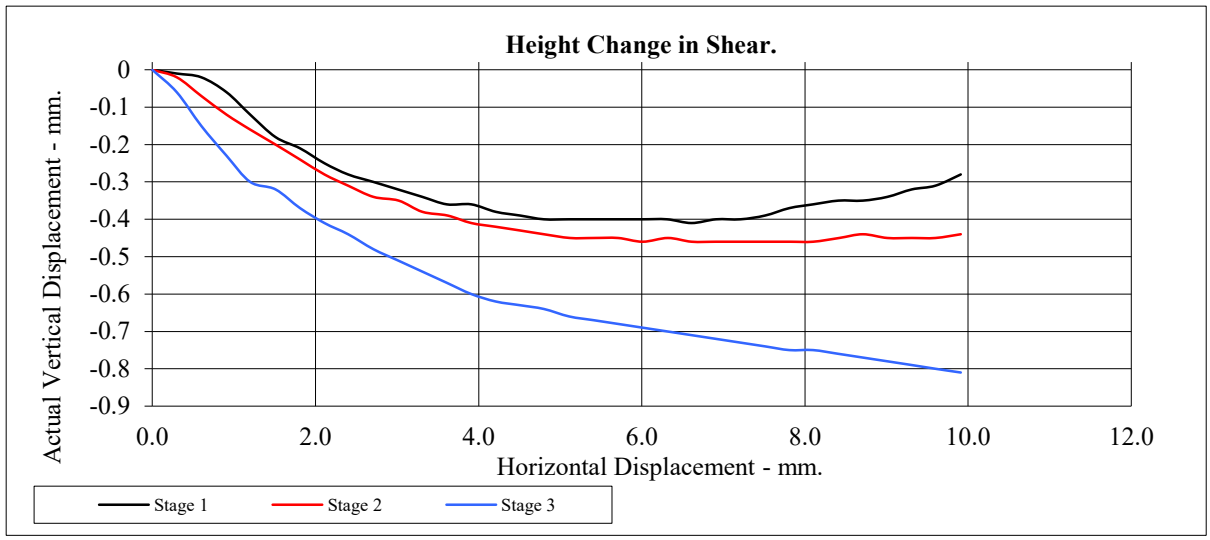
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**12.00**
Sample Number:	**32**	Base Depth:	**13.00**





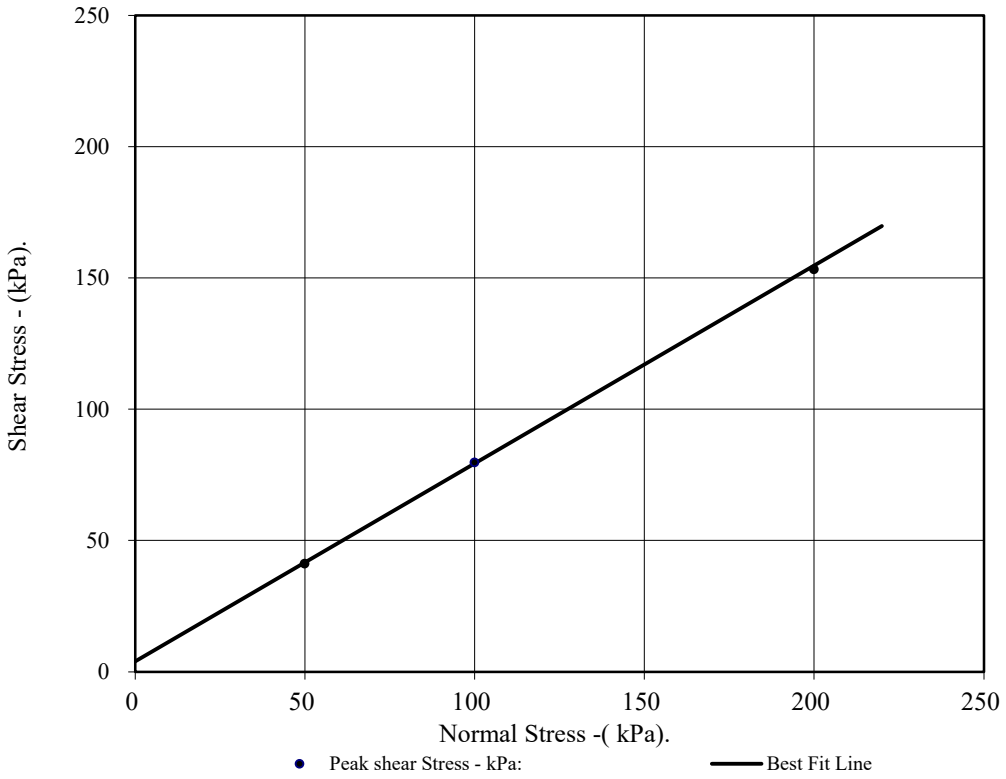


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**13.50**	
Sample Number:	**33**		Base Depth:	**14.50**	
Sample Conditions:	Dry		Sample Type	**P**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	1.75	1.75	1.75
Dry Density - Mg/m3:	1.57	1.57	1.57
Voids Ratio:	0.688	0.692	0.689
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.66	19.02	18.65
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	6.91	4.21	9.01
Peak shear Stress - kPa:	41	80	153
Final Consolidated Conditions			
Moisture Content - %:	10	10	9.2
Bulk Density - Mg/m3:	1.79	1.84	1.88
Dry Density - Mg/m3:	1.62	1.67	1.73
Peak			
Angle of Shearing Resistance:(~~θ~~)	**37**		
Effective Cohesion - kPa:	**4**		



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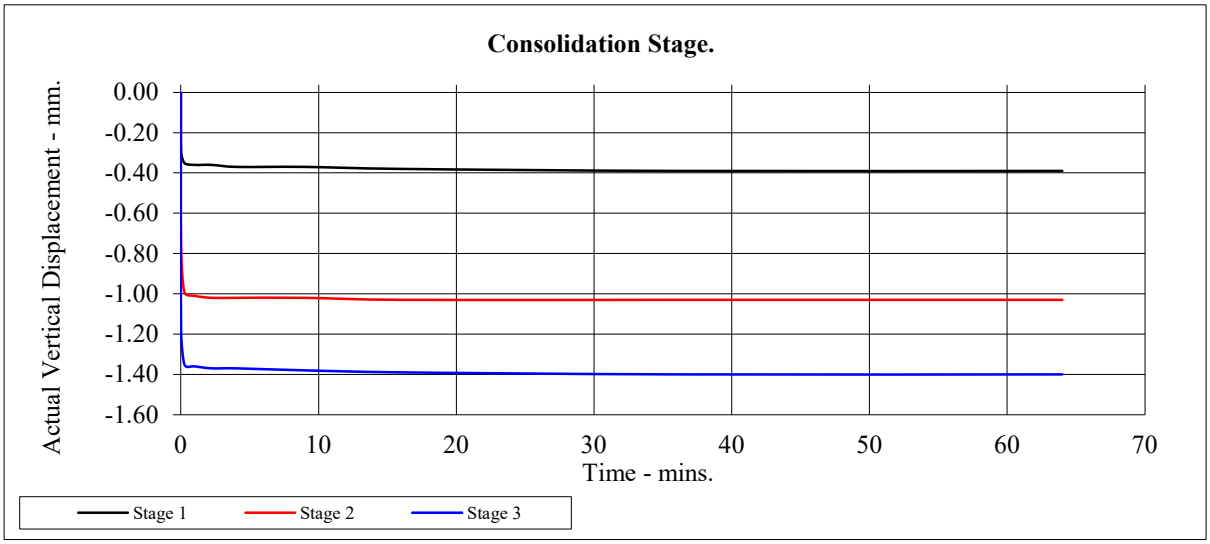
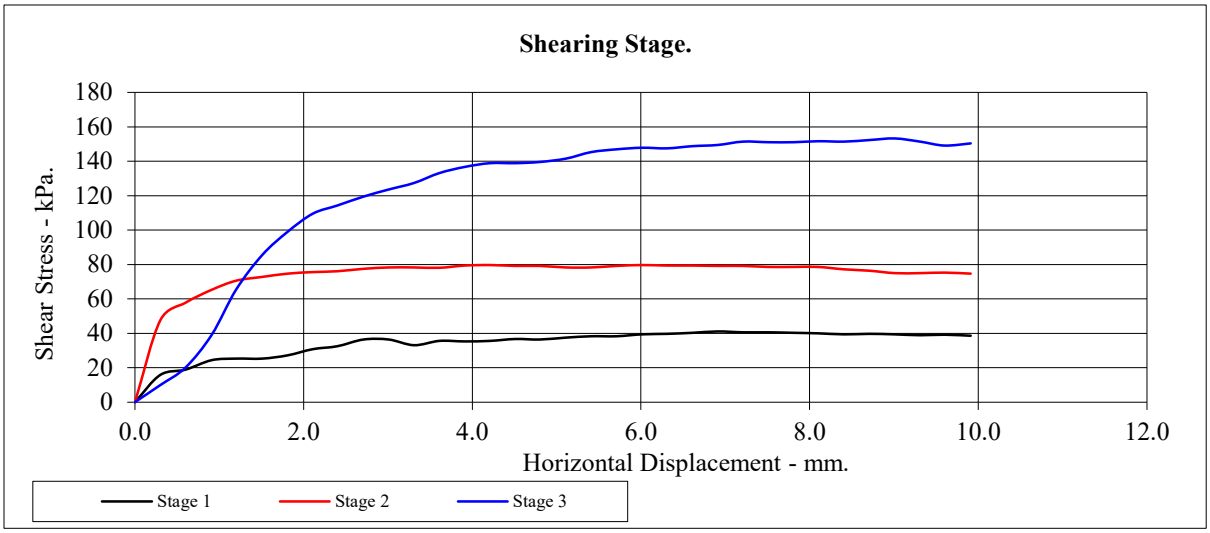
Client Ref: 19-0382

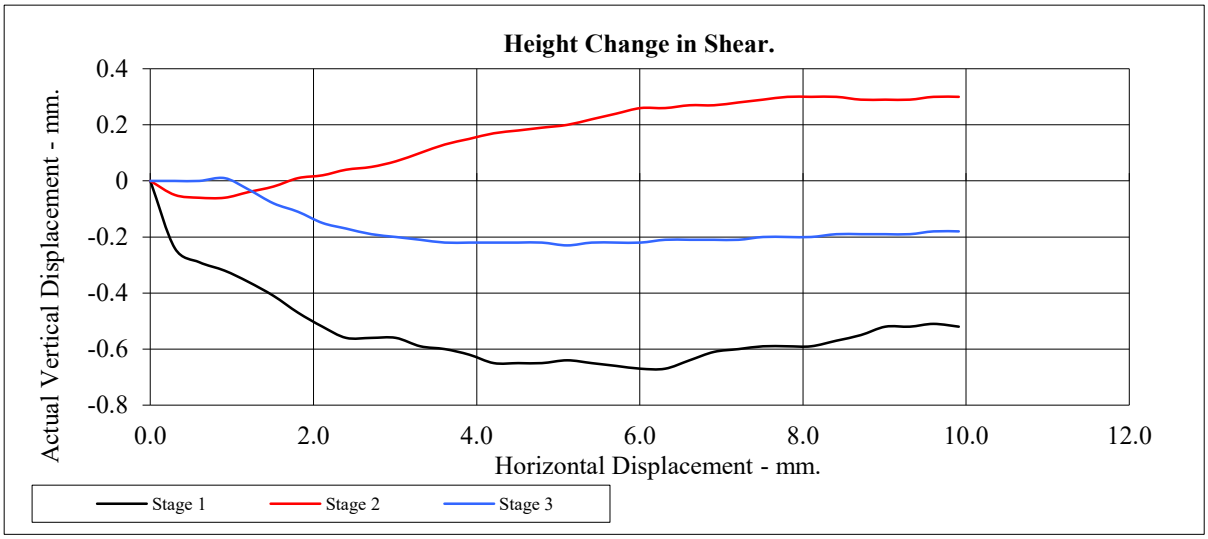
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**13.50**
Sample Number:	**33**	Base Depth:	**14.50**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

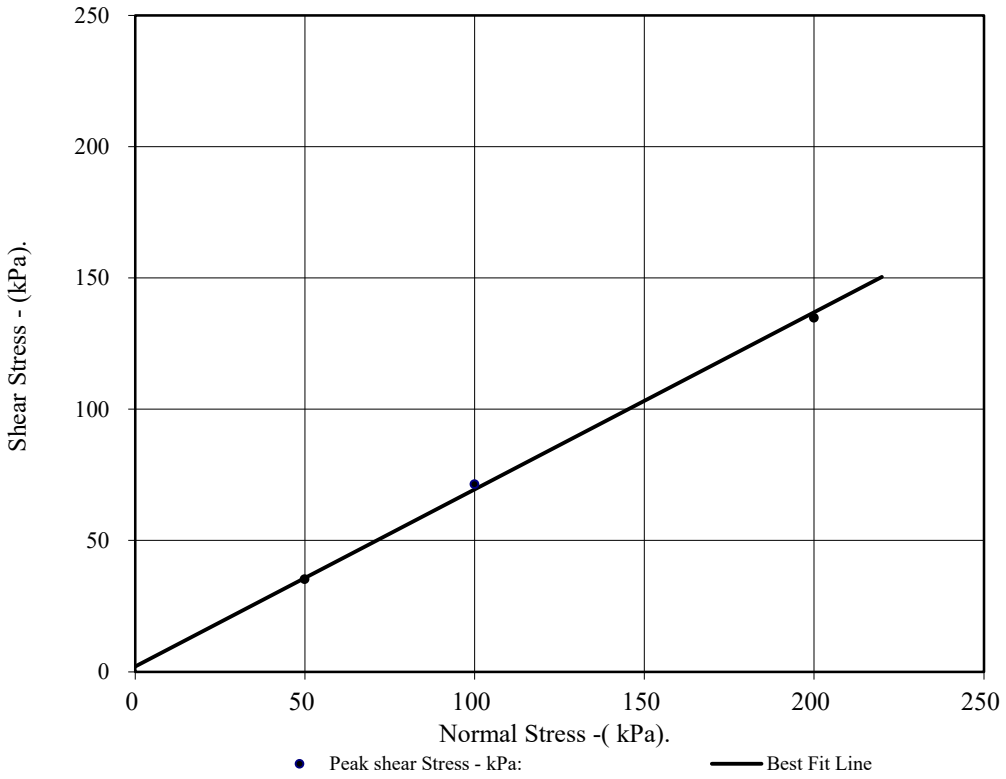
Contract No:	
PSL19/4788	
Client Ref:	
19-0382	

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**22.00**	
Sample Number:	**56**		Base Depth:	**22.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	2.2	2.2	2.2
Bulk Density - Mg/m3:	1.75	1.74	1.75
Dry Density - Mg/m3:	1.71	1.71	1.71
Voids Ratio:	0.552	0.553	0.552
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.50	19.12	18.37
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	6.31	6.01	6.01
Peak shear Stress - kPa:	35	71	135
Final Consolidated Conditions			
Moisture Content - %:	2.0	1.9	1.8
Bulk Density - Mg/m3:	1.80	1.83	1.91
Dry Density - Mg/m3:	1.76	1.80	1.87
Peak			
Angle of Shearing Resistance:(~~θ~~)	**34**		
Effective Cohesion - kPa:	**2**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

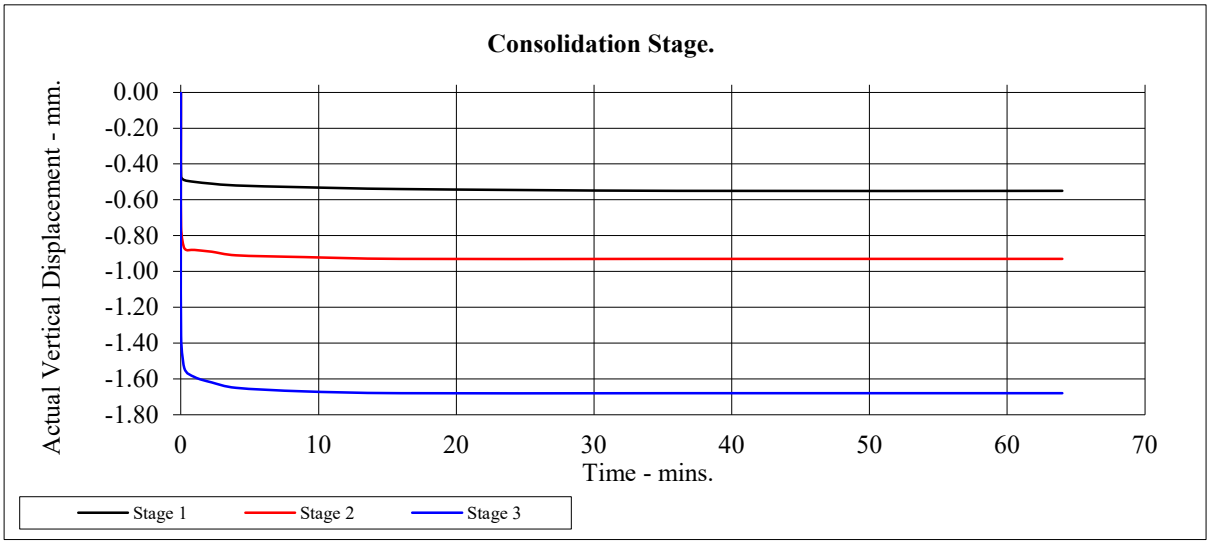
Contract No: PSL19/4788

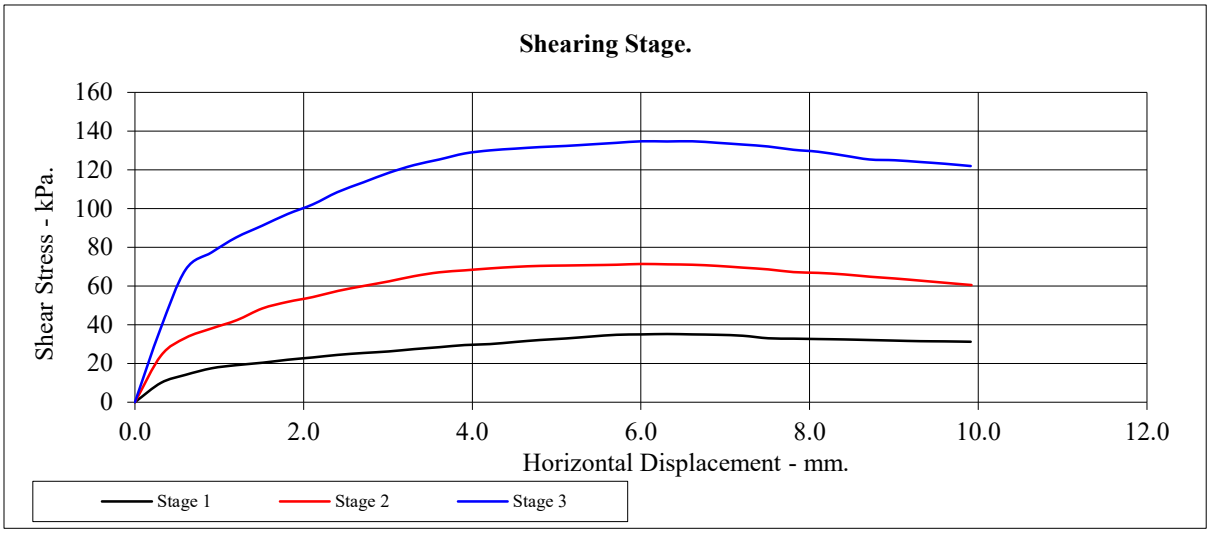
Client Ref: 19-0382

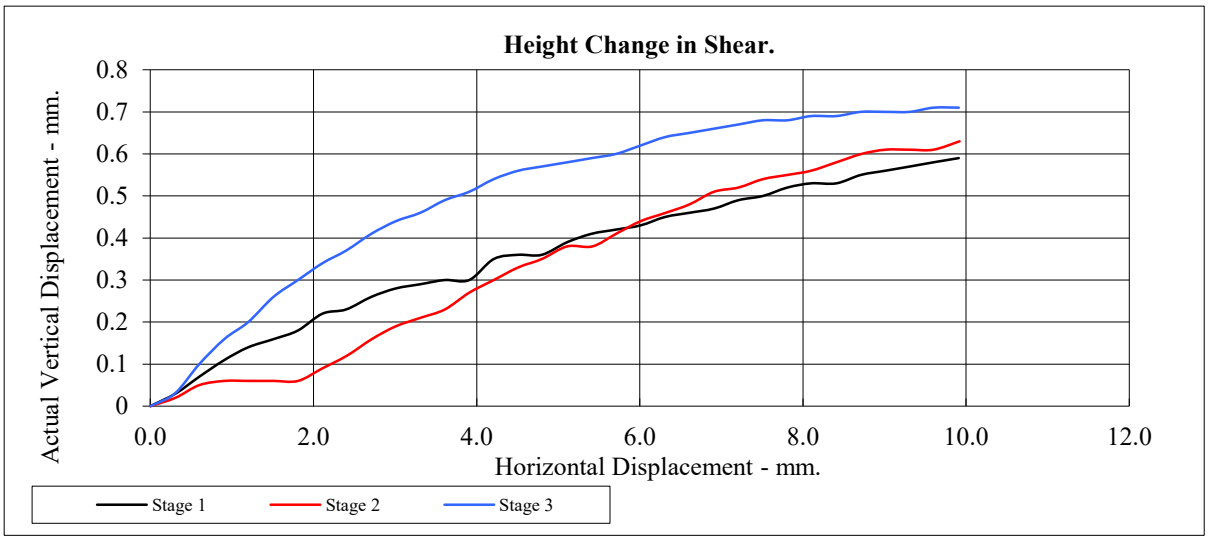
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**22.00**
Sample Number:	**56**	Base Depth:	**22.50**





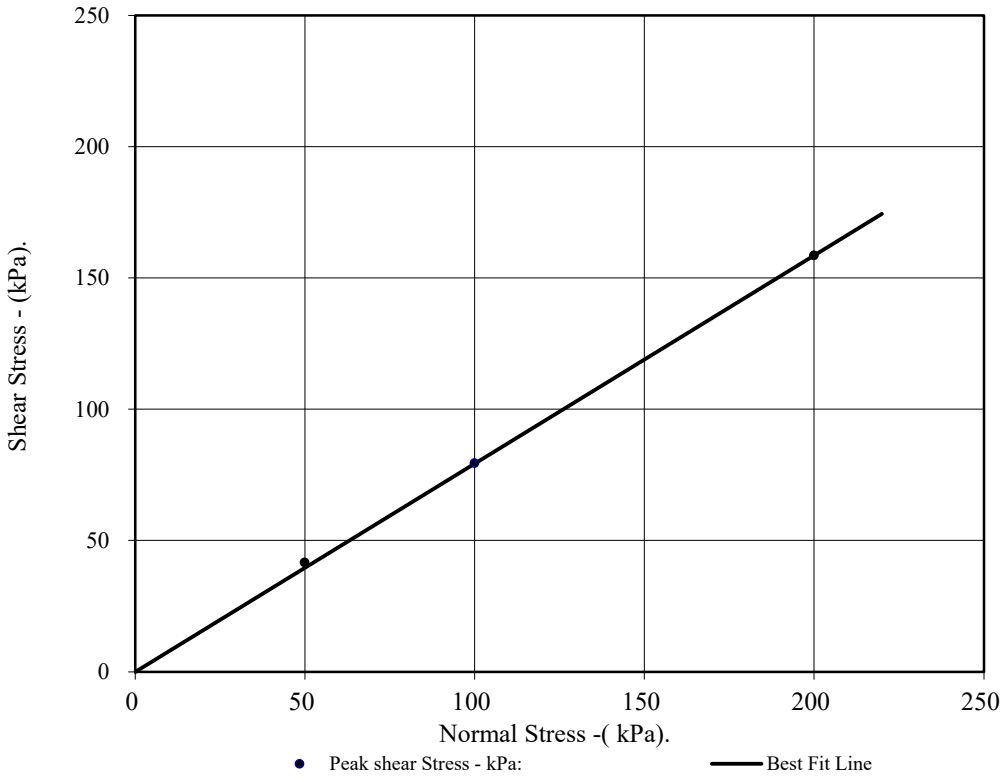


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**		Top Depth:	**23.50**
Sample Number:	**62**		Base Depth:	**24.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.9	4.9	4.9
Bulk Density - Mg/m3:	1.87	1.85	1.86
Dry Density - Mg/m3:	1.78	1.76	1.77
Voids Ratio:	0.490	0.502	0.494
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.65	19.44	19.26
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	8.71	8.71	6.91
Peak shear Stress - kPa:	42	79	159
Final Consolidated Conditions			
Moisture Content - %:	4.4	4.0	3.7
Bulk Density - Mg/m3:	1.90	1.91	1.94
Dry Density - Mg/m3:	1.82	1.83	1.87
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**0**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

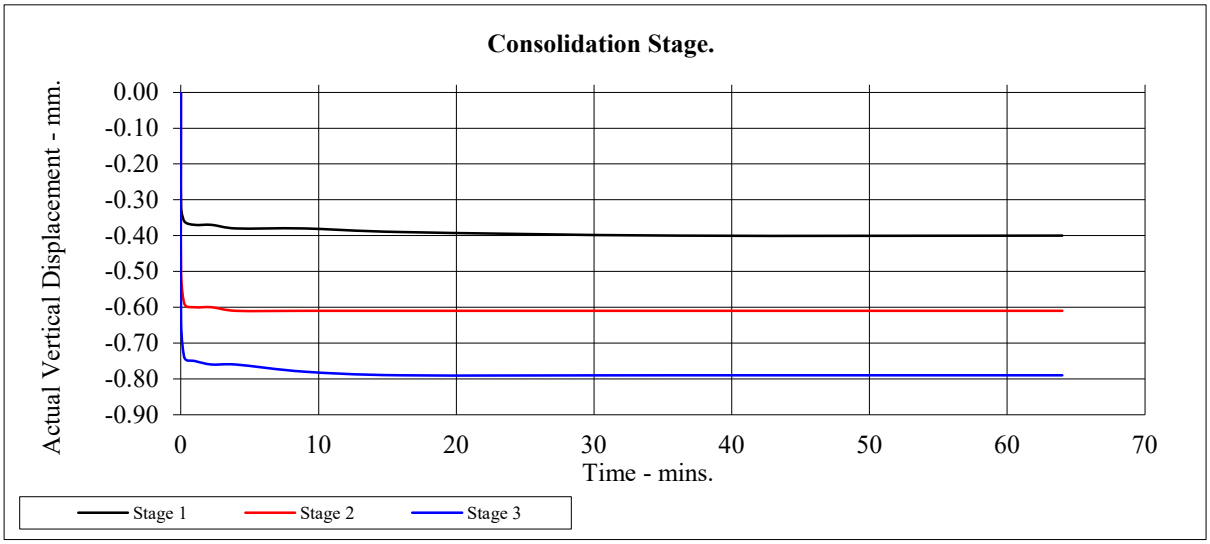
Contract No: PSL19/4788

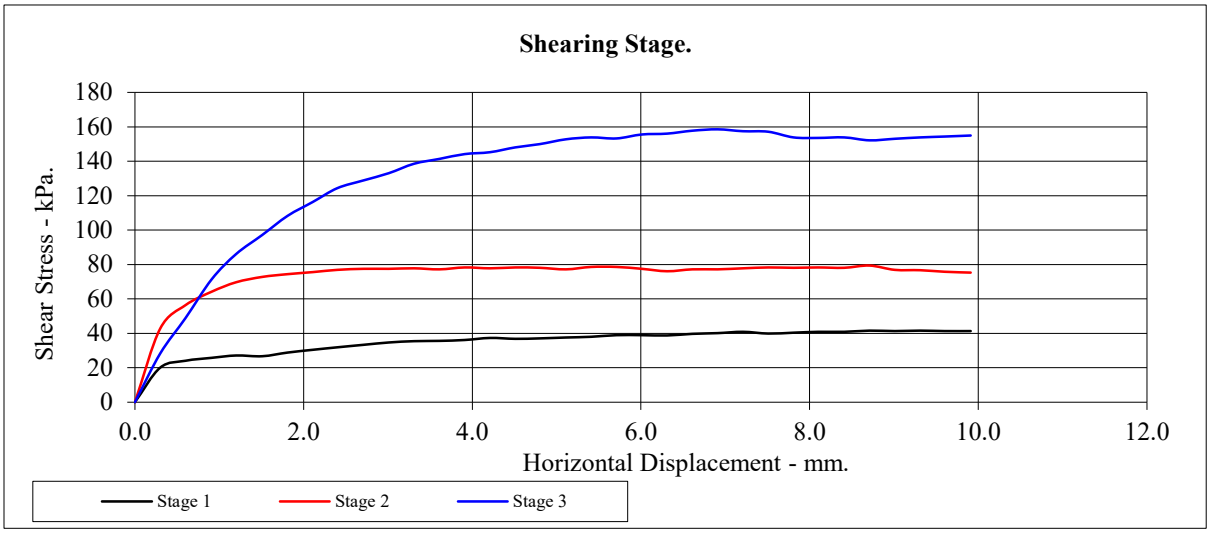
Client Ref: 19-0382

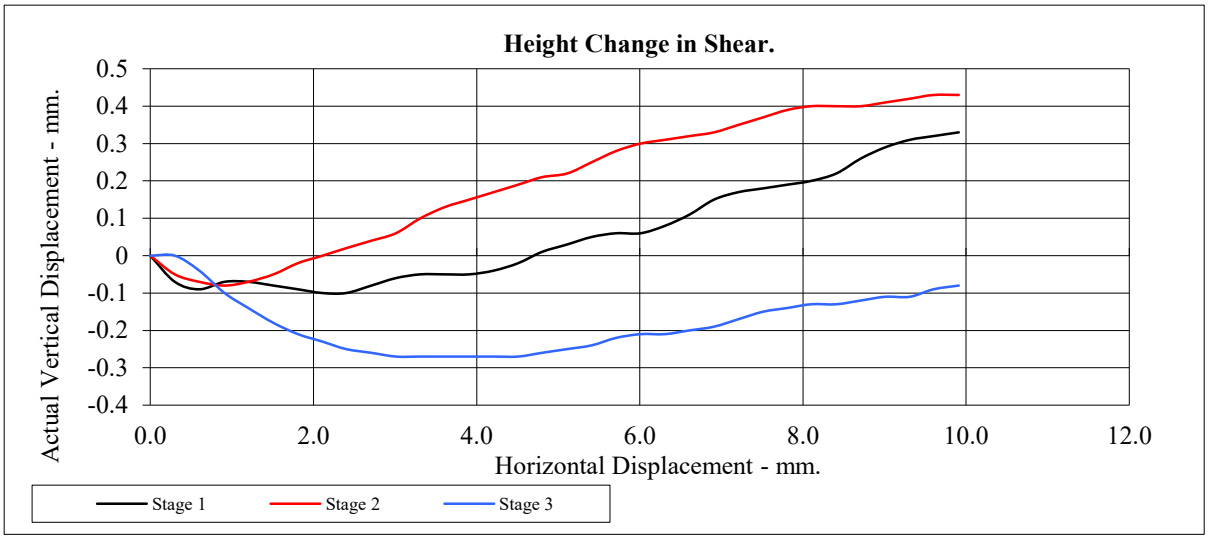
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH44**	Top Depth:	**23.50**
Sample Number:	**62**	Base Depth:	**24.00**





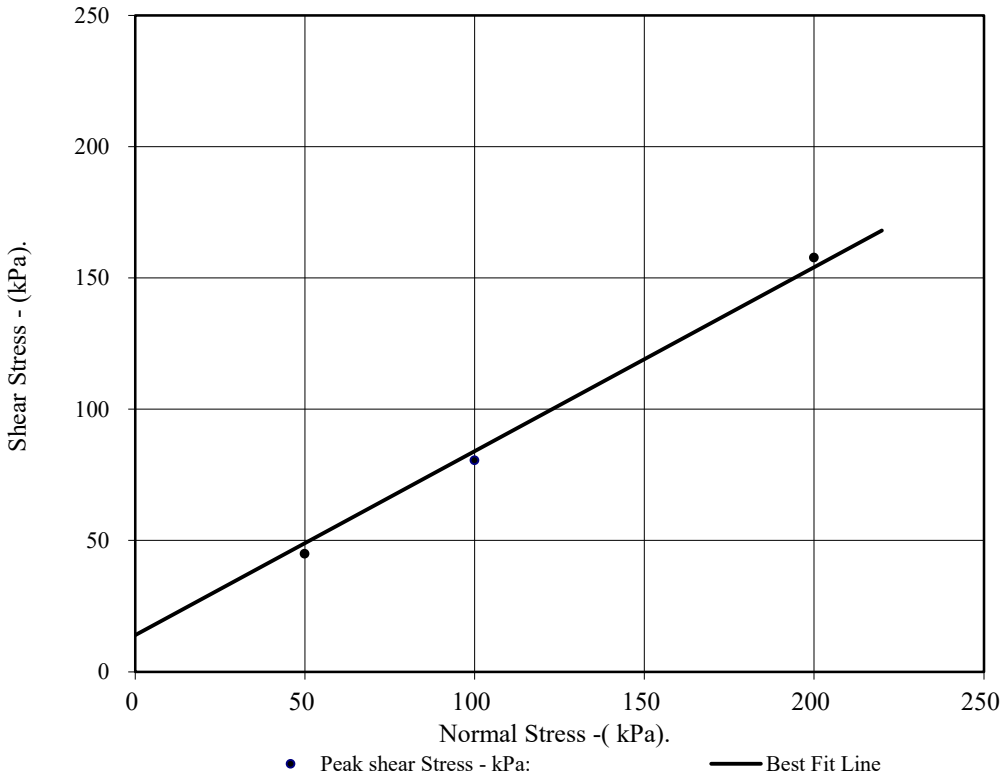


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**		Top Depth:	**1.00**	
Sample Number:	**4**		Base Depth:	**1.50**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	27	27	27
Bulk Density - Mg/m3:	1.95	1.95	1.95
Dry Density - Mg/m3:	1.53	1.53	1.53
Voids Ratio:	0.728	0.729	0.730
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	18.47	17.32	17.12
Shearing Stage			
Rate of Strain (mm/min)	0.048	0.048	0.048
Displacement at peak shear stress (mm)	8.50	6.73	7.96
Peak shear Stress - kPa:	45	81	158
Final Consolidated Conditions			
Moisture Content - %:	26	23	21
Bulk Density - Mg/m3:	2.11	2.25	2.28
Dry Density - Mg/m3:	1.68	1.83	1.89
Peak			
Angle of Shearing Resistance:(~~θ~~)	**35**		
Effective Cohesion - kPa:	**14**		

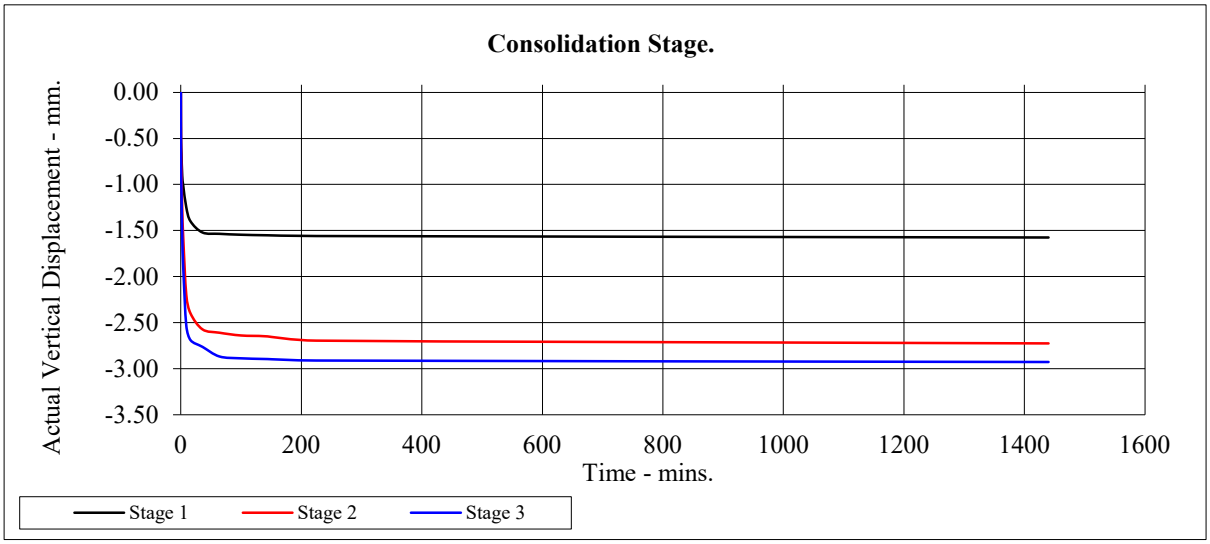


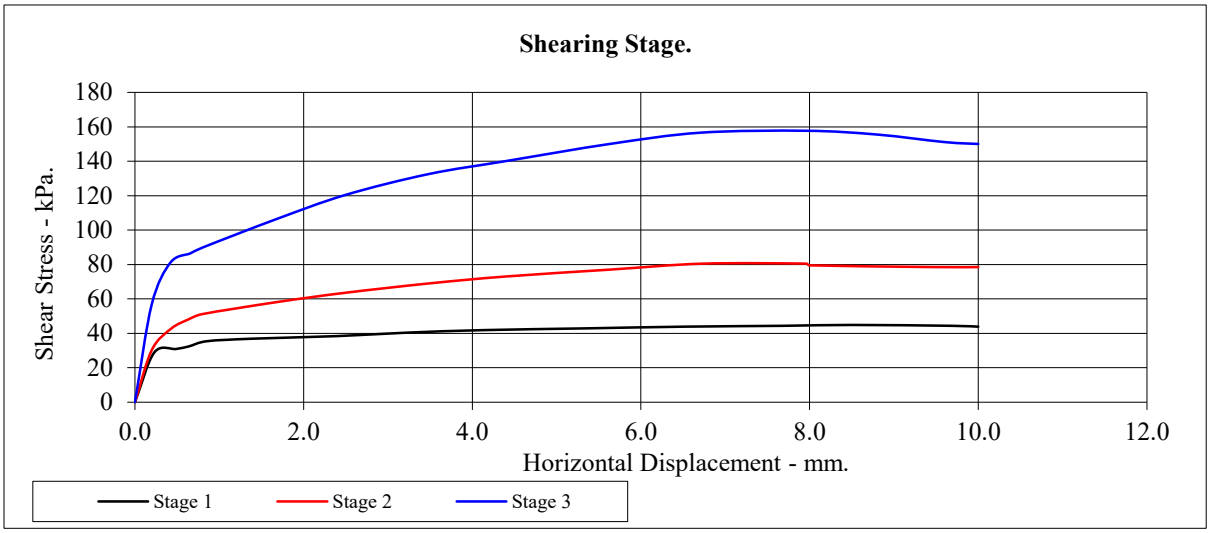
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4788 **Client Ref:** 19-0382

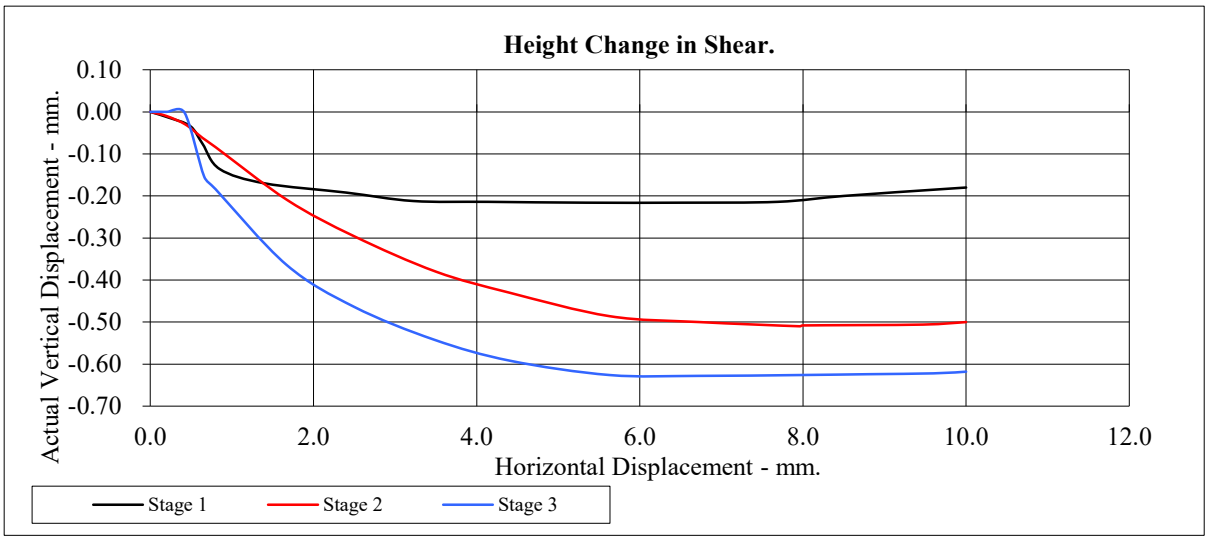
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**	Top Depth:	**1.00**
Sample Number:	**4**	Base Depth:	**1.50**





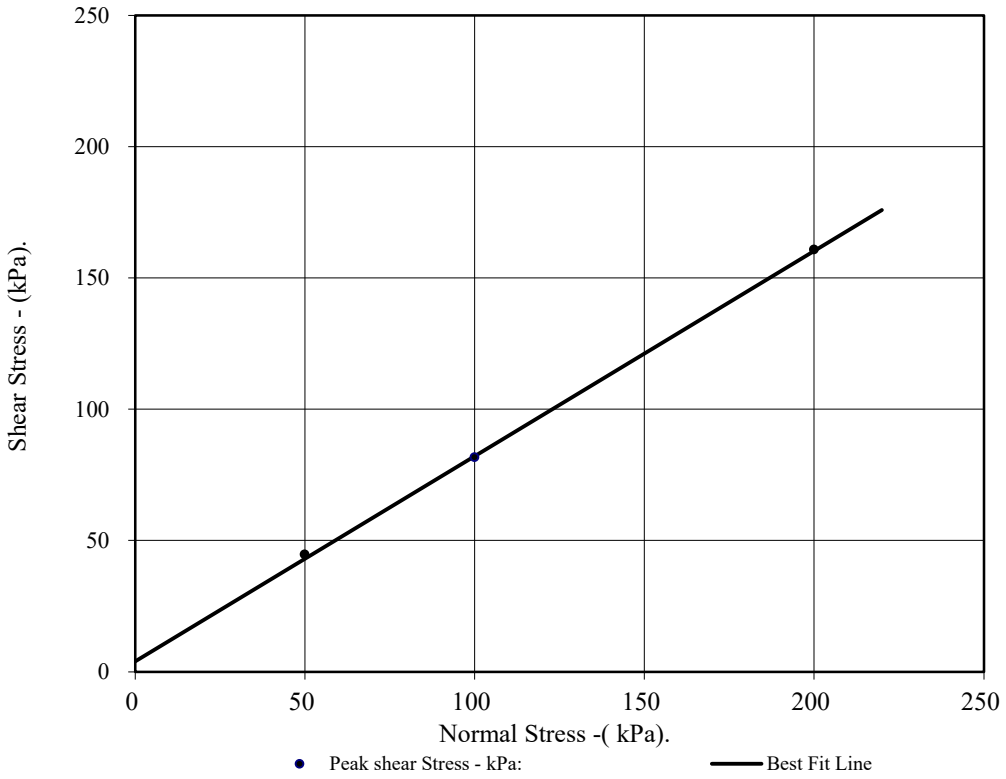


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**		Top Depth:	**3.00**
Sample Number:	**10**		Base Depth:	**3.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	6.1	6.1	6.1
Bulk Density - Mg/m3:	1.87	1.87	1.86
Dry Density - Mg/m3:	1.76	1.76	1.76
Voids Ratio:	0.507	0.507	0.508
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.61	19.48	19.15
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	7.81	8.41	8.71
Peak shear Stress - kPa:	45	82	161
Final Consolidated Conditions			
Moisture Content - %:	5.6	4.9	4.8
Bulk Density - Mg/m3:	1.91	1.92	1.95
Dry Density - Mg/m3:	1.81	1.83	1.86
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**4**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

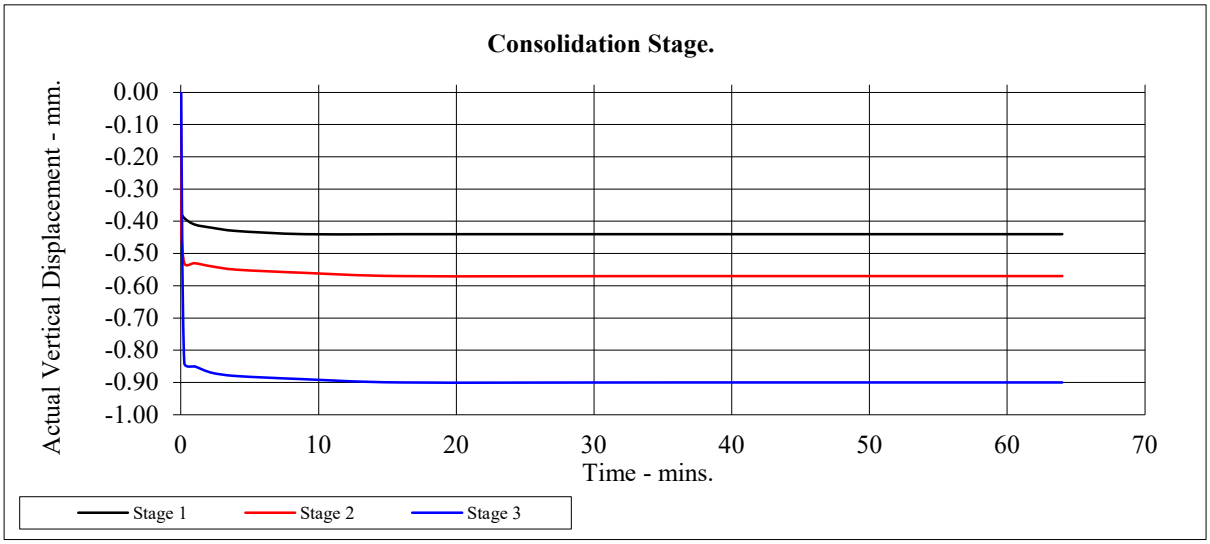
Contract No: PSL19/4788

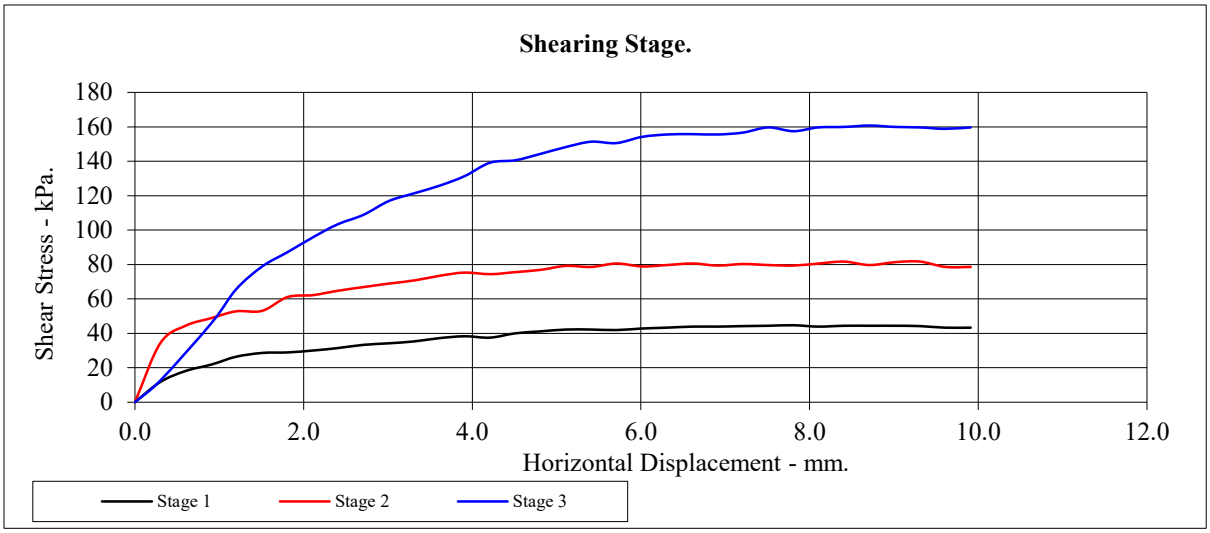
Client Ref: 19-0382

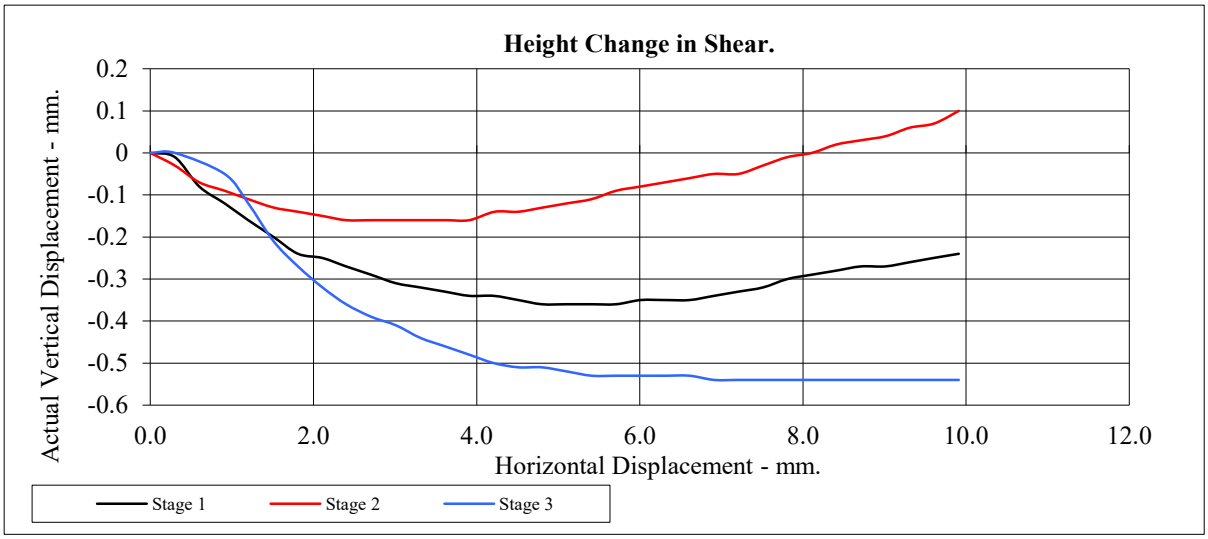
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**	Top Depth:	**3.00**
Sample Number:	**10**	Base Depth:	**3.50**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

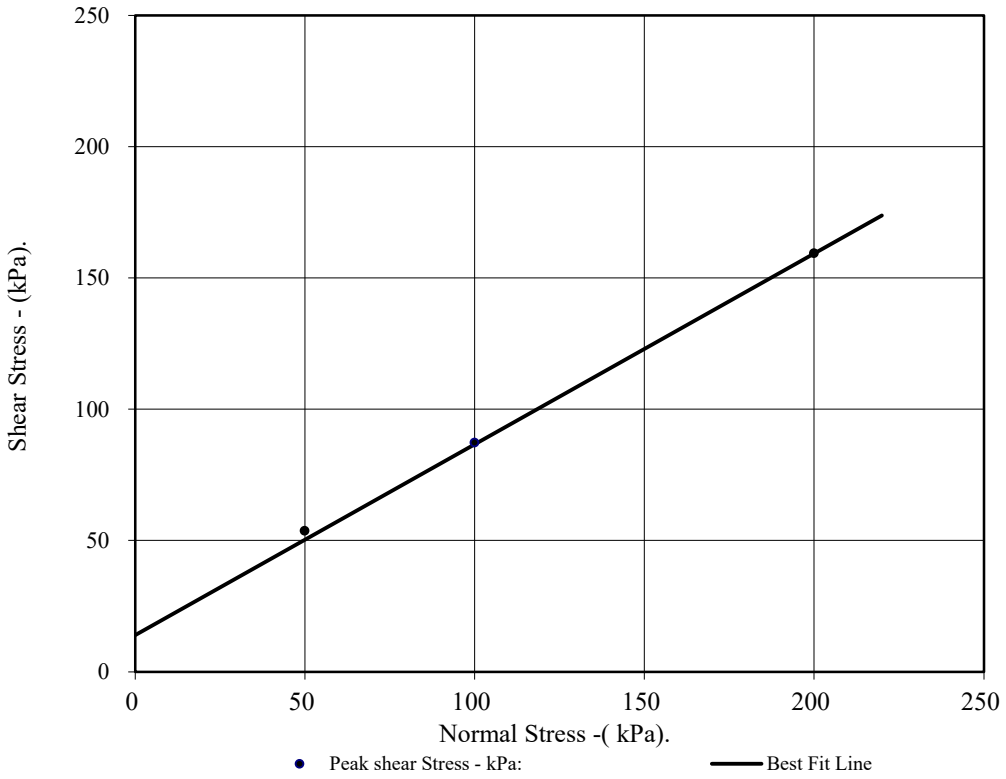
Contract No:
PSL19/4788
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**		Top Depth:	**4.60**
Sample Number:	**13**		Base Depth:	**5.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.3	5.3	5.3
Bulk Density - Mg/m3:	1.75	1.76	1.75
Dry Density - Mg/m3:	1.67	1.67	1.67
Voids Ratio:	0.591	0.586	0.590
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.58	19.50	19.23
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	2.11	6.91	6.91
Peak shear Stress - kPa:	54	87	159
Final Consolidated Conditions			
Moisture Content - %:	4.9	4.5	4.4
Bulk Density - Mg/m3:	1.80	1.81	1.83
Dry Density - Mg/m3:	1.71	1.73	1.75
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**14**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

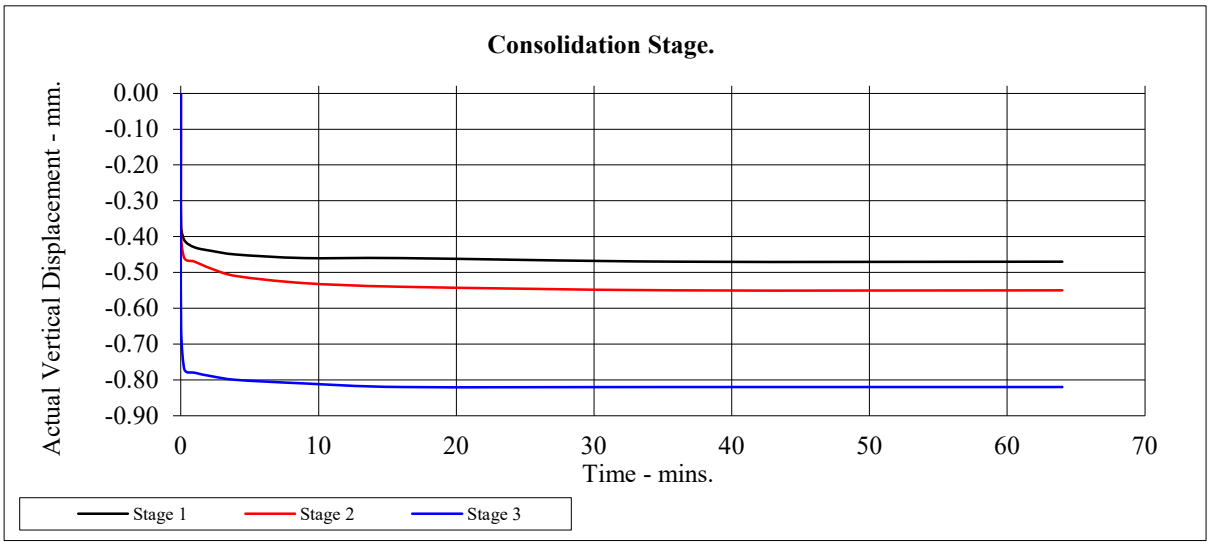
Contract No: PSL19/4788

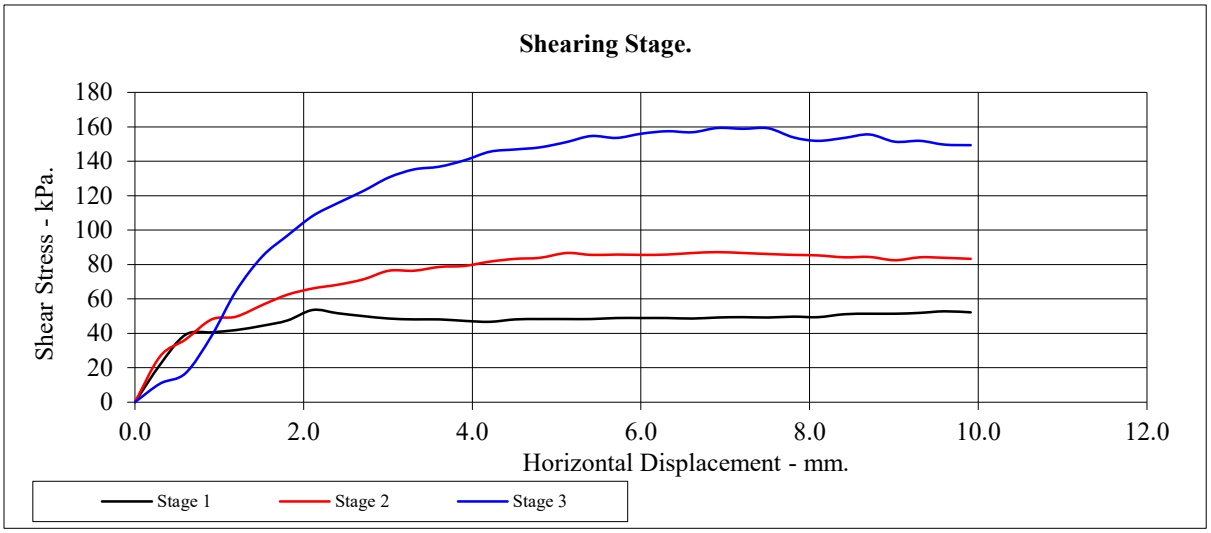
Client Ref: 19-0382

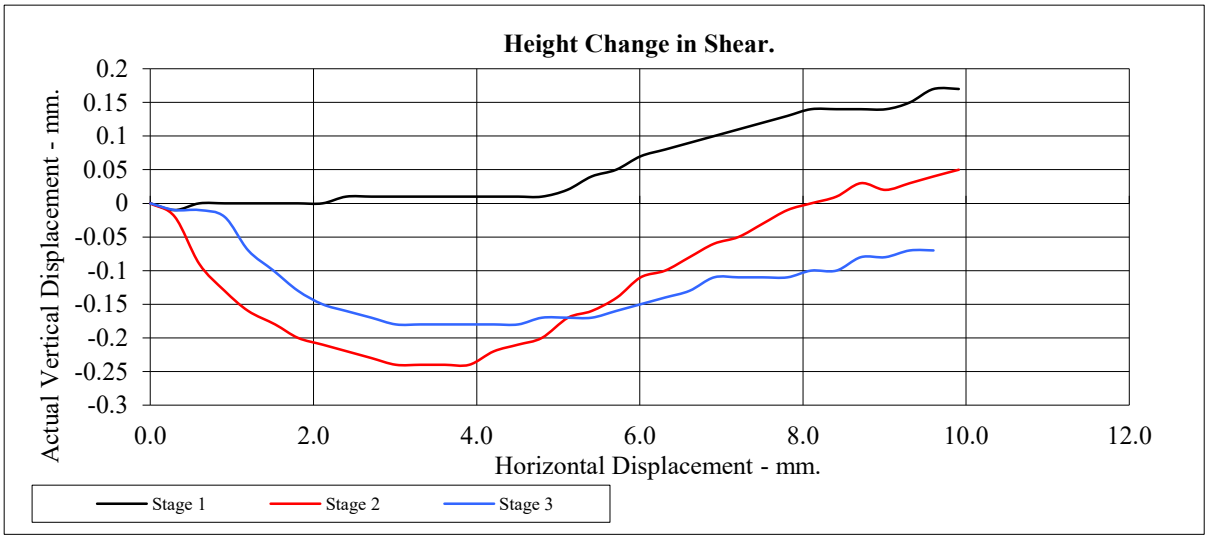
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**	Top Depth:	**4.60**
Sample Number:	**13**	Base Depth:	**5.00**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

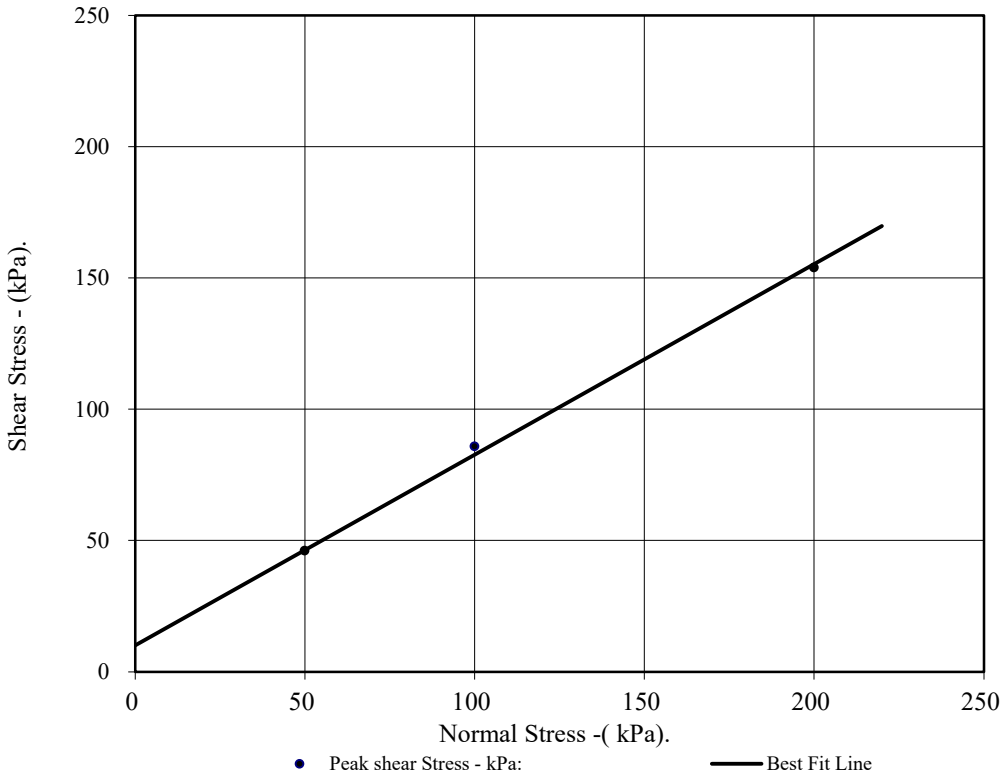
Contract No:
PSL19/4788
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**		Top Depth:	**5.00**
Sample Number:	**15**		Base Depth:	**6.60**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	7.3	7.3	7.3
Bulk Density - Mg/m3:	1.84	1.84	1.87
Dry Density - Mg/m3:	1.72	1.72	1.74
Voids Ratio:	0.545	0.542	0.519
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.51	18.52	18.00
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	4.51	9.61	8.71
Peak shear Stress - kPa:	46	86	154
Final Consolidated Conditions			
Moisture Content - %:	6.1	5.9	5.5
Bulk Density - Mg/m3:	1.89	2.00	2.08
Dry Density - Mg/m3:	1.78	1.88	1.98
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**10**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

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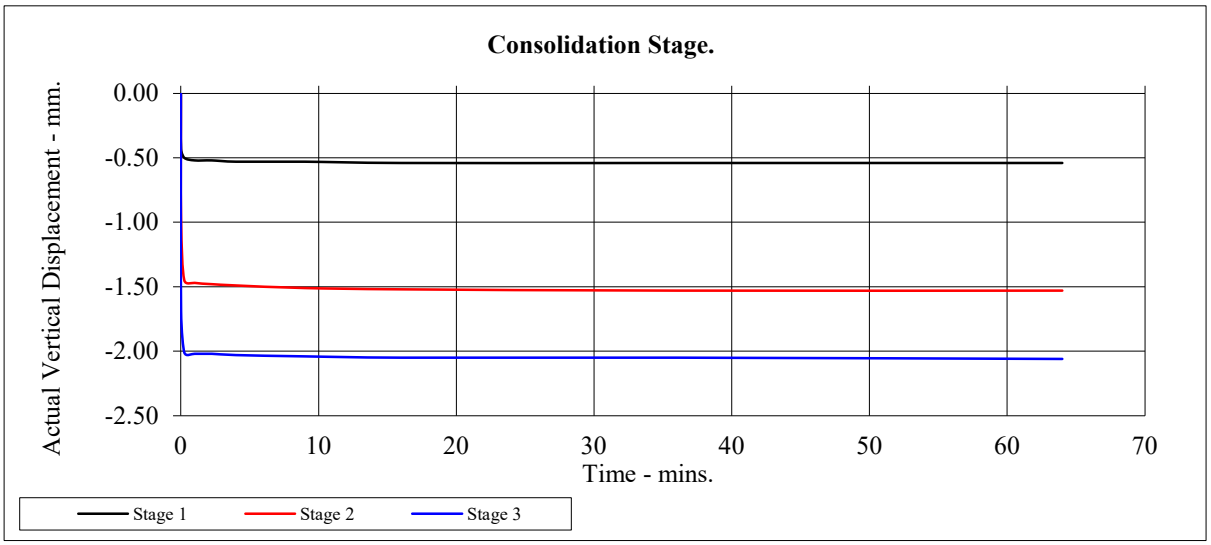
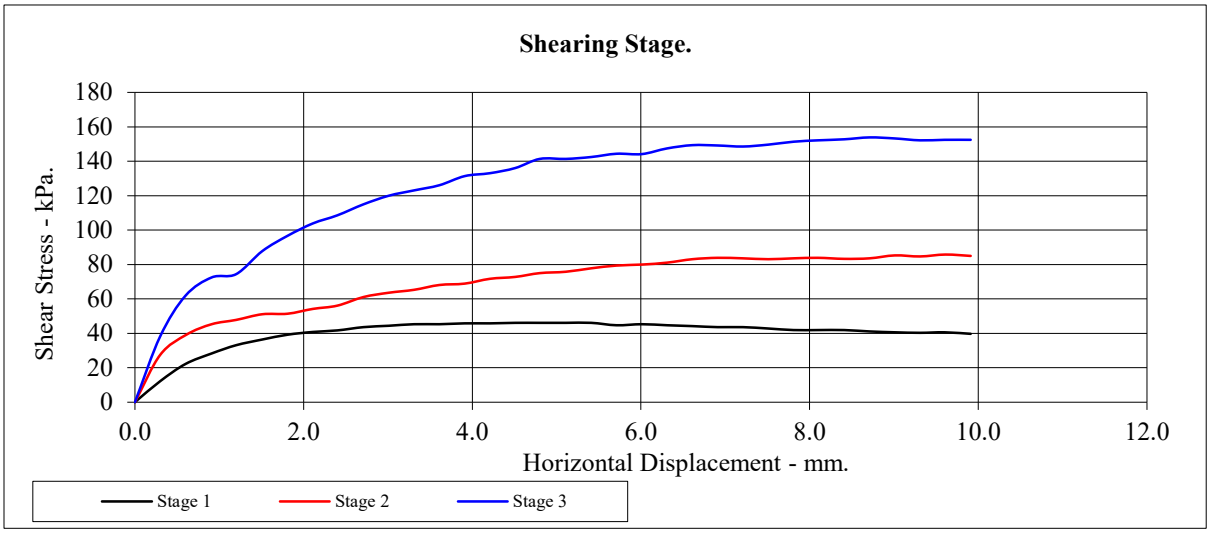
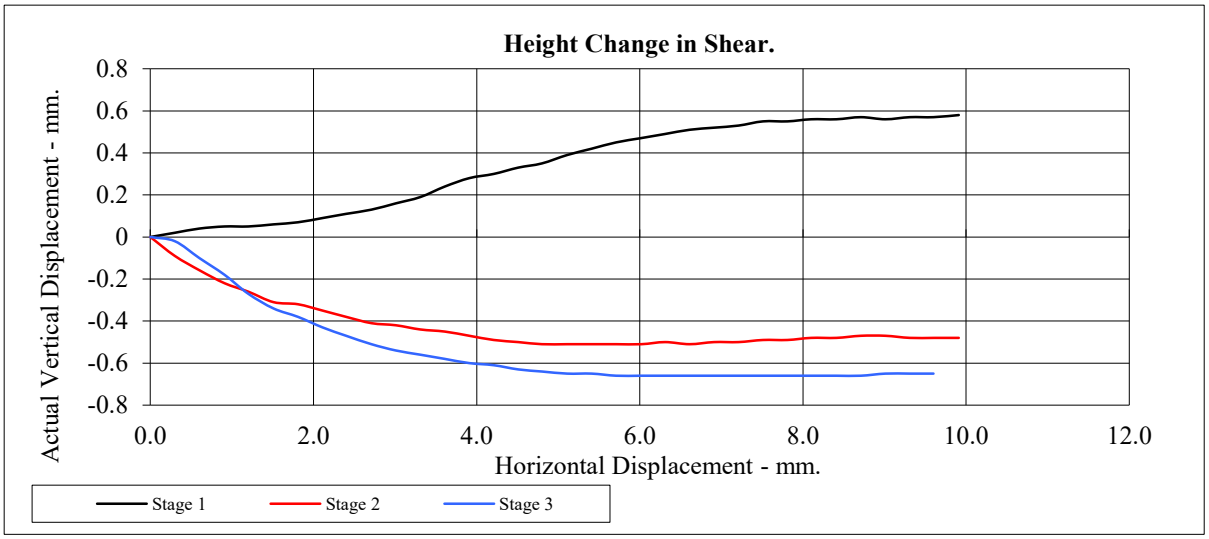
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**	Top Depth:	**5.00**
Sample Number:	**15**	Base Depth:	**6.60**





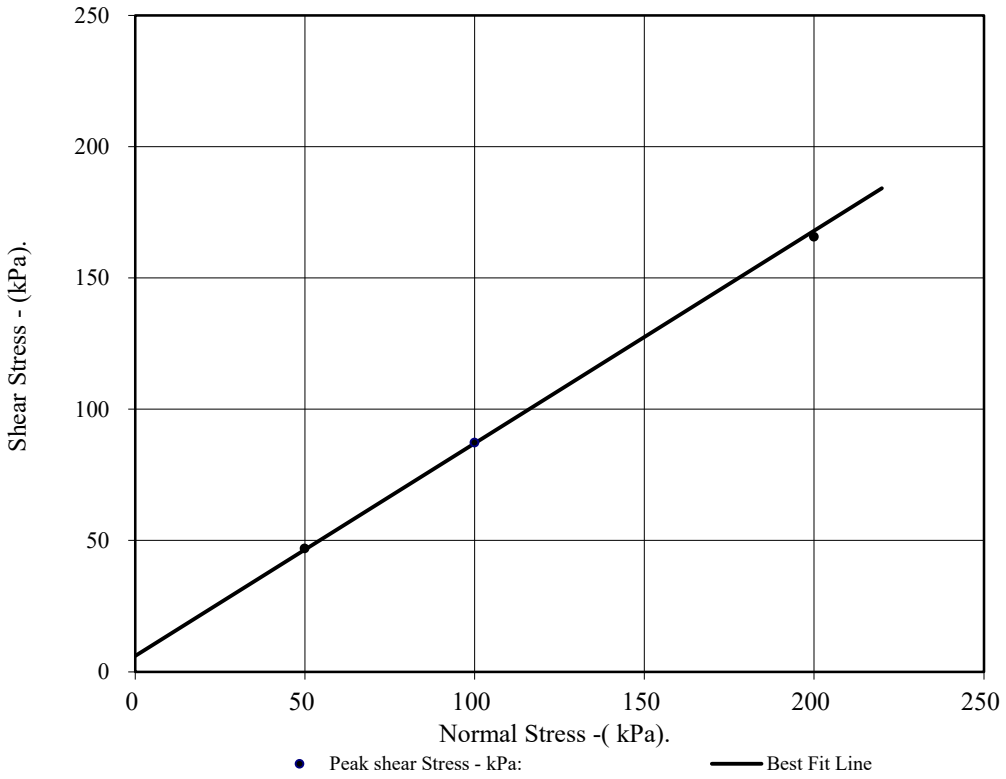


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**		Top Depth:	**7.00**	
Sample Number:	**20**		Base Depth:	**7.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	8.0	8.0	8.0
Bulk Density - Mg/m3:	1.75	1.78	1.76
Dry Density - Mg/m3:	1.62	1.65	1.63
Voids Ratio:	0.633	0.610	0.626
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.80	19.40	19.26
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.60	9.91	8.41
Peak shear Stress - kPa:	47	87	166
Final Consolidated Conditions			
Moisture Content - %:	7.8	7.6	7.5
Bulk Density - Mg/m3:	1.78	1.84	1.83
Dry Density - Mg/m3:	1.65	1.71	1.71
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**6**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

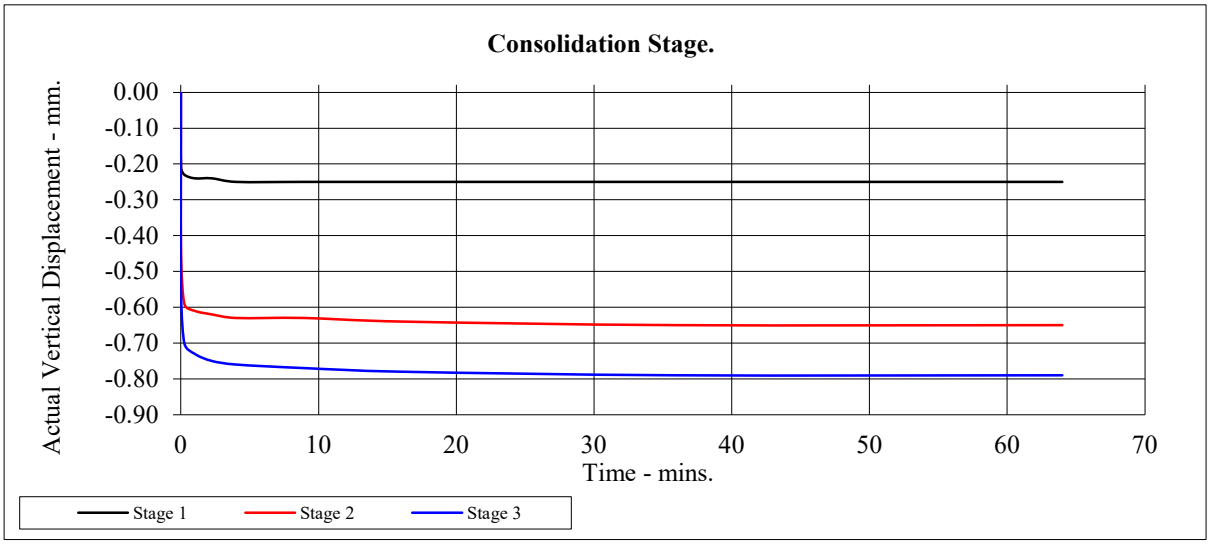
Contract No: PSL19/4788

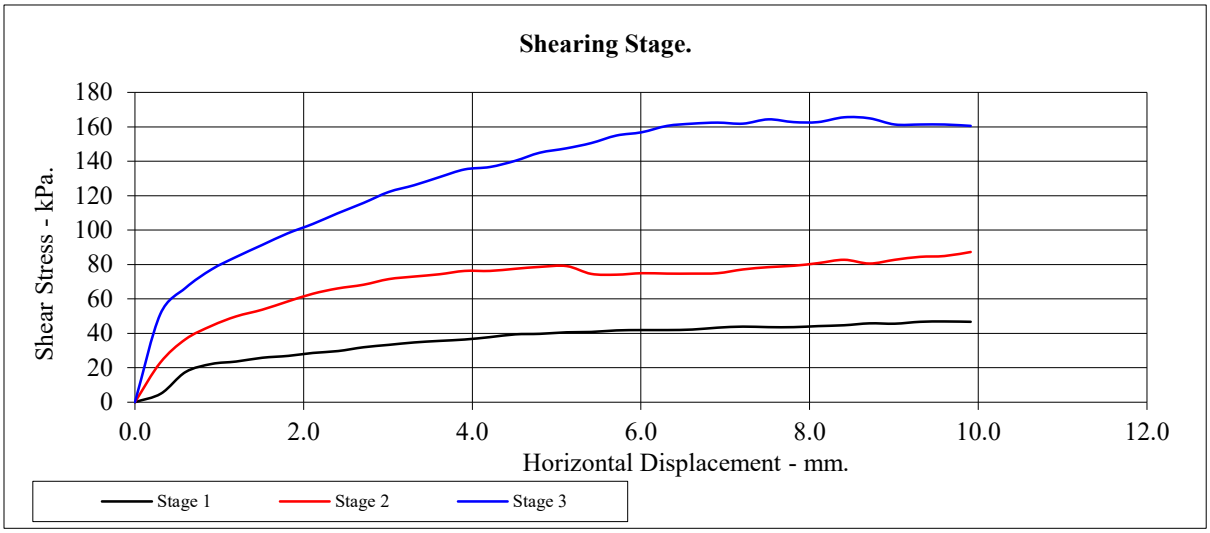
Client Ref: 19-0382

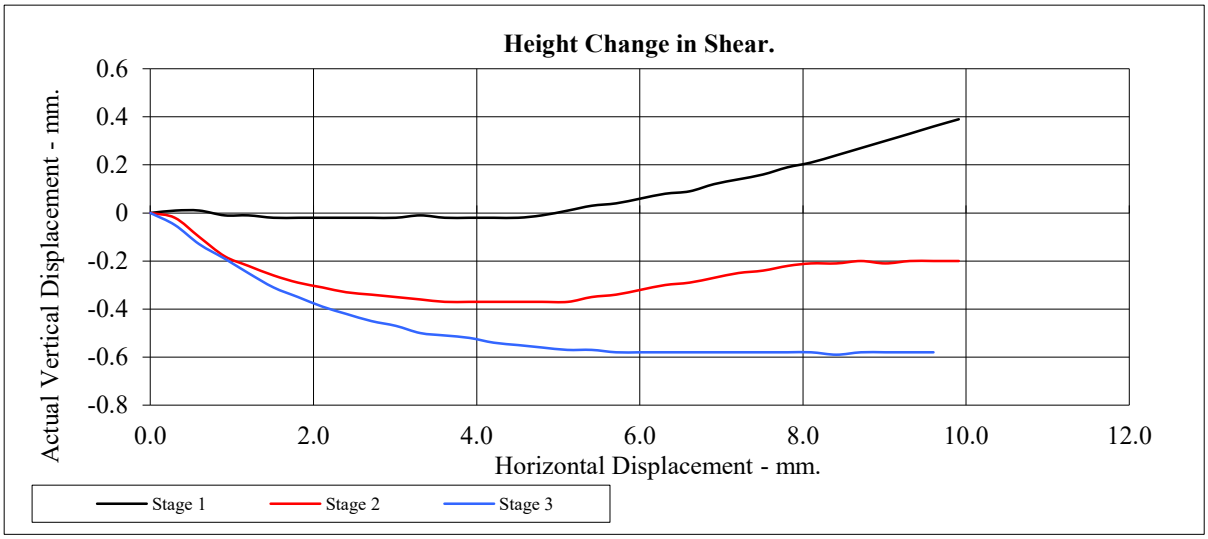
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH46**	Top Depth:	**7.00**
Sample Number:	**20**	Base Depth:	**7.50**







ONE DIMENSIONAL CONSOLIDATION TEST

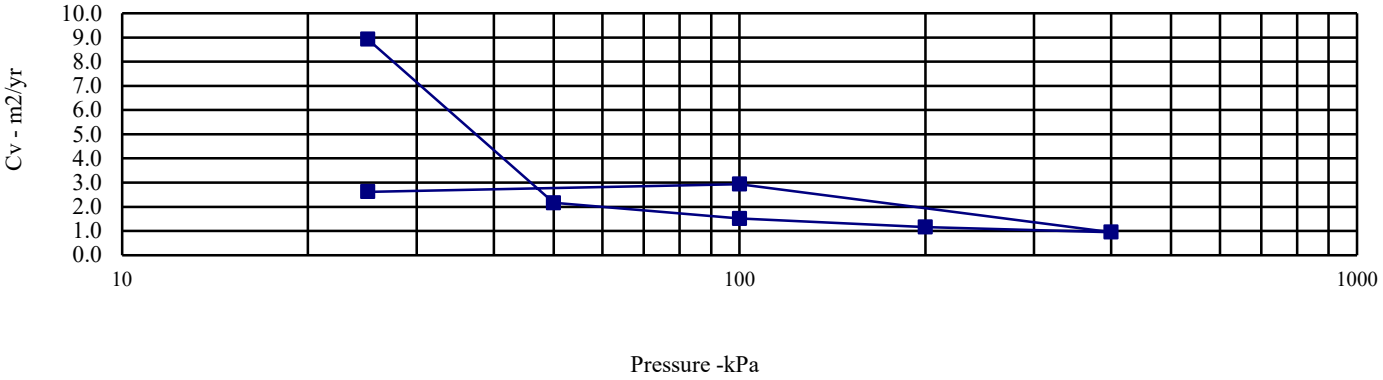
BS 1377: Part 5: 1990: Clause 3

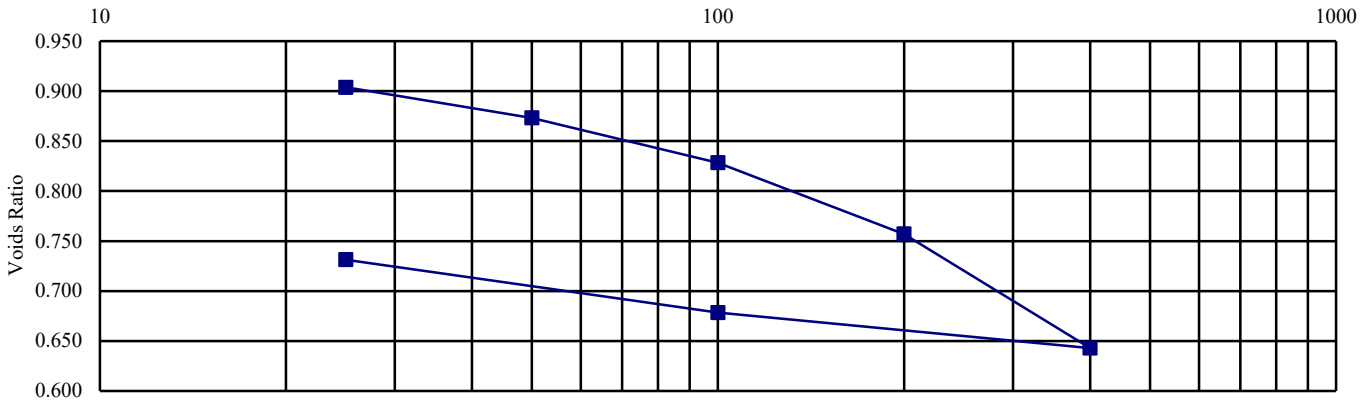
Hole Number: **BH42** **Top Depth (m):** **22.50**

Sample Number: **40** **Base Depth (m) :** **23.35**

Sample Type: **P**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	36						
Bulk Density (Mg/m3):	1.86	0	25	0.678	8.930	Method used to	
Dry Density (Mg/m3):	1.37	25	50	0.642	2.161	determine CV:	T90
Voids Ratio:	0.937	50	100	0.480	1.517	Nominal temperature	
Degree of saturation:	101.4	100	200	0.390	1.156	during test ' C:	20
Height (mm):	19.522	200	400	0.325	0.953	Remarks:	
Diameter (mm)	75.018	400	100	0.072	2.935	See summary of soil descriptions	
Particle Density (Mg/m3): Assumed	2.65	100	25	0.421	2.620		





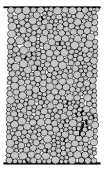
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4788 **Client Ref:** 19-0382

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			22.50-23.35m P40
Description			See summary of soil descriptions.
Type			Undisturbed, Vertical orientation.
Initial Sample Length	L_0	(mm)	209.5
Initial Sample Diameter	D_0	(mm)	98.5
Initial Sample Weight	W_0	(gr)	3016.9
Initial Bulk Density	ρ_0	(Mg/m3)	1.89
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	850	900	1000
Initial Back Pressure	U_{bi}	(kPa)	800	800	800
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	36		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.39		
Initial Voids Ratio	e_i	.	0.908		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions

Final Moisture	ω_f	(%)	32		
Final Dry Density	ρ_{df}	(Mg/m3)	1.49		
Final Voids Ratio	e_f	.	0.783		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	5.08	9.11
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	52.9	76.4	119.6
Minor Stress At Failure	σ_3'	(kPa)	27.0	49.0	91.0
Major Stress At Failure	σ_1'	(kPa)	79.9	125.4	210.6
Principal Stress At Failure	σ_1'/σ_3'		2.959	2.559	2.314

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH42 22.50-23.35m P40
		Test Date	13/08/2019
		Borehole	BH42
Jobfile	Stornoway Deep Water Port	Sample	22.50-23.35m P40
Client	Causeway Geotech Ltd	Depth	22.50-23.35m P40

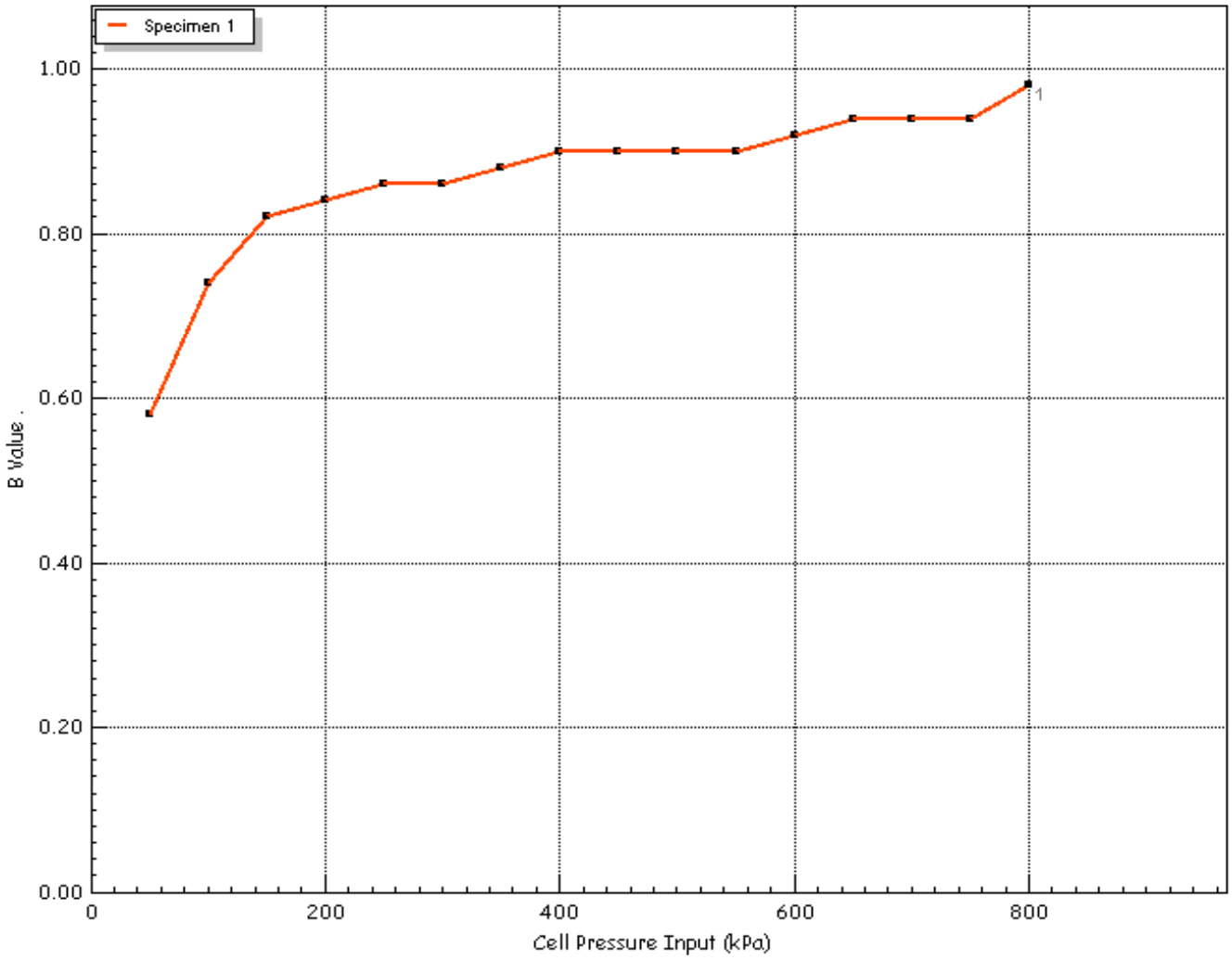
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	800
Pore Water Pressure Input	u pwp	(kPa)	787
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH42 22.50-23.35m P40
		Test Date	13/08/2019
		Borehole	BH42
Jobfile	Stornoway Deep Water Port	Sample	22.50-23.35m P40
Client	Causeway Geotech Ltd	Depth	22.50-23.35m P40

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

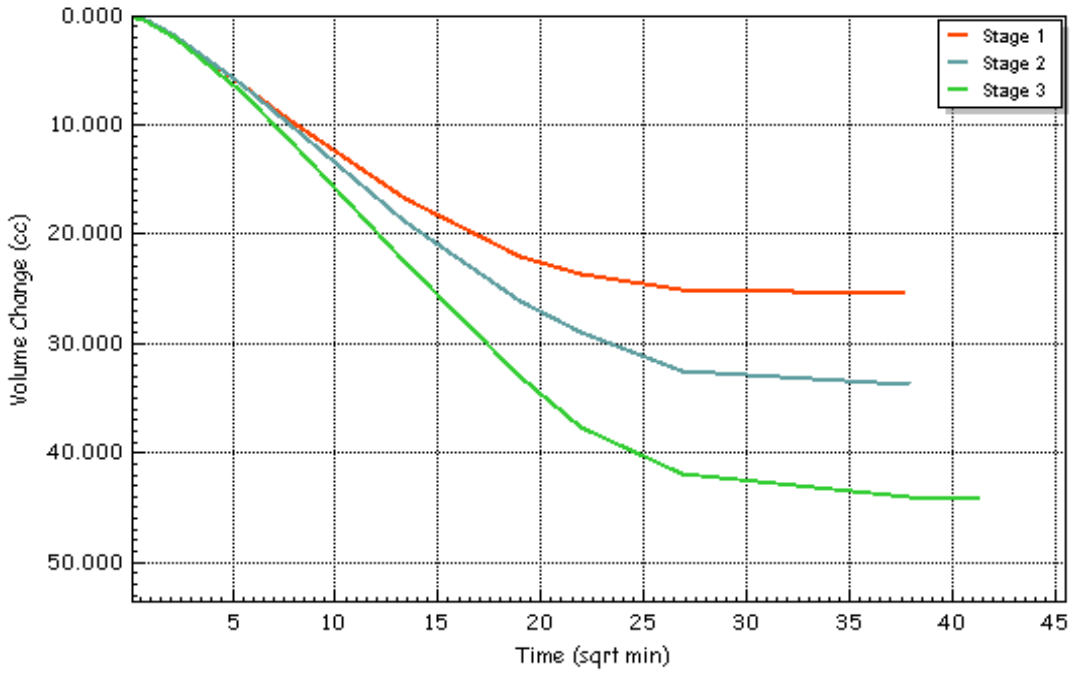
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	850	900	1000
Initial Back Pressure	u_{bi}	(kPa)	800	800	800
Pore Water Pressure Input	u_{pwp}	(kPa)	836	863	932
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	100.00	98.41	96.97
Volumetric Strain	ε_v%	(%)	1.59	3.70	6.47
Corrected Length	L_C	(mm)	208.4	201.8	190.5
Corrected Area	A_C	(cm2)	75.39	74.96	75.43
Corrected Volume	V_C	(cc)	1571.058	1537.276	1493.054
T100 Time to Failure	t_{100}	(min)	389.50	389.5	389.5
Consolidation	c_v	(m2/year)	0.514	0.541	0.541
Compressibility	m_v	(m2/MN)	0.441	0.598	0.506
Test Time	t_F	(h:m:s)	11:41:06	11:41:06	11:41:06
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01486	0.01439	0.01358

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH42 22.50-23.35m P40
		Test Date	13/08/2019
		Borehole	BH42
Jobfile	Stornoway Deep Water Port	Sample	22.50-23.35m P40
Client	Causeway Geotech Ltd	Depth	22.50-23.35m P40

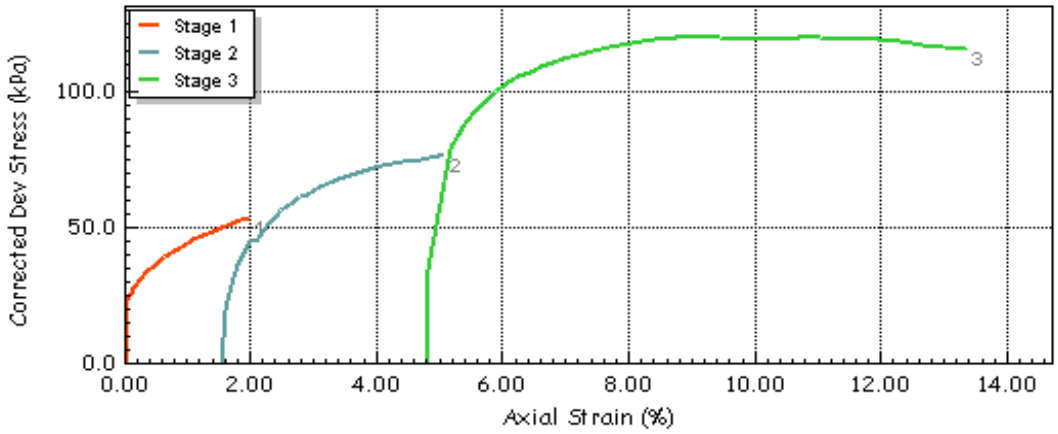
UKAS TESTING 4043

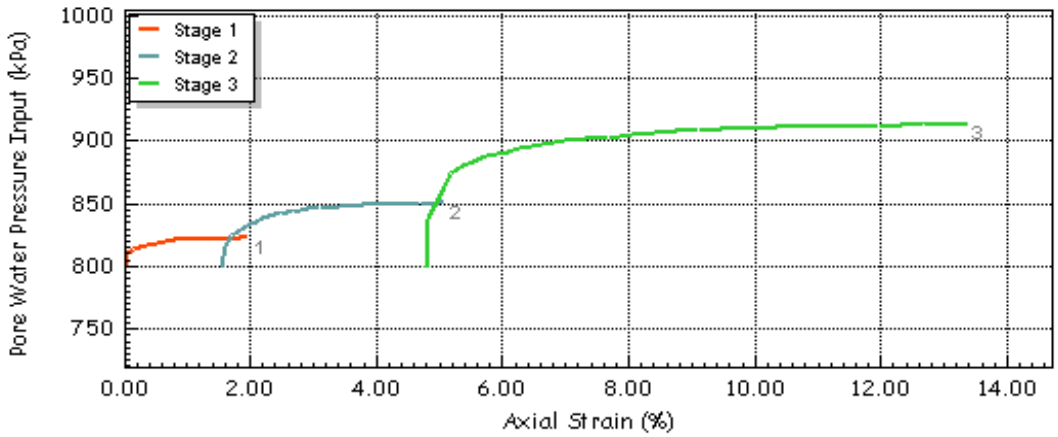
PSL Professional Soils Laboratory

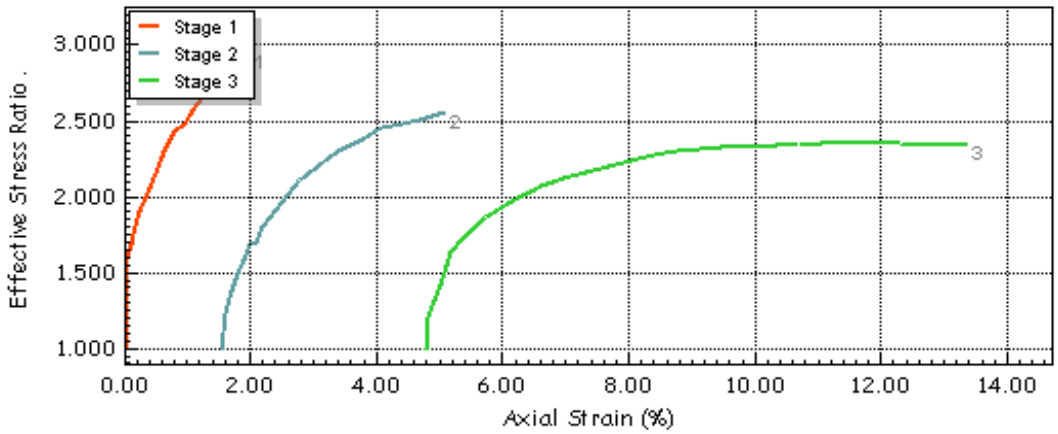
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH42 22.50-23.35m P40
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH42
Client	Causeway Geotech Ltd	Sample	22.50-23.35m P40
		Depth	22.50-23.35m P40

UKAS TESTING 4043

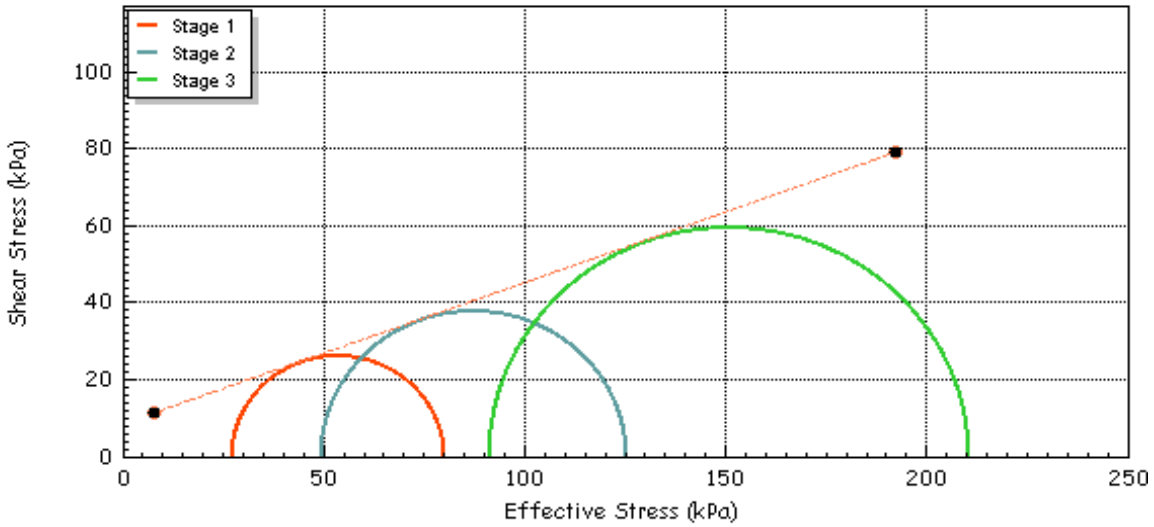
PSL Professional Soils Laboratory

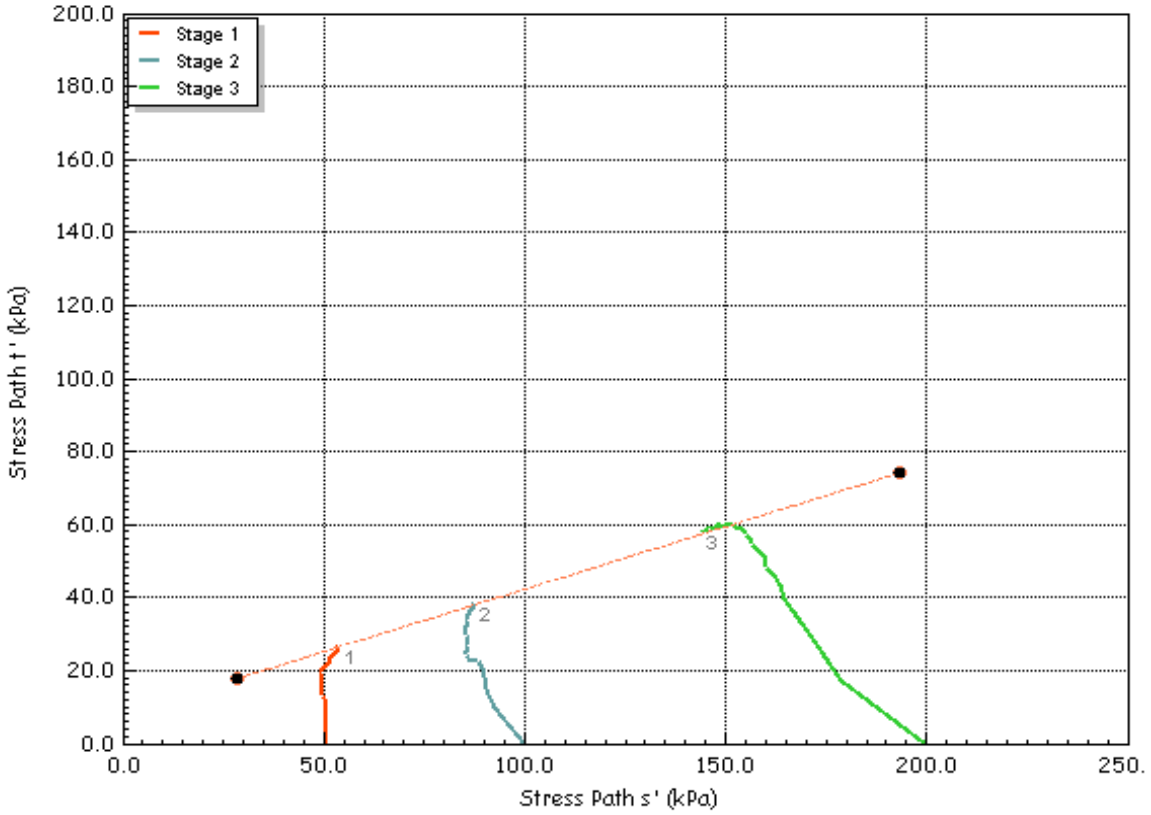
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	8.61	Effective Cohesion	c'	(kPa)	8.61
Effective Friction	ϕ'	(deg)	20.1	Effective Friction	ϕ'	(deg)	20.1





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH42 22.50-23.35m P40
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH42
Client	Causeway Geotech Ltd	Sample	22.50-23.35m P40
		Depth	22.50-23.35m P40

UKAS TESTING 4043

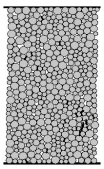
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth		16.50-17.50m P35	
Description		See summary of soil descriptions.	
Type		Undisturbed, Vertical orientation.	
Initial Sample Length	L_0	(mm)	209.6
Initial Sample Diameter	D_0	(mm)	102.8
Initial Sample Weight	W_0	(gr)	3191.8
Initial Bulk Density	ρ_0	(Mg/m3)	1.83
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	36		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.35		
Initial Voids Ratio	e_i	.	0.962		
Initial Degree of Saturation	S_i	(%)	99		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	24		
Final Dry Density	ρ_{df}	(Mg/m3)	1.52		
Final Voids Ratio	e_f	.	0.741		
Final Degree of Saturation	S_f	(%)	87.2		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	4.83	9.53	15.32
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	56.3	84.1	128.6
Minor Stress At Failure	σ_3'	(kPa)	17.0	36.0	68.0
Major Stress At Failure	σ_1'	(kPa)	73.3	120.1	196.6
Principal Stress At Failure	σ_1'/σ_3'		4.312	3.337	2.891

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 16.50-17.50m P35
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	16.50-17.50m P35
Client	Causeway Geotech Ltd	Depth	16.50-17.50m P35

UKAS TESTING 4043

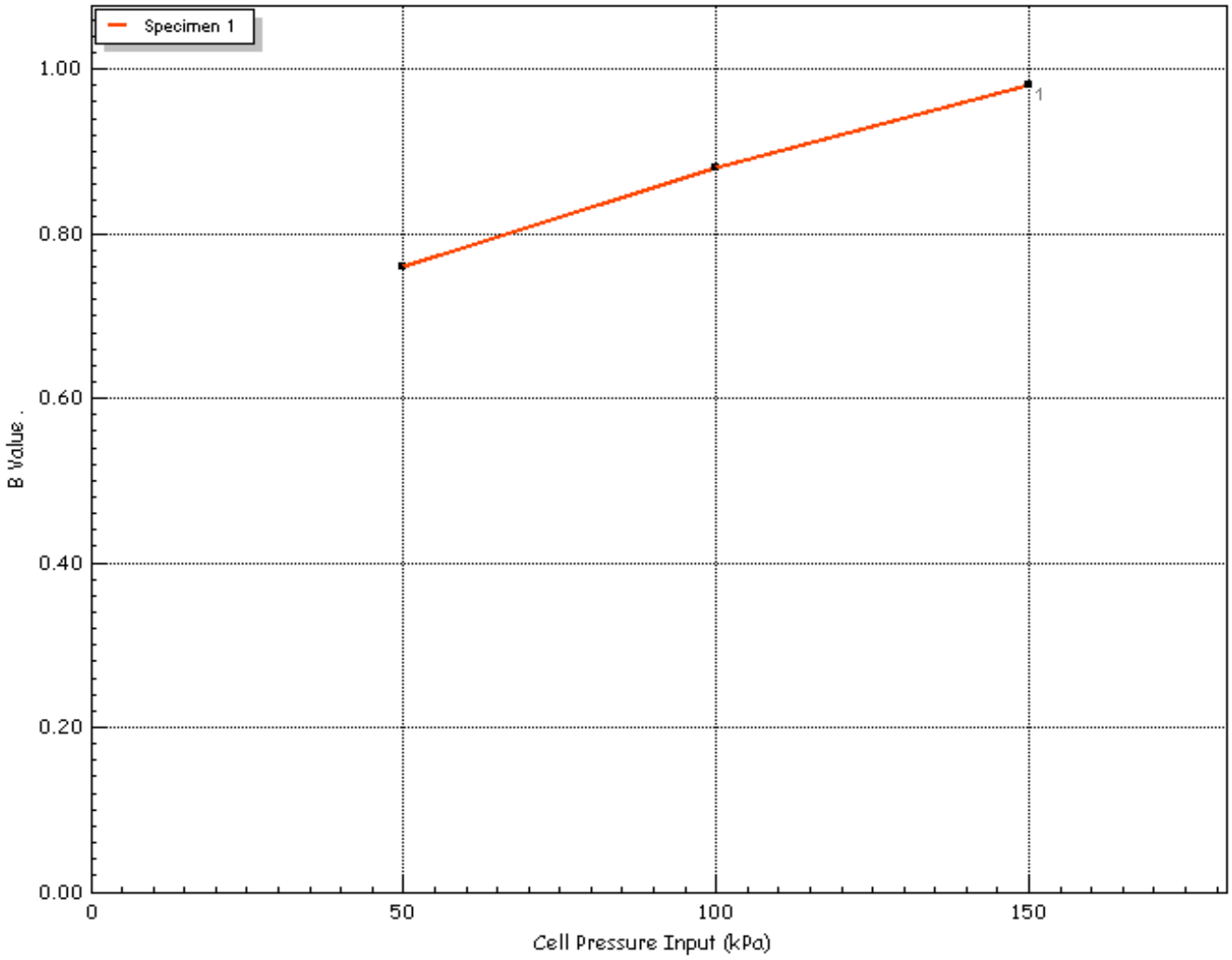
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	145
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 16.50-17.50m P35
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	16.50-17.50m P35
Client	Causeway Geotech Ltd	Depth	16.50-17.50m P35

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

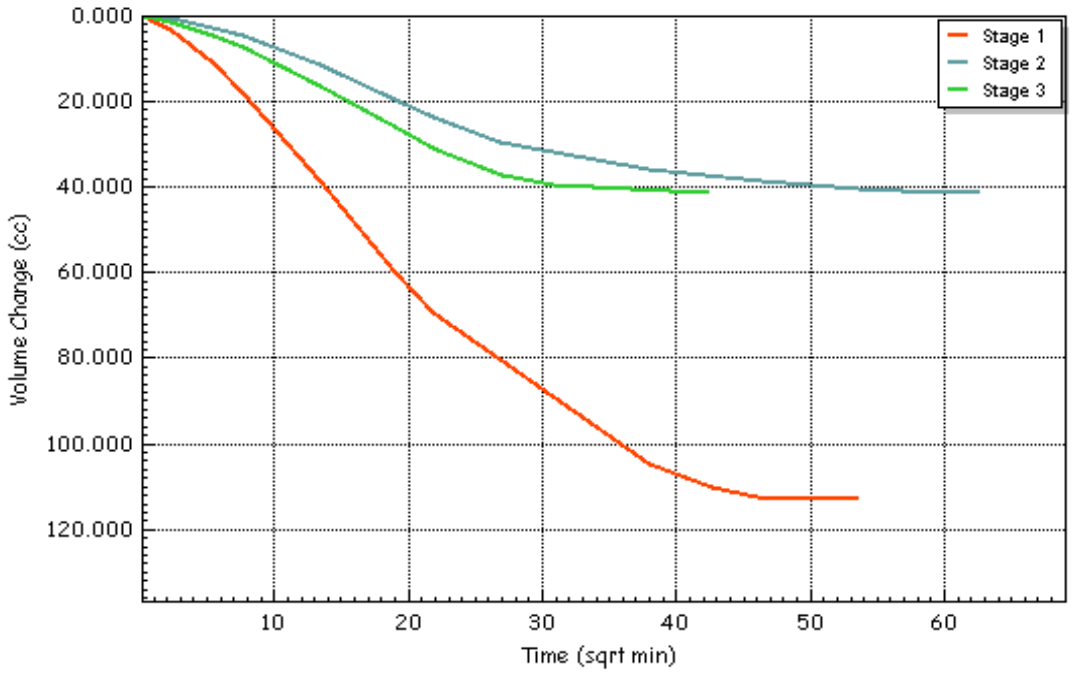
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	347	361	458
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.87	96.72	97.47
Volumetric Strain	ε_v%	(%)	6.49	8.87	11.25
Corrected Length	L_C	(mm)	205.1	189.1	172.5
Corrected Area	A_C	(cm2)	79.41	78.20	81.16
Corrected Volume	V_C	(cc)	1626.772	1585.331	1543.967
T100 Time to Failure	t_{100}	(min)	1098.25	1098.25	1098.25
Consolidation	c_v	(m2/year)	0.199	0.199	0.199
Compressibility	m_v	(m2/MN)	1.411	1.504	0.730
Test Time	t_F	(h:m:s)	32:56:51	32:56:51	32:56:51
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00519	0.00478	0.00436

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 16.50-17.50m P35
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	16.50-17.50m P35
Client	Causeway Geotech Ltd	Depth	16.50-17.50m P35

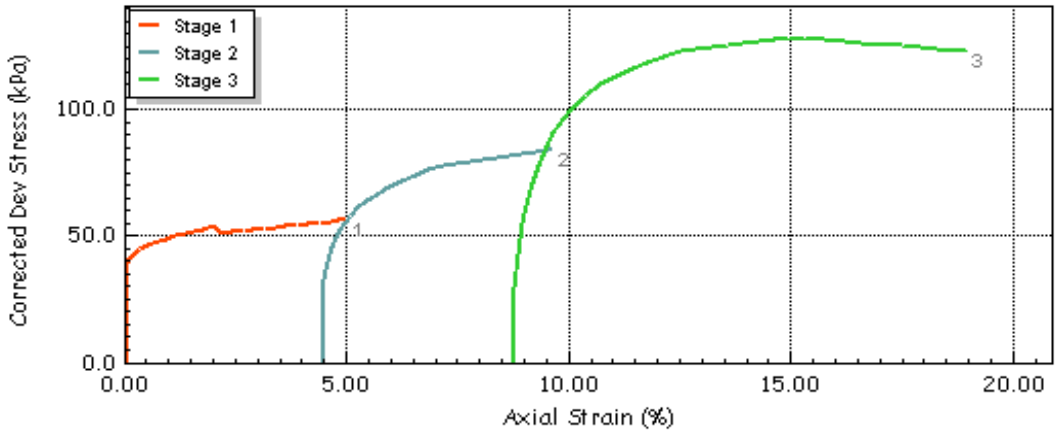
UKAS TESTING 4043

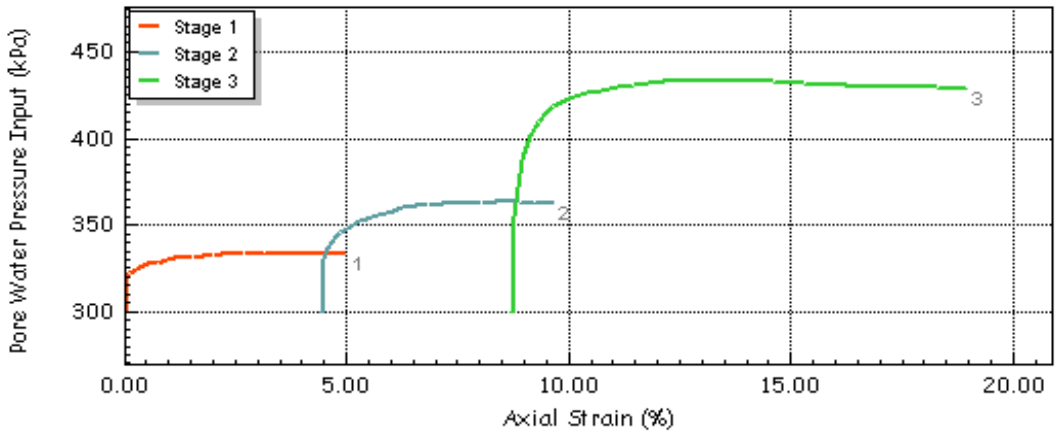
PSL Professional Soils Laboratory

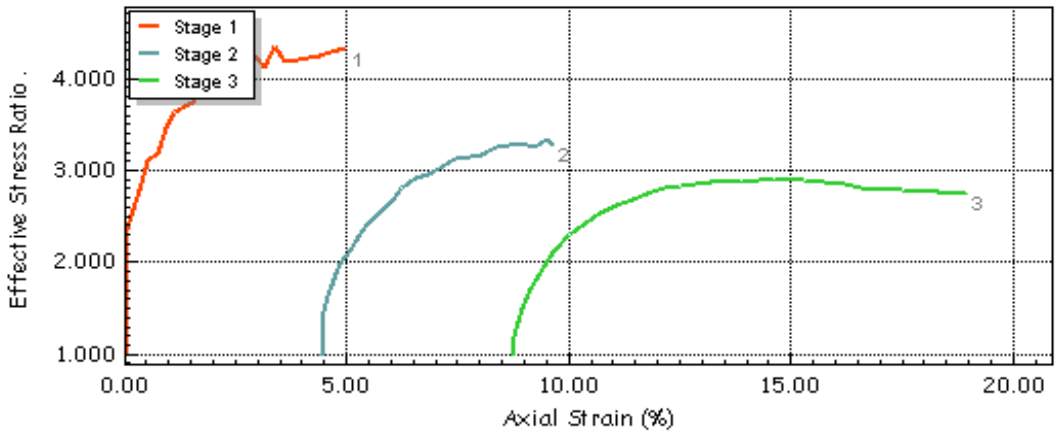
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 16.50-17.50m P35
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH44
Client	Causeway Geotech Ltd	Sample	16.50-17.50m P35
		Depth	16.50-17.50m P35

UKAS TESTING 4043

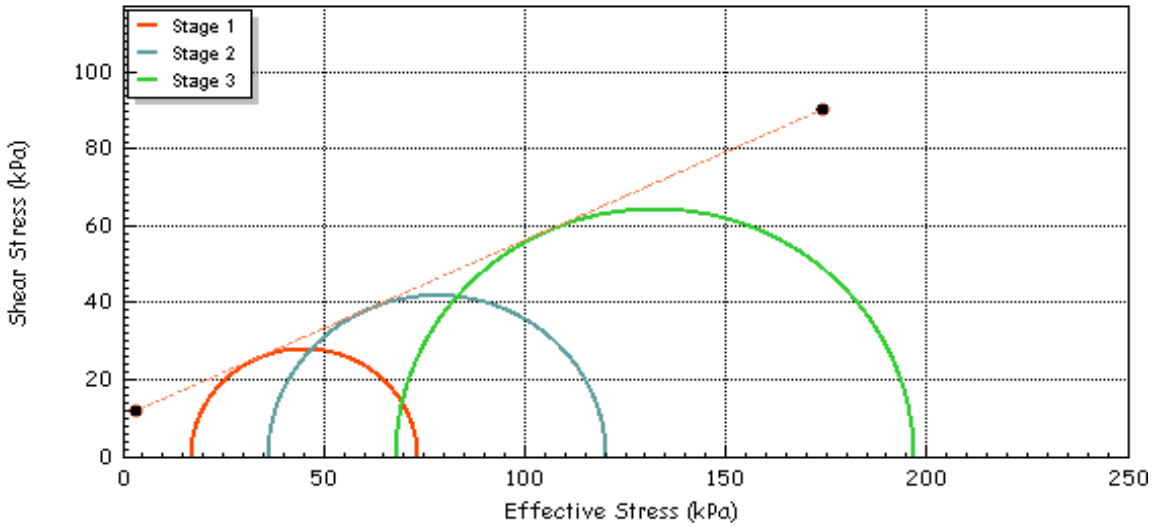
PSL Professional Soils Laboratory

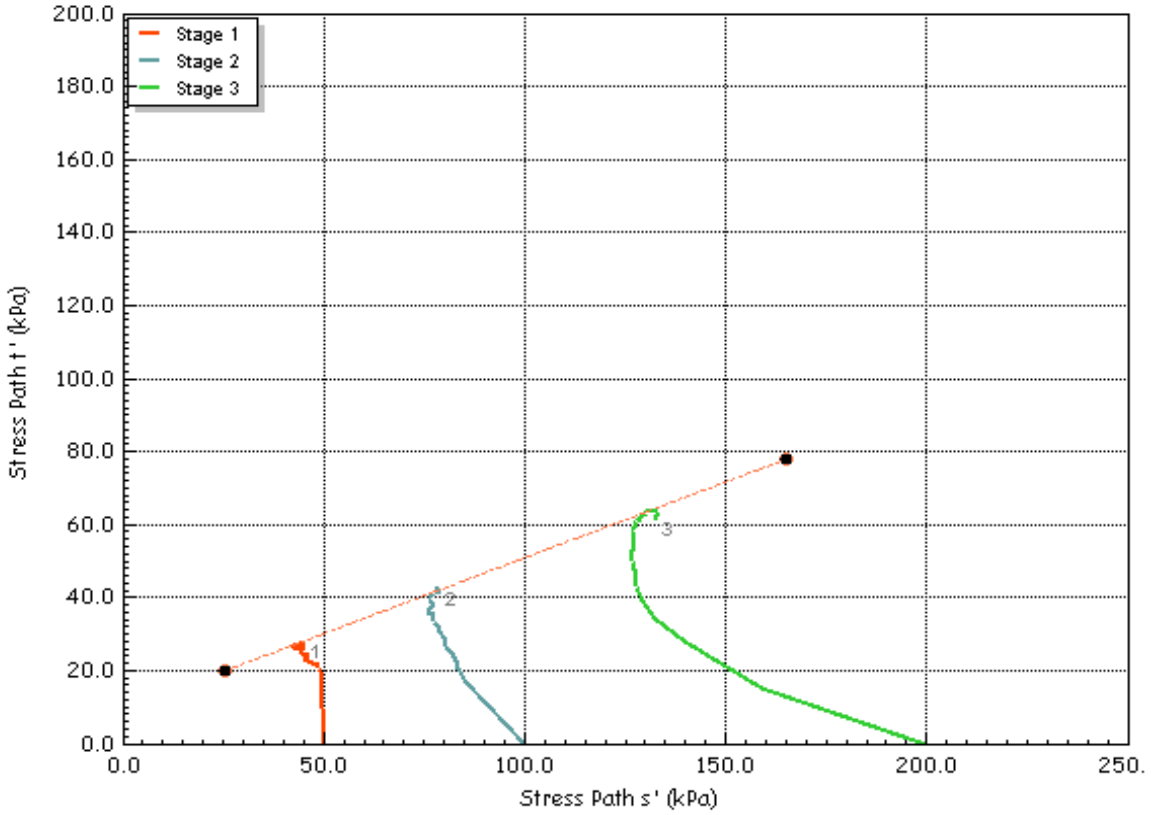
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	10.32	Effective Cohesion	c'	(kPa)	10.32
Effective Friction	ϕ'	(deg)	24.6	Effective Friction	ϕ'	(deg)	24.6





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 16.50-17.50m P35
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH44
Client	Causeway Geotech Ltd	Sample	16.50-17.50m P35
		Depth	16.50-17.50m P35

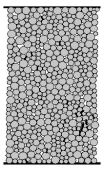
UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
	Depth	18.00-19.00m P36		
	Description	See summary of soil descriptions.		
	Type	Undisturbed, Vertical orientation.		
	Initial Sample Length	L_0	(mm)	200.4
	Initial Sample Diameter	D_0	(mm)	97.2
	Initial Sample Weight	W_0	(gr)	2980.7
sketch showing specimen location in original sample	Initial Bulk Density	ρ_0	(Mg/m3)	2.00
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 6		
Initial Moisture	ω_i	(%)	32		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.52		
Initial Voids Ratio	e_i	.	0.747		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	21		
Final Dry Density	ρ_{df}	(Mg/m3)	1.77		
Final Voids Ratio	e_f	.	0.496		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	2.00	11.65	17.39
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	59.2	90.8	164.2
Minor Stress At Failure	σ_3'	(kPa)	16.0	35.0	78.0
Major Stress At Failure	σ_1'	(kPa)	75.2	125.8	242.2
Principal Stress At Failure	σ_1'/σ_3'		4.701	3.594	3.105

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 18.00-19.00m P36
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	18.00-19.00m P36
Client	Causeway Geotech Ltd	Depth	18.00-19.00m P36

UKAS TESTING 4043

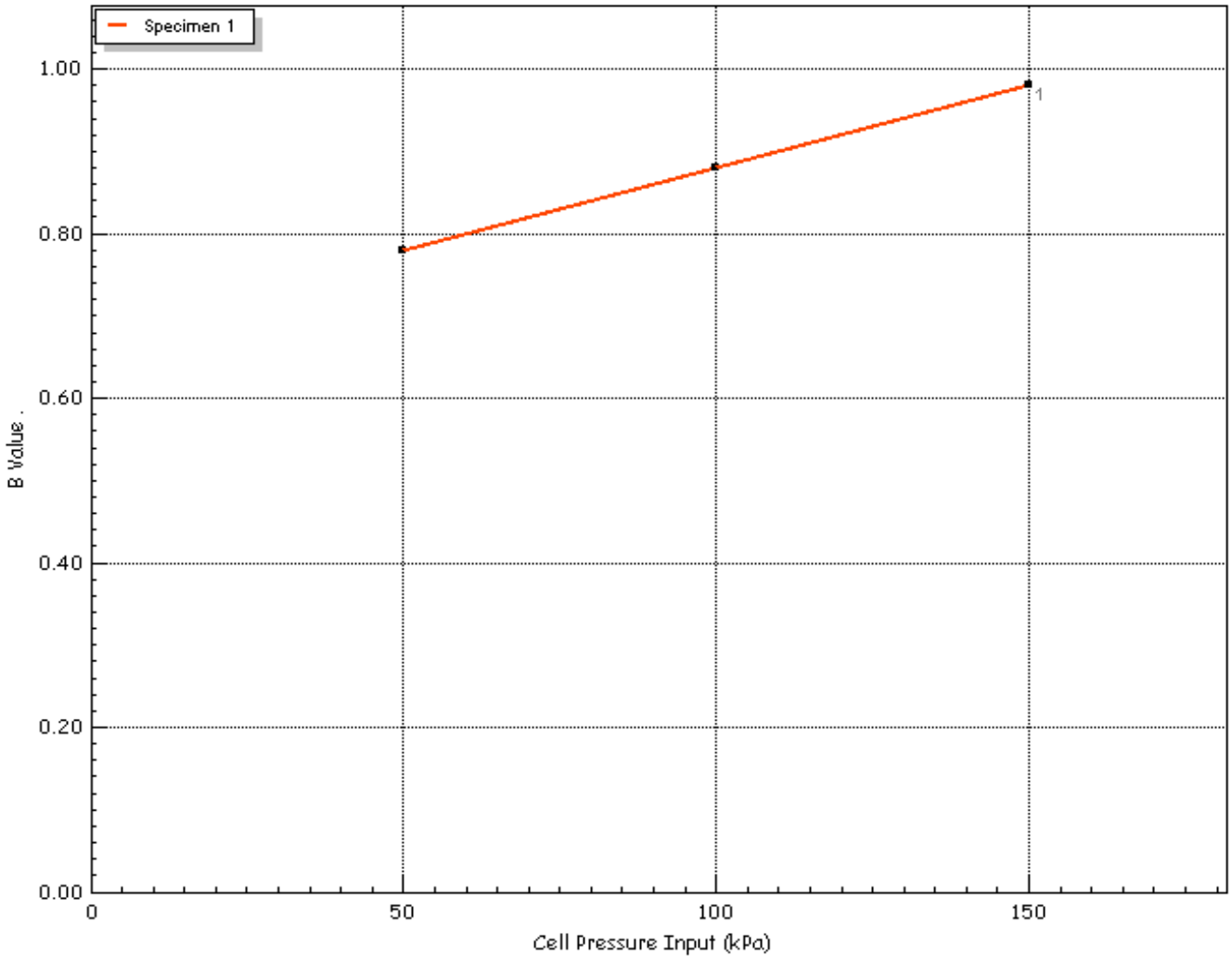
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	146
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 18.00-19.00m P36
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	18.00-19.00m P36
Client	Causeway Geotech Ltd	Depth	18.00-19.00m P36

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Effective Stress Triaxial Compression

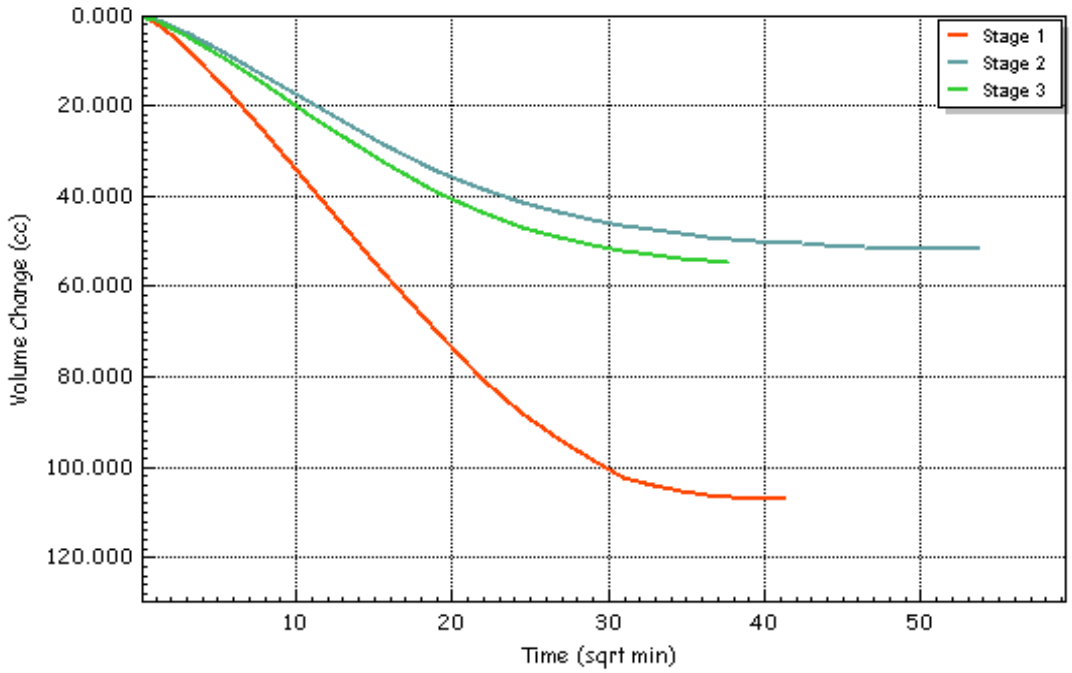
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	346	378	462
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.85	98.73	98.15
Volumetric Strain	ε_v%	(%)	7.20	10.68	14.36
Corrected Length	L_C	(mm)	195.6	184.1	159.4
Corrected Area	A_C	(cm2)	70.64	66.74	70.84
Corrected Volume	V_C	(cc)	1380.015	1328.203	1273.554
T100 Time to Failure	t_{100}	(min)	776.28	776.28	776.28
Consolidation	c_v	(m2/year)	0.251	0.251	0.251
Compressibility	m_v	(m2/MN)	1.583	1.378	0.902
Test Time	t_F	(h:m:s)	23:17:18	23:17:18	23:17:18
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00700	0.00659	0.00570

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 18.00-19.00m P36
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	18.00-19.00m P36
Client	Causeway Geotech Ltd	Depth	18.00-19.00m P36

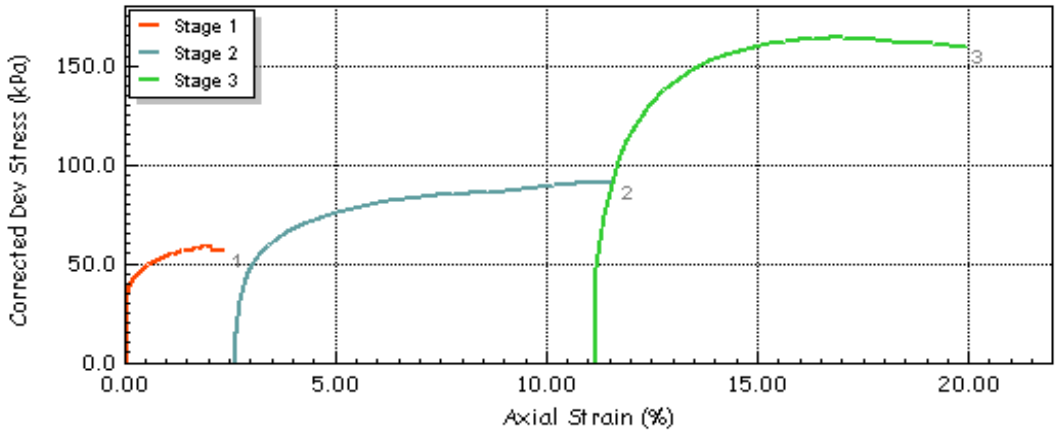
UKAS TESTING 4043

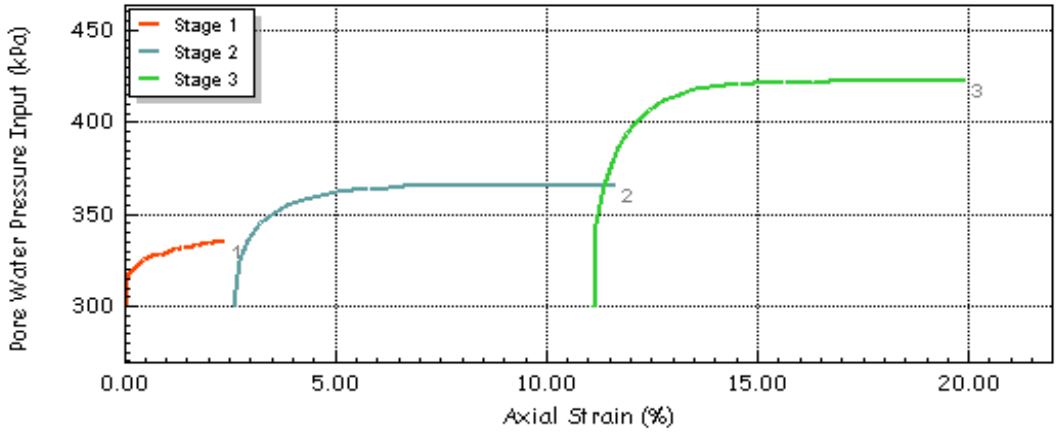
PSL Professional Soils Laboratory

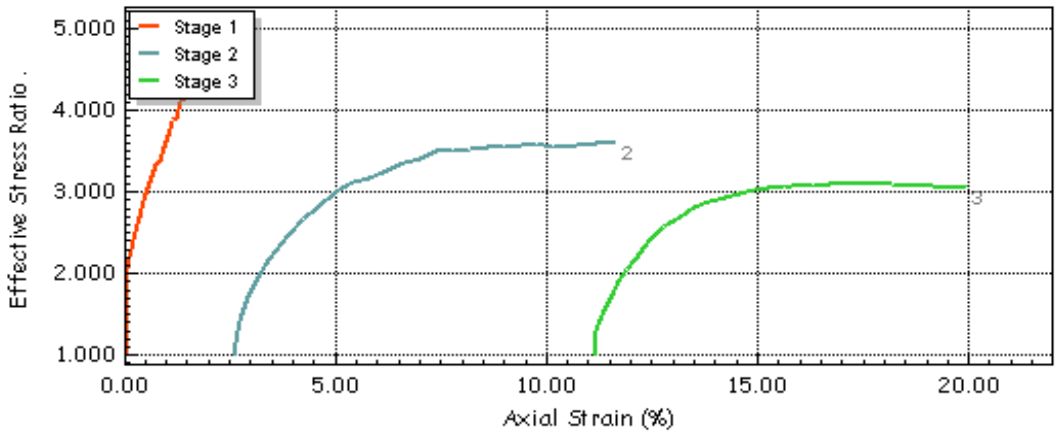
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 18.00-19.00m P36
		Test Date	13/08/2019
		Borehole	BH44
Jobfile	Stornoway Deep Water Port	Sample	18.00-19.00m P36
Client	Causeway Geotech Ltd	Depth	18.00-19.00m P36

UKAS TESTING 4043

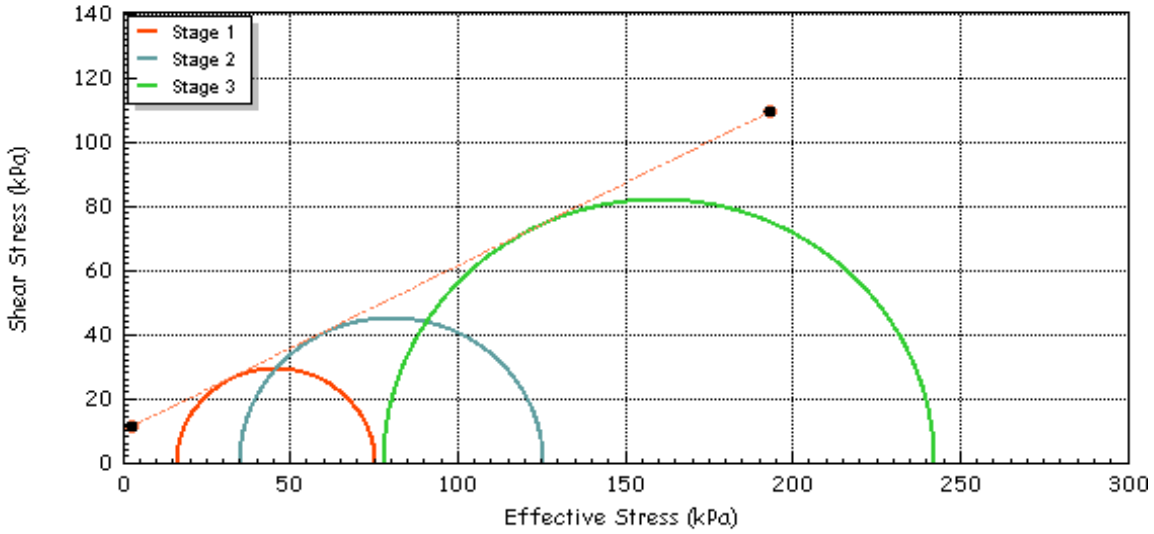
PSL Professional Soils Laboratory

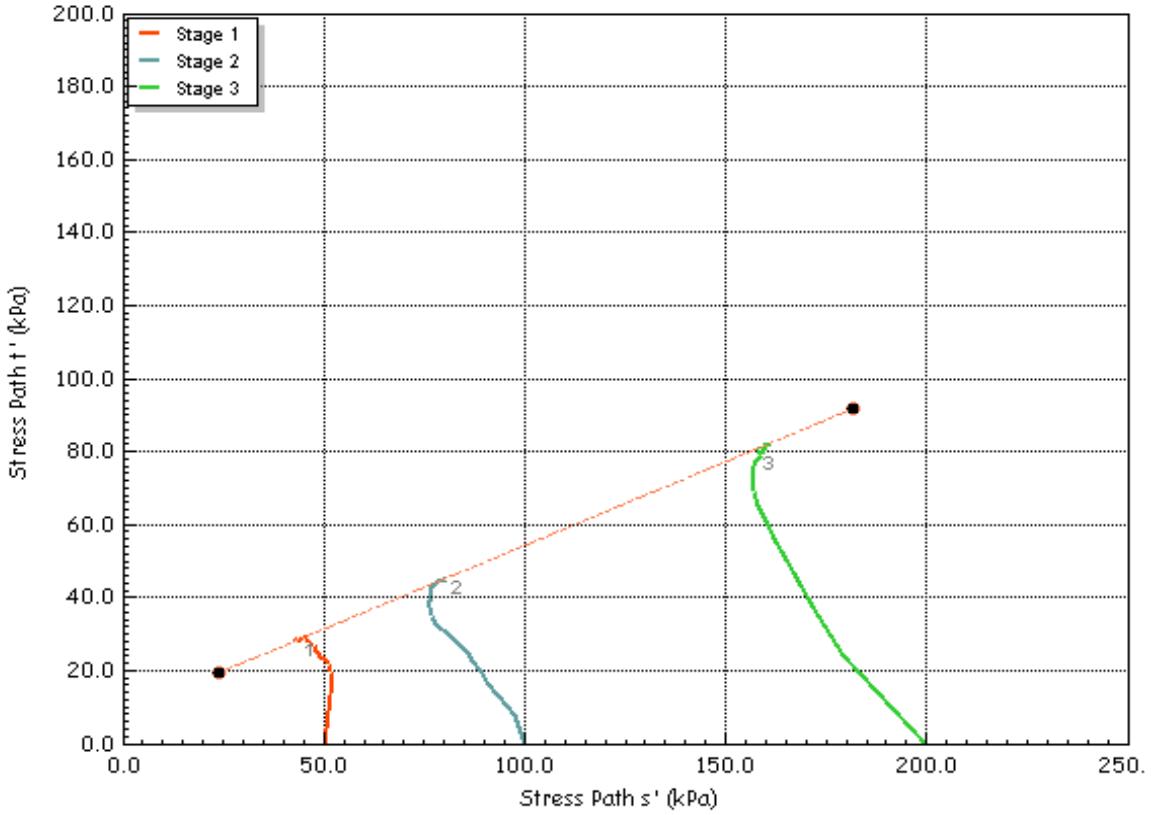
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	9.91	Effective Cohesion	c'	(kPa)	9.91
Effective Friction	ϕ'	(deg)	27.3	Effective Friction	ϕ'	(deg)	27.3





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH44 18.00-19.00m P36
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH44
Client	Causeway Geotech Ltd	Sample	18.00-19.00m P36
		Depth	18.00-19.00m P36

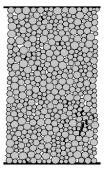
UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
	Depth		10.50-11.50m P22	
	Description		See summary of soil descriptions.	
	Type		Undisturbed, Vertical orientation.	
	Initial Sample Length	L_0	(mm)	185.8
	Initial Sample Diameter	D_0	(mm)	98.4
	Initial Sample Weight	W_0	(gr)	2870.1
sketch showing specimen location in original sample	Initial Bulk Density	ρ_0	(Mg/m3)	2.03
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 6		
Initial Moisture	ω_i	(%)	30		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.56		
Initial Voids Ratio	e_i	.	0.701		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	25		
Final Dry Density	ρ_{df}	(Mg/m3)	1.73		
Final Voids Ratio	e_f	.	0.530		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	2.50	7.37	13.07
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	106.5	176.6	290.3
Minor Stress At Failure	σ_3'	(kPa)	18.0	39.0	76.0
Major Stress At Failure	σ_1'	(kPa)	124.5	215.6	366.3
Principal Stress At Failure	σ_1'/σ_3'		6.919	5.527	4.820

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 10.50-11.50m P22
		Test Date	14/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	10.50-11.50m P22
Client	Causeway Geotech Ltd	Depth	10.50-11.50m P22

UKAS TESTING 4043

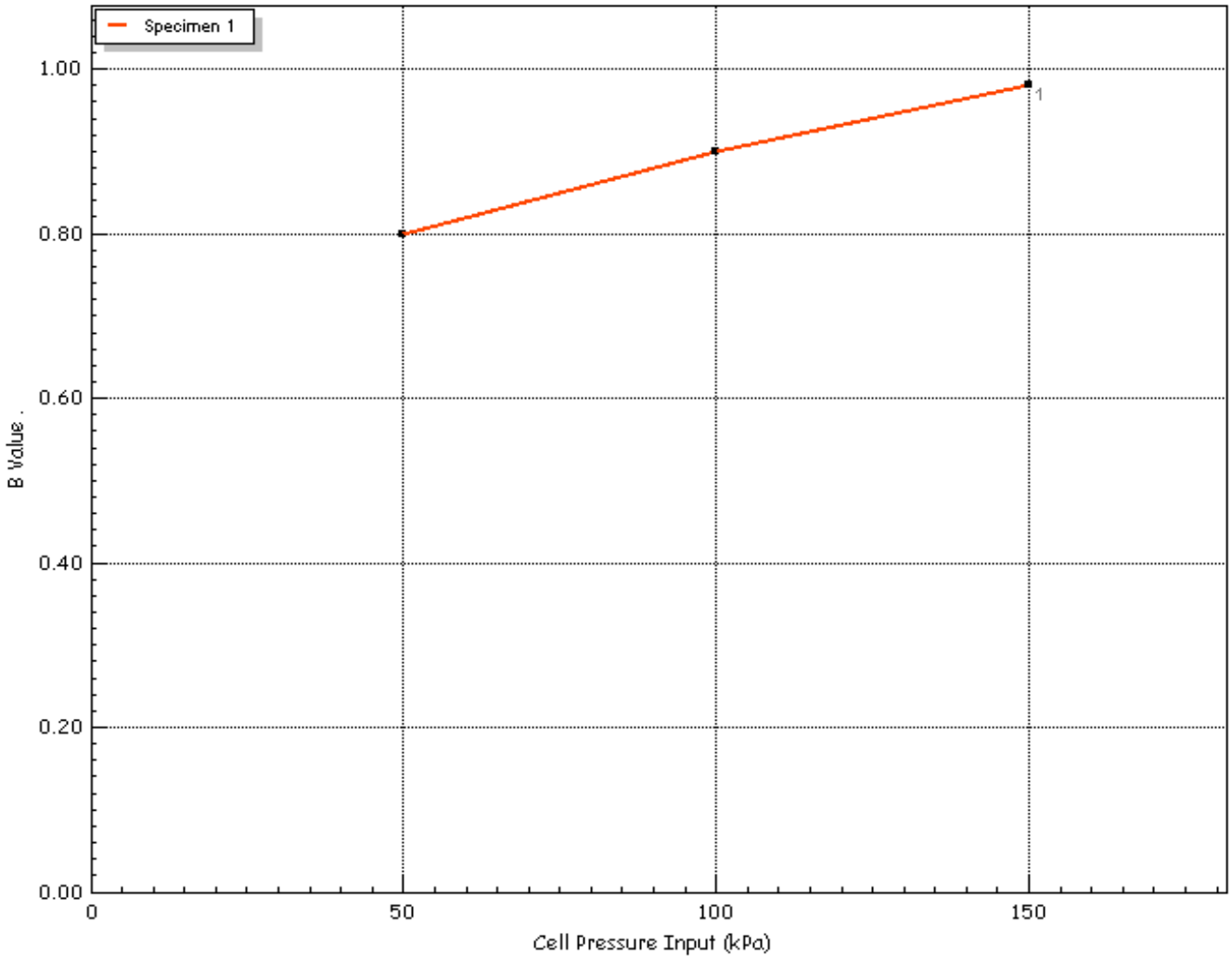
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	135
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 10.50-11.50m P22
		Test Date	14/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	10.50-11.50m P22
Client	Causeway Geotech Ltd	Depth	10.50-11.50m P22

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

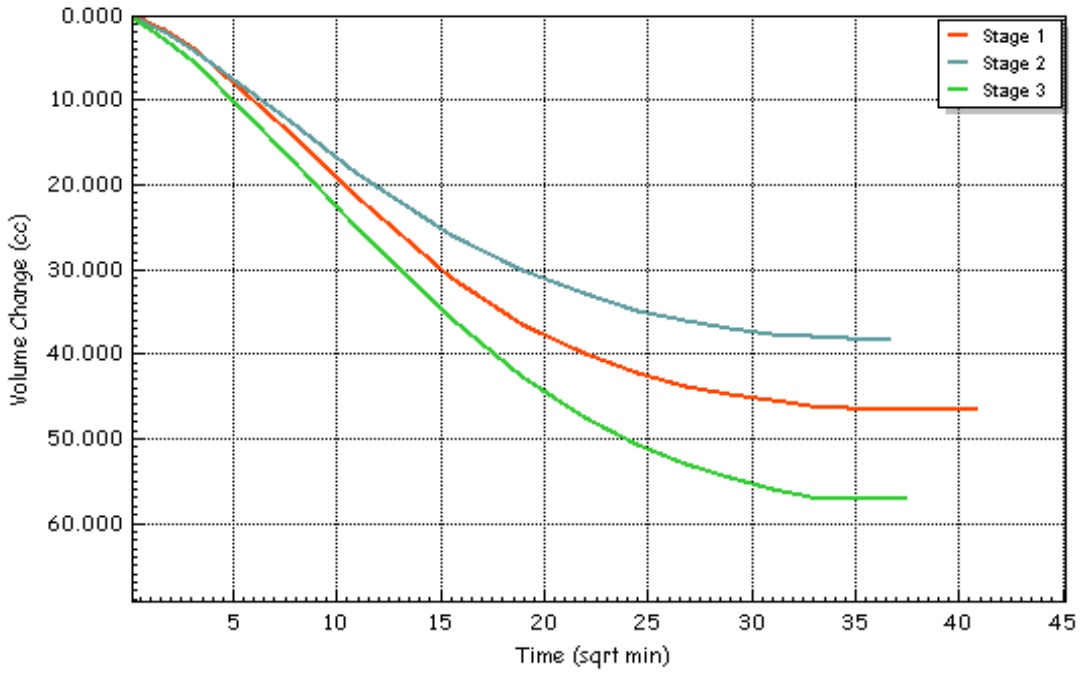
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	332	369	460
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	100.00	100.00	100.00
Volumetric Strain	ε_v%	(%)	3.30	6.01	10.05
Corrected Length	L_C	(mm)	183.8	175.5	158.2
Corrected Area	A_C	(cm2)	74.38	73.12	75.35
Corrected Volume	V_C	(cc)	1366.377	1328.084	1270.989
T100 Time to Failure	t_{100}	(min)	506.01	506.01	506.01
Consolidation	c_v	(m2/year)	0.433	0.433	0.433
Compressibility	m_v	(m2/MN)	1.028	0.866	0.629
Test Time	t_F	(h:m:s)	15:10:49	15:10:49	15:10:49
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01009	0.00964	0.00869

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 10.50-11.50m P22
		Test Date	14/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	10.50-11.50m P22
Client	Causeway Geotech Ltd	Depth	10.50-11.50m P22

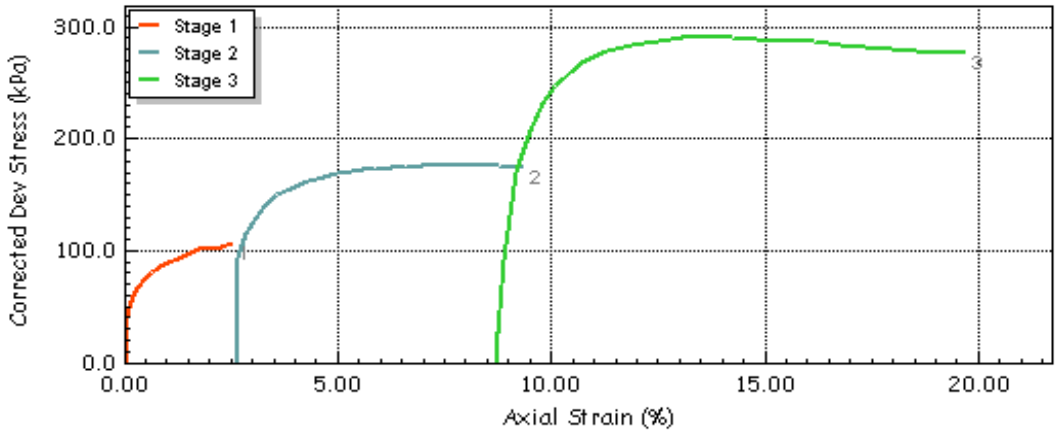
UKAS TESTING 4043

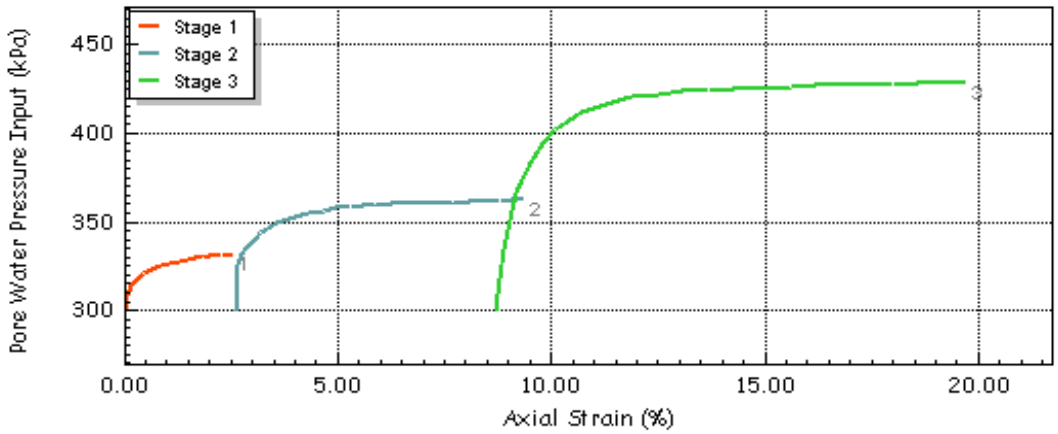
PSL Professional Soils Laboratory

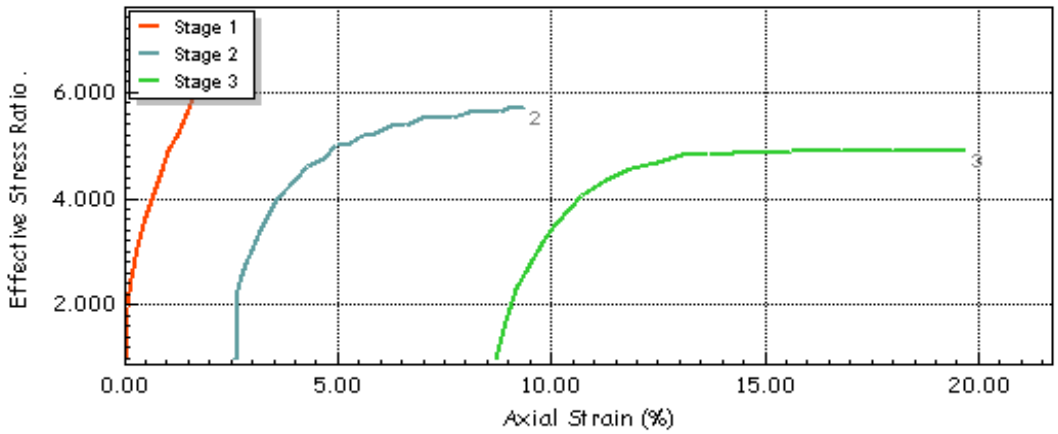
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 10.50-11.50m P22
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH46
Client	Causeway Geotech Ltd	Sample	10.50-11.50m P22
		Depth	10.50-11.50m P22

UKAS TESTING 4043

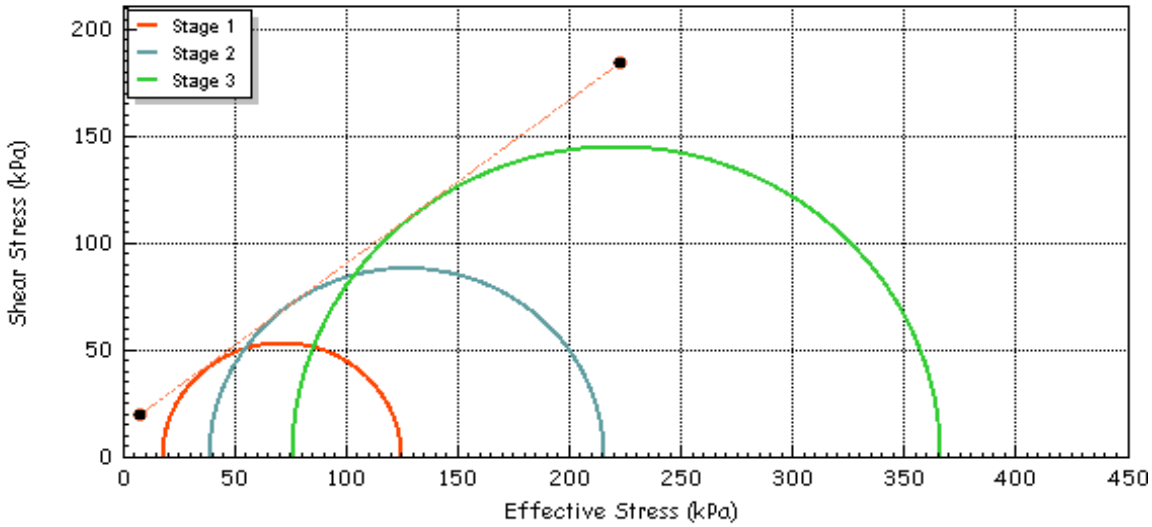
PSL Professional Soils Laboratory

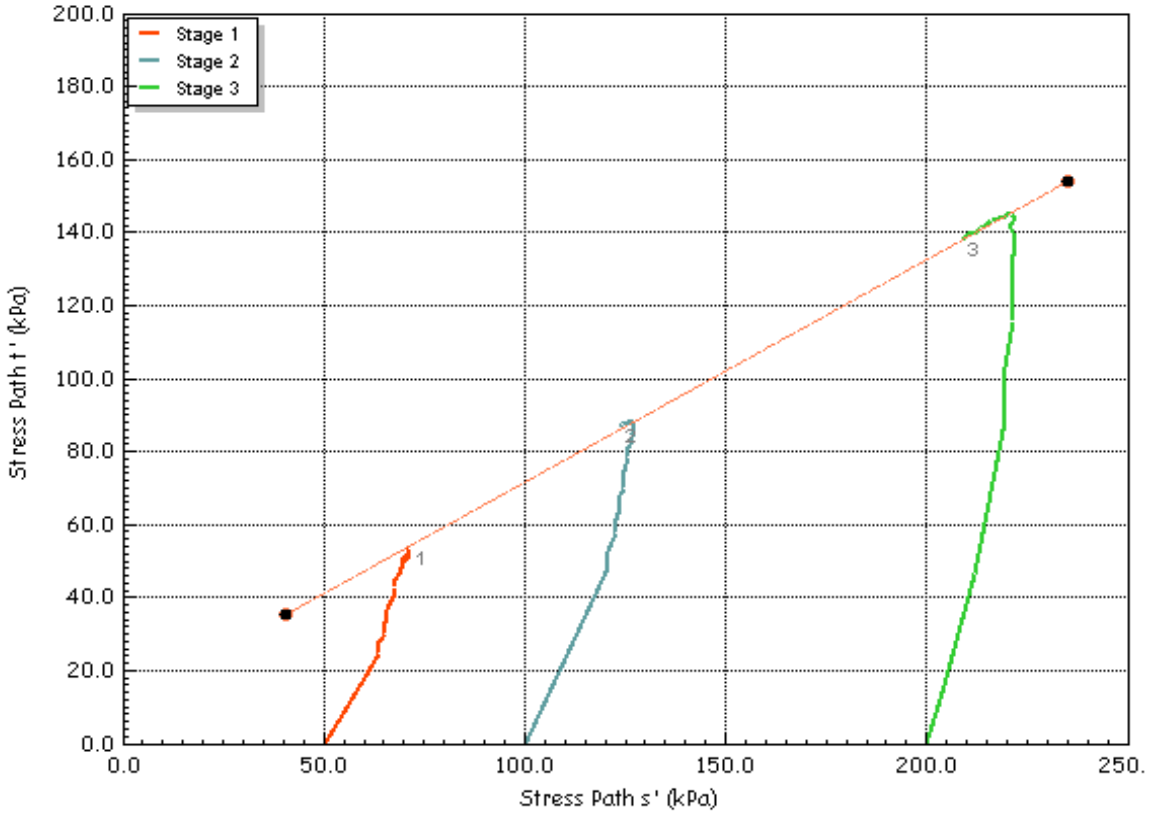
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	13.52	Effective Cohesion	c'	(kPa)	13.52
Effective Friction	ϕ'	(deg)	37.6	Effective Friction	ϕ'	(deg)	37.6





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 10.50-11.50m P22
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH46
Client	Causeway Geotech Ltd	Sample	10.50-11.50m P22
		Depth	10.50-11.50m P22

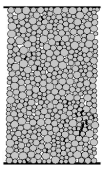
UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
	Depth	13.50-13.95m U23		
	Description	See summary of soil descriptions.		
	Type	Undisturbed, Vertical orientation.		
	Initial Sample Length	L_0	(mm)	210.0
	Initial Sample Diameter	D_0	(mm)	103.9
	Initial Sample Weight	W_0	(gr)	3993.5
sketch showing specimen location in original sample	Initial Bulk Density	ρ_0	(Mg/m3)	2.24
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	16		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.94		
Initial Voids Ratio	e_i	.	0.366		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	12		
Final Dry Density	ρ_{df}	(Mg/m3)	2.06		
Final Voids Ratio	e_f	.	0.285		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	3.34	8.41	19.90
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	72.5	122.8	218.1
Minor Stress At Failure	σ_3'	(kPa)	22.0	49.0	102.0
Major Stress At Failure	σ_1'	(kPa)	94.5	171.8	320.1
Principal Stress At Failure	σ_1'/σ_3'		4.294	3.507	3.139

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 13.50-13.95m U23
		Test Date	08/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	13.50-13.95m U23
Client	Causeway Geotech Ltd	Depth	13.50-13.95m U23

UKAS TESTING 4043

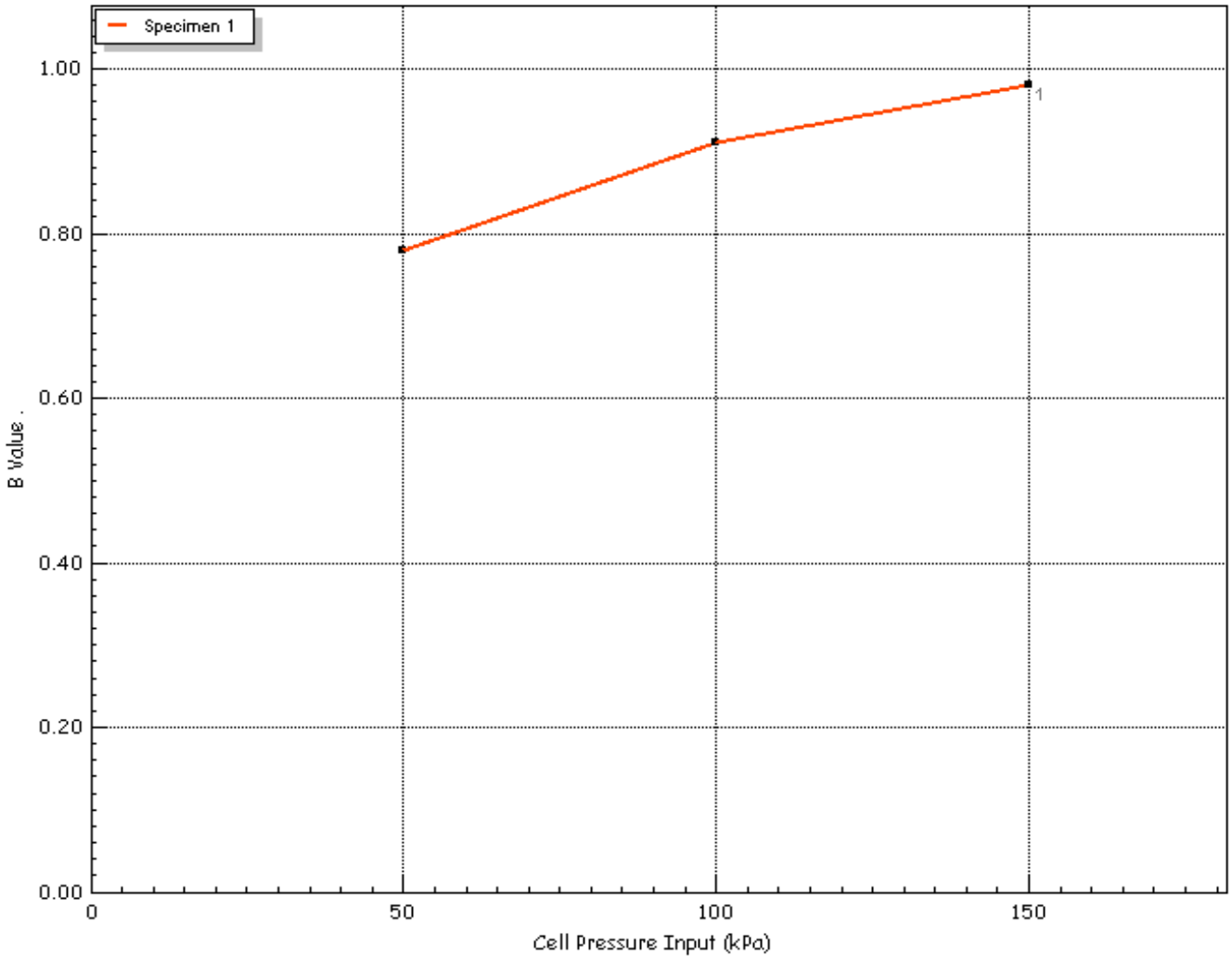
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	138
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 13.50-13.95m U23
		Test Date	08/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	13.50-13.95m U23
Client	Causeway Geotech Ltd	Depth	13.50-13.95m U23

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

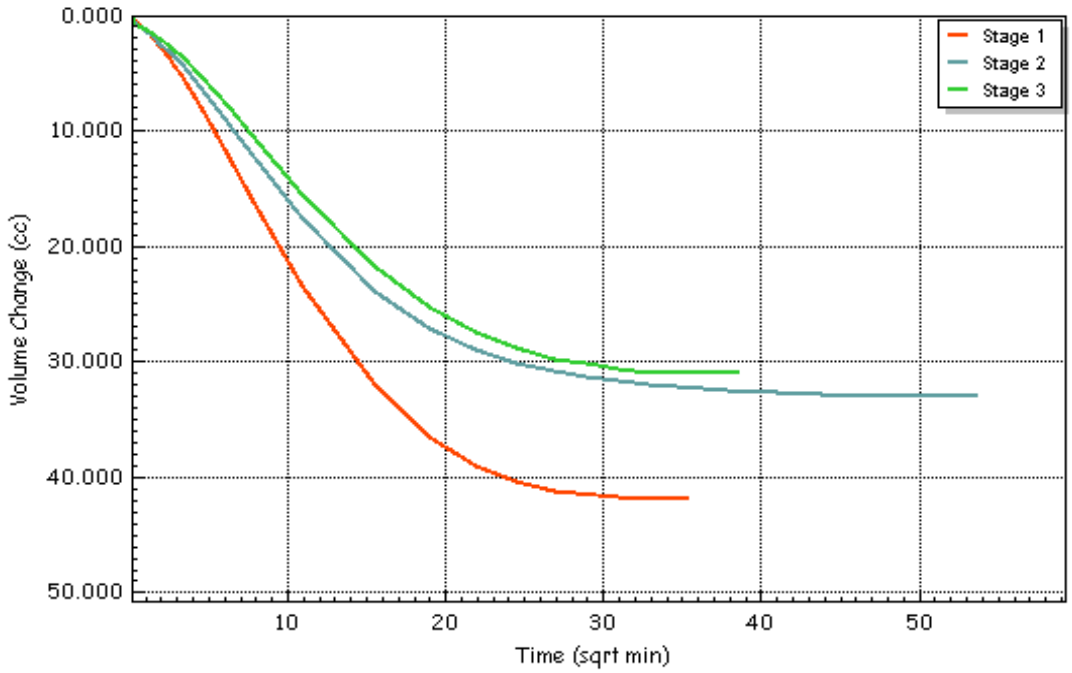
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	336	378	455
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.23	98.72	98.07
Volumetric Strain	ε_v%	(%)	2.35	4.21	5.94
Corrected Length	L_C	(mm)	208.4	198.6	183.9
Corrected Area	A_C	(cm2)	83.46	83.85	87.17
Corrected Volume	V_C	(cc)	1738.604	1705.614	1674.694
T100 Time to Failure	t_{100}	(min)	359.03	359.03	359.03
Consolidation	c_v	(m2/year)	0.621	0.621	0.621
Compressibility	m_v	(m2/MN)	0.670	0.546	0.390
Test Time	t_F	(h:m:s)	10:46:15	10:46:15	10:46:15
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01612	0.01536	0.01422

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 13.50-13.95m U23
		Test Date	08/08/2019
		Borehole	BH46
Jobfile	Stornoway Deep Water Port	Sample	13.50-13.95m U23
Client	Causeway Geotech Ltd	Depth	13.50-13.95m U23

UKAS TESTING 4043

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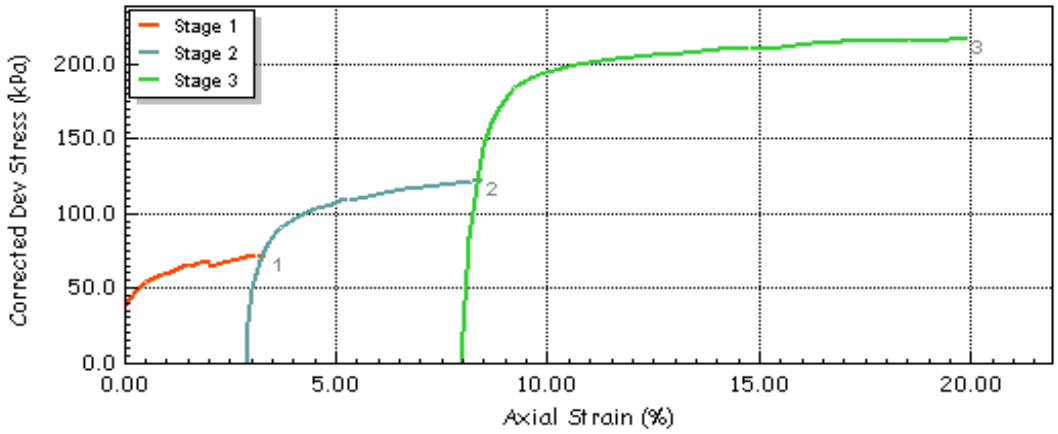
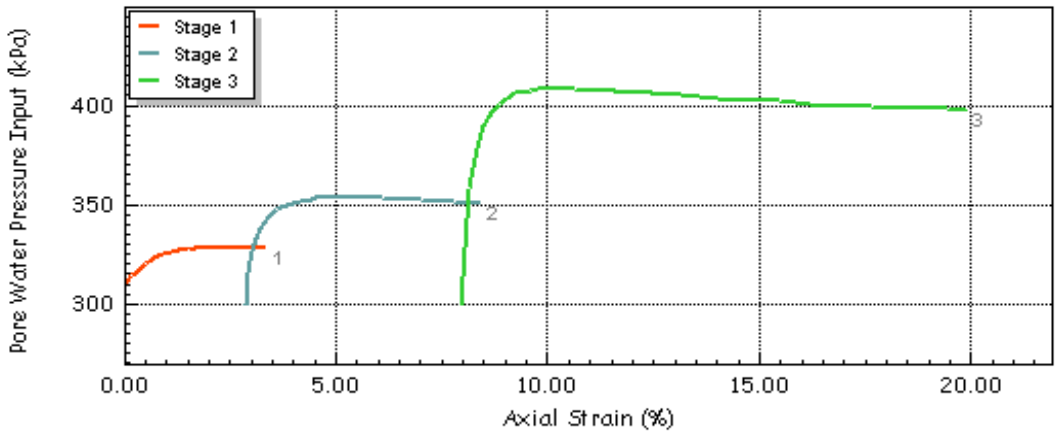
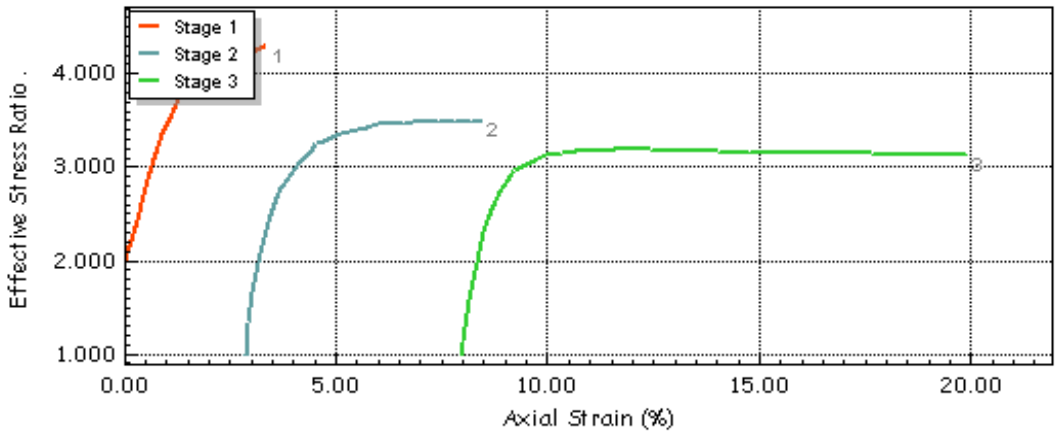
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 13.50-13.95m U23
			Test Date	08/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole	BH46
			Sample	13.50-13.95m U23
	Client	Causeway Geotech Ltd	Depth	13.50-13.95m U23

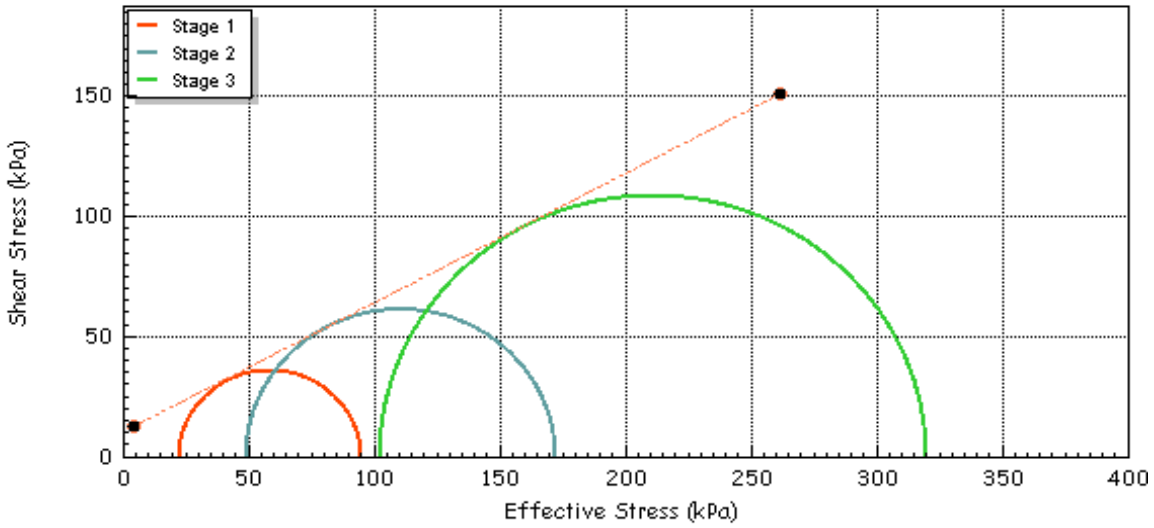
PSL Professional Soils Laboratory

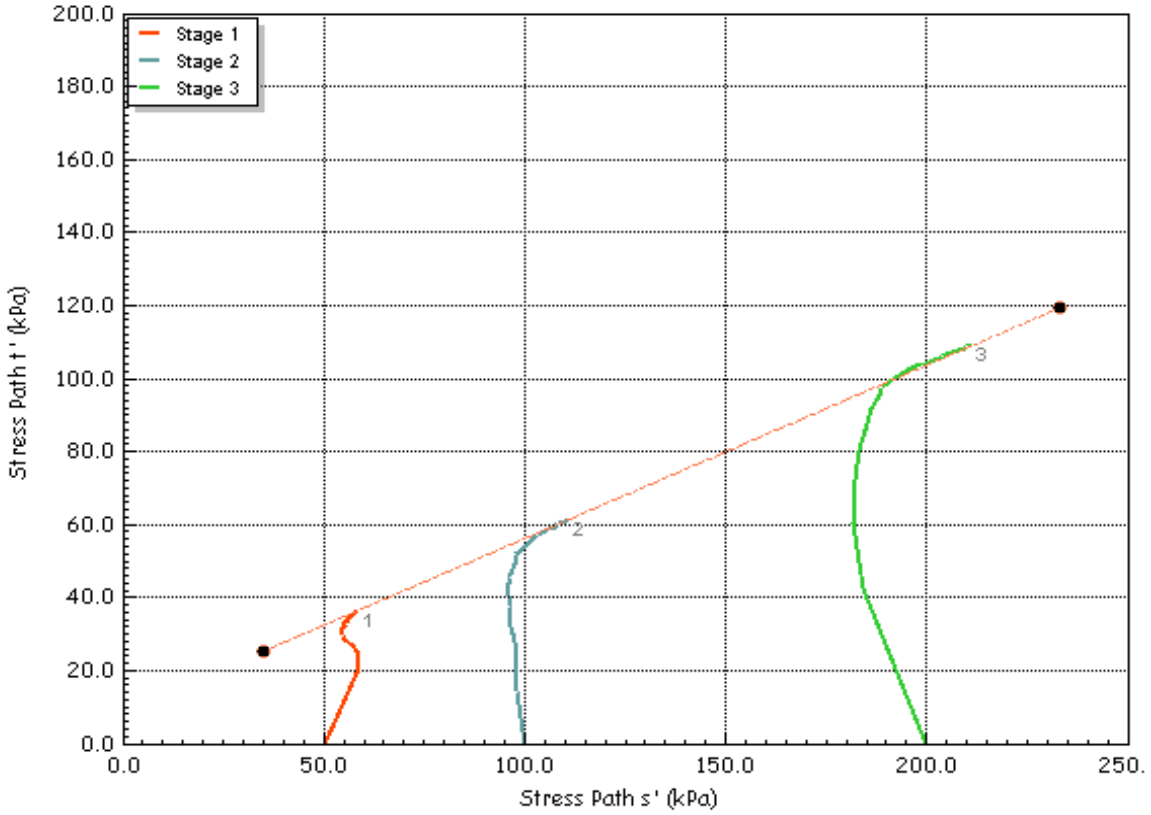
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	9.77	Effective Cohesion	c'	(kPa)	9.77
Effective Friction	ϕ'	(deg)	28.4	Effective Friction	ϕ'	(deg)	28.4





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH46 13.50-13.95m U23
		Test Date	08/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH46
Client	Causeway Geotech Ltd	Sample	13.50-13.95m U23
		Depth	13.50-13.95m U23

UKAS TESTING 4043

PSL Professional Soils Laboratory

LABORATORY REPORT

4043

Contract Number: PSL19/4945

Report Date: 29 August 2019

Client's Reference: 19-0382-1

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 15/8/2019
Date Commenced: 15/8/2019
Date Completed: 29/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

[redacted]

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S Eyre (Senior Technician)
L Knight (Senior Technician)

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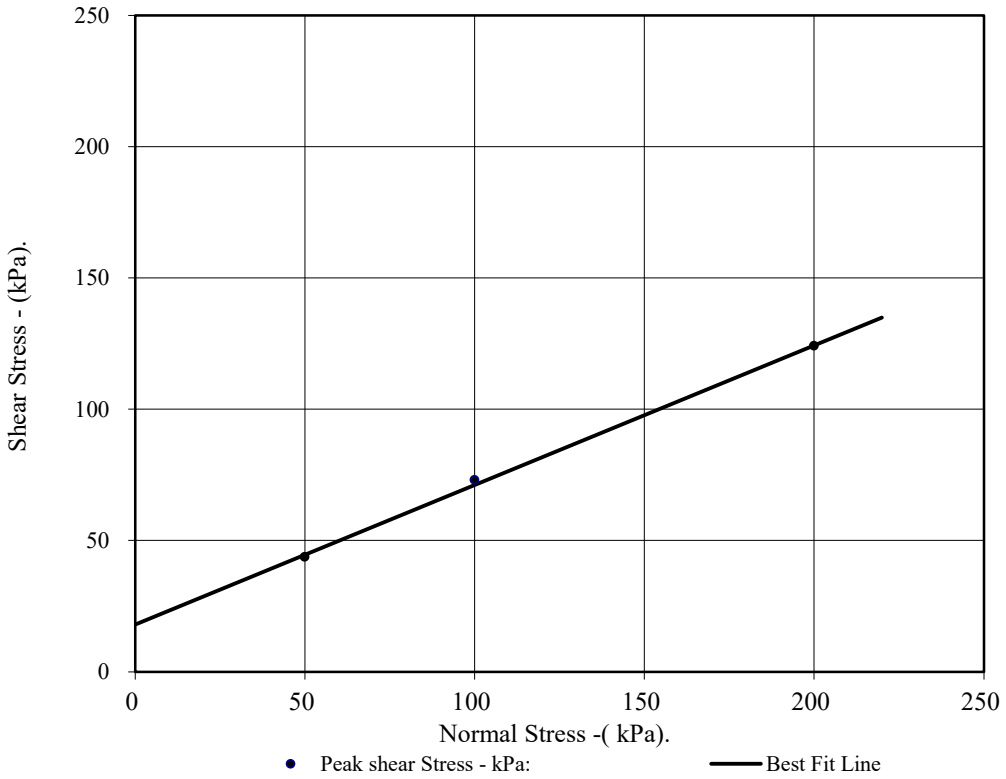
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**15.00**	
Sample Number:	**26**		Base Depth:	**15.45**	
Sample Conditions:	Submerged		Sample Type	**UT**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Cut and Trimmed Undisturbed				
Sample Description:	**Brown slightly sandy organic CLAY.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	72	72	72
Bulk Density - Mg/m3:	1.29	1.30	1.30
Dry Density - Mg/m3:	0.75	0.76	0.76
Voids Ratio:	2.526	2.503	2.505
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.89	17.01	15.89
Shearing Stage			
Rate of Strain (mm/min)	0.039	0.039	0.039
Displacement at peak shear stress (mm)	4.30	7.25	7.09
Peak shear Stress - kPa:	44	73	124
Final Consolidated Conditions			
Moisture Content - %:	106	96	87
Bulk Density - Mg/m3:	1.45	1.53	1.64
Dry Density - Mg/m3:	0.71	0.78	0.88
Peak			
Angle of Shearing Resistance:(~~θ~~)	**28**		
Effective Cohesion - kPa:	**18**		

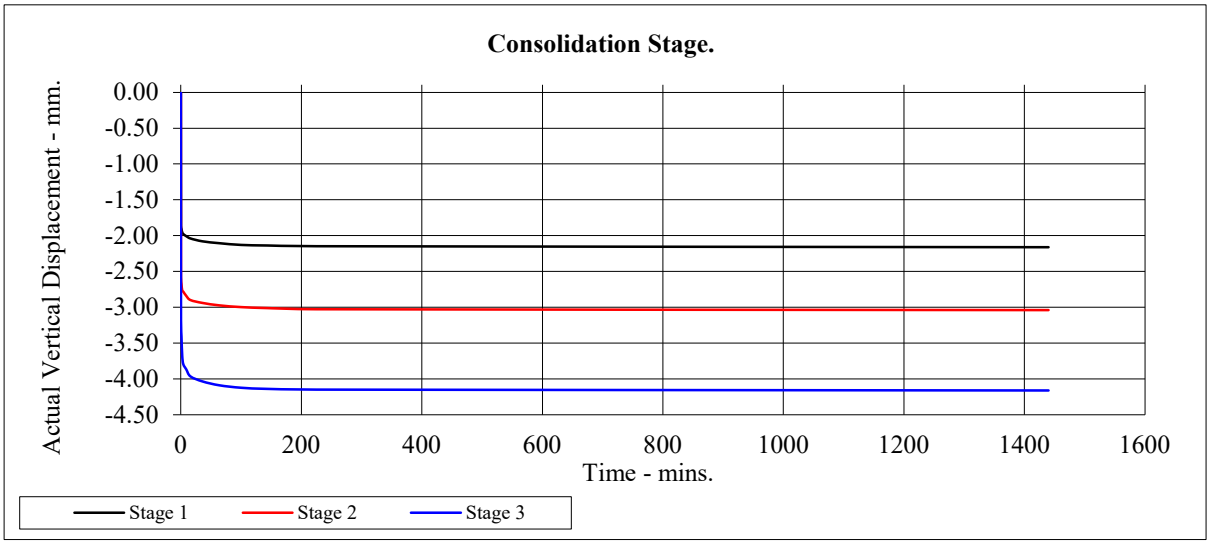


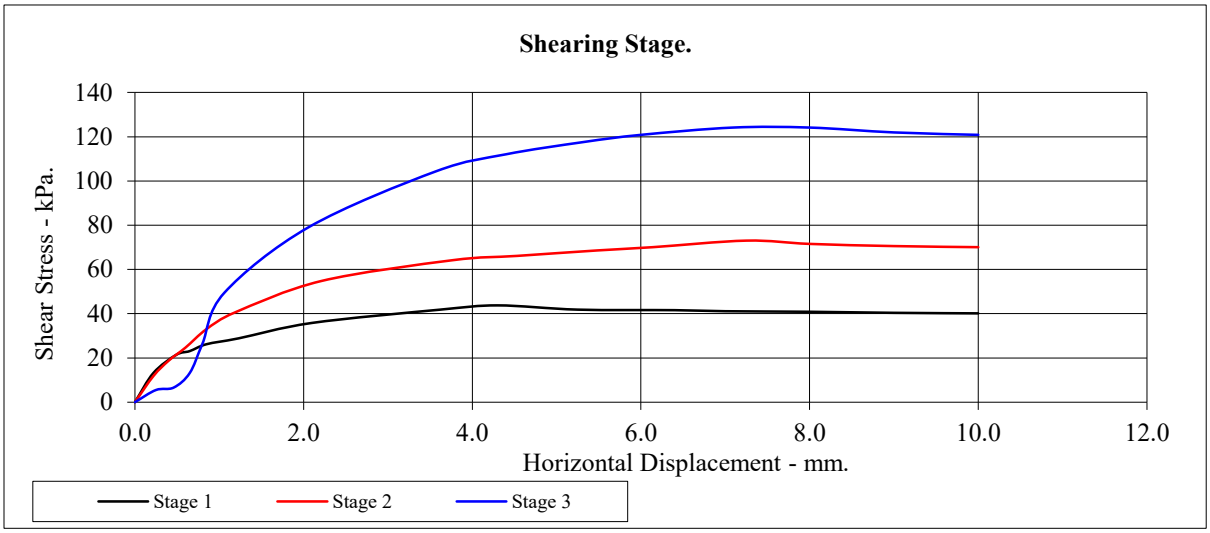
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4945** **Client Ref:** **19-0382**

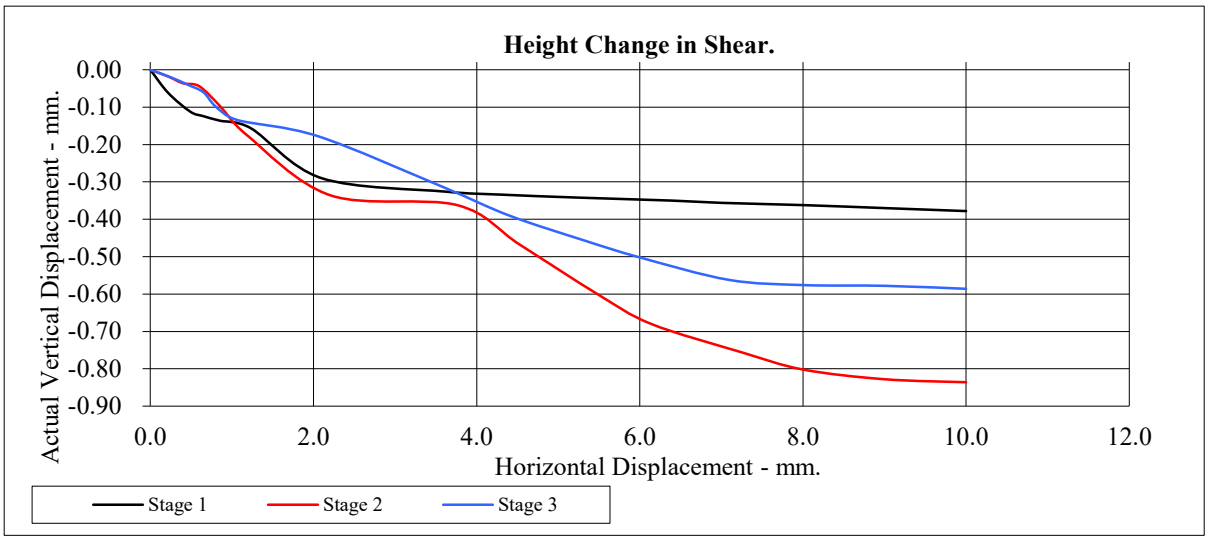
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**15.00**
Sample Number:	**26**	Base Depth:	**15.45**





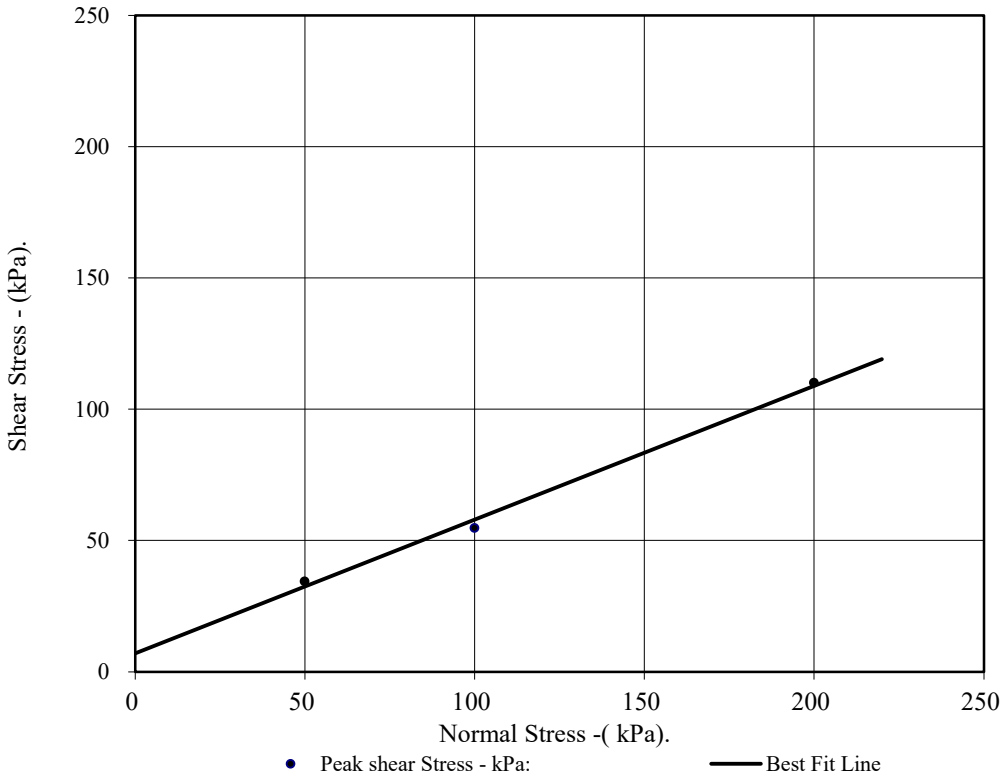


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**19.50**
Sample Number:	**34**		Base Depth:	**19.95**
Sample Conditions:	Submerged		Sample Type	**UT**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Cut and Trimmed Undisturbed			
Sample Description:	**Grey slightly sandy CLAY.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	34	34	34
Bulk Density - Mg/m3:	1.87	1.88	1.88
Dry Density - Mg/m3:	1.40	1.40	1.40
Voids Ratio:	0.894	0.888	0.889
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.56	16.94	15.75
Shearing Stage			
Rate of Strain (mm/min)	0.038	0.038	0.038
Displacement at peak shear stress (mm)	5.64	8.00	7.27
Peak shear Stress - kPa:	34	55	110
Final Consolidated Conditions			
Moisture Content - %:	29	27	24
Bulk Density - Mg/m3:	2.14	2.22	2.39
Dry Density - Mg/m3:	1.66	1.75	1.93
Peak			
Angle of Shearing Resistance:(~~θ~~)	**27**		
Effective Cohesion - kPa:	**7**		

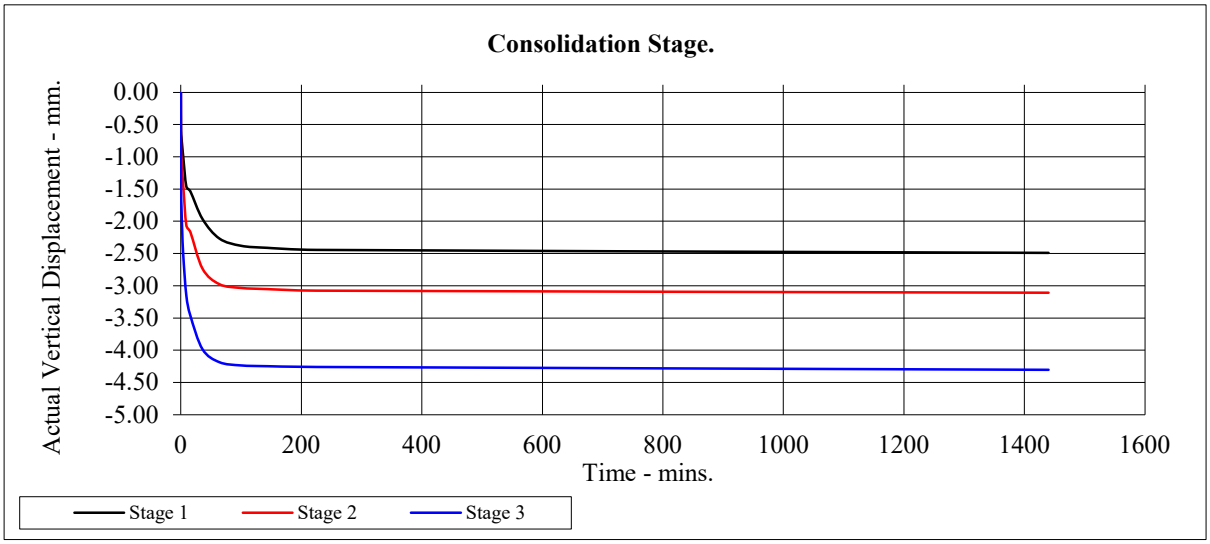


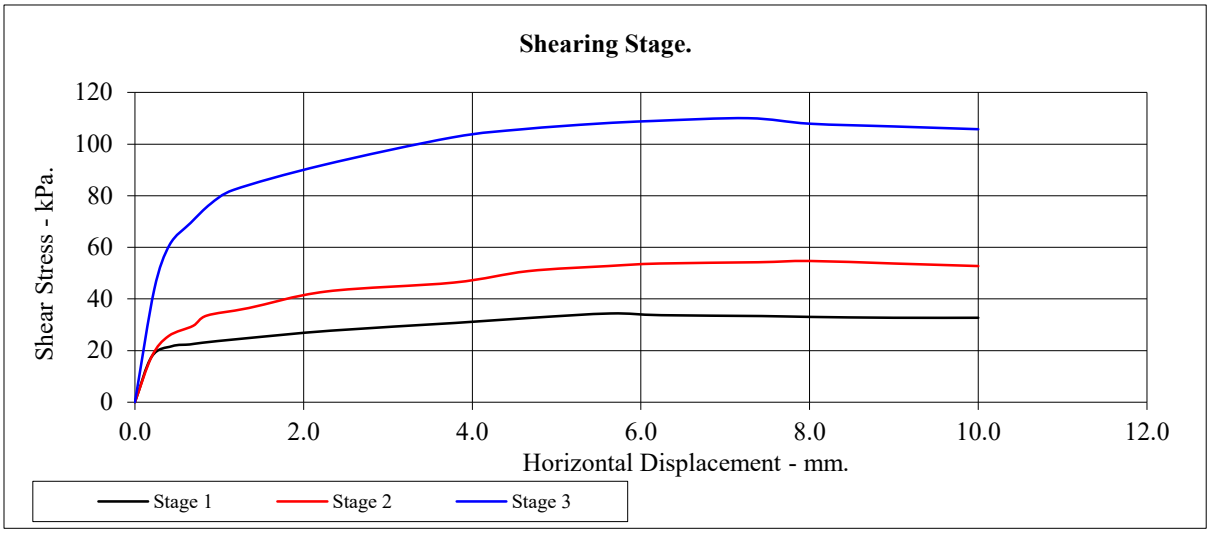
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4945** **Client Ref:** **19-0382**

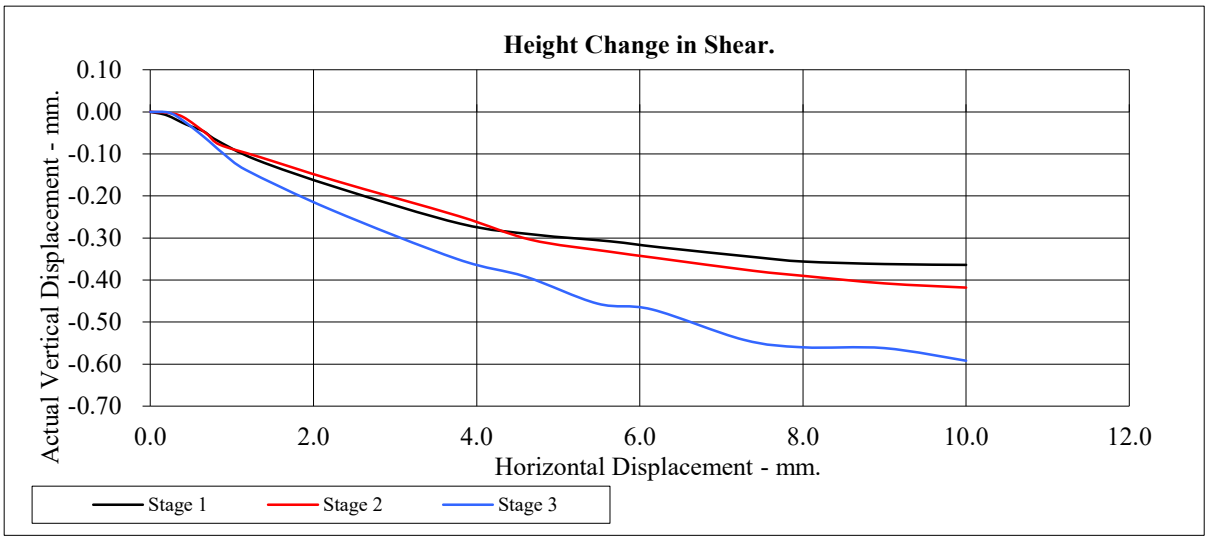
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**19.50**
Sample Number:	**34**	Base Depth:	**19.95**





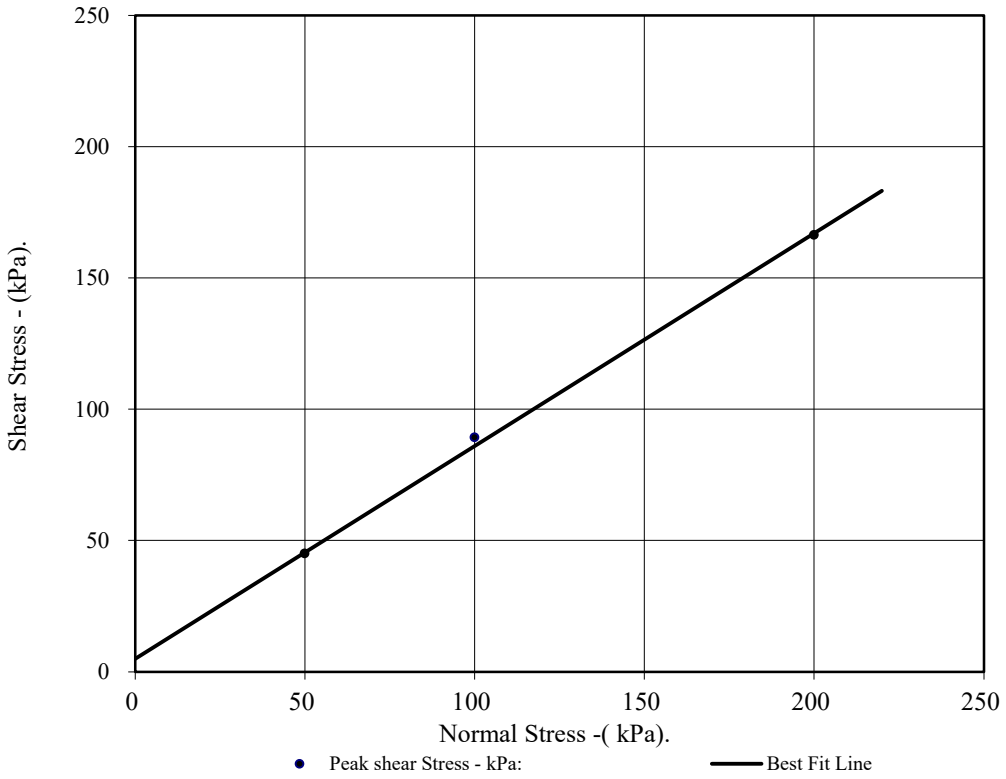


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**		Top Depth:	**29.70**	
Sample Number:	**52**		Base Depth:	**30.00**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**Brown gravelly SAND.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	8.3	8.3	8.3
Bulk Density - Mg/m3:	1.79	1.79	1.80
Dry Density - Mg/m3:	1.65	1.66	1.66
Voids Ratio:	0.606	0.601	0.596
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.75	18.98	18.78
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.91	5.41	7.51
Peak shear Stress - kPa:	45	89	166
Final Consolidated Conditions			
Moisture Content - %:	8.2	7.5	7.1
Bulk Density - Mg/m3:	1.81	1.89	1.92
Dry Density - Mg/m3:	1.68	1.76	1.79
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**5**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

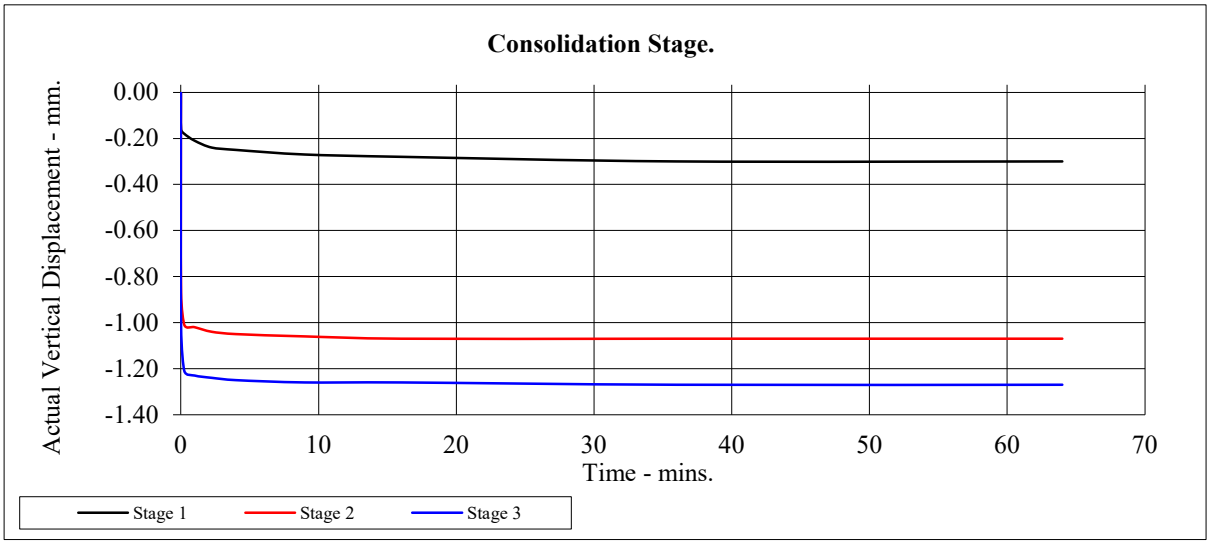
Contract No: PSL19/4945

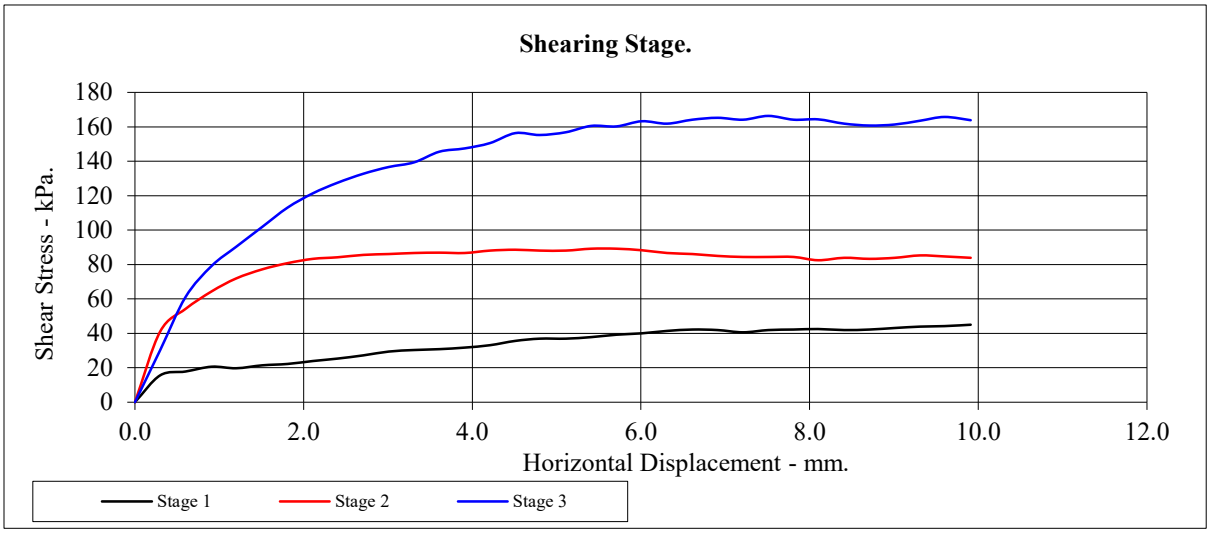
Client Ref: 19-0382

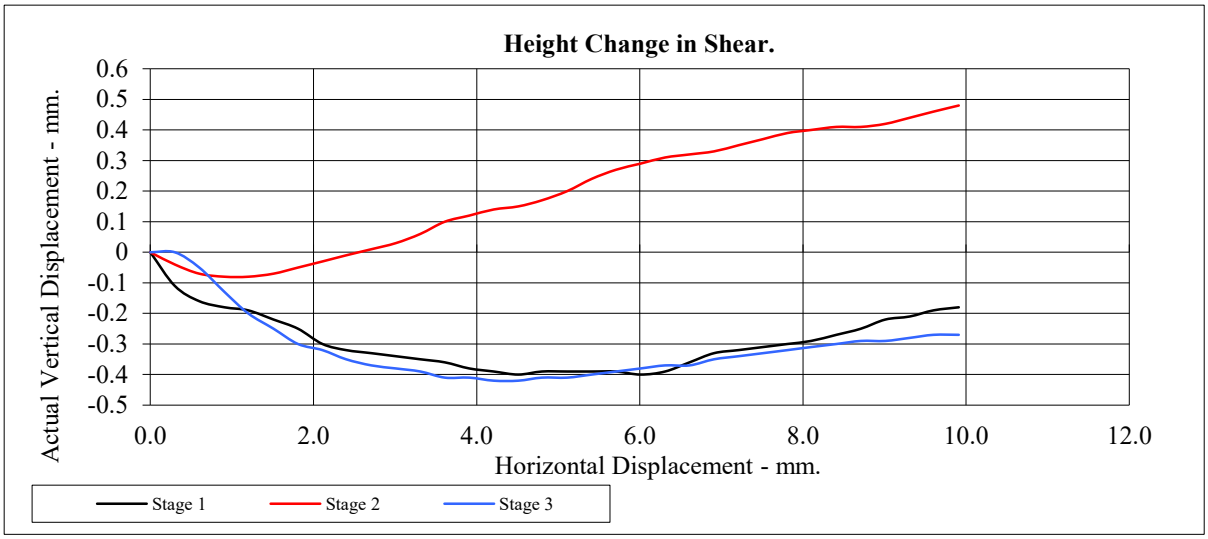
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH42**	Top Depth:	**29.70**
Sample Number:	**52**	Base Depth:	**30.00**







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Company Number: 633786

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

1 October 2019

Project Name:	Stornoway Deep Water Port
Project No.:	19-0382
Client:	Stornoway Port Authority
Engineer:	Wallace Stone Consulting Civil Engineers

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

[redacted]

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

SCS ISO 9001 CERTIFIED
SCS ISO 14001 CERTIFIED
SCS ISO 45001 CERTIFIED
UKAS MANAGEMENT SYSTEMS 9235
UKAS TESTING 10122
AGS
BRITISH DRILLING ASSOCIATION

Project Name: Stornoway Deep Water Port

Report Reference: G02 - FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	18
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	17
SOIL	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	17
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	15
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	4
SOIL	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	5
	Extra over days (more than initial 5 days)		10
SOIL	Undrained shear strength – triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 9	4

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	3
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	3
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	5
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	4
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	3
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Direct Shear Strength using 60mm Small Shearbox (up to 3 days)	BS 1377-7: 1990: Cl 4	9
	Extra over days (more than initial 3 days)		24
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Effective shear strength consolidated undrained triaxial compression test with measurement of volume change (up to 4 days)	BS 1377-8:1990	9
	Extra over days (more than initial 4 days)		42
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	1
	Extra over days (more than initial 5 days)		2
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Undrained shear strength – triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 9	1

Summary of Classification Test Results

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH41	57	16.00		D	Blackish grey slightly gravelly slightly sandy clayey SILT.			92.0	99	53 -1pt	33	20		MH
BH41	70	22.50		B	Greyish brown sandy slightly gravelly silty CLAY.	2.00	1.57	23.0	88	29 -1pt	18	11		CL
BH41	73	23.70		LB	Greyish brown sandy slightly gravelly silty CLAY.			36.0	95	32 -1pt	16	16		CL
BH41	83	24.70		P	Greyish brown sandy slightly gravelly silty CLAY.			31.0						
BH41	79	26.50		B	Greyish brown sandy slightly gravelly silty CLAY.			43.0	89	50 -1pt	18	32		CI/CH
BH41	84	27.10		B	Greyish brown sandy slightly gravelly silty CLAY.	1.74	1.23	41.0	96	56 -1pt	23	33		CH
BH47	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.	1.59	0.89	61.0	97	56 -1pt	29	27		CH
BH47	8	2.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.50	0.82	86.0	97	62 -1pt	29	33		CH
BH47	15	5.00		B	Greyish brown sandy slightly gravelly silty CLAY.	1.90	1.41	36.0	88	44 -1pt	20	24		CI
BH47	25	8.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.90	1.38	33.0	88	46 -1pt	22	24		CI
BH48	7	1.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.48	0.82	92.0	97	40 -1pt	17	23		CI
BH48	11	3.00		B	Blackish grey slightly sandy silty CLAY.			101.0	97	55 -1pt	29	26		CH

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

27/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH48	25	7.80		B	Greyish brown sandy SILT/CLAY.	1.77	1.09	54.0	97	50 -1pt	29	21		CI/CH/MI/MH
BH48	31	11.00		B	Greyish brown sandy silty CLAY.	1.88	1.40	40.0	96	30 -1pt	20	10		CL
BH50	8	2.50		B	Greyish brown sandy slightly gravelly SILT.	1.95	1.56	78.0	98	52 -1pt	31	21		MH
BH50	14	4.50		B	Greyish brown sandy slightly gravelly SILT/ CLAY.	1.78	1.25	44.0	91	41 -1pt	26	15		MI/CI
BH50	19	8.00		B	Greyish brown sandy SILT.	1.65	1.06	160.0	96	97 -1pt	73	24		ME
BH50	27	11.50		B	Greyish brown sandy slightly gravelly silty CLAY.			43.0	86	46 -1pt	19	27		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

27/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

Density Tests - Summary of Results

Project No.: 19-0382

Project Name: Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Linear Measurement			Immersion in water			Water displacement			Remarks
	Ref	Top	Base	Type		Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	
BH41	37	10.60		B	Greyish brown silty fine to coarse SAND.	1.78	1.51	17.4							
BH41	42	11.50		D	Greyish brown silty slightly gravelly fine to coarse SAND.	1.81	1.58	14.8							
BH41	70	22.50		B	Greyish brown sandy slightly gravelly silty CLAY.	2.00	1.57	27.0							
BH41	84	27.10		B	Greyish brown sandy slightly gravelly silty CLAY.	1.74	1.23	41.1							
BH47	3	1.00		B	Greyish brown sandy slightly gravelly silty CLAY.	1.59	0.89	77.8							
BH47	8	2.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.50	0.82	83.4							
BH47	15	5.00		B	Greyish brown sandy slightly gravelly silty CLAY.	1.90	1.41	35.2							
BH47	25	8.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.90	1.38	37.8							
BH48	7	1.50		B	Greyish brown sandy slightly gravelly silty CLAY.	1.48	0.82	81.5							
BH48	16	5.00		B	Greyish brown silty fine to coarse SAND.	1.89	1.06	78.2							
BH48	18	6.00		B	Greyish brown sandy slightly gravelly silty CLAY.	1.86	1.64	14.0							
BH48	25	7.80		B	Greyish brown sandy SILT/CLAY.	1.77	1.09	63.0							
BH48	31	11.00		B	Greyish brown sandy silty CLAY.	1.88	1.40	34.5							
BH48	64	21.50		B	Greyish brown sandy subangular fine to coarse GRAVEL.	1.95	1.82	6.9							
BH50	8	2.50		B	Greyish brown sandy slightly gravelly SILT.	1.95	1.56	25.0							
BH50	14	4.50		B	Greyish brown sandy slightly gravelly SILT/ CLAY.	1.78	1.25	43.2							
BH50	19	8.00		B	Greyish brown sandy SILT.	1.65	1.06	56.1							

Legend w moisture content of the density test specimen

Notes

Tests carried out in accordance with BS1377:Part2:1990 and the following clauses unless annotated otherwise

Linear measurement	clause 7.2
Immersion in water	clause 7.3
Water displacement	clause 7.4

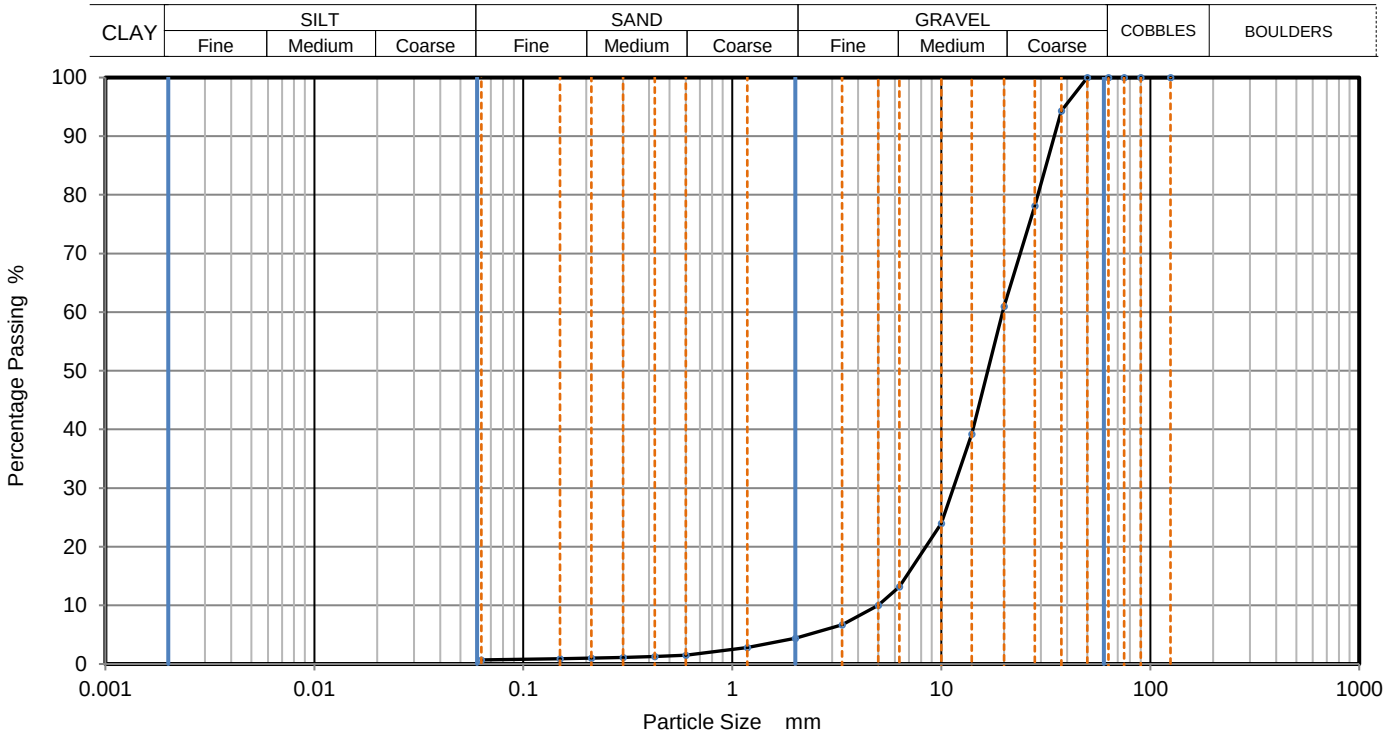
Date Printed: 27/08/2019

Approved By: Stephen.Watson

Table 1

sheet 1

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port			Sample No.	4
Soil Description	Greyish brown slightly sandy slightly silty subangular fine to coarse GRAVEL.			Depth, m	1.60
Specimen Reference	6	Specimen Depth	1.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080145



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	78		
20	61		
14	39		
10	24		
6.3	13		
5	10		
3.35	7		
2	4		
1.18	3		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	10149

Sample Proportions	% dry mass
Cobbles	0
Gravel	96
Sand	4
Fines <0.063mm	1

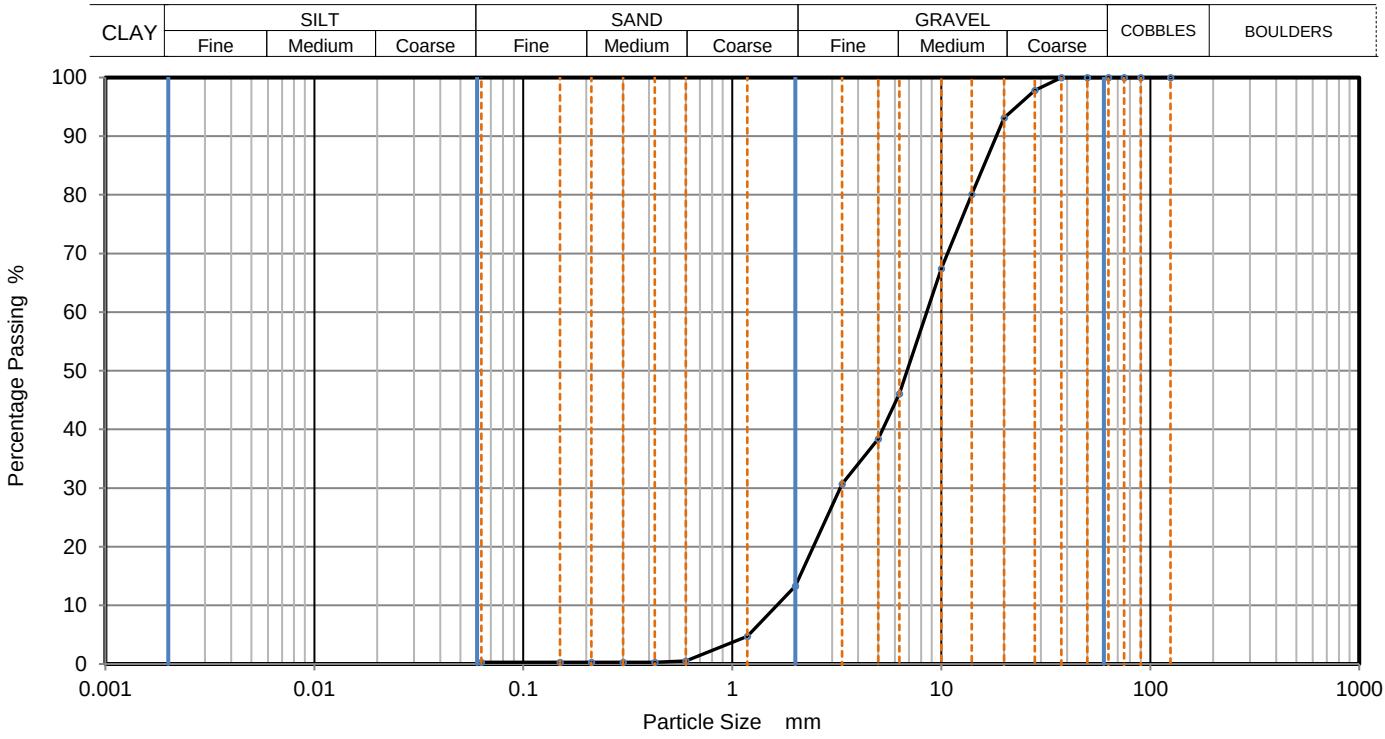
Grading Analysis		
D100	mm	
D60	mm	19.7
D30	mm	11.4
D10	mm	4.99
Uniformity Coefficient		3.9
Curvature Coefficient		1.3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port			Sample No.	35
Soil Description	Greyish brown slightly sandy slightly silty subangular fine to coarse GRAVEL.			Depth, m	10.00
Specimen Reference	6	Specimen Depth	10 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080146



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	93		
14	80		
10	67		
6.3	46		
5	38		
3.35	31		
2	13		
1.18	5		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	3323

Sample Proportions	% dry mass
Cobbles	0
Gravel	87
Sand	13
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	8.52
D30	mm	3.28
D10	mm	1.64
Uniformity Coefficient		5.2
Curvature Coefficient		0.77

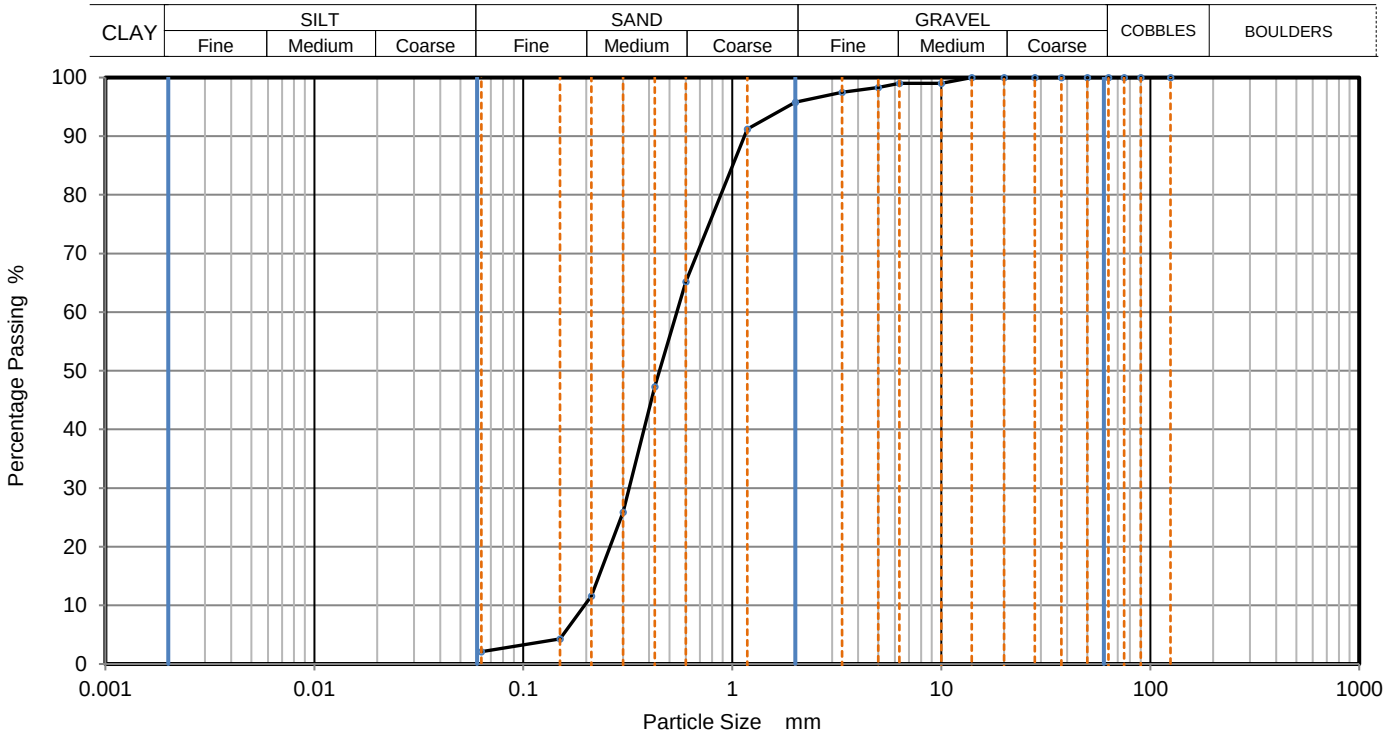
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port			Sample No.	37
Soil Description	Greyish brown silty fine to coarse SAND.			Depth, m	10.60
Specimen Reference	6	Specimen Depth	10.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080147



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	98		
3.35	98		
2	96		
1.18	91		
0.6	65		
0.425	47		
0.3	26		
0.212	12		
0.15	4		
0.063	2		

Dry Mass of sample, g: 286

Sample Proportions	% dry mass
Cobbles	0
Gravel	4
Sand	94
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	0.542
D30	mm	0.321
D10	mm	0.196
Uniformity Coefficient		2.8
Curvature Coefficient		0.97

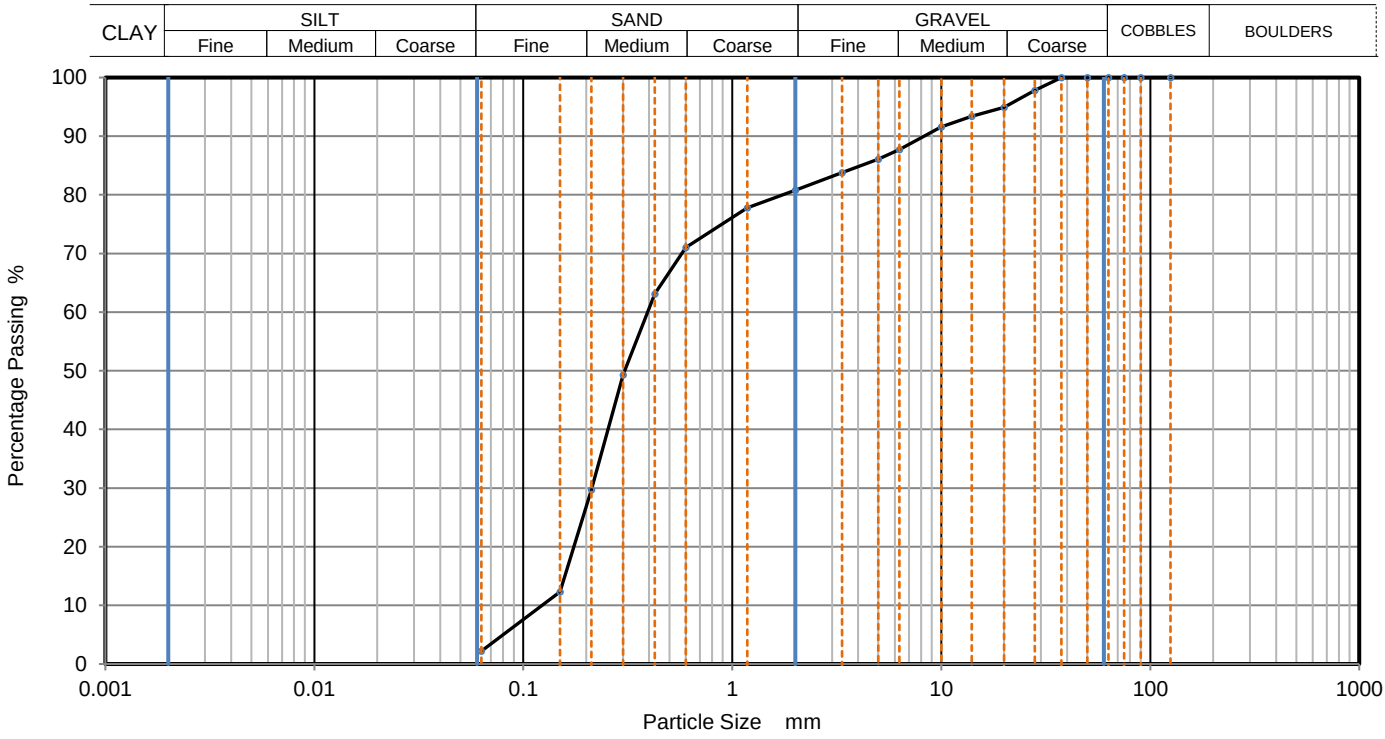
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port			Sample No.	42
Soil Description	Greyish brown silty slightly gravelly fine to coarse SAND.			Depth, m	11.50
Specimen Reference	6	Specimen Depth	11.5 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080148



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	95		
14	93		
10	92		
6.3	88		
5	86		
3.35	84		
2	81		
1.18	78		
0.6	71		
0.425	63		
0.3	49		
0.212	30		
0.15	12		
0.063	2		

Dry Mass of sample, g	2993

Sample Proportions	% dry mass
Cobbles	0
Gravel	19
Sand	79
Fines <0.063mm	2

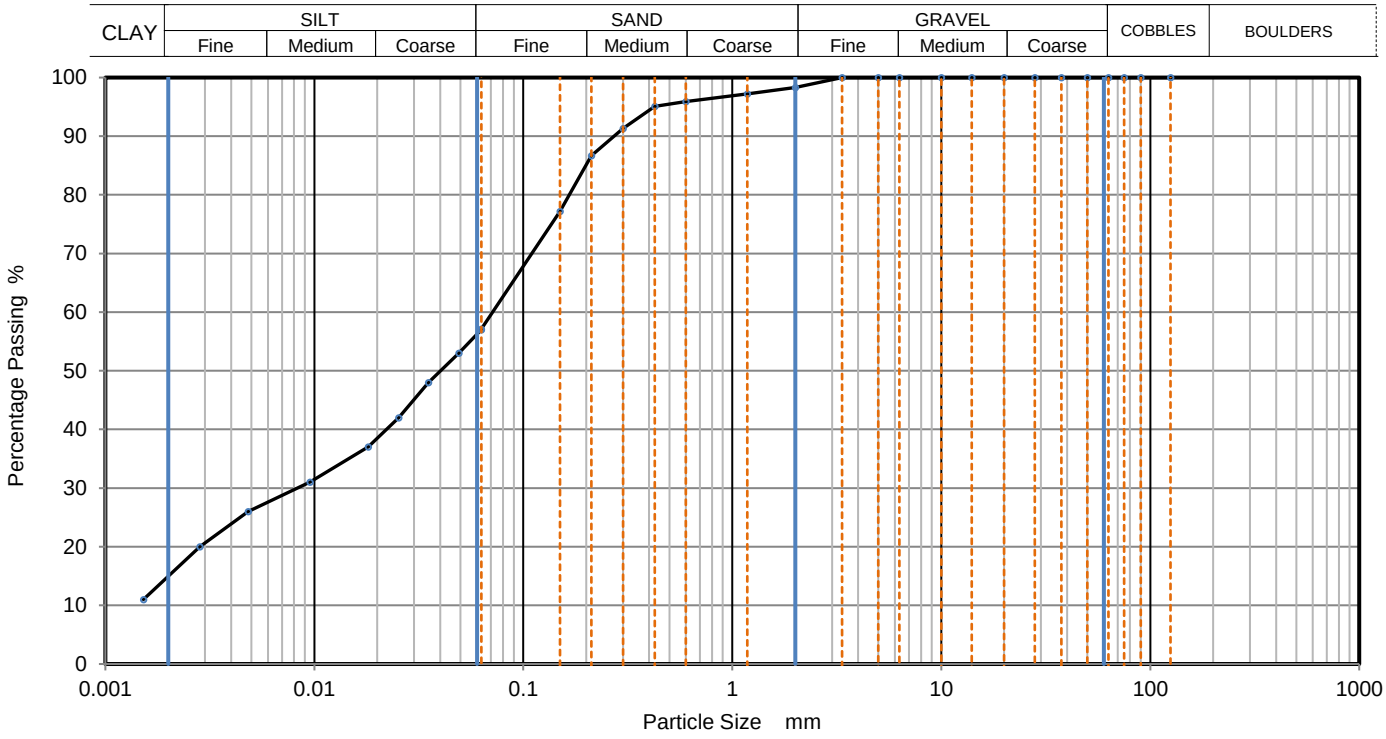
Grading Analysis		
D100	mm	
D60	mm	0.393
D30	mm	0.213
D10	mm	0.124
Uniformity Coefficient		3.2
Curvature Coefficient		0.94

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port			Sample No.	73
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	23.70
Specimen Reference	7	Specimen Depth	23.7 m	Sample Type	LB
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080151



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	57
90	100	0.0491	53
75	100	0.0351	48
63	100	0.0253	42
50	100	0.0181	37
37.5	100	0.0095	31
28	100	0.0048	26
20	100	0.0028	20
14	100	0.0015	11
10	100		
6.3	100		
5	100		
3.35	100		
2	98		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	91		
0.212	87		
0.15	77		
0.063	57		

Dry Mass of sample, g	294

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	41
Silt	42
Clay	15

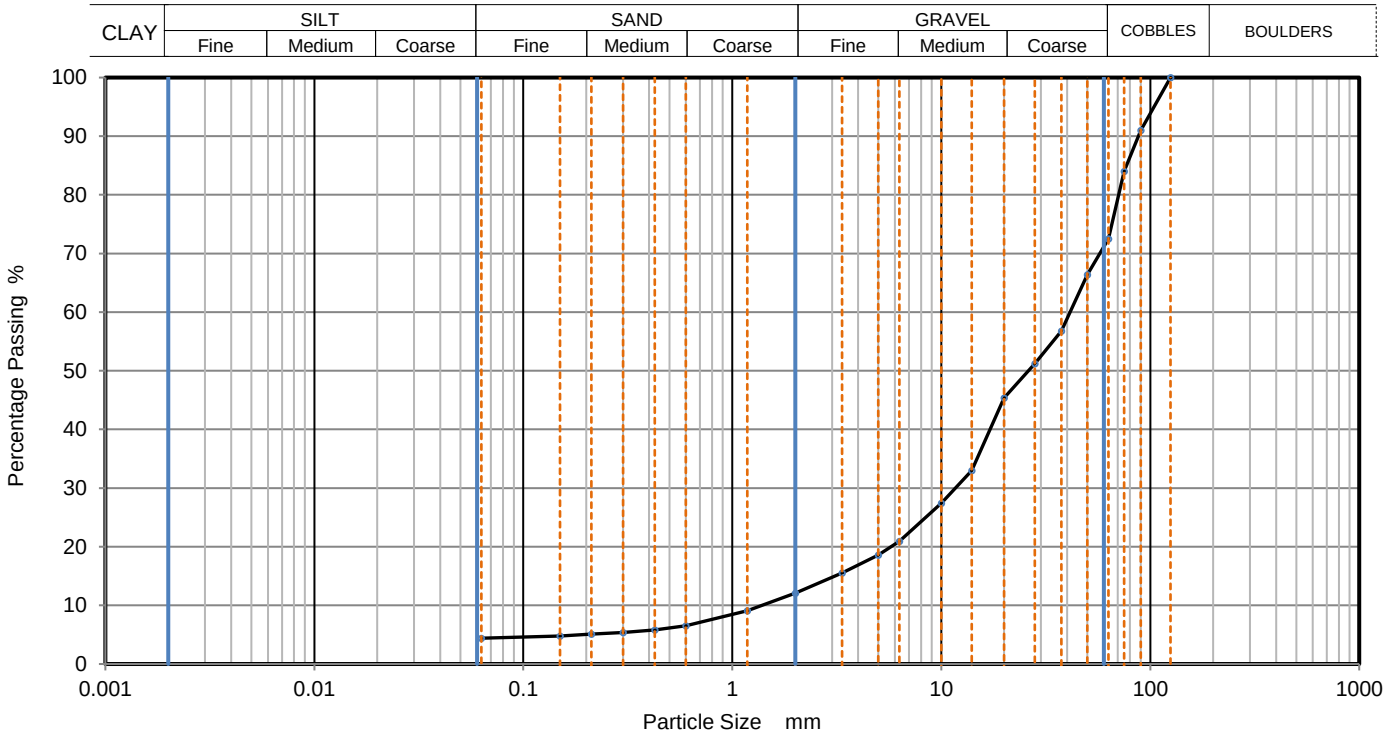
Grading Analysis		
D100	mm	
D60	mm	0.0714
D30	mm	0.00848
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH47
Site Name	Stornoway Deep Water Port			Sample No.	35
Soil Description	Greyish brown sandy gravelly silty CLAY.			Depth, m	11.00
Specimen Reference	6	Specimen Depth	11 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080160



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	91		
75	84		
63	73		
50	66		
37.5	57		
28	51		
20	45		
14	33		
10	27		
6.3	21		
5	19		
3.35	16		
2	12		
1.18	9		
0.6	7		
0.425	6		
0.3	5		
0.212	5		
0.15	5		
0.063	4		

Dry Mass of sample, g	35189

Sample Proportions	% dry mass
Cobbles	28
Gravel	60
Sand	8
Fines <0.063mm	4

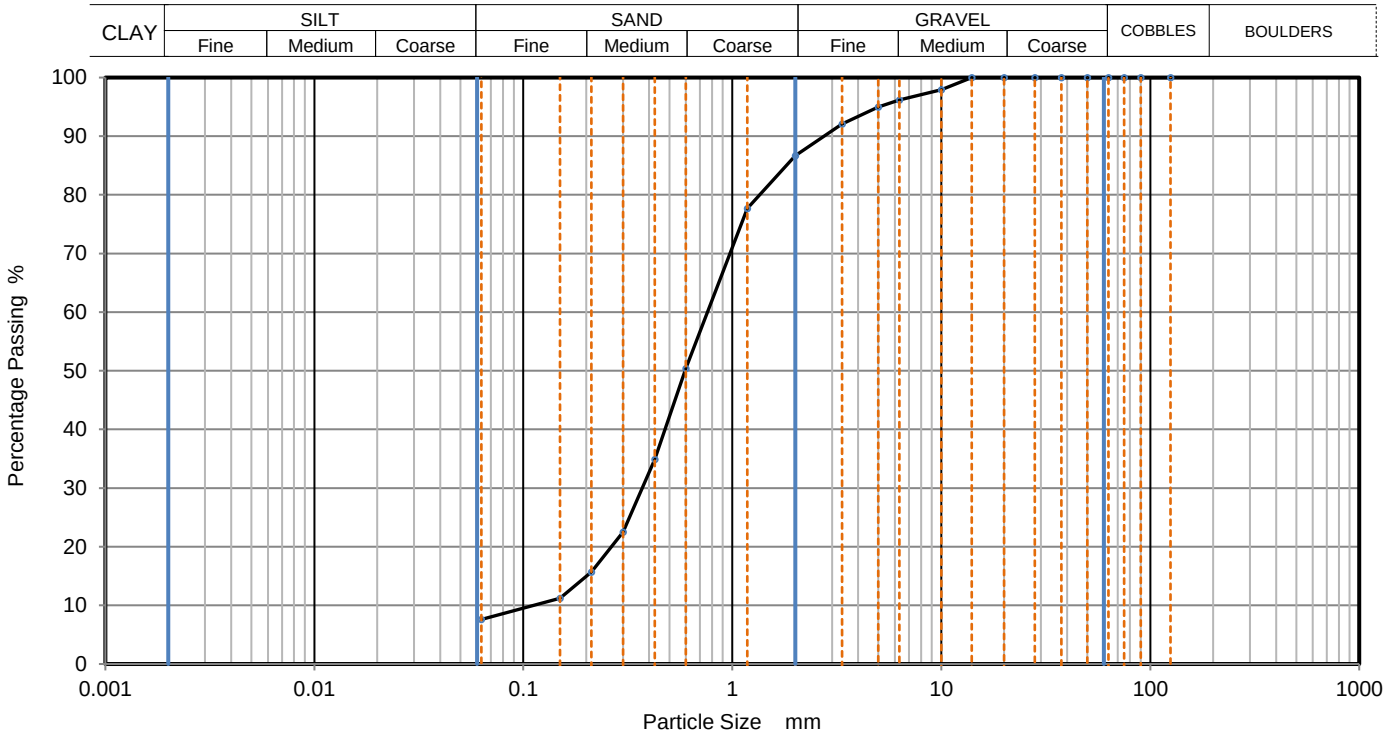
Grading Analysis		
D100	mm	125
D60	mm	41.3
D30	mm	11.7
D10	mm	1.39
Uniformity Coefficient		30
Curvature Coefficient		2.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	16
Soil Description	Greyish brown silty fine to coarse SAND.			Depth, m	5.00
Specimen Reference	6	Specimen Depth	5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080164



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	98		
6.3	96		
5	95		
3.35	92		
2	87		
1.18	78		
0.6	50		
0.425	35		
0.3	23		
0.212	16		
0.15	11		
0.063	8		

Dry Mass of sample, g	530

Sample Proportions	% dry mass
Cobbles	0
Gravel	13
Sand	79
Fines <0.063mm	8

Grading Analysis		
D100	mm	
D60	mm	0.761
D30	mm	0.37
D10	mm	0.113
Uniformity Coefficient		6.7
Curvature Coefficient		1.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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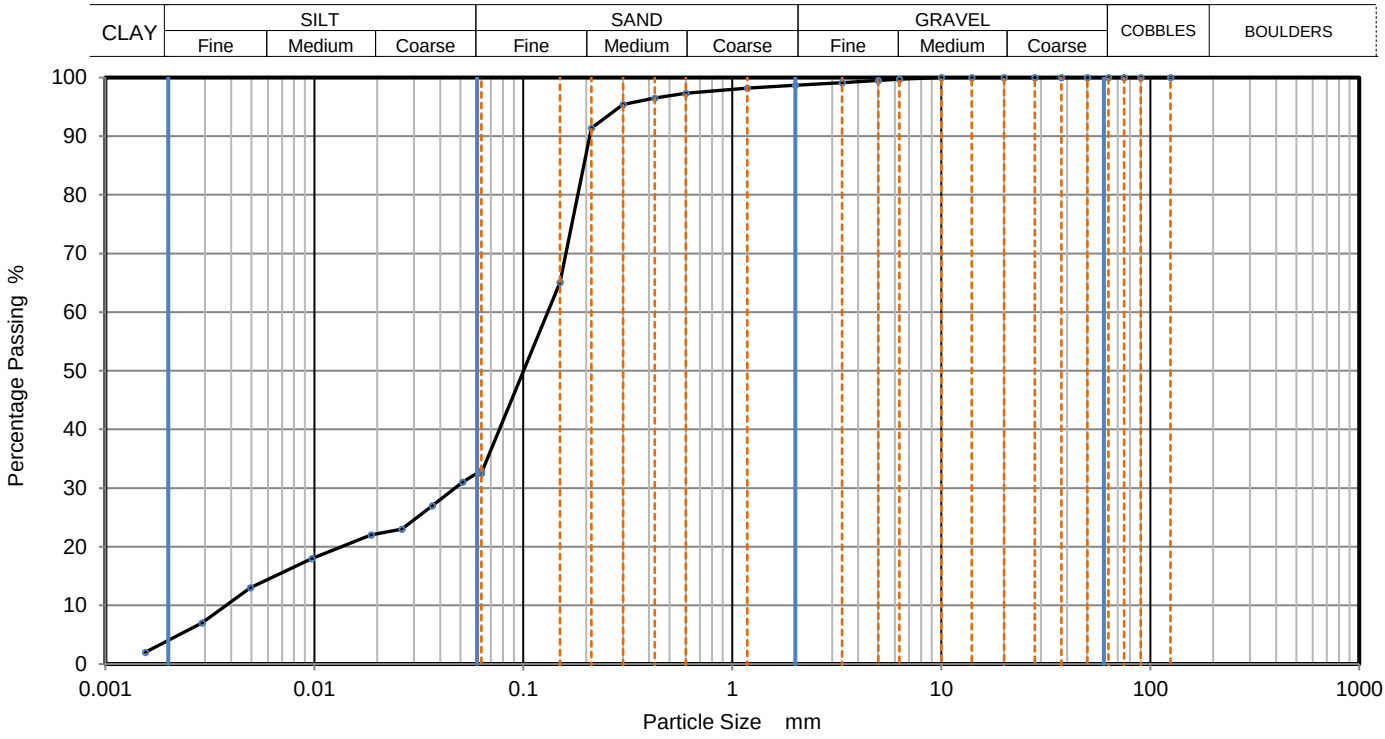
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	18
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	6.00
Specimen Reference	6	Specimen Depth	6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080165



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	33
90	100	0.0513	31
75	100	0.0367	27
63	100	0.0262	23
50	100	0.0187	22
37.5	100	0.0097	18
28	100	0.0050	13
20	100	0.0029	7
14	100	0.0016	2
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	97	2.65	Mg/m3
0.3	95		
0.212	91		
0.15	65		
0.063	33		

Dry Mass of sample, g	569

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	66
Silt	28
Clay	4

Grading Analysis		
D100	mm	
D60	mm	0.131
D30	mm	0.0481
D10	mm	0.00382
Uniformity Coefficient		34
Curvature Coefficient		4.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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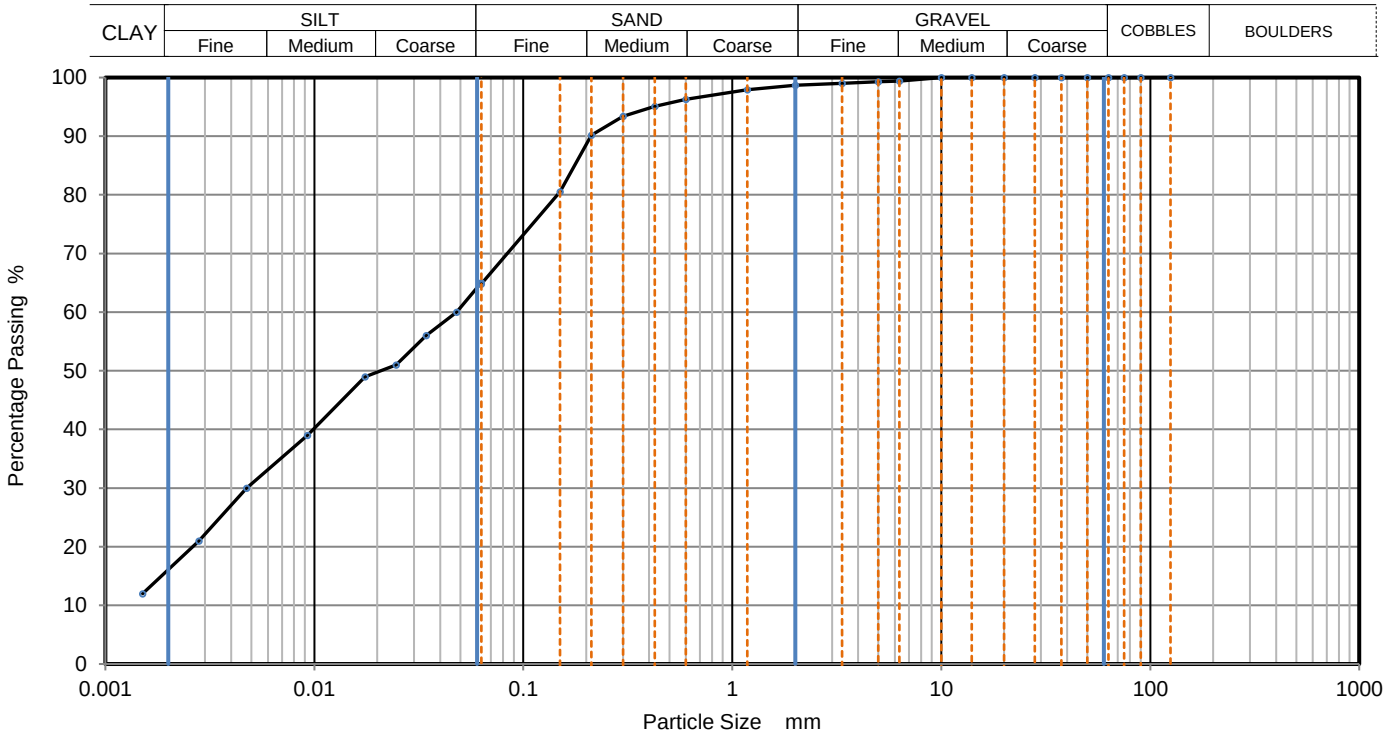
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port				Sample No.	25
Soil Description	Greyish brown sandy SILT/CLAY.				Depth, m	7.80
Specimen Reference	10	Specimen Depth	7.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus2019080166



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	65
90	100	0.0479	60
75	100	0.0343	56
63	100	0.0246	51
50	100	0.0175	49
37.5	100	0.0093	39
28	100	0.0047	30
20	100	0.0028	21
14	100	0.0015	12
10	100		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	93		
0.212	90		
0.15	81		
0.063	65		

Dry Mass of sample, g	270

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	34
Silt	49
Clay	16

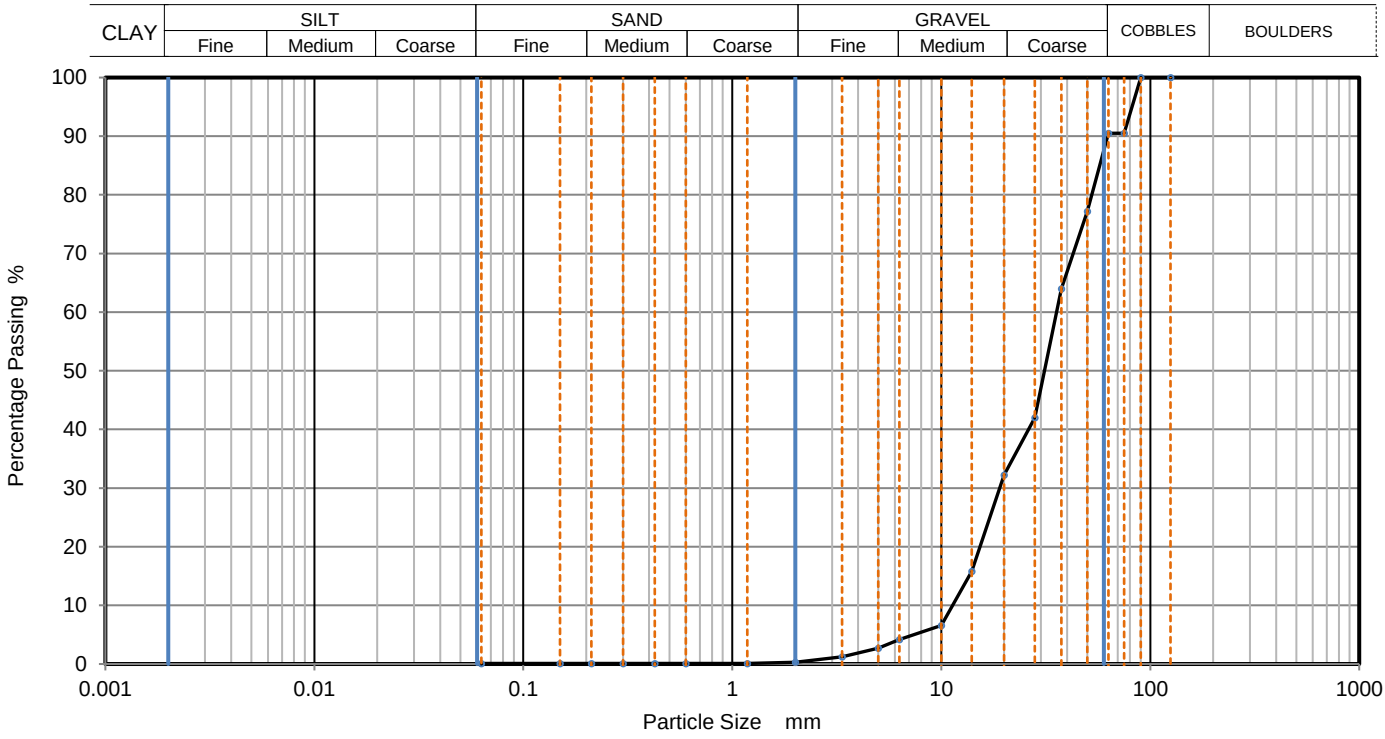
Grading Analysis		
D100	mm	
D60	mm	0.0473
D30	mm	0.00472
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	47
Soil Description	Greyish brown subangular fine to coarse GRAVEL with some cobbles.			Depth, m	17.00
Specimen Reference	6	Specimen Depth	17 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080171



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	91		
63	91		
50	77		
37.5	64		
28	42		
20	32		
14	16		
10	7		
6.3	4		
5	3		
3.35	1		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	17516

Sample Proportions	% dry mass
Cobbles	10
Gravel	90
Sand	0
Fines <0.063mm	0

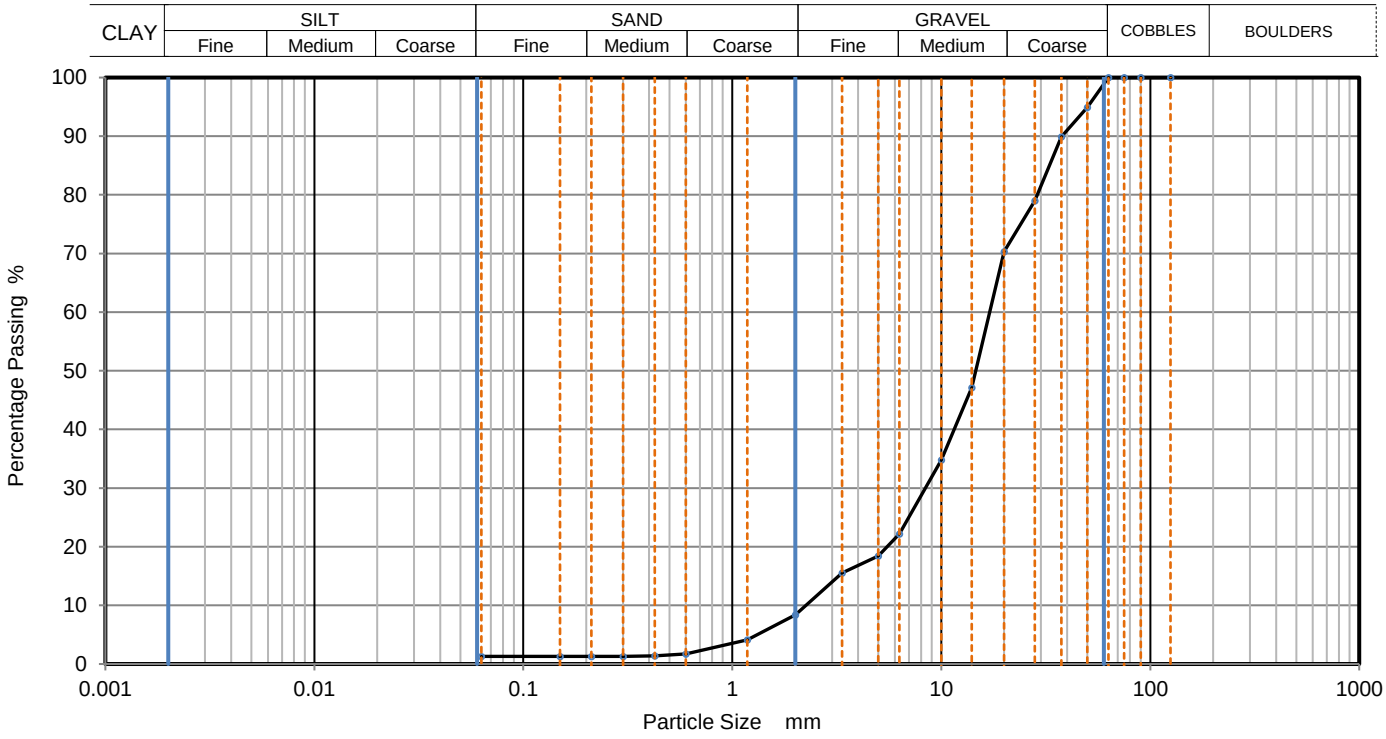
Grading Analysis		
D100	mm	
D60	mm	35.5
D30	mm	19.1
D10	mm	11.3
Uniformity Coefficient		3.1
Curvature Coefficient		0.9

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	54
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL.			Depth, m	19.00
Specimen Reference	6	Specimen Depth	19 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080172



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	90		
28	79		
20	70		
14	47		
10	35		
6.3	22		
5	18		
3.35	16		
2	8		
1.18	4		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	12546

Sample Proportions	% dry mass
Cobbles	0
Gravel	92
Sand	7
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	17.1
D30	mm	8.4
D10	mm	2.25
Uniformity Coefficient		7.6
Curvature Coefficient		1.8

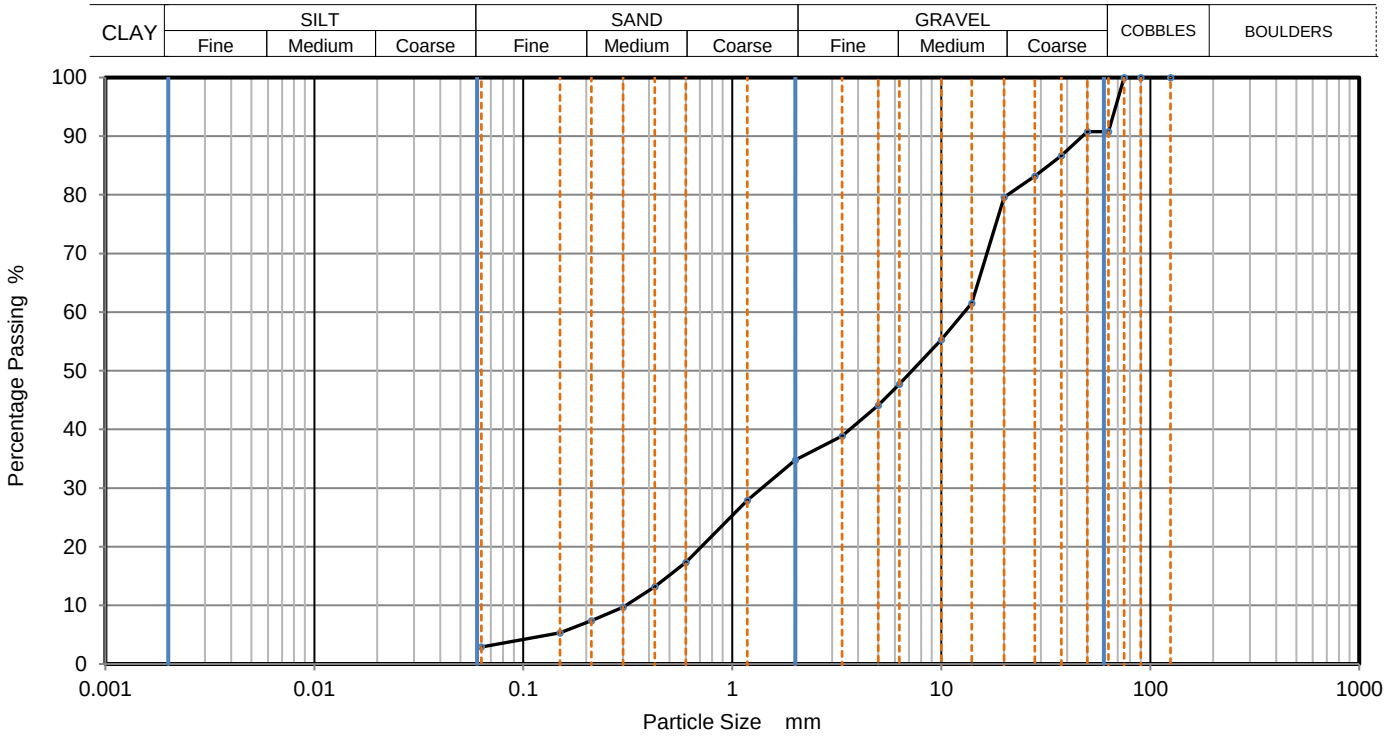
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	58
Soil Description	Greyish brown sandy subangular fine to coarse GRAVEL with some cobbles.			Depth, m	20.00
Specimen Reference	6	Specimen Depth	20 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080173



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	91		
50	91		
37.5	87		
28	83		
20	80		
14	62		
10	55		
6.3	48		
5	44		
3.35	39		
2	35		
1.18	28		
0.6	17		
0.425	13		
0.3	10		
0.212	7		
0.15	5		
0.063	3		

Dry Mass of sample, g	13870

Sample Proportions	% dry mass
Cobbles	9
Gravel	56
Sand	32
Fines <0.063mm	3

Grading Analysis		
D100	mm	
D60	mm	12.9
D30	mm	1.39
D10	mm	0.308
Uniformity Coefficient		42
Curvature Coefficient		0.48

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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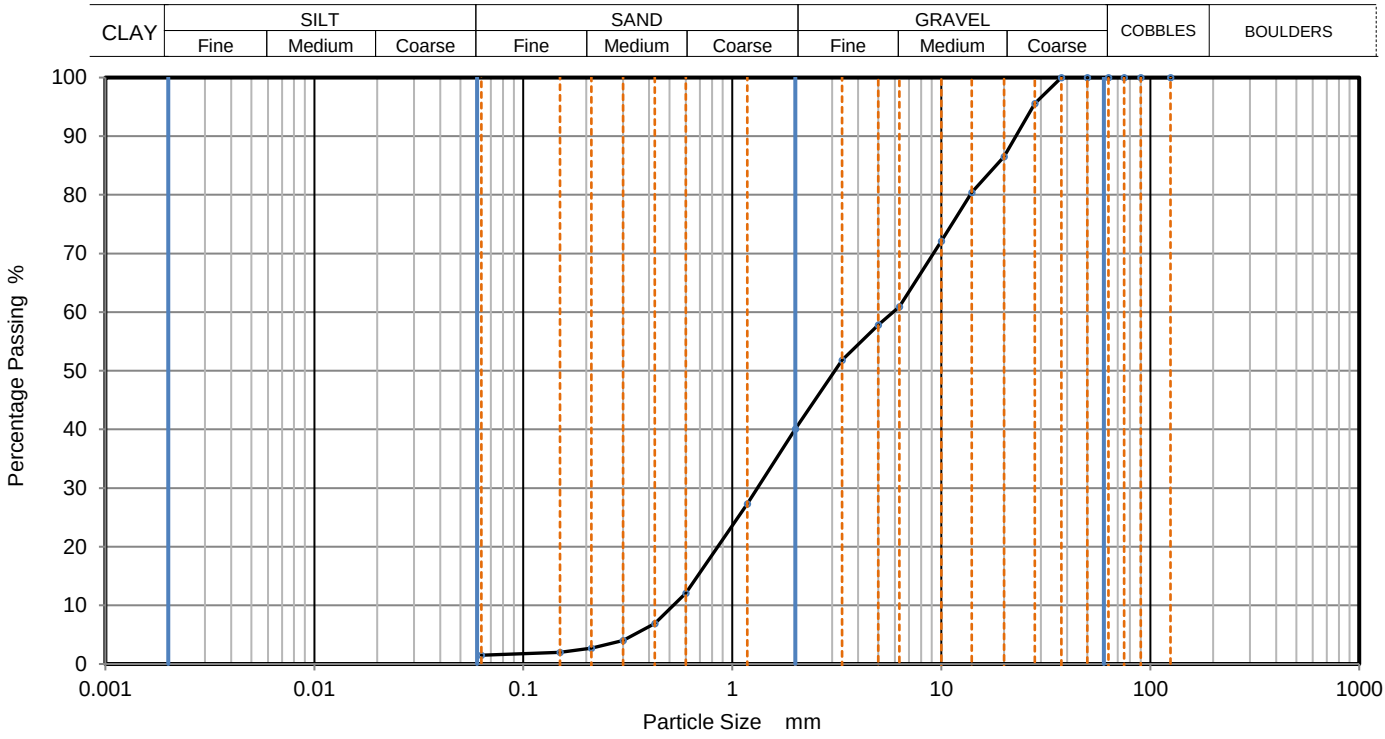
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port				Sample No.	64
Soil Description	Greyish brown sandy subangular fine to coarse GRAVEL.				Depth, m	21.50
Specimen Reference	6	Specimen Depth	21.5	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2019080174



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	87		
14	80		
10	72		
6.3	61		
5	58		
3.35	52		
2	40		
1.18	27		
0.6	12		
0.425	7		
0.3	4		
0.212	3		
0.15	2		
0.063	2		

Dry Mass of sample, g	2906

Sample Proportions	% dry mass
Cobbles	0
Gravel	60
Sand	39
Fines <0.063mm	1

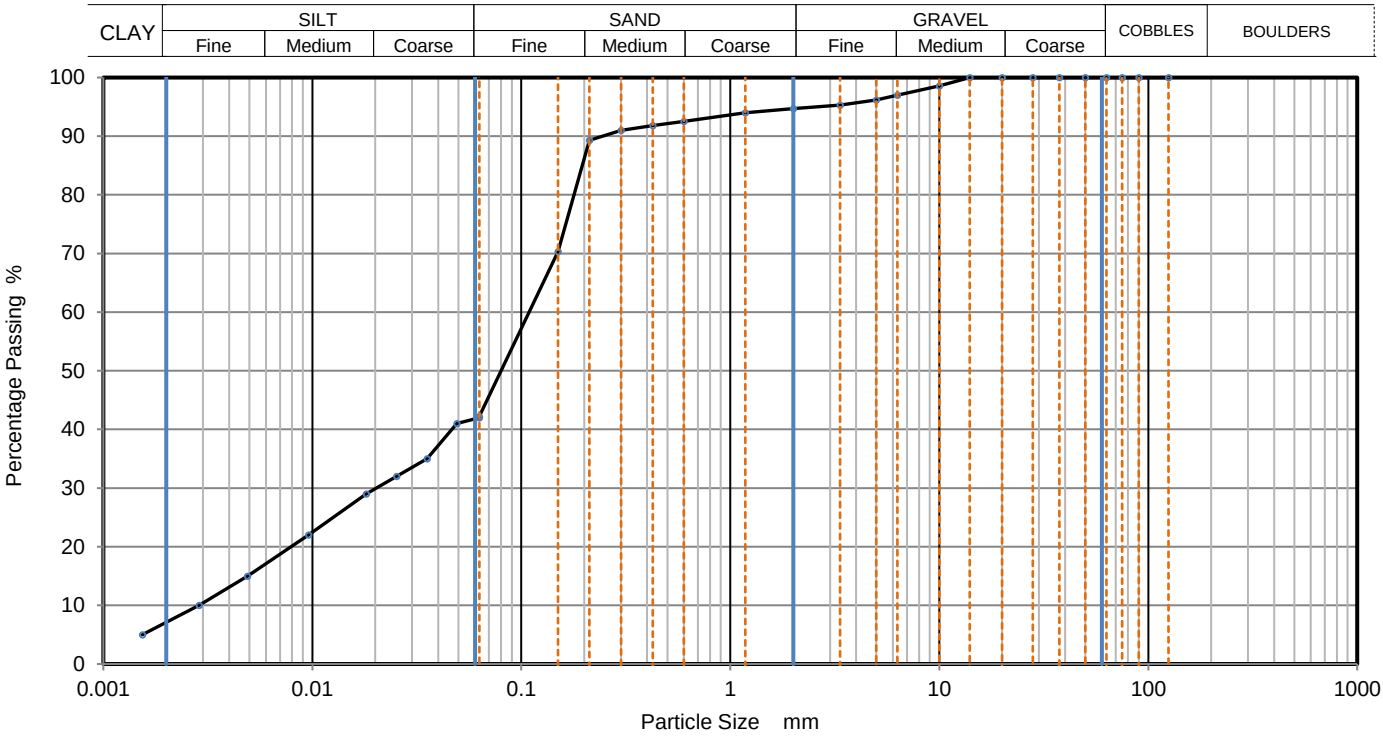
Grading Analysis		
D100	mm	
D60	mm	5.89
D30	mm	1.32
D10	mm	0.522
Uniformity Coefficient		11
Curvature Coefficient		0.57

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH50
Site Name	Stornoway Deep Water Port			Sample No.	14
Soil Description	Greyish brown sandy slightly gravelly SILT/ CLAY.			Depth, m	4.50
Specimen Reference	10	Specimen Depth	4.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080176



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	42
90	100	0.0491	41
75	100	0.0354	35
63	100	0.0253	32
50	100	0.0181	29
37.5	100	0.0096	22
28	100	0.0049	15
20	100	0.0029	10
14	100	0.0015	5
10	99		
6.3	97		
5	96		
3.35	95		
2	95		
1.18	94		
0.6	93	Particle density	(assumed)
0.425	92	2.65	Mg/m3
0.3	91		
0.212	89		
0.15	70		
0.063	42		

Dry Mass of sample, g: 633

Sample Proportions	% dry mass
Cobbles	0
Gravel	5
Sand	53
Silt	35
Clay	7

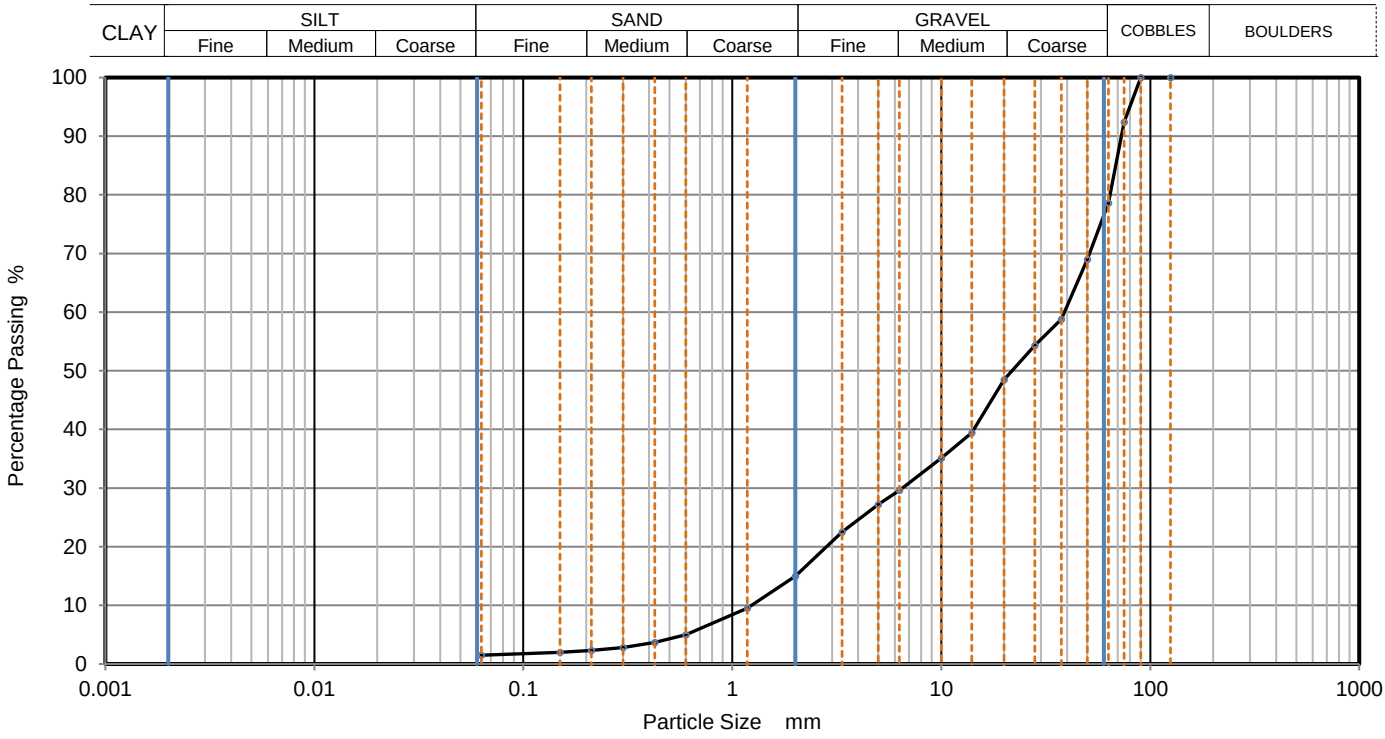
Grading Analysis		
D100	mm	
D60	mm	0.109
D30	mm	0.0206
D10	mm	0.00283
Uniformity Coefficient		39
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH50
Site Name	Stornoway Deep Water Port			Sample No.	31
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL with some cobbles.			Depth, m	12.50
Specimen Reference	6	Specimen Depth	12.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080181



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	92		
63	79		
50	69		
37.5	59		
28	54		
20	49		
14	39		
10	35		
6.3	30		
5	27		
3.35	23		
2	15		
1.18	10		
0.6	5		
0.425	4		
0.3	3		
0.212	2		
0.15	2		
0.063	2		

Dry Mass of sample, g	13746

Sample Proportions	% dry mass
Cobbles	21
Gravel	64
Sand	13
Fines <0.063mm	2

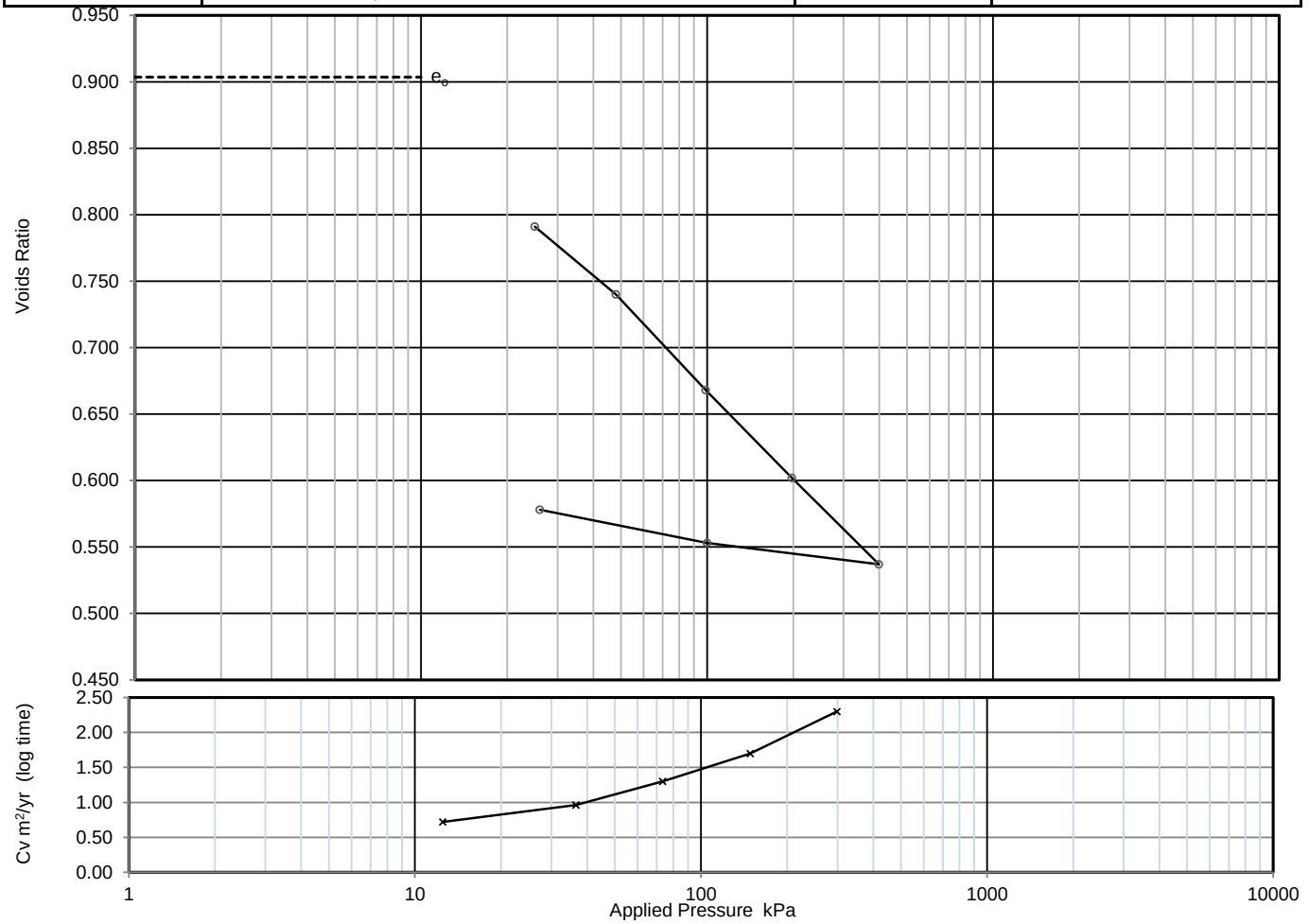
Grading Analysis		
D100	mm	
D60	mm	38.8
D30	mm	6.5
D10	mm	1.24
Uniformity Coefficient		31
Curvature Coefficient		0.88

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH47
Site Name	Stornoway Deep Water Port				Sample No.	25
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.				Depth	8.5
Specimen Reference	12	Specimen Depth	8.55	m	Sample Type	B
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080159
Test Method	BS1377:Part 5:1990, clause 3				Date started	12/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.903	-	-	-	-
25	0.791	2.4	0.72	0.58	0.0033
48	0.740	1.2	0.96	0.95	0.0034
99	0.668	0.82	1.3	1.5	0.0057
198	0.602	0.4	1.7	2.4	0.0036
399	0.537	0.2	2.3	3.4	0.0041
100	0.553	0.035			
26	0.578	0.22			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	16.42	mm
Moisture Content	36.3	23.6	%
Bulk density	1.90	2.07	Mg/m3
Dry density	1.39	1.68	Mg/m3
Voids Ratio	0.903	0.578	
Saturation	106	108	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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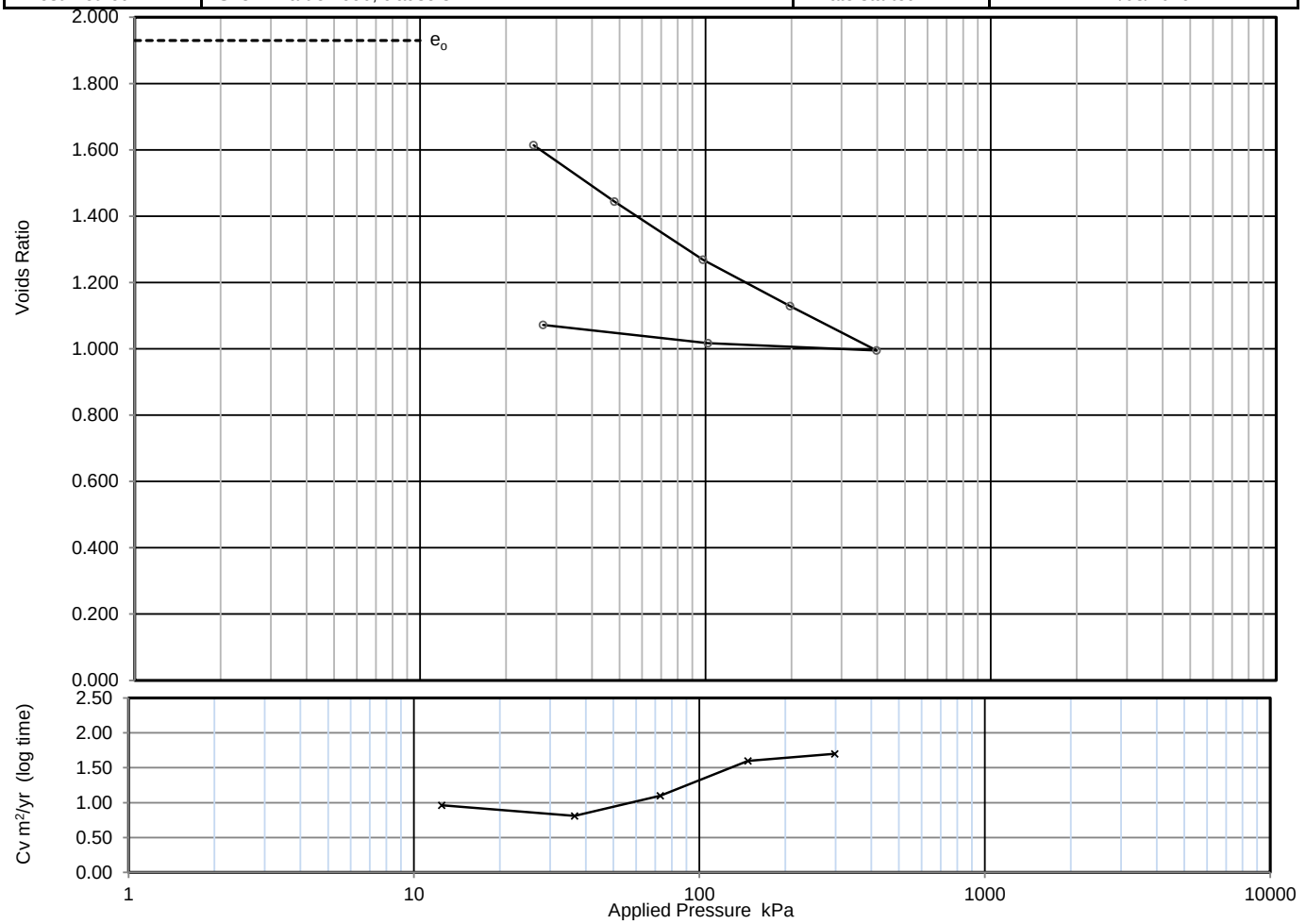
UKAS TESTING 10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	19-0382
				Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port			Sample No.	5
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth	1
Specimen Reference	3	Specimen Depth	1 m	Sample Type	B
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2019080161
Test Method	BS1377:Part 5:1990, clause 3			Date started	12/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.930	-	-	-	-
25	1.614	4.3	0.96	0.85	0.0031
48	1.444	2.8	0.81	0.78	0.013
98	1.269	1.4	1.1	1.3	0.0098
198	1.129	0.62	1.6	1.8	0.0091
398	0.995	0.31	1.7	1.9	0.0079
102	1.017	0.036			
27	1.072	0.37			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.10	14.22	mm
Moisture Content	76.0	40.7	%
Bulk density	1.59	1.80	Mg/m3
Dry density	0.90	1.28	Mg/m3
Voids Ratio	1.930	1.073	
Saturation	104	101	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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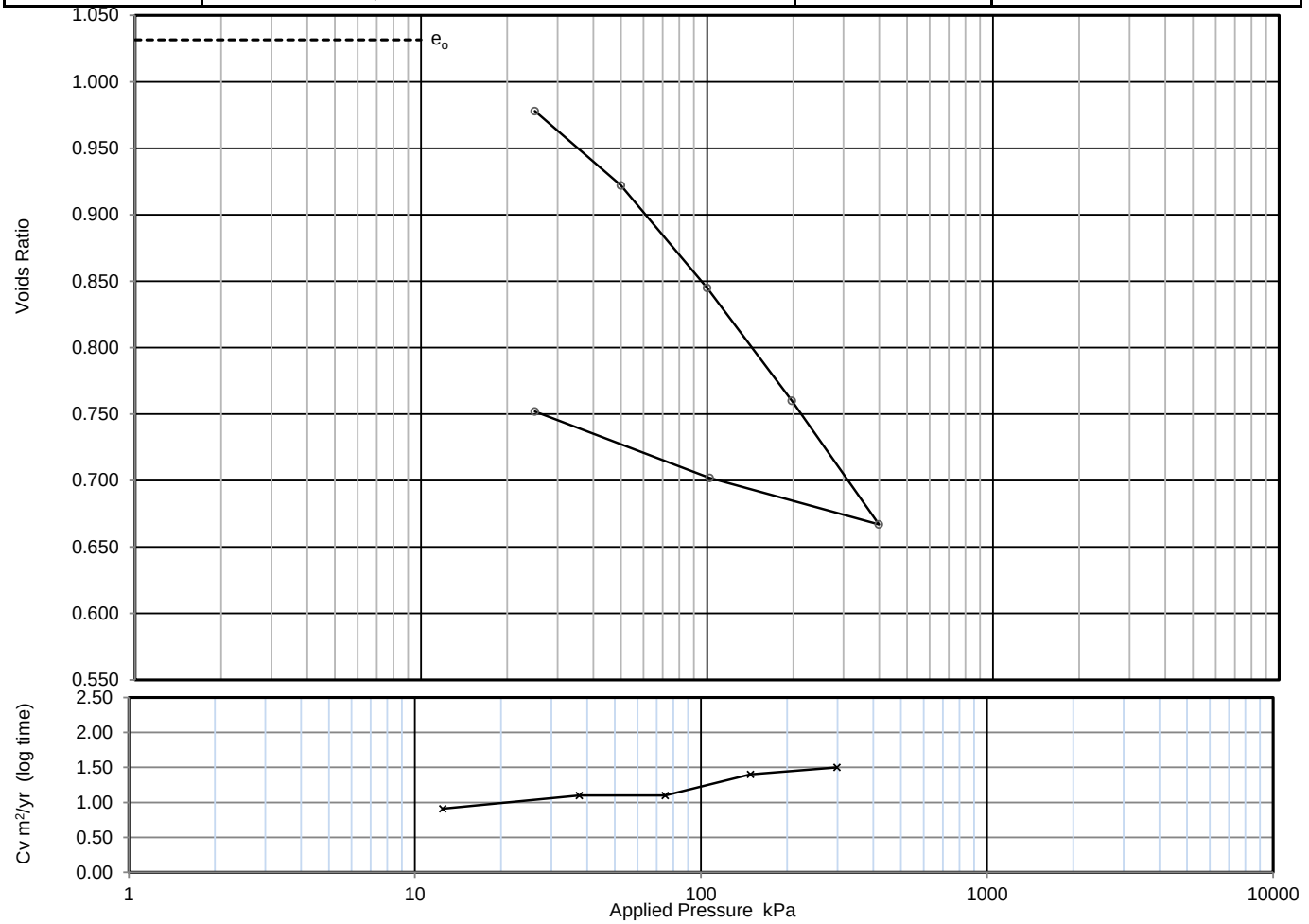
UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port				Sample No.	43
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.				Depth	15.5
Specimen Reference	3	Specimen Depth	15.55	m	Sample Type	UT
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080170
Test Method	BS1377:Part 5:1990, clause 3				Date started	14/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.032	-	-	-	-
25	0.978	1	0.91	1.1	0.0018
50	0.922	1.1	1.1	1.7	0.0021
100	0.845	0.8	1.1	1.7	0.0039
198	0.760	0.47	1.4	1.8	0.0036
399	0.667	0.26	1.5	2.2	0.0035
102	0.702	0.071			
25	0.752	0.38			

Preparation

Index tests Liquid limit % Plastic limit %

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.85	17.12	mm
Moisture Content	41.5	30.8	%
Bulk density	1.85	1.98	Mg/m3
Dry density	1.30	1.51	Mg/m3
Voids Ratio	1.032	0.752	
Saturation	107	109	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved

Stephen.Watson

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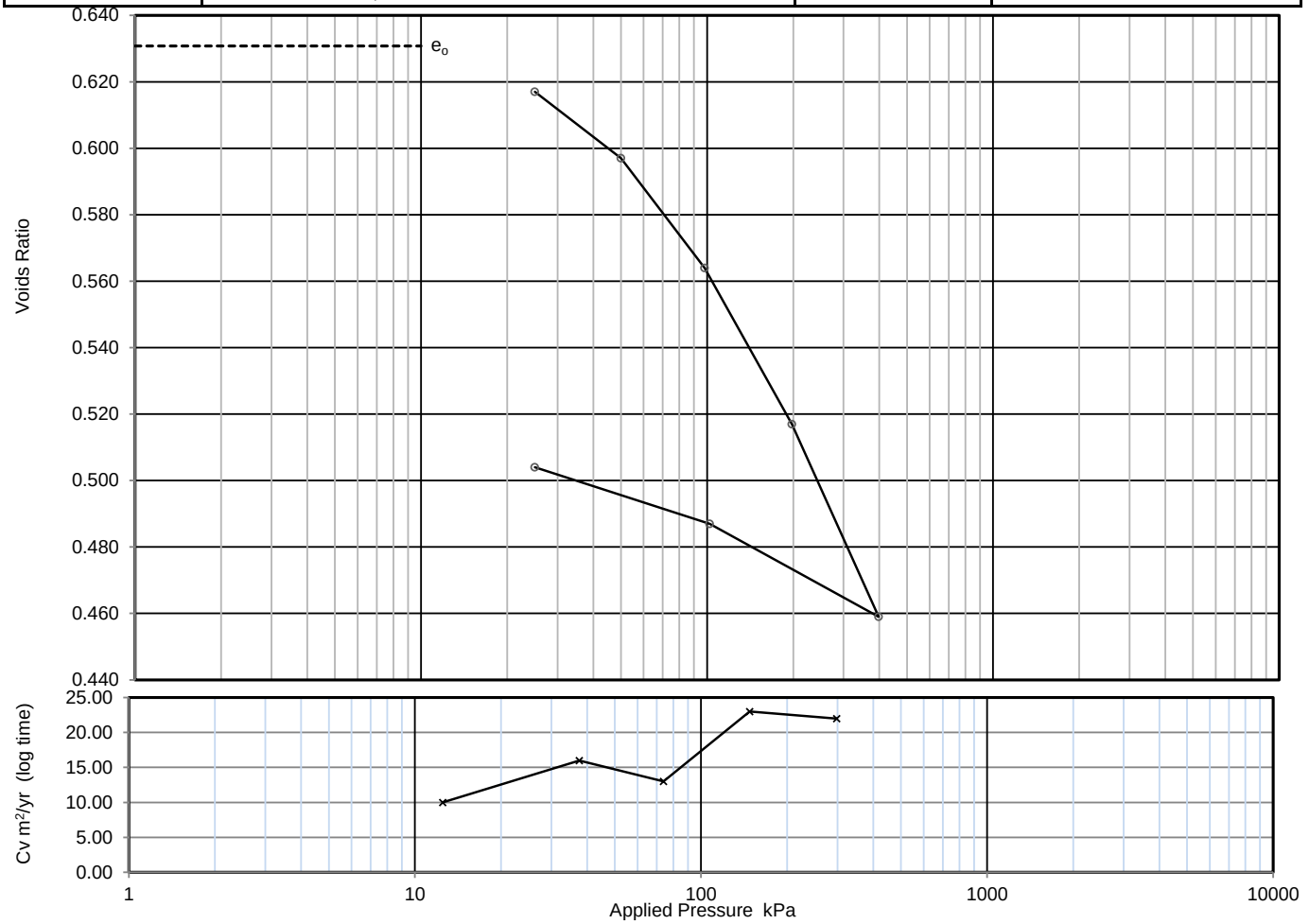
10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH50
Site Name	Stornoway Deep Water Port				Sample No.	16
Soil Description	Greyish brown sandy slightly gravelly SILT/ CLAY.				Depth	6
Specimen Reference	6	Specimen Depth	6.05	m	Sample Type	P
Specimen Description	Greyish brown sandy slightly gravelly SILT/ CLAY.				KeyLAB ID	Caus2019080177
Test Method	BS1377:Part 5:1990, clause 3				Date started	14/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.631	-	-	-	-
25	0.617	0.34	10	13	0.00094
50	0.597	0.5	16	48	0.0015
98	0.564	0.42	13	52	0.0015
198	0.517	0.3	23	64	0.0034
398	0.459	0.19	22	100	0.003
102	0.487	0.065			
25	0.504	0.14			

Preparation

Index tests Liquid limit % Plastic limit %

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	18.44	mm
Moisture Content	27.3	22.8	%
Bulk density	2.07	2.16	Mg/m3
Dry density	1.62	1.76	Mg/m3
Voids Ratio	0.631	0.504	
Saturation	115	120	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved

Stephen.Watson

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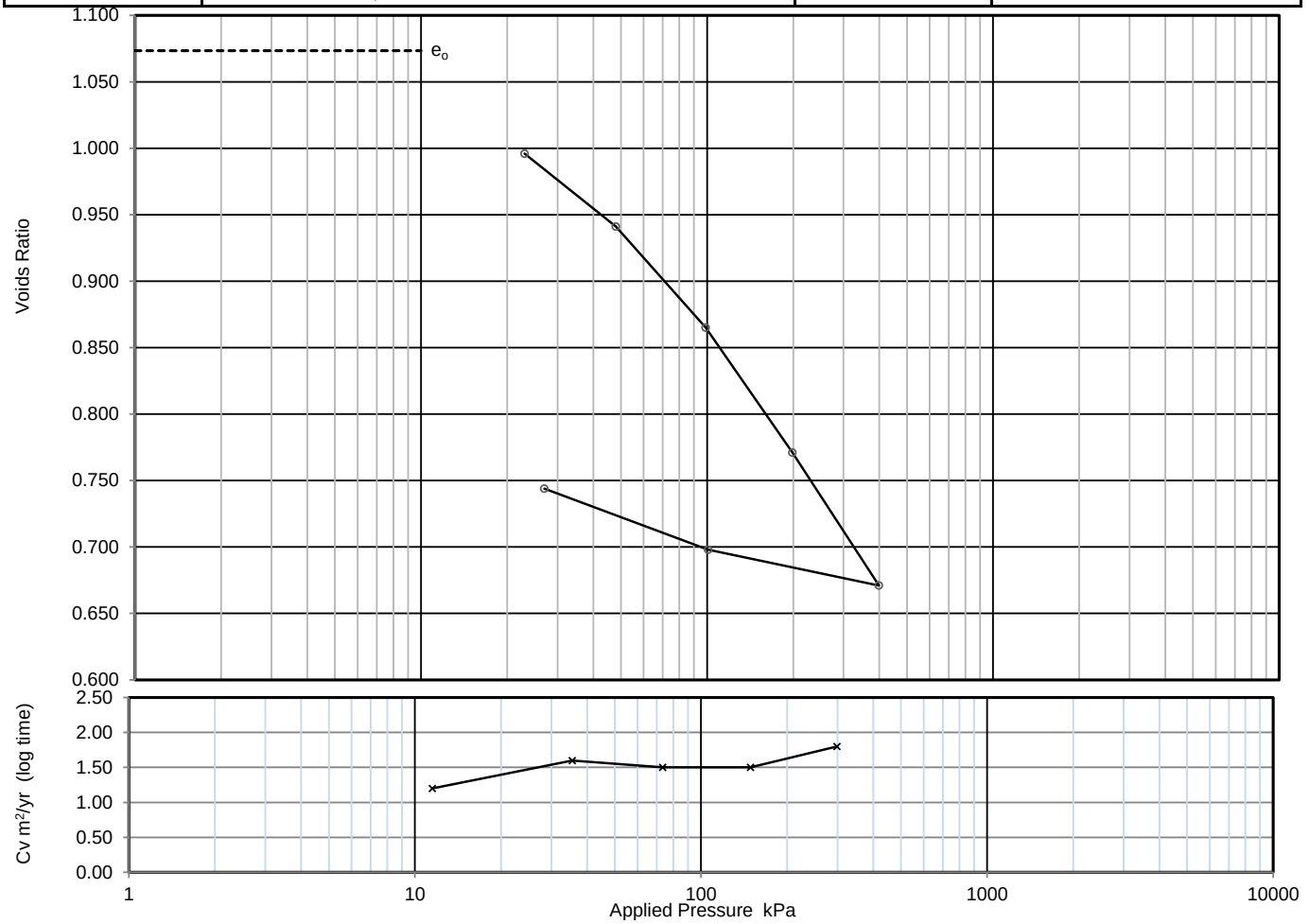
10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH50
Site Name	Stornoway Deep Water Port				Sample No.	22
Soil Description	Greyish brown sandy SILT.				Depth	9
Specimen Reference	3	Specimen Depth	9.05	m	Sample Type	P
Specimen Description	Greyish brown sandy SILT.				KeyLAB ID	Caus2019080179
Test Method	BS1377:Part 5:1990, clause 3				Date started	16/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.073	-	-	-	-
23	0.996	1.6	1.2	1.1	0.0044
48	0.941	1.1	1.6	2.4	0.0036
99	0.865	0.77	1.5	2.3	0.0053
199	0.771	0.5	1.5	2.1	0.005
399	0.671	0.28	1.8	2.2	0.0049
101	0.698	0.055			
27	0.744	0.36			

Preparation

Index tests Liquid limit % Plastic limit %

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.60	16.48	mm
Moisture Content	43.6	31.2	%
Bulk density	1.83	1.99	Mg/m3
Dry density	1.28	1.52	Mg/m3
Voids Ratio	1.073	0.744	
Saturation	108	111	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved

Stephen.Watson

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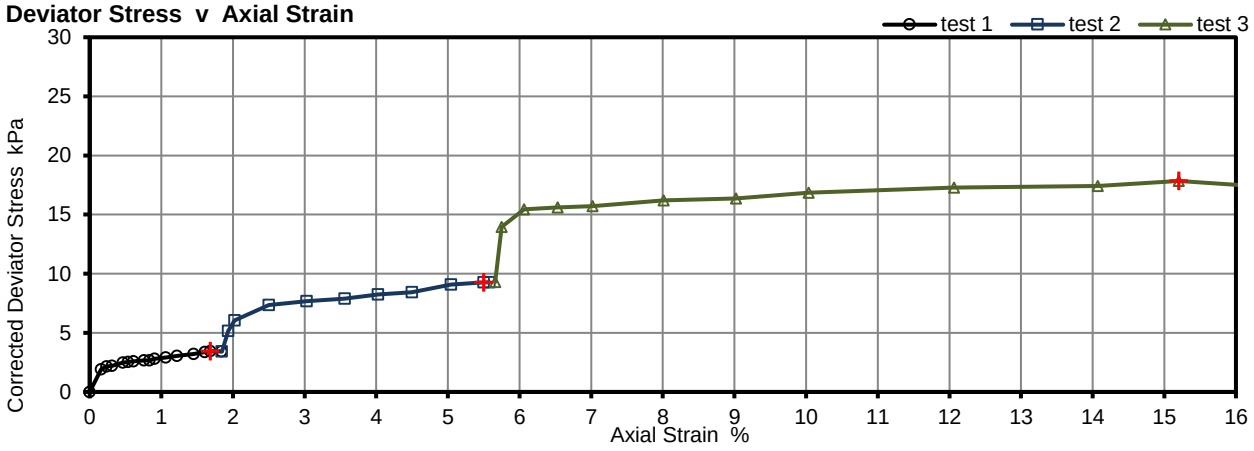
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH41
Site Name	Stornoway Deep Water Port				Sample No.	84
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.				Depth	27.10
Specimen Reference	12	Specimen Depth	27.10	m	Sample Type	B
Specimen Description	Very soft greyish brown sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080154
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	07/08/2019

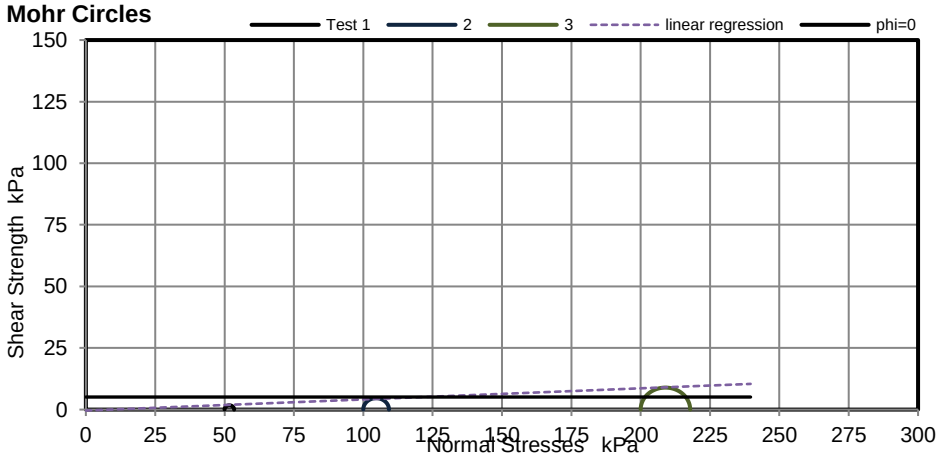
Length	mm	210.5
Diameter	mm	106.6
Bulk Density	Mg/m3	1.74
Moisture Content	%	41.1
Dry Density	Mg/m3	1.23

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	1.7	5.5	15.2
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	3.4	9.3	17.8
	Shear strength, cu	kPa	1.7	4.6	8.9
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 5 kPa

Linear Regression
ϕu 2.6 °
cu 0 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Approved	Printed
Stephen.Watson	27/08/2019 14:20

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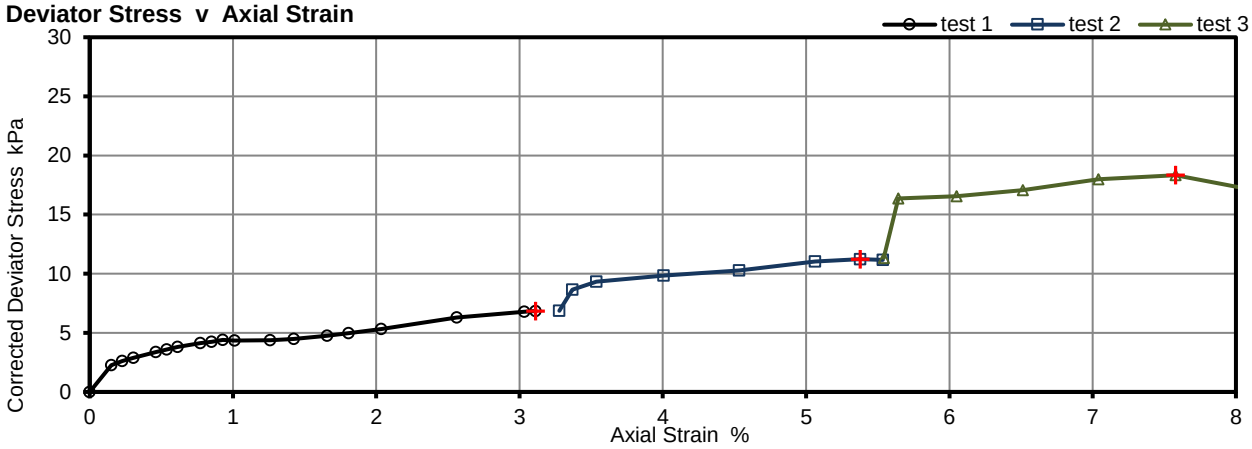
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	19-0382
				Borehole/Pit No.	BH47
Site Name	Stornoway Deep Water Port			Sample No.	15
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth	5.00
Specimen Reference	12	Specimen Depth	5.00 m	Sample Type	B
Specimen Description	Very soft greyish brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2019080158
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	07/08/2019

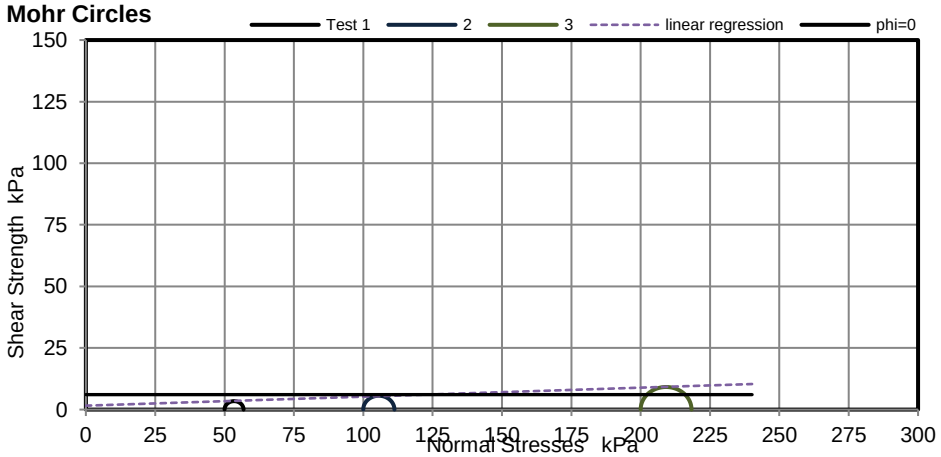
Length	mm	209.2
Diameter	mm	106.1
Bulk Density	Mg/m3	1.88
Moisture Content	%	37.8
Dry Density	Mg/m3	1.36

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	3.1	5.4	7.6
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	6.8	11.2	18.3
	Shear strength, cu	kPa	3.4	5.6	9.2
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 6 kPa

Linear Regression
ϕu 2.1 °
cu 2 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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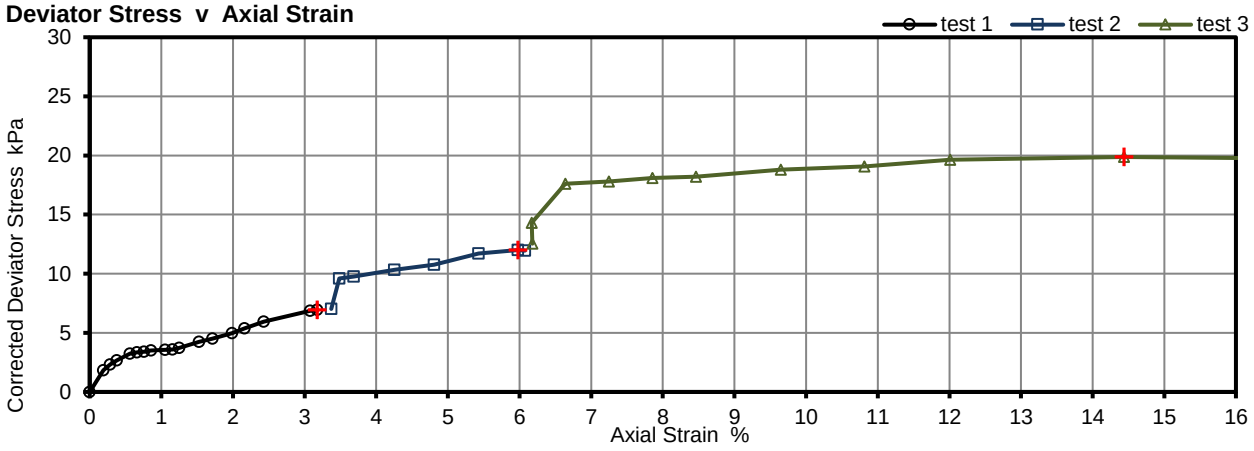
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH48
Site Name	Stornoway Deep Water Port				Sample No.	32
Soil Description	Greyish brown sandy silty CLAY.				Depth	11.50
Specimen Reference	3	Specimen Depth	11.50	m	Sample Type	UT
Specimen Description	Very soft greyish brown sandy silty CLAY.				KeyLAB ID	Caus2019080169
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	07/08/2019

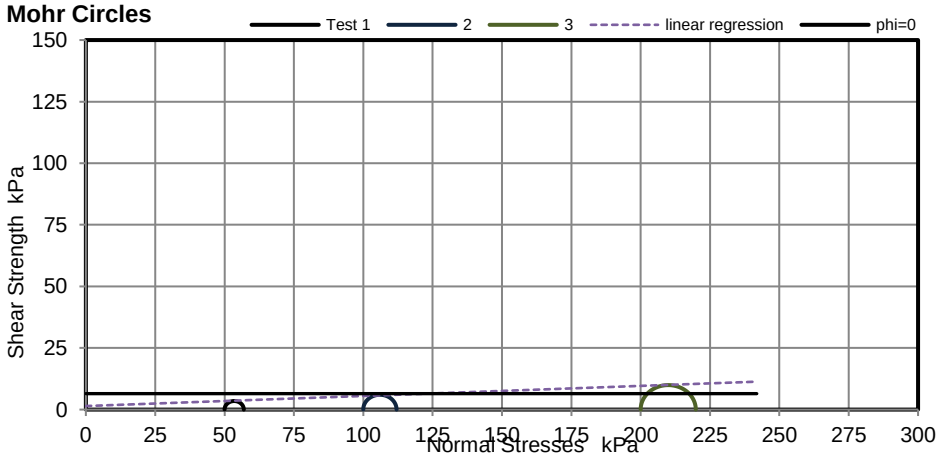
Length	mm	175.0
Diameter	mm	106.5
Bulk Density	Mg/m3	2.19
Moisture Content	%	40.8
Dry Density	Mg/m3	1.56

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	3.2	6.0	14.4
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	6.9	12.0	19.9
	Shear strength, cu	kPa	3.5	6.0	9.9
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 6 kPa

Linear Regression

ϕu 2.3 °

cu 1 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Approved	Printed
Stephen.Watson	27/08/2019 14:20

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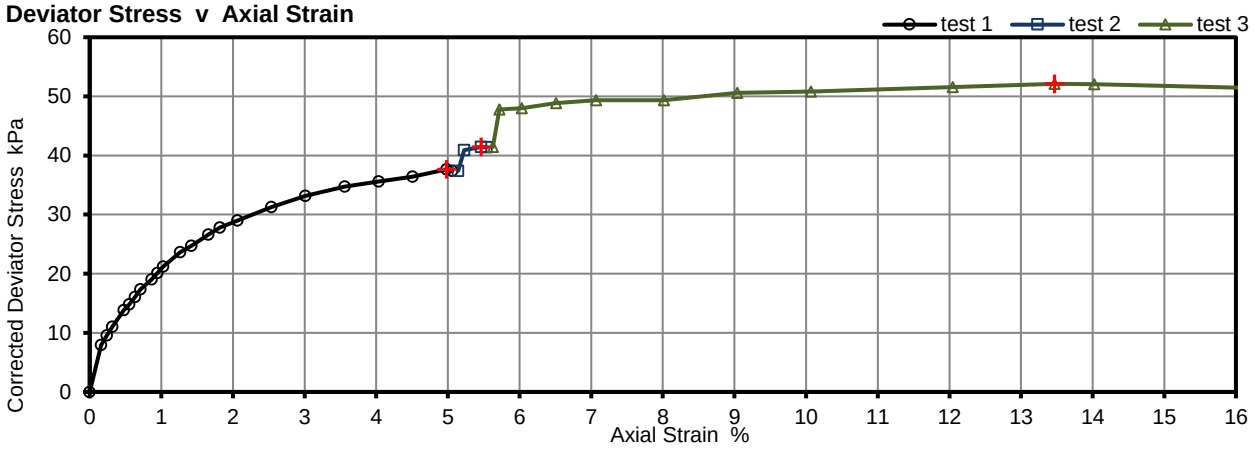
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	19-0382
				Borehole/Pit No.	BH50
Site Name	Stornoway Deep Water Port			Sample No.	16
Soil Description	Greyish brown sandy slightly gravelly SILT/ CLAY.			Depth	6.00
Specimen Reference	5	Specimen Depth	6.00 m	Sample Type	P
Specimen Description	Soft greyish brown sandy slightly gravelly SILT/ CLAY.			KeyLAB ID	Caus2019080177
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	08/08/2019

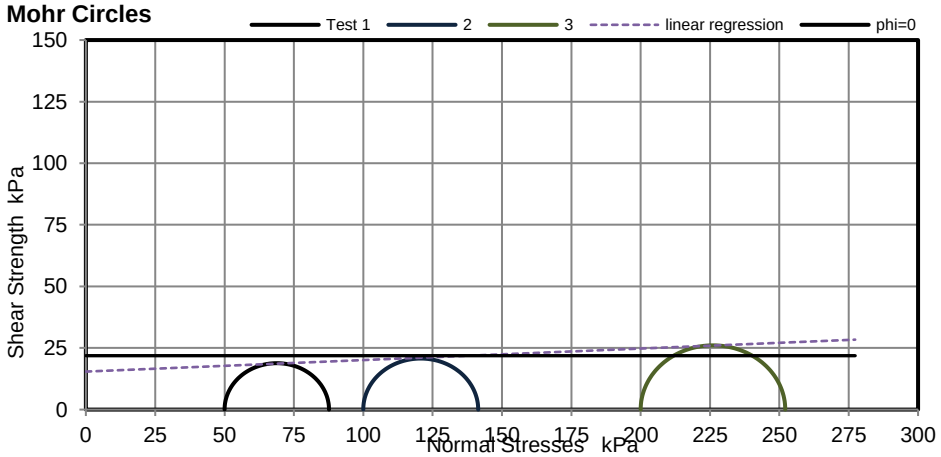
Length	mm	210.8
Diameter	mm	100.3
Bulk Density	Mg/m3	2.05
Moisture Content	%	29.1
Dry Density	Mg/m3	1.59

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	5.0	5.5	13.5
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	37.7	41.4	52.1
	Shear strength, cu	kPa	18.8	20.7	26.1
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 22 kPa

Linear Regression
ϕu 2.7 °
cu 15 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Approved	Printed
Stephen.Watson	27/08/2019 14:20

LAB 16R Version 4

UKAS TESTING
10122

LABORATORY REPORT

4043

Contract Number: PSL19/4791

Report Date: 12 September 2019

Client's Reference: 19-0382-2

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 7/8/2019
Date Commenced: 7/8/2019
Date Completed: 12/9/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)

A Watkins (Director)

R Berriman (Quality Manager)

S Royle (Laboratory Manager)

S Eyre (Senior Technician)

L Knight (Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH41	29	B	8.50	9.00	Brown very sandy GRAVEL.
BH41	53	B	14.00	14.20	Brown very sandy very silty CLAY.
BH41	56	B	15.20	15.70	Brown very sandy very silty organic CLAY.
BH41	62	B	18.20	18.70	Brown very sandy very silty CLAY.
BH41	66	B	20.60	21.00	Brown slightly gravelly sandy very silty CLAY.
BH41	82	P	23.70	24.55	Brown slightly gravelly sandy very silty CLAY.
BH41	79	B	26.50	27.00	Brown slightly gravelly slightly sandy very silty CLAY.
BH47	7	B	2.00	2.50	Brown very andy very silty CLAY.
BH47	12	B	4.50	5.00	Brown very gravelly very sandy very silty CLAY.
BH47	21	B	7.30	8.00	Brown slightly gravelly sandy very silty CLAY.
BH48	19	B	6.50	7.00	Brown slightly gravelly very sandy very silty CLAY.
BH48	38	UT	14.00	14.45	Brown gravelly sandy very silty CLAY.
BH50	5	B	1.50	2.00	Brown slightly gravelly slightly sandy very silty CLAY.
BH50	11	B	3.50	4.00	Brown very sandy clayey silty GRAVEL.
BH50	15	P	5.00	6.00	Brown slightly gravelly sandy very silty CLAY.
BH50	17	P	7.00	8.00	Very soft brown slightly gravelly slightly sandy very silty CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH41	53	B	14.00	14.20	25			34	18	16	100	Low plasticity CL.
BH41	62	B	18.20	18.70	24			32	16	16	100	Low plasticity CL.
BH41	79	B	26.50	27.00	41			51	23	28	98	High plasticity CH.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

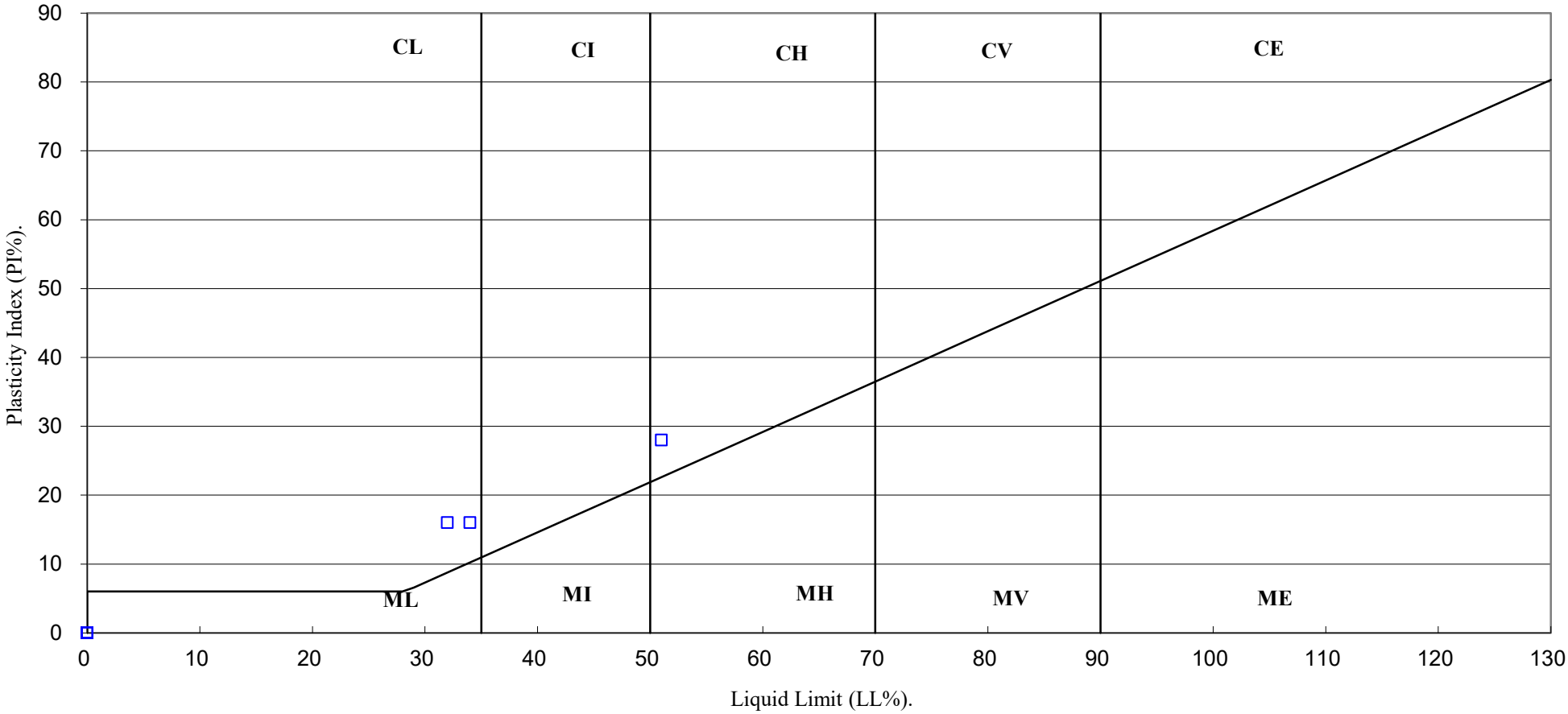
Contract No:

PSL19/4791

Client Ref:

19-0382

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Stornoway Deep Water Port	Contract No: PSL19/4791 Client Ref: 19-0382

SUMMARY OF SOIL DENSITY RELATED TESTS

(BS1377 : PART 2 & 4 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Retained 20mm %	Retained 37.5mm %	Method of compaction kg	Maximum Dry Density Mg/m^3	Minimum Dry Density Mg/m^3	Remarks
BH41	29	B	8.50	9.00	5.0	1.78	1.70						
BH41	53	B	14.00	14.20	25	2.01	1.61						
BH41	62	B	18.20	18.70	24	1.97	1.59						
BH47	12	B	4.50	5.00	29	1.92	1.49						
BH50	11	B	3.50	4.00	12	2.18	1.95						

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Stornoway Deep Water Port

Contract No:
PSL19/4791
Client Ref:
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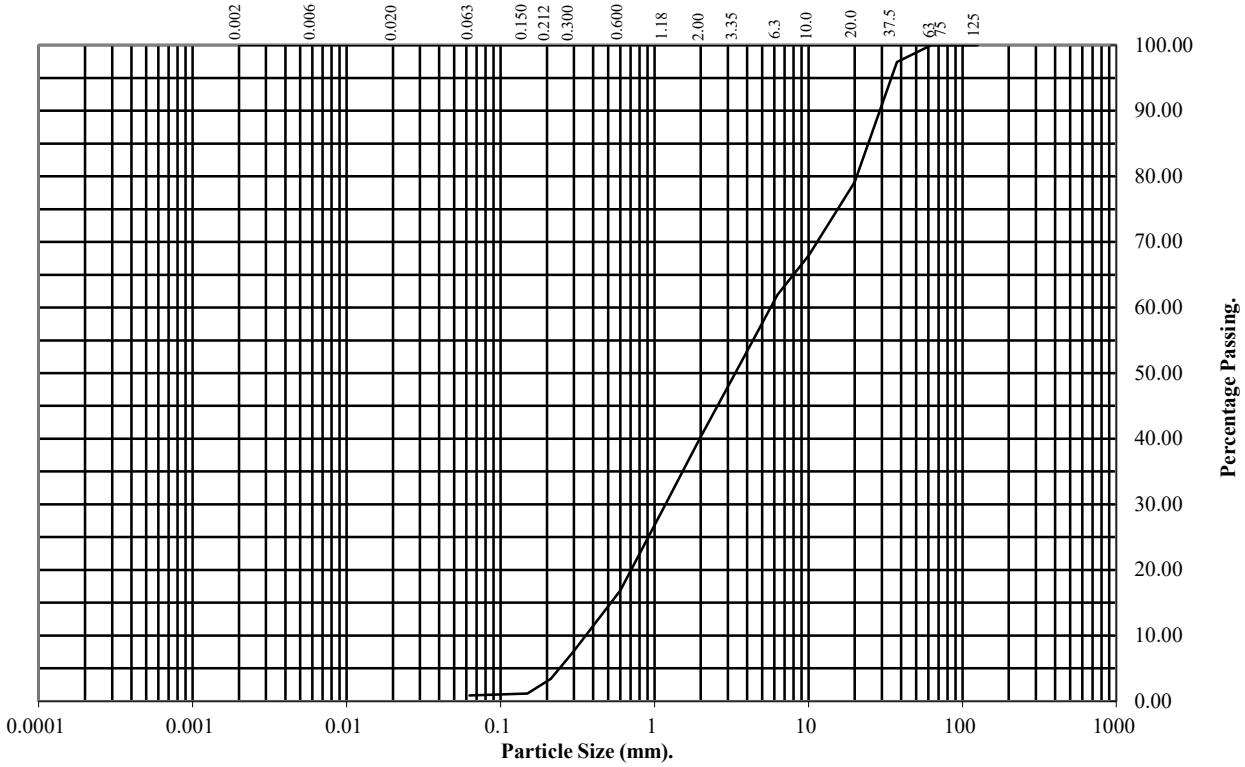
PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH41**	**Top Depth (m):**	**8.50**
Sample Number:	**29**	**Base Depth(m):**	**9.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	79
10	68
6.3	62
3.35	50
2	40
1.18	30
0.6	17
0.3	8
0.212	3
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	60
Sand	39
Silt/Clay	1

Remarks:

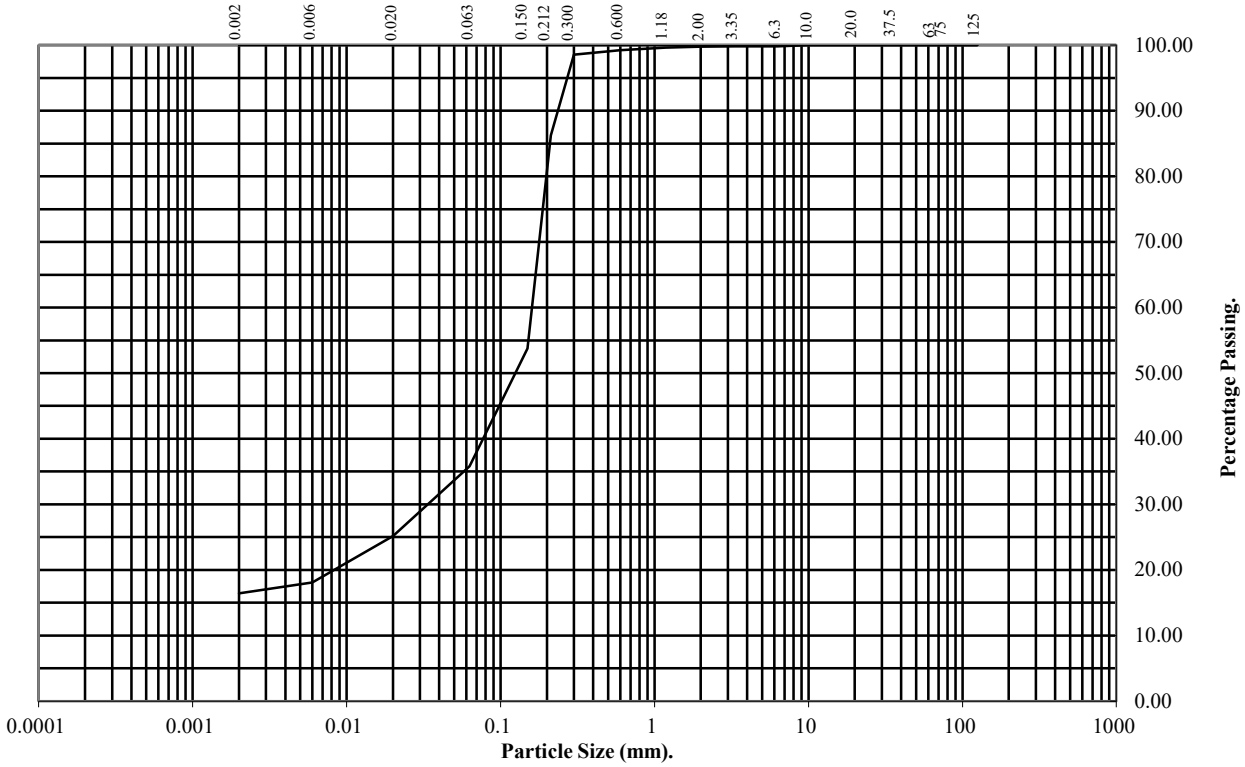
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH41**	**Top Depth (m):**	**14.00**
Sample Number:	**53**	**Base Depth(m):**	**14.20**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	99
0.3	99
0.212	86
0.15	54
0.063	36

Particle Diameter	Percentage Passing
0.02	25
0.006	18
0.002	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	64
Silt	20
Clay	16

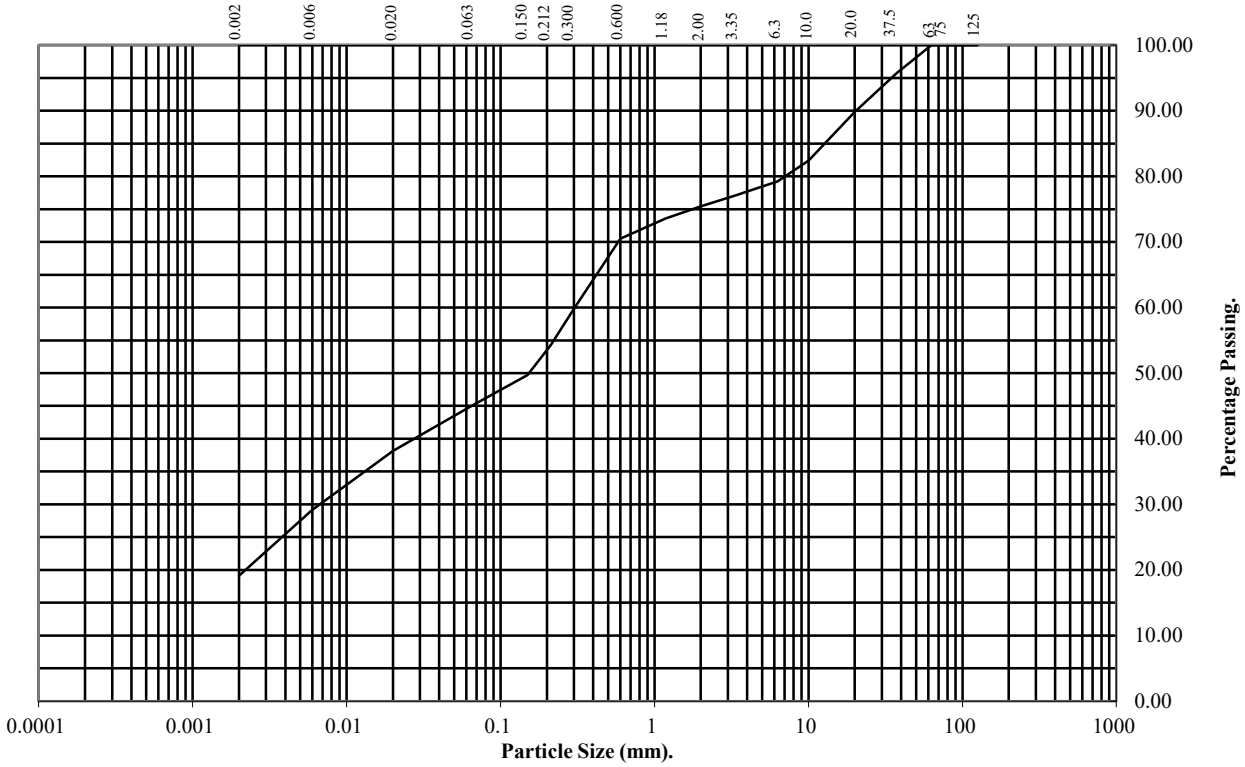
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH47**	**Top Depth (m):**	**4.50**
Sample Number:	**12**	**Base Depth(m):**	**5.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	90
10	82
6.3	79
3.35	77
2	75
1.18	74
0.6	71
0.3	60
0.212	54
0.15	50
0.063	45

Particle Diameter	Percentage Passing
0.02	38
0.006	29
0.002	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	30
Silt	26
Clay	19

Remarks:

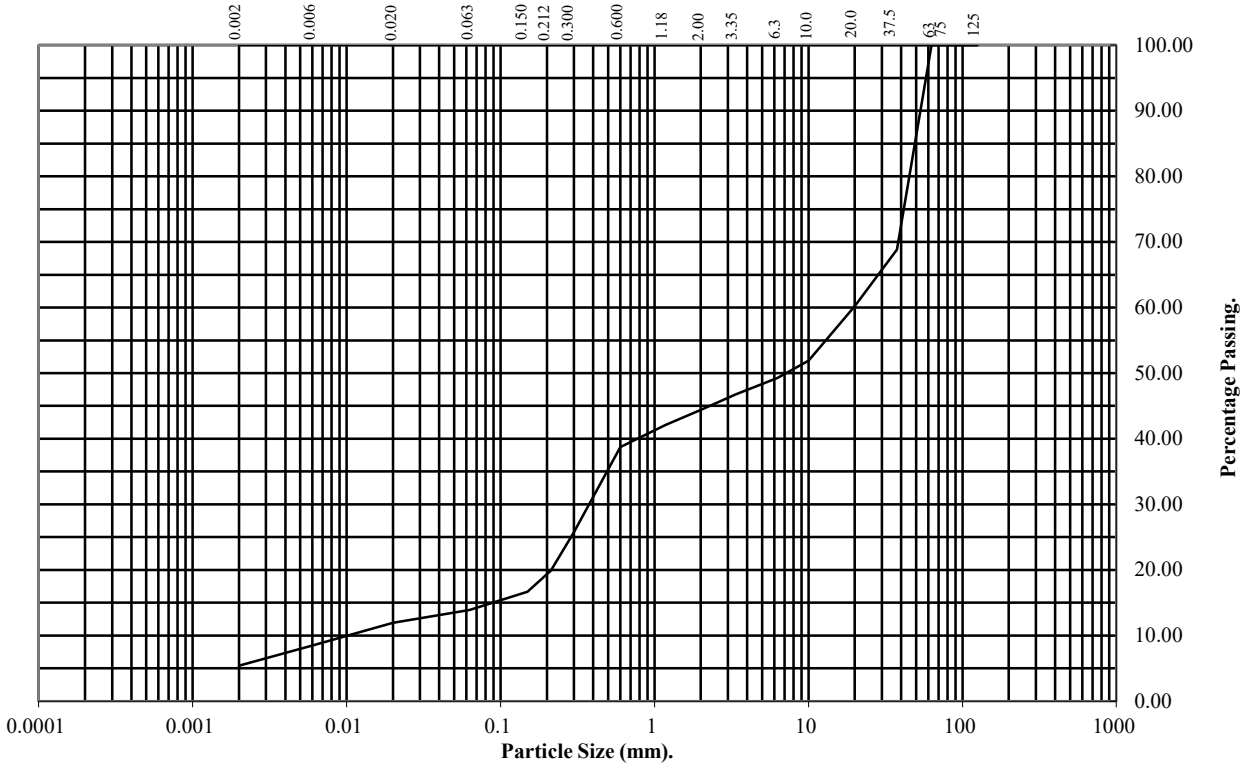
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH50**	**Top Depth (m):**	**3.50**
Sample Number:	**11**	**Base Depth(m):**	**4.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	69
20	60
10	52
6.3	49
3.35	47
2	44
1.18	42
0.6	39
0.3	26
0.212	20
0.15	17
0.063	14

Particle Diameter	Percentage Passing
0.02	12
0.006	8
0.002	5

Soil Fraction	Total Percentage
Cobbles	0
Gravel	56
Sand	30
Silt	9
Clay	5

Remarks:
See Summary of Soil Descriptions

ONE DIMENSIONAL CONSOLIDATION TEST

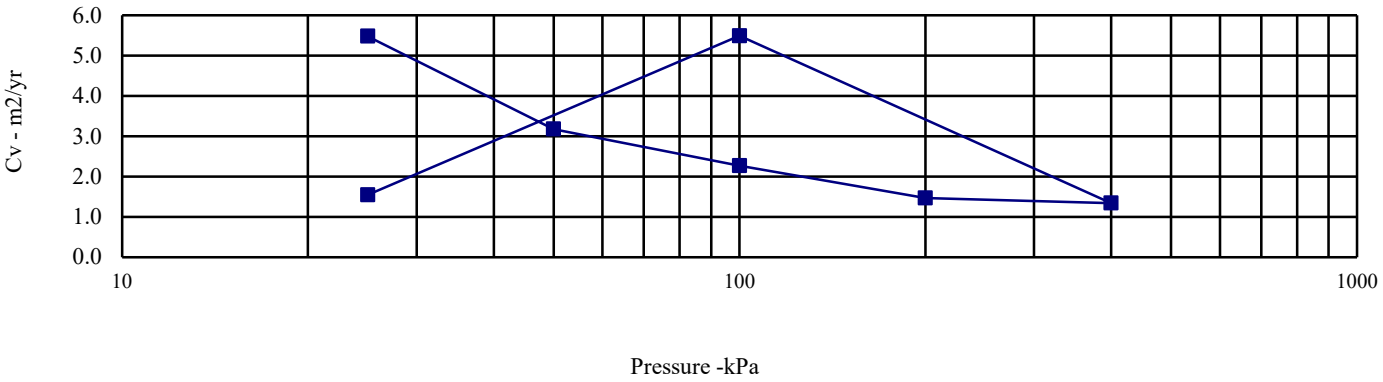
BS 1377: Part 5: 1990: Clause 3

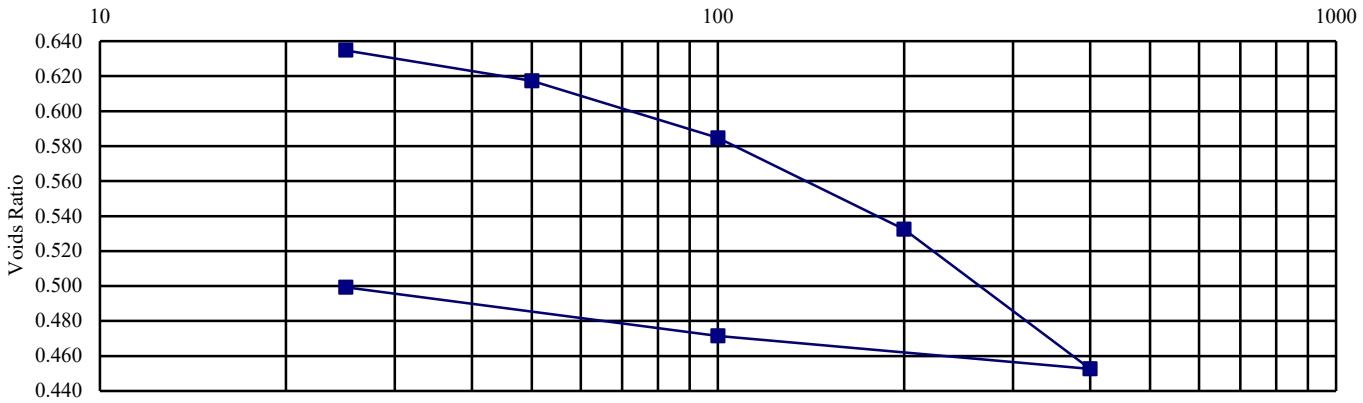
Hole Number: **BH41** **Top Depth (m):** **23.70**

Sample Number: **82** **Base Depth (m) :** **24.55**

Sample Type: **P**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27						
Bulk Density (Mg/m3):	2.04	0	25	0.528	5.479	Method used to	
Dry Density (Mg/m3):	1.60	25	50	0.426	3.175	determine CV:	T90
Voids Ratio:	0.657	50	100	0.404	2.266	Nominal temperature	
Degree of saturation:	110.5	100	200	0.330	1.468	during test ' C:	20
Height (mm):	19.774	200	400	0.261	1.343	Remarks:	
Diameter (mm)	74.955	400	100	0.043	5.491	See summary of soil descriptions	
Particle Density (Mg/m3): Assumed	2.65	100	25	0.252	1.543		





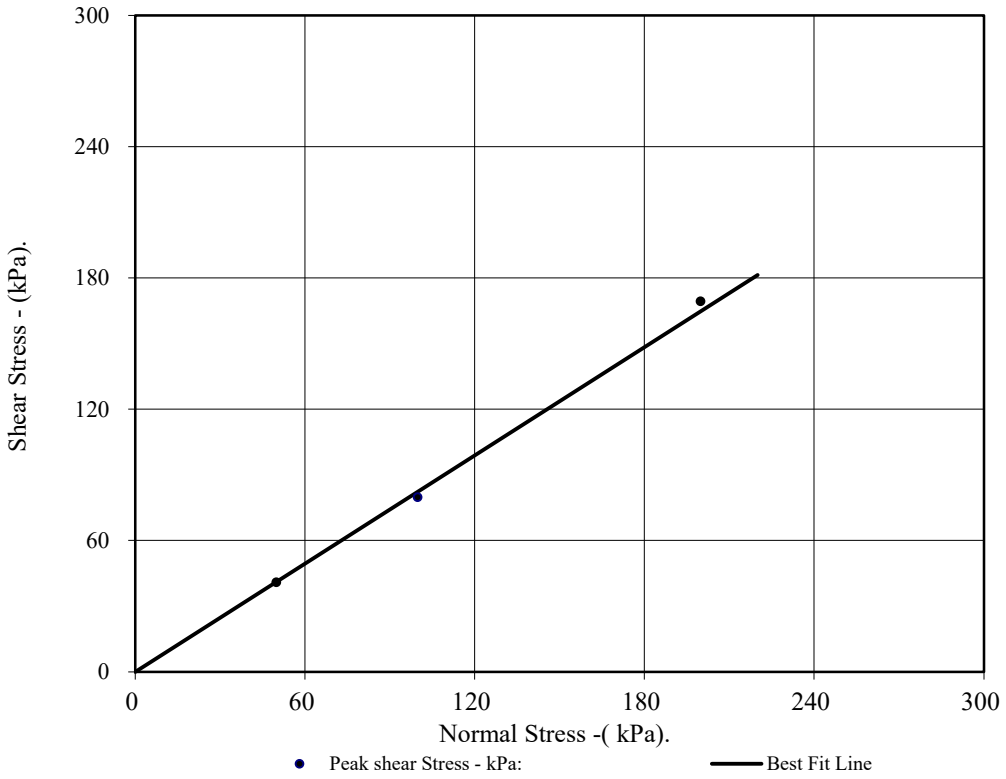
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port#**	**Contract No:** PSL19/4791 **Client Ref:** 19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**		Top Depth:	**8.50**
Sample Number:	**29**		Base Depth:	**9.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.9	5.9	5.9
Bulk Density - Mg/m3:	1.68	1.68	1.68
Dry Density - Mg/m3:	1.59	1.59	1.58
Voids Ratio:	0.667	0.671	0.672
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.66	19.52	19.07
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	7.51	4.80	5.11
Peak shear Stress - kPa:	41	80	169
Final Consolidated Conditions			
Moisture Content - %:	5.5	3.6	3.8
Bulk Density - Mg/m3:	1.72	1.73	1.76
Dry Density - Mg/m3:	1.63	1.66	1.70
Peak			
Angle of Shearing Resistance:(~~θ~~)	**40**		
Effective Cohesion - kPa:	**0**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

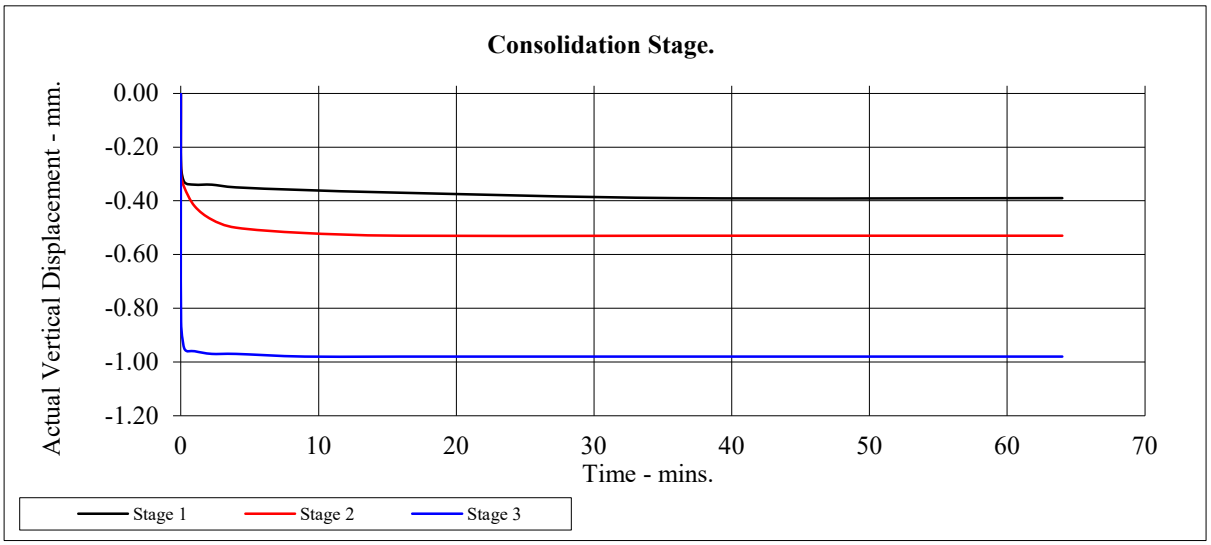
Contract No: PSL19/4791

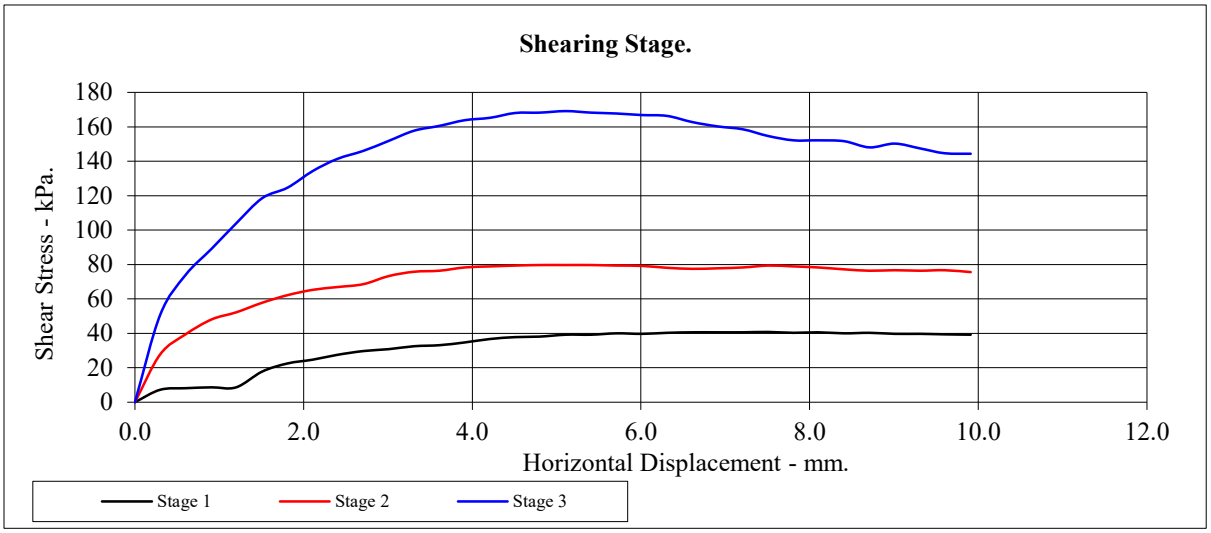
Client Ref: 19-0382

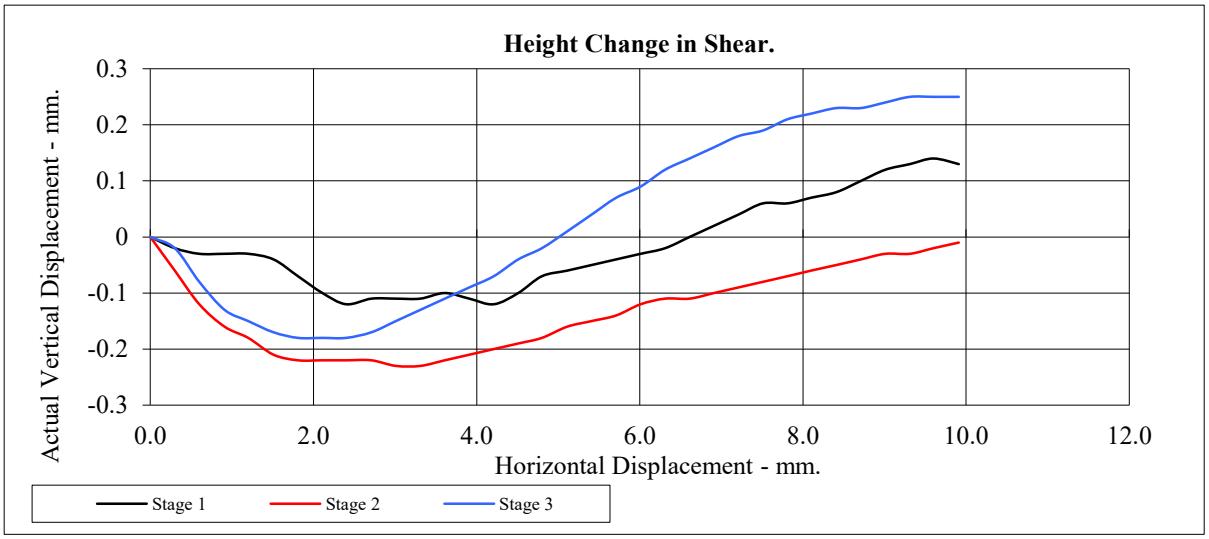
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**	Top Depth:	**8.50**
Sample Number:	**29**	Base Depth:	**9.00**





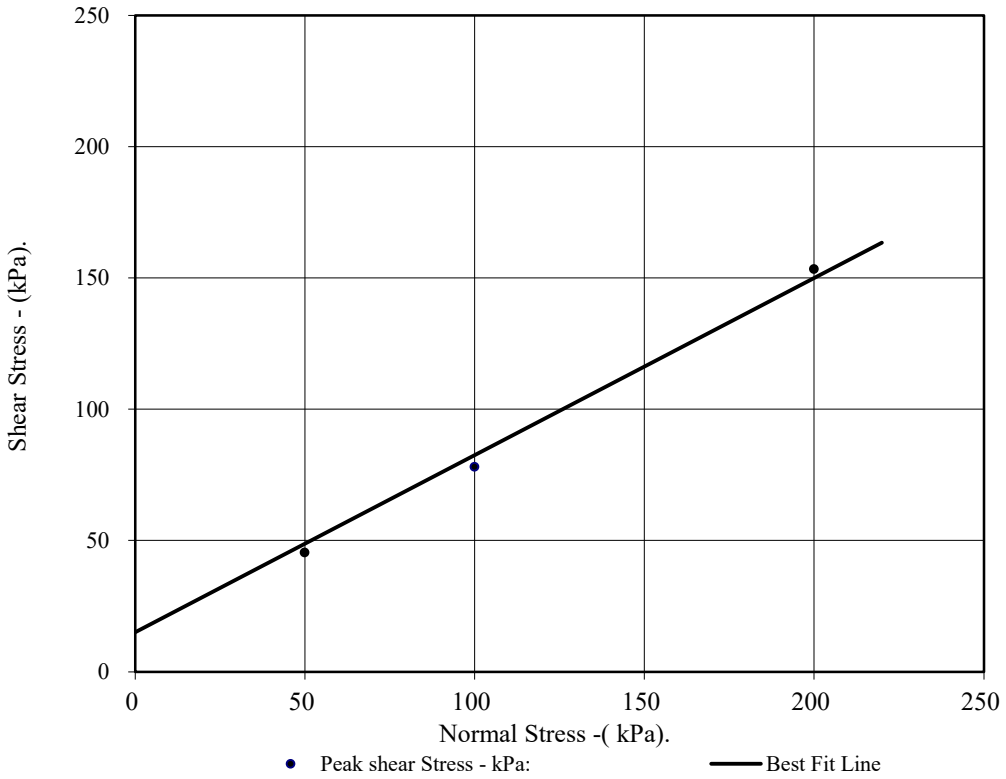


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**		Top Depth:	**14.00**	
Sample Number:	**53**		Base Depth:	**14.20**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	25	25	25
Bulk Density - Mg/m3:	2.02	2.01	2.01
Dry Density - Mg/m3:	1.61	1.60	1.60
Voids Ratio:	0.644	0.653	0.651
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.85	17.34	16.86
Shearing Stage			
Rate of Strain (mm/min)	0.042	0.042	0.042
Displacement at peak shear stress (mm)	4.10	4.33	6.68
Peak shear Stress - kPa:	45	78	153
Final Consolidated Conditions			
Moisture Content - %:	24	24	22
Bulk Density - Mg/m3:	2.26	2.32	2.39
Dry Density - Mg/m3:	1.82	1.88	1.96
Peak			
Angle of Shearing Resistance:(~~θ~~)	**34**		
Effective Cohesion - kPa:	**15**		

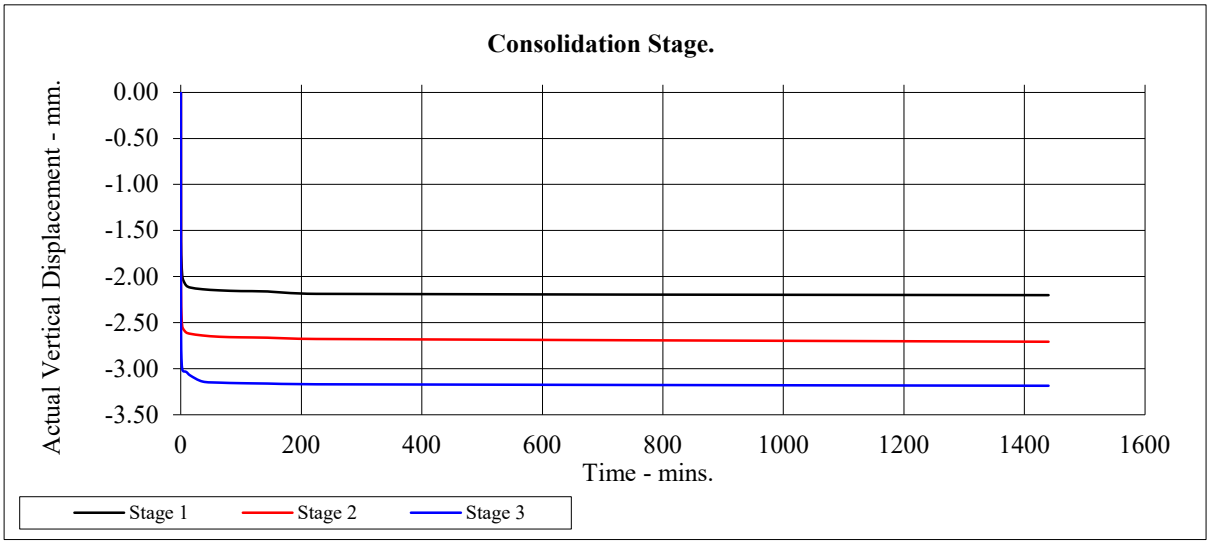


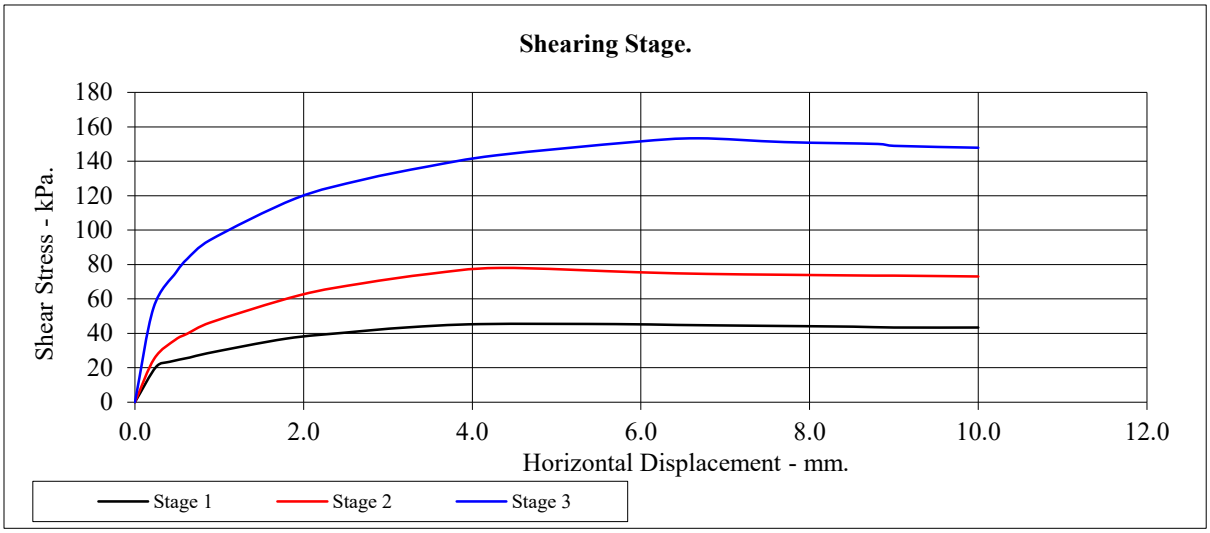
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4791 **Client Ref:** 19-0382

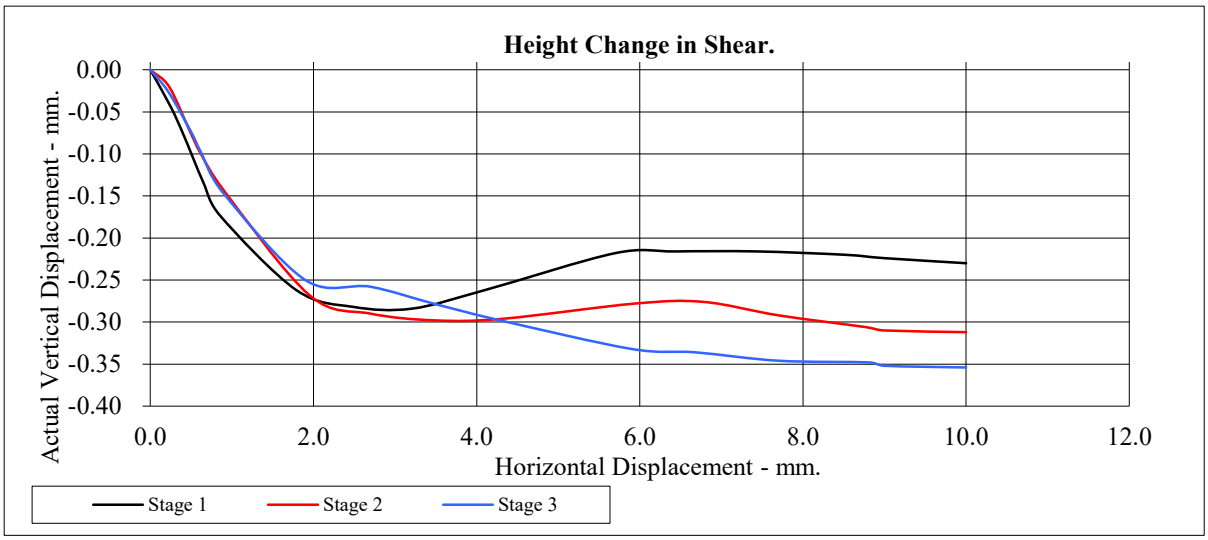
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**	Top Depth:	**14.00**
Sample Number:	**53**	Base Depth:	**14.20**





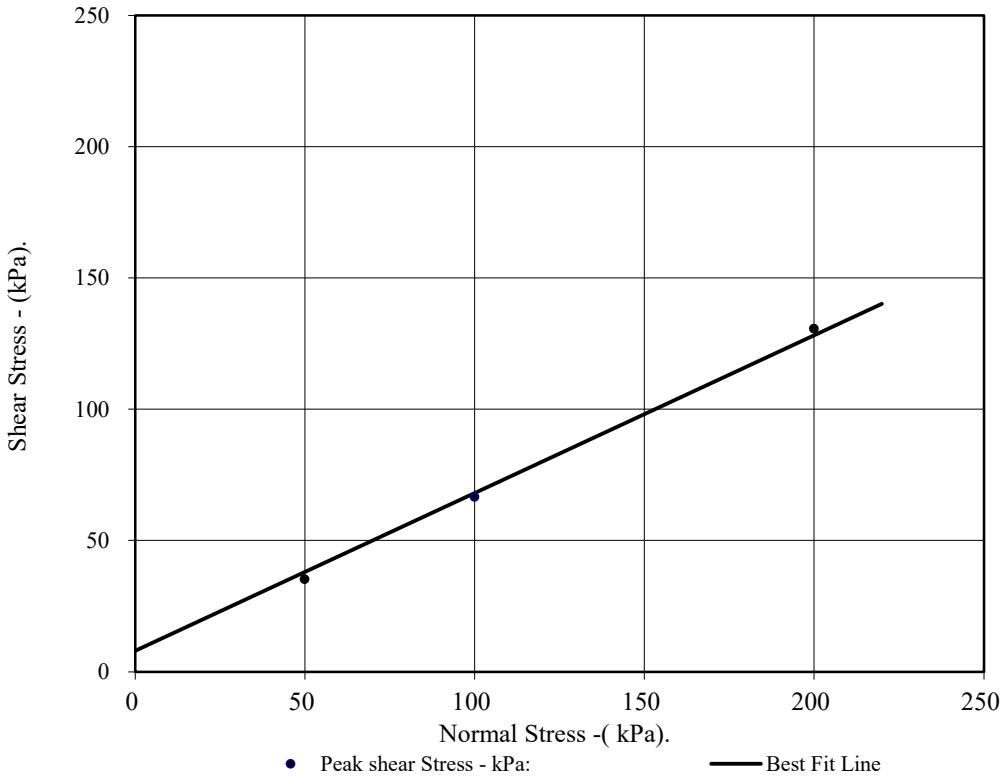


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**		Top Depth:	**18.20**	
Sample Number:	**62**		Base Depth:	**18.70**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	24	24	24
Bulk Density - Mg/m3:	1.97	1.98	1.97
Dry Density - Mg/m3:	1.59	1.59	1.58
Voids Ratio:	0.669	0.666	0.672
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.04	15.92	15.33
Shearing Stage			
Rate of Strain (mm/min)	0.038	0.038	0.038
Displacement at peak shear stress (mm)	9.00	8.44	5.90
Peak shear Stress - kPa:	35	67	131
Final Consolidated Conditions			
Moisture Content - %:	25	24	22
Bulk Density - Mg/m3:	2.32	2.49	2.58
Dry Density - Mg/m3:	1.86	2.01	2.12
Peak			
Angle of Shearing Resistance:(~~θ~~)	**31**		
Effective Cohesion - kPa:	**8**		

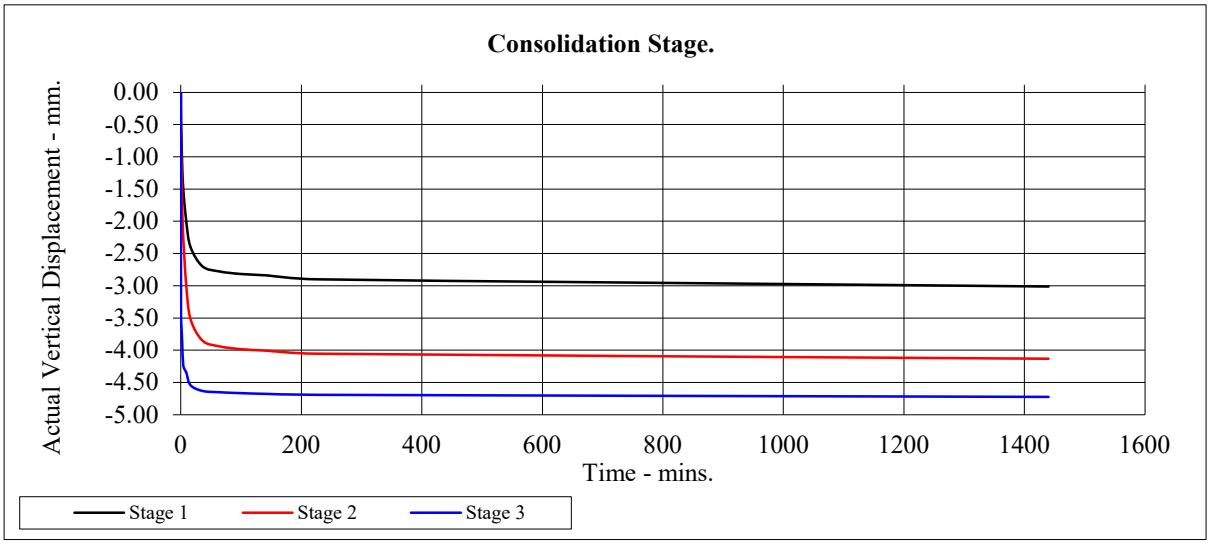


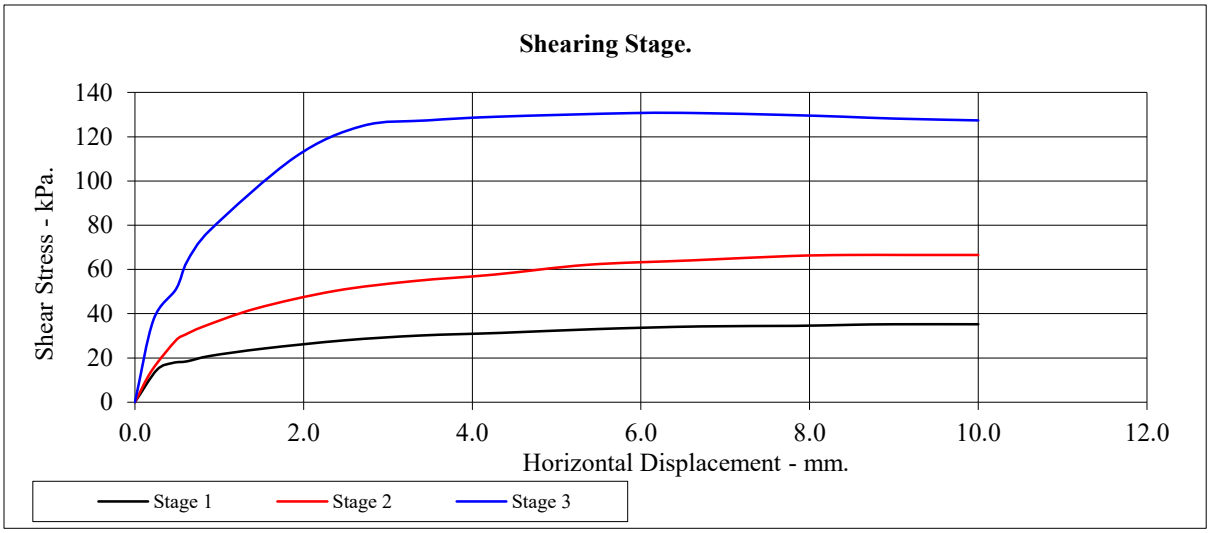
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4791 **Client Ref:** 19-0382

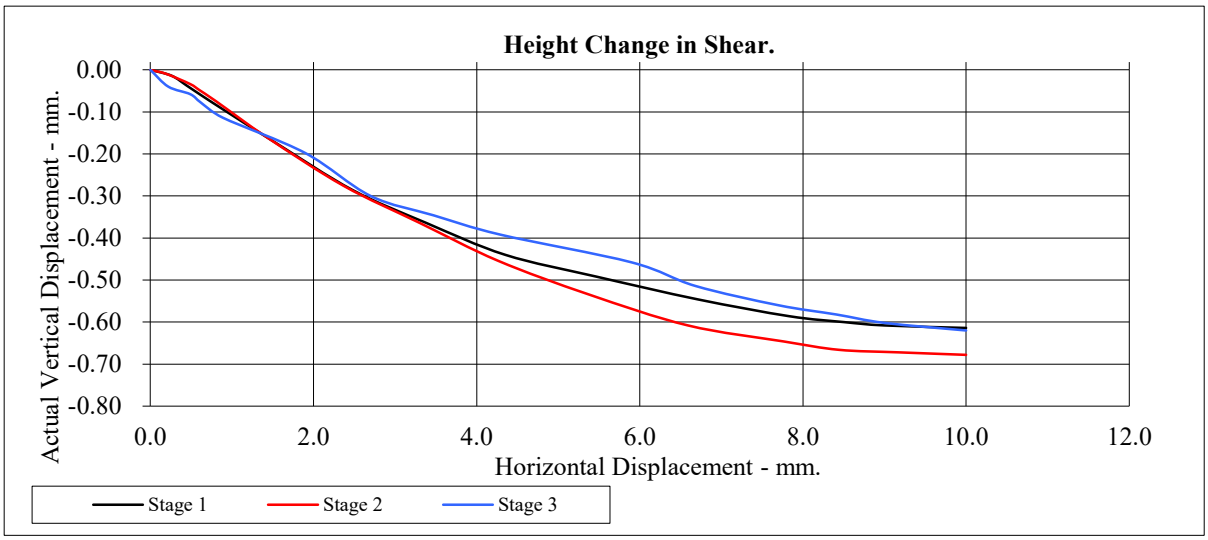
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH41**	Top Depth:	**18.20**
Sample Number:	**62**	Base Depth:	**18.70**







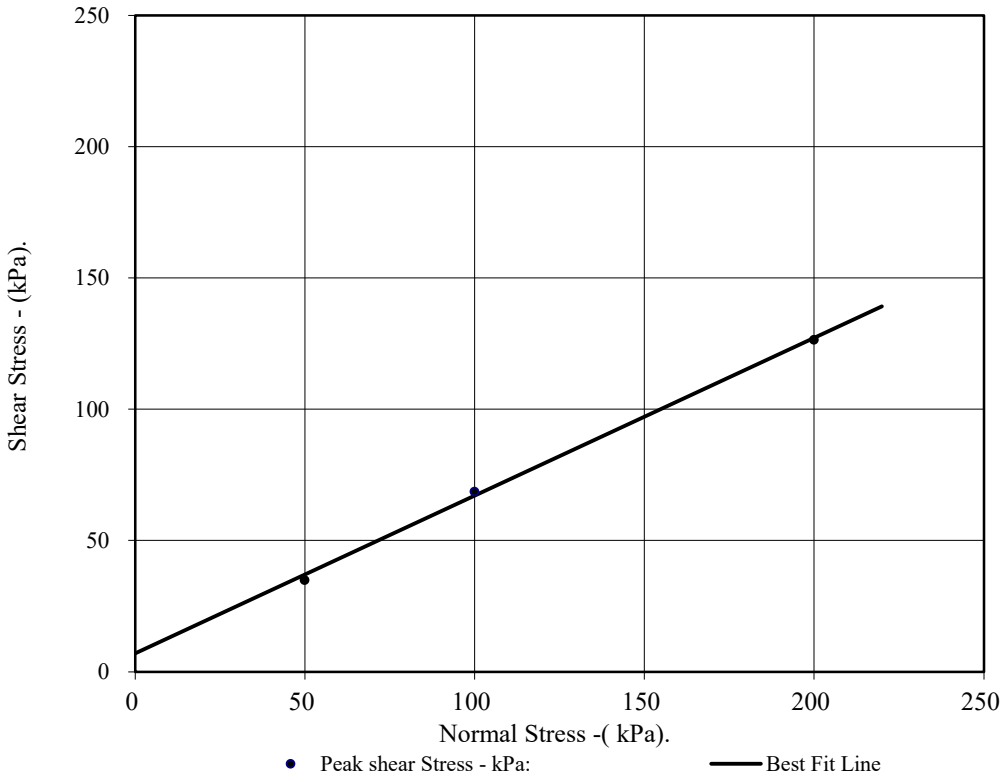
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No: PSL19/4791** **Client Ref: 19-0382**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH47**		Top Depth:	**4.50**
Sample Number:	**12**		Base Depth:	**5.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	29	29	29
Bulk Density - Mg/m3:	1.92	1.92	1.92
Dry Density - Mg/m3:	1.49	1.49	1.49
Voids Ratio:	0.784	0.781	0.782
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	16.78	15.91	15.20
Shearing Stage			
Rate of Strain (mm/min)	0.041	0.041	0.041
Displacement at peak shear stress (mm)	9.00	8.40	8.28
Peak shear Stress - kPa:	35	69	126
Final Consolidated Conditions			
Moisture Content - %:	29	27	27
Bulk Density - Mg/m3:	2.29	2.42	2.53
Dry Density - Mg/m3:	1.78	1.91	1.99
Peak			
Angle of Shearing Resistance:(~~θ~~)	**31**		
Effective Cohesion - kPa:	**7**		

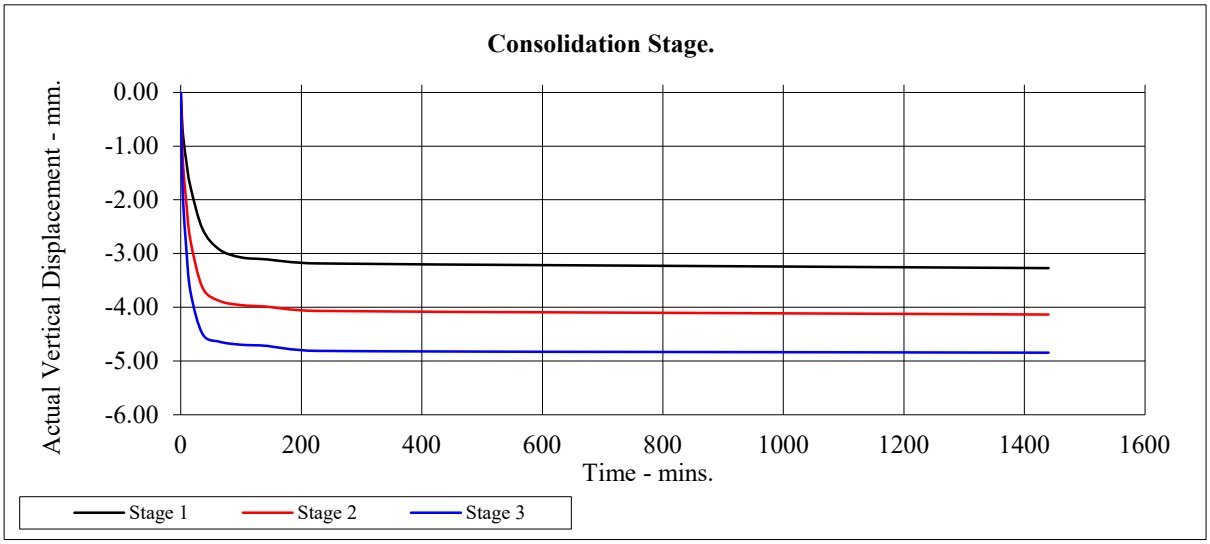


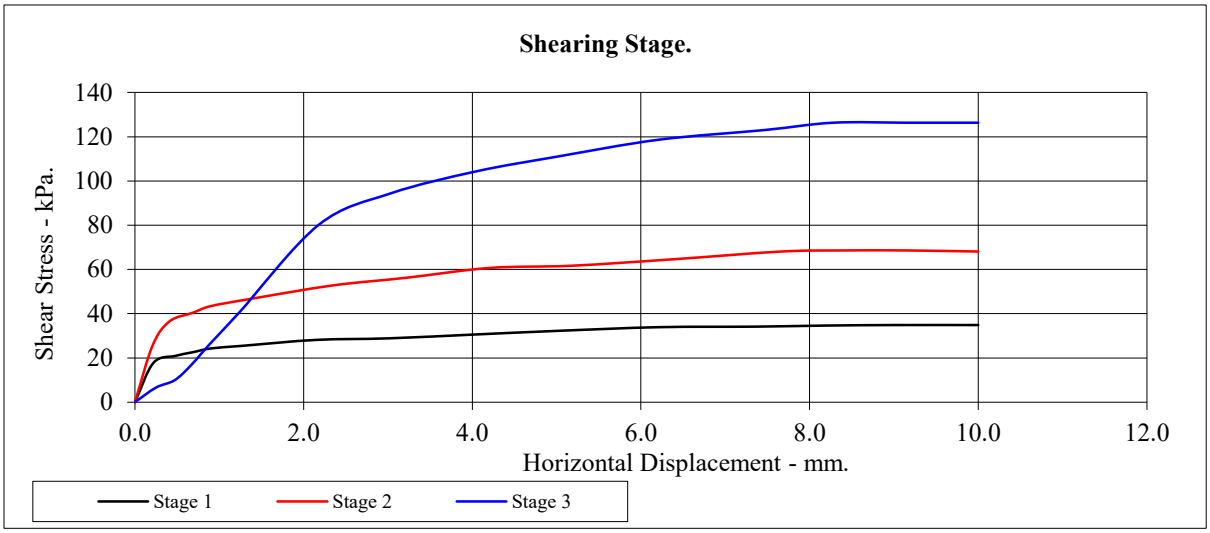
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4791** **Client Ref:** **19-0382**

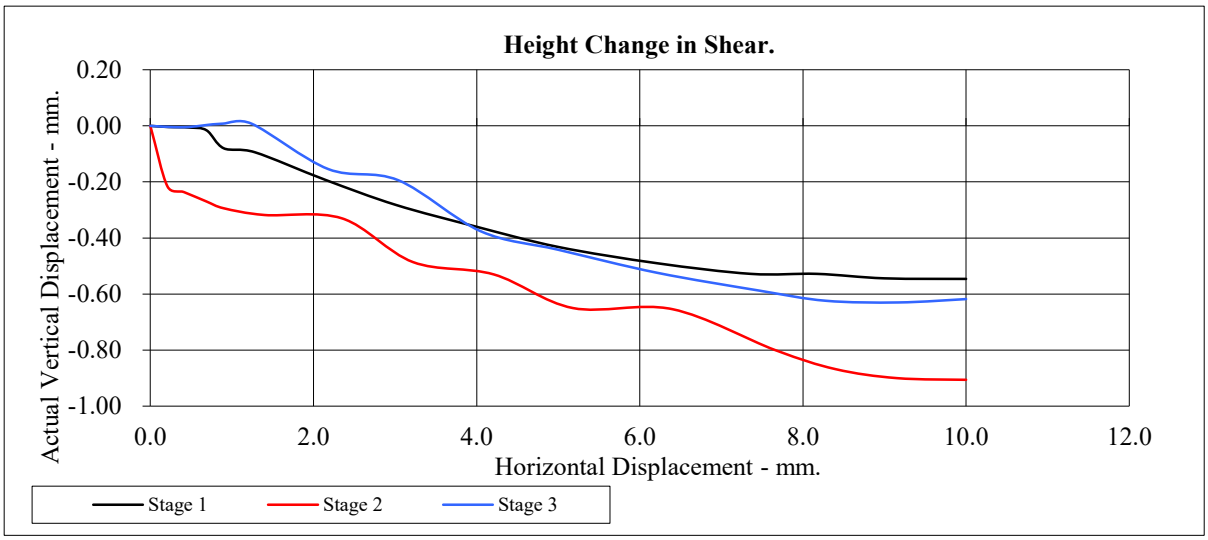
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH47**	Top Depth:	**4.50**
Sample Number:	**12**	Base Depth:	**5.00**







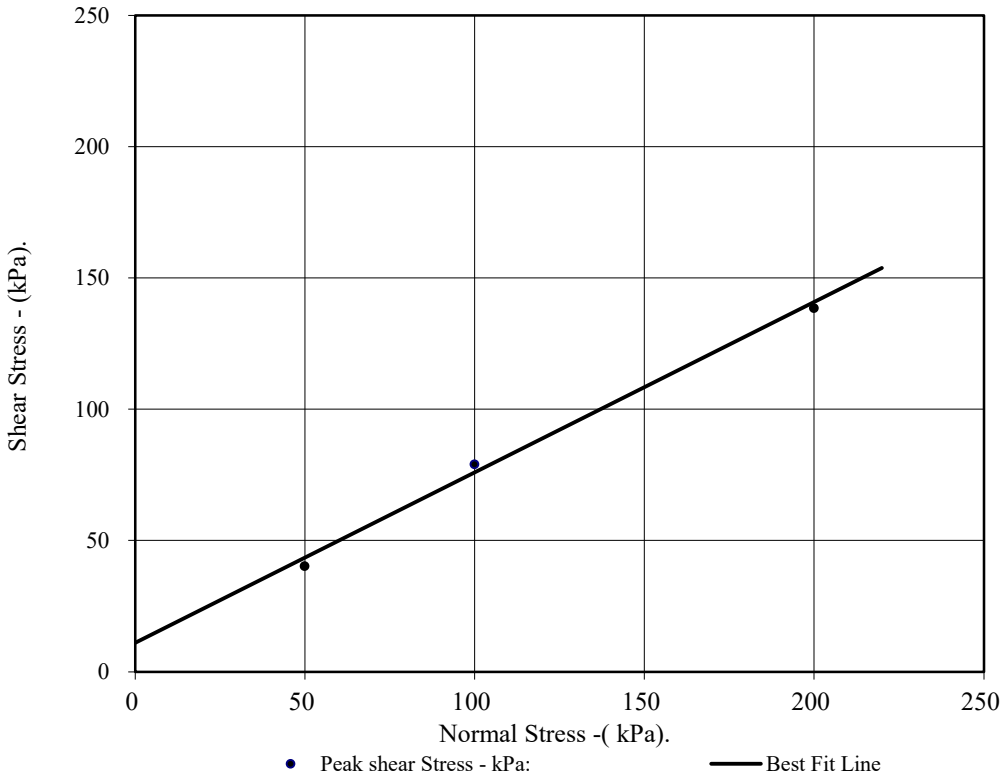
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4791** **Client Ref:** **19-0382**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH48**		Top Depth:	**6.50**	
Sample Number:	**19**		Base Depth:	**7.00**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	35	35	35
Bulk Density - Mg/m3:	1.86	1.86	1.86
Dry Density - Mg/m3:	1.38	1.38	1.38
Voids Ratio:	0.924	0.924	0.921
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	16.52	15.90	15.41
Shearing Stage			
Rate of Strain (mm/min)	0.051	0.051	0.051
Displacement at peak shear stress (mm)	9.17	8.48	7.32
Peak shear Stress - kPa:	40	79	138
Final Consolidated Conditions			
Moisture Content - %:	29	26	24
Bulk Density - Mg/m3:	2.26	2.35	2.42
Dry Density - Mg/m3:	1.74	1.86	1.96
Peak			
Angle of Shearing Resistance:(~~θ~~)	**33**		
Effective Cohesion - kPa:	**11**		

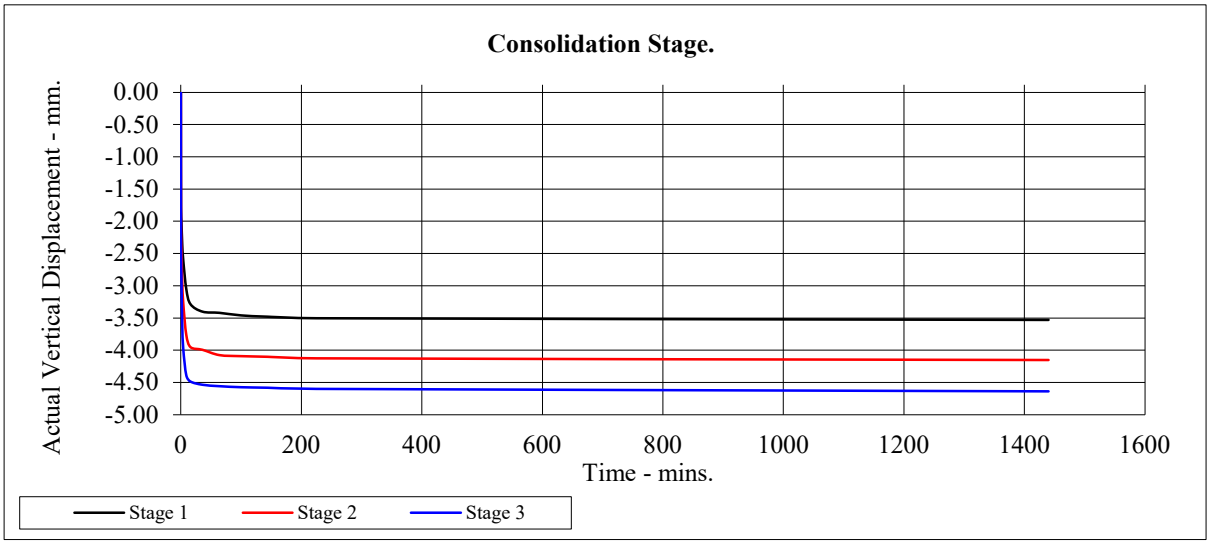


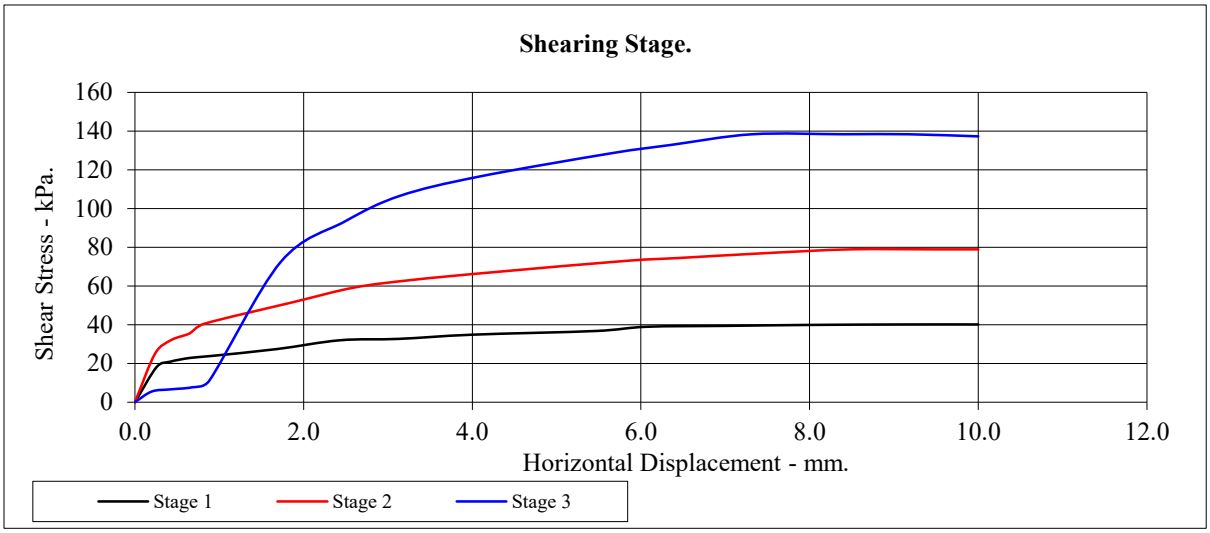
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4791 **Client Ref:** 19-0382

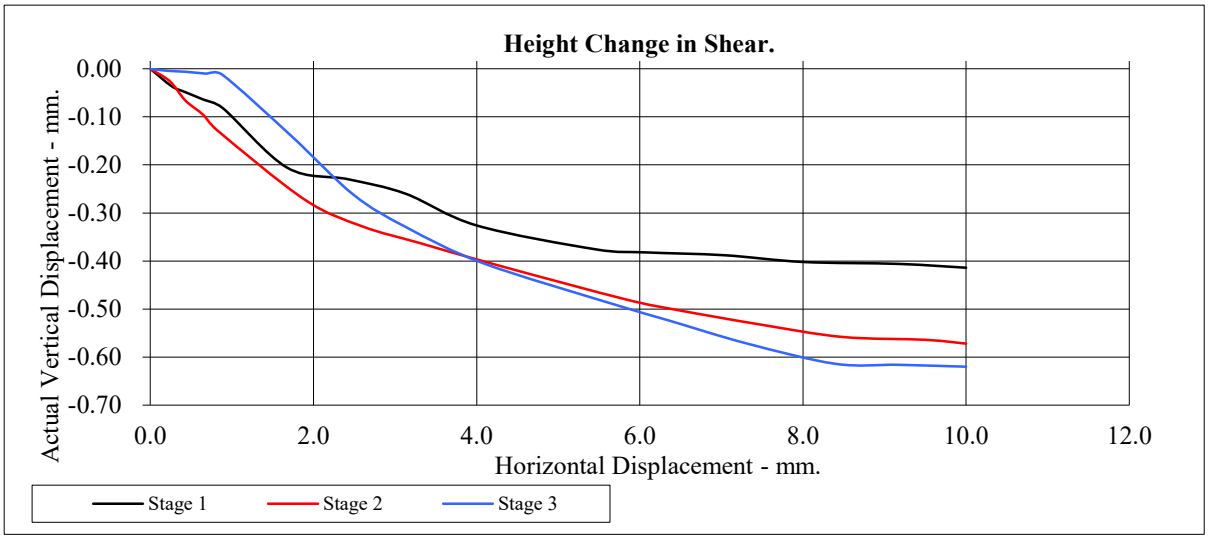
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH48**	Top Depth:	**6.50**
Sample Number:	**19**	Base Depth:	**7.00**





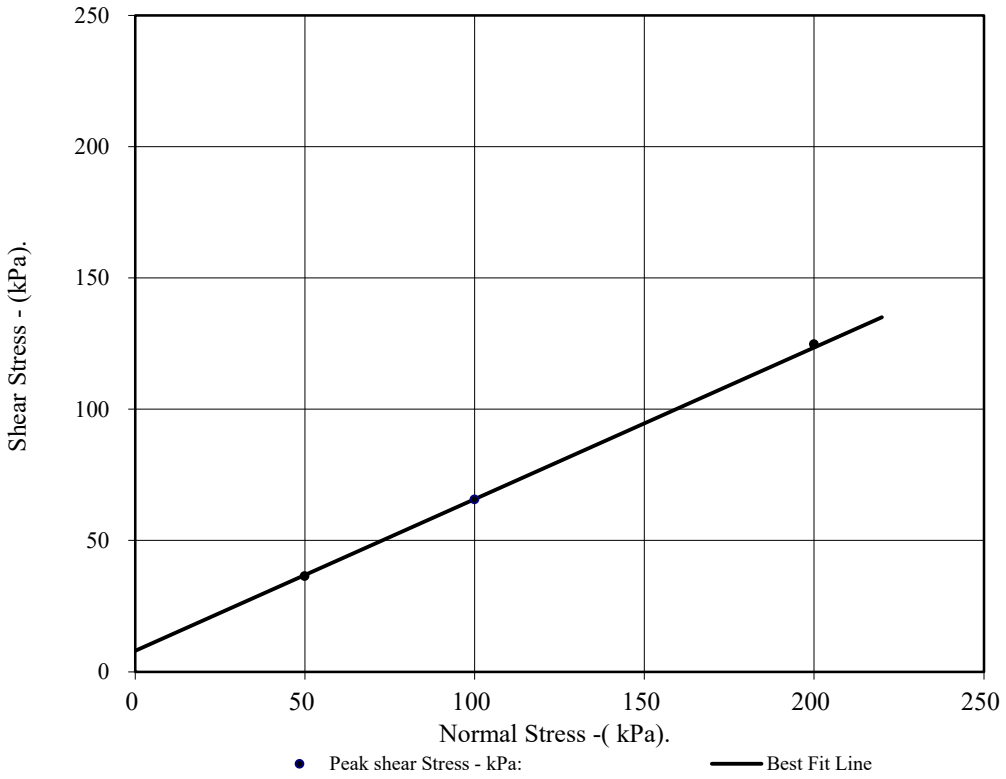


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH50**		Top Depth:	**1.50**
Sample Number:	**5**		Base Depth:	**2.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	44	44	44
Bulk Density - Mg/m3:	1.88	1.89	1.89
Dry Density - Mg/m3:	1.31	1.31	1.31
Voids Ratio:	1.030	1.027	1.026
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.07	16.50	15.14
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.60	9.91	9.91
Peak shear Stress - kPa:	36	66	125
Final Consolidated Conditions			
Moisture Content - %:	44	40	36
Bulk Density - Mg/m3:	2.21	2.29	2.50
Dry Density - Mg/m3:	1.54	1.64	1.83
Peak			
Angle of Shearing Resistance:(~~θ~~)	**30**		
Effective Cohesion - kPa:	**8**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

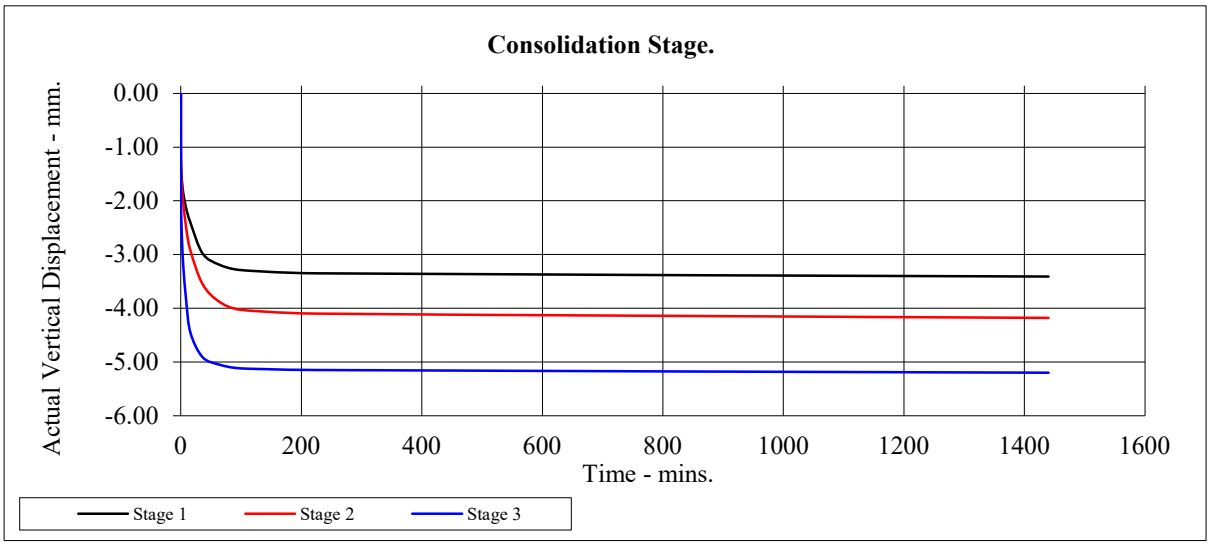
Stornoway Deep Water Port

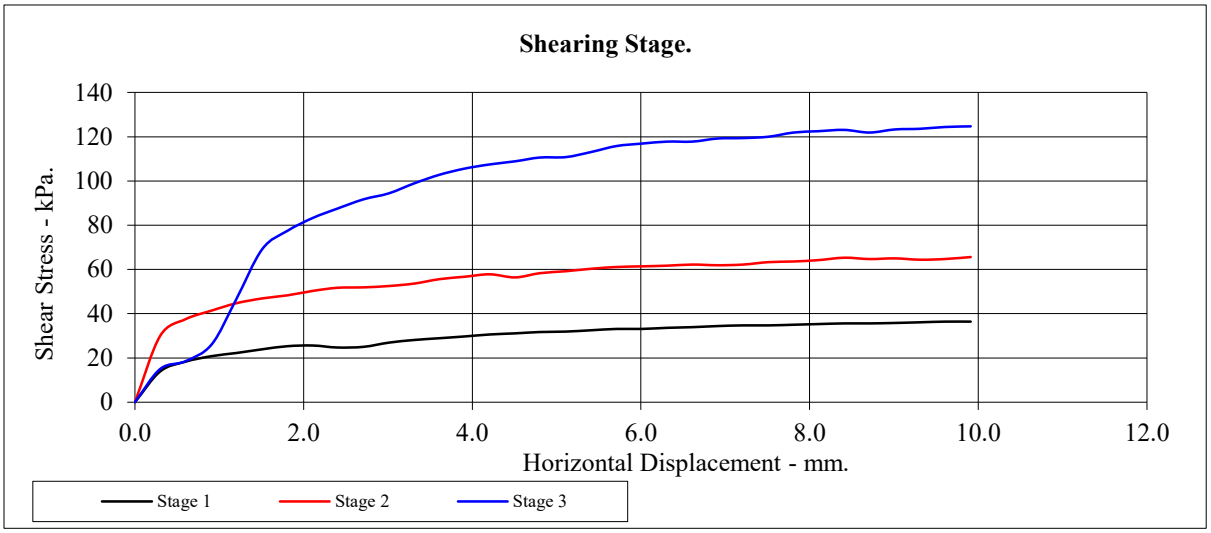
Contract No:
PSL19/4791
Client Ref:
19-0382

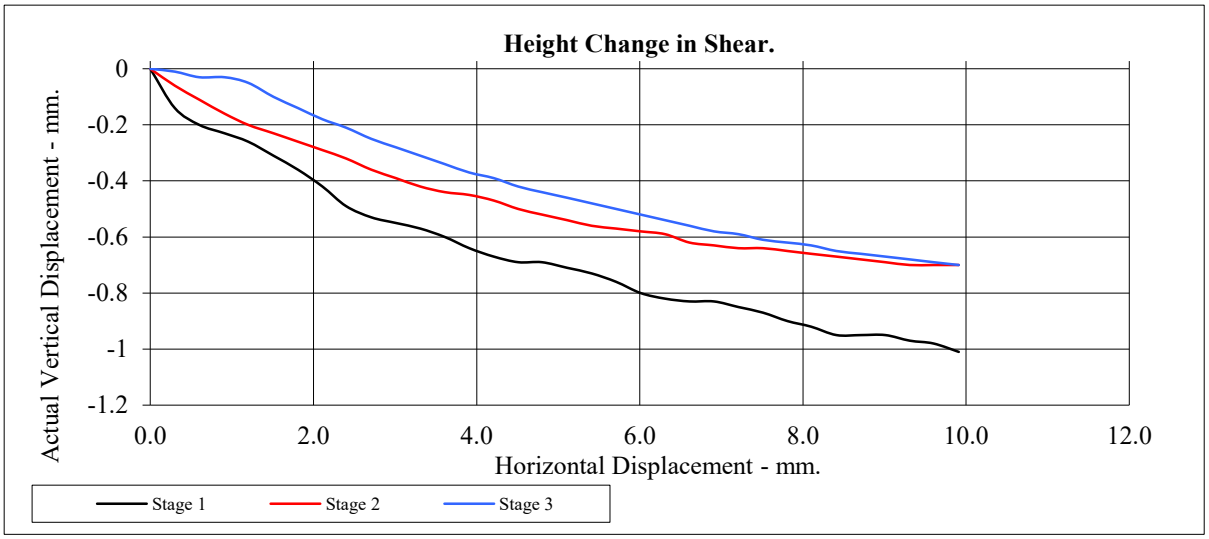
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH50**	Top Depth:	**1.50**
Sample Number:	**5**	Base Depth:	**2.00**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

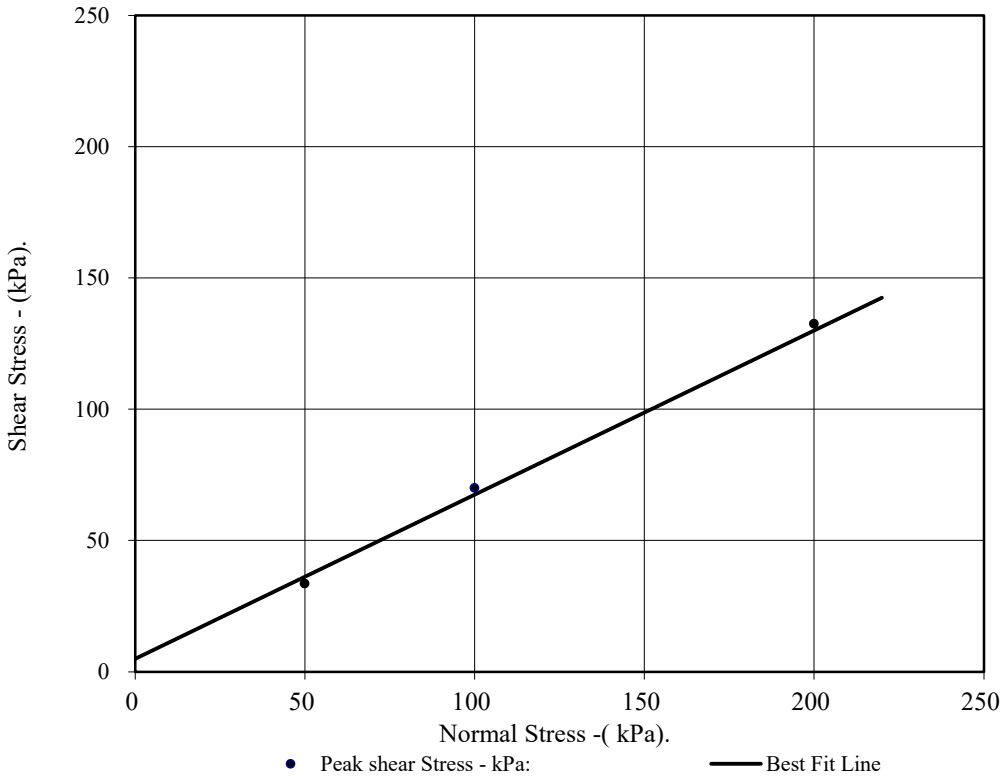
Contract No:	
PSL19/4791	
Client Ref:	
19-0382	

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH50**		Top Depth:	**3.50**	
Sample Number:	**11**		Base Depth:	**4.00**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	16	16	16
Bulk Density - Mg/m3:	2.15	2.15	2.15
Dry Density - Mg/m3:	1.85	1.86	1.86
Voids Ratio:	0.431	0.425	0.427
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	18.51	17.16	15.97
Shearing Stage			
Rate of Strain (mm/min)	0.056	0.056	0.056
Displacement at peak shear stress (mm)	6.64	9.00	8.40
Peak shear Stress - kPa:	34	70	132
Final Consolidated Conditions			
Moisture Content - %:	19	18	18
Bulk Density - Mg/m3:	2.33	2.51	2.69
Dry Density - Mg/m3:	1.96	2.13	2.29
Peak			
Angle of Shearing Resistance:(~~θ~~)	**32**		
Effective Cohesion - kPa:	**5**		

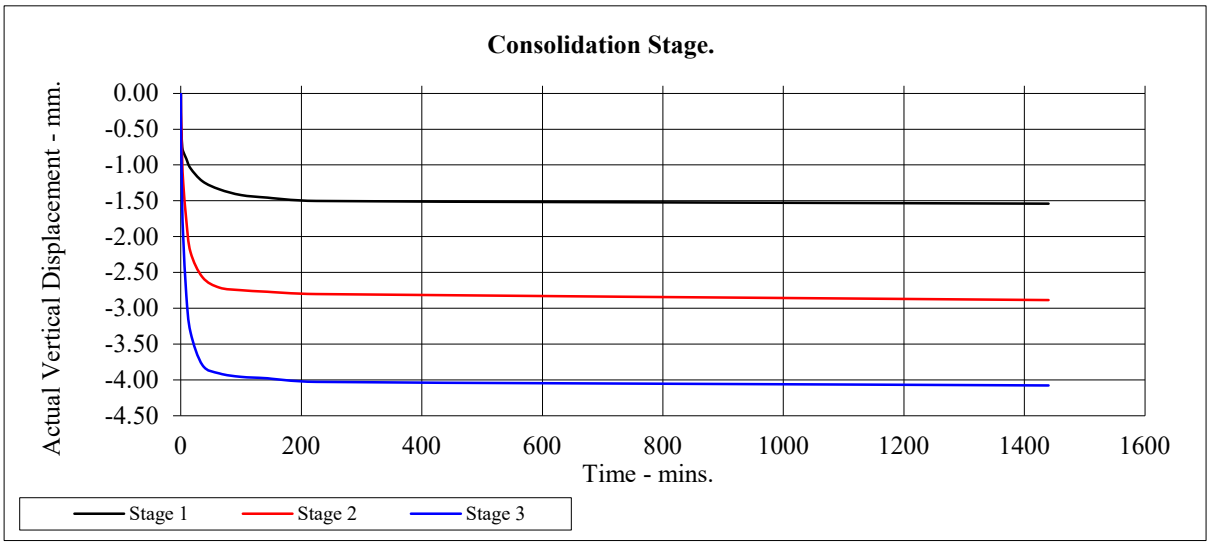


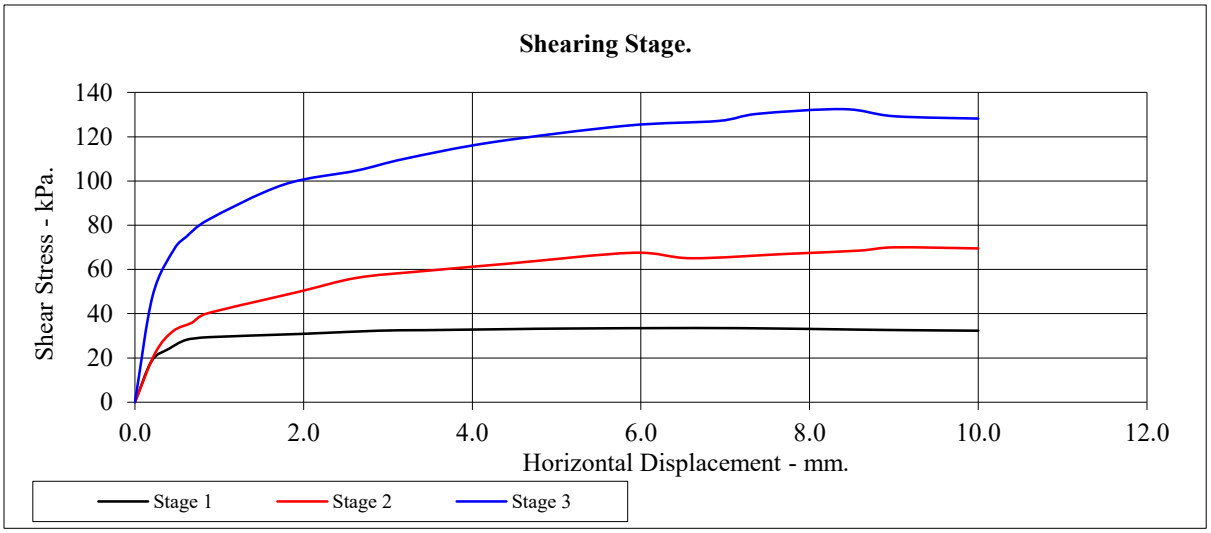
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4791 **Client Ref:** 19-0382

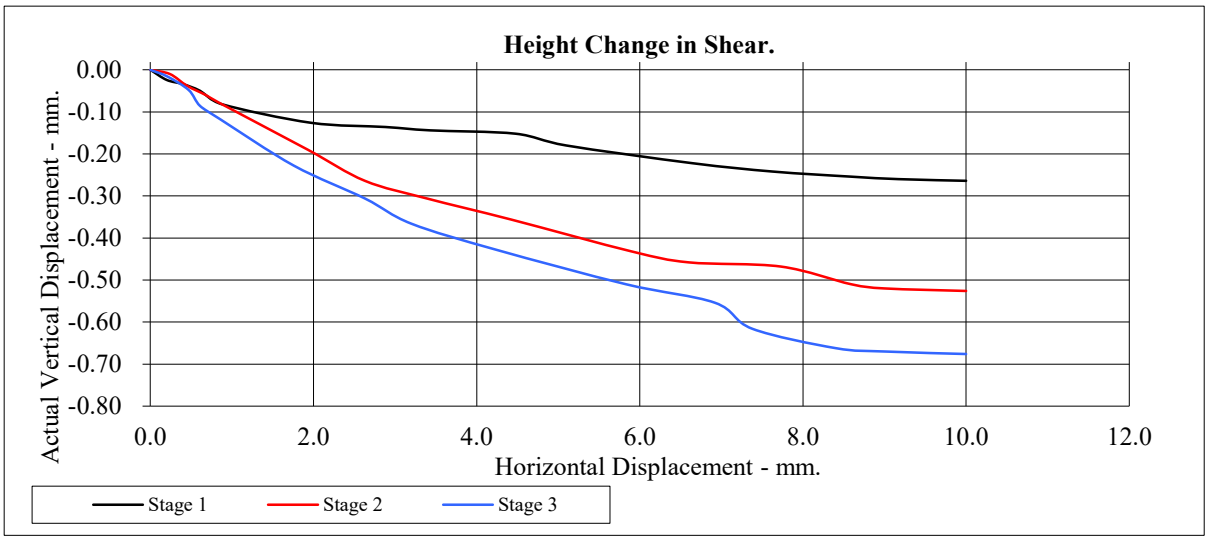
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH50**	Top Depth:	**3.50**
Sample Number:	**11**	Base Depth:	**4.00**





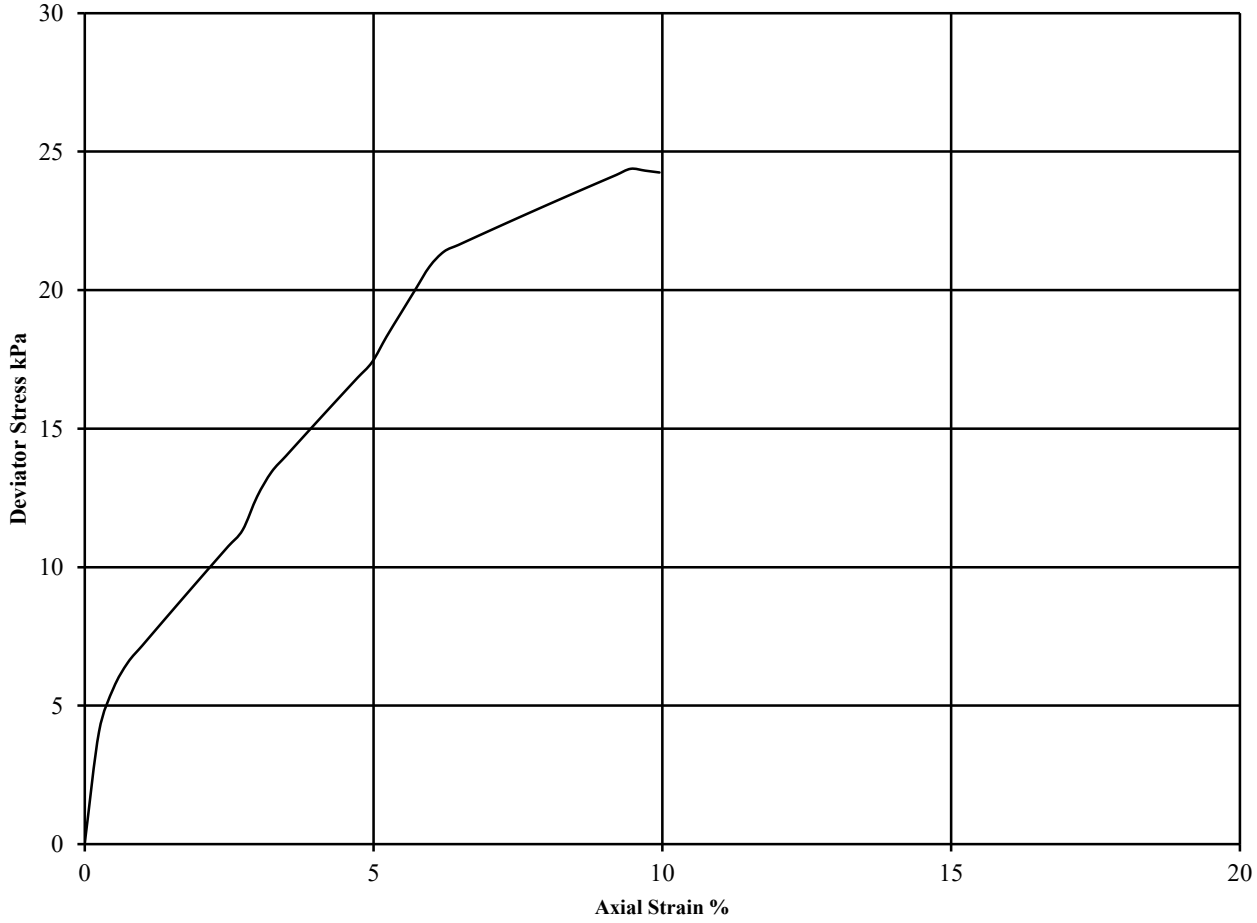


UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**BH50**	**Top Depth (m):**	**7.00**
Sample Number:	**17**	**Base Depth (m):**	**8.00**
Sample Type	**P**		



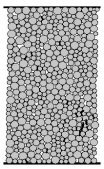
Diameter (mm):		103	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	33	1.90	1.43	50	11	6	2.7		0.36 0.36 0.35
				100	17	9	5.0		See summary of soil descriptions
				200	24	12	9.5	Plastic	

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			15.20-15.70m B56
Description			See summary of soil descriptions.
Type			Remoulded using hand tamped method.
Initial Sample Length	L_0	(mm)	197.4
Initial Sample Diameter	D_0	(mm)	99.0
Initial Sample Weight	W_0	(gr)	2347.5
Initial Bulk Density	ρ_0	(Mg/m3)	1.54
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	80		
Initial Dry Density	ρ_{di}	(Mg/m3)	0.86		
Initial Voids Ratio	e_i	.	2.096		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	58		
Final Dry Density	ρ_{df}	(Mg/m3)	1.02		
Final Voids Ratio	e_f	.	1.609		
Final Degree of Saturation	S_f	(%)	94.9		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	2.00	14.39	19.99
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	67.0	106.7	176.2
Minor Stress At Failure	σ_3'	(kPa)	16.0	33.0	65.0
Major Stress At Failure	σ_1'	(kPa)	83.0	139.7	241.2
Principal Stress At Failure	σ_1'/σ_3'		5.189	4.233	3.710

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 15.20-15.70m B56
		Test Date	14/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	15.20-15.70m B56
Client	Causeway Geotech Ltd	Depth	15.20-15.70m B56

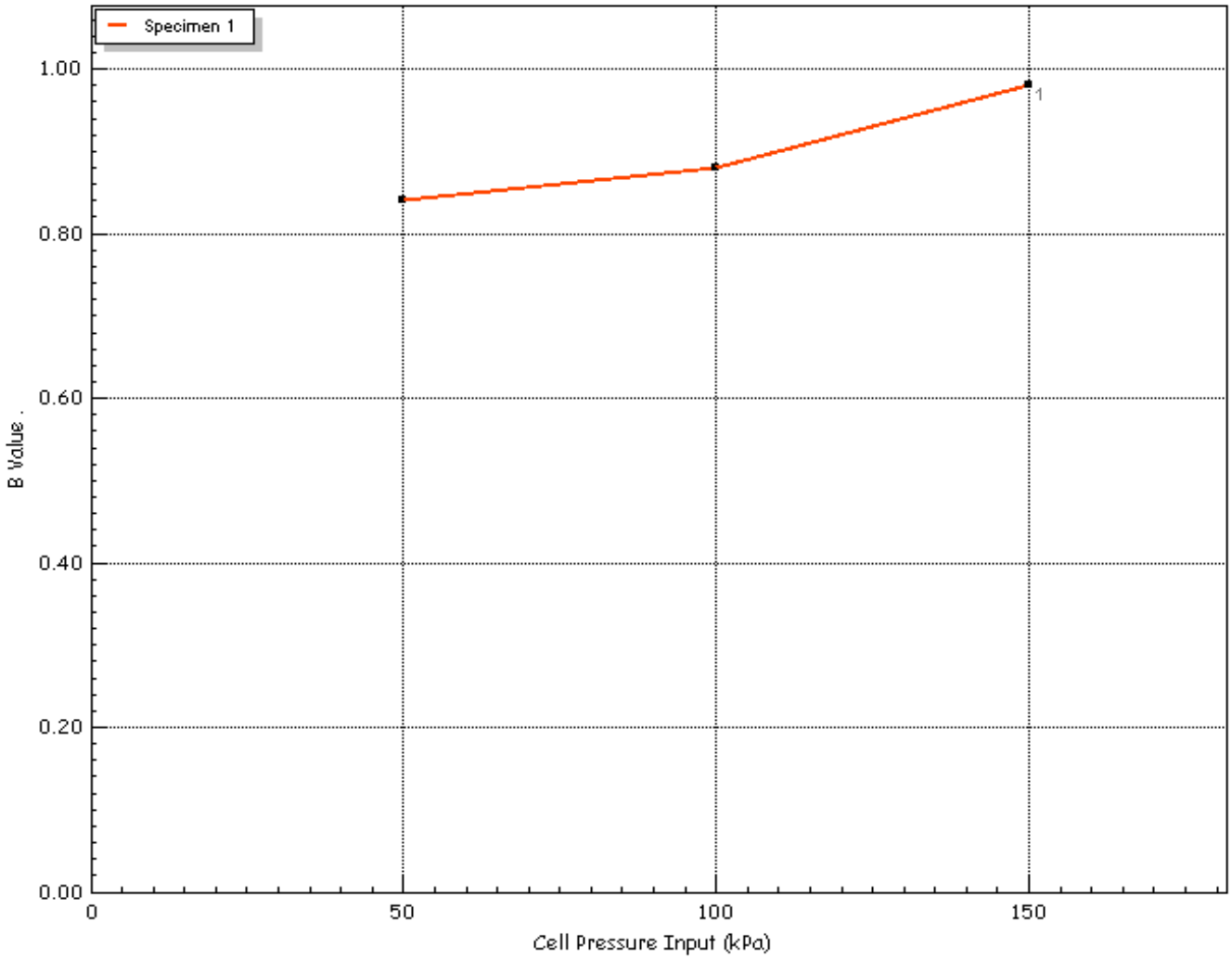
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	133
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 15.20-15.70m B56
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	15.20-15.70m B56
		Depth	15.20-15.70m B56

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

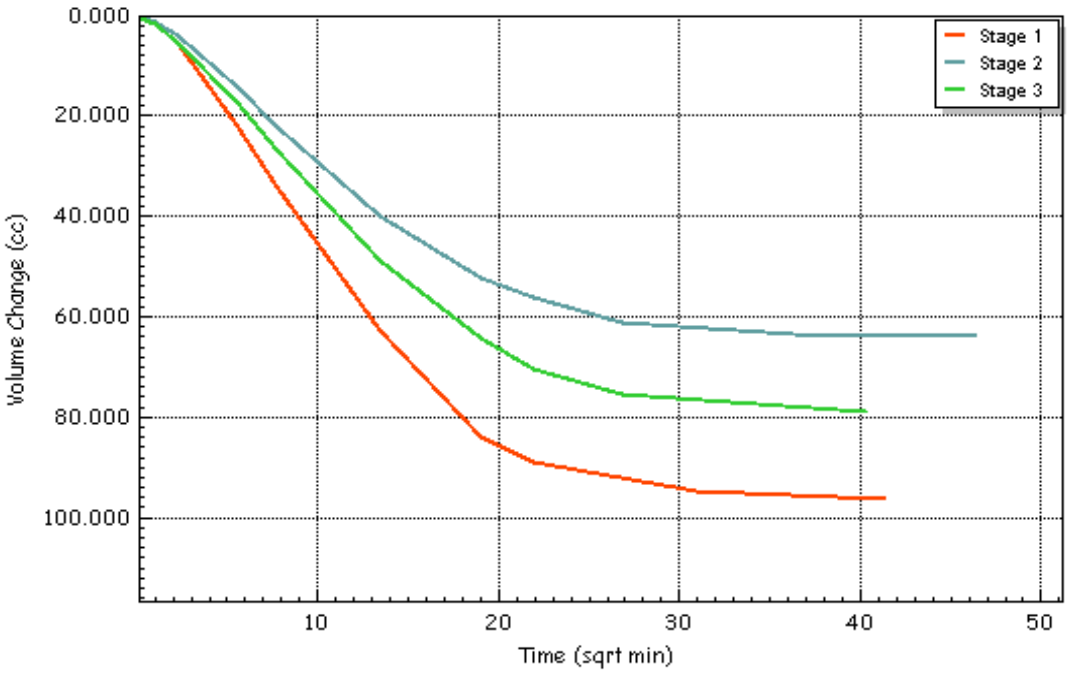
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	332	365	456
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	100.00	96.92	98.08
Volumetric Strain	ε_v%	(%)	6.34	10.55	15.74
Corrected Length	L_C	(mm)	193.2	181.7	152.8
Corrected Area	A_C	(cm2)	73.72	69.90	74.38
Corrected Volume	V_C	(cc)	1423.199	1359.221	1280.353
T100 Time to Failure	t_{100}	(min)	382.92	382.92	382.92
Consolidation	c_v	(m2/year)	0.531	0.531	0.531
Compressibility	m_v	(m2/MN)	1.981	1.675	1.029
Test Time	t_F	(h:m:s)	11:29:15	11:29:15	11:29:15
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01402	0.01318	0.01109

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 15.20-15.70m B56
		Test Date	14/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	15.20-15.70m B56
Client	Causeway Geotech Ltd	Depth	15.20-15.70m B56

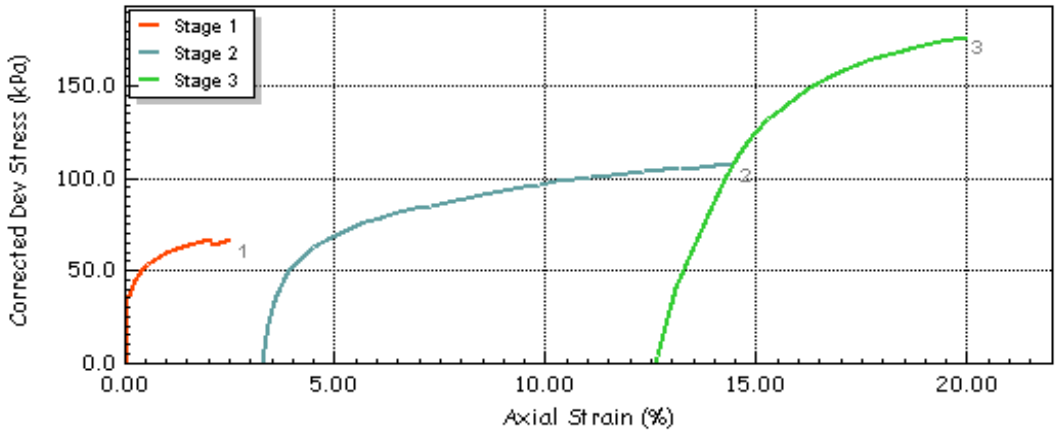
UKAS TESTING 4043

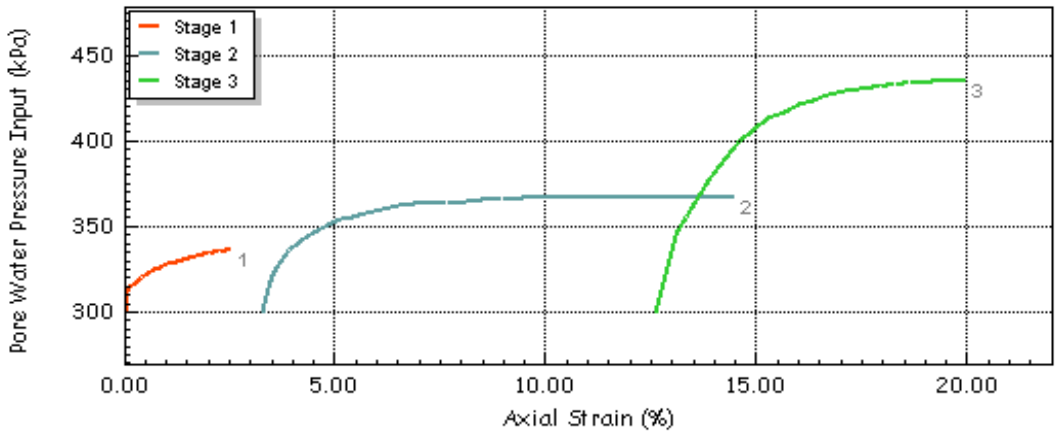
PSL Professional Soils Laboratory

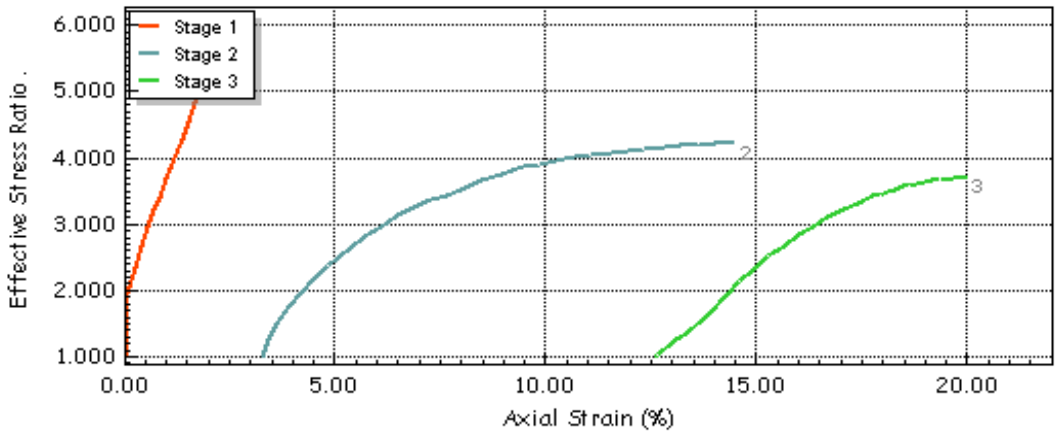
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 15.20-15.70m B56
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	15.20-15.70m B56
		Depth	15.20-15.70m B56

UKAS TESTING 4043

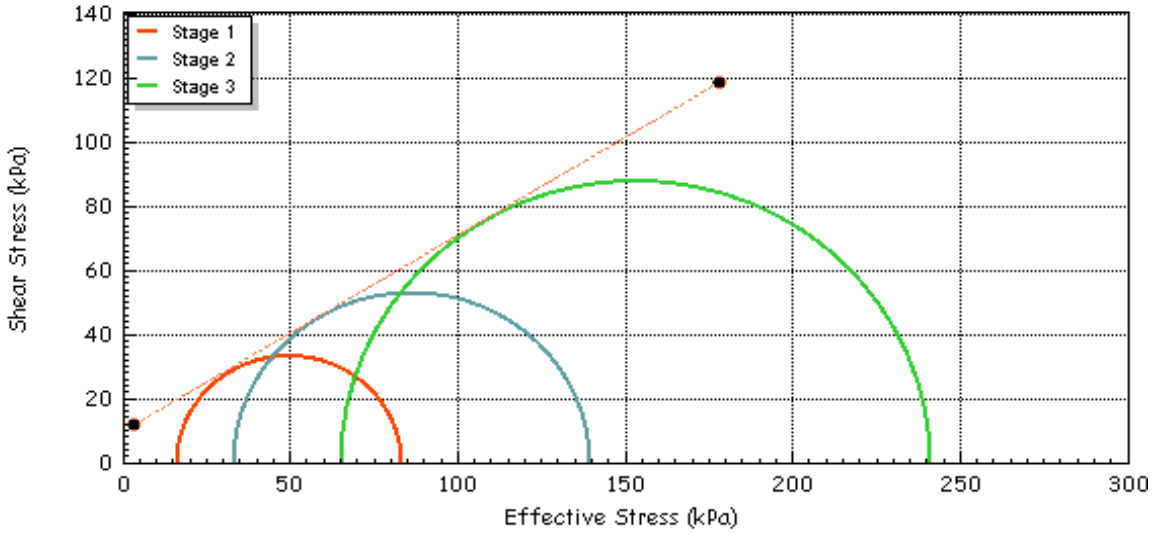
PSL Professional Soils Laboratory

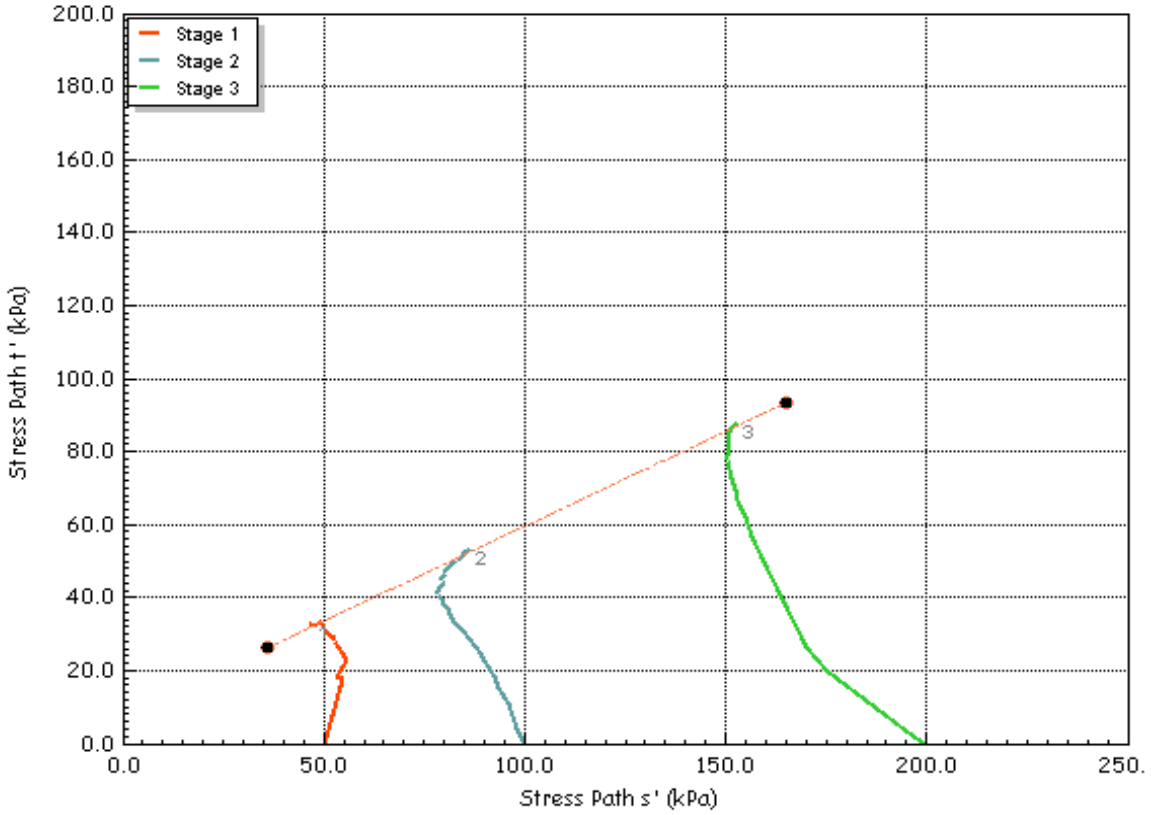
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	10.00	Effective Cohesion	c'	(kPa)	10.00
Effective Friction	ϕ'	(deg)	31.3	Effective Friction	ϕ'	(deg)	31.3





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 15.20-15.70m B56
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	15.20-15.70m B56
		Depth	15.20-15.70m B56

UKAS TESTING 4043

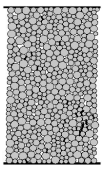
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			20.60-21.00m B66
Description			See summary of soil descriptions.
Type			Recompacted using hand tamped method.
Initial Sample Length	L_0	(mm)	200.4
Initial Sample Diameter	D_0	(mm)	97.2
Initial Sample Weight	W_0	(gr)	3115.9
Initial Bulk Density	ρ_0	(Mg/m3)	2.10
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	27		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.65		
Initial Voids Ratio	e_i	.	0.608		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	18		
Final Dry Density	ρ_{df}	(Mg/m3)	1.91		
Final Voids Ratio	e_f	.	0.388		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	4.98	11.94	16.60
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	87.3	159.0	271.9
Minor Stress At Failure	σ_3'	(kPa)	16.0	45.0	94.0
Major Stress At Failure	σ_1'	(kPa)	103.3	204.0	365.9
Principal Stress At Failure	σ_1'/σ_3'		6.456	4.534	3.893

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 20.60-21.00m B66
		Test Date	15/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	20.60-21.00m B66
Client	Causeway Geotech Ltd	Depth	20.60-21.00m B66

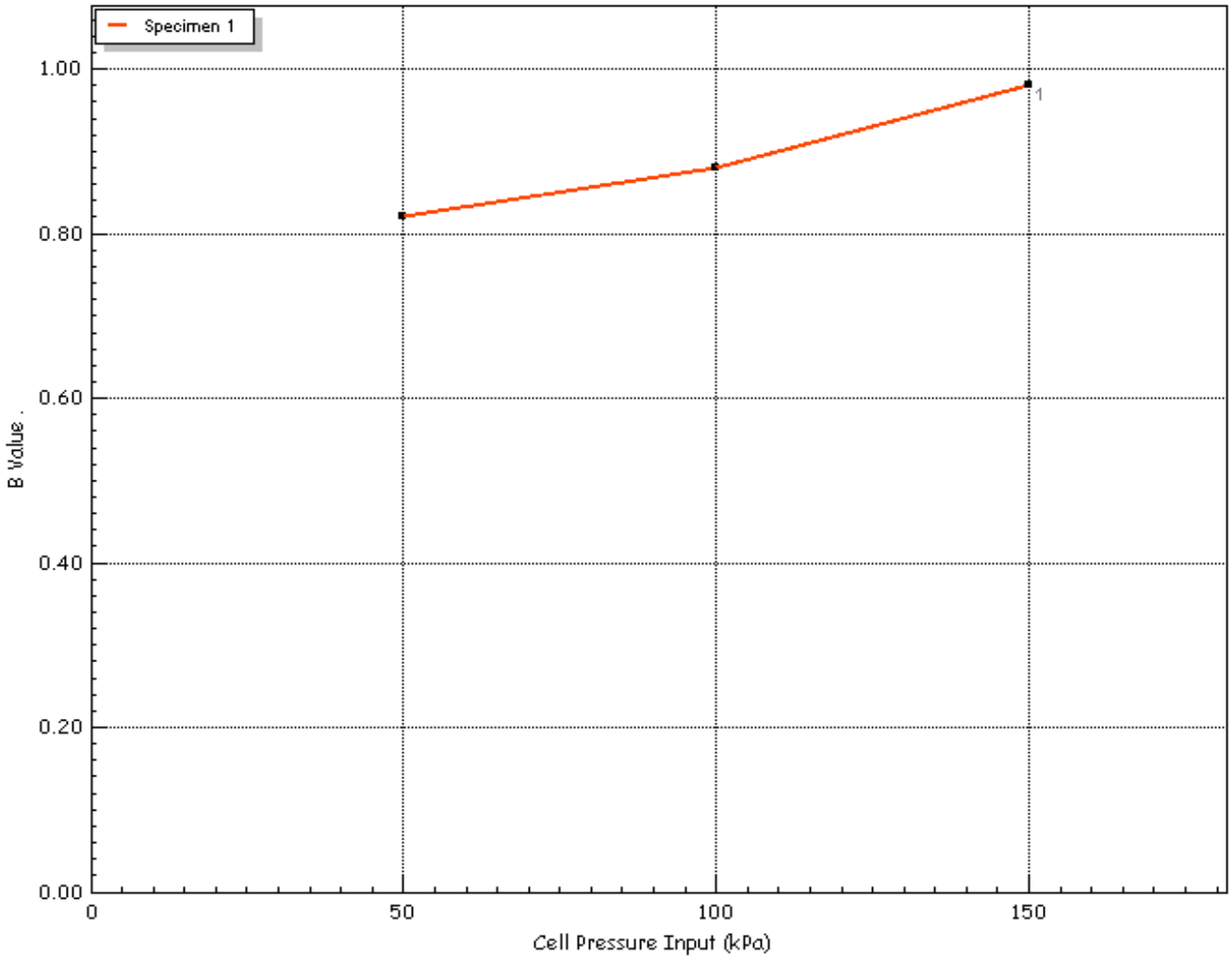
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	146
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 20.60-21.00m B66
		Test Date	15/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	20.60-21.00m B66
Client	Causeway Geotech Ltd	Depth	20.60-21.00m B66

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

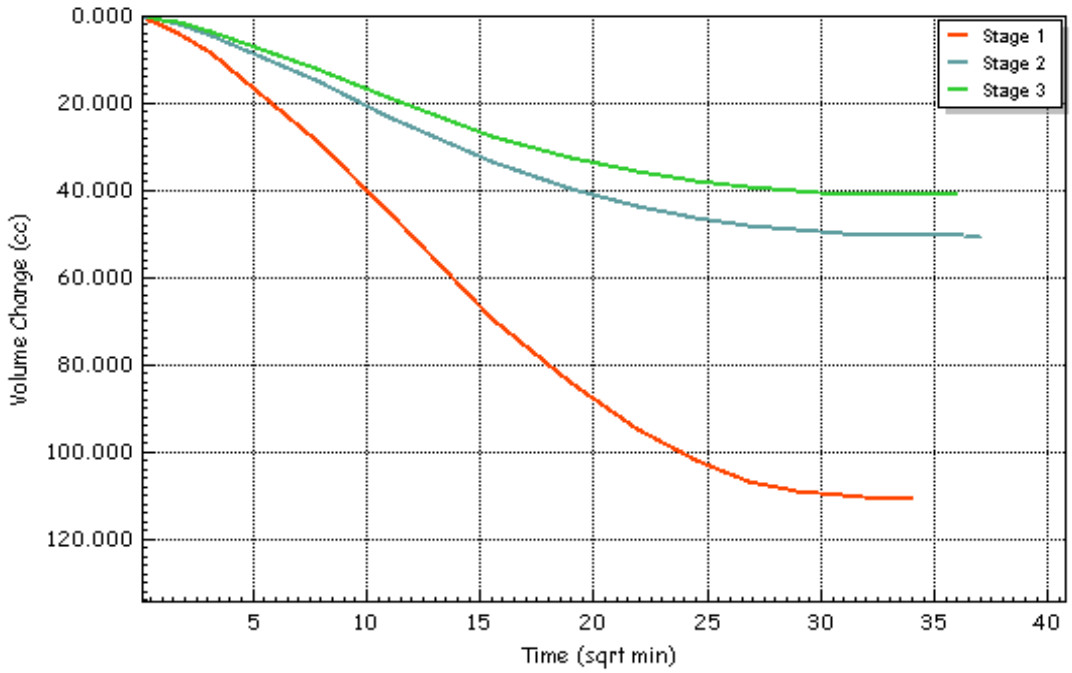
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	347	390	465
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.87	100.00	97.58
Volumetric Strain	ε_v%	(%)	7.45	10.86	13.63
Corrected Length	L_C	(mm)	195.4	179.0	159.2
Corrected Area	A_C	(cm2)	70.52	68.32	71.37
Corrected Volume	V_C	(cc)	1376.259	1325.572	1284.400
T100 Time to Failure	t_{100}	(min)	549.32	549.32	549.32
Consolidation	c_v	(m2/year)	0.355	0.355	0.355
Compressibility	m_v	(m2/MN)	1.619	1.206	0.846
Test Time	t_F	(h:m:s)	16:28:46	16:28:46	16:28:46
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00988	0.00905	0.00805

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 20.60-21.00m B66
		Test Date	15/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	20.60-21.00m B66
Client	Causeway Geotech Ltd	Depth	20.60-21.00m B66

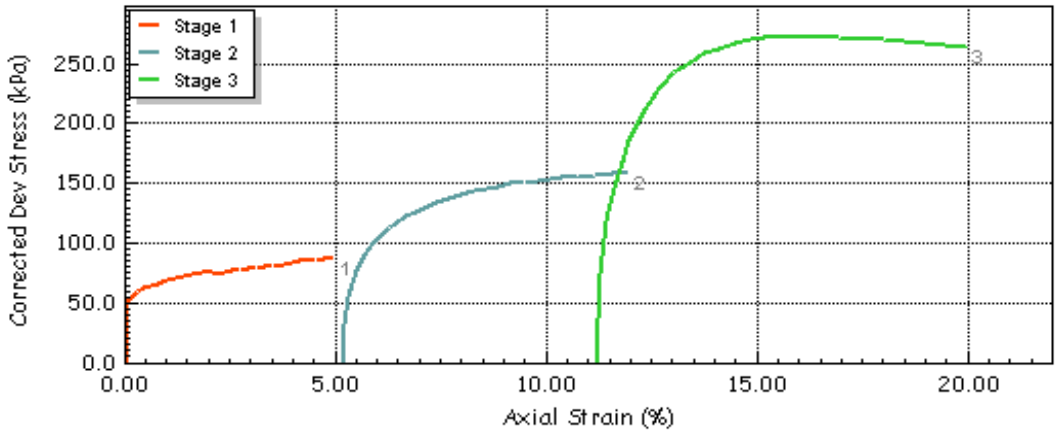
UKAS TESTING 4043

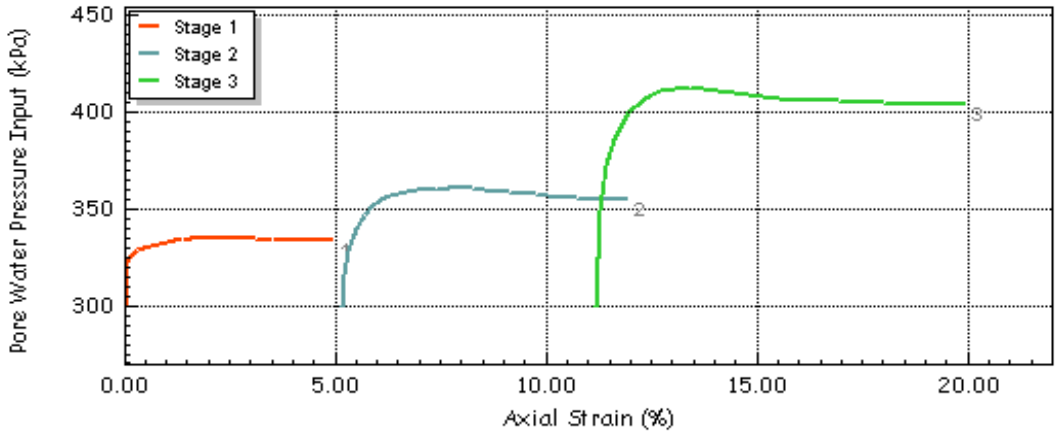
PSL Professional Soils Laboratory

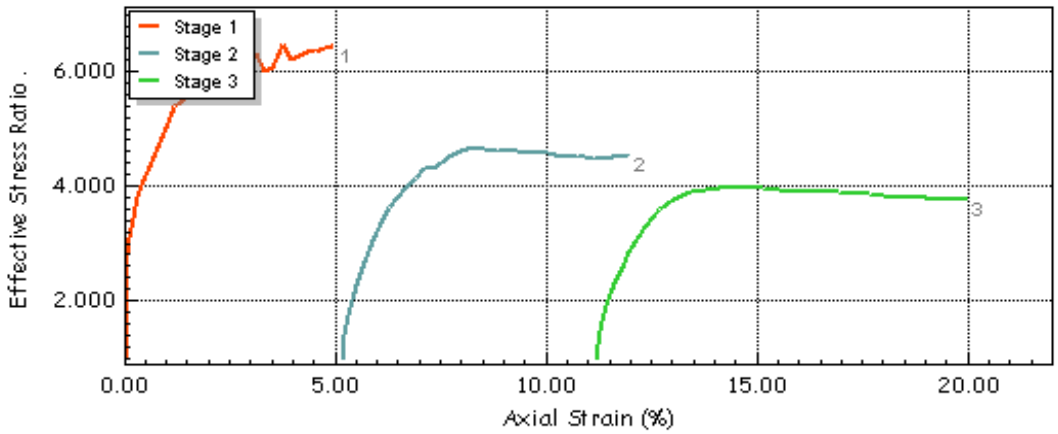
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 20.60-21.00m B66
			Test Date	15/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole	BH41
			Sample	20.60-21.00m B66
	Client	Causeway Geotech Ltd	Depth	20.60-21.00m B66

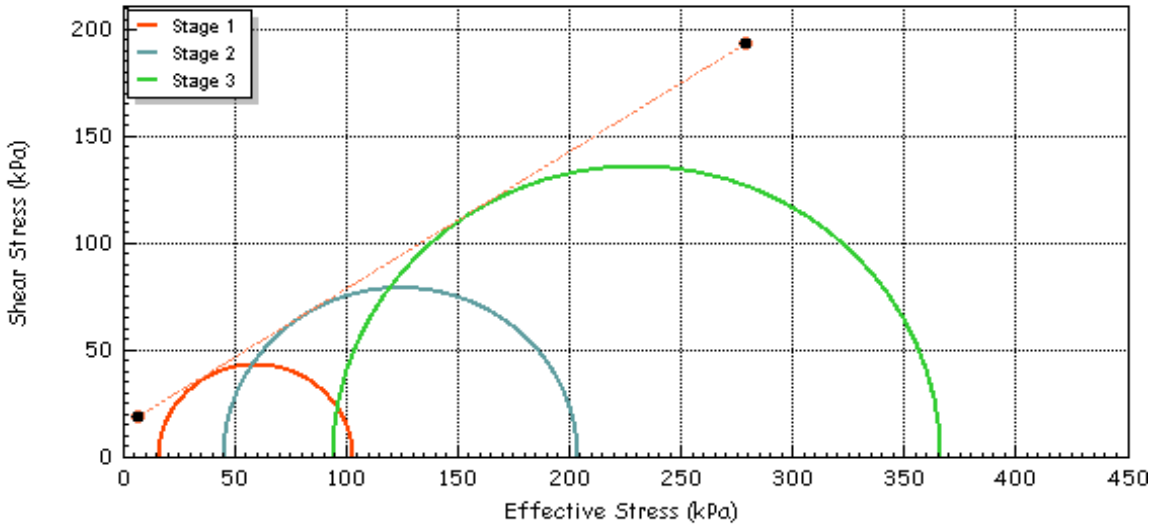
PSL Professional Soils Laboratory

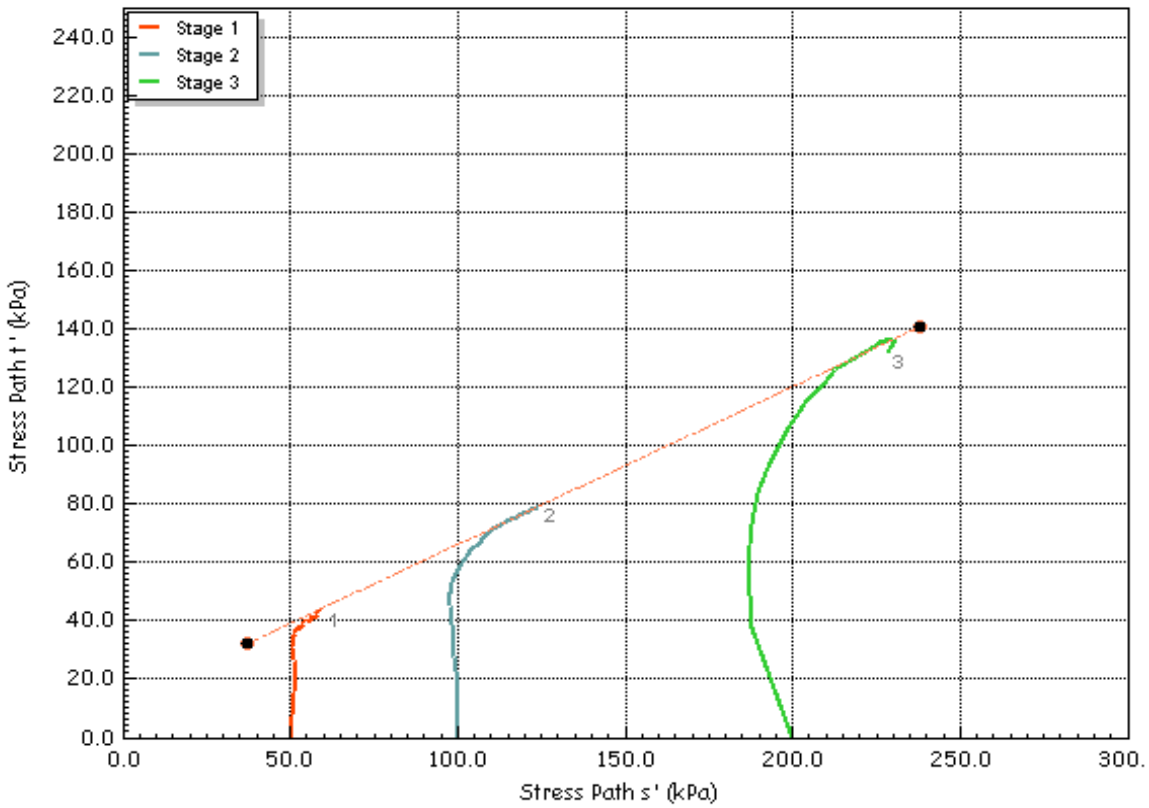
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	14.25	Effective Cohesion	c'	(kPa)	14.25
Effective Friction	ϕ'	(deg)	32.7	Effective Friction	ϕ'	(deg)	32.7





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 20.60-21.00m B66
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	20.60-21.00m B66
		Depth	20.60-21.00m B66

UKAS TESTING 4043

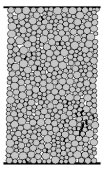
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			23.70-24.55m P82
Description			See summary of soil descriptions.
Type			Undisturbed, Vertical orientation.
Initial Sample Length	L_0	(mm)	209.8
Initial Sample Diameter	D_0	(mm)	99.8
Initial Sample Weight	W_0	(gr)	3434.8
Initial Bulk Density	ρ_0	(Mg/m3)	2.09
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	26		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.66		
Initial Voids Ratio	e_i	.	0.592		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	22		
Final Dry Density	ρ_{df}	(Mg/m3)	1.77		
Final Voids Ratio	e_f	.	0.499		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	3.70	8.17	11.60
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	88.2	144.1	213.9
Minor Stress At Failure	σ_3'	(kPa)	27.0	58.0	95.0
Major Stress At Failure	σ_1'	(kPa)	115.2	202.1	308.9
Principal Stress At Failure	σ_1'/σ_3'		4.265	3.484	3.252

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 23.70-24.55m P82
		Test Date	22/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	23.70-24.55m P82
Client	Causeway Geotech Ltd	Depth	23.70-24.55m P82

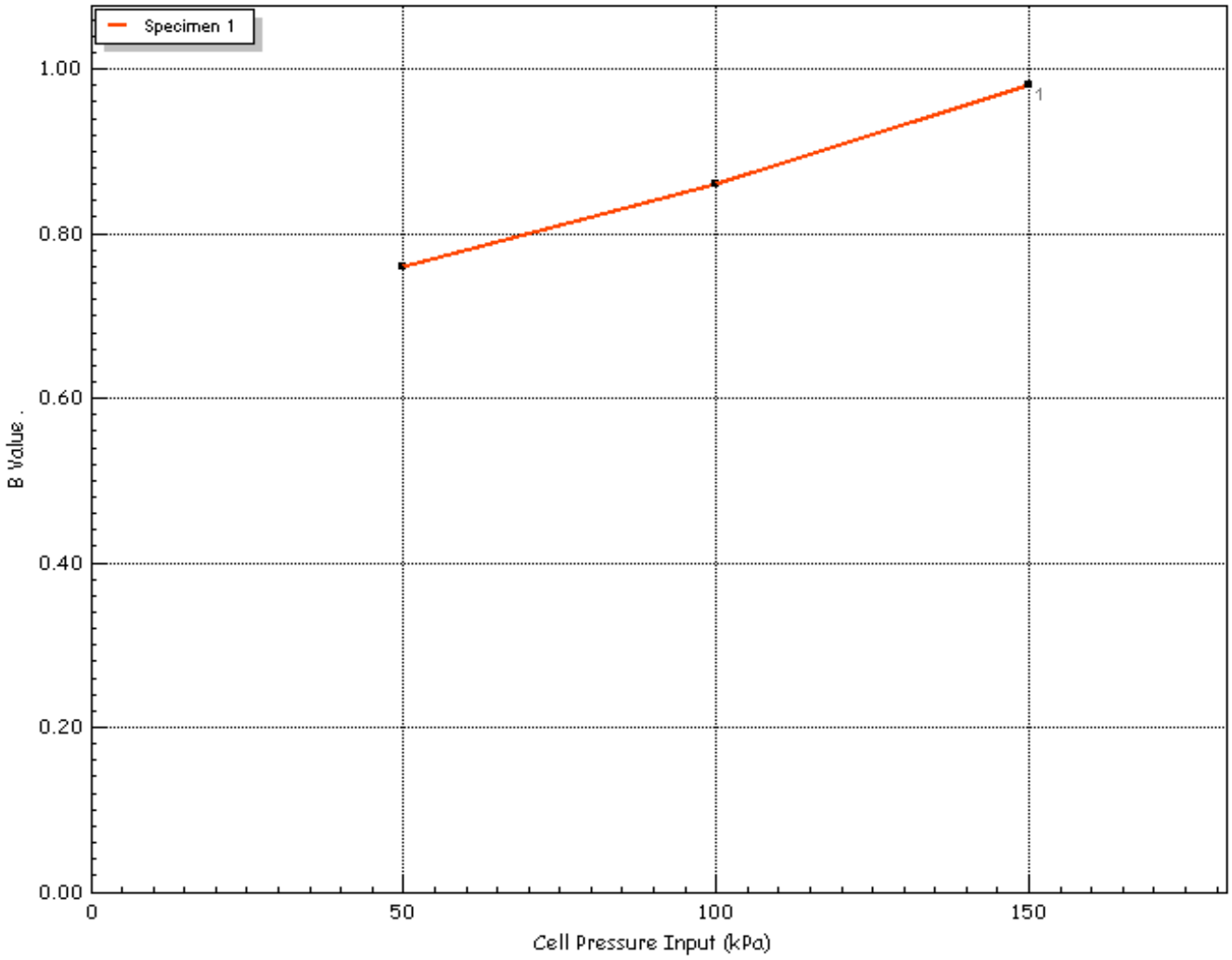
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	134
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 23.70-24.55m P82
		Test Date	22/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	23.70-24.55m P82
Client	Causeway Geotech Ltd	Depth	23.70-24.55m P82

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

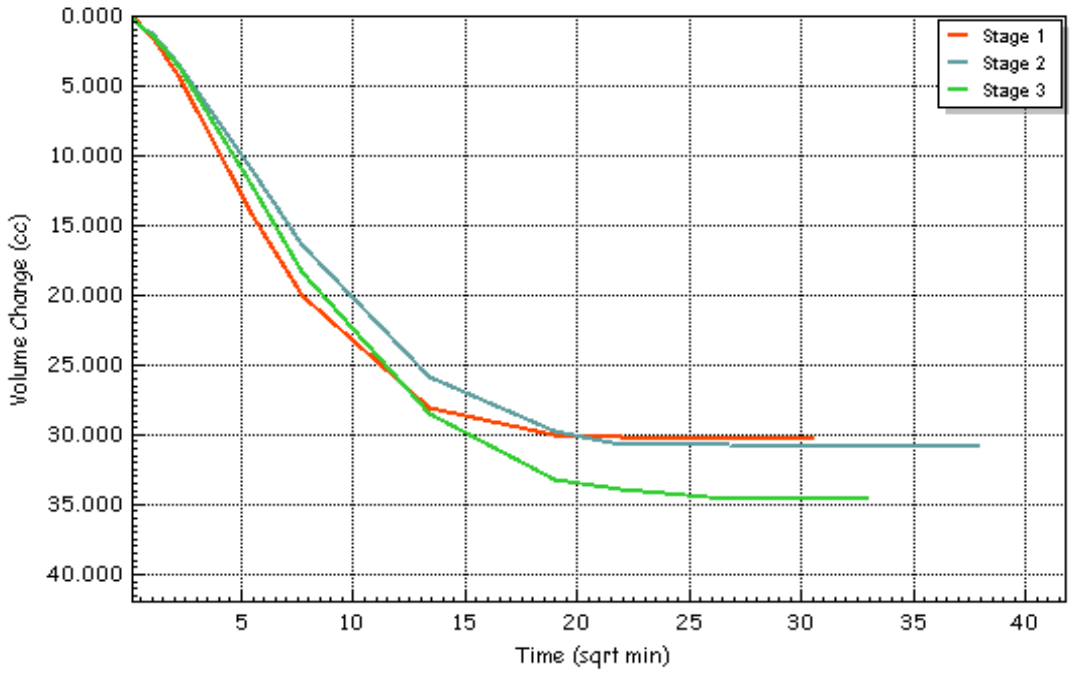
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	331	370	451
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	96.77	97.14	98.68
Volumetric Strain	ε_v%	(%)	1.84	3.72	5.83
Corrected Length	L_C	(mm)	208.5	198.3	184.3
Corrected Area	A_C	(cm2)	77.26	78.20	80.68
Corrected Volume	V_C	(cc)	1610.932	1580.113	1545.495
T100 Time to Failure	t_{100}	(min)	119.82	119.82	119.82
Consolidation	c_v	(m2/year)	1.717	1.717	1.717
Compressibility	m_v	(m2/MN)	0.614	0.547	0.391
Test Time	t_F	(h:m:s)	03:35:40	03:35:40	03:35:40
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.04834	0.04597	0.04272

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 23.70-24.55m P82
		Test Date	22/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	23.70-24.55m P82
Client	Causeway Geotech Ltd	Depth	23.70-24.55m P82

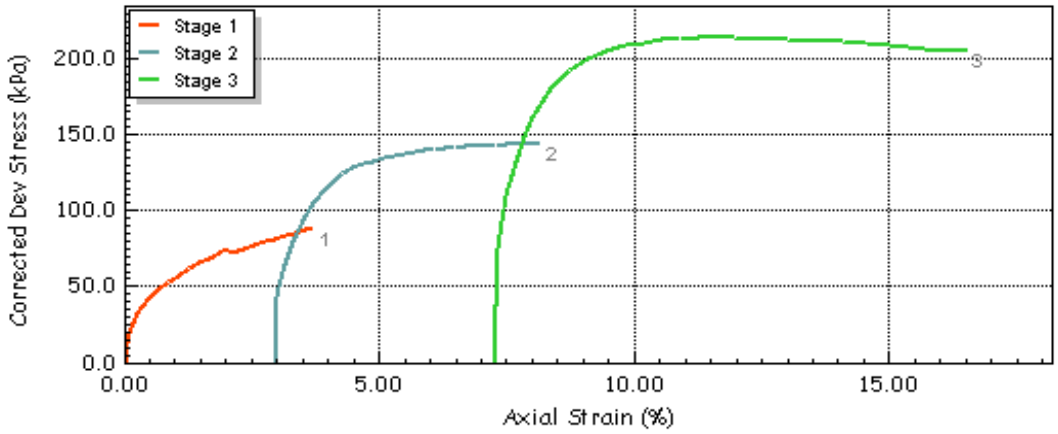
UKAS TESTING 4043

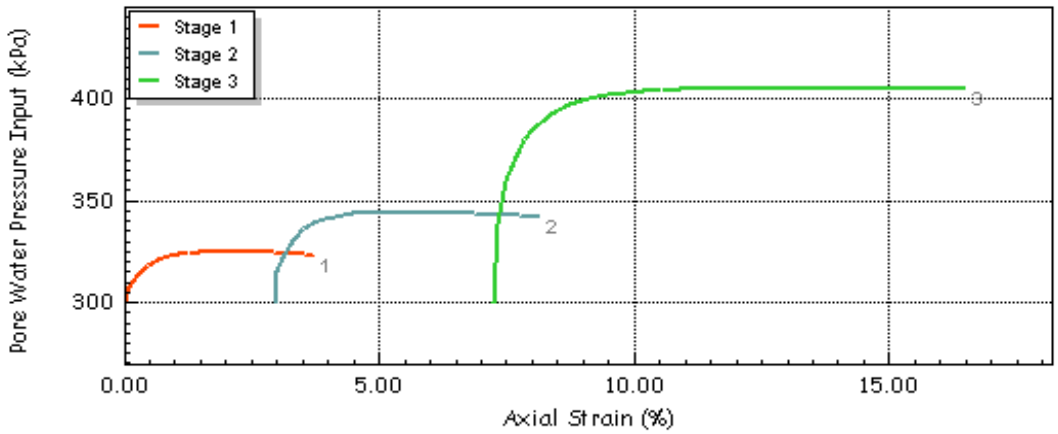
PSL Professional Soils Laboratory

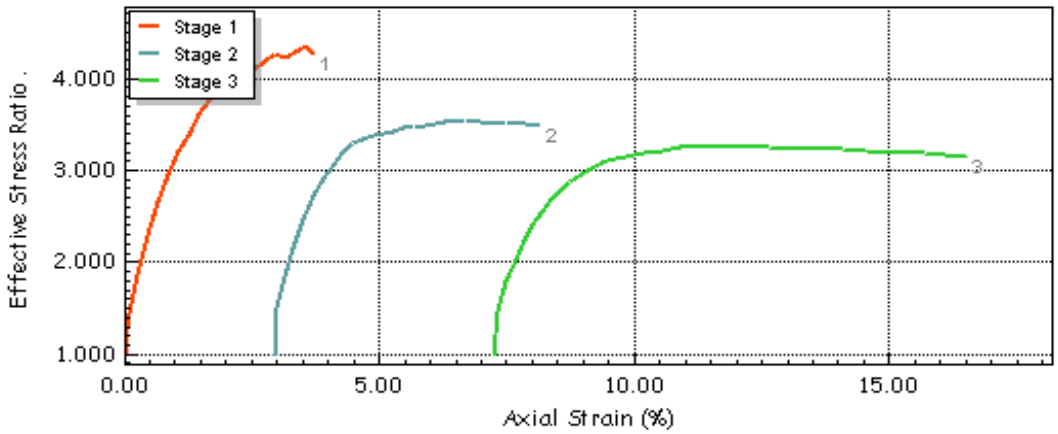
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 23.70-24.55m P82
			Test Date	22/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole	BH41
			Sample	23.70-24.55m P82
	Client	Causeway Geotech Ltd	Depth	23.70-24.55m P82

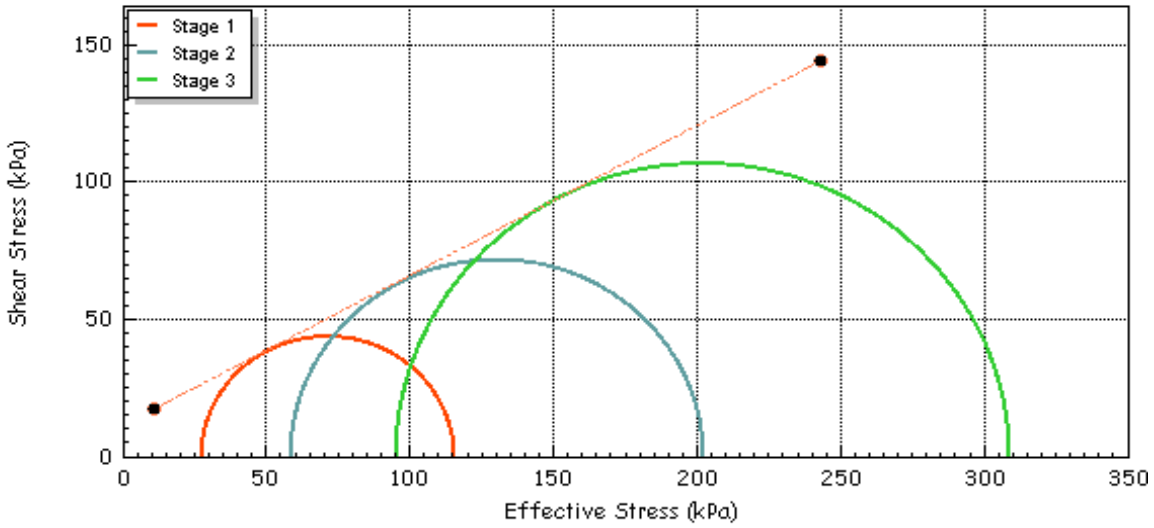
PSL Professional Soils Laboratory

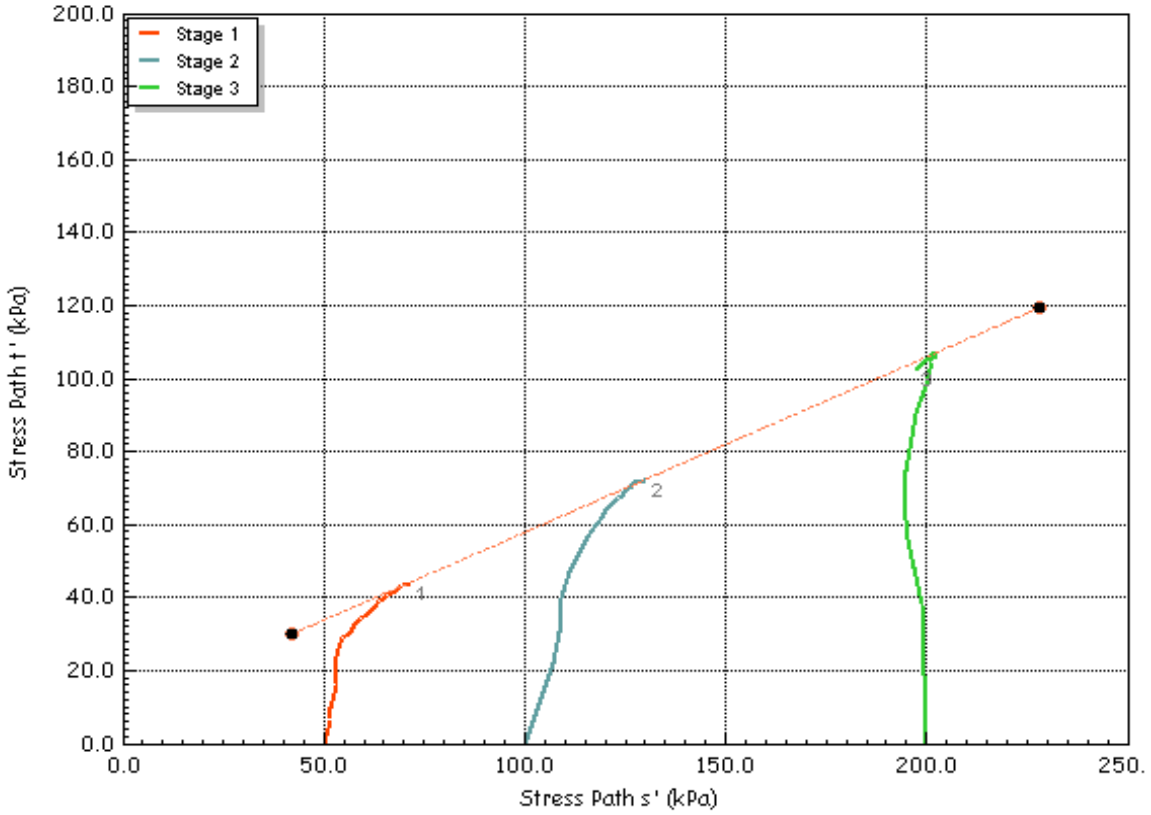
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	11.33	Effective Cohesion	c'	(kPa)	11.33
Effective Friction	ϕ'	(deg)	28.6	Effective Friction	ϕ'	(deg)	28.6





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 23.70-24.55m P82
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	23.70-24.55m P82
		Depth	23.70-24.55m P82

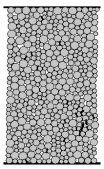
UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth			26.50-27.00m B79
	Description			See summary of soil descriptions.
	Type			Recompacted using hand tamped method.
	Initial Sample Length	L_0	(mm)	200.4
	Initial Sample Diameter	D_0	(mm)	97.2
	Initial Sample Weight	W_0	(gr)	2843.1
	Initial Bulk Density	ρ_0	(Mg/m3)	1.91
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 6		
Initial Moisture	ω_i	(%)	40		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.36		
Initial Voids Ratio	e_i	.	0.944		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	25		
Final Dry Density	ρ_{df}	(Mg/m3)	1.67		
Final Voids Ratio	e_f	.	0.584		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	4.84	10.34	18.04
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	49.7	81.5	142.7
Minor Stress At Failure	σ_3'	(kPa)	14.0	34.0	74.0
Major Stress At Failure	σ_1'	(kPa)	63.7	115.5	216.7
Principal Stress At Failure	σ_1'/σ_3'		4.548	3.398	2.929

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 26.50-17.00m B79
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	26.50-27.00m B79
		Depth	26.50-27.00m B79

UKAS TESTING 4043

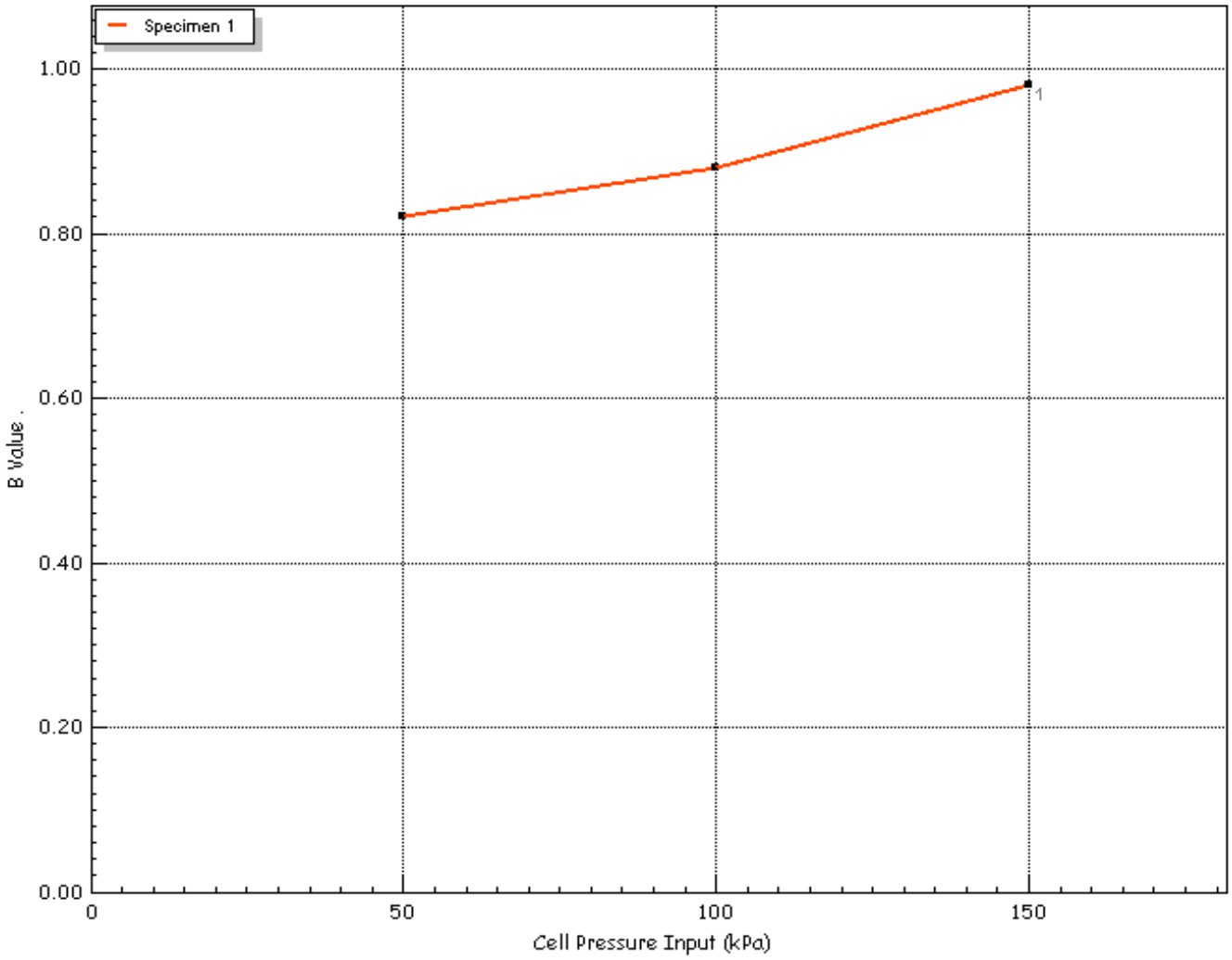
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	152
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 26.50-17.00m B79
		Test Date	15/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	26.50-27.00m B79
Client	Causeway Geotech Ltd	Depth	26.50-27.00m B79

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

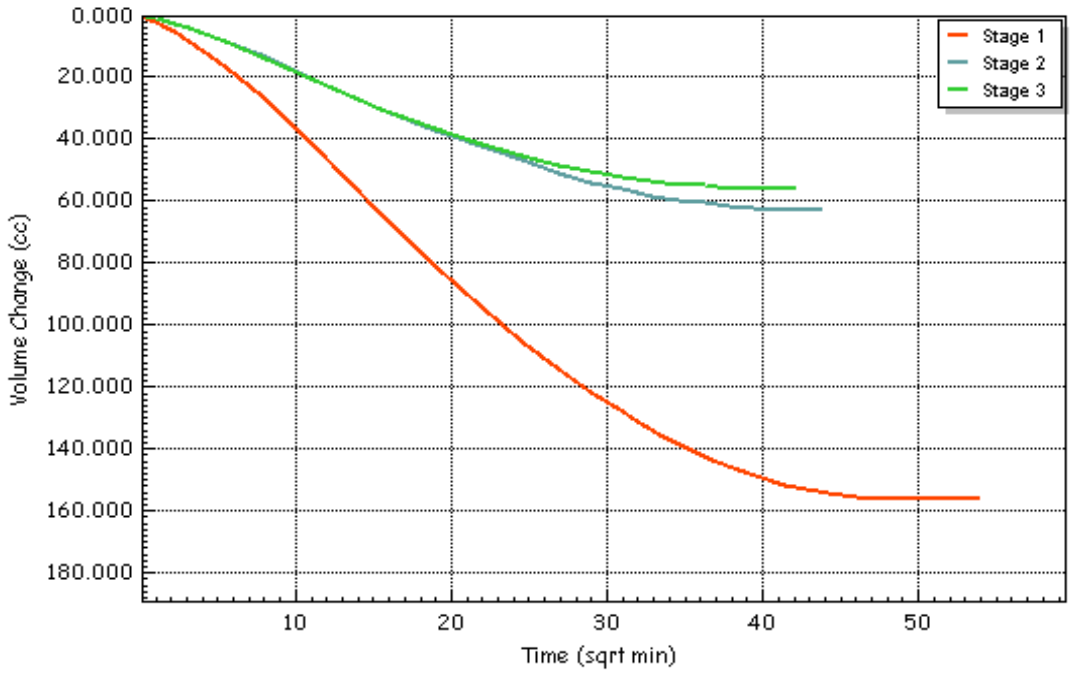
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	351	384	458
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	96.10	97.63	98.11
Volumetric Strain	ε_v%	(%)	10.50	14.74	18.52
Corrected Length	L_C	(mm)	193.4	175.0	154.9
Corrected Area	A_C	(cm2)	69.01	64.38	65.66
Corrected Volume	V_C	(cc)	1330.888	1267.865	1211.564
T100 Time to Failure	t_{100}	(min)	1181.13	1181.13	1181.13
Consolidation	c_v	(m2/year)	0.165	0.165	0.165
Compressibility	m_v	(m2/MN)	2.132	1.789	1.193
Test Time	t_F	(h:m:s)	35:26:02	35:26:02	35:26:02
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00455	0.00412	0.00364

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 26.50-17.00m B79
		Test Date	15/08/2019
		Borehole	BH41
Jobfile	Stornoway Deep Water Port	Sample	26.50-27.00m B79
Client	Causeway Geotech Ltd	Depth	26.50-27.00m B79

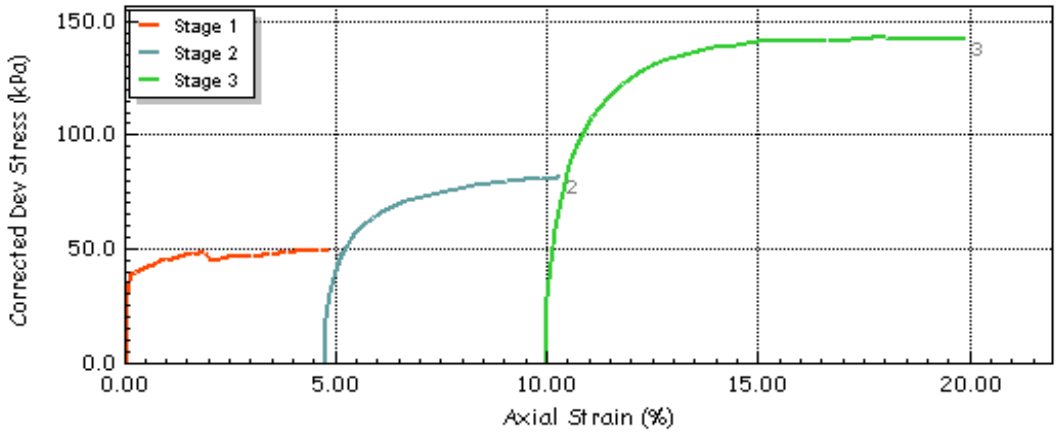
UKAS TESTING 4043

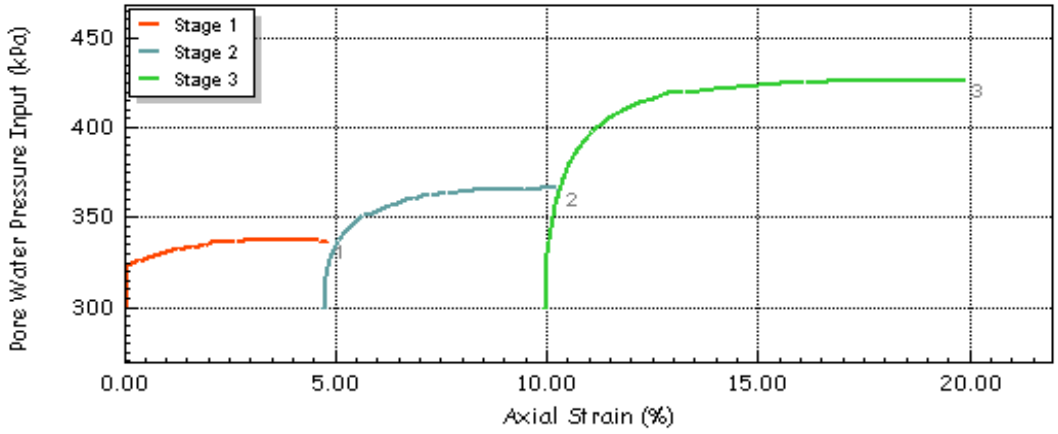
PSL Professional Soils Laboratory

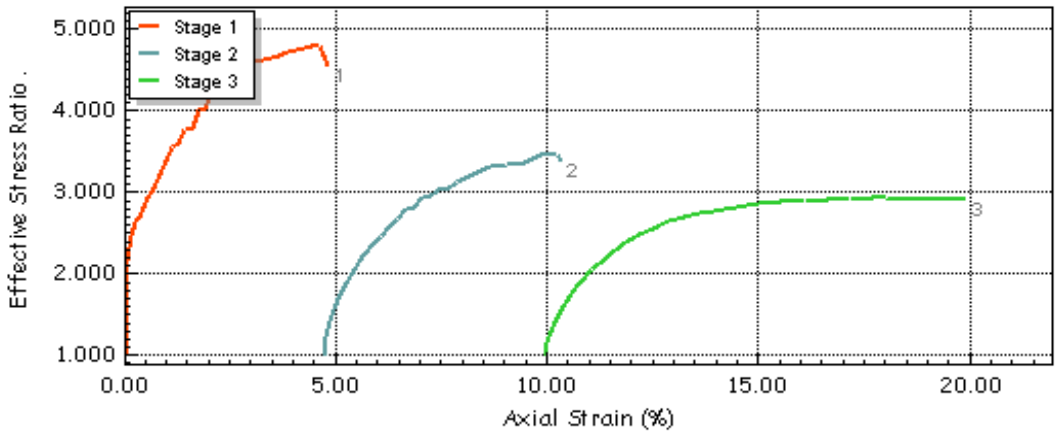
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 26.50-17.00m B79
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	26.50-27.00m B79
		Depth	26.50-27.00m B79

UKAS TESTING 4043

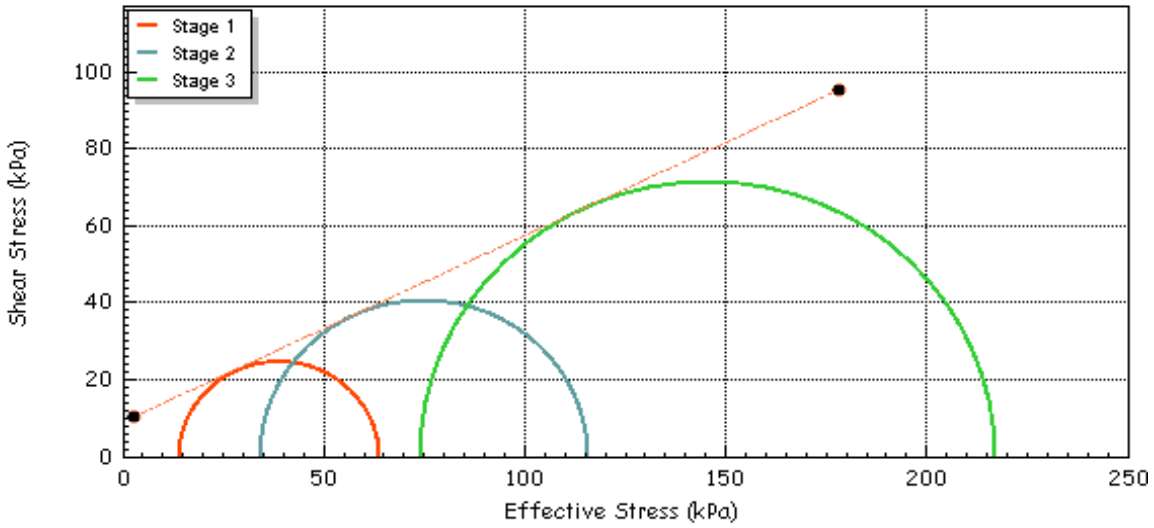
PSL Professional Soils Laboratory

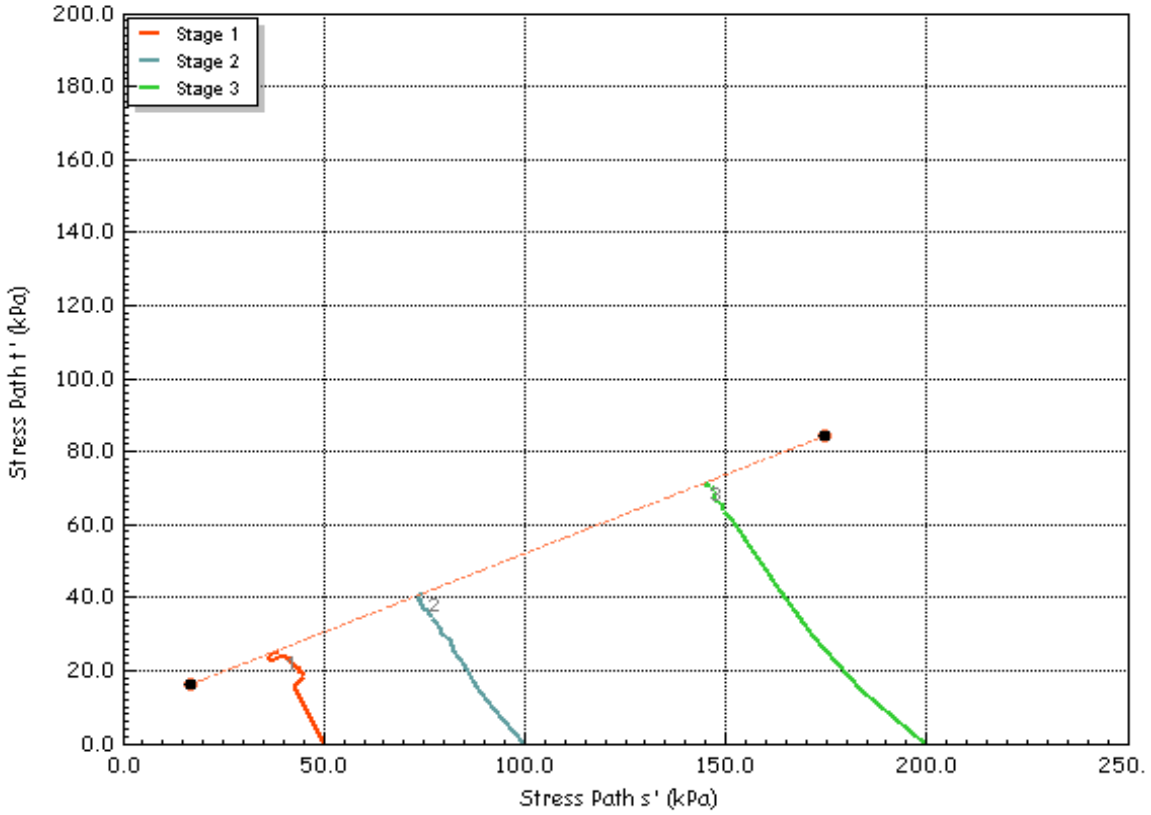
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	9.02	Effective Cohesion	c'	(kPa)	9.02
Effective Friction	ϕ'	(deg)	25.8	Effective Friction	ϕ'	(deg)	25.8





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH41 26.50-17.00m B79
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH41
Client	Causeway Geotech Ltd	Sample	26.50-27.00m B79
		Depth	26.50-27.00m B79

UKAS TESTING 4043

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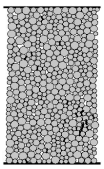
Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			2.00-2.50m B7
Description			See summary of soil descriptions.
Type			Recompacted using hand tamped method.
Initial Sample Length	L_0	(mm)	200.4
Initial Sample Diameter	D_0	(mm)	97.2
Initial Sample Weight	W_0	(gr)	2451.7
Initial Bulk Density	ρ_0	(Mg/m3)	1.65
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	37		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.21		
Initial Voids Ratio	e_i	.	1.194		
Initial Degree of Saturation	S_i	(%)	81		
B Value	B	.	0.98		

Final Conditions

Final Moisture	ω_f	(%)	9.54		
Final Dry Density	ρ_{df}	(Mg/m3)	1.67		
Final Voids Ratio	e_f	.	0.589		
Final Degree of Saturation	S_f	(%)	42.9		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	4.68	10.30	17.89
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	51.4	80.2	131.9
Minor Stress At Failure	σ_3'	(kPa)	13.0	29.0	57.0
Major Stress At Failure	σ_1'	(kPa)	64.4	109.2	188.9
Principal Stress At Failure	σ_1'/σ_3'		4.951	3.764	3.314

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 2.00-2.50m B7
		Test Date	15/08/2019
		Borehole	BH47
Jobfile	Stornoway Deep Water Port	Sample	2.00-2.50m B7
Client	Causeway Geotech Ltd	Depth	2.00-2.50m B7

UKAS TESTING 4043

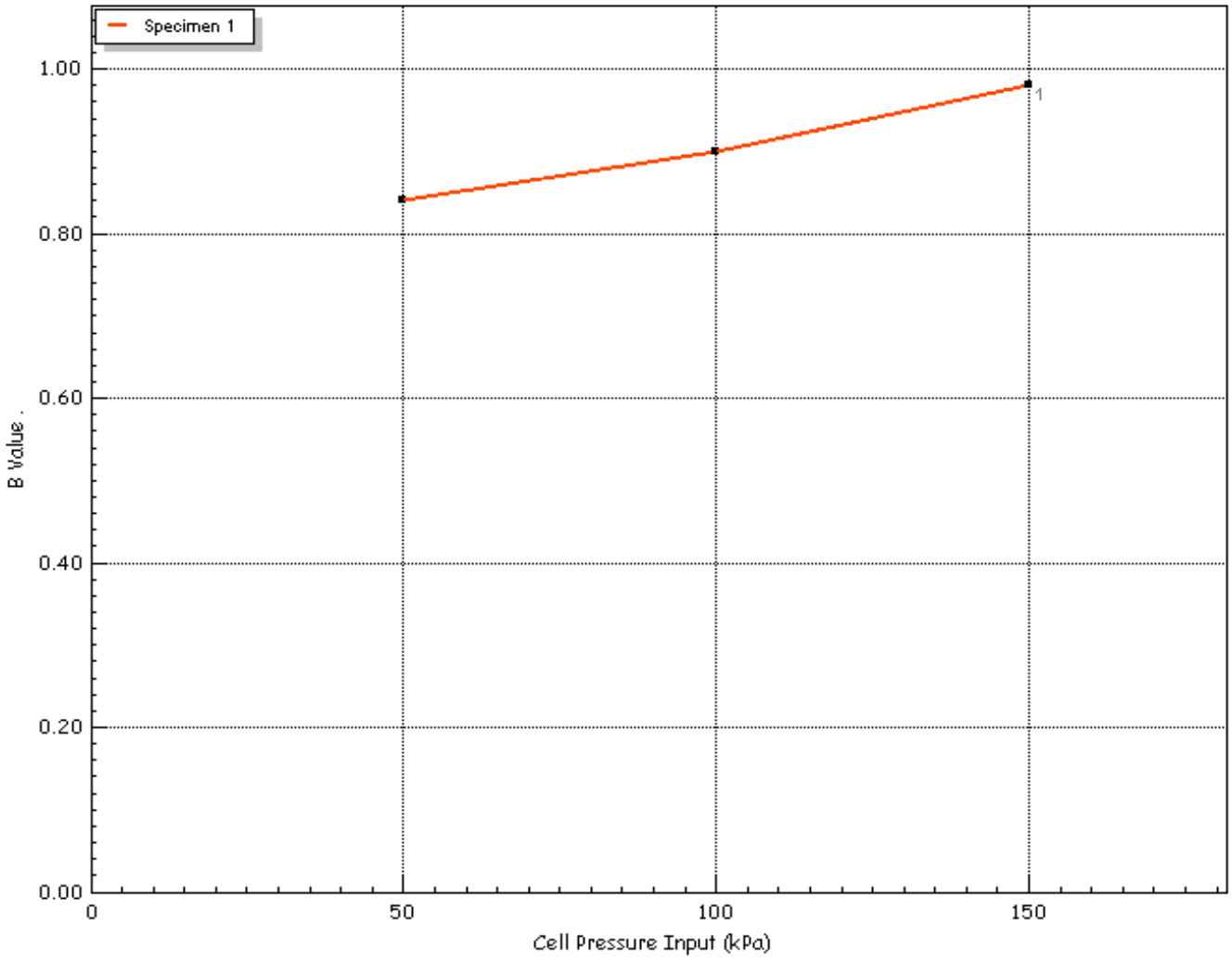
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	148
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 2.00-2.50m B7
		Test Date	15/08/2019
		Borehole	BH47
Jobfile	Stornoway Deep Water Port	Sample	2.00-2.50m B7
Client	Causeway Geotech Ltd	Depth	2.00-2.50m B7

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Effective Stress Triaxial Compression

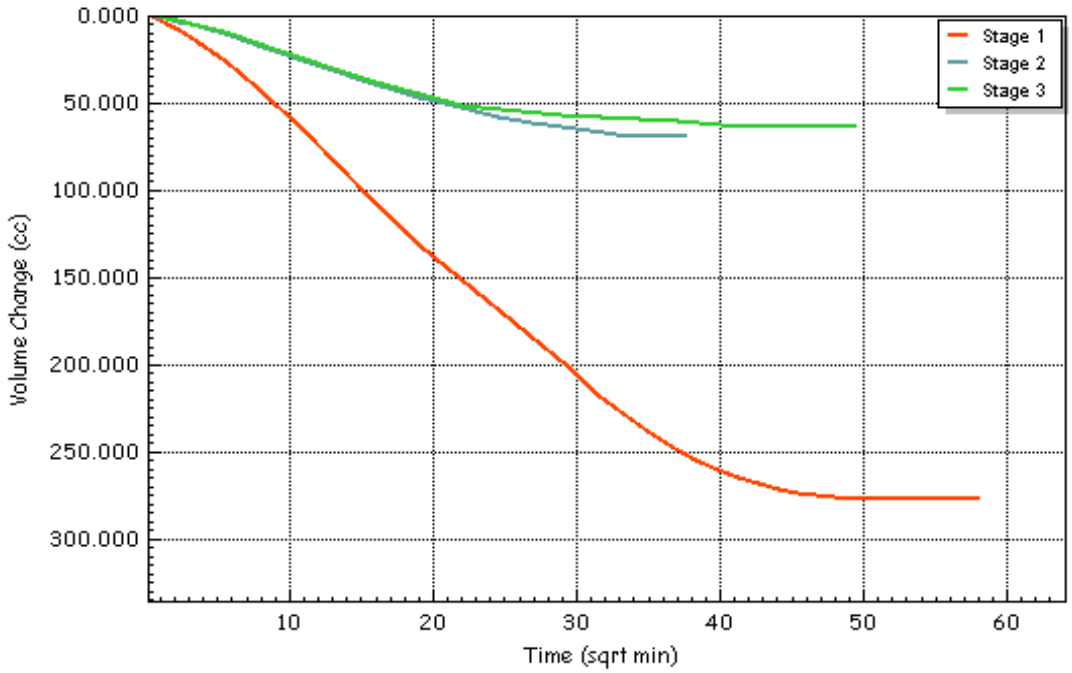
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	348	379	443
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.91	97.46	97.19
Volumetric Strain	ε_v%	(%)	18.64	23.31	27.62
Corrected Length	L_C	(mm)	188.0	164.9	141.9
Corrected Area	A_C	(cm2)	64.98	54.75	55.43
Corrected Volume	V_C	(cc)	1209.909	1140.452	1076.268
T100 Time to Failure	t_{100}	(min)	1387.70	1387.70	1387.70
Consolidation	c_v	(m2/year)	0.141	0.141	0.141
Compressibility	m_v	(m2/MN)	3.987	3.035	1.998
Test Time	t_F	(h:m:s)	41:37:51	41:37:51	41:37:51
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00376	0.00330	0.00284

Notes



UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name: BH47 2.00-2.50m B7 Test Date: 15/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole: BH47 Sample: 2.00-2.50m B7
	Client	Causeway Geotech Ltd	Depth: 2.00-2.50m B7

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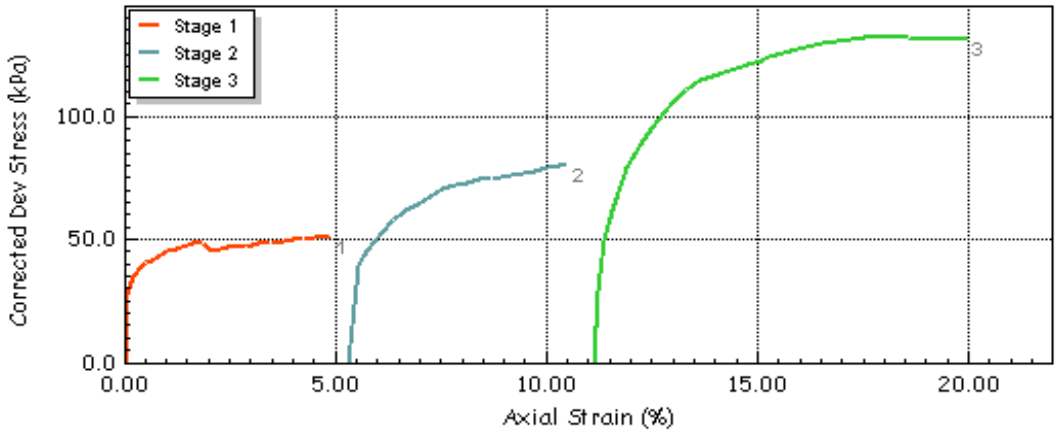
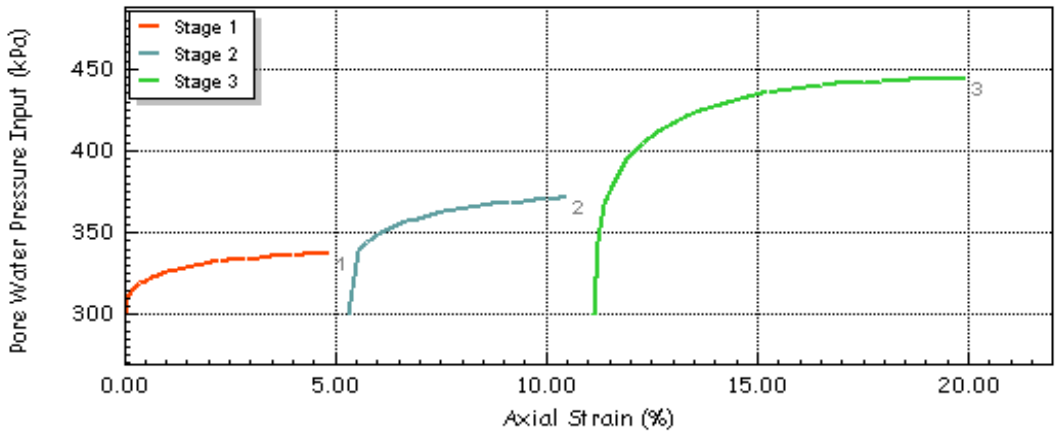
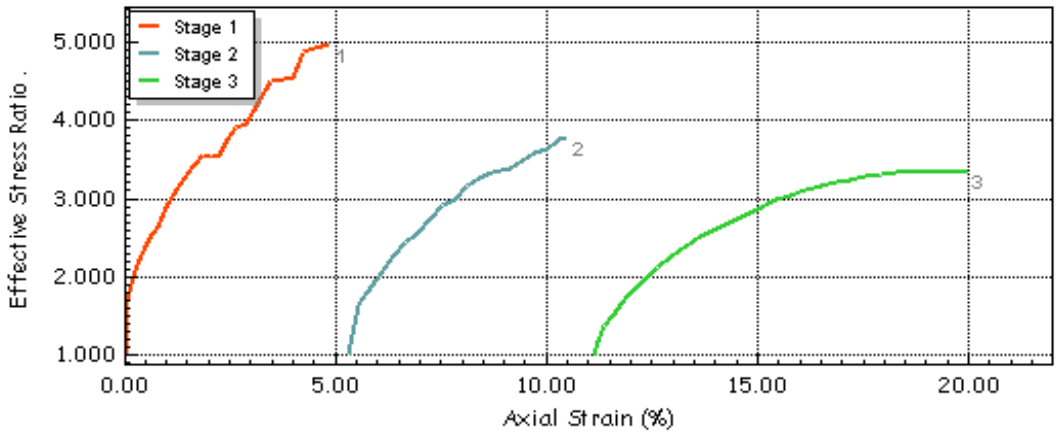
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 2.00-2.50m B7
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH47
Client	Causeway Geotech Ltd	Sample	2.00-2.50m B7
		Depth	2.00-2.50m B7

UKAS TESTING 4043

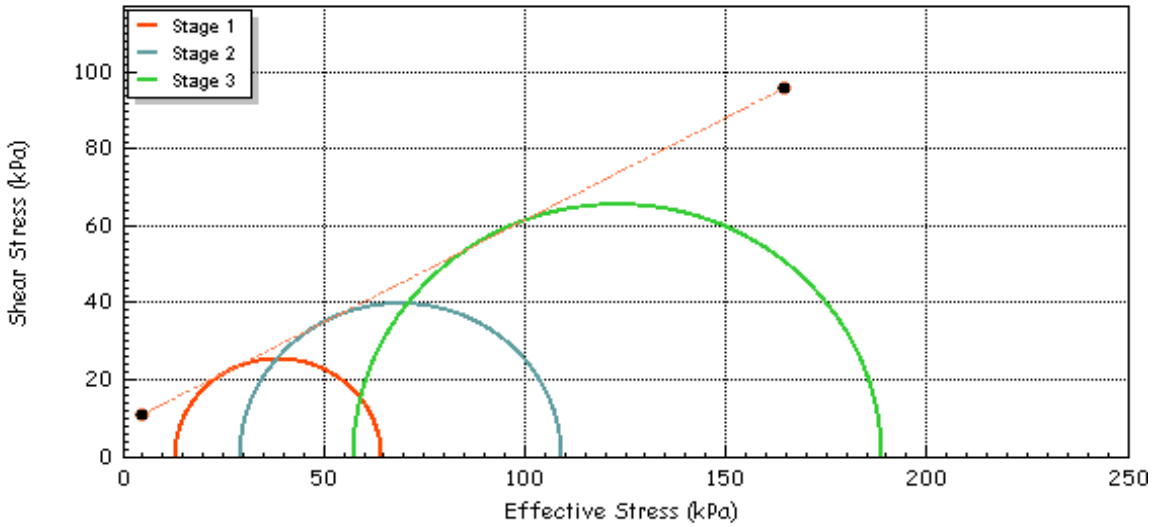
PSL Professional Soils Laboratory

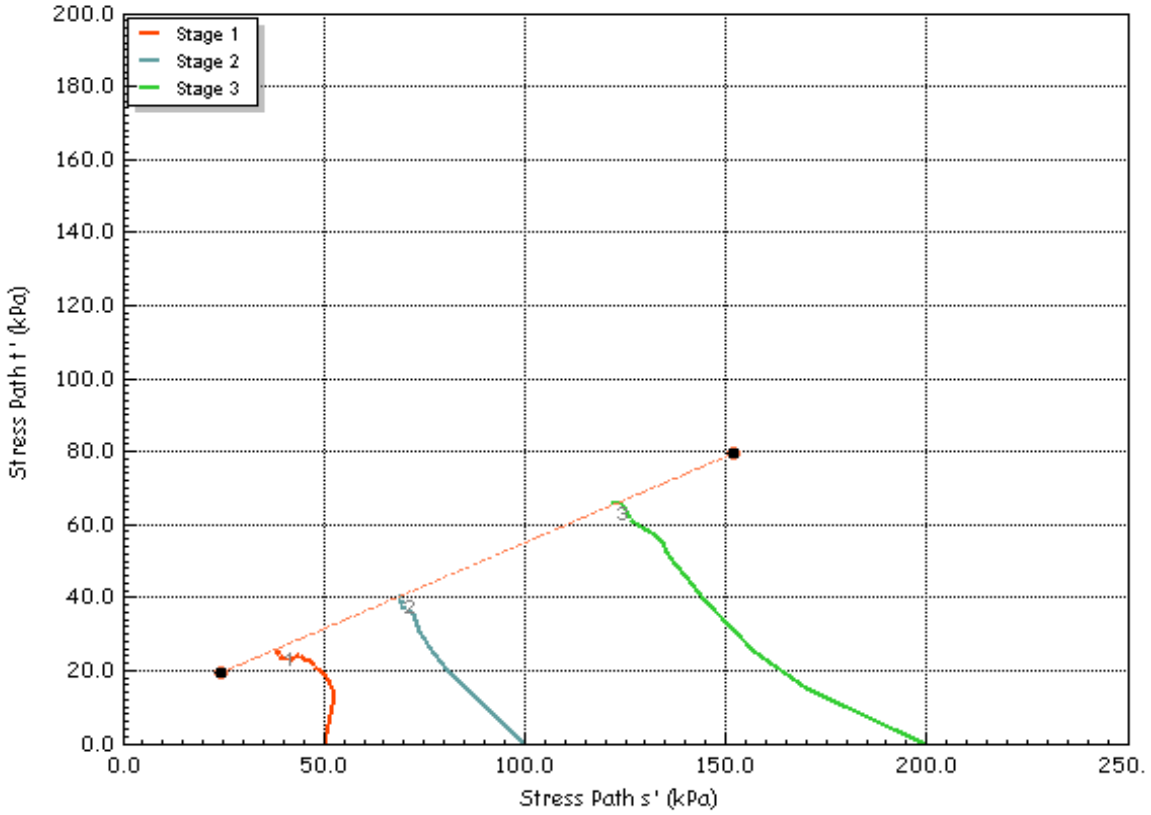
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	8.48	Effective Cohesion	c'	(kPa)	8.48
Effective Friction	ϕ'	(deg)	28.0	Effective Friction	ϕ'	(deg)	28.0





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 2.00-2.50m B7
		Test Date	15/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH47
Client	Causeway Geotech Ltd	Sample	2.00-2.50m B7
		Depth	2.00-2.50m B7

UKAS TESTING 4043

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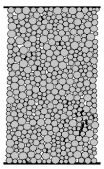
Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth		7.30-8.00m B21	
Description		See summary of soil descriptions.	
Type		Recompacted using hand tamped method.	
Initial Sample Length	L_0	(mm)	200.4
Initial Sample Diameter	D_0	(mm)	97.2
Initial Sample Weight	W_0	(gr)	3240.3
Initial Bulk Density	ρ_0	(Mg/m3)	2.18
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 6		
Initial Moisture	ω_i	(%)	26		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.73		
Initial Voids Ratio	e_i	.	0.536		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.99		

Final Conditions					
Final Moisture	ω_f	(%)	17		
Final Dry Density	ρ_{df}	(Mg/m3)	1.93		
Final Voids Ratio	e_f	.	0.371		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	5.86	18.65
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	61.4	112.1	206.2
Minor Stress At Failure	σ_3'	(kPa)	13.0	40.0	88.0
Major Stress At Failure	σ_1'	(kPa)	74.4	152.1	294.2
Principal Stress At Failure	σ_1'/σ_3'		5.722	3.802	3.343

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 7.30-8.00m B21
		Test Date	14/08/2019
		Borehole	BH47
Jobfile	Stornoway Deep Water Port	Sample	7.30-8.00m B21
Client	Causeway Geotech Ltd	Depth	7.30-8.00m B21

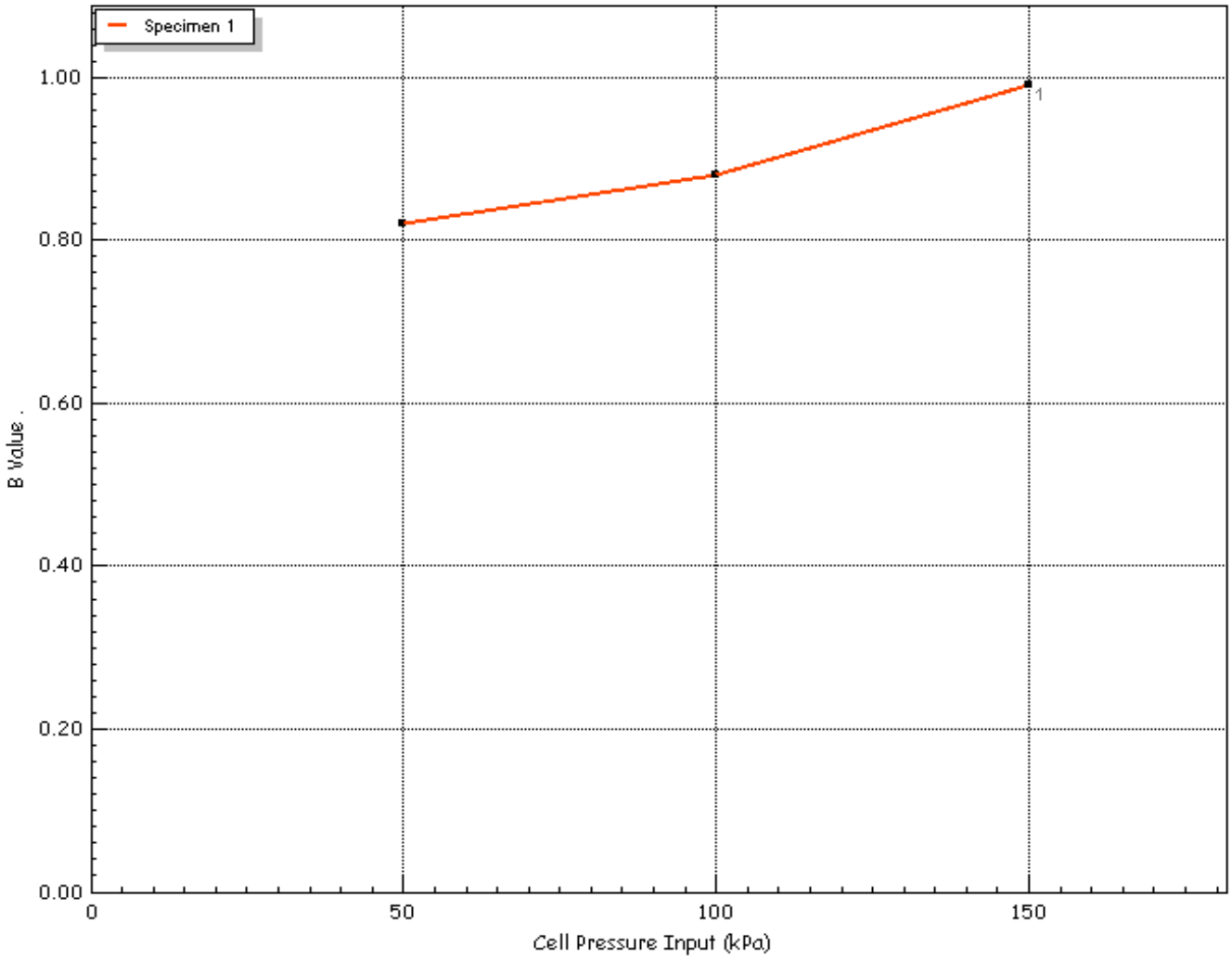
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	135
B Value	B	.	0.99



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 7.30-8.00m B21
		Test Date	14/08/2019
		Borehole	BH47
Jobfile	Stornoway Deep Water Port	Sample	7.30-8.00m B21
Client	Causeway Geotech Ltd	Depth	7.30-8.00m B21

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PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

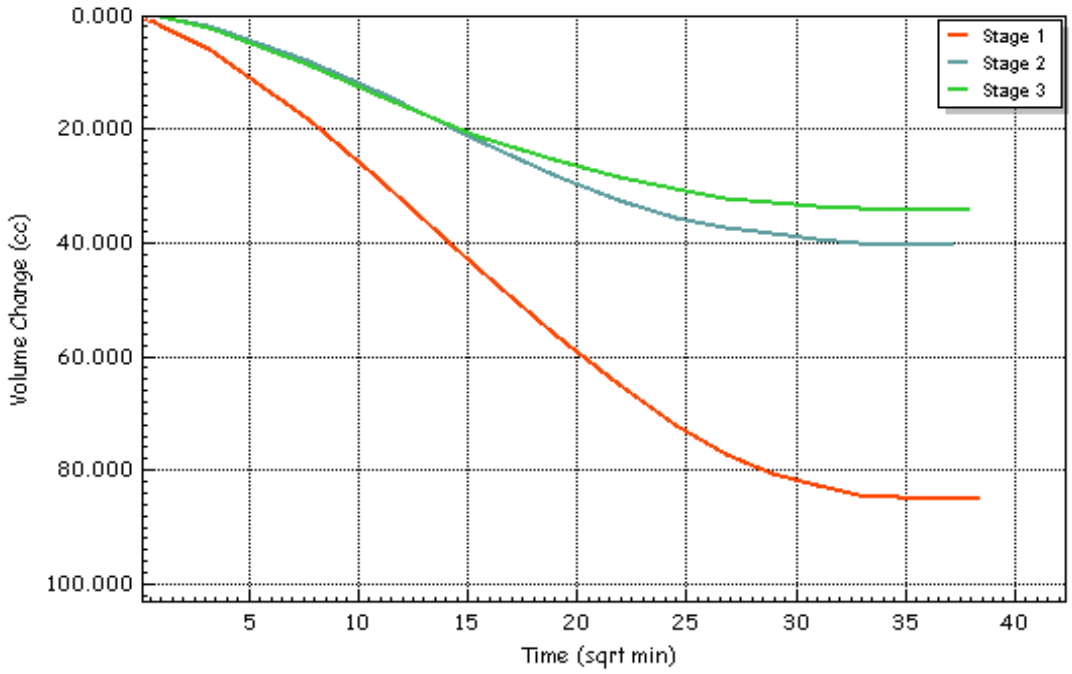
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	337	342	409
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.27	97.64	96.34
Volumetric Strain	ε_v%	(%)	5.72	8.44	10.75
Corrected Length	L_C	(mm)	196.6	186.6	173.5
Corrected Area	A_C	(cm2)	71.37	68.67	69.73
Corrected Volume	V_C	(cc)	1401.958	1361.457	1327.109
T100 Time to Failure	t_{100}	(min)	808.38	808.38	808.38
Consolidation	c_v	(m2/year)	0.241	0.241	0.241
Compressibility	m_v	(m2/MN)	1.605	2.042	1.022
Test Time	t_F	(h:m:s)	24:15:05	24:15:05	24:15:05
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00675	0.00641	0.00596

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 7.30-8.00m B21
		Test Date	14/08/2019
		Borehole	BH47
Jobfile	Stornoway Deep Water Port	Sample	7.30-8.00m B21
Client	Causeway Geotech Ltd	Depth	7.30-8.00m B21

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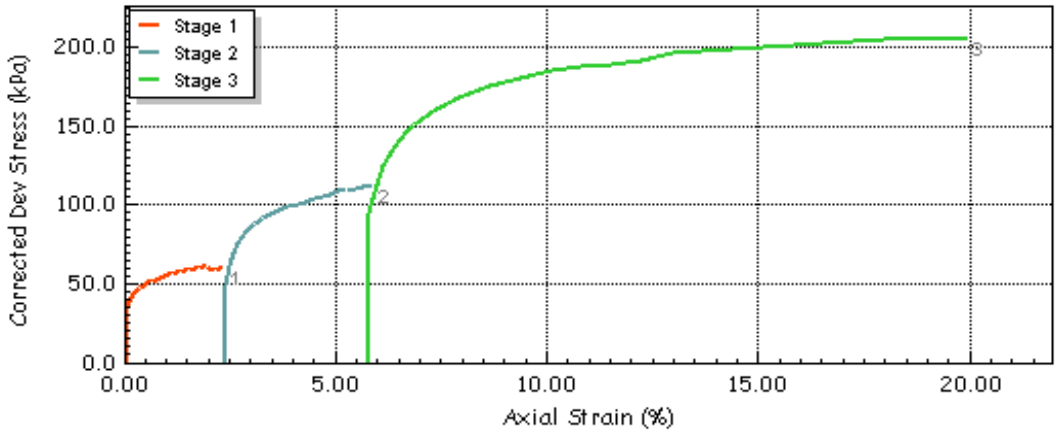
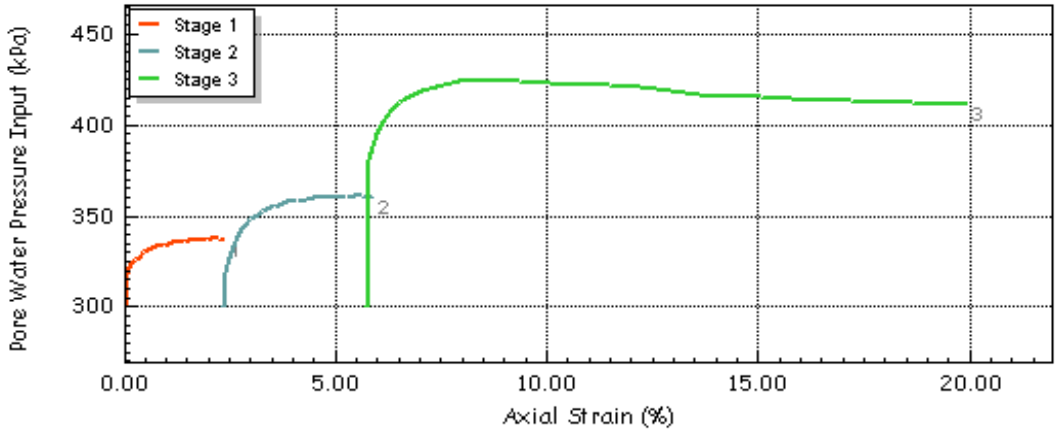
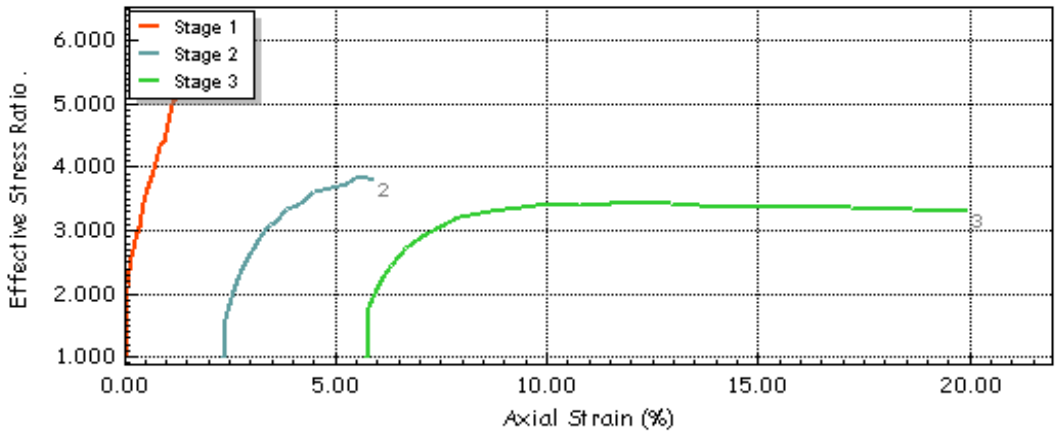
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 7.30-8.00m B21
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH47
Client	Causeway Geotech Ltd	Sample	7.30-8.00m B21
		Depth	7.30-8.00m B21

UKAS TESTING 4043

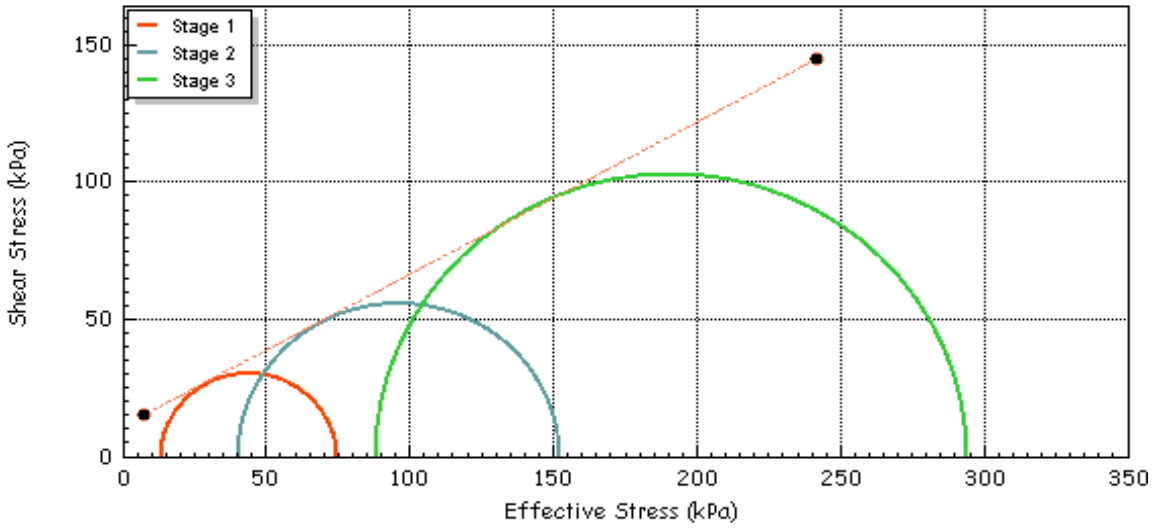
PSL Professional Soils Laboratory

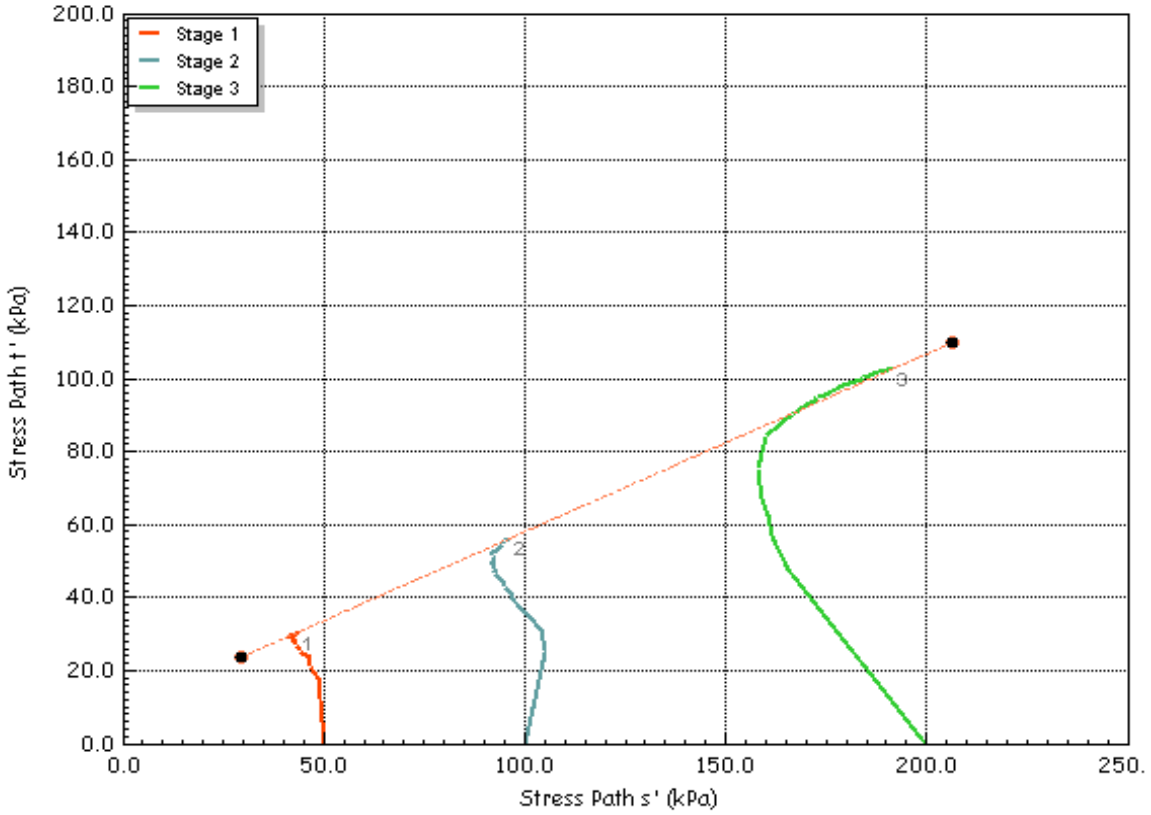
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	10.96	Effective Cohesion	c'	(kPa)	10.96
Effective Friction	ϕ'	(deg)	29.0	Effective Friction	ϕ'	(deg)	29.0





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH47 7.30-8.00m B21
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH47
Client	Causeway Geotech Ltd	Sample	7.30-8.00m B21
		Depth	7.30-8.00m B21

UKAS TESTING 4043

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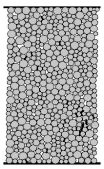
Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
	Depth	14.00-14.45m UT38		
	Description	See summary of soil descriptions.		
	Type	Undisturbed, Vertical orientation.		
	Initial Sample Length	L_0	(mm)	209.7
	Initial Sample Diameter	D_0	(mm)	102.7
	Initial Sample Weight	W_0	(gr)	3760.9
sketch showing specimen location in original sample	Initial Bulk Density	ρ_0	(Mg/m3)	2.17
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	22		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.77		
Initial Voids Ratio	e_i	.	0.499		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	16		
Final Dry Density	ρ_{df}	(Mg/m3)	1.92		
Final Voids Ratio	e_f	.	0.378		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	2.89	7.71	15.99
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	61.9	98.5	170.8
Minor Stress At Failure	σ_3'	(kPa)	25.0	49.0	96.0
Major Stress At Failure	σ_1'	(kPa)	86.9	147.5	266.8
Principal Stress At Failure	σ_1'/σ_3'		3.475	3.011	2.780

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH48 14.00-14.45m UT38
		Test Date	21/08/2019
		Borehole	BH48
Jobfile	Stornoway Deep Water Port	Sample	14.00-14.45m UT38
Client	Causeway Geotech Ltd	Depth	14.00-14.45m UT38

UKAS TESTING 4043

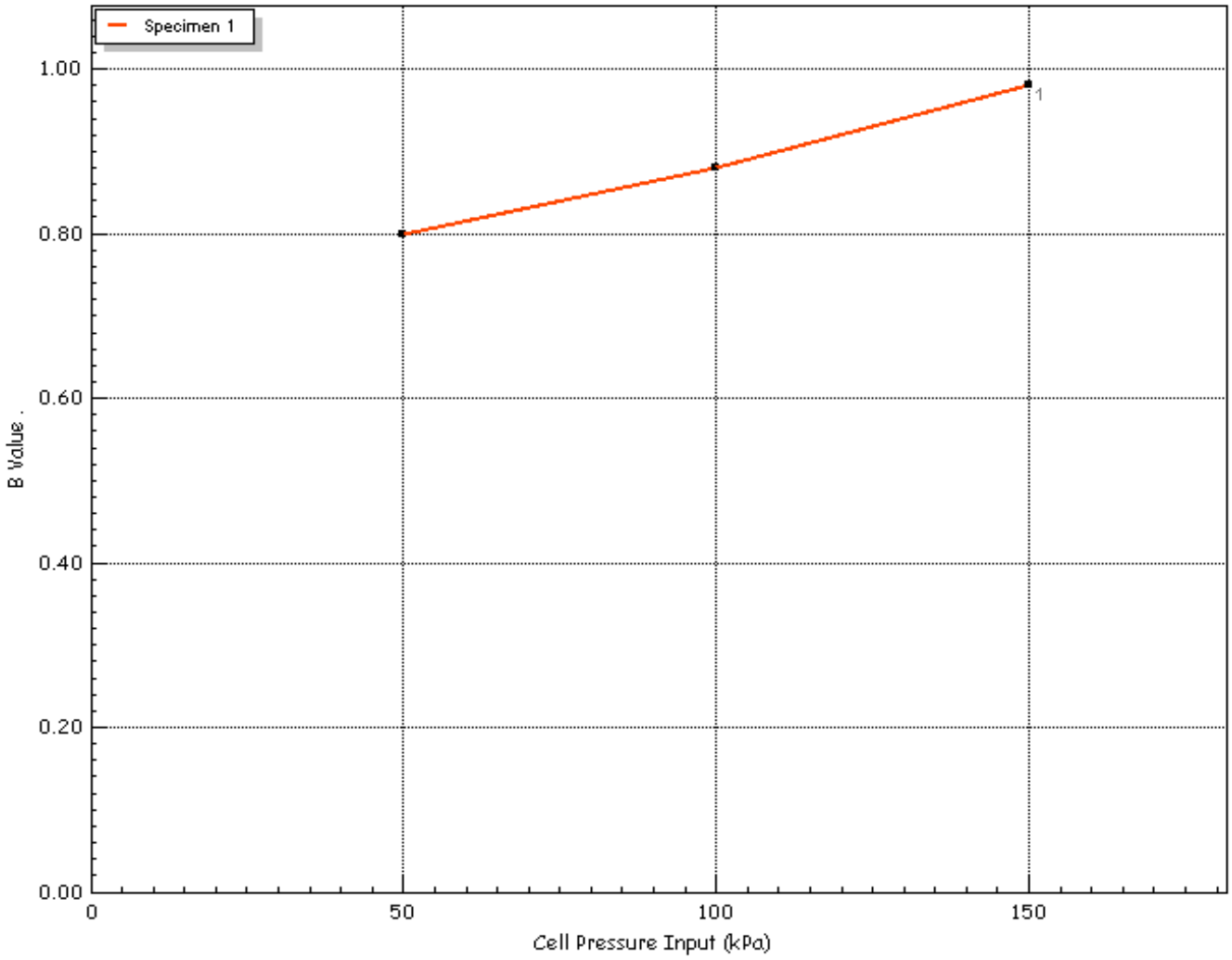
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	134
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH48 14.00-14.45m UT38
		Test Date	21/08/2019
		Borehole	BH48
Jobfile	Stornoway Deep Water Port	Sample	14.00-14.45m UT38
Client	Causeway Geotech Ltd	Depth	14.00-14.45m UT38

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PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

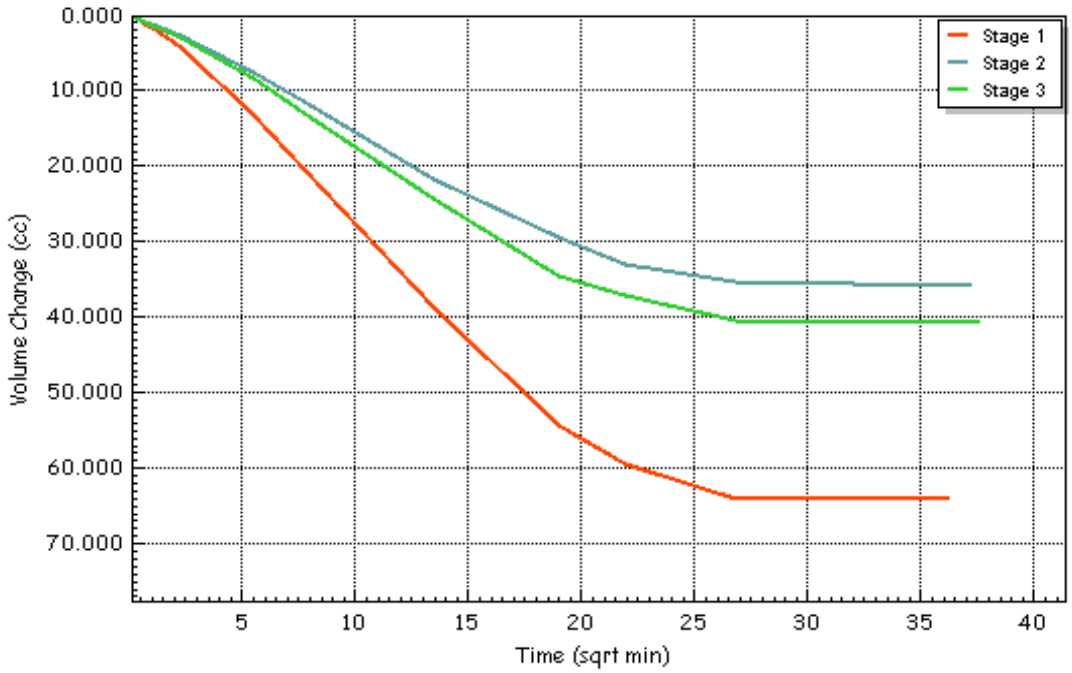
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	332	368	449
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	96.88	98.53	98.66
Volumetric Strain	ε_v%	(%)	3.69	5.75	8.10
Corrected Length	L_C	(mm)	207.1	197.2	182.3
Corrected Area	A_C	(cm2)	80.80	79.90	82.39
Corrected Volume	V_C	(cc)	1673.043	1637.146	1596.354
T100 Time to Failure	t_{100}	(min)	462.77	462.77	462.77
Consolidation	c_v	(m2/year)	0.471	0.471	0.471
Compressibility	m_v	(m2/MN)	1.190	0.859	0.551
Test Time	t_F	(h:m:s)	13:52:59	13:52:59	13:52:59
Estimated Strain to Failure	ε_f	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01243	0.01184	0.01094

Notes



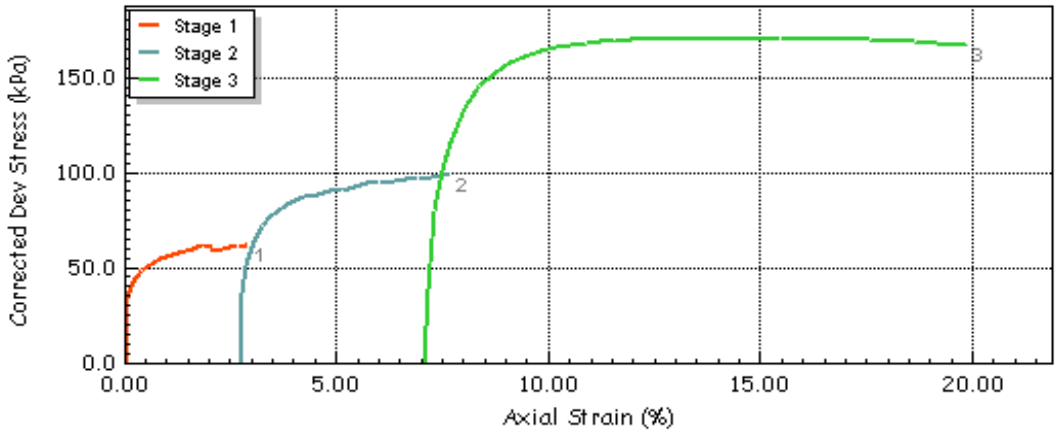
UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name: BH48 14.00-14.45m UT38 Test Date: 21/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole: BH48 Sample: 14.00-14.45m UT38
	Client	Causeway Geotech Ltd	Depth: 14.00-14.45m UT38

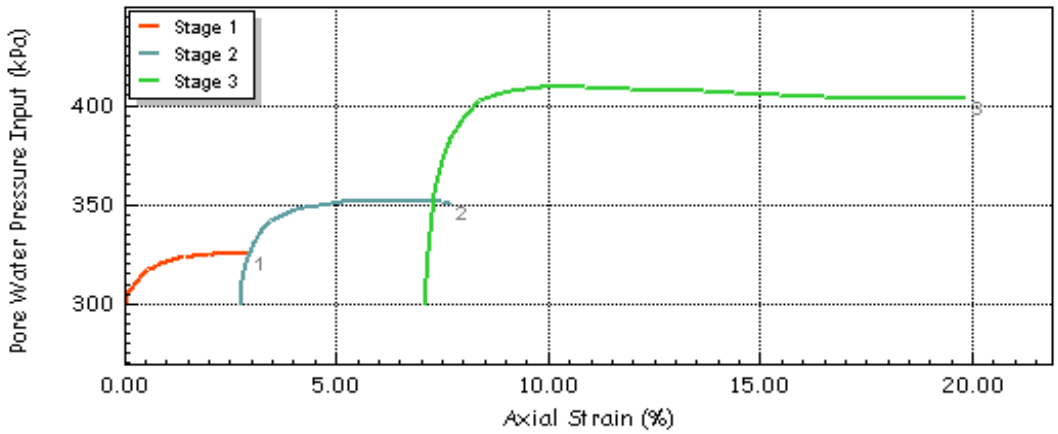
PSL Professional Soils Laboratory

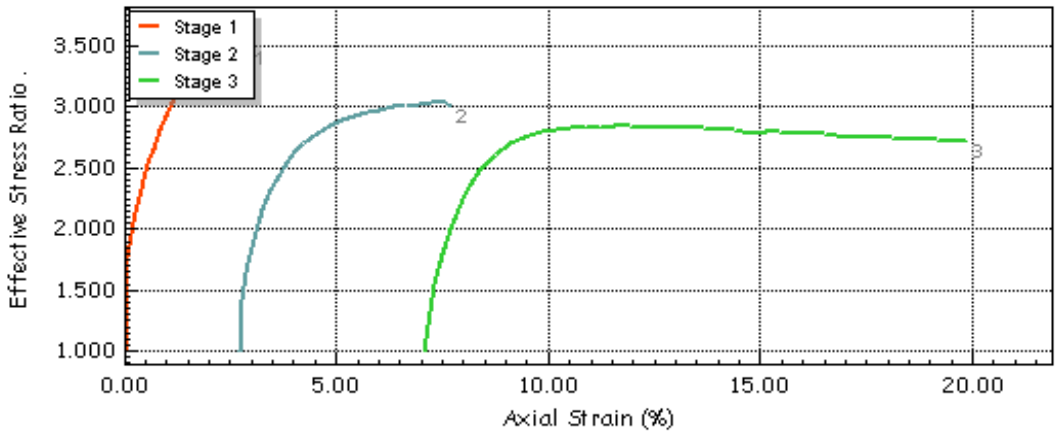
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH48 14.00-14.45m UT38
		Test Date	21/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH48
Client	Causeway Geotech Ltd	Sample	14.00-14.45m UT38
		Depth	14.00-14.45m UT38

UKAS TESTING 4043

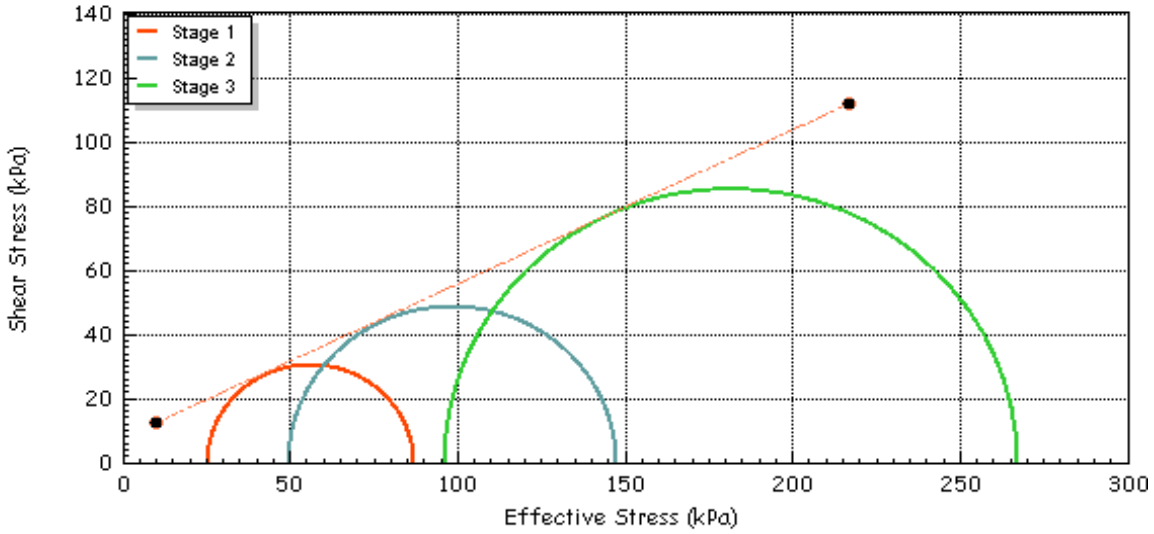
PSL Professional Soils Laboratory

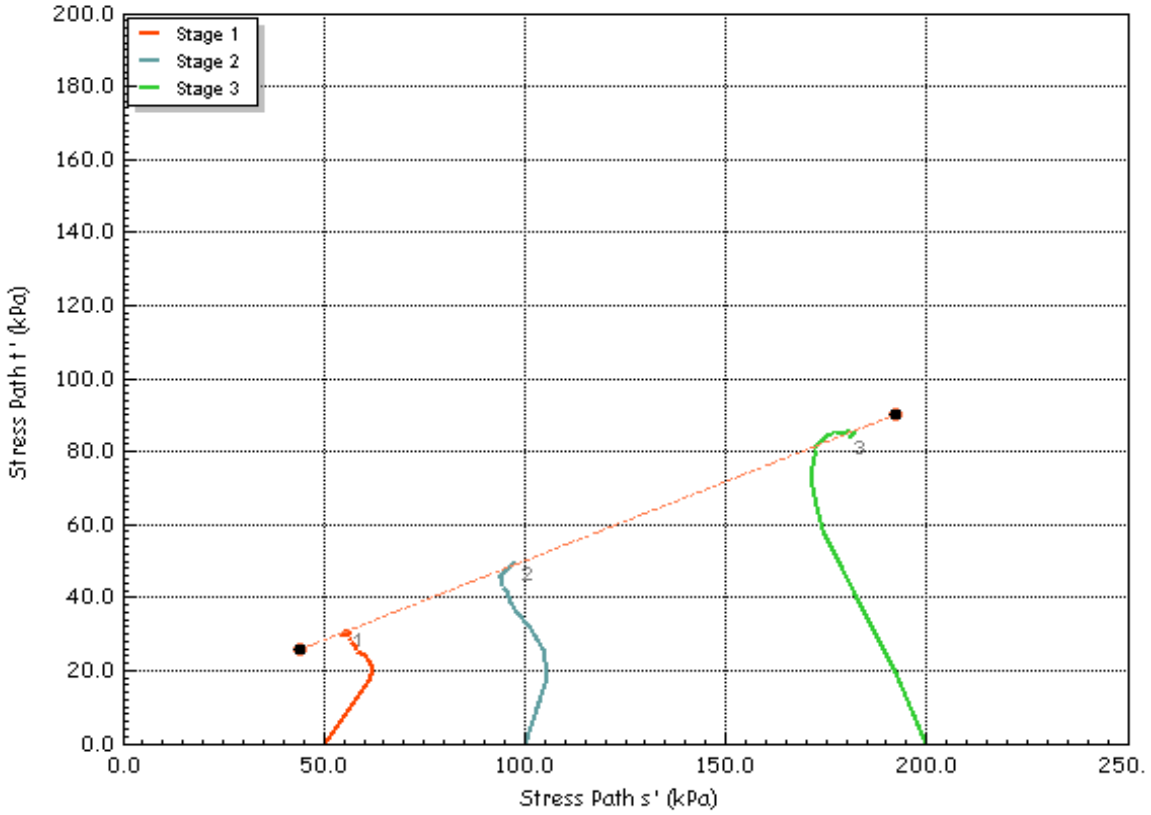
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	7.66	Effective Cohesion	c'	(kPa)	7.66
Effective Friction	ϕ'	(deg)	25.6	Effective Friction	ϕ'	(deg)	25.6





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH48 14.00-14.45m UT38
		Test Date	21/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH48
Client	Causeway Geotech Ltd	Sample	14.00-14.45m UT38
		Depth	14.00-14.45m UT38

UKAS TESTING 4043

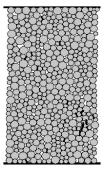
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth		5.00-6.00m P15	
Description		See summary of soil descriptions.	
Type		Undisturbed, Vertical orientation.	
Initial Sample Length	L_0	(mm)	209.4
Initial Sample Diameter	D_0	(mm)	103.1
Initial Sample Weight	W_0	(gr)	3423.4
Initial Bulk Density	ρ_0	(Mg/m3)	1.96
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	30		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.50		
Initial Voids Ratio	e_i	.	0.765		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	22		
Final Dry Density	ρ_{df}	(Mg/m3)	1.66		
Final Voids Ratio	e_f	.	0.600		
Final Degree of Saturation	S_f	(%)	95.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	8.01	12.26
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	52.6	82.9	127.5
Minor Stress At Failure	σ_3'	(kPa)	20.0	41.0	72.0
Major Stress At Failure	σ_1'	(kPa)	72.6	123.9	199.5
Principal Stress At Failure	σ_1'/σ_3'		3.629	3.021	2.771

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 5.00-6.00m P15
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH50
Client	Causeway Geotech Ltd	Sample	5.00-6.00m P15
		Depth	5.00-6.00m P15

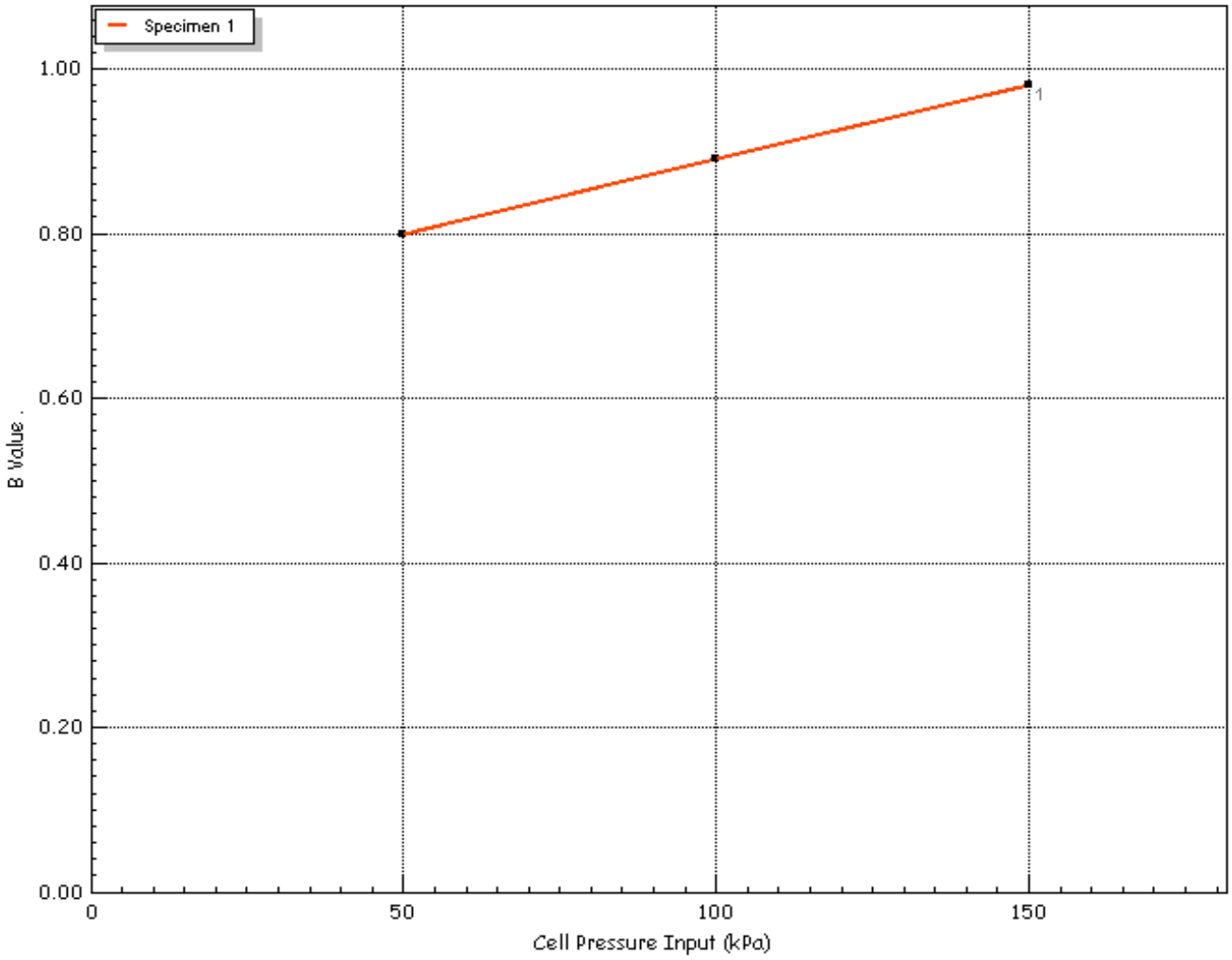
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	133
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 5.00-6.00m P15
		Test Date	22/08/2019
		Borehole	BH50
Jobfile	Stornoway Deep Water Port	Sample	5.00-6.00m P15
Client	Causeway Geotech Ltd	Depth	5.00-6.00m P15

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

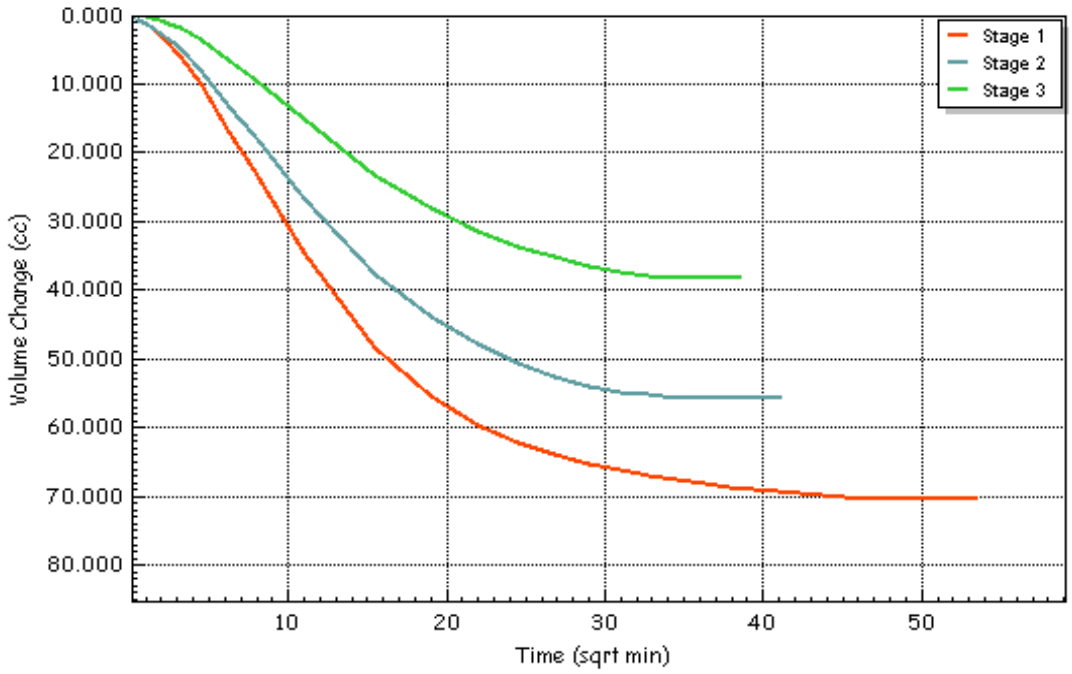
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	330	372	405
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	96.71	97.21	96.19
Volumetric Strain	ε_v%	(%)	4.03	7.22	9.41
Corrected Length	L_C	(mm)	206.6	193.3	178.9
Corrected Area	A_C	(cm2)	81.24	80.48	81.88
Corrected Volume	V_C	(cc)	1677.795	1622.004	1583.697
T100 Time to Failure	t_{100}	(min)	425.33	425.33	425.33
Consolidation	c_V	(m2/year)	0.516	0.516	0.516
Compressibility	m_V	(m2/MN)	1.369	1.037	0.931
Test Time	t_F	(h:m:s)	12:45:35	12:45:35	12:45:35
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01349	0.01262	0.01168

Notes



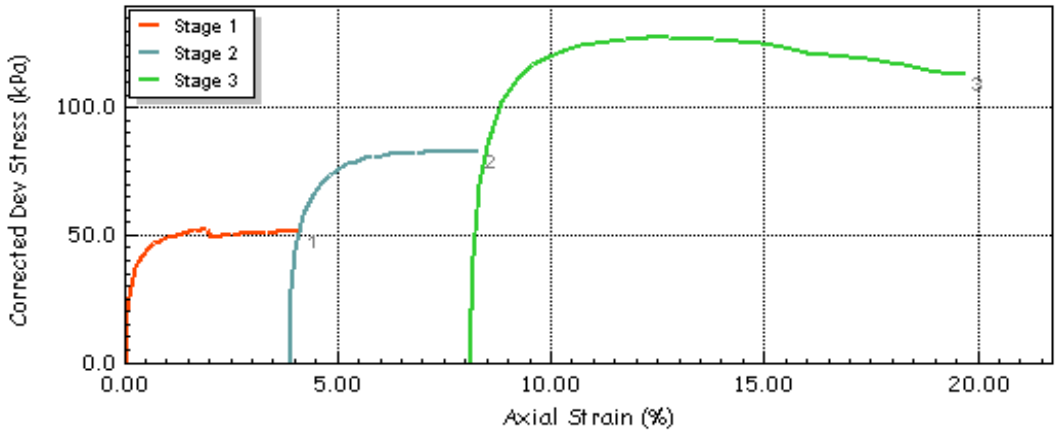
UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name: BH50 5.00-6.00m P15 Test Date: 22/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole: BH50 Sample: 5.00-6.00m P15
	Client	Causeway Geotech Ltd	Depth: 5.00-6.00m P15

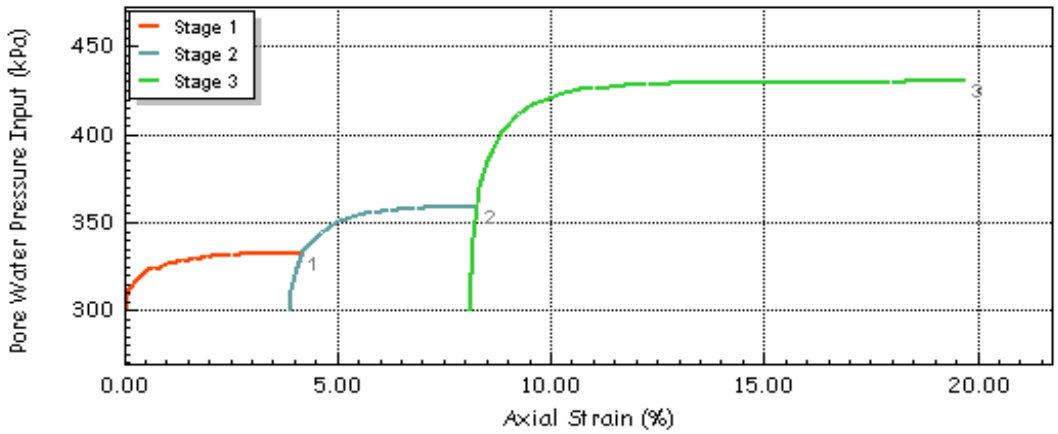
PSL Professional Soils Laboratory

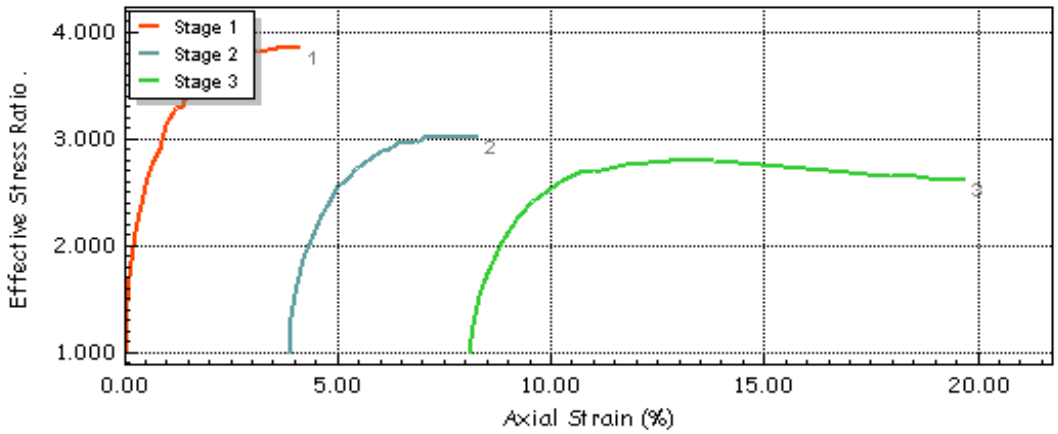
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 5.00-6.00m P15
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH50
Client	Causeway Geotech Ltd	Sample	5.00-6.00m P15
		Depth	5.00-6.00m P15

UKAS TESTING 4043

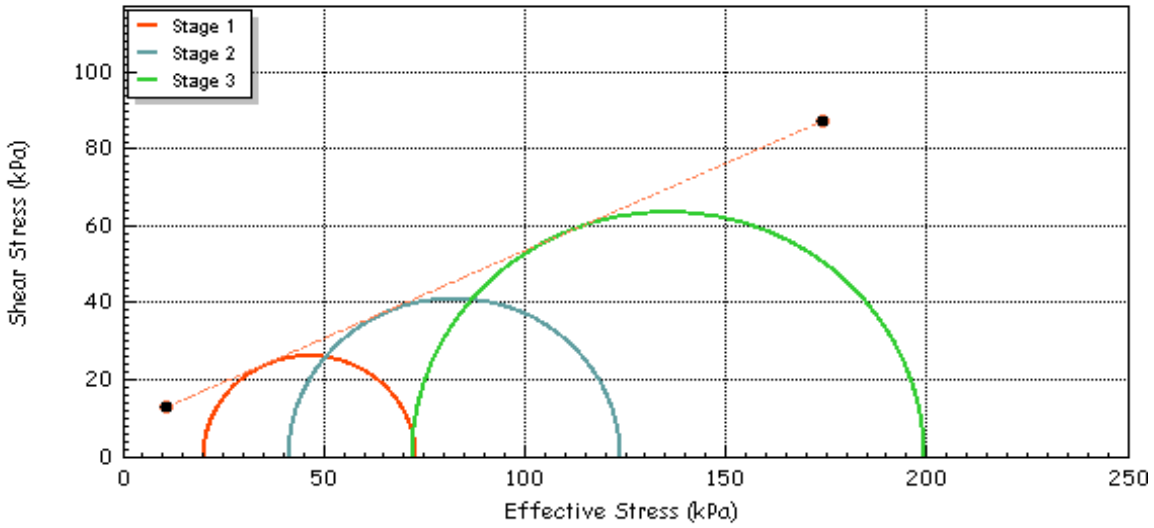
PSL Professional Soils Laboratory

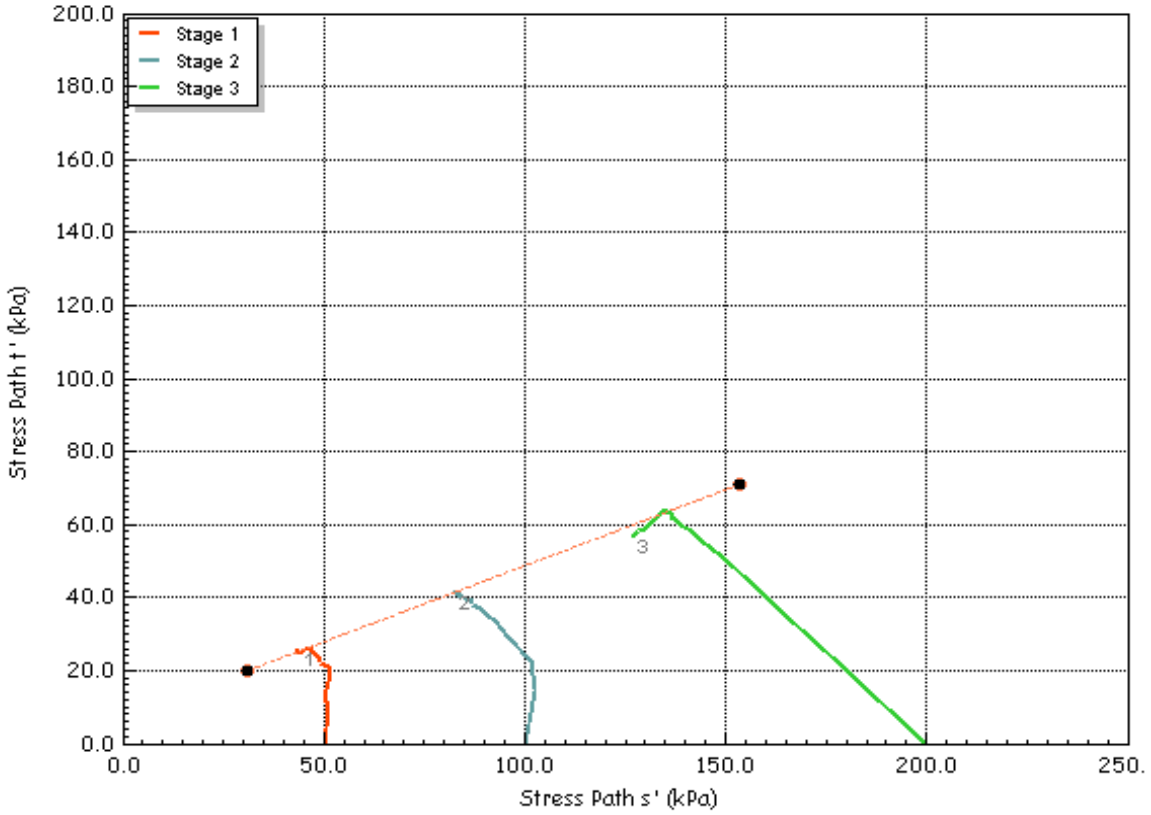
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	7.90	Effective Cohesion	c'	(kPa)	7.90
Effective Friction	ϕ'	(deg)	24.5	Effective Friction	ϕ'	(deg)	24.5





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 5.00-6.00m P15
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH50
Client	Causeway Geotech Ltd	Sample	5.00-6.00m P15
		Depth	5.00-6.00m P15

UKAS TESTING 4043

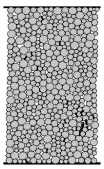
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth		7.00-8.00m P17	
Description		See summary of soil descriptions.	
Type		Undisturbed, Vertical orientation.	
Initial Sample Length	L_0	(mm)	207.4
Initial Sample Diameter	D_0	(mm)	99.4
Initial Sample Weight	W_0	(gr)	3199.1
Initial Bulk Density	ρ_0	(Mg/m3)	1.99
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	35		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.48		
Initial Voids Ratio	e_i	.	0.794		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	24		
Final Dry Density	ρ_{df}	(Mg/m3)	1.69		
Final Voids Ratio	e_f	.	0.573		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	9.14	15.93
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	49.9	73.8	127.5
Minor Stress At Failure	σ_3'	(kPa)	14.0	28.0	64.0
Major Stress At Failure	σ_1'	(kPa)	63.9	101.8	191.5
Principal Stress At Failure	σ_1'/σ_3'		4.564	3.637	2.993

Notes

UKAS TESTING 4043

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 7.00-8.00m P17
		Test Date	22/08/2019
		Borehole	BH50
Jobfile	Stornoway Deep Water Port	Sample	7.00-8.00m P17
Client	Causeway Geotech Ltd	Depth	7.00-8.00m P17

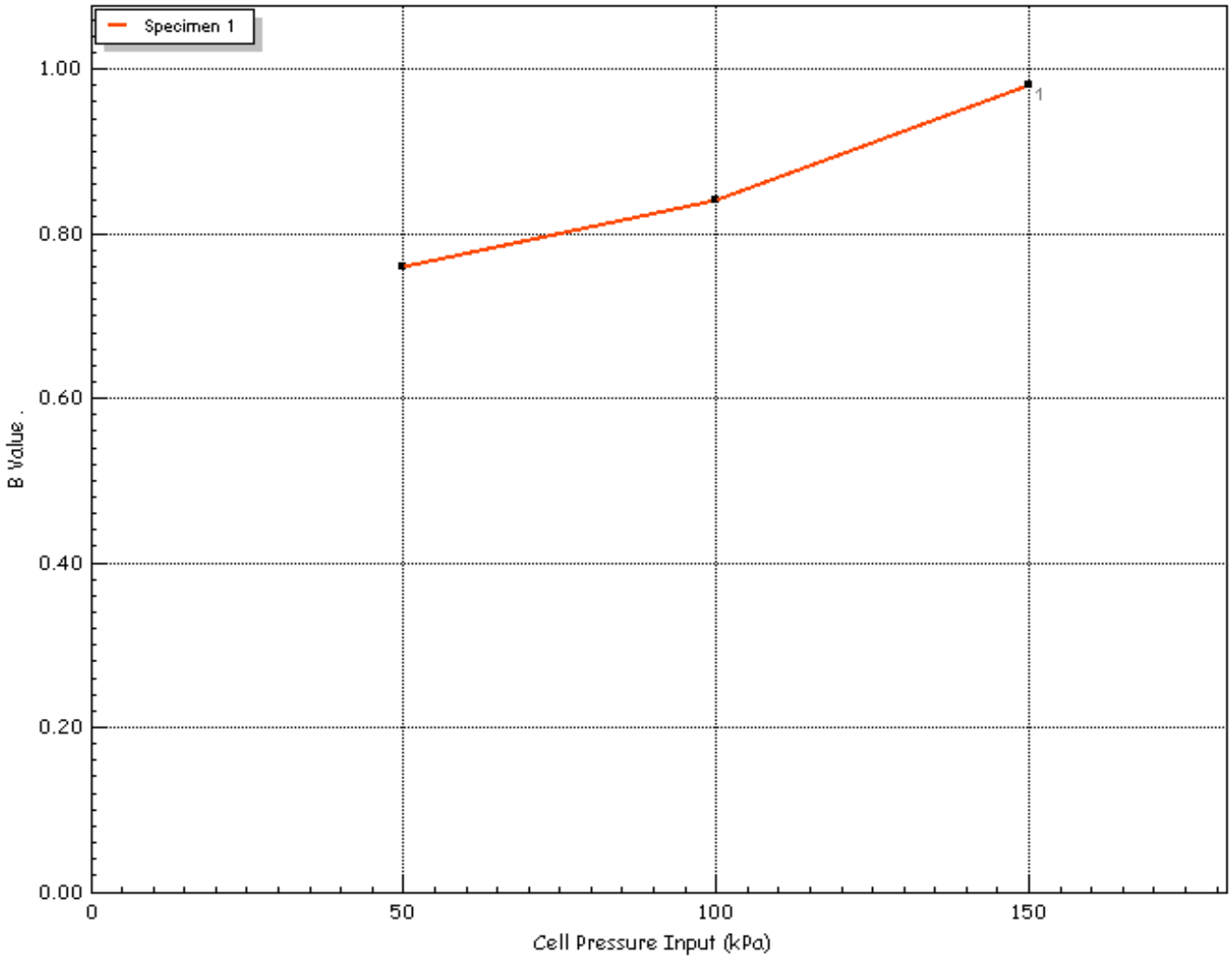
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	147
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 7.00-8.00m P17
		Test Date	22/08/2019
		Borehole	BH50
Jobfile	Stornoway Deep Water Port	Sample	7.00-8.00m P17
Client	Causeway Geotech Ltd	Depth	7.00-8.00m P17

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

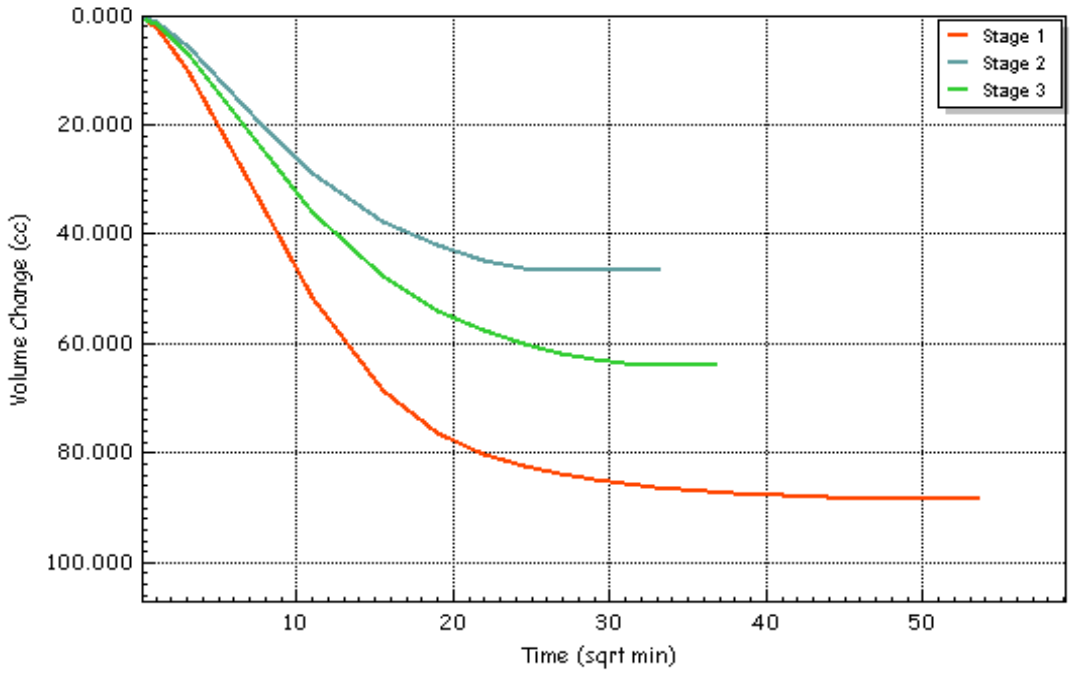
Consolidated Undrained

Consolidation Plots

Initial Conditions					
			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	348	381	462
Drainage Method			Radial+One End		

Final Conditions					
			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.92	96.30	97.53
Volumetric Strain	ε_v%	(%)	5.49	8.39	12.36
Corrected Length	L_C	(mm)	203.6	191.8	172.2
Corrected Area	A_C	(cm2)	74.76	72.53	74.70
Corrected Volume	V_C	(cc)	1521.017	1474.448	1410.513
T100 Time to Failure	t_{100}	(min)	320.44	320.44	320.44
Consolidation	c_V	(m2/year)	0.637	0.637	0.637
Compressibility	m_V	(m2/MN)	1.169	1.075	0.782
Test Time	t_F	(h:m:s)	09:36:47	09:36:47	09:36:47
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.01765	0.01663	0.01493

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 7.00-8.00m P17
		Test Date	22/08/2019
		Borehole	BH50
Jobfile	Stornoway Deep Water Port	Sample	7.00-8.00m P17
Client	Causeway Geotech Ltd	Depth	7.00-8.00m P17

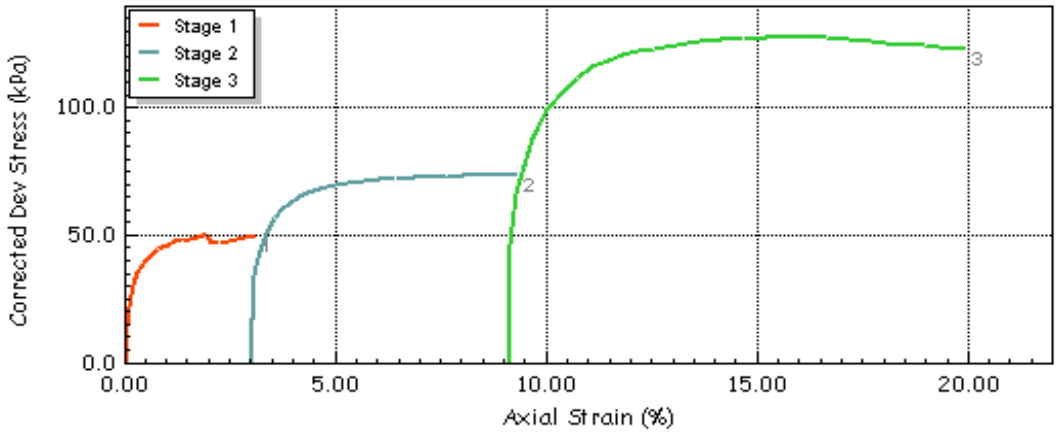
UKAS TESTING 4043

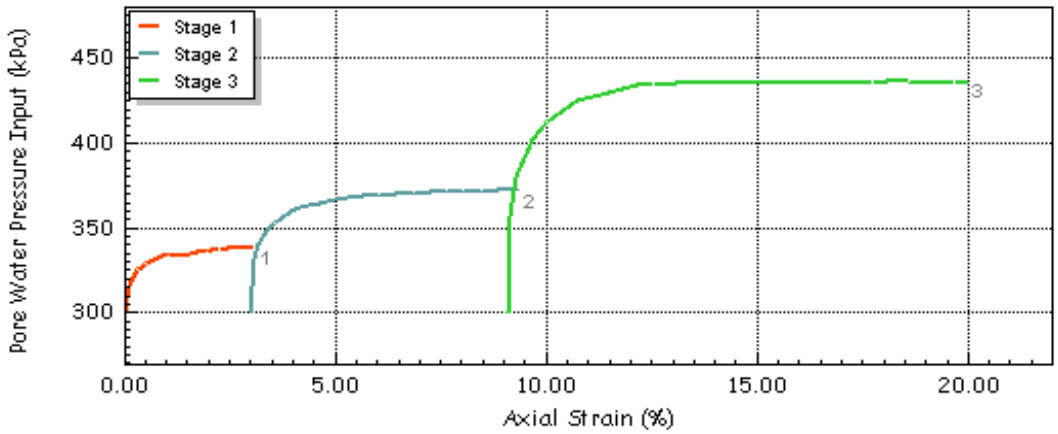
PSL Professional Soils Laboratory

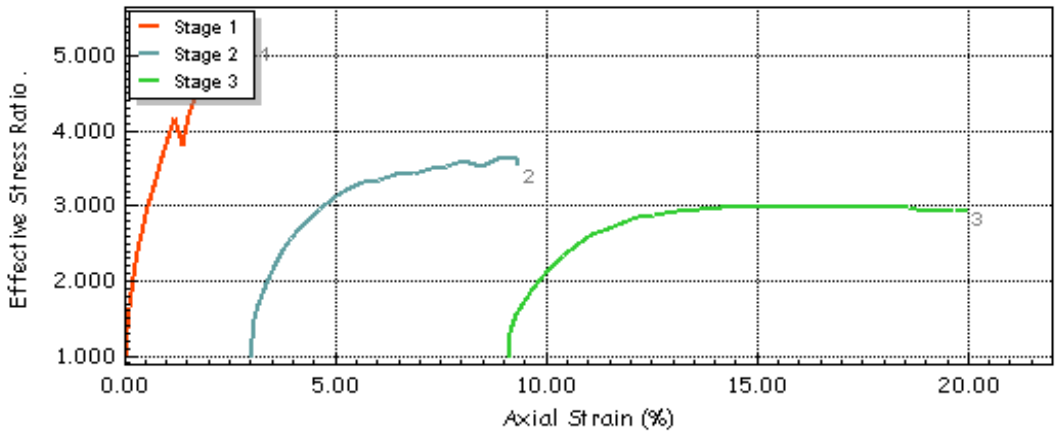
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 7.00-8.00m P17
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH50
Client	Causeway Geotech Ltd	Sample	7.00-8.00m P17
		Depth	7.00-8.00m P17

UKAS TESTING 4043

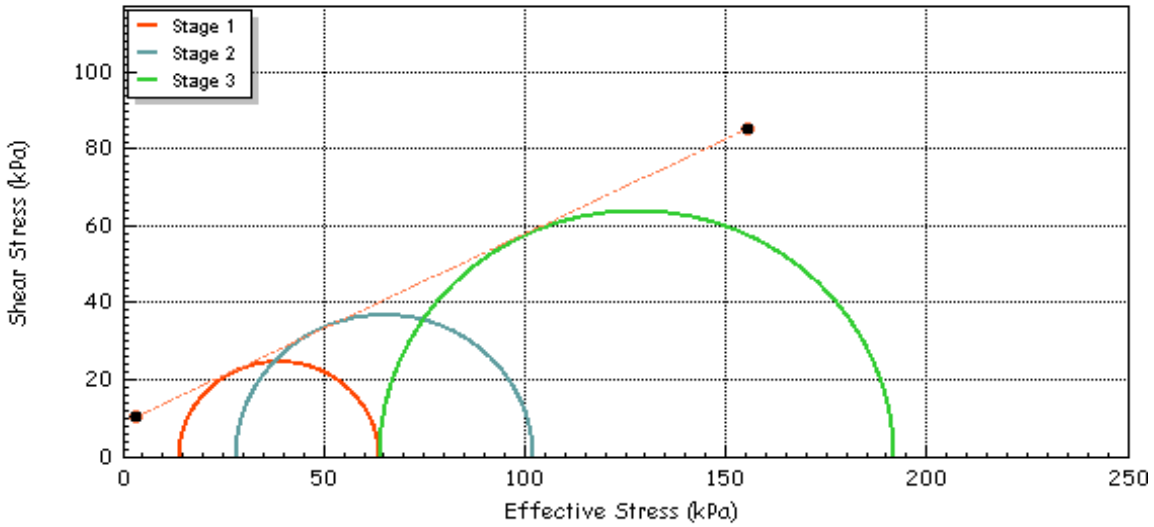
PSL Professional Soils Laboratory

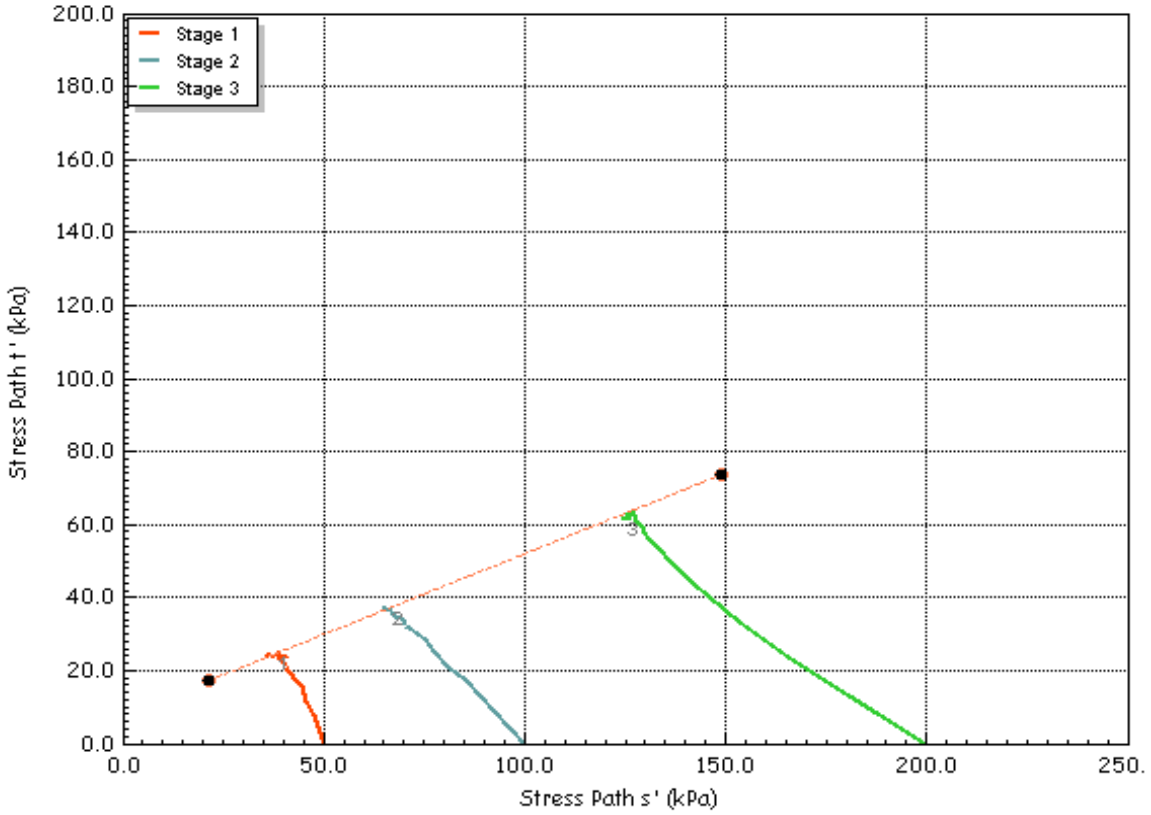
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	8.83	Effective Cohesion	c'	(kPa)	8.83
Effective Friction	ϕ'	(deg)	26.2	Effective Friction	ϕ'	(deg)	26.2





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH50 7.00-8.00m P17
		Test Date	22/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH50
Client	Causeway Geotech Ltd	Sample	7.00-8.00m P17
		Depth	7.00-8.00m P17

UKAS TESTING 4043

PSL Professional Soils Laboratory

LABORATORY REPORT

4043

Contract Number: PSL19/4944

Report Date: 29 August 2019

Client's Reference: 19-0382-2

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 15/8/2019
Date Commenced: 15/8/2019
Date Completed: 29/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
S Royle (Laboratory Manager)	S Eyre (Senior Technician)	L Knight (Senior Technician)

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Doncaster DN4 0AR
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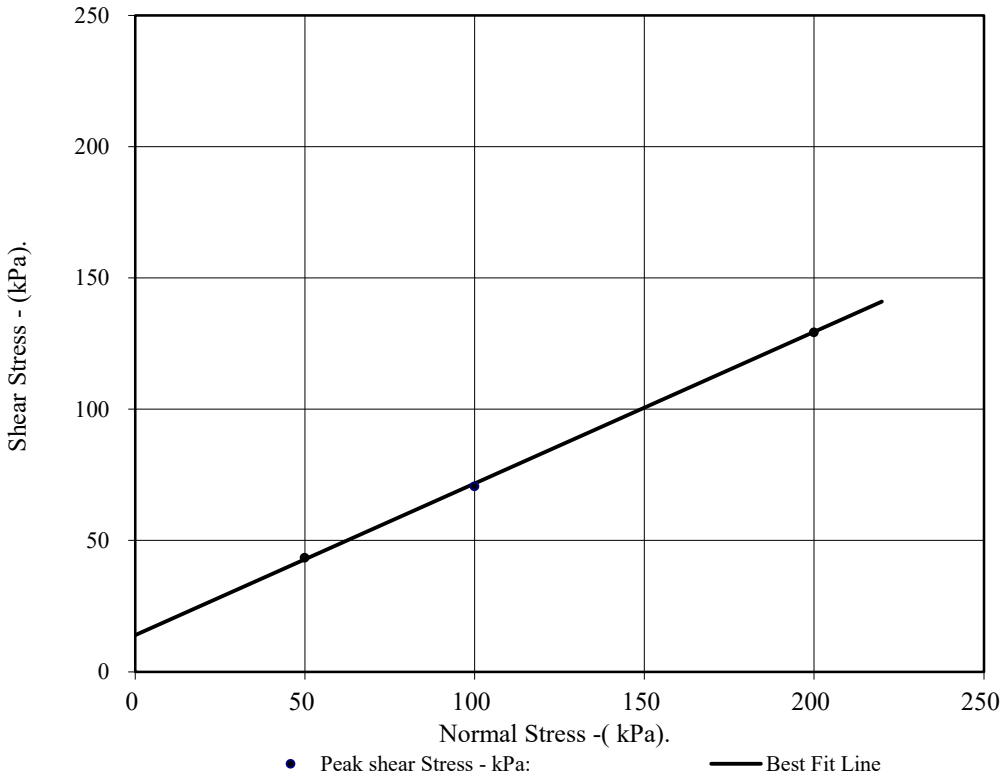
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH47**		Top Depth:	**1.50**
Sample Number:	**5**		Base Depth:	**2.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort			
Sample Description:	**Grey slightly gravelly slightly sandy CLAY.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	32	32	32
Bulk Density - Mg/m3:	1.79	1.79	1.79
Dry Density - Mg/m3:	1.36	1.36	1.36
Voids Ratio:	0.952	0.951	0.950
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.77	15.85	15.25
Shearing Stage			
Rate of Strain (mm/min)	0.038	0.038	0.038
Displacement at peak shear stress (mm)	10.00	7.44	7.45
Peak shear Stress - kPa:	43	71	129
Final Consolidated Conditions			
Moisture Content - %:	46	45	41
Bulk Density - Mg/m3:	2.02	2.27	2.36
Dry Density - Mg/m3:	1.39	1.56	1.67
Peak			
Angle of Shearing Resistance:(~~θ~~)	**30**		
Effective Cohesion - kPa:	**14**		

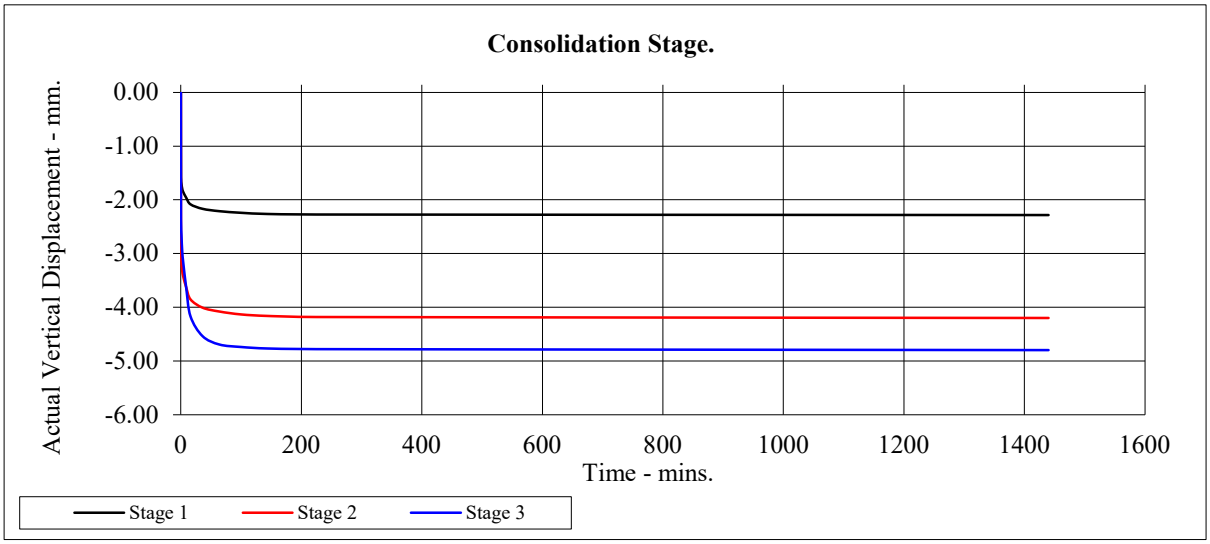


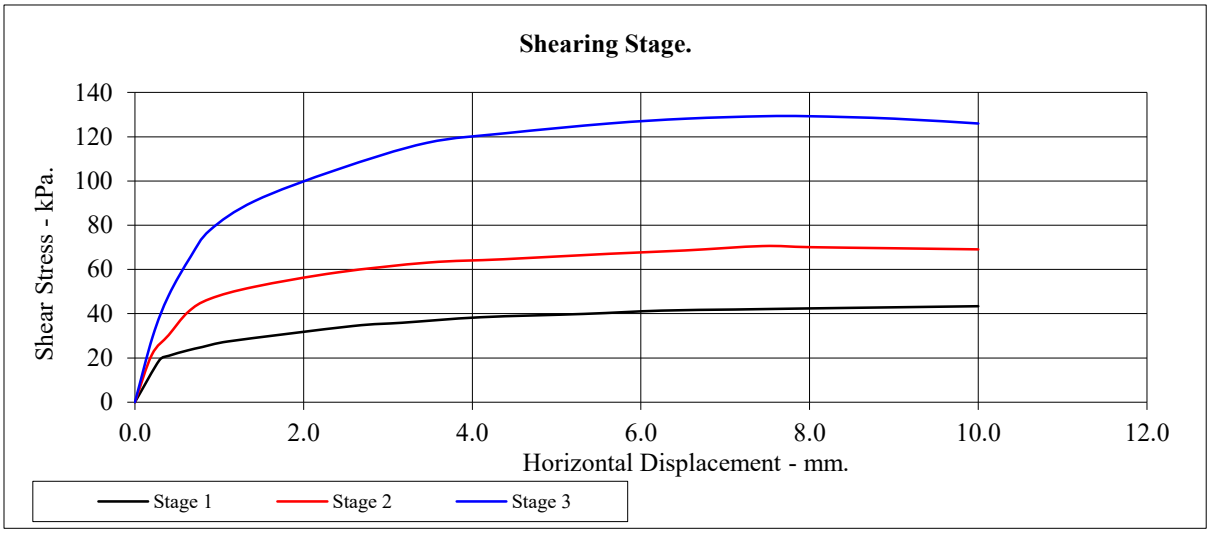
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4944 **Client Ref:** 19-0382

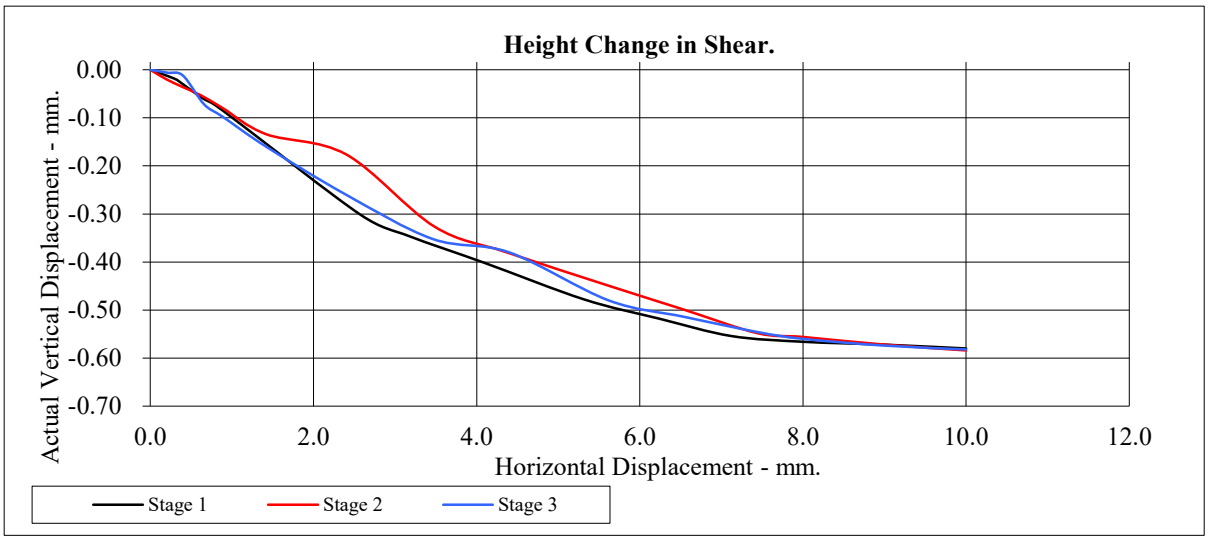
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH47**	Top Depth:	**1.50**
Sample Number:	**5**	Base Depth:	**2.00**





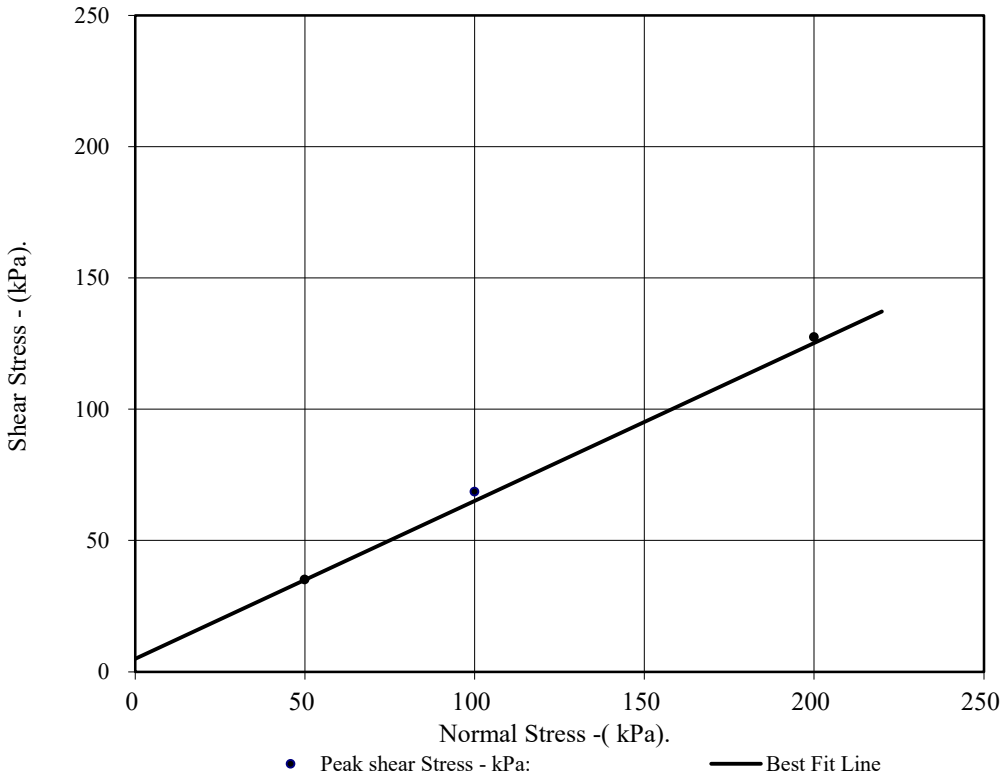


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH48**		Top Depth:	**10.00**
Sample Number:	**29**		Base Depth:	**10.45**
Sample Conditions:	Submerged		Sample Type	**UT**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Cut and Trimmed Undisturbed			
Sample Description:	**Grey slightly gravelly slightly sandy CLAY.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	30	30	30
Bulk Density - Mg/m3:	1.85	1.85	1.86
Dry Density - Mg/m3:	1.42	1.42	1.43
Voids Ratio:	0.860	0.862	0.858
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.75	17.49	16.13
Shearing Stage			
Rate of Strain (mm/min)	0.032	0.032	0.032
Displacement at peak shear stress (mm)	6.00	8.03	8.00
Peak shear Stress - kPa:	35	69	127
Final Consolidated Conditions			
Moisture Content - %:	26	24	22
Bulk Density - Mg/m3:	2.09	2.12	2.31
Dry Density - Mg/m3:	1.67	1.71	1.90
Peak			
Angle of Shearing Resistance:(~~θ~~)	**31**		
Effective Cohesion - kPa:	**5**		

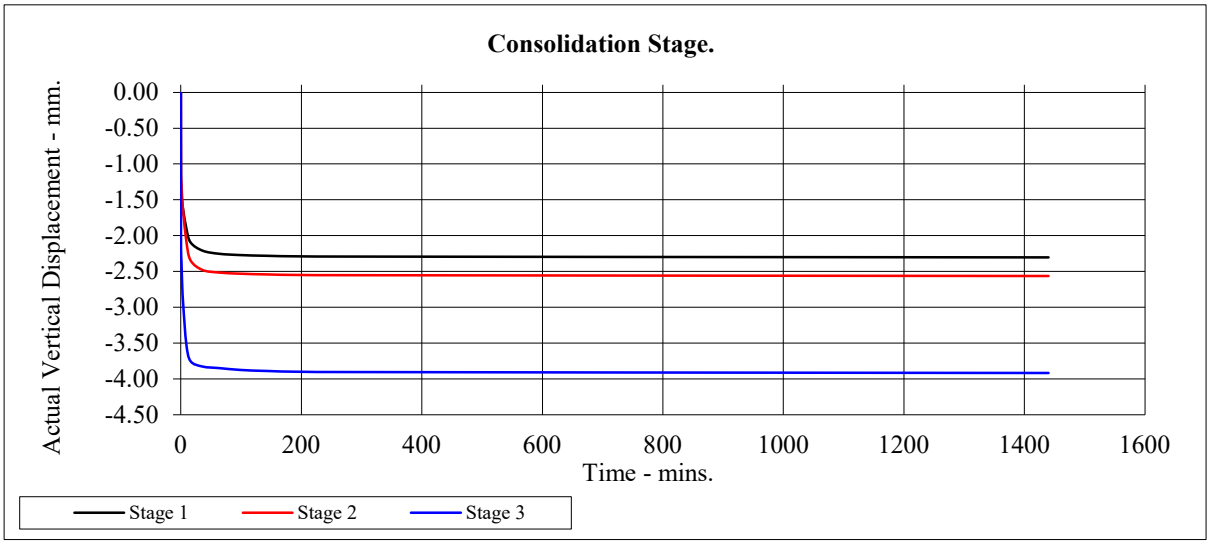


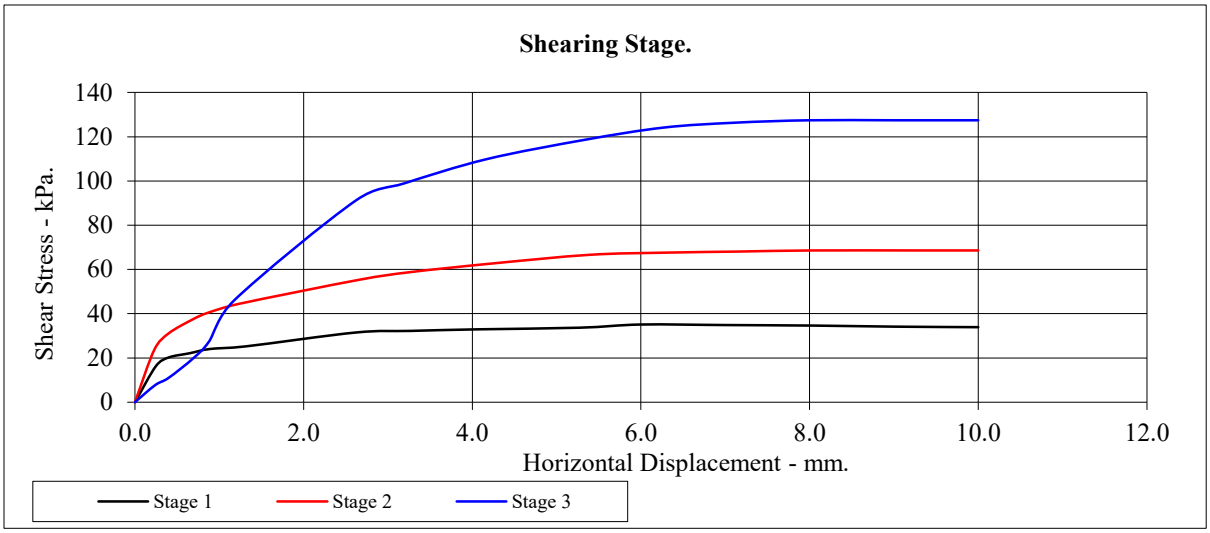
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4944** **Client Ref:** **19-0382**

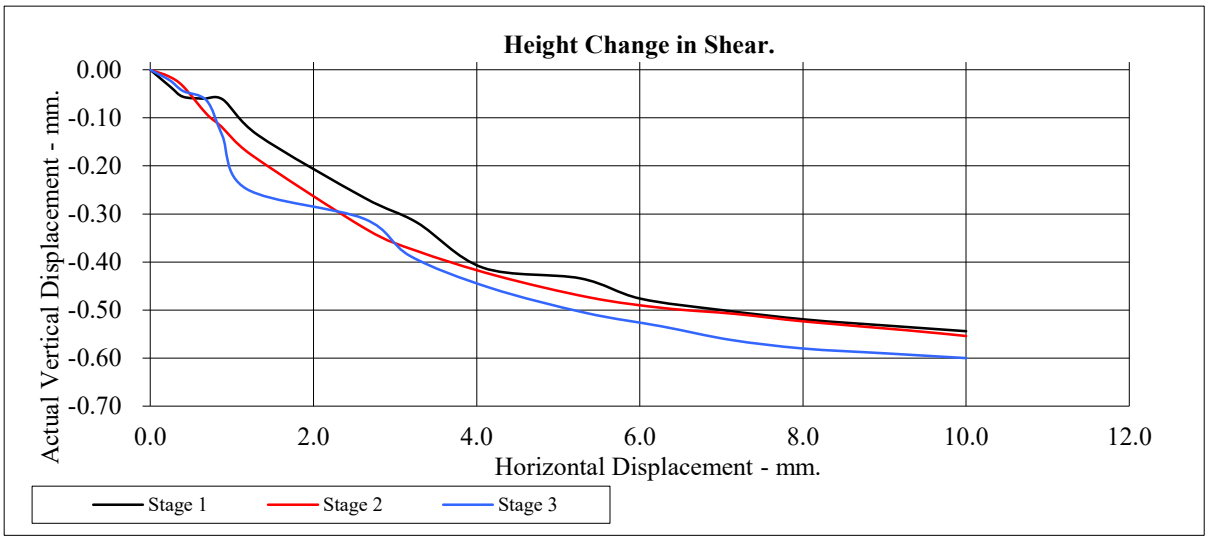
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH48**	Top Depth:	**10.00**
Sample Number:	**29**	Base Depth:	**10.45**







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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

1 October 2019

Project Name:	Stornoway Deep Water Port
Project No.:	19-0382
Client:	Stornoway Port Authority
Engineer:	Wallace Stone Consulting Civil Engineers

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

[redacted]

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

SCS ISO 9001 CERTIFIED
SCS ISO 14001 CERTIFIED
SCS ISO 45001 CERTIFIED
UKAS MANAGEMENT SYSTEMS 9235
UKAS TESTING 10122
AGS
BRITISH DRILLING ASSOCIATION

Project Name: Stornoway Deep Water Port

Report Reference: G03 – FINAL

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	25
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	25
SOIL	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	23
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	24
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	7
SOIL	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	12
	Extra over days (more than initial 5 days)		24
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 8	1
SOIL	Undrained shear strength – triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 9	3

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Bulk and dry density by Linear Measurement Method	BS 1377-2: 1990: Cl 7.2	5
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	5
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Direct Shear Strength using 60mm Small Shearbox (up to 3 days)	BS 1377-7: 1990: Cl 4	21
	Extra over days (more than initial 3 days)		12
SOIL – subcontracted to Pro Soils Limited (UKAS 4043)	Direct Shear Strength using 300mm Small Shearbox	BS 1377-7: 1990: Cl 4	4
	Extra over days (more than initial 3 days)		3
SOIL – subcontracted to Pro Soils Limited *(UKAS 4043)*	Effective shear strength consolidated undrained triaxial compression test with measurement of volume change (up to 4 days)	BS 1377-8:1990	3
	Extra over days (more than initial 4 days)		10

Summary of Classification Test Results

CAUSEWAY GEOTECH

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density bulk Mg/m3	Density dry Mg/m3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH43	35	9.70		B	Grey silty fine to medium SAND.	2.16	1.84	25.0	92	32 -1pt	NP			
BH43	61	16.50		B	Grey sandy slightly gravelly silty CLAY.	1.97	1.53	33.0	80	41 -1pt	18	23		CI
BH43	77	20.50		B	Grey sandy slightly gravelly silty CLAY.	2.01	1.60	28.0	97	32 -1pt	14	18		CL
BH43	109	29.10		B	Grey sandy slightly gravelly silty CLAY.	2.26	1.99	14.0	76	37 -1pt	13	24		CI
BH45	40	9.80		B	Grey sandy slightly gravelly organic SILT.	1.71	1.13	66.0	95	68 -1pt	52	16		MH
BH45	46	11.00		B	Grey sandy slightly gravelly silty CLAY.			44.0	87	44 -1pt	20	24		CI
BH45	58	14.00		B	Grey slightly sandy slightly gravelly silty CLAY.			25.0	95	34 -1pt	16	18		CL
BH45	73	18.00		B	Grey slightly sandy slightly gravelly silty CLAY.	2.02	1.52	29.0	97	39 -1pt	14	25		CI
BH49	21	5.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.15	1.80	22.0	86	32 -1pt	17	15		CL
BH49	27	6.50		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	1.93	1.44	41.0	89	46 -1pt	21	25		CI
BH49	33	8.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	1.90	1.43	40.0	82	41 -1pt	18	23		CI
BH49	41	10.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			44.0	93	48 -1pt	20	28		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

27/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density bulk Mg/m3	Density dry Mg/m3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH49	49	12.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.22	1.92	19.0	63	26 -1pt	12	14		CL
BH49	54	13.50		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			44.0	87	46 -1pt	20	26		CI
BH49	57	15.60		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.45	2.25	10.0	54	20 -1pt	12	8		CL
BH49	69	20.50		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.30	2.16	6.1	42	24 -1pt	15	9		CL
BH51	1	0.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.47	0.83	83.0	96	63 -1pt	30	33		CH
BH51	9	4.00		B	Grey slightly silty fine to coase SAND with shell fragments.	2.00	1.57	24.0	94	32 -1pt	NP			
BH51	15	7.00		B	Grey slightly sandy slightly gravelly silty CLAY.	1.59	0.95	91.0	96	50 -1pt	27	23		CI/CH
BH51	19	9.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			46.0	95	32 -1pt	19	13		CL
BH51	23	11.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.91	1.45	31.0	90	30 -1pt	21	9		CL
BH51	27	13.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			35.0	90	34 -1pt	17	17		CL
BH51	31	15.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.84	1.34	42.0	92	54 -1pt	18	36		CH
BH52	21	8.30		B	Grey clayey fine to coarse SAND.	1.68	1.15	63.0	87	36 -1pt	16	20		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

27/08/2019

Approved By

Stephen.Watson

UKAS TESTING

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CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH52	27	11.00		B	Greyish brown sandy silty CLAY.	2.01	1.58	30.0	95	29 -1pt	19	10		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

27/08/2019

Approved By

Stephen.Watson

UKAS TESTING

10122

Density Tests - Summary of Results

Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Linear Measurement			Immersion in water			Water displacement			Remarks
	Ref	Top	Base	Type		Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	
BH43	32	8.00		B	Grey slightly silty gravelly fine to coarse SAND.	2.08	1.82	14.5							
BH43	35	9.70		B	Grey silty fine to medium SAND.	2.16	1.84	17.4							
BH43	61	16.50		B	Grey sandy slightly gravelly silty CLAY.	1.97	1.53	29.3							
BH43	77	20.50		B	Grey sandy slightly gravelly silty CLAY.	2.01	1.60	26.2							
BH43	83	22.00		B	Grey sandy gravelly silty CLAY.	2.45	2.26	8.5							
BH43	103	27.00		B	Grey sandy gravelly silty CLAY.	2.36	2.21	7.0							
BH43	109	29.10		B	Grey sandy slightly gravelly silty CLAY.	2.26	1.99	13.6							
BH45	12	3.00		B	Grey very gravelly fine to coarse SAND.	1.88	1.81	4.0							
BH45	40	9.80		B	Grey sandy slightly gravelly organic SILT.	1.71	1.13	50.8							
BH45	73	18.00		B	Grey slightly sandy slightly gravelly silty CLAY.	2.02	1.52	32.6							
BH49	21	5.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.15	1.80	19.5							
BH49	27	6.50		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	1.93	1.44	33.5							
BH49	33	8.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	1.90	1.43	32.6							
BH49	49	12.00		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.22	1.92	15.5							
BH49	57	15.60		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.45	2.25	8.8							
BH49	69	20.50		B	Dark brownish grey slightly sandy slightly gravelly silty CLAY.	2.30	2.16	6.5							
BH51	1	0.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.47	0.83	77.4							
BH51	9	4.00		B	Grey slightly silty fine to coase SAND with shell fragments.	2.00	1.57	27.1							
BH51	15	7.00		B	Grey slightly sandy slightly gravelly silty CLAY.	1.59	0.95	66.7							
BH51	23	11.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.91	1.45	32.0							

Legend w moisture content of the density test specimen

Notes			Date Printed	Approved By	Table
Tests carried out in accordance with BS1377:Part2:1990 and the following clauses unless annotated otherwise	Linear measurement	clause 7.2	27/08/2019		1
	Immersion in water	clause 7.3			sheet
	Water displacement	clause 7.4		Stephen.Watson	1

Density Tests - Summary of Results

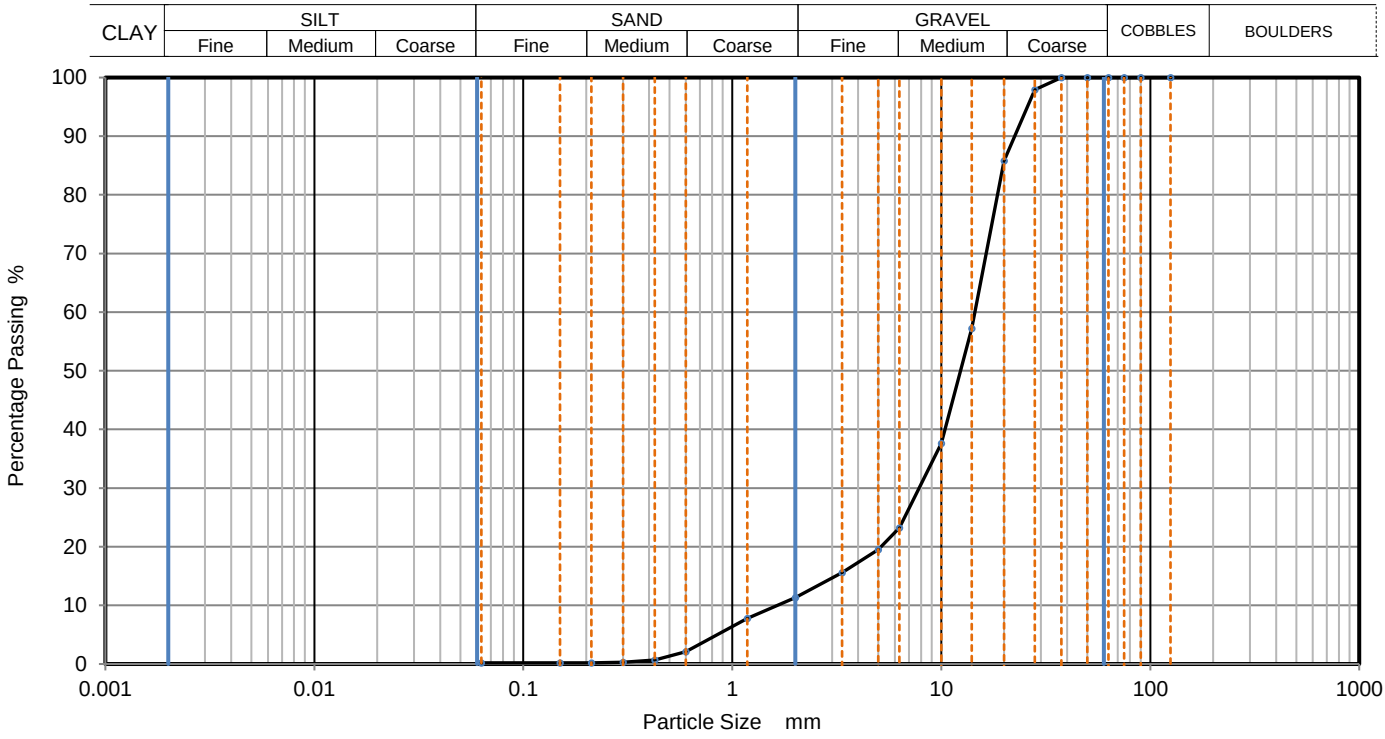
Project No.	Project Name
19-0382	Stornoway Deep Water Port

Hole No.	Sample				Soil Description	Linear Measurement			Immersion in water			Water displacement			Remarks
	Ref	Top	Base	Type		Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	Bulk density Mg/m3	Dry density Mg/m3	w %	
BH51	31	15.00		B	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.	1.84	1.34	37.0							
BH52	21	8.30		B	Grey clayey fine to coarse SAND.	1.68	1.15	46.5							
BH52	27	11.00		B	Greyish brown sandy silty CLAY.	2.01	1.58	26.9							

Legend w moisture content of the density test specimen

Notes			Date Printed	Approved By	Table
Tests carried out in accordance with BS1377:Part2:1990 and the following clauses unless annotated otherwise	Linear measurement	clause 7.2	27/08/2019		1
	Immersion in water	clause 7.3			sheet
	Water displacement	clause 7.4		Stephen.Watson	2

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	3
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	0.50
Specimen Reference	4	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080182



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	86		
14	57		
10	38		
6.3	23		
5	20		
3.35	16		
2	11		
1.18	8		
0.6	2		
0.425	1		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7940

Sample Proportions	% dry mass
Cobbles	0
Gravel	89
Sand	11
Fines <0.063mm	0

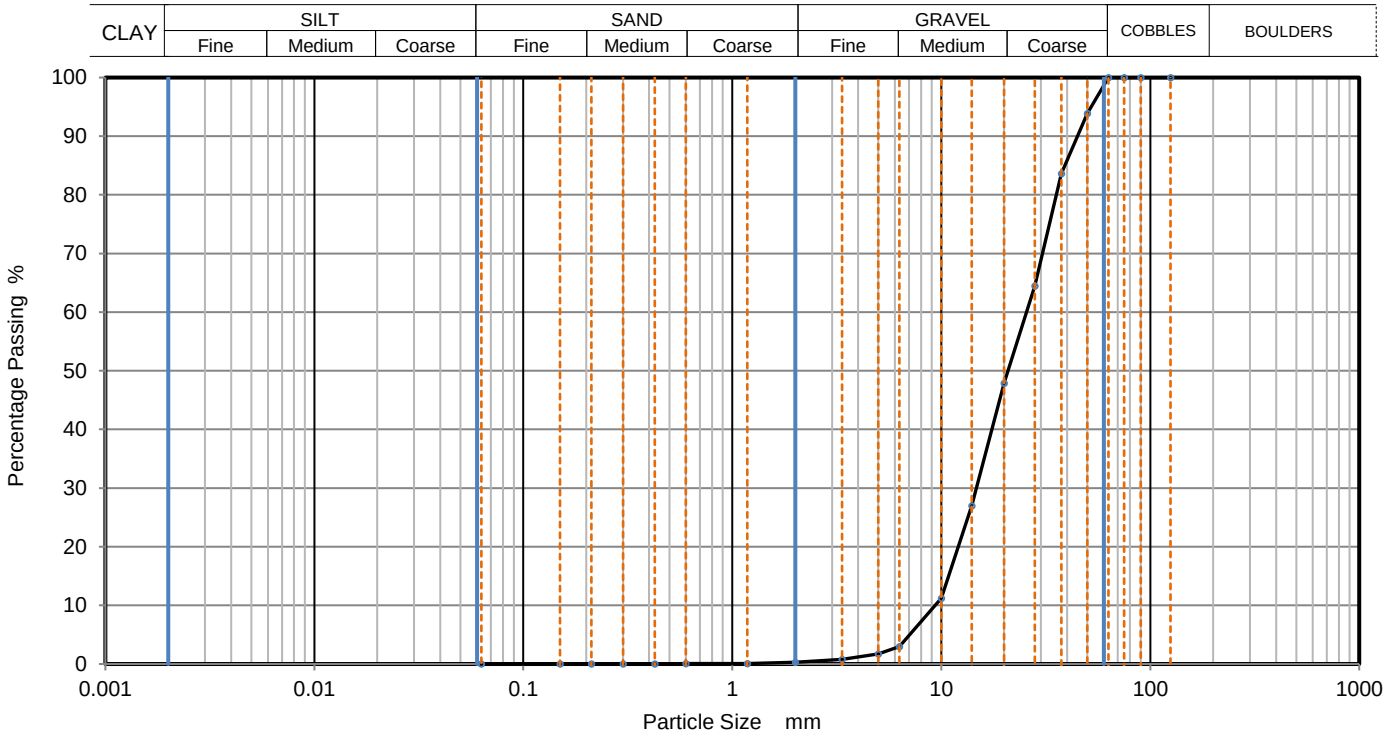
Grading Analysis		
D100	mm	
D60	mm	14.5
D30	mm	7.84
D10	mm	1.64
Uniformity Coefficient		8.8
Curvature Coefficient		2.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	5
Soil Description	Grey subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	1.00
Specimen Reference	2	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080183



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	84		
28	65		
20	48		
14	27		
10	11		
6.3	3		
5	2		
3.35	1		
2	0		
1.18	0		
0.6	0		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	16477

Sample Proportions	% dry mass
Cobbles	0
Gravel	100
Sand	0
Fines <0.063mm	0

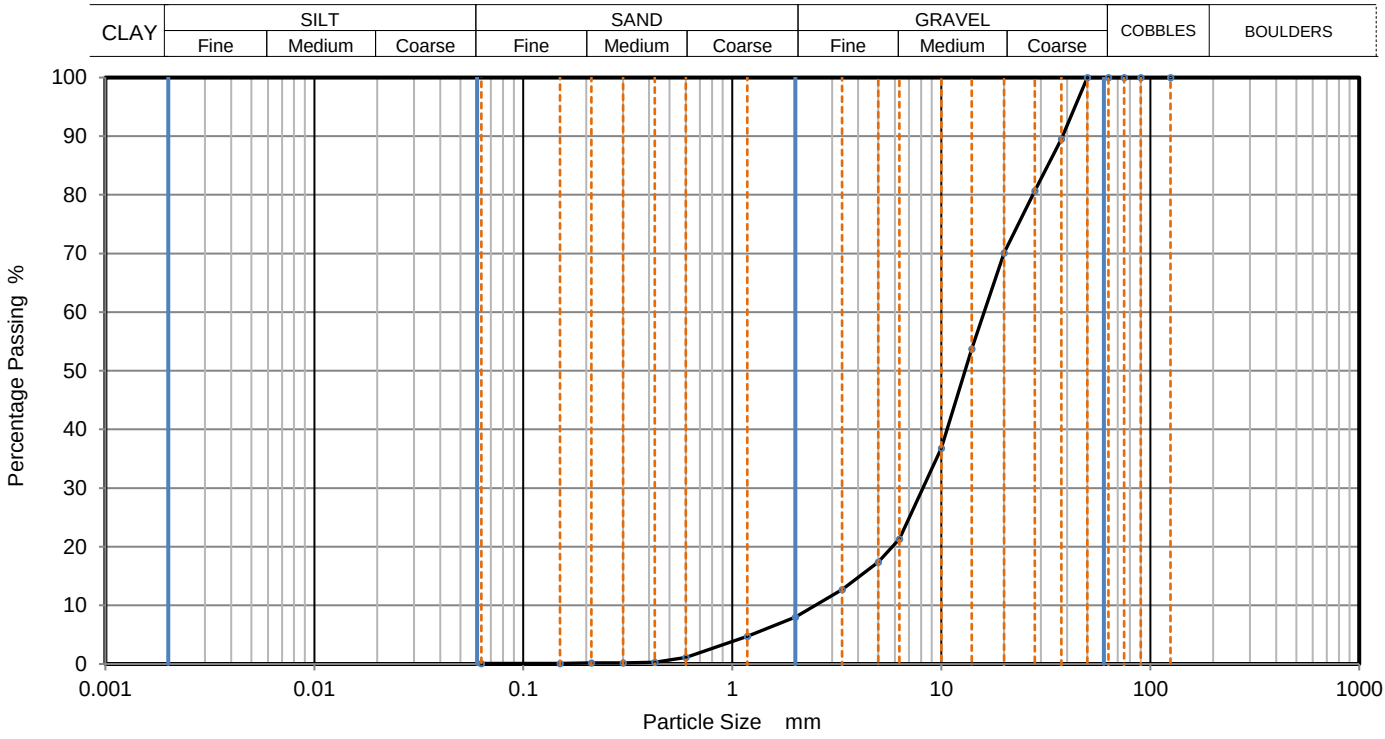
Grading Analysis		
D100	mm	
D60	mm	25.6
D30	mm	14.7
D10	mm	9.33
Uniformity Coefficient		2.7
Curvature Coefficient		0.91

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	23
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	5.50
Specimen Reference	2	Specimen Depth	5.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080185



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	90		
28	81		
20	70		
14	54		
10	37		
6.3	21		
5	17		
3.35	13		
2	8		
1.18	5		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	7301

Sample Proportions	% dry mass
Cobbles	0
Gravel	92
Sand	8
Fines <0.063mm	0

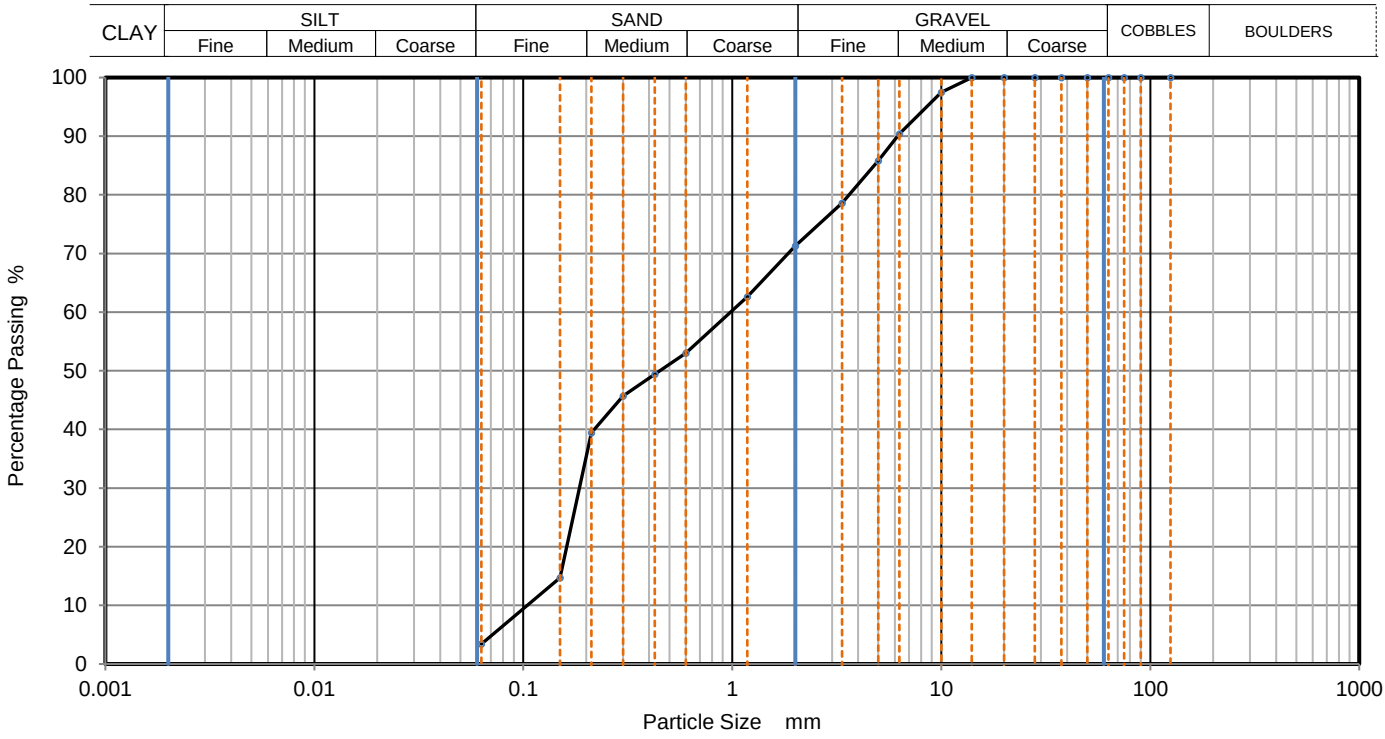
Grading Analysis		
D100	mm	
D60	mm	16.1
D30	mm	8.17
D10	mm	2.49
Uniformity Coefficient		6.5
Curvature Coefficient		1.7

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	32
Soil Description	Grey slightly silty gravelly fine to coarse SAND.			Depth, m	8.00
Specimen Reference	4	Specimen Depth	8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080186



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	98		
6.3	90		
5	86		
3.35	79		
2	71		
1.18	63		
0.6	53		
0.425	49		
0.3	46		
0.212	39		
0.15	15		
0.063	3		

Dry Mass of sample, g	602

Sample Proportions	% dry mass
Cobbles	0
Gravel	29
Sand	68
Fines <0.063mm	3

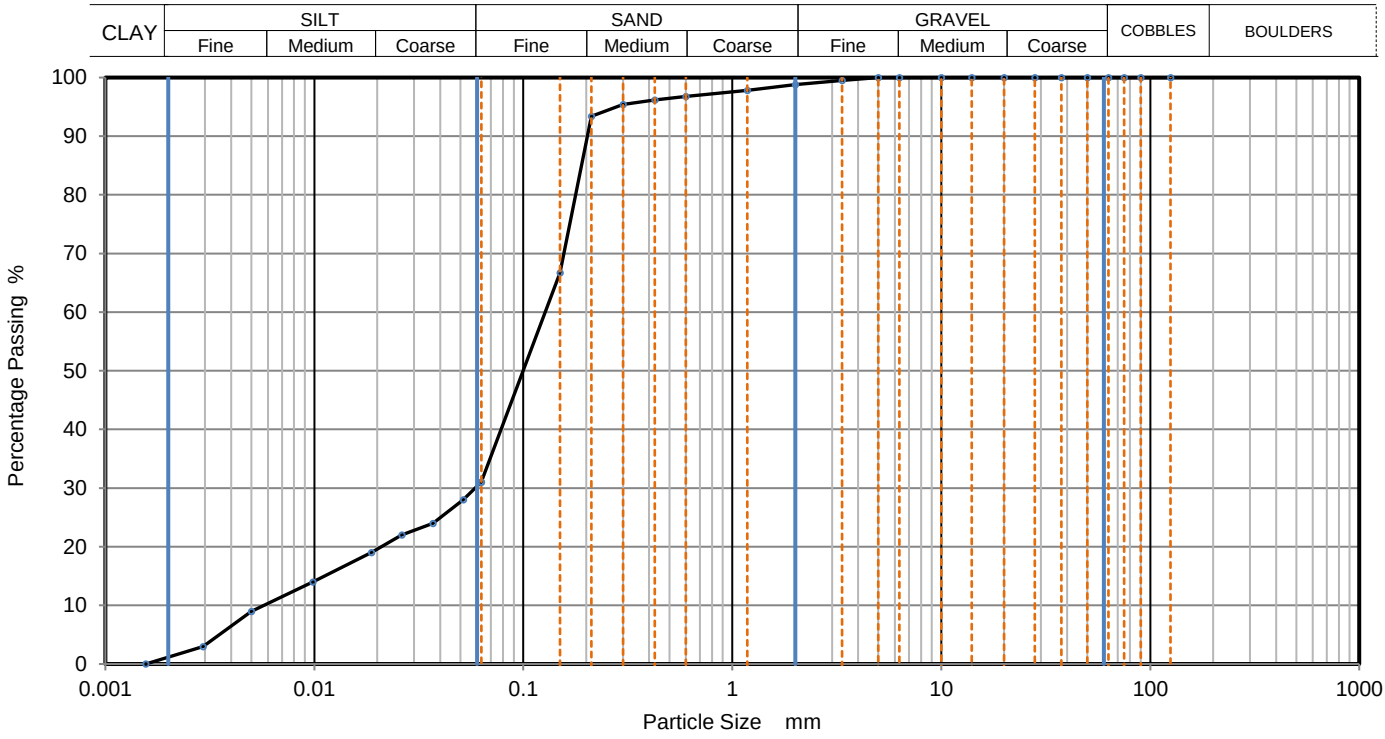
Grading Analysis		
D100	mm	
D60	mm	0.985
D30	mm	0.186
D10	mm	0.105
Uniformity Coefficient		9.4
Curvature Coefficient		0.33

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	35
Soil Description	Grey silty fine to medium SAND.			Depth, m	9.70
Specimen Reference	6	Specimen Depth	9.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080187



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	31
90	100	0.0516	28
75	100	0.0369	24
63	100	0.0262	22
50	100	0.0188	19
37.5	100	0.0099	14
28	100	0.0050	9
20	100	0.0029	3
14	100	0.0016	0
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	93		
0.15	67		
0.063	31		

Dry Mass of sample, g	328

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	68
Silt	30
Clay	1

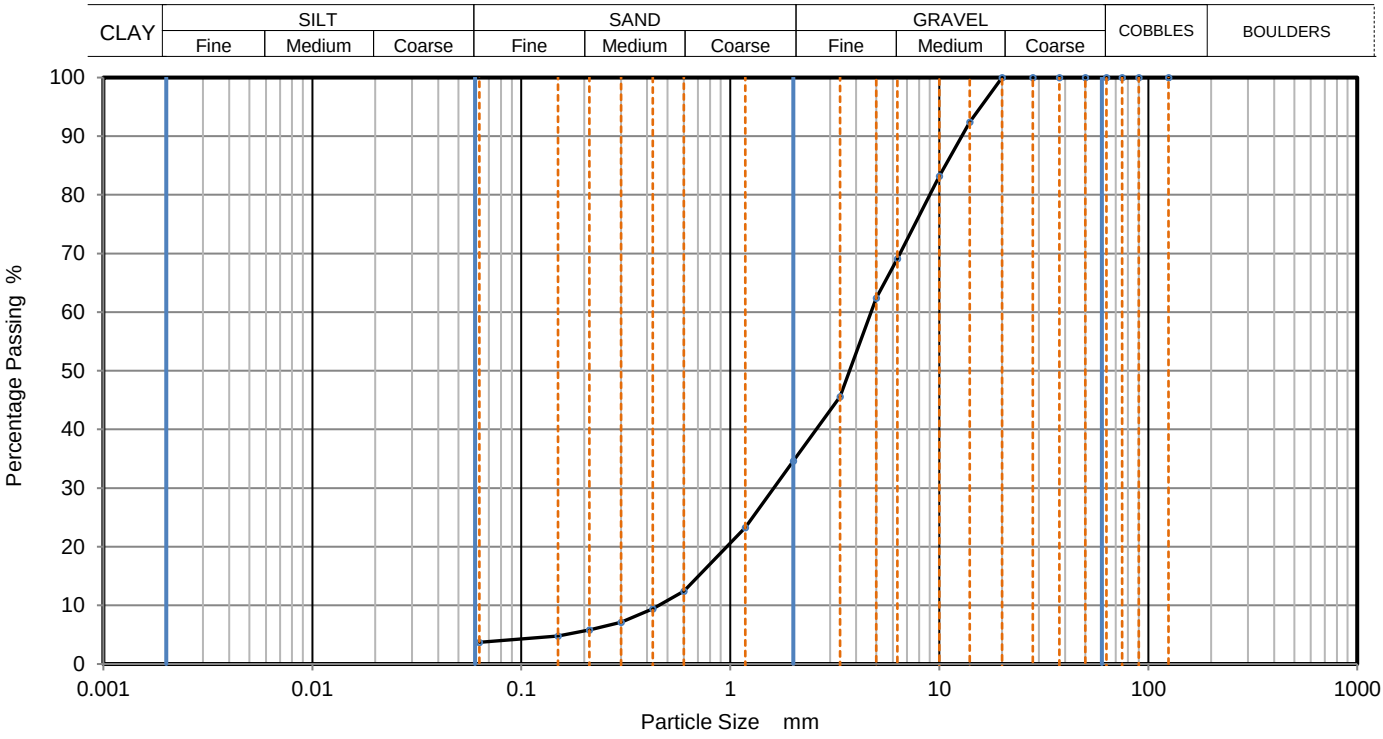
Grading Analysis		
D100	mm	
D60	mm	0.127
D30	mm	0.0593
D10	mm	0.006
Uniformity Coefficient		21
Curvature Coefficient		4.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	42
Soil Description	Greyish brown sandy slightly silty subangular to subrounded fine to medium GRAVEL.			Depth, m	11.50
Specimen Reference	4	Specimen Depth	11.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080188



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	92		
10	83		
6.3	69		
5	62		
3.35	46		
2	35		
1.18	23		
0.6	12		
0.425	9		
0.3	7		
0.212	6		
0.15	5		
0.063	4		

Dry Mass of sample, g	1046

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	31
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	4.72
D30	mm	1.61
D10	mm	0.457
Uniformity Coefficient		10
Curvature Coefficient		1.2

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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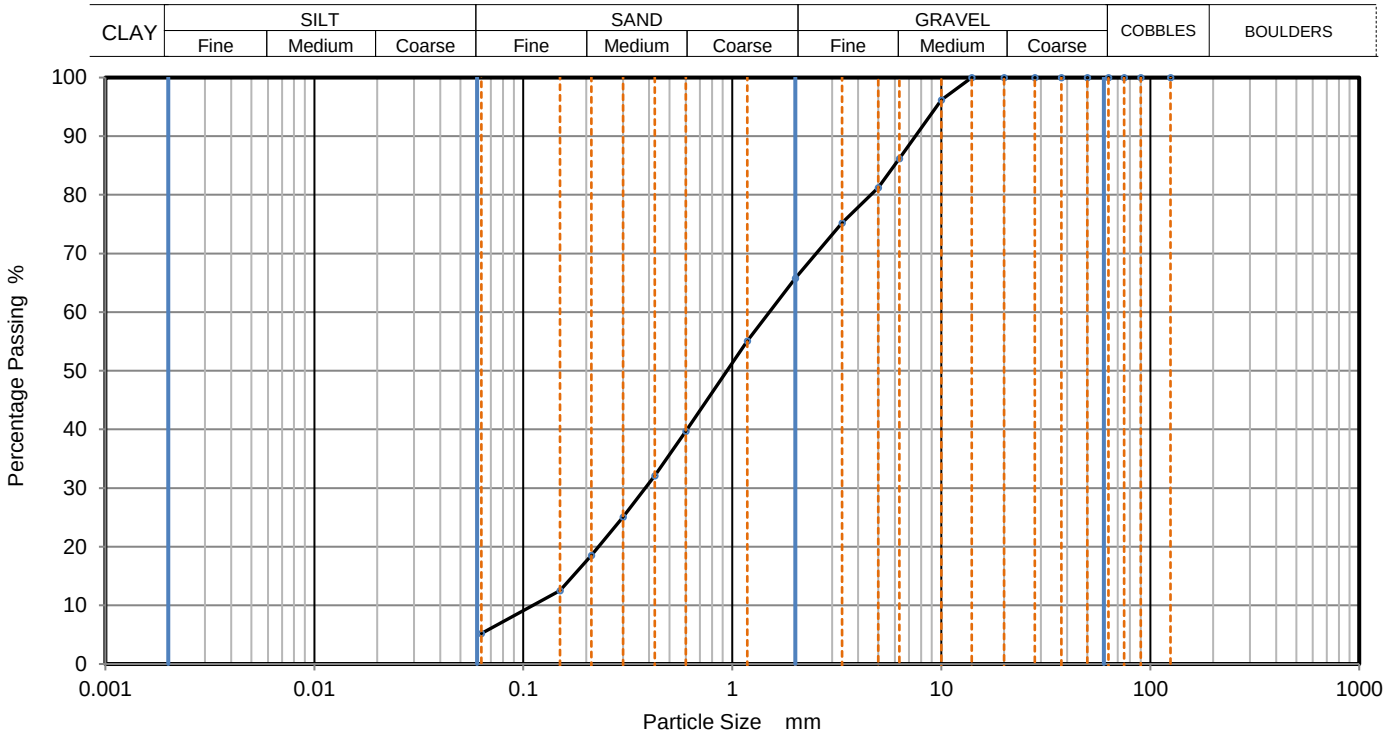
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	55
Soil Description	Greyish brown gravelly silty fine to coarse SAND.			Depth, m	15.00
Specimen Reference	2	Specimen Depth	15 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080189



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	96		
6.3	86		
5	81		
3.35	75		
2	66		
1.18	55		
0.6	40		
0.425	32		
0.3	25		
0.212	19		
0.15	13		
0.063	5		

Dry Mass of sample, g	565

Sample Proportions	% dry mass
Cobbles	0
Gravel	34
Sand	61
Fines <0.063mm	5

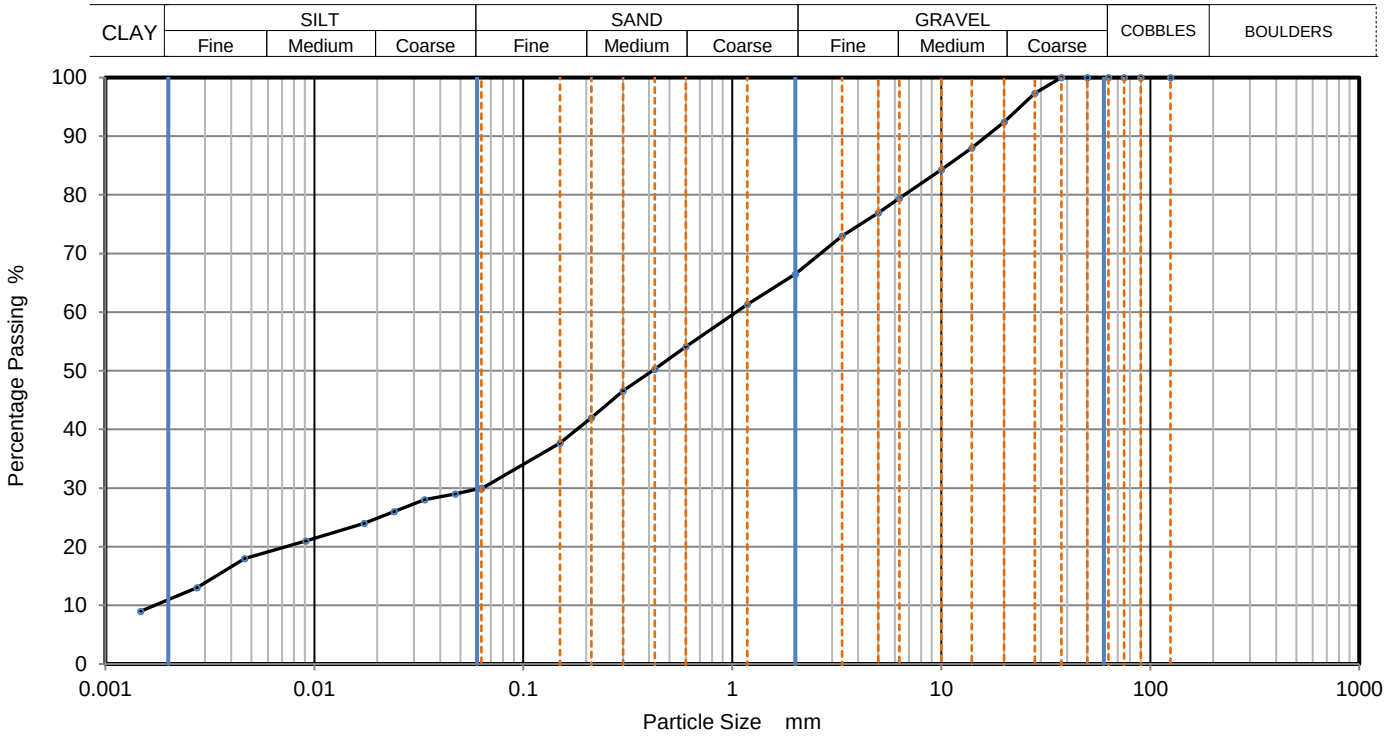
Grading Analysis		
D100	mm	
D60	mm	1.5
D30	mm	0.383
D10	mm	0.111
Uniformity Coefficient		13
Curvature Coefficient		0.88

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	83
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	22.00
Specimen Reference	4	Specimen Depth	22 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080195



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0472	29
75	100	0.0336	28
63	100	0.0241	26
50	100	0.0173	24
37.5	100	0.0091	21
28	97	0.0046	18
20	92	0.0027	13
14	88	0.0015	9
10	84		
6.3	79		
5	77		
3.35	73		
2	67		
1.18	61		
0.6	54	Particle density	(assumed)
0.425	50	2.65	Mg/m3
0.3	47		
0.212	42		
0.15	38		
0.063	30		

Dry Mass of sample, g	3577

Sample Proportions	% dry mass
Cobbles	0
Gravel	34
Sand	37
Silt	19
Clay	11

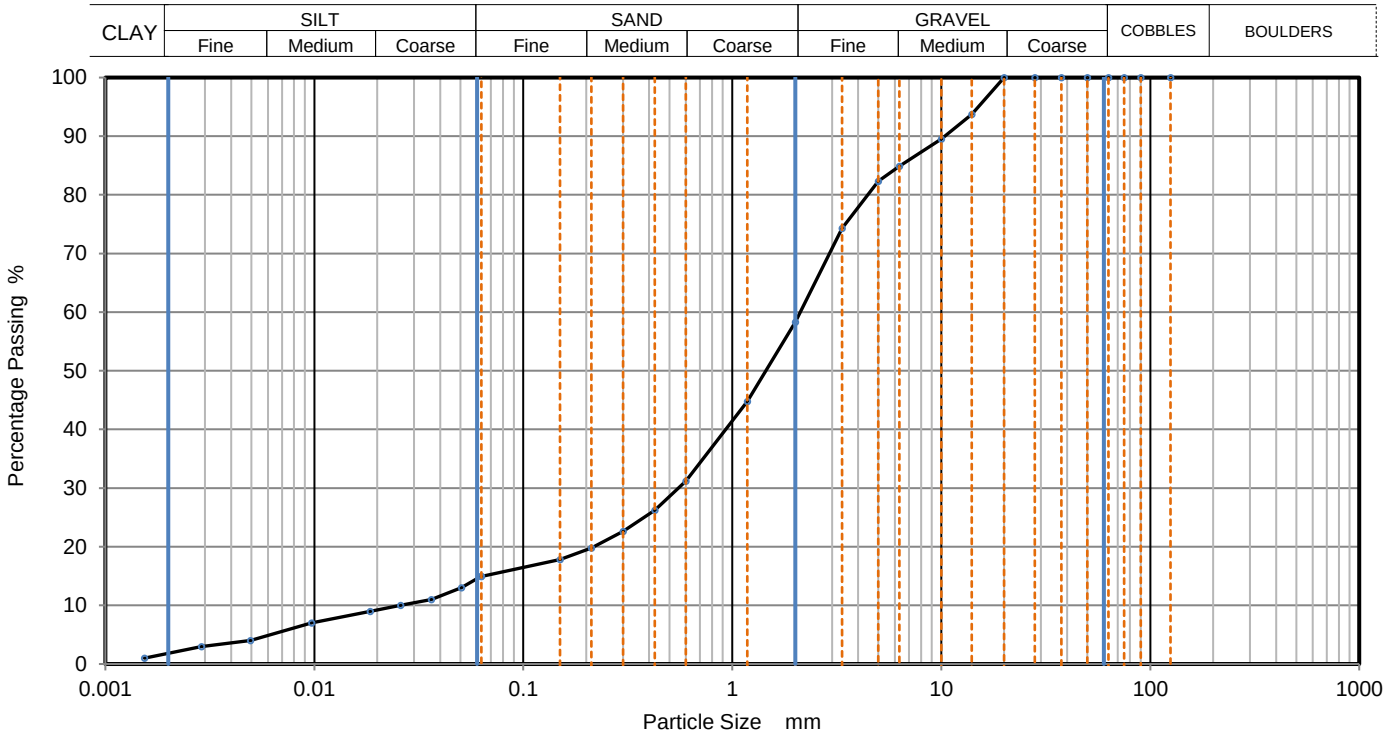
Grading Analysis		
D100	mm	
D60	mm	1.04
D30	mm	0.0635
D10	mm	0.00164
Uniformity Coefficient		630
Curvature Coefficient		2.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	93
Soil Description	Grey gravelly silty fine to coarse SAND.			Depth, m	24.00
Specimen Reference	4	Specimen Depth	24 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080196



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	15
90	100	0.0505	13
75	100	0.0363	11
63	100	0.0259	10
50	100	0.0185	9
37.5	100	0.0097	7
28	100	0.0049	4
20	100	0.0029	3
14	94	0.0015	1
10	90		
6.3	85		
5	82		
3.35	74		
2	58		
1.18	45		
0.6	31	Particle density	(assumed)
0.425	26	2.65	Mg/m3
0.3	23		
0.212	20		
0.15	18		
0.063	15		

Dry Mass of sample, g	502

Sample Proportions	% dry mass
Cobbles	0
Gravel	42
Sand	43
Silt	13
Clay	2

Grading Analysis		
D100	mm	
D60	mm	2.11
D30	mm	0.552
D10	mm	0.0235
Uniformity Coefficient		90
Curvature Coefficient		6.1

Remarks

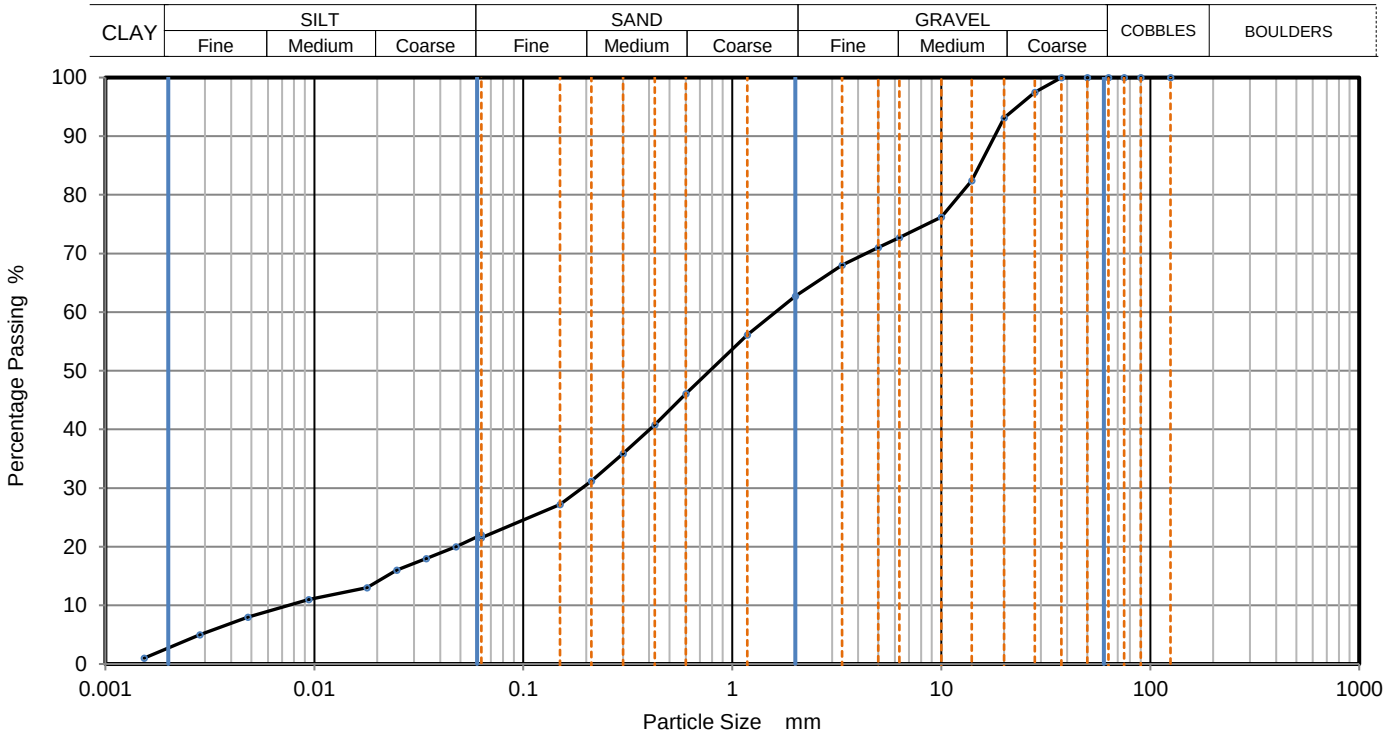
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port			Sample No.	103
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	27.00
Specimen Reference	4	Specimen Depth	27 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019080197



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	22
90	100	0.0476	20
75	100	0.0343	18
63	100	0.0248	16
50	100	0.0178	13
37.5	100	0.0094	11
28	98	0.0048	8
20	93	0.0028	5
14	82	0.0015	1
10	76		
6.3	73		
5	71		
3.35	68		
2	63		
1.18	56		
0.6	46	Particle density	(assumed)
0.425	41	2.65	Mg/m3
0.3	36		
0.212	31		
0.15	27		
0.063	22		

Dry Mass of sample, g	3718

Sample Proportions	% dry mass
Cobbles	0
Gravel	37
Sand	41
Silt	18
Clay	3

Grading Analysis		
D100	mm	
D60	mm	1.61
D30	mm	0.191
D10	mm	0.00729
Uniformity Coefficient		220
Curvature Coefficient		3.1

Remarks

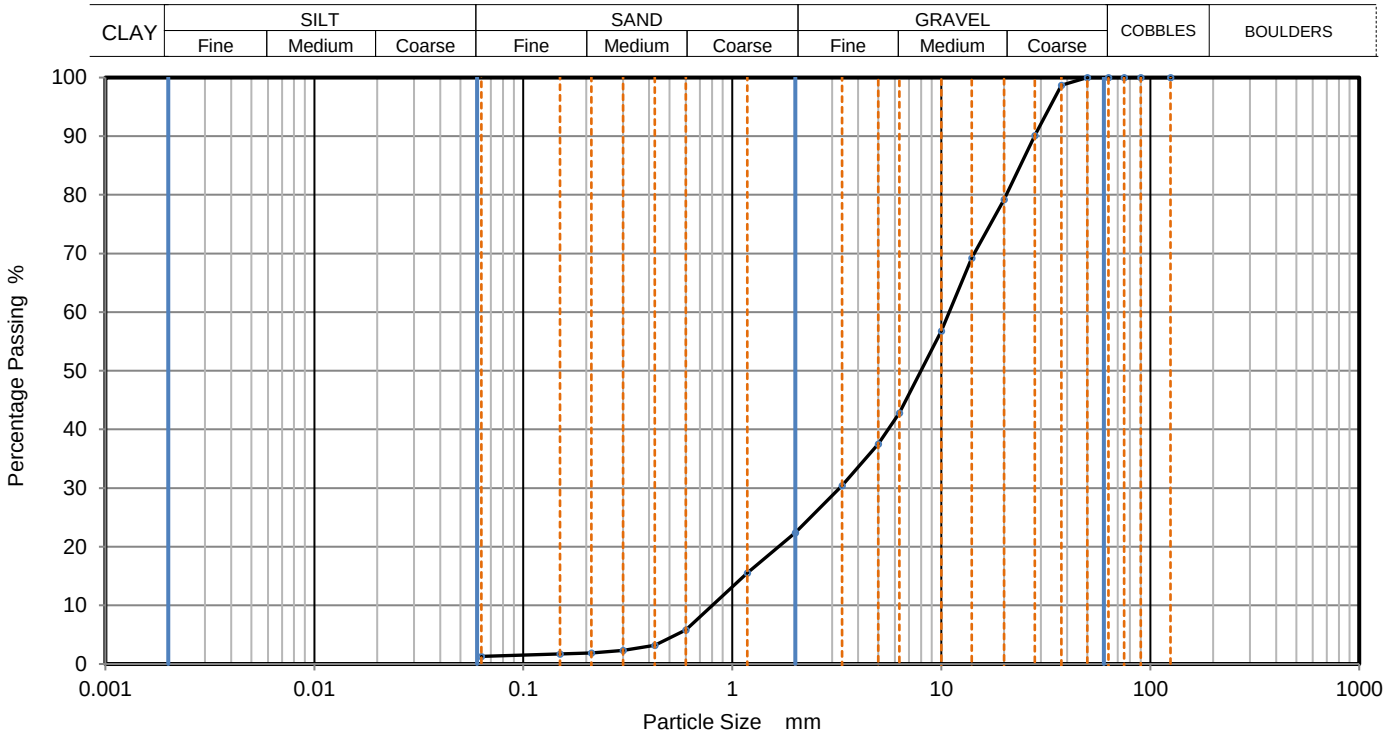
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	1
Soil Description	Grey sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	0.00
Specimen Reference	4	Specimen Depth	0 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019080199



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	90		
20	79		
14	69		
10	57		
6.3	43		
5	38		
3.35	30		
2	22		
1.18	16		
0.6	6		
0.425	3		
0.3	2		
0.212	2		
0.15	2		
0.063	1		

Dry Mass of sample, g	8394

Sample Proportions	% dry mass
Cobbles	0
Gravel	78
Sand	21
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	10.9
D30	mm	3.27
D10	mm	0.804
Uniformity Coefficient		14
Curvature Coefficient		1.2

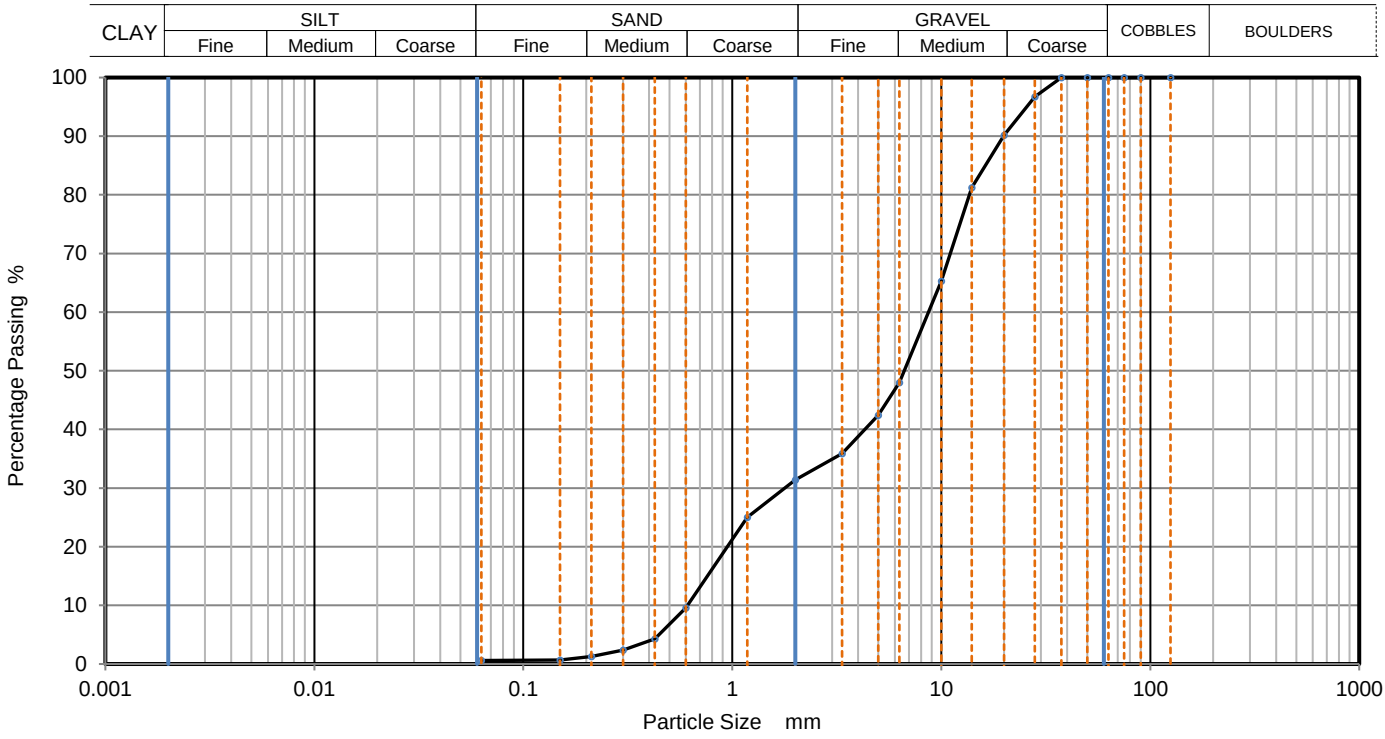
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	12
Soil Description	Grey very gravelly fine to coarse SAND.			Depth, m	3.00
Specimen Reference	4	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801100



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	90		
14	81		
10	65		
6.3	48		
5	42		
3.35	36		
2	31		
1.18	25		
0.6	10		
0.425	4		
0.3	2		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	5578

Sample Proportions	% dry mass
Cobbles	0
Gravel	69
Sand	31
Fines <0.063mm	1

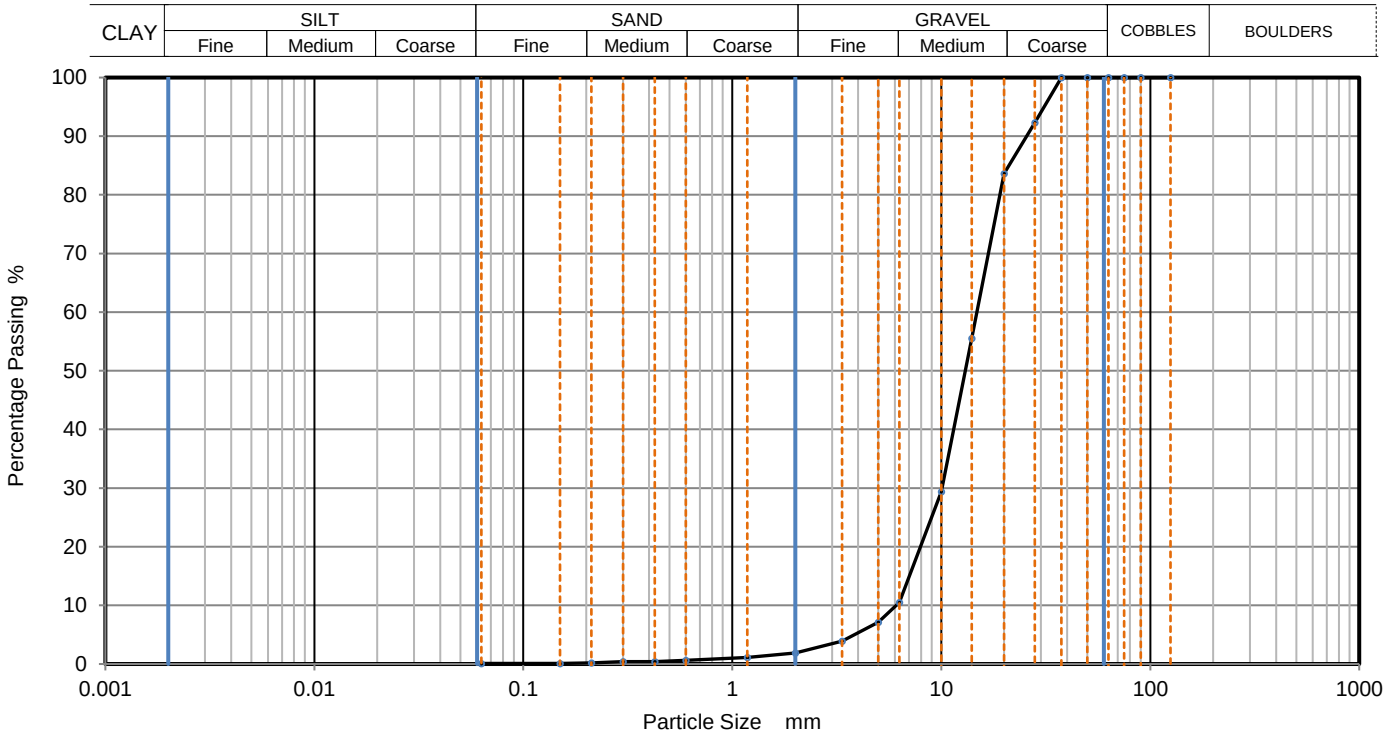
Grading Analysis		
D100	mm	
D60	mm	8.69
D30	mm	1.78
D10	mm	0.611
Uniformity Coefficient		14
Curvature Coefficient		0.6

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	26
Soil Description	Grey subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	6.50
Specimen Reference	4	Specimen Depth	6.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801101



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	92		
20	84		
14	56		
10	29		
6.3	11		
5	7		
3.35	4		
2	2		
1.18	1		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	4379

Sample Proportions	% dry mass
Cobbles	0
Gravel	98
Sand	2
Fines <0.063mm	0

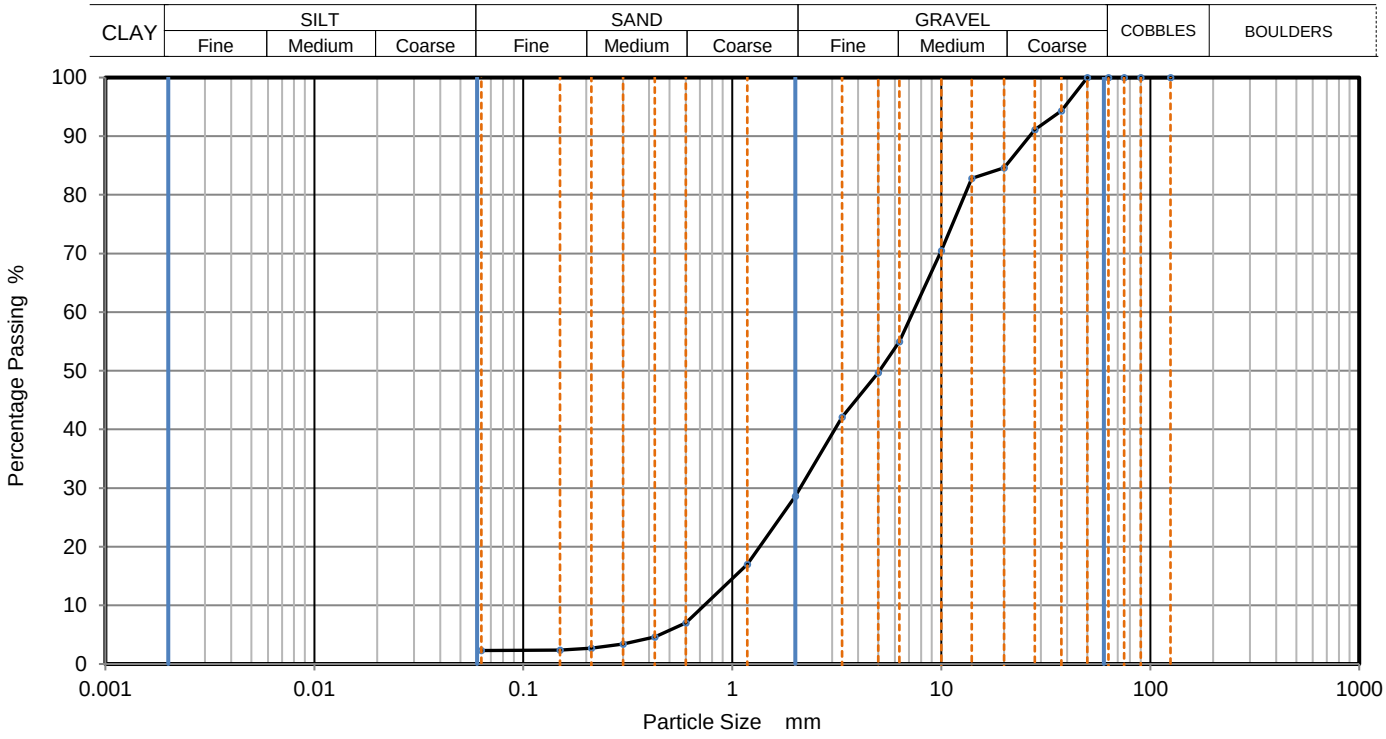
Grading Analysis		
D100	mm	
D60	mm	14.8
D30	mm	10.1
D10	mm	6.1
Uniformity Coefficient		2.4
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	77
Soil Description	Grey sandy subangular to subrounded fine to coarse GRAVEL.			Depth, m	19.00
Specimen Reference	4	Specimen Depth	19 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801107



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	91		
20	85		
14	83		
10	71		
6.3	55		
5	50		
3.35	42		
2	29		
1.18	17		
0.6	7		
0.425	5		
0.3	3		
0.212	3		
0.15	2		
0.063	2		

Dry Mass of sample, g	4061

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	26
Fines <0.063mm	2

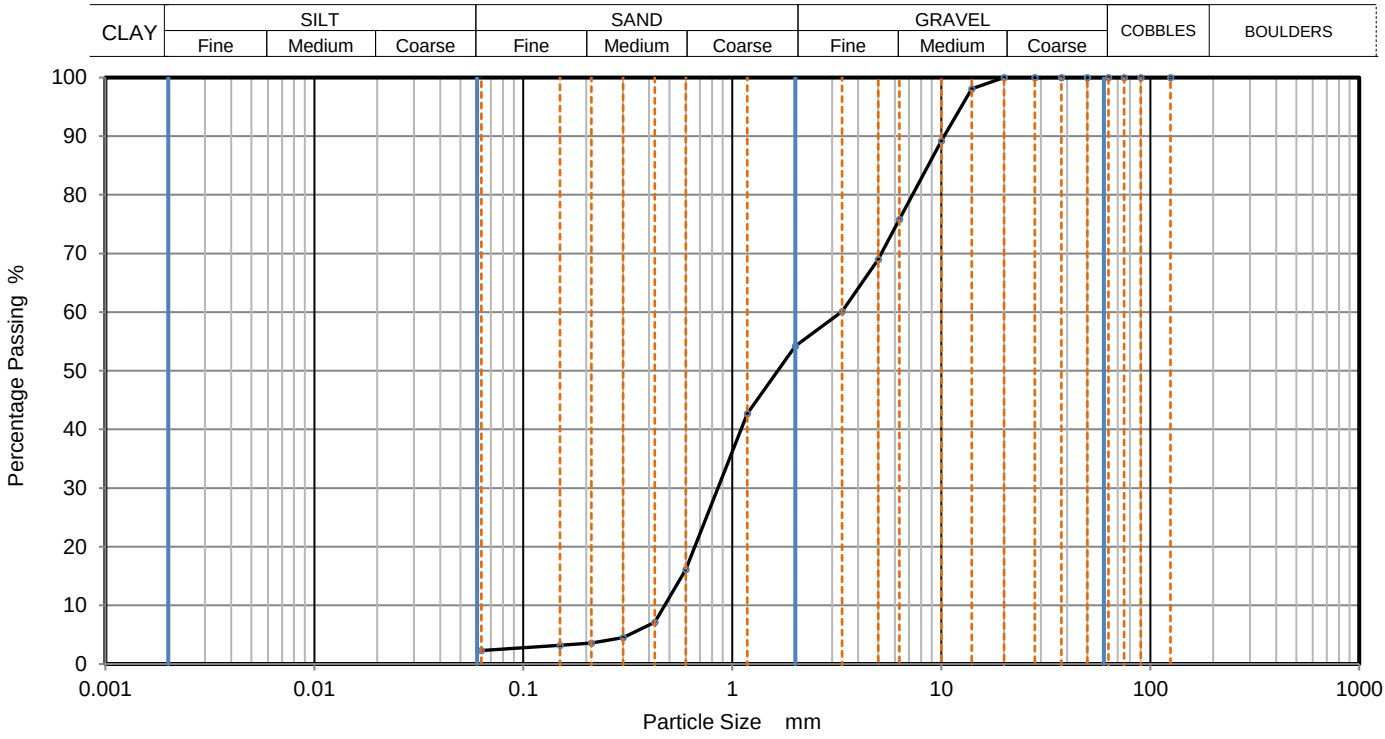
Grading Analysis		
D100	mm	
D60	mm	7.32
D30	mm	2.11
D10	mm	0.735
Uniformity Coefficient		9.9
Curvature Coefficient		0.83

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	83
Soil Description	Grey gravelly silty fine to coarse SAND.			Depth, m	20.50
Specimen Reference	4	Specimen Depth	20.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801108



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	89		
6.3	76		
5	69		
3.35	60		
2	54		
1.18	43		
0.6	16		
0.425	7		
0.3	5		
0.212	4		
0.15	3		
0.063	2		

Dry Mass of sample, g	3221

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	52
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	3.33
D30	mm	0.853
D10	mm	0.475
Uniformity Coefficient		7
Curvature Coefficient		0.46

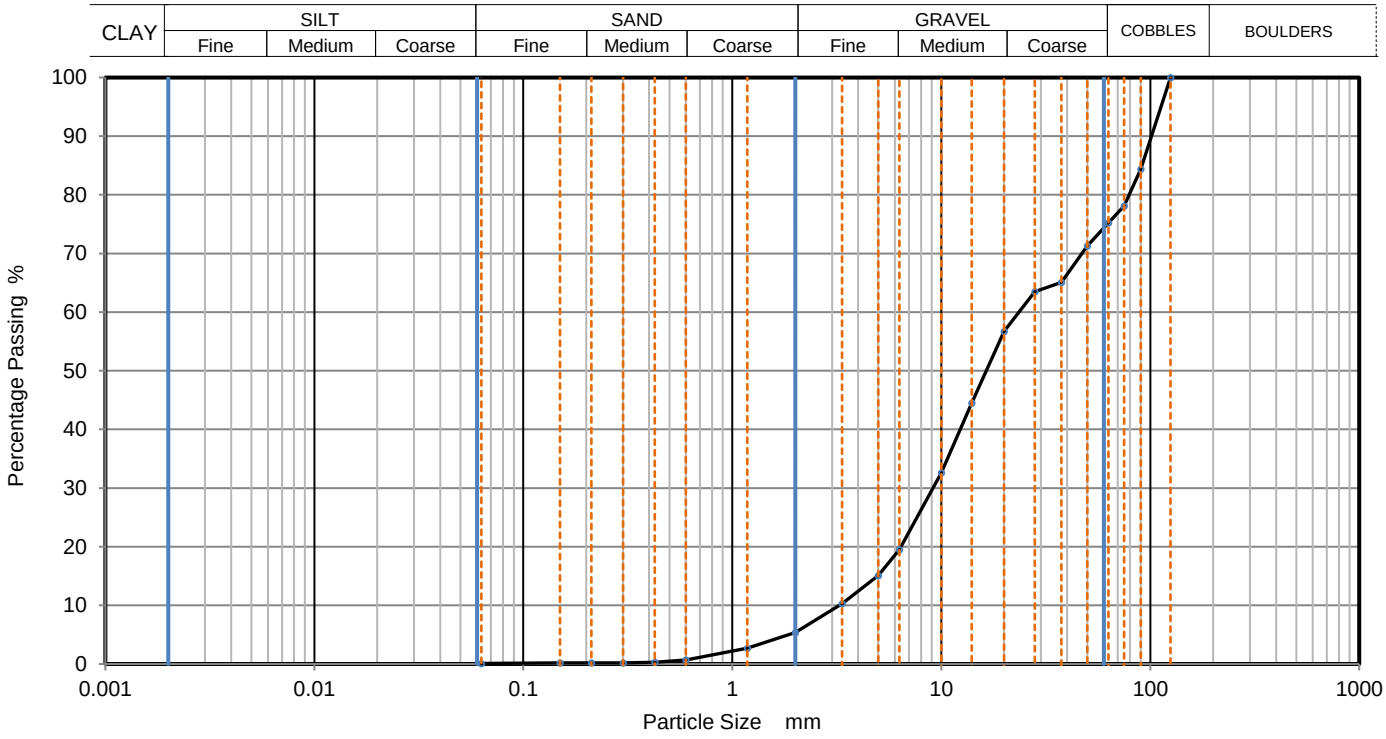
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port			Sample No.	7
Soil Description	Grey subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	1.50
Specimen Reference	2	Specimen Depth	1.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019081518



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	84		
75	78		
63	75		
50	71		
37.5	65		
28	64		
20	57		
14	45		
10	33		
6.3	20		
5	15		
3.35	10		
2	5		
1.18	3		
0.6	1		
0.425	0		
0.3	0		
0.212	0		
0.15	0		
0.063	0		

Dry Mass of sample, g	19823

Sample Proportions	% dry mass
Cobbles	25
Gravel	70
Sand	5
Fines <0.063mm	0

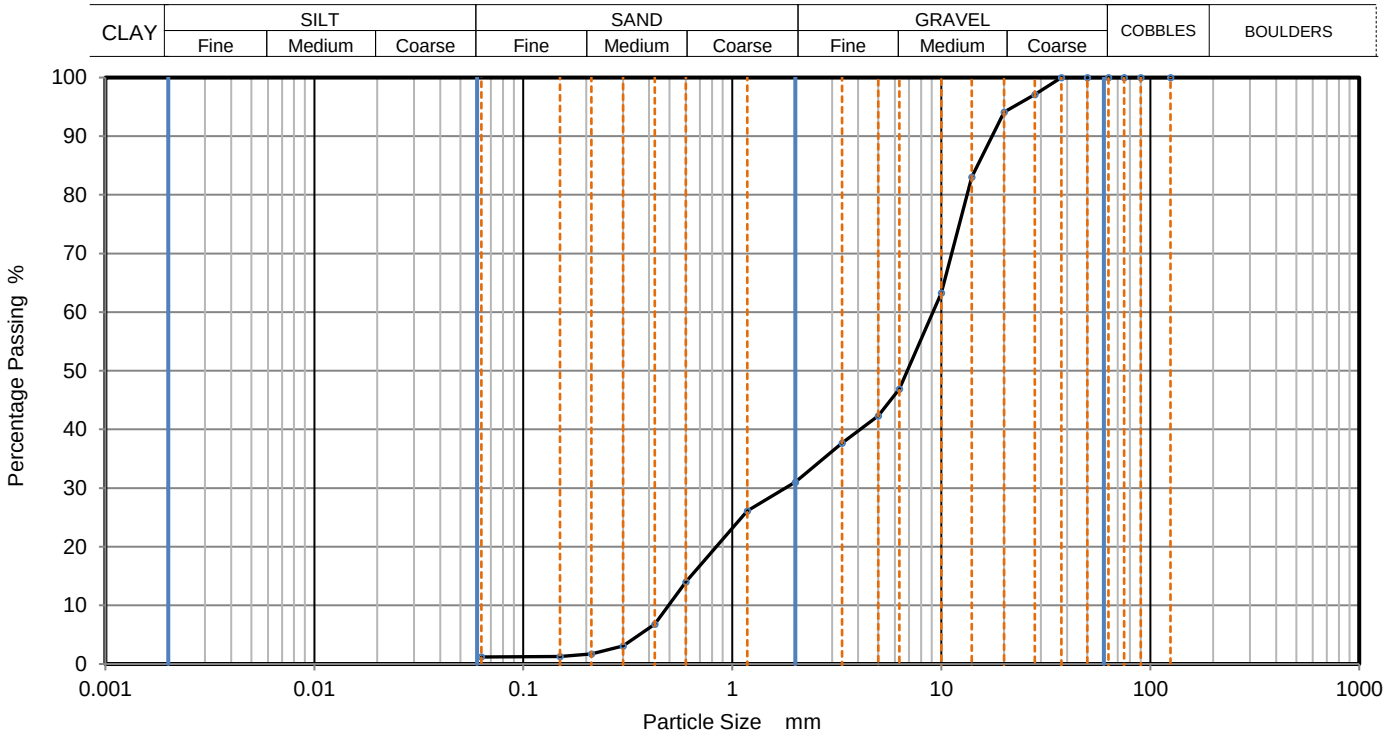
Grading Analysis		
D100	mm	125
D60	mm	23.5
D30	mm	9.11
D10	mm	3.25
Uniformity Coefficient		7.2
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0382
				Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port			Sample No.	13
Soil Description	Grey sandy subangular to subrounded fine to coarse GRAVEL with shell fragments.			Depth, m	3.00
Specimen Reference	4	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801110



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	94		
14	83		
10	63		
6.3	47		
5	42		
3.35	38		
2	31		
1.18	26		
0.6	14		
0.425	7		
0.3	3		
0.212	2		
0.15	1		
0.063	1		

Dry Mass of sample, g	5159

Sample Proportions	% dry mass
Cobbles	0
Gravel	69
Sand	30
Fines <0.063mm	1

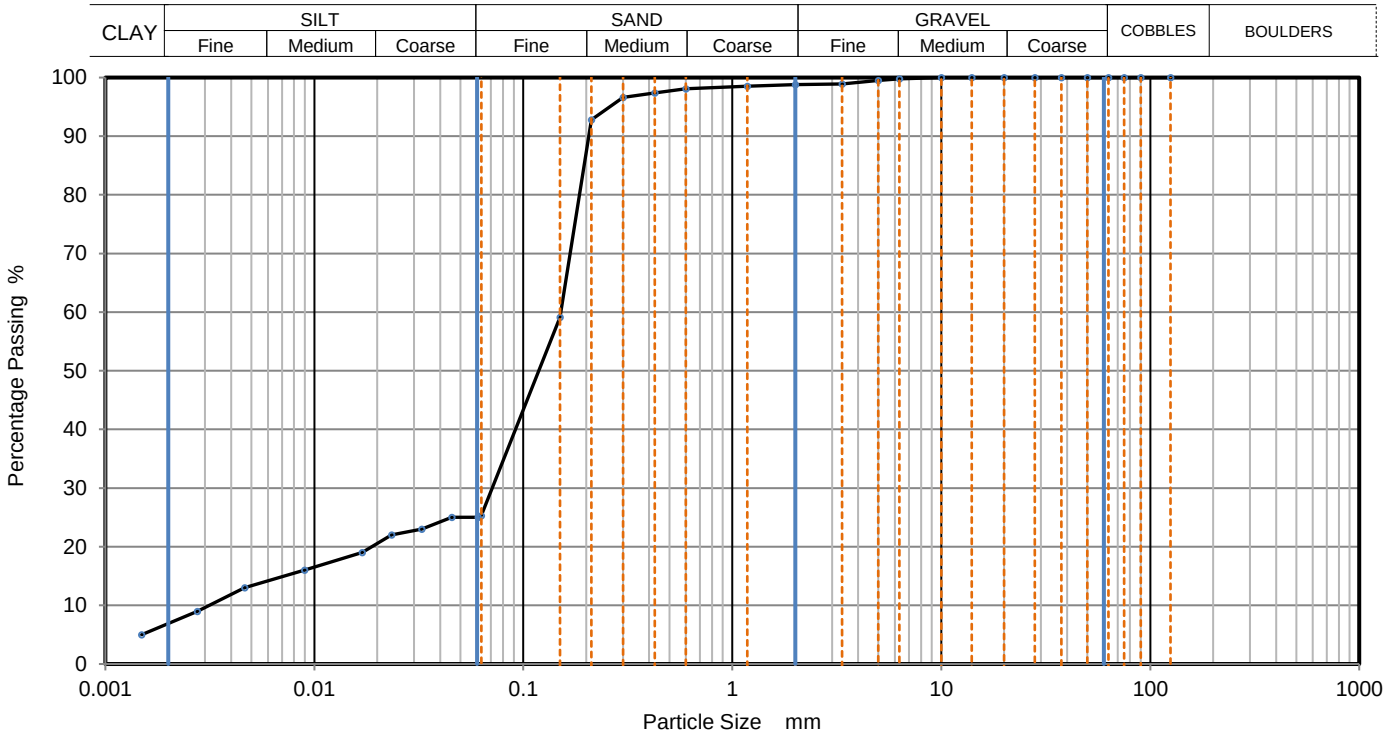
Grading Analysis		
D100	mm	
D60	mm	9.11
D30	mm	1.8
D10	mm	0.495
Uniformity Coefficient		18
Curvature Coefficient		0.72

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	9
Soil Description	Grey slightly silty fine to coase SAND with shell fragments.			Depth, m	4.00
Specimen Reference	6	Specimen Depth	4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190801129



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0608	25
90	100	0.0456	25
75	100	0.0327	23
63	100	0.0235	22
50	100	0.0169	19
37.5	100	0.0090	16
28	100	0.0046	13
20	100	0.0028	9
14	100	0.0015	5
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	97	2.65	Mg/m3
0.3	97		
0.212	93		
0.15	59		
0.063	25		

Dry Mass of sample, g	323

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	74
Silt	18
Clay	7

Grading Analysis		
D100	mm	
D60	mm	0.151
D30	mm	0.0711
D10	mm	0.0032
Uniformity Coefficient		47
Curvature Coefficient		10

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

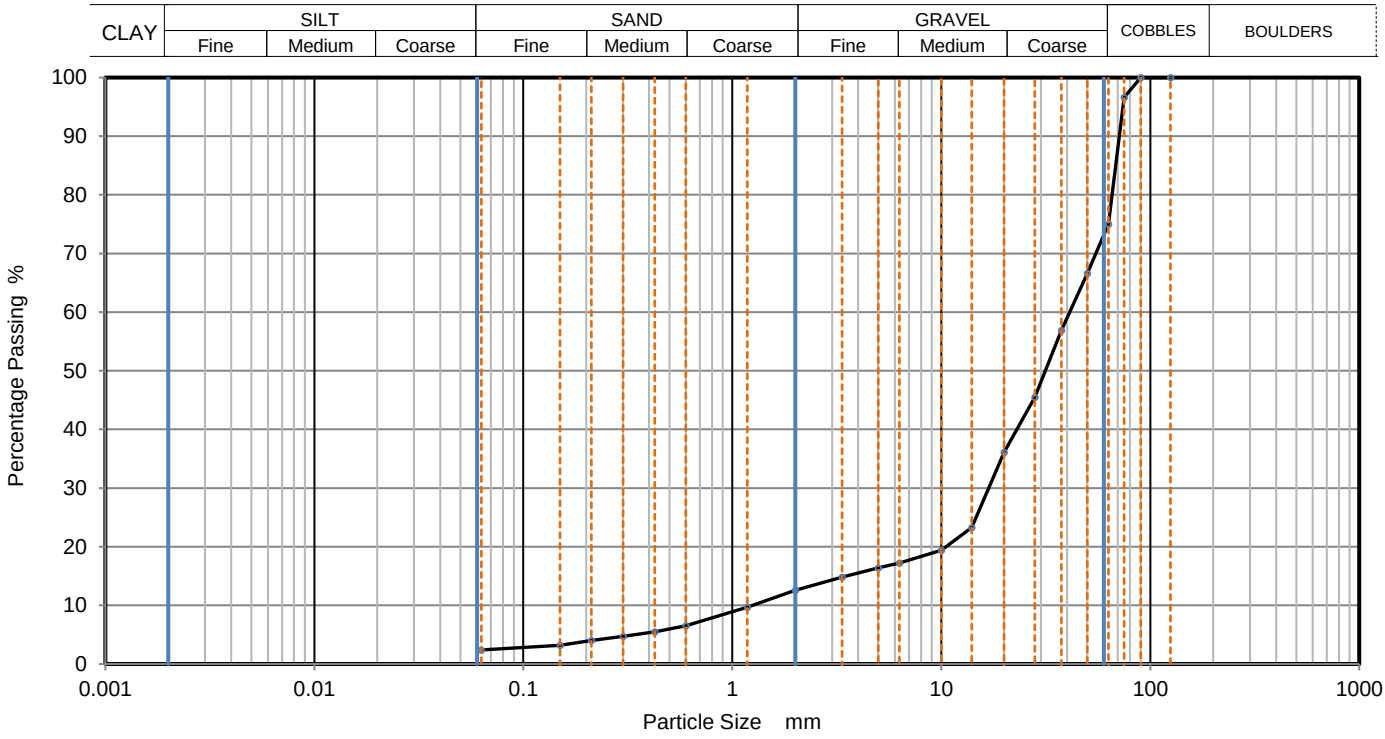
Approved
Stephen.Watson

UKAS TESTING

10122

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0382**
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	34
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content.			Depth, m	16.10
Specimen Reference	4	Specimen Depth	16.1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801138



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	97		
63	75		
50	67		
37.5	57		
28	46		
20	36		
14	23		
10	19		
6.3	17		
5	16		
3.35	15		
2	13		
1.18	10		
0.6	7		
0.425	6		
0.3	5		
0.212	4		
0.15	3		
0.063	2		

Dry Mass of sample, g	21982

Sample Proportions	% dry mass
Cobbles	25
Gravel	62
Sand	10
Fines <0.063mm	2

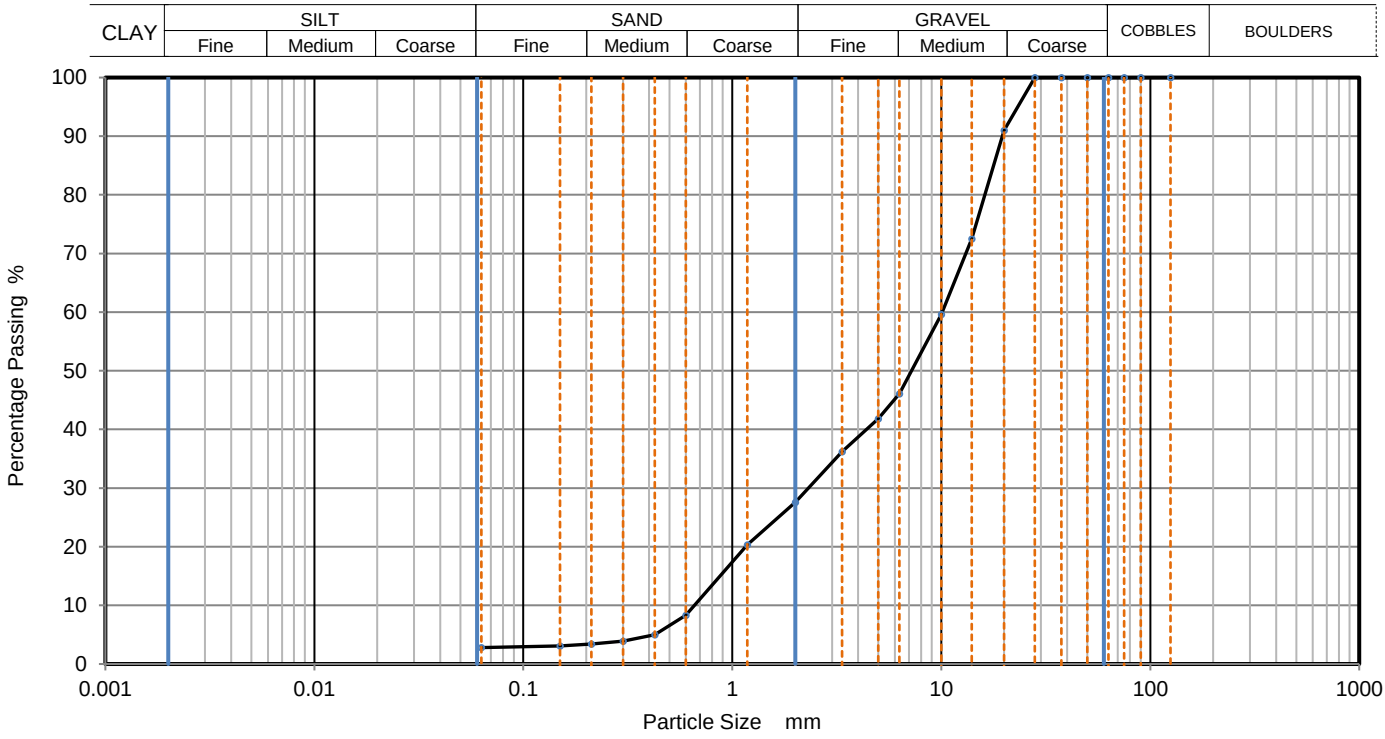
Grading Analysis		
D100	mm	
D60	mm	41.1
D30	mm	16.9
D10	mm	1.26
Uniformity Coefficient		33
Curvature Coefficient		5.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH52
Site Name	Stornoway Deep Water Port			Sample No.	7
Soil Description	Grey sandy subrounded to rounded fine to coarse GRAVEL.			Depth, m	0.50
Specimen Reference	4	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20190801139



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	91		
14	73		
10	60		
6.3	46		
5	42		
3.35	36		
2	28		
1.18	20		
0.6	8		
0.425	5		
0.3	4		
0.212	3		
0.15	3		
0.063	3		

Dry Mass of sample, g	2766

Sample Proportions	% dry mass
Cobbles	0
Gravel	72
Sand	25
Fines <0.063mm	3

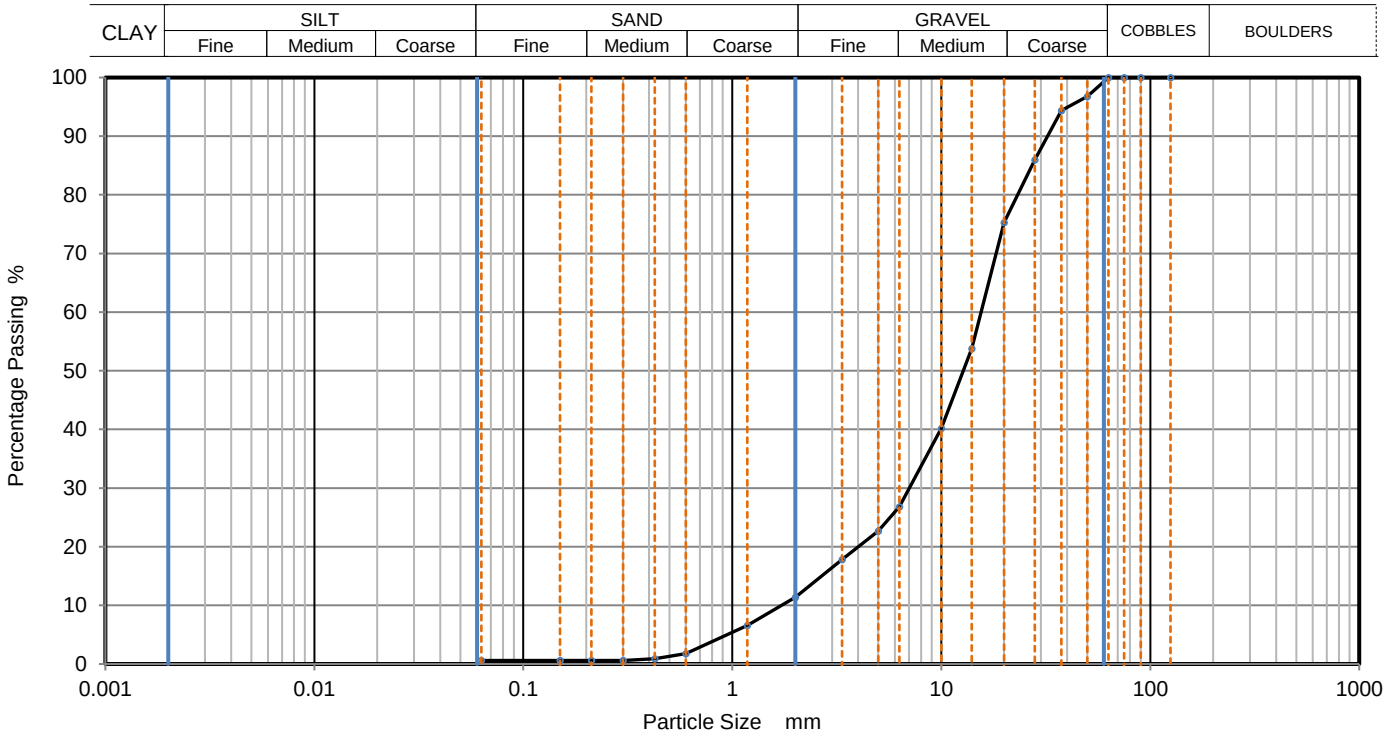
Grading Analysis		
D100	mm	
D60	mm	10.1
D30	mm	2.31
D10	mm	0.66
Uniformity Coefficient		15
Curvature Coefficient		0.8

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH52
Site Name	Stornoway Deep Water Port				Sample No.	13
Soil Description	Grey sandy subrounded to rounded fine to medium GRAVEL.				Depth, m	3.70
Specimen Reference	4	Specimen Depth	3.7	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus20190801140



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	94		
28	86		
20	75		
14	54		
10	40		
6.3	27		
5	23		
3.35	18		
2	11		
1.18	7		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Dry Mass of sample, g	6825

Sample Proportions	% dry mass
Cobbles	0
Gravel	89
Sand	11
Fines <0.063mm	1

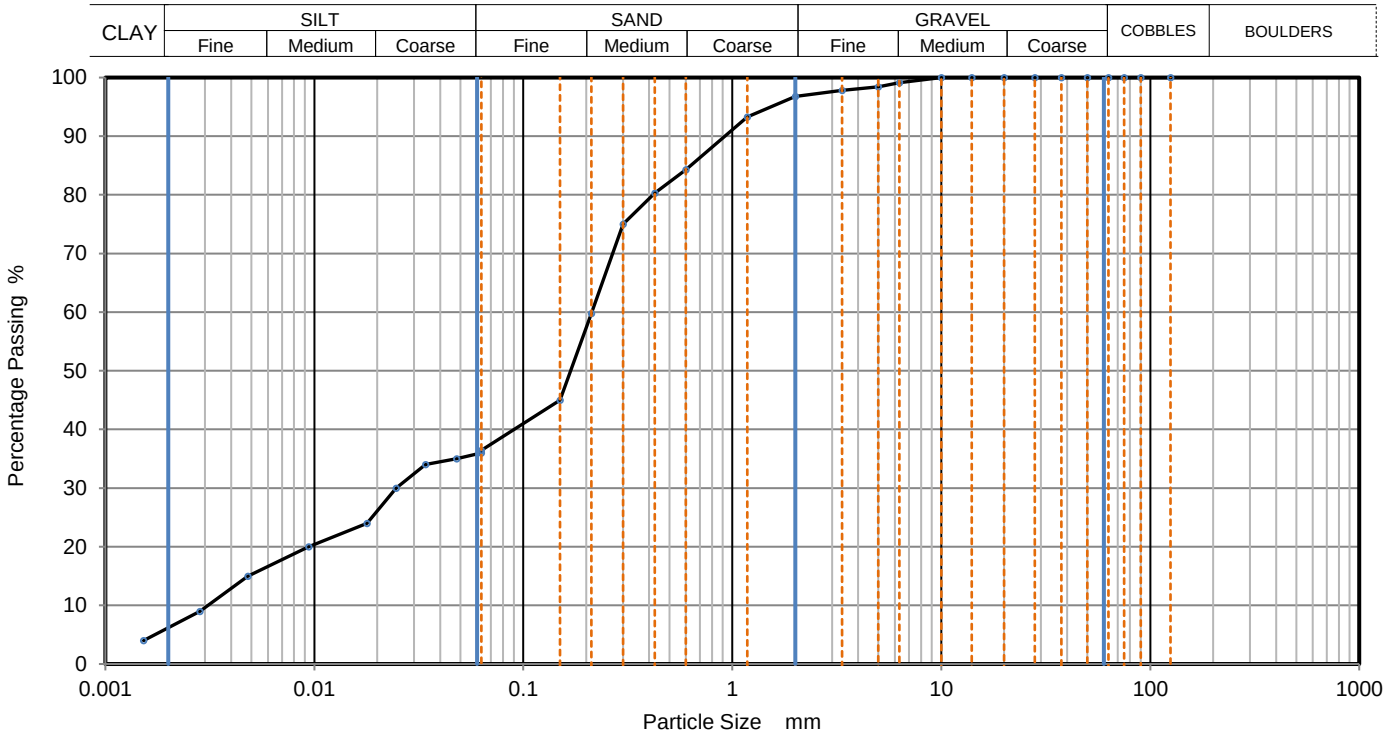
Grading Analysis		
D100	mm	
D60	mm	15.5
D30	mm	7.03
D10	mm	1.72
Uniformity Coefficient		9
Curvature Coefficient		1.9

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH52
Site Name	Stornoway Deep Water Port				Sample No.	21
Soil Description	Grey silty fine to coarse SAND.				Depth, m	8.30
Specimen Reference	6	Specimen Depth	8.3	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus20190801141



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	36
90	100	0.0479	35
75	100	0.0341	34
63	100	0.0246	30
50	100	0.0178	24
37.5	100	0.0094	20
28	100	0.0048	15
20	100	0.0028	9
14	100	0.0015	4
10	100		
6.3	99		
5	98		
3.35	98		
2	97		
1.18	93		
0.6	84	Particle density	(assumed)
0.425	80	2.65	Mg/m3
0.3	75		
0.212	60		
0.15	45		
0.063	36		

Dry Mass of sample, g	303

Sample Proportions	% dry mass
Cobbles	0
Gravel	3
Sand	60
Silt	30
Clay	6

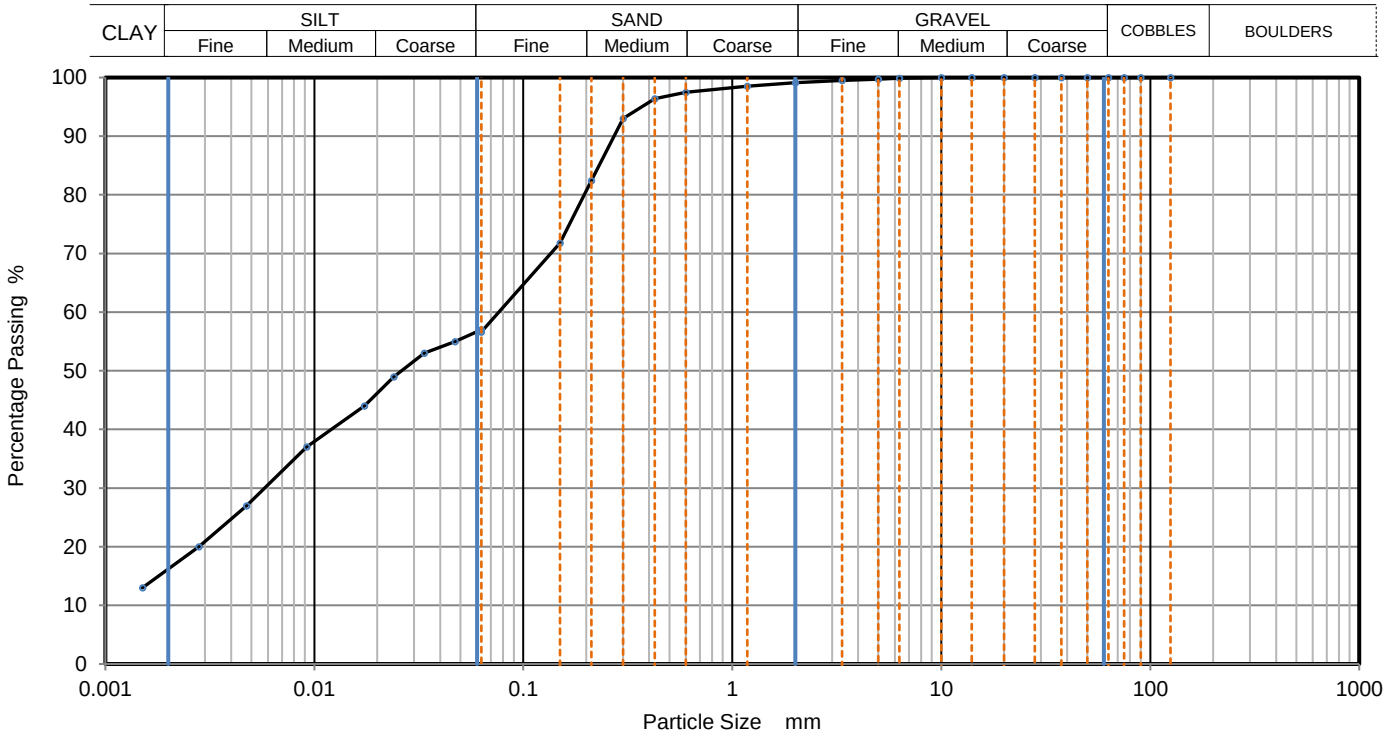
Grading Analysis		
D100	mm	
D60	mm	0.213
D30	mm	0.0253
D10	mm	0.003
Uniformity Coefficient		71
Curvature Coefficient		1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0382**
				Borehole/Pit No.	BH52
Site Name	Stornoway Deep Water Port			Sample No.	27
Soil Description	Greyish brown sandy SILT.			Depth, m	11.00
Specimen Reference	6	Specimen Depth	11 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190801142



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0629	57
90	100	0.0471	55
75	100	0.0335	53
63	100	0.0240	49
50	100	0.0173	44
37.5	100	0.0092	37
28	100	0.0047	27
20	100	0.0028	20
14	100	0.0015	13
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	93		
0.212	82		
0.15	72		
0.063	57		

Dry Mass of sample, g	385

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	43
Silt	41
Clay	16

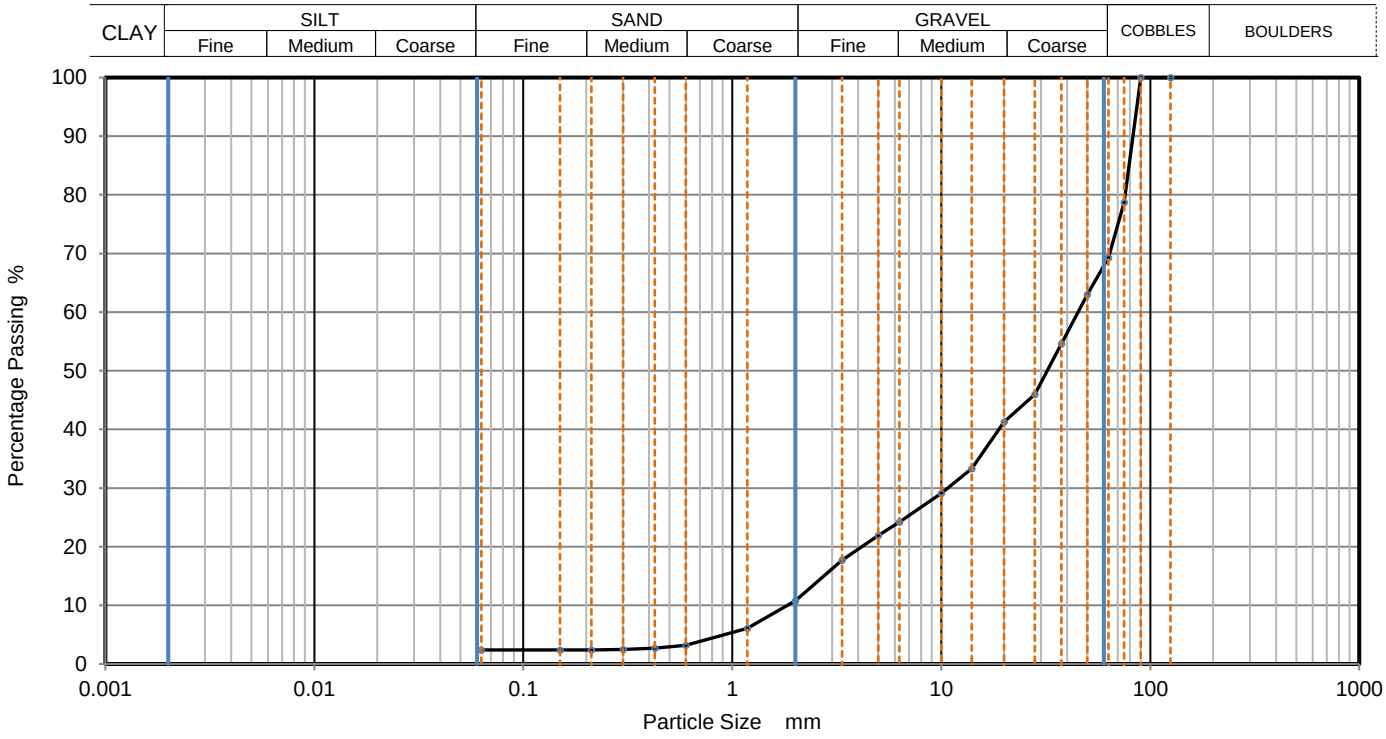
Grading Analysis		
D100	mm	
D60	mm	0.0766
D30	mm	0.00573
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	19-0382
					Borehole/Pit No.	BH52
Site Name	Stornoway Deep Water Port				Sample No.	35
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content.				Depth, m	15.40
Specimen Reference	4	Specimen Depth	15.4	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus20190801143



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	79		
63	69		
50	63		
37.5	55		
28	46		
20	41		
14	33		
10	29		
6.3	24		
5	22		
3.35	18		
2	11		
1.18	6		
0.6	3		
0.425	3		
0.3	3		
0.212	2		
0.15	2		
0.063	2		

Dry Mass of sample, g	17757

Sample Proportions	% dry mass
Cobbles	31
Gravel	58
Sand	8
Fines <0.063mm	2

Grading Analysis		
D100	mm	
D60	mm	45.1
D30	mm	10.7
D10	mm	1.82
Uniformity Coefficient		25
Curvature Coefficient		1.4

Remarks

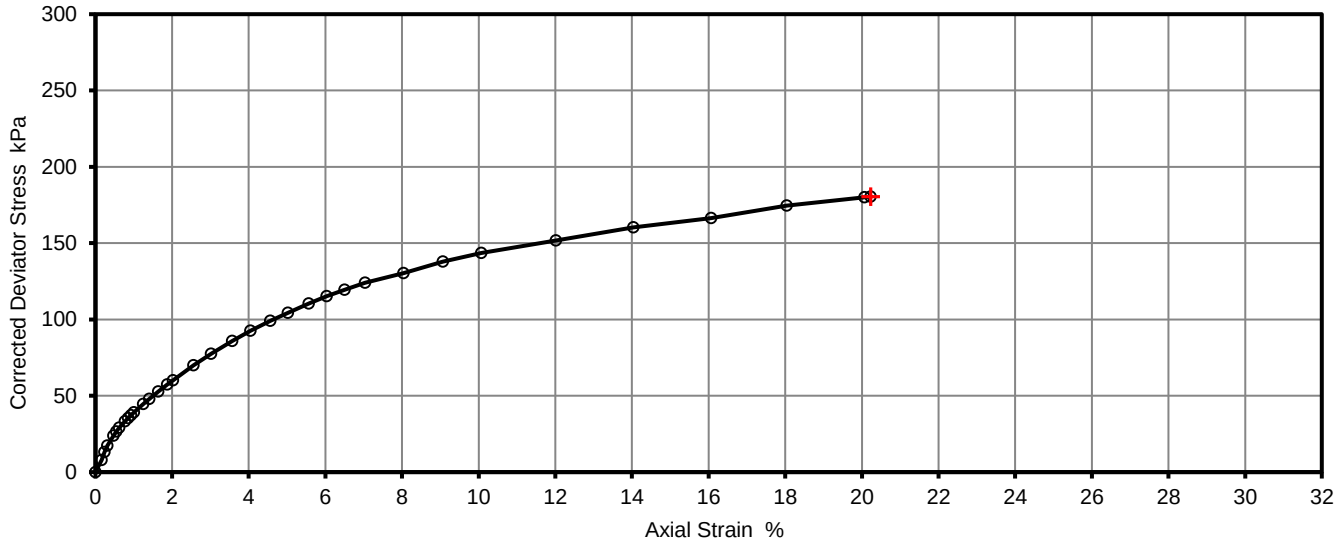
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

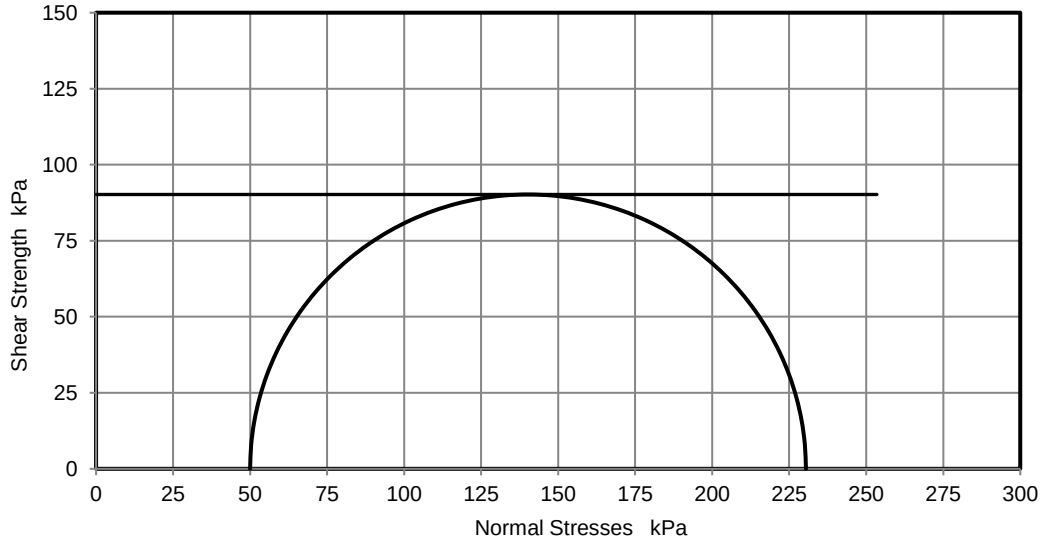
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	19-0382
				Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port			Sample No.	61
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			Depth	16.50
Specimen Reference	3	Specimen Depth	16.50 m	Sample Type	B
Specimen Description	Stiff dark brownish grey slightly sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20190801123
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	09/08/2019

Test Number		1	
Length		209.7	mm
Diameter		106.5	mm
Bulk Density		2.48	Mg/m3
Moisture Content		6.8	%
Dry Density		2.32	Mg/m3
Rate of Strain		1.0	%/min
Cell Pressure		50	kPa
At failure	Axial Strain	20.2	%
	Deviator Stress, (σ1 - σ3)f	180	kPa
	Undrained Shear Strength, cu	90	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects based on Fig 11 BS1377-7:1990

Mohr circles and their interpretation is not covered by BS1377-7.
This is provided for information only.

Remarks

Testing terminated at 20% axial strain

Approved	Printed
Stephen.Watson	23/08/2019 12:42

UKAS TESTING

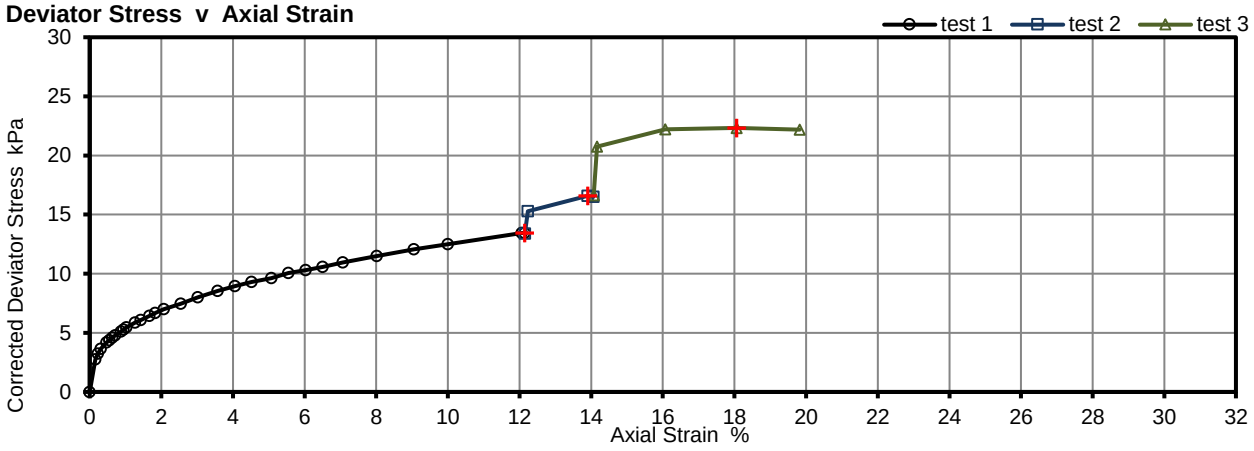
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**				Job Ref	19-0382
					Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port				Sample No.	67
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth	18.00
Specimen Reference	2	Specimen Depth	18.00	m	Sample Type	B
Specimen Description	Very soft grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080192
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe				Date of test	08/08/2019

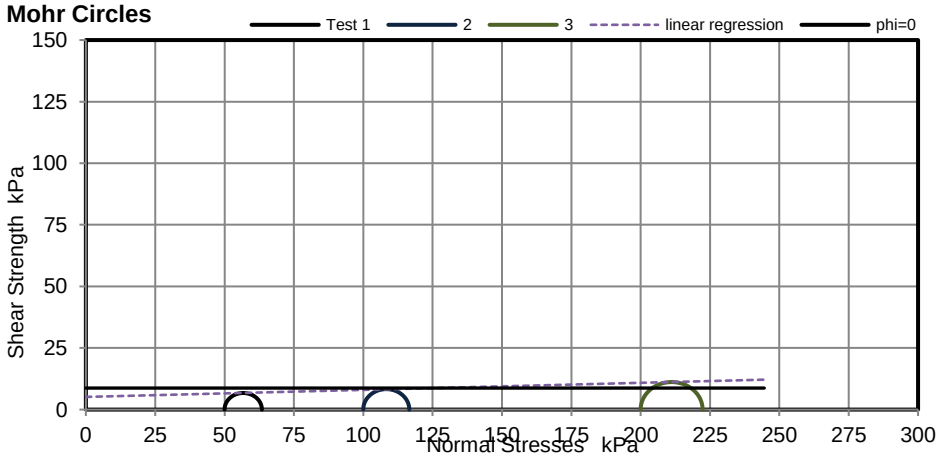
Length	mm	209.7
Diameter	mm	106.3
Bulk Density	Mg/m3	2.03
Moisture Content	%	27.6
Dry Density	Mg/m3	1.59

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	12.1	13.9	18.1
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	13.5	16.6	22.3
	Shear strength, cu	kPa	6.7	8.3	11.2
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 9 kPa

Linear Regression
ϕu 1.6 °
cu 5 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Approved	Printed
Stephen.Watson	23/08/2019 12:43

LAB 16R Version 4

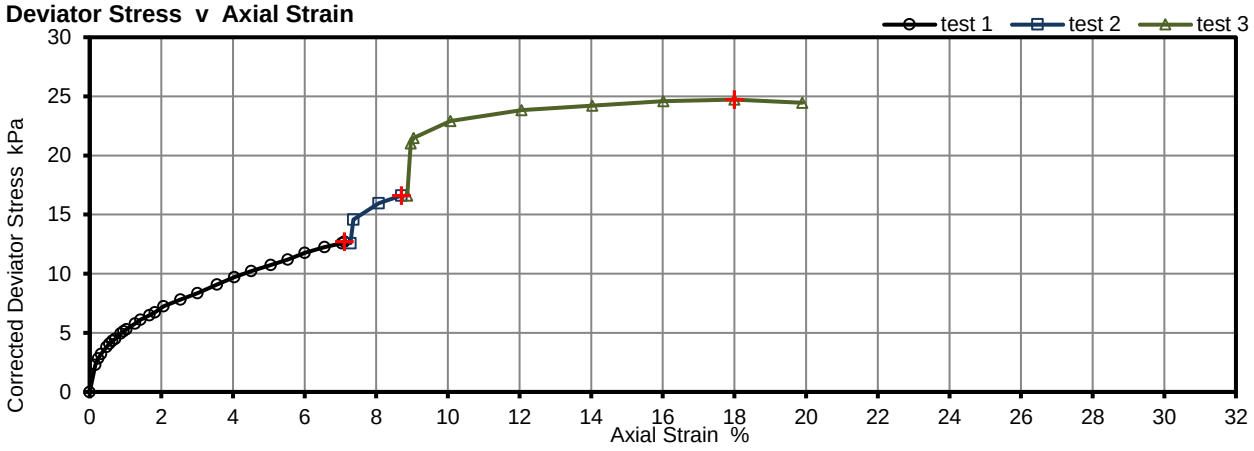
UKAS TESTING 10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	19-0382
				Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port			Sample No.	73
Soil Description	Grey slightly sandy slightly gravelly silty CLAY.			Depth	18.00
Specimen Reference	8	Specimen Depth	18.00 m	Sample Type	B
Specimen Description	Very soft grey slightly sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20190801106
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	09/08/2019

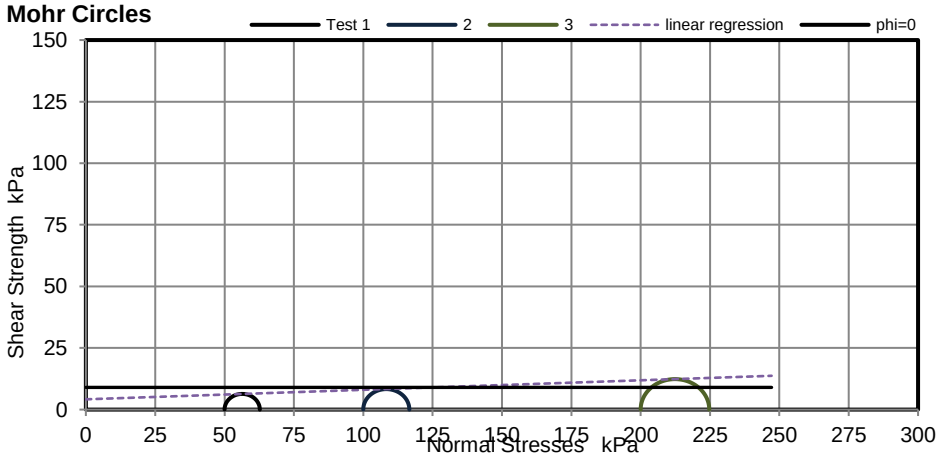
Length	mm	210.4
Diameter	mm	106.0
Bulk Density	Mg/m3	2.01
Moisture Content	%	32.6
Dry Density	Mg/m3	1.52

Rate of Strain		%/min	1.00	
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	7.1	8.7	18.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	12.7	16.6	24.7
	Shear strength, cu	kPa	6.4	8.3	12.4
	Mode of failure		Plastic		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 9 kPa

Linear Regression
ϕu 2.2 °
cu 4 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Approved	Printed
Stephen.Watson	23/08/2019 12:43

LAB 16R Version 4

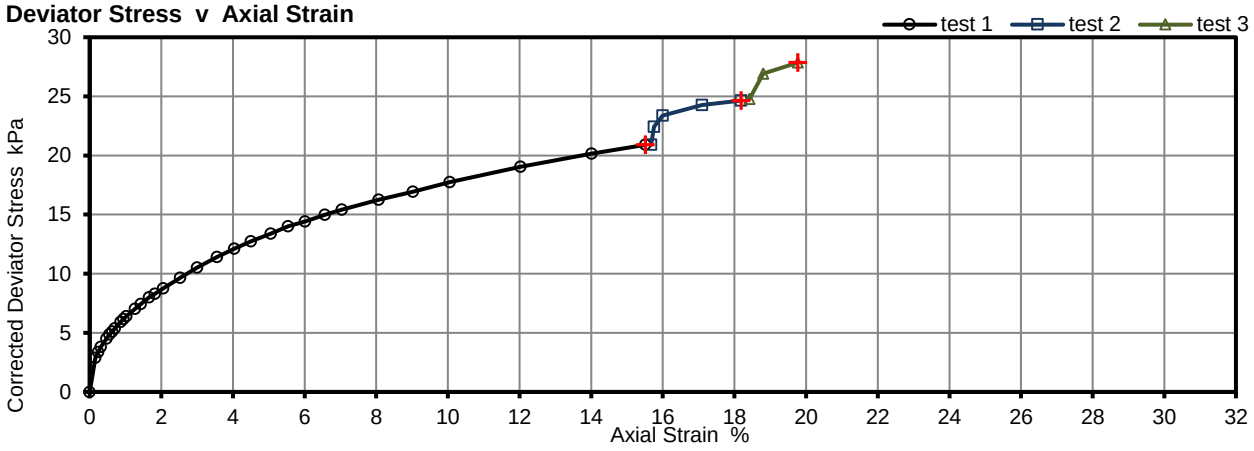
UKAS TESTING 10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	19-0382
				Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port			Sample No.	23
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			Depth	5.50
Specimen Reference	2	Specimen Depth	5.50 m	Sample Type	B
Specimen Description	Very soft dark brownish grey slightly sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20190801112
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	09/08/2019

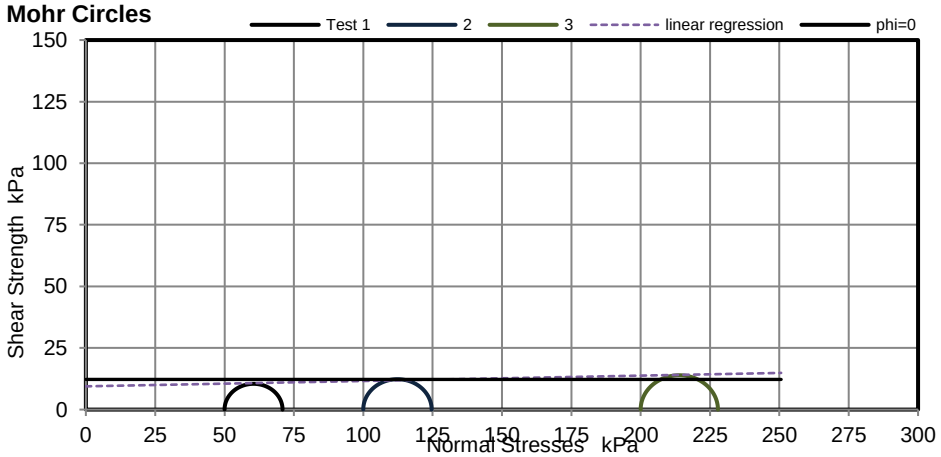
Length	mm	210.5
Diameter	mm	105.8
Bulk Density	Mg/m3	2.10
Moisture Content	%	25.6
Dry Density	Mg/m3	1.67

Rate of Strain		%/min	1.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	15.5	18.2	19.8
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	20.9	24.7	27.9
	Shear strength, cu	kPa	10.4	12.3	13.9
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0
Average cu 12 kPa

Linear Regression
ϕu 1.2 °
cu 9 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Testing terminated at 20% axial strain

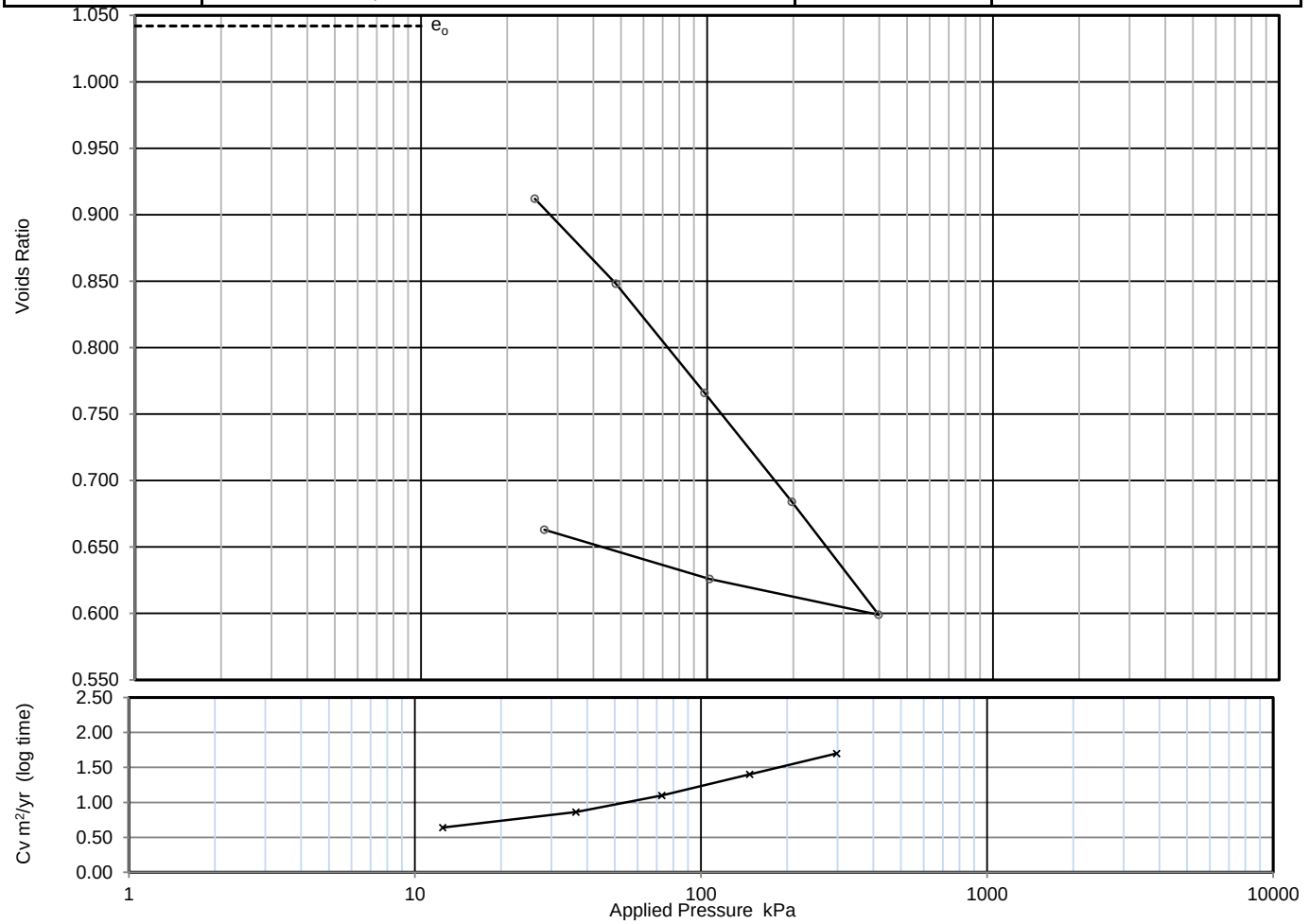
Approved: Stephen.Watson

Printed: 23/08/2019 12:43

LAB 16R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port				Sample No.	63
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth	17
Specimen Reference	3	Specimen Depth	17.05	m	Sample Type	B
Specimen Description	Grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080191
Test Method	BS1377:Part 5:1990, clause 3				Date started	19/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.042	-	-	-	-
25	0.912	2.5	0.64	0.56	0.0025
48	0.848	1.5	0.86	1.1	0.0028
98	0.766	0.88	1.1	1.5	0.0025
198	0.684	0.47	1.4	2	0.0036
398	0.599	0.25	1.7	2.7	0.0023
102	0.626	0.058			
27	0.663	0.31			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.95	-	mm
Height	19.65	16.01	mm
Moisture Content	39.3	27.4	%
Bulk density	1.81	2.03	Mg/m3
Dry density	1.30	1.59	Mg/m3
Voids Ratio	1.042	0.663	
Saturation	100	109	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

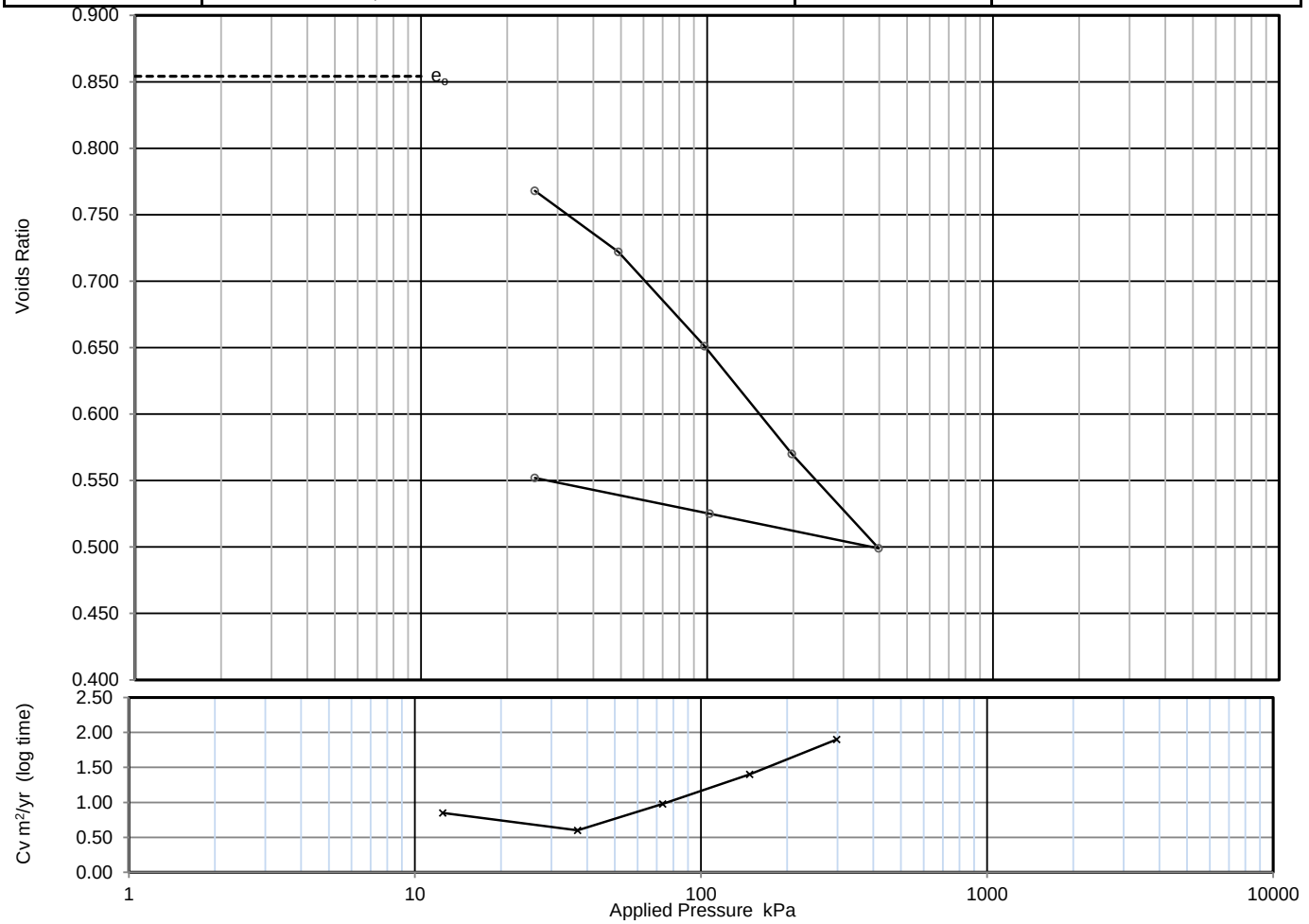
Approved: Stephen.Watson

Printed : 01/10/2019 16:31

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port				Sample No.	71
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth	19
Specimen Reference	3	Specimen Depth	19.05	m	Sample Type	B
Specimen Description	Grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080193
Test Method	BS1377:Part 5:1990, clause 3				Date started	19/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.854	-	-	-	-
25	0.768	1.9	0.85	0.81	0.003
49	0.722	1.1	0.6	2	0.001
98	0.651	0.84	0.98	1.2	0.0026
198	0.570	0.49	1.4	2.1	0.002
398	0.499	0.22	1.9	3.9	0.0018
102	0.525	0.058			
25	0.552	0.23			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	16.58	mm
Moisture Content	35.8	23.2	%
Bulk density	1.94	2.11	Mg/m3
Dry density	1.43	1.71	Mg/m3
Voids Ratio	0.854	0.551	
Saturation	111	112	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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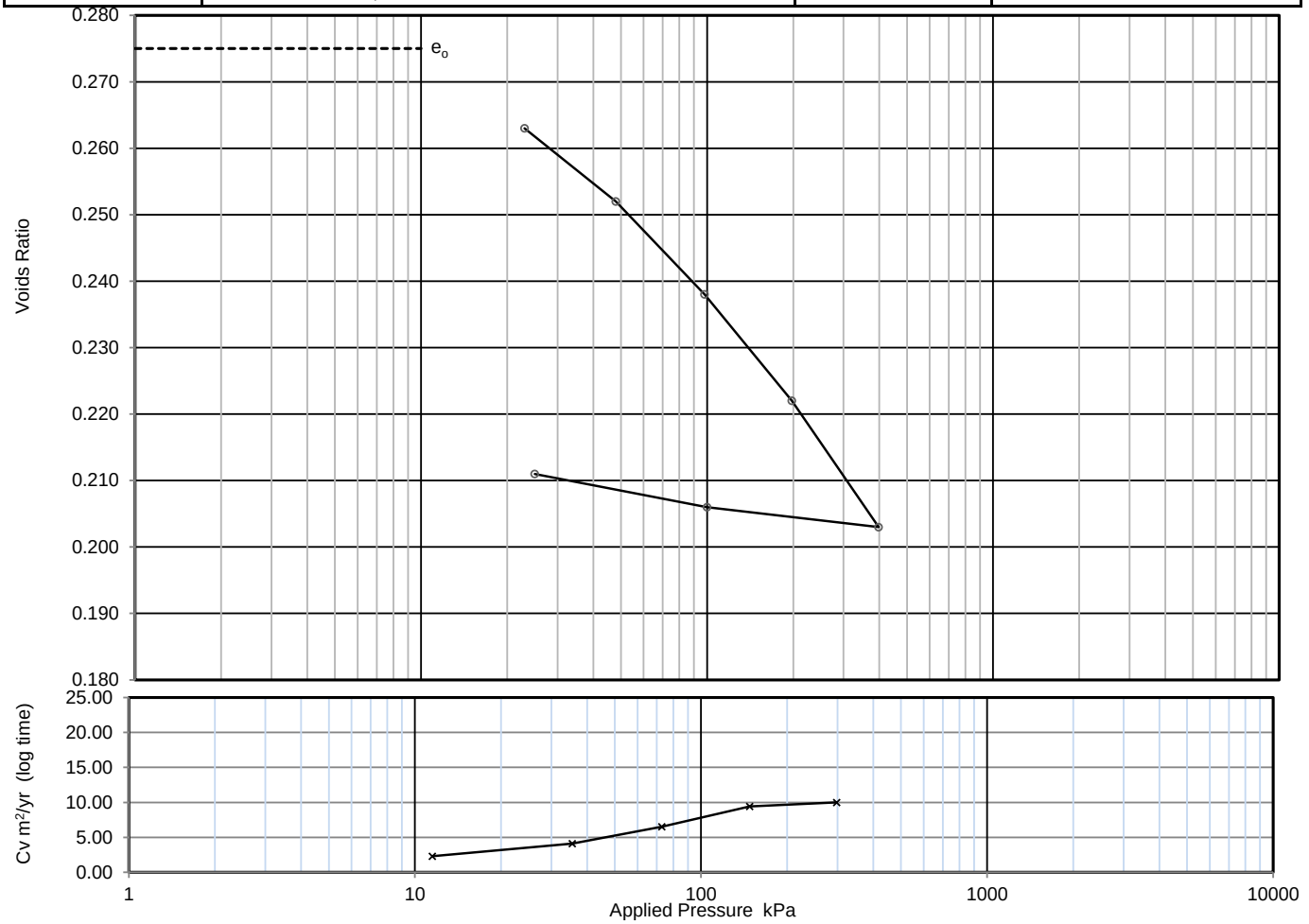
LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH43
Site Name	Stornoway Deep Water Port				Sample No.	109
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth	29.1
Specimen Reference	9	Specimen Depth	29.1	m	Sample Type	B
Specimen Description	Grey sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus2019080198
Test Method	BS1377:Part 5:1990, clause 3				Date started	03/09/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.275	-	-	-	-
23	0.263	0.41	2.3	2	0.0013
48	0.252	0.35	4.1	66	0.00099
98	0.238	0.23	6.5	60	0.001
198	0.222	0.13	9.4	52	0.0012
398	0.203	0.075	10	70	0.00099
100	0.206	0.0057			
25	0.211	0.063			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.60	18.62	mm
Moisture Content	14.0	12.0	%
Bulk density	2.37	2.45	Mg/m3
Dry density	2.08	2.19	Mg/m3
Voids Ratio	0.275	0.211	
Saturation	135	151	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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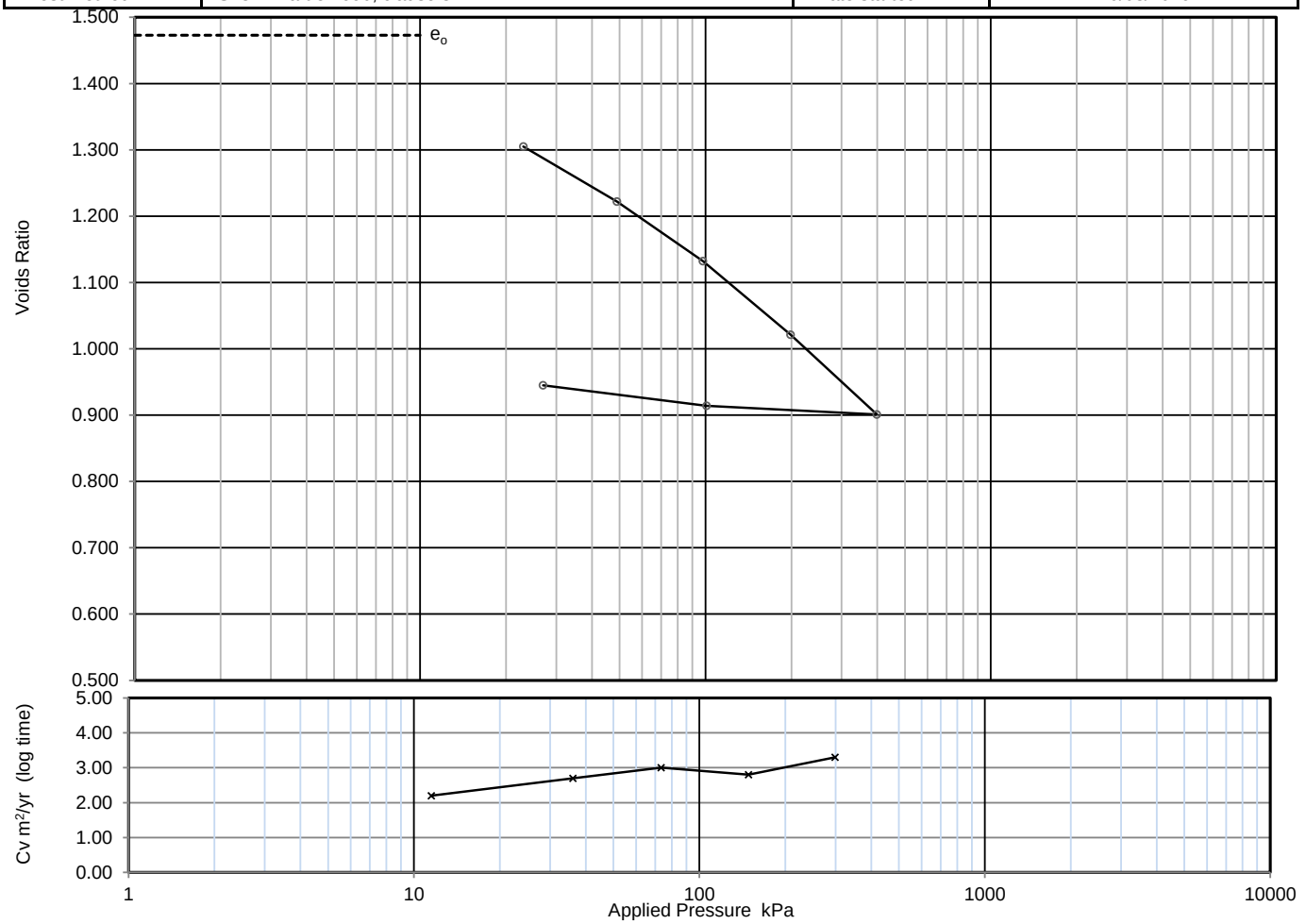
LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH45
Site Name	Stornoway Deep Water Port				Sample No.	42
Soil Description	Grey sandy slightly gravelly organic SILT.				Depth	10
Specimen Reference	3	Specimen Depth	1.05	m	Sample Type	B
Specimen Description	Grey sandy slightly gravelly organic SILT.				KeyLAB ID	Caus20190801103
Test Method	BS1377:Part 5:1990, clause 3				Date started	20/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.473	-	-	-	-
23	1.305	2.9	2.2	1.4	0.0047
49	1.222	1.4	2.7	3.7	0.0055
98	1.132	0.83	3	3.9	0.0067
199	1.021	0.51	2.8	4.9	0.0066
399	0.901	0.3	3.3	5.3	0.0075
101	0.914	0.023			
27	0.945	0.22			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.65	15.46	mm
Moisture Content	59.6	37.9	%
Bulk density	1.71	1.88	Mg/m3
Dry density	1.07	1.36	Mg/m3
Voids Ratio	1.473	0.945	
Saturation	107	106	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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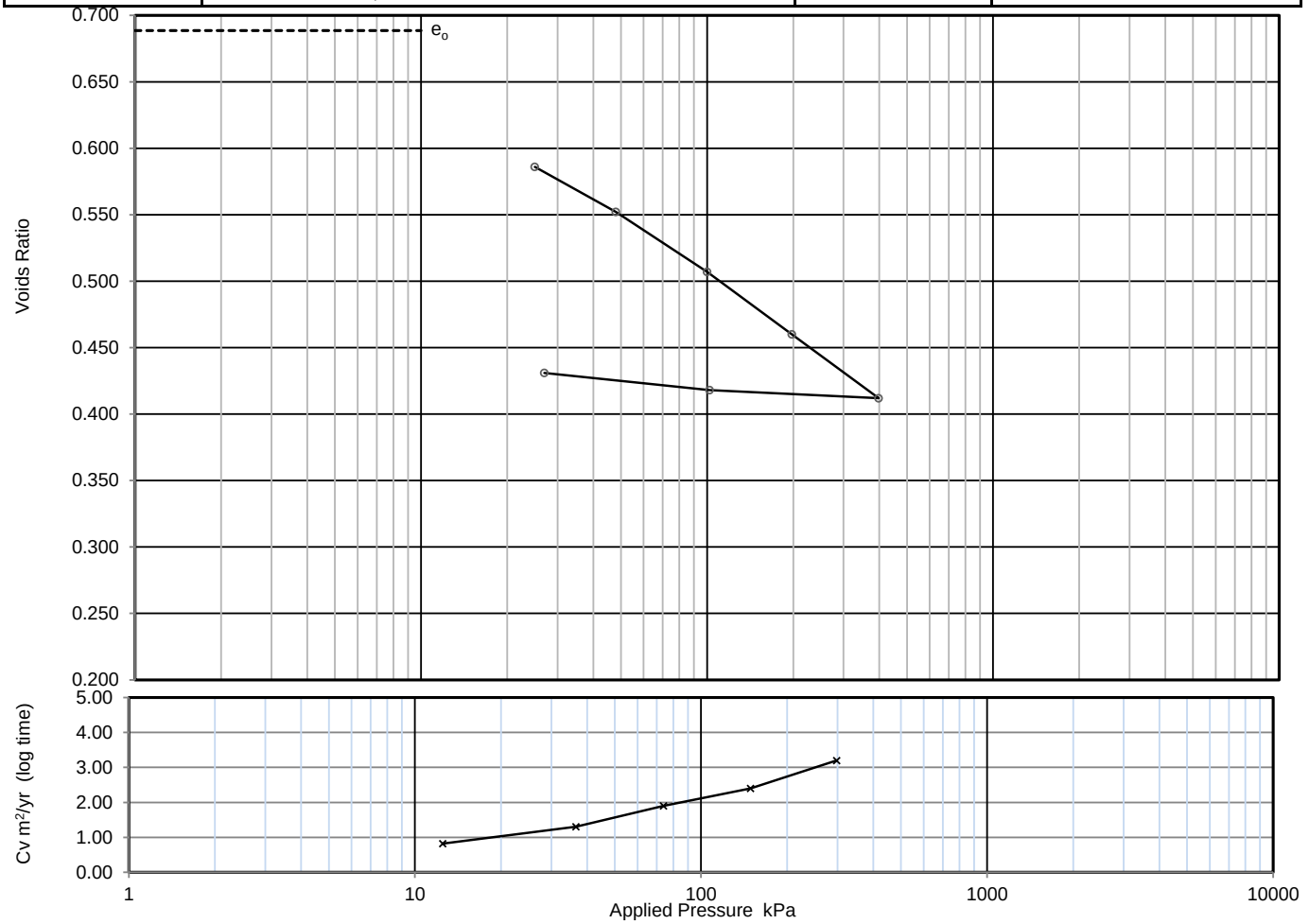
LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port				Sample No.	29
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				Depth	7
Specimen Reference	3	Specimen Depth	7.05	m	Sample Type	B
Specimen Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus20190801114
Test Method	BS1377:Part 5:1990, clause 3				Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.689	-	-	-	-
25	0.586	2.4	0.82	0.62	0.0019
48	0.552	0.95	1.3	1.6	0.0022
100	0.507	0.56	1.9	2.6	0.0022
198	0.460	0.32	2.4	3.7	0.0023
398	0.412	0.16	3.2	4.5	0.0023
102	0.418	0.016			
27	0.431	0.12			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.95	-	mm
Height	19.65	16.65	mm
Moisture Content	30.0	19.5	%
Bulk density	2.04	2.21	Mg/m3
Dry density	1.57	1.85	Mg/m3
Voids Ratio	0.689	0.431	
Saturation	115	120	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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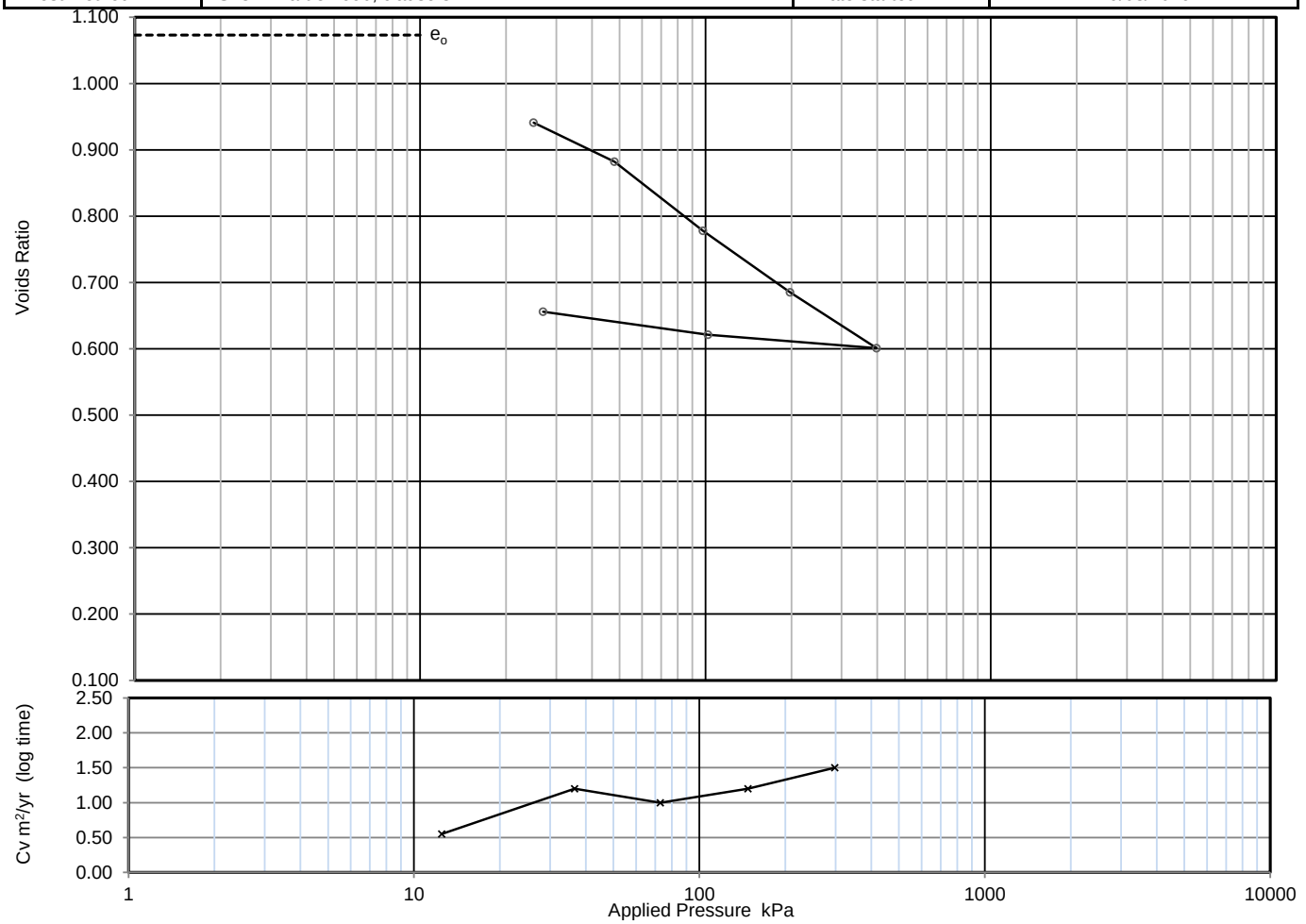
LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port				Sample No.	35
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				Depth	8.5
Specimen Reference	3	Specimen Depth	8.55	m	Sample Type	B
Specimen Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus20190801116
Test Method	BS1377:Part 5:1990, clause 3				Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.073	-	-	-	-
25	0.941	2.5	0.55	0.57	0.0032
48	0.882	1.3	1.2	1.8	0.003
98	0.778	1.1	1	1.1	0.0069
198	0.685	0.52	1.2	1.5	0.0025
398	0.601	0.25	1.5		0.0028
102	0.621	0.041			
27	0.656	0.29			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.80	-	mm
Height	19.65	15.69	mm
Moisture Content	44.6	27.8	%
Bulk density	1.85	2.05	Mg/m3
Dry density	1.28	1.60	Mg/m3
Voids Ratio	1.073	0.656	
Saturation	110	112	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

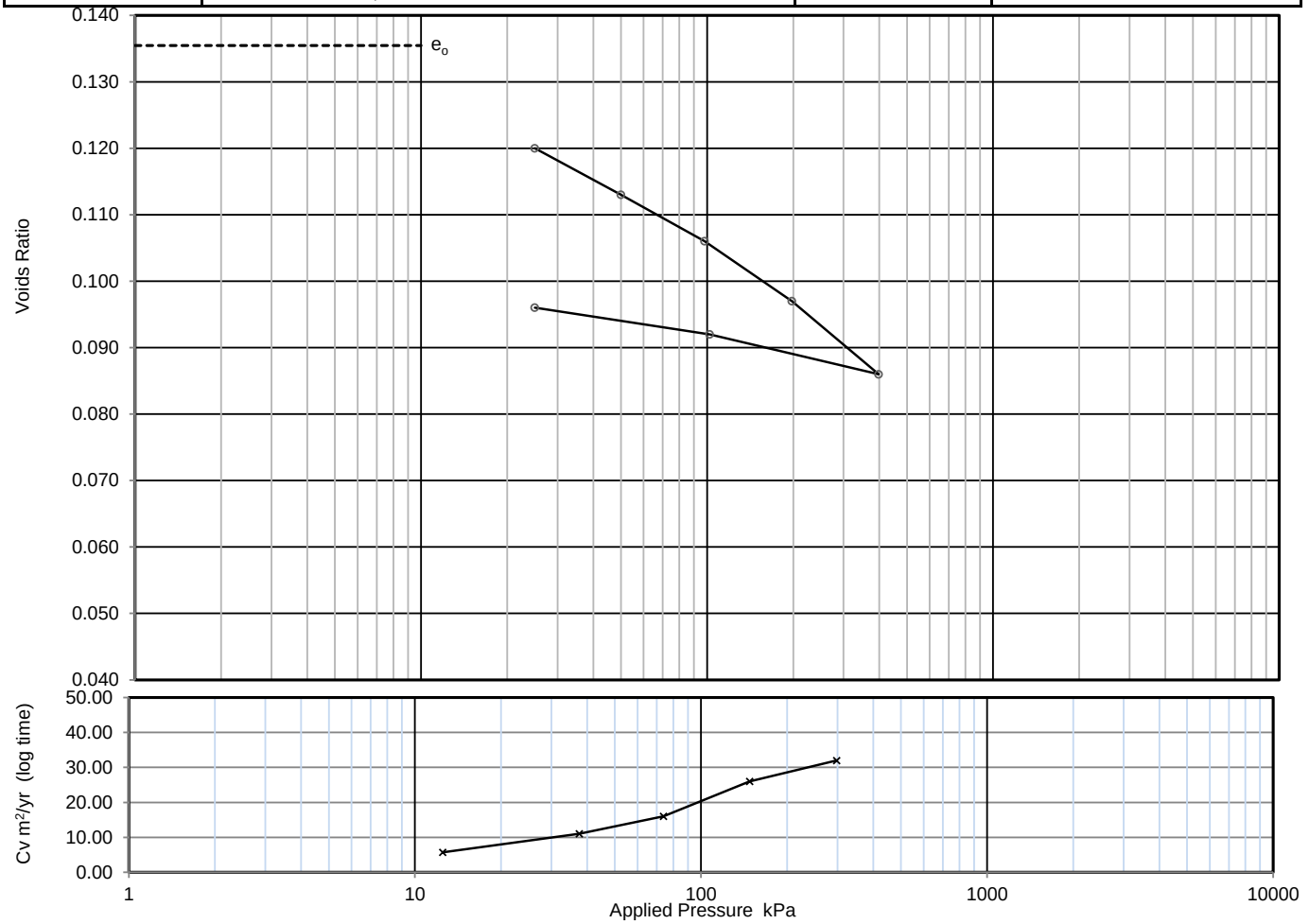
Approved: Stephen.Watson

Printed : 01/10/2019 16:31

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref	19-0382
					Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port				Sample No.	52
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				Depth	13.2
Specimen Reference	3	Specimen Depth	13.25	m	Sample Type	B
Specimen Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.				KeyLAB ID	Caus20190801119
Test Method	BS1377:Part 5:1990, clause 3				Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.135	-	-	-	-
25	0.120	0.55	5.7	4	0.00084
50	0.113	0.23	11	290	0.0004
98	0.106	0.14	16	300	0.00041
198	0.097	0.082	26	300	0.00049
398	0.086	0.047	32	300	0.00052
102	0.092	0.017			
25	0.096	0.05			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.90	19.21	mm
Moisture Content	9.3	7.8	%
Bulk density	2.55	2.61	Mg/m3
Dry density	2.33	2.42	Mg/m3
Voids Ratio	0.135	0.096	
Saturation	181	215	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

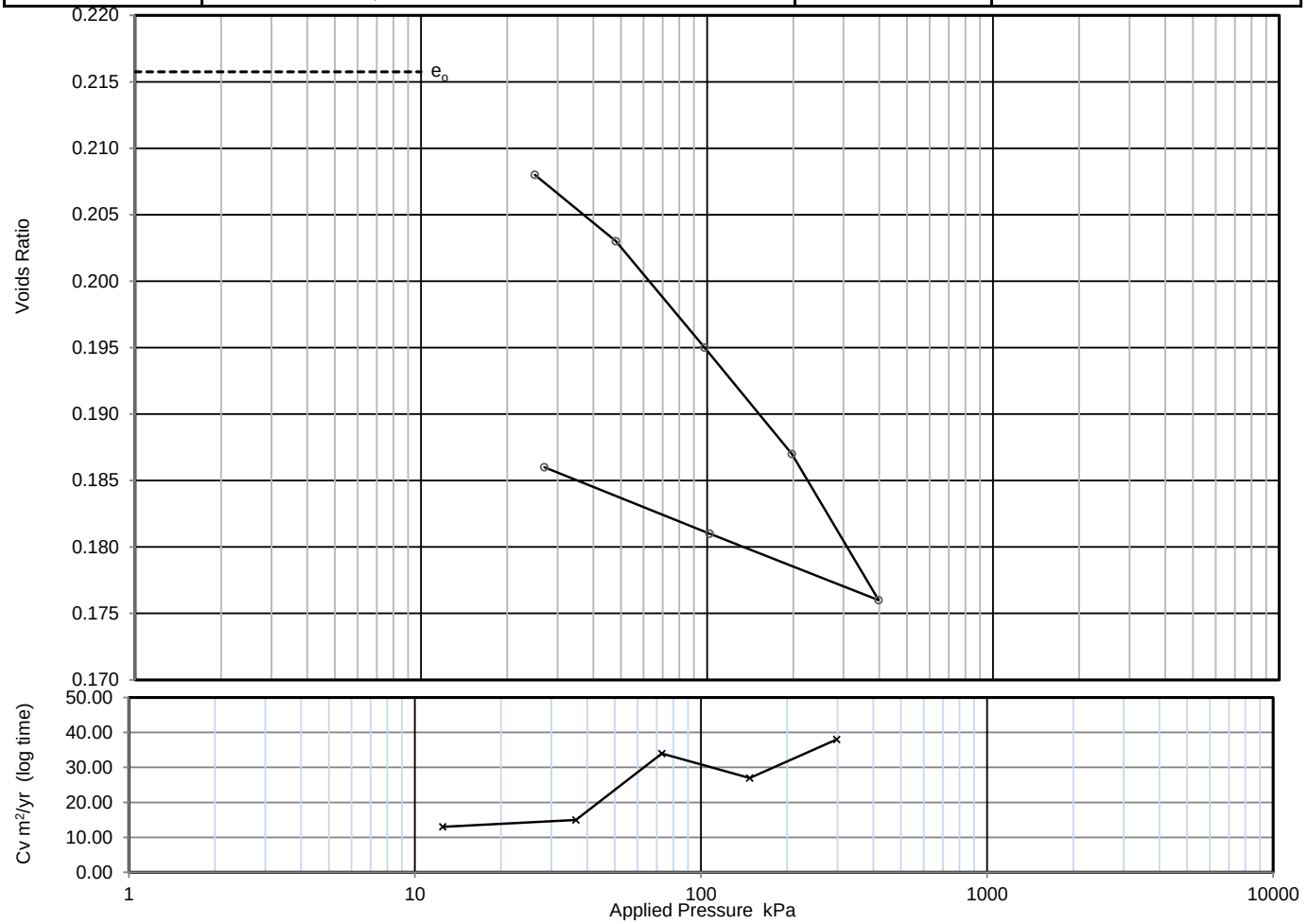
Approved: Stephen.Watson

Printed : 01/10/2019 16:31

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	19-0382
				Borehole/Pit No.	BH49
Site Name	Stornoway Deep Water Port			Sample No.	58
Soil Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			Depth	16
Specimen Reference	3	Specimen Depth	16.05 m	Sample Type	B
Specimen Description	Dark brownish grey slightly sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20190801122
Test Method	BS1377:Part 5:1990, clause 3			Date started	23/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.216	-	-	-	-
25	0.208	0.26	13	11	0.00059
48	0.203	0.19	15	310	0.00029
98	0.195	0.13	34	310	0.00041
198	0.187	0.071	27	310	0.00035
398	0.176	0.045	38	300	0.0005
102	0.181	0.015			
27	0.186	0.056			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.90	-	mm
Height	19.75	19.27	mm
Moisture Content	8.7	8.1	%
Bulk density	2.37	2.42	Mg/m3
Dry density	2.18	2.23	Mg/m3
Voids Ratio	0.216	0.186	
Saturation	107	116	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

Printed : 01/10/2019 16:31

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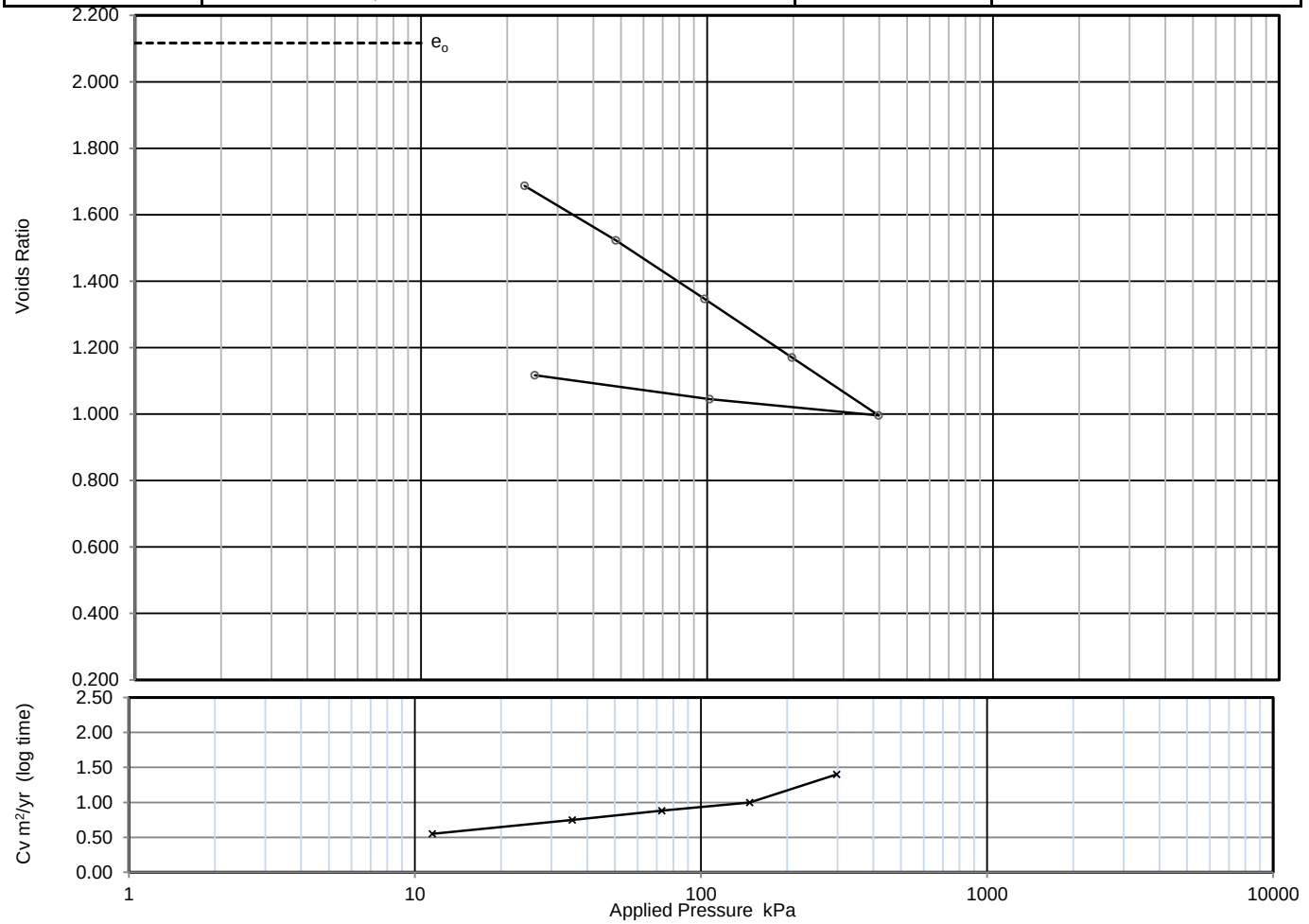
UKAS TESTING 10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	19-0382
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	3
Soil Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			Depth	1
Specimen Reference	3	Specimen Depth	1.05 m	Sample Type	B
Specimen Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			KeyLAB ID	Caus20190801128
Test Method	BS1377:Part 5:1990, clause 3			Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	2.117	-	-	-	-
23	1.687	6	0.55	0.44	0.0058
48	1.523	2.5	0.75	0.96	0.009
98	1.347	1.4	0.88	1.2	0.01
198	1.170	0.75	1	1.5	0.0086
398	0.996	0.4	1.4	2.1	0.0085
102	1.045	0.084			
25	1.117	0.45			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.60	13.31	mm
Moisture Content	85.7	42.8	%
Bulk density	1.58	1.79	Mg/m3
Dry density	0.85	1.25	Mg/m3
Voids Ratio	2.117	1.117	
Saturation	107	102	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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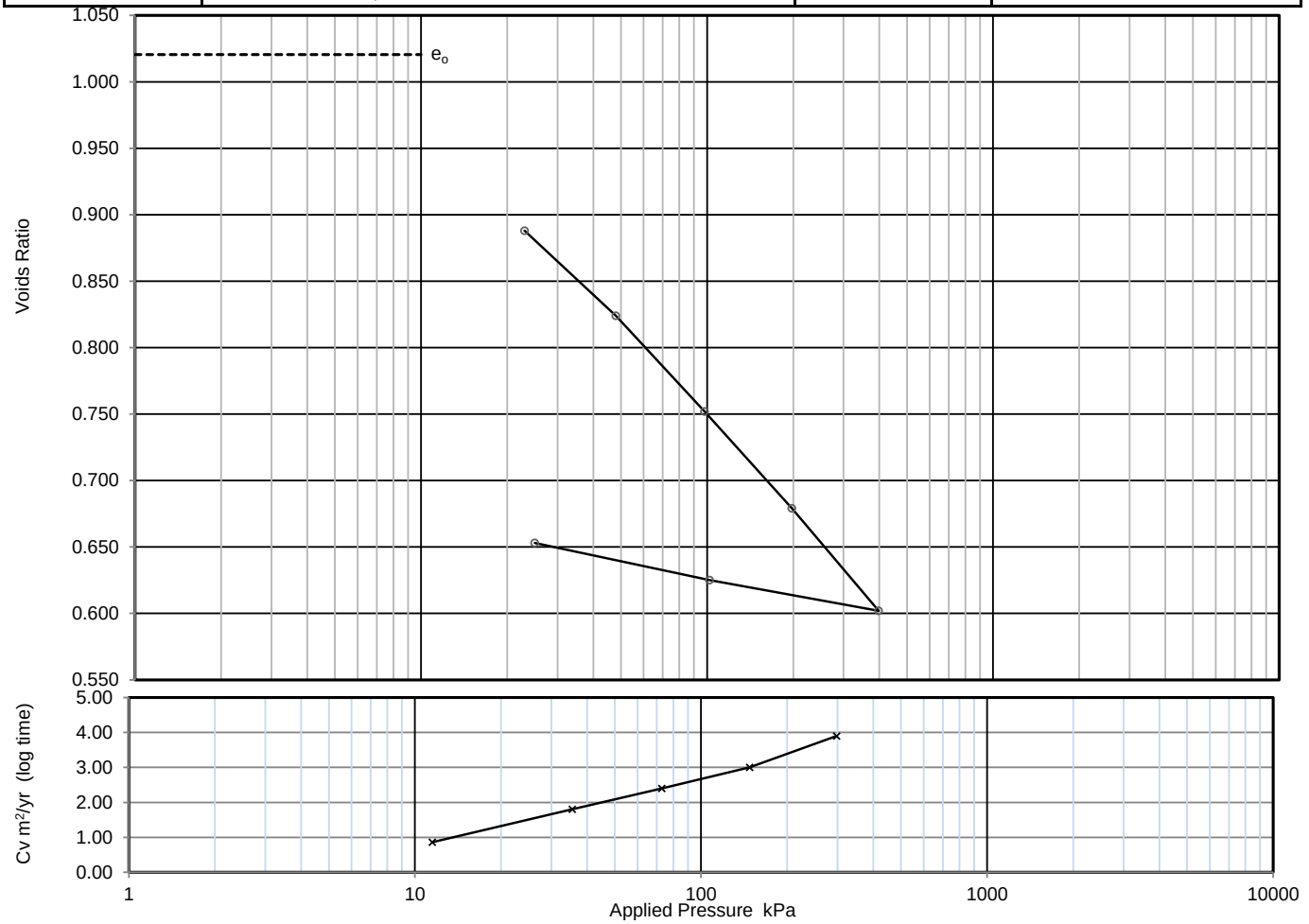
UKAS TESTING 10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	19-0382
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	17
Soil Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			Depth	8
Specimen Reference	3	Specimen Depth	8.05 m	Sample Type	B
Specimen Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			KeyLAB ID	Caus20190801131
Test Method	BS1377:Part 5:1990, clause 3			Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.020	-	-	-	-
23	0.888	2.9	0.86	0.48	0.0027
48	0.824	1.3	1.8	2.3	0.0037
98	0.752	0.8	2.4	4.5	0.004
198	0.679	0.42	3	5.8	0.0039
398	0.602	0.23	3.9	10	0.0036
102	0.625	0.047			
25	0.653	0.22			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.80	-	mm
Height	19.70	16.11	mm
Moisture Content	43.8	25.6	%
Bulk density	1.89	2.01	Mg/m3
Dry density	1.31	1.60	Mg/m3
Voids Ratio	1.020	0.653	
Saturation	114	104	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

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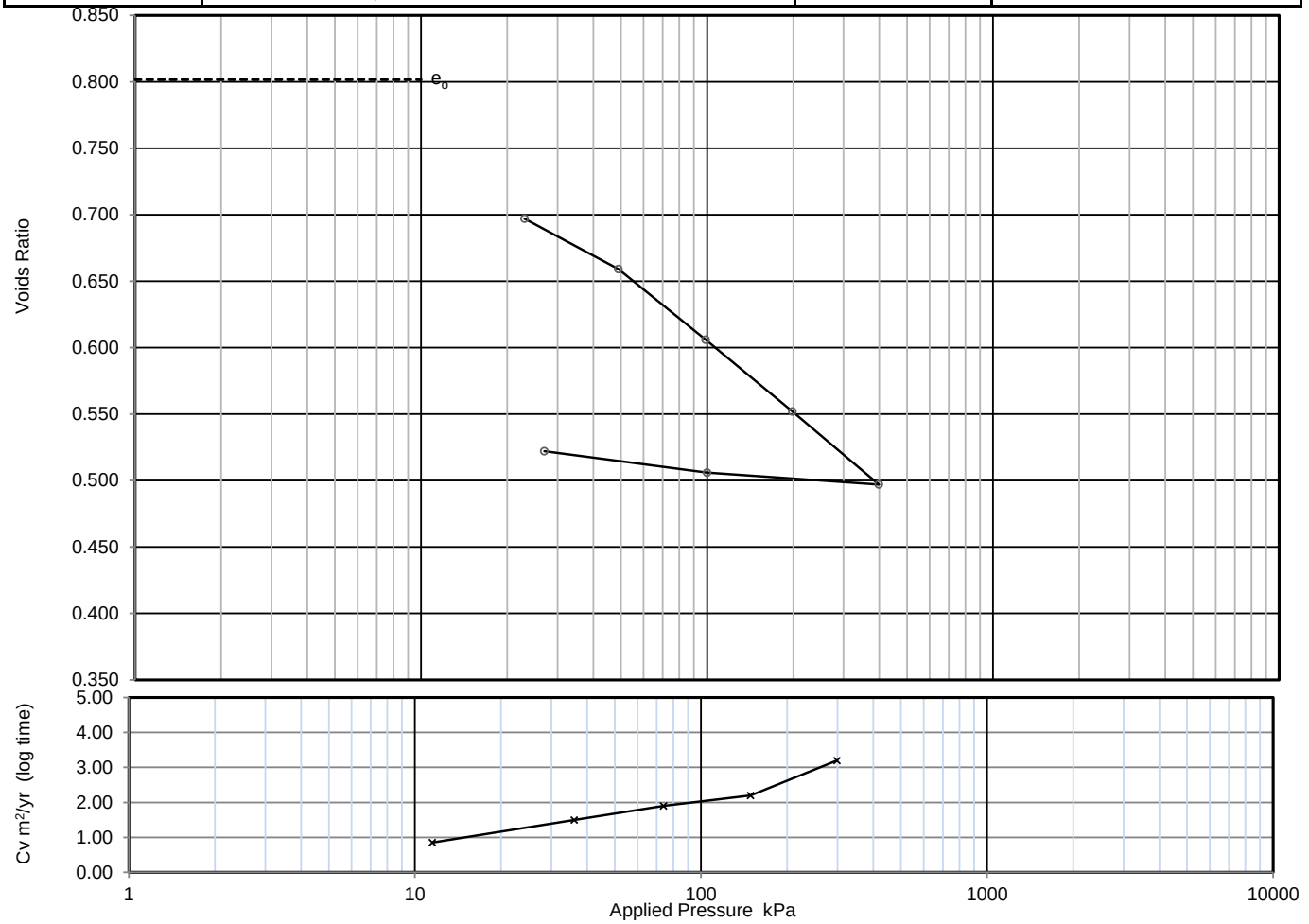
UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3			Job Ref	19-0382
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	25
Soil Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			Depth	12
Specimen Reference	3	Specimen Depth	12.05 m	Sample Type	B
Specimen Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			KeyLAB ID	Caus20190801134
Test Method	BS1377:Part 5:1990, clause 3			Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.802	-	-	-	-
23	0.697	2.5	0.85	0.61	0.0019
49	0.659	0.86	1.5	1.6	0.0026
99	0.606	0.63	1.9	2.7	0.0027
199	0.552	0.34	2.2	3.5	0.0028
399	0.497	0.18	3.2	4.6	0.0031
100	0.506	0.02			
27	0.522	0.14			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.70	16.65	mm
Moisture Content	33.7	22.6	%
Bulk density	1.97	2.13	Mg/m3
Dry density	1.47	1.74	Mg/m3
Voids Ratio	0.802	0.522	
Saturation	112	114	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

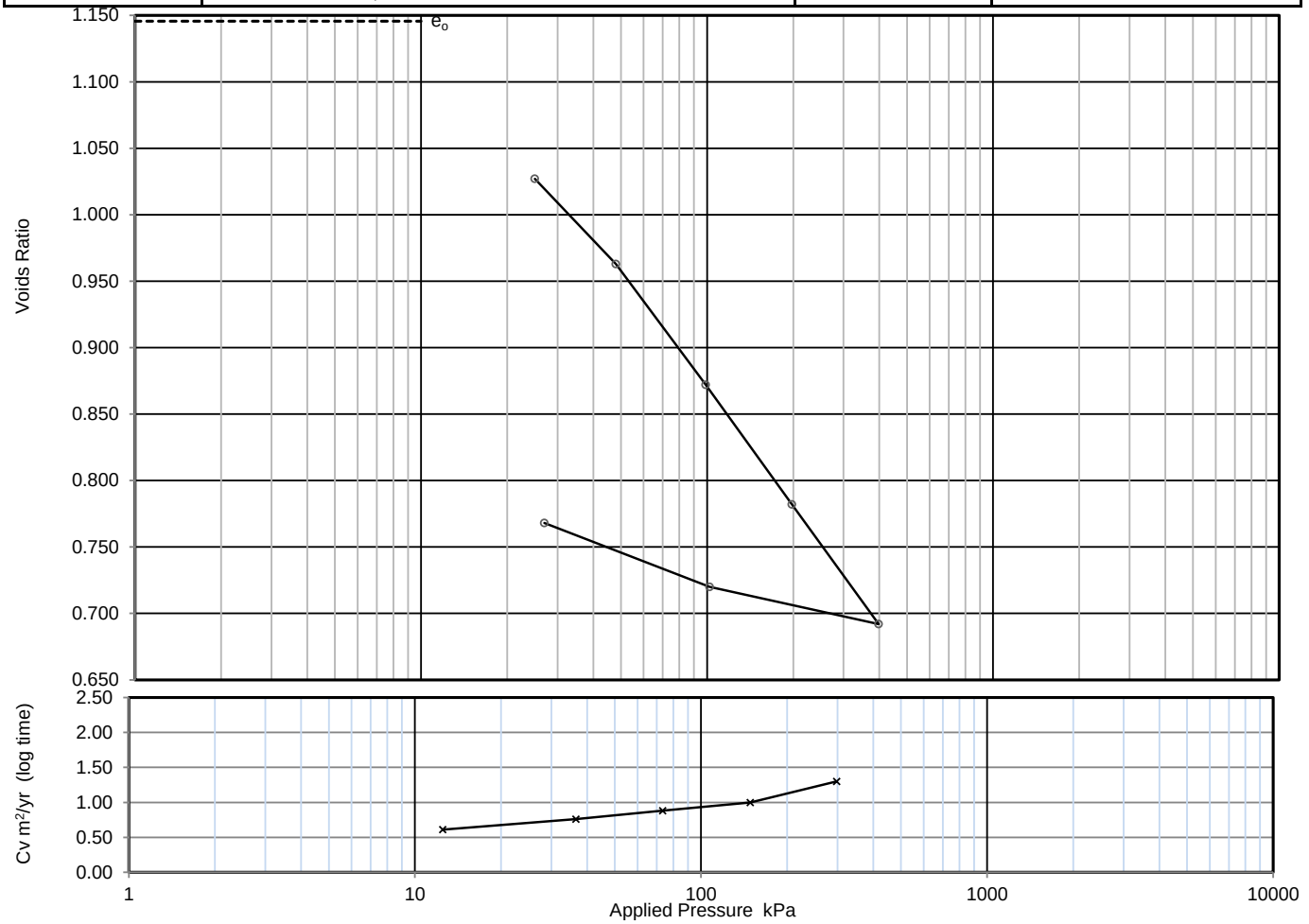
Approved: Stephen.Watson

Printed : 01/10/2019 16:31

LAB 13R Version 4

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3			Job Ref	19-0382
				Borehole/Pit No.	BH51
Site Name	Stornoway Deep Water Port			Sample No.	32
Soil Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			Depth	15.5
Specimen Reference	3	Specimen Depth	15.55 m	Sample Type	B
Specimen Description	Grey slightly sandy slightly gravelly silty CLAY with shell fragments.			KeyLAB ID	Caus20190801137
Test Method	BS1377:Part 5:1990, clause 3			Date started	29/08/2019



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	1.146	-	-	-	-
25	1.027	2.2	0.61	0.55	0.0031
48	0.963	1.4	0.76	0.95	0.0033
99	0.872	0.91	0.88	1.1	0.0033
198	0.782	0.48	1	1.3	0.0031
398	0.692	0.25	1.3	1.6	0.0033
102	0.720	0.057			
27	0.768	0.37			

Preparation: Sample remoulded using the 2.5kg rammer

Index tests: Liquid limit % Plastic limit %

Particle density: assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	20.00	16.48	mm
Moisture Content	137.8	31.3	%
Bulk density	2.94	1.97	Mg/m3
Dry density	1.24	1.50	Mg/m3
Voids Ratio	1.146	0.768	
Saturation	319	108	%
Average temperature for test			oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Final values should be used with caution

Cv plotted at mid point of load increments

Cv corrected to 20oC

Approved: Stephen.Watson

Printed : 01/10/2019 16:31

LAB 13R Version 4

UKAS TESTING 10122

LABORATORY REPORT

4043

Contract Number: PSL19/4943

Report Date: 29 August 2019

Client's Reference: 19-0382-3

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 15/8/2019
Date Commenced: 15/8/2019
Date Completed: 29/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
S Royle (Laboratory Manager)	S Eyre (Senior Technician)	L Knight (Senior Technician)

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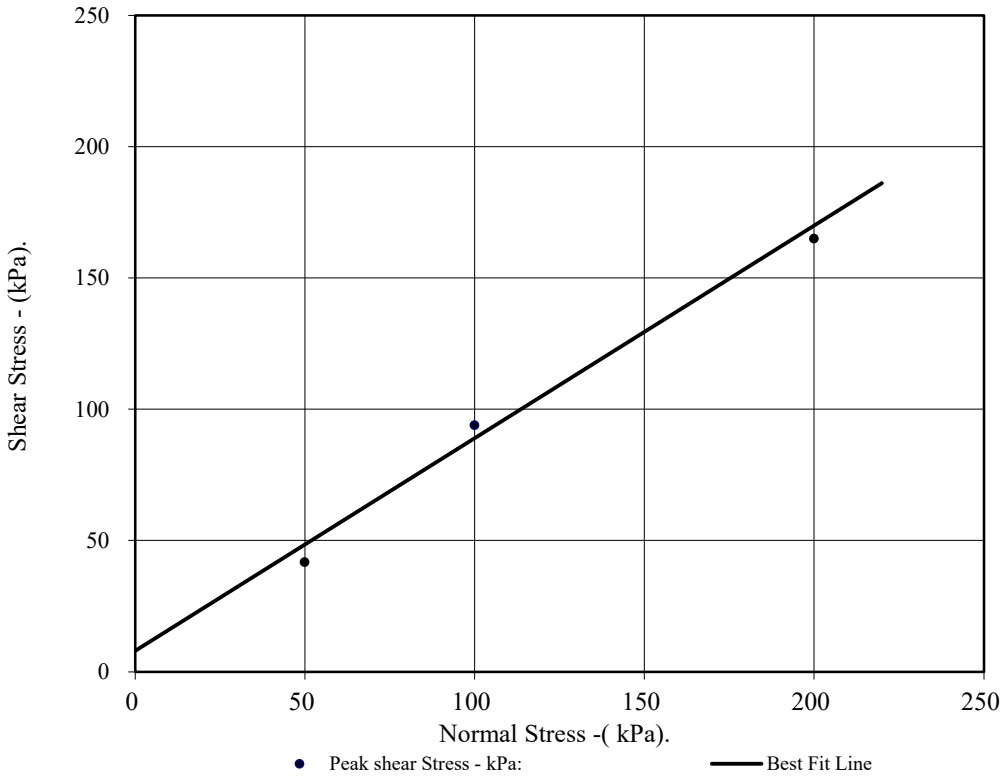
awatkins@prosoils.co.uk

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**		Top Depth:	**1.00**
Sample Number:	**5**		Base Depth:	**1.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**Brown SAND & GRAVEL.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.0	5.0	5.0
Bulk Density - Mg/m3:	1.79	1.79	1.80
Dry Density - Mg/m3:	1.70	1.71	1.71
Voids Ratio:	0.558	0.553	0.548
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.59	19.27	19.21
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.91	4.80	6.61
Peak shear Stress - kPa:	42	94	165
Final Consolidated Conditions			
Moisture Content - %:	4.1	4.2	4.2
Bulk Density - Mg/m3:	1.83	1.86	1.88
Dry Density - Mg/m3:	1.76	1.79	1.80
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**8**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

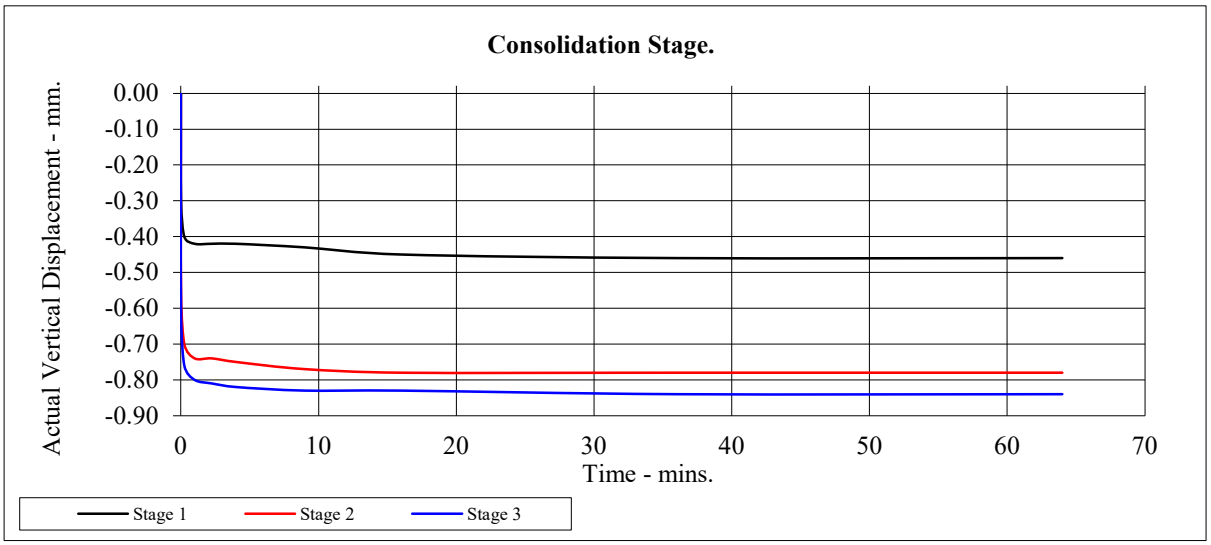
Stornoway Deep Water Port

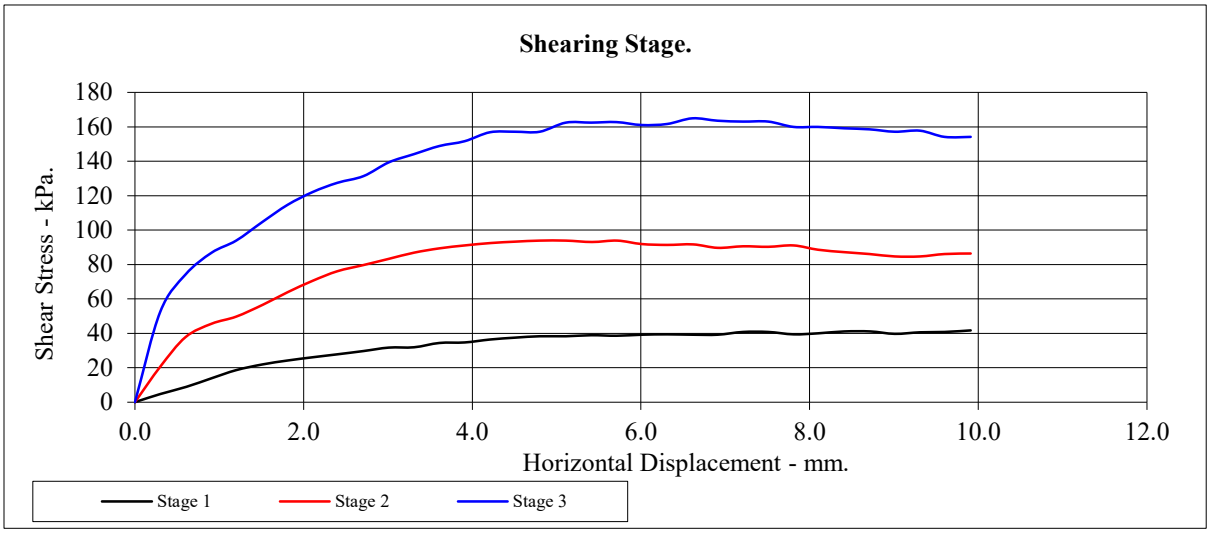
Contract No:
PSL19/4943
Client Ref:
19-0382

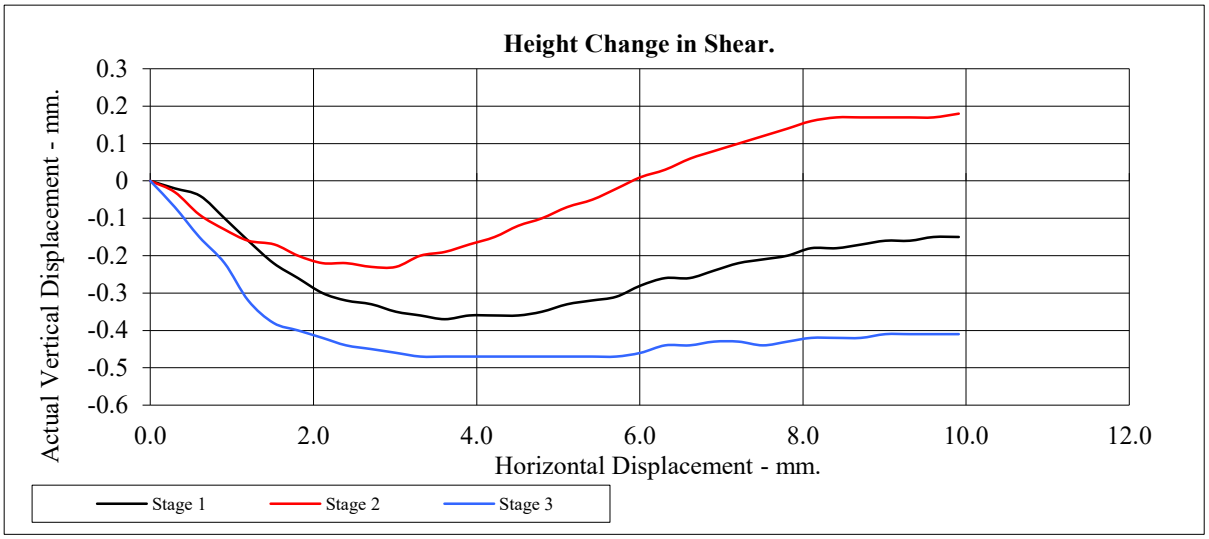
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**	Top Depth:	**1.00**
Sample Number:	**5**	Base Depth:	**1.50**





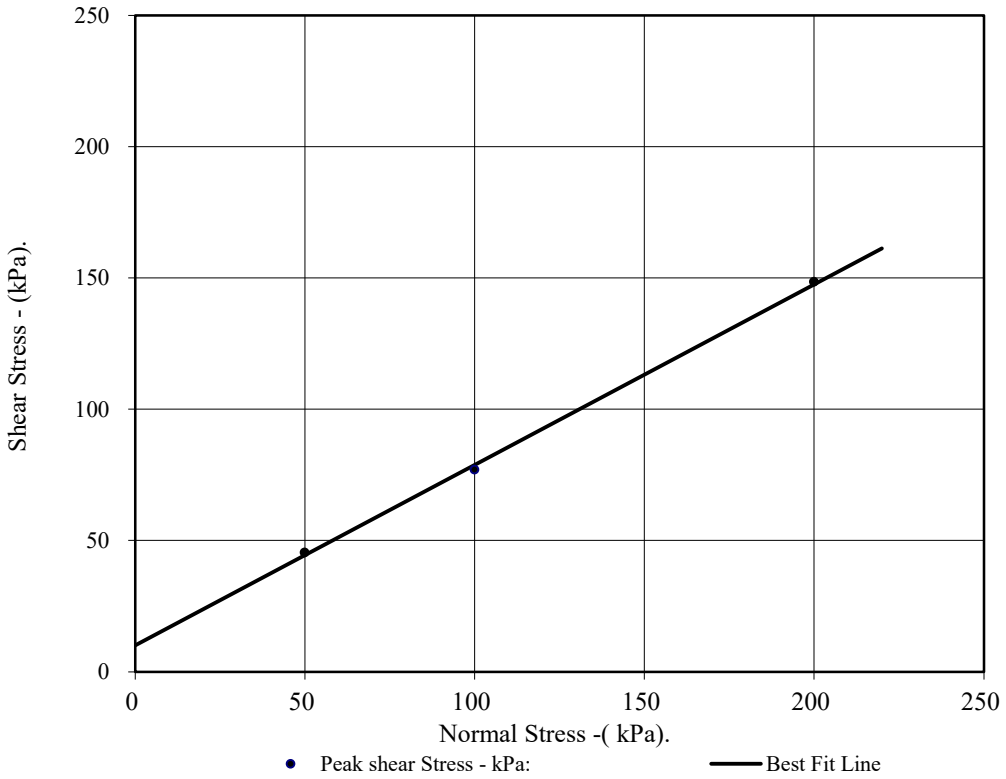


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**		Top Depth:	**21.00**	
Sample Number:	**71**		Base Depth:	**21.50**	
Sample Conditions:	Submerged		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	**Grey gravelly sandy CLAY.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	11	11	11
Bulk Density - Mg/m3:	2.21	2.21	2.21
Dry Density - Mg/m3:	1.99	1.99	1.99
Voids Ratio:	0.332	0.334	0.334
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.50	18.95	17.78
Shearing Stage			
Rate of Strain (mm/min)	0.054	0.054	0.054
Displacement at peak shear stress (mm)	3.38	5.53	4.25
Peak shear Stress - kPa:	45	77	149
Final Consolidated Conditions			
Moisture Content - %:	11	11	10
Bulk Density - Mg/m3:	2.27	2.33	2.49
Dry Density - Mg/m3:	2.04	2.10	2.25
Peak			
Angle of Shearing Resistance:(~~θ~~)	**35**		
Effective Cohesion - kPa:	**10**		

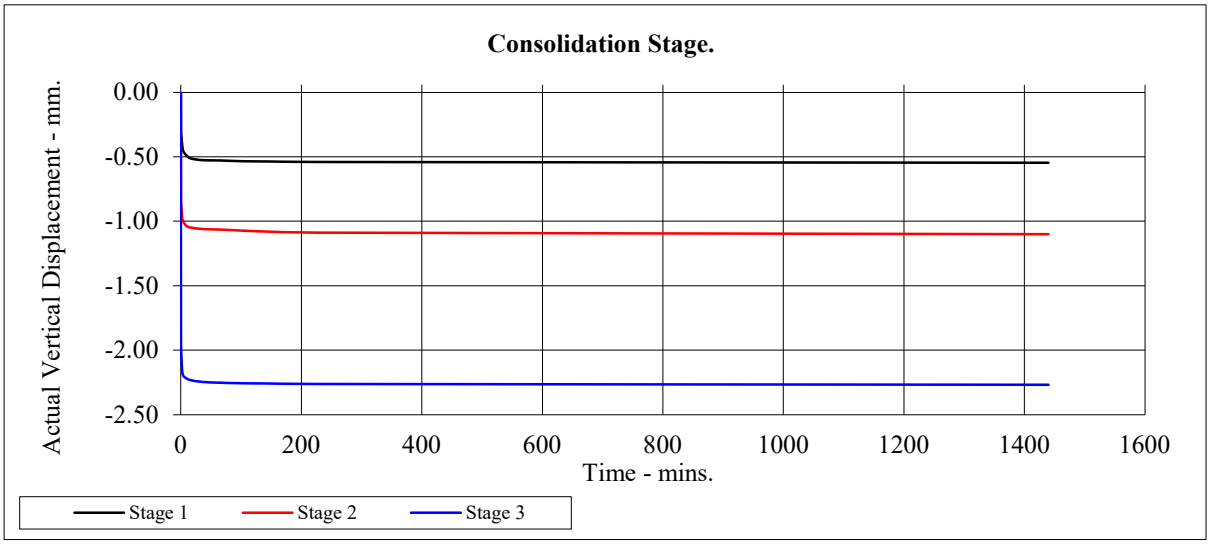


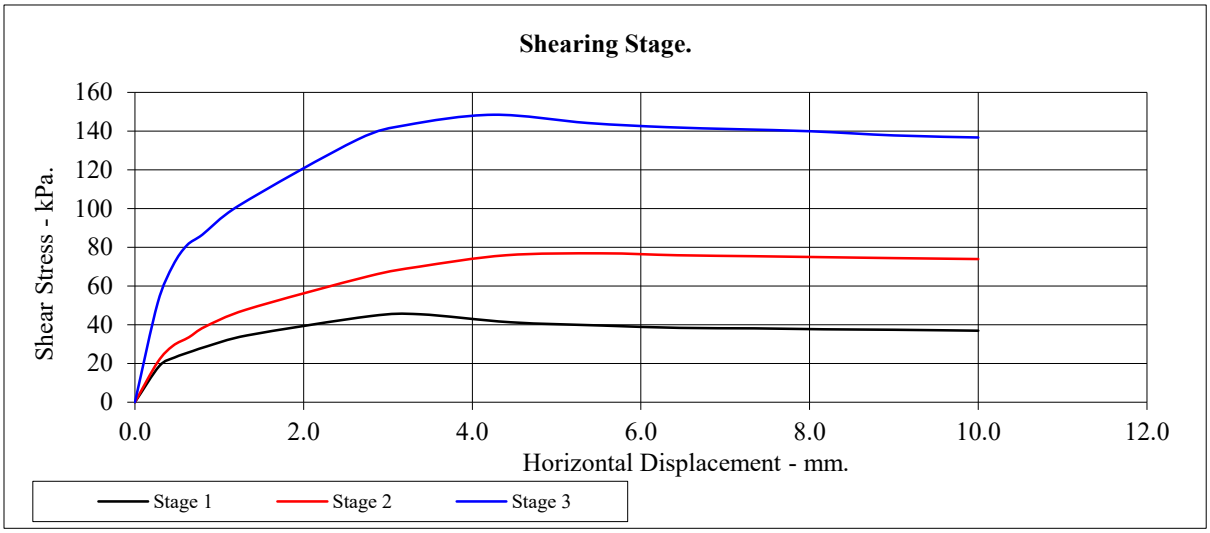
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** **PSL19/4943** **Client Ref:** **19-0382**

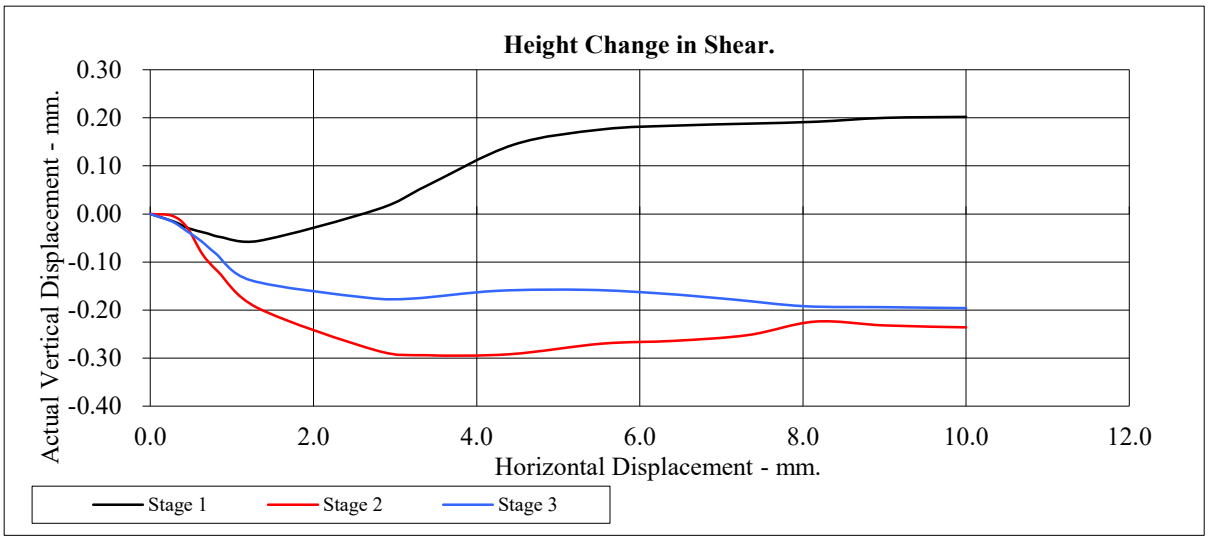
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**	Top Depth:	**21.00**
Sample Number:	**71**	Base Depth:	**21.50**







LABORATORY REPORT

4043

Contract Number: PSL19/4789

Report Date: 24 September 2019

Client's Reference: 19-0382-3

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Stornoway Deep Water Port

Date Received: 7/8/2019
Date Commenced: 7/8/2019
Date Completed: 24/9/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

[redacted]

S Royle (Laboratory Manager)
S Eyre (Senior Technician)
L Knight (Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH43	1	B	0.00	0.50	Brown very gravelly SAND.
BH43	7	B	1.50	2.00	Brown very gravelly SAND.
BH43	25	B	6.00	6.50	Brown sandy GRAVEL.
BH43	30	B	7.50	8.00	Brown very gravelly SAND.
BH43	37	B	10.30	10.70	Brown gravelly SAND.
BH43	53	B	14.50	15.00	Brown gravelly SAND.
BH43	57	B	15.50	16.00	Brown very gravelly SAND.
BH43	73	B	19.50	20.00	Grey slightly gravelly slightly sandy CLAY.
BH43	85	B	22.20	22.50	Brown sandy GRAVEL.
BH45	3	B	0.50	1.00	Brown very gravelly SAND.
BH45	5	B	1.00	1.50	Brown SAND & GRAVEL.
BH45	9	B	2.00	2.50	Brown SAND & GRAVEL.
BH45	14	B	3.50	4.00	Brown very gravelly SAND.
BH45	28	B	7.00	7.50	Brown very gravelly SAND.
BH45	38	B	9.20	9.80	Brown very gravelly SAND.
BH45	60	B	14.50	15.00	Brown slightly gravelly sandy CLAY.
BH45	79	B	19.50	20.00	Brown very gravelly SAND.
BH49	3	B	0.50	1.00	Brown sandy GRAVEL.
BH49	15	B	3.50	4.00	Brown very gravelly SAND.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH49	75	B	22.00	22.50	Grey very gravelly very silty SAND.
BH51	7	B	3.00	4.00	Brown sandy GRAVEL.
BH51	11	B	5.00	6.00	Grey slightly gravelly sandy CLAY.
BH52	9	B	1.50	2.00	Brown very gravelly SAND.
BH52	15	B	4.50	5.50	Brown very gravelly SAND.
BH52	23	B	9.00	10.00	Grey slightly gravelly sandy CLAY.
BH52	30	B	13.00	14.00	Grey slightly gravelly sandy CLAY.

SUMMARY OF SOIL DENSITY RELATED TESTS

(BS1377 : PART 2 & 4 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Retained 20mm %	Retained 37.5mm %	Method of compaction kg	Maximum Dry Density Mg/m^3	Minimum Dry Density Mg/m^3	Remarks
BH43	57	B	15.50	16.00	7.1	1.90	1.77						
BH45	5	B	1.00	1.50	5.1	1.85	1.76						
BH45	9	B	2.00	2.50	2.5	2.10	2.05						
BH45	38	B	9.20	9.80	9.5	2.00	1.83						
BH51	7	B	3.00	4.00	3.2	1.89	1.83						

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Stornoway Deep Water Port

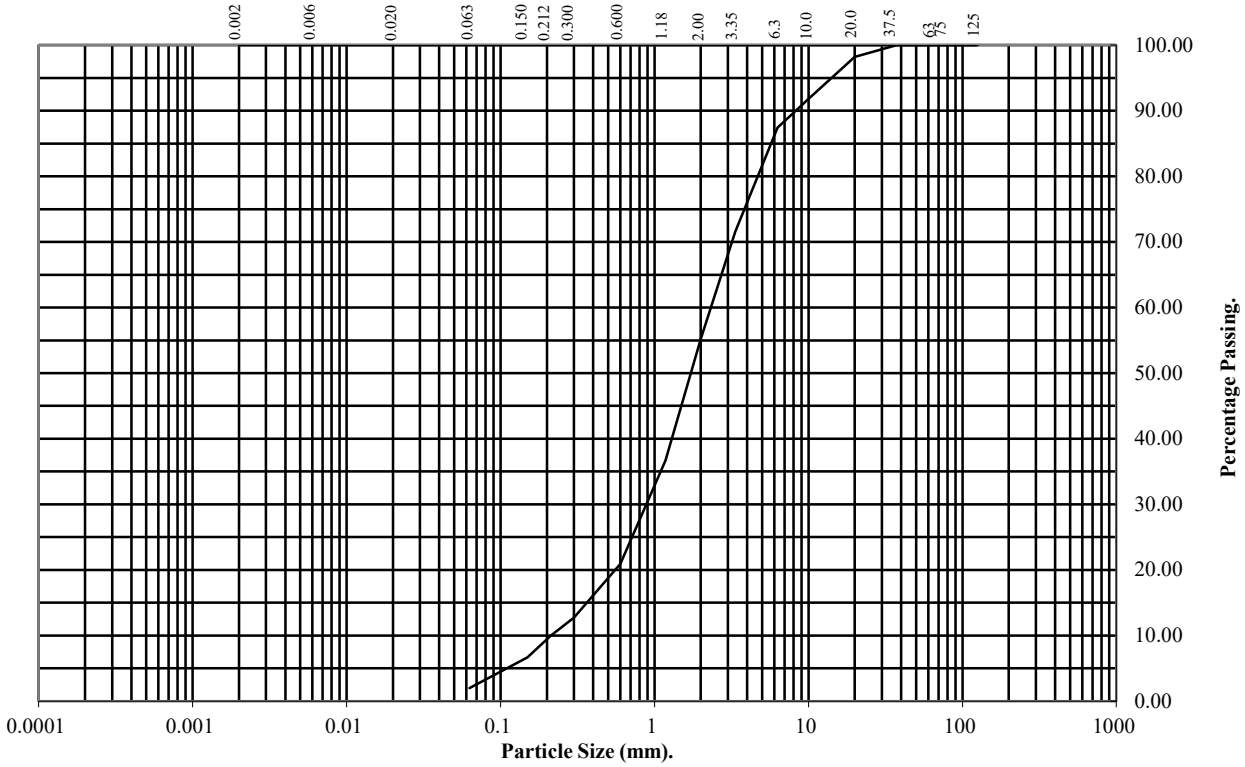
Contract No:
PSL19/4789
Client Ref:
19-0382

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH43**	**Top Depth (m):**	**15.50**
Sample Number:	**57**	**Base Depth(m):**	**16.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	92
6.3	87
3.35	72
2	55
1.18	37
0.6	21
0.3	13
0.212	10
0.15	7
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	53
Silt/Clay	2

Remarks:

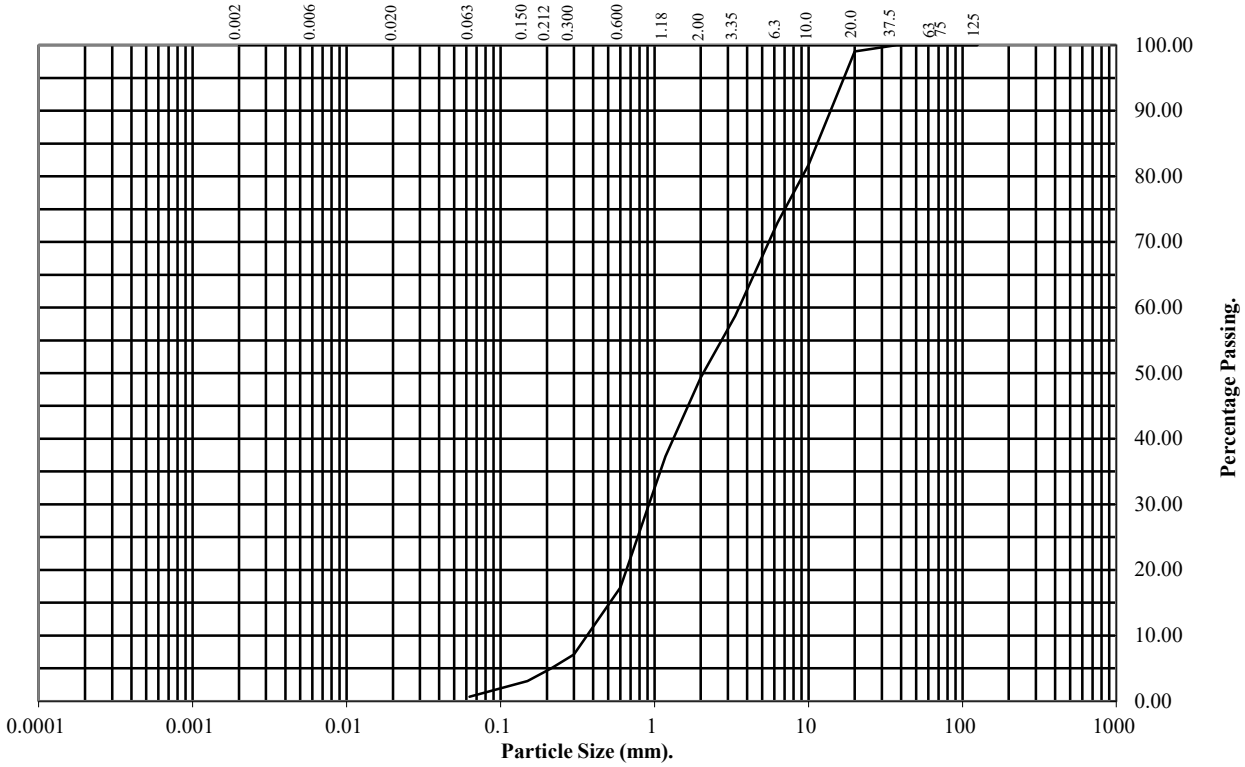
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH45**	**Top Depth (m):**	**1.00**
Sample Number:	**5**	**Base Depth(m):**	**1.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	99
10	82
6.3	73
3.35	59
2	49
1.18	37
0.6	17
0.3	7
0.212	5
0.15	3
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	51
Sand	48
Silt/Clay	1

Remarks:

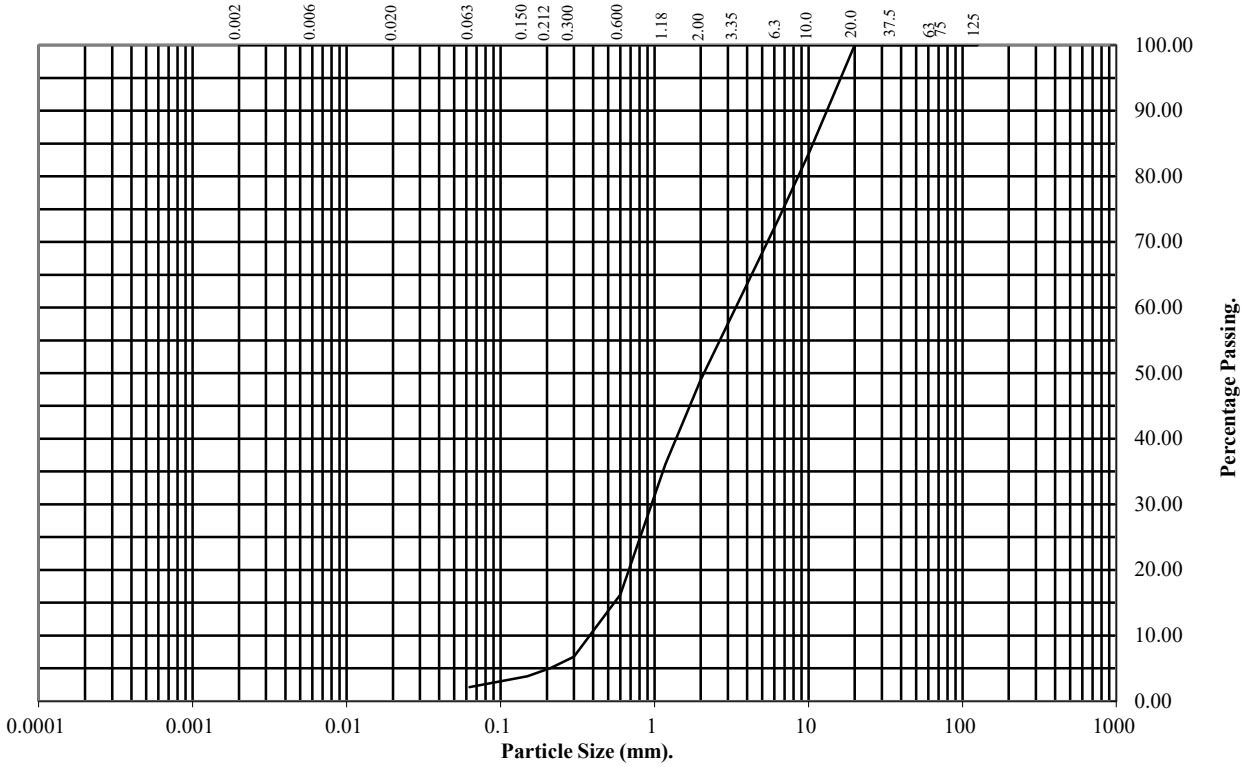
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH45**	**Top Depth (m):**	**2.00**
Sample Number:	**9**	**Base Depth(m):**	**2.50**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	83
6.3	73
3.35	60
2	49
1.18	36
0.6	16
0.3	7
0.212	5
0.15	4
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	51
Sand	47
Silt/Clay	2

Remarks:

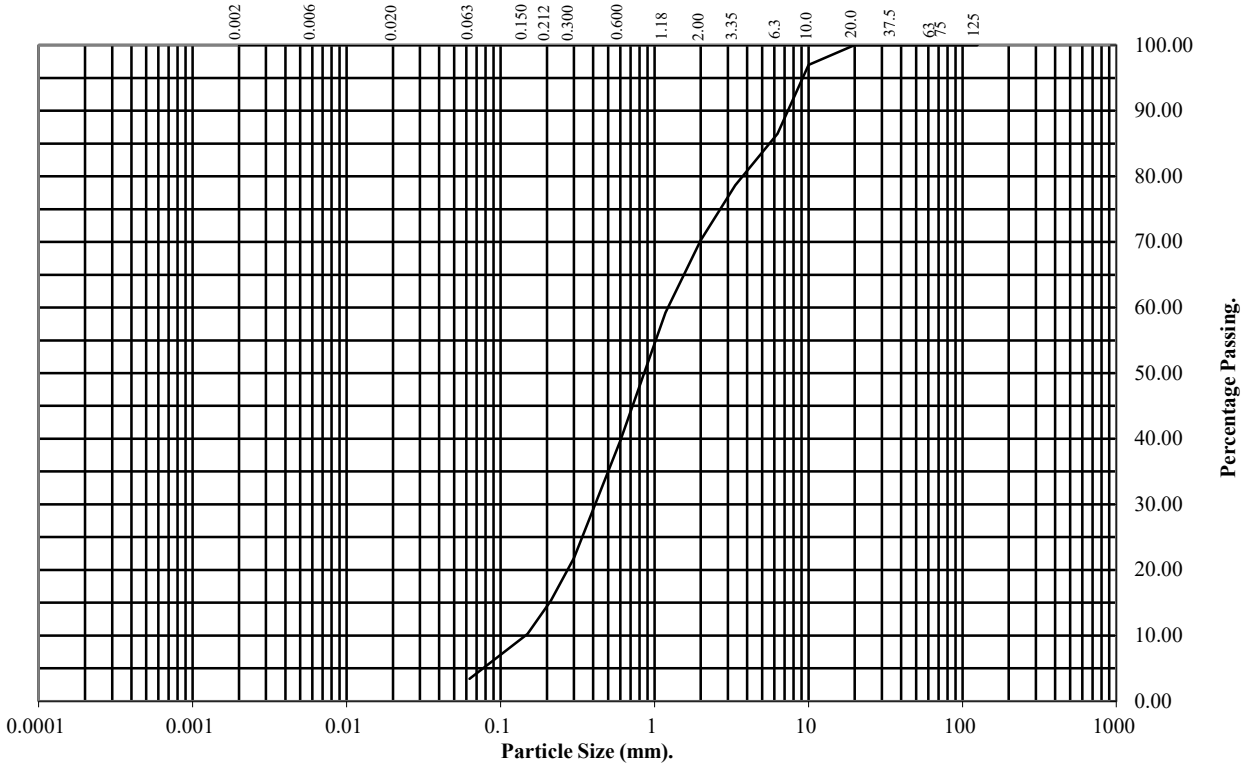
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH45**	**Top Depth (m):**	**9.20**
Sample Number:	**38**	**Base Depth(m):**	**9.80**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	87
3.35	79
2	70
1.18	59
0.6	40
0.3	22
0.212	15
0.15	10
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	30
Sand	67
Silt/Clay	3

Remarks:

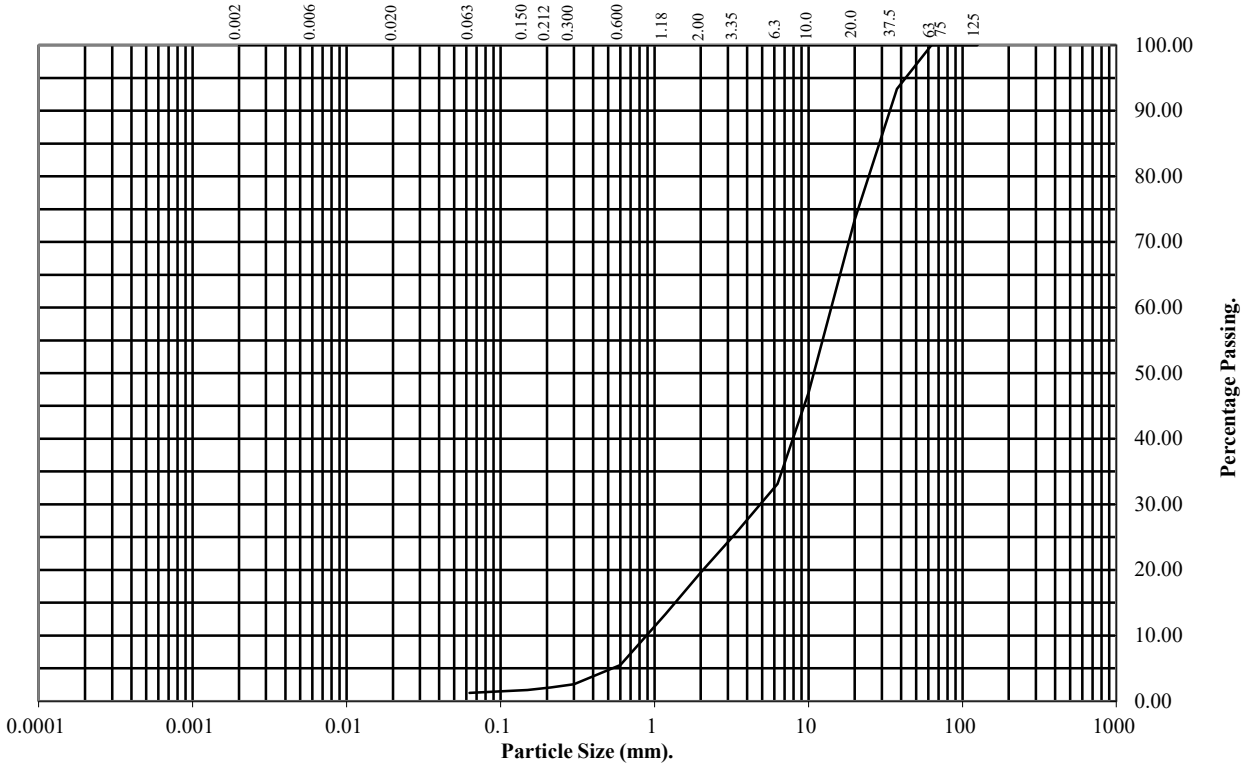
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**BH51**	**Top Depth (m):**	**3.00**
Sample Number:	**7**	**Base Depth(m):**	**4.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	93
20	73
10	47
6.3	33
3.35	25
2	20
1.18	13
0.6	6
0.3	3
0.212	2
0.15	2
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	80
Sand	19
Silt/Clay	1

Remarks:

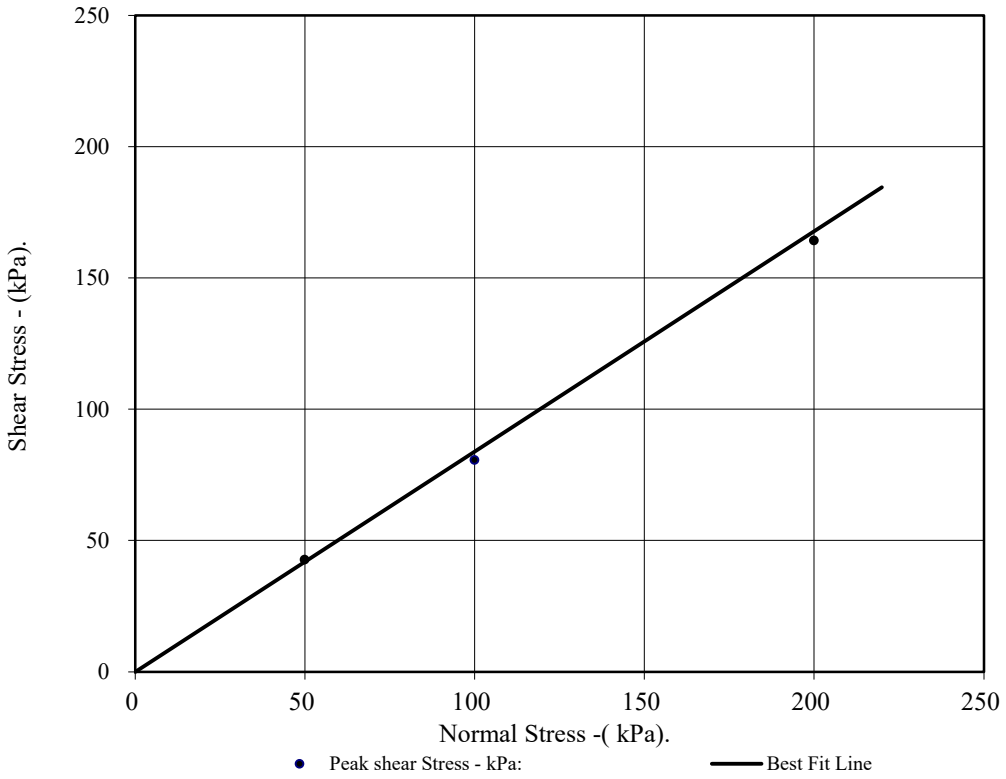
See Summary of Soil Descriptions

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**0.00**
Sample Number:	**1**		Base Depth:	**0.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.6	4.6	4.6
Bulk Density - Mg/m3:	1.75	1.75	1.76
Dry Density - Mg/m3:	1.67	1.68	1.68
Voids Ratio:	0.582	0.581	0.574
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.76	19.54	19.32
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.31	9.31	7.21
Peak shear Stress - kPa:	43	81	164
Final Consolidated Conditions			
Moisture Content - %:	2.4	2.6	2.7
Bulk Density - Mg/m3:	1.78	1.80	1.83
Dry Density - Mg/m3:	1.74	1.75	1.78
Peak			
Angle of Shearing Resistance:(~~θ~~)	**40**		
Effective Cohesion - kPa:	**0**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

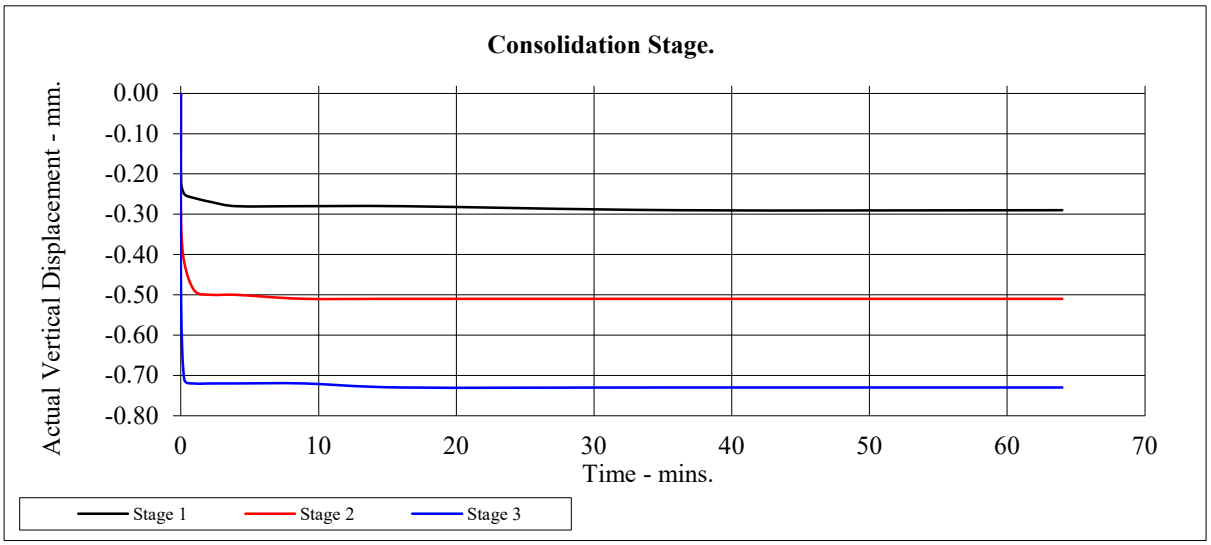
Stornoway Deep Water Port

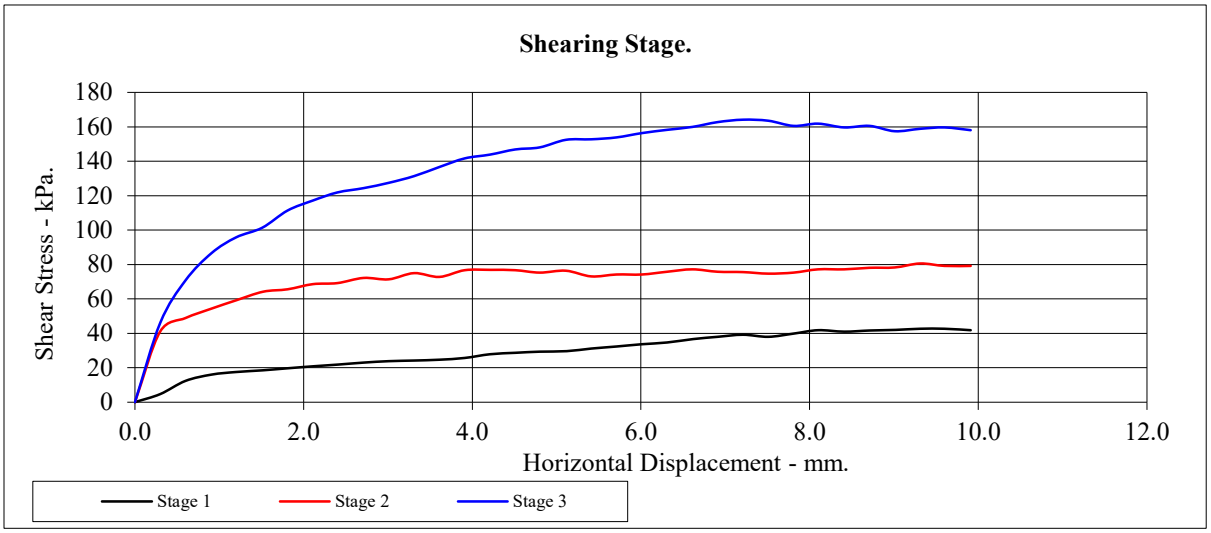
Contract No:
PSL19/4789
Client Ref:
19-0382

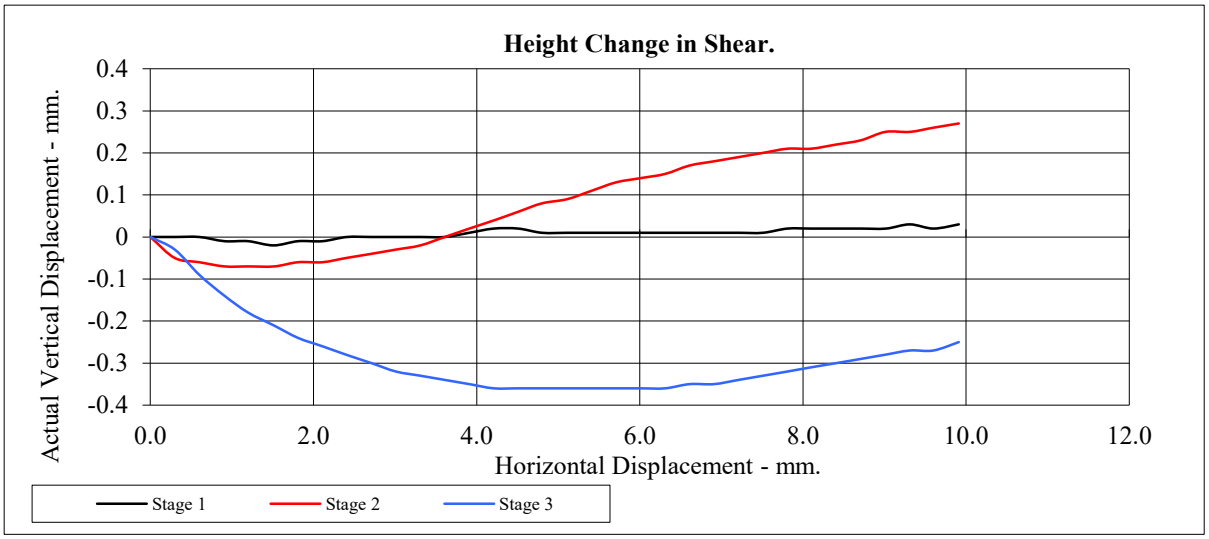
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**0.00**
Sample Number:	**1**	Base Depth:	**0.50**





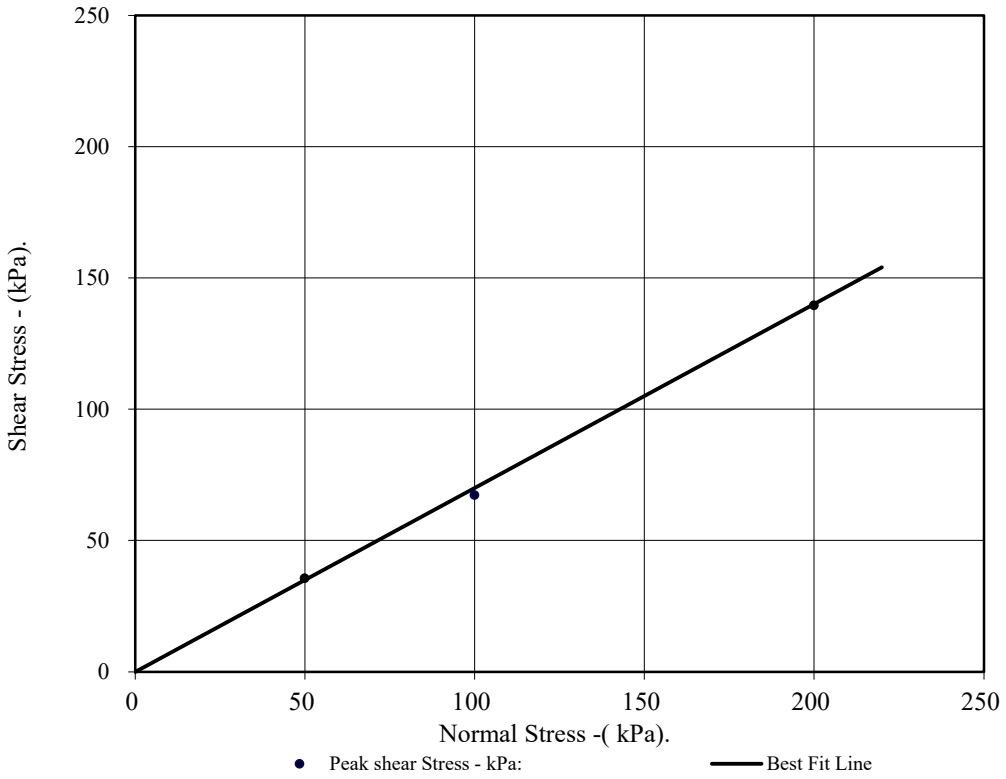


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**1.50**
Sample Number:	**7**		Base Depth:	**2.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	2.5	2.5	2.5
Bulk Density - Mg/m3:	1.67	1.68	1.68
Dry Density - Mg/m3:	1.63	1.64	1.64
Voids Ratio:	0.627	0.619	0.616
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.97	19.66	18.88
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.31	4.51	5.71
Peak shear Stress - kPa:	36	67	140
Final Consolidated Conditions			
Moisture Content - %:	1.9	1.8	1.9
Bulk Density - Mg/m3:	1.68	1.71	1.79
Dry Density - Mg/m3:	1.65	1.68	1.75
Peak			
Angle of Shearing Resistance:(~~θ~~)	**35**		
Effective Cohesion - kPa:	**0**		



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PSL Professional Soils Laboratory

Stornoway Deep Water Port

Contract No: PSL19/4789

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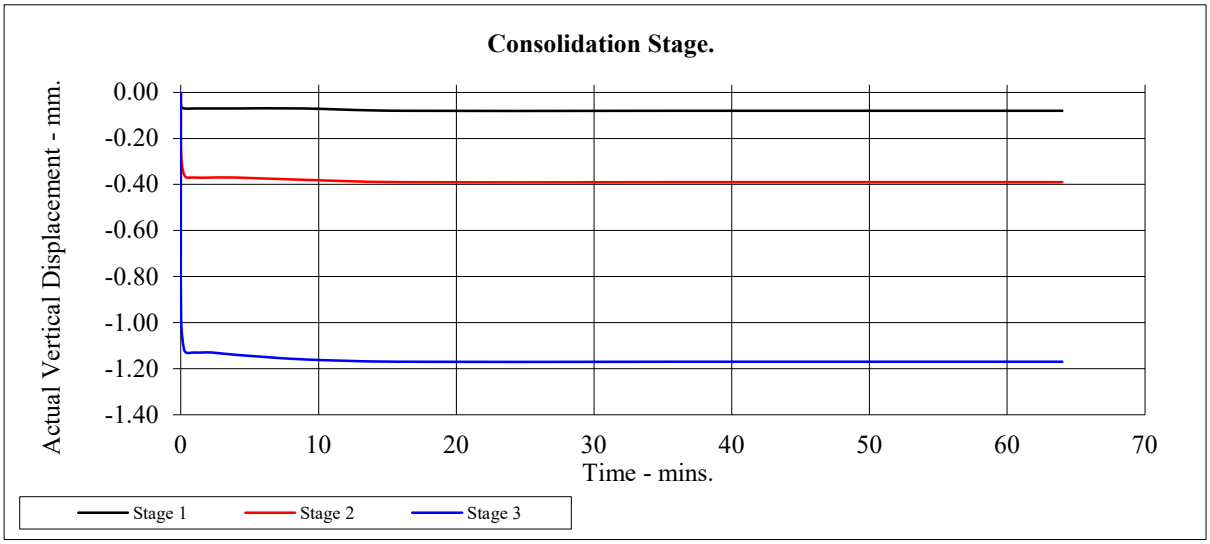
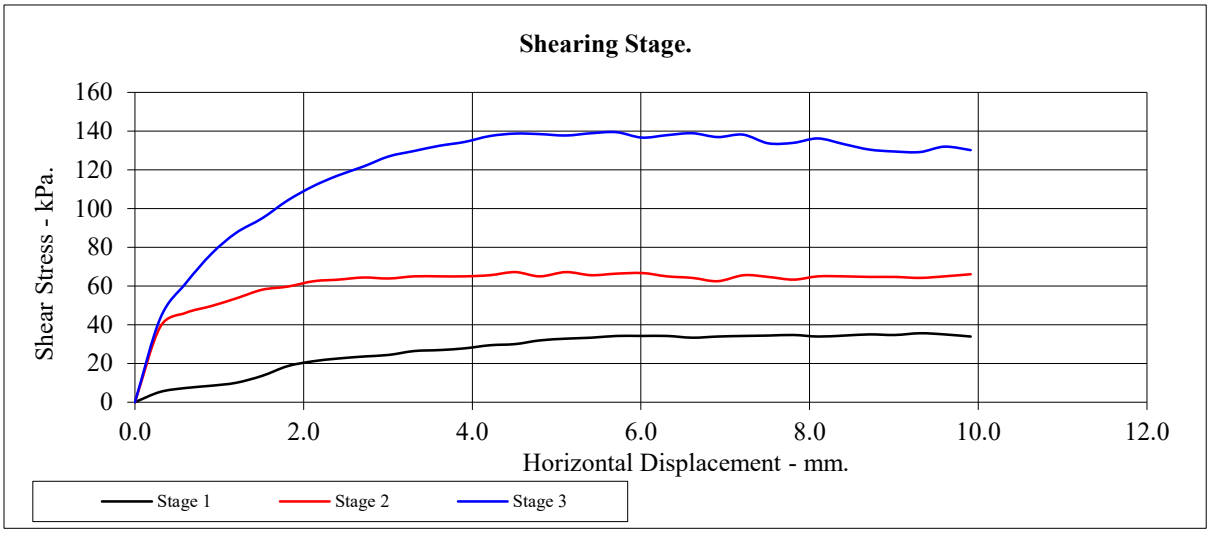
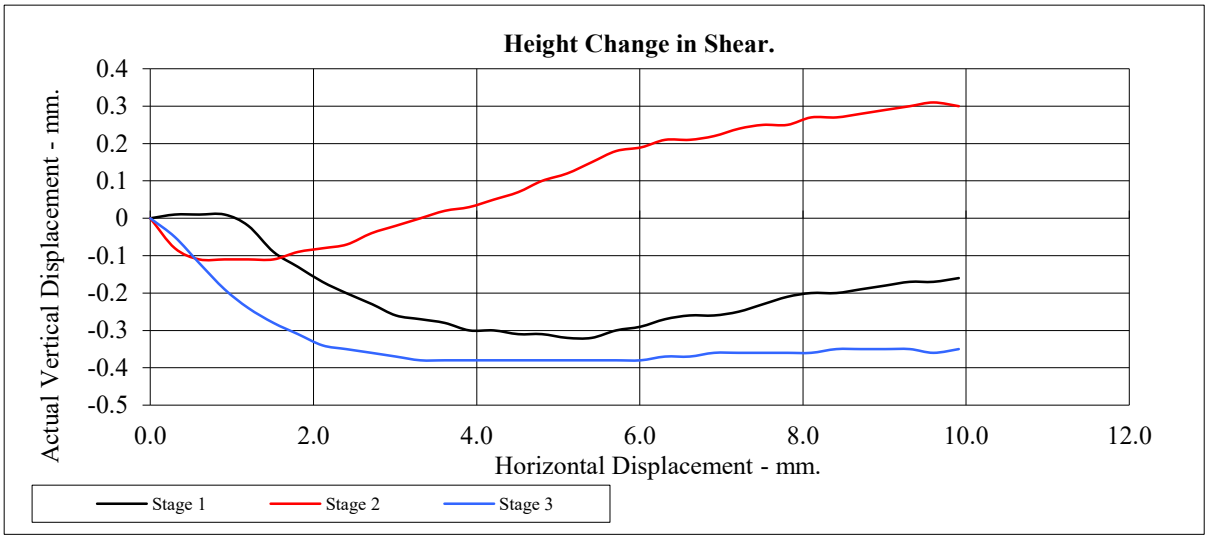
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**1.50**
Sample Number:	**7**	Base Depth:	**2.00**





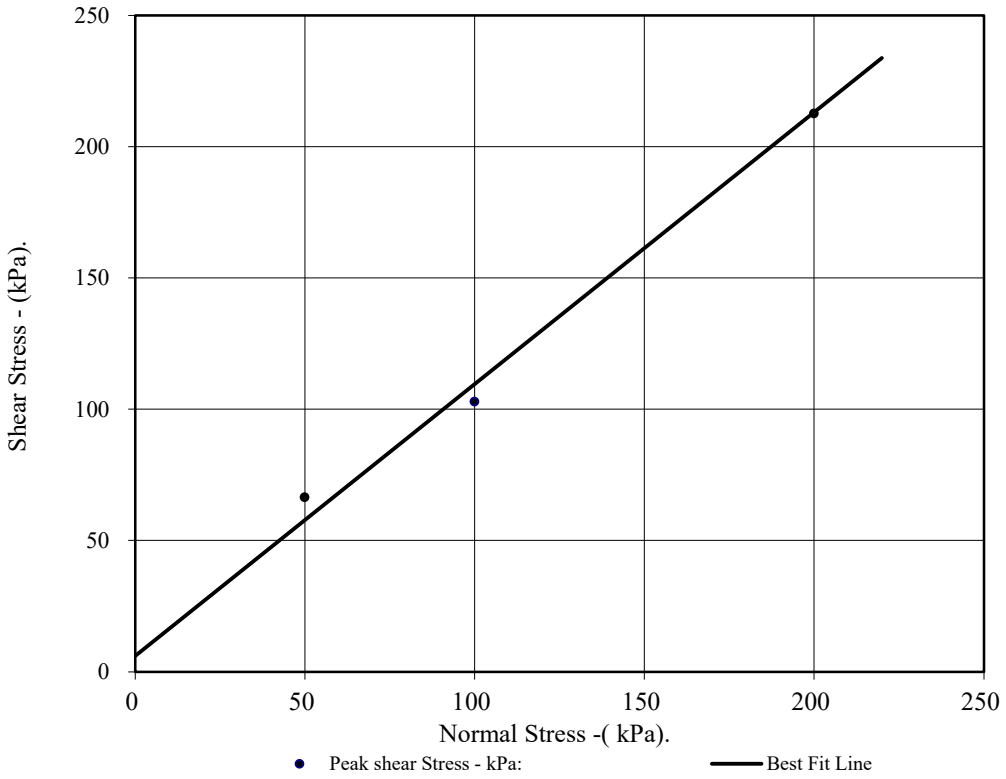


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH43**		Top Depth:	**6.00**
Sample Number:	**25**		Base Depth:	**6.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 20mm sieve			
Sample Description:	**See summary of soil description's.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	147	147	147
Length - mm:	300	300	300
Moisture Content - %:	2.9	2.9	2.9
Bulk Density - Mg/m3:	1.89	1.89	1.89
Dry Density - Mg/m3:	1.84	1.84	1.84
Voids Ratio:	0.444	0.444	0.444
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	146.80	146.42	145.96
Shearing Stage			
Rate of Strain (mm/min)	1.00	1.00	1.00
Displacement at peak shear stress (mm)	12.00	27.00	25.50
Peak shear Stress - kPa:	66	103	213
Final Consolidated Conditions			
Moisture Content - %:	2.8	2.8	2.6
Bulk Density - Mg/m3:	1.89	1.90	1.90
Dry Density - Mg/m3:	1.84	1.85	1.86
Peak			
Angle of Shearing Resistance:(~~θ~~)	**46**		
Effective Cohesion - kPa:	**6**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

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PSL19/4789
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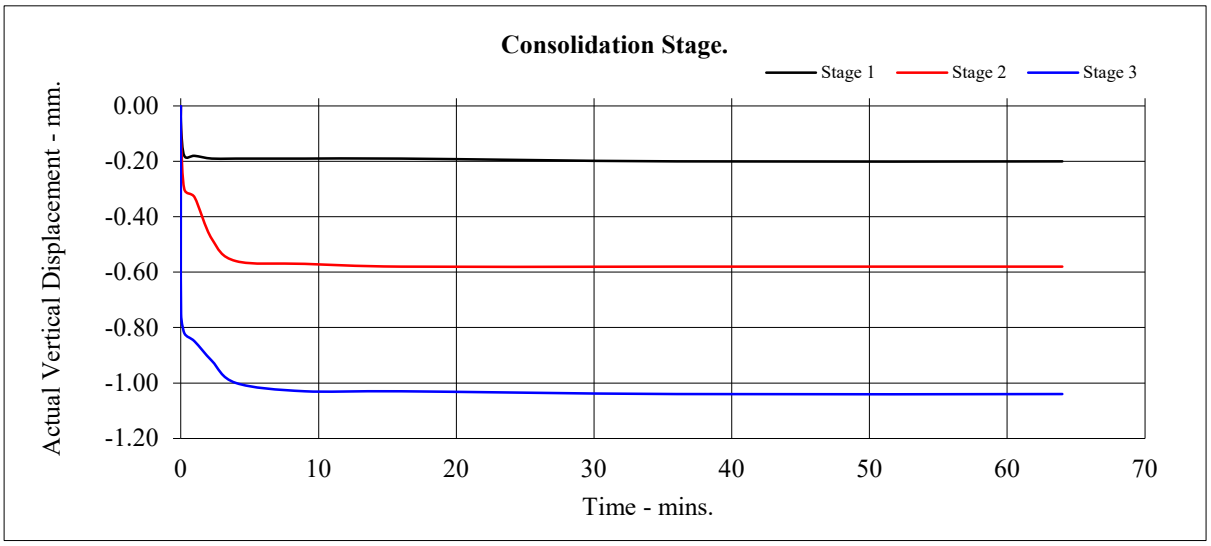
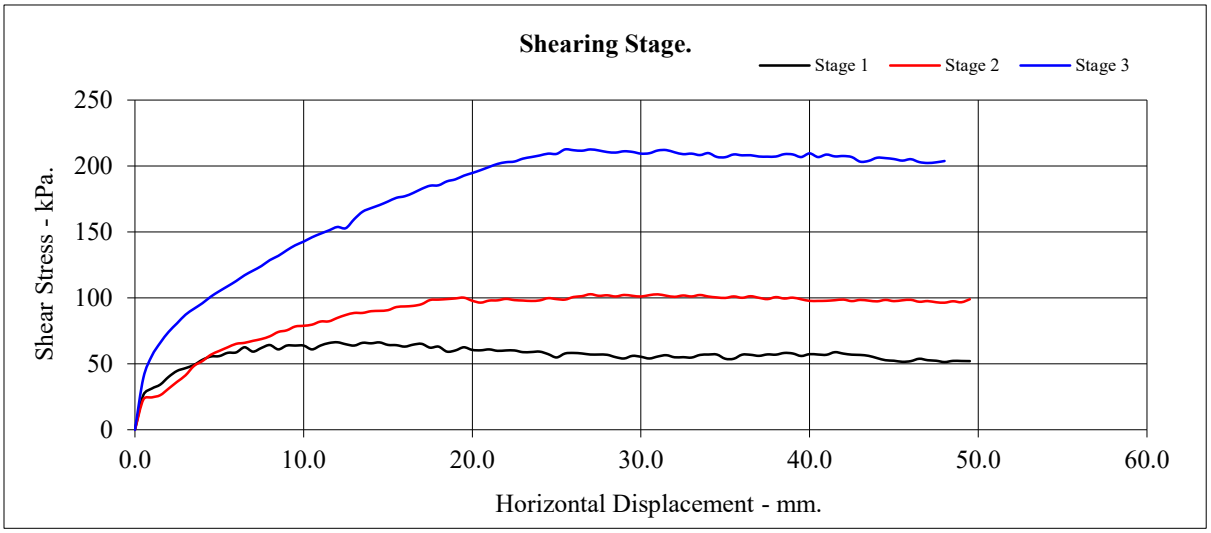
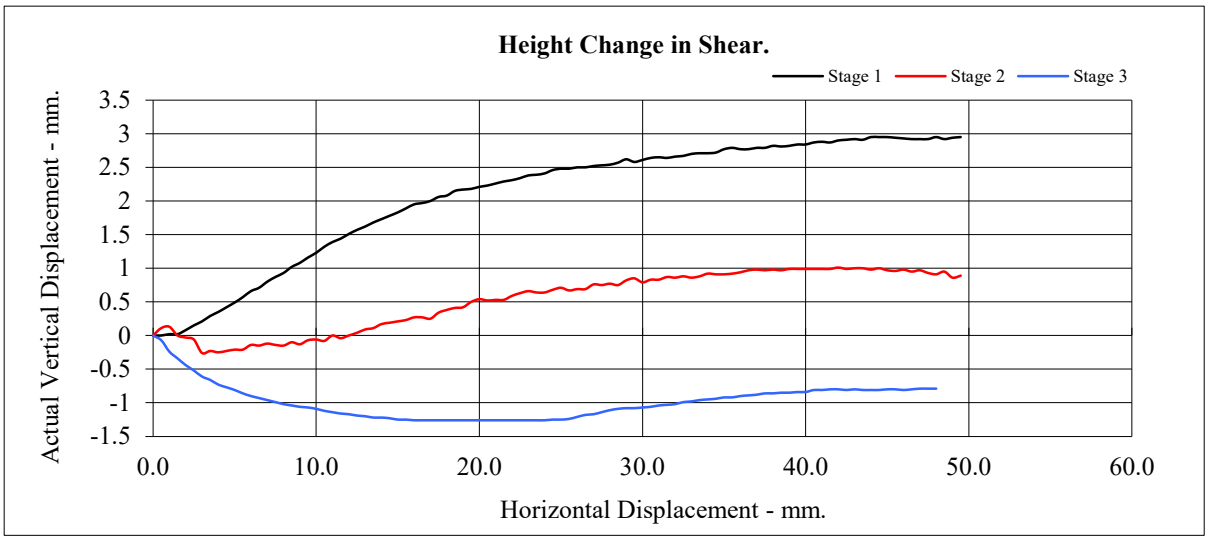
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH43**	Top Depth:	**6.00**
Sample Number:	**25**	Base Depth:	**6.50**







UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

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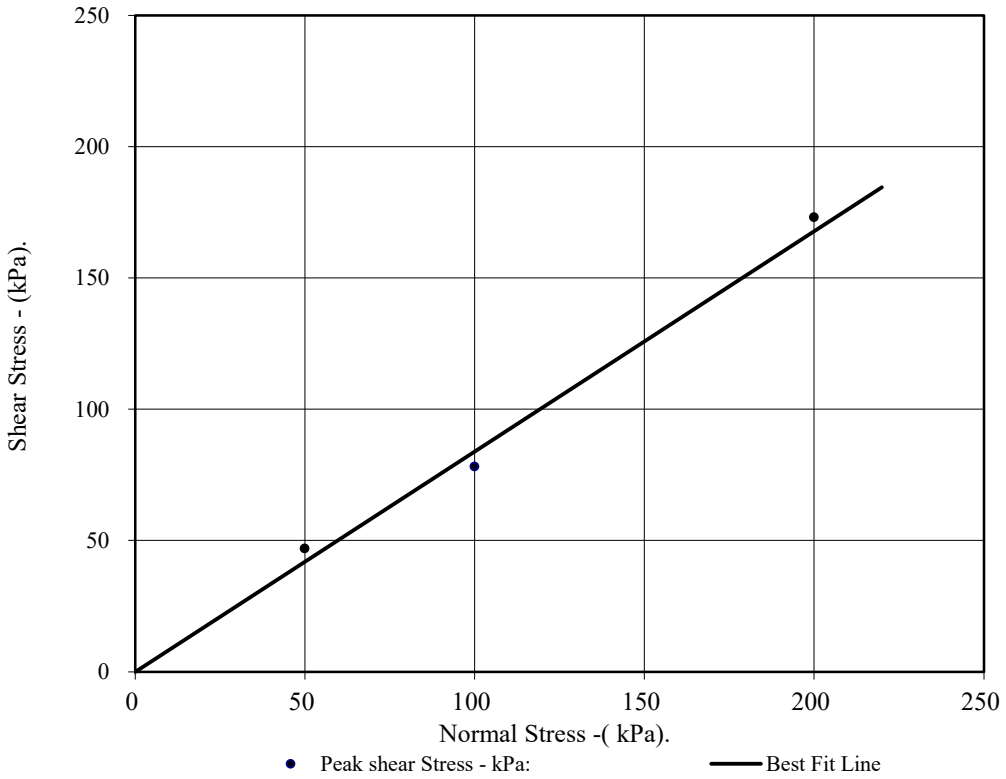
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**7.50**
Sample Number:	**30**		Base Depth:	**8.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	6.3	6.3	6.3
Bulk Density - Mg/m3:	1.66	1.66	1.66
Dry Density - Mg/m3:	1.56	1.57	1.57
Voids Ratio:	0.694	0.693	0.693
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.52	19.11	18.63
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	7.00	5.00	5.00
Peak shear Stress - kPa:	47	78	173
Final Consolidated Conditions			
Moisture Content - %:	6.3	5.3	6.1
Bulk Density - Mg/m3:	1.71	1.75	1.79
Dry Density - Mg/m3:	1.61	1.66	1.69
Peak			
Angle of Shearing Resistance:(~~θ~~)	**40**		
Effective Cohesion - kPa:	**0**		



4043

Professional Soils Laboratory

Stornoway Deep Water Port

Contract No:
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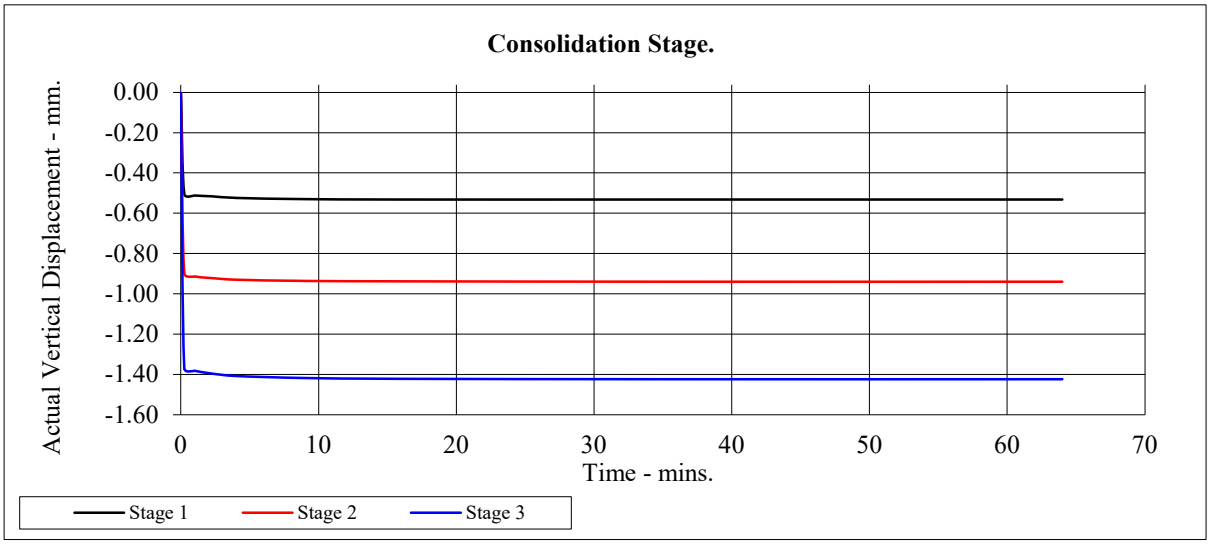
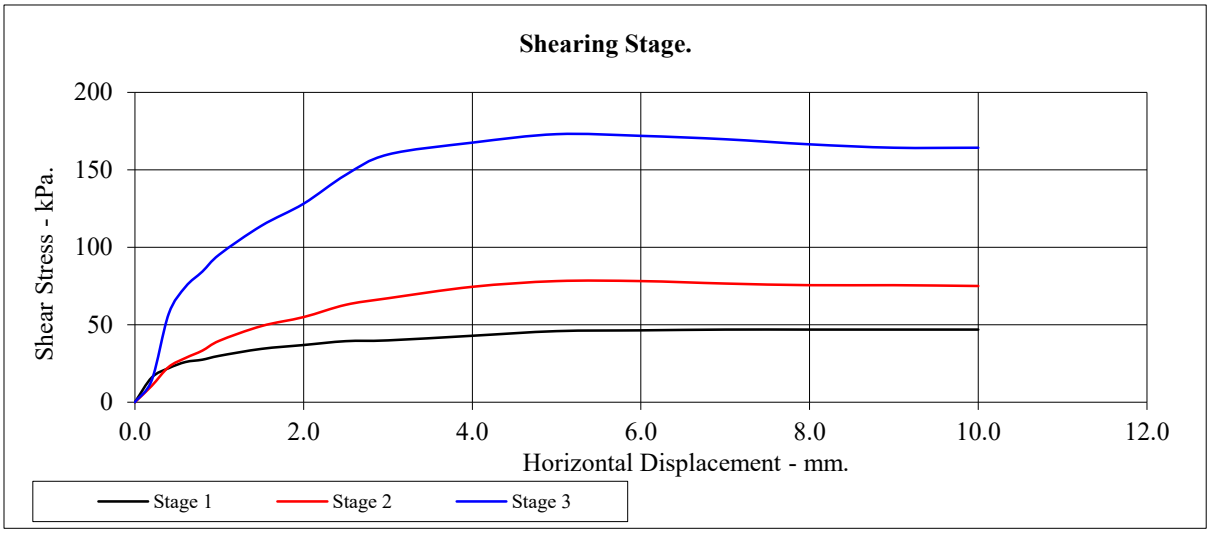
Client Ref:
19-0382

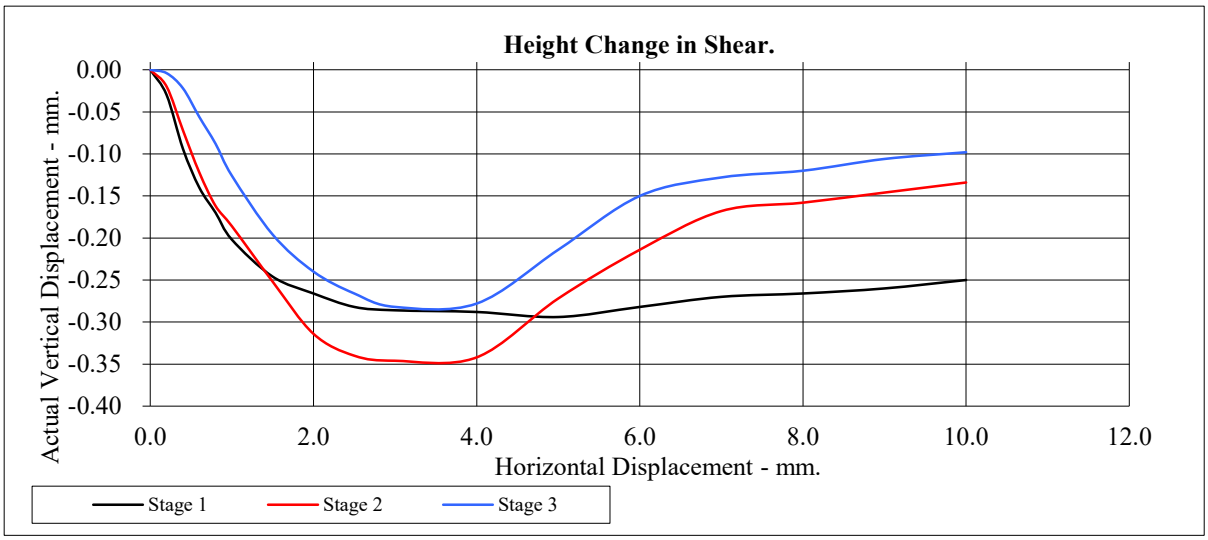
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**7.50**
Sample Number:	**30**	Base Depth:	**8.00**





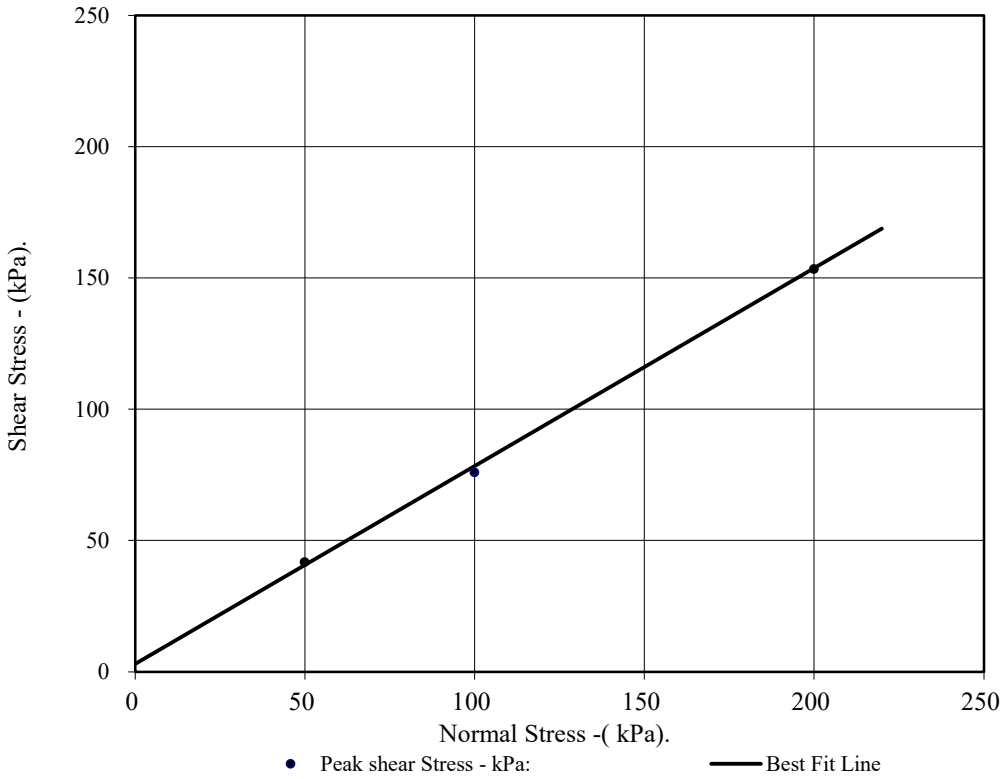


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**10.30**
Sample Number:	**37**		Base Depth:	**10.70**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

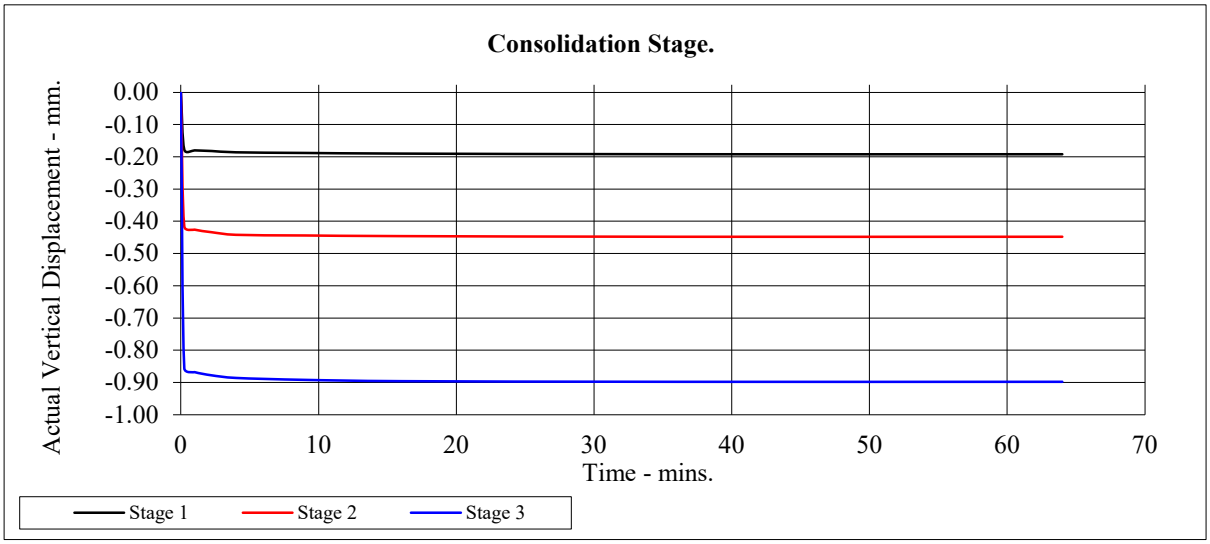
STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	14	14	14
Bulk Density - Mg/m3:	2.02	2.00	2.01
Dry Density - Mg/m3:	1.77	1.75	1.76
Voids Ratio:	0.497	0.513	0.505
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.86	19.60	19.15
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	2.50	4.00	4.00
Peak shear Stress - kPa:	42	76	153
Final Consolidated Conditions			
Moisture Content - %:	14	13	13
Bulk Density - Mg/m3:	2.04	2.04	2.10
Dry Density - Mg/m3:	1.79	1.80	1.85
Peak			
Angle of Shearing Resistance:(~~θ~~)	**37**		
Effective Cohesion - kPa:	**3**		

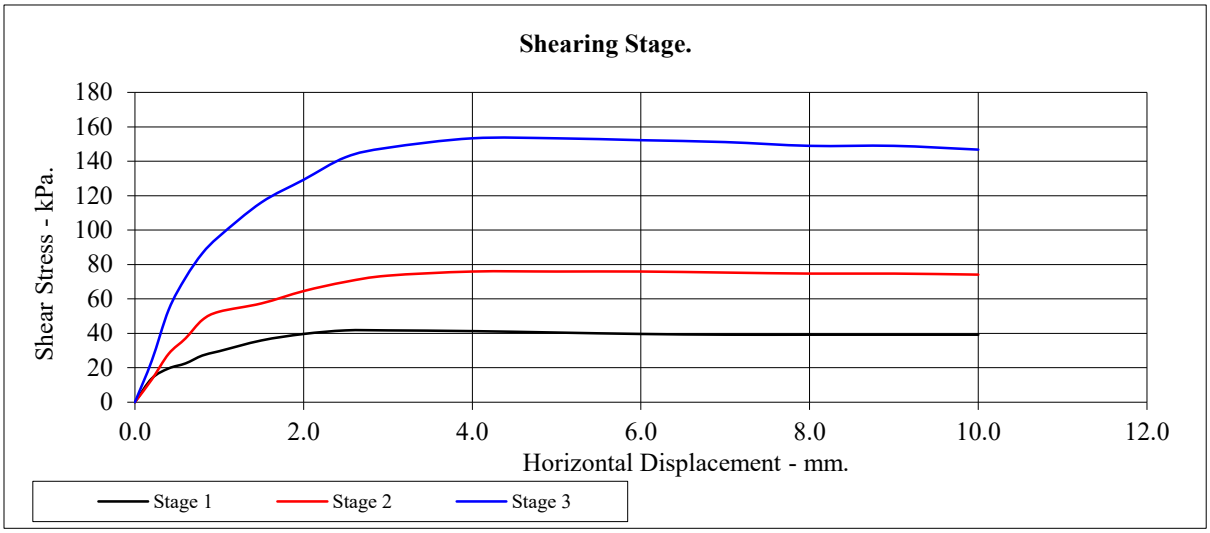


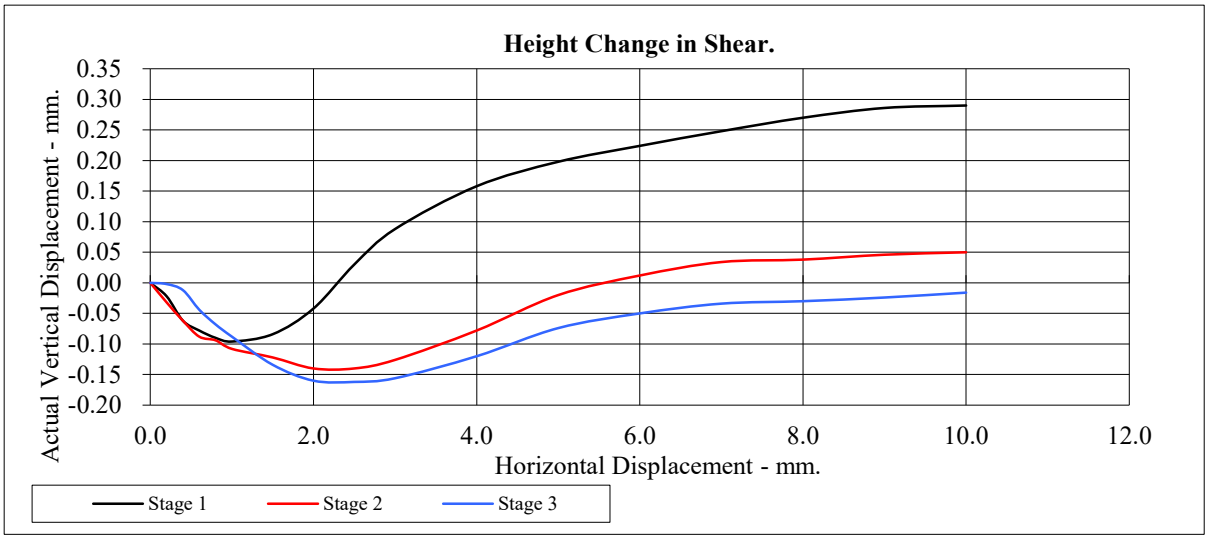
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**10.30**
Sample Number:	**37**	Base Depth:	**10.70**





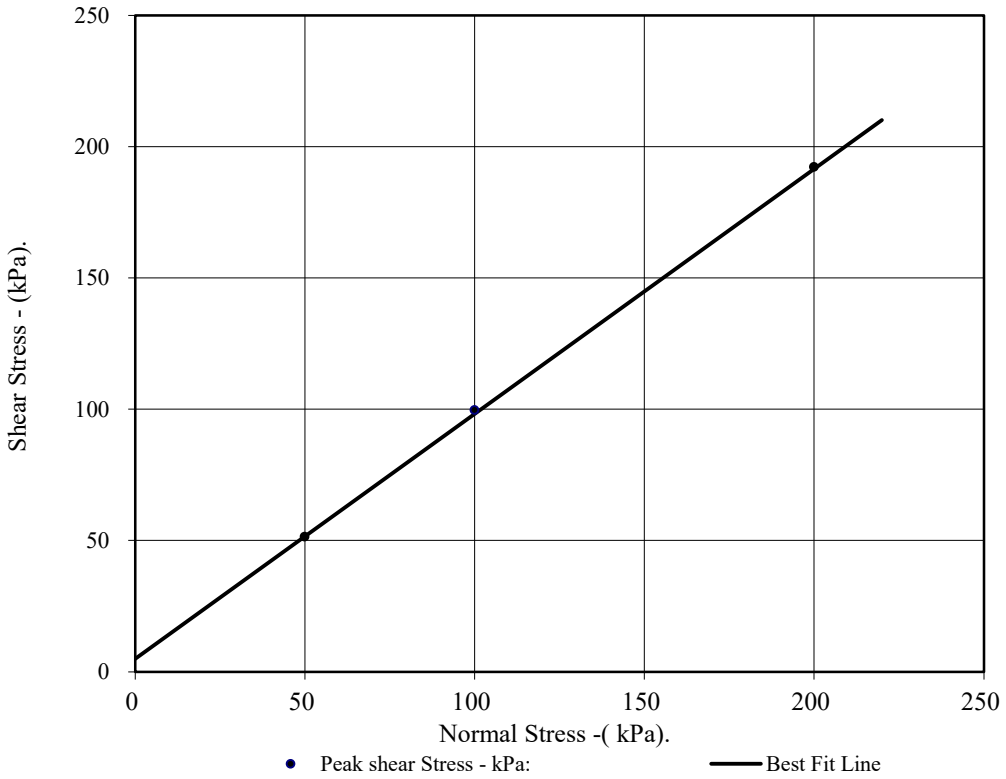


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**14.50**	
Sample Number:	**53**		Base Depth:	**15.00**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	1.82	1.83	1.83
Dry Density - Mg/m3:	1.65	1.66	1.66
Voids Ratio:	0.601	0.597	0.597
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.75	19.68	19.00
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	6.00	5.00	8.00
Peak shear Stress - kPa:	51	100	192
Final Consolidated Conditions			
Moisture Content - %:	9.5	8.8	10
Bulk Density - Mg/m3:	1.85	1.86	1.93
Dry Density - Mg/m3:	1.69	1.71	1.75
Peak			
Angle of Shearing Resistance:(~~θ~~)	**43**		
Effective Cohesion - kPa:	**5**		

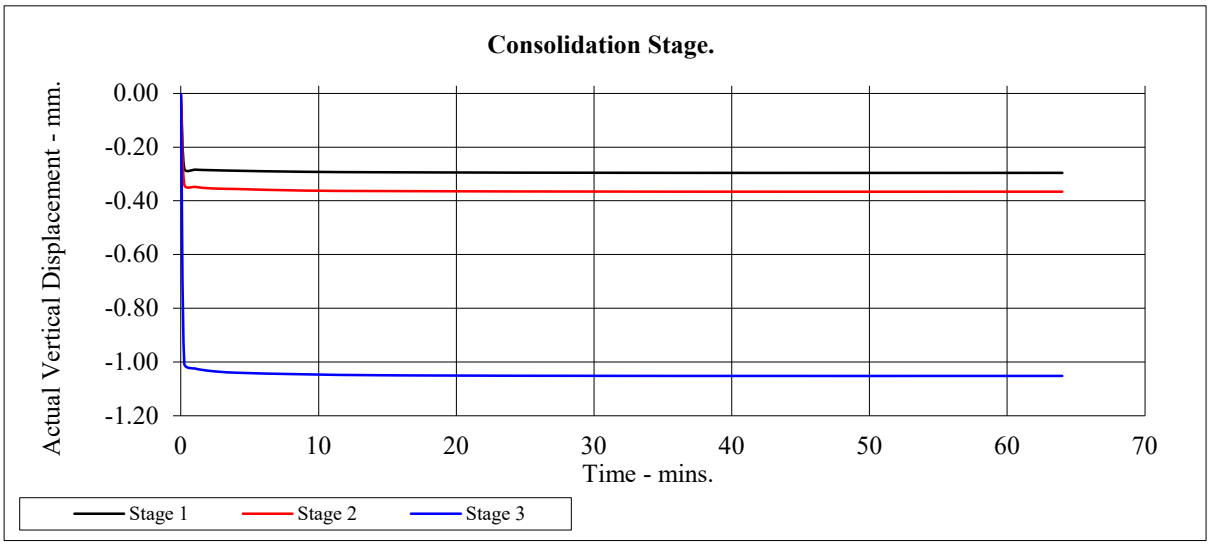


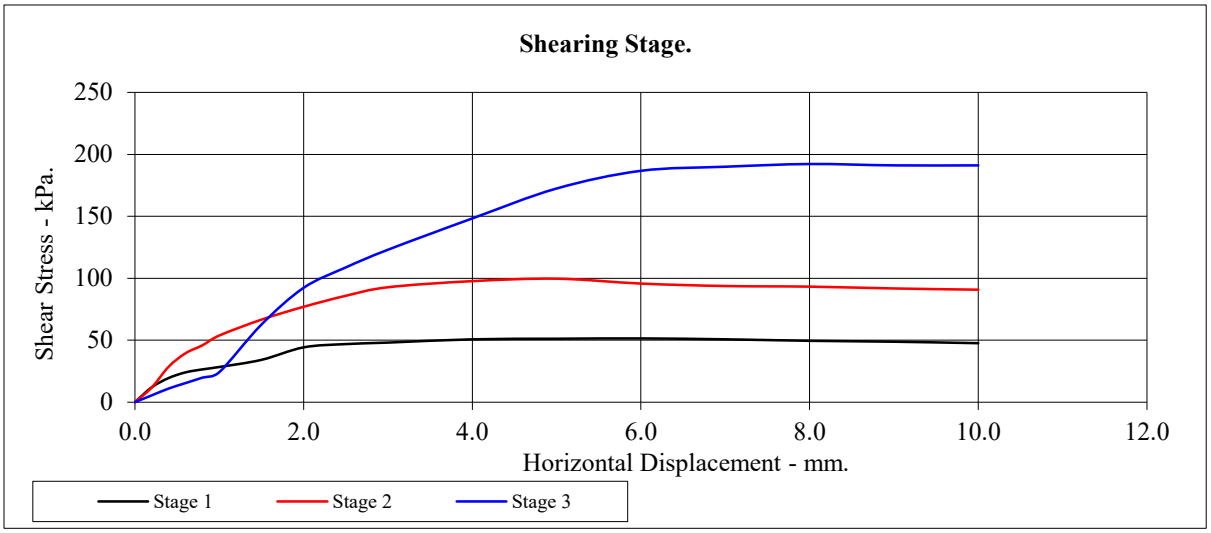
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4789 **Client Ref:** 19-0382

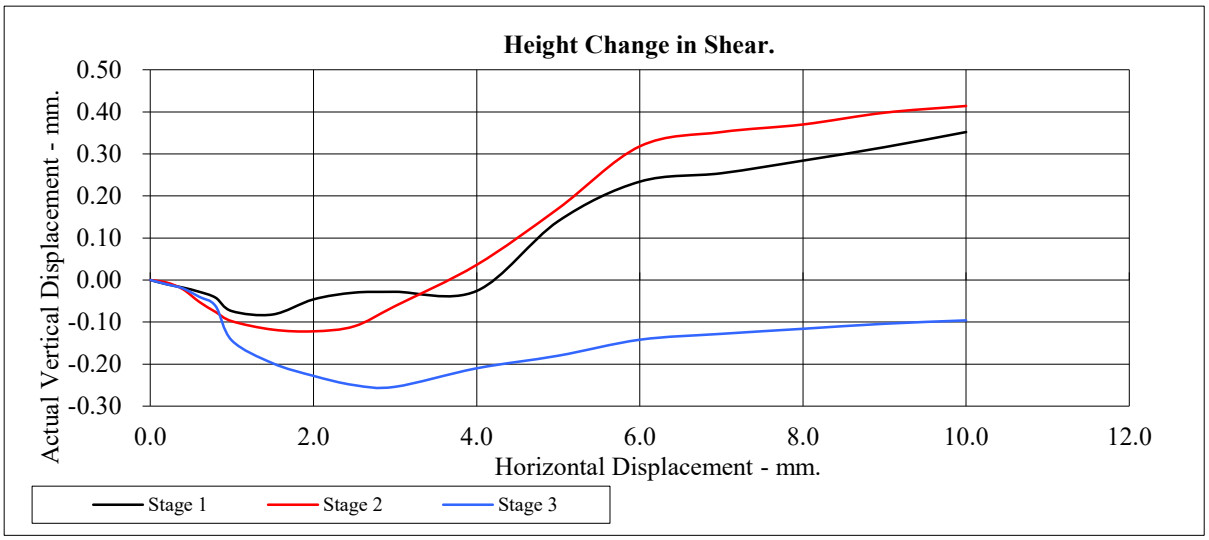
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**14.50**
Sample Number:	**53**	Base Depth:	**15.00**





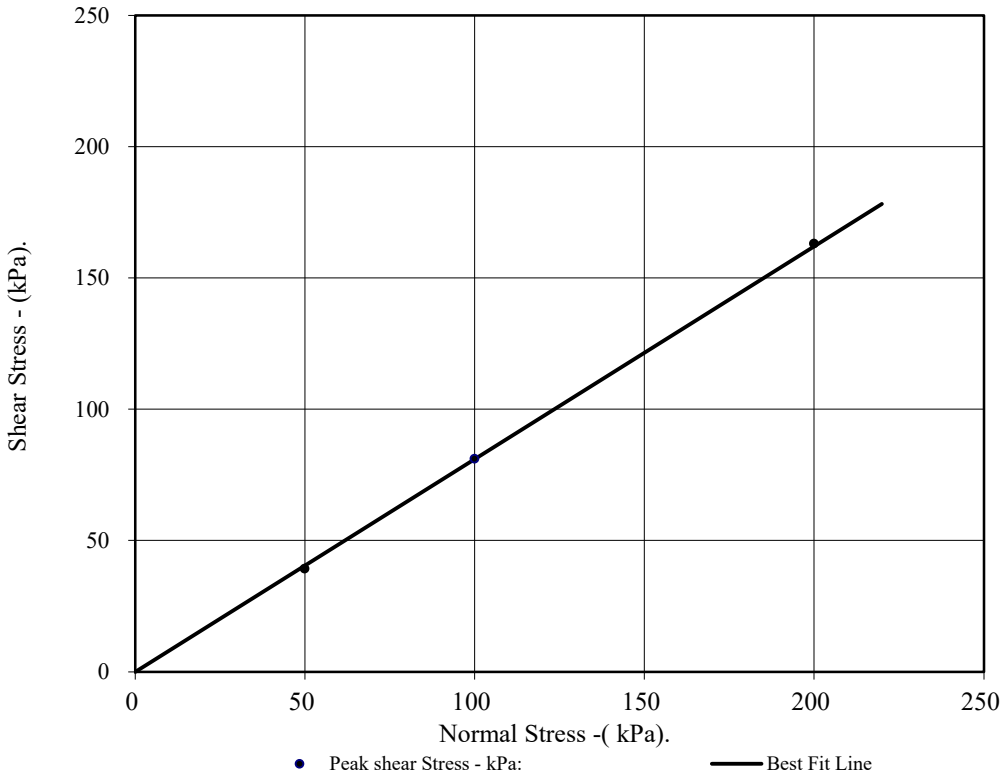


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**		Top Depth:	**15.50**	
Sample Number:	**57**		Base Depth:	**16.00**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort				
Sample Description:	**See summary of soil descriptions.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	9.6	9.6	9.6
Bulk Density - Mg/m3:	1.73	1.73	1.75
Dry Density - Mg/m3:	1.58	1.58	1.60
Voids Ratio:	0.674	0.678	0.659
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.59	19.42	17.94
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.01	3.61	3.91
Peak shear Stress - kPa:	39	81	163
Final Consolidated Conditions			
Moisture Content - %:	7.1	7.2	7.5
Bulk Density - Mg/m3:	1.77	1.79	1.96
Dry Density - Mg/m3:	1.66	1.67	1.82
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**0**		



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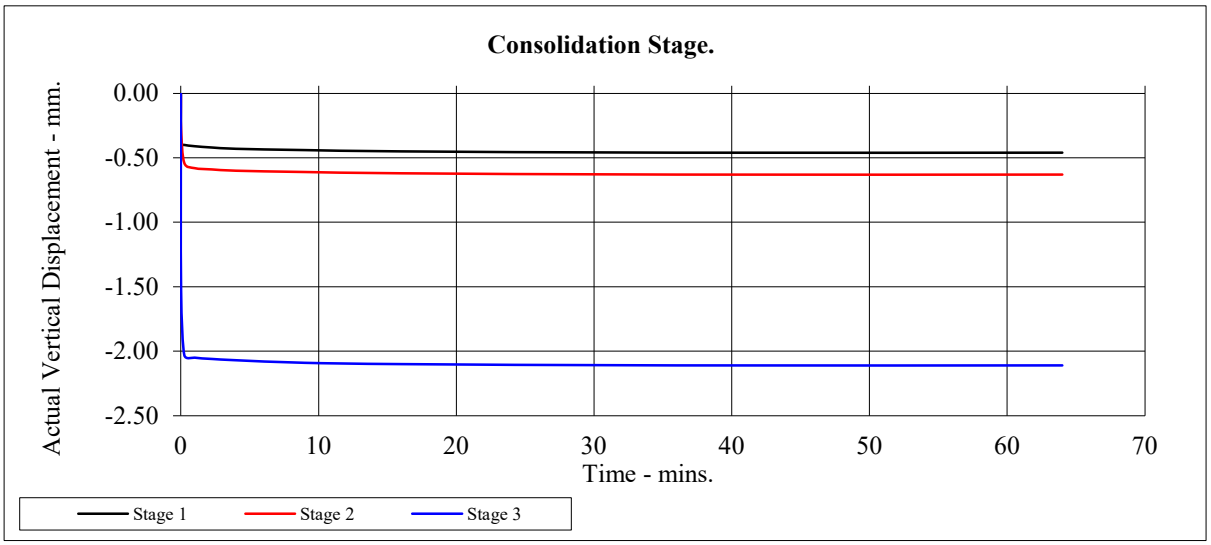
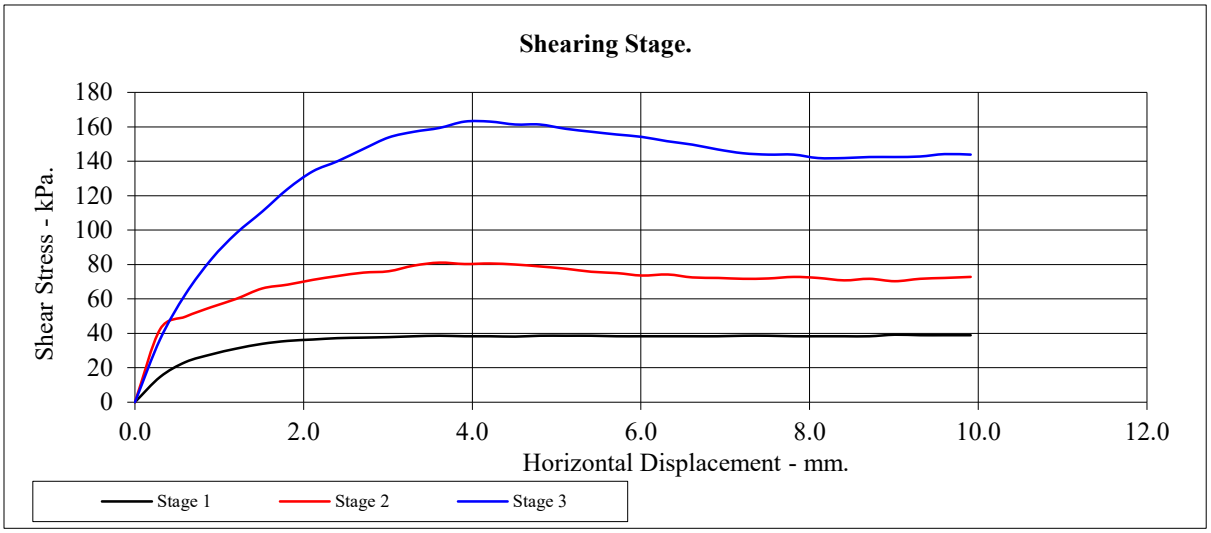
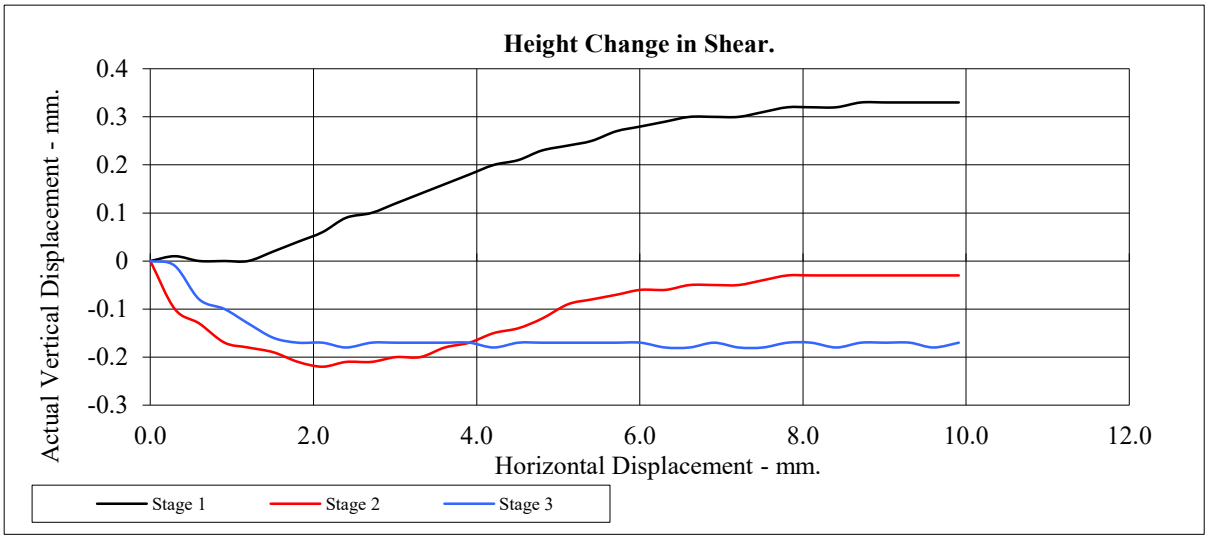
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH43**	Top Depth:	**15.50**
Sample Number:	**57**	Base Depth:	**16.00**







UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**

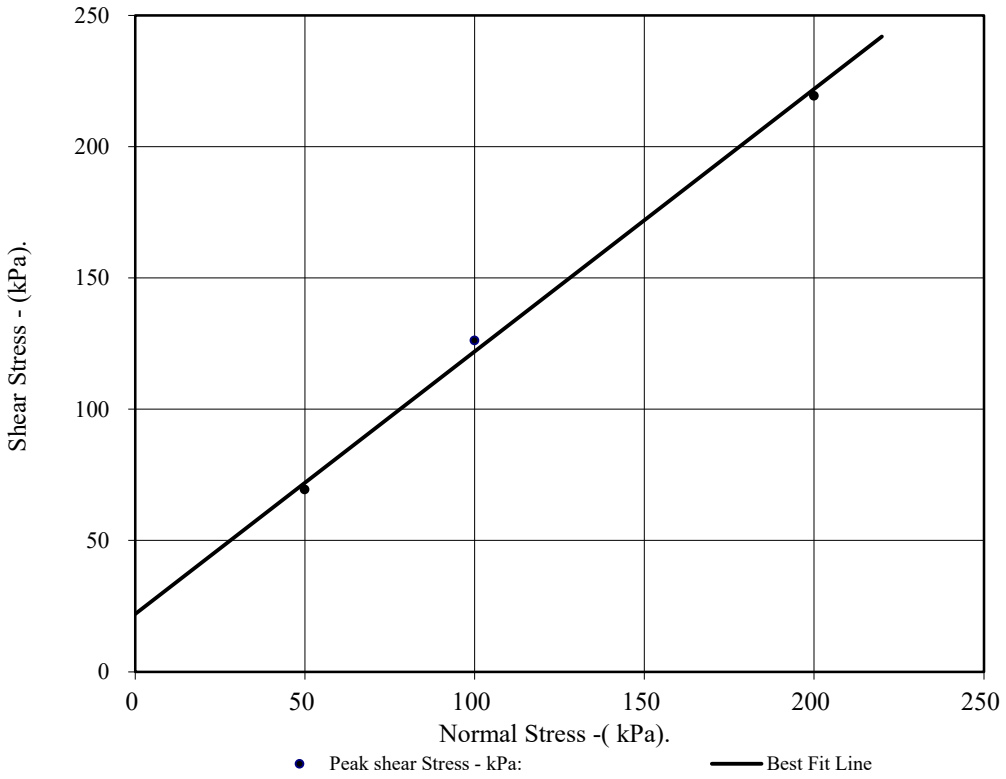
Contract No:
PSL19/4789
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH43**		Top Depth:	**22.20**	
Sample Number:	**85**		Base Depth:	**22.50**	
Sample Conditions:	Dry		Sample Type	**B**	
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**		
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 20mm sieve				
Sample Description:	**See summary of soil description's.**				

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	137	137	137
Length - mm:	300	300	300
Moisture Content - %:	3.3	3.3	3.3
Bulk Density - Mg/m3:	1.95	1.95	1.95
Dry Density - Mg/m3:	1.88	1.88	1.88
Voids Ratio:	0.407	0.407	0.407
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	136.72	136.48	136.11
Shearing Stage			
Rate of Strain (mm/min)	1.00	1.00	1.00
Displacement at peak shear stress (mm)	19.50	29.50	31.00
Peak shear Stress - kPa:	69	126	219
Final Consolidated Conditions			
Moisture Content - %:	3.0	2.8	2.6
Bulk Density - Mg/m3:	1.95	1.95	1.96
Dry Density - Mg/m3:	1.89	1.90	1.91
Peak			
Angle of Shearing Resistance:(~~θ~~)	**45**		
Effective Cohesion - kPa:	**22**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

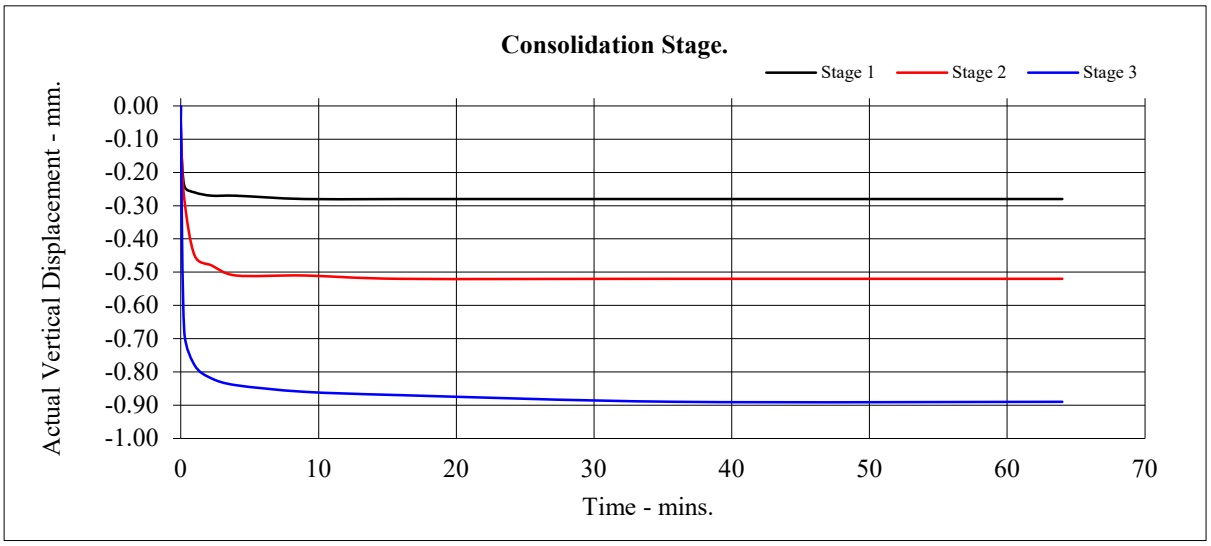
Contract No: PSL19/4789

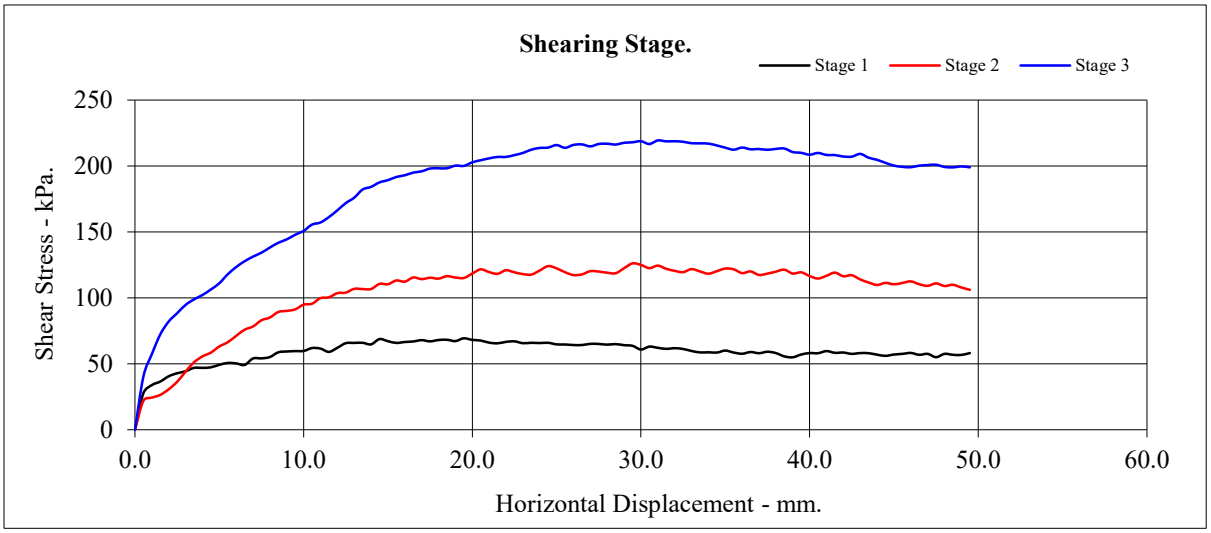
Client Ref: 19-0382

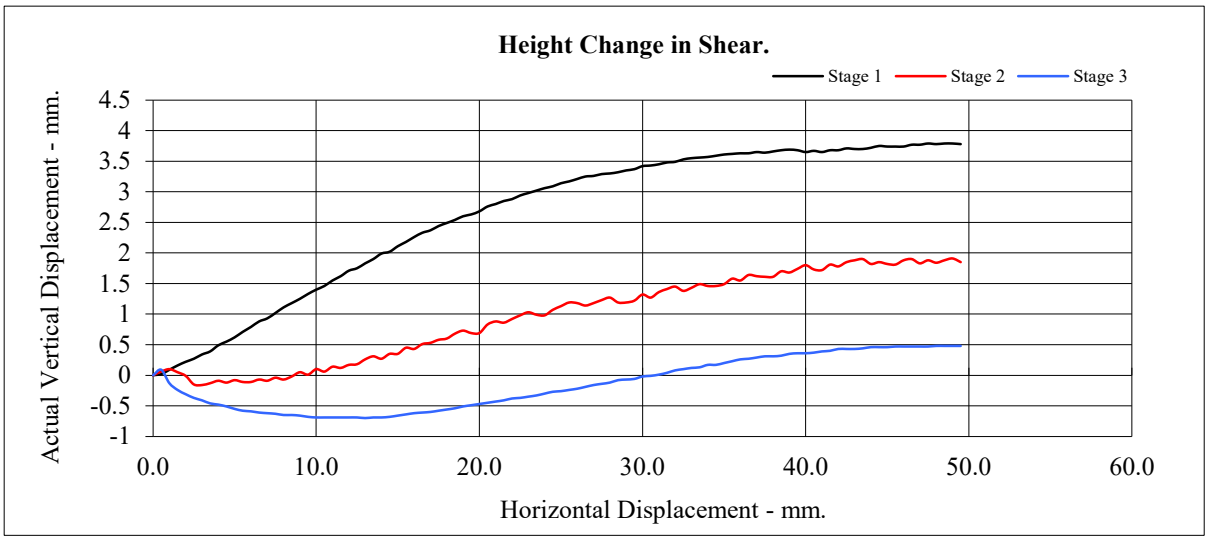
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH43**	Top Depth:	**22.20**
Sample Number:	**85**	Base Depth:	**22.50**





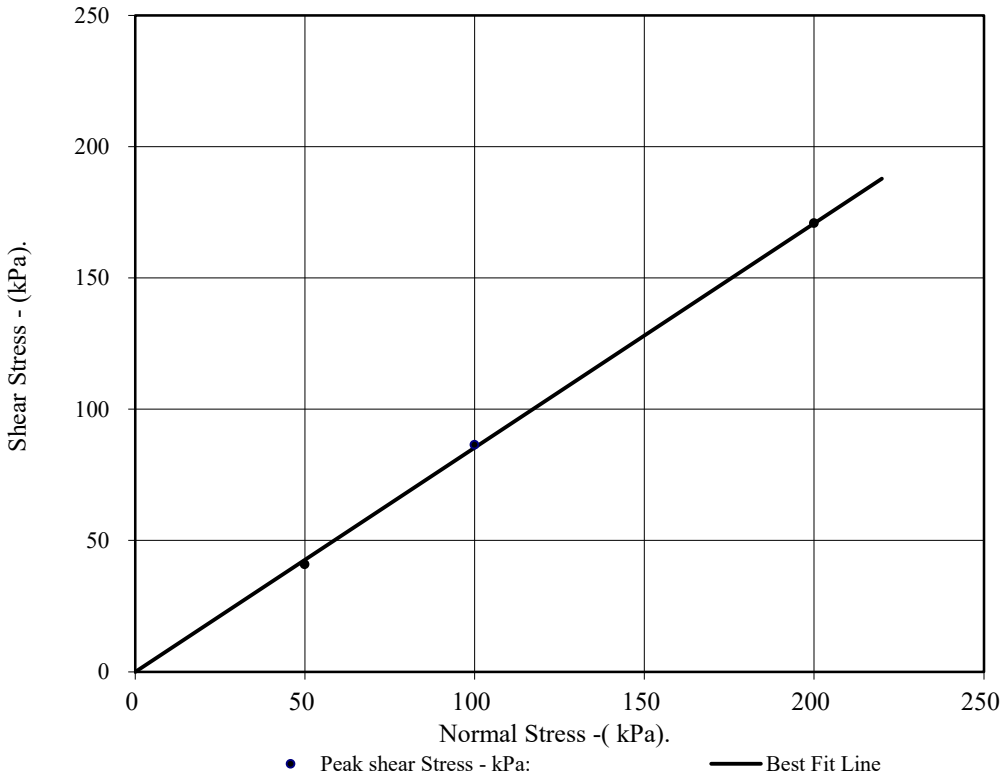


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**0.50**
Sample Number:	**3**		Base Depth:	**1.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	6.9	6.9	6.9
Bulk Density - Mg/m3:	1.68	1.68	1.68
Dry Density - Mg/m3:	1.57	1.57	1.57
Voids Ratio:	0.686	0.686	0.683
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.55	19.31	19.09
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	4.00	4.00	6.00
Peak shear Stress - kPa:	41	86	171
Final Consolidated Conditions			
Moisture Content - %:	6.6	6.1	6.4
Bulk Density - Mg/m3:	1.72	1.74	1.77
Dry Density - Mg/m3:	1.62	1.64	1.66
Peak			
Angle of Shearing Resistance:(~~θ~~)	**41**		
Effective Cohesion - kPa:	**0**		

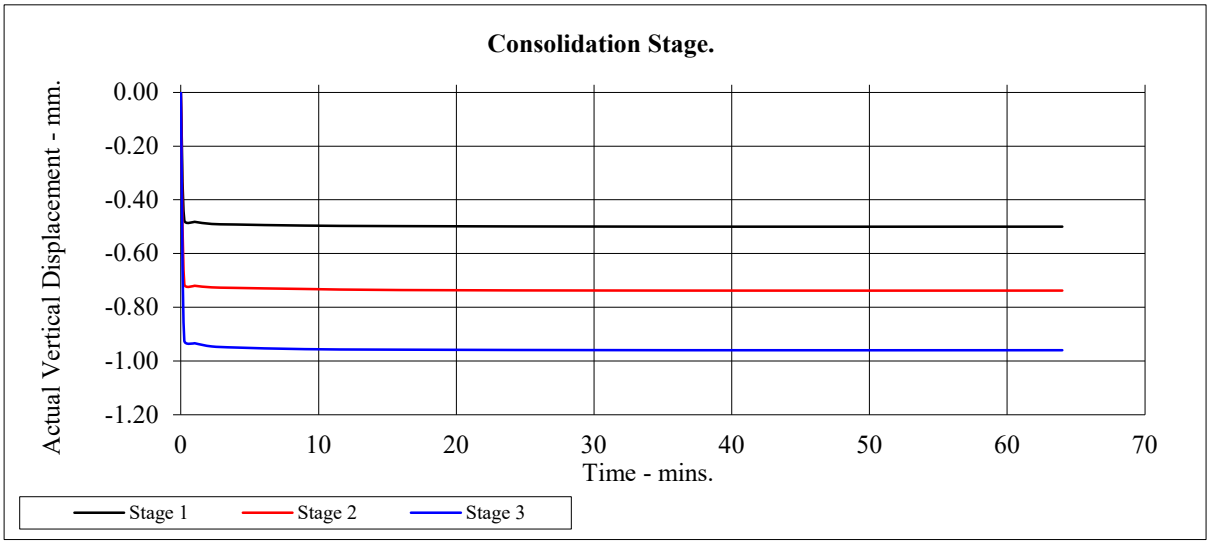


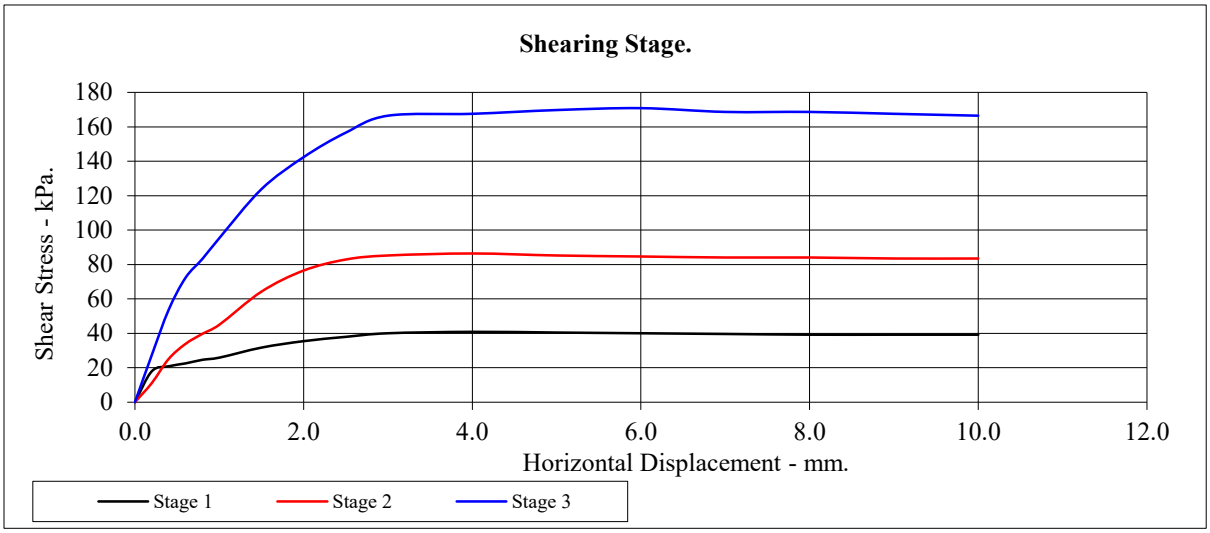
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4789 **Client Ref:** 19-0382

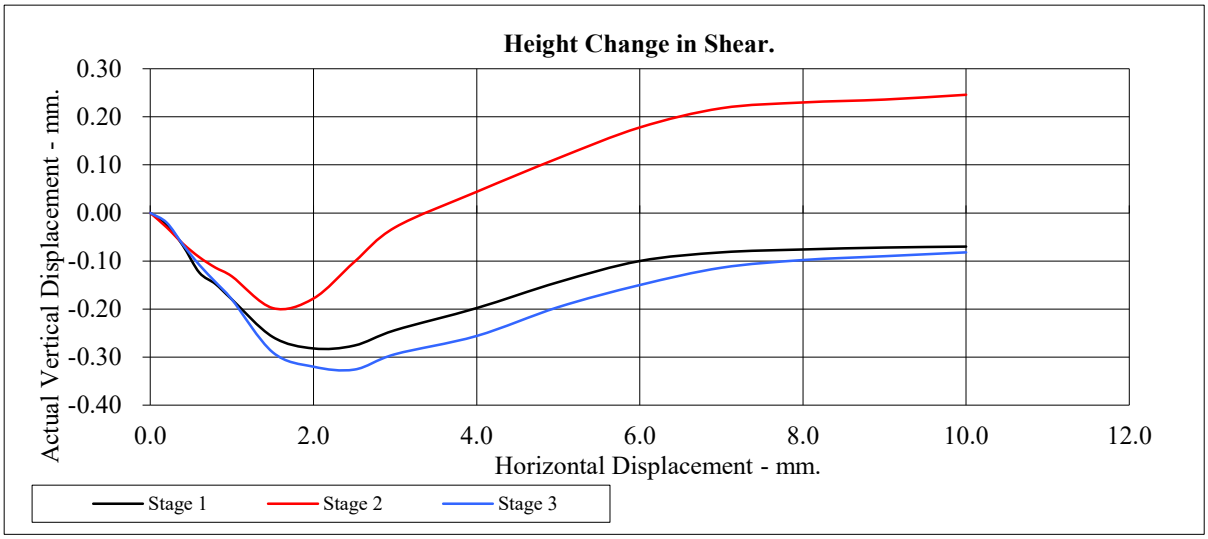
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**0.50**
Sample Number:	**3**	Base Depth:	**1.00**





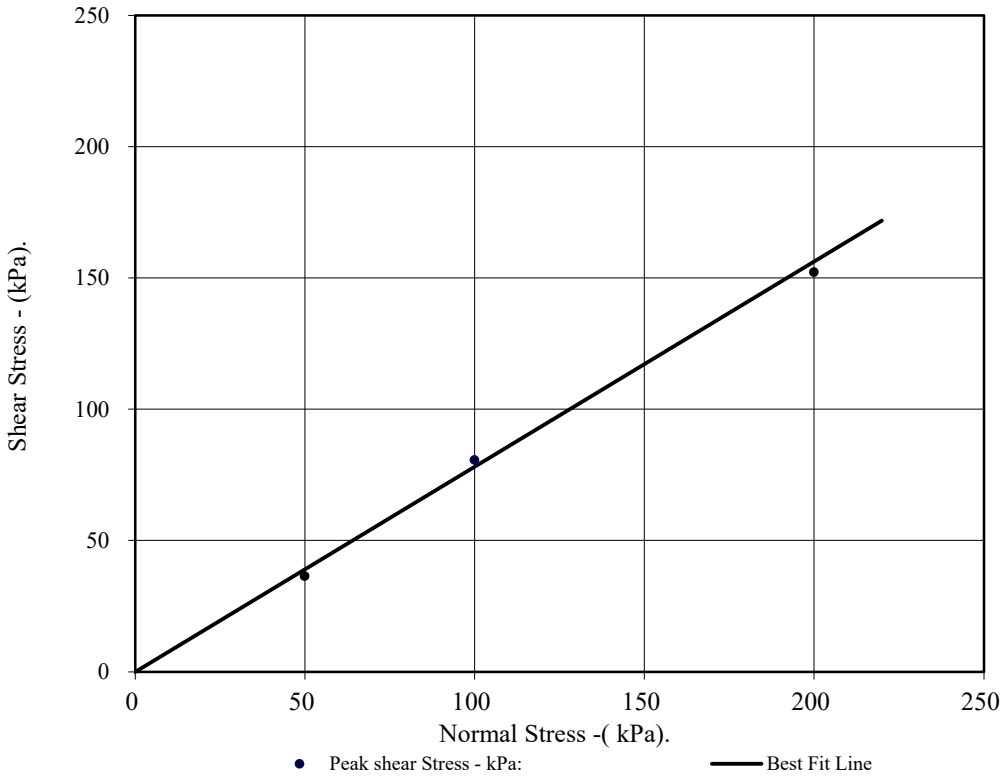


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**1.00**
Sample Number:	**5**		Base Depth:	**1.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	7.3	7.3	7.3
Bulk Density - Mg/m3:	1.66	1.68	1.68
Dry Density - Mg/m3:	1.55	1.56	1.56
Voids Ratio:	0.708	0.694	0.697
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.34	19.22	18.59
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	8.10	7.82	8.41
Peak shear Stress - kPa:	36	81	152
Final Consolidated Conditions			
Moisture Content - %:	5.6	5.6	5.5
Bulk Density - Mg/m3:	1.73	1.75	1.81
Dry Density - Mg/m3:	1.63	1.66	1.71
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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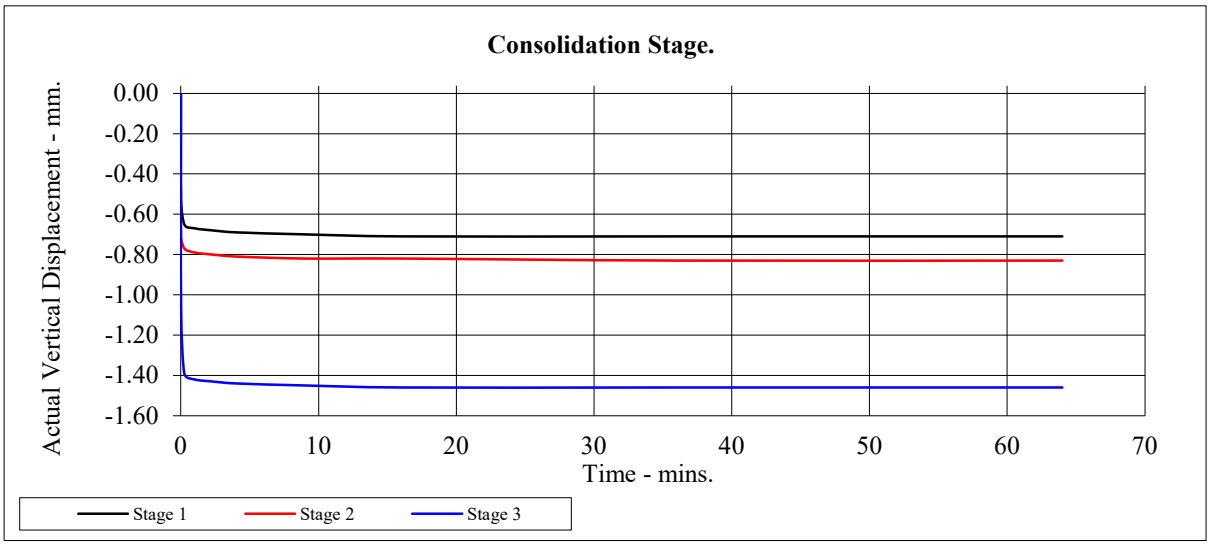
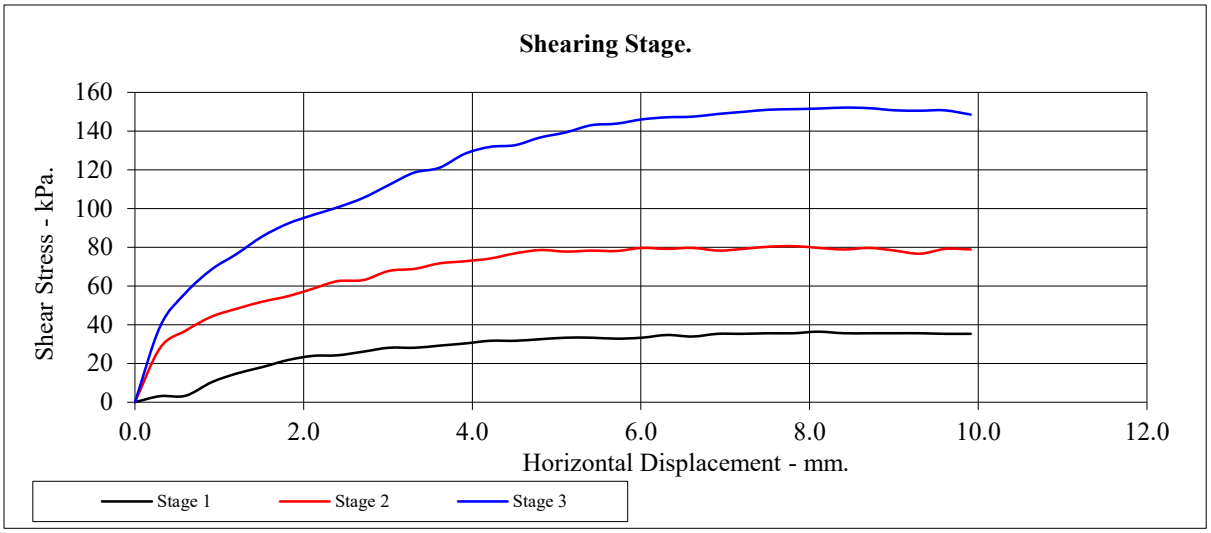
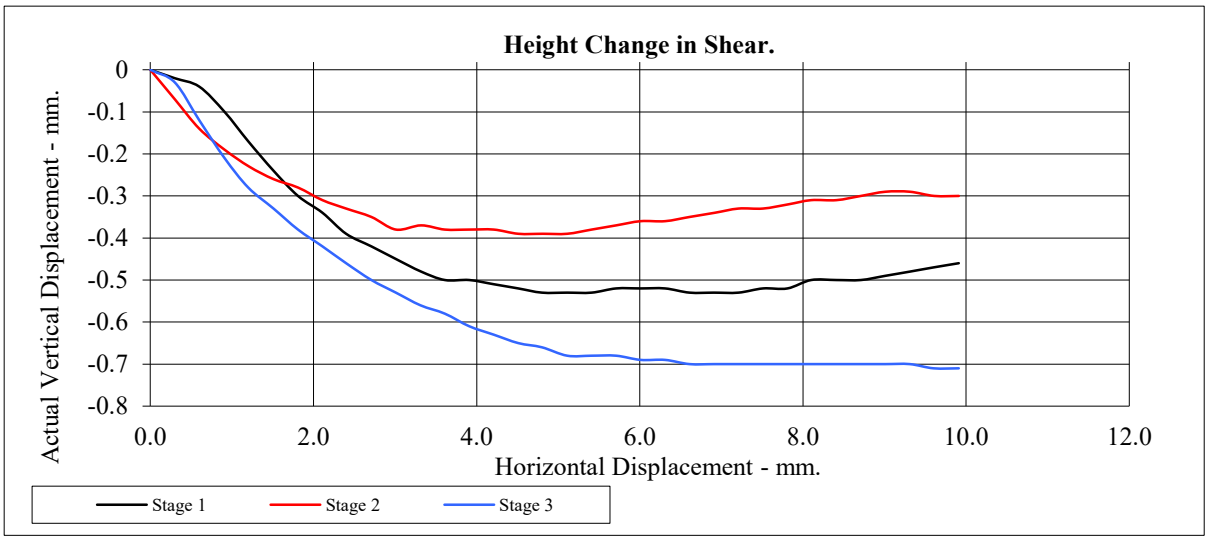
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**1.00**
Sample Number:	**5**	Base Depth:	**1.50**





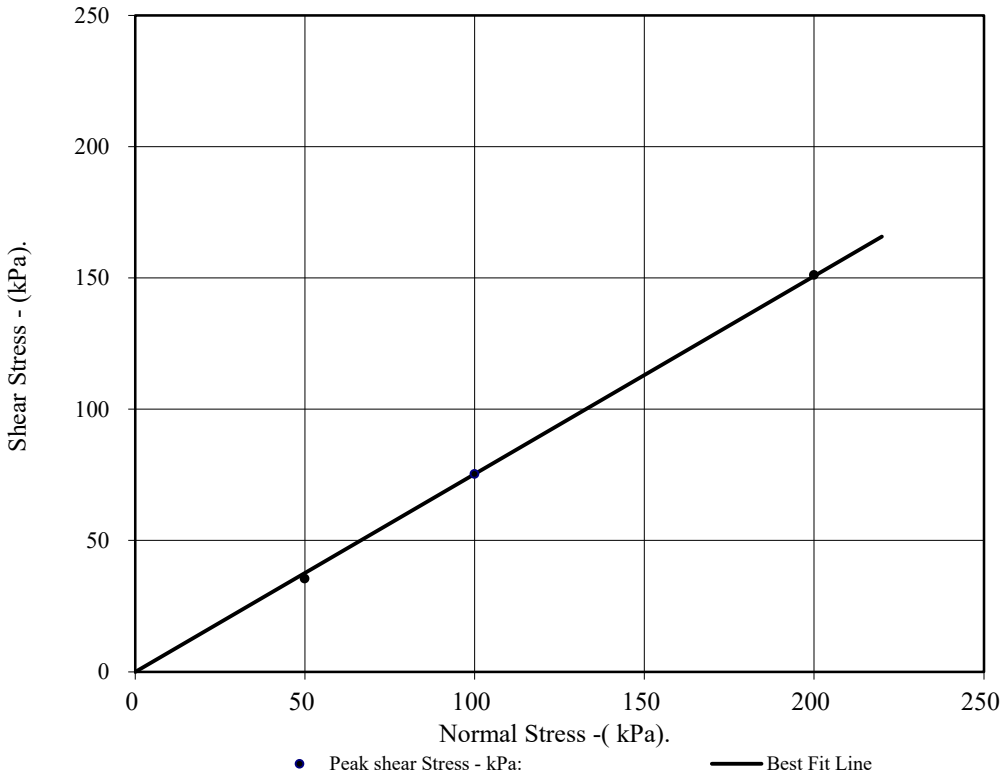


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**2.00**
Sample Number:	**9**		Base Depth:	**2.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	3.6	3.6	3.6
Bulk Density - Mg/m3:	1.85	1.84	1.85
Dry Density - Mg/m3:	1.78	1.78	1.78
Voids Ratio:	0.488	0.490	0.488
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.96	19.76	18.91
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.91	2.71	6.01
Peak shear Stress - kPa:	35	75	151
Final Consolidated Conditions			
Moisture Content - %:	3.1	3.1	3.2
Bulk Density - Mg/m3:	1.85	1.87	1.96
Dry Density - Mg/m3:	1.80	1.81	1.90
Peak			
Angle of Shearing Resistance:(~~θ~~)	**37**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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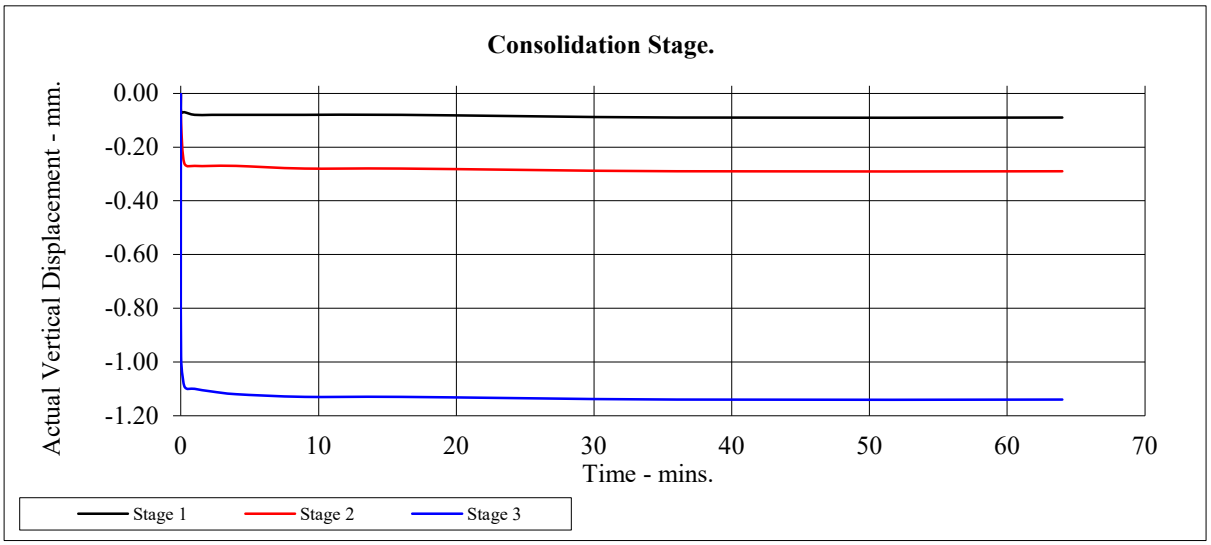
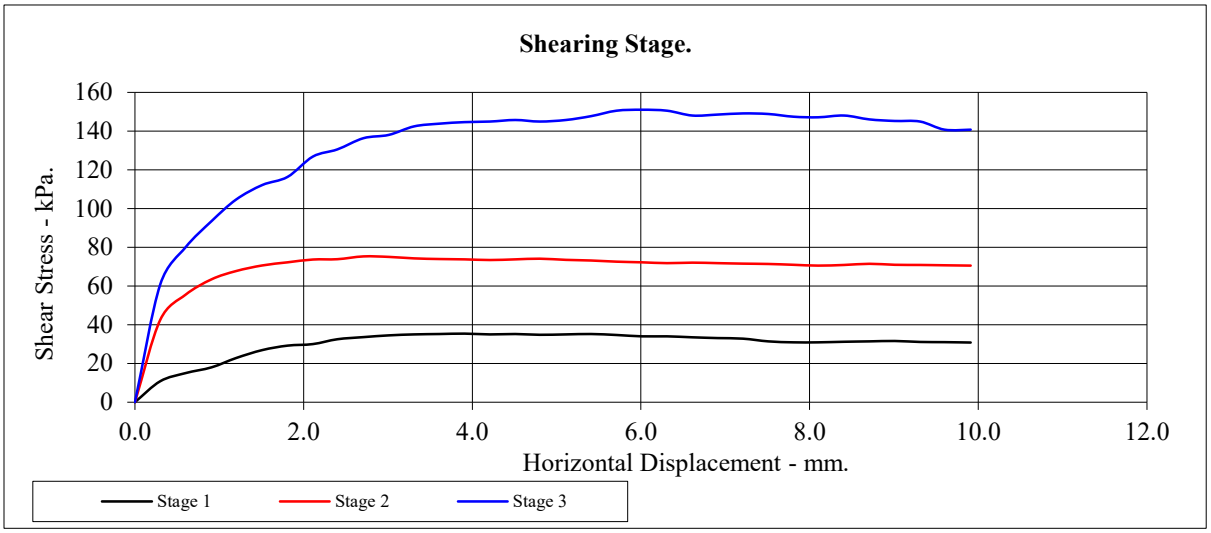
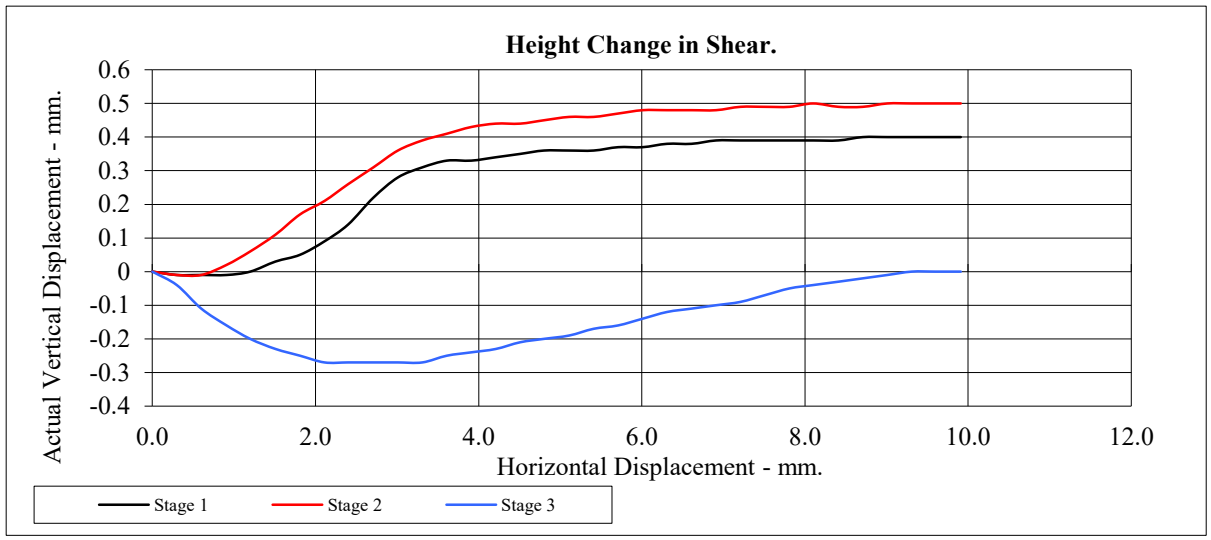
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**2.00**
Sample Number:	**9**	Base Depth:	**2.50**







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Stornoway Deep Water Port

Contract No:
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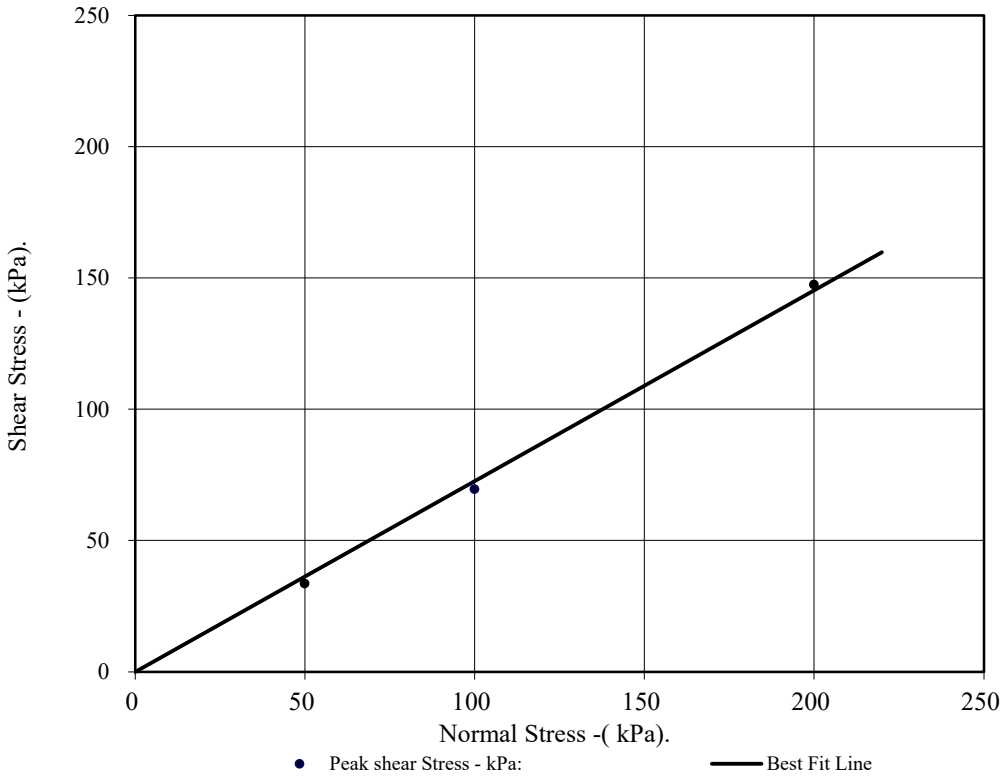
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**3.50**
Sample Number:	**14**		Base Depth:	**4.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.4	4.4	4.4
Bulk Density - Mg/m3:	1.66	1.66	1.69
Dry Density - Mg/m3:	1.59	1.59	1.62
Voids Ratio:	0.670	0.665	0.634
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.39	19.16	18.79
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	7.21	6.63	7.81
Peak shear Stress - kPa:	34	70	148
Final Consolidated Conditions			
Moisture Content - %:	4.0	3.9	4.0
Bulk Density - Mg/m3:	1.71	1.74	1.81
Dry Density - Mg/m3:	1.65	1.67	1.74
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**0**		



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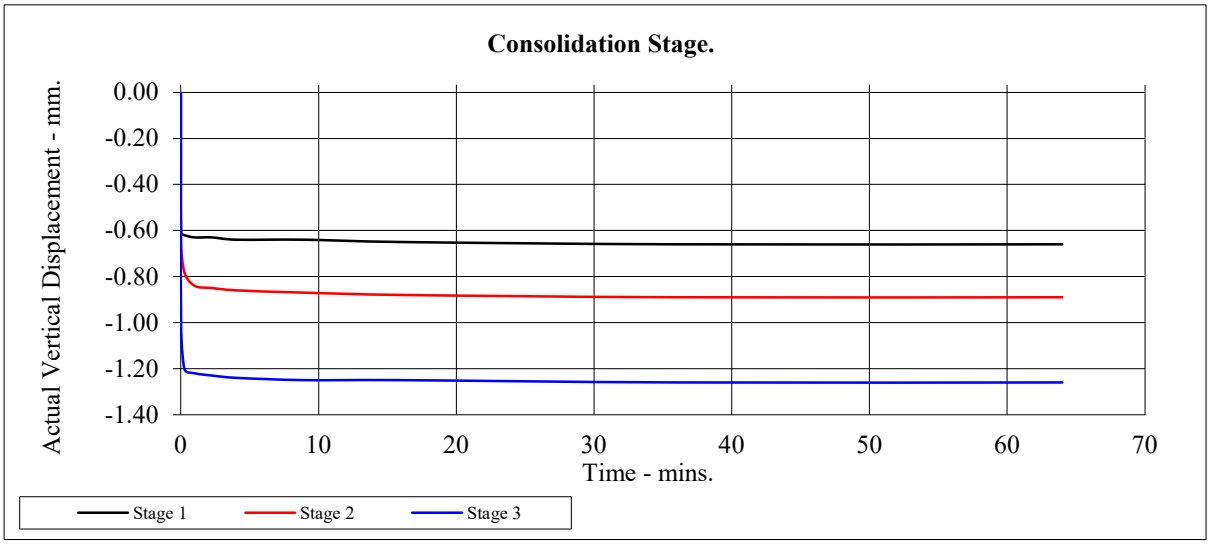
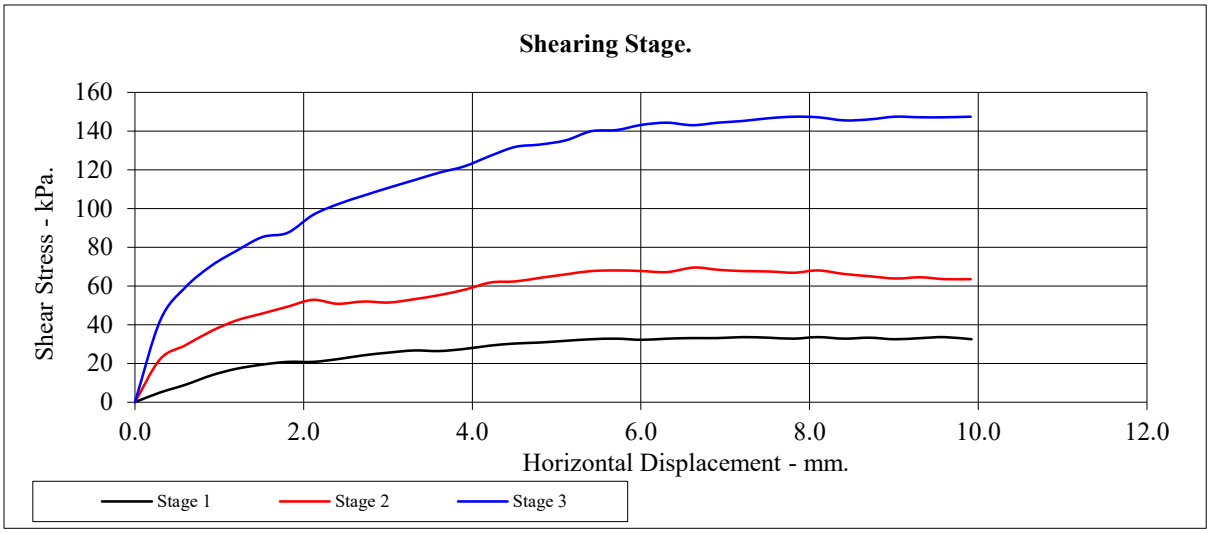
Client Ref: 19-0382

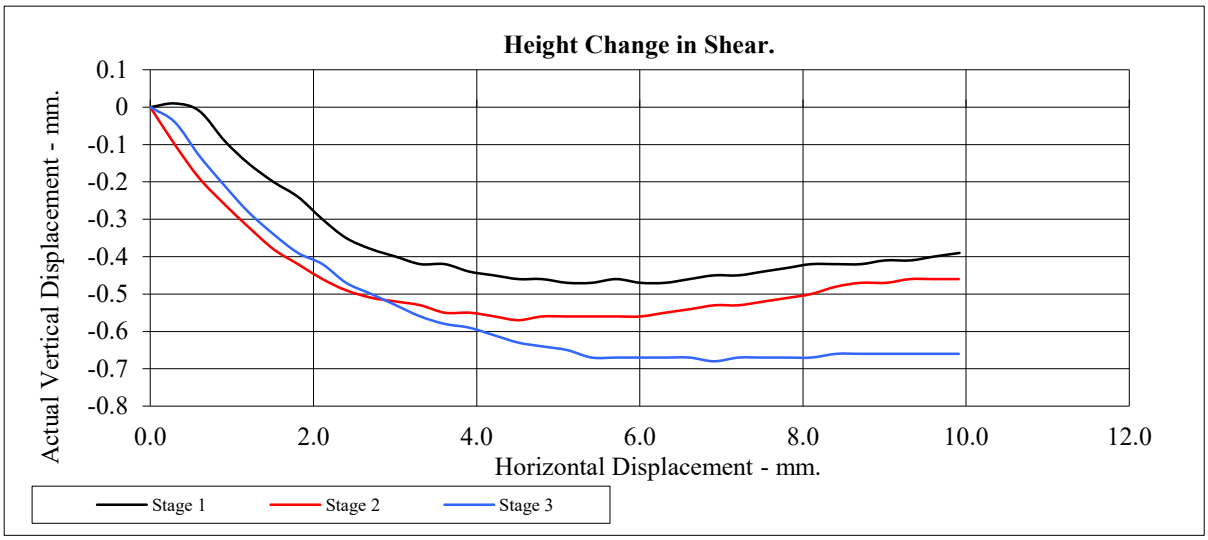
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**3.50**
Sample Number:	**14**	Base Depth:	**4.00**







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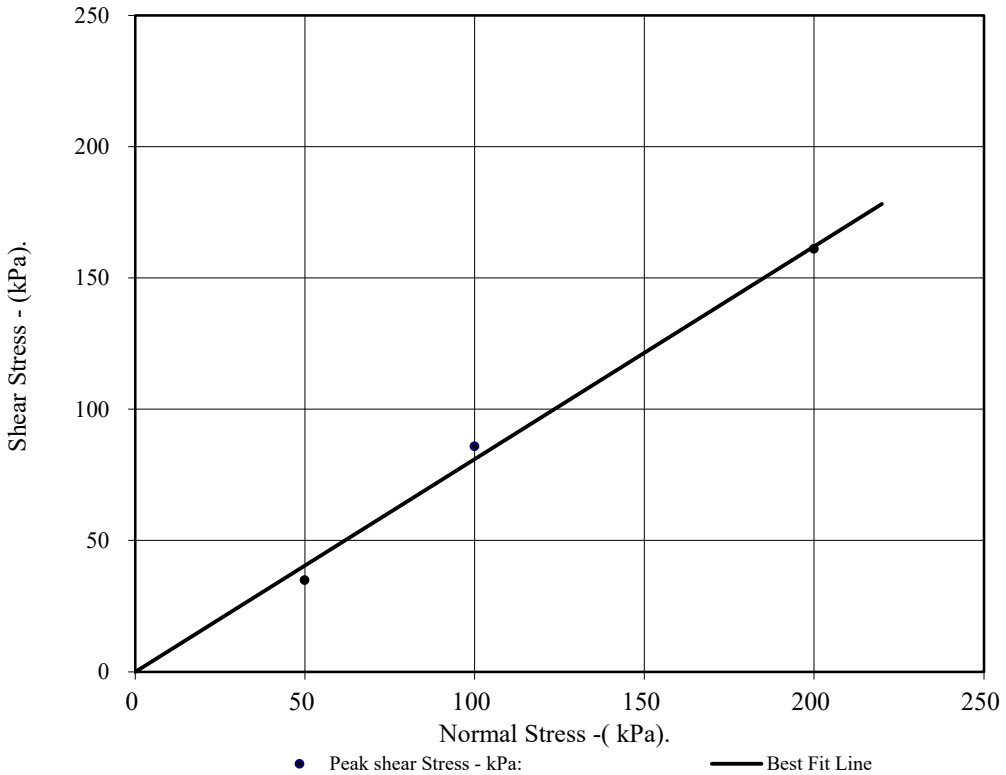
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**7.00**
Sample Number:	**28**		Base Depth:	**7.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	2.5	2.5	2.5
Bulk Density - Mg/m3:	1.71	1.71	1.71
Dry Density - Mg/m3:	1.66	1.67	1.67
Voids Ratio:	0.592	0.591	0.590
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.81	19.63	19.39
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.91	5.71	4.51
Peak shear Stress - kPa:	35	86	161
Final Consolidated Conditions			
Moisture Content - %:	2.1	1.9	1.9
Bulk Density - Mg/m3:	1.73	1.74	1.77
Dry Density - Mg/m3:	1.69	1.71	1.73
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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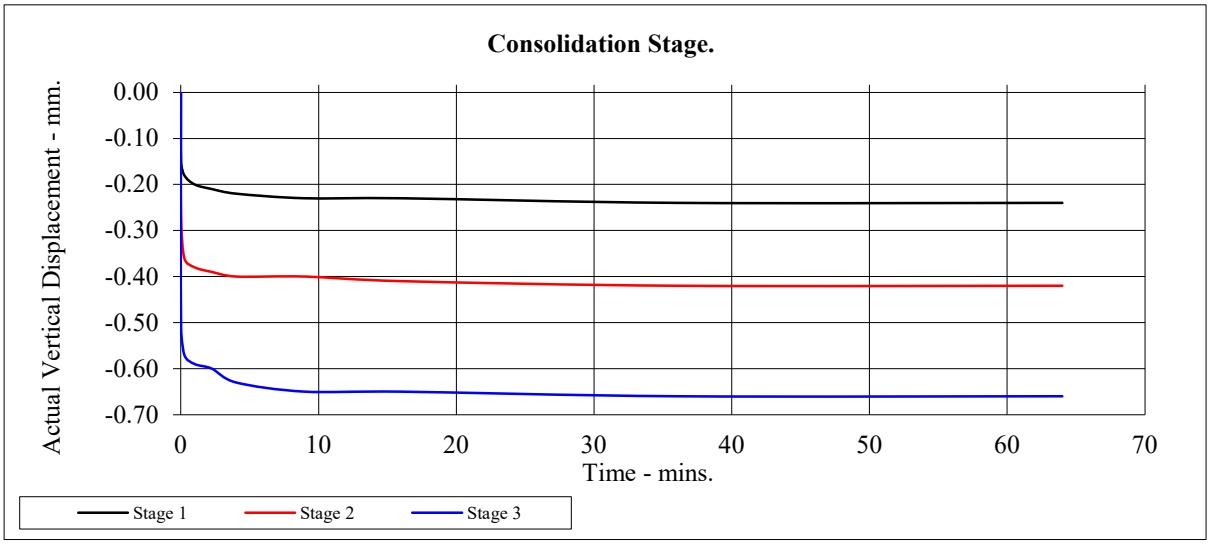
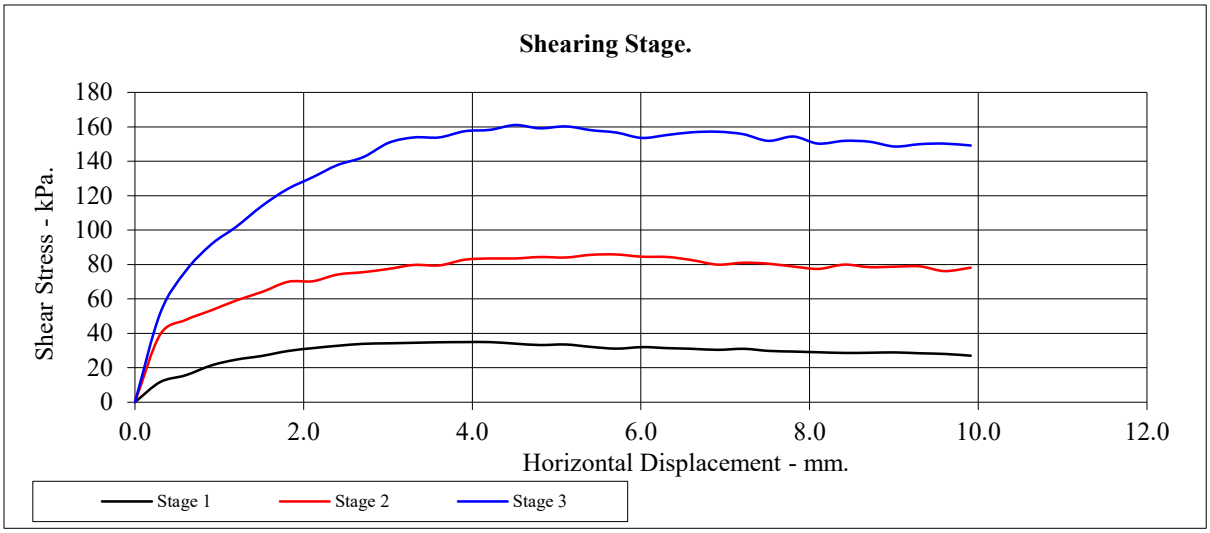
Client Ref: 19-0382

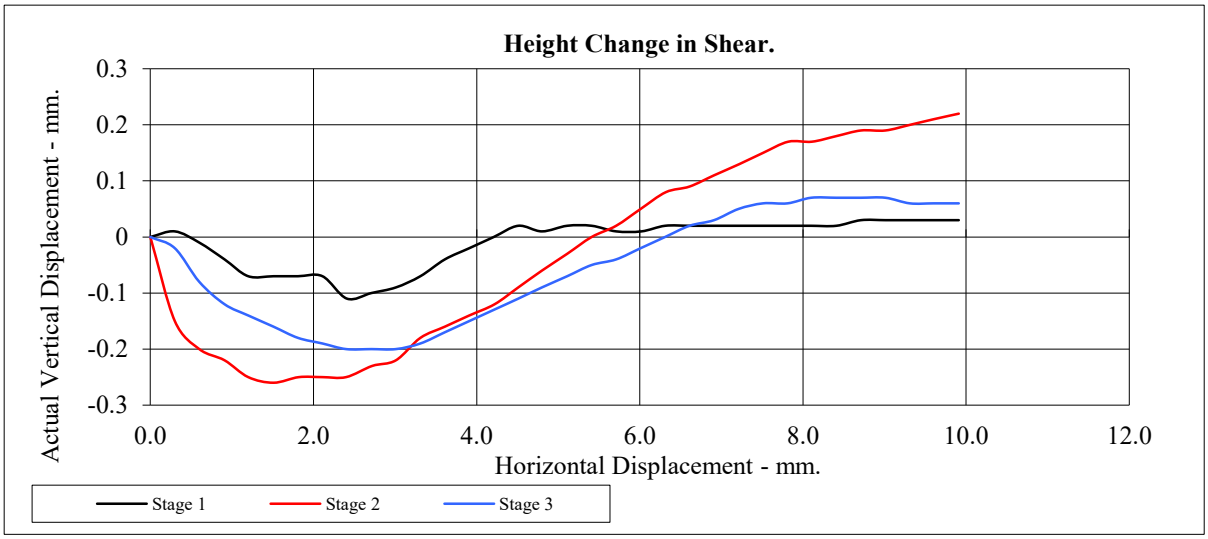
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**7.00**
Sample Number:	**28**	Base Depth:	**7.50**







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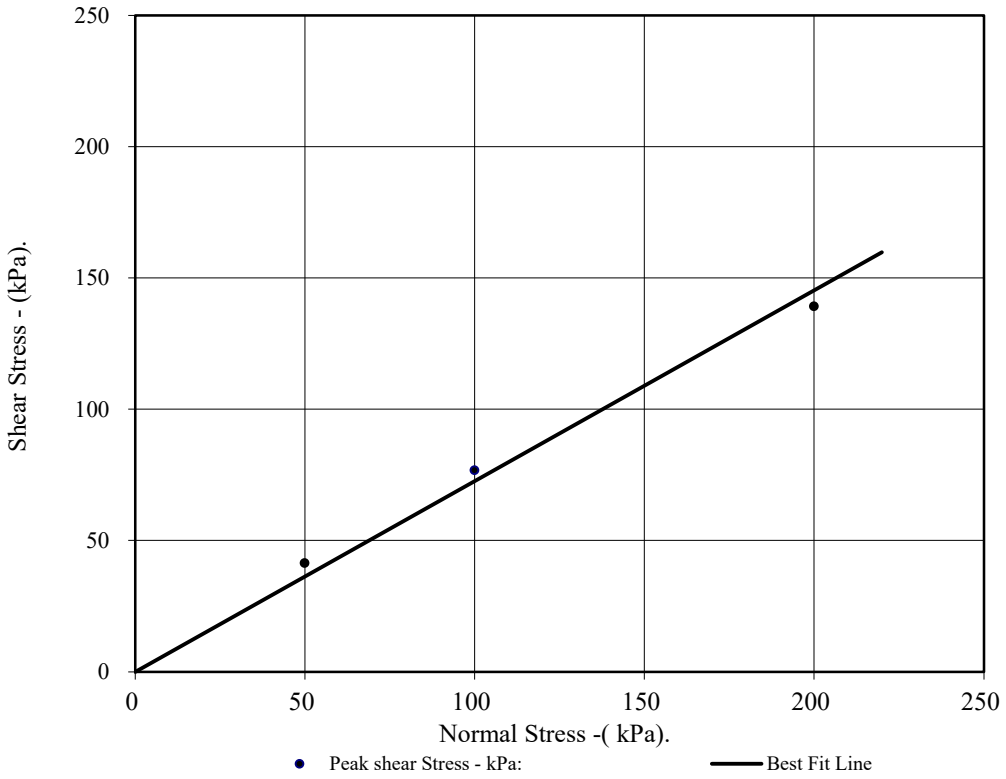
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**9.20**
Sample Number:	**38**		Base Depth:	**9.80**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	11	11	11
Bulk Density - Mg/m3:	1.89	1.89	1.89
Dry Density - Mg/m3:	1.71	1.71	1.71
Voids Ratio:	0.553	0.552	0.550
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.88	19.54	18.72
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.01	3.01	5.41
Peak shear Stress - kPa:	41	77	139
Final Consolidated Conditions			
Moisture Content - %:	8.5	9.7	9.6
Bulk Density - Mg/m3:	1.90	1.94	2.03
Dry Density - Mg/m3:	1.76	1.77	1.85
Peak			
Angle of Shearing Resistance:(~~θ~~)	**36**		
Effective Cohesion - kPa:	**0**		



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Stornoway Deep Water Port

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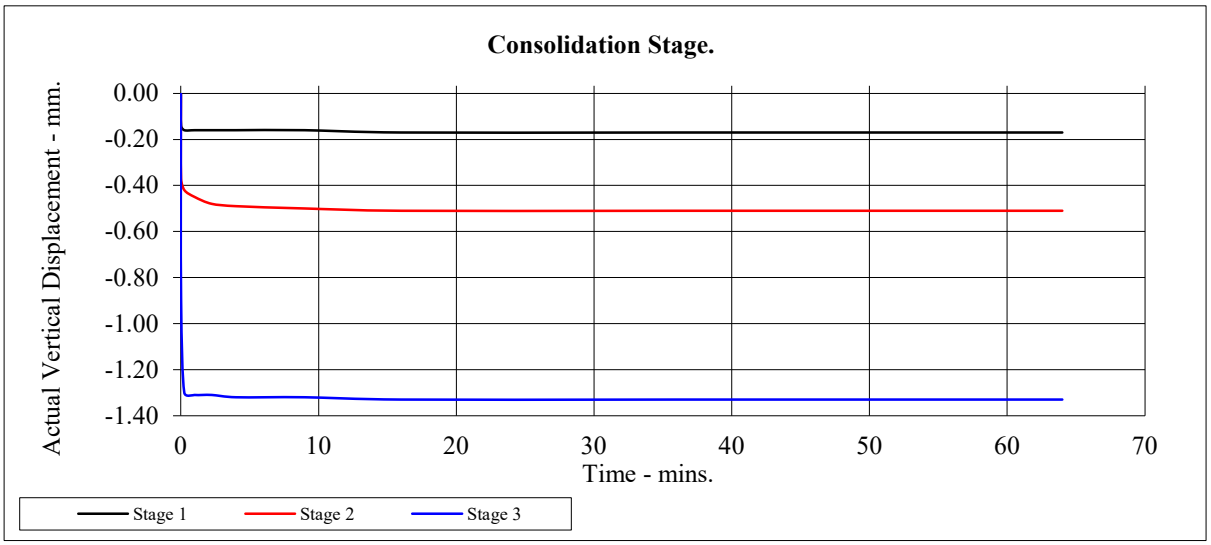
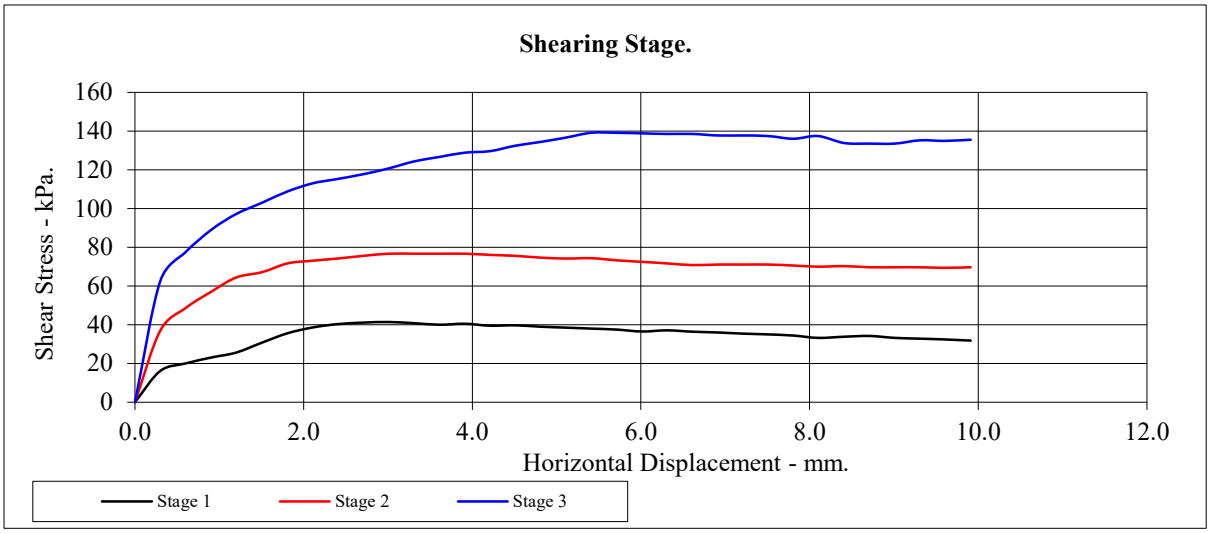
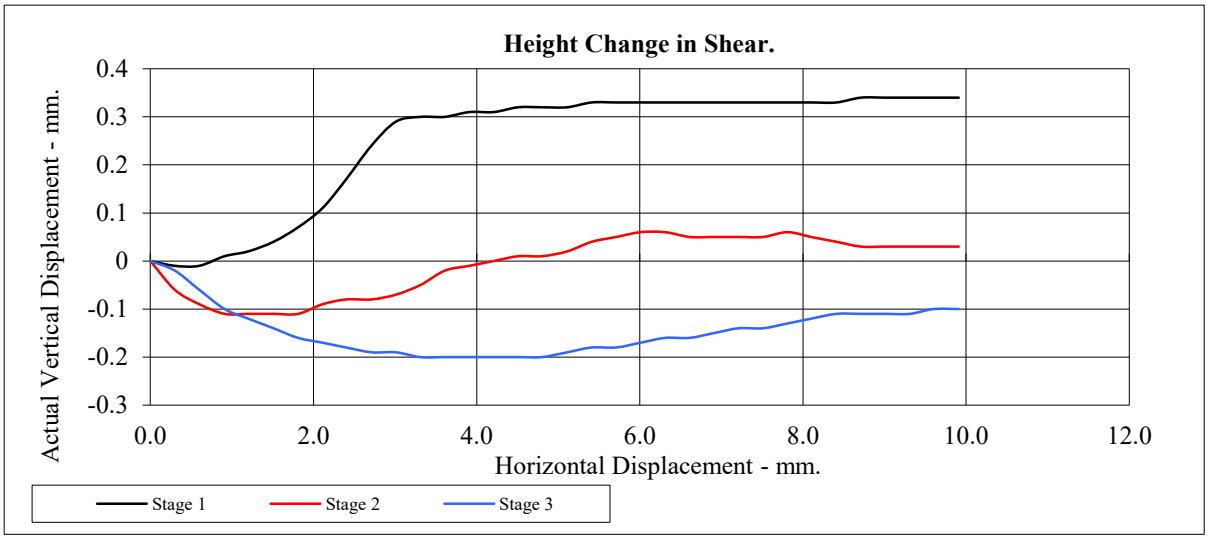
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**9.20**
Sample Number:	**38**	Base Depth:	**9.80**







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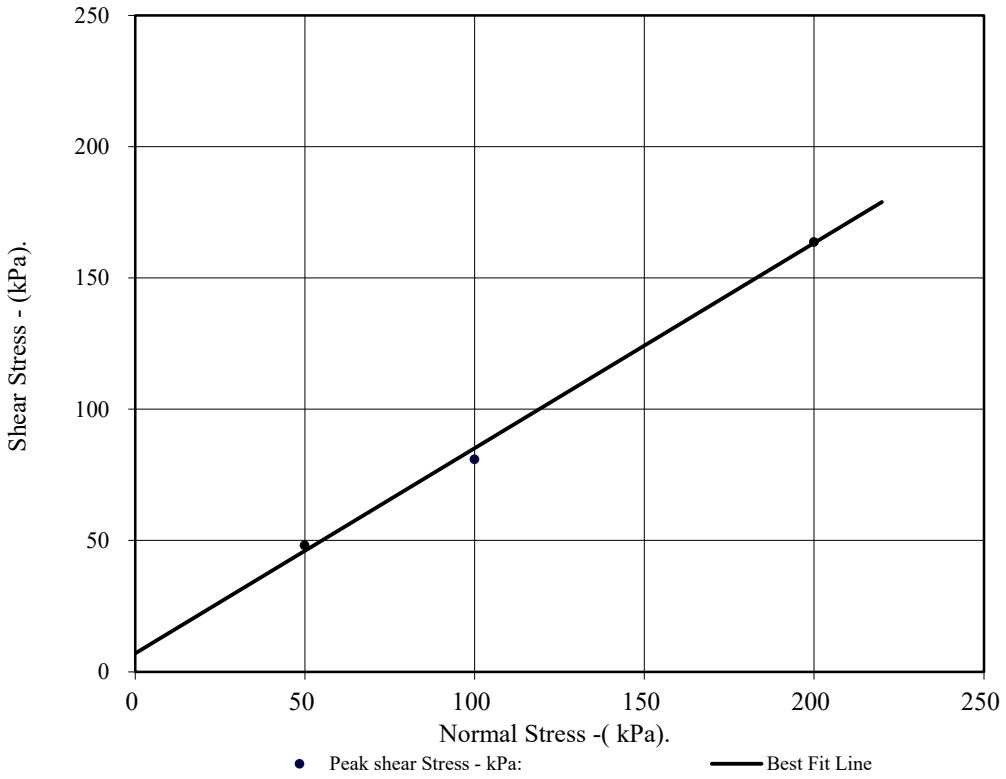
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**		Top Depth:	**19.50**
Sample Number:	**79**		Base Depth:	**20.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.6	4.6	4.6
Bulk Density - Mg/m3:	1.81	1.81	1.81
Dry Density - Mg/m3:	1.73	1.73	1.73
Voids Ratio:	0.531	0.529	0.528
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.92	19.71	18.79
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.91	6.31	6.31
Peak shear Stress - kPa:	48	81	164
Final Consolidated Conditions			
Moisture Content - %:	4.3	3.3	3.7
Bulk Density - Mg/m3:	1.82	1.84	1.93
Dry Density - Mg/m3:	1.75	1.78	1.87
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**7**		



UKAS TESTING 4043

PSL Professional Soils Laboratory

Stornoway Deep Water Port

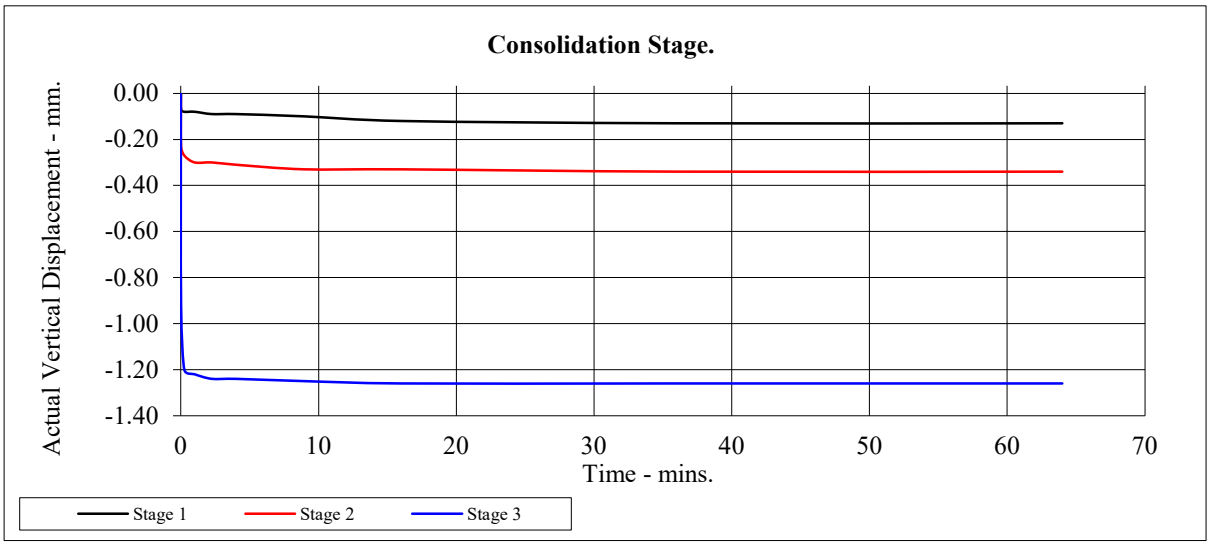
Contract No: PSL19/4789

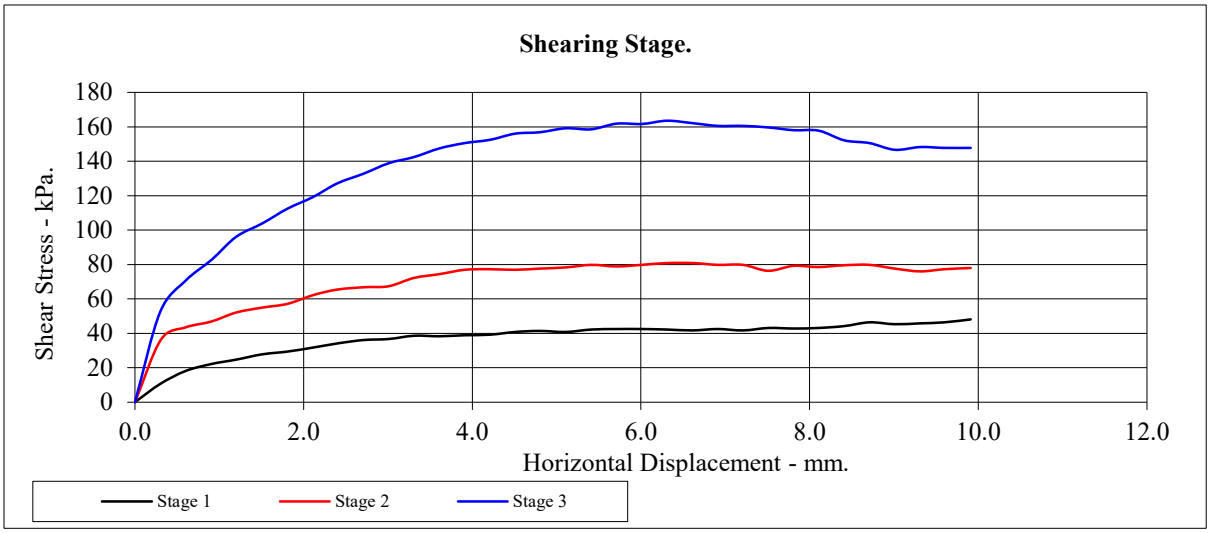
Client Ref: 19-0382

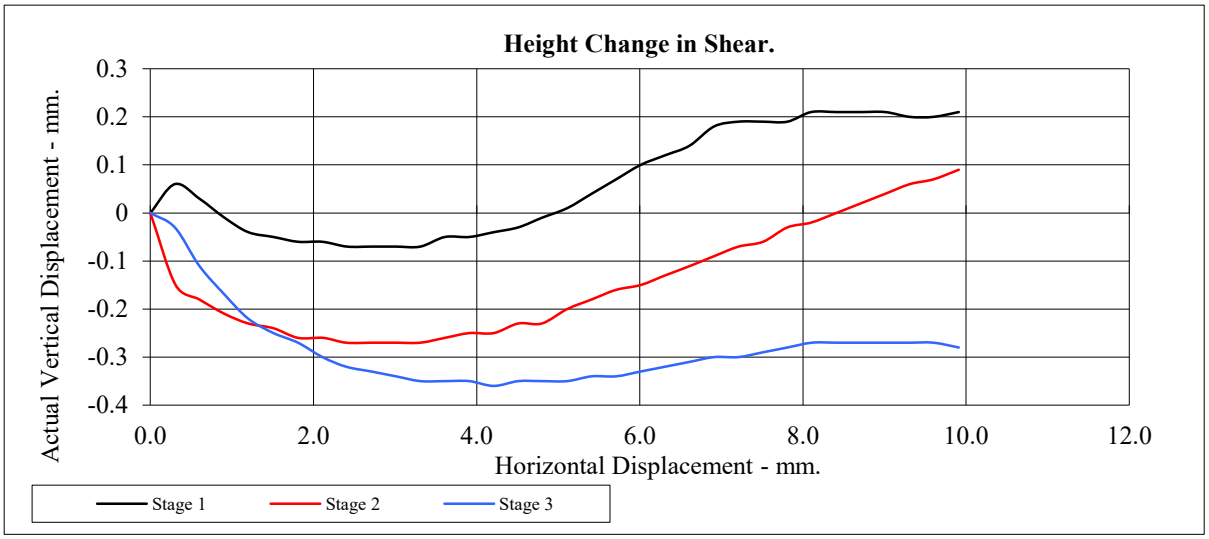
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH45**	Top Depth:	**19.50**
Sample Number:	**79**	Base Depth:	**20.00**







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PSL Professional Soils Laboratory

Stornoway Deep Water Port

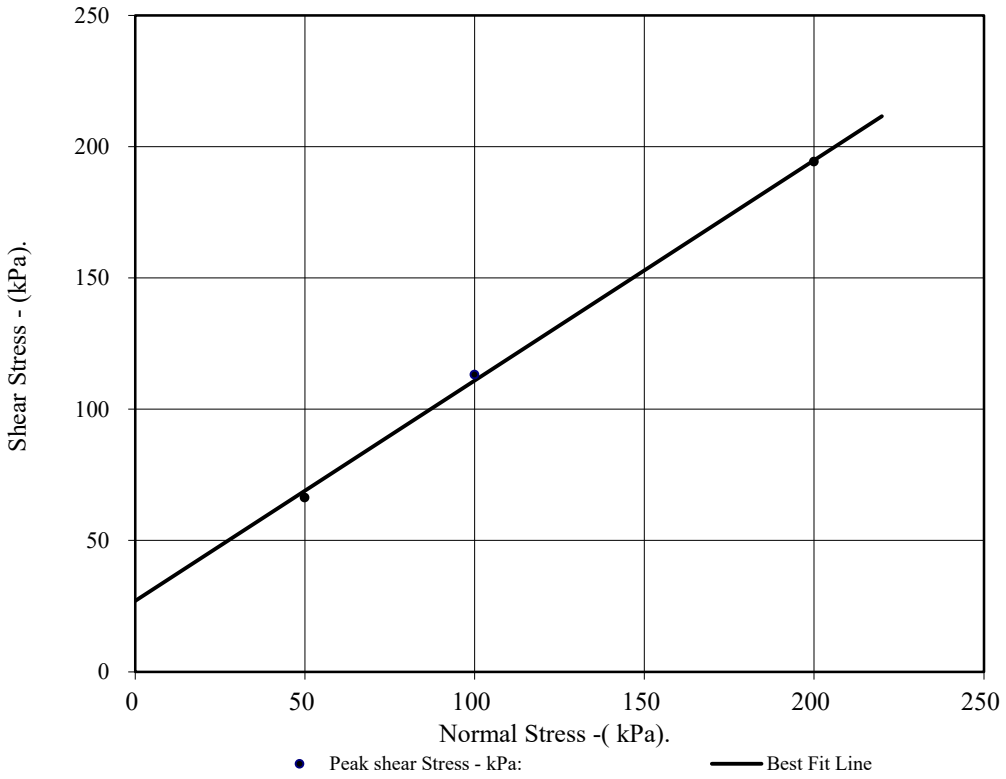
Contract No:
PSL19/4789
Client Ref:
19-0382

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH49**		Top Depth:	**0.50**
Sample Number:	**3**		Base Depth:	**1.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 20mm sieve			
Sample Description:	**See summary of soil description's.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132	132	132
Length - mm:	300	300	300
Moisture Content - %:	3.2	3.2	3.2
Bulk Density - Mg/m3:	1.89	1.89	1.89
Dry Density - Mg/m3:	1.84	1.84	1.84
Voids Ratio:	0.444	0.444	0.444
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	131.68	131.38	131.12
Shearing Stage			
Rate of Strain (mm/min)	1.00	1.00	1.00
Displacement at peak shear stress (mm)	19.50	39.50	43.50
Peak shear Stress - kPa:	66	113	194
Final Consolidated Conditions			
Moisture Content - %:	3.0	2.9	2.7
Bulk Density - Mg/m3:	1.90	1.90	1.91
Dry Density - Mg/m3:	1.84	1.85	1.86
Peak			
Angle of Shearing Resistance:(~~θ~~)	**40**		
Effective Cohesion - kPa:	**27**		



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CONSOLIDATED DRAINED SHEARBOX TEST

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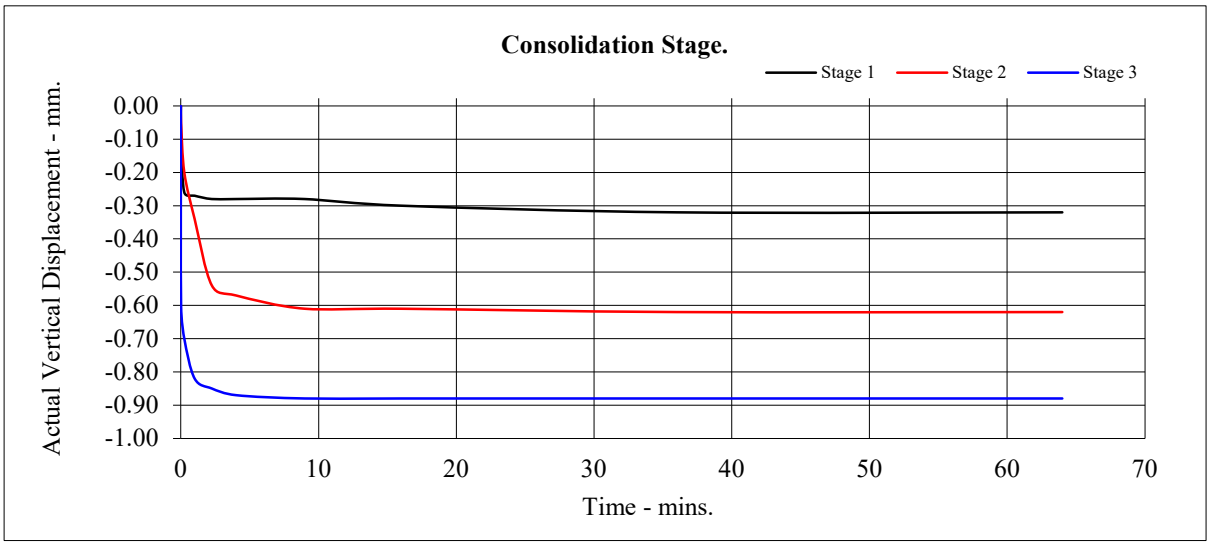
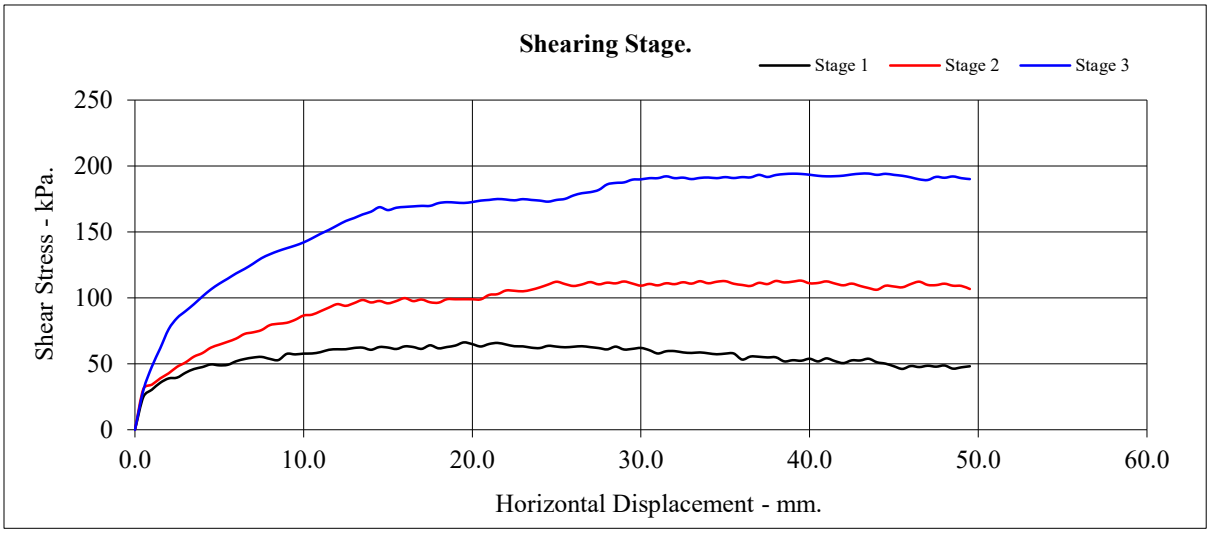
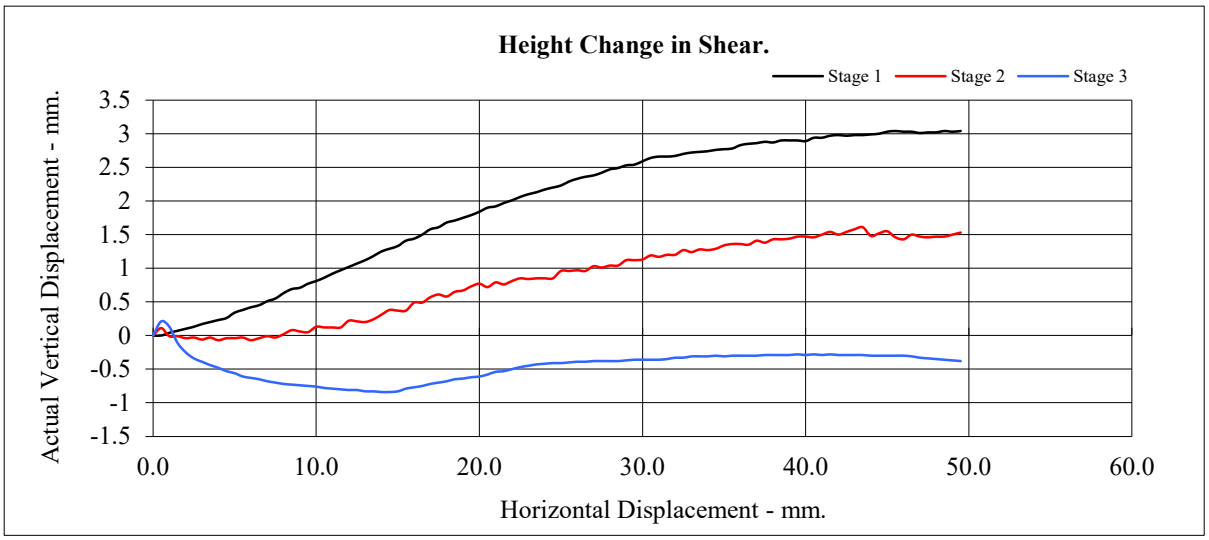
Hole Number:	**BH49**	Top Depth:	**0.50**
Sample Number:	**3**	Base Depth:	**1.00**







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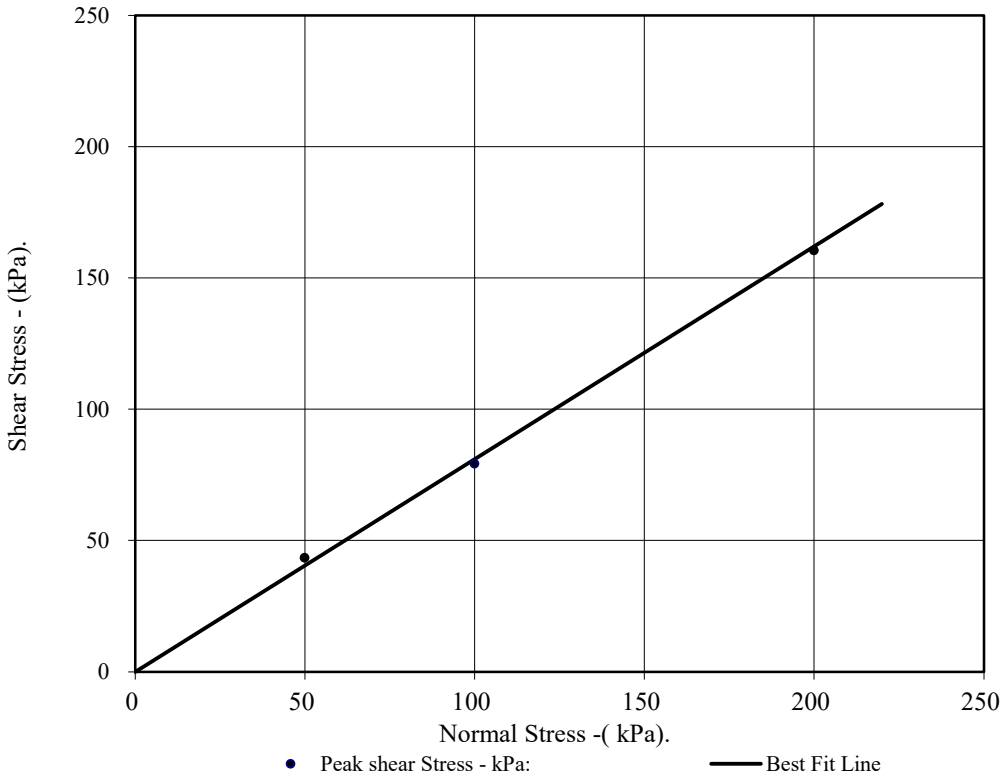
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**		Top Depth:	**3.50**
Sample Number:	**15**		Base Depth:	**4.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	7.6	7.6	7.6
Bulk Density - Mg/m3:	1.72	1.72	1.72
Dry Density - Mg/m3:	1.60	1.60	1.60
Voids Ratio:	0.658	0.655	0.656
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.85	19.47	19.20
Shearing Stage			
Rate of Strain (mm/min)	0.600	0.600	0.600
Displacement at peak shear stress (mm)	6.00	4.00	5.00
Peak shear Stress - kPa:	43	79	160
Final Consolidated Conditions			
Moisture Content - %:	3.8	3.1	4.4
Bulk Density - Mg/m3:	1.74	1.77	1.80
Dry Density - Mg/m3:	1.67	1.72	1.72
Peak			
Angle of Shearing Resistance:(~~θ~~)	**39**		
Effective Cohesion - kPa:	**0**		



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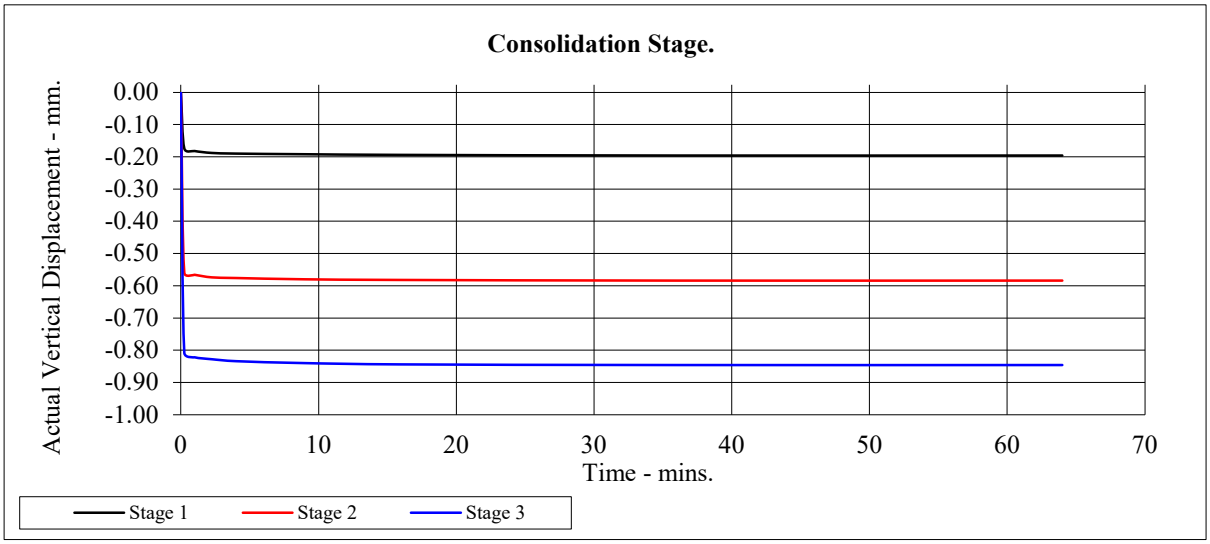
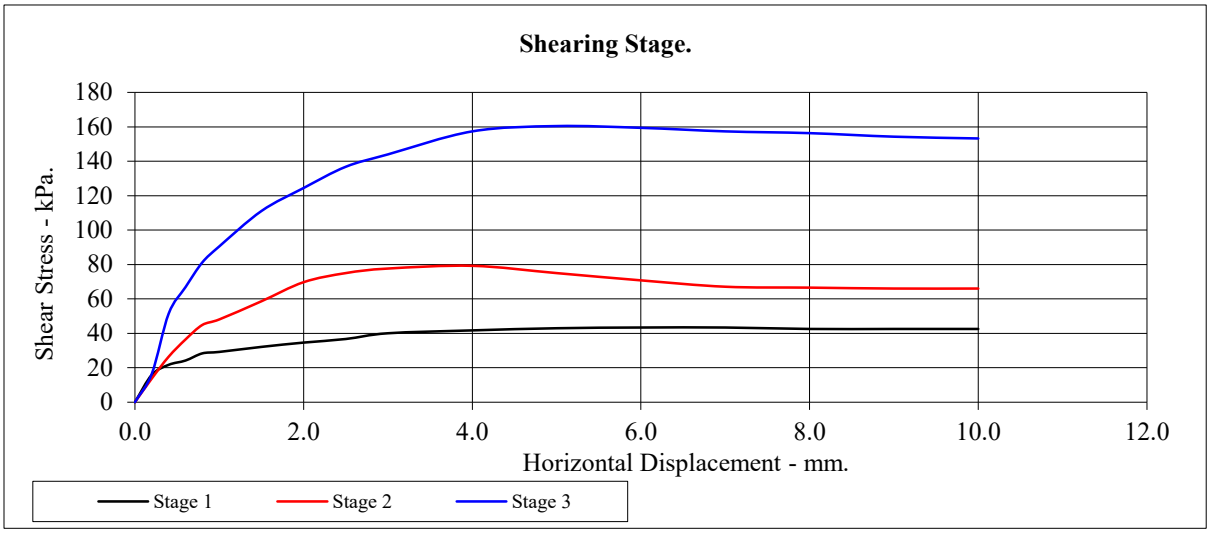
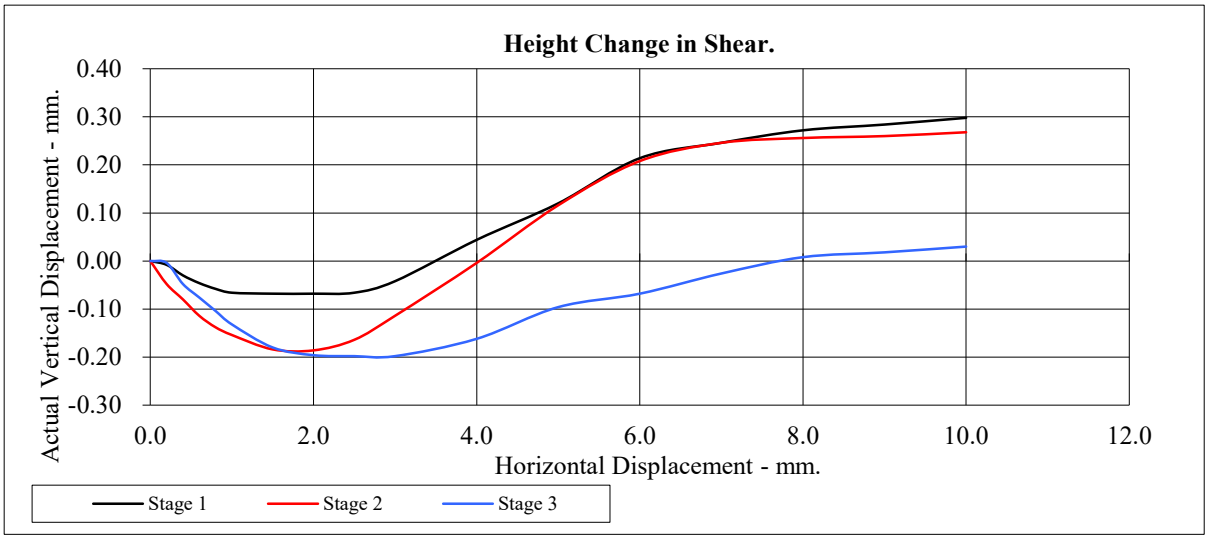
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH49**	Top Depth:	**3.50**
Sample Number:	**15**	Base Depth:	**4.00**





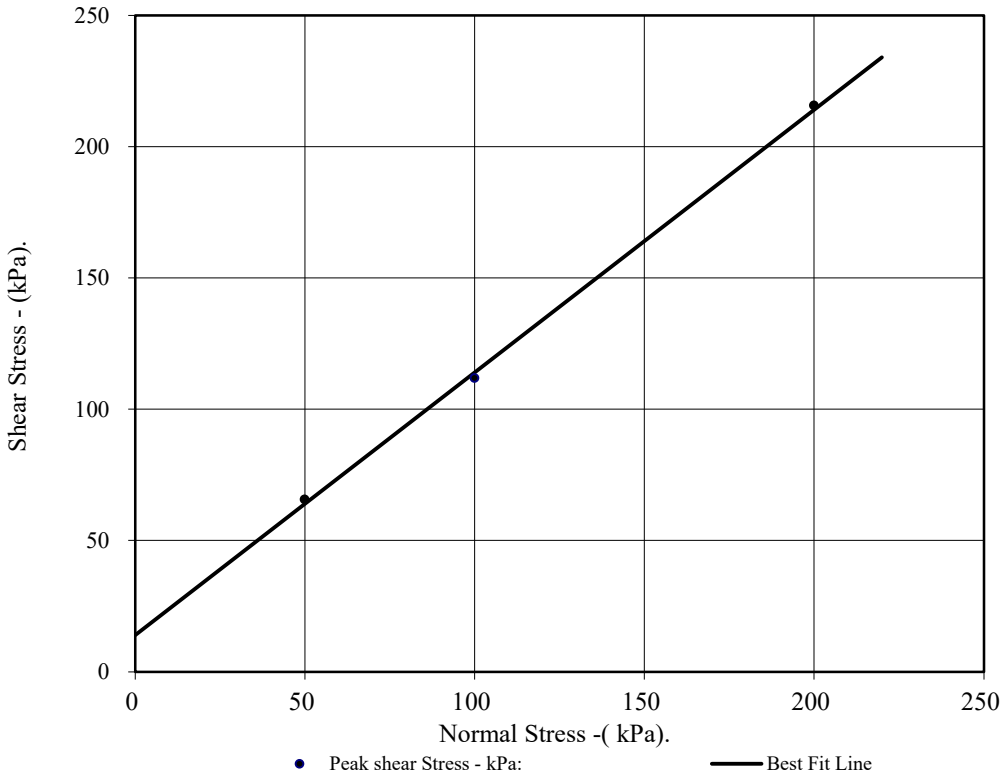


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH51**		Top Depth:	**3.00**
Sample Number:	**7**		Base Depth:	**4.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Remoulded using 2.5kg effort. Material tested passing 20mm sieve			
Sample Description:	**See summary of soil description's.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132	132	132
Length - mm:	300	300	300
Moisture Content - %:	3.2	3.2	3.2
Bulk Density - Mg/m3:	1.89	1.89	1.89
Dry Density - Mg/m3:	1.84	1.84	1.84
Voids Ratio:	0.444	0.444	0.444
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	131.62	131.19	130.68
Shearing Stage			
Rate of Strain (mm/min)	1.00	1.00	1.00
Displacement at peak shear stress (mm)	17.00	22.50	28.50
Peak shear Stress - kPa:	66	112	216
Final Consolidated Conditions			
Moisture Content - %:	3.1	3.0	2.7
Bulk Density - Mg/m3:	1.90	1.91	1.91
Dry Density - Mg/m3:	1.84	1.85	1.86
Peak			
Angle of Shearing Resistance:(~~θ~~)	**45**		
Effective Cohesion - kPa:	**14**		



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Stornoway Deep Water Port

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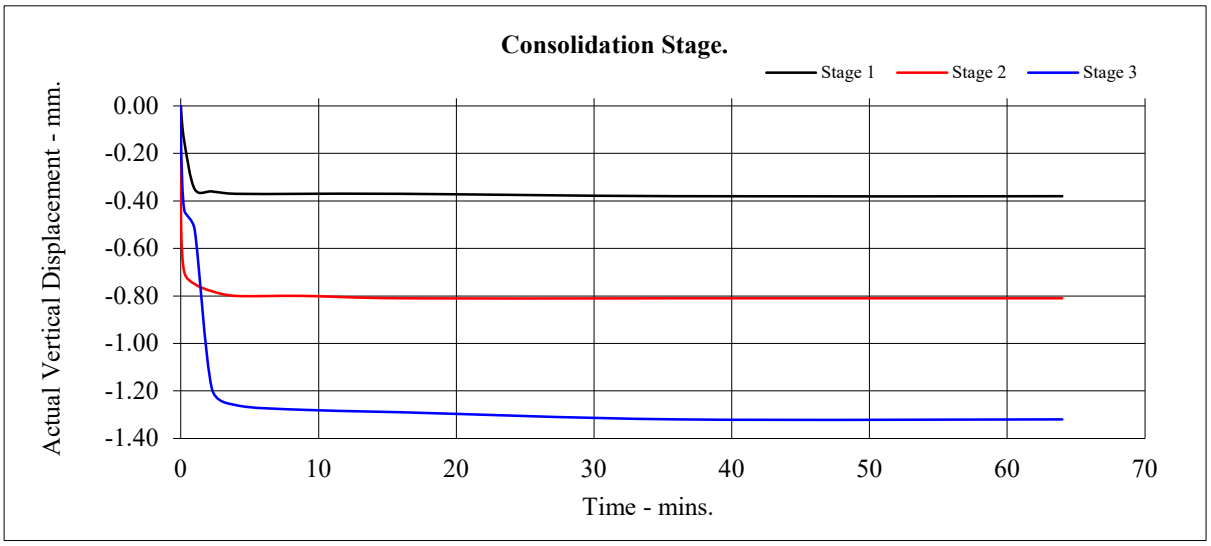
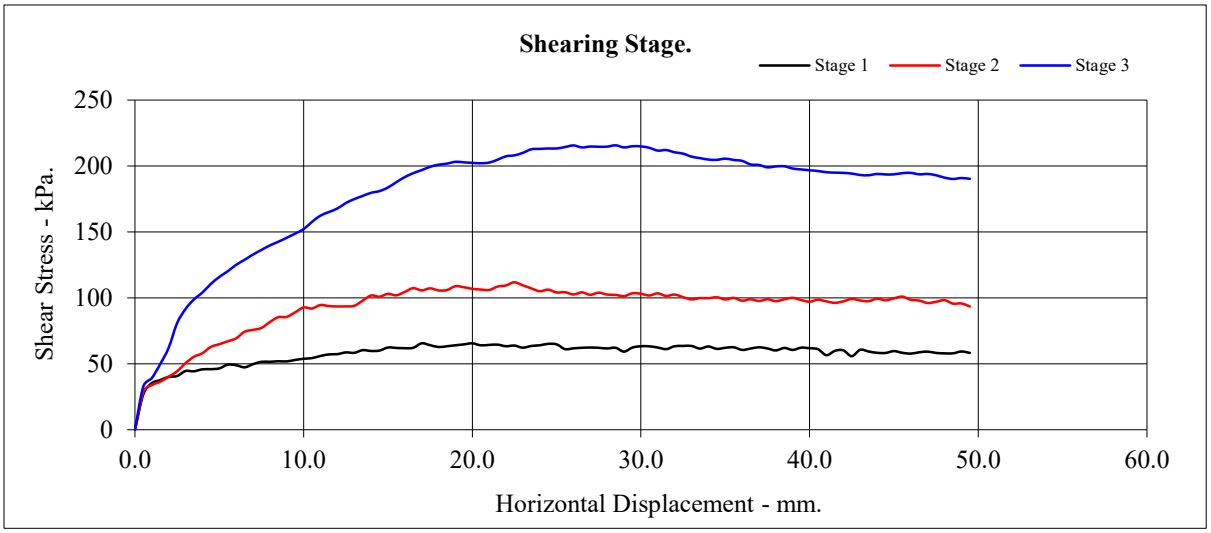
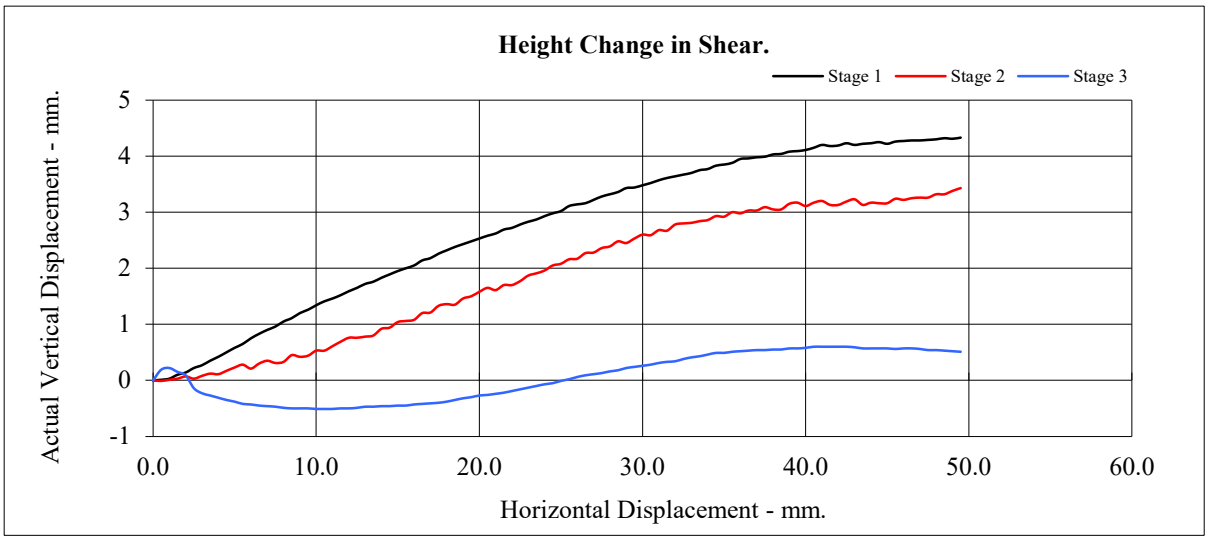
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 5

Hole Number:	**BH51**	Top Depth:	**3.00**
Sample Number:	**7**	Base Depth:	**4.00**







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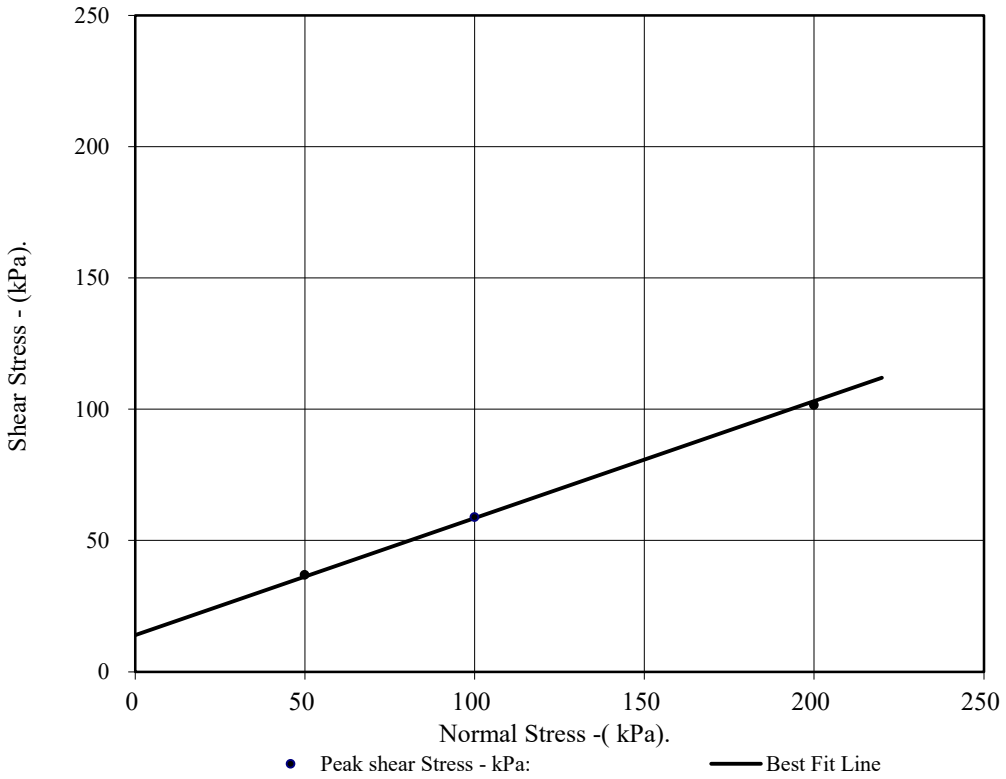
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH51**		Top Depth:	**5.00**
Sample Number:	**11**		Base Depth:	**6.00**
Sample Conditions:	Submerged		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	36	36	36
Bulk Density - Mg/m3:	2.08	2.08	2.08
Dry Density - Mg/m3:	1.53	1.53	1.53
Voids Ratio:	0.734	0.737	0.736
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	16.58	16.34	15.18
Shearing Stage			
Rate of Strain (mm/min)	0.048	0.048	0.048
Displacement at peak shear stress (mm)	6.56	6.87	5.54
Peak shear Stress - kPa:	37	59	102
Final Consolidated Conditions			
Moisture Content - %:	32	29	29
Bulk Density - Mg/m3:	2.51	2.55	2.74
Dry Density - Mg/m3:	1.91	1.98	2.12
Peak			
Angle of Shearing Resistance:(~~θ~~)	**24**		
Effective Cohesion - kPa:	**14**		

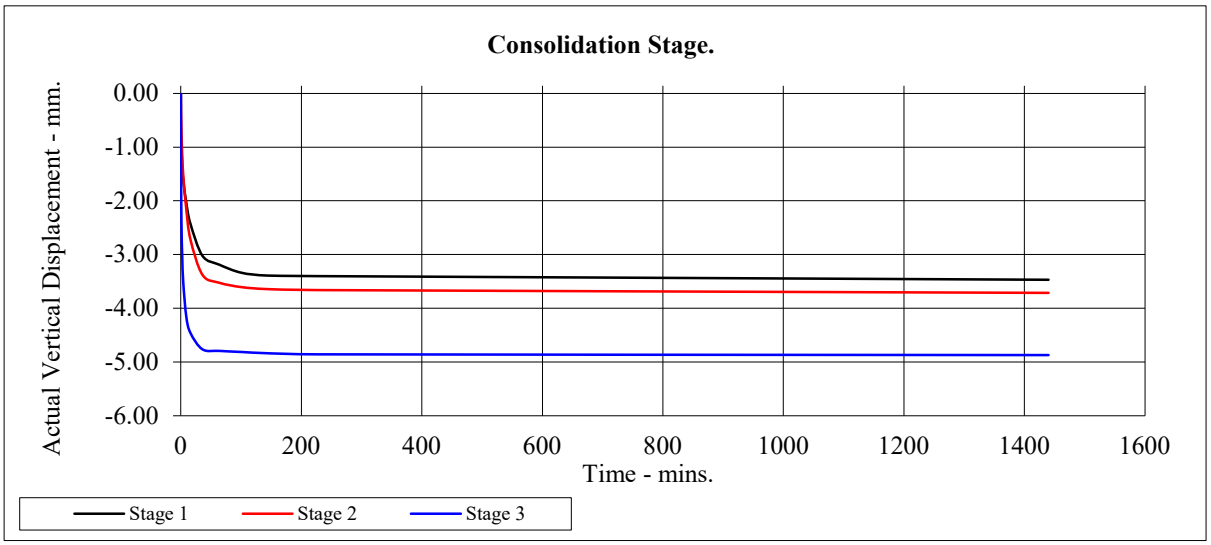


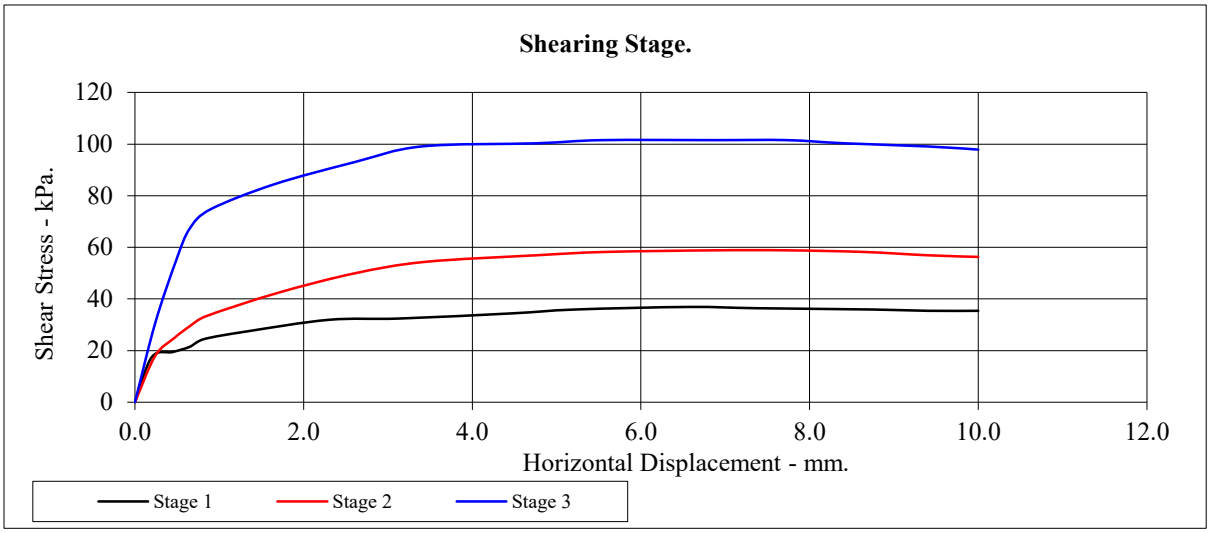
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4789 **Client Ref:** 19-0382

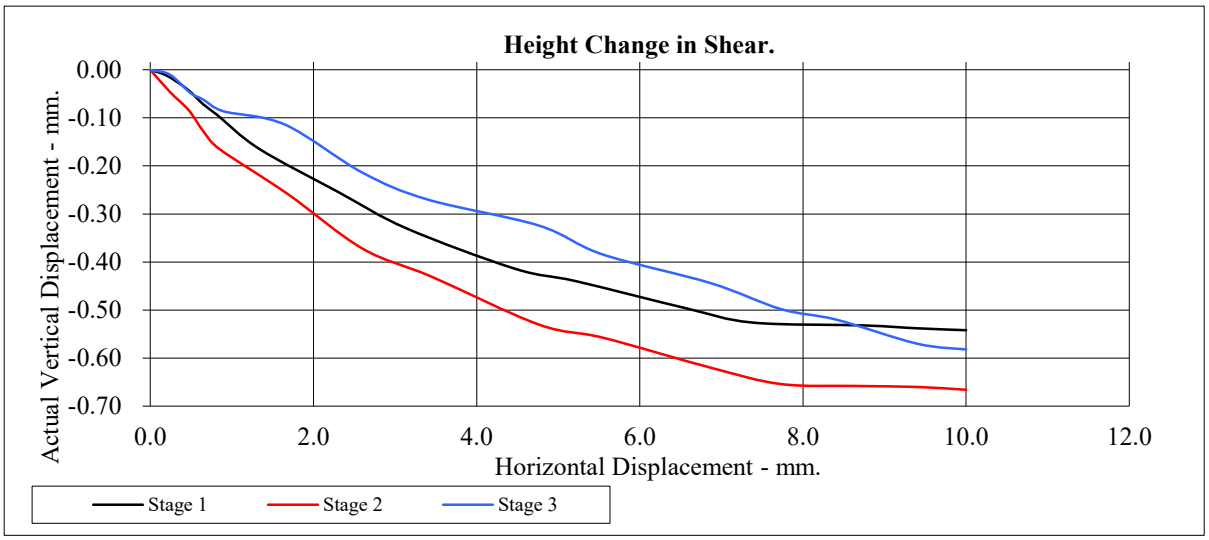
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH51**	Top Depth:	**5.00**
Sample Number:	**11**	Base Depth:	**6.00**





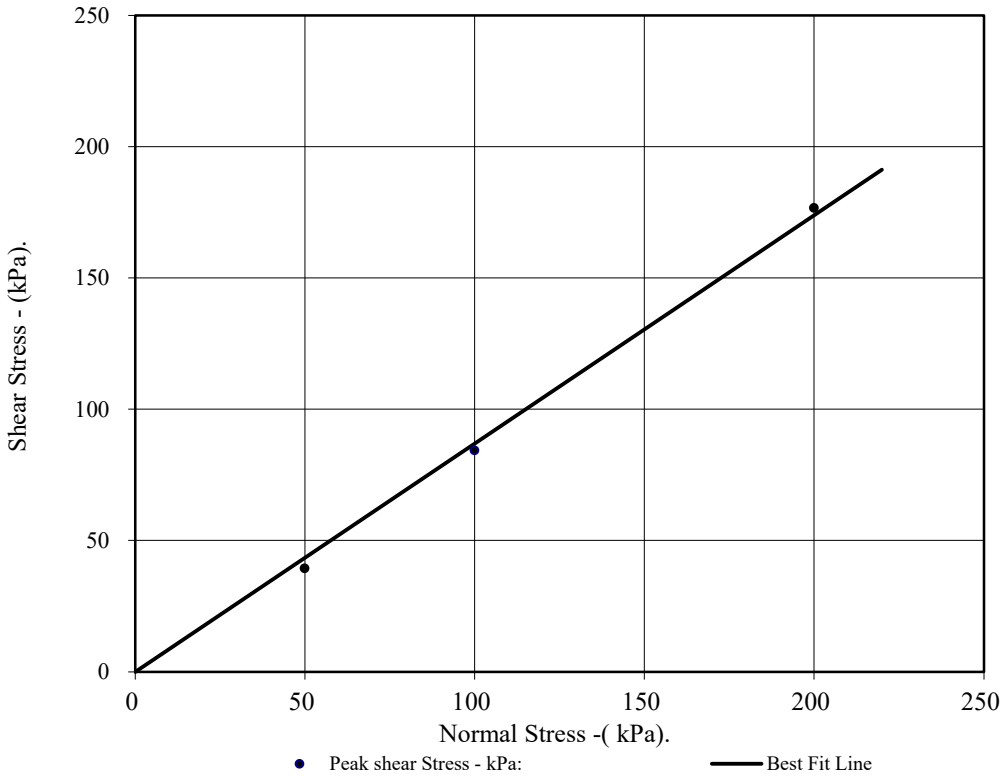


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**		Top Depth:	**1.50**
Sample Number:	**9**		Base Depth:	**2.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	5.9	5.9	5.9
Bulk Density - Mg/m3:	1.72	1.72	1.72
Dry Density - Mg/m3:	1.62	1.62	1.63
Voids Ratio:	0.631	0.632	0.629
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.73	19.42	18.67
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	3.61	9.01	6.01
Peak shear Stress - kPa:	39	84	177
Final Consolidated Conditions			
Moisture Content - %:	5.7	5.1	5.2
Bulk Density - Mg/m3:	1.75	1.78	1.85
Dry Density - Mg/m3:	1.65	1.69	1.76
Peak			
Angle of Shearing Resistance:(~~θ~~)	**41**		
Effective Cohesion - kPa:	**0**		



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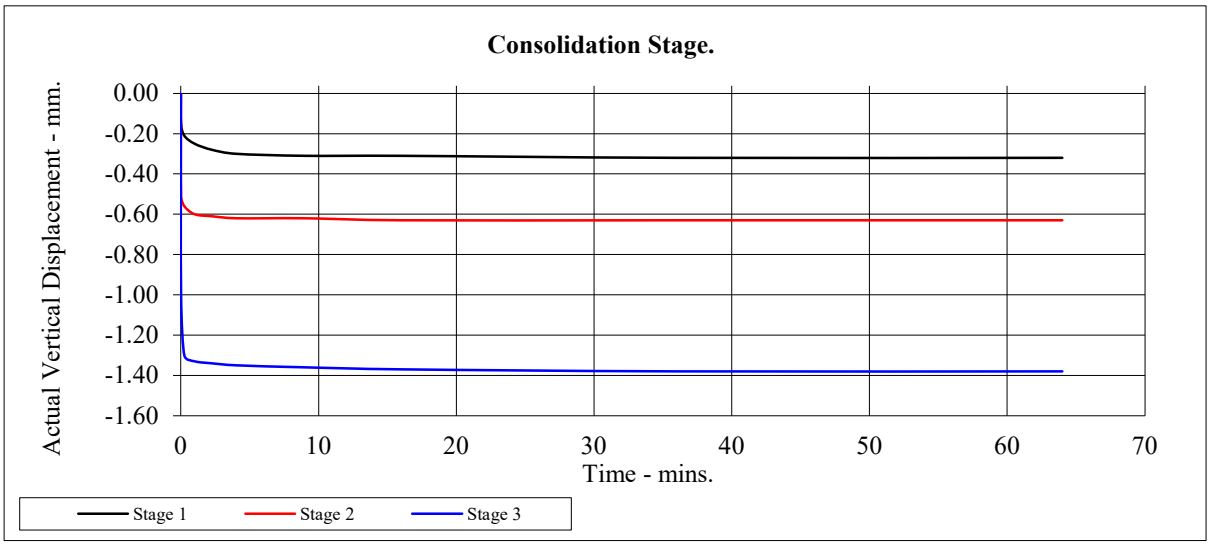
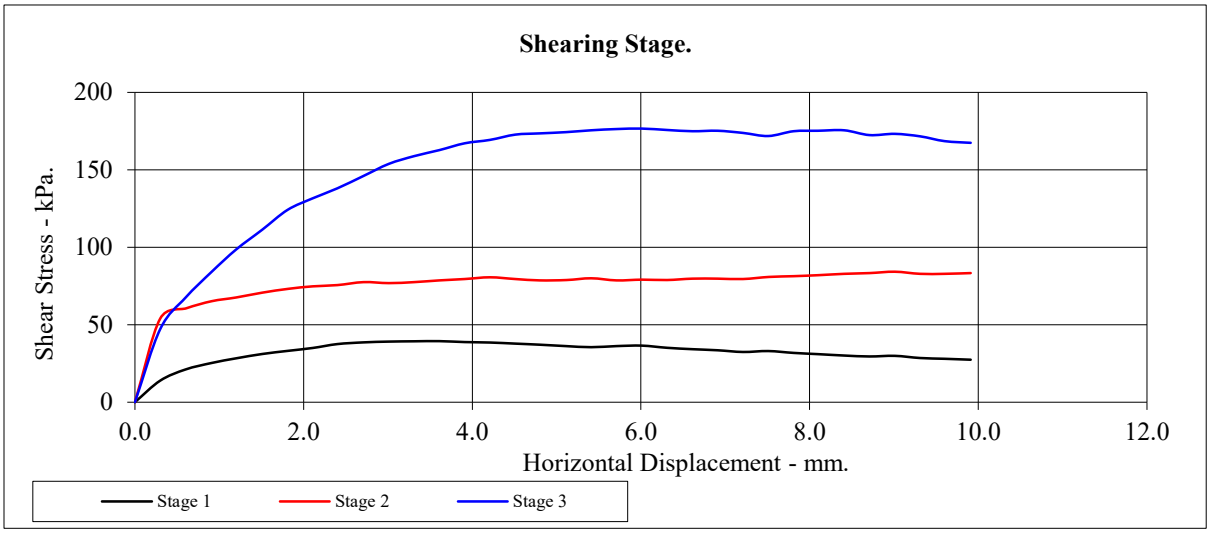
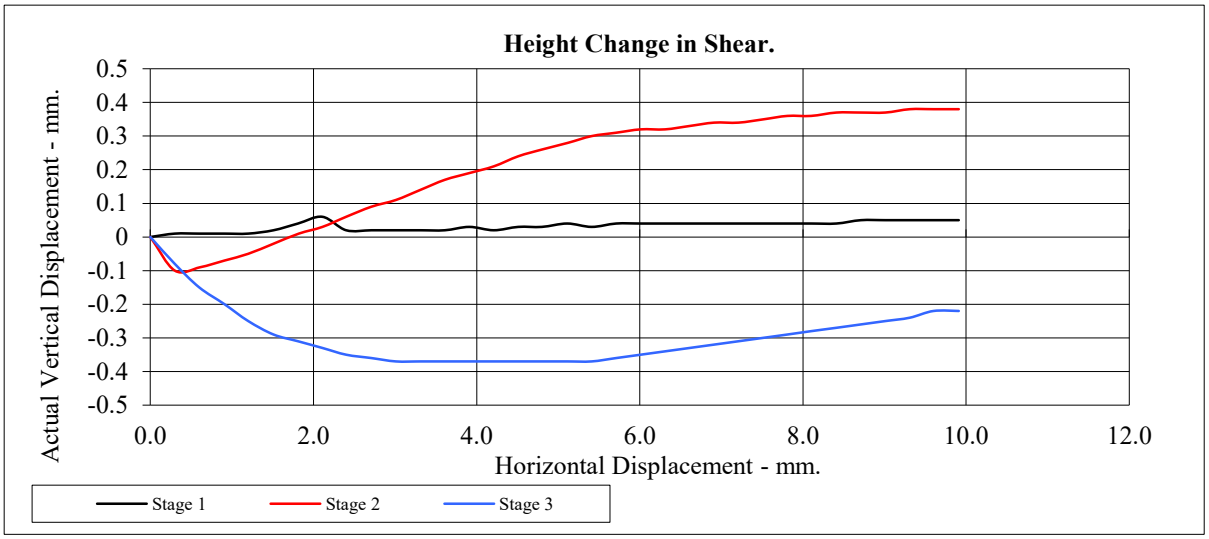
BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**	Top Depth:	**1.50**
Sample Number:	**9**	Base Depth:	**2.50**







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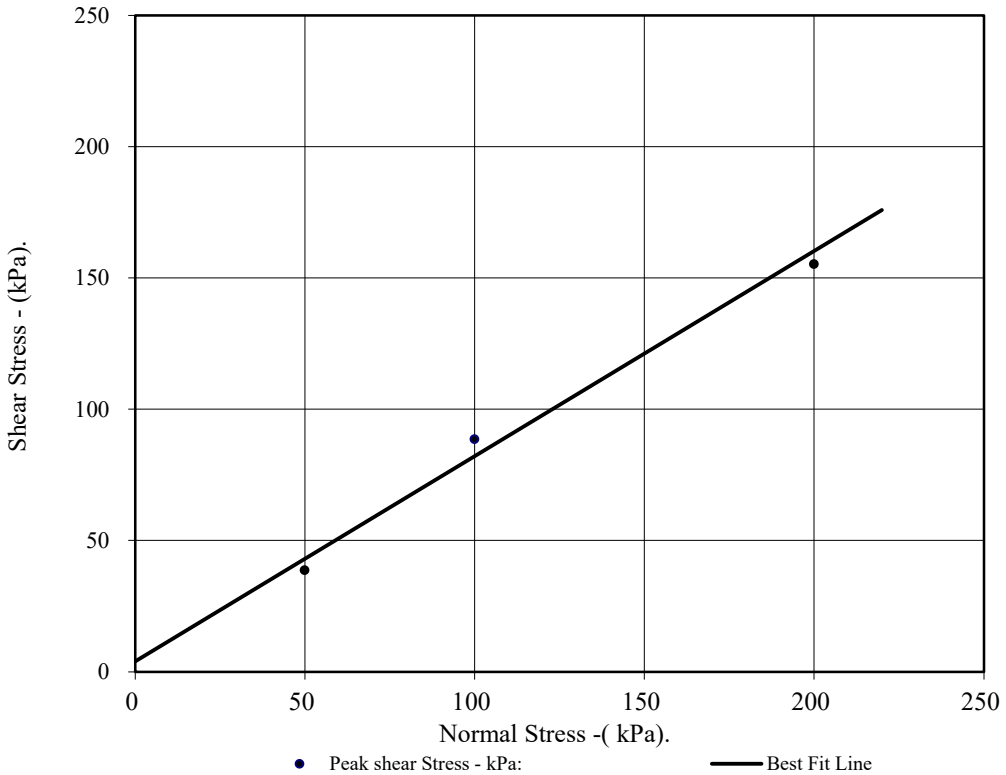
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**		Top Depth:	**4.50**
Sample Number:	**15**		Base Depth:	**5.50**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions.**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	4.9	4.9	4.9
Bulk Density - Mg/m3:	1.77	1.77	1.77
Dry Density - Mg/m3:	1.68	1.68	1.69
Voids Ratio:	0.574	0.575	0.572
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	19.89	19.50	19.11
Shearing Stage			
Rate of Strain - mm/min	0.60	0.60	0.60
Displacement at peak shear stress - mm	9.91	5.11	7.51
Peak shear Stress - kPa:	39	89	155
Final Consolidated Conditions			
Moisture Content - %:	3.6	3.5	3.5
Bulk Density - Mg/m3:	1.78	1.82	1.86
Dry Density - Mg/m3:	1.72	1.75	1.79
Peak			
Angle of Shearing Resistance:(~~θ~~)	**38**		
Effective Cohesion - kPa:	**4**		



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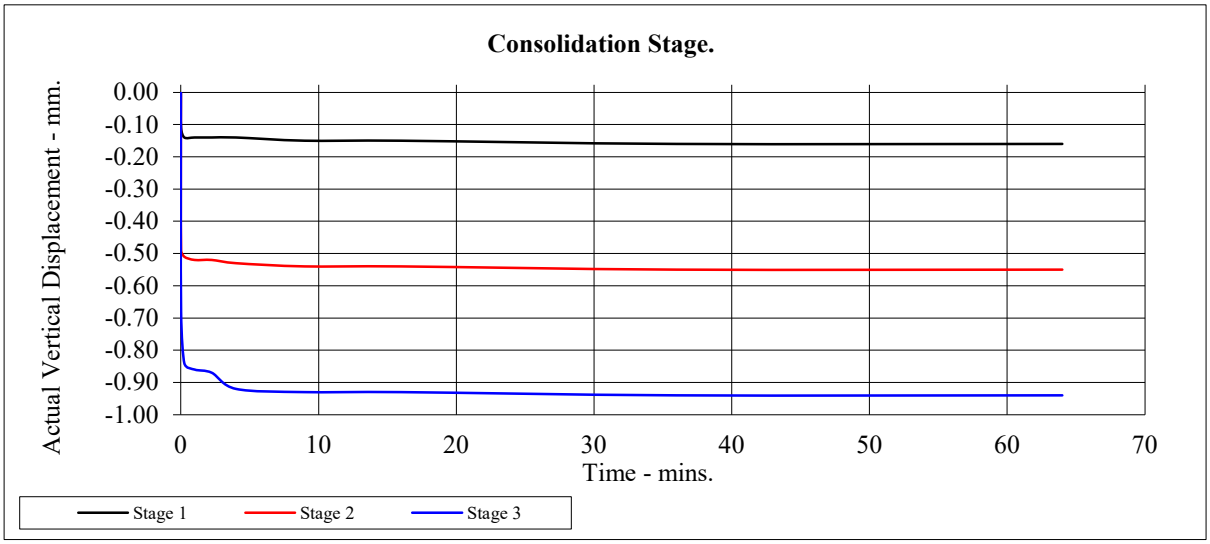
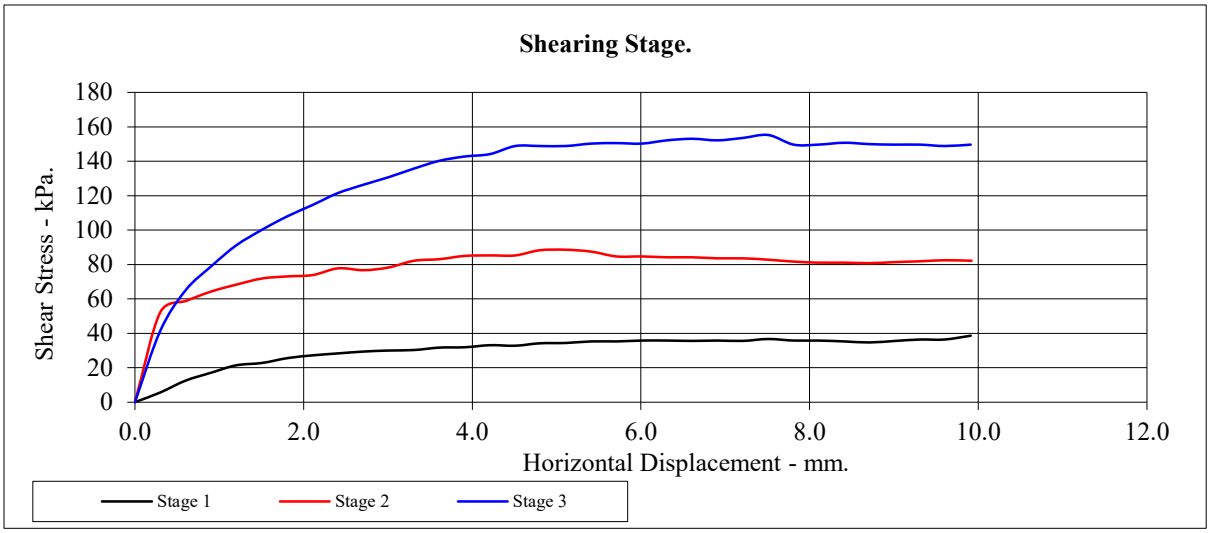
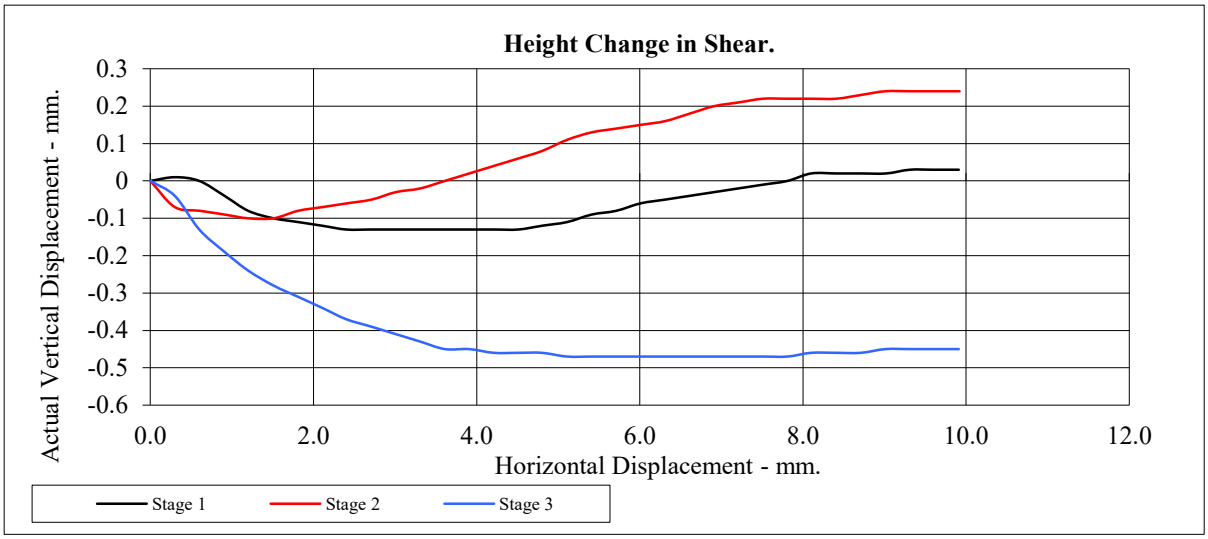
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**	Top Depth:	**4.50**
Sample Number:	**15**	Base Depth:	**5.50**





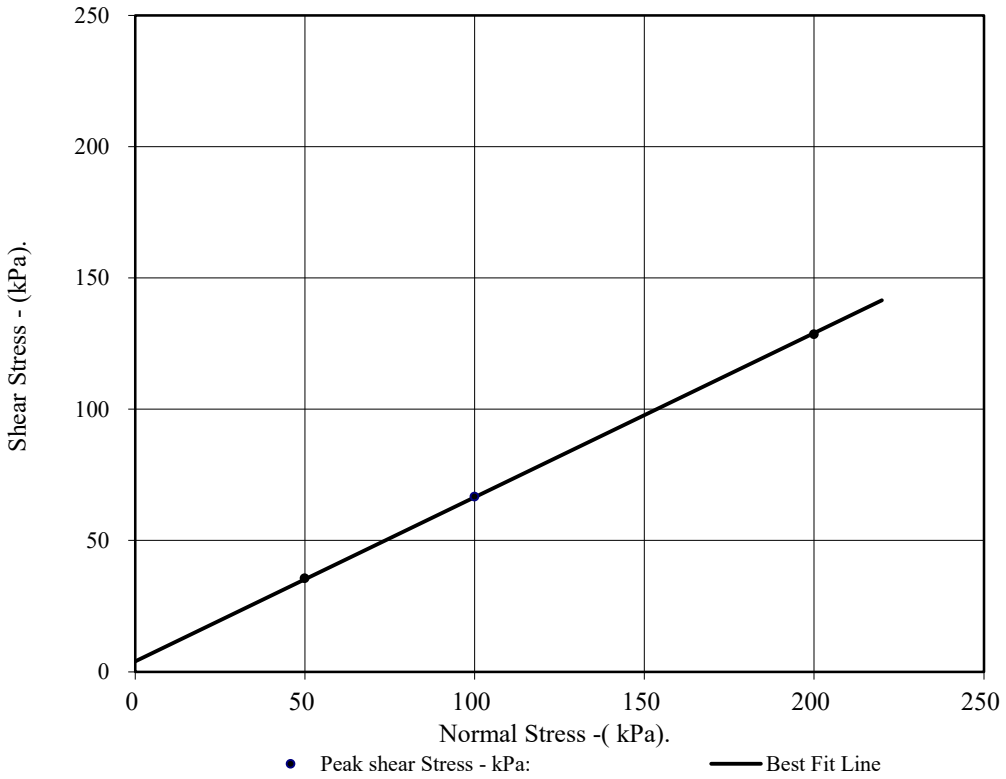


CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**		Top Depth:	**9.00**
Sample Number:	**23**		Base Depth:	**10.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	34	34	34
Bulk Density - Mg/m3:	1.98	1.99	1.98
Dry Density - Mg/m3:	1.48	1.49	1.48
Voids Ratio:	0.791	0.784	0.787
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	17.47	16.98	15.94
Shearing Stage			
Rate of Strain (mm/min)	0.040	0.040	0.040
Displacement at peak shear stress (mm)	6.70	7.23	8.34
Peak shear Stress - kPa:	36	67	129
Final Consolidated Conditions			
Moisture Content - %:	29	27	24
Bulk Density - Mg/m3:	2.28	2.35	2.49
Dry Density - Mg/m3:	1.76	1.85	2.01
Peak			
Angle of Shearing Resistance:(~~θ~~)	**32**		
Effective Cohesion - kPa:	**4**		

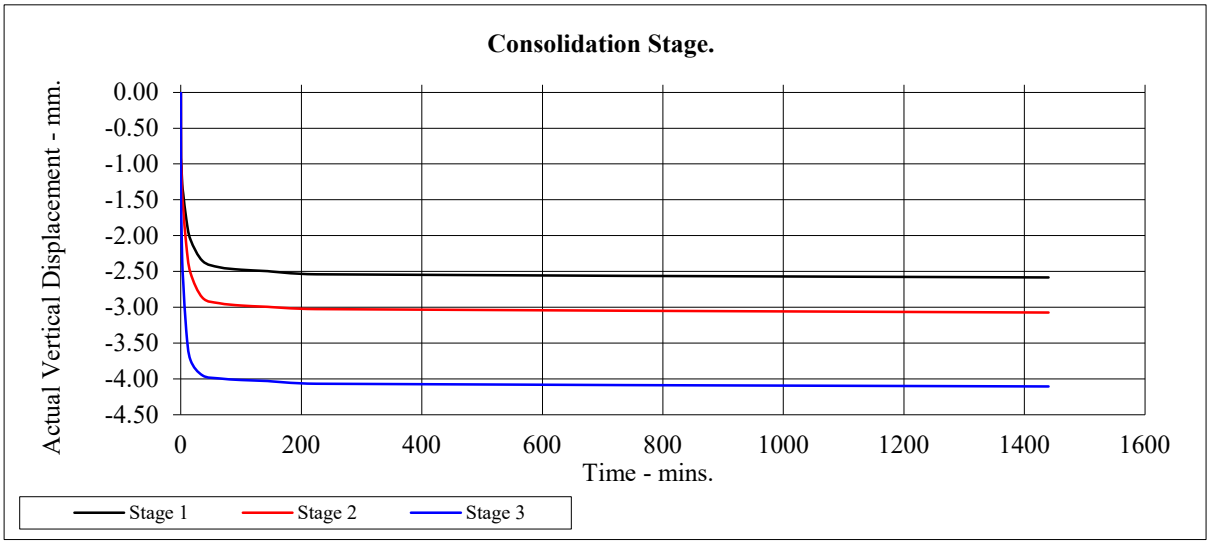


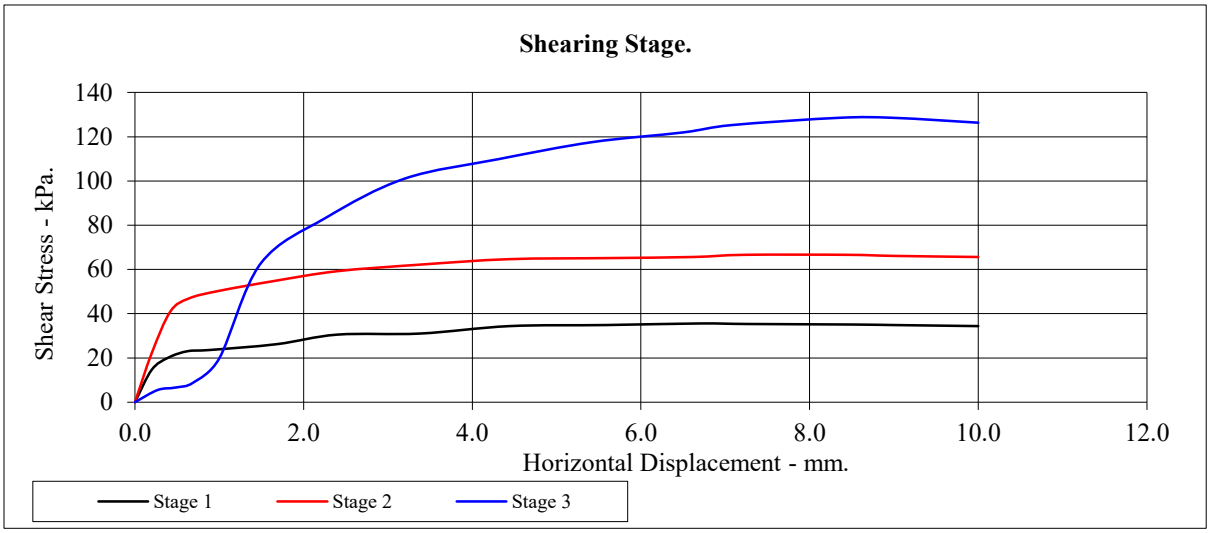
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4789 **Client Ref:** 19-0382

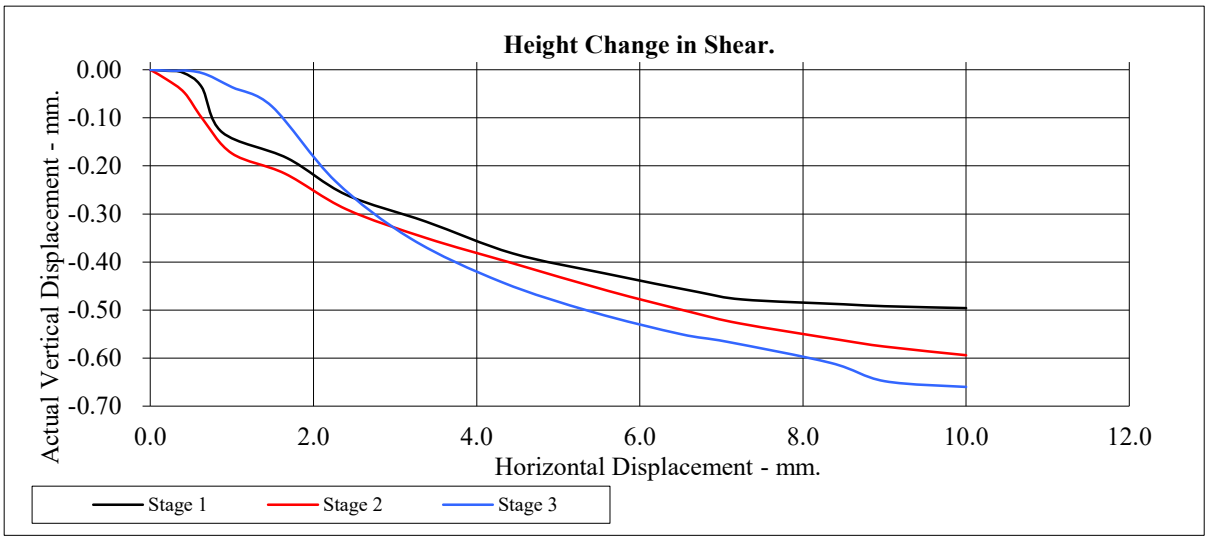
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**	Top Depth:	**9.00**
Sample Number:	**23**	Base Depth:	**10.00**







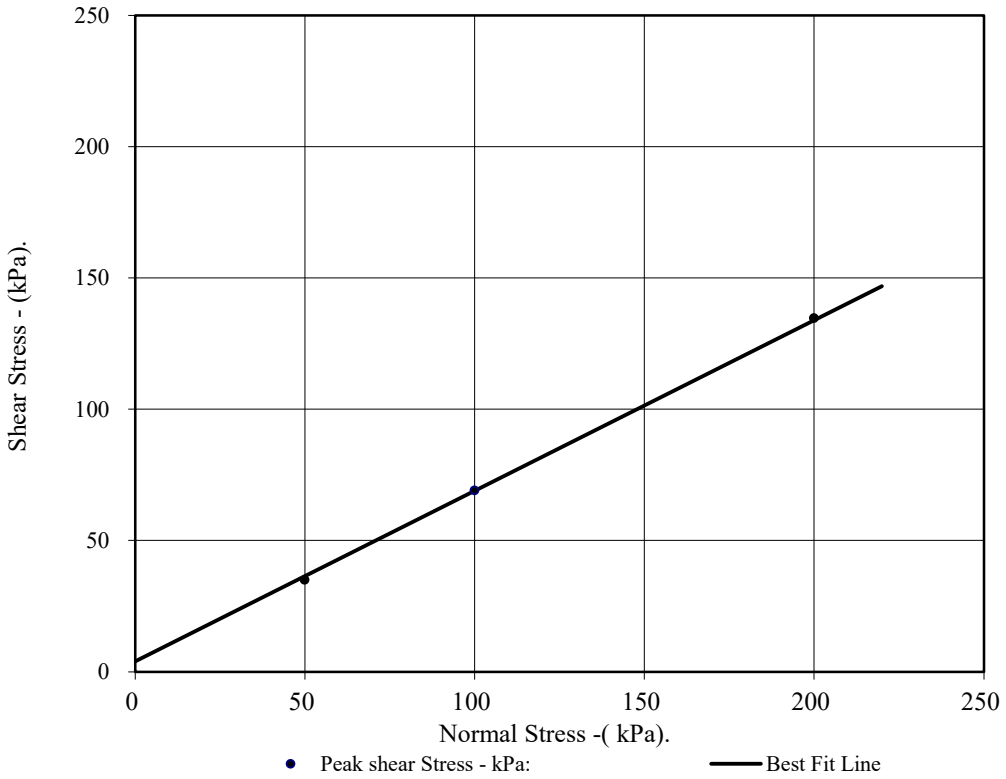
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No: PSL19/4789** **Client Ref: 19-0382**

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**		Top Depth:	**13.00**
Sample Number:	**30**		Base Depth:	**14.00**
Sample Conditions:	Dry		Sample Type	**B**
Particle Density - Mg/m3:	2.65	Assumed	**Remarks:**	
Sample Preparation:	Material tested passing 2mm sieve Remoulded using hand tamped effort			
Sample Description:	**See summary of soil descriptions**			

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	20.05	20.05	20.05
Length - mm:	59.97	59.97	59.97
Moisture Content - %:	26	26	26
Bulk Density - Mg/m3:	1.96	1.97	1.97
Dry Density - Mg/m3:	1.56	1.57	1.57
Voids Ratio:	0.703	0.689	0.691
Normal Pressure- kPa	50	100	200
Consolidation Stage			
Consolidated Height - mm:	18.78	17.86	16.99
Shearing Stage			
Rate of Strain (mm/min)	0.044	0.044	0.044
Displacement at peak shear stress (mm)	5.38	9.40	7.43
Peak shear Stress - kPa:	35	69	135
Final Consolidated Conditions			
Moisture Content - %:	22	21	20
Bulk Density - Mg/m3:	2.09	2.21	2.32
Dry Density - Mg/m3:	1.71	1.83	1.94
Peak			
Angle of Shearing Resistance:(~~θ~~)	**33**		
Effective Cohesion - kPa:	**4**		

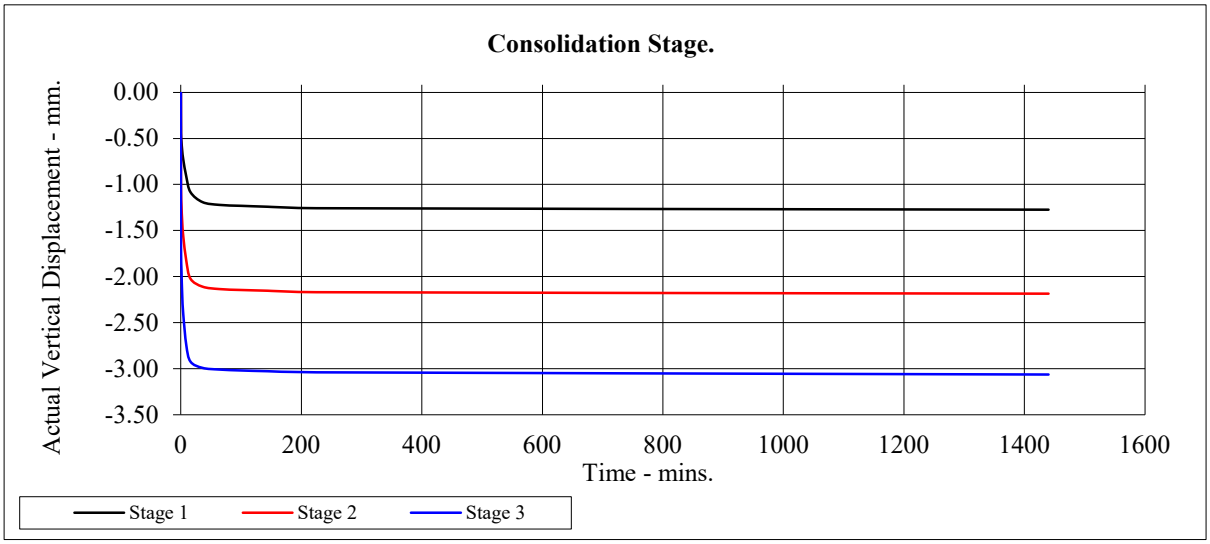


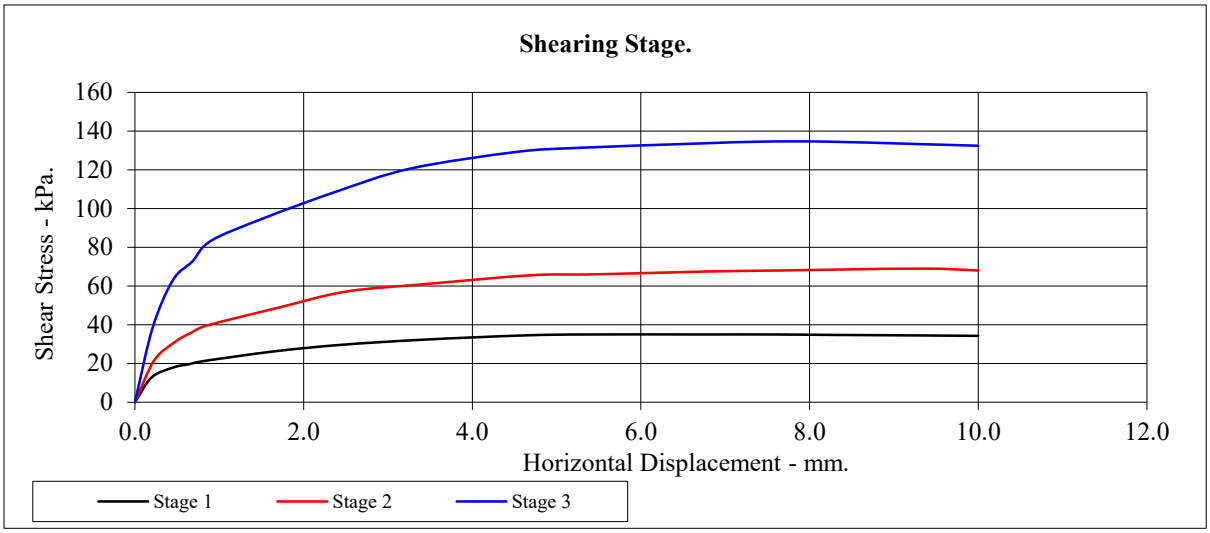
UKAS TESTING 4043	PSL Professional Soils Laboratory	**Stornoway Deep Water Port**	**Contract No:** PSL19/4789 **Client Ref:** 19-0382

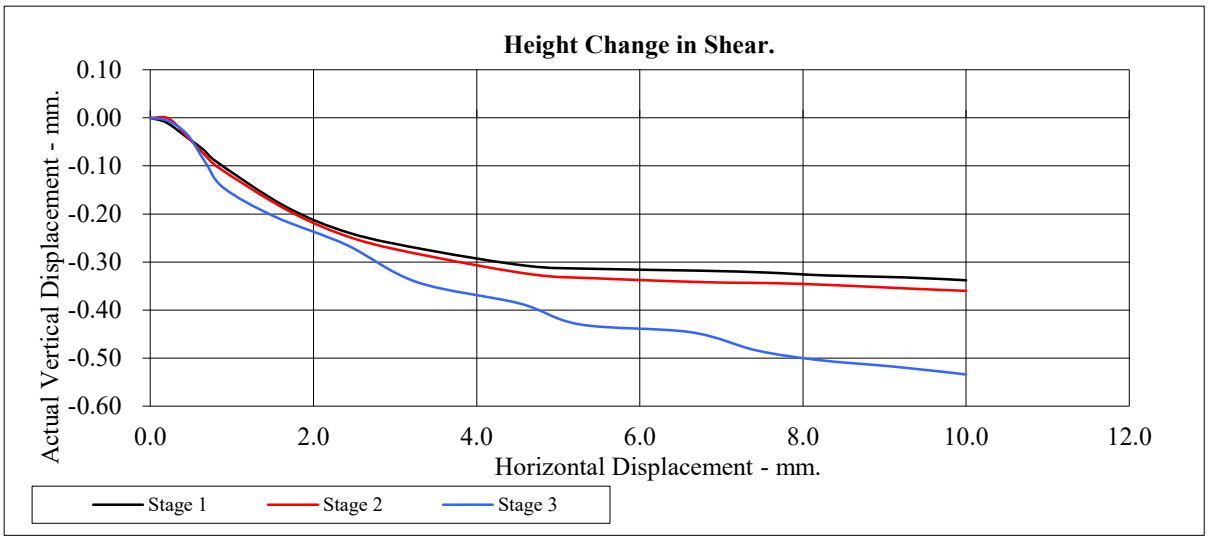
CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	**BH52**	Top Depth:	**13.00**
Sample Number:	**30**	Base Depth:	**14.00**



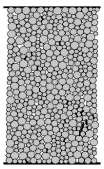




Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth	19.50-20.00m B23		
	Description	See summary of soil descriptions.		
	Type	Recompacted using hand tamped method.		
	Initial Sample Length	L_0	(mm)	200.4
	Initial Sample Diameter	D_0	(mm)	97.2
	Initial Sample Weight	W_0	(gr)	3209.2
	Initial Bulk Density	ρ_0	(Mg/m3)	2.16
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	0.600		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	24		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.73		
Initial Voids Ratio	e_i	.	0.529		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	17		
Final Dry Density	ρ_{df}	(Mg/m3)	1.89		
Final Voids Ratio	e_f	.	0.403		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	8.65	19.99
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	71.2	117.5	222.9
Minor Stress At Failure	σ_3'	(kPa)	21.0	48.0	112.0
Major Stress At Failure	σ_1'	(kPa)	92.2	165.5	334.9
Principal Stress At Failure	σ_1'/σ_3'		4.389	3.447	2.991

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH43 19.50-20.00m B73
		Test Date	12/08/2019
		Borehole	BH43
Jobfile	Stornoway Deep Water Port	Sample	19.50-20.00m B73
Client	Causeway Geotech Ltd	Depth	19.50-20.00m B23

UKAS TESTING 4043

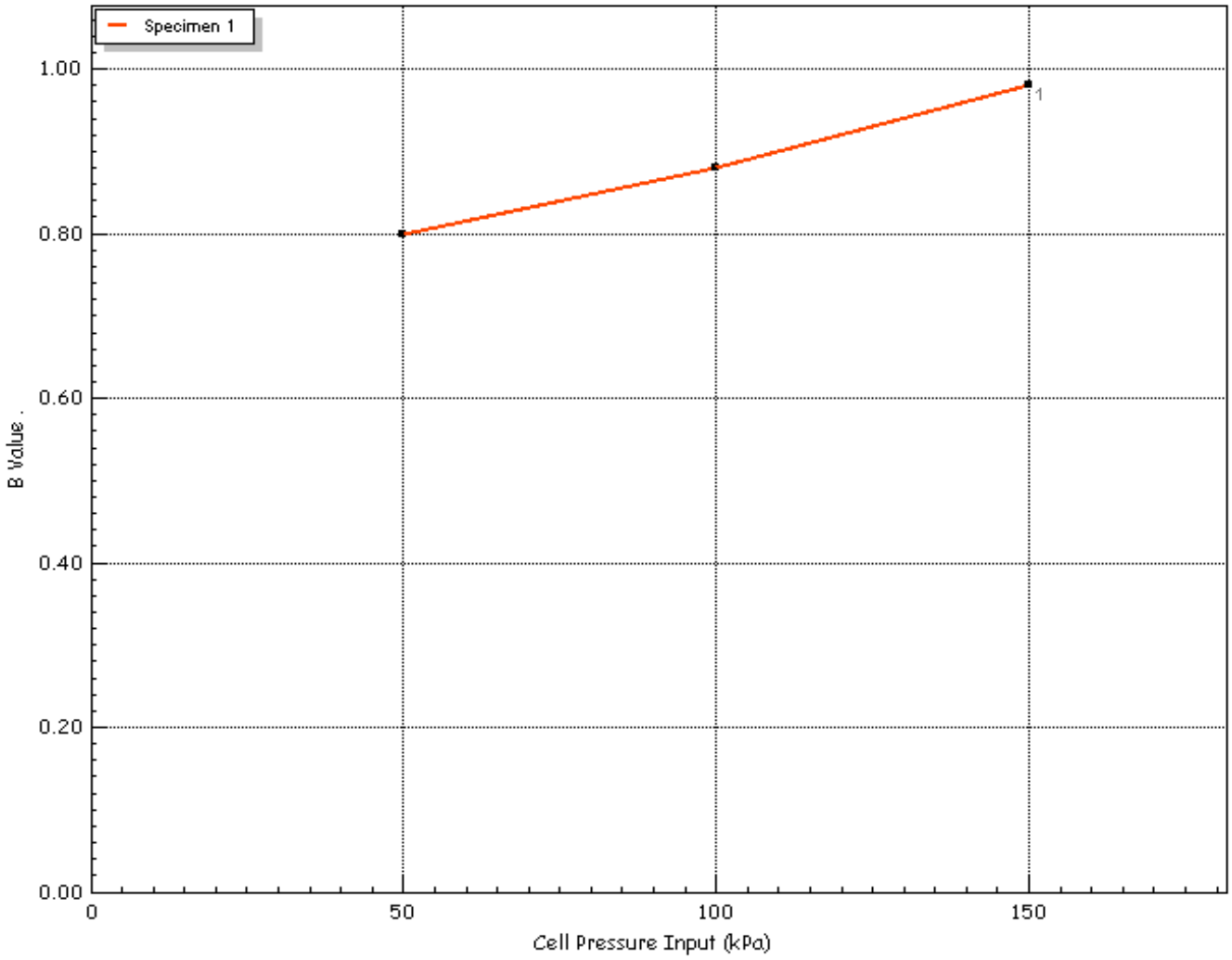
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	133
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH43 19.50-20.00m B73
		Test Date	12/08/2019
		Borehole	BH43
Jobfile	Stornoway Deep Water Port	Sample	19.50-20.00m B73
Client	Causeway Geotech Ltd	Depth	19.50-20.00m B23

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

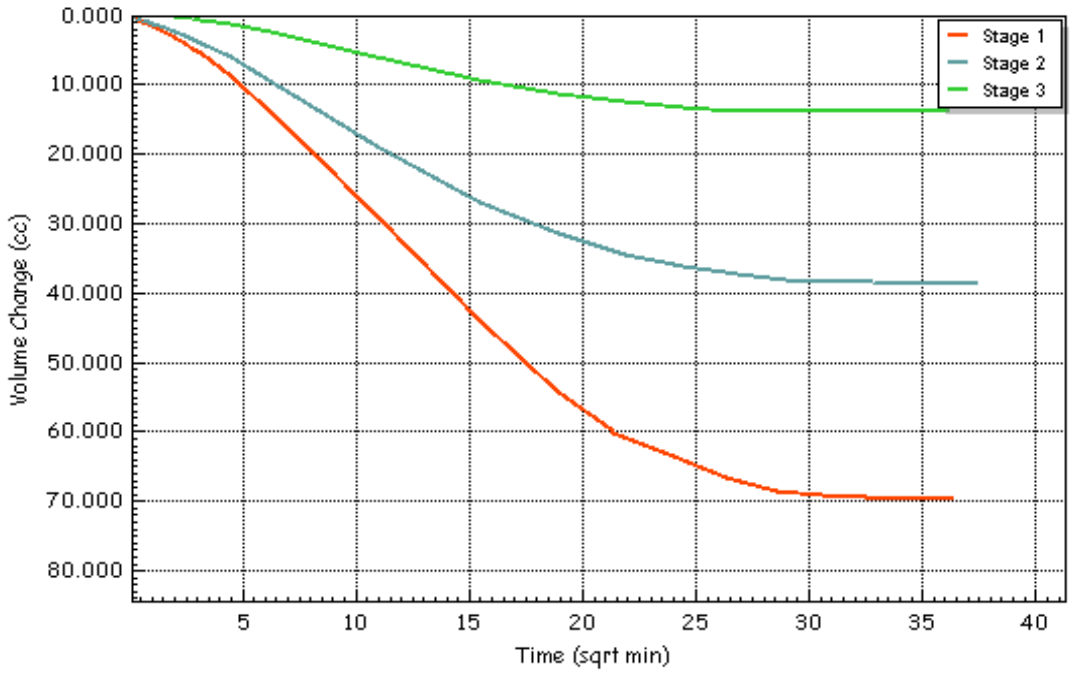
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	331	370	353
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	96.82	97.16	98.13
Volumetric Strain	ε_v%	(%)	4.68	7.28	8.21
Corrected Length	L_C	(mm)	197.3	186.8	171.0
Corrected Area	A_C	(cm2)	71.89	70.26	73.81
Corrected Volume	V_C	(cc)	1417.371	1378.749	1364.917
T100 Time to Failure	t_{100}	(min)	552.07	552.07	552.07
Consolidation	c_v	(m2/year)	0.353	0.353	0.353
Compressibility	m_v	(m2/MN)	1.541	1.066	1.567
Test Time	t_F	(h:m:s)	16:33:43	16:33:43	16:33:43
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00993	0.00940	0.00860

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH43 19.50-20.00m B73
		Test Date	12/08/2019
		Borehole	BH43
Jobfile	Stornoway Deep Water Port	Sample	19.50-20.00m B73
Client	Causeway Geotech Ltd	Depth	19.50-20.00m B23

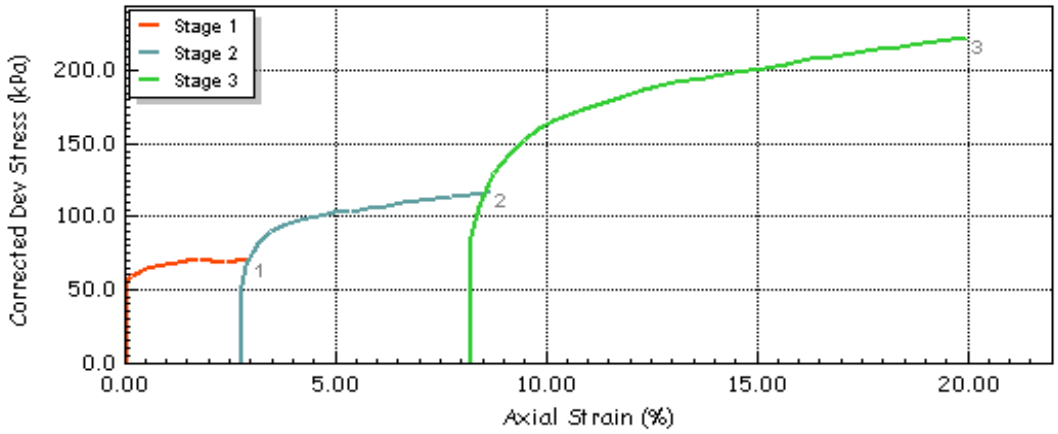
UKAS TESTING 4043

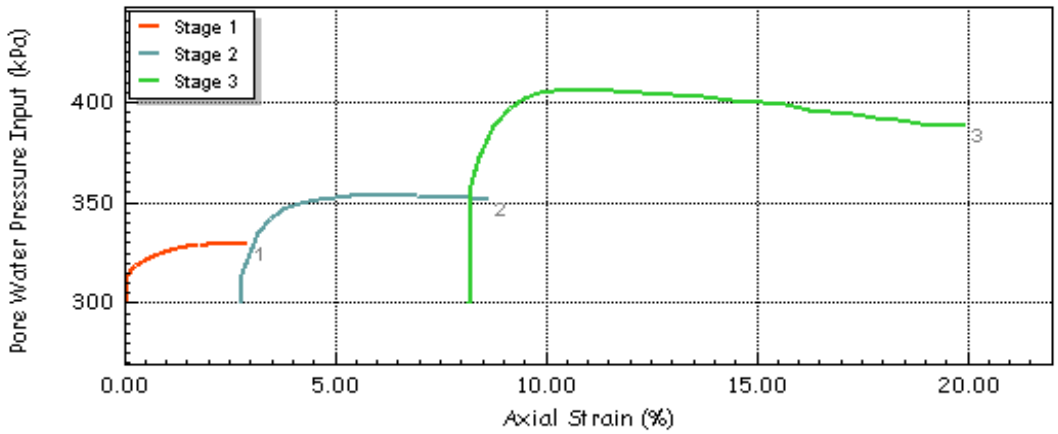
PSL Professional Soils Laboratory

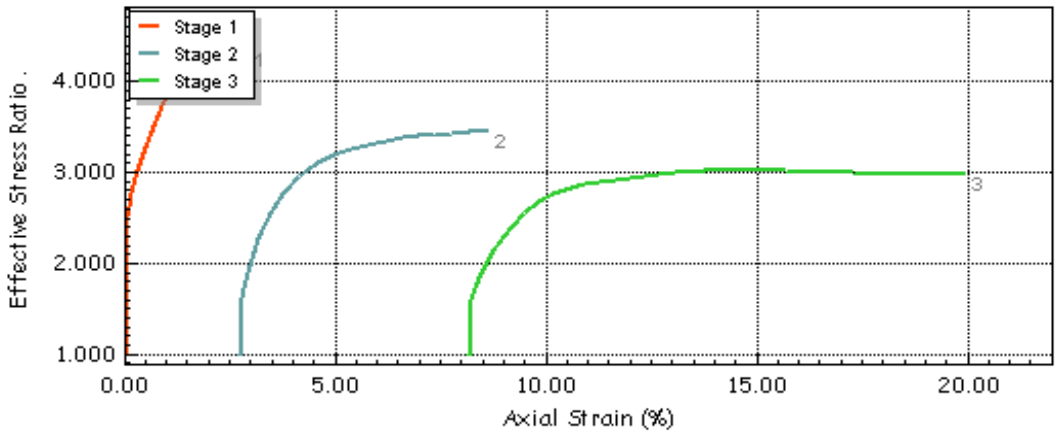
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH43 19.50-20.00m B73
		Test Date	12/08/2019
		Borehole	BH43
Jobfile	Stornoway Deep Water Port	Sample	19.50-20.00m B73
Client	Causeway Geotech Ltd	Depth	19.50-20.00m B23

UKAS TESTING 4043

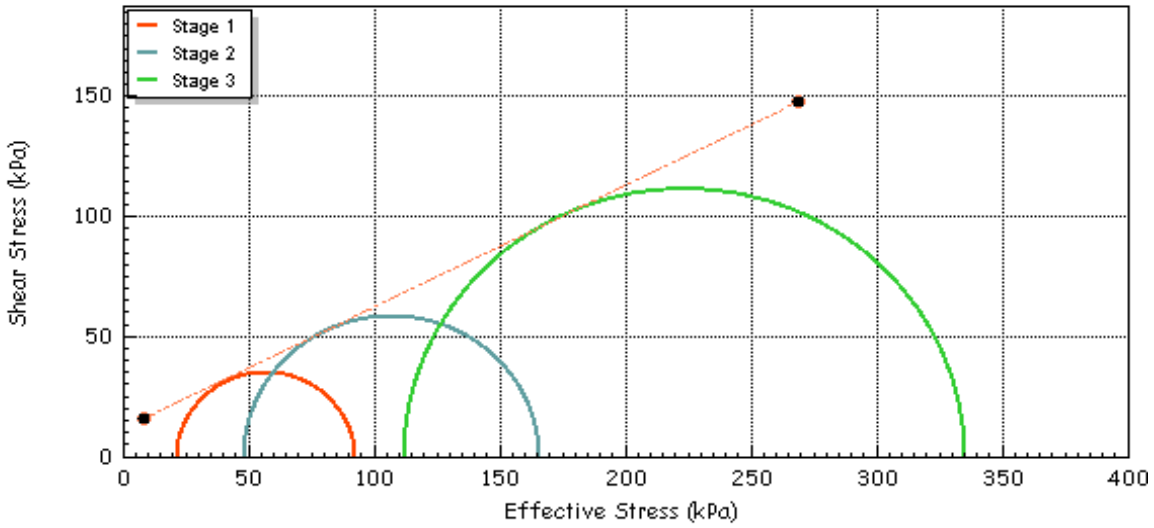
PSL Professional Soils Laboratory

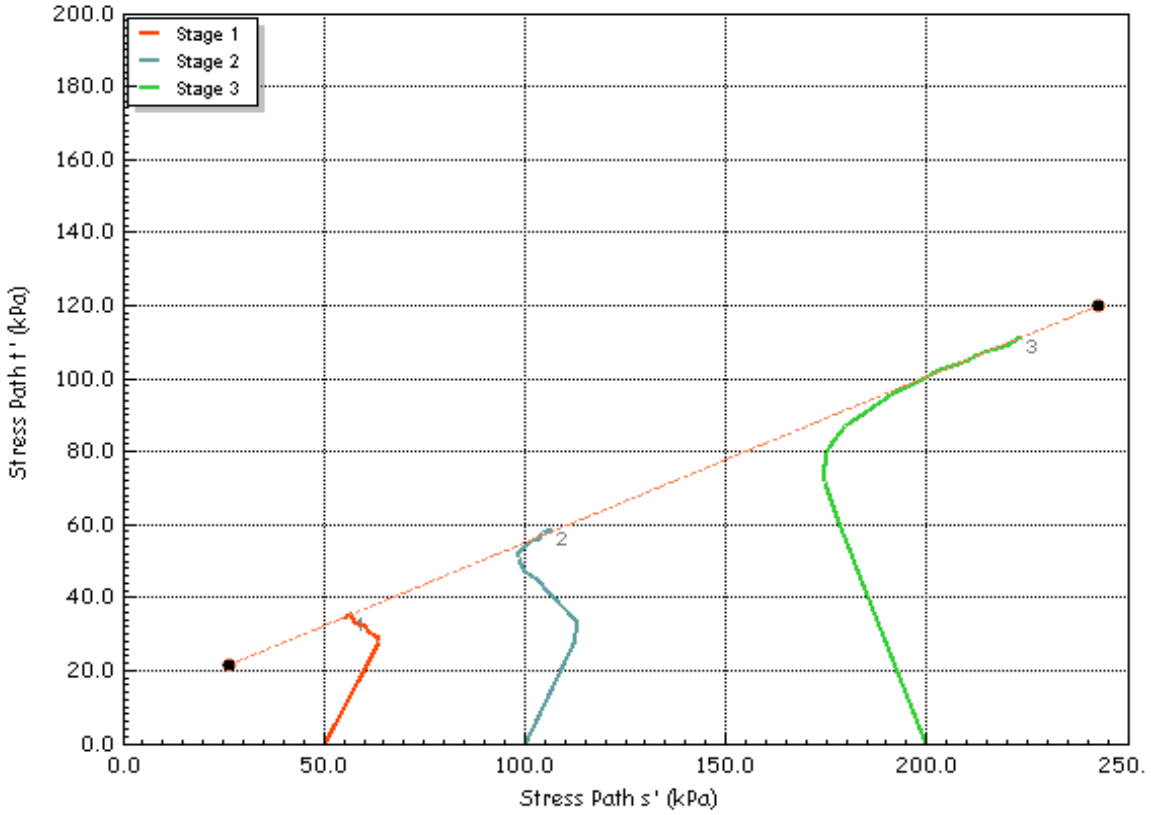
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	10.96	Effective Cohesion	c'	(kPa)	10.96
Effective Friction	ϕ'	(deg)	27.0	Effective Friction	ϕ'	(deg)	27.0





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH43 19.50-20.00m B73
		Test Date	12/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH43
Client	Causeway Geotech Ltd	Sample	19.50-20.00m B73
		Depth	19.50-20.00m B23

UKAS TESTING 4043

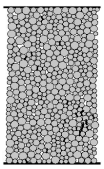
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			14.50-15.00m B60
Description			Brown slightly gravelly slightly sandy CLAY.
Type			Recompacted using had tamped method.
Initial Sample Length	L_0	(mm)	200.4
Initial Sample Diameter	D_0	(mm)	97.2
Initial Sample Weight	W_0	(gr)	3316.8
Initial Bulk Density	ρ_0	(Mg/m3)	2.23
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	350	400	500
Initial Back Pressure	U_{bi}	(kPa)	300	300	300
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 4		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	37		
Initial Dry Density	ρ_{di}	(Mg/m3)	1.63		
Initial Voids Ratio	e_i	.	0.628		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.97		

Final Conditions					
Final Moisture	ω_f	(%)	18		
Final Dry Density	ρ_{df}	(Mg/m3)	1.86		
Final Voids Ratio	e_f	.	0.428		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	4.40	8.82	12.38
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	81.0	131.7	209.2
Minor Stress At Failure	σ_3'	(kPa)	19.0	44.0	86.0
Major Stress At Failure	σ_1'	(kPa)	100.0	175.7	295.2
Principal Stress At Failure	σ_1'/σ_3'		5.261	3.994	3.432

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH45 14.50-15.00m B60
		Test Date	13/08/2019
		Borehole	BH45
Jobfile	Stornoway Deep Water Port	Sample	14.50-15.00m B60
Client	Causeway Geotech Ltd	Depth	14.50-15.00m B60

UKAS TESTING 4043

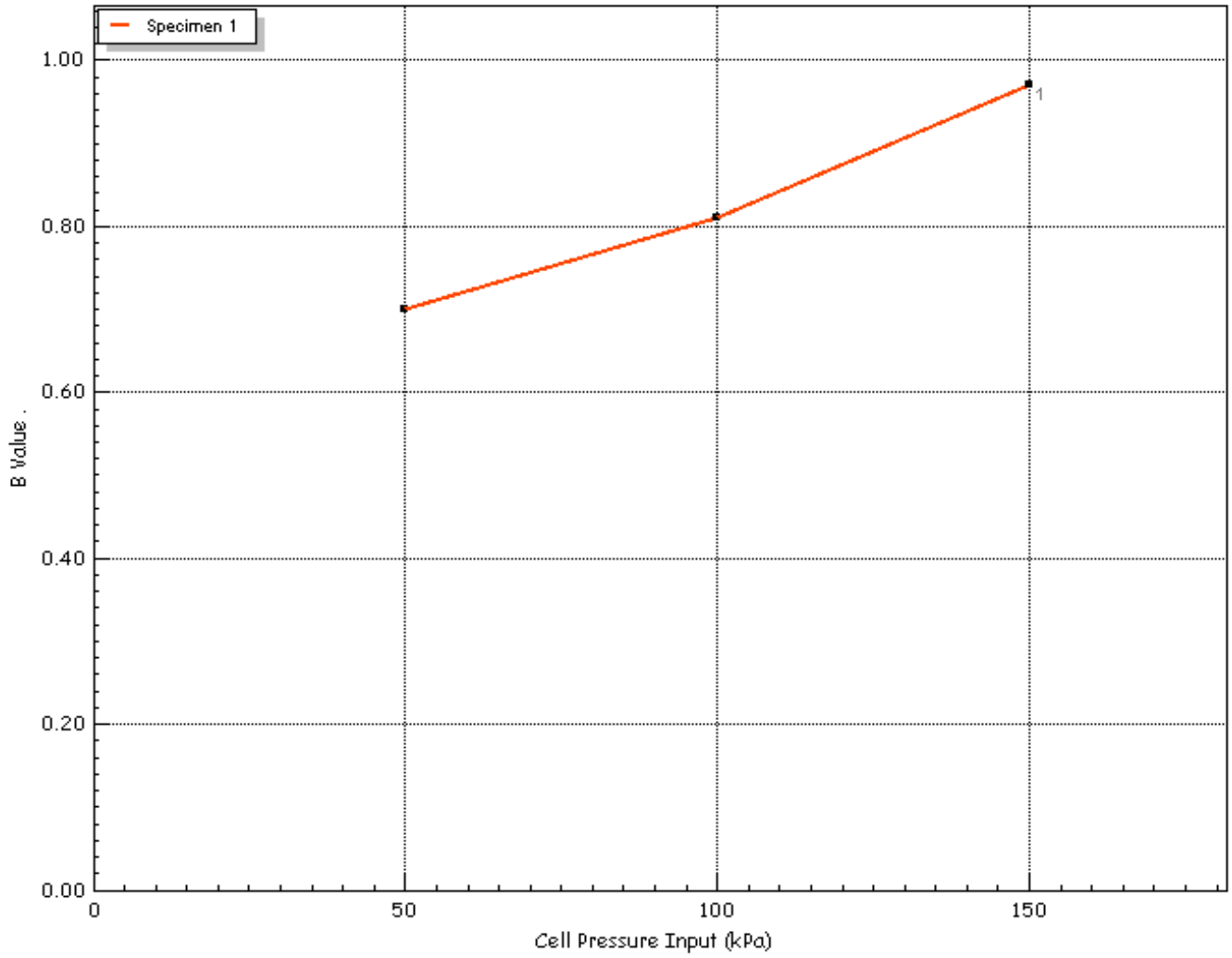
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	150
Pore Water Pressure Input	u pwp	(kPa)	144
B Value	B	.	0.97



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH45 14.50-15.00m B60
		Test Date	13/08/2019
		Borehole	BH45
Jobfile	Stornoway Deep Water Port	Sample	14.50-15.00m B60
Client	Causeway Geotech Ltd	Depth	14.50-15.00m B60

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

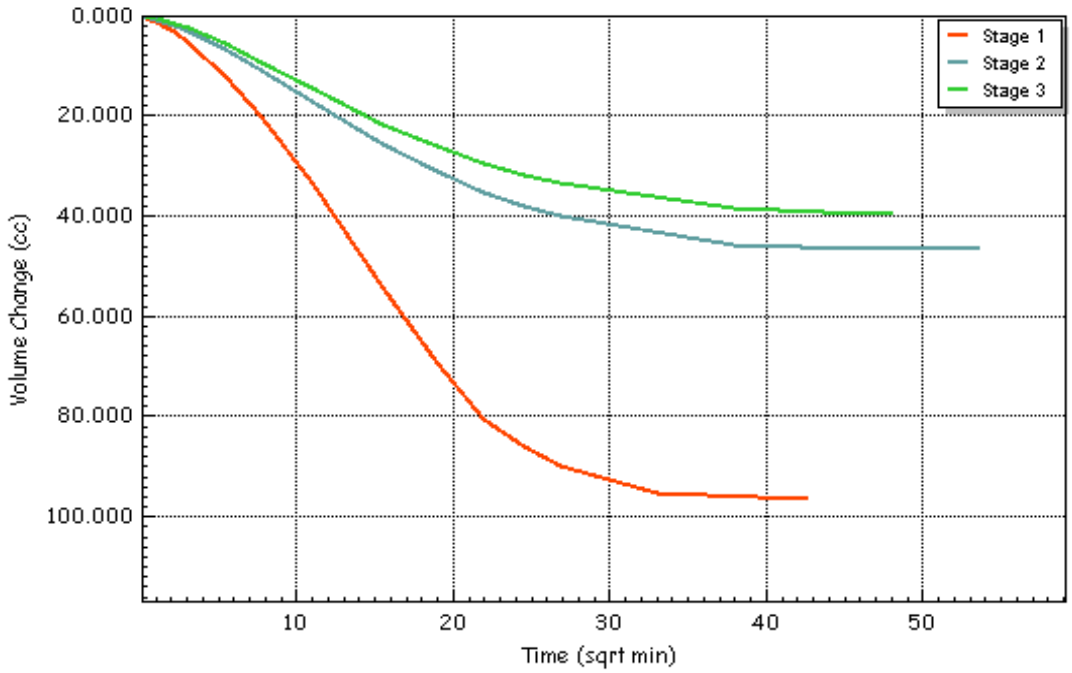
Consolidated Undrained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	350	400	500
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	343	378	454
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	95.77	97.44	99.35
Volumetric Strain	ε_v%	(%)	6.49	9.62	12.29
Corrected Length	L_C	(mm)	196.1	181.4	165.6
Corrected Area	A_C	(cm2)	70.99	69.10	70.78
Corrected Volume	V_C	(cc)	1390.557	1343.960	1304.299
T100 Time to Failure	t_{100}	(min)	629.46	629.46	629.46
Consolidation	c_V	(m2/year)	0.310	0.310	0.310
Compressibility	m_V	(m2/MN)	1.590	1.263	0.805
Test Time	t_F	(h:m:s)	18:53:01	18:53:01	18:53:01
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00865	0.00801	0.00731

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH45 14.50-15.00m B60
		Test Date	13/08/2019
		Borehole	BH45
Jobfile	Stornoway Deep Water Port	Sample	14.50-15.00m B60
Client	Causeway Geotech Ltd	Depth	14.50-15.00m B60

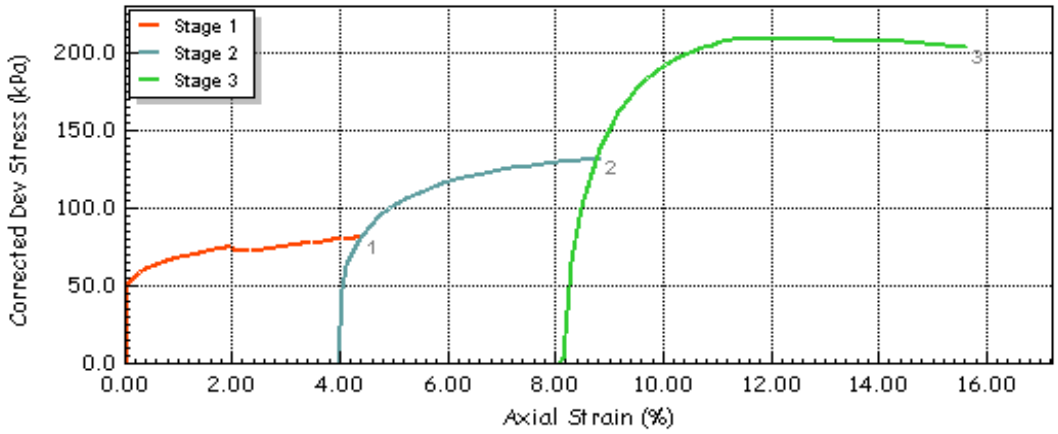
UKAS TESTING 4043

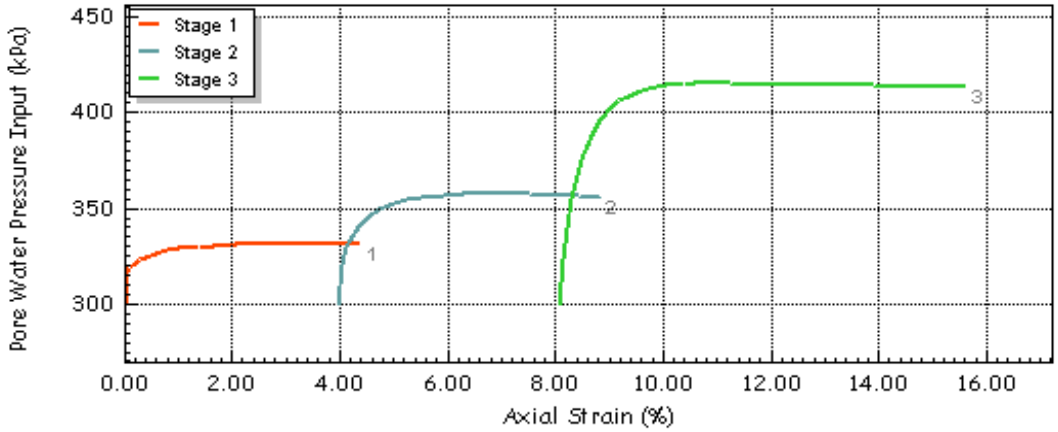
PSL Professional Soils Laboratory

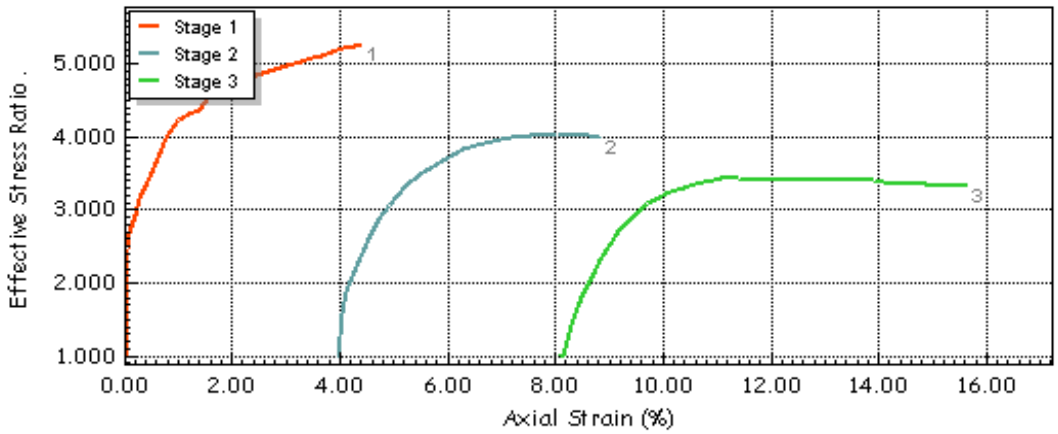
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







UKAS TESTING 4043	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH45 14.50-15.00m B60
			Test Date	13/08/2019
	Jobfile	Stornoway Deep Water Port	Borehole	BH45
	Client	Causeway Geotech Ltd	Sample	14.50-15.00m B60
			Depth	14.50-15.00m B60

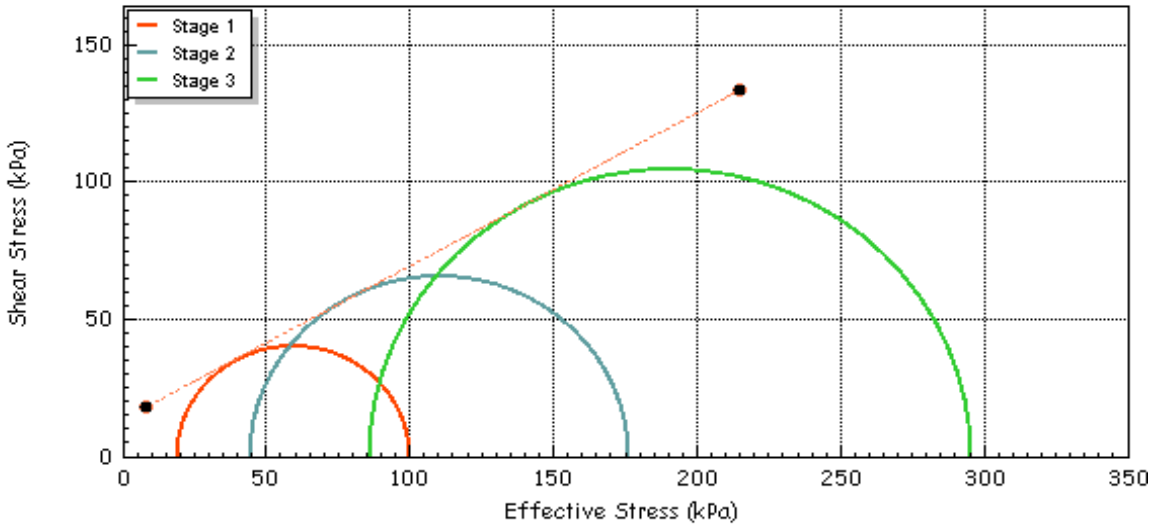
PSL Professional Soils Laboratory

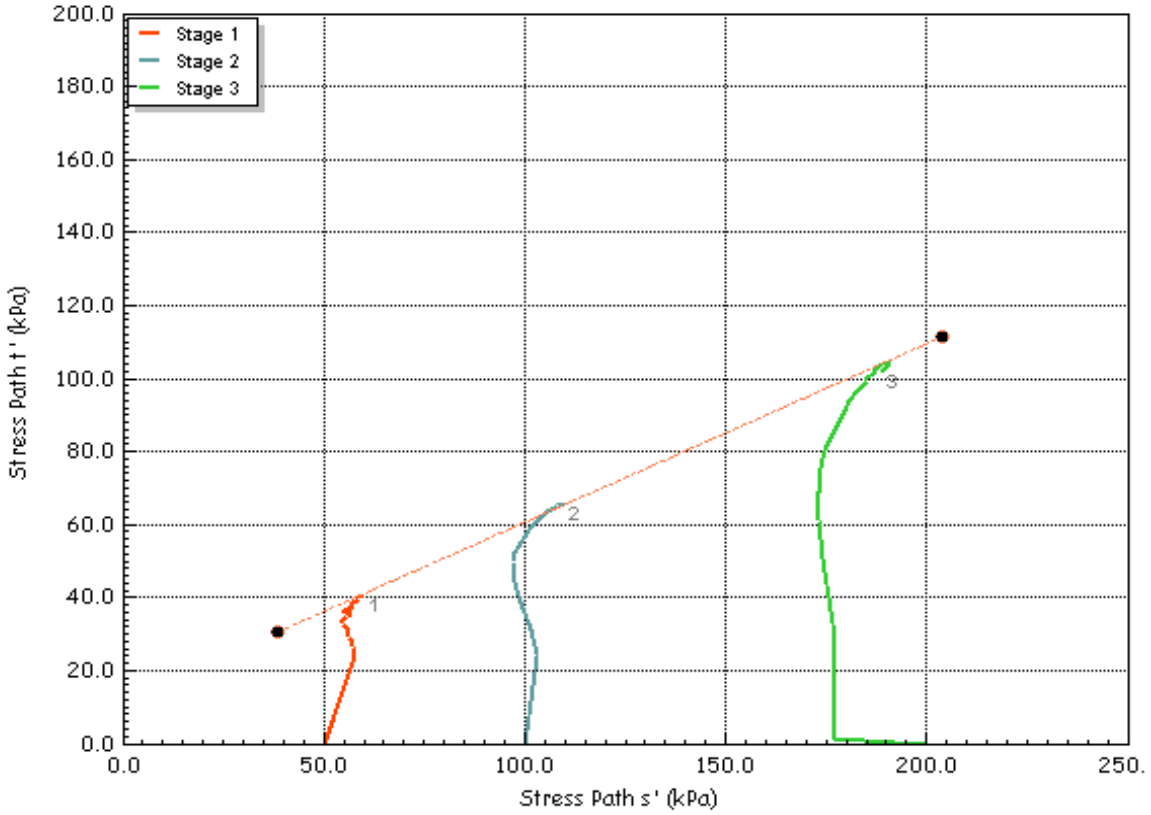
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	13.60	Effective Cohesion	c'	(kPa)	13.60
Effective Friction	ϕ'	(deg)	29.2	Effective Friction	ϕ'	(deg)	29.2





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH45 14.50-15.00m B60
		Test Date	13/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH45
Client	Causeway Geotech Ltd	Sample	14.50-15.00m B60
		Depth	14.50-15.00m B60

UKAS TESTING 4043

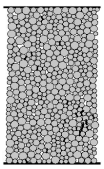
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			22.00-22.50m B75
Description			See summary of soil descriptions.
Type			Recompacted using 2.5kg effort.
Initial Sample Length	L_0	(mm)	200.0
Initial Sample Diameter	D_0	(mm)	100.7
Initial Sample Weight	W_0	(gr)	4115.0
Initial Bulk Density	ρ_0	(Mg/m3)	2.58
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_{3i}	(kPa)	700	750	850
Initial Back Pressure	U_{bi}	(kPa)	650	650	650
Membrane Thickness	m_b	(mm)	1.200		
Displacement Input	L_{IP}	(mm)	CH 2		
Load Input	N_{IP}	(N)	CH 1		
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3		
Sample Volume	V	(cc)	CH 2		
Initial Moisture	ω_i	(%)	13		
Initial Dry Density	ρ_{di}	(Mg/m3)	2.28		
Initial Voids Ratio	e_i	.	0.162		
Initial Degree of Saturation	S_i	(%)	100		
B Value	B	.	0.98		

Final Conditions					
Final Moisture	ω_f	(%)	6.40		
Final Dry Density	ρ_{df}	(Mg/m3)	2.34		
Final Voids Ratio	e_f	.	0.131		
Final Degree of Saturation	S_f	(%)	100.0		
			Stage 1	2	3
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress
Strain At Failure	ε_f	(%)	1.95	4.68	14.66
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	280.0	788.8	2443.2
Minor Stress At Failure	σ_3'	(kPa)	55.0	176.0	607.0
Major Stress At Failure	σ_1'	(kPa)	335.0	964.8	3050.2
Principal Stress At Failure	σ_1'/σ_3'		6.091	5.482	5.025

Notes

Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH49 22.00-22.50m B75
		Test Date	14/08/2019
		Borehole	BH49
Jobfile	Stornoway Deep Water Port	Sample	22.00-22.50m B75
Client	Causeway Geotech Ltd	Depth	22.00-22.50m B75

UKAS TESTING 4043

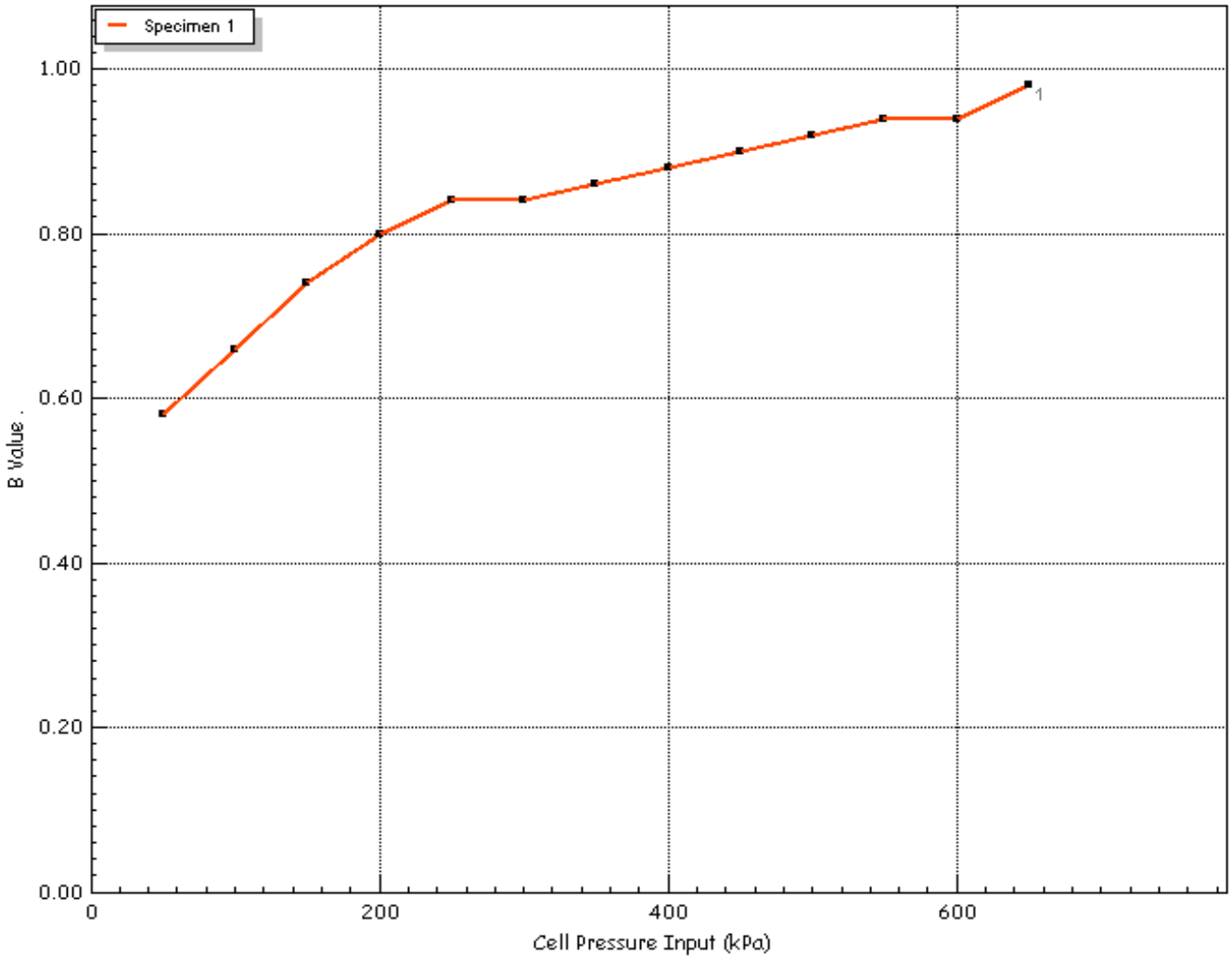
PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	650
Pore Water Pressure Input	u pwp	(kPa)	629
B Value	B	.	0.98



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH49 22.00-22.50m B75
		Test Date	14/08/2019
		Borehole	BH49
Jobfile	Stornoway Deep Water Port	Sample	22.00-22.50m B75
Client	Causeway Geotech Ltd	Depth	22.00-22.50m B75

UKAS TESTING 4043

PSL Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

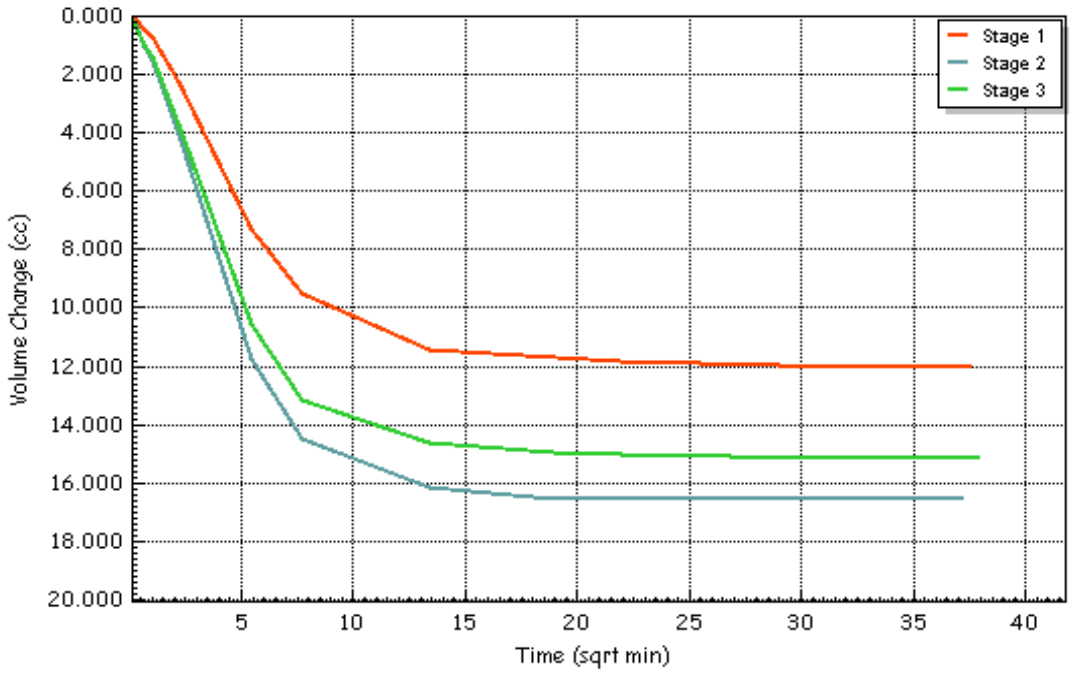
Initial Conditions

			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	700	750	850
Initial Back Pressure	u_{bi}	(kPa)	650	650	650
Pore Water Pressure Input	u_{pwp}	(kPa)	675	735	822
Drainage Method			Radial+One End		

Final Conditions

			Stage 1	2	3
PWP Dissipation %	U%	(%)	100.00	97.65	99.42
Volumetric Strain	ε_v%	(%)	0.75	1.79	2.74
Corrected Length	L_C	(mm)	199.5	194.4	186.6
Corrected Area	A_C	(cm2)	79.24	79.84	81.52
Corrected Volume	V_C	(cc)	1580.850	1564.316	1549.168
T100 Time to Failure	t_{100}	(min)	71.30	71.30	71.30
Consolidation	c_v	(m2/year)	2.970	2.970	2.970
Compressibility	m_v	(m2/MN)	0.302	0.216	0.160
Test Time	t_F	(h:m:s)	02:08:20	02:08:20	02:08:20
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.07772	0.07575	0.07270

Notes



Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH49 22.00-22.50m B75
		Test Date	14/08/2019
		Borehole	BH49
Jobfile	Stornoway Deep Water Port	Sample	22.00-22.50m B75
Client	Causeway Geotech Ltd	Depth	22.00-22.50m B75

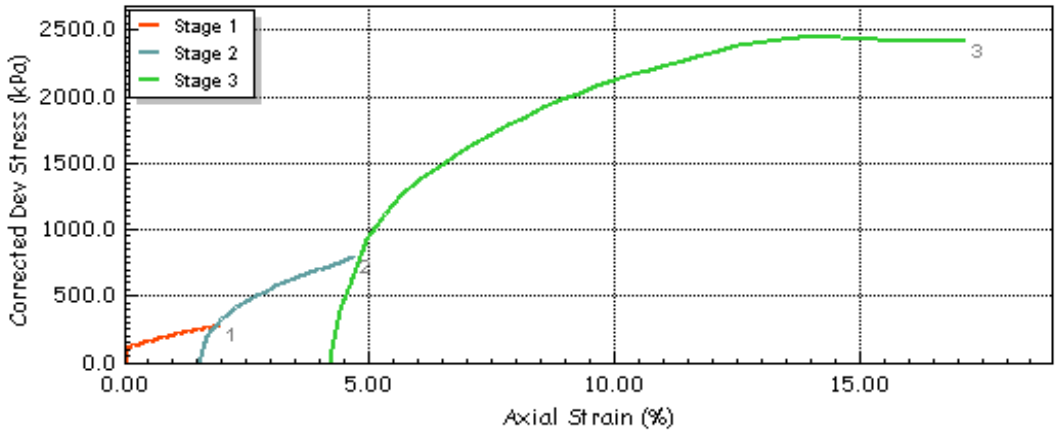
UKAS TESTING 4043

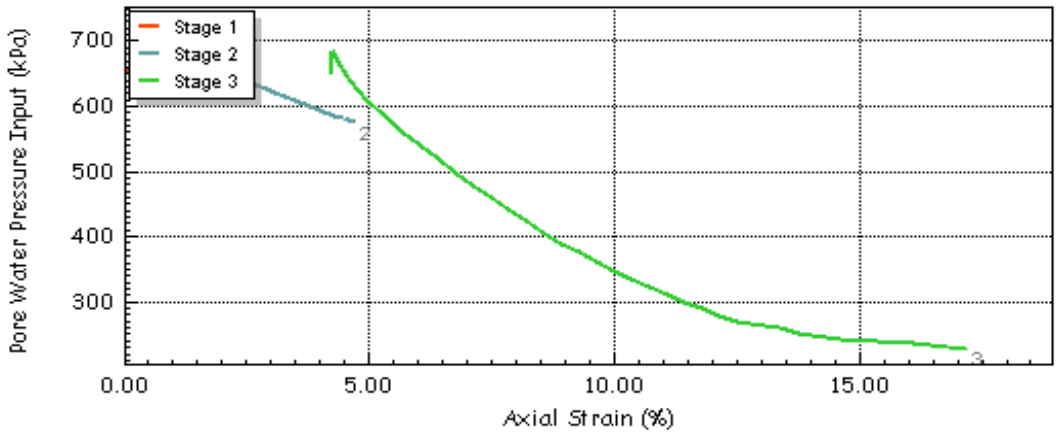
PSL Professional Soils Laboratory

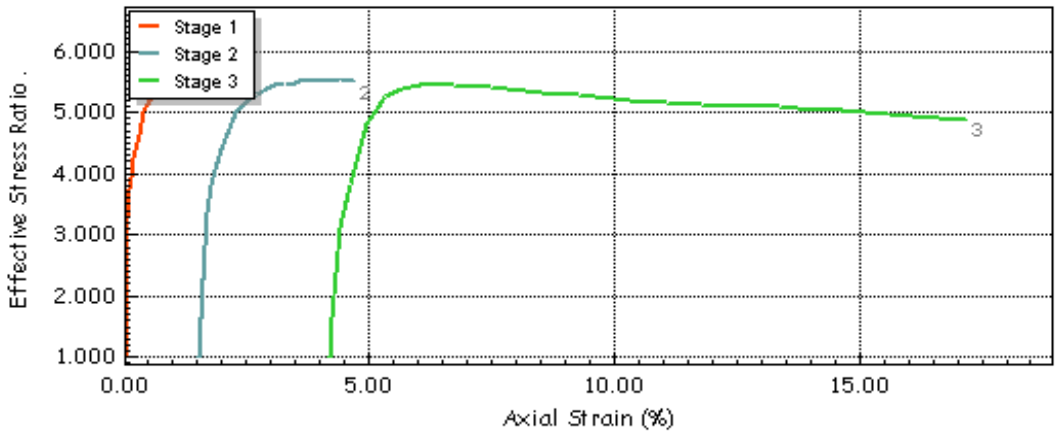
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH49 22.00-22.50m B75
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH49
Client	Causeway Geotech Ltd	Sample	22.00-22.50m B75
		Depth	22.00-22.50m B75

UKAS TESTING 4043

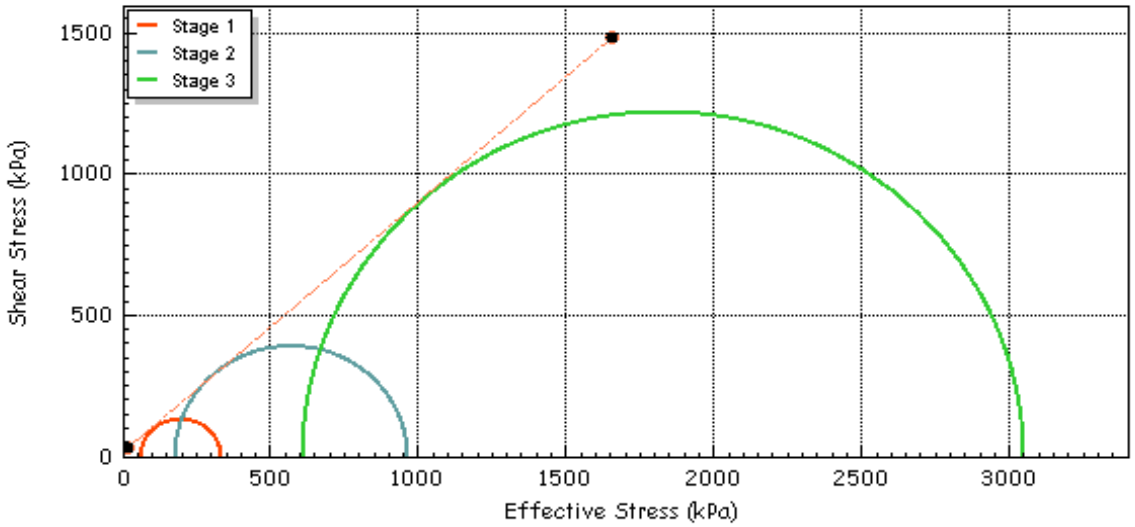
PSL Professional Soils Laboratory

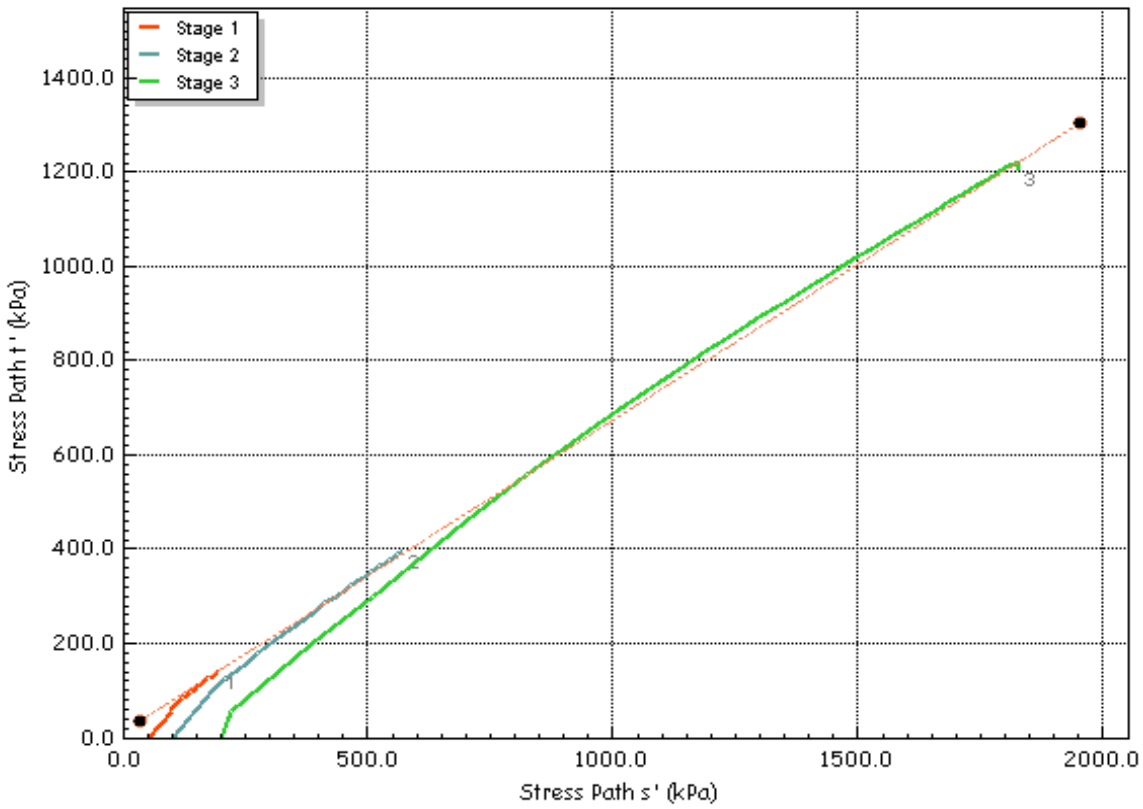
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	16.45	Effective Cohesion	c'	(kPa)	16.45
Effective Friction	ϕ'	(deg)	41.5	Effective Friction	ϕ'	(deg)	41.5





Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH49 22.00-22.50m B75
		Test Date	14/08/2019
Jobfile	Stornoway Deep Water Port	Borehole	BH49
Client	Causeway Geotech Ltd	Sample	22.00-22.50m B75
		Depth	22.00-22.50m B75

UKAS TESTING 4043

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CAUSEWAY GEOTECH

APPENDIX D

Dredge analysis laboratory test results

Marine Scotland
Pre-disposal Sampling Guidance
Version 2 - November 2017

Table 2 Action Levels

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Arsenic	20	70
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Mercury	0.25	1.5
Nickel	30	150
Lead	50	400
Zinc	130	600
Tributyltin	0.1	0.5
Polychlorinated Biphenyls	0.02	0.18
Polyaromatic Hydrocarbons		
Acenaphthene	0.1	
Acenaphthylene	0.1	
Anthracene	0.1	
Fluorene	0.1	
Naphthalene	0.1	
Phenanthrene	0.1	
Benzo[a]anthracene	0.1	
Benzo[b]flouranthene	0.1	
Benzo[k]fluoranthene	0.1	
Benzo[a]pyrene	0.1	
Benzo[g,h,i]perylene	0.1	
Dibenzo[a,h]anthracene	0.01	
Chrysene	0.1	
Fluoranthene	0.1	
Pyrene	0.1	
Indeno(1,2,3cd)pyrene	0.1	
Total Hydrocarbons	100	
Booster Biocide and		
Brominated Flame Retardents*		

*Provisional Action Levels for these compounds are subject to further investigation.

Results which exceed the Contaminant Action Levels are highlighted in blue or red, as appropriate, on the following pages

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR00327**	
Issue Version	1	
Customer	Causeway Geotech, 8 Drumahiskey Road, Ballymoney, Co. Antrim, BT53 7QL	
Customer Reference	Stornoway	
Date Sampled	03-06Jun19	
Date Received	10-Jul-19	
Date Reported	31-Jul-19	
Condition of samples	Cold	Satisfactory

Authorised by: Marya Hubbard

Position: Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

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Certificate of Analysis

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

		Units	%	%	%	%	%	mg/m3	% M/M
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Doncaster*	SOCOTEC Env Chem*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	N/A	0.02
		Accreditation	UKAS	UKAS	N	N	N	N	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**Particle Density**	**TOC**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	6.40	93.6	74.7	21.2	4.2	Not Amenable*	0.06
BH52 (0.50-1.00m)	MAR00327.002	Sediment	7.62	92.4	70.5	24.8	4.7	Not Amenable*	0.06
BH52 (1.00-1.50m)	MAR00327.003	Sediment	6.40	93.6	66.1	27.0	6.9	Not Amenable*	0.05
BH52 (1.50-2.00m)	MAR00327.004	Sediment	8.78	91.2	60.1	31.6	8.3	Not Amenable*	0.06
BH53 (0.00-0.50m)	MAR00327.005	Sediment	31.1	68.9	19.7	35.2	45.1	Not Amenable*	0.41
BH53 (0.50-1.00m)	MAR00327.006	Sediment	24.8	75.2	61.1	17.9	21.0	Not Amenable*	0.58
BH53 (1.00-1.50m)	MAR00327.007	Sediment	17.6	82.4	80.1	12.3	7.6	Not Amenable*	0.79
BH53 (1.50-2.00m)	MAR00327.008	Sediment	13.8	86.2	91.3	6.7	2.1	Not Amenable*	0.16
BH53 (2.00-2.50m)	MAR00327.009	Sediment	13.2	86.8	72.9	23.2	3.9	Not Amenable*	0.10
BH53 (2.50-3.00m)	MAR00327.010	Sediment	6.20	93.8	83.6	14	2.4	Not Amenable*	0.06
BH53 (3.00-3.50m)	MAR00327.011	Sediment	5.80	94.2	82.8	15.7	1.5	Not Amenable*	0.05
BH53 (3.50-4.00m)	MAR00327.012	Sediment	14.6	85.4	69.1	28.7	2.2	Not Amenable*	0.07
BH53 (4.00-4.50m)	MAR00327.013	Sediment	12.8	87.2	70.7	28.1	1.1	Not Amenable*	0.08
Reference Material (% Recovery)			N/A	N/A	N/A	N/A	N/A	N/A	102
QC Blank			N/A	N/A	N/A	N/A	N/A	N/A	<0.02

* See Report Notes

NADIS - No Asbestos Detected In Sample

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Certificate of Analysis

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

		Units	mg/Kg (Dry Weight)							
		Method No	SOCOTEC Env Chem*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	N	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	1.3	<0.04	19.9	17.3	0.02	19.7	2.9	34.5
BH52 (0.50-1.00m)	MAR00327.002	Sediment	1.4	<0.04	18.6	16.5	0.014	18.7	2.3	33.9
BH52 (1.00-1.50m)	MAR00327.003	Sediment	0.8	0.04	20.9	17.6	0.01	19.8	2.0	34.5
BH52 (1.50-2.00m)	MAR00327.004	Sediment	0.7	<0.04	21.8	13.7	0.01	19.2	2.2	29.0
BH53 (0.00-0.50m)	MAR00327.005	Sediment	6	0.1	21.8	13.8	0.02	17.2	5.4	33.0
BH53 (0.50-1.00m)	MAR00327.006	Sediment	6.9	0.14	20.5	12.5	0.02	16.4	4.2	37.0
BH53 (1.00-1.50m)	MAR00327.007	Sediment	2.8	0.06	15.4	29.1	0.08	14.2	3.3	31.6
BH53 (1.50-2.00m)	MAR00327.008	Sediment	2.2	0.05	18.2	13.3	0.04	17.3	2.7	38.5
BH53 (2.00-2.50m)	MAR00327.009	Sediment	1.7	<0.04	19.1	16.9	0.03	17.7	2.7	34.1
BH53 (2.50-3.00m)	MAR00327.010	Sediment	1.3	<0.04	16.4	14.6	0.02	17.3	2.3	30.3
BH53 (3.00-3.50m)	MAR00327.011	Sediment	1.6	0.05	31.8	28.5	0.02	29.6	3.6	46.6
BH53 (3.50-4.00m)	MAR00327.012	Sediment	1.5	<0.04	20.1	17	0.012	17.9	2.4	29.1
BH53 (4.00-4.50m)	MAR00327.013	Sediment	1.1	<0.04	19.7	27.8	0.011	19.5	2.5	123
Certified Reference Material SETOC 774 (% Recovery)			98	105	96	105	94	99	97	101
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	<1	<1
BH52 (0.50-1.00m)	MAR00327.002	Sediment	<1	<1
BH52 (1.00-1.50m)	MAR00327.003	Sediment	<1	<1
BH52 (1.50-2.00m)	MAR00327.004	Sediment	<1	<1
BH53 (0.00-0.50m)	MAR00327.005	Sediment	<1	<1
BH53 (0.50-1.00m)	MAR00327.006	Sediment	<1	<1
BH53 (1.00-1.50m)	MAR00327.007	Sediment	<1	<1
BH53 (1.50-2.00m)	MAR00327.008	Sediment	<1	<1
BH53 (2.00-2.50m)	MAR00327.009	Sediment	<1	<1
BH53 (2.50-3.00m)	MAR00327.010	Sediment	<1	<1
BH53 (3.00-3.50m)	MAR00327.011	Sediment	<1	<1
BH53 (3.50-4.00m)	MAR00327.012	Sediment	<1	<1
BH53 (4.00-4.50m)	MAR00327.013	Sediment	<1	<1
Certified Reference Material BCR-646 (% Recovery)			80	73
QC Blank			<1	<1

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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00327
Issue Version 1
Customer Reference Stornoway

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	<1	<1	<1	3.67	5.01	4.13
BH52 (0.50-1.00m)	MAR00327.002	Sediment	1.67	<1	<1	2.57	3.76	3.28
BH52 (1.00-1.50m)	MAR00327.003	Sediment	<1	<1	1.53	2.82	4.42	3.61
BH52 (1.50-2.00m)	MAR00327.004	Sediment	<1	<1	1.44	3.33	5.74	5.06
BH53 (0.00-0.50m)	MAR00327.005	Sediment	2.08	6.92	9.56	50.1	90.5	68.2
BH53 (0.50-1.00m)	MAR00327.006	Sediment	<1	1.78	2.45	10.1	17.6	15.2
BH53 (1.00-1.50m)	MAR00327.007	Sediment	3.50	2.12	7.22	21.2	32.2	27.1
BH53 (1.50-2.00m)	MAR00327.008	Sediment	<1	<1	2.05	7.35	14.3	11.9
BH53 (2.00-2.50m)	MAR00327.009	Sediment	<1	<1	<1	3.10	5.33	4.53
BH53 (2.50-3.00m)	MAR00327.010	Sediment	<1	<1	<1	2.92	7.02	6.27
BH53 (3.00-3.50m)	MAR00327.011	Sediment	<1	<1	5.04	5.15	5.50	4.89
BH53 (3.50-4.00m)	MAR00327.012	Sediment	<1	<1	<1	1.82	2.62	2.17
BH53 (4.00-4.50m)	MAR00327.013	Sediment	<1	<1	<1	<1	<1	<1
Certified Reference Material CRM180013 1941b (% Recovery)			104	106	73	72	67	86
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

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Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00327
Issue Version 1
Customer Reference Stornoway

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	3.36	1.68	3.98	<1	5.36	<1
BH52 (0.50-1.00m)	MAR00327.002	Sediment	3.07	1.99	2.82	<1	5.85	1.15
BH52 (1.00-1.50m)	MAR00327.003	Sediment	3.21	1.65	3.08	<1	5.78	<1
BH52 (1.50-2.00m)	MAR00327.004	Sediment	6.46	1.92	3.68	<1	4.16	1.21
BH53 (0.00-0.50m)	MAR00327.005	Sediment	66.4	33.4	48.4	14.1	49.4	5.57
BH53 (0.50-1.00m)	MAR00327.006	Sediment	13.7	6.19	11.0	2.90	14.9	<1
BH53 (1.00-1.50m)	MAR00327.007	Sediment	31.5	10	21.6	4.97	30.7	2.67
BH53 (1.50-2.00m)	MAR00327.008	Sediment	11.2	6.51	8.44	2.03	8.38	<1
BH53 (2.00-2.50m)	MAR00327.009	Sediment	4.37	2.90	3.34	<1	3.77	<1
BH53 (2.50-3.00m)	MAR00327.010	Sediment	4.81	3.41	3.63	<1	2.51	<1
BH53 (3.00-3.50m)	MAR00327.011	Sediment	5.34	2.35	5.26	<1	8.74	1.83
BH53 (3.50-4.00m)	MAR00327.012	Sediment	1.59	1.10	2.02	<1	2.40	<1
BH53 (4.00-4.50m)	MAR00327.013	Sediment	<1	<1	<1	<1	<1	<1
Certified Reference Material CRM180013 1941b (% Recovery)			76	78	89	118	81	57
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	UKAS	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	3.80	<1	1.16	6.18	2490
BH52 (0.50-1.00m)	MAR00327.002	Sediment	3.55	<1	5.11	5.50	2350
BH52 (1.00-1.50m)	MAR00327.003	Sediment	3.54	<1	2.45	5.75	2140
BH52 (1.50-2.00m)	MAR00327.004	Sediment	4.64	<1	3.63	6.39	3720
BH53 (0.00-0.50m)	MAR00327.005	Sediment	60.8	6.33	22.9	99.4	28200
BH53 (0.50-1.00m)	MAR00327.006	Sediment	14.3	1.57	6.80	21.5	10600
BH53 (1.00-1.50m)	MAR00327.007	Sediment	24.8	2.42	12.0	39.9	15900
BH53 (1.50-2.00m)	MAR00327.008	Sediment	11.5	<1	3.39	14.0	7220
BH53 (2.00-2.50m)	MAR00327.009	Sediment	4.21	<1	2.19	6.47	5050
BH53 (2.50-3.00m)	MAR00327.010	Sediment	4.52	<1	1.45	4.10	2150
BH53 (3.00-3.50m)	MAR00327.011	Sediment	2.74	<1	13.5	6.91	5380
BH53 (3.50-4.00m)	MAR00327.012	Sediment	1.53	<1	<1	3.36	2310
BH53 (4.00-4.50m)	MAR00327.013	Sediment	<1	<1	<1	1.54	980
Certified Reference Material CRM180013 1941b (% Recovery)			84	63	85	72	106~
QC Blank			<1	<1	<1	<1	<100

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	N	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
BH52 (0.00-0.50m)	MAR00327.001	Sediment	0.30	0.27	0.10	<0.08	<0.08	<0.08	<0.08
BH52 (0.50-1.00m)	MAR00327.002	Sediment	0.41	0.40	0.12	<0.08	<0.08	<0.08	<0.08
BH52 (1.00-1.50m)	MAR00327.003	Sediment	0.24	0.21	0.08	<0.08	<0.08	<0.08	<0.08
BH52 (1.50-2.00m)	MAR00327.004	Sediment	0.34	0.30	0.10	<0.08	<0.08	<0.08	<0.08
BH53 (0.00-0.50m)	MAR00327.005	Sediment	0.39	0.39	0.08	<0.08	<0.08	<0.08	<0.08
BH53 (0.50-1.00m)	MAR00327.006	Sediment	0.53	0.46	0.11	<0.08	<0.08	<0.08	<0.08
BH53 (1.00-1.50m)	MAR00327.007	Sediment	0.32	0.33	0.12	<0.08	<0.08	<0.08	<0.08
BH53 (1.50-2.00m)	MAR00327.008	Sediment	0.40	0.36	0.10	<0.08	<0.08	<0.08	<0.08
BH53 (2.00-2.50m)	MAR00327.009	Sediment	0.45	0.41	0.12	<0.08	<0.08	<0.08	<0.08
BH53 (2.50-3.00m)	MAR00327.010	Sediment	0.24	0.24	0.08	<0.08	<0.08	<0.08	<0.08
BH53 (3.00-3.50m)	MAR00327.011	Sediment	0.28	0.30	0.08	<0.08	<0.08	<0.08	<0.08
BH53 (3.50-4.00m)	MAR00327.012	Sediment	0.20	0.19	<0.08	<0.08	<0.08	<0.08	<0.08
BH53 (4.00-4.50m)	MAR00327.013	Sediment	0.19	0.13	<0.08	<0.08	<0.08	<0.08	<0.08
Certified Reference Material SRM 1941b (% Recovery)			76	105	100	110	121	101	103
QC Blank			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

For full analyte name see method summaries

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Test Report ID MAR00327
Issue Version 1
Customer Reference Stornoway

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR00327.001-013	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR00327.001-013	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/303/304	MAR00327.001-013	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.
SOCOTEC Doncaster*	MAR00327.001-013	Sample is Unsuitable for Testing - Sample is Sand & Gravel with Medium Pieces of Gravel.

DEVIATING SAMPLE STATEMENT

Deviation Code	Devation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

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Certificate of Analysis

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Test Report ID	MAR00327
Issue Version	1
Customer Reference	Stornoway

Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 105°C to constant weight.
Total Organic Carbon (TOC)	Air dried	Carbonate removal and sulphurous acid/combustion at 800°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Diben[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDE	p,p'-Dichorodiphenyldicloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDT	p,p'-Dichorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene		
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

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CAUSEWAY GEOTECH

APPENDIX E

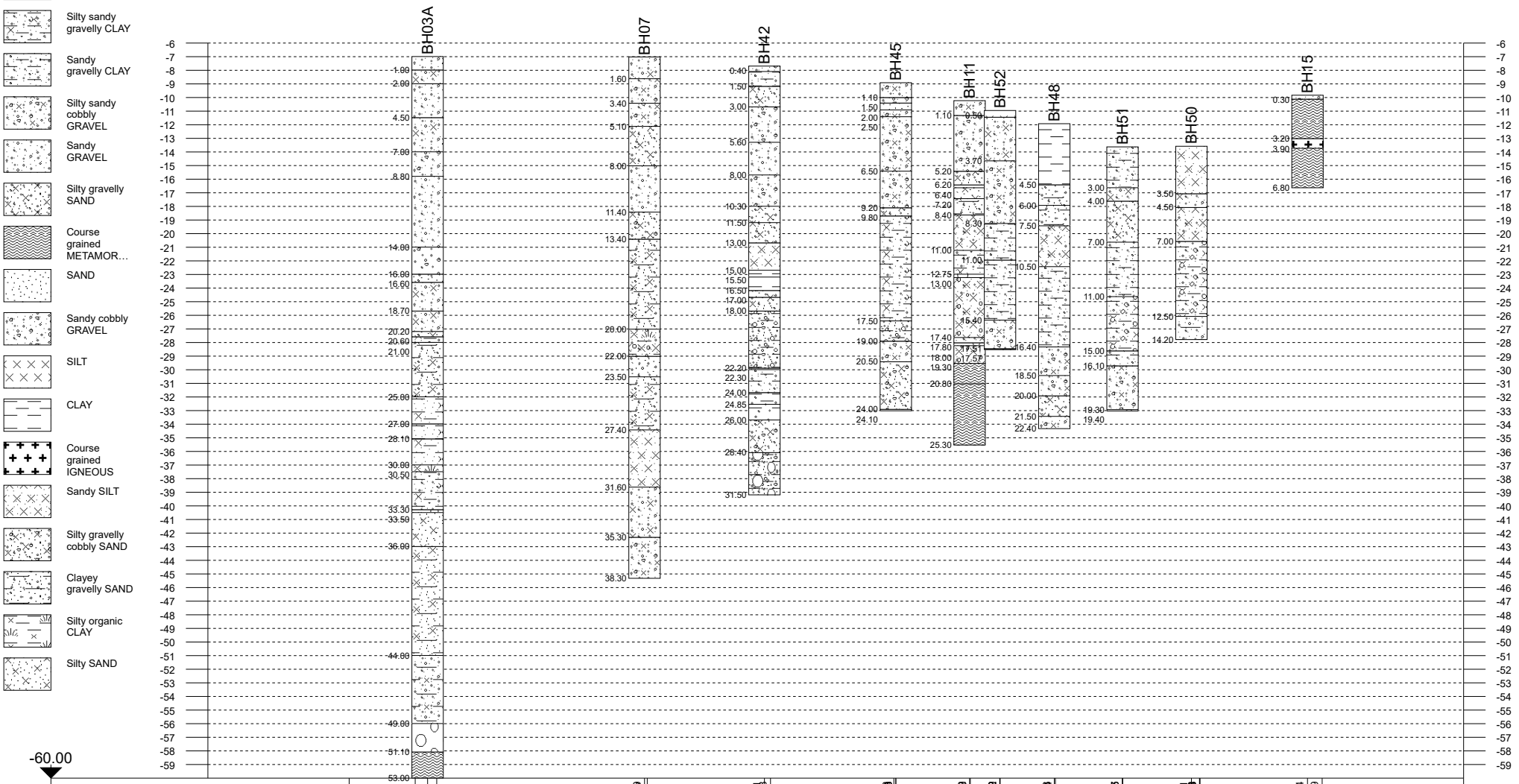
Geological long sections

Project Id: 19-0382	Title: Section line 1
Project Title: Stornoway Deep Water Port	Vertical Scale: 1:414
Location:	Horizontal Scale: 1:2017
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

Legend Key

- Silty sandy GRAVEL
- Silty sandy gravelly CLAY
- Sandy gravelly CLAY
- Silty sandy cobbly GRAVEL
- Sandy GRAVEL
- Silty gravelly SAND
- Course grained METAMOR…
- SAND
- Sandy cobbly GRAVEL
- SILT
- CLAY
- Course grained IGNEOUS
- Sandy SILT
- Silty gravelly cobbly SAND
- Clayey gravelly SAND
- Silty organic CLAY
- Silty SAND



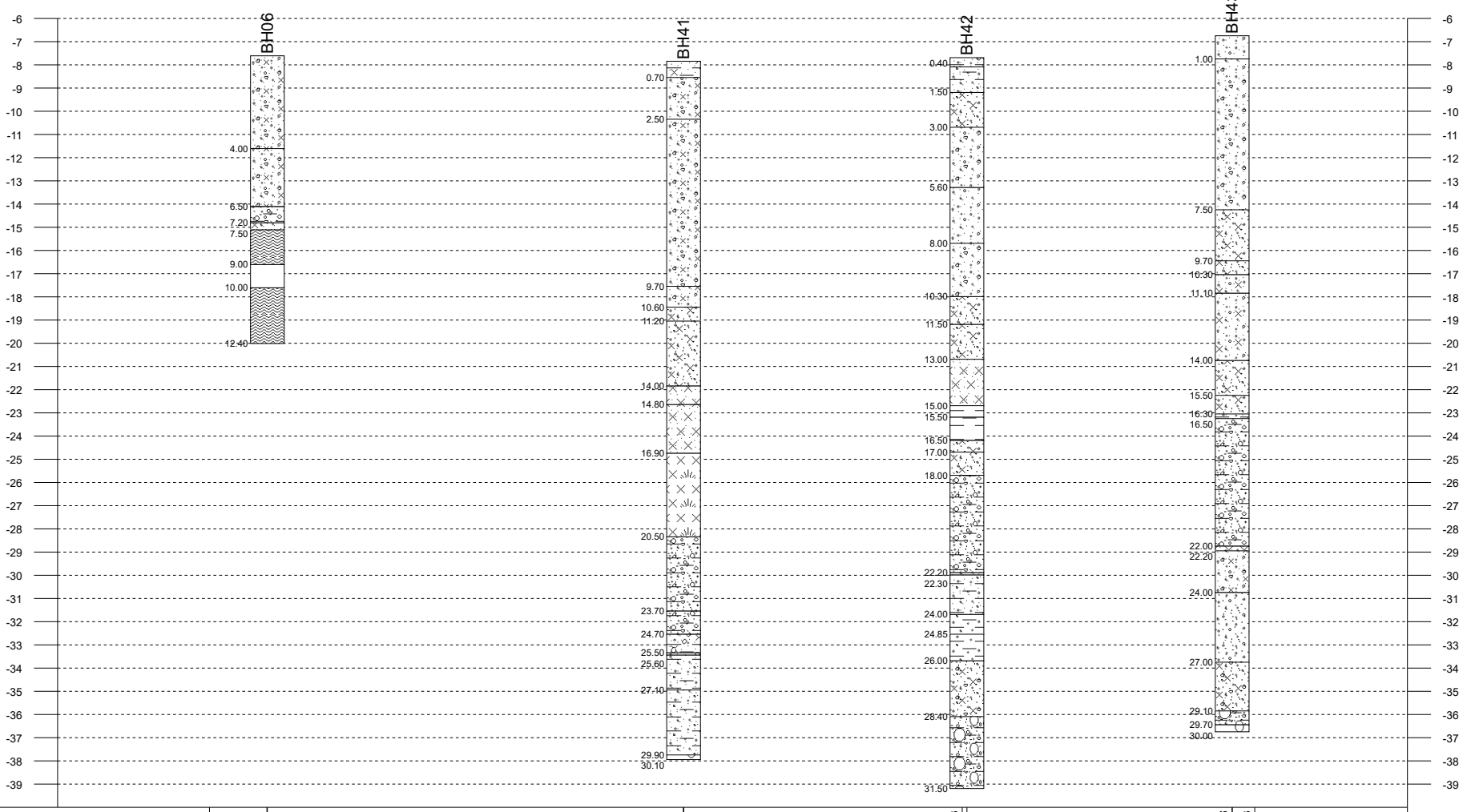
| | | |

Project Id: 19-0382	Title: Section line 2
Project Title: Stornoway Deep Water Port	Vertical Scale: 1:261
Location:	Horizontal Scale: 1:876
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH

Legend Key

- Sandy GRAVEL
- Silty sandy cobbly GRAVEL
- Silty sandy gravelly CLAY
- Sandy cobbly GRAVEL
- Silty sandy CLAY
- Sandy gravelly CLAY
- Silty gravelly SAND
- Sandy gravelly cobbly CLAY
- Silty sandy GRAVEL
- Course grained METAMOR…
- Void
- Sandy SILT
- CLAY
- Organic SILT
- Sandy gravelly SILT
- SAND and GRAVEL
- Gravelly CLAY

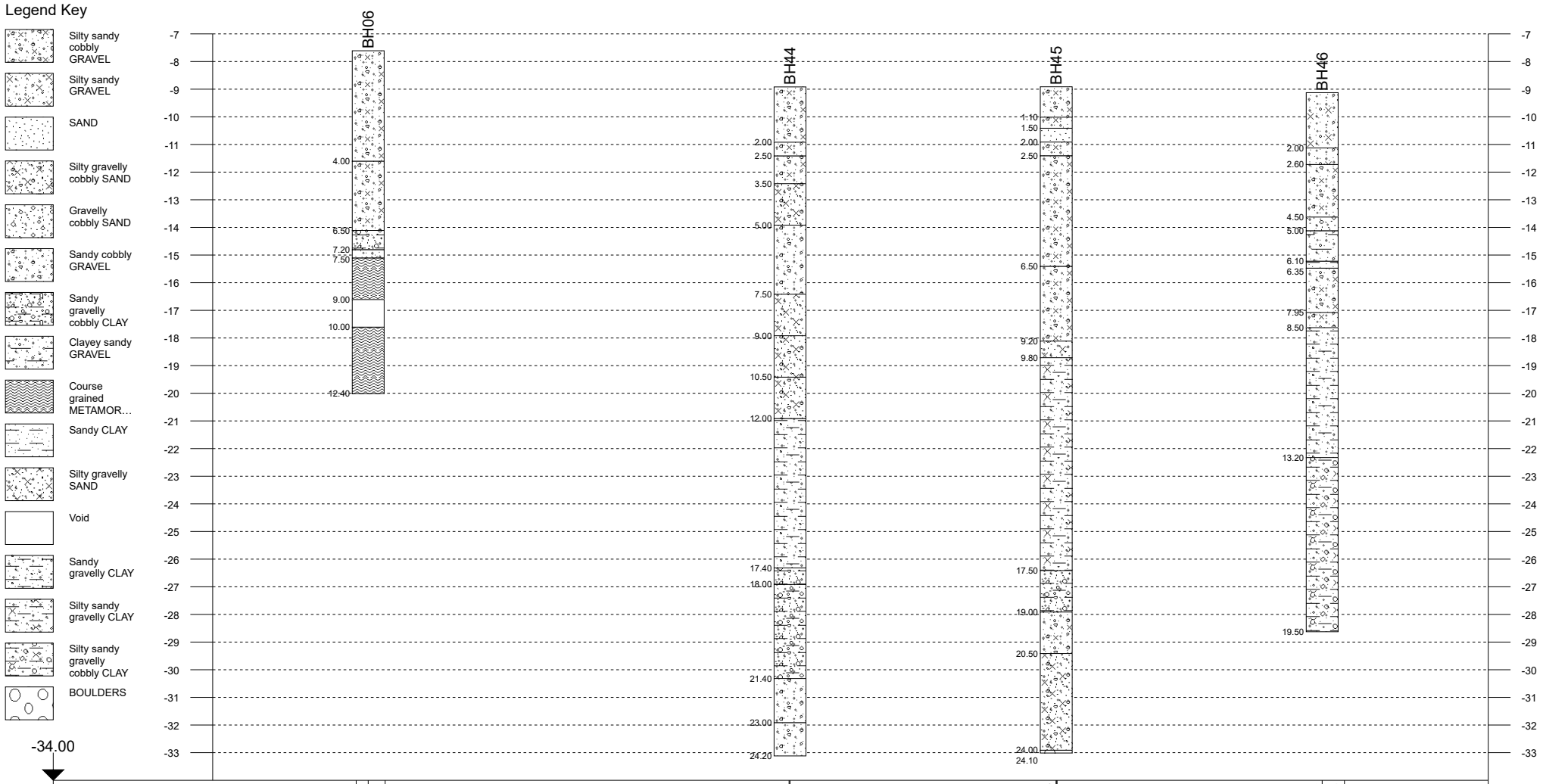


-40.00

Chainage (m)	0.00	8.30	68.55	108.83	108.83	147.88	151.13	
Offset (m)	0.49		0.51		0.29	0.36		
Elevation (mCD)	-7.61		-7.84		-7.69	-6.75		

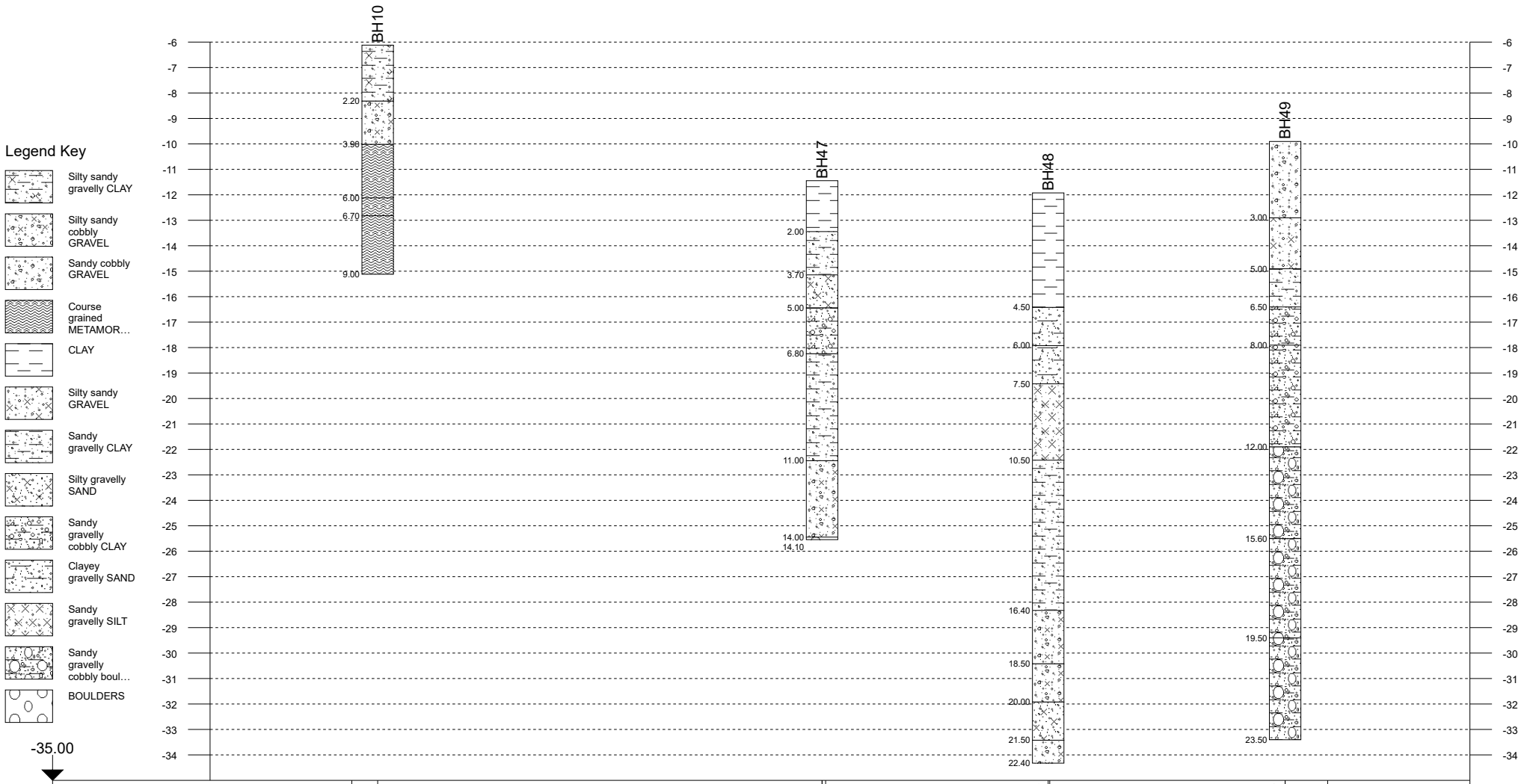
Project Id: 19-0382	Title: Section line 3
Project Title: Stornoway Deep Water Port	Vertical Scale: 1:207
Location:	Horizontal Scale: 1:851
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers

CAUSEWAY GEOTECH



| | | |

Project Id: 19-0382	Title: Section line 4
Project Title: Stornoway Deep Water Port	Vertical Scale: 1:222
Location:	Horizontal Scale: 1:985
Client: Stornoway Port Authority	Engineer: Wallace Stone Consulting Civil Engineers



| | | |

CAUSEWAY GEOTECH

APPENDIX F

Cone penetration test report (In-Situ SI)

IN SITU
SITE INVESTIGATION

STATIC CONE PENETRATION TEST

FACTUAL REPORT

CLIENT: Causeway Geotech Ltd

PROJECT: Stornoway Deep Water Port 2

Project	**Stornoway Deep Water Port 2**
Project No.	**1190227**
Client	**Causeway Geotech Ltd**
Address	**8 Drumahiskey Road, Ballymoney, Co. Antrim, BT53 7QL**

Attention: Mr. Darren O'Mahony

Dear Mr. O'Mahony,

We have pleasure in providing a digital copy of our report and data in AGS format for the above project.

We hope that you are satisfied with the performance of our staff, equipment and reporting on this project. If you should have any queries about any aspect of the works carried out, please do not hesitate to contact us. We look forward to being of service to you in the future.

Yours faithfully,
In Situ Site Investigation Limited

[redacted]

Darren Ward
Director

Report Issue

Issue	Date	Prepared	Sign	Checked	Sign	Approved	Sign
01	29/07/2019	Chloe Wickens	[redacted]	Luisa Dhimitri	[redacted]	Darren Ward	[redacted]

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1.0 INTRODUCTION

In Situ Site Investigation Limited (In Situ) was engaged in a geotechnical site investigation at Stornoway Deep Water Port 2 at the request of Causeway Geotech Ltd. The site investigation consisted of completing 8 Static Piezocone Penetration Tests (CPTU) to provide information on the soil conditions and derived geotechnical parameters at:

Site Compound:
Pier 1 Stornoway Harbour
South Beach
Stornoway
HS1 2XX

All test locations were provided by the client. A site map is included in the end of Appendix A of this report (if provided by the client). The tests were stopped when they reached the target depth as per the client's technical specifications or for other technical reasons, as detailed in the Project Summary Table in Appendix A.1 and on each CPTU log included in Appendix B of this report.

The fieldwork was carried out from 20th June 2019 to 5th July 2019 as per the client's request.

The work on site and the final factual reporting have been undertaken in accordance with the international technical standard *BS EN ISO 22475-1:2012*.

2.0 FIELDWORK

2.1 CONE PENETRATION TESTS

The fieldwork activity is summarised in Table 2.1.

Table 2.1 Fieldwork Summary	
CPT Operator/s	Max Holland & Dom Gain
Date Started	20th June 2019
Date Finished	5th July 2019
In Situ S.I. Project Manager	Darren Ward
Main Contractor's Site Manager	Finlay Galbraith

2.1.1 Rig Information

Details of CPTU rig used in this project are shown in Table 2.2. Full data sheet for the rig is presented in *Appendix A.2*.

Table 2.2 Rig Summary	
Rig Name	**Rig Description**
CPT003	3.5 Tonne Track Mounted CPT Rig

2.1.2 CPTU Cone

Details of electric CPTU cone (Type TE2) used in this project conforming to the requirements of Application Class 2 of *ISO 22476-1:2012*, are shown in Table 2.3.

Table 2.3 Cone Summary		
Number	**Cross-section area**	**Filter position**
S10-CFIP.768	10cm^2	u_2
S10-CFIP.786	10cm^2	u_2
S15-CFIP.825	15cm^2	u_2

A full datasheet of the cone used is shown in *Appendix A.3*.

The cone's measured parameters are shown in Table 2.4.

Table 2.4 Completed Fieldwork Summary
8 CPTU to a maximum depth of 26.28m. Each test measured Cone Resistance, q_c, Sleeve Friction, f_s, Porewater Pressure in the shoulder position, u_2, Inclination in X and Y axes.
Provision of factual report with estimated soil type, derived geotechnical parameters & AGS data file.

2.1.3 CPTU Cone Calibration

The cone resistance and sleeve friction are recorded by calibrated load cells in the cone. The CPTU load cells and pressure transducers are regularly calibrated in line with *ISO 22476-1:2012* standard by the cone manufacturer. The cone calibration certificate for the cone used at this site are presented in *Appendix A.4*.

2.1.4 CPTU Cone Saturation

The pore water pressure is recorded using a calibrated pressure transducer located in the piezocone. To ensure pore water pressure measurements are not affected by the presence of air in the measuring transducer, a de-airing procedure is carried out prior to each test. The cone and filter are saturated using a glycerine fluid with a viscosity of 10,000 CST.

2.1.5 Test Procedure

The tests are carried out in accordance with the *International Standard for Electrical Cone and Piezocone Penetration Test (ISO 22476-1:2012)*.

The final depths of the tests were determined by either completion to the specified test depth or when the maximal safe capacity of the equipment was reached. A schedule of the tests performed is shown in *Appendix A.1*, which has been compiled from the operators' daily progress reports.

The data is transmitted from the digital CPTU through an umbilical cable that runs through the push rods to the data acquisition system. Results are displayed instantaneously on the computer logging screen. The results are recorded on the computer hard disc.

The rate of penetration is kept constant at 2cm/s ±10% except when penetrating very dense or hard strata. Before each test is carried out zero values are taken of the cone to check if it is within calibration. At the end of each test, zero values are taken again to see if there has been any drift during the test. These values are inspected during the post processing stage. This is a quality check on the data and the testing procedure. Individual test zero values are shown on their corresponding test results in *Appendix B*.

2.1.6 *In Situ Pore Pressure (u_0)*

The in situ or hydrostatic pore pressure is required for the calculation of several derived parameters included in this report. For this report, the groundwater level is assumed at 2.00 m below ground surface, for calculation purposes. The in situ pore pressure (u_0) values are presented on the pore pressure plot, on *CPT Log 01,* which is included in *Appendix B*.

2.2 POSITIONING

Positioning and surveying of all investigated locations was the responsibility of the client. All tests coordinates are included in the summary sheet in *Appendix A.1*.

3.0 CONE PENETRATION MEASURED PARAMETERS

All measured parameters of tests carried with the CPTU cone are shown in *Appendix B* and all the information about data processing and results are given in sections *3.1*, *3.2* and *3.3*.

3.1 DATA PROCESSING

The measured parameters, cone end resistance, q_c, sleeve friction, f_s, porewater pressure measurements with filter in shoulder position, u_2 and inclination for *x* and *y* axis, I_x, I_y, were recorded for every *10 mm* of penetration keeping a constant speed of *20 mm/s ± 5 mm/s*, which may slightly change when the cone is penetrating hard strata.

The measured data from the site works is processed and presented using specialised CPT software. The interpretations on the CPTU results were carried out following the recommendations of *Lunne et al. (1997)*, *Robertson (2015)* and *BS EN ISO 22475-1:2012.* Measured parameters, mentioned in *Sections 3.2* and *3.3*, were used to derive all the geotechnical parameters, which are presented in *Chapter 4.0*. The soil behaviour type method used on this report is *Robertson et al. (1986)*, shown in *Figure 3.2*.

3.1.1 Zero Measurements

Before and after each CPTU test, zero measurements are recorded for each channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

3.2 MEASURED PARAMETERS

3.2.1 Cone Resistance (q_c)

Cone resistance, q_c, is measured as the total force acting on the cone, divided by the projected area of the cone. The results are presented in *MPa*, on *CPT Log 01*, in *Appendix B*, scale *0-20 MPa* with a minor scale printing on the same graph at *0-4 MPa*.

3.2.2 Sleeve Friction (f_s)

Sleeve friction, f_s, is measured as the total frictional force acting on the friction sleeve divided by its surface area. The results are presented in *kPa*, on *CPT Log 01*, in *Appendix B*, using a scale of *0-500 kPa*.

3.2.3 Porewater pressure (u_2)

The pore pressure, u_2, is measured during the test. If the material is free draining and saturation is maintained it will normally measure hydrostatic pore pressure. In materials that are not free draining, it will record the total pore pressure (hydrostatic plus any excess pore pressures generated) created by the cone penetration through this material.

The filter element can be mounted in one of three positions. For all tests carried out in this project the filter was mounted in the u_2 position (see *Figure 3.1*).

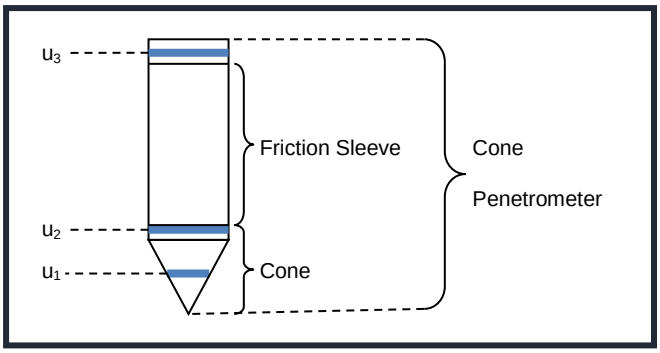

Figure 3.1: *Diagram showing pore pressure filter locations (after Lunne et al., 1997)*

3.2.4 Inclination (I_x, I_y)

The CPT rig was set up to obtain a thrust direction as near as possible to vertical. The CPTU cones have inclinometers incorporated to measure the non-verticality of the test. For test depths less than *15 m*, significant non-verticality is unusual, provided the initial thrust direction is vertical.

3.3 ESTIMATED SOIL BEHAVIOUR TYPE

3.3.1 Friction Ratio (R_f)

The friction ratio, R_f is the ratio between the sleeve friction and the cone resistance (Lunne *et al.*, 1997).

$$Fricton\ Ratio\ (R_f) = \left(\frac{Sleeve\ Friction\ (f_s)}{Cone\ Resistance\ (q_c)}\right) \times 100$$

3.3.2 Estimated Soil Behaviour Type (SBT)

The estimation of soil behaviour type, *SBT*, using measurements of cone resistance and sleeve friction is based upon the variations of the friction ratio and cone resistance. The friction

ratio varies depending upon whether the soil is cohesive or granular. The cone resistance varies depending on the strength and densities of the soil.

The interpretation used in this report is *Robertson et al. (1986)*, which is shown in Figure 3.2. The results are presented on *CPT Log 01*, in *Appendix B*.

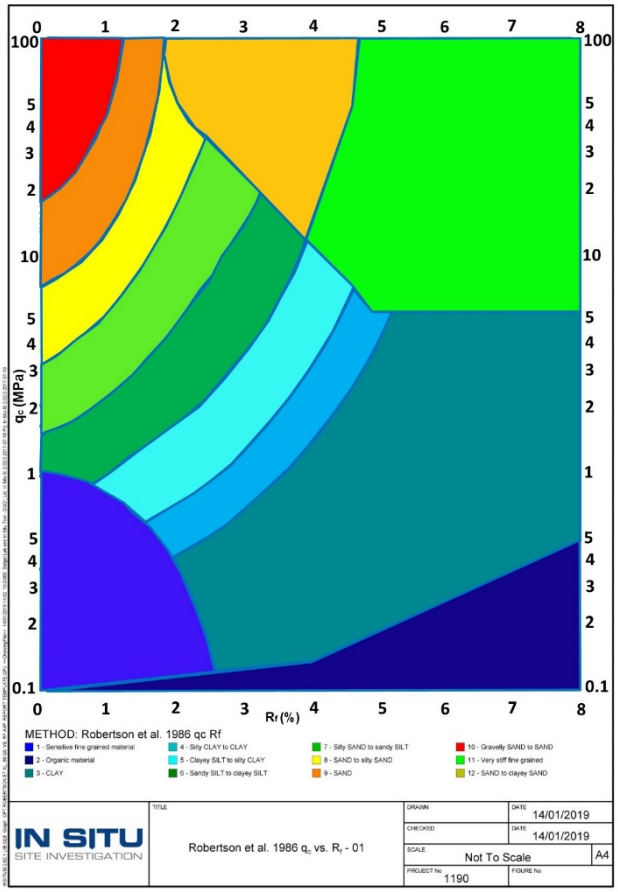

Figure 3.2: *Robertson et al., 1986 soil behaviour type chart.*

3.3.3 Pore Pressure Ratio (B_q)

Pore pressure ratio, B_q is the ratio between the measured pore pressure generated during penetration and the corrected cone resistance minus the total overburden stress.

Pore pressure ratio as defined by *Senneset and Janbu (1985)* is defined as:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{vo}}$$

where

u_2	is pore pressure measured between the cone and the friction sleeve
u_0	is equilibrium pore pressure
σ_{vo}	is total overburden stress
q_t	is cone resistance corrected for unequal end area effects

3.4 APPLIED CORRECTIONS

3.4.1 Corrected Cone Resistance (q_t)

For each penetration test, the measured cone resistance, q_c, can be corrected for the ''unequal area effect'' due to the influence of the ambient pore water pressure acting on the cone.

The correction has been applied using the following equation by Lunne et *al.,* 1997:

$$q_t = q_c + [u_2.(1 - \alpha)]$$

where

α is the cone area ratio

The cone used on this project has a cone area ratio of *0.79*. This value is geometrically measured.

3.4.2 Depth Correction

All tests in the report have been corrected for depth difference caused by inclination. This has been calculated using the method described in *ISO 22476-1:2012*.

To calculate the corrected depth the following formula is used:

$$z = \int_0^l C_{inc} \cdot dl$$

where

z is penetration depth, in *m*
l is penetration length, in *m*
C_{inc} is correction factor for the effect of the inclination of the CPTU relative to the vertical axis.

The equation for calculating the correction factor for the influence of the inclination for a bi-axial inclinometer is:

$$C_{inc} = \frac{1}{\sqrt{(1 + tan^2\beta_1 + tan^2\beta_2}}$$

where

β_1 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
β_2 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1, in degrees

4.0 GEOTECHNICAL DERIVED PARAMETERS

A number of empirical correlations can be used to derive geotechnical parameters from CPTU data. This report includes only the parameters which are described in this chapter. The results of all correlations used to obtain the geotechnical derived parameters are presented on *CPT Log 02* and *CPT Log 03* in *Appendix B*.

Please, note that each empirical correlation is derived for a certain type of soil, and may not be appropriate for all the soil types encountered on this project.

4.1 SOIL BEHAVIOUR TYPE INDEX (I_c)

The soil behaviour type index, I_c, was derived by *Jefferies and Davies (1991)*, and was created to simplify the application of CPTU SBT chart shown in *Chapter 3*, *Figure 3.2*. This approach has been modified for use with the *Robertson (1990)* normalised CPT soil classification chart, *Figure 4.1*. The normalised cone parameters Q_t and F_r (for definitions see *Appendix A5* Symbol List) can be combined into one Soil Behaviour Type Index, I_c, *(Lunne et al., 1997)*.

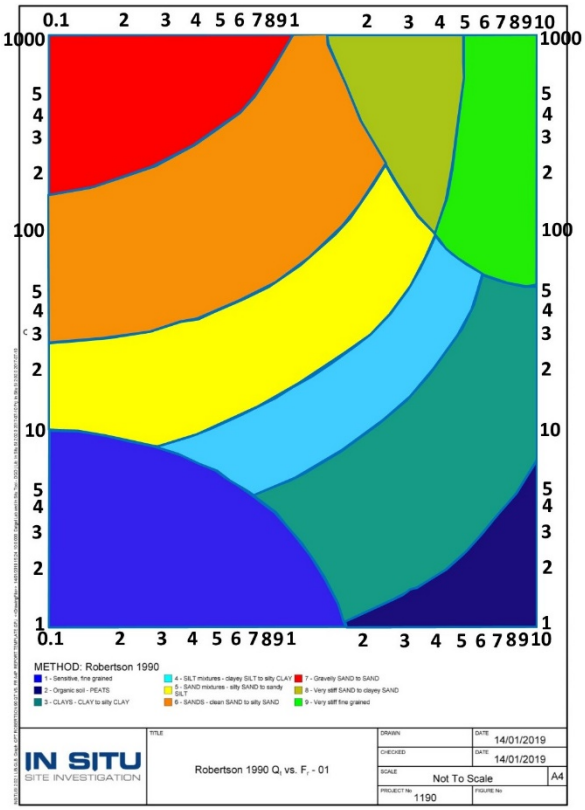

Figure 4.1: *Robertson 1990 soil behaviour type chart.*

The soil behaviour type index, I_c, can then be defined using *Robertson (2010)* formula, given below:

$$I_c = ((3.47 - logQ_t)^2 + (logF_r + 1.22)^2)^{0.5}$$

where

Q_t is the normalized cone resistance which represents the simple normalization with a stress exponent (n) of *1.0*, which applies well to clay-like soils

F_R is the normalized friction ratio, in *%*

The boundaries of soil behaviour type are then given in terms of the index, I_c, presented in *Table 4.1* below.

The soils behaviour type index does not apply to zones *1*, *8* and *9*. The profiles of I_c provide a simple guide to the continuous variation of soil behaviour type in a given soil profile based on CPTU results, with a reliability greater than *80%* compared with soil samples *(Robertson, 2015).*

Zone	Soil Behaviour Type	I_c
1	Sensitive fine grained	N/A
2	Organic Soils – clay	>3.6
3	Clays – silty clay to clay	2.95 – 3.6
4	Silt mixtures – clayey silt to silty clay	2.60 – 2.95
5	Sand mixtures – silty sand to sandy silt	2.05 – 2.6
6	Sands – clean sand to silty sand	1.31 – 2.05
7	Gravelly sand to dense sand	<1.31
8	Very stiff sand to clayey sand*	N/A
9	Very stiff fine grained *	N/A

** Heavily over consolidated or cemented*

Table 4.1: *Normalized CPTU Soil Behaviour Type (SBT_n) Index values, I_c.(Robertson, 2010)*

4.2 N VALUE OF STANDARD PENETRATION TEST (SPT) (N_{60})

The derived *N* value of *SPT,* N_{60}, is strongly and directly related to the cone resistance, q_c.

In this report the N_{60} value is derived using the following correlations, developed by *Robertson and Wride (1998)* and *Jefferies and Davies (1998)*

1) *Robertson & Wride (1998)*

$$N_{60} = \frac{q_c}{8.5 \cdot p_a \left(1 - \frac{I_C}{4.6}\right)}$$

2) *Jefferies and Davies (1993)*

$$N_{60} = \frac{q_c}{0.85 \cdot \left(1 - \frac{I_C}{4.75}\right)}$$

where

q_c	is the cone resistance
p_a	is the atmospheric pressure equal to *100 kPa*
I_c	is the soil behaviour type index calculated as given in *section 4.1*

It is suggested that this method provides a better estimation of the *N* value than the actual *SPT* test, due to its poor repeatability. But in fine grained soil with high sensitivity these methods of estimating N_{60} may overestimate it *(Jefferies and Davies, 1991).*

4.3 RELATIVE DENSITY (D_r)

Relative density, D_r, is an intermediate parameter for coarse grained soils, widely used to describe sand deposits. All the research on deriving the relative density from CPTU tests results are carried out for ***clean predominantly quartz sands***. The studies have shown that CPTU resistance in granular soils is controlled by sand relative density, in situ effective stresses and compressibility. The more compressible sands tend to give lower penetration resistance for a given relative density then less compressible sands.

In this report relative density is calculated using the methods suggested by *Baldi et al., (1986)*, *Jamiolkowski et al., (2001)* and *Kulhawy and Mayne (1990)* as shown in the equations below:

1) Baldi et al., (1986)

$$D_r = \frac{1}{C_2} \cdot ln\left(\frac{q_c \cdot Wehr}{C_1 \cdot (\sigma'_{v0})^{0.55}}\right) \cdot 100$$

where

C_1 is a consolidation coefficient which is *157* for normally consolidated soils and *181* for over consolidated soils

C_2 is a consolidation coefficient which is *2.41* for normally consolidated soils and *2.46* for over consolidated soils

Wehr is a correction coefficient for calcareous soils

2) Jamiolkowski et al., (2001)

$$D_r = 100 \cdot \left[0.268 \cdot ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma'_{v0}/\sigma_{atm}}}\right) + C_1\right]$$

where

C_1 is a compressibility coefficient which is *-0.675* for average compressible soils, *≤1.0* for high compressible soils and carbonate or calcareous sands and *≥-2.0* for low compressible soils

q_t is corrected cone resistance

σ_{atm} is the atmospheric pressure

3) Kulhawy and Mayne, (1990)

$$D_r = \left[\frac{q_{c1}}{305 \cdot C_1 \cdot OCR^{0.18} \cdot \left(1.2 + 0.05 \cdot log(t/100)\right)}\right]^{0.5} \cdot 100$$

where

q_{c1} is the cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{c1} = \frac{q_c}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

where

q_c is the cone resistance in *kPa*

σ'_{v0} is the initial vertical effective stress in *kPa*

C_1 is a compressibility coefficient which is *-0.91* for low compressible sands, *1.0* for medium compressible sands and *1.09* for high compressible sands

t is time in years

4.4 FRICTION ANGLE (φ')

Friction angle, *φ*', is used to express the shear strength of uncemented, coarse grained soils. In this report friction angle is derived by the correlations of *Mayne and Campanella (2005)*, *Robertson and Campanella (1983)* and *Kulhawy and Mayne (1990)*.

1) Mayne and Campanella, (2005)

$$\varphi' = 29.5^0 \cdot B_q^{0.121} \cdot \left[0.256 + 0.336 \cdot B_q + logQ_t\right]$$

where

B_q is the pore pressure ratio, calculated as in Session 3.3

Q_t is the normalized cone resistance

2) Robertson and Campanella, (1983)

$$\varphi' = \tan^{-1}\left(0.1 + 0.38 \cdot log\left(\frac{q_t}{\sigma'_{v0}}\right)\right)$$

where

q_c is the cone resistance in *kPa*

σ'_{v0} is the initial vertical effective stress in *kPa*

3) Kulhawy and Mayne, (1990)

$$\varphi' = 17.6^0 + 11.0^0 \cdot log(q_{t1})$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

The method suggested by *Mayne and Campanella (2005)* will not provide reliable results for heavily over consolidated soils, fissured geomaterials and highly cemented or structures clays. This approach gives reliable results when pore pressure is positive and varies $0.1 < B_q < 1.0$. The correlation suggested by *Robertson and Campanella (1983)* estimates the peak friction angle for uncemented, unaged, moderately compressible, predominately quartz sands. For sands of higher compressibility, the method will tend to predict low friction angles. The method suggested by *Kulhawy and Mayne (1990)* is an alternate relationship for clean, rounded, uncemented, quartz sands.

4.5 FINES CONTENT (*FC*)

The fines content, *FC*, in this report is estimated using two different methods, one from *Robertson and Wride (1998)* and the other, *Suzuki et al. (1998)* as presented below:

1) Robertson and Wride (1998)

$$I_C < 1.26: FC = 0$$
$$1.26 \leq I_C \leq 3.5: FC(\%) = 1.75I_C^{3.25} - 3.7$$
$$3.5 < I_C: \ FC = 100\%$$

2) Suzuki et al. (1998)

$$FC(\%) = 2.8I_C^{2.6}$$

where

I_c is the soil behaviour type index, calculated as in section 4.1

4.6 UNDRAINED SHEAR STRENGTH (s_u)

Estimation of undrained shear strength, s_u, from CPTU tests using corrected cone resistance is carried out using the following correlation from *Lunne et al. (1981)*:

$$S_u = \frac{(q_t - \sigma_{v0})}{N_{kt}}$$

where

N_{kt} is the empirical cone factor, which varies from *10* (*6* for very soft sensitive fine grained soils) to *20*. In this report 3 values are considered: *15*, *17.5* and *20*. N_{kt} tends to increase with increasing plasticity and decrease with increasing soil sensitivity. It decreases as B_q increases. (*Lunne et al., 1997*)

σ_{vo} = total overburden stress.

This report only presents the undrained shear strength data on soils with soil behaviour type index, I_c values greater than *2.60*.

The value of undrained shear strength, s_u to be used in analysis depends on the design problem. In general, the simple shear in the direction of loading often represents the average undrained strength. For larger, moderate to high risk projects, where high quality field and laboratory data may be available, site specific correlations should be developed based on appropriate and reliable values of s_u.

4.7 SENSITIVITY (S_t)

The sensitivity, S_t of clays is defined as the ratio of undisturbed peak undrained shear strength to totally remoulded undrained shear strength.

In this report S_t is calculated using two correlations developed by *Schmertmann (1978)* and *Mayne (2007)*.

1) Schmertmann (1978)

$$S_t = \frac{s_u}{s_{u(rem)}} = \frac{q_t - \sigma_v}{N_{kt}} \left(\frac{1}{f_s}\right)$$

where

$s_{u(rem)}$ is the remoulded undrained shear strength. It can be assumed equal to the sleeve resistance, f_s.

2) Mayne (2007)

$$S_t = \frac{0.073 \cdot (q_t - \sigma_{v0})}{f_s}$$

For relatively sensitive clays, $S_t > 10$, the value of f_s can be very low and not very accurate, hence the estimate of sensitivity should be used as a guide only.

4.8 SOIL UNIT WEIGHT (γ)

Soil unit weight, γ in this report is calculated by using one method for sands, considered under dry conditions and two methods for clays, considered under saturated conditions. These relationships are developed by *Mayne (2007)* and the equations are presented below:

1) Mayne (2007)

Dry unit weight for sands:

$$\gamma_{dry} = 1.89 \cdot log(q_{t1}) + 11.82$$

Saturated unit weight for clays method 1

$$\gamma_{sat} = 8.32 \cdot log(V_S) - 1.61 \cdot log(z)$$

Saturated unit for clays method 2

$$\gamma_{sat} = 2.60 \cdot log(f_s) + 15 \cdot G_s - 26.5$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula:

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

z is the depth

V_s is the shear wave velocity, calculated as $V_S = 118.8 \cdot log\left(f_s\right) + 18.5$

G_s is the specific gravity of solids, typically between *2.40* and *2.90*

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APPENDIX A

APPENDIX A1 – Project Summary Sheet

Piezocone Tests Summary Sheet

HOLE ID	Final Depth (m)	Date of Test	Cone Used	Test Remarks
BH 41	26.28	22/06/2019	S10-CFIP.786	Test refused on tip resistance.
BH 43	22.09	27/06/2019	S10-CFIP.786	Test refused on inclination.
BH 45	20.72	24/06/2019	S10-CFIP.768	Test refused on inclination.
BH 47	11.63	21/06/2019	S10-CFIP.786	Test refused on tip resistance.
BH 49	12.17	26/06/2019	S10-CFIP.786	Test refused on total pressure.
BH 50A	9.77	20/06/2019	S15-CFIP.825	Test stopped due to technical issues.
BH 51	16.23	05/07/2019	S10-CFIP.786	Test refused on inclination.
BH 52	15.34	03/07/2019	S10-CFIP.786	Test refused on total pressure.

Piezocone Tests Coordinates

HOLE ID	Easting	Northing	Elevation (mCD)
BH 41	142475.28	931271.63	-7.84
BH 43	142554.56	931271.70	-6.75
BH 45	142515.40	931227.12	-8.91
BH 47	142476.25	931164.78	-11.44
BH 49	142554.83	931181.93	-9.90
BH 50A	142515.95	931119.31	-13.22
BH 51	142515.44	931146.99	-13.63
BH 52	142518.01	931190.60	-10.95

APPENDIX A2 – CPT Rig Datasheet

RIGS

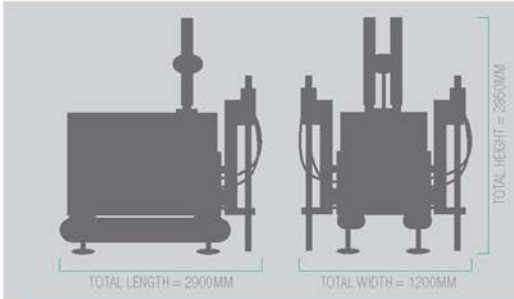
3.5 TONNE CPT TRACK MOUNTED RIG (CPT003)

In Situ has a wide range of rigs which meet the clients varied CPT requirements often in difficult terrains. Projects may require CPT testing in areas which range from motorways to rugged mountainous terrain, to offshore work; the access to the projects may often be restricted for manoeuvring.

In Situ has rigs to meet all clients needs and situations .

CPT RIG DETAILS	
DRIVE SYSTEM	SMALL TRACKED SYSTEM
TOTAL WEIGHT	3.5 TONNES
ADDITIONAL REACTION WEIGHT	4 HYDRAULICALLY DRIVEN SCREW ANCHORS
CPT RAM THRUST CAPACITY	20 TONNES
MAXIMUM PENETRATION	10-30M DEPENDING ON THE GROUND CONDITIONS AND REACTION FROM SCREW ANCHORS.
PERFORMANCE RATES	50-100M OF TESTING IN A DAY DEPENDING ON ACCESS TO POSITIONS.
TYPICAL SITES FOR THIS RIG	SPECIALISES ON SOFT GROUND SITES. CAN BE MOUNTED ON MARINE JACK-UPS AND RAIL TRAILERS.

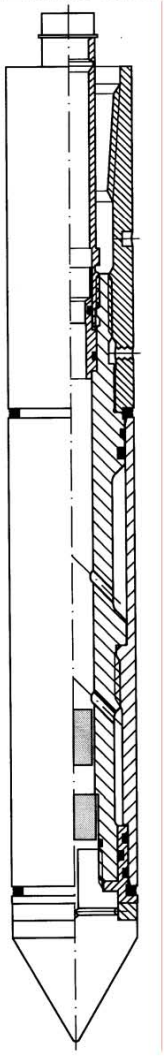
CPT RIG DIMENSIONS



IN SITU SITE INVESTIGATION INSITUSI.COM

APPENDIX A3 – Cone Datasheet

GeoPoint Systems bv
Rijksstraatweg 22F
2171 AL Sassenheim
Tel. : +31 71 301 92 51
Fax : +31 71 301 92 52
E-mail : info@geopoint.nl
ING bank : 68.23.01.396
Postbank : 5226758
BTW nr. : NL806331677B01



SPECIFICATIONS S10 SERIES ELECTRICAL CONES

The electronic subtraction cones have been developed to address the durability problems inherent in other cone designs. The unit consists of a single element temperature compensated strain gauge transducer for measuring both cone resistance and local sleeve friction. This design is therefore more robust than a compression type cone. The cone support electronics package is located directly behind the transducer. The precision strain gauge amplifiers and power supply eliminate the effects of cable resistance on the measurements. A standard subtraction cone is capable of measuring simultaneously the following channels: Tip, Local friction, Pore pressure, Temperature and Inclination.

GENERAL SPECIFICATIONS

Cone Tip Section Area	1,000 mm2
Friction Sleeve Surface	15,000 mm2
Total Length	285 mm
Weight	2800 g
Power Supply	± 15 VDC, 100 mA.
Output	0 – 10 VDC*
Working Temperature	0 - 60°C
Storage Temperature	- 40 to + 85°C
Connector	Lemo 10 pins (others on request)

TIP RESISTANCE

Range	10/50/100* kN
Accuracy	0.25 % FS
Maximum Load	150 % of range
Cone Area Ratio	0.8

LOCAL SLEEVE FRICTION

Range	10/25/50* kN
Accuracy	0.50 % FS
Maximum Load	150 %
Sleeve Area Ratio	1.0 (EA)

PORE PRESSURE

Range	1/2/5/10* MPa
Accuracy	0.5 % FS
Maximum Load	150 % of range
Filter position	u1 & u2

INCLINATION

Range	25 ° (biaxial)
Accuracy	1.0 % FS

All our equipment complies with the ISSMGE, ASTM, DIN and NEN Standards.

** Other output and voltage ranges available on request. Loadcells may be calibrated for lower ranges.*

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Fax : +31 71 301 92 52
E-mail : info@geopoint.nl
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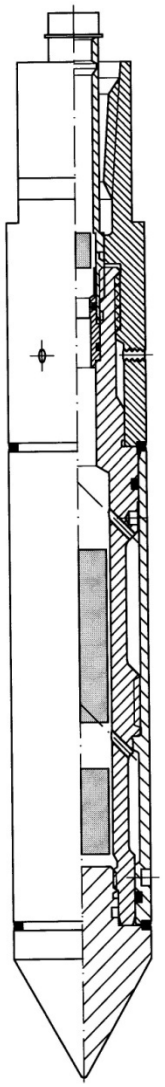
Postbank : 5226758
BTW nr. : NL806331677B01



SPECIFICATIONS S15 SERIES ELECTRICAL CONES

The electronic subtraction cones have been developed to address the durability problems inherent in other cone designs. The unit consists of a single element temperature compensated strain gauge transducer for measuring both cone resistance and local sleeve friction. This design is therefore more robust than a compression type cone. The cone support electronics package is located directly behind the transducer. The precision strain gauge amplifiers and power supply eliminate the effects of cable resistance on the measurements. A standard subtraction cone is capable of measuring simultaneously the following channels: Tip, Local friction, Pore pressure, Temperature and Inclination.

GENERAL SPECIFICATIONS

Cone Tip Section Area	1,500 mm2
Friction Sleeve Surface	22,500 mm2
Total Length	325 mm
Weight	4200 g
Power Supply	± 15 VDC, 100 mA.
Output	0 – 10 VDC*
Working Temperature	0 - 60˚C
Storage Temperature	- 40 to + 85˚C
Connector	Lemo 10 pins (others on request)

TIP RESISTANCE

Range	100/150* kN
Accuracy	0.25 % FS
Maximum Load	150 % of range
Cone Area Ratio	0.75

LOCAL SLEEVE FRICTION

Range	100/150* kN
Accuracy	0.50 % FS
Maximum Load	150 %
Sleeve Area Ratio	1.0 (EA)

PORE PRESSURE

Range	1/2/5/10* MPa
Accuracy	0.5 % FS
Maximum Load	150 % of range

INCLINATION

Range	25 ˚ (biaxial)
Accuracy	< 2 ˚

All our equipment complies with the ISSMGE, ASTM, DIN and NEN Standards.

**Other output and voltage ranges available on request. Loadcells may be calibrated for lower ranges.*

APPENDIX A4 – Cone Calibration Certificate

Eijkelkamp GeoPoint SoilSolutions
Rijkstraatweg 22F
2171 AL Sassenheim
The Netherlands
T +31 71 301 9251
E info@eijkelkamp-geopoint.com
I eijkelkamp-geopoint.com

Cone Calibration Certificate

Certificate:	**GS-768-012**	
Instrument Type:	Electric Subtraction Cone	
Model:	S10-CFIIP	
Serial number:	768	
Calibration date:	06-03-2019	
Client:	Insitu	
Calibrated by:	M.van Es	
Calibration instruments		
Manufacturer:	Hottinger Baldwin Messtechnik GmbH	
HBM certificate no. :	49046	
Calibration conditions		
Ambient temperature:	19.9	°C
Atmospheric pressure:	997	mBar
Cone specifications		
Cone base area:	1000	mm2
Load tip resistance (nom.):	50	kN
Friction sleeve area:	15000	mm2
Load tip + local friction (nom.):	50	kN
Load local friction (nom.):	15	kN
Load pore pressure (nom.):	2	MPa
Inclination (nom.):	+/- 20	°
Temperature compensation (all channels):	0...+40	°C
Maximum overload capacity (all channels):	100	%
Cone area ratio (a):	0.80	
Max. Inaccuracy, relative to measurement value:	1.0	%

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:		
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	X (mV)	Y (mV)
Zero points:		0257		0253		0216			
	0	0	0	0	0	0	0	2468	2363
	5	0377	5	0380	0.4	1638	-20	0321	0207
	10	0756	10	0762	0.8	3266	20	4441	4514
	15	1136	15	1144	1.2	4887			
	20	1515	20	1527	1.6	6500			
	25	1895	25	1910	2.0	8123			
	30	2274	30	2292					
	35	2654	35	2675					
	40	3034	40	3059					
	45	3411	45	3439					
	50	3787	50	3819					

Max. error, abs. qc: 35 kPa
Max. error, abs. fs: 2 kPa
Max. error, abs. u2: 10 kPa
Max. error, abs. I: 1 °

This calibration is compliant with GeoPoint Systems internal quality system, internal calibration procedures and meets the requirements of NEN 2649, NEN-EN-ISO 22476-1, NORSOK G-001, ISSMFE and ASTM using calibration equipment traceable to (Inter-)National Standards.

Approved by: B. van Eijk
Date: 06-03-2019

Eijkelkamp GeoPoint SoilSolutions
V.A.T. NO. NL 8584.21.422.B01
Trade Reg. Arnhem no. 70686149
IBAN NL43 RABO 0326 7904 38
BIC: RABONL2U

Eijkelkamp GeoPoint
SoilSolutions

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2171 AL Sassenheim
The Netherlands

T +31 71 301 9251
E info@eijkelkamp-geopoint.com
I eijkelkamp-geopoint.com

Cone Calibration Certificate

Certificate:	**GS-786-013**	
Instrument Type:	Electric Subtraction Cone	
Model:	S10-CFIIP	
Serial number:	786	
Calibration date:	18-03-2019	
Client:	Insitu	
Calibrated by:	M.van Es	
Calibration instruments		
Manufacturer:	Hottinger Baldwin Messtechnik GmbH	
HBM certificate no. :	49046	
Calibration conditions		
Ambient temperature:	19.5	°C
Atmospheric pressure:	1021	mBar
Cone specifications		
Cone base area:	1000	mm2
Load tip resistance (nom.):	50	kN
Friction sleeve area:	15000	mm2
Load tip + local friction (nom.):	50	kN
Load local friction (nom.):	15	kN
Load pore pressure (nom.):	2	MPa
Inclination (nom.):	+/- 20	°
Temperature compensation (all channels):	0...+40	°C
Maximum overload capacity (all channels):	100	%
Cone area ratio (a):	0.80	
Max. Inaccuracy, relative to measurement value:	1.0	%

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:		
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	X (mV)	Y (mV)
Zero points:		0254		0222		0237			
	0	0	0	0	0	0	0	2543	2622
	5	0381	5	0383	0.4	1380	-20	0404	0616
	10	0763	10	0767	0.8	2751	20	4531	4655
	15	1144	15	1151	1.2	4125			
	20	1528	20	1536	1.6	5492			
	25	1912	25	1923	2.0	6858			
	30	2294	30	2307					
	35	2678	35	2694					
	40	3061	40	3079					
	45	3442	45	3463					
	50	3822	50	3845					

Max. error, abs. qc:	35 kPa
Max. error, abs. fs:	2 kPa
Max. error, abs. u2:	10 kPa
Max. error, abs. I:	1 °

This calibration is compliant with GeoPoint Systems internal quality system, internal calibration procedures and meets the requirements of NEN 2649, NEN-EN-ISO 22476-1, NORSOK G-001, ISSMFE and ASTM using calibration equipment traceable to (Inter-)National Standards.

Approved by: B. van Eijk
Date: 18-03-2019

Eijkelkamp GeoPoint SoilSolutions
V.A.T. NO. NL 8584.21.422.B01
Trade Reg. Arnhem no. 70686149

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I eijkelkamp-geopoint.com

Cone Calibration Certificate

Certificate:	**GS-825-014**	
Instrument Type:	Electric Subtraction Cone	
Model:	S15-CFIIP	
Serial number:	825	
Calibration date:	28-09-2018	
Client:	Insitu	
Calibrated by:	M.van Es	
Calibration instruments		
Manufacturer:	Hottinger Baldwin Messtechnik GmbH	
HBM certificate no. :	49046	
Calibration conditions		
Ambient temperature:	20.7	°C
Atmospheric pressure:	1027	mBar
Cone specifications		
Cone base area:	1500	mm2
Load tip resistance (nom.):	100	kN
Friction sleeve area:	22500	mm2
Load tip + local friction (nom.):	100	kN
Load friction sleeve (nom.):	22.5	kN
Load pore pressure (nom.):	2	MPa
Inclination (nom.):	+/- 20	°
Temperature compensation (all channels):	0...+40	°C
Maximum overload capacity (all channels):	100	%
Cone area ratio (a):	0.79	
Max. Inaccuracy, relative to measurement value:	1.0	%

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:		
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	X (mV)	Y (mV)
Zero points:		0201		0202		0285			
	0	0	0	0	0	0	0	2388	2422
	5	0303	5	0311	0.4	1288	-20	0380	0379
	10	0607	10	0622	0.8	2572	20	4428	4471
	15	0912	15	0935	1.2	3849			
	20	1216	20	1248	1.6	5125			
	25	1521	25	1561	2.0	6393			
	30	1827	30	1874					
	35	2132	35	2187					
	40	2437	40	2500					
	45	2741	45	2811					
	50	3043	50	3121					
	75	4556	75	4672					
	100	6062	100	6215					

Max. eror, abs. qc:	35 kPa
Max. error, abs. fs:	2 kPa
Max. error, abs. u2:	10 kPa
Max. error, abs. I:	1 °

This calibration is compliant with GeoPoint Systems internal quality system, internal calibration procedures and meets the requirements of NEN2649, NEN-EN-ISO 22476-1, NORSOK G-001, ISSMFE and ASTM using calibration equipment traceable to (Inter-) National Standards.

Approved by: B. van Eijk
Date: 28-09-2018

Eijkelkamp GeoPoint SoilSolutions
V.A.T. NO. NL 8584.21.422.B01
Trade Reg. Arnhem no. 70686149

IBAN NL43 RABO 0326 7904 38
BIC: RABONL2U

APPENDIX A5 – Symbol List

English

a	is area ratio of the cone ($= {}^{A_n}/_{A_c}$)
A	is area
A_c	is projected area of the cone
A_n	is cross sectional area of load cell or shaft
A_s	is area of friction sleeve
A_{sb}	is bottom end area of friction sleeve
A_{st}	is top end area of friction sleeve
B_q	is pore pressure parameter ($= {}^{(u_2 - u_0)}/_{(q_t - \sigma_{v0})}$)
c_h	is horizontal coefficient of consolidation
c_v	is vertical coefficient of consolidation
D	is diameter
D_r	is relative density ($= \frac{e_{max} - e}{e_{max} - e_{min}} x100\%$)
e	is void ratio
e_{max}	is maximum void ratio
e_{min}	is minimum void ratio
E	is Young's modulus
f_s	is unit sleeve friction resistance
f_t	is sleeve friction corrected for pore pressure effects
F_s	is total force acting on friction sleeve
F_R	is normalized friction ratio ($= {}^{f_s}/_{(q_t - \sigma_{v0})}$)
FoS	is factor of safety
FC	is fines content
g	is acceleration due to gravity
G_0	is initial or maximum shear modulus, shear stiffness
I_c	is soil behavior type index
I_r	is rigidity index ($= {}^{G}/_{s_u}$)
I_p	is plasticity index
k	is coefficient of permeability
k_h	is coefficient of permeability in horizontal direction
k_v	is coefficient of permeability in vertical direction
K_0	is coefficient of earth pressure at rest ($= {}^{\sigma'_{h0}}/_{\sigma'_{v0}}$)
L	is length
m_v	is coefficient of volume change
M	is constrained deformation modulus
M7.5	is earthquake magnitude of 7.5 Richter scale
N	is number of blows of SPT
N_{60}	is SPT energy ratio
N_k	is cone factor
N_{ke}	is cone factor
N_{kt}	is cone factor
$N_{\Delta u}$	is cone factor
p_a	is reference stress ($= 100\ kPa$)
q_c	is measured cone resistance
q_e	is effective cone resistance ($= q_t - u_2$)
q_n	is net cone resistance ($= q_t - \sigma_{v0}$)
q_t	is corrected cone resistance ($= q_c - (1 - a)u_2$)
Q_c	is total force acting on the cone
Q_t	is normalized cone resistance ($= {}^{q_t - \sigma_{v0}}/_{\sigma'_{v0}}$)

R_f	is friction ratio ($= \left({}^{f_t}/_{q_t}\right) x100\%$ or alternatively $= \left({}^{f_t}/_{q_t}\right) x100\%$)
s_u	is undrained shear strength
s_{ur}	is remoulded undrained shear strength
S_t	is sensitivity
t	is time
t_{50}	is time for 50% dissipation of excess pore water pressure
T_{50}	is time factor at $U = 50\ \%$
u	is pore water pressure
u_0	is in situ pore pressure
u_1	is pore pressure measured on the cone
u_2	is pore pressure measured behind the cone
u_3	is pore pressure measured behind sleeve friction
Δu	is excess pore water pressure
U	is normalized excess pore pressure
V_s	is shear wave velocity
z	is depth

Greek

α	is constant
α	is cone roughness
β	is constant
β_1	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
β_2	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1, in degrees
γ	is unit weight of soil
γ_w	unit weight of water
Δ	is change
Δu	is excess pore pressure ($= u - u_0$)
μ	is Poisson's ratio
ρ	is density
ψ	is state parameter
σ, σ'	is normal stress (total, effective)
σ_h, σ_h'	is horizontal stress (total, effective)
σ_v, σ_v'	is horizontal stress (total, effective)
σ_{v0},σ_{v0}'	is overburden stress (total, effective)
τ_{av}	is average cyclic shear stress
τ_{cy}	is cyclic shear stress
φ'	is effective friction angle

APPENDIX A6 – Abbreviations

ASTM	American Society for Testing and Materials
CPTU	Cone Penetration Test with Pore Pressure Measurement (Piezocone Test)
CRR	Cyclic Resistance Ratio
CSR	Cyclic Stress Ratio
GWT	Ground Water Table
NC	Normally Consolidated
OC	Over consolidated
OCR	Over consolidation Ratio
PL	Limit Pressure
SDMT	Seismic Dilatometer Marchetti
SPT	Standard Penetration Test
TC	Technical Committee

APPENDIX A7 – Glossary

CPT
Cone Penetration Test.

Cone
The part of the cone penetrometer on which the end bearing is developed.

Cone Penetrometer
The assembly containing the *cone*, *friction sleeve*, any other sensors and measuring systems, as well as the connections to the *push-rods.*

Cone resistance, q_c
The total force acting on the cone, Q_c, divided by the projected area of the cone, A_c. $q_c = {Q_c}/{A_c}$

Corrected cone resistance, q_t
The *cone resistance*, q_c corrected for pore water pressure effects.

Corrected sleeve friction, f_t
The *sleeve friction* corrected for pore water pressure effects on the ends of the *friction sleeve*.

Data acquisition system
The system used to measure and record the measurements made by the *cone penetrometer*.

Dissipation Test
A test when the decay of the pore water pressure is monitored during a pause in penetration.

Filter element
The porous element inserted into the cone penetrometer to allow transmission of the pore water pressure to the pore pressure sensor, while maintaining the correct profile of the *cone penetrometer*.

Friction ratio, R_f
The ratio, expressed as a percentage of the *sleeve friction*, f_s, to the *cone resistance*, q_c, both measured at the same depth.

Friction reducer
A local enlargement on the push-rod surface, placed at a distance above the cone penetrometer, and provided to reduce the friction on the *push-rods*.

Friction sleeve
The section of the *cone penetrometer* upon which the *sleeve friction* is measured.

Normalized cone resistance, Q_c or Q_t
The *cone resistance* expressed in a non-dimensional form and taking account of stress changes *in situ*, $Q_c = {(q_c - \sigma_{v0})}/{\sigma'_{v0}}$, or when the *corrected cone resistance* is used $Q_t = {(q_t - \sigma_{v0})}/{\sigma'_{v0}}$. where σ_{v0} and σ'_{v0} are the total and effective vertical stress respectively.

Net cone resistance, q_n
The *corrected cone resistance* minus the vertical total stress. $q_n = q_t - \sigma_{v0}$

Normalized friction ratio, F_r
The *sleeve friction* normalized by the *net cone resistance*.

Piezocone
A *cone penetrometer* containing a pore pressure sensor.

Pore pressure, *u*
The pore pressure generated during penetration and measured by a pore pressure sensor, u_1 when measured on the cone, u_2 when measured just behind the cone and u_3 when measured just behind the friction sleeve.

Pore pressure ratio, B_q
The *net pore pressure* normalized with respect to the *net cone resistance*.

Push-rods
The thick-walled tubes or rods used for advancing the cone penetrometer.

Rig machine
The equipment which pushes the cone penetrometer and rods into the ground.

Sleeve friction, f_s
The total frictional force acting on the *friction sleeve*, F_s, divided by its *surface area*, A_s. $f_s = {F_s}/{A_s}$

APPENDIX A8 – Soils Description Tables

GRANULAR SOILS (Sands and Gravels)

Description	Relative Density D_r (%)	SPT N value, N_{SPT}
Very Loose	0 – 15	0 - 4
Loose	15 – 35	4 - 10
Medium Dense	35 – 65	10 - 30
Dense	65 – 85	30 - 50
Very Dense	>85	>50

COHESIVE SOILS (Clays and Silts)

Term based on measurement	Undrained Shear Strength Classification, s_u (kPa)
Extremely low	<10
Very low	10 - 20
Low	20 - 40
Medium	40 - 75
High	75 - 150
Very high	150 - 300
Extremely high	>300

APPENDIX A9 – Pictures from Site Works

APPENDIX B

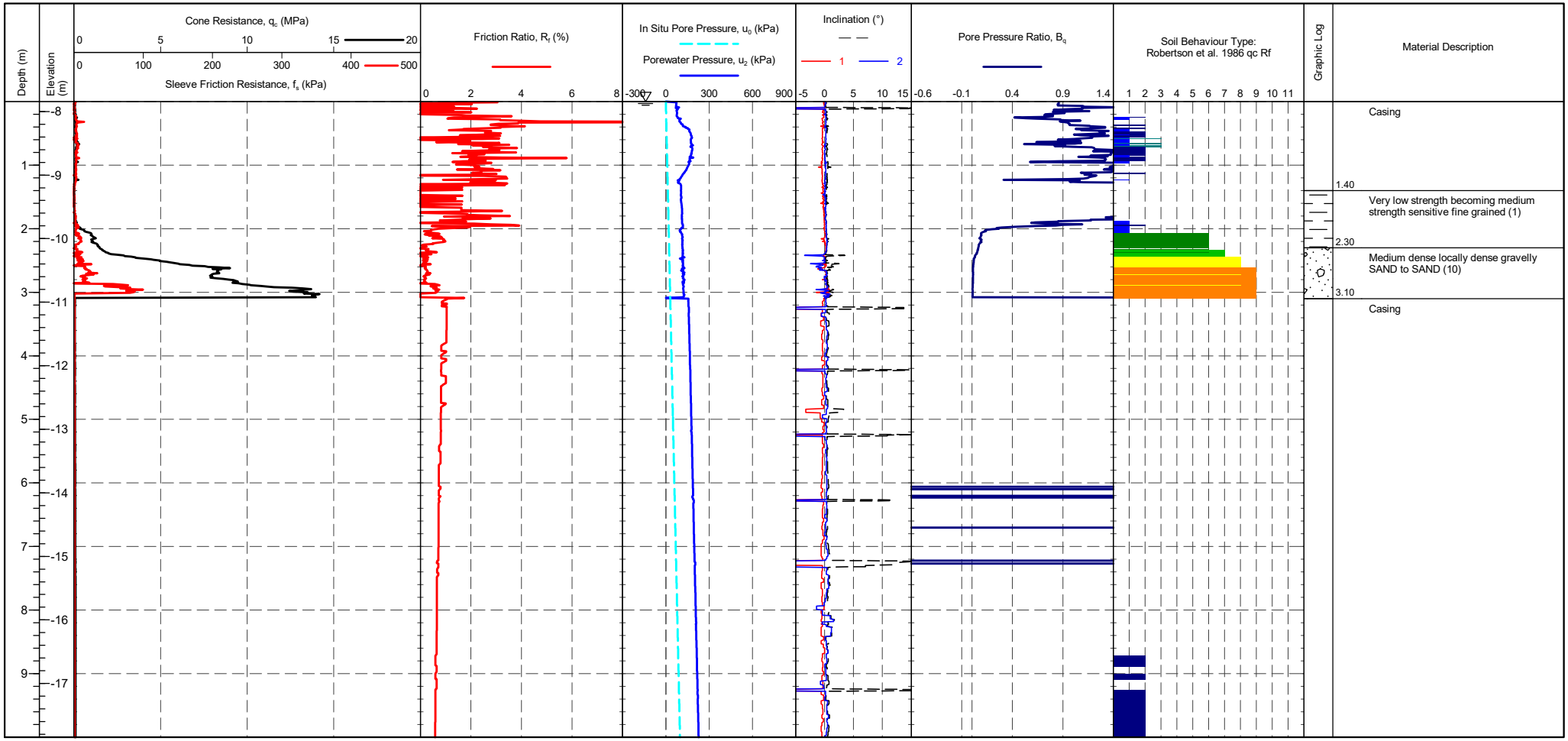
Cone Penetration Measured Parameters and Geotechnical Derived Parameters

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

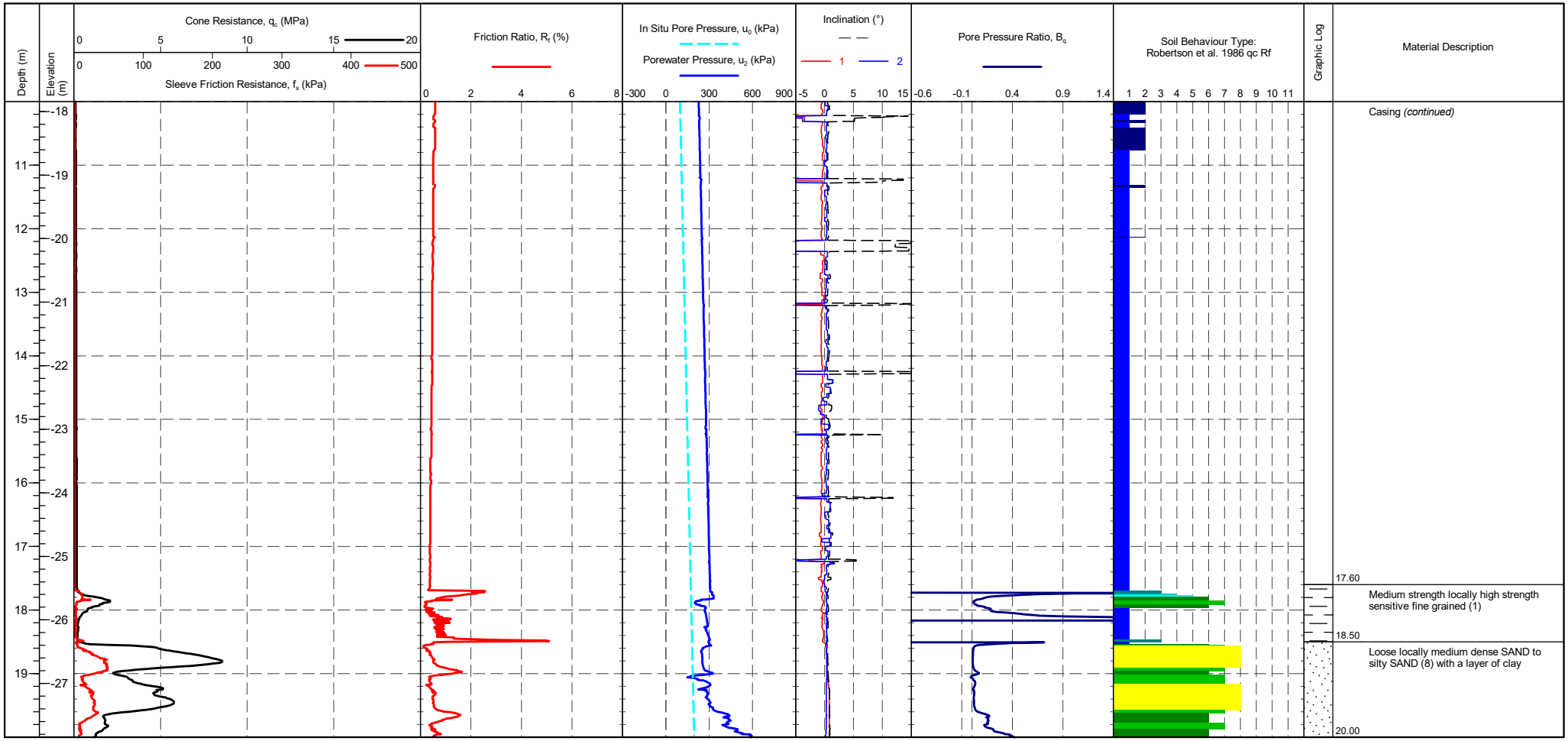
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

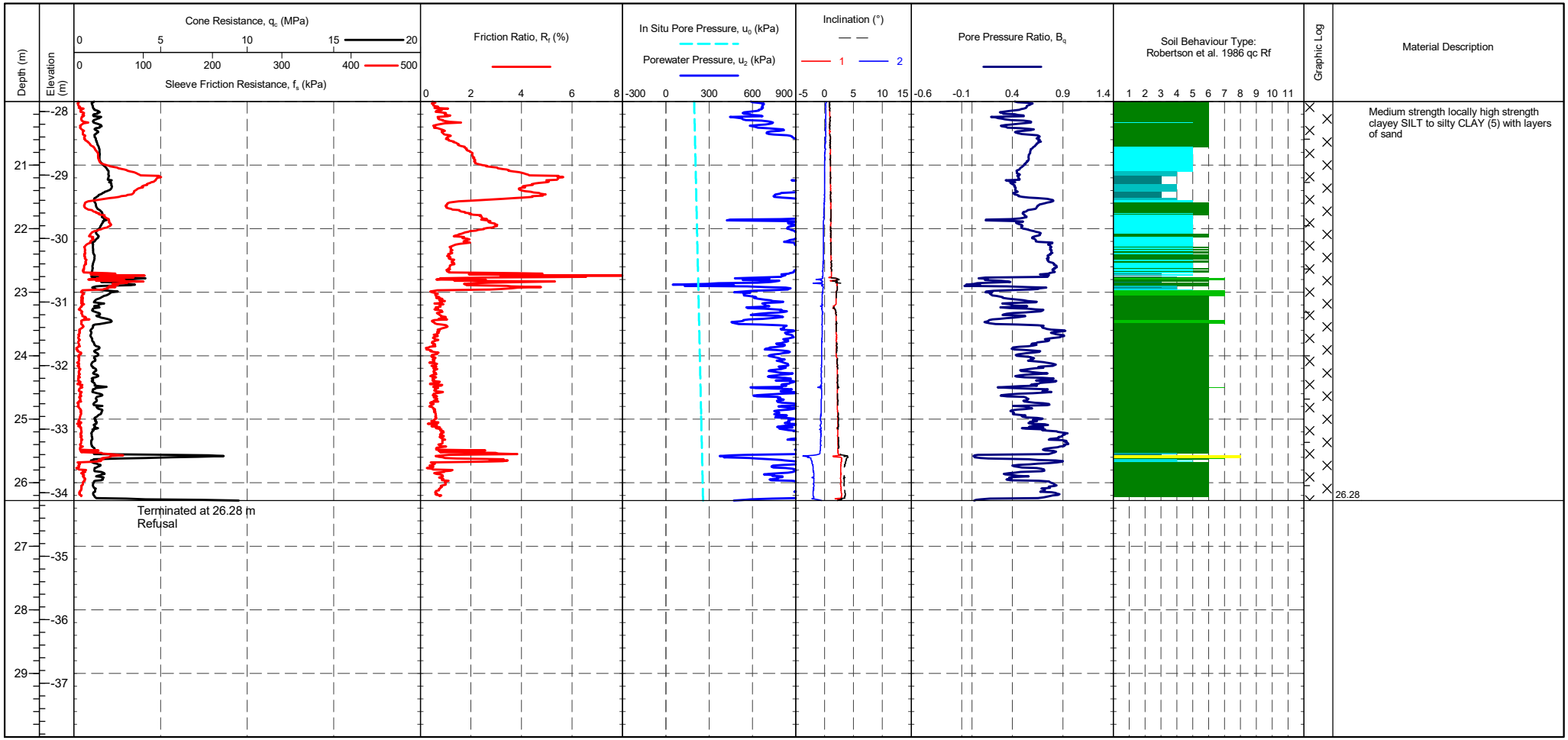
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

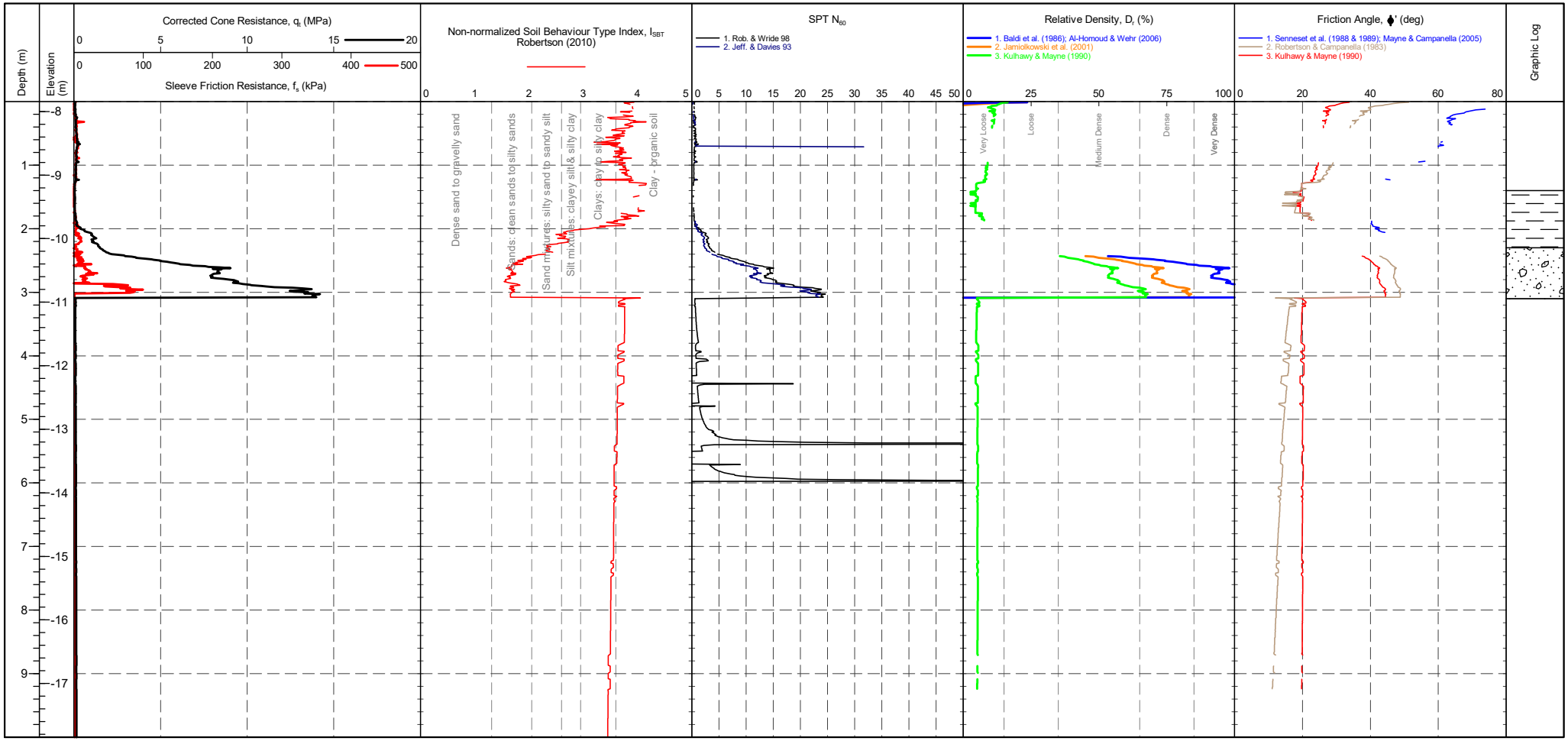
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	241 mV	238 mV	-0.039 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	X-Y Inclinometer	2559 mV	2492 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

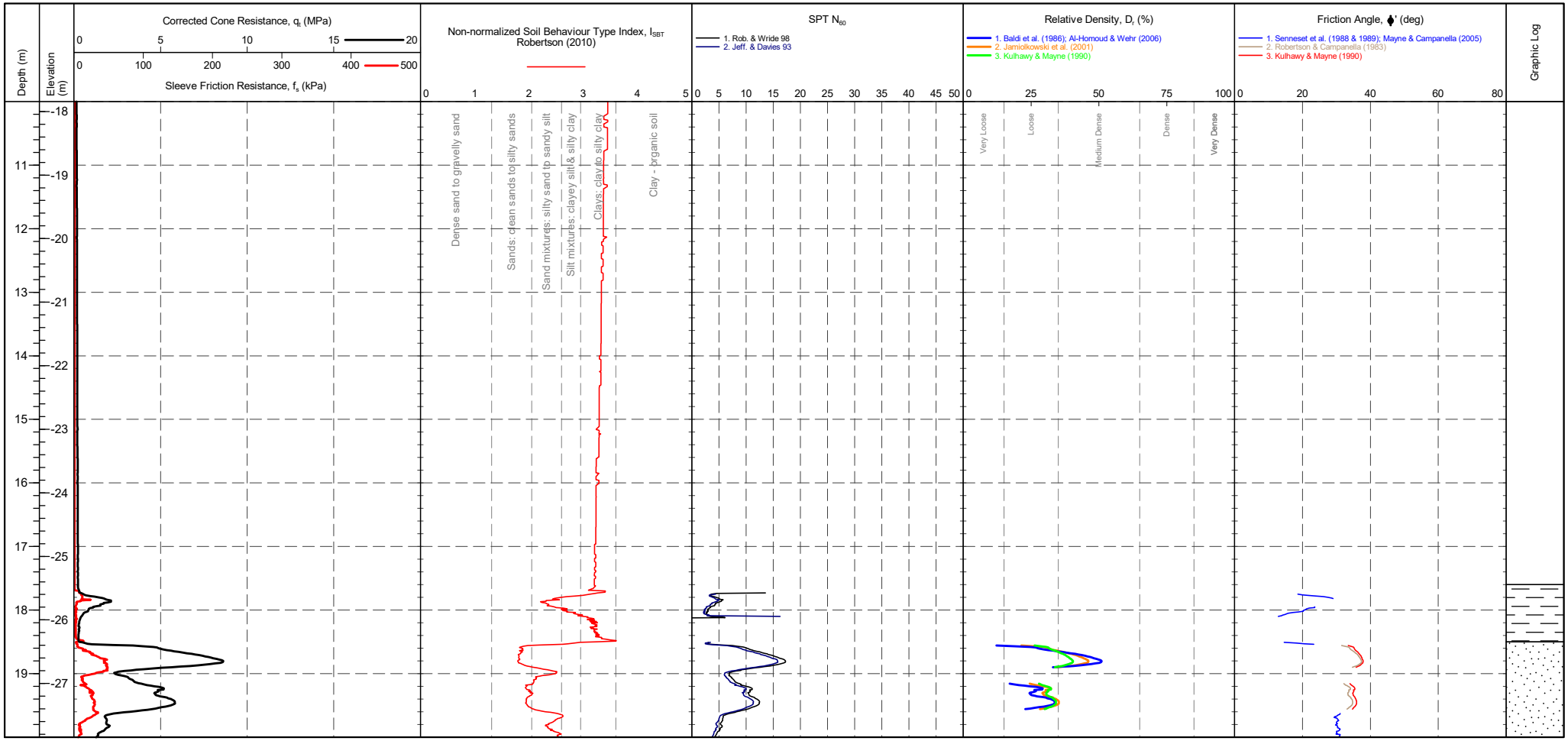
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

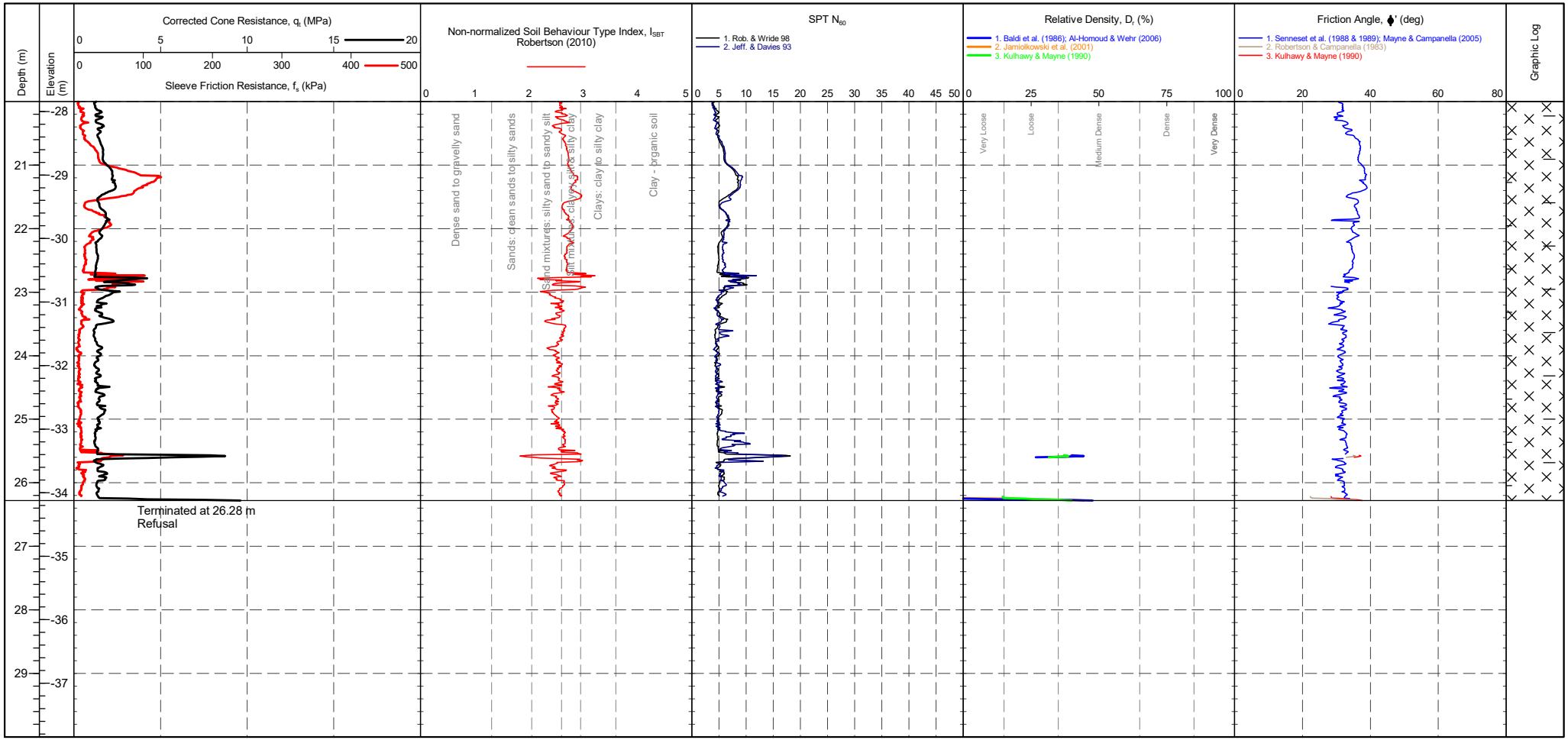
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

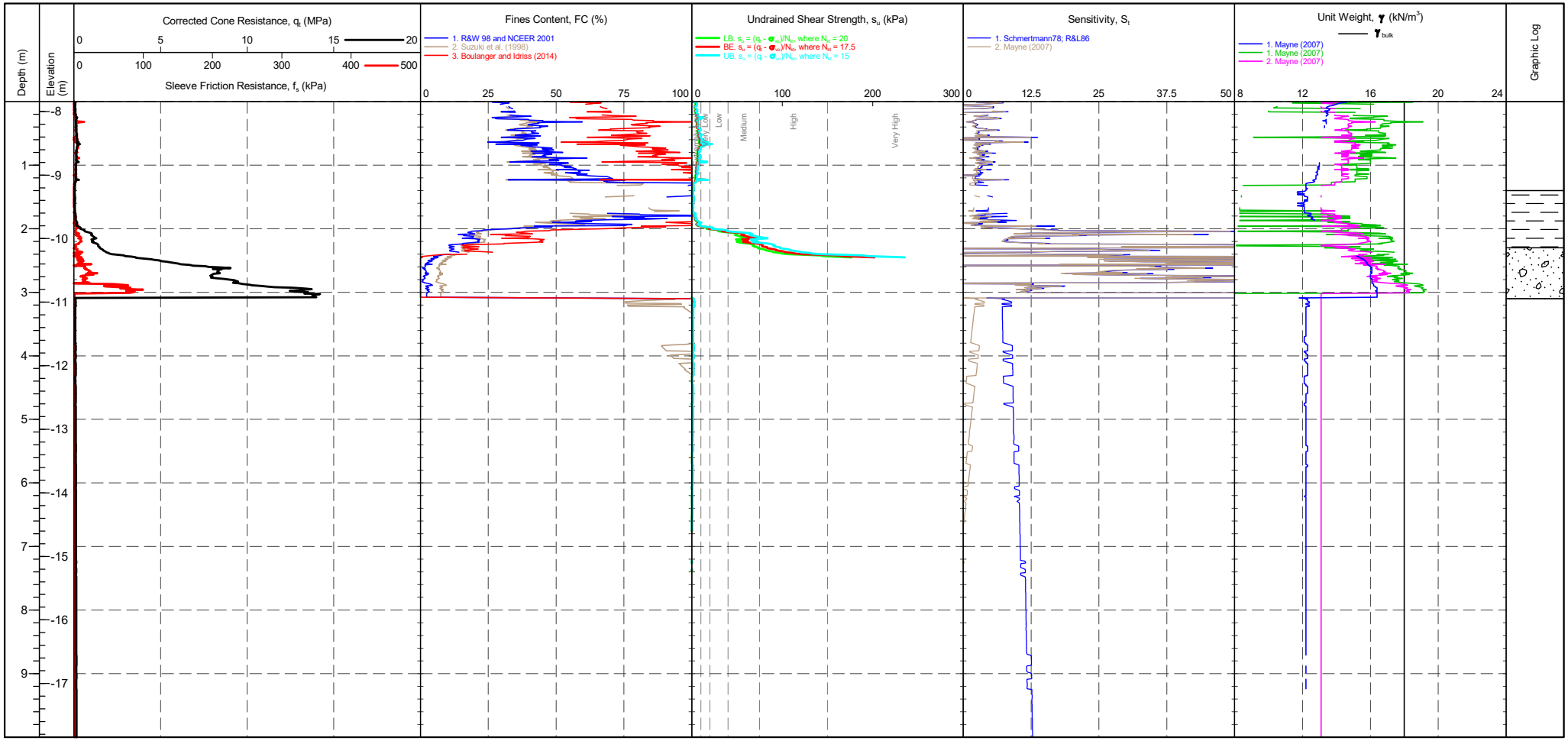
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	241 mV	238 mV	-0.039 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	X-Y Inclinometer	2559 mV	2492 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

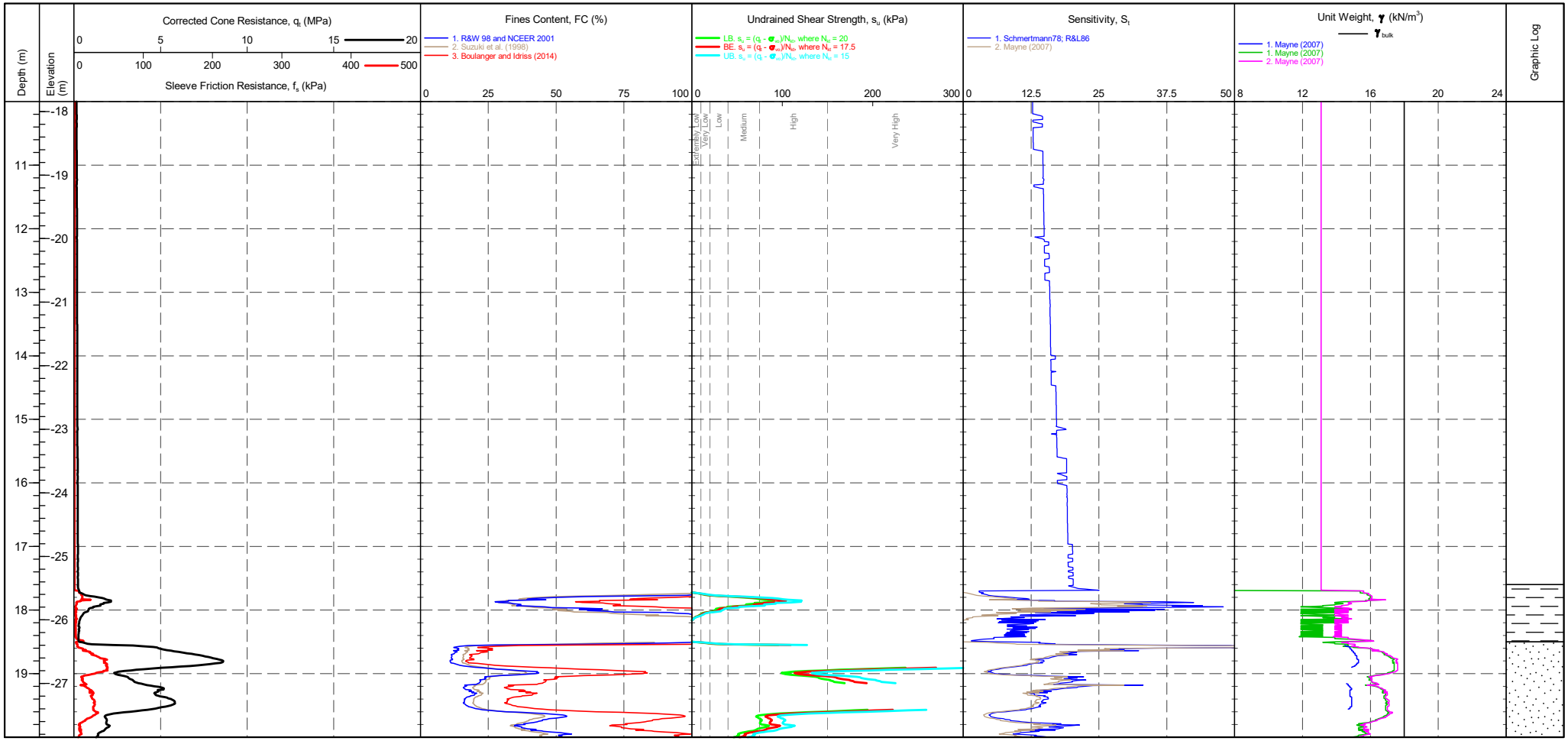
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV

Difference
-0.039 MPa
-0.003 kPa
0.003 kPa

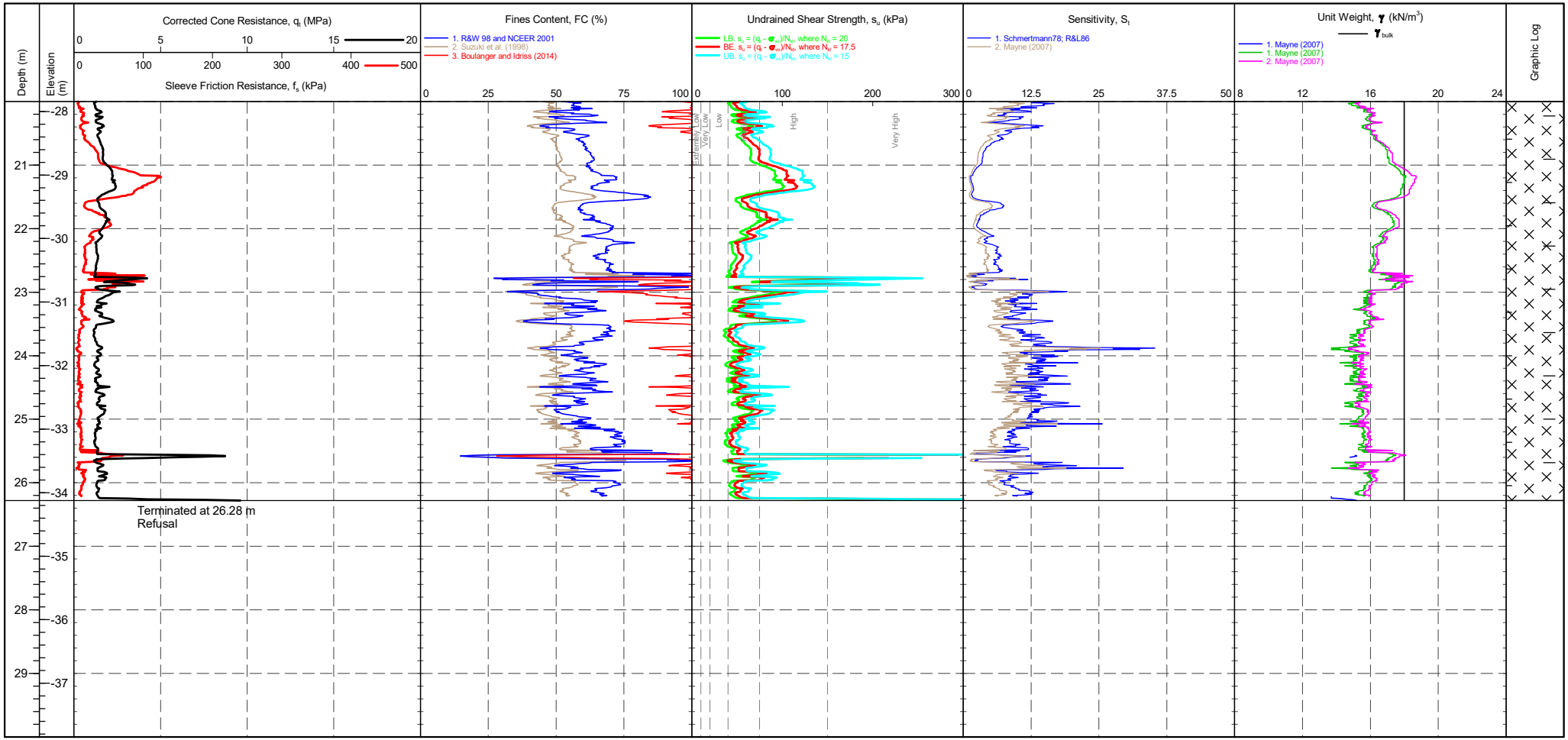
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

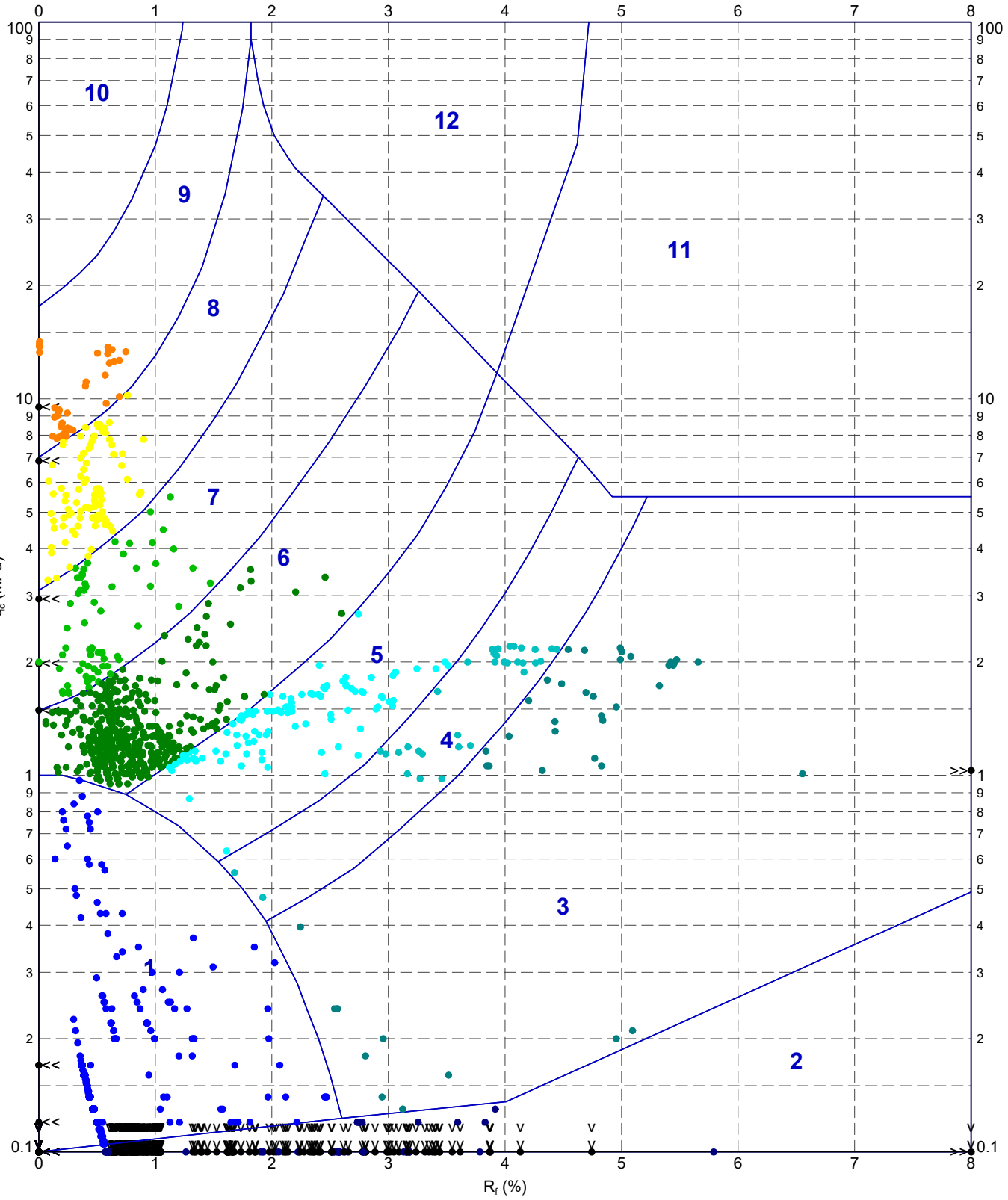
PointID
BH 41

CLIENT : Causeway	EASTING : 142475.279 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931271.630 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -7.844 m CD		TEST DATE : 22/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	241 mV	238 mV	-0.039 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	221 mV	218 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 41	Pore Pressure 2	287 mV	298 mV	0.003 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2559 mV	2492 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 41

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

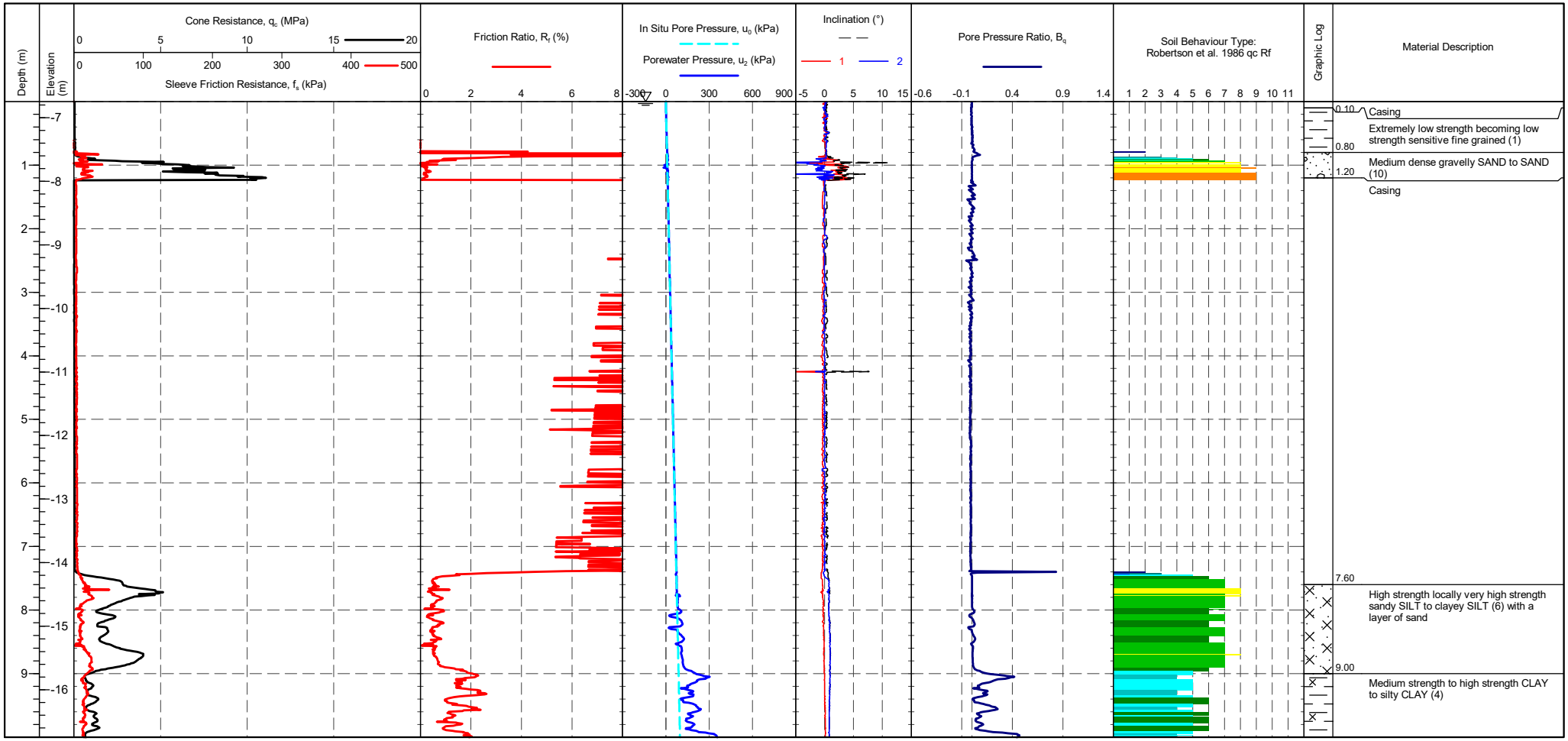
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:18 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

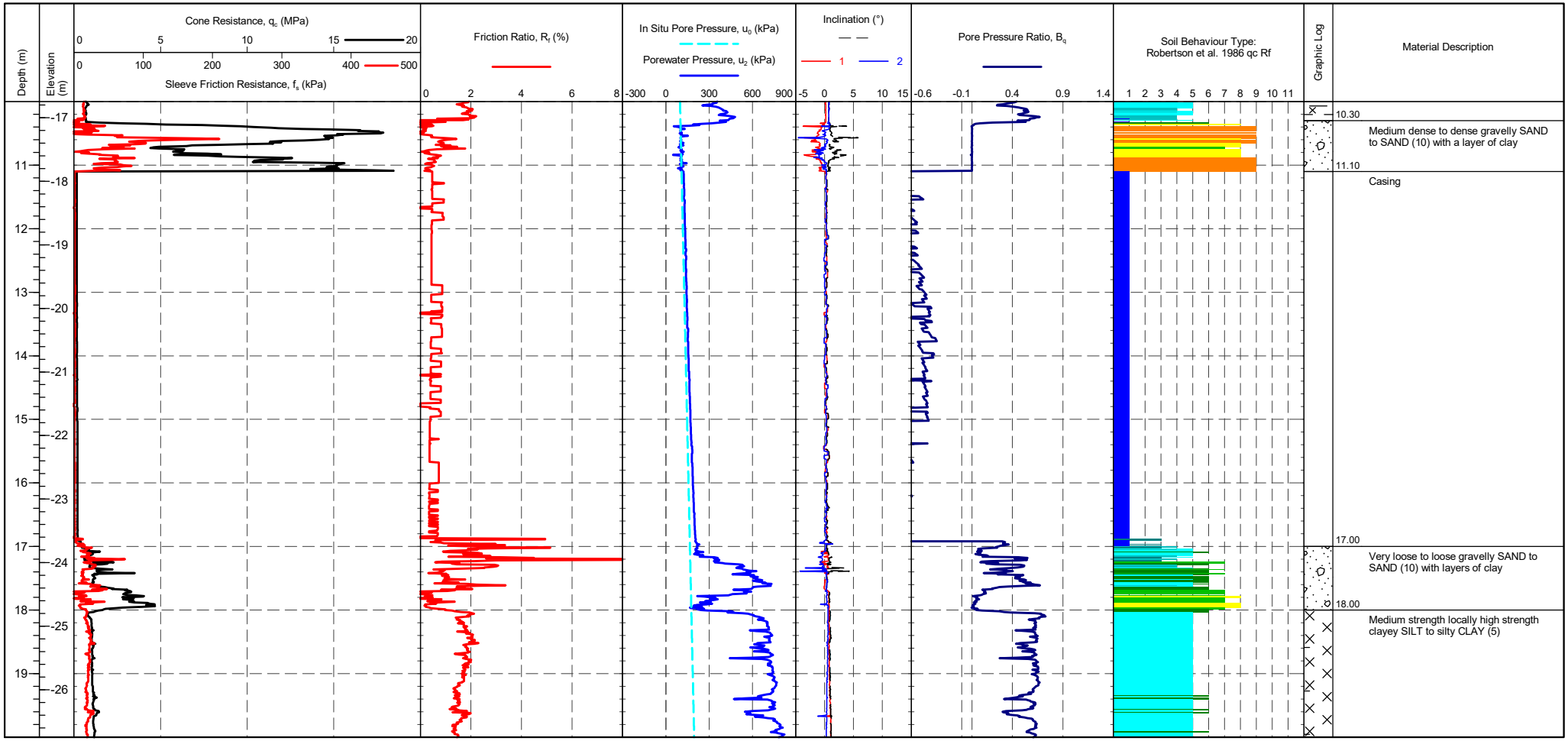
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

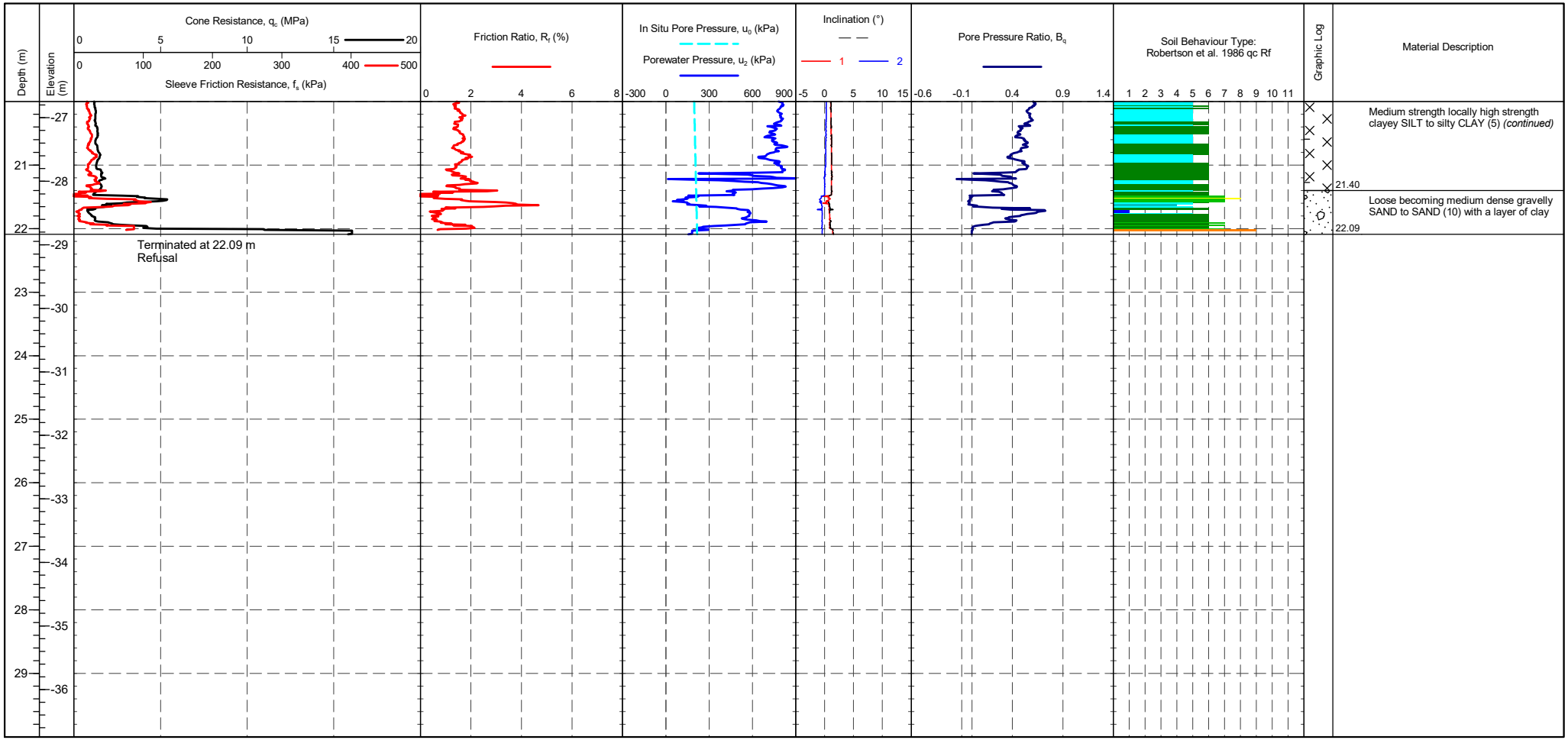
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

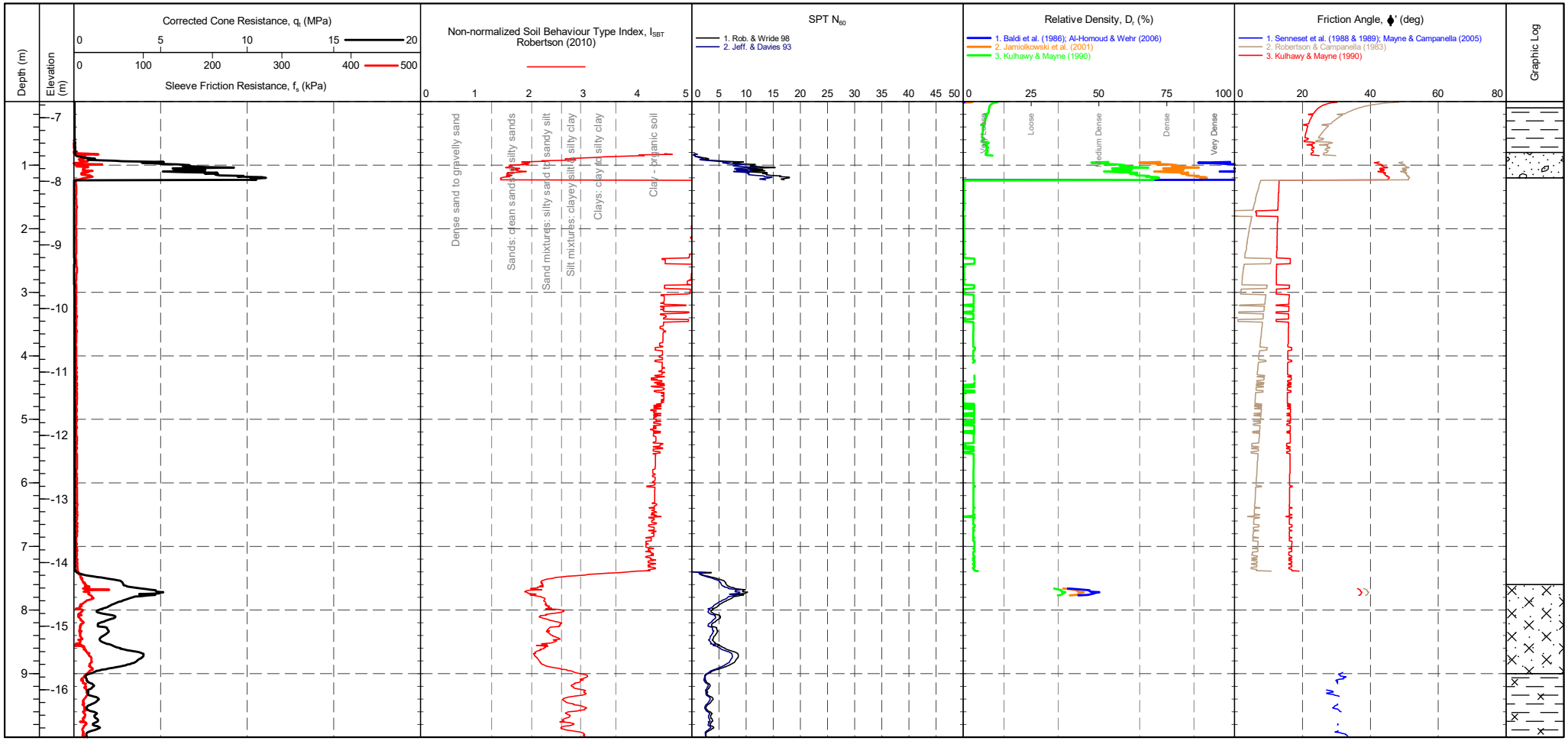
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 43

CLIENT : Causeway PROJECT : Stornoway LOCATION : Stornoway PROJECT No. : 1190227	EASTING : 142554.556 m NORTHING : 931271.701 m ELEVATION : -6.746 m CD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on inclination.	SHEET : 1 OF 3 STATUS : Final TEST DATE : 27/06/2019 PLOT DATE : 11/07/2019 METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

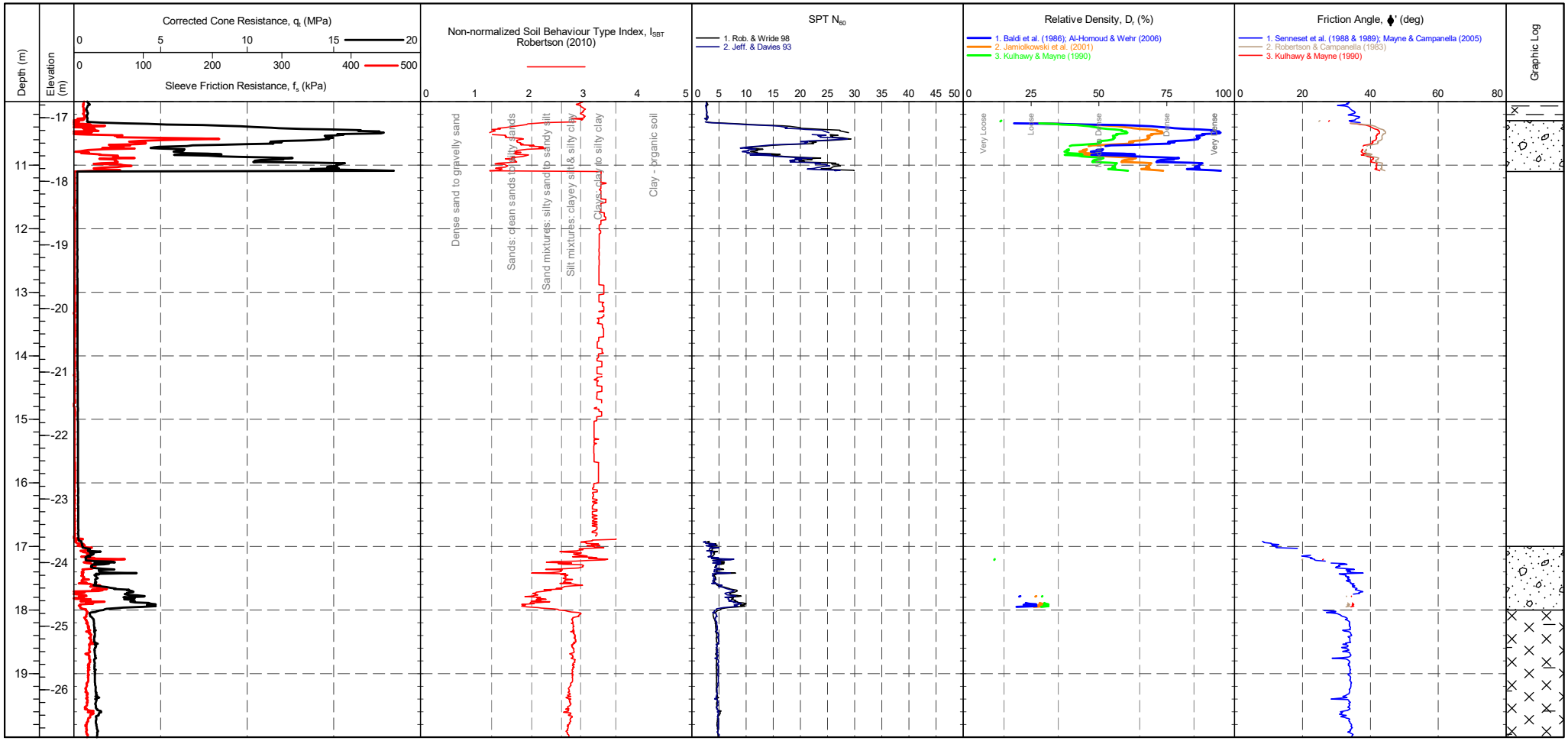
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

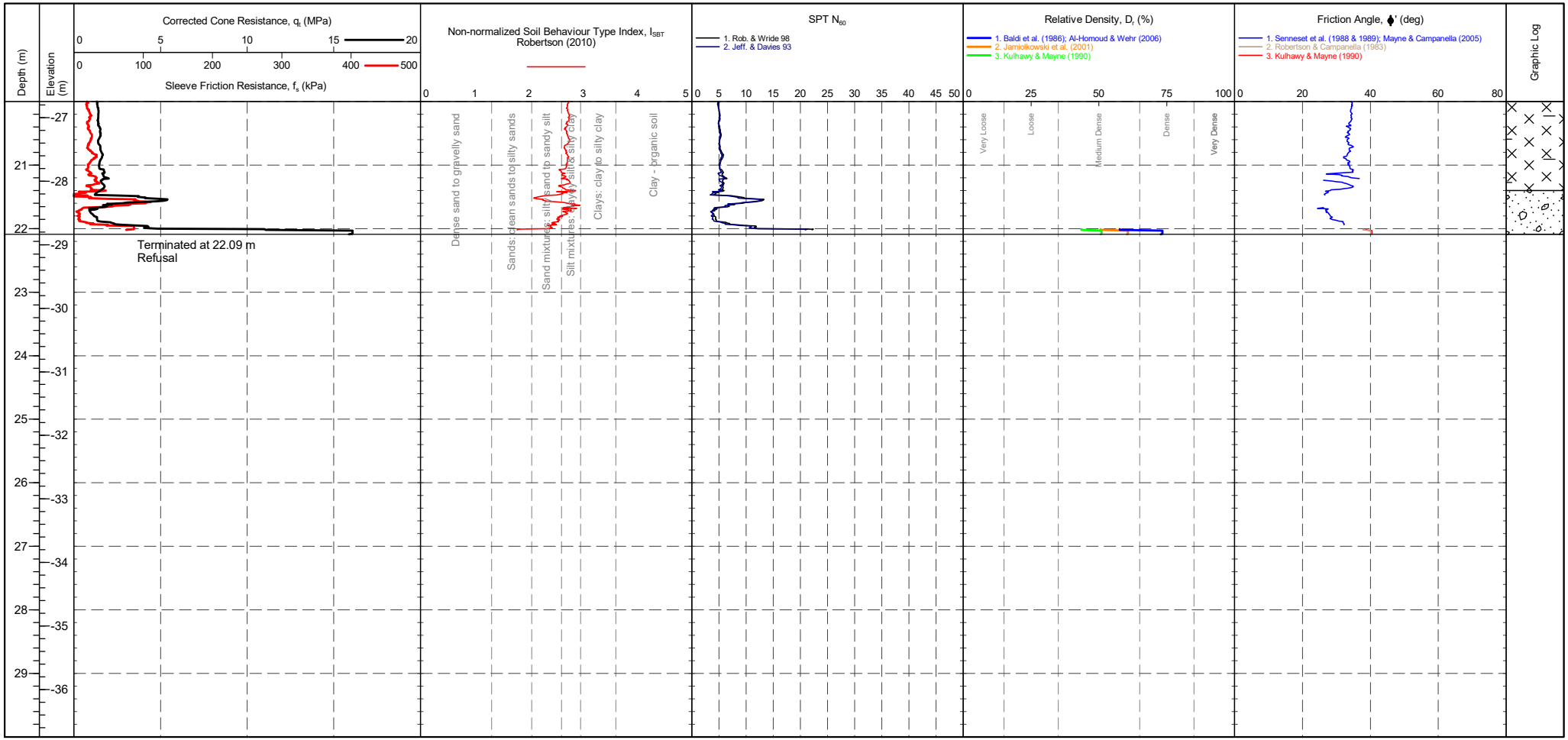
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Tip	238 mV	239 mV	0.013 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	X-Y Inclinometer	2467 mV	2416 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

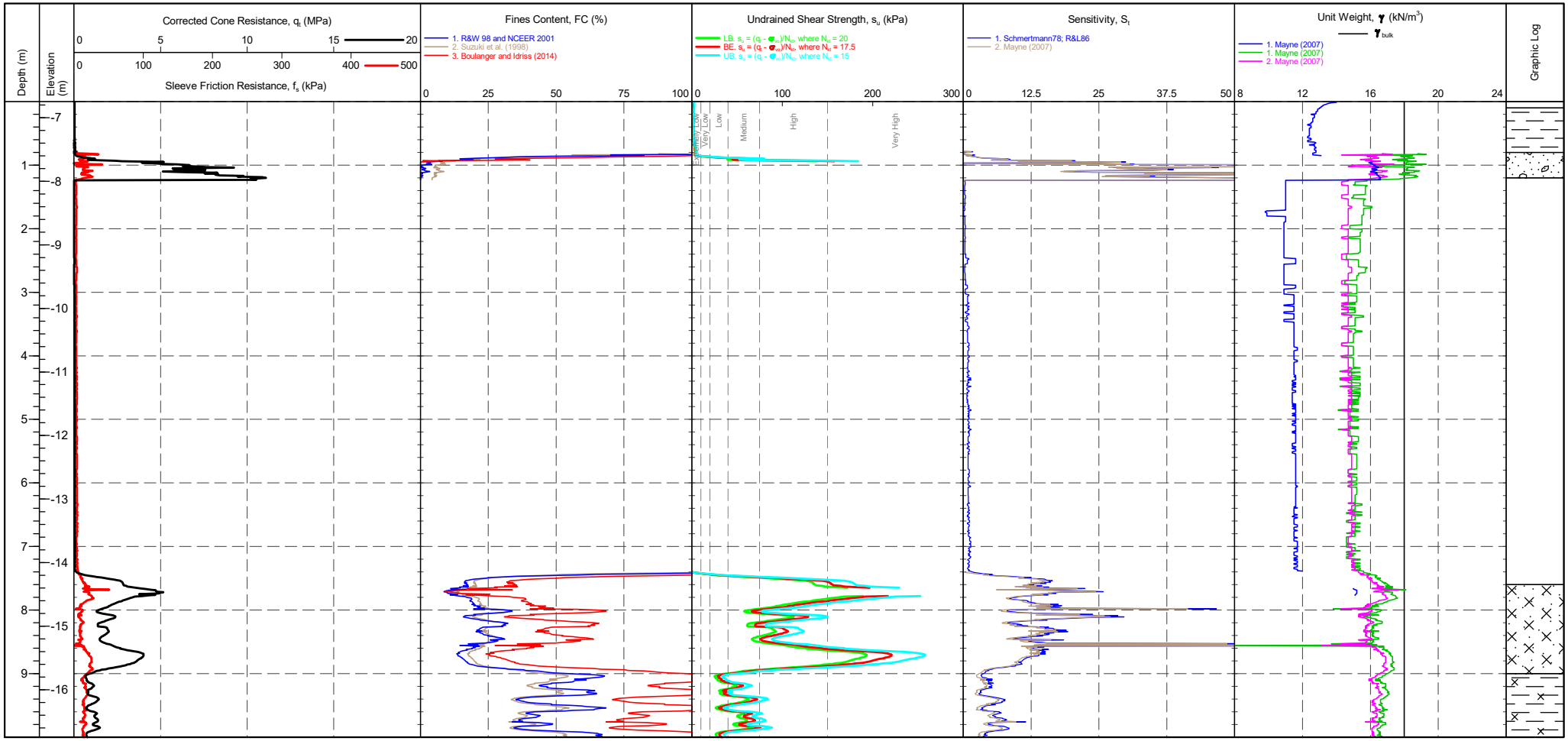
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

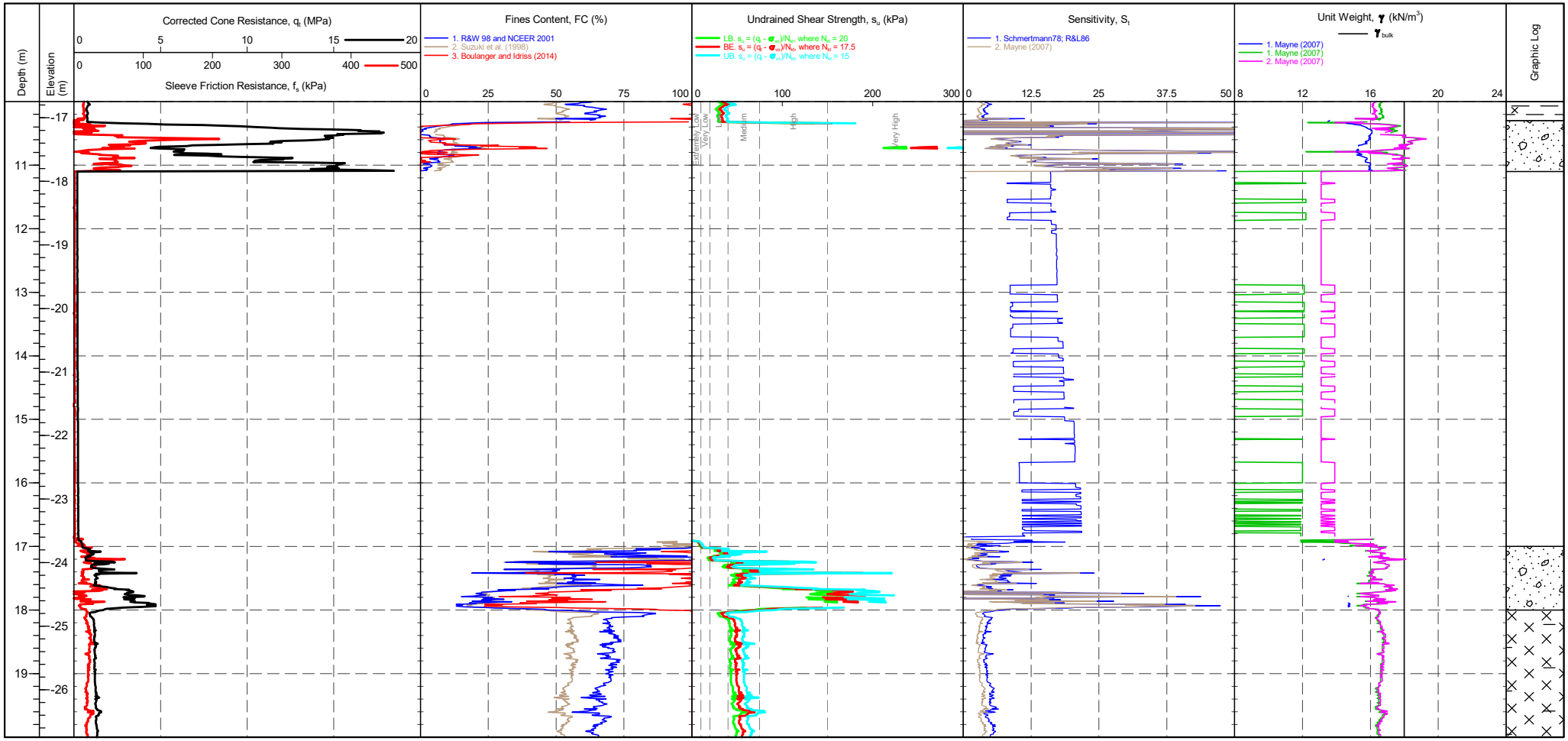
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 43

CLIENT : Causeway	EASTING : 142554.556 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931271.701 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -6.746 m CD		TEST DATE : 27/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

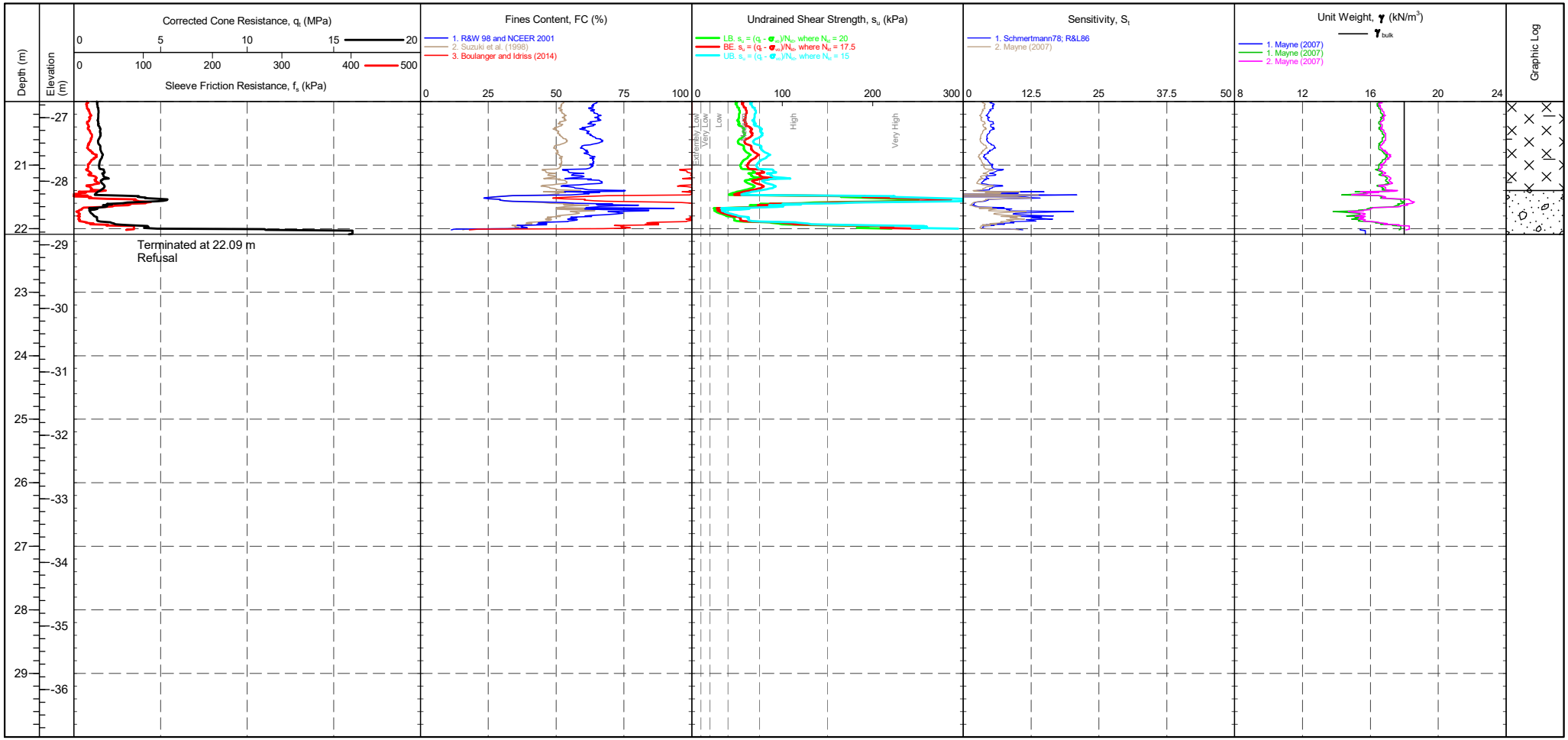
PointID
BH 43

CLIENT : Causeway
PROJECT : Stornoway
LOCATION : Stornoway
PROJECT No. : 1190227

EASTING : 142554.556 m
NORTHING : 931271.701 m
ELEVATION : -6.746 m CD
CHECKED BY : LD
TERMINATION REASON : Refusal

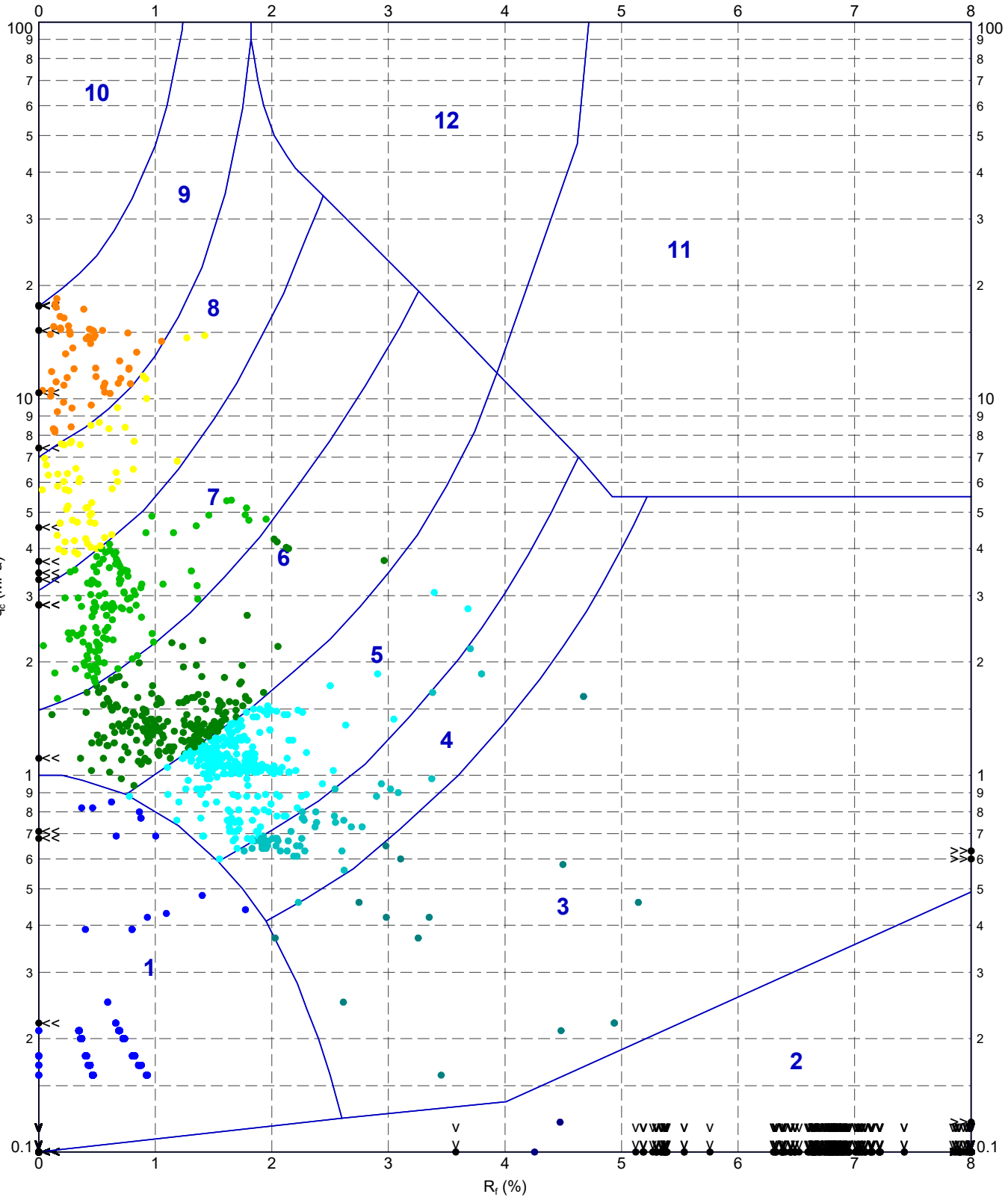
Remark:
Test refused on inclination.

SHEET : 3 OF 3
STATUS : Final
TEST DATE : 27/06/2019
PLOT DATE : 11/07/2019
METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	238 mV	239 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	210 mV	191 mV	-0.016 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 43	Pore Pressure 2	267 mV	271 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2467 mV	2416 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 43

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

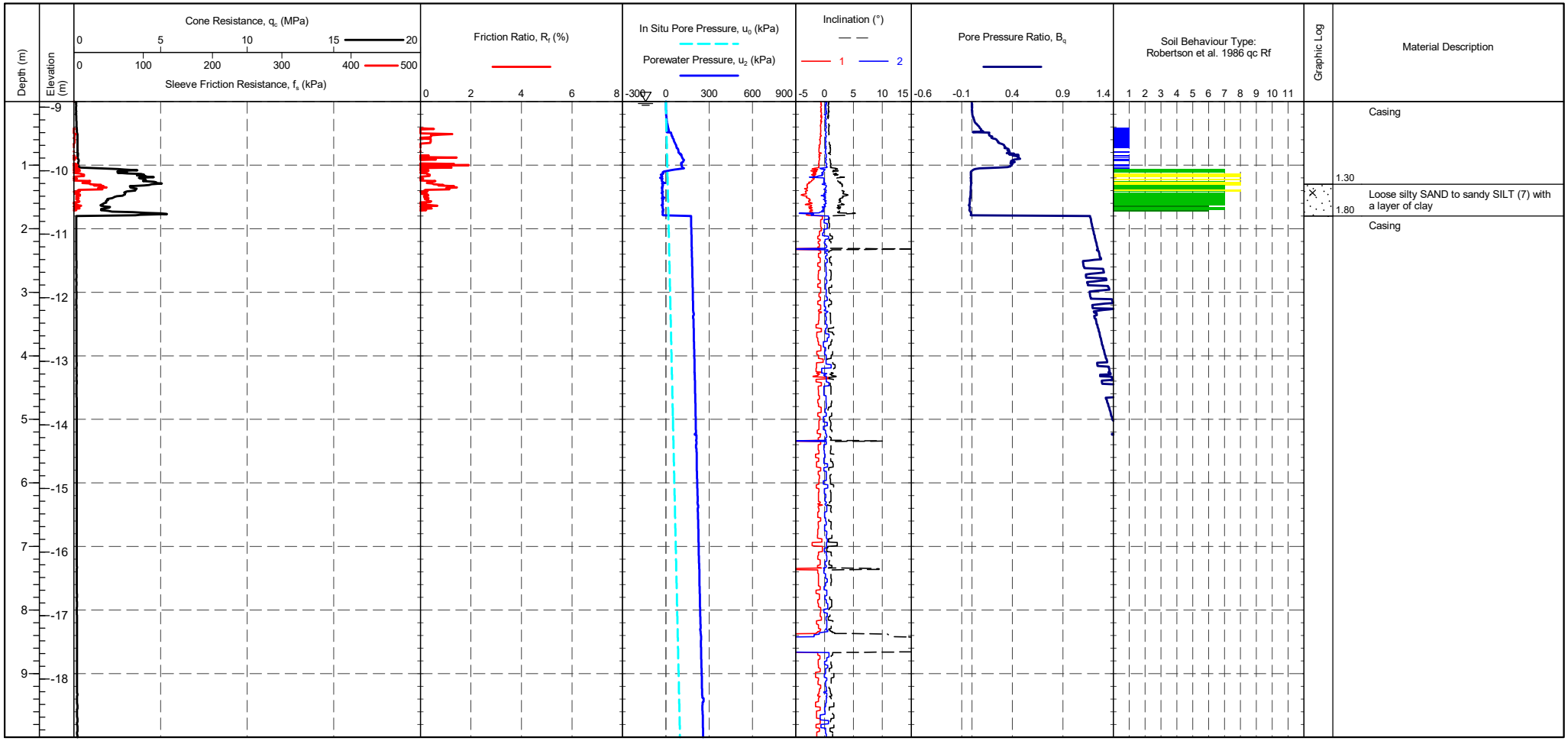
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:20 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

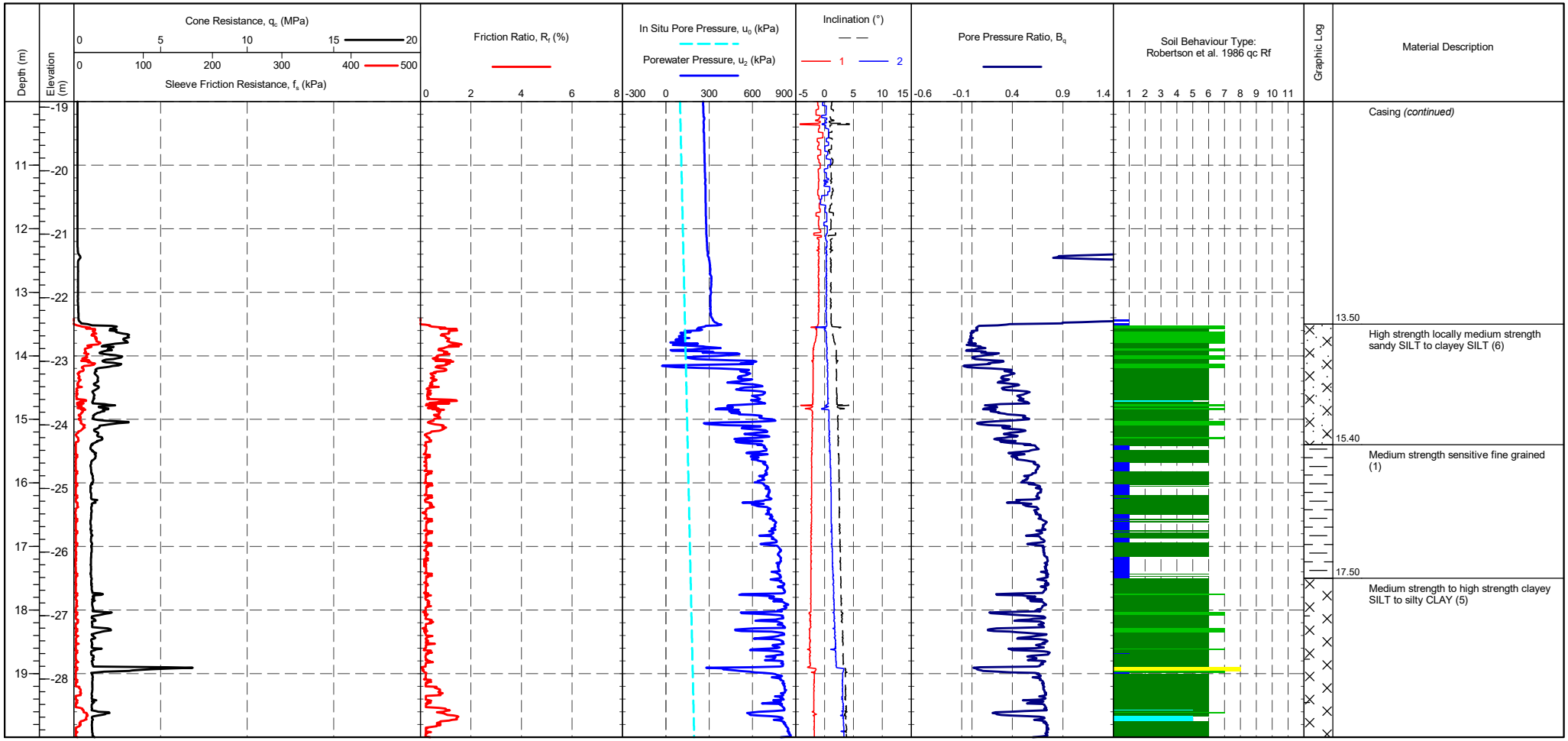
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV

Difference
0 MPa
-0.001 kPa
0 kPa

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

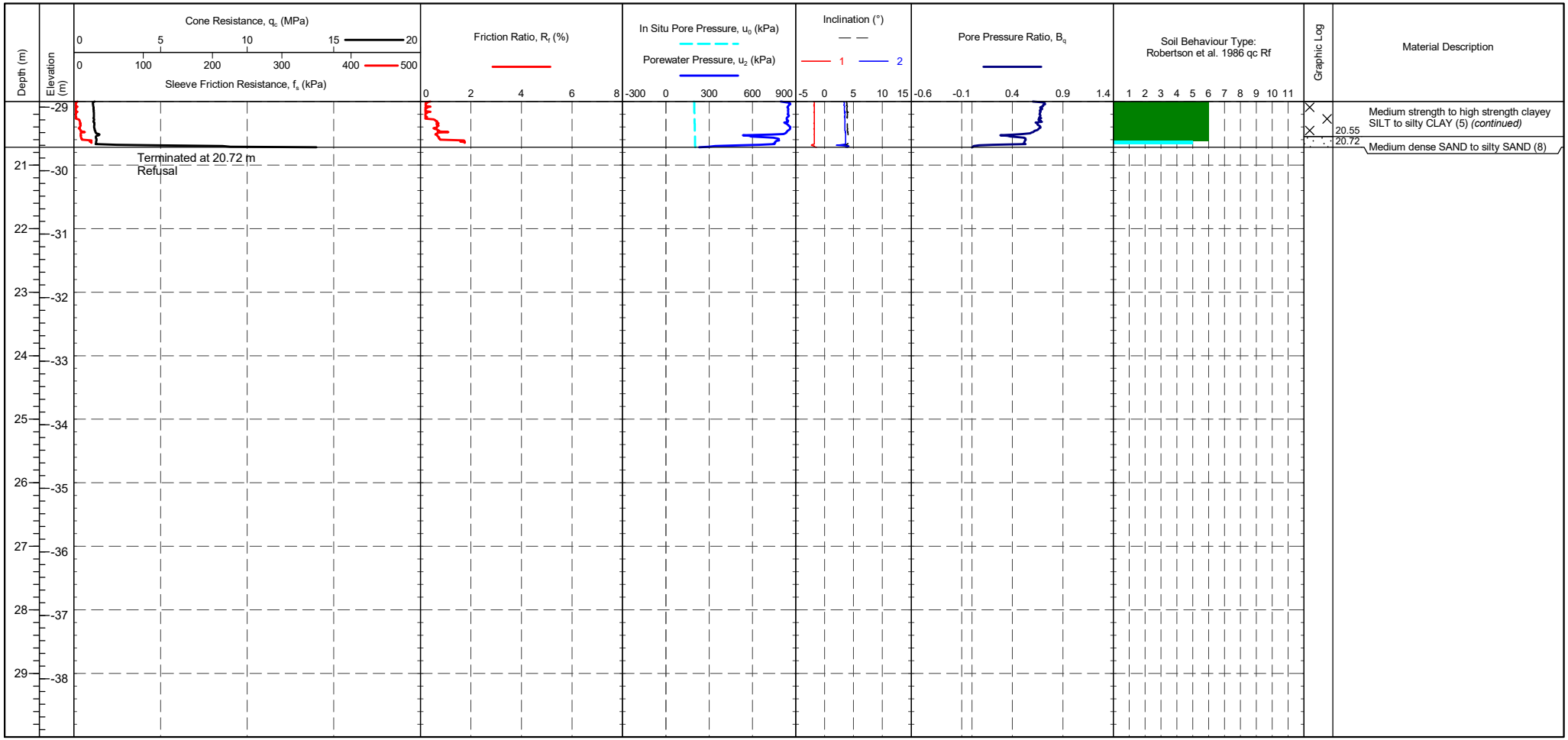
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

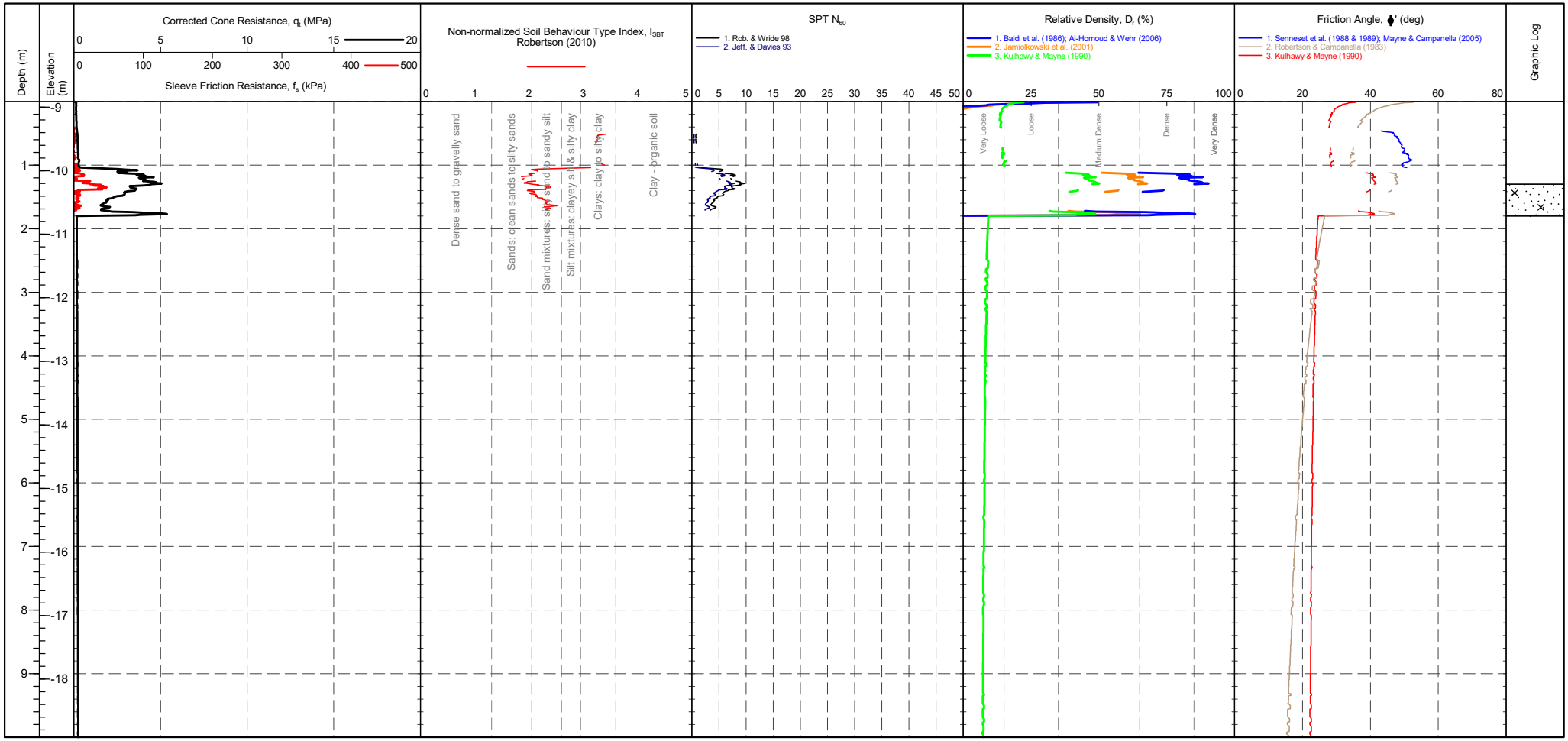
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 1 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	249 mV	249 mV	0 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	258 mV	259 mV	0 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	X-Y Inclinometer	2376 mV	2372 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

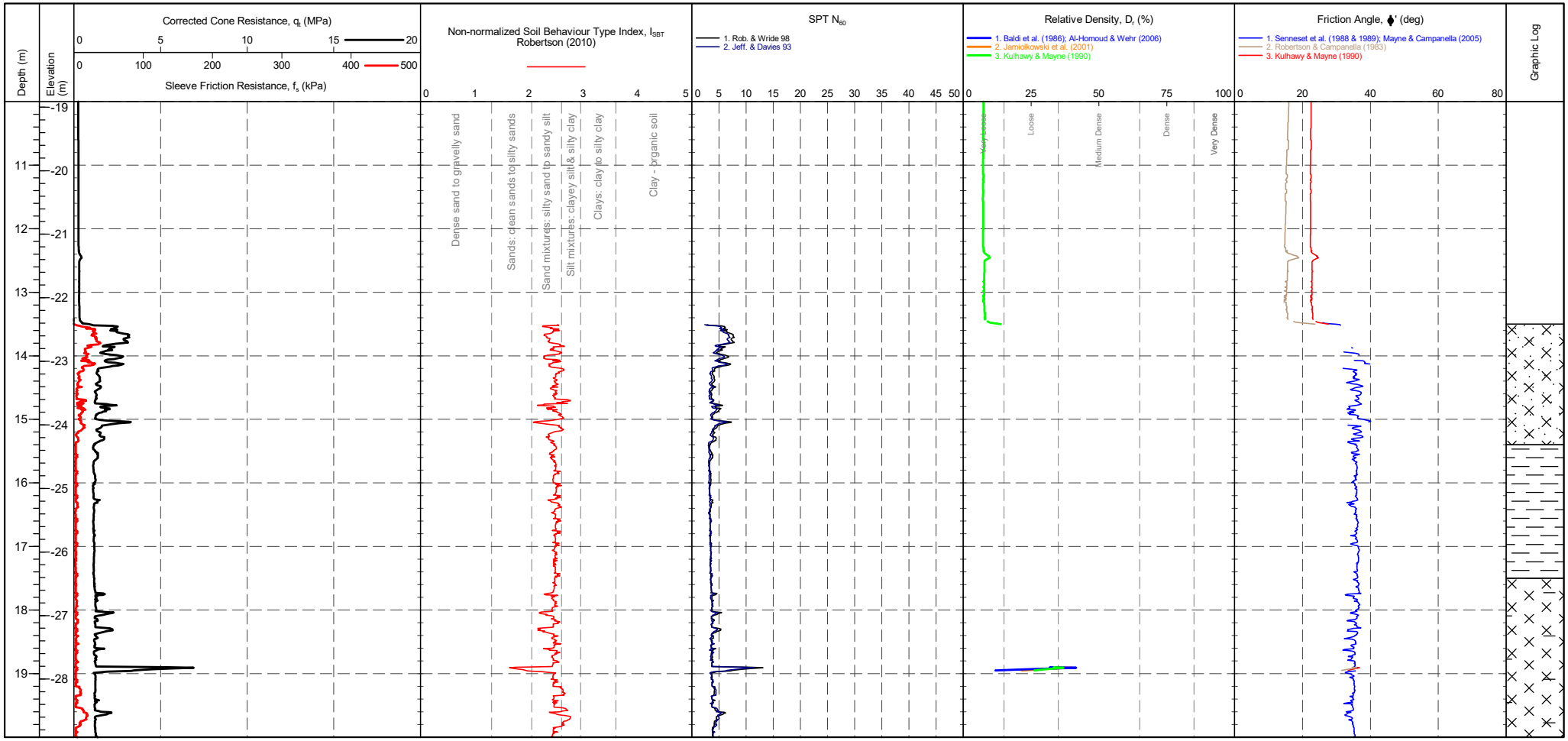
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	249 mV	249 mV	0 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	258 mV	259 mV	0 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	X-Y Inclinometer	2376 mV	2372 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

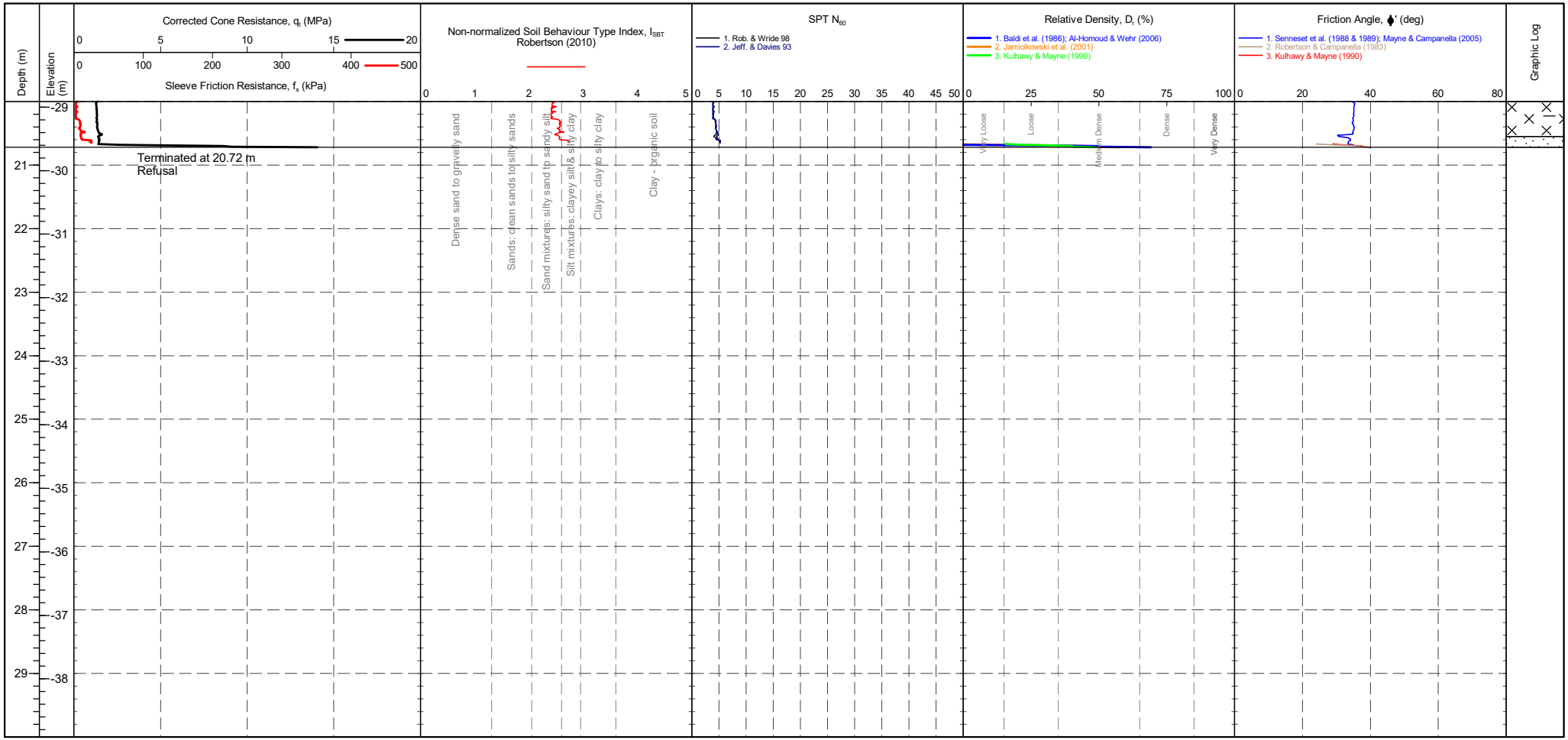
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 3 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

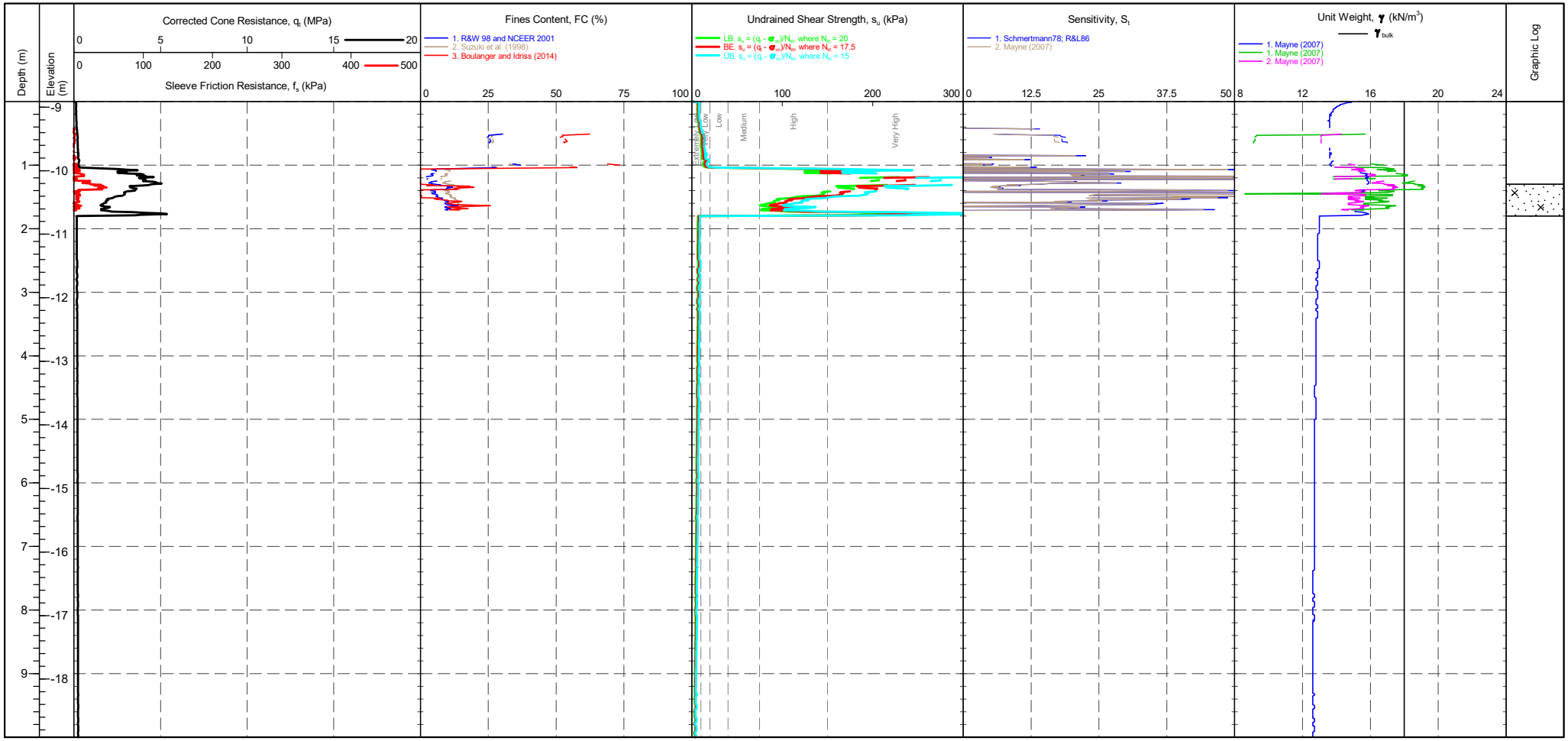
PointID
BH 45

CLIENT : Causeway
PROJECT : Stornoway
LOCATION : Stornoway
PROJECT No. : 1190227

EASTING : 142515.400 m
NORTHING : 931227.118 m
ELEVATION : -8.913 m CD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on inclination.

SHEET : 1 OF 3
STATUS : Final
TEST DATE : 24/06/2019
PLOT DATE : 11/07/2019
METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

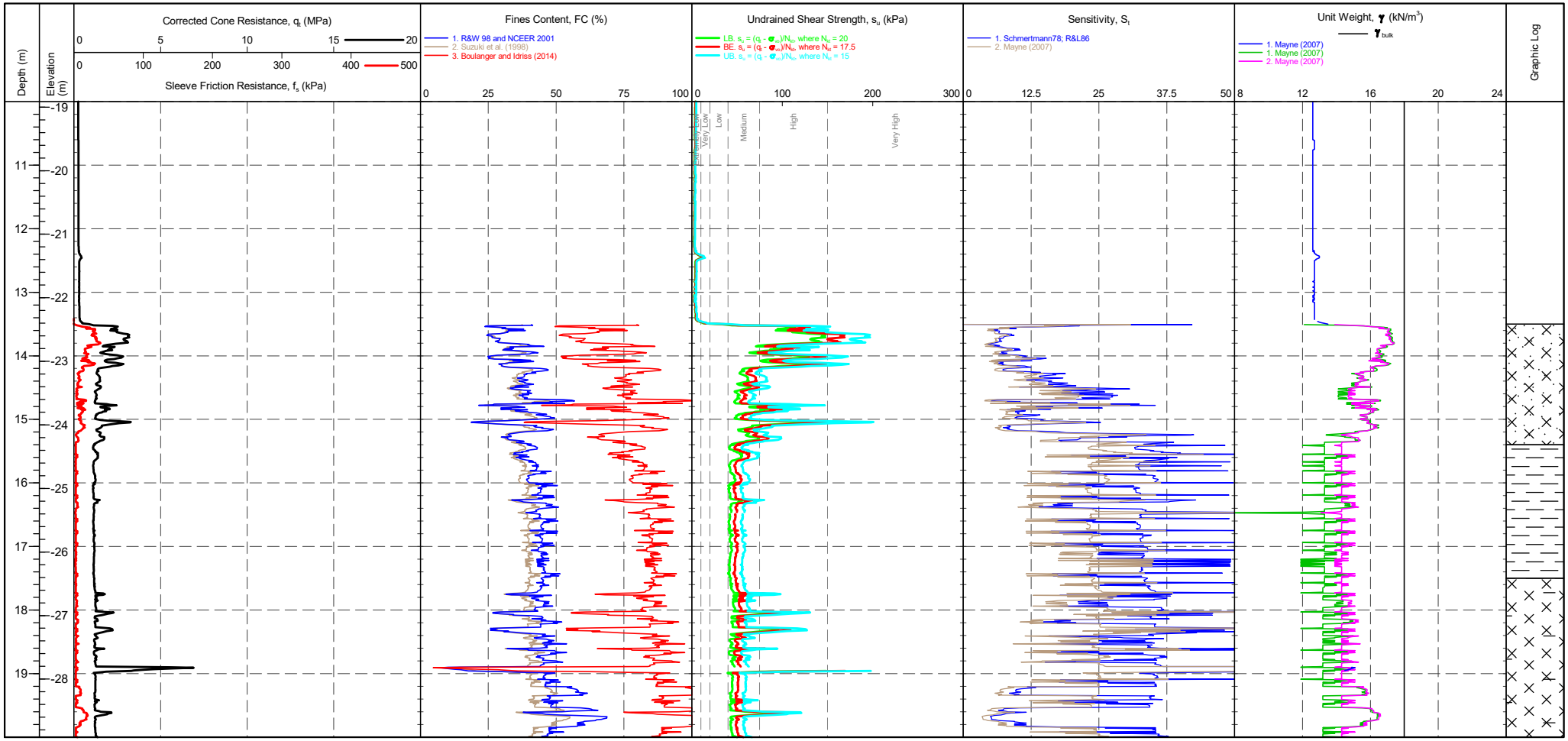
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 45

CLIENT : Causeway	EASTING : 142515.400 m	Remark:	SHEET : 2 OF 3
PROJECT : Stornoway	NORTHING : 931227.118 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -8.913 m CD		TEST DATE : 24/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

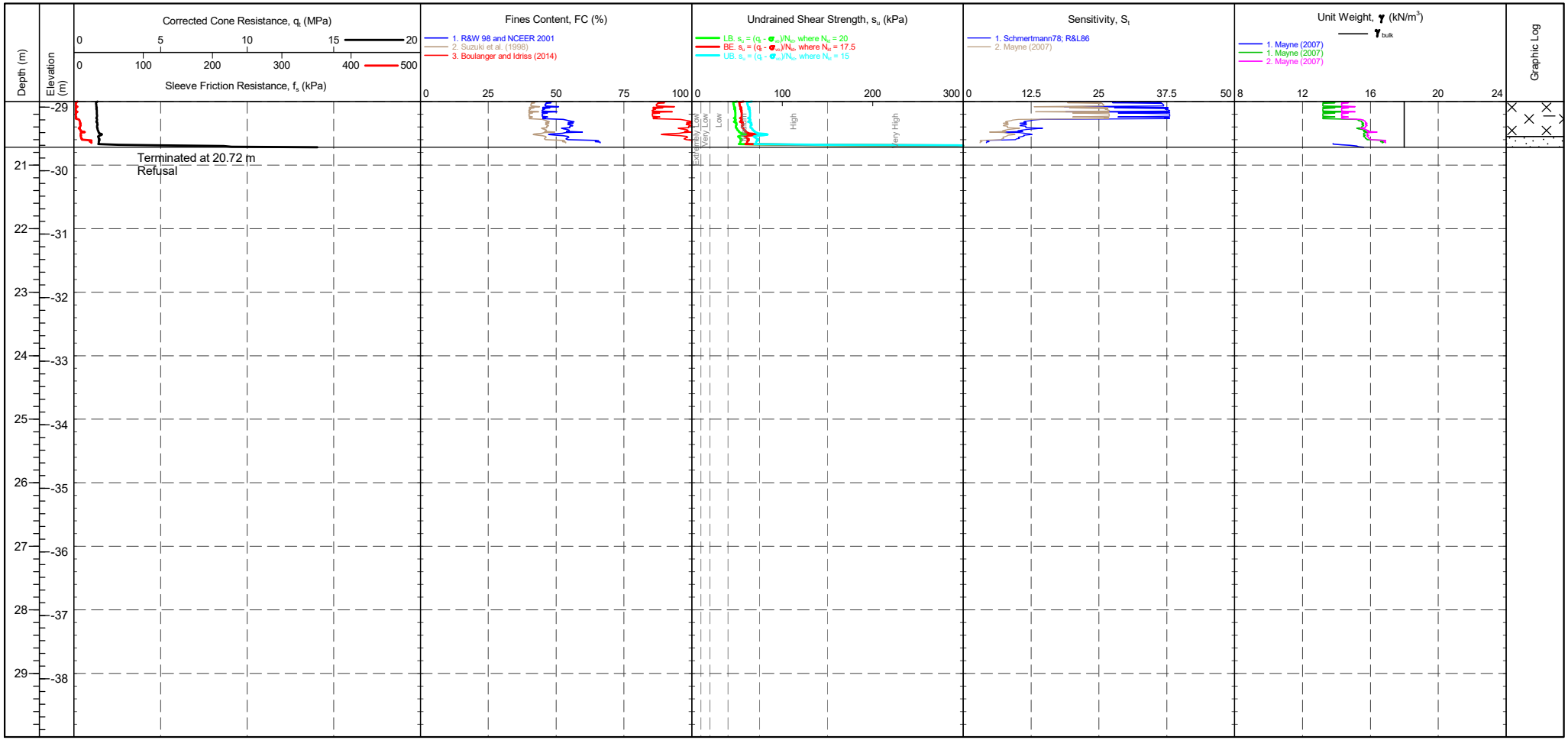
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

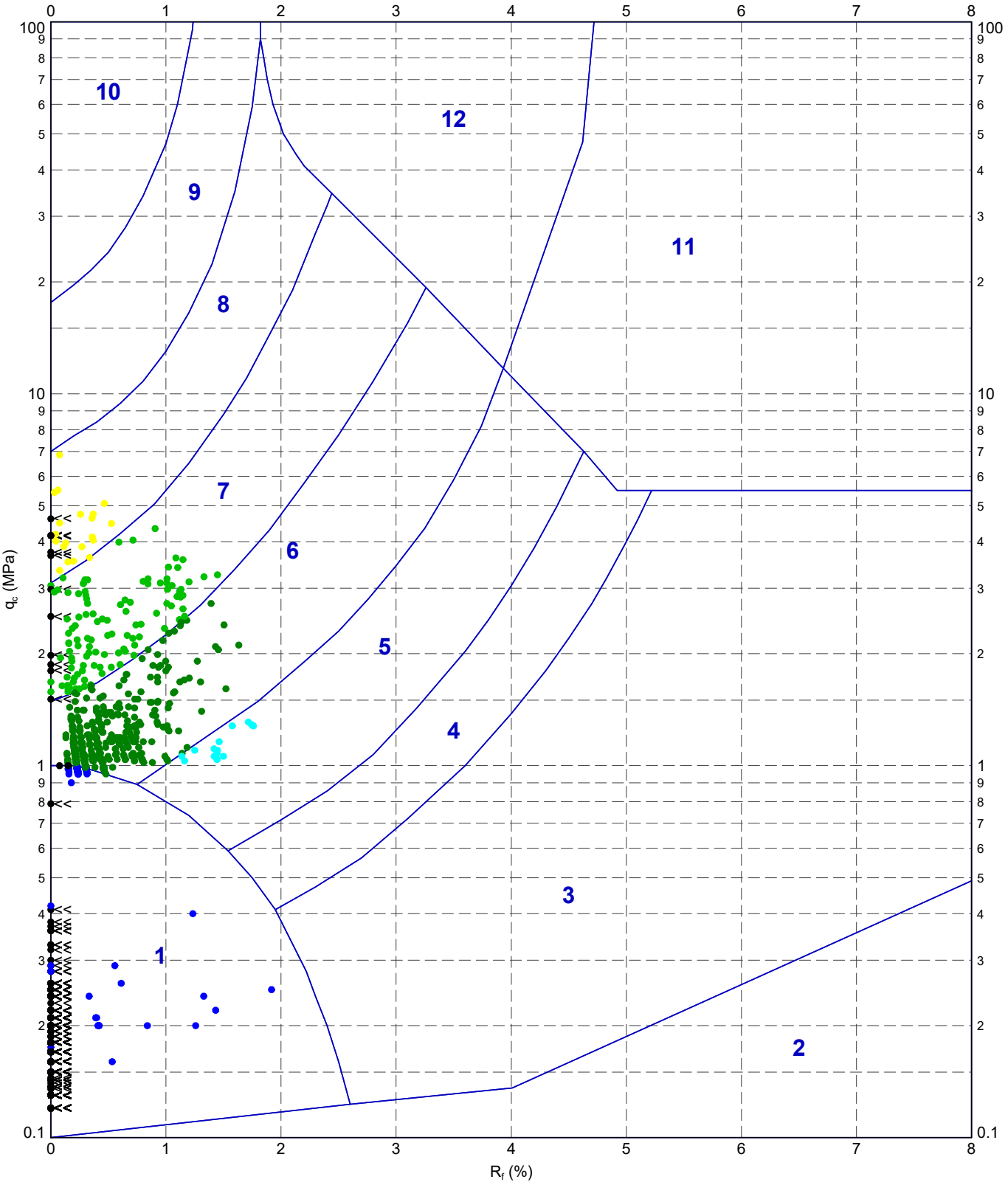
PointID
BH 45

CLIENT : Causeway PROJECT : Stornoway LOCATION : Stornoway PROJECT No. : 1190227	EASTING : 142515.400 m NORTHING : 931227.118 m ELEVATION : -8.913 m CD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on inclination.	SHEET : 3 OF 3 STATUS : Final TEST DATE : 24/06/2019 PLOT DATE : 11/07/2019 METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.768	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	249 mV	249 mV	0 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	246 mV	245 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 45	Pore Pressure 2	258 mV	259 mV	0 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2376 mV	2372 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 45

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

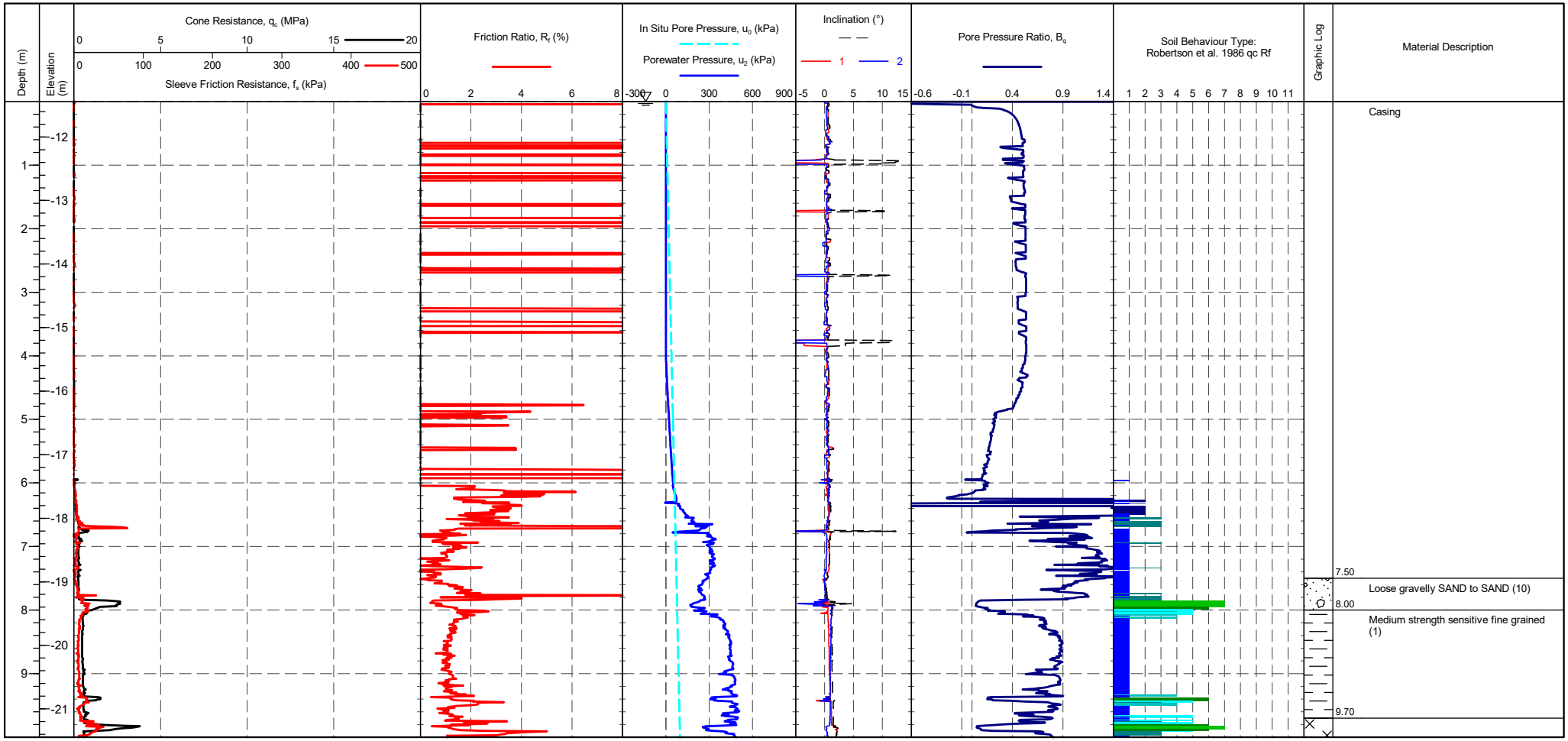
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:23 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 47

CLIENT : Causeway	EASTING : 142476.248 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931164.781 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -11.444 m CD		TEST DATE : 21/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	240 mV	241 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	220 mV	217 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47	Pore Pressure 2	291 mV	295 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2490 mV	2377 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

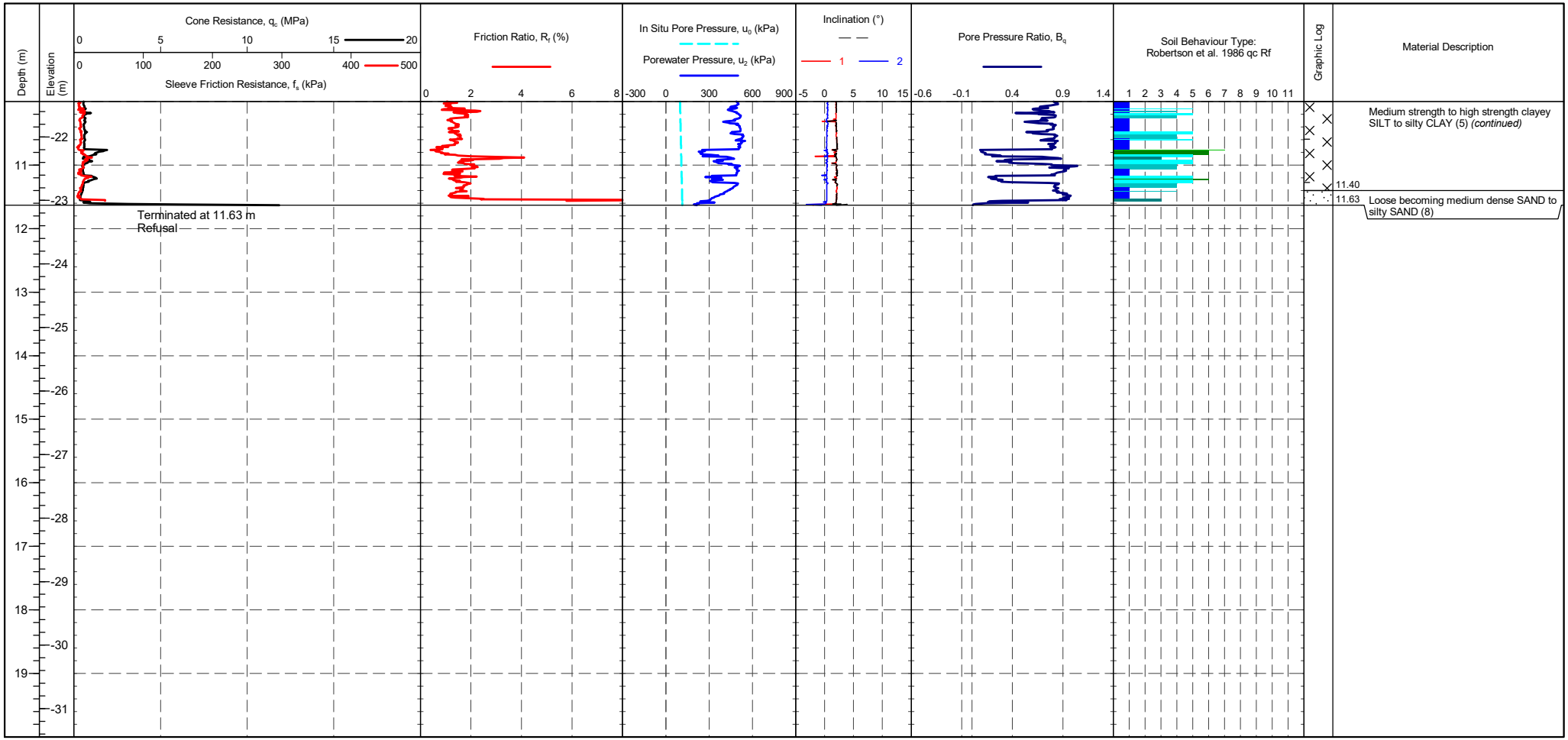
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 47

CLIENT : Causeway	EASTING : 142476.248 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931164.781 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -11.444 m CD		TEST DATE : 21/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	240 mV	241 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	220 mV	217 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47	Pore Pressure 2	291 mV	295 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2490 mV	2377 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

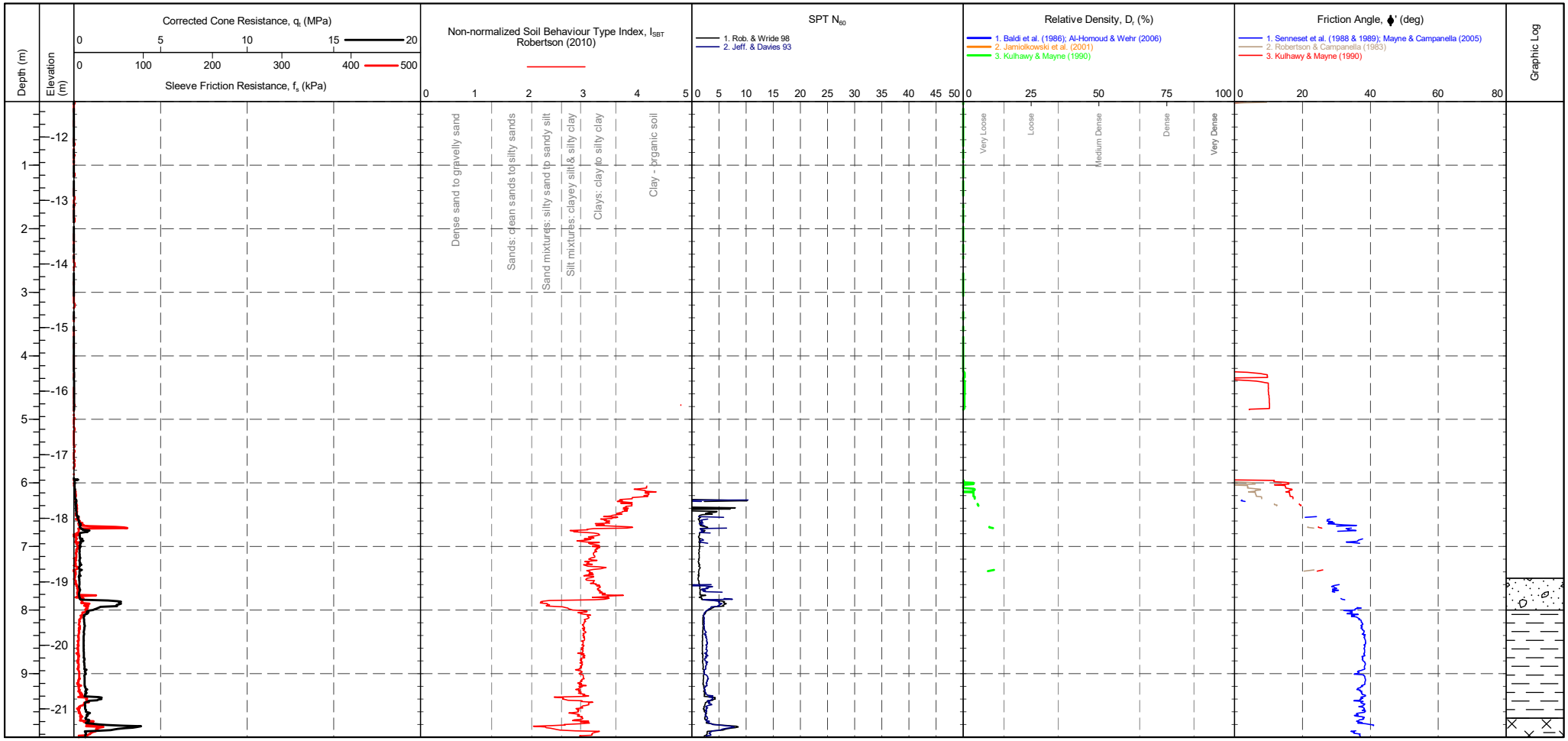
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 47

CLIENT : Causeway PROJECT : Stornoway LOCATION : Stornoway PROJECT No. : 1190227	EASTING : 142476.248 m NORTHING : 931164.781 m ELEVATION : -11.444 m CD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on tip resistance.	SHEET : 1 OF 2 STATUS : Final TEST DATE : 21/06/2019 PLOT DATE : 11/07/2019 METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post / Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	240 mV	241 mV / 0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	220 mV	217 mV / -0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47	Pore Pressure 2	291 mV	295 mV / 0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2490 mV	2377 mV

Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

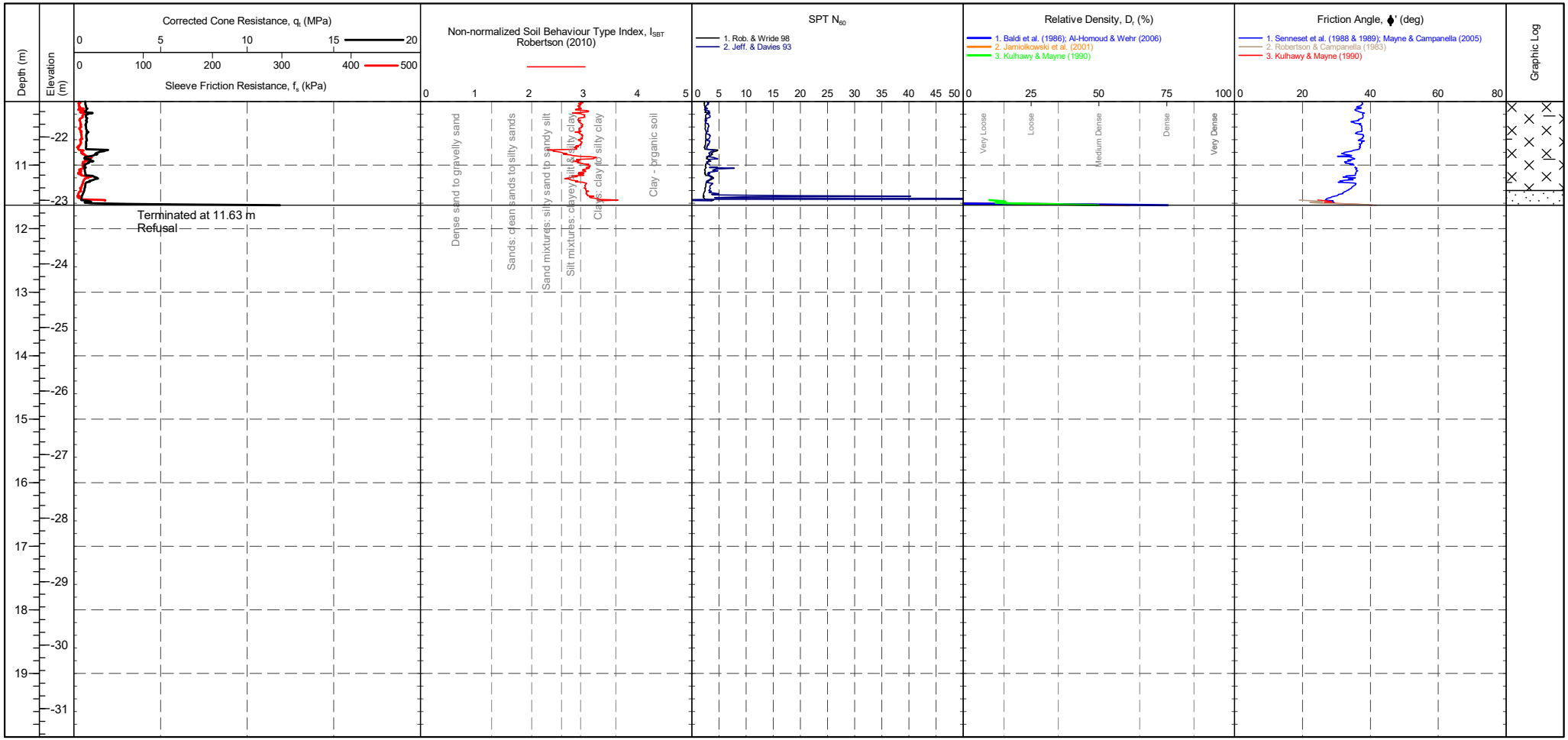
PointID
BH 47

CLIENT : Causeway
PROJECT : Stornoway
LOCATION : Stornoway
PROJECT No. : 1190227

EASTING : 142476.248 m
NORTHING : 931164.781 m
ELEVATION : -11.444 m CD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on tip resistance.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2019
PLOT DATE : 11/07/2019
METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2		
CONE AREA RATIO	: 0.79	RIG	: CPT 003		
FILTER POSITION	: u2	OPERATOR	: MO & DG		
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47		
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild		

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	240 mV	241 mV	0.013 MPa
Sleeve	220 mV	217 mV	-0.003 kPa
Pore Pressure 2	291 mV	295 mV	0.001 kPa
X-Y Inclinometer	2490 mV	2377 mV	

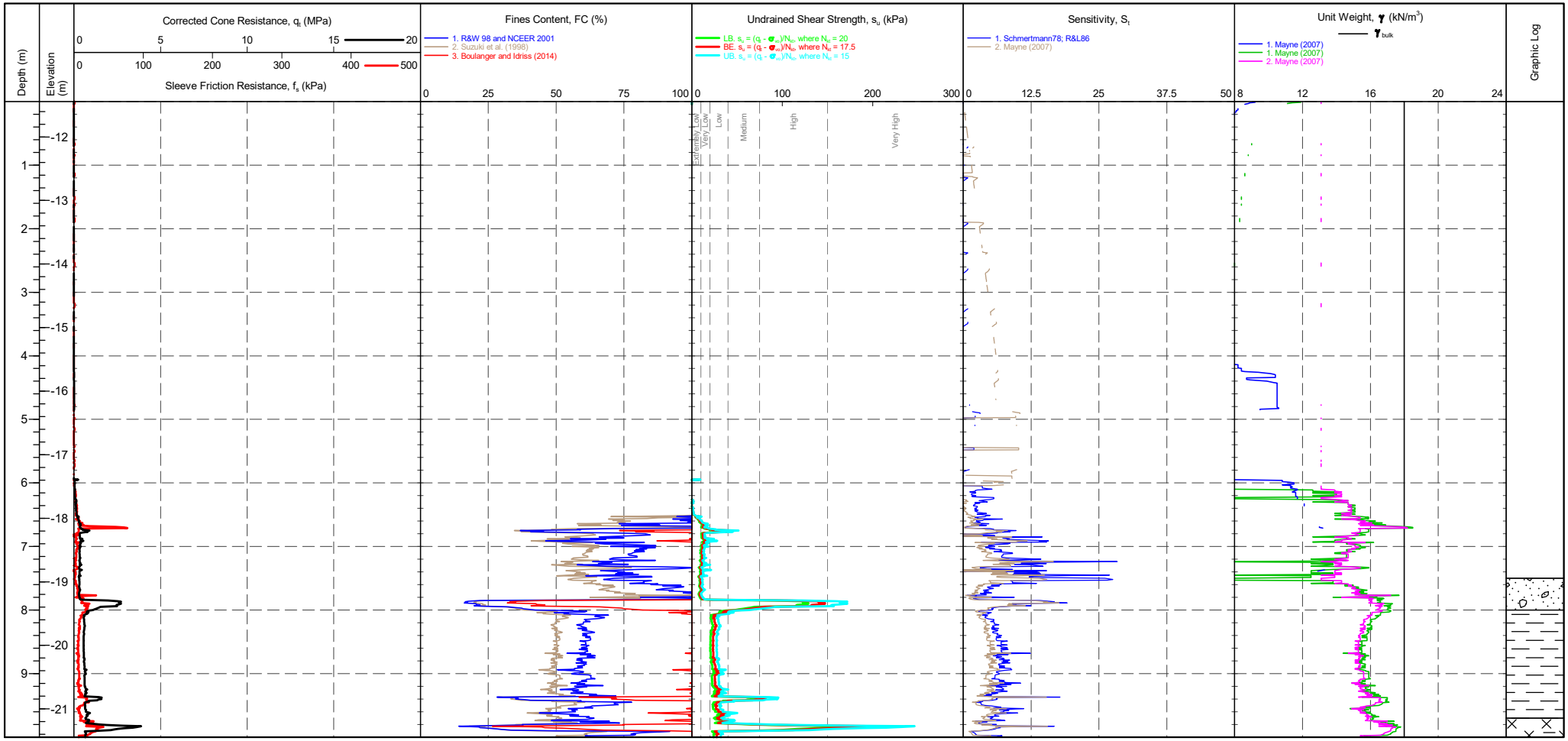
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 47

CLIENT : Causeway	EASTING : 142476.248 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931164.781 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -11.444 m CD		TEST DATE : 21/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	240 mV	241 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	220 mV	217 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47	Pore Pressure 2	291 mV	295 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2490 mV	2377 mV	

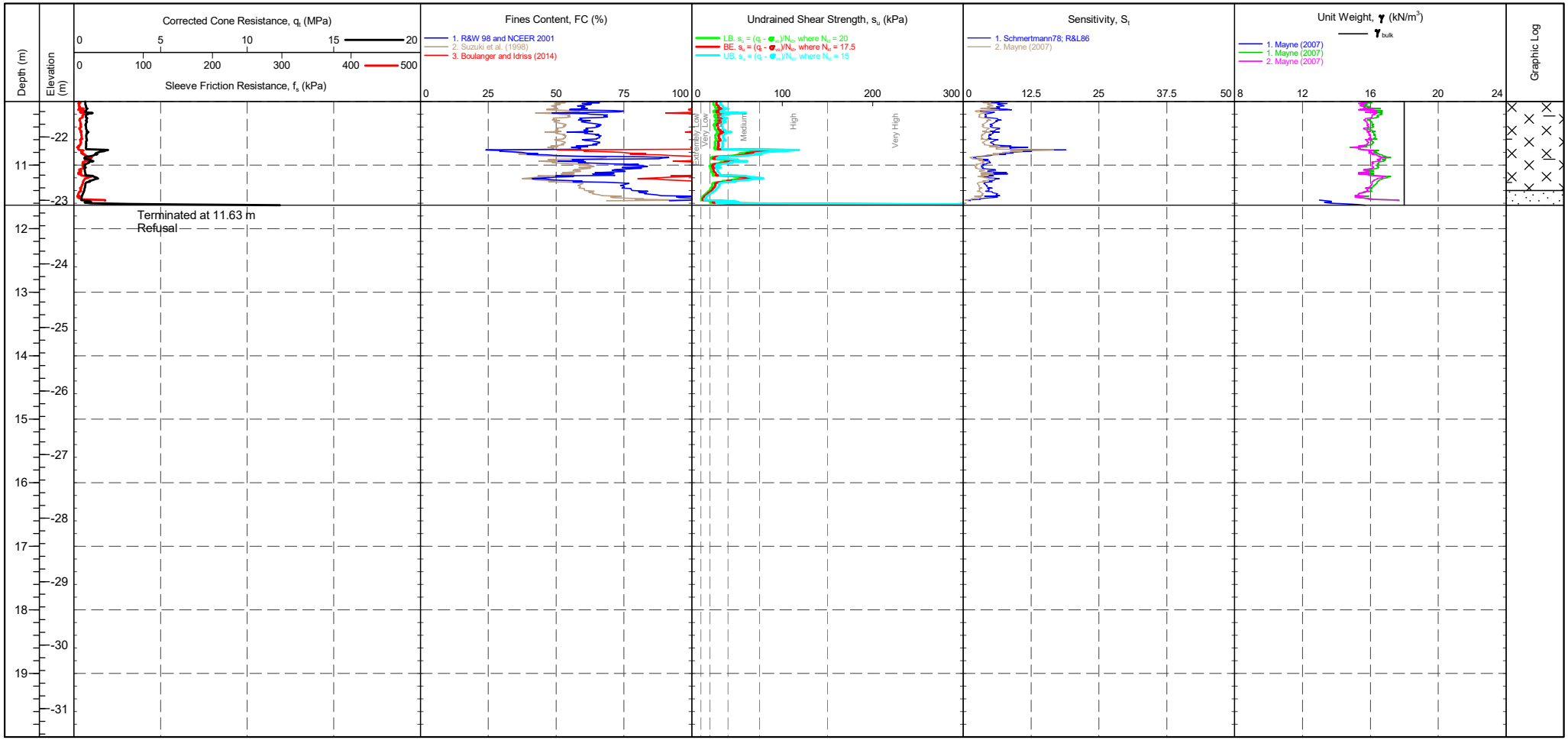
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

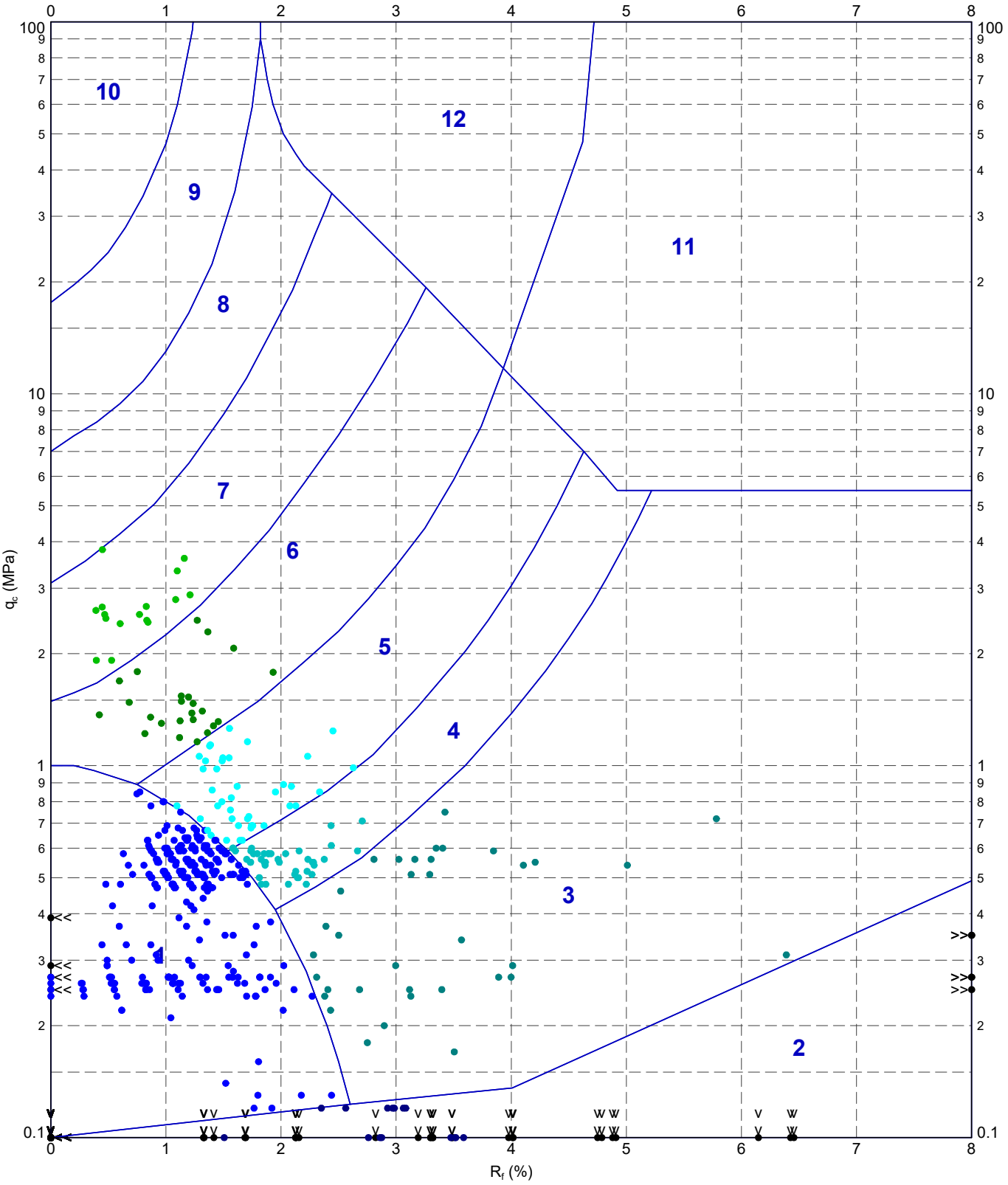
PointID
BH 47

CLIENT : Causeway	EASTING : 142476.248 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931164.781 m	Test refused on tip resistance.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -11.444 m CD		TEST DATE : 21/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	240 mV	241 mV	0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	220 mV	217 mV	-0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 47	Pore Pressure 2	291 mV	295 mV	0.001 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2490 mV	2377 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 47

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:24 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

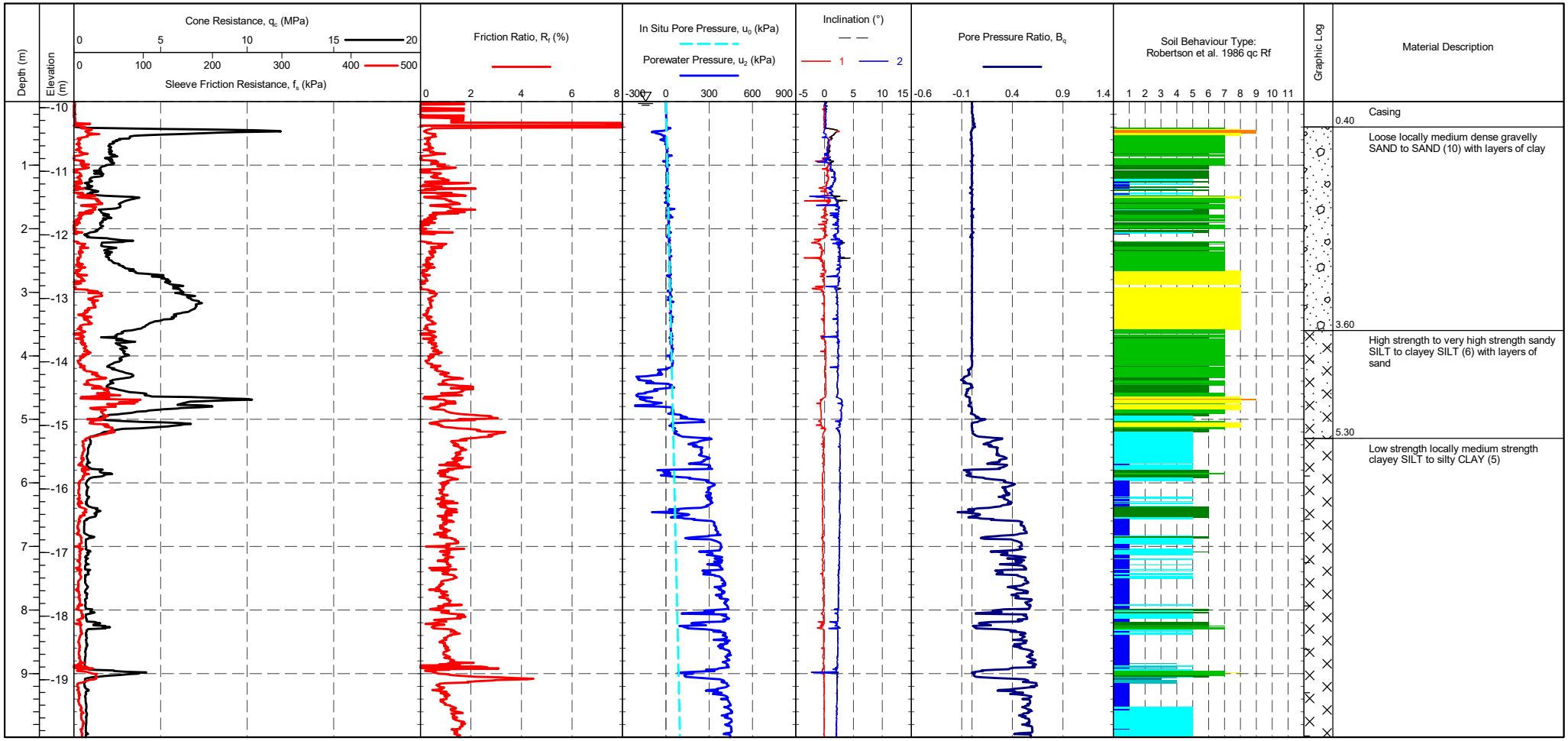
PointID
BH 49

CLIENT : Causeway
PROJECT : Stornoway
LOCATION : Stornoway
PROJECT No. : 1190227

EASTING : 142554.829 m
NORTHING : 931181.931 m
ELEVATION : -9.904 m CD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 26/06/2019
PLOT DATE : 11/07/2019
METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2		
CONE AREA RATIO	: 0.79	RIG	: CPT 003		
FILTER POSITION	: u2	OPERATOR	: MO & DG		
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49		
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild		

CPTU ZERO VALUES

	Pre	Post	Difference
Transducer			
Tip	236 mV	235 mV	-0.013 MPa
Sleeve	216 mV	215 mV	-0.001 kPa
Pore Pressure 2	264 mV	271 mV	0.002 kPa
X-Y Inclinometer	2456 mV	2466 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

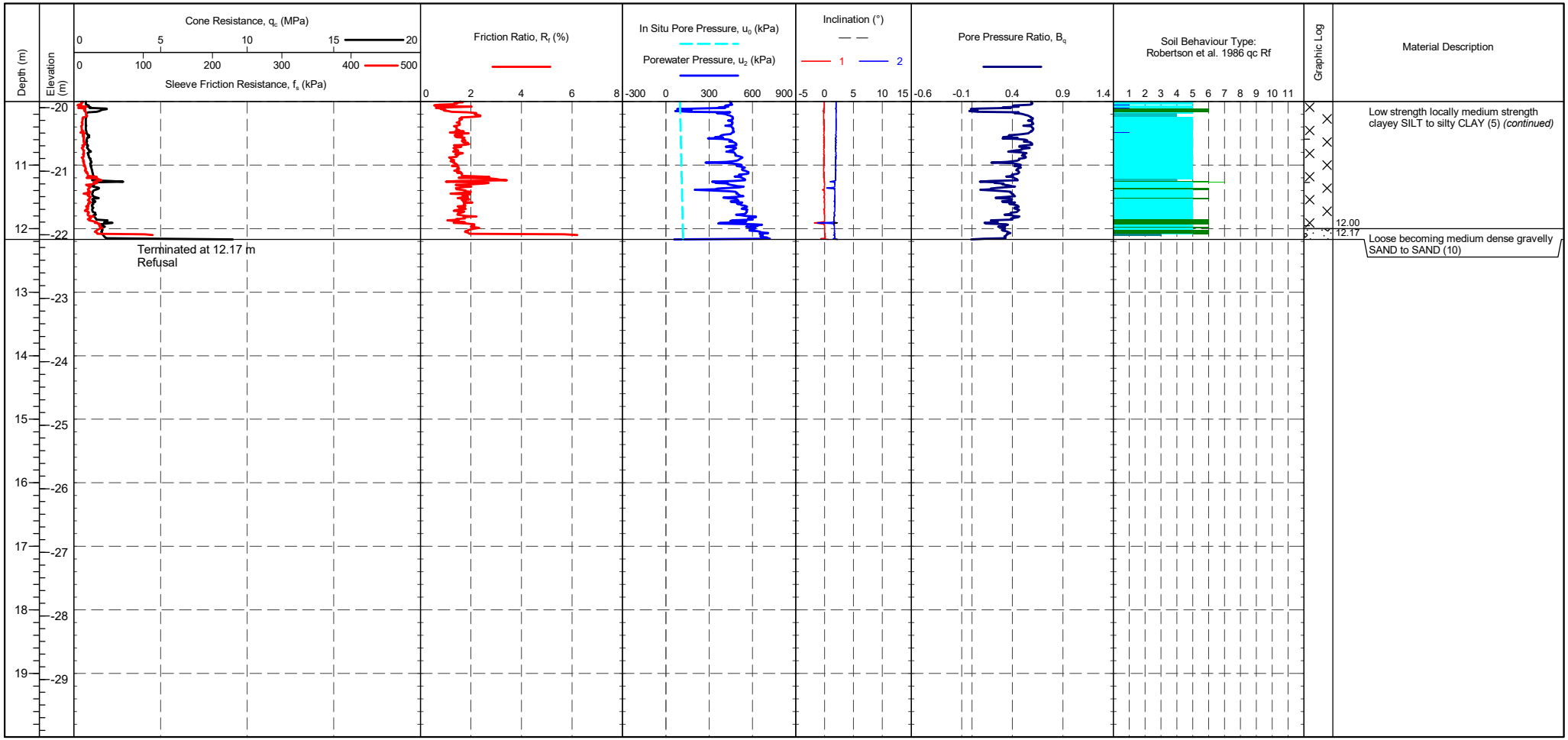
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 49

CLIENT : Causeway	EASTING : 142554.829 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931181.931 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -9.904 m CD		TEST DATE : 26/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	236 mV	235 mV	-0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	215 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49	Pore Pressure 2	264 mV	271 mV	0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2456 mV	2466 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

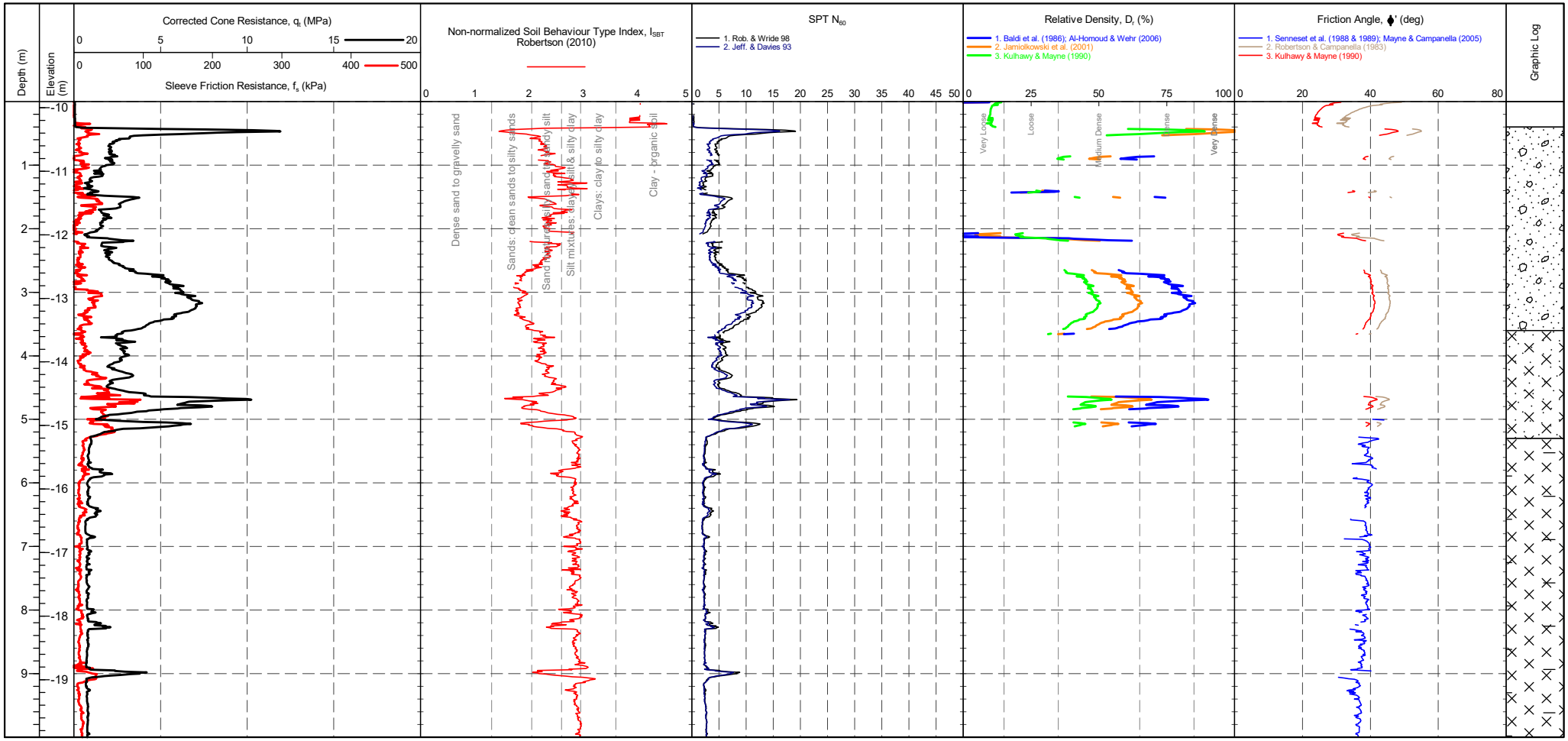
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 49

CLIENT : Causeway	EASTING : 142554.829 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931181.931 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -9.904 m CD		TEST DATE : 26/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post / Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	236 mV	235 mV / -0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	215 mV / -0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49	Pore Pressure 2	264 mV	271 mV / 0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2456 mV	2466 mV

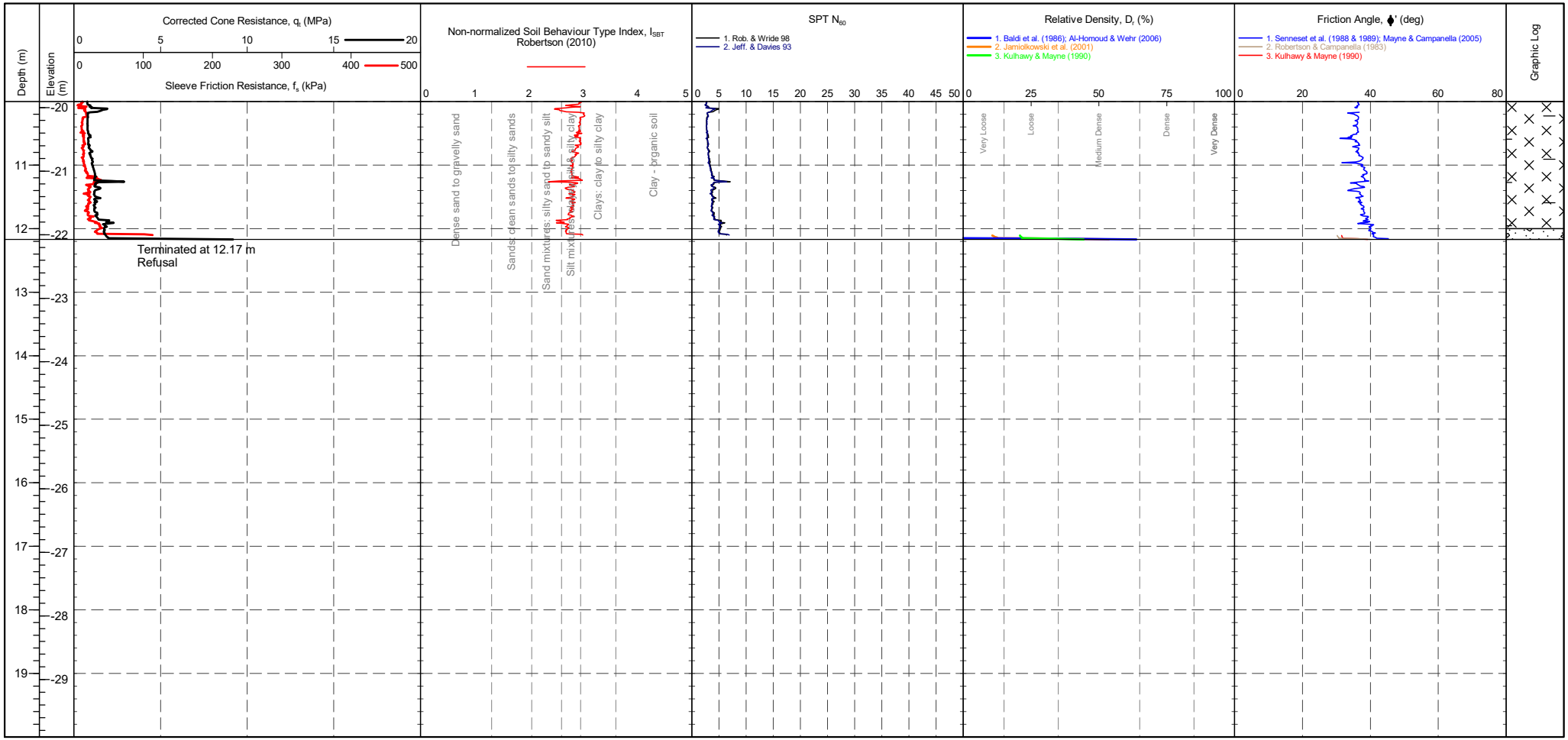
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 49

CLIENT : Causeway	EASTING : 142554.829 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931181.931 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -9.904 m CD		TEST DATE : 26/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Tip	236 mV	235 mV	-0.013 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	216 mV	215 mV	-0.001 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	264 mV	271 mV	0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49	X-Y Inclinometer	2456 mV	2466 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

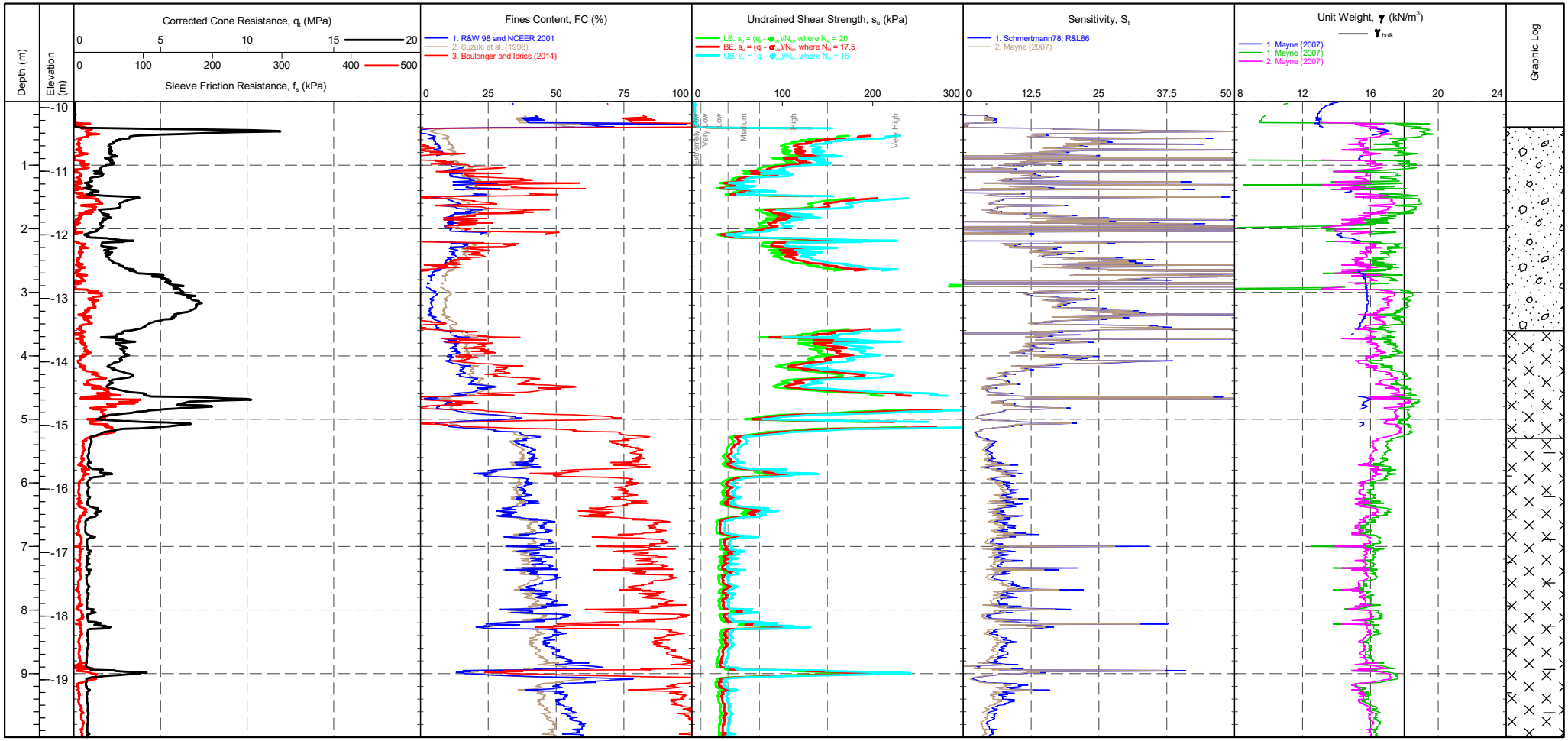
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 49

CLIENT : Causeway	EASTING : 142554.829 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931181.931 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -9.904 m CD		TEST DATE : 26/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	236 mV	235 mV	-0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	215 mV	-0.001 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49	Pore Pressure 2	264 mV	271 mV	0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2456 mV	2466 mV	

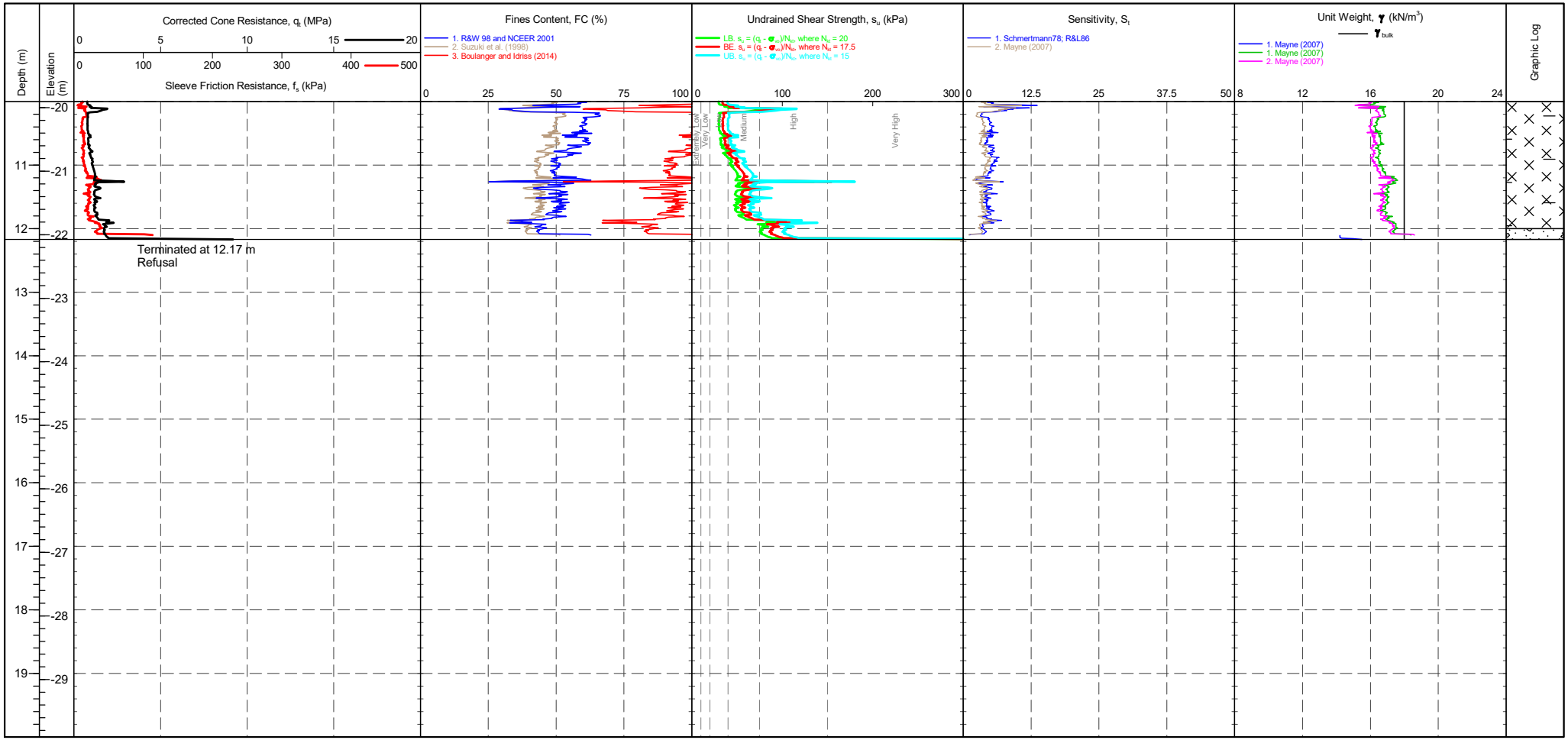
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

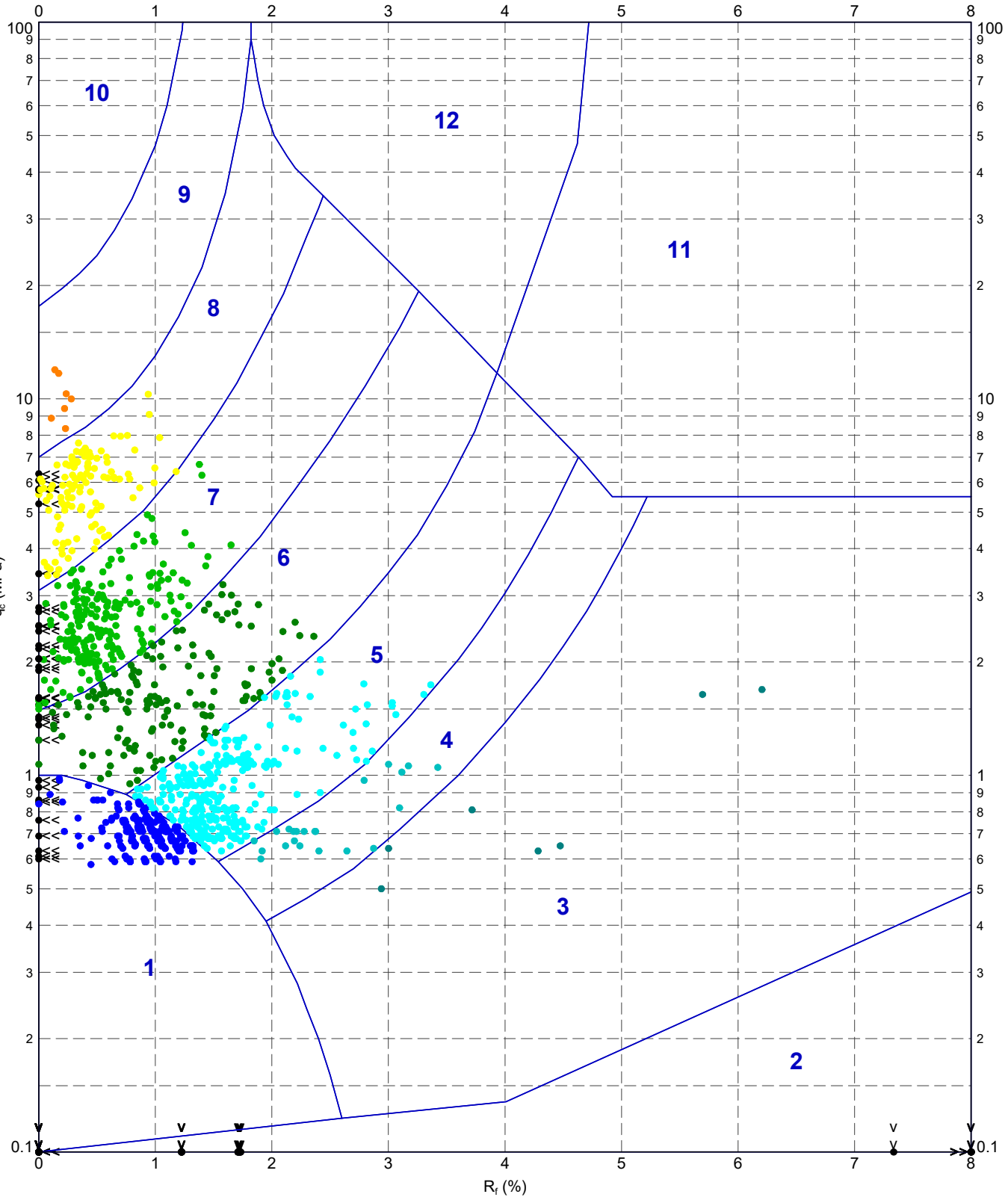
PointID
BH 49

CLIENT : Causeway	EASTING : 142554.829 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931181.931 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -9.904 m CD		TEST DATE : 26/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	236 mV	235 mV	-0.013 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	216 mV	215 mV	-0.001 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	264 mV	271 mV	0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 49	X-Y Inclinometer	2456 mV	2466 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 49

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

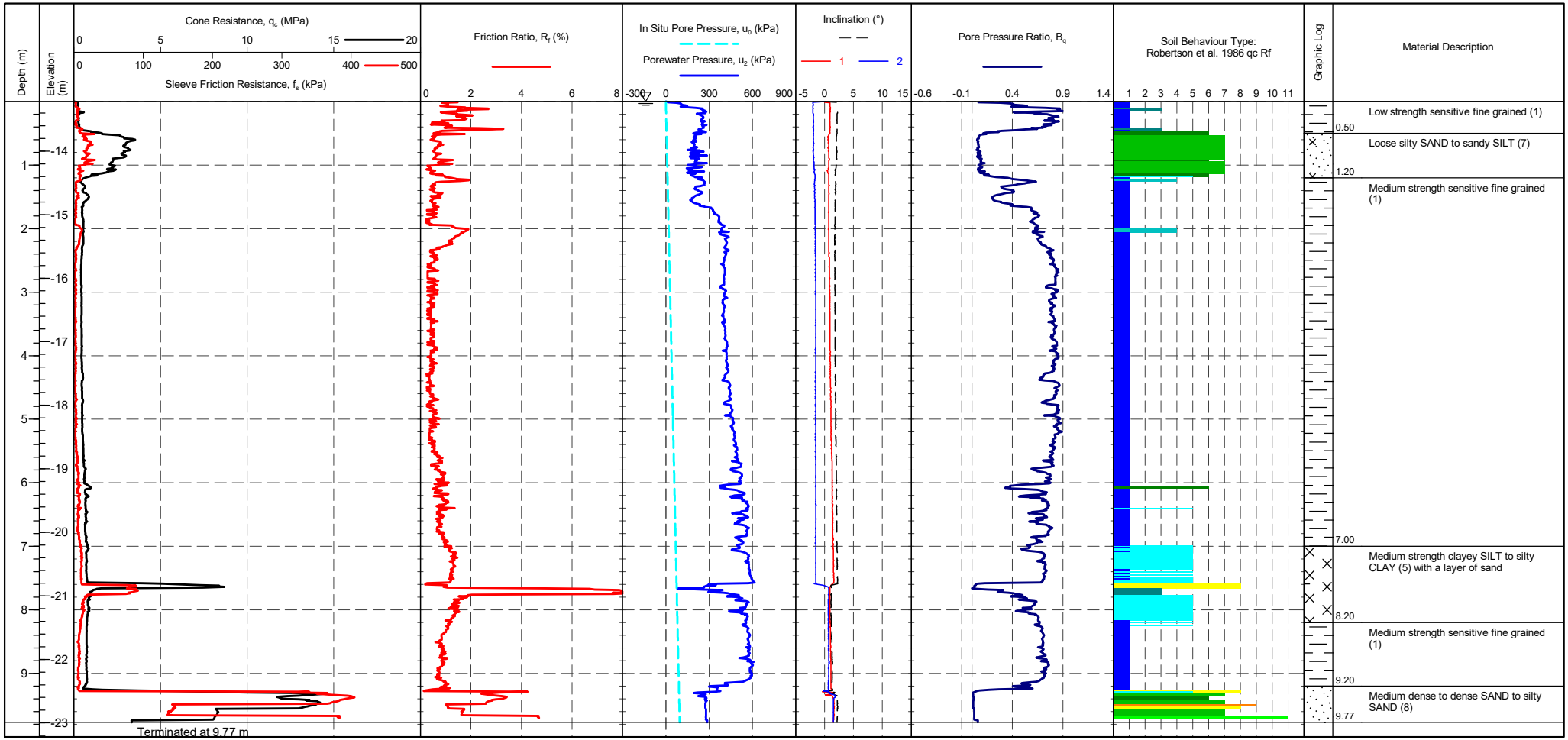
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:26 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 50A

CLIENT : Causeway	EASTING : 142515.951 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931119.314 m	Test stopped due to technical issues.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.220 m CD		TEST DATE : 20/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Equipment failure		METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIP.825	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 15cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	210 mV	58 mV	-1.672 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	63 mV	-0.109 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 50	Pore Pressure 2	287 mV	66 mV	-0.069 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2349 mV	57 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

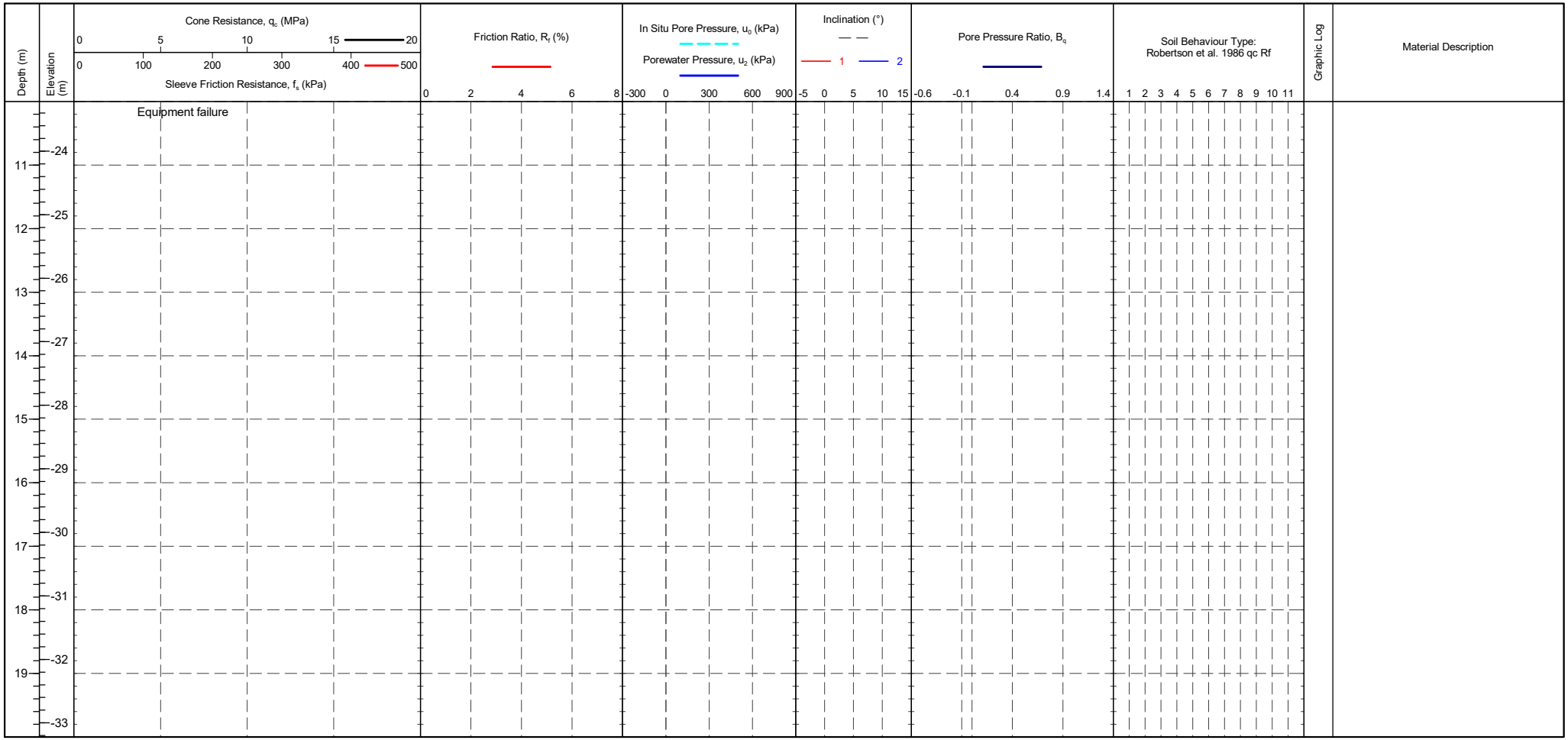
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 50A

CLIENT : Causeway	EASTING : 142515.951 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931119.314 m	Test stopped due to technical issues.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.220 m CD		TEST DATE : 20/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Equipment failure		METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIP.825	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 15cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	210 mV	58 mV	-1.672 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	63 mV	-0.109 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 50	Pore Pressure 2	287 mV	66 mV	-0.069 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2349 mV	57 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

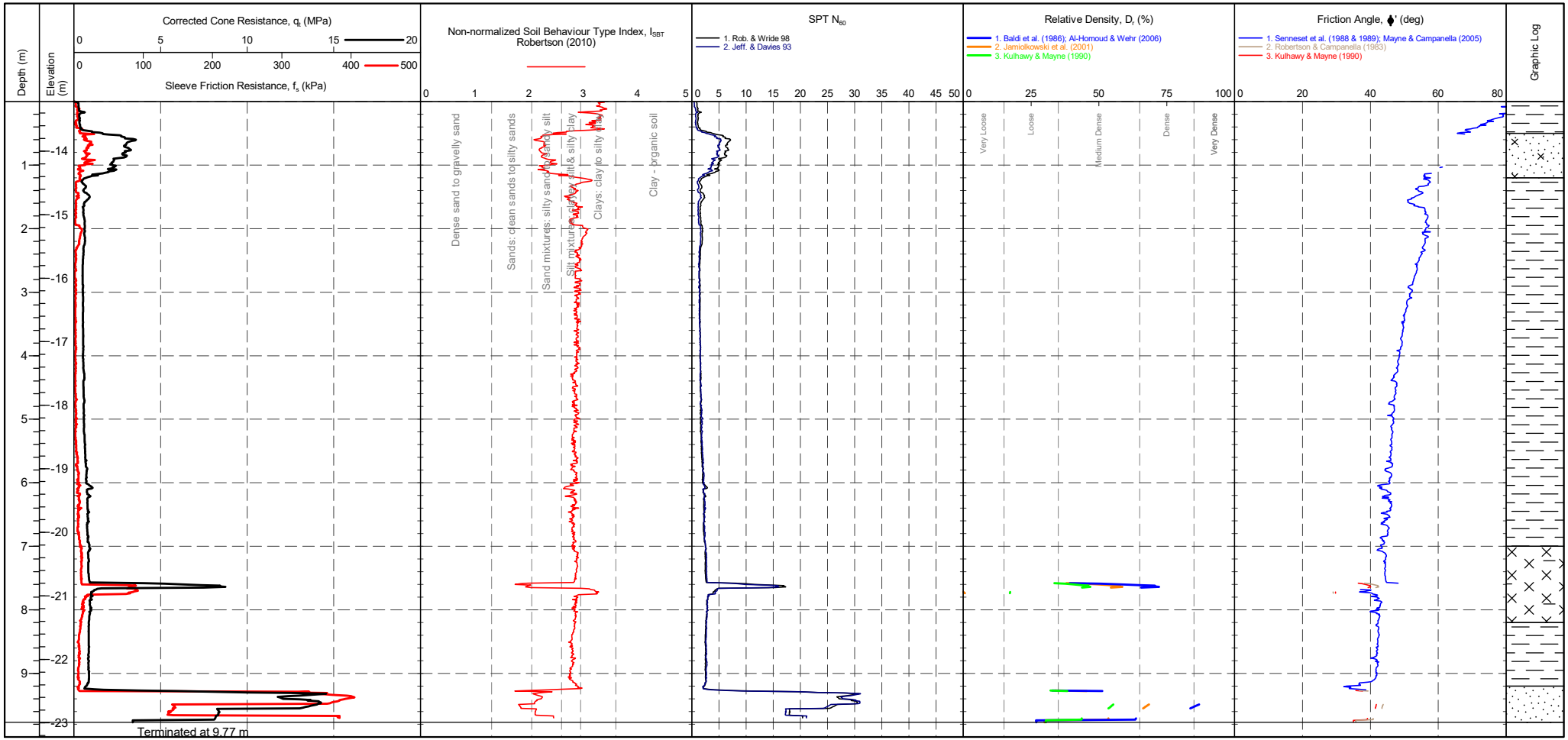
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 50A

CLIENT : Causeway	EASTING : 142515.951 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931119.314 m	Test stopped due to technical issues.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.220 m CD		TEST DATE : 20/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Equipment failure		METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIP.825	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 15cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	210 mV	58 mV	-1.672 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	63 mV	-0.109 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 50	Pore Pressure 2	287 mV	66 mV	-0.069 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2349 mV	57 mV	

Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

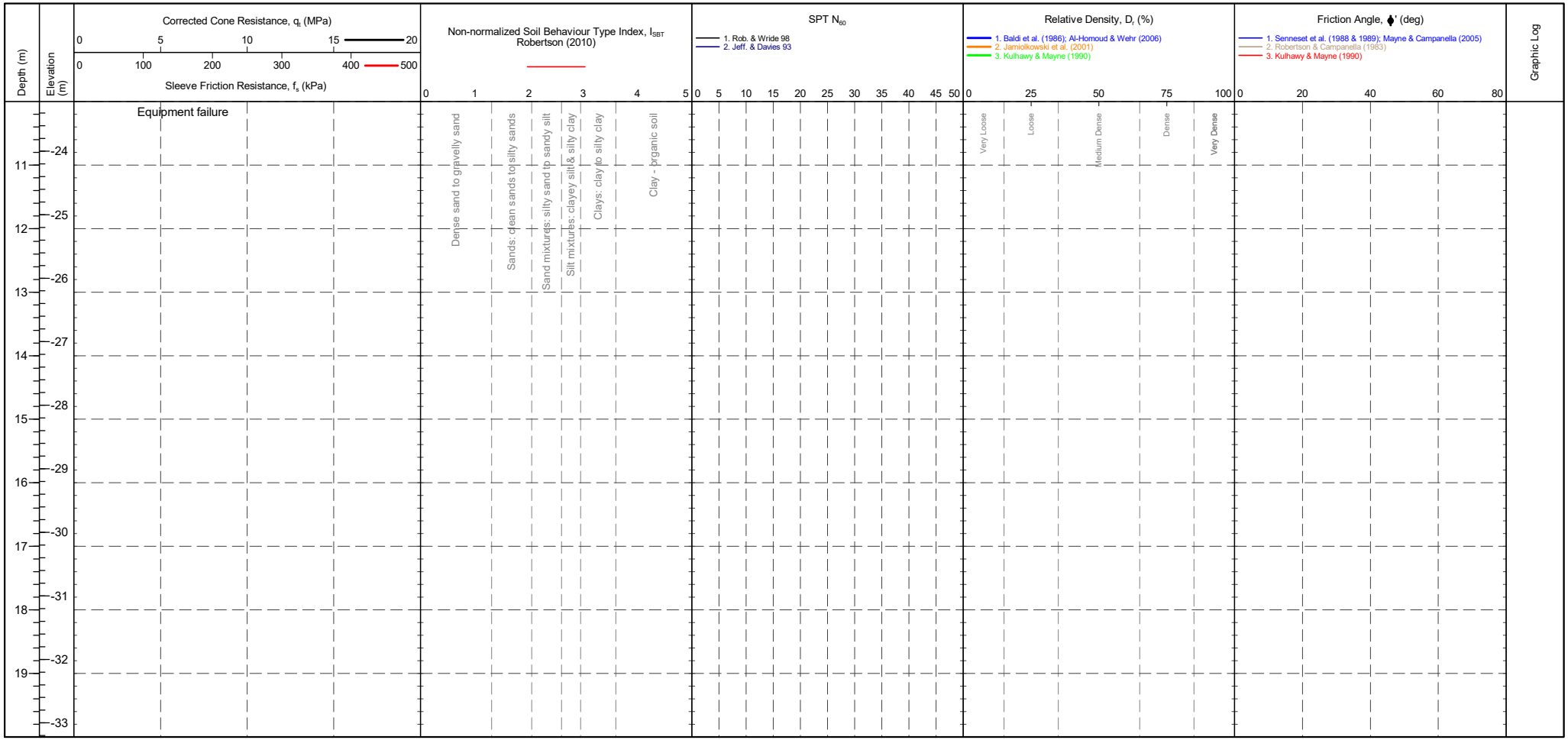
PointID
BH 50A

CLIENT : Causeway
PROJECT : Stornoway
LOCATION : Stornoway
PROJECT No. : 1190227

EASTING : 142515.951 m
NORTHING : 931119.314 m
ELEVATION : -13.220 m CD
CHECKED BY : LD
TERMINATION REASON : Equipment failure

Remark:
Test stopped due to technical issues.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 20/06/2019
PLOT DATE : 11/07/2019
METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIP.825
CONE AREA	: 15cm²
CONE AREA RATIO	: 0.79
FILTER POSITION	: u2
FILTER TYPE	: HDPE
FRICTION REDUCER	: None

TEST TYPE	: TE2
APPLICATION CLASS	: 2
RIG	: CPT 003
OPERATOR	: MO & DG
FILE NAME	: 1190227-BH 50
WEATHER	: Overcast & Mild

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	210 mV	58 mV	-1.672 MPa
Sleeve	216 mV	63 mV	-0.109 kPa
Pore Pressure 2	287 mV	66 mV	-0.069 kPa
X-Y Inclinometer	2349 mV	57 mV	

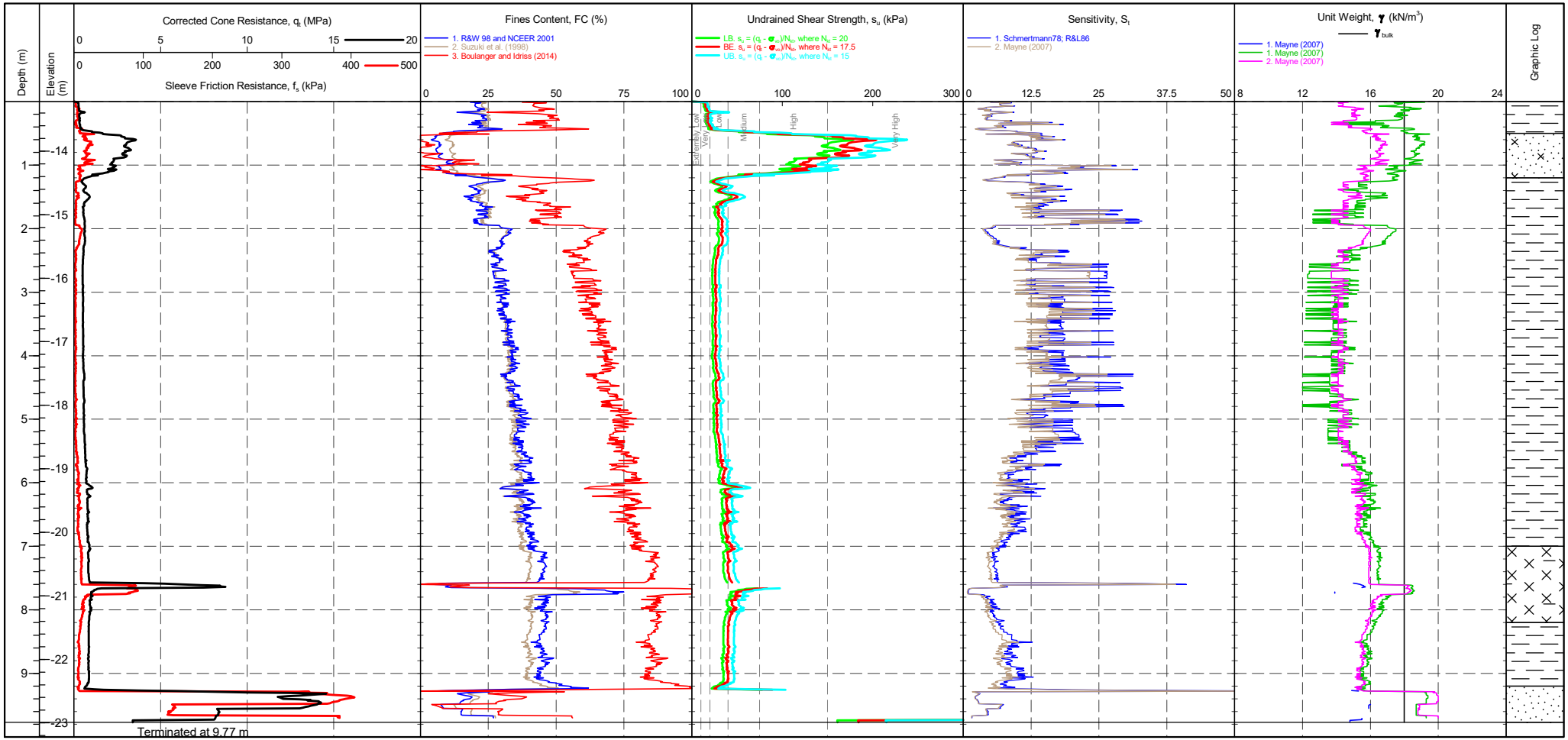
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 50A

CLIENT : Causeway	EASTING : 142515.951 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931119.314 m	Test stopped due to technical issues.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.220 m CD		TEST DATE : 20/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Equipment failure		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S15-CFIP.825	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 15cm^2	APPLICATION CLASS	: 2	Tip	210 mV	58 mV	-1.672 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	216 mV	63 mV	-0.109 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	287 mV	66 mV	-0.069 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 50	X-Y Inclinometer	2349 mV	57 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

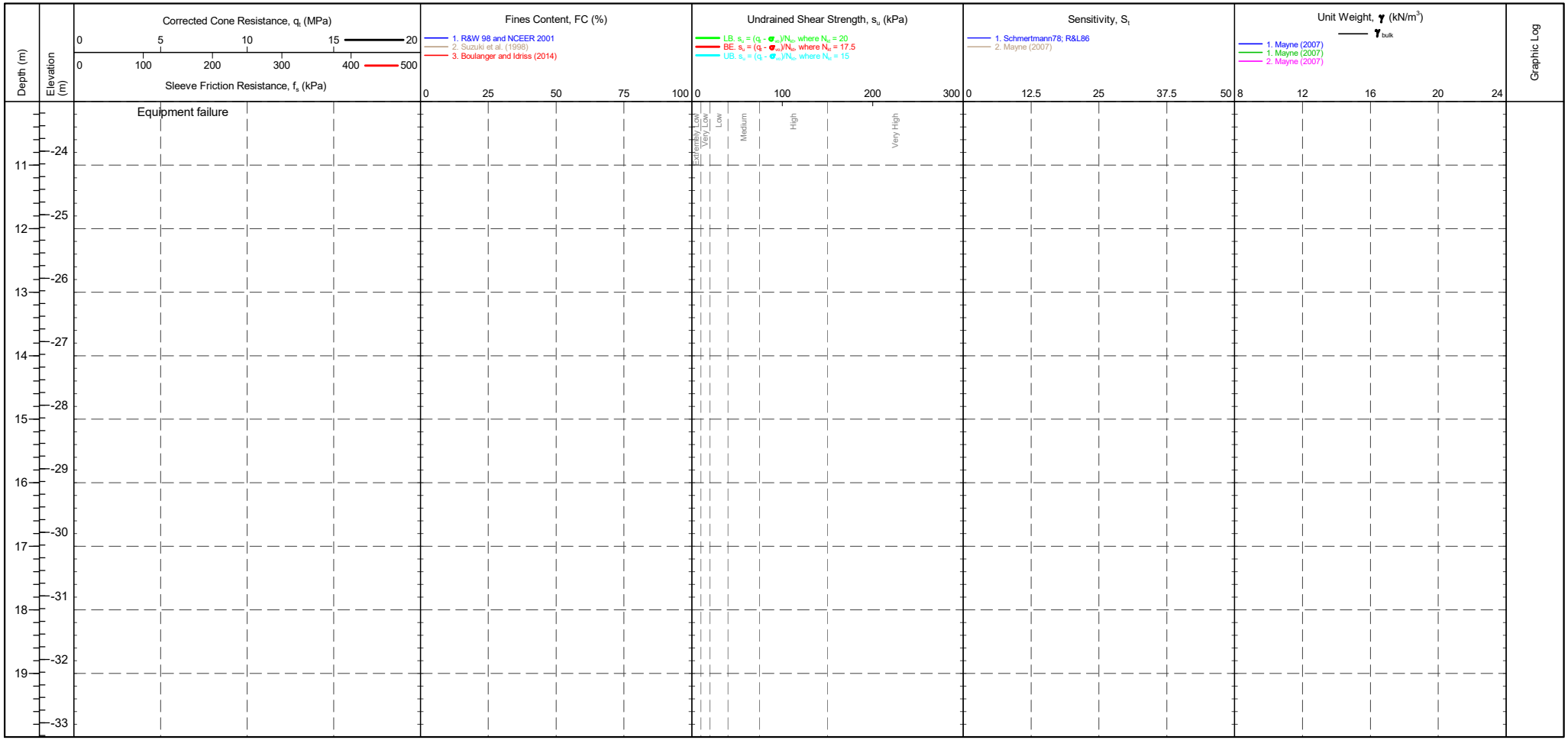
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

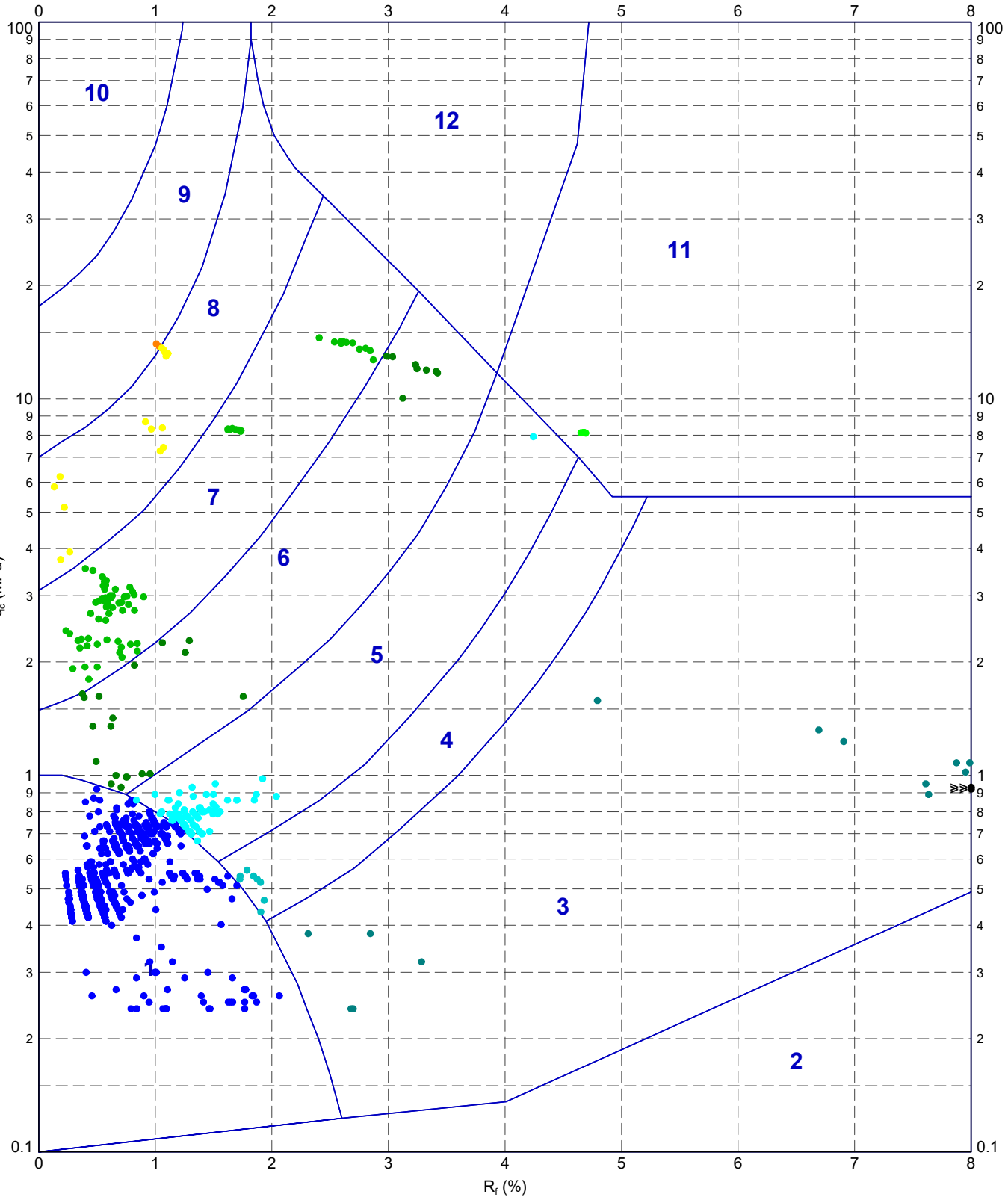
PointID
BH 50A

CLIENT : Causeway	EASTING : 142515.951 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931119.314 m	Test stopped due to technical issues.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.220 m CD		TEST DATE : 20/06/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Equipment failure		METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIP.825	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 15cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	210 mV	58 mV	-1.672 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	216 mV	63 mV	-0.109 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 50	Pore Pressure 2	287 mV	66 mV	-0.069 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2349 mV	57 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 50A

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

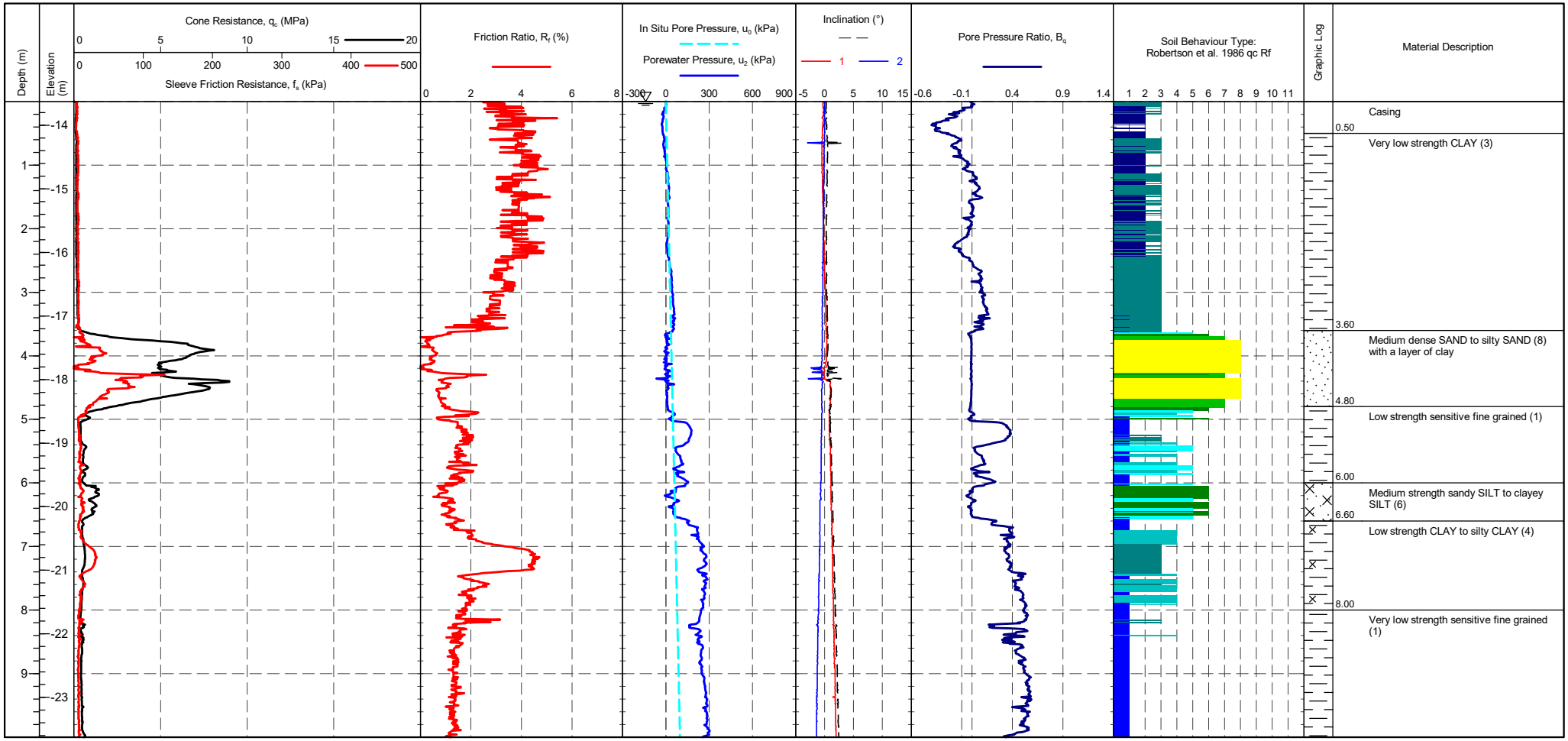
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:27 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 51

CLIENT : Causeway	EASTING : 142515.441 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931146.994 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.626 m CD		TEST DATE : 05/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2		
CONE AREA	: 10cm²	APPLICATION CLASS	: 2		
CONE AREA RATIO	: 0.79	RIG	: CPT 003		
FILTER POSITION	: u2	OPERATOR	: MO & DG		
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 51		
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild		

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	242 mV	241 mV	-0.013 MPa
Sleeve	219 mV	221 mV	0.002 kPa
Pore Pressure 2	257 mV	264 mV	0.002 kPa
X-Y Inclinometer	2489 mV	2382 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

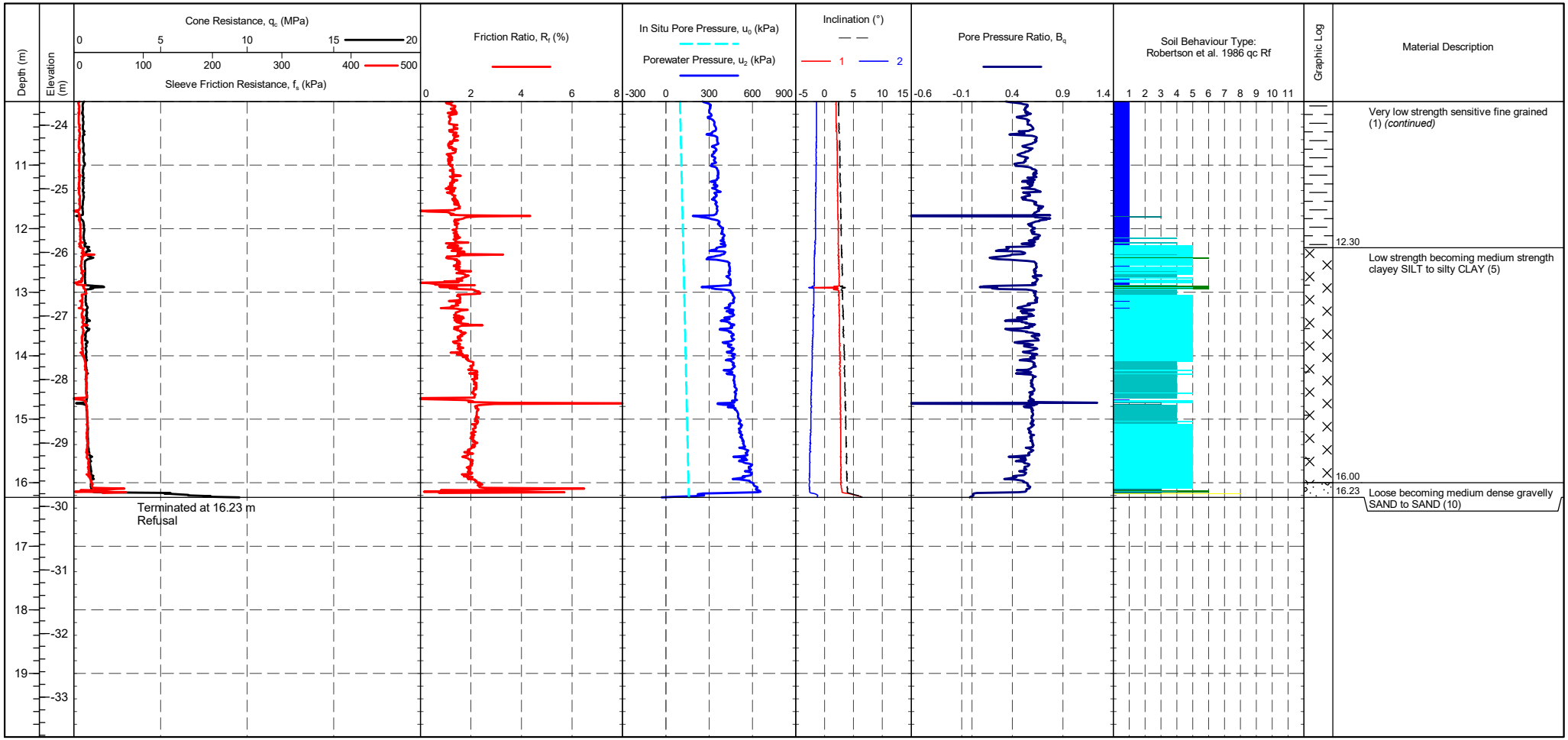
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 51

CLIENT : Causeway	EASTING : 142515.441 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931146.994 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.626 m CD		TEST DATE : 05/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	242 mV	241 mV	-0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	219 mV	221 mV	0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 51	Pore Pressure 2	257 mV	264 mV	0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2489 mV	2382 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

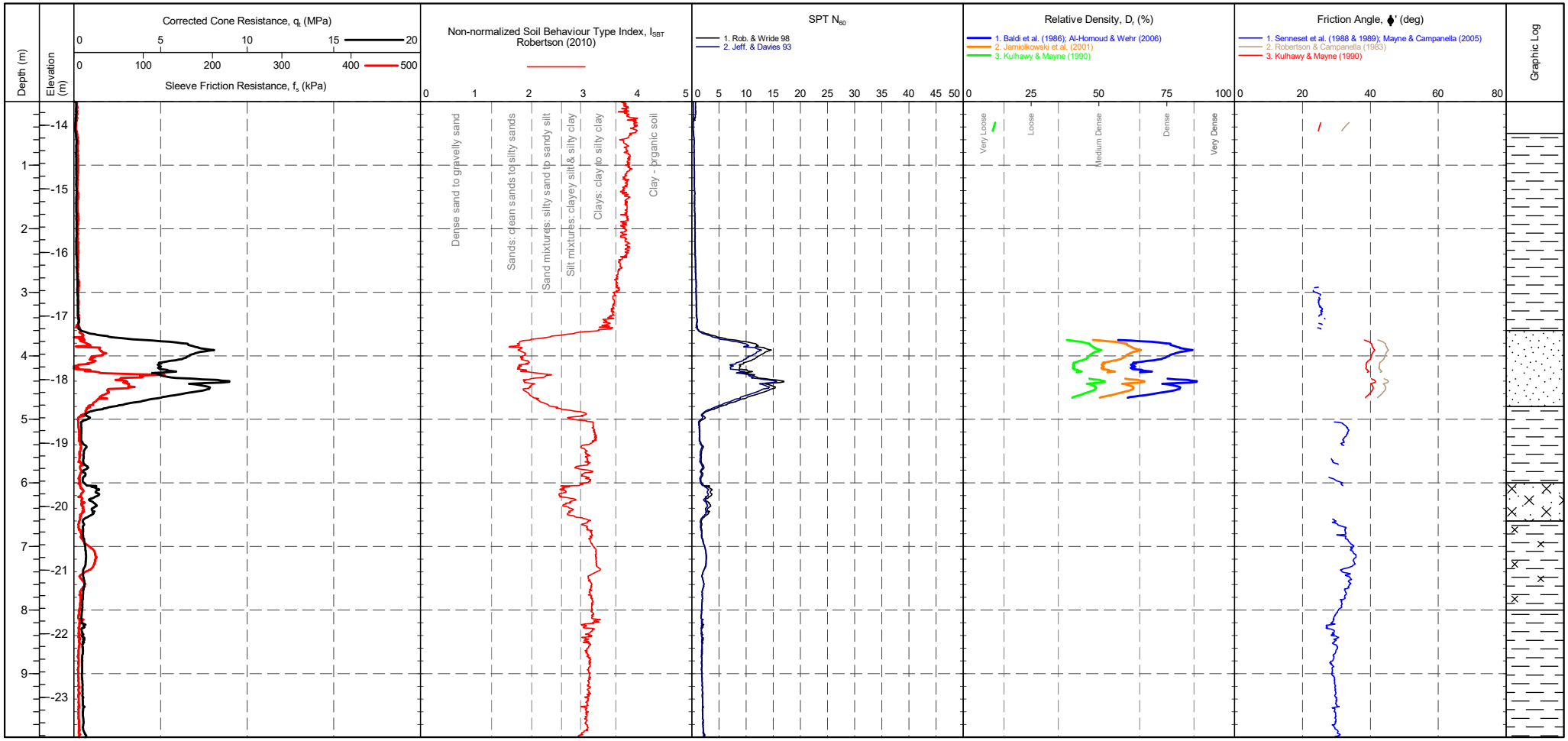
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 51

CLIENT : Causeway	EASTING : 142515.441 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931146.994 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.626 m CD		TEST DATE : 05/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID : S10-CFIP.786	TEST TYPE : TE2			Transducer	Pre	Post	Difference
CONE AREA : 10cm²	APPLICATION CLASS : 2			Tip	242 mV	241 mV	-0.013 MPa
CONE AREA RATIO : 0.79	RIG : CPT 003			Sleeve	219 mV	221 mV	0.002 kPa
FILTER POSITION : u2	OPERATOR : MO & DG			Pore Pressure 2	257 mV	264 mV	0.002 kPa
FILTER TYPE : HDPE	FILE NAME : 1190227-BH 51			X-Y Inclinometer	2489 mV	2382 mV	
FRICTION REDUCER : None	WEATHER : Overcast & Mild						

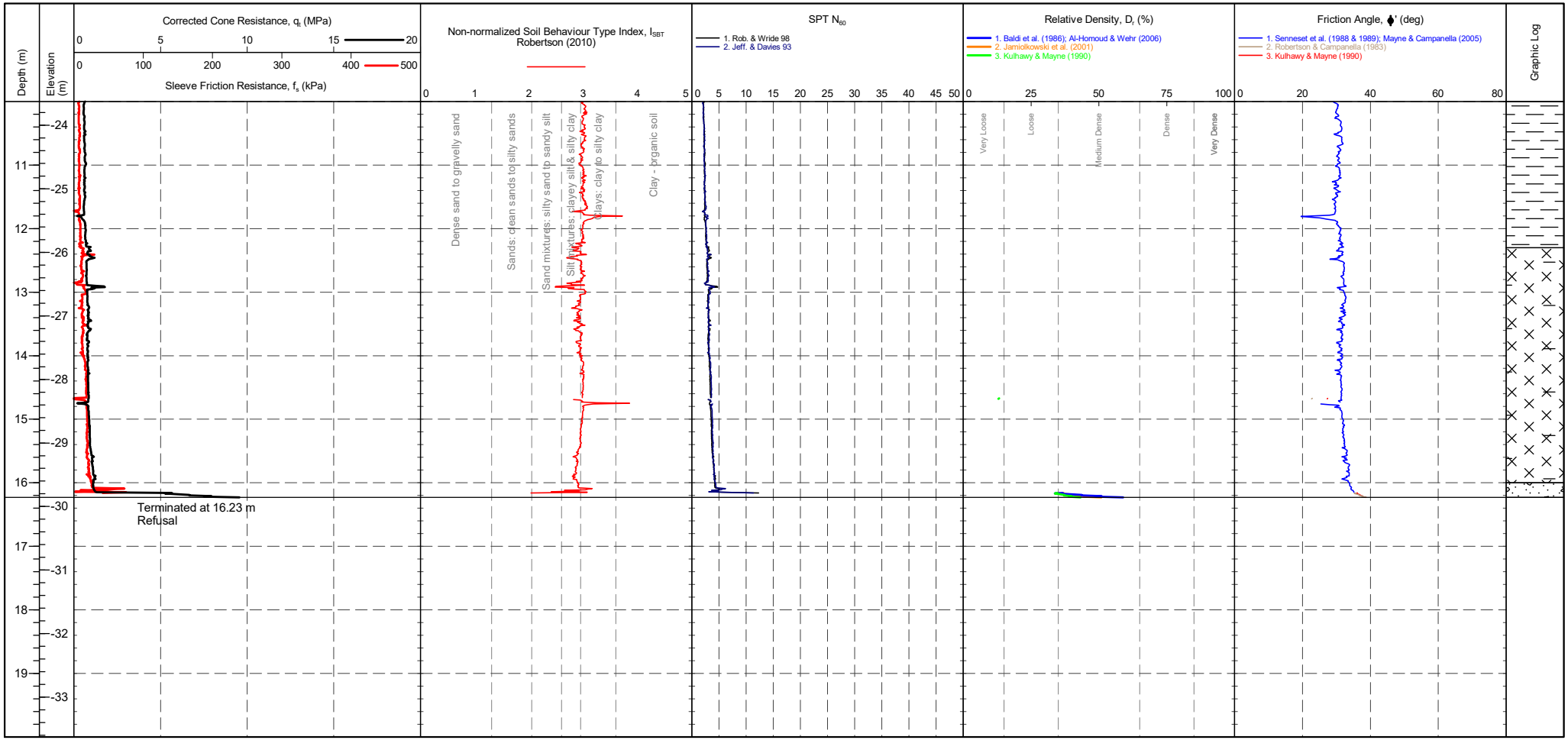
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 51

CLIENT : Causeway	EASTING : 142515.441 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931146.994 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.626 m CD		TEST DATE : 05/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	242 mV	241 mV	-0.013 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	219 mV	221 mV	0.002 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	257 mV	264 mV	0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 51	X-Y Inclinometer	2489 mV	2382 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

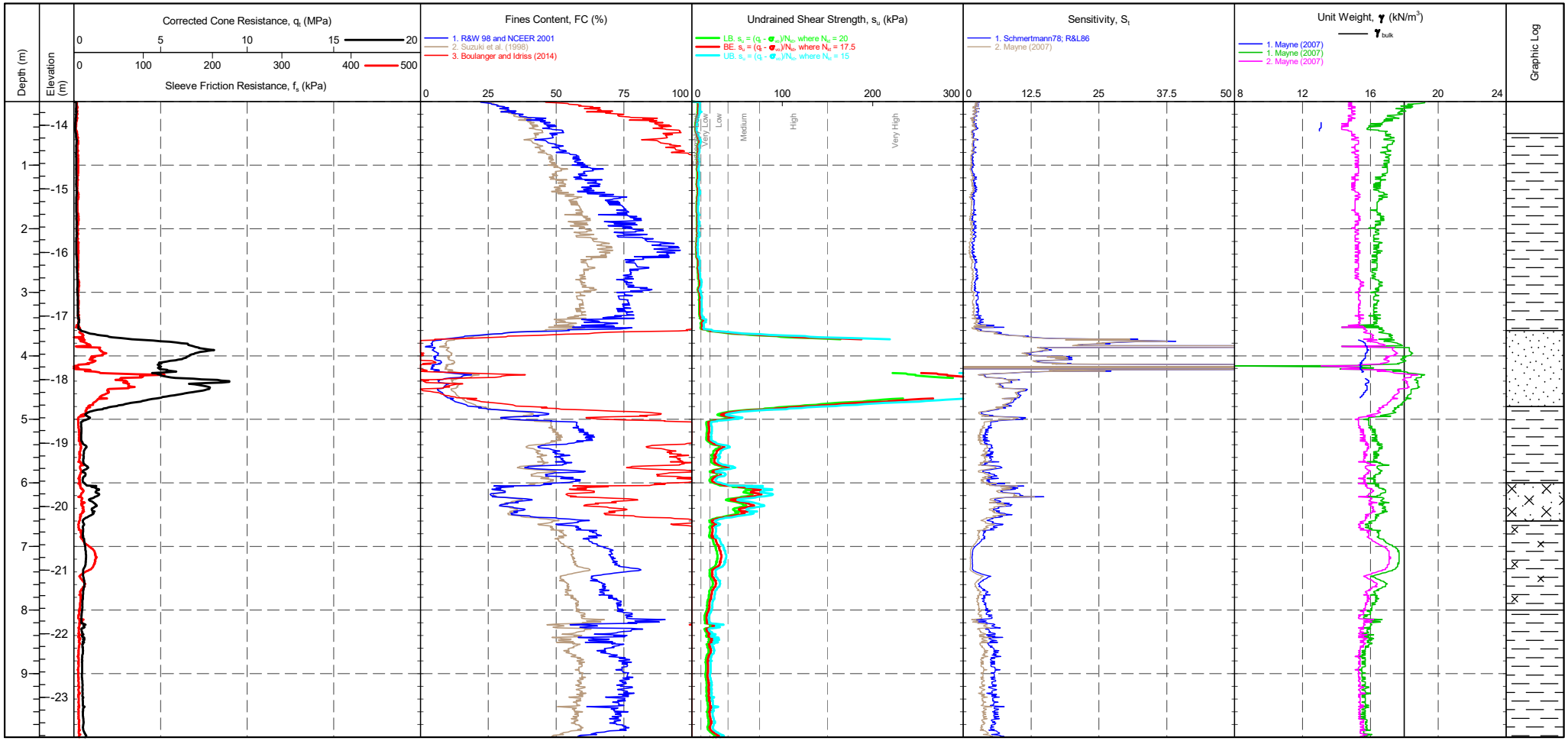
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 51

CLIENT : Causeway	EASTING : 142515.441 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931146.994 m	Test refused on inclination.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -13.626 m CD		TEST DATE : 05/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post / Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	242 mV	241 mV / -0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	219 mV	221 mV / 0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 51	Pore Pressure 2	257 mV	264 mV / 0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2489 mV	2382 mV

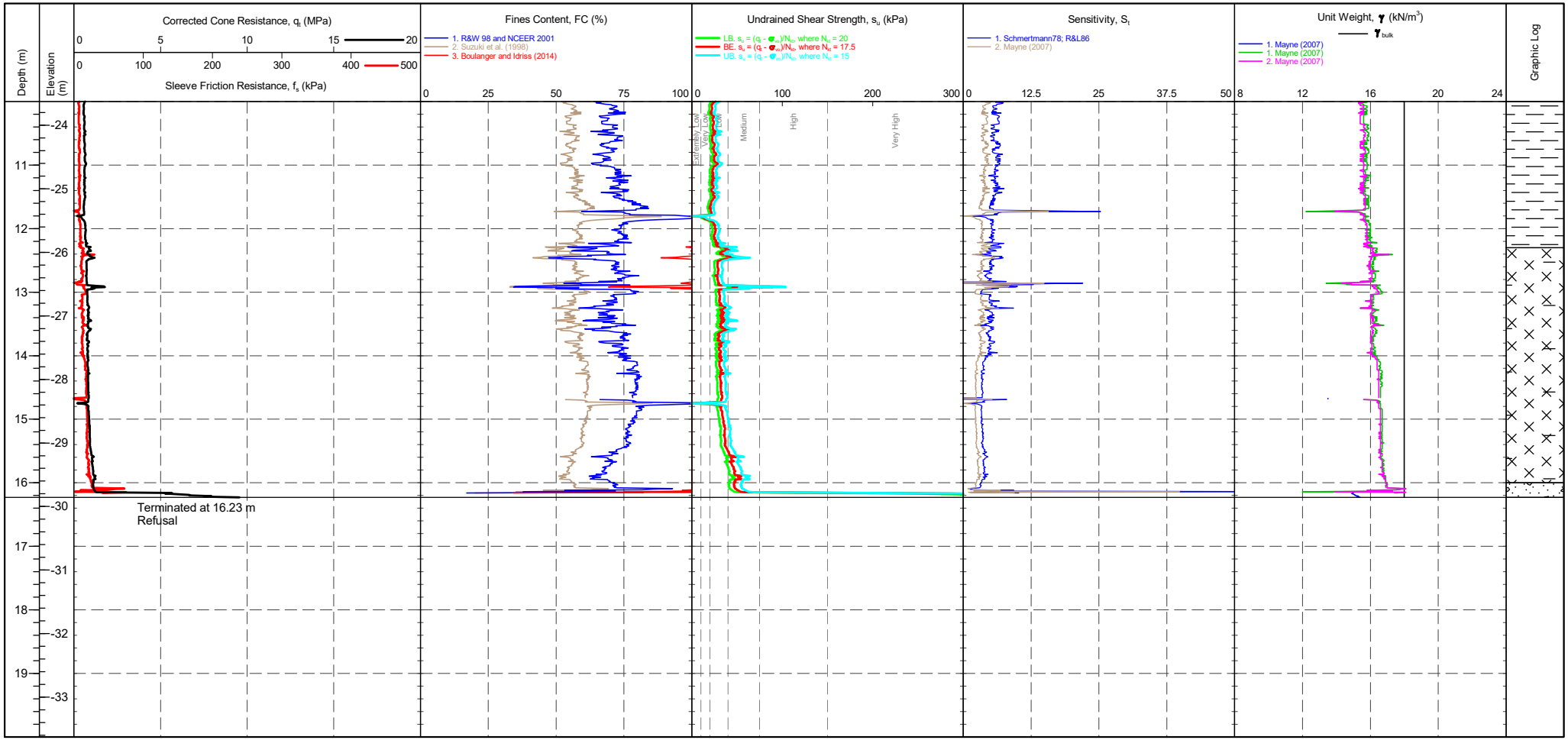
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

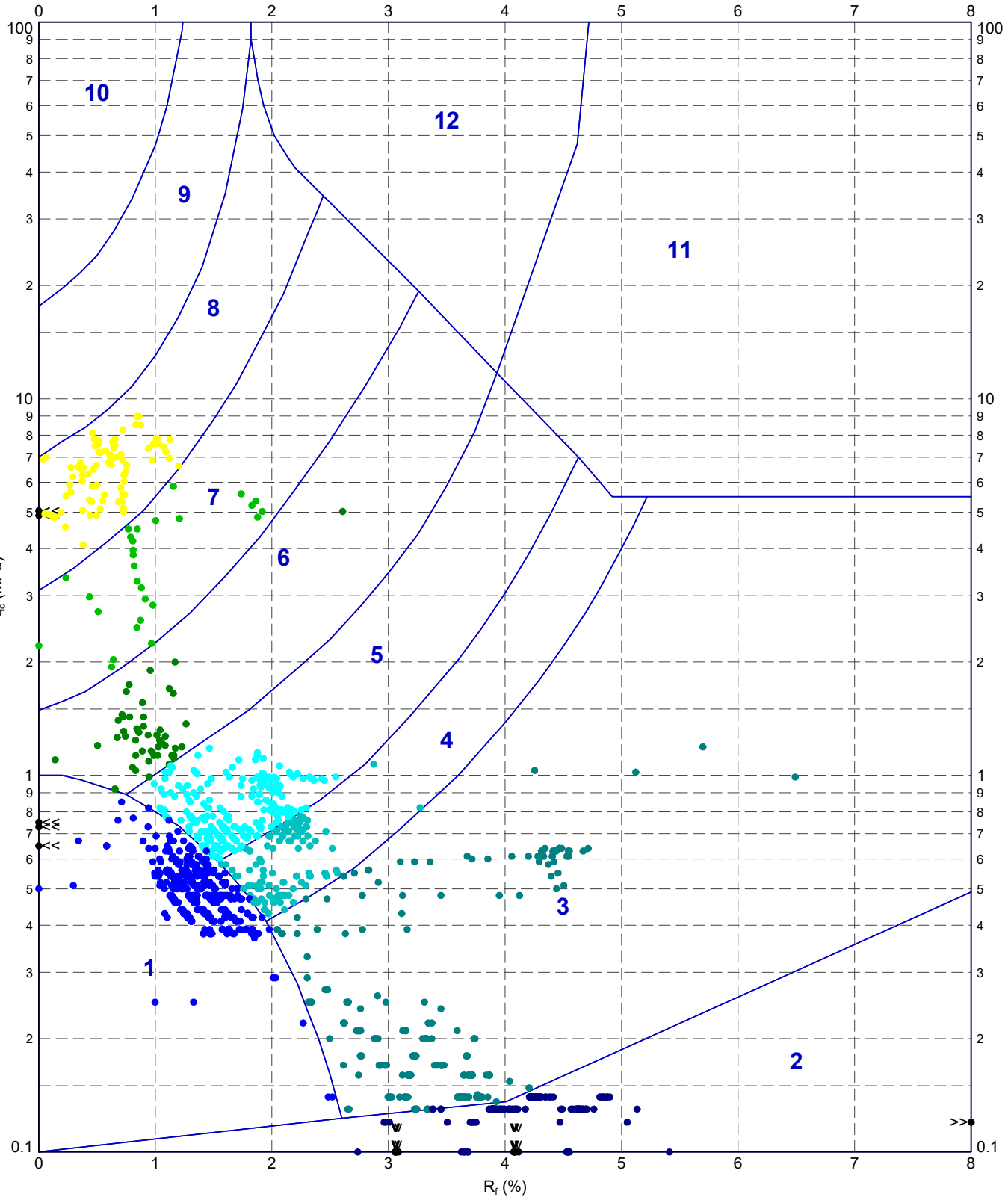
PointID
BH 51

CLIENT : Causeway PROJECT : Stornoway LOCATION : Stornoway PROJECT No. : 1190227	EASTING : 142515.441 m NORTHING : 931146.994 m ELEVATION : -13.626 m CD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on inclination.	SHEET : 2 OF 2 STATUS : Final TEST DATE : 05/07/2019 PLOT DATE : 11/07/2019 METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post / Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	242 mV	241 mV / -0.013 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	219 mV	221 mV / 0.002 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 51	Pore Pressure 2	257 mV	264 mV / 0.002 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2489 mV	2382 mV

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

- 1 - Sensitive fine grained material
- 2 - Organic material
- 3 - CLAY
- 4 - Silty CLAY to CLAY
- 5 - Clayey SILT to silty CLAY
- 6 - Sandy SILT to clayey SILT
- 7 - Silty SAND to sandy SILT
- 8 - SAND to silty SAND
- 9 - SAND
- 10 - Gravelly SAND to SAND
- 11 - Very stiff fine grained
- 12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 51

DRAWN	DATE 11/07/2019
CHECKED	DATE 11/07/2019
SCALE Not To Scale	A4
PROJECT No 1190227	FIGURE No

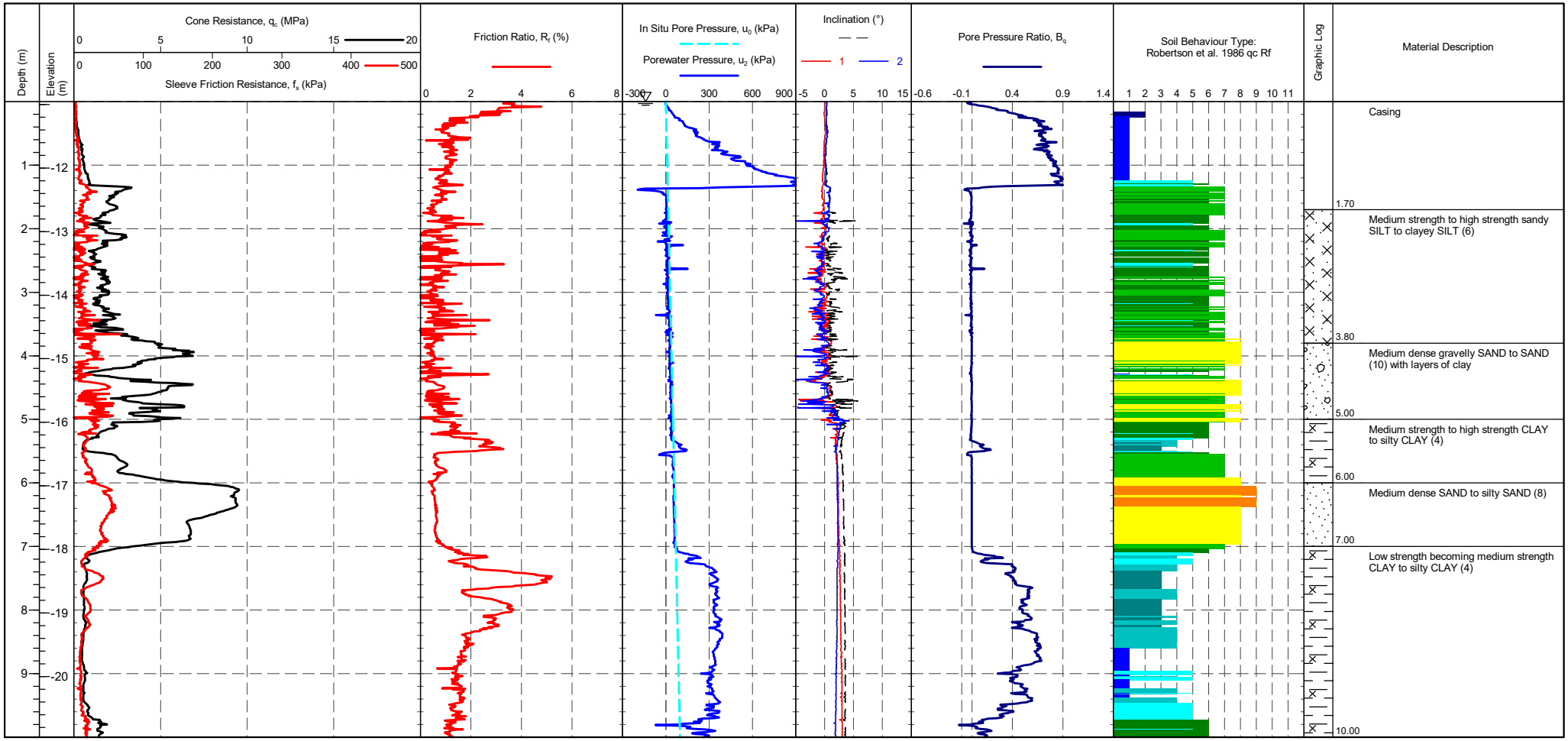
INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:29 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -10.954 m CD		TEST DATE : 03/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	244 mV	242 mV	-0.026 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	214 mV	217 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 52	Pore Pressure 2	221 mV	197 mV	-0.007 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2584 mV	2594 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

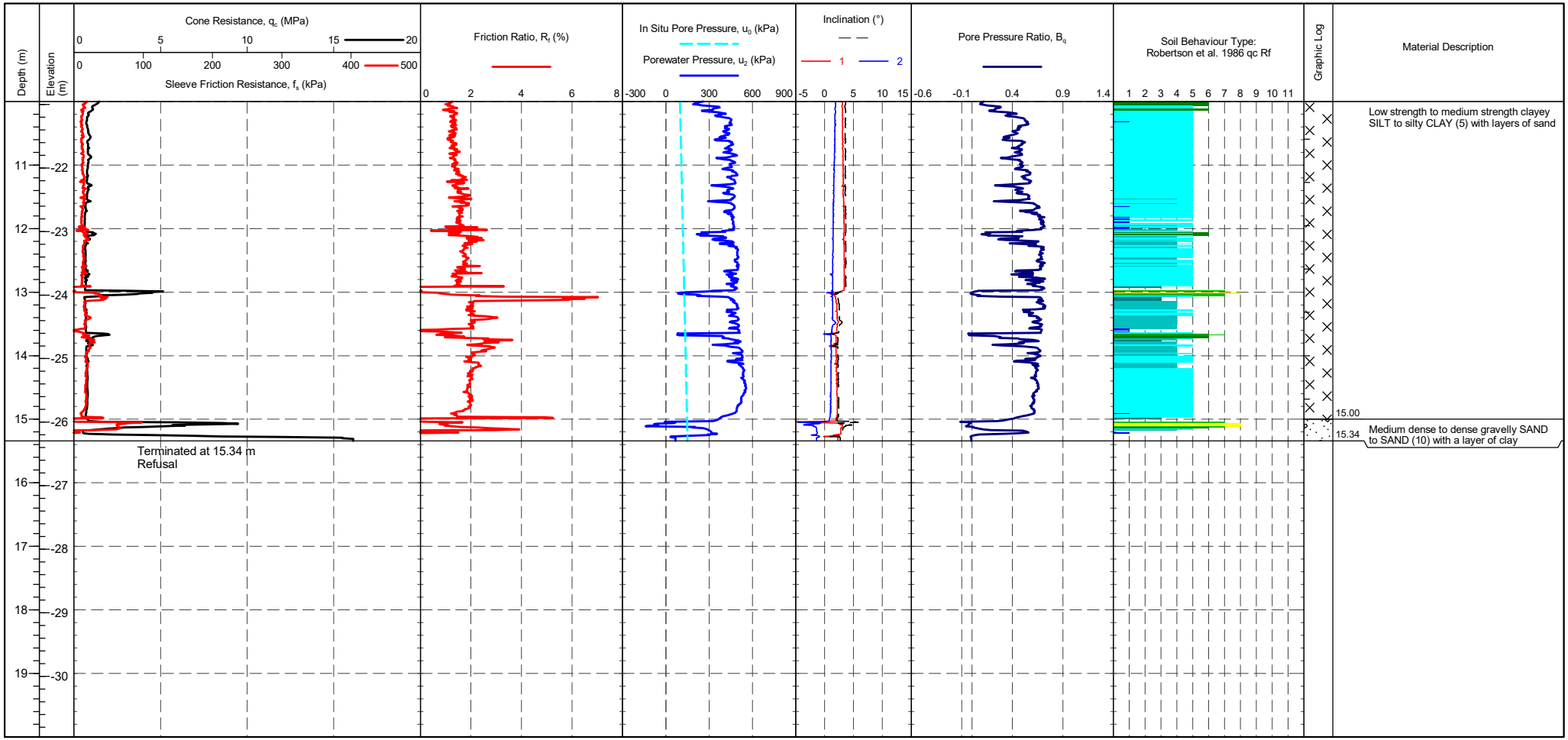
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 01

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -10.954 m CD		TEST DATE : 03/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	244 mV	242 mV	-0.026 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	214 mV	217 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 52	Pore Pressure 2	221 mV	197 mV	-0.007 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2584 mV	2594 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

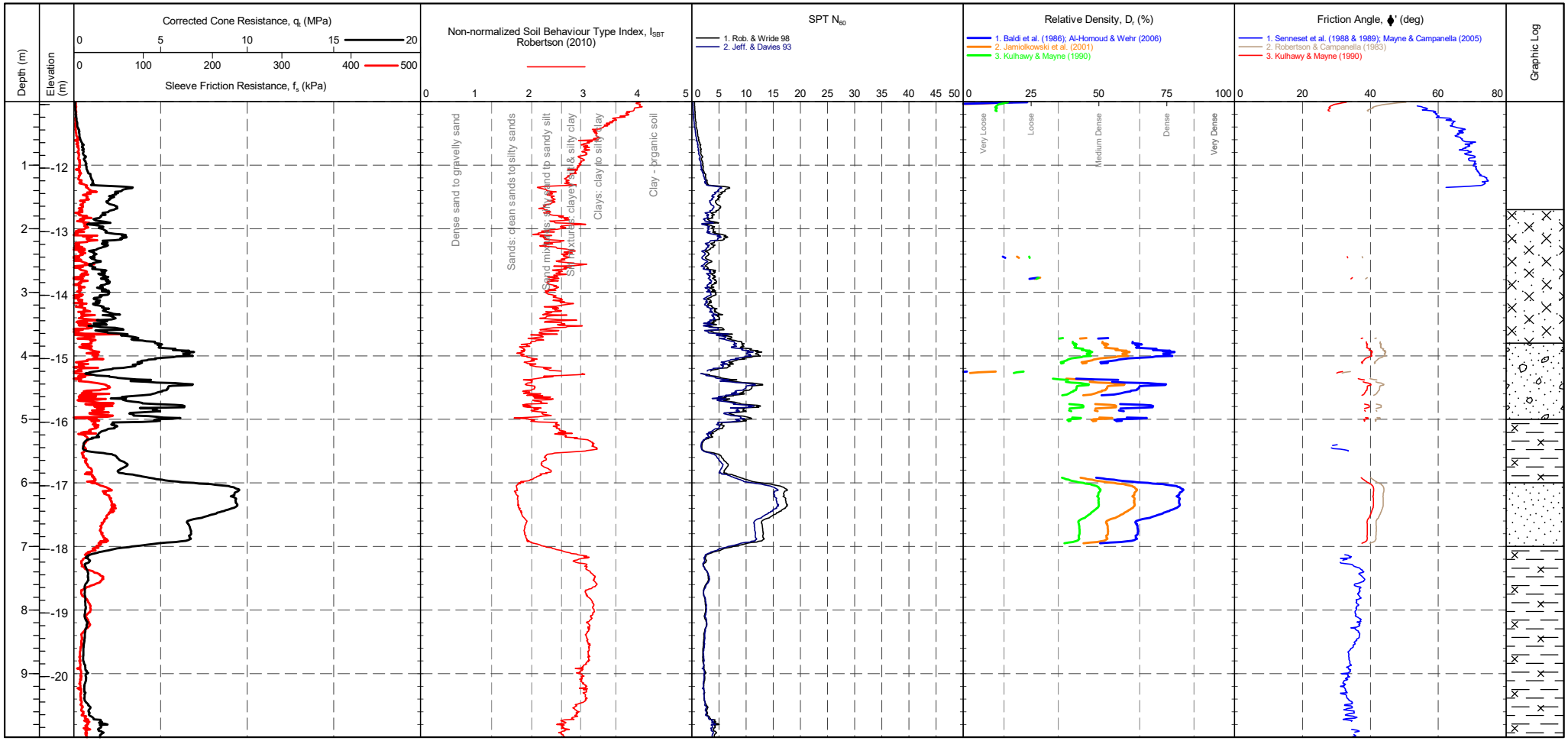
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -10.954 m CD		TEST DATE : 03/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES		
CONE AREA	: 10cm²	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	244 mV	242 mV	-0.026 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	214 mV	217 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 52	Pore Pressure 2	221 mV	197 mV	-0.007 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2584 mV	2594 mV	

Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 02

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
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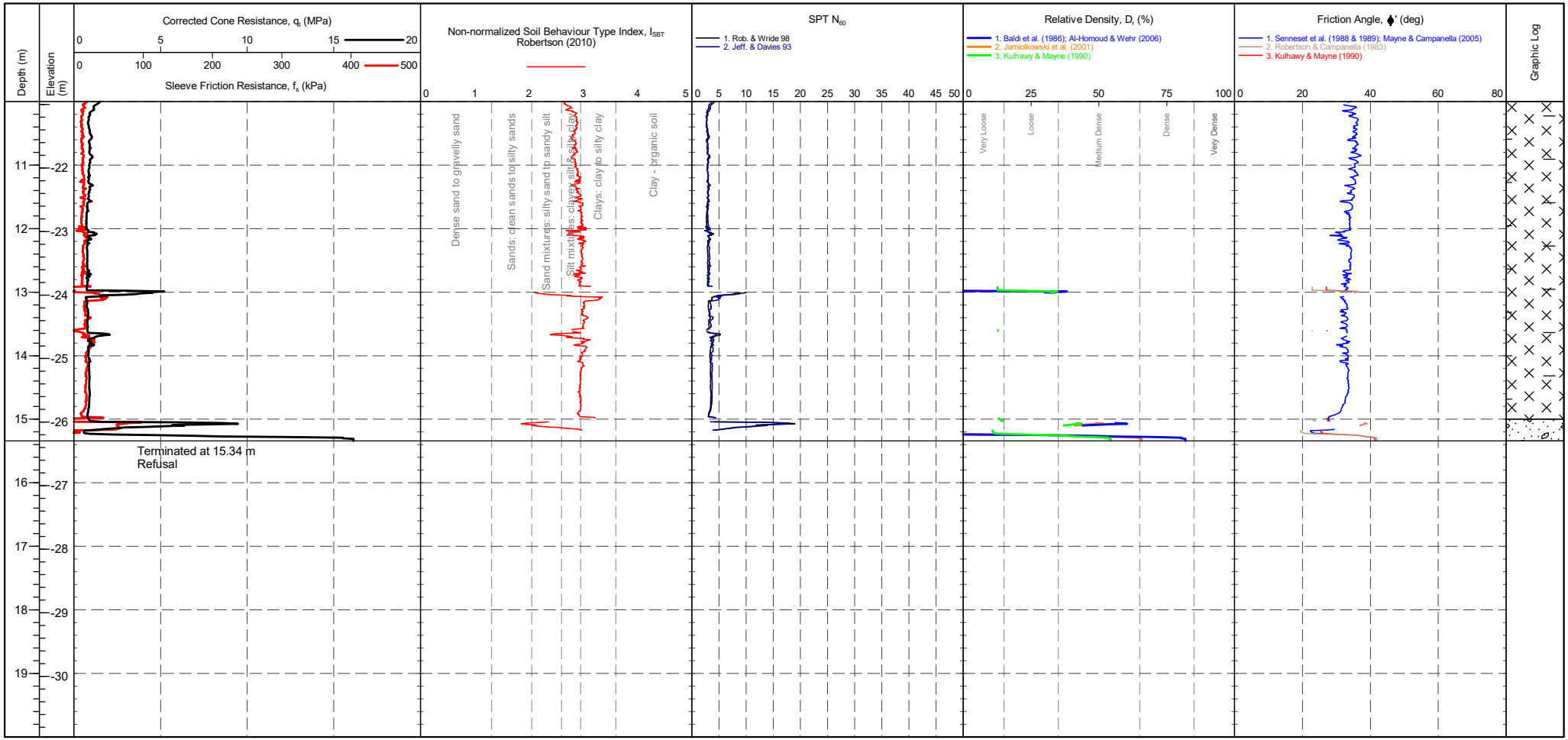


				CPTU ZERO VALUES			
CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	Transducer	Pre	Post	Difference
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Tip	244 mV	242 mV	-0.026 MPa
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Sleeve	214 mV	217 mV	0.003 kPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Pore Pressure 2	221 mV	197 mV	-0.007 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 52	X-Y Inclinometer	2584 mV	2594 mV	
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild				

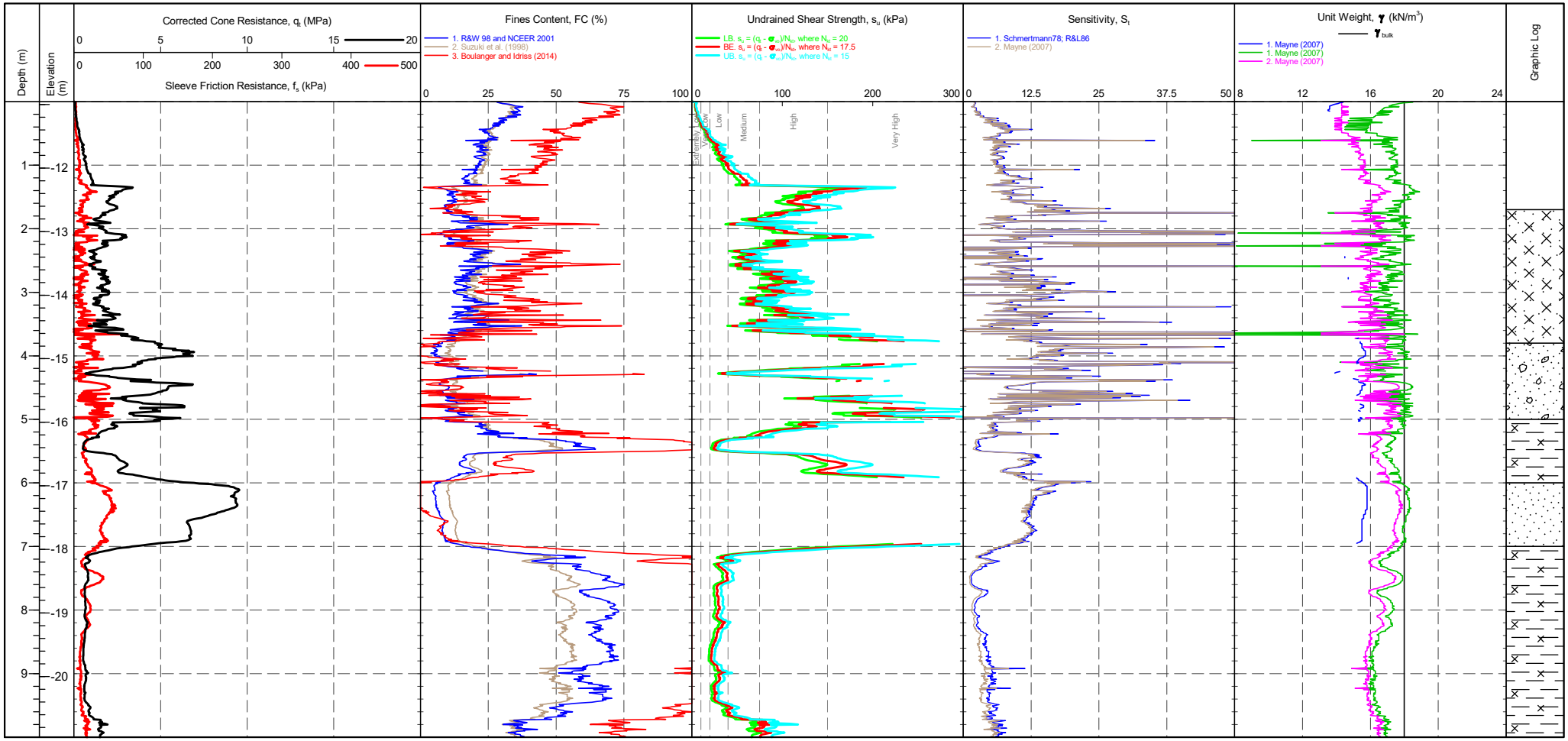
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 1 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -10.954 m CD		TEST DATE : 03/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
CONE AREA RATIO	: 0.79	RIG	: CPT 003	Tip	244 mV	242 mV	-0.026 MPa
FILTER POSITION	: u2	OPERATOR	: MO & DG	Sleeve	214 mV	217 mV	0.003 kPa
FILTER TYPE	: HDPE	FILE NAME	: 1190227-BH 52	Pore Pressure 2	221 mV	197 mV	-0.007 kPa
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2584 mV	2594 mV	

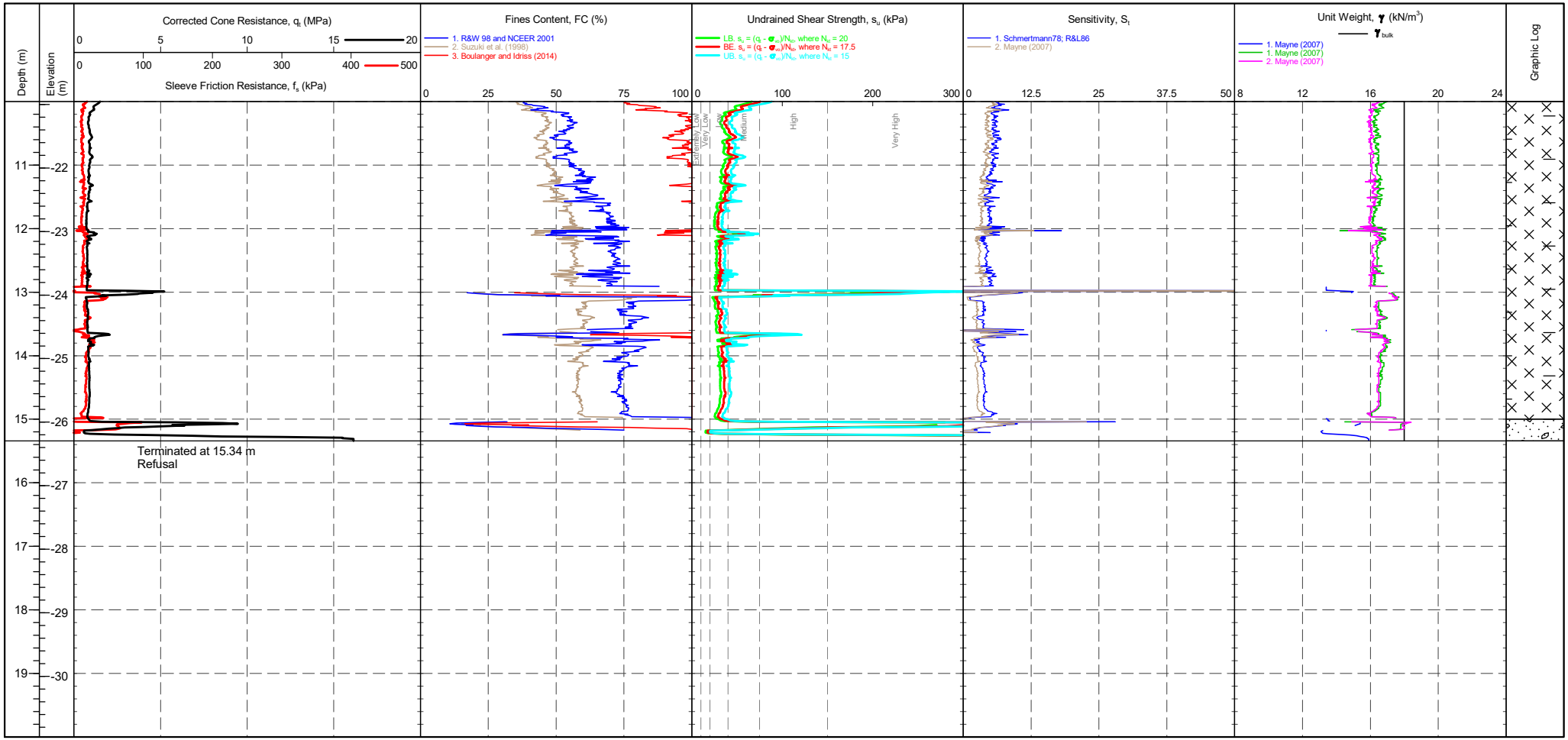
Groundwater Level
Dissipation Test

IN SITU
SITE INVESTIGATION Working with:

CPT LOG 03

PointID
BH 52

CLIENT : Causeway	EASTING : 142518.009 m	Remark:	SHEET : 2 OF 2
PROJECT : Stornoway	NORTHING : 931190.596 m	Test refused on total pressure.	STATUS : Final
LOCATION : Stornoway	ELEVATION : -10.954 m CD		TEST DATE : 03/07/2019
PROJECT No. : 1190227	CHECKED BY : LD		PLOT DATE : 11/07/2019
	TERMINATION REASON : Refusal		METHOD : ISO 22476-1:2012



CONE ID	: S10-CFIP.786	TEST TYPE	: TE2	CPTU ZERO VALUES			
CONE AREA	: 10cm^2	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference
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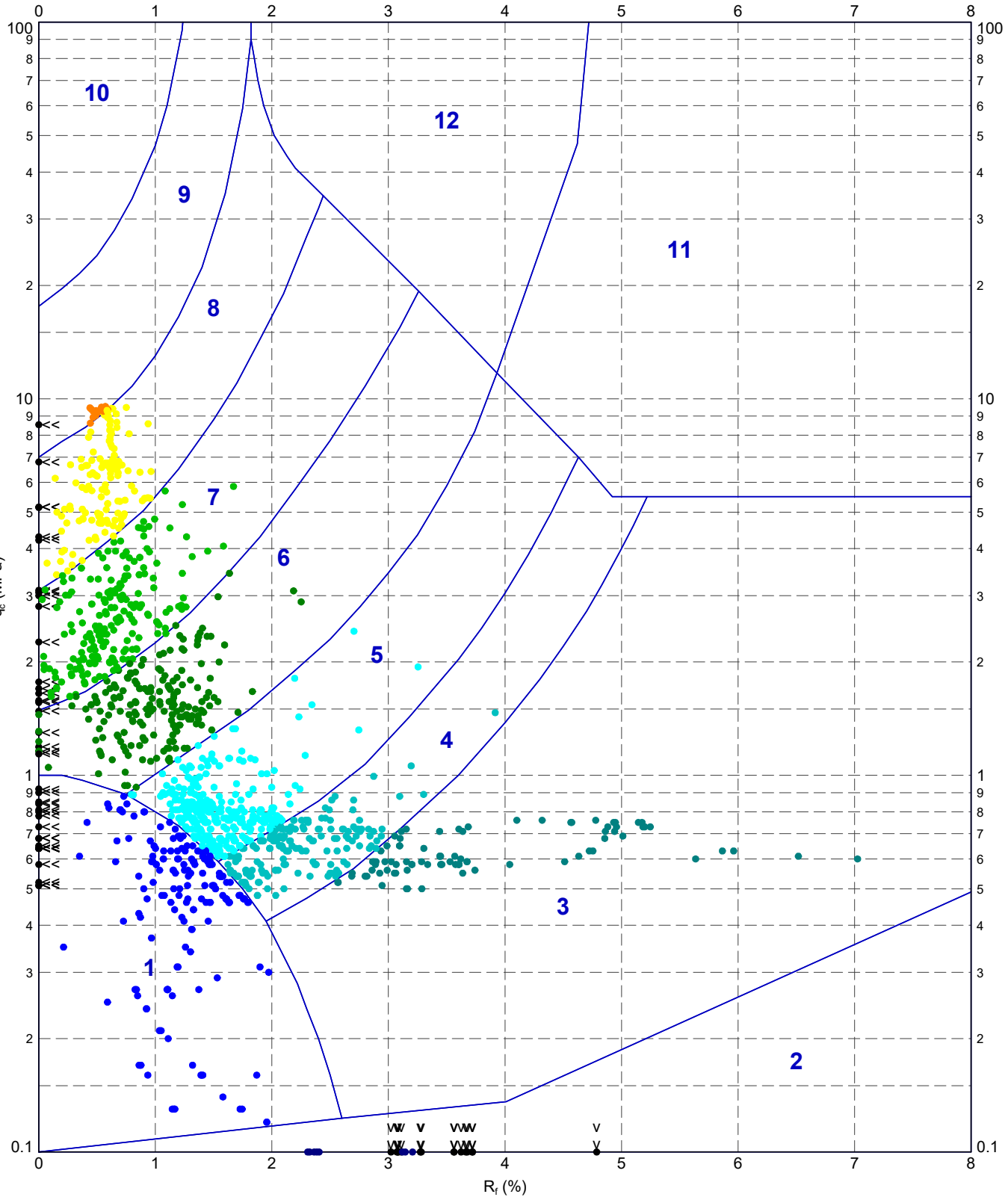
FRICTION REDUCER	: None	WEATHER	: Overcast & Mild	X-Y Inclinometer	2584 mV	2594 mV	

Groundwater Level
Dissipation Test



METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	4 - Silty CLAY to CLAY	7 - Silty SAND to sandy SILT	10 - Gravelly SAND to SAND
2 - Organic material	5 - Clayey SILT to silty CLAY	8 - SAND to silty SAND	11 - Very stiff fine grained
3 - CLAY	6 - Sandy SILT to clayey SILT	9 - SAND	12 - SAND to clayey SAND

IN SITU
SITE INVESTIGATION

TITLE

Causeway
Stornoway
Stornoway
Robertson et al. 1986 q_c vs. R_f - BH 52

DRAWN		DATE	11/07/2019
CHECKED		DATE	11/07/2019
SCALE	Not To Scale		A4
PROJECT No	1190227	FIGURE No	

INSITUSI 2.02.1 LIB.GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF A4P 1190227-STORNOWAY.GPJ <<DrawingFile>> 11/07/2019 23:31 10.00.01.07 Datgel Lab and In Situ Tool - DGD | Lib: In Situ SI 2.02.0 2017-07-10 Prj: In Situ SI 2.02.0 2017-07-10

IN SITU SITE INVESTIGATION

Unit 23 Hastings Innovation
Centre,
Highfield Drive
St. Leonards on Sea, East Sussex,
TN38 9UH, U.K.

Company No.: 6339499
VAT No.: 922 3561 41

CAUSEWAY GEOTECH

APPENDIX G

SPT HAMMER ENERGY MEASUREMENT REPORT

Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
5-8 victory parkway
victory road
Derby
DE24 8ZF

Hammer Ref:	D.93
Test Date:	14/03/2019
Report Date:	14/03/2019
File Name:	D.93.spt
Test Operator:	TS

Instrumented Rod Data

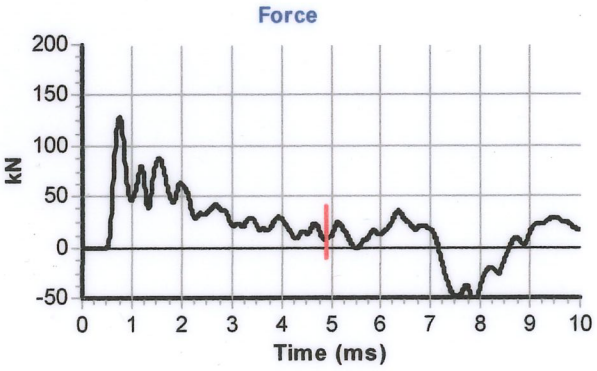
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	9603
Accelerometer No.2:	6457

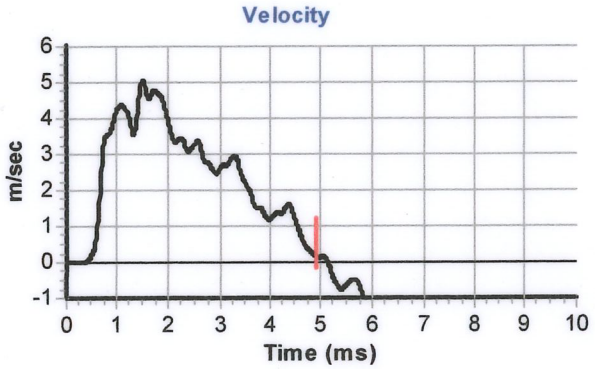
Hammer Information

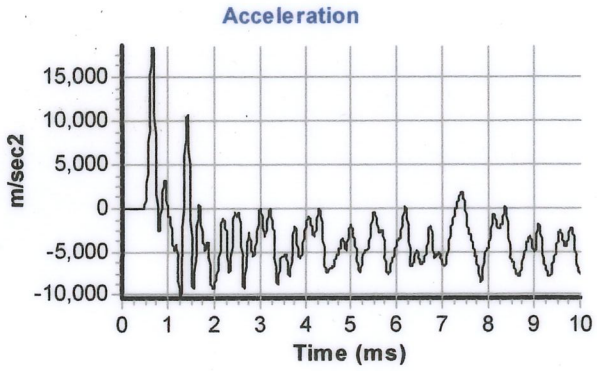
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	15.0

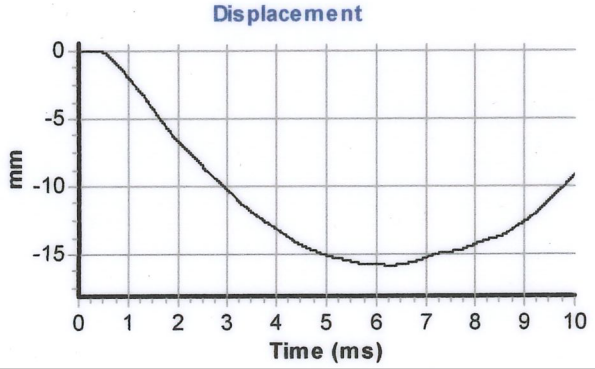
Comments / Location

Drillwell hammer tested at Dynamic samplings yard.









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	340

Energy Ratio E_r (%): **72**

[redacted]

Signed: A.parker.

Title: Associate Director.

The recommended calibration interval is 12 months

SPTMAN ver.Hammer Energy ver. 1.93 All rights reserved, Testconsult ©2010