Tionscadal Soláthair Uisce
Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 6 of 6: Appendices

(Appendix 10.5) RWRM Ground Investigations

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Irish Water

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Eastern and Midlands Region WSP Lot 1 Raw Water Rising Main (RWRM) – Ground Investigation

Client:	Irish Water
Client's Representative:	Mott MacDonald
Report No.:	21-1682 RWRM
Date:	4th January 2023
Status:	Final for Issue

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Approved: ISO 9001 • ISO 14001 • OHSAS 18001

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Document Control Sheet

Report No.:		21-1682 RWRM			
Project Title:		Water Supply Project Eastern and Midlands Region - Lot1 Raw Water Rising Main (RWRM) Ground Investigation			
Client:		Irish Water			
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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+A1:2020, Code of practice for ground investigations.

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

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

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+A1:2020, The Code of Practice for Ground 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.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	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+A1:2020	
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) measured in millimetres.

2 Lot 1 – RAW WATER RISING MAIN (RWRM)

2.1 INTRODUCTION

2.1.1 Authority

On the instruction of Mott MacDonald, ("Client's Representative"), acting on the behalf of Irish Water ("Client"), a ground investigation was undertaken at the above location. The Raw Water Rising Main (RWRM) works are part of the overall Water Supply Project (WSP) to service the Eastern and Midlands Region.

The Water Supply Project – Eastern and Midlands Region consists of the following:

- a Raw Water Abstraction Point with new Raw Water Intake and Pumping Station (RWIPS), and Raw Water Rising Main (RWRM)
- a new Water Treatment Plant (WTP) connecting up to the Raw Water Rising Main (RWRM)
- a new pressurised pipeline extending from the WTP to a new Break Pressure Tank (BPT)
- A new gravity fed pipeline from the BPT to a Terminal Point Reservoir (TPR).

The proposed scheme extends from Parteen Basin in North Tipperary to Peamount Reservoir in West Dublin. It is proposed to transport the water approximately 170km. The proposed pipeline route will pass through counties Tipperary, Offaly, Kildare and Dublin.

The scheme corridor, termed 'the site', passes through variable ground conditions comprising predominantly glacial till deposits, but also glaciofluvial, glaciolacustrine and alluvial deposits as well as significant areas of peat. Underlying bedrock is anticipated to comprise limestone, sandstone and shale at variable depths along the scheme ranging from several metres below ground level (bgl) to near surface.

The site is largely rural in nature with significant sections of the route in open farmland predominantly used for grazing livestock and crop production. The route also passes through marshy land with wet conditions underfoot. Approximately 28% of the pipeline route is anticipated to be underlain by peat deposits and associated soft ground conditions.

The purpose of the Ground Investigation (GI) Contract (intrusive and non-intrusive) is to adequately characterise the ground conditions in order to inform the next stage design and construction of the scheme. The GI has been designed to identify and investigate geotechnical risks such that adequate mitigation may be implemented to manage those risks in the next stage of works.

This report is specific to the RWRM infrastructure site undertaken as part of the WSP Ground Investigation Works. 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 ground 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, between exploratory hole points, or beneath 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.

2.1.2 Scope

The extent of the investigation at the RWRM works area, as instructed by the Client's Representative, included boreholes, trial pits, soil and rock core sampling, in-situ and laboratory testing, geophysical surveying and a factual report on the findings.

2.1.3 References

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland.

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. National Standards Authority of Ireland.

BS 5930: 2015+A1:2020: Code of practice for ground investigations. 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 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

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.

BS EN ISO 22282-2: 2012: Geotechnical investigation and testing. Geohydraulic testing – Part 2: Water permeability tests in a borehole using open systems.

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

2.2 SITE AND GEOLOGY

2.2.1 Description of the site

As shown on the site location plans in Appendix 2K, the works were conducted on agricultural lands north of Birdhill, County Tipperary. The site is transected by the R494 carriageway, bordered by other agricultural lands to the north and south. To the west and east of the RWRM works locations are forested areas.

The site is mostly gently rolling drumlins across the RWRM works area which flatten out as you approach the forested areas.

2.2.2 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise alluvium, gravels and glacial till. These deposits are underlain by Palaeozoic limestones.

2.2.2.1 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:

- **Topsoil:** encountered typically in 100-400mm thickness across the site.
- **Made Ground (fill):** reworked sandy gravelly clay fill encountered at the surface in a number of locations, typically in 200-300mm thickness.
- **Recent deposits (peat):** found in RWRM-DS006 between 1.30-2.00m as low plasticity dark brown pseudo-fibrous slightly gravelly peat.
- **Alluvium deposits:** typically, very soft to firm sandy gravelly silts and clays; found to a maximum depth of 5.00m in RWRM-BH021.
- **Fluvioglacial deposits:** typically, loose to medium dense gravelly clayey sands and sandy clayey gravels interspersed with layers of sandy gravelly clay; found to a maximum depth of 10.00m in RWRM-BH002 where the borehole was terminated in this material at scheduled depth.
- **Glacial Till:** sandy gravelly clay, frequently with low to medium cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth. Found to termination depths on the majority of boreholes in this area; deepest was 20.20m.

2.2.2.2 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during percussion boring through soil as shallow water seepage between 1.00m and 3.00m in a number of boreholes: RWRM-BH001, RWRM-BH002, RWRM-BH005, RWRM-BH008, RWRM-BH017, RWRM-BH021, RWRM-BH028, RWRM-DS002 and RWRM-DS006. Water strikes were also observed at depth in a number of boreholes: RWRM-BH002 (7.20m rising to 6.10m after 20min), RWRM-BH013 (at 5.00m rising to ground level after 20mins) and finally as seepage in RWRM-BH016 at 4.50m and 5.80m. Groundwater was encountered as seepage between 1.50m and 2.30m in all three trial pits excavated at the site and was coincident with granular strata or granular-rich horizons within the cohesive material.

Groundwater was not noted during drilling at many 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 and the possibility of encountering groundwater during excavation works should not be ruled out.

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

2.3 FIELDWORK

2.3.1 Summary of site works

Site operations, which were conducted between 23rd May to 22nd September 2022, comprised:

- Twenty-nine boreholes
  - Three light cable percussion boreholes
  - Fourteen boreholes by light cable percussive extended by rotary follow-on drilling
  - Five boreholes by rotary drilling techniques only
  - One borehole by sonic drilling extended by rotary follow-on drilling
  - Six boreholes by dynamic (windowless) sampling
- Three machine dug trial pits
- A variable head test performed in three boreholes
- High pressure dilatometer testing attempted in four boreholes
- Multi-discipline geophysical surveying (ERT and SR)

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plans in Appendix 2K.

2.3.2 Boreholes

A total of twenty-nine boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light percussion boring using Dando Terrier rigs, light cable percussion boring by Dando 2000, and 2500 rigs, rotary drilling by Comacchio 405, Beretta T44 rotary drilling rigs, and Fraste CRS XL Duo rotosonic drilling rigs.

The borehole logs state the methodology and plant used for each location and the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

2.3.2.1 Light cable percussion boreholes

Three boreholes (RWRM-BH001, RWRM-BH002 and RWRM-BH022) were put down to completion in minimum 200mm diameter using three light cable percussion boring rigs. All boreholes were terminated either at their scheduled completion depths, or else on encountering virtual refusal on obstructions, including large boulders and weathered bedrock.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Undisturbed (U100) samples were taken where appropriate and as directed within fine soils.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 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. All relevant SPT hammer energy measurement reports are provided following the borehole logs in Appendix 2A.

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.

Appendix 2A presents the borehole logs.

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

Thirteen boreholes (RWRM-BH007 – RWRM-BH019) 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 percussive methods were employed to advance the borehole to bedrock; symmetrix-cased open-hole drilling was used, with SPTs carried out at standard intervals as required.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 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 borehole logs are uncorrected and no allowance has been made for energy ratio corrections. All relevant SPT hammer energy measurement reports are provided following the borehole logs in Appendix 2A.

Where coring was carried out within bedrock strata, Geobore-S was used. The core was extracted in up to 1.5m lengths using an SK6L core barrel, which produced core of nominal 102mm 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+A1:2020: Code of practice for ground investigations*.

Appendix 2A presents the borehole logs, all soil and rock core photographs presented in Appendix 2I.

2.3.2.3 Rotary drilled boreholes

Six boreholes (RWRM-BH005, RWRM-BH006, RWRM-BH008A, RWRM-BH020, and RWRM-BH027 – RWRM-BH028) were put to their completion by rotary drilling techniques only. The boreholes were completed using either low ground bearing tracked Comacchio 405 and Beretta T44 drilling rigs, or Fraste CRS XL Duo rotosonic tracked drilling rigs.

Symmetrix-cased open-hole drilling or sonic drilling techniques were employed to advance the boreholes to bedrock, after which Geobore-S was employed to recover core samples of the bedrock. SPTs were carried out at standard intervals throughout the overburden, with small and bulk disturbed samples obtained where possible through the soil strata. All relevant SPT hammer energy measurement reports are provided following the borehole logs in Appendix 2A.

Where coring was carried out within bedrock strata, Geobore-S was used. The core was extracted in up to 1.5m lengths using an SK6L core barrel, which produced core of nominal 102mm 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+A1:2020: Code of practice for ground investigations*.

Appendix 2A presents the borehole logs, all soil and rock core photographs presented in Appendix 2I.

2.3.2.4 Sonic drilled boreholes

One borehole (RWRM-BH021) was put to their completion by sonic drilling techniques with rotary follow-on drilling techniques with core recovery in bedrock. The boreholes were completed using a Fraste CRS XL Duo rubber-tracked sonic drilling rig.

A hand dug inspection pit was carried out between ground level and 1.20m depth to ensure the borehole was put down clear of services or subsurface obstructions. Fully cased sonic drilling techniques were employed to advance the boreholes of nominal 175mm diameter to a specific depth after which Geobore-S was undertaken with core recovery in overburden and bedrock strata.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 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 2A.

The disturbed sonic samples were placed in a rigid core liner in single channel wooden core boxes.

Where coring was carried out within overburden and bedrock strata, Geobore-S was used. The core was extracted in up to 1.5m lengths using an SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

Appendix 2A presents the borehole logs, all soil and rock core photographs presented in Appendix 2I.

2.3.2.5 Dynamic sampled boreholes

Six boreholes (RWRM-DS001, RWRM-DS002, RWRM-DS005, RWRM-DS005A, RWRM-DS006, and RWRM-DS007) were put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down clear of services or subsurface obstructions. The boreholes were taken to depths ranging between 1.30m and 4.00m where they were terminated on encountering virtual refusal on obstructions.

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

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 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 2B.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded. Details of the water strikes are presented on the individual borehole logs.

Appendix 2B presents the dynamic sample borehole logs.

2.3.3 Trial Pits

Three trial pits (RWRM-TP002, RWRM-TP003, and RWRM-TP007) were excavated using both 8t wheeled and a 13t tracked excavator fitted with a 600mm wide bucket, to depths of between 1.50m and 3.00m.

Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix 2C presents the trial pit logs with photographs of the pits and arising provided in Appendix 2I.

2.3.4 Variable head permeability testing

In-situ permeability tests were carried out within RWRM-BH007, RWRM-BH010, and RWRM-BH021 by variable head permeability methods. Testing was carried out in accordance with the guidance as set out in BS EN ISO 22282-2: 2012

The results are presented in Appendix 2E.

2.3.5 High pressure dilatometer tests

Five High-Pressure Dilatometer (HPD) tests were successfully completed by In-Situ Site Investigation at given depths in boreholes RWRM-BH008 (2 tests), RWRM-BH014 (2 tests), and RWRM-BH020 (1 test). There were three failed attempts; one in RWRM-BH005 which failed due to an oversize test pocket, another in RWRM-BH005 due to the collapse of the test pocket, and a final one in RWRM-BH020 again due to the collapse of the test pocket.

Details of the tests and the methods used are provided in their report in Appendix 2F.

2.3.6 Geophysical surveys

Initially 16 distinct locations were identified by the Client's Representative for geophysical surveys to help confirm a variety of ground conditions: overburden thickness, depth to bedrock, cohesive strength of overburden, bedrock lithology, bedrock excavatability, presence of silt and sand lenses, soft ground and potential backfilled areas.

Apex Geophysics Ltd were appointed and attended site to complete a combination of geophysical surveys; 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction (SR) surveys were conducted as part of the works on this scheme.

The extent of the geophysics surveys on the RWRM works area was limited to Location 1 and included 5 no. ERT profiles and 12no. SR profiles in agricultural lands close to the Ballina Road in the townland of Kilmaglasderry.

The APEX Geophysics Ltd report is presented here in Appendix 2G for review.

2.3.7 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 R10 GPS system employing Virtual Reference Station (VRS) and Real Time Kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation in meters Ordnance Datum (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole location plan presented in Appendix 2K shows these as-built positions.

2.4 LABORATORY TESTING

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

2.4.1 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 (single and multi)
- **Compaction related:** Moisture Condition Value at natural moisture content, California bearing ratio tests, California bearing ratio at natural moisture content tests.
- **Soil chemistry:** BRE SD1 Suite B – Greenfield pyrite present (pH, water-soluble sulphate content, acid-soluble sulphate content, total sulphur), organic matter content, mass loss on ignition.

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 2H.

CAUSEWAY GEOTECH

APPENDIX 2A

BOREHOLE RECORDS
SPT HAMMER REPORTS



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).

Stratum Legend Key



101
TOPSOIL



102
MADE GROUND



103
MADE GROUND



104
CONCRETE



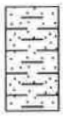
105
WOOD



201
CLAY



202
Silty CLAY



203
Sandy CLAY



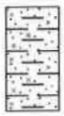
204
Gravelly CLAY



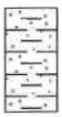
205
Cobbly CLAY



206
Bouldery CLAY



207
Silty sandy CLAY



208
Silty gravelly CLAY



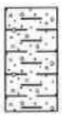
209
Silty cobbly CLAY



210
Silty bouldery CLAY



211
Silty sandy gravelly CLAY



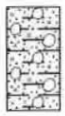
212
Silty sandy cobbly CLAY



213
Silty sandy bouldery CLAY



214
Silty sandy gravelly cobbly CLAY



215
Silty sandy gravelly bouldery CLAY



216
Silty sandy gravelly cobbly bouldery CLAY



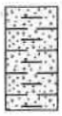
217
Silty sandy peaty CLAY



218
Silty sandy gravelly peaty CLAY



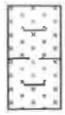
219
Silty peaty CLAY



220
Sandy gravelly CLAY



301
SILT



302
Clayey SILT



303
Sandy SILT



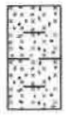
304
Gravelly SILT



305
Peaty SILT



306
Clayey sandy SILT



307
Gravelly clayey SILT



308
Sandy gravelly clayey SILT



309
Clayey bouldery SILT



310
Sandy gravelly SILT



312
Clayey sandy gravelly SILT



313
Clayey sandy gravelly peaty SILT



314
Clayey sandy gravelly peaty cobbly SILT



316
Sandy cobbly SILT



317
Sandy bouldery SILT

CAUSEWAY GEOTECH

Stratum Legend Key


318
Sandy peaty SILT


319
Sandy gravelly peaty SILT


320
Sandy gravelly cobbly SILT


321
Sandy gravelly peaty cobbly SILT


322
Gravelly cobbly SILT


323
Gravelly bouldery SILT


324
Gravelly peaty SILT


325
Gravelly peaty cobbly SILT


326
Cobbly SILT


327
Cobbly bouldery SILT


328
Peaty cobbly SILT


329
Clayey cobbly SILT


330
Clayey peaty SILT

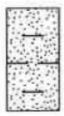

331
Bouldery SILT


332
slightly shelly SILT


333
very shelly SILT


334
Sandy clayey peaty SILT


401
SAND


402
Clayey SAND


403
Silty SAND


404
Gravelly SAND


405
Cobbly SAND


406
Bouldery SAND


407
Clayey silty SAND


408
Clayey silty gravelly SAND


409
Clayey silty gravelly cobbly SAND


410
Clayey gravelly SAND


411
Clayey gravelly cobbly SAND


412
Silty gravelly SAND


413
Silty gravelly cobbly SAND


414
Silty gravelly cobbly bouldery SAND


415
Gravelly cobbly SAND


416
Gravelly cobbly bouldery SAND


417
Gravelly bouldery SAND


418
Cobbly bouldery SAND


430
SAND and GRAVEL


431
Peaty SAND


432
Clayey peaty SAND


433
Silty peaty SAND


434
Gravelly peaty SAND

CAUSEWAY GEOTECH

Stratum Legend Key



435
Cobbly peaty SAND



436
Bouldery peaty SAND



437
Clayey silty peaty SAND



438
Clayey silty gravelly peaty SAND



439
slightly shelly SAND



440
very shelly SAND



441
slightly shelly silty SAND



442
very shelly silty SAND



443
slightly shelly silty gravelly SAND



444
very shelly silty gravelly SAND



501
GRAVEL



502
Clayey GRAVEL



503
Silty GRAVEL



504
Sandy GRAVEL



505
Peaty GRAVEL



506
Cobbly GRAVEL



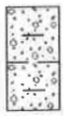
507
Bouldery GRAVEL



508
Clayey silty GRAVEL



509
Clayey sandy GRAVEL



510
Clayey cobbly GRAVEL



511
Clayey bouldery GRAVEL



512
Clayey peaty GRAVEL



513
Clayey silty sandy GRAVEL



514
Clayey silty cobbly GRAVEL



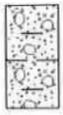
515
Clayey silty bouldery GRAVEL



516
Clayey silty peaty GRAVEL



517
Clayey sandy peaty GRAVEL



518
Clayey silty sandy bouldery GRAVEL



519
Clayey silty sandy peaty GRAVEL



520
Silty sandy GRAVEL



521
Silty cobbly GRAVEL



522
Silty bouldery GRAVEL



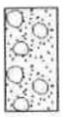
523
Silty peaty GRAVEL



524
Silty peaty sandy GRAVEL



525
Sandy cobbly GRAVEL



526
Sandy bouldery GRAVEL



527
Sandy peaty GRAVEL



528
Silty sandy cobbly GRAVEL



601
PEAT



602
Clayey PEAT

CAUSEWAY GEOTECH

Stratum Legend Key



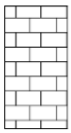
801
Mudstone



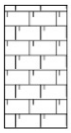
802
Siltstone



803
Sandstone



804
Limestone



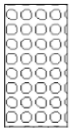
805
Chalk



806
Coal



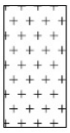
807
Breccia



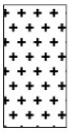
808
Conglomerate



809
Fine grained igneous



810
Medium grained igneous



811
Coarse grained igneous



812
Fine grained metamorphic



813
Medium grained
metamorphic



814
Coarse grained
metamorphic



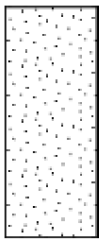
815
Pyroclastic
(volcanic ash)



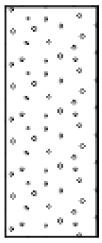
816
Gypsum, rocksalt

CAUSEWAY
GEOTECH

Backfill Legend Key



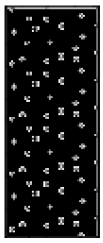
901
Sand backfill



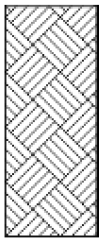
902
Gravel backfill



903
Bentonite



904
Grout



905
Arisings



906
Concrete

CAUSEWAY GEOTECH

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH001
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	10.00	570315.61 E 670141.05 N

Final Depth:	10.00 m	Start Date:	01/06/2022	Driller:	BM	Sheet 1 of 2 Scale: 1:40
Elevation:	41.30 mOD	End Date:	01/06/2022	Logger:	NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL [TOPSOIL]		
0.40 - 0.60	B1				40.90	0.40				
0.50	D9							Soft to firm brownish grey slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
0.80 - 1.00	B2									
1.00	D10									
1.20 - 1.65	U17	Ublow=20 90%	1.00	Dry						
1.80 - 2.00	B3									
2.00	D11				39.30	2.00				
2.00 - 2.45	SPT (C)	N=12 (4,3/3,3,3,3) Hammer SN = 1386 Slow seepage at 2.40	1.50	Dry				Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. [ALLUVIUM]	▼	
2.80 - 3.00	B4									
3.00	D12									
3.00 - 3.45	SPT (C)	N=13 (4,3/3,4,3,3) Hammer SN = 1386	3.00	Dry						
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.40	U18	Ublow=25 100%	4.00	Dry						
5.00 - 5.45	SPT (C)	N=14 (3,4/3,3,4,4) Hammer SN = 1386	4.50	Dry						
5.80 - 6.00	B6									
6.00	D14									
6.00 - 6.45	SPT (C)	N=14 (3,3/4,3,3,4) Hammer SN = 1386	6.00	Dry						

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

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.40	2.40		

Casing Details

To (m)	Diameter
10.00	200

Water Added

From (m)	To (m)

Chiselling Details

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

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH001
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	10.00	570315.61 E 670141.05 N

Final Depth:	10.00 m	Start Date:	01/06/2022	Driller:	BM	Sheet 2 of 2 Scale: 1:40
Elevation:	41.30 mOD	End Date:	01/06/2022	Logger:	NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
7.50 - 7.90	U19	Ublow=90 70%	7.50	Dry				Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. [ALLUVIUM]		
7.80 - 8.00	B7									
8.00	D15									
9.00 - 9.45	SPT (C)	N=14 (3,4/3,3,4,4) Hammer SN = 1386	7.50	Dry						
9.80 - 10.00	B8									
10.00	D16				31.30	10.00		End of Borehole at 10.00m		
10.00 - 10.45	SPT (C)	N=16 (3,3/3,4,4,5) Hammer SN = 1386	7.50	Dry						

7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.40	2.40		

Casing Details

To (m)	Diameter
10.00	200

Water Added

From (m)	To (m)

Chiselling Details

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

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH002
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	10.00	570465.62 E 670115.33 N

Final Depth:	10.00 m	Start Date:	23/05/2022	Driller:	BM
Elevation:	29.50 mOD	End Date:	24/05/2022	Logger:	NP

Sheet 1 of 2
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
					29.20	0.30		TOPSOIL: Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [TOPSOIL]
0.40 - 0.60	B1							Medium dense brownish grey clayey subangular to subrounded fine to coarse GRAVEL of various lithologies and fine to coarse SAND. [FLUVIOGLACIAL]
0.80 - 1.00	B2							
1.00	D5							
1.20 - 1.65	SPT (C)	N=21 (6,8/8,6,4,3) Hammer SN = 1386	1.00	Dry				
					28.20	1.30		Medium dense brownish black sandy subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]
1.40 - 1.60	B3							
1.50	D6				27.90	1.60		Medium dense brown sandy subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]
2.00 - 2.45	SPT (C)	N=11 (3,5/4,3,2,2) Hammer SN = 1386 Seepage at 2.00m	2.00	1.90				
2.80 - 3.00	B4							
3.00	D7				26.50	3.00		Loose to medium dense brown sandy clayey subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]
3.00 - 3.45	SPT (C)	N=6 (4,4/2,2,1,1) Hammer SN = 1386	3.00	1.70				
3.80 - 4.00	B9							
4.00	D14							
4.00 - 4.45	SPT (S)	N=13 (11,7/3,4,3,3) Hammer SN = 1386	4.00	3.10				
					24.90	4.60		Firm to stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]
4.80 - 5.00	B10							
5.00	D15							
5.00 - 5.45	SPT (S)	N=16 (9,3/4,4,4,4) Hammer SN = 1386	5.00	4.90				
5.80 - 6.00	B11							
6.00	D16							
6.00	U8	Ublow=50 0%						
6.30 - 6.60	U18	Ublow=50 50%		Dry				
		Slow seepage at 7.20m			22.30	7.20		Medium dense grey sandy clayey subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]
7.30 - 7.50	B12							

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

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.00	2.00	20	1.90
7.20	7.20	20	6.10

Casing Details

To (m)	Diameter
10.00	200

Water Added

From (m)	To (m)

Chiselling Details

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

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH002
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	10.00	570465.62 E 670115.33 N

Final Depth:	10.00 m	Start Date:	23/05/2022	Driller:	BM	Sheet 2 of 2 Scale: 1:40
Elevation:	29.50 mOD	End Date:	24/05/2022	Logger:	NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
7.50	D17							Medium dense grey sandy clayey subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
7.50 - 7.95	SPT (S)	N=14 (7,3/4,3,3,4) Hammer SN = 1386	7.50	6.00						
9.00 - 10.00	B13									
9.00 - 9.45	SPT (S)	N=15 (13,7/3,3,4,5) Hammer SN = 1386	9.00	3.10						
10.00 - 10.45	SPT (S)	N=16 (9,6/3,4,4,5) Hammer SN = 1386	10.0	5.90	19.50	10.00		End of Borehole at 10.00m		

7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.00	2.00	20	1.90
7.20	7.20	20	6.10

Casing Details

To (m)	Diameter
10.00	200

Water Added

From (m)	To (m)

Chiselling Details

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

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH005
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Open Hole Boring	Beretta T44	0.00	2.20	
Geobore-S	Beretta T44	2.20	9.70	570825.86 E
				670020.13 N

Final Depth:	9.70 m	Start Date:	11/07/2022	Driller:	PJ	Sheet 1 of 2
Elevation:	29.43 mOD	End Date:	12/07/2022	Logger:	TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.00 - 0.50	B1										TOPSOIL [TOPSOIL]		
								29.13	0.30		Very soft brownish grey mottled grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
0.50 - 1.00	B2							28.93	0.50		Soft to firm grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
1.00 - 2.00	B3 Water strike at 1.00m											▼	
2.20 - 2.65	SPT(C) N=17 (2,3/3,4,5,5) Hammer SN = 1385	53			AZCL			27.23	2.20		Low recovery: Stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL] *2.20m to 2.90m: AZCL disturbance due to SPT.*		
3.70		22			AZCL						*3.70m to 6.05m: AZCL fines and gravel scrubbed/washed out with drilling fluid (conventional core barrel).*		
								23.13	6.30		Low recovery: Grey and light grey subangular to subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Cobbles are subangular of limestone. [FLUVIOGLACIAL] *6.70m to 7.65m: AZCL gravels scrubbed/washed out with drilling fluid.*		
6.70					AZCL								
		TCR	SCR	RQD	FI								

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

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.00	1.00		

Casing Details

To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 3.70 to 6.70m, pocket had to be extended due to borehole walls collapsing
HPD test from 3.70 to 6.70m failed due to unsuitable material

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH005
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 9.70 m	Start Date: 11/07/2022	Driller: PJ	Sheet 2 of 2
Open Hole Boring	Beretta T44	0.00	2.20					Scale: 1:40
Geobore-S	Beretta T44	2.20	9.70	570825.86 E	Elevation: 29.43 mOD	End Date: 12/07/2022	Logger: TH	FINAL
				670020.13 N				

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		37									Low recovery: Grey and light grey subangular to subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Cobbles are subangular of limestone. [FLUVIOGLACIAL]		
8.20 - 8.40 8.20	SPT(C) N=50 (25 for 75mm/50 for 125mm) Hammer SN = 1385	6			AZCL						*8.20m to 9.60m: AZCL disturbance due to SPT/granular material scrubbed out with drilling.*		
9.70								19.73	9.70		End of Borehole at 9.70m		

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.00	1.00		

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 3.70 to 6.70m, pocket had to be extended due to borehole walls collapsing
HPD test from 3.70 to 6.70m failed due to unsuitable material

Casing Details	
To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel: SK6L

Flush Type: Polymer

Termination Reason: Terminated at scheduled depth

Last Updated: 04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH006
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)
Open Hole Boring	Beretta T44	0.00	2.20
Geobore-S	Beretta T44	2.20	9.70

Coordinates: 570846.12 E, 670018.00 N

Final Depth: 9.70 m | **Start Date:** 13/07/2022 | **Driller:** PJ | **Logger:** TH | **Elevation:** 29.91 mOD | **End Date:** 13/07/2022

Sheet 1 of 2 | Scale: 1:40 | FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.00 - 0.50	B1							29.61	0.30		TOPSOIL [TOPSOIL]		
0.50 - 1.00	B2							29.41	0.50		Very soft brownish grey slightly gravelly sandy CLAY with occasional rootlets and plant matter. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
1.00 - 2.00	B3							28.91	1.00		Soft brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
											Firm to stiff brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
2.20 - 3.70 2.20 - 2.65	C1 SPT(C) N=27 (4,6/6,8,6,7) Hammer SN = 1385	37			AZCL			27.71	2.20		Stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL] *2.20m to 3.15m: AZCL disturbance due to SPT*		
3.70 - 4.15 3.70	SPT(C) N=26 (6,5/6,7,6,7) Hammer SN = 1385	33			AZCL			26.41	3.50		Very stiff brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL] *3.70m to 4.70m: AZCL disturbance due to SPT*		
5.20 - 5.65 5.20	SPT(C) N=21 (3,3/5,4,5,7) Hammer SN = 1385	43			AZCL						*5.20m to 6.05m: Disturbance due to SPT*		
								23.51	6.40		Medium dense grey subangular to subrounded fine to coarse GRAVEL of various lithologies, low cobble content and rare pockets of brown sandy gravelly CLAY. Sand is fine to coarse. Cobbles are subangular of limestone. [FLUVIOGLACIAL] *6.70m to 8.20m: AZCL disturbance due to SPT/material scrubbed out during drilling*		
6.70 - 7.15 6.70	SPT(C) N=21 (4,4/4,5,6,6) Hammer SN = 1385												
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel: SK6L

Flush Type: Polymer

Remarks: Hand dug inspection pit excavated to 1.20m

Termination Reason: Terminated at scheduled depth

Last Updated: 04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH006
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Open Hole Boring	Beretta T44	0.00	2.20	
Geobore-S	Beretta T44	2.20	9.70	570846.12 E
				670018.00 N

Final Depth:	9.70 m	Start Date:	13/07/2022	Driller:	PJ	Sheet 2 of 2
Elevation:	29.91 mOD	End Date:	13/07/2022	Logger:	TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		0			AZCL						Medium dense grey subangular to subrounded fine to coarse GRAVEL of various lithologies, low cobble content and rare pockets of brown sandy gravelly CLAY. Sand is fine to coarse. Cobbles are subangular of limestone. [FLUVIOGLACIAL]		
8.20 - 8.65 8.20	SPT(C) N=10 (2,2/2,3,2,3) Hammer SN = 1385	23			AZCL						*8.20m to 9.35m: AZCL disturbance due to SPT/ material scrubbed out with drilling*		
9.70 - 10.15 9.70	SPT(C) N=25 (4,5/5,6,7,7) Hammer SN = 1385							20.21	9.70		End of Borehole at 9.70m		
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH007
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion Geobore-S	Dando 2000 Fraste CRS XL Duo Rotosonic	0.00 10.50	10.50 19.50	570880.27 E 670027.82 N

Final Depth:	19.50 m	Start Date:	20/06/2022	Driller:	MJ+RS	Sheet 1 of 3 Scale: 1:50
Elevation:	32.90 mOD	End Date:	30/06/2022	Logger:	TH+NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					32.70	0.20		TOPSOIL [TOPSOIL]		
					32.30	0.60		Soft brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [ALLUVIUM]		
1.00 - 1.20	B1							Loose brown very gravelly very silty fine to coarse SAND. Gravel is subangular to subrounded fine to medium of various lithologies. [FLUVIOGLACIAL]		
1.20	D12									
1.20 - 1.65	SPT (S)	N=6 (1,2/2,1,2,1) Hammer SN = 1369	1.20							
2.00	D13				30.90	2.00		Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
2.00 - 2.30	B2									
2.00 - 2.45	SPT (S)	N=26 (4,5/6,6,7,7) Hammer SN = 1369	2.00							
3.00 - 3.30	B3									
3.00 - 3.45	U9	Ublow=57 100%								
					29.00	3.90		Dense brown sandy clayey subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Sand fine to coarse. Cobbles are subangular of limestone. [FLUVIOGLACIAL]		
4.00	D14									
4.00 - 4.30	B4									
4.00 - 4.45	SPT (S)	N=35 (8,10/11,9,7,8) Hammer SN = 1369	4.00							
					28.20	4.70		Stiff to very stiff light brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
4.80 - 5.00	B5									
5.00 - 5.20	U10	Ublow=100 0%								
5.20	D15									
5.20 - 5.37	SPT (S)	N=50 (25 for 30mm/50 for 140mm) Hammer SN = 1369	5.20							
6.30 - 6.50	B6									
6.50	D16									
6.50 - 6.94	SPT (S)	N=50 (8,8/50 for 285mm) Hammer SN = 1369	6.50							
8.00 - 8.30	B7									
8.00 - 8.44	SPT (S)	N=50 (6,12/50 for 295mm) Hammer SN = 1369	8.00							

Water Strikes

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

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)
3.90	4.70
9.60	9.80

Chiselling Details

From (m)	To (m)	Time (hh:mm)
5.30	5.60	00:45
9.60	9.80	00:30

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 1.40-1.70m
Standpipe installation (subsequently removed at landowners request)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH007
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth	Start Date	Driller	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Fraste CRS XL Duo Rotosonic	0.00 10.50	10.50 19.50	570880.27 E 670027.82 N	19.50 m	20/06/2022	MJ+RS	Sheet 2 of 3 Scale: 1:50
					Elevation: 32.90 mOD	End Date: 30/06/2022	Logger: TH+NP	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.40 - 9.60	B8													
9.50 - 9.57	SPT (S)	N=50 (25 for 40mm/50 for 30mm) Hammer SN = 1369					9.50							
									23.10	9.80				
10.30 - 10.50	B11											Very stiff brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone.		
10.50 - 12.00	C1						10.6		22.40	10.50		[GLACIAL TILL]		
10.60 - 10.61	SPT(S) N=50 (25 for 5mm/50 for 5mm) Hammer SN = 1369		100									Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone and limestone. [GLACIAL TILL]		
11.50 - 11.60	C2													
11.60 - 11.90	C3													
12.00							12.0							
12.00	D17													
12.00 - 13.50	C4													
12.00 - 12.45	SPT(S) N=50 (7,10/12,12,13,13) Hammer SN = 1353		100											
13.50							13.5			(5.90)				
13.50	D18													
13.50 - 15.00	C5													
13.50 - 13.78	SPT(S) N=50 (25 for 140mm/50 for 145mm) Hammer SN = 1353		100											
15.00							15.0							
15.00	D19													
15.00 - 16.50	C6													
15.00 - 15.21	SPT(S) N=50 (25 for 125mm/50 for 85mm) Hammer SN = 1353		100											
15.30 - 15.50	C7													
16.50							16.5		16.50	16.40		Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subrounded of sandstone. [GLACIAL TILL]		
16.50	D20													
16.50 - 18.00	C8													
16.50 - 16.65	SPT(S) N=50 (25 for 100mm/50 for 50mm) Hammer SN = 1353		97							(1.20)				
									15.30	17.60		Very stiff brown slightly sandy very gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobble are subrounded of sandstone. [GLACIAL TILL]		
18.00							18.0					*17.70m to 18.65m: AZCL granular material washed out with drilling fluid.*		
18.00	D21					AZCL				(1.45)				

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
5.30	5.60	00:45
9.60	9.80	00:30

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)
3.90	4.70
9.60	9.80

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 1.40-1.70m
Standpipe installation (subsequently removed at landowners request)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH007
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 19.50 m	Start Date: 20/06/2022	Driller: MJ+RS	Sheet 3 of 3 Scale: 1:50
Cable Percussion Geobore-S	Dando 2000 Fraste CRS XL Duo Rotosonic	0.00 10.50	10.50 19.50	570880.27 E 670027.82 N	Elevation: 32.90 mOD	End Date: 30/06/2022	Logger: TH+NP	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.00 - 18.14	SPT(S) N=50 (25 for 125mm/50 for 20mm) Hammer SN = 1353	80						13.85	19.05		Very stiff brown slightly sandy very gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobble are subrounded of sandstone. [GLACIAL TILL]		
									(0.45)				
19.50						19.5		13.40	19.50		Very stiff greyish brown slightly sandy CLAY. Sand is fine to medium. [GLACIAL TILL]		
19.50	D22										End of Borehole at 19.50m		
19.50 - 19.92	SPT(S) N=50 (10,12/50 for 265mm) Hammer SN = 1353												
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)
3.90	4.70
9.60	9.80

Chiselling Details

From (m)	To (m)	Time (hh:mm)
5.30	5.60	00:45
9.60	9.80	00:30

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 1.40-1.70m
Standpipe installation (subsequently removed at landowners request)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH008
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	9.90	570878.27 E 670023.83 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 2
9.90 m	15/06/2022	RS	Scale: 1:40
Elevation: 32.70 mOD	**End Date:** 15/06/2022	**Logger:** NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.20 - 0.40	B1				32.50	0.20		TOPSOIL [TOPSOIL]		
					32.20	0.50		Brown sandy slightly silty subangular fine to coarse GRAVEL of various lithologies with rootlets. Sand is fine to coarse. [ALLUVIUM]		
1.00	D12							Loose brown very gravelly very clayey fine to coarse SAND. Gravel is subangular fine to medium of various lithologies. [FLUVIOGLACIAL]		
1.00 - 1.20	B2									
1.20 - 1.65	SPT (S)	N=6 (2,1/2,2,1,1) Hammer SN = 1369 Slow seepage at 1.50m	1.20						▼	
2.00	D13									
2.00 - 2.30	B3									
2.00 - 2.45	SPT (S)	N=9 (2,3/2,3,2,2) Hammer SN = 1369	2.00							
2.40 - 2.70	B4				30.30	2.40		Very stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
3.00 - 3.20	B5									
3.00 - 3.45	U16	Ublow=49 0%	3.00							
3.45 - 3.90	SPT (S)	N=39 (9,9/8,9,10,12) Hammer SN = 1369	3.45							
4.00	D14									
4.00 - 4.20	B6									
4.00 - 4.39	SPT (S)	N=50 (7,9/50 for 240mm) Hammer SN = 1369	4.00							
5.00 - 5.20	B7									
5.00 - 5.45	SPT (S)	N=33 (6,7/7,8,9,9) Hammer SN = 1369	5.00							
5.70 - 6.00	B8									
6.00	D15									
6.50 - 6.80	B9									
6.50 - 6.95	U17	Ublow=72 80%	6.50							

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.50	1.50	20	1.30

Casing Details

To (m)	Diameter
9.90	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
9.70	9.90	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
RWRM-BH008A was redrilled adjacent to this location to allow HPD testing to be completed at shallower depths than the CP element

Termination Reason

Terminated on virtual refusal on boulder at 9.90m

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH008
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	9.90	570878.27 E 670023.83 N

Final Depth:	9.90 m	Start Date:	15/06/2022	Driller:	RS	Sheet 2 of 2 Scale: 1:40
Elevation:	32.70 mOD	End Date:	15/06/2022	Logger:	NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
8.00 - 8.30 8.00 - 8.40	B10 SPT (S)	N=50 (6,9/50 for 245mm) Hammer SN = 1369	8.00					Very stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
					24.00	8.70		Very stiff dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
9.50 - 9.70 9.50 - 9.75	B11 SPT (S)	N=50 (7,14/50 for 96mm) Hammer SN = 1369	9.50		23.00	9.70		Large BOULDER recovered as angular coarse gravel of limestone. [GLACIAL TILL]		
					22.80	9.90		End of Borehole at 9.90m		

7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.50	1.50	20	1.30

Casing Details

To (m)	Diameter
9.90	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
9.70	9.90	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
RWRM-BH008A was redrilled adjacent to this location to allow HPD testing to be completed at shallower depths than the CP element

Termination Reason

Terminated on virtual refusal on boulder at 9.90m

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH008A
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Geobore-S	Fraste CRS XL Duo	0.00	19.90	570879.13 E 670024.42 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 3
19.90 m	07/07/2022	MJ	Scale: 1:40
Elevation: 32.72 mOD	**End Date:** 07/07/2022	**Logger:** TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.00 - 1.50	B1							32.52	0.20		TOPSOIL [TOPSOIL]		
								32.27	0.45		Very soft dark brown slightly gravelly sandy CLAY with occasional rootlets. Sand is fine to coarse. Gravel is subangular fine of various lithologies. [ALLUVIUM]		
		73						31.97	0.75		Very soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [ALLUVIUM]		
					AZCL						Loose to medium dense brown very gravelly very clayey fine to coarse SAND. Gravel is subangular fine to medium of various lithologies. [FLUVIOGLACIAL] *1.10m to 1.50m: AZCL fines possibly washed out with drilling fluid*		
1.50 - 3.00	B2					1.50	0.50						
1.50 - 1.95	SPT(C) N=26												
1.50	(4,6/6,7,6,7)												
	Hammer SN = 1353												
2.10	C1							30.62	2.10		Firm brownish grey mottled dark brown slightly sandy CLAY. Sand is fine. [GLACIAL TILL]		
		100						30.22	2.50		Stiff becoming very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
3.00 - 4.50	B3												
3.00 - 4.50	C2												
3.00													
3.30 - 3.60	C4												
3.70	C3	100											
								28.62	4.10		Very soft brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
								28.37	4.35		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to medium of various lithologies. [GLACIAL TILL]		
4.50 - 6.00	B4												
4.50 - 6.00	C5												
4.50													
		90											
5.60 - 6.00	C6												
5.70 - 6.00	C7												
6.00													
		70											
					AZCL						*7.05m to 8.95m: AZCL possible bed of gravel washed out during drilling*		
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
19.90	150

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m
Redrilled adjacent to original RWRM-BH008 location to allow HPD testing at shallower depths than CP element
HPD test pocket from 6.00 to 7.80m
HPD test pocket from 10.00 to 11.80m, pocket had to be extended due to borehole walls collapsing

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH	**Project No.** 21-1682	**Project Name:** Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only **Client:** Irish Water **Client's Rep** Mott MacDonald		**Borehole ID** RWRM-BH008A

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**	**Final Depth:** 19.90 m	**Start Date:** 07/07/2022	**Driller:** MJ	Sheet 2 of 3 Scale: 1:40
Geobore-S	Fraste CRS XL Duo	0.00	19.90	570879.13 E 670024.42 N	**Elevation:** 32.72 mOD	**End Date:** 07/07/2022	**Logger:** TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
7.50											Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to medium of various lithologies. [GLACIAL TILL]		
		0			AZCL								
7.80													
		30			AZCL								
								23.77	8.95				
								23.57	9.15		Grey angular to subangular fine to coarse GRAVEL of various lithologies. [GLACIAL TILL]		
9.40											Very stiff light brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
		37			AZCL						*9.40m to 10.35m: AZCL possible bed of gravel washed out/borehole collapsing*		
10.90 - 12.40	C8							21.82	10.90				
10.90		100									Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
											11.40m to 11.55m: Bed of grey subangular fine to coarse gravel.		
12.40 - 12.76	SPT(C) N=50 (25 for 140mm/50 for 220mm) Hammer SN = 1353					12.4	3.00						
12.40		93											
13.90 - 14.22	SPT(C) N=50 (25 for 125mm/50 for 200mm) Hammer SN = 1353					13.9	3.00						
13.90													
14.60 - 14.90	C9												
		TCR	SCR	RQD	FI								

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

Remarks

Hand dug inspection pit excavated to 1.20m
Redrilled adjacent to original RWRM-BH008 location to allow HPD testing at shallower depths than CP element
HPD test pocket from 6.00 to 7.80m
HPD test pocket from 10.00 to 11.80m, pocket had to be extended due to borehole walls collapsing

Casing Details	
To (m)	Diam (mm)
19.90	150

Core Barrel
SK6L

Flush Type	**Termination Reason**	**Last Updated**
Polymer	Terminated at scheduled depth	04/01/2023

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH008A
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Geobore-S	Fraste CRS XL Duo	0.00	19.90	570879.13 E 670024.42 N

Final Depth:	Start Date:	Driller:	Sheet 3 of 3
19.90 m	07/07/2022	MJ	Scale: 1:40
Elevation: 32.72 mOD	**End Date:** 07/07/2022	**Logger:** TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100						17.87	14.85		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
15.40 - 15.70 15.40 - 15.76 15.40	C10 SPT(C) N=50 (25 for 140mm/50 for 220mm) Hammer SN = 1353	87				15.4	3.00				Very stiff reddish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of various lithologies. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
16.90 - 17.16 16.90	SPT(C) N=50 (25 for 115mm/50 for 150mm) Hammer SN = 1353	63			AZCL	16.9	3.00				*16.90m to 17.35m: AZCL disturbance due to SPT*		
18.40 - 18.60 18.40	SPT(C) N=50 (25 for 95mm/50 for 105mm) Hammer SN = 1353	33			AZCL	18.4	3.00				*18.40m to 19.40m: AZCL disturbance due to SPT*		
19.90 - 20.07 19.90	SPT(C) N=50 (25 for 95mm/50 for 75mm) Hammer SN = 1353					19.9	3.00	12.82	19.90		End of Borehole at 19.90m		
		TCR	SCR	RQD	FI								

15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5

Water Strikes

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

Remarks

Hand dug inspection pit excavated to 1.20m
Redrilled adjacent to original RWRM-BH008 location to allow HPD testing at shallower depths than CP element
HPD test pocket from 6.00 to 7.80m
HPD test pocket from 10.00 to 11.80m, pocket had to be extended due to borehole walls collapsing

Casing Details

To (m)	Diam (mm)
19.90	150

Core Barrel

SK6L

Flush Type

Polymer

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH009
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2500	0.00	7.50	
Geobore-S	Fraste CRS XL Duo	7.50	19.50	570885.47 E
				669962.54 N

Final Depth:	19.50 m	Start Date:	13/06/2022	Driller:	RW+KW	Sheet 1 of 3
Elevation:	32.75 mOD	End Date:	30/06/2022	Logger:	NP+TH	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10 - 0.70	B1				32.65	0.10		TOPSOIL [TOPSOIL]		
								Soft light brown gravelly SILT. Gravel is subangular to subrounded fine to coarse of various lithologies. [ALLUVIUM]		
0.70 - 1.20	B2				32.05	0.70		Medium dense brownish grey very sandy clayey subangular to subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of limestone. [FLUVIOGLACIAL]		
1.20 - 1.70	B3									
1.20 - 1.65	SPT (C)	N=16 (2,3/4,4,4,4) Hammer SN = 1410	1.20	Dry						
1.70 - 3.00	B4				31.05	1.70		Soft brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone. [FLUVIOGLACIAL]		
2.00 - 2.40	U9	Ublow=50 50%	2.00	1.20						
3.00 - 4.00	B5									
3.00 - 3.38	SPT (C)	N=50 (3,6/50 for 235mm) Hammer SN = 1410	3.00	0.50	29.55	3.20		Medium dense to dense brownish grey rounded fine to coarse GRAVEL of various lithologies. [FLUVIOGLACIAL]		
4.00 - 4.90	B6				28.75	4.00		Stiff to very stiff brown sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
4.00 - 4.45	SPT (C)	N=25 (6,6/6,6,7,6) Hammer SN = 1410	4.00	1.30						
4.90 - 6.30	B7				27.85	4.90		Very stiff brown slightly gravelly sandy silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
5.00 - 5.40	U10	Ublow=180 90%	5.00	2.80						
6.00 - 7.50	B8									
6.00 - 6.43	SPT (C)	N=50 (4,8/50 for 280mm) Hammer SN = 1410	6.00	4.50						
7.00 - 7.32	SPT (C)	N=50 (25 for 145mm/50 for 170mm) Hammer SN = 1410	7.00	5.70						
7.50 - 9.00	C1	67			25.25	7.50		Very stiff brown slightly gravelly sandy CLAY with closely spaced thick laminations of fine to medium sand. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL] *7.50m to 8.00m: AZCL fines washed out during drilling fluid*		
7.80 - 8.00	C2					(0.95)				
					24.30	8.45		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
9.00					9.00	2.20				
9.00	D11									

TCR	SCR	RQD	FI

Water Strikes

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

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)
1.20	7.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.40	7.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH009
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2500	0.00	7.50	
Geobore-S	Fraste CRS XL Duo	7.50	19.50	570885.47 E
				669962.54 N

Final Depth:	19.50 m	Start Date:	13/06/2022	Driller:	RW+KW	Sheet 2 of 3
Elevation:	32.75 mOD	End Date:	30/06/2022	Logger:	NP+TH	Scale: 1:50
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.45	SPT(S) N=48 (6,10/12,12,10,14) Hammer SN = 1398	83							(2.30)		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
10.20 - 10.50	C3												
10.50						10.5	1.50						
10.50	D12												
10.50 - 12.00	C4							22.00	10.75				
10.50 - 10.90	SPT(S) N=50 (10,14/50 for 255mm) Hammer SN = 1398	100									Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. Cobbles are subangular to subrounded of sandstone. [GLACIAL TILL]		
12.00						12.0	1.50						
12.00	D13								(2.75)				
12.00 - 13.50	C5												
12.00 - 12.45	SPT(S) N=50 (10,11/12,14,14,10) Hammer SN = 1398	100									12.65m to 12.95m: Bed of sandy gravelly CLAY		
											13.35m to 13.38: Very sandy CLAY		
13.50						13.5	1.50	19.25	13.50		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
13.50	D14												
13.50 - 13.78	SPT(S) N=50 (25 for 115mm/50 for 160mm) Hammer SN = 1398	100											
15.00						15.0	1.50						
15.00	D15												
15.00 - 15.24	SPT(S) N=50 (25 for 95mm/50 for 145mm) Hammer SN = 1398	100							(3.60)				
15.50 - 15.80	C6												
16.50						16.5	2.00						
16.50 - 18.00	C7												
16.50 - 16.87	SPT(C) N=50 (9,12/50 for 220mm) Hammer SN = 1398	100						15.65	17.10		Very stiff brown becoming brownish grey slightly sandy slightly gravelly CLAY with low cobble content and occasional lenses of greyish brown fine to medium sand. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular to subrounded of limestone and sandstone. [GLACIAL TILL]		
16.80 - 17.10	C8								(1.35)				
18.00						18.0	2.00						
18.00 - 19.50	C9												
								14.30	18.45		Very stiff brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
		TCR	SCR	RQD	FI								

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.40	7.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)
1.20	7.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH009
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2500	0.00	7.50	570885.47 E	19.50 m	13/06/2022	RW+KW	Scale: 1:50
Geobore-S	Fraste CRS XL Duo	7.50	19.50	669962.54 N	Elevation: 32.75 mOD	End Date: 30/06/2022	Logger: NP+TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.00 - 18.36	SPT(C) N=50 (10,11/50 for 215mm) Hammer SN = 1398	100							(1.05)		Very stiff brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
19.50								13.25	19.50		End of Borehole at 19.50m		

TCR	SCR	RQD	FI

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.40	7.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)
1.20	7.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH010
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percusion	Dando 2000	0.00	4.50	570920.76 E
Geobore-S	Fraste CRS XL Duo	4.50	19.50	670039.15 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 3
19.50 m	22/06/2022	RS+,MJ	Scale: 1:50
Elevation: 36.41 mOD	**End Date:** 04/07/2022	**Logger:** TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					36.21	0.20		TOPSOIL [TOPSOIL]		
1.00 - 1.20	B1							Firm brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subangular to subrounded of limestone. [GLACIAL TILL]		
1.20 - 1.65	SPT (C)	N=12 (1,1/2,3,3,4) Hammer SN = 1369	1.20							
1.80 - 2.00	B2									
2.00	U5	Ublow=100 0%			34.41	2.00		Very stiff brown slightly sandy slightly gravelly CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
2.20 - 2.65	SPT (C)	N=33 (6,7/7,8,9,9) Hammer SN = 1369	2.20							
2.80 - 3.00	B3									
3.00 - 3.45	SPT (C)	N=45 (9,10/10,12,11,12) Hammer SN = 1369	3.00							
3.80 - 4.00	B4									
4.00 - 4.04	SPT (C)	N=50 (25 for 20mm/50 for 20mm) Hammer SN = 1369	4.00		32.41	4.00		BOULDER of limestone. [GLACIAL TILL]		
4.50 - 6.00	C1				31.91	4.50 (0.40)		Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
5.00 - 5.02	SPT(C) N=50 (25 for 10mm/50 for 10mm) Hammer SN = 1369	100	5.00		31.51	4.90 (0.80)		Very stiff brownish grey slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
6.00					30.71	5.70		Very stiff brown slightly sandy slightly gravelly CLAY Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
6.00 - 7.50	C2	100				(3.30)				
7.50			7.50	1.50				*7.50m to 7.80m: Bed of sandy gravelly clay.*		
7.50 - 7.88	SPT(S) N=50 (9,15/50 for 230mm) Hammer SN = 1353									
7.90 - 8.20	C4	100								
8.25 - 8.40	C3									
9.00			9.00	1.50	27.41	9.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		

TCR	SCR	RQD	FI

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	5.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 4.50-5.60m

Casing Details

To (m)	Diam (mm)
4.00	200
19.50	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH010
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 19.50 m	Start Date: 22/06/2022	Driller: RS+,MJ	Sheet 2 of 3
Cable Percusion	Dando 2000	0.00	4.50	570920.76 E				Scale: 1:50
Geobore-S	Fraste CRS XL Duo	4.50	19.50	670039.15 N	Elevation: 36.41 mOD	End Date: 04/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.36	SPT(S) N=50 (24 for 135mm/50 for 225mm) Hammer SN = 1353	100									Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
10.50						10.5	1.50						
10.50 - 12.00	C5												
10.50 - 10.83	SPT(C) N=50 (25 for 125mm/50 for 205mm) Hammer SN = 1353	100											
10.60 - 10.90	C6												
12.00						12.0	1.50						
12.00 - 12.40	SPT(C) N=50 (12,13/50 for 245mm) Hammer SN = 1353	93							(6.85)				
13.50						13.5	1.50						
13.50 - 13.88	SPT(C) N=50 (25 for 140mm/50 for 240mm) Hammer SN = 1353	100											
15.00						15.0	1.50						
15.00 - 15.19	SPT(C) N=50 (25 for 115mm/50 for 75mm) Hammer SN = 1353	93						20.56	15.85				
											Very stiff light brown slightly sandy slightly gravelly CLAY Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
16.50						16.5	1.50						
16.50 - 18.00	C7												
16.50 - 16.89	SPT(C) N=50 (25 for 145mm/50 for 245mm) Hammer SN = 1353	100							(3.65)				
18.00						18.0	1.50						
18.00 - 18.23	SPT(C) N=50 (25 for 130mm/50 for 95mm) Hammer SN = 1353												
		TCR	SCR	RQD	FI								

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	5.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 4.50-5.60m

Casing Details

To (m)	Diam (mm)
4.00	200
19.50	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH010
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percusion	Dando 2000	0.00	4.50	570920.76 E	19.50 m	22/06/2022	RS+,MJ	Scale: 1:50
Geobore-S	Fraste CRS XL Duo	4.50	19.50	670039.15 N	Elevation: 36.41 mOD	End Date: 04/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		95									Very stiff light brown slightly sandy slightly gravelly CLAY Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
19.50						19.5	1.50	16.91	19.50				
19.50 - 19.94	SPT(C) N=50 (10,12/50 for 290mm) Hammer SN = 1353										End of Borehole at 19.50m		
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
4.00	200
19.50	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	5.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 4.50-5.60m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH011
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Fraste CRS XL Duo	0.00 7.50	7.50 19.50	570928.74 E 670020.15 N	19.50 m	22/06/2022	MJ+BM	Sheet 1 of 3 Scale: 1:50
					Elevation: 37.32 mOD	End Date: 10/07/2022	Logger: TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					37.12	0.20		TOPSOIL [TOPSOIL]		
0.30 - 0.50	B1							Brown very sandy silty subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
0.50	D9									
0.80 - 1.00	B2									
1.00	D10									
1.20 - 1.65	U17	Ublow=25 90%	1.00	Dry	36.12	1.20		Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
1.80 - 2.00	B3									
2.00	D11									
2.00 - 2.45	SPT (C)	N=13 (3,3/3,3,3,4) Hammer SN = 1386	1.50	Dry						
2.80 - 3.00	B4									
3.00	D12				34.32	3.00		Stiff to very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to medium of various lithologies. [GLACIAL TILL]		
3.00 - 3.45	SPT (C)	N=25 (3,5/8,5,6,6) Hammer SN = 1386	3.00	Dry						
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.45	U18	Ublow=50 100%	3.00	Dry						
4.80 - 5.00	B6									
5.00	D14									
5.00 - 5.45	SPT (C)	N=33 (5,7/7,7,9,10) Hammer SN = 1386	4.50	Dry						
5.80 - 6.00	B7									
6.00	D15									
6.00 - 6.10	U19	Ublow=0 0%								
6.00 - 6.38	SPT (C)	N=50 (8,12/50 for 225mm) Hammer SN = 1386	6.00	Dry						
7.00 - 7.50	B8									
7.50	D16		7.50	Dry	29.82	7.50		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
7.50 - 9.00	C1									
7.50 - 7.90	SPT(C) N=50 (7,10/50 for 245mm) Hammer SN = 1386	TCR 100								
8.30	C2									
8.70 - 9.00	C3									
9.00			9.00	2.50						

TCR | SCR | RQD | FI

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	8.20	03:00

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m
Cable Percussion crew note pushing boulder from 6.00-8.20m for 3hrs

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Water	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH011
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 19.50 m	Start Date: 22/06/2022	Driller: MJ+BM	Sheet 2 of 3
Cable Percussion	Dando 2000	0.00	7.50	570928.74 E				Scale: 1:50
Geobore-S	Fraste CRS XL Duo	7.50	19.50	670020.15 N	Elevation: 37.32 mOD	End Date: 10/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.45	SPT(C) N=40 (8,8/9,10,10,11) Hammer SN = 1353	100									Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
10.50						10.5	1.50						
10.50 - 12.00	C4												
10.50 - 10.94	SPT(C) N=50 (10,13/50 for 285mm) Hammer SN = 1353	100											
11.15 - 11.45	C5								(5.90)				
12.00						12.0	1.50						
12.00 - 12.42	SPT(C) N=50 (12,15/50 for 275mm) Hammer SN = 1353	87											
13.50						13.5	1.50	23.92	13.40				
13.50 - 15.00	C6				AZCL						Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to medium of various lithologies. Cobbles are subangular of sandstone and mudstone. [GLACIAL TILL]		
13.50 - 13.68	SPT(C) N=50 (25 for 110mm/50 for 70mm) Hammer SN = 1353	60									13.50m to 14.40m: AZCL disturbance due to SPT		
15.00						15.0	1.50						
15.00 - 15.32	SPT(C) N=50 (25 for 115mm/50 for 200mm) Hammer SN = 1353	60			AZCL				(3.70)		15.00m to 15.60m: AZCL disturbance due to SPT		
16.50						16.5	2.00						
16.50 - 18.00	C7												
16.50 - 16.82	SPT(C) N=50 (25 for 125mm/50 for 200mm) Hammer SN = 1353	80						20.22	17.10		Very stiff reddish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [GLACIAL TILL]		
18.00						18.0	1.50		(2.40)				
18.00 - 18.27	SPT(C) N=50 (25 for 115mm/50 for 155mm) Hammer SN = 1353												
		TCR	SCR	RQD	FI								

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	8.20	03:00

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m
Cable Percussion crew note pushing boulder from 6.00-8.20m for 3hrs

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Water	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH011
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	7.50	570928.74 E
Geobore-S	Fraste CRS XL Duo	7.50	19.50	670020.15 N

Final Depth:	19.50 m	Start Date:	22/06/2022	Driller:	MJ+BM	Sheet 3 of 3
Elevation:	37.32 mOD	End Date:	10/07/2022	Logger:	TH	Scale: 1:50
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		93									Very stiff reddish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [GLACIAL TILL]		
19.50						19.5	1.50	17.82	19.50				
19.50 - 19.82	SPT(C) N=50 (25 for 125mm/50 for 200mm) Hammer SN = 1353					6.00	1.50				End of Borehole at 19.50m		
19.50	09-07-2022												

TCR	SCR	RQD	FI

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	8.20	03:00

Remarks

Hand dug inspection pit excavated to 1.20m
Cable Percussion crew note pushing boulder from 6.00-8.20m for 3hrs

Casing Details

To (m)	Diam (mm)
7.50	200
19.50	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Water	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH012
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth	Start Date	Driller	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Beretta T44	0.00 12.70	12.70 20.20	570930.57 E 669997.56 N	20.20 m	21/06/2022	PJ+BM	Sheet 1 of 3 Scale: 1:50
					Elevation: 37.86 mOD	End Date: 06/07/2022	Logger: TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					37.66	0.20		TOPSOIL [TOPSOIL]		
0.30 - 0.50	B1							Medium dense brown sandy silty subrounded to subangular fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
0.50	D9									
0.80 - 1.00	B2									
1.00	D10									
1.20 - 1.65	SPT (S)	N=16 (4,3/3,4,4,5) Hammer SN = 1386	1.00	Dry						
1.80 - 2.00	B3				36.06	1.80		Stiff to very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
2.00	D11									
2.00 - 2.45	SPT (C)	N=18 (3,4/5,4,4,5) Hammer SN = 1386	1.50	Dry						
2.80 - 3.00	B4									
3.00	D12									
3.00 - 3.45	U17	Ublow=40 100%	3.00	Dry						
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.45	SPT (S)	N=26 (4,5/5,5,7,9) Hammer SN = 1386	3.00	Dry						
4.80 - 5.00	B6									
5.00	D14									
5.00 - 5.45	SPT (C)	N=32 (11,9/8,8,8,8) Hammer SN = 1386	4.50	Dry						
5.80 - 6.00	B7									
6.00	D15									
6.00 - 6.45	U18	Ublow=40 100%	6.00	Dry						
7.00 - 7.50	B8									
7.50	D16									
7.50 - 7.95	SPT (C)	N=34 (7,8/10,8,8,8) Hammer SN = 1386	6.00	Dry						
8.50 - 9.00	B20									
9.00	D23				28.86	9.00		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
9.00 - 10.50	B21									
9.00 - 9.45	U19	Ublow=50 100%	6.00	Dry						

Water Strikes

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

Casing Details

To (m)	Diam (mm)
12.90	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.90	13.10	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH012
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Cable Percussion	Dando 2000	0.00	12.70	570930.57 E	20.20 m	21/06/2022	PJ+BM	Sheet 2 of 3
Geobore-S	Beretta T44	12.70	20.20	669997.56 N	Elevation: 37.86 mOD	End Date: 06/07/2022	Logger: TH	Scale: 1:50
								FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.00 - 10.50	B26									
10.50	D24									
10.50 - 10.95	SPT (C)	N=36 (7,8/8,8,10,10) Hammer SN = 1386	6.00	Dry						
11.50 - 12.00	B22									
12.00	D25									
12.00 - 12.45	SPT (C)	N=50 (8,8/13,10,11,16) Hammer SN = 1386	6.00	Dry						
					25.16	12.70		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
		100								
14.20			14.2			(2.85)				
14.20 - 15.70	C1									
14.20 - 14.58	SPT(C) N=50 (25 for 140mm/50 for 240mm) Hammer SN = 1385									
		100								
14.60 - 14.90	C2									
					22.31	15.55		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
15.70			15.7							
15.70 - 16.08	SPT(C) N=50 (25 for 145mm/50 for 235mm) Hammer SN = 1385									
		95								
17.20			17.2			(3.15)				
17.20 - 18.70	C3									
17.20 - 17.42	SPT(C) N=50 (25 for 130mm/50 for 95mm) Hammer SN = 1385									
		100								
		TCR SCR RQD FI								

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.90	13.10	01:00

Casing Details

To (m)	Diam (mm)
12.90	200
20.20	150

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH012
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	12.70	570930.57 E	20.20 m	21/06/2022	PJ+BM	Scale: 1:50
Geobore-S	Beretta T44	12.70	20.20	669997.56 N	Elevation: 37.86 mOD	End Date: 06/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.70						18.7		19.16	18.70		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
18.70 - 20.20	C4												
18.70 - 18.96	SPT(C) N=50 (25 for 110mm/50 for 150mm) Hammer SN = 1385	100							(1.50)		Very stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
20.20						20.2		17.66	20.20		End of Borehole at 20.20m		
20.20 - 20.45	SPT(C) N=50 (25 for 100mm/50 for 155mm) Hammer SN = 1385												

TCR	SCR	RQD	FI

Water Strikes

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

Casing Details

To (m)	Diam (mm)
12.90	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
12.90	13.10	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH013
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2500	0.00	11.20	
Geobore-S	Beretta T44	11.20	20.20	570959.63 E
				670054.83 N

Final Depth:	20.20 m	Start Date:	08/06/2022	Driller:	RW+PJ
Elevation:	37.09 mOD	End Date:	07/07/2022	Logger:	TH

Sheet 1 of 3
Scale: 1:50
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
0.10 - 1.20	B5				36.99	0.10		TOPSOIL [TOPSOIL]
								Firm light grey mottled orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]
1.00 - 1.20	D14							
1.20	D15							
1.20 - 1.50	B6							
1.20 - 1.60	U1	Ublow=50 30%	1.20	Dry	35.59	1.50		Firm to stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]
1.50 - 3.00	B7							
2.00	D16							
2.00 - 2.45	SPT (S)	N=12 (3,3/2,3,4,3) Hammer SN = 1410	2.00	Dry				
2.20	D17							
3.00 - 3.40	U2	Ublow=30 30%	3.00	Dry				
3.00 - 4.00	B8							
3.20	D18							
4.00	D19							
4.00 - 5.00	B9							
4.00 - 4.45	SPT (S)	N=35 (3,4/5,8,12,10) Hammer SN = 1410	4.00	Dry				
4.20	D20							
5.00 - 6.60	B10				32.09	5.00		Very dense greyish brown very sandy slightly clayey subangular fine to coarse GRAVEL of various lithologies with low cobble content. Sand is fine to coarse. Cobbles are subangular of limestone. [FLUVIOGLACIAL]
5.00 - 5.42	SPT (C)	N=50 (7,7/50 for 265mm) Hammer SN = 1410 Slow seepage at 5.00m	5.00	Dry				
5.20	D21							
6.00 - 6.29	SPT (C)	N=50 (25 for 140mm/50 for 150mm) Hammer SN = 1410	6.00	4.20				
6.20	D22							
6.60 - 8.00	B11				30.49	6.60		Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]
7.00 - 7.32	SPT (C)	N=50 (7,12/50 for 165mm) Hammer SN = 1410	7.00	4.50				
7.20	D23							
8.00 - 8.45	U3	Ublow=200 90%	8.00	5.70				
8.00 - 9.00	B12							
8.20	D24							
9.00 - 9.28	SPT (C)	N=50 (25 for 125mm/50 for 160mm) Hammer SN = 1410	9.00	6.00	28.09	9.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]
9.20	D25							

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

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.00	5.00	20	0.10

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	6.30	01:00
11.20	11.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Casing Details

To (m)	Diam (mm)
11.50	200
20.20	150

Water Added

From (m)	To (m)
5.00	9.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH013
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Cable Percussion	Dando 2500	0.00	11.20	570959.63 E	20.20 m	08/06/2022	RW+PJ	Sheet 2 of 3
Geobore-S	Beretta T44	11.20	20.20	670054.83 N	Elevation: 37.09 mOD	End Date: 07/07/2022	Logger: TH	Scale: 1:50
								FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.00 - 10.40	U4	Ublow=200 30%					10.0	3.20						
10.00 - 11.50	B13													
11.00 - 11.35	SPT (C)	N=50 (25 for 130mm/50 for 220mm) Hammer SN = 1410					11.0	5.00						
			95						25.89	11.20		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
12.70							12.7							
12.70 - 14.20	C1													
12.70 - 12.94	SPT(C) N=50 (25 for 90mm/50 for 155mm) Hammer SN = 1385		100											
13.50 - 13.80	C2									(4.80)				
14.20							14.2							
14.20 - 14.58	SPT(C) N=50 (12,13/50 for 225mm) Hammer SN = 1385		100											
15.70							15.7							
15.70 - 17.20	C3													
15.70 - 16.05	SPT(C) N=50 (25 for 125mm/50 for 225mm) Hammer SN = 1385		100						21.09	16.00		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
17.20							17.2							
17.20 - 17.46	SPT(C) N=50 (25 for 105mm/50 for 155mm) Hammer SN = 1385		100							(4.20)				

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.00	5.00	20	0.10

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	6.30	01:00
11.20	11.50	01:00

Casing Details

To (m)	Diam (mm)
11.50	200
20.20	150

Water Added

From (m)	To (m)
5.00	9.00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH013
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2500	0.00	11.20	
Geobore-S	Beretta T44	11.20	20.20	570959.63 E
				670054.83 N

Final Depth:	20.20 m	Start Date:	08/06/2022	Driller:	RW+PJ	Sheet 3 of 3
Elevation:	37.09 mOD	End Date:	07/07/2022	Logger:	TH	Scale: 1:50
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.70						18.7							
18.70 - 18.91	SPT(C) N=50 (25 for 75mm/50 for 135mm) Hammer SN = 1385	100									Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
20.20						20.2		16.89	20.20				
20.20 - 20.35	SPT(C) N=50 (25 for 75mm/50 for 75mm) Hammer SN = 1385										End of Borehole at 20.20m		

TCR	SCR	RQD	FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.00	5.00	20	0.10

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.00	6.30	01:00
11.20	11.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Casing Details

To (m)	Diam (mm)
11.50	200
20.20	150

Water Added

From (m)	To (m)
5.00	9.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH014
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Perussion	Dando 2500	0.00	8.00	
Geobore-S	Fraste CRS XL Duo	8.00	20.00	570973.41 E
				670035.37 N

Final Depth:	20.00 m	Start Date:	09/06/2022	Driller:	MJ+RW	Sheet 1 of 3
Elevation:	37.07 mOD	End Date:	06/07/2022	Logger:	TH	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL [TOPSOIL]		
0.40 - 1.20	B1				36.67	0.40		Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
1.20	D9				35.87	1.20				
1.20 - 1.60	U19	Ublow=40 40%	1.20	Dry				Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
1.20 - 2.00	B2									
2.00	D18									
2.00 - 3.00	B3									
2.00 - 2.45	SPT (S)	N=31 (11,10/8,8,7,8) Hammer SN = 1410	2.00	1.50						
2.20	D10									
3.00 - 3.20	U20	Ublow=100 0%	3.00	2.20	34.07	3.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
3.00 - 4.00	B4									
3.20	D11									
4.00 - 5.00	B5				33.07	4.00		Very stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
4.00 - 4.10	SPT (C)	N=50 (25 for 60mm/50 for 40mm) Hammer SN = 1410	4.00	3.00						
4.20	D12									
5.00 - 6.00	B6									
5.00 - 5.43	SPT (C)	N=49 (25 for 130mm/9,11,14,15) Hammer SN = 1410	5.00	3.60						
5.20	D13									
6.00 - 6.40	U21	Ublow=200 50%	6.00	5.00						
6.00 - 7.00	B7									
6.20	D14									
7.00 - 9.00	B8									
7.00 - 7.45	SPT (C)	N=48 (9,9/10,10,12,16) Hammer SN = 1410	7.00	4.80						
7.20	D15									
8.00 - 8.40	U22	Ublow=200 0%	8.00	3.20						
8.00 - 9.50	C1									
8.20	D16									
8.45 - 8.60	C2									
8.70 - 9.00	C3	100 (TCR)								
					9.00	4.00				
					28.07	9.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble		

TCR	SCR	RQD	FI
100			

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.00	3.50	01:00
9.30	0.40	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 6.00 to 8.00m, pocket had to be extended due to borehole walls collapsing
HPD test pocket from 11.00-12.50m

Casing Details

To (m)	Diam (mm)
8.00	200
20.00	150

Water Added

From (m)	To (m)
2.00	9.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH014
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Perussion	Dando 2500	0.00	8.00	
Geobore-S	Fraste CRS XL Duo	8.00	20.00	570973.41 E
				670035.37 N

Final Depth:	20.00 m	Start Date:	09/06/2022	Driller:	MJ+RW	Sheet 2 of 3
						Scale: 1:50
Elevation:	37.07 mOD	End Date:	06/07/2022	Logger:	TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.24	SPT(C) N=50 (10,14/50 for 95mm) Hammer SN = 1410					9.50	0.50				Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse Gravel is subangular fine to medium of limestone. Cobbles are subangular of limestone. [GLACIAL TILL]		
9.20	D17												
9.50													
9.50 - 11.00	C4	100											
9.50 - 9.95	SPT(C) N=38 (7,9/9,10,9,10) Hammer SN = 1353												
11.00						11.0	0.50		(3.50)		11.00-12.50m: AZCL unable to recover core due to drilling pocket for HPD test		
11.00 - 11.45	SPT(C) N=42 (6,8/10,10,11,11) Hammer SN = 1353	0			AZCL								
12.50								24.57	12.50				
12.50 - 14.00	C5	100									Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
14.00						14.0	0.50						
14.00 - 14.45	SPT(C) N=49 (9,12/12,13,11,13) Hammer SN = 1353	66			AZCL						AZCL: probable fines washed away during drilling		
15.50						15.5	0.50		(7.50)				
15.50 - 15.71	SPT(C) N=50 (25 for 130mm/50 for 78mm) Hammer SN = 1353	83											
17.00						17.0	1.20						
17.00 - 17.36	SPT(C) N=50 (25 for 135mm/50 for 225mm) Hammer SN = 1353	100											
18.50						18.5	1.20						
		TCR	SCR	RQD	FI								

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.00	3.50	01:00
9.30	0.40	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 6.00 to 8.00m, pocket had to be extended due to borehole walls collapsing
HPD test pocket from 11.00-12.50m

Casing Details

To (m)	Diam (mm)
8.00	200
20.00	150

Water Added

From (m)	To (m)
2.00	9.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH014
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2500	0.00	8.00	570973.41 E	20.00 m	09/06/2022	MJ+RW	Scale: 1:50
Geobore-S	Fraste CRS XL Duo	8.00	20.00	670035.37 N	Elevation: 37.07 mOD	End Date: 06/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.50 - 18.86	SPT(C) N=50 (25 for 140mm/50 for 220mm) Hammer SN = 1353	100									Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
20.00								17.07	20.00		End of Borehole at 20.00m		

TCR	SCR	RQD	FI

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.00	3.50	01:00
9.30	0.40	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 6.00 to 8.00m, pocket had to be extended due to borehole walls collapsing
HPD test pocket from 11.00-12.50m

Casing Details

To (m)	Diam (mm)
8.00	200
20.00	150

Water Added

From (m)	To (m)
2.00	9.00

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH015
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	10.50	
Geobore-S	Fraste CRS XL Duo	10.50	19.50	570980.38 E
				670018.59 N

Final Depth:	19.50 m	Start Date:	20/06/2022	Driller:	BM+KW	Sheet 1 of 3
Elevation:	37.25 mOD	End Date:	04/07/2022	Logger:	TH	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					37.05	0.20		TOPSOIL [TOPSOIL]		
0.30 - 0.50	B1									
0.50	D9				36.75	0.50		Soft to firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [ALLUVIUM]		
0.80 - 1.00	B2									
1.00	D10							Medium dense brown very sandy clayey subangular fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
1.20 - 1.65	SPT (C)	N=15 (2,3/3,4,3,5) Hammer SN = 1386	1.00	Dry						
1.80 - 2.00	B3				35.45	1.80				
2.00	D11							Firm to stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
2.00 - 2.65	U17	Ublow=20 100%	1.50	Dry						
2.80 - 3.00	B4									
3.00	D12									
3.00 - 3.45	SPT (C)	N=29 (7,8/8,6,9,6) Hammer SN = 1386	3.00	Dry						
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.44	SPT (C)	N=20 (25 for 145mm/9,2,2,7) Hammer SN = 1386	4.00	Dry						
4.80 - 5.00	B6									
5.00	D14									
5.00 - 5.45	U18	Ublow=40 90%	4.50	Dry						
5.80 - 6.00	B7									
6.00	D15				31.25	6.00				
6.00 - 6.42	SPT (C)	N=50 (13,12/50 for 265mm) Hammer SN = 1386	4.50	Dry				Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
7.00 - 7.50	B8									
7.50	D16									
7.50 - 7.88	SPT (C)	N=50 (11,14/50 for 230mm) Hammer SN = 1386	4.50	Dry						
8.50 - 9.00	B19									
9.00	D22									
9.00 - 9.45	U25	Ublow=50 80%	6.00	Dry						

Water Strikes

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

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.10	4.40	00:30
6.80	7.30	00:30
12.50	12.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH015
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Fraste CRS XL Duo	0.00 10.50	10.50 19.50	570980.38 E 670018.59 N	19.50 m	20/06/2022	BM+KW	Sheet 2 of 3 Scale: 1:50
					Elevation: 37.25 mOD	End Date: 04/07/2022	Logger: TH	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.00 - 10.50	B20													
10.50	D23						6.00	Dry	26.75	10.50		Very stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
10.50 - 10.85	SPT(S) N=50 (10,14/50 for 200mm) Hammer SN = 1386	100												
10.75 - 10.90	C1													
11.35 - 11.65	C2													
11.50 - 12.00	B21													
12.00							6.00	Dry						
12.00	D24													
12.00 - 12.40	U26 Ublow=50 90%	100								(4.25)				
13.50							13.0	2.00						
13.50 - 13.92	SPT(S) N=50 (9,10/50 for 275mm) Hammer SN = 1398	100												
15.00							15.0	2.00	22.50	14.75		Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
15.00 - 16.50	C3													
15.00 - 15.28	SPT(S) N=50 (8,12/50 for 125mm) Hammer SN = 1398	100												
16.50							16.5	2.00		(4.75)				
16.50 - 16.81	SPT(S) N=50 (10,14/50 for 160mm) Hammer SN = 1398	100												
18.00							18.0	2.00						
18.00 - 18.33	SPT(S) N=50 (12,13/50 for 180mm) Hammer SN = 1398													

Water Strikes

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

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.10	4.40	00:30
6.80	7.30	00:30
12.50	12.80	01:00

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH015
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	10.50	570980.38 E	19.50 m	20/06/2022	BM+KW	Scale: 1:50
Geobore-S	Fraste CRS XL Duo	10.50	19.50	670018.59 N	Elevation: 37.25 mOD	End Date: 04/07/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100									Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
19.50								17.75	19.50		End of Borehole at 19.50m		

TCR	SCR	RQD	FI

Water Strikes

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

Casing Details

To (m)	Diam (mm)
10.50	200
19.50	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.10	4.40	00:30
6.80	7.30	00:30
12.50	12.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L		Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH016
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 1 of 3
Cable Percussion	Dando 2000	0.00	9.70	571031.14 E	20.20 m	13/06/2022	PJ+BM	Scale: 1:50
Geobore-S	Beretta T44	9.70	20.20	670083.38 N	Elevation: 35.54 mOD	End Date: 15/07/2022	Logger: TH+NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.30 - 0.50	B1				35.24	0.30		MADE GROUND: Soft brownish grey sandy gravelly CLAY (reworked). Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [MADE GROUND]		
0.50	D8									
0.80 - 1.00	B2							Soft to firm brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
1.00	D9									
1.20 - 1.65	U15	Ublow=12 90%	1.00	Dry						
1.80 - 2.00	B3									
2.00	D10									
2.00 - 2.45	SPT (C)	N=13 (2,2/3,3,3,4) Hammer SN = 1386	2.00	Dry						
					33.14	2.40		Firm to stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
2.80 - 3.00	B4									
3.00	D11									
3.00 - 3.45	SPT (C)	N=37 (6,6/6,9,10,12) Hammer SN = 1386	3.00	Dry						
3.80 - 4.00	B5									
4.00	D12									
4.00 - 4.45	U16	Ublow=50 80%	3.00	Dry						
		Slow seepage at 4.50m			31.04	4.50		Medium dense brown sandy slightly clayey subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]	▼	
4.80 - 5.00	B6									
5.00	D13									
5.00 - 5.45	SPT (C)	N=19 (4,4/5,4,5,5) Hammer SN = 1386	5.00	Dry						
5.80 - 6.00	B7	Seepage at 5.80							▼	
6.00	D14									
6.00 - 6.45	SPT (C)	N=31 (8,9/8,7,6,10) Hammer SN = 1386	6.00	5.60	29.24	6.30		Very stiff brown slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
7.00 - 7.50	B17									
7.50	D20									
7.50 - 7.90	U23	Ublow=50 70%	7.50	6.70						
8.50 - 9.00	B18									
9.00	D21									
9.00 - 9.38	SPT (C)	N=50 (10,11/50 for 235mm) Hammer SN = 1386	9.00	8.60						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.50	4.50	20	4.50
5.80	5.80	20	5.80

Casing Details

To (m)	Diam (mm)
9.70	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
10.50	10.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH016
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 20.20 m	Start Date: 13/06/2022	Driller: PJ+BM	Sheet 2 of 3
Cable Percussion	Dando 2000	0.00	9.70	571031.14 E				Scale: 1:50
Geobore-S	Beretta T44	9.70	20.20	670083.38 N	Elevation: 35.54 mOD	End Date: 15/07/2022	Logger: TH+NP	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.70 - 11.20	C1								25.84	9.70		Very stiff brown slightly sandy slightly gravelly SILT with low cobble content and occasional gravel sized pockets of brownish grey fine to medium sand. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subrounded of various lithologies. [GLACIAL TILL]		
10.00 - 10.50	B19													
10.50	D22		93											
10.80 - 10.85	SPT(C) N=50 (25 for 25mm/50 for 25mm) Hammer SN = 1386						10.5	9.90						
11.20														
11.60	C2													
11.80 - 12.10	C3		100							(5.30)				
12.70							12.7							
12.70 - 12.99	SPT(C) N=50 (25 for 115mm/50 for 175mm) Hammer SN = 1385		100											
14.20							14.2							
14.20 - 14.27	SPT(C) N=50 (25 for 45mm/50 for 25mm) Hammer SN = 1385		67			AZCL						14.20-14.70m: AZCL disturbance due to SPT		
									20.54	15.00		Very stiff reddish brown slightly sandy slightly gravelly CLAY with low cobble content and rare pockets of brownish grey fine to medium sand. Sand is fine to coarse of various lithologies. Gravel is subangular fine to medium. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
15.70							15.7							
15.70 - 17.20	C4					AZCL						15.70-16.15m: AZCL disturbance due to SPT		
15.70 - 16.01	SPT(C) N=50 (25 for 120mm/50 for 190mm) Hammer SN = 1385		70							(4.50)				
17.20							17.2							
17.20 - 17.24	SPT(C) N=50 (25 for 25mm/50 for 20mm) Hammer SN = 1385		53			AZCL						17.20-17.90m: AZCL disturbance due to SPT		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.50	4.50	20	4.50
5.80	5.80	20	5.80

Chiselling Details

From (m)	To (m)	Time (hh:mm)
10.50	10.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Casing Details

To (m)	Diam (mm)
9.70	200
20.20	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH016
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	9.70	571031.14 E	20.20 m	13/06/2022	PJ+BM	Scale: 1:50
Geobore-S	Beretta T44	9.70	20.20	670083.38 N	Elevation: 35.54 mOD	End Date: 15/07/2022	Logger: TH+NP	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.70						18.7							
18.70 - 18.94	SPT(C) N=50 (25 for 95mm/50 for 150mm) Hammer SN = 1385	100						16.04	19.50		Very stiff reddish brown slightly sandy slightly gravelly CLAY with low cobble content and rare pockets of brownish grey fine to medium sand. Sand is fine to coarse of various lithologies. Gravel is subangular fine to medium. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
									(0.70)		Very stiff reddish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
20.20						20.2		15.34	20.20		End of Borehole at 20.20m		
20.20 - 20.24	SPT(C) N=50 (25 for 20mm/50 for 15mm) Hammer SN = 1385												

TCR	SCR	RQD	FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.50	4.50	20	4.50
5.80	5.80	20	5.80

Chiselling Details

From (m)	To (m)	Time (hh:mm)
10.50	10.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Casing Details

To (m)	Diam (mm)
9.70	200
20.20	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH017
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	11.20	571029.47 E
Geobore-S	Beretta T44	11.20	20.20	670057.43 N

Final Depth:	20.20 m	Start Date:	14/06/2022	Driller:	PJ+BM	Sheet 1 of 3
Elevation:	35.12 mOD	End Date:	21/07/2022	Logger:	TH+NP	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.30 - 0.50	B1				34.82	0.30		MADE GROUND: Firm brown sandy gravelly CLAY (reworked). Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [MADE GROUND]		
0.50	D5									
0.80 - 1.00	B2							Firm to stiff brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
1.00	D6									
1.20 - 1.65	SPT (C)	N=21 (3,7/9,5,4,3) Hammer SN = 1386	1.00	Dry						
1.80 - 2.00	B3									
2.00	D7				33.12	2.00				
2.00 - 2.45	U9	Ublow=35 100% Slow seepage at 2.30	1.50	Dry				Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]	▼	
2.80 - 3.00	B10									
2.80 - 3.00	B4				32.12	3.00				
3.00	D16									
3.00	D8									
3.00 - 3.45	SPT (C)	N=28 (4,4/5,7,7,9) Hammer SN = 1386	3.00	1.50				Stiff to very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
3.80 - 4.00	B11									
4.00	D17									
4.00 - 4.08	SPT (C)	N=50 (25 for 50mm/50 for 25mm) Hammer SN = 1386	4.00	3.90						
4.80 - 5.00	B12									
5.00	D18									
5.00 - 5.40	U22	Ublow=50 50%	5.00	4.90						
5.80 - 6.00	B13									
6.00	D19									
6.00 - 6.42	SPT (C)	N=50 (9,13/50 for 275mm) Hammer SN = 1386	6.00	5.80						
					28.32	6.80		Very stiff brownish grey slightly sandy CLAY. Sand is fine to coarse. [GLACIAL TILL]		
7.00 - 7.50	B14									
7.50	D20									
7.50 - 7.90	U23	Ublow=50 60%	7.50							
					27.12	8.00		Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
8.50 - 9.00	B15									
9.00	D21				26.12	9.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
9.00	D25									

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.30	2.30		

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	4.80	01:00
11.50	11.70	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH017
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 20.20 m	Start Date: 14/06/2022	Driller: PJ+BM	Sheet 2 of 3 Scale: 1:50
Cable Percussion	Dando 2000	0.00	11.20	571029.47 E				
Geobore-S	Beretta T44	11.20	20.20	670057.43 N	Elevation: 35.12 mOD	End Date: 21/07/2022	Logger: TH+NP	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.38	SPT (C)	N=50 (10,12/50 for 225mm) Hammer SN = 1386					9.00	Dry						
10.00 - 10.50	B24													
10.50	D26													
10.50 - 10.90	U27	Ublow=50 70%												
									23.92	11.20		Very stiff dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
11.50 - 11.58	SPT(C) N=50 (25 for 50mm/50 for 25mm) Hammer SN = 1386		100				11.5	Dry		(1.50)				
11.60 - 11.90	C2													
11.95	C1													
12.70							12.7		22.42	12.70		Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
12.70 - 13.02	SPT(C) N=50 (25 for 115mm/50 for 200mm) Hammer SN = 1385		93											
14.20							14.2			(2.60)				
14.20 - 14.49	SPT(C) N=50 (25 for 110mm/50 for 180mm) Hammer SN = 1385		77											
15.70							15.7		19.82	15.30		Very stiff dark brown becoming reddish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
15.70 - 17.20	C3											*15.90-16.00m: Bed of angular fine to coarse gravel*		
15.70 - 16.01	SPT(C) N=50 (25 for 120mm/50 for 190mm) Hammer SN = 1385		97											
17.20							17.2			(3.55)				
17.20 - 17.24	SPT(C) N=50 (25 for 20mm/50 for 20mm) Hammer SN = 1385		100											

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.30	2.30		

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	4.80	01:00
11.50	11.70	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH017
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	11.20	571029.47 E	20.20 m	14/06/2022	PJ+BM	Scale: 1:50
Geobore-S	Beretta T44	11.20	20.20	670057.43 N	Elevation: 35.12 mOD	End Date: 21/07/2022	Logger: TH+NP	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.70						18.7							
18.70 - 18.95	SPT(C) N=50 (25 for 90mm/50 for 165mm) Hammer SN = 1385	80						16.27	18.85		Very stiff dark brown becoming reddish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
									(1.35)		Very stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
20.20						20.2		14.92	20.20		End of Borehole at 20.20m		
20.20 - 20.25	SPT(C) N=50 (25 for 30mm/50 for 20mm) Hammer SN = 1385												

TCR	SCR	RQD	FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.30	2.30		

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.00	4.80	01:00
11.50	11.70	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Location of borehole was moved from the field to an adjacent farm passage at landowners request

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH018
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth	Start Date	Driller	Sheet / Scale
Cable Percussion	Dando 2000	0.00	11.20	571028.57 E	20.20 m	16/06/2022	PJ+BM	Sheet 1 of 3
Geobore-S	Beretta T44	11.20	20.20	670039.94 N	Elevation: 35.24 mOD	End Date: 25/07/2022	Logger: TH+NP	Scale: 1:50
								FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.30 - 0.50	B1				35.04	0.20		MADE GROUND: Firm brown sandy gravelly CLAY (reworked). Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [MADE GROUND]		
0.50	D8									
0.80 - 1.00	B2							Soft to firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]		
1.00	D9									
1.20 - 1.65	SPT (C)	N=12 (2,3/2,3,3,4) Hammer SN = 1386	1.00	Dry						
					33.84	1.40		Medium dense brown fine to coarse SAND and subangular fine to coarse GRAVEL of various lithologies. [FLUVIOGLACIAL]		
1.80 - 2.00	B3				33.44	1.80				
2.00	D10							Firm to stiff brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
2.00 - 2.45	SPT (C)	N=16 (3,3/4,4,4,4) Hammer SN = 1386	1.50	Dry						
2.80 - 3.00	B4									
3.00	D11				32.24	3.00				
3.00 - 3.45	U15	Ublow=40 60%	3.00	Dry				Stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
3.80 - 4.00	B5									
4.00	D12									
4.00 - 4.45	SPT (C)	N=17 (3,3/4,4,4,5) Hammer SN = 1386	3.00	Dry						
4.80 - 5.00	B6									
5.00	D13									
5.80 - 6.00	B7									
6.00	D14									
6.00 - 6.45	U16	Ublow=50 50%	6.00	Dry						
7.00 - 7.50	B17				28.24	7.00		Stiff to very stiff brown sandy silty CLAY. Sand is fine to coarse. [GLACIAL TILL]		
7.50	D20									
7.50 - 7.95	SPT (C)	N=38 (6,7/7,9,10,12) Hammer SN = 1386	7.50	Dry						
8.50 - 9.00	B18				26.74	8.50		Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
9.00	D21									
9.00 - 9.40	U23	Ublow=50 80%	9.00							

Water Strikes

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

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
11.00	11.20	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH018
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth	Start Date	Driller	Sheet / Scale
Cable Percussion	Dando 2000	0.00	11.20	571028.57 E	20.20 m	16/06/2022	PJ+BM	Sheet 2 of 3
Geobore-S	Beretta T44	11.20	20.20	670039.94 N	Elevation: 35.24 mOD	End Date: 25/07/2022	Logger: TH+NP	Scale: 1:50
								FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.00 - 10.50	B19													
10.50	D22													
10.50 - 10.88	SPT (C)	N=50 (11,13/50 for 225mm) Hammer SN = 1386					9.00	Dry						
			30			AZCL			24.04	11.20		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular to subrounded of various lithologies. [GLACIAL TILL]		
												11.20m to 12.25m: AZCL		
12.70							12.7					*12.70m to 13.55m: AZCL*		
12.70 - 14.20	C1													
12.70 - 12.99	SPT(C) N=50 (25 for 110mm/50 for 180mm) Hammer SN = 1385		43			AZCL				(4.55)				
14.20							14.2							
14.20 - 14.28	SPT(C) N=50 (25 for 50mm/50 for 35mm) Hammer SN = 1385		80											
15.70							15.7		19.49	15.75		Very stiff reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. [GLACIAL TILL]		
15.70 - 16.00	SPT(C) N=50 (25 for 115mm/50 for 185mm) Hammer SN = 1385													
16.30	C2		97											
17.20							17.2			(4.00)				
17.20 - 18.70	C4													
17.20 - 17.26	SPT(C) N=50 (25 for 30mm/50 for 30mm) Hammer SN = 1385		100											

Water Strikes

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

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
11.00	11.20	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

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CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH018
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	11.20	571028.57 E	20.20 m	16/06/2022	PJ+BM	Scale: 1:50
Geobore-S	Beretta T44	11.20	20.20	670039.94 N	Elevation: 35.24 mOD	End Date: 25/07/2022	Logger: TH+NP	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
18.70						18.7							
18.70 - 18.95	SPT(C) N=50 (25 for 90mm/50 for 160mm) Hammer SN = 1385	63			AZCL						Very stiff reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. [GLACIAL TILL] *18.70m to 19.25m: AZCL*		
								15.49	19.75				
									(0.45)		Very stiff reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of various lithologies. [GLACIAL TILL]		
20.20						20.2		15.04	20.20		End of Borehole at 20.20m		
20.20 - 20.36	SPT(C) N=50 (25 for 25mm/50 for 130mm) Hammer SN = 1385												

TCR	SCR	RQD	FI

Water Strikes

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

Casing Details

To (m)	Diam (mm)
11.20	200
20.20	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
11.00	11.20	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH019
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	9.00	
Geobore-S	Fraste CRS XL Duo	9.00	19.50	571060.42 E
				670101.88 N

Final Depth:	19.50 m	Start Date:	09/06/2022	Driller:	BM+KW	Sheet 1 of 3
Elevation:	34.08 mOD	End Date:	09/07/2022	Logger:	NP+TH	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL [TOPSOIL]		
0.30 - 0.50	B1				33.78	0.30		Soft brownish grey slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
0.50	D5									
0.80 - 1.00	B2									
1.00	D6									
1.20 - 1.60	U9	Ublow=12 80%		Dry						
1.80 - 2.00	B3				32.28	1.80		Soft to firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
2.00	D7									
2.00 - 2.45	SPT (S)	N=11 (2,2/2,3,3,3) Hammer SN = 1386	2.00	Dry						
2.80 - 3.00	B4									
3.00	D8				31.08	3.00		Firm to stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
3.00 - 3.45	SPT (S)	N=20 (3,3/4,4,5,7) Hammer SN = 1386	3.00	Dry						
3.80 - 4.00	B10									
4.00	D15									
4.00 - 4.40	U20	Ublow=25 70%	4.00							
4.80 - 5.00	B11									
5.00	D16				29.08	5.00		Stiff to very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
5.00 - 5.45	SPT (S)	N=31 (5,6/7,7,8,9) Hammer SN = 1386	5.00	Dry						
5.80 - 6.00	B12									
6.00	D17									
6.00 - 6.45	SPT (S)	N=38 (7,8/8,9,10,11) Hammer SN = 1386	6.00	Dry						
6.80 - 7.00	B13									
7.50	D18									
7.50 - 7.80	U21	Ublow=100 0%	7.50							
7.50 - 7.54	SPT (S)	N=50 (25 for 25mm/50 for 20mm) Hammer SN = 1386	7.50	Dry						
8.50 - 9.00	B14									
9.00	D19		9.00	Dry	25.08	9.00		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble		
9.00 - 10.50	C1		9.00							
9.00 - 9.10	U22 Ublow=100 0%	TCR SCR RQD AZCL FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
9.00	200
19.50	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
9.00	9.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH019
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	9.00	
Geobore-S	Fraste CRS XL Duo	9.00	19.50	571060.42 E
				670101.88 N

Final Depth:	19.50 m	Start Date:	09/06/2022	Driller:	BM+KW	Sheet 2 of 3
Elevation:	34.08 mOD	End Date:	09/07/2022	Logger:	NP+TH	Scale: 1:50
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
9.00 - 9.04	SPT(S) N=50 (25 for 20mm/50 for 25mm) Hammer SN = 1386										Very stiff brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
9.20	C2	67									*9.00m to 9.50m: AZCL disturbance due to SPT*		
10.50					AZCL				(3.05)		*10.50m to 11.15m: AZCL fines possibly washed out with drilling fluid*		
		85											
12.00						12.0	2.00	22.02	12.05				
12.00 - 13.50	C3										Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
12.00 - 12.30	SPT(S) N=50 (10,15/50 for 155mm) Hammer SN = 1398	90									*12.05m to 12.20m: Bed of subangular coarse gravel*		
12.20 - 12.50	C4												
13.50						13.5	2.00				*13.50m to 13.90m: AZCL disturbance due to SPT/possible granular material washed out with drilling*		
13.50 - 13.88	SPT(C) N=50 (12,12/50 for 225mm) Hammer SN = 1398	73			AZCL				(5.10)		*13.90m to 14.00m: Bed of subrounded fine to medium gravel*		
15.00						15.0	2.00						
15.00 - 15.15	SPT(S) N=50 (25 for 75mm/50 for 75mm) Hammer SN = 1398	100											
16.00 - 16.30	C5												
16.50						16.5	2.00				*16.50m to 17.15m: AZCL disturbance due to SPT/possible granular material washed out with drilling*		
16.50 - 16.73	SPT(S) N=50 (20,5/50 for 75mm) Hammer SN = 1398	57			AZCL			16.92	17.15		Dark and light grey subangular fine to coarse GRAVEL of various lithologies with low cobble content and some pockets of brown sandy gravelly clay. Sand is fine to coarse. Cobbles are subangular of limestone. [GLACIAL TILL]		
									(0.75)				
18.00						18.0	2.00	16.18	17.90		Very stiff reddish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [GLACIAL TILL]		
18.00 - 18.30	SPT(S) N=50 (18,7/50 for 150mm) Hammer SN = 1398												
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
9.00	200
19.50	150

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
9.00	9.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH019
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	9.00	571060.42 E	19.50 m	09/06/2022	BM+KW	Scale: 1:50
Geobore-S	Fraste CRS XL Duo	9.00	19.50	670101.88 N	Elevation: 34.08 mOD	End Date: 09/07/2022	Logger: NP+TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100							(1.60)		Very stiff reddish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [GLACIAL TILL]		
19.50								14.58	19.50		End of Borehole at 19.50m		
		TCR	SCR	RQD	FI								

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

Casing Details	
To (m)	Diam (mm)
9.00	200
19.50	150

Water Added	
From (m)	To (m)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
9.00	9.50	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH020
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Sonic	Fraste CRS XL Duo	0.00	9.00	
Geobore-S	Fraste CRS XL Duo	9.00	19.50	571069.47 E
				670075.81 N

Final Depth:	19.50 m	Start Date:	06/07/2022	Driller:	KW	Sheet 1 of 3
Elevation:	33.58 mOD	End Date:	07/07/2022	Logger:	NP+TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.00 - 1.50	B1	50			AZCL			33.38	0.20		TOPSOIL [TOPSOIL]		
								33.22	0.35		Very soft dark brown slightly sandy CLAY Sand is medium. [ALLUVIUM]		
											Dark greyish brown slightly gravelly clayey fine to coarse SAND. Gravel is subangular fine of various lithologies. [ALLUVIUM]		
											0.75-1.50m: AZCL disturbance due to drilling		
1.50 - 3.50	B2	100				1.50	1.00	32.08	1.50		Firm brown occasionally light grey slightly sandy CLAY. Sand is fine to medium. [ALLUVIUM]		
1.50 - 1.95	SPT(S) N=14 (3,3/4,3,3,4) Hammer SN = 1398												
1.50													
3.00		67			AZCL						3.00-3.50m: AZCL disturbance due to drilling		
3.50 - 4.50	B3							29.98	3.60		Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded medium to coarse of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
4.50 - 6.00	B4	33			AZCL	4.50	3.00	29.08	4.50		Dense greyish brown subangular fine to coarse GRAVEL with low cobble content and some pockets of light brown sandy gravelly clay. Cobbles are subangular of limestone. [GLACIAL TILL]		
4.50 - 4.95	SPT(S) N=33 (4,5/5,6,10,12) Hammer SN = 1398												
4.50											4.50-5.50m: AZCL disturbance due to drilling/borehole collapsing		
6.00 - 7.50	B5	33			AZCL						6.00-7.00m: AZCL disturbance due to drilling/borehole collapsing		
6.00													
		TCR	SCR	RQD	FI								

Water Strikes

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

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 1.50 to 3.50m
HPD test pocket from 4.50 to 6.00m

Casing Details

To (m)	Diam (mm)
9.00	177
19.50	150

Core Barrel

SK6L

Flush Type

Polymer

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH020
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Sonic	Fraste CRS XL Duo	0.00	9.00	
Geobore-S	Fraste CRS XL Duo	9.00	19.50	571069.47 E
				670075.81 N

Final Depth:	19.50 m	Start Date:	06/07/2022	Driller:	KW	Sheet 2 of 3
Elevation:	33.58 mOD	End Date:	07/07/2022	Logger:	NP+TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
7.50 - 9.00	B6										Dense greyish brown subangular fine to coarse GRAVEL with low cobble content and some pockets of light brown sandy gravelly clay. Cobbles are subangular of limestone. [GLACIAL TILL]		
7.50					AZCL						*7.50-8.00m: AZCL disturbance due to drilling*		
								25.58	8.00		Dark greyish brown slightly gravelly clayey fine to coarse SAND. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
		67						25.28	8.30		Brownish grey slightly sandy very clayey subangular fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [GLACIAL TILL]		
								25.02	8.55		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
9.00 - 10.50	C1					9.00	2.00						
9.00 - 9.45	SPT(C) N=46												
9.00	(6,9/10,10,12,14) Hammer SN = 1398												
		100											
10.10 - 10.40	C3												
								23.18	10.40		Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
10.50 - 10.88	SPT(C) N=50					10.5	2.00						
10.50	(10,14/50 for 225mm) Hammer SN = 1398												
		100											
11.10 - 11.45	C2												
12.00 - 13.50	C4					12.0	2.00						
12.00 - 12.37	SPT(C) N=50												
12.00	(11,13/50 for 220mm) Hammer SN = 1398												
		100											
13.50 - 13.88	SPT(C) N=50					13.5	2.00						
13.50	(10,12/50 for 225mm) Hammer SN = 1398												
		100											
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
9.00	177
19.50	150

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 1.50 to 3.50m
HPD test pocket from 4.50 to 6.00m

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH020
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Sonic	Fraste CRS XL Duo	0.00	9.00	
Geobore-S	Fraste CRS XL Duo	9.00	19.50	571069.47 E
				670075.81 N

Final Depth:	19.50 m	Start Date:	06/07/2022	Driller:	KW	Sheet 3 of 3
Elevation:	33.58 mOD	End Date:	07/07/2022	Logger:	NP+TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
15.00 - 15.08 15.00	SPT(C) N=50 (25 for 80mm/50 for 5mm) Hammer SN = 1398	100				15.0	2.00				Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
16.50 - 18.00 16.50 - 16.60 16.50	C5 SPT(C) N=50 (25 for 95mm/50 for 5mm) Hammer SN = 1398	100				16.5	2.00	17.08	16.50		Very stiff light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
18.00 - 18.28 18.00	SPT(C) N=50 (25 for 105mm/50 for 175mm) Hammer SN = 1398	97				18.0	2.00	15.28	18.30		Very stiff light brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
19.50								14.08	19.50		End of Borehole at 19.50m		

TCR	SCR	RQD	FI

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

Remarks

Hand dug inspection pit excavated to 1.20m
HPD test pocket from 1.50 to 3.50m
HPD test pocket from 4.50 to 6.00m

Casing Details	
To (m)	Diam (mm)
9.00	177
19.50	150

Core Barrel: SK6L

Flush Type: Polymer

Termination Reason: Terminated at scheduled depth

Last Updated: 04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH021
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Comacchio 405	0.00 12.00	12.00 19.50	571075.96 E 670055.36 N	19.50 m	08/06/2022	KW+BM	Sheet 1 of 3 Scale: 1:50
					Elevation: 33.17 mOD	End Date: 06/07/2022	Logger: TH+JAC	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					32.97	0.20		TOPSOIL [TOPSOIL]		
0.40 - 0.60	B1							Medium dense brownish grey very gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
0.50	D9									
0.80 - 1.00	B2									
1.00	D10									
1.20 - 1.65	SPT (C)	N=15 (3,5/5,4,3,3) Hammer SN = 1386	1.00	Dry						
					31.77	1.40		Loose greyish brown very gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
1.80 - 2.00	B3									
2.00	D11									
2.00 - 2.45	SPT (C)	N=4 (2,2/1,1,1,1) Hammer SN = 1386	1.50	Dry						
		Slow seepage at 2.70m							▼	
2.80 - 3.00	B4									
3.00	D12				30.17	3.00				
3.00 - 3.45	SPT (C)	N=4 (1,1/1,1,1,1) Hammer SN = 1386	3.00	2.70				Very soft to soft brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [ALLUVIUM]		
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.45	U18	Ublow=10 80%	4.00	3.30						
5.00	D14				28.17	5.00				
5.00 - 5.45	SPT (C)	N=9 (1.5,1.5/2,2,2,3) Hammer SN = 1386	5.00	Dry				Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
5.80 - 6.00	B6									
6.00	D15									
6.00 - 6.45	SPT (C)	N=14 (2,2/3,3,4,4) Hammer SN = 1386	6.00	Dry						
7.30 - 7.50	B7									
7.50	D16									
7.50 - 7.60	U19	Ublow=50 0%	7.50	Dry						
8.80 - 9.00	B8							Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
9.00	D17				24.17	9.00				
9.00 - 9.45	U20	Ublow=50 80%	9.00	Dry						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.70	2.70	20	2.70

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.60	8.00	00:30
15.40	15.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 5.00-6.00m

Casing Details

To (m)	Diam (mm)
12.00	200
19.50	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH021
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth	Start Date	Driller	Sheet / Scale
Cable Percussion Geobore-S	Dando 2000 Comacchio 405	0.00 12.00	12.00 19.50	571075.96 E 670055.36 N	19.50 m	08/06/2022	KW+BM	Sheet 2 of 3 Scale: 1:50
					Elevation: 33.17 mOD	End Date: 06/07/2022	Logger: TH+JAC	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
10.50 - 10.84	SPT (C)	N=50 (25 for 145mm/50 for 195mm) Hammer SN = 1386					9.00	Dry						
11.80 - 12.00	B21													
12.00	D23								21.17	12.00				
12.00	U26 Ublow=50 90%													
12.00 - 13.50	C1		73							(1.30)		Very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. Cobbles are subangular of limestone. [GLACIAL TILL]		
13.50							13.5	Dry	19.87	13.30				
13.50	D24											Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
13.50 - 14.00	B22													
13.50 - 15.00	C2													
13.50 - 13.84	SPT(C) N=50 (11,14/50 for 190mm) Hammer SN = 1386		90											
14.00	D25													
15.00														
15.00 - 15.40	U27 Ublow=50 60%		90							(6.20)				
16.50							16.0	2.00						
16.50 - 18.00	C3													
16.50 - 16.90	SPT(S) N=50 (8,12/50 for 245mm) Hammer SN = 1398		100											
18.00							18.0	2.00						
18.00 - 18.30	SPT(S) N=50 (10,14/50 for 150mm) Hammer SN = 1398													

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.70	2.70	20	2.70

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.60	8.00	00:30
15.40	15.60	01:00

Casing Details

To (m)	Diam (mm)
12.00	200
19.50	150

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 5.00-6.00m

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH021
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 3 of 3
Cable Percussion	Dando 2000	0.00	12.00	571075.96 E	19.50 m	08/06/2022	KW+BM	Scale: 1:50
Geobore-S	Comacchio 405	12.00	19.50	670055.36 N	Elevation: 33.17 mOD	End Date: 06/07/2022	Logger: TH+JAC	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100									Very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
19.50								13.67	19.50		End of Borehole at 19.50m		

TCR	SCR	RQD	FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.70	2.70	20	2.70

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.60	8.00	00:30
15.40	15.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m
Falling Head Test completed 5.00-6.00m

Casing Details

To (m)	Diam (mm)
12.00	200
19.50	150

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
SK6L	Polymer	Terminated at scheduled depth	04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH022
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	8.00	571228.81 E 670105.26 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 2
8.00 m	23/06/2022	BM	Scale: 1:40
Elevation: 34.46 mOD	**End Date:** 23/06/2022	**Logger:** NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					34.26	0.20		TOPSOIL [TOPSOIL]		
0.30 - 0.50	B1							Medium dense brownish grey very sandy silty subangular to subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Sand is fine to coarse. Cobbles are subrounded of limestone. [FLUVIOGLACIAL]		
0.50	D9									
0.80 - 1.00	B2									
1.00	D10									
1.20 - 1.65	SPT (C)	N=17 (3,3/4,4,4,5) Hammer SN = 1386	1.00	Dry						
1.80 - 2.00	B3				32.66	1.80		Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
2.00	D11									
2.00 - 2.45	SPT (C)	N=19 (3,4/5,4,5,5) Hammer SN = 1386	1.50	Dry	32.26	2.20		Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. [GLACIAL TILL]		
2.80 - 3.00	B4									
3.00	D12									
3.00 - 3.45	U17	Ublow=20 100%	3.00	Dry						
					31.16	3.30		Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
3.80 - 4.00	B5									
4.00	D13									
4.00 - 4.35	SPT (C)	N=50 (6,8/50 for 200mm) Hammer SN = 1386	3.00	Dry						
4.80 - 5.00	B6									
5.00	D14									
5.00 - 5.44	SPT (C)	N=50 (7,9/50 for 295mm) Hammer SN = 1386	4.50	Dry						
5.80 - 6.00	B7									
6.00	D15									
6.00 - 6.45	U18	Ublow=50 100%	6.00	Dry						
6.00 - 7.50	B8									

Water Strikes

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

Casing Details

To (m)	Diameter
8.00	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.30	6.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on instruction of Engineer

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH022
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	8.00	571228.81 E 670105.26 N

Final Depth:	Start Date:	Driller:	Sheet 2 of 2
8.00 m	23/06/2022	BM	Scale: 1:40
Elevation: 34.46 mOD	**End Date:** 23/06/2022	**Logger:** NP	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
7.50 7.50 - 7.92	D16 SPT (C)	N=50 (9,10/50 for 265mm) Hammer SN = 1386	6.50	Dry				Very stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. Cobbles are subrounded of limestone. [GLACIAL TILL]		
					26.46	8.00		End of Borehole at 8.00m		

7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5

Water Strikes

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

Casing Details

To (m)	Diameter
8.00	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.30	6.80	01:00

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on instruction of Engineer

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH027
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Open Hole Boring	Beretta T44	0.00	2.20	
Geobore-S	Beretta T44	2.20	9.70	571714.19 E
				670315.52 N

Final Depth:	9.70 m	Start Date:	21/09/2022	Driller:	PJ	Sheet 1 of 2
Elevation:	57.14 mOD	End Date:	22/09/2022	Logger:	NP+CM	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								57.04	0.10		TOPSOIL [TOPSOIL]		
											Very soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [ALLUVIUM]		
								56.04	1.10		Soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [ALLUVIUM]		
2.20	C1					2.20	1.00	54.94	2.20		Firm becoming stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of various lithologies. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
2.20 - 2.65	D1												
2.20 - 2.65	SPT(S) N=9 (1,1/1,2,2,4) Hammer SN = 1385												
2.30 - 2.60	C2	25			AZCL						*2.60-3.70m: AZCL (possibly due to fines and gravel being washed out with flush).*		
3.70 - 4.15	D2					3.70	1.00						
3.70 - 4.15	SPT(S) N=18 (1,1/3,5,5,5) Hammer SN = 1385										*3.80-5.20m: AZCL (possibly due to fines and gravel being washed out with flush).*		
3.70		7			AZCL								
5.20	C3					5.20	1.00						
5.20 - 5.65	D3												
5.20 - 5.65	SPT(S) N=20 (1,1/3,5,6,6) Hammer SN = 1385												
5.20													
5.90	C4	63			AZCL						*6.15-6.70m: AZCL (possibly due to fines and gravel being washed out with flush).*		
6.70 - 7.15	D4					6.70	1.00						
6.70 - 7.02	SPT(S) N=50 (6,12/50 for 170mm) Hammer SN = 1385												
6.70													
		TCR	SCR	RQD	FI								

Water Strikes

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

Casing Details

To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m

Additional works location completed outside the footprint of the RWRM site due to access constraints

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH027
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Open Hole Boring	Beretta T44	0.00	2.20	
Geobore-S	Beretta T44	2.20	9.70	571714.19 E
				670315.52 N

Final Depth:	9.70 m	Start Date:	21/09/2022	Driller:	PJ	Sheet 2 of 2
Elevation:	57.14 mOD	End Date:	22/09/2022	Logger:	NP+CM	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		40			AZCL						Firm becoming stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of various lithologies. Cobbles are subangular of various lithologies. [GLACIAL TILL]		
8.20 - 8.65 8.20 - 8.57 8.20	D5 SPT(S) N=50 (2,2/50 for 225mm) Hammer SN = 1385					8.20	1.00				*7.35-8.20m: AZCL (possibly due to fines and gravel being washed out with flush).*		
		35			AZCL						*8.75-9.70m: AZCL (possibly due to fines and gravel being washed out with flush).*		
9.70 - 10.10 9.70	SPT(S) N=50 (3,5/50 for 245mm) Hammer SN = 1385					9.70	1.00	47.44	9.70		End of Borehole at 9.70m		
		TCR	SCR	RQD	FI								

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

Remarks

Hand dug inspection pit excavated to 1.20m

Additional works location completed outside the footprint of the RWRM site due to access constraints

Casing Details	
To (m)	Diam (mm)
2.20	200
9.70	150

Core Barrel

SK6L

Flush Type

Polymer

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH028
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Open Hole Boring	Comacchio 405	0.00	2.60	
Geobore-S	Comacchio 405	2.60	9.65	571764.78 E
				670483.18 N

Final Depth:	9.65 m	Start Date:	19/09/2022	Driller:	RC	Sheet 1 of 2
Elevation:	62.20 mOD	End Date:	20/09/2022	Logger:	TH	Scale: 1:40
						FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								61.90	0.30		MADE GROUND: Firm sandy gravelly CLAY (reworked). Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [MADE GROUND]		
											Soft to firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [ALLUVIUM]		
	Water strike at 1.65m											▼	
2.60 - 3.05	SPT(S) N=26 (3,3/6,6,6,8)					2.60	Dry	59.60	2.60		Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
3.00 - 3.65	C1	95											
3.65 - 4.10	SPT(S) N=41 (3,6/9,10,10,12)					2.60	1.65	58.55	3.65		Very stiff brownish grey slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
3.65								58.10	4.10		Very stiff brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. [GLACIAL TILL]		
4.50	C2	87											
4.60 - 5.15	C3												
5.15 - 6.65	C4					2.60	1.65	57.05	5.15		Very stiff brownish grey slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
5.15 - 5.60	SPT(S) N=41 (3,6/10,10,10,11)												
5.15								56.50	5.70		Very stiff light brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subangular of limestone and sandstone. [GLACIAL TILL]		
		80											
6.65 - 7.05	C5					2.60	1.65				*6.65-7.35m: AZCL disturbance due to SPT*		
6.65 - 7.10	SPT(S) N=38 (3,8/9,9,11,9)												
6.65					AZCL								
		TCR	SCR	RQD	FI								

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.65	1.65	20	1.65

Casing Details

To (m)	Diam (mm)
2.60	200
9.65	146

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m

Additional works location completed outside the footprint of the RWRM site due to access constraints

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-BH028
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth: 9.65 m	Start Date: 19/09/2022	Driller: RC	Sheet 2 of 2
Open Hole Boring	Comacchio 405	0.00	2.60					Scale: 1:40
Geobore-S	Comacchio 405	2.60	9.65	571764.78 E				
				670483.18 N	Elevation: 62.20 mOD	End Date: 20/09/2022	Logger: TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		53									Very stiff light brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subangular of limestone and sandstone. [GLACIAL TILL]		
8.15 - 8.60 8.15	SPT(S) N=36 (3,6/6,9,9,12)	60			AZCL	2.60	1.65				8.15-8.45m: AZCL disturbance due to SPT		
8.90		71											
9.65 - 10.10 9.65	SPT(S) N=38 (6,6/8,8,10,12)					2.60	1.65	52.55	9.65		End of Borehole at 9.65m		

TCR	SCR	RQD	FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.65	1.65	20	1.65

Casing Details

To (m)	Diam (mm)
2.60	200
9.65	146

Core Barrel

SK6L

Flush Type

Polymer

Remarks

Hand dug inspection pit excavated to 1.20m
Additional works location completed outside the footprint of the RWRM site due to access constraints

Termination Reason

Terminated at scheduled depth

Last Updated

04/01/2023

AGS



Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Hammer Ref:	D123
Test Date:	20/10/2021
Report Date:	
File Name:	D123.spt
Test Operator:	B HUNTER

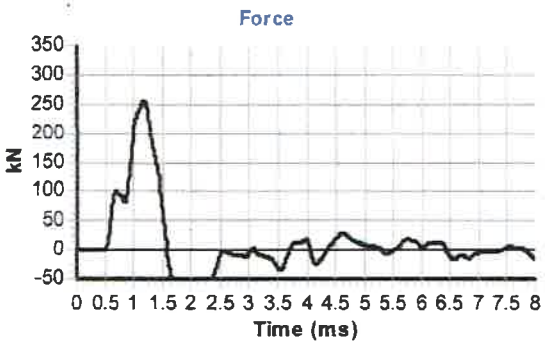
Instrumented Rod Data

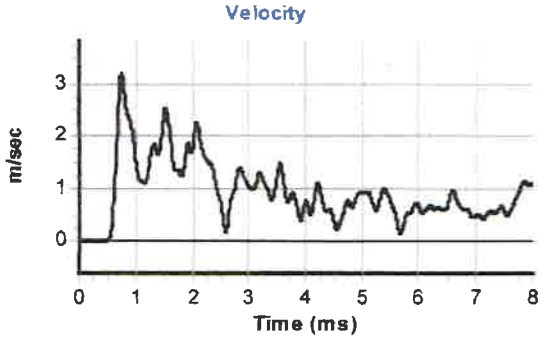
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	62902

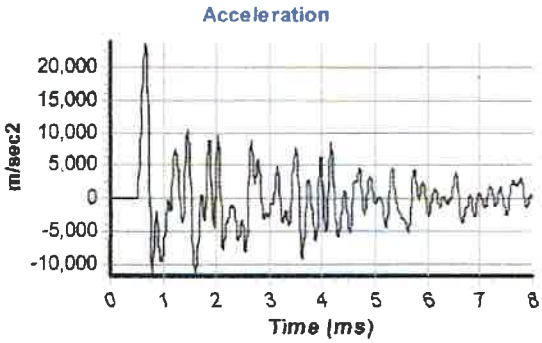
Hammer Information

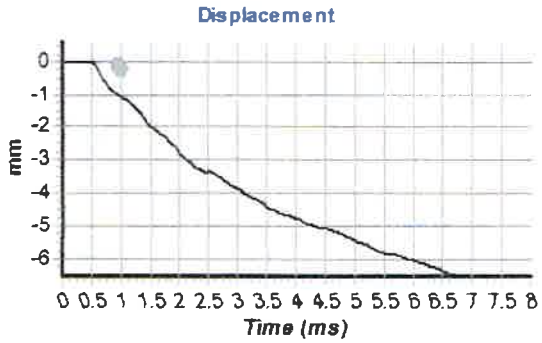
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	10.0

Comments / Location Asset 1383 1385









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	263

Energy Ratio E_r (%): **56**

Signed:

Title: Operations Manager

The recommended calibration interval is 12 months

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Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Hammer Ref:	D124
Test Date:	20/10/2021
Report Date:	
File Name:	D124.spt
Test Operator:	B HUNTER

Instrumented Rod Data

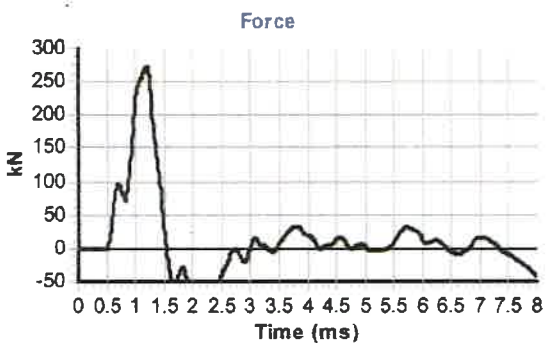
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	62902

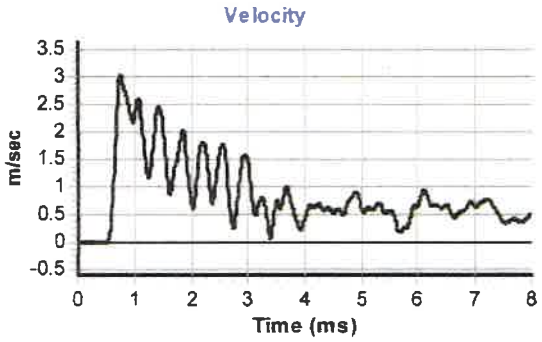
Hammer Information

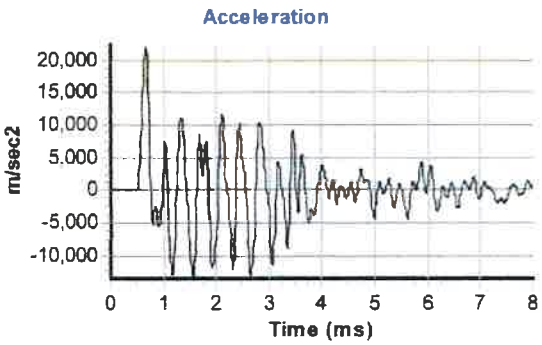
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	10.0

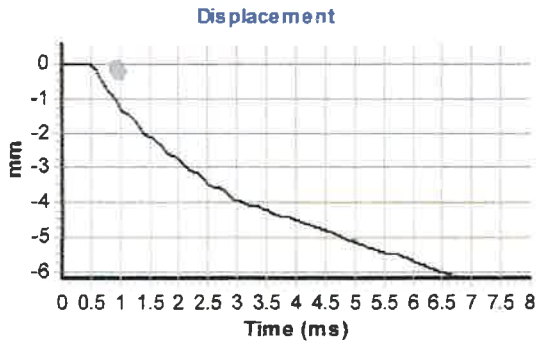
Comments / Location

Asset 1384.
1386.









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	260

Energy Ratio E_r (%): **55**

Signed:

Title: Operations Manager

The recommended calibration interval is 12 months

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Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwoods Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref:	1369
Test Date:	12/02/2022
Report Date:	14/02/2022
File Name:	1369.spt
Test Operator:	NPB

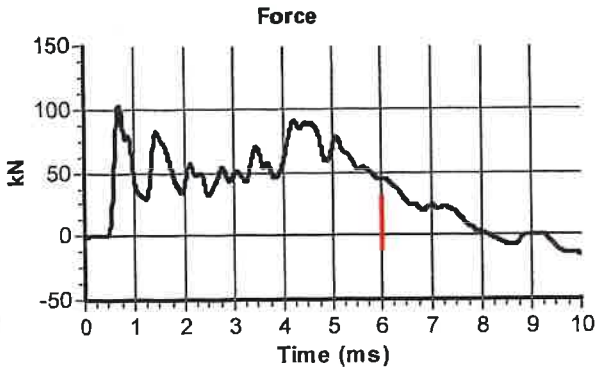
Instrumented Rod Data

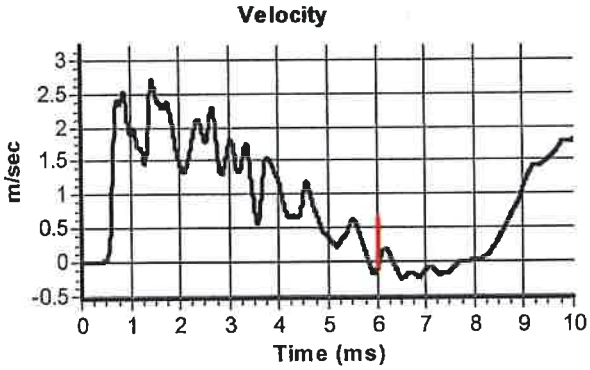
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	64786
Accelerometer No.2:	64789

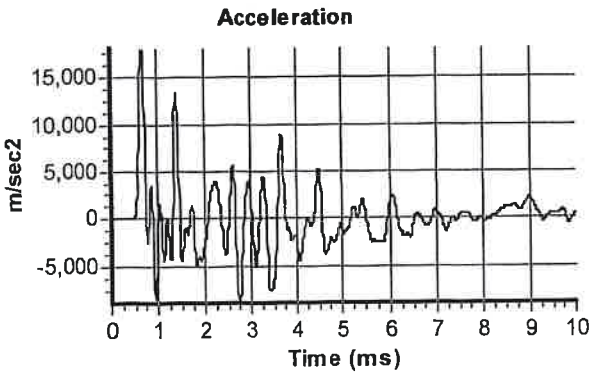
SPT Hammer Information

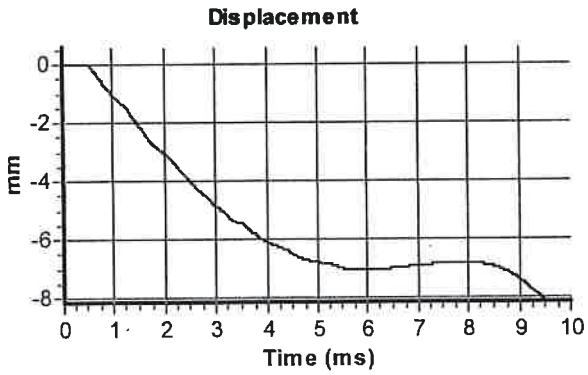
Hammer Mass m (kg):	63.0
Falling Height h (mm):	760
SPT String Length L (m):	12.0

Comments / Location
CAUSEWAY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	410

Energy Ratio E_r (%): **87**

The recommended calibration interval is 12 months

N Burrows

Signed: N Burrows
Title: FOC Manager

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Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic Sampling Uk Ltd
Unit 8 Victory Park
Victory Road
Derby
DE24 8ZF

Hammer Ref:	D129 **(Asset No. 1411)**
Test Date:	25/04/2022
Report Date:	25/04/2022
File Name:	D129.spt
Test Operator:	B.HUNTER

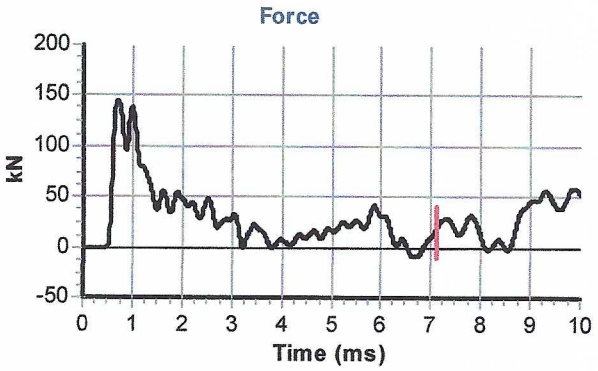
Instrumented Rod Data

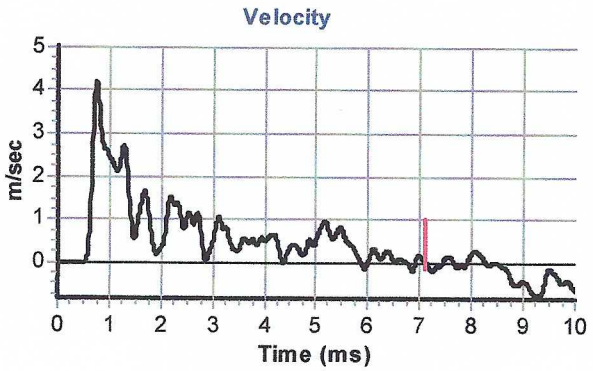
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.5
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	62902

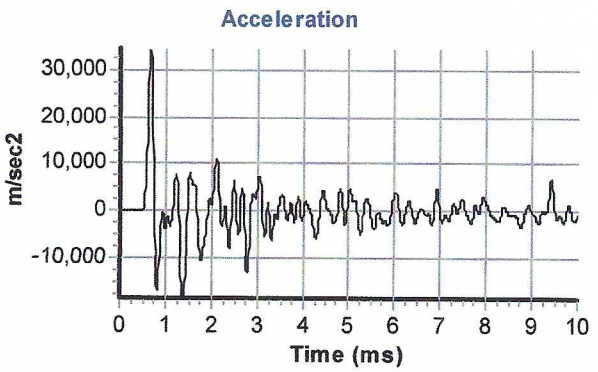
Hammer Information

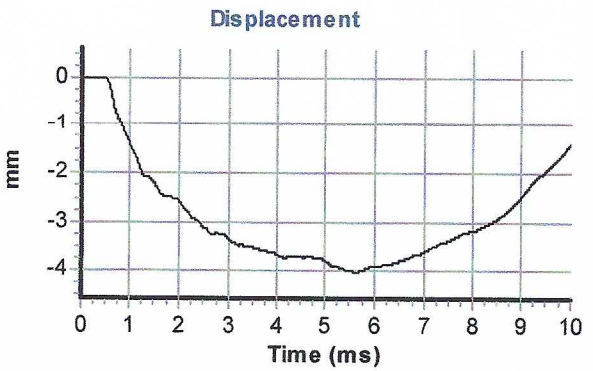
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	970
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	320

Energy Ratio E_r (%): **68**

Signed: B.Hunter

Title: Operations Manager

The recommended calibration interval is 12 months

SPTMAN ver.Hammer Energy ver. 1.93 All rights reserved, Testconsult ©2010

DICHIARAZIONE DI CONFORMITA' SPT
SPT CONFORMITY DECLARATION

Il sottoscritto, in qualità di Fabbricante:
We undersigned, as Manufacturer:

FRASTE S.P.A.
via Molino di Sopra, 71
37054 Nogara (VR) - Italia
Partita IVA CE IT 02248120236

dichiara sotto la propria responsabilità che il componente di seguito descritto:
hereby declare, under our own responsibility that the component described below:

Categoria *Category*	SPT (Prova Penetrometrica Dinamica) *SPT (Standard Penetration Test)*
Marca *Brand*	FRASTE
Tipo *Type*	SPT
Installato su perforatrice matricola numero Assembled on drilling rig serial number	X2107333
Massa del martello *Mass of the hammer*	63,5 ± 0.5 kg
Altezza di caduta *Falling height*	760 ± 10 mm
Enegia teorica *Energy theorical*	473 J
Enegia misurata *Energy measured*	385 J

è stato costruito e testato in conformità alla seguente normativa:
has been manufactured and tested in accordance with the following normative:

1. Norma EN ISO 22476-3:2012 che specifica i requisiti per le indagini indirette dei terreni mediante prova di penetrazione dinamica SPT.
   Normative EN ISO 22476-3:2012 that specifies requirements for indirect investigations of soil by dynamic penetration test SPT

(*) Il valore di energia misurato, è stato ottenuto testando l'SPT nuovo e in condizioni di pulizia e lubrificazione ottimali, in modo da ridurre al minimo gli attriti che si generano durante il funzionamento.

(*) The value of measured energy, was obtained by testing the SPT new and in clean conditions and optimal lubrication, so as to minimize the friction generated during the operation.

Il detentore della documentazione tecnica è individuato nella figura del Sig. Fracca Vittorio presso la sede della FRASTE SPA.

The holder of the technical documentation is identified in the figure of Mr. Vittorio Fracca at the Fraste SPA headquarters.

Nogara, 25/11/2021

FRASTE SPA
Fracca Vittorio
General Manager/Technical Director

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwood Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref: 1353
Test Date: 28/03/2022
Report Date: 01/04/2022
File Name: 1353.spt
Test Operator: NPB

Instrumented Rod Data

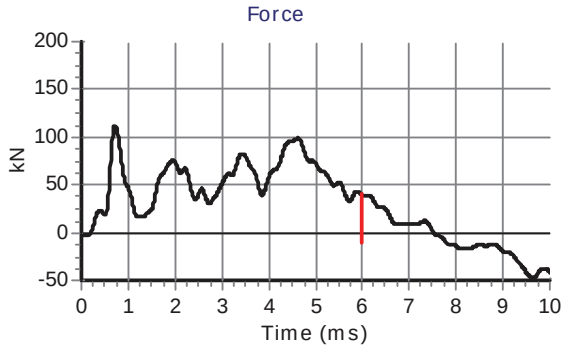
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.3
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 6458
Accelerometer No.2: 9607

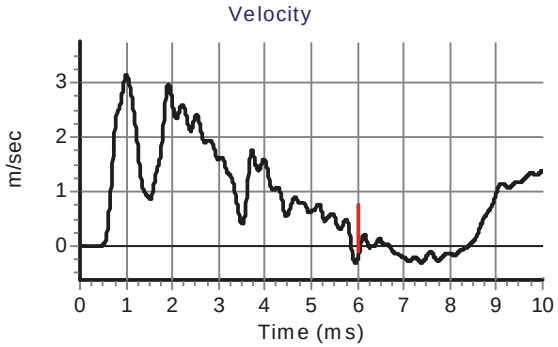
SPT Hammer Information

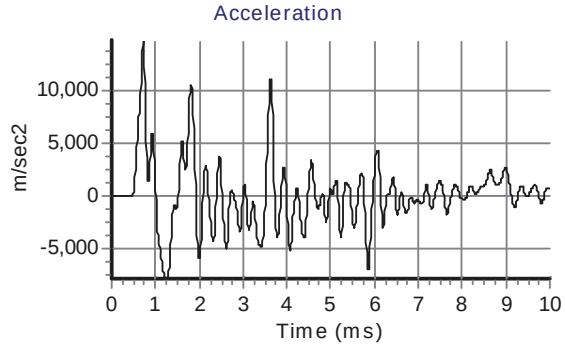
Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 11.0

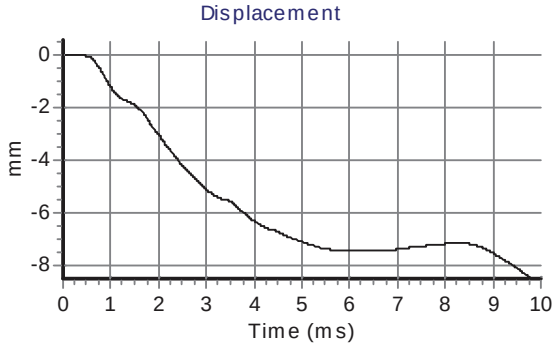
Comments / Location

BALLYMONEY









Calculations

Area of Rod A (mm2): 944
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 363

Energy Ratio E_r (%): 77

The recommended calibration interval is 12 months

Signed: N P Burrows
Title: Field Operations Manager

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CAUSEWAY GEOTECH

APPENDIX 2B

DYNAMIC SAMPLING RECORDS



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).

Stratum Legend Key



101
TOPSOIL



102
MADE GROUND



103
MADE GROUND



104
CONCRETE



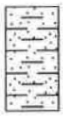
105
WOOD



201
CLAY



202
Silty CLAY



203
Sandy CLAY



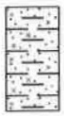
204
Gravelly CLAY



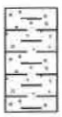
205
Cobbly CLAY



206
Bouldery CLAY



207
Silty sandy CLAY



208
Silty gravelly CLAY



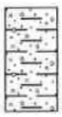
209
Silty cobbly CLAY



210
Silty bouldery CLAY



211
Silty sandy gravelly CLAY



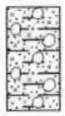
212
Silty sandy cobbly CLAY



213
Silty sandy bouldery CLAY



214
Silty sandy gravelly cobbly CLAY



215
Silty sandy gravelly bouldery CLAY



216
Silty sandy gravelly cobbly bouldery CLAY



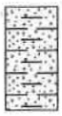
217
Silty sandy peaty CLAY



218
Silty sandy gravelly peaty CLAY



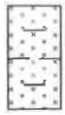
219
Silty peaty CLAY



220
Sandy gravelly CLAY



301
SILT



302
Clayey SILT



303
Sandy SILT



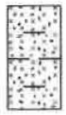
304
Gravelly SILT



305
Peaty SILT



306
Clayey sandy SILT



307
Gravelly clayey SILT



308
Sandy gravelly clayey SILT



309
Clayey bouldery SILT



310
Sandy gravelly SILT



312
Clayey sandy gravelly SILT



313
Clayey sandy gravelly peaty SILT



314
Clayey sandy gravelly peaty cobbly SILT



316
Sandy cobbly SILT



317
Sandy bouldery SILT

CAUSEWAY GEOTECH

Stratum Legend Key


318
Sandy peaty SILT


319
Sandy gravelly peaty SILT


320
Sandy gravelly cobbly SILT


321
Sandy gravelly peaty cobbly SILT


322
Gravelly cobbly SILT


323
Gravelly bouldery SILT


324
Gravelly peaty SILT


325
Gravelly peaty cobbly SILT


326
Cobbly SILT


327
Cobbly bouldery SILT


328
Peaty cobbly SILT


329
Clayey cobbly SILT


330
Clayey peaty SILT

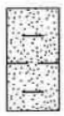

331
Bouldery SILT


332
slightly shelly SILT


333
very shelly SILT


334
Sandy clayey peaty SILT


401
SAND


402
Clayey SAND


403
Silty SAND


404
Gravelly SAND


405
Cobbly SAND


406
Bouldery SAND


407
Clayey silty SAND


408
Clayey silty gravelly SAND


409
Clayey silty gravelly cobbly SAND


410
Clayey gravelly SAND


411
Clayey gravelly cobbly SAND


412
Silty gravelly SAND


413
Silty gravelly cobbly SAND


414
Silty gravelly cobbly bouldery SAND


415
Gravelly cobbly SAND


416
Gravelly cobbly bouldery SAND


417
Gravelly bouldery SAND


418
Cobbly bouldery SAND


430
SAND and GRAVEL


431
Peaty SAND


432
Clayey peaty SAND


433
Silty peaty SAND


434
Gravelly peaty SAND

CAUSEWAY GEOTECH

Stratum Legend Key



435
Cobbly peaty SAND



436
Bouldery peaty SAND



437
Clayey silty peaty SAND



438
Clayey silty gravelly peaty SAND



439
slightly shelly SAND



440
very shelly SAND



441
slightly shelly silty SAND



442
very shelly silty SAND



443
slightly shelly silty gravelly SAND



444
very shelly silty gravelly SAND



501
GRAVEL



502
Clayey GRAVEL



503
Silty GRAVEL



504
Sandy GRAVEL



505
Peaty GRAVEL



506
Cobbly GRAVEL



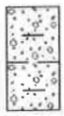
507
Bouldery GRAVEL



508
Clayey silty GRAVEL



509
Clayey sandy GRAVEL



510
Clayey cobbly GRAVEL



511
Clayey bouldery GRAVEL



512
Clayey peaty GRAVEL



513
Clayey silty sandy GRAVEL



514
Clayey silty cobbly GRAVEL



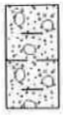
515
Clayey silty bouldery GRAVEL



516
Clayey silty peaty GRAVEL



517
Clayey sandy peaty GRAVEL



518
Clayey silty sandy bouldery GRAVEL



519
Clayey silty sandy peaty GRAVEL



520
Silty sandy GRAVEL



521
Silty cobbly GRAVEL



522
Silty bouldery GRAVEL



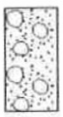
523
Silty peaty GRAVEL



524
Silty peaty sandy GRAVEL



525
Sandy cobbly GRAVEL



526
Sandy bouldery GRAVEL



527
Sandy peaty GRAVEL



528
Silty sandy cobbly GRAVEL



601
PEAT



602
Clayey PEAT

CAUSEWAY GEOTECH

Stratum Legend Key



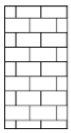
801
Mudstone



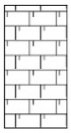
802
Siltstone



803
Sandstone



804
Limestone



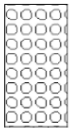
805
Chalk



806
Coal



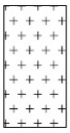
807
Breccia



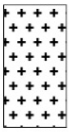
808
Conglomerate



809
Fine grained igneous



810
Medium grained igneous



811
Coarse grained igneous



812
Fine grained metamorphic



813
Medium grained
metamorphic



814
Coarse grained
metamorphic



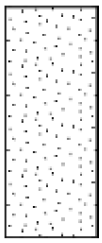
815
Pyroclastic
(volcanic ash)



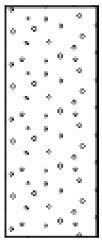
816
Gypsum, rocksalt

CAUSEWAY
GEOTECH

Backfill Legend Key



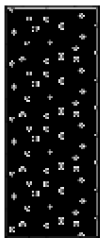
901
Sand backfill



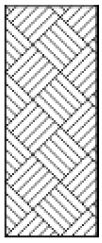
902
Gravel backfill



903
Bentonite



904
Grout



905
Arisings



906
Concrete

CAUSEWAY GEOTECH

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS001

Client: Irish Water

Client's Rep: Mott MacDonald

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	4.00	570306.66 E 670154.22 N

Final Depth: 4.00 m **Start Date:** 03/08/2022 **Driller:** JD

Elevation: 28.91 mOD **End Date:** 03/08/2022 **Logger:** TH

Sheet 1 of 1
Scale: 1:50
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10	D1				28.80	0.10		TOPSOIL [TOPSOIL]		
0.30	D2				28.60	0.30		Soft dark brown slightly gravelly sandy CLAY with occasional rootlets. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. [ALLUVIUM]		
0.30 - 0.80	B6									
0.80	D3				28.10	0.80		Firm orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [ALLUVIUM]		
0.80 - 1.40	B7									
1.20 - 1.65	SPT (S)	N=13 (2,2/3,3,3,4) Hammer SN = 0269	1.00							
1.40	D4				27.50	1.40		Firm to stiff orangish brown mottled grey slightly sandy CLAY. Sand is fine to coarse. [GLACIAL TILL]		
1.40 - 2.70	B8									
2.00 - 2.45	SPT (S)	N=17 (3,3/4,4,4,5) Hammer SN = 0269	2.00					Stiff brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
2.70	D5				26.20	2.70				
2.70 - 4.00	B9							Stiff greyish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
3.00 - 3.45	SPT (S)	N=19 (4,4/5,4,5,5) Hammer SN = 0269	3.00							
4.00 - 4.45	SPT (S)	N=23 (4,5/5,6,6,6) Hammer SN = 0269	4.00		24.90	4.00		End of Borehole at 4.00m		

Water Strikes

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

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on virtual refusal of sampler at 4.00m

Last Updated

25/11/2022

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS002
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	3.00	570364.04 E 670105.92 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1
3.00 m	02/08/2022	JD	Scale: 1:50
Elevation: 29.02 mOD	**End Date:** 02/08/2022	**Logger:** TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					28.82	0.20		TOPSOIL [TOPSOIL]		
0.50	B1							Soft greyish brown mottled orangish brown slightly sandy CLAY. Sand is fine to medium. [ALLUVIUM]		
1.10	B2				28.02	1.00				
1.20	D4							Firm to stiff brownish grey slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [GLACIAL TILL]		
1.20 - 1.65	SPT (S)	N=18 (2,3/3,5,5,5) Hammer SN = 0269	1.00							
2.00	B3				27.02	2.00			▼	
2.00	D5							Stiff brown slightly sandy CLAY. Sand is fine to coarse. [GLACIAL TILL]		
2.00 - 2.45	SPT (S)	N=21 (2,4/5,5,4,7) Hammer SN = 0269 Water strike at 2.00m	2.00							
3.00	D6				26.02	3.00		End of Borehole at 3.00m		
3.00 - 3.44	SPT (S)	N=50 (6,8/50 for 295mm) Hammer SN = 0269	3.00							

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.00		20	2.00

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on virtual refusal of sampler at 3.00m

Last Updated

25/11/2022

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS005
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	1.30	570838.34 E 669999.19 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1
1.30 m	02/08/2022	JD	Scale: 1:50
Elevation: 29.71 mOD	**End Date:** 02/08/2022	**Logger:** TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10	B1				29.60	0.10		TOPSOIL [TOPSOIL]		
0.30	B2				29.40	0.30		Soft greyish brown mottled orangish brown slightly sandy CLAY. Sand is fine to coarse. [ALLUVIUM]		
1.20	D3							Firm to stiff bluish grey mottled orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
1.20 - 1.42	SPT (S)	N=50 (3,21/50 for 70mm) Hammer SN = 0269	1.00		28.40	1.30		End of Borehole at 1.30m		

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

Remarks

Hand dug inspection pit excavated to 1.20m
Rebore attempted at RWRM-DS005A

Termination Reason

Terminated on virtual refusal of sampler at 1.30m

Last Updated

25/11/2022

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS005A
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet / Scale
Dynamic Sampling	Dando Terrier	0.00	1.30	570836.35 E 669998.64 N	1.30 m	02/08/2022	JD	Sheet 1 of 1 Scale: 1:50
					Elevation: 29.65 mOD	End Date: 02/08/2022	Logger: TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10	B1				29.55	0.10		TOPSOIL [TOPSOIL]		
0.30	B2				29.35	0.30		Soft greyish brown mottled orangish brown slightly sandy CLAY. Sand is fine to coarse. [ALLUVIUM]		
1.20	D3				28.35	1.30		Firm to stiff bluish grey mottled orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [GLACIAL TILL]		
								End of Borehole at 1.30m		

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

Remarks

Hand dug inspection pit excavated to 1.20m
Rebore of RWRM-DS005; virtual refusal at 1.30m

Termination Reason

Terminated on virtual refusal of sampler at 1.30m

Last Updated

25/11/2022

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS006
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates	Final Depth:	Start Date:	Driller:	Sheet 1 of 1
Dynamic Sampling	Dando Terrier	0.00	4.00	571137.08 E 670114.07 N	4.00 m	28/07/2022	JD	Scale: 1:50
					Elevation: 33.08 mOD	End Date: 28/07/2022	Logger: TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10	B1				32.98	0.10		TOPSOIL [TOPSOIL] Soft to firm light brown slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [ALLUVIUM]		
1.00	B2									
1.20	D3									
1.20 - 1.65	SPT (S)	N=1 (0,1/0,0,1,0) Hammer SN = 0269	1.00		31.78	1.30		Low plasticity dark brown pseudo-fibrous slightly gravelly PEAT. Gravel is angular fine to medium of various lithologies. [PEAT]		
2.00 - 2.45	SPT (S)	N=8 (3,3/3,2,1,2) Hammer SN = 0269 Water strike at 2.00m	2.00		31.08	2.00		Loose grey very sandy clayey subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]		
2.50	B4									
3.00 - 3.45	SPT (C)	N=10 (0,0/1,1,3,5) Hammer SN = 0269 Water strike at 3.00m	3.00		29.88	3.20		Firm to stiff brownish grey slightly sandy CLAY. Sand is fine to medium. [GLACIAL TILL]		
3.50	B5									
4.00	D6				29.08	4.00		End of Borehole at 4.00m		
4.00 - 4.37	SPT (S)	N=50 (8,9/50 for 220mm) Hammer SN = 0269	4.00							

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.00		20	2.00
3.00		30	2.50

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on virtual refusal of sampler at 4.00m

Last Updated

25/11/2022

AGS

CAUSEWAY GEOTECH

Project No.	Project Name	Borehole ID
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	RWRM-DS007
	Client: Irish Water	
	Client's Rep: Mott MacDonald	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	3.00	571283.59 E 670090.83 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1
3.00 m	29/07/2022	JD	Scale: 1:50
Elevation: 34.60 mOD	**End Date:** 29/07/2022	**Logger:** TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10	B1				34.50	0.10		TOPSOIL [TOPSOIL]		
0.30	B2				34.30	0.30		Soft brown slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies. [ALLUVIUM]		
1.00	B3				33.60	1.00		Soft to firm greyish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of various lithologies. [ALLUVIUM]		
1.20	D4									
1.20 - 1.65	SPT (S)	N=17 (0,2/2,7,5,3) Hammer SN = 0269	1.00					Firm to stiff grey mottled orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [GLACIAL TILL]		
2.00	D5									
2.00 - 2.45	SPT (S)	N=27 (3,5/5,6,8,8) Hammer SN = 0269	2.00							
					32.10	2.50		Very stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. [GLACIAL TILL]		
3.00	D6				31.60	3.00		End of Borehole at 3.00m		
3.00 - 3.29	SPT (S)	N=50 (8,10/50 for 140mm) Hammer SN = 0269	3.00							

Water Strikes

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

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m

Termination Reason

Terminated on virtual refusal of sampler at 3.00m

Last Updated

25/11/2022

AGS

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwood Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref:	T4
Test Date:	27/02/2021
Report Date:	01/03/2021
File Name:	T4.spt
Test Operator:	NPB

Instrumented Rod Data

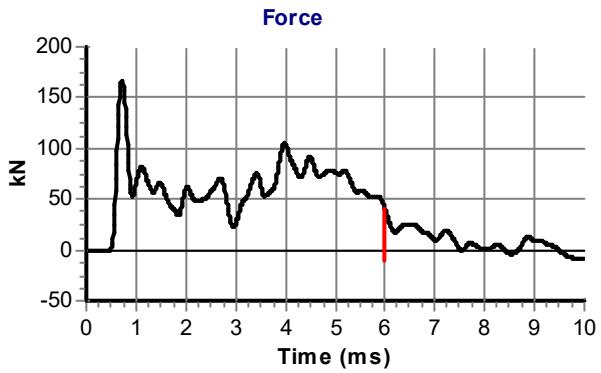
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6458
Accelerometer No.2:	9607

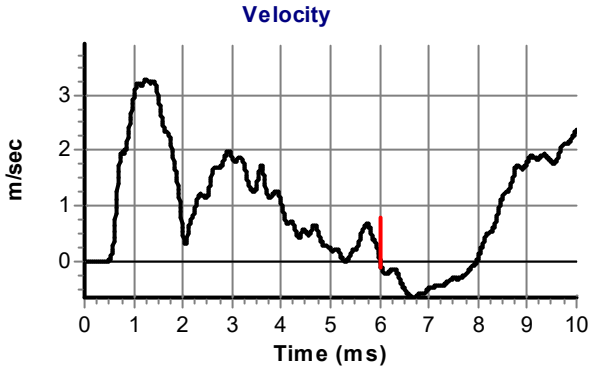
SPT Hammer Information

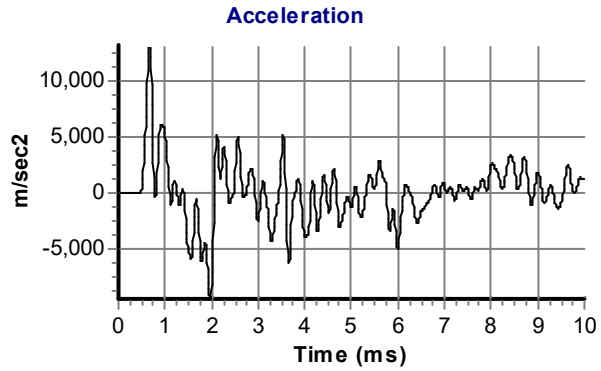
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	11.0

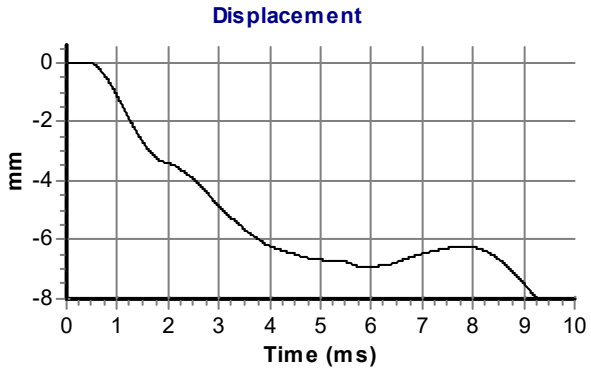
Comments / Location

BALLYMONEY









Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	433

Energy Ratio E_r (%): **91**

Signed: N P Burrows

Title: Field Operations Manager

The recommended calibration interval is 12 months

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CAUSEWAY GEOTECH

APPENDIX 2C

TRIAL PIT RECORDS



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).

Stratum Legend Key



101
TOPSOIL



102
MADE GROUND



103
MADE GROUND



104
CONCRETE



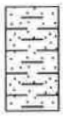
105
WOOD



201
CLAY



202
Silty CLAY



203
Sandy CLAY



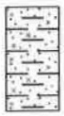
204
Gravelly CLAY



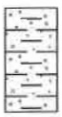
205
Cobbly CLAY



206
Bouldery CLAY



207
Silty sandy CLAY



208
Silty gravelly CLAY



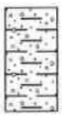
209
Silty cobbly CLAY



210
Silty bouldery CLAY



211
Silty sandy gravelly CLAY



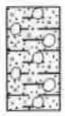
212
Silty sandy cobbly CLAY



213
Silty sandy bouldery CLAY



214
Silty sandy gravelly cobbly CLAY



215
Silty sandy gravelly bouldery CLAY



216
Silty sandy gravelly cobbly bouldery CLAY



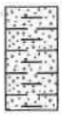
217
Silty sandy peaty CLAY



218
Silty sandy gravelly peaty CLAY



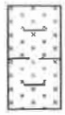
219
Silty peaty CLAY



220
Sandy gravelly CLAY



301
SILT



302
Clayey SILT



303
Sandy SILT



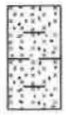
304
Gravelly SILT



305
Peaty SILT



306
Clayey sandy SILT



307
Gravelly clayey SILT



308
Sandy gravelly clayey SILT



309
Clayey bouldery SILT



310
Sandy gravelly SILT



312
Clayey sandy gravelly SILT



313
Clayey sandy gravelly peaty SILT



314
Clayey sandy gravelly peaty cobbly SILT



316
Sandy cobbly SILT



317
Sandy bouldery SILT

CAUSEWAY GEOTECH

Stratum Legend Key


318
Sandy peaty SILT


319
Sandy gravelly peaty SILT


320
Sandy gravelly cobbly SILT


321
Sandy gravelly peaty cobbly SILT


322
Gravelly cobbly SILT


323
Gravelly bouldery SILT


324
Gravelly peaty SILT


325
Gravelly peaty cobbly SILT


326
Cobbly SILT


327
Cobbly bouldery SILT


328
Peaty cobbly SILT


329
Clayey cobbly SILT


330
Clayey peaty SILT

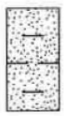

331
Bouldery SILT


332
slightly shelly SILT


333
very shelly SILT


334
Sandy clayey peaty SILT


401
SAND


402
Clayey SAND


403
Silty SAND


404
Gravelly SAND


405
Cobbly SAND


406
Bouldery SAND


407
Clayey silty SAND


408
Clayey silty gravelly SAND


409
Clayey silty gravelly cobbly SAND


410
Clayey gravelly SAND


411
Clayey gravelly cobbly SAND


412
Silty gravelly SAND


413
Silty gravelly cobbly SAND


414
Silty gravelly cobbly bouldery SAND


415
Gravelly cobbly SAND


416
Gravelly cobbly bouldery SAND


417
Gravelly bouldery SAND


418
Cobbly bouldery SAND


430
SAND and GRAVEL


431
Peaty SAND


432
Clayey peaty SAND


433
Silty peaty SAND


434
Gravelly peaty SAND

CAUSEWAY GEOTECH

Stratum Legend Key



435
Cobbly peaty SAND



436
Bouldery peaty SAND



437
Clayey silty peaty SAND



438
Clayey silty gravelly peaty SAND



439
slightly shelly SAND



440
very shelly SAND



441
slightly shelly silty SAND



442
very shelly silty SAND



443
slightly shelly silty gravelly SAND



444
very shelly silty gravelly SAND



501
GRAVEL



502
Clayey GRAVEL



503
Silty GRAVEL



504
Sandy GRAVEL



505
Peaty GRAVEL



506
Cobbly GRAVEL



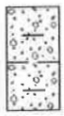
507
Bouldery GRAVEL



508
Clayey silty GRAVEL



509
Clayey sandy GRAVEL



510
Clayey cobbly GRAVEL



511
Clayey bouldery GRAVEL



512
Clayey peaty GRAVEL



513
Clayey silty sandy GRAVEL



514
Clayey silty cobbly GRAVEL



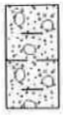
515
Clayey silty bouldery GRAVEL



516
Clayey silty peaty GRAVEL



517
Clayey sandy peaty GRAVEL



518
Clayey silty sandy bouldery GRAVEL



519
Clayey silty sandy peaty GRAVEL



520
Silty sandy GRAVEL



521
Silty cobbly GRAVEL



522
Silty bouldery GRAVEL



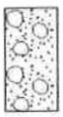
523
Silty peaty GRAVEL



524
Silty peaty sandy GRAVEL



525
Sandy cobbly GRAVEL



526
Sandy bouldery GRAVEL



527
Sandy peaty GRAVEL



528
Silty sandy cobbly GRAVEL



601
PEAT



602
Clayey PEAT

CAUSEWAY GEOTECH

Stratum Legend Key



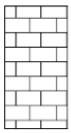
801
Mudstone



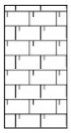
802
Siltstone



803
Sandstone



804
Limestone



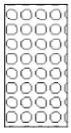
805
Chalk



806
Coal



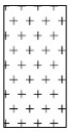
807
Breccia



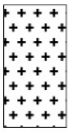
808
Conglomerate



809
Fine grained igneous



810
Medium grained igneous



811
Coarse grained igneous



812
Fine grained metamorphic



813
Medium grained
metamorphic



814
Coarse grained
metamorphic



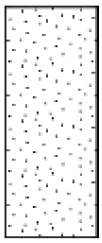
815
Pyroclastic
(volcanic ash)



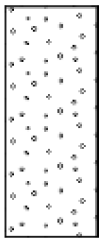
816
Gypsum, rocksalt

CAUSEWAY
GEOTECH

Backfill Legend Key



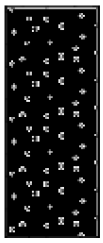
901
Sand backfill



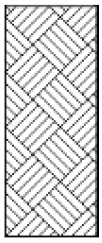
902
Gravel backfill



903
Bentonite



904
Grout



905
Arisings



906
Concrete

CAUSEWAY GEOTECH

CAUSEWAY GEOTECH

Project No. 21-1682	**Project Name:** Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only		**Trial Pit ID** RWRM-TP002
Coordinates 570368.93 E 670128.79 N	**Client:** Irish Water		
Method: Trial Pitting	**Client's Representative:** Mott MacDonald		Sheet 1 of 1 Scale: 1:25
Plant: 8t Wheeled Excavator	**Elevation** 28.74 mOD	**Date:** 16/08/2022	**Logger:** DC	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
						TOPSOIL [TOPSOIL]	
0.30 - 0.60	B1		28.44	0.30		Soft light brown sandy gravelly CLAY with rare rootlets. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]	
0.60 - 1.40	B2		28.14	0.60		Firm greyish orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of various lithologies. [ALLUVIUM]	
1.40 - 1.90	B3		27.34	1.40		Firm brownish grey slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of various lithologies. Cobbles are subangular to subrounded of limestone. [GLACIAL TILL]	
1.90 - 3.10	B4		26.84	1.90		Very soft brownish grey slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subangular to subrounded of limestone. [GLACIAL TILL]	
		Steady flow at 2.30m					▼
			25.64	3.10		End of trial pit at 3.10m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks
2.30	Steady flow at 2.30m

Depth: 3.10
Width: 0.65
Length: 2.50

Remarks:
Material unsuitable for hand vane
Backfilled with arisings

Stability:	Termination Reason	Last Updated
Unstable	Terminated due to water ingress and pit wall collapse	25/11/2022

AGS

CAUSEWAY GEOTECH

Project No. 21-1682	**Project Name:** Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only		**Trial Pit ID** RWRM-TP003
Coordinates 570468.73 E 670140.15 N	**Client:** Irish Water		
Method: Trial Pitting	**Client's Representative:** Mott MacDonald		Sheet 1 of 1 Scale: 1:25
Plant: 8t Wheeled Excavator	**Elevation** 29.52 mOD	**Date:** 16/08/2022	**Logger:** DC	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
						TOPSOIL [TOPSOIL]	
0.25 - 0.90	B1		29.27	0.25		Light brown sandy slightly clayey subrounded fine to coarse GRAVEL of various lithologies with high cobble content and occasional rootlets. Sand is fine to coarse. Cobbles are subangular to subrounded of various lithologies. [FLUVIOGLACIAL]	
0.90 - 1.30	B2		28.62	0.90		Brown very sandy clayey subrounded fine to coarse GRAVEL of various lithologies with rare rootlets. Sand is fine to coarse. [FLUVIOGLACIAL]	
1.30 - 2.30	B3		28.22	1.30		Brown very sandy clayey subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. [FLUVIOGLACIAL]	
		Fast seepage at 2.20m					▼
			27.22	2.30		End of trial pit at 2.30m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks
2.20	Fast seepage at 2.20m

Depth: 2.30
Width: 0.60
Length: 2.30

Remarks:
Material unsuitable for hand vane
Backfilled with arisings

Stability: Unstable

Termination Reason: Terminated due to water ingress and pit wall collapse

Last Updated: 25/11/2022

AGS

CAUSEWAY GEOTECH

Project No. 21-1682	**Project Name:** Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only		**Trial Pit ID** RWRM-TP007
Coordinates 570830.85 E 670041.27 N	**Client:** Irish Water		
Method: Trial Pitting	**Client's Representative:** Mott MacDonald		Sheet 1 of 1 Scale: 1:25
Plant: 13t Tracked Excavator	**Elevation** 29.59 mOD	**Date:** 12/07/2022	**Logger:** NP	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			29.59	0.00		TOPSOIL [TOPSOIL]	
0.50	B1		29.34	0.25		Very soft bluish grey slightly sandy slightly gravelly CLAY with occasional rootlets. Sand is fine to coarse. Gravel is subangular fine of various lithologies. [ALLUVIUM]	
0.50	D3						
			28.49	1.10		Bluish grey sandy clayey subrounded fine to coarse GRAVEL of various lithologies with low cobble content. Sand is fine to coarse. Cobbles are subangular of limestone. [FLUVIOGLACIAL]	
1.30	B2						
1.30	D4						
		Water strike at 1.50m	28.09	1.50		End of trial pit at 1.50m	▼

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes

Struck at (m)	Remarks
1.50	Water strike at 1.50m

Depth: 1.50
Width: 0.80
Length: 3.60

Remarks:
Material unsuitable for hand vane
Backfilled with arisings

Stability: Unstable

Termination Reason: Terminated due to water ingress and pit wall collapse

Last Updated: 25/11/2022

AGS

CAUSEWAY GEOTECH

APPENDIX 2E

FIELD / IN-SITU TEST RESULTS



VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

Project Name: Water Supply Project
Project No.: 21-1682
Test Date: 20/06/2022

Borehole No.: RWRM-BH007
Test No.: 1
Type of test: Falling Head

Diameter of casing (D):	0.20m
Height of top of casing above ground level:	0.23m
Depth to bottom of casing below ground level:	1.40m
Depth to bottom of borehole below ground level:	1.70m
Length of the test section (L):	0.30m
Standing ground water level (SWL) below ground leve	Dry

DATUM: Water level measured from top of casing, i.e. SWL is 1.93m below datum

TIME ELAPSED (mins)	WATER LEVEL (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.20	1.73	1.00
1	0.21	1.72	0.99
2	0.22	1.71	0.99
3	0.23	1.70	0.98
4	0.24	1.69	0.98
5	0.26	1.67	0.97
10	0.31	1.62	0.94
15	0.32	1.61	0.93
20	0.33	1.60	0.92
25	0.34	1.59	0.92
30	0.35	1.58	0.91
40	0.37	1.56	0.90
50	0.39	1.54	0.89
60	0.41	1.53	0.88
75	0.42	1.52	0.88
90	0.42	1.51	0.87
120	0.43	1.50	0.87

CALCULATION OF PERMEABILITY:

Employing Horslev Method (1951)

$$k = \frac{2.3A}{F(t_2 - t_1)} \log \frac{h_1}{h_2}$$

where: k is the permeability of soil

A is the cross-section area of borehole/standpipe

F is the shape factor (see below)

h_1 and h_2 are the hydraulic heads measured respectively at the times t1 (start of test) and t2 (0.37 head reached)

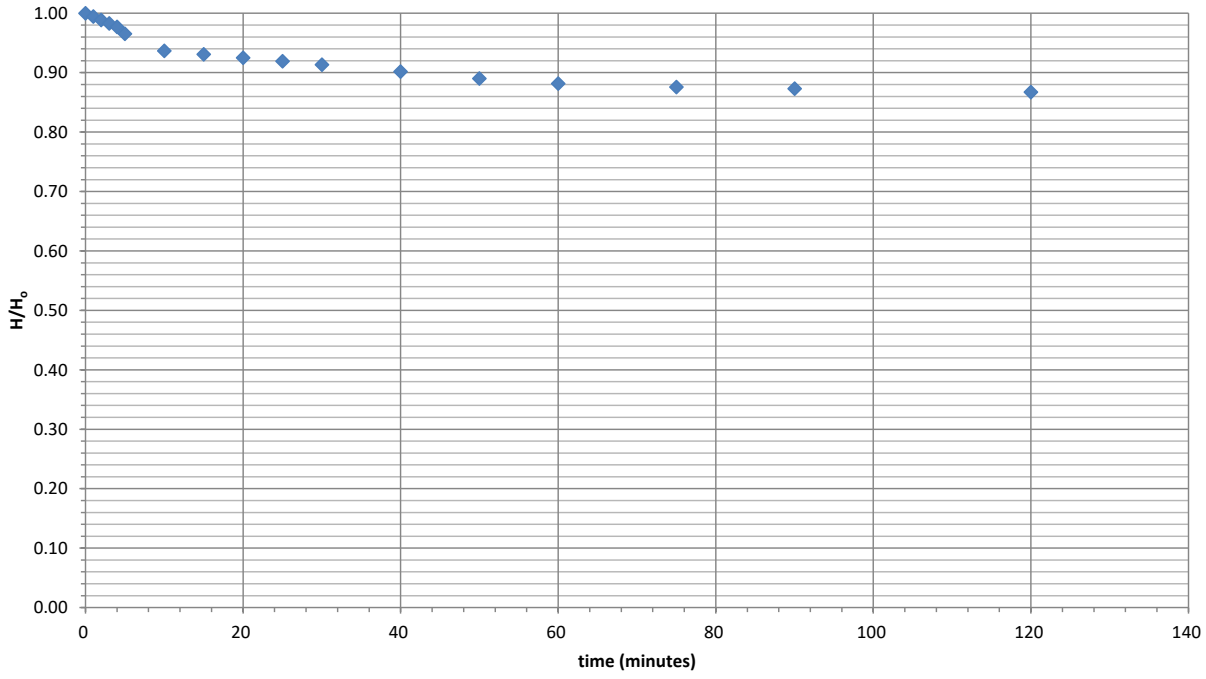
Values for the shape factor (F) are given for various conditions (cases A-E) in Annex B of BS EN ISO 22282-1:2012

L/D is 1.5, so Case D is assumed, therefore:

*=(2*π*L)/(LN((L/D)+√((L/D)^2)+1)*

i.e.	F =	1.58	(m)
	A =	0.031	(m^2)
	h_1 =	1.73	(m)
	h_2 =	0.64	(m)
	t_1 =	0	(s)
	t_2 =	N/A	(s)

Permeability unable to be calculated due to water not dropping to 37% of initial Head



VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

Project Name: Water Supply Project
Project No.: 21-1682
Test Date: 22/06/2022

Borehole No.: RWRM-BH010
Test No.: 1
Type of test: Falling Head

Diameter of casing (D):	0.20m
Height of top of casing above ground level:	0.20m
Depth to bottom of casing below ground level:	4.50m
Depth to bottom of borehole below ground level:	5.60m
Length of the test section (L):	1.10m
Standing ground water level (SWL) below ground level:	Dry

DATUM: Water level measured from top of casing, i.e. SWL is 5.80m below datum

TIME ELAPSED (mins)	WATER LEVEL (m)	HEAD H (m)	HEAD RATIO H/Ho
0	0.20	5.60	1.00
1	0.22	5.58	1.00
2	0.24	5.56	0.99
3	0.26	5.54	0.99
4	0.27	5.53	0.99
5	0.29	5.51	0.98
10	0.33	5.47	0.98
15	0.35	5.45	0.97
20	0.38	5.42	0.97
25	0.41	5.39	0.96
30	0.45	5.35	0.96
40	0.53	5.27	0.94
50	0.58	5.22	0.93
60	0.64	5.16	0.92
75	0.70	5.10	0.91
90	0.76	5.04	0.90
120	0.98	4.82	0.86

CALCULATION OF PERMEABILITY:

Employing Horslev Method (1951)

$$k = \frac{2.3A}{F(t_2 - t_1)} \log \frac{h_1}{h_2}$$

where: k is the permeability of soil

A is the cross-section area of borehole/standpipe

F is the shape factor (see below)

h_1 and h_2 are the hydraulic heads measured respectively at the times t1 (start of test) and t2 (0.37 head reached)

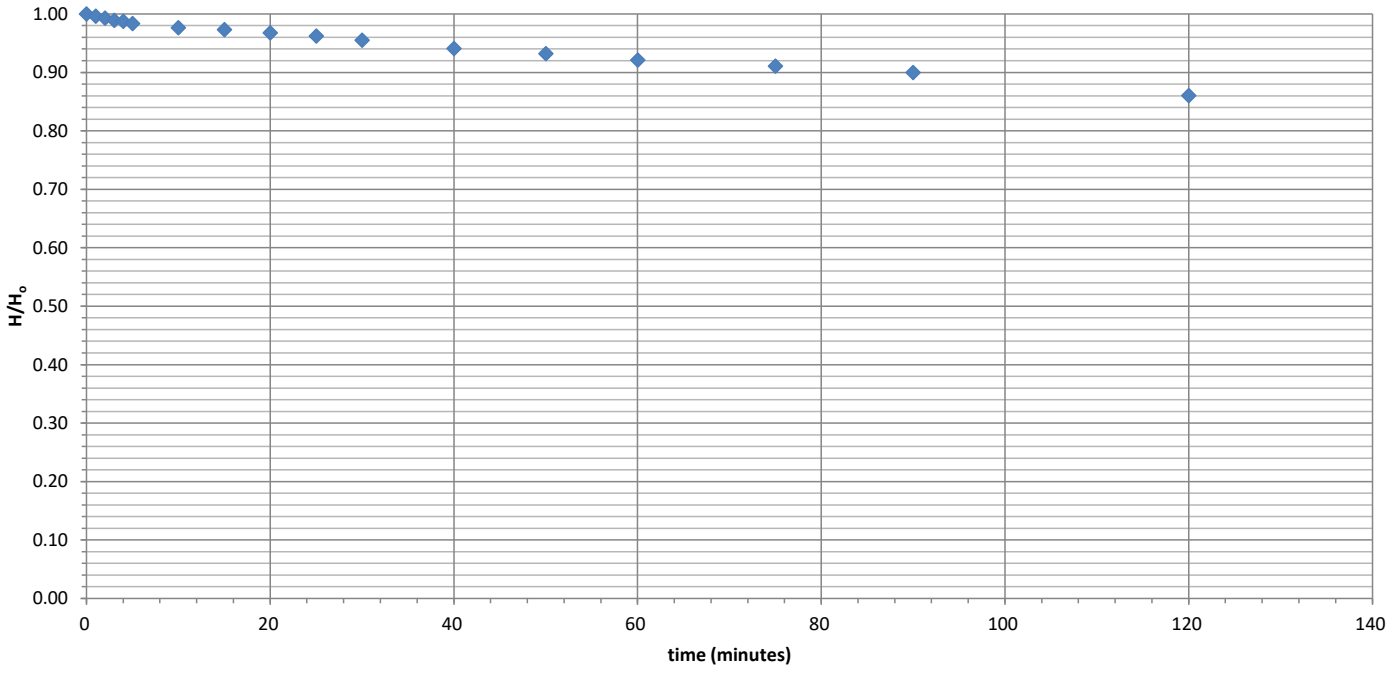
Values for the shape factor (F) are given for various conditions (cases A-E) in Annex B of BS EN ISO 22282-1:2012

L/D is 5.5, so Case D is assumed, therefore:

$F=(2*\pi*L)/(LN((L/D)+\sqrt{((L/D)^2)+1}))$

i.e.	F =	2.87 (m)
	A =	0.031 (m^2)
	h_1 =	5.60 (m)
	h_2 =	2.07 (m)
	t_1 =	0 (s)
	t_2 =	N/A (s)

Permeability unable to be calculated due to water not dropping to 37% of initial Head



VARIABLE HEAD PERMEABILITY TEST (BOREHOLE)

Project Name: Water Supply Project
Project No.: 21-1682
Test Date: 08/06/2022

Borehole No.: RWRM-BH021
Test No.: 1
Type of test: Falling Head

Diameter of casing (D):	0.20m
Height of top of casing above ground level:	1.20m
Depth to bottom of casing below ground level:	5.00m
Depth to bottom of borehole below ground level:	6.00m
Length of the test section (L):	1.00m
Standing ground water level (SWL) below ground leve	Dry

DATUM: Water level measured from top of casing, i.e. SWL is 7.20m below datum

TIME ELAPSED (mins)	WATER LEVEL (m)	HEAD H (m)	HEAD RATIO H/Ho
0	1.20	6.00	1.00
1	1.20	6.00	1.00
2	1.20	6.00	1.00
3	1.21	5.99	1.00
5	1.22	5.98	1.00
7	1.23	5.97	1.00
10	1.25	5.95	0.99
15	1.28	5.92	0.99
20	1.31	5.89	0.98
30	1.37	5.83	0.97
40	1.42	5.78	0.96
50	1.47	5.73	0.96
60	1.51	5.69	0.95
80	1.63	5.57	0.93
100	1.74	5.46	0.91
120	1.84	5.36	0.89

CALCULATION OF PERMEABILITY:

Employing Horslev Method (1951)

$$k = \frac{2.3A}{F(t_2 - t_1)} \log \frac{h_1}{h_2}$$

where: k is the permeability of soil

A is the cross-section area of borehole/standpipe

F is the shape factor (see below)

h_1 and h_2 are the hydraulic heads measured respectively at the times t1 (start of test) and t2 (0.37 head reached)

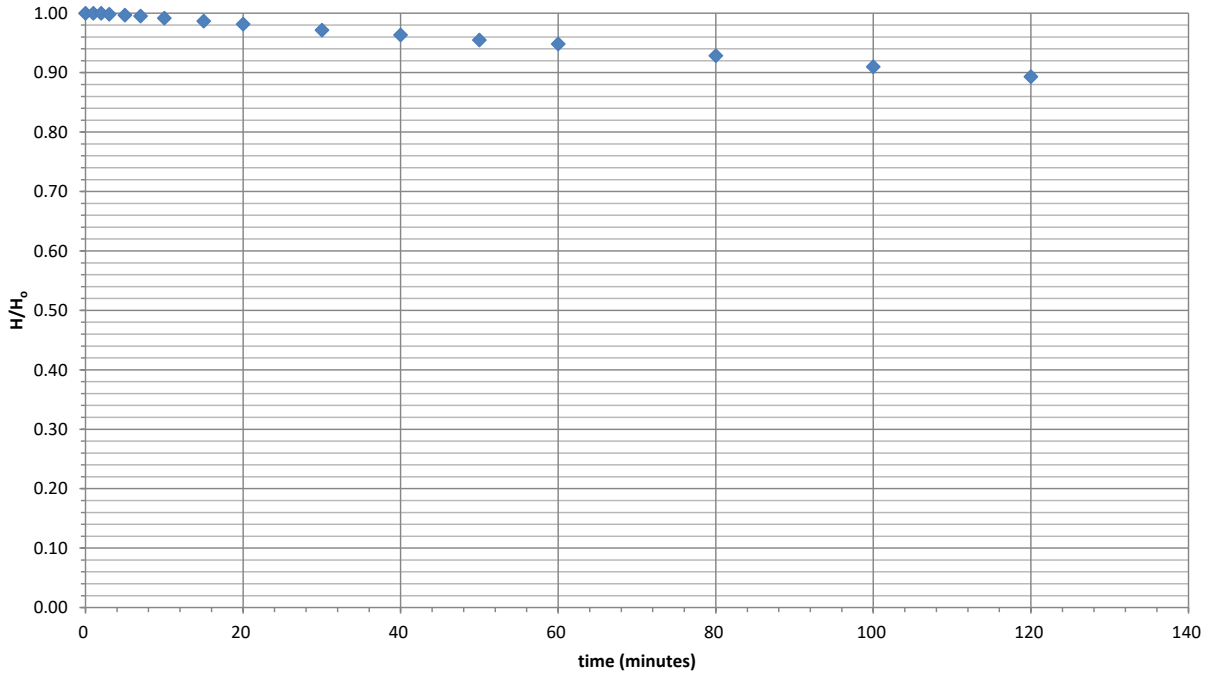
Values for the shape factor (F) are given for various conditions (cases A-E) in Annex B of BS EN ISO 22282-1:2012

L/D is 5.0, so Case D is assumed, therefore:

*=(2*π*L)/(LN((L/D)+√((L/D)^2)+1)*

i.e. F =	2.72	(m)
A =	0.031	(m^2)
h_1 =	6.00	(m)
h_2 =	2.22	(m)
t_1 =	0	(s)
t_2 =	N/A	(s)

Permeability unable to be calculated due to water not dropping to 37% of initial Head



CAUSEWAY GEOTECH

APPENDIX 2F

SPECIALIST IN-SITU TEST RESULTS



Project: Eastern and Midlands Region WSP - Ground Investigation - Lot 1

Raw Water Rising Main Section Only

Pressuremeter Testing Factual Report

Client: Causeway Geotech Ltd

Contract No.: P1220109

Issue	Date	Description	Prepared	Checked	Approved
01	08/10/2022	Final	JH	JH	RC

Date: 8th October 2022
Our Ref: P1220109

Hastings Innovation Centre
Highfield Drive
St Leonards on Sea
East Sussex TN38 9UH

Causeway Geotech Ltd
8 Drumahiskey Road
Ballymoney
Co. Antrim
BT53 7QL

Attention: Neil Haggan

Pressuremeter testing at
Eastern and Midlands Region WSP - Ground Investigation - Lot 1 RWRM Section Only

We have pleasure in providing a digital copy of our report 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



Darren Ward
Director

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ABBREVIATIONS

Pressuremeter types	
HPD	High pressure dilatometer
SBP	Self-boring pressuremeter
RPM	Reaming pressuremeter

In situ horizontal stress (σho)	
p_o	Cavity reference pressure
σho (M&R)	In situ horizonal stress from Marsland & Randolph (1977) analysis (where $P_{yield} = P_L - S_u$)
σho (LO)	In situ horizonal stress from lift-off analysis (SBP)
σho (H&W)	In situ horizonal stress from unloading curve (Houlsby & Withers, 1988; RPM)
σho (CM)	In situ horizonal stress from curve modelling (Whittle, 1999; SBP)

Undrained shear strength (kPa)	
$s_{u\ (loading)}$	Shear strength from loading curve, via Gibson & Anderson (1961) analysis
$s_{u\ (M\&R)}$	Shear strength from Marsland & Randolph (1977) analysis (where $S_u = P_{yield} - P_L$)
$s_{u\ (unloading)}$	Shear strength from unloading curve, via Jefferies (1988) analysis (RPM & SBP)
$s_{u\ (H\&W)}$	Shear strength from unloading curve, via Houlsby & Withers (1988) analysis (RPM)
P_L	Limit pressure via Gibson & Anderson (1961) analysis
$P_{L\ (H\&W)}$	Limit pressure via Houlsby & Withers (1988) analysis (RPM)

Shear modulus parameters	
G_i	Initial shear modulus (MPa) derived from steep linear section of loading path, prior to yield
G_{ur}	Shear modulus (MPa) derived from unload-reload loop
ε_c	Cavity strain range over the unload-reload loop
β	Exponent of elasticity, after Bolton & Whittle (1999), where 1 is linear elastic
α	Shear stress constant (MPa), after Bolton & Whittle (1999)

Other	
P_{max}	Maximum test pressure reached prior to instrument unloading (MPa)
P_{yield}	Pressure at which material yield is assessed, defined as end of linear loading curve

1.0 INTRODUCTION

1.1 Site Details

At the request of Causeway Geotech Ltd, In Situ Site Investigation Limited (In Situ S.I.) carried out pressuremeter testing as part of the Water Supply Project – Eastern and Midlands Region project. The works form part of the proposed scheme to transport water from the Parteen Basin in North Tipperary to Peamount Reservoir in West Dublin.

The project was split into three separate Lots, with this report presenting pressuremeter testing carried out on Lot 1 as part of the Raw Water Rising Main (RWRM) siteworks. Testing was located approximately 25 km north east of Limerick city centre.

The pressuremeter testing was attempted in four boreholes. The fieldwork was carried out from 5th to 12th July 2022.

This report presents the factual records of the pressuremeter testing, together with an interpretation of the test results to derive material parameters. Further specific details relating to the ground investigation, i.e., borehole locations and exploratory hole logs, are provided in the Causeway Geotech Ltd report, Project No. 21-1682.

2.0 FIELDWORK

2.1 General

Five pressuremeter tests were carried out in boreholes constructed using rotary drilling rigs, operated by Causeway Geotech Ltd. A further three tests were attempted, but could not be completed due to unsuitable test pockets. The tests were carried out using a high-pressure dilatometer (HPD). The testing was conducted in general accordance with BS EN ISO 22476-5 (2012) and BS 5930 (2020). The test depths were scheduled by the Client. A summary table of the tests is presented below.

Table 1. *Summary of pressuremeter tests.*

Borehole Reference	Test Reference	Date	Test Depth	Probe	Operator	Remarks
RWRM-BH005	-	12/07/2022	4.85	HPD06 Kylie	I Musson	No test due to oversize pocket
	-	12/07/2022	10.30	HPD06 Kylie	I Musson	No test due to pocket collapsing
RWRM-BH008A	1	07/07/2022	6.80	HPD06 Kylie	I Musson	
	2	08/07/2022	10.30	HPD06 Kylie	I Musson	
RWRM-BH014	1	05/07/2022	7.00	HPD06 Kylie	I Musson	
	2	06/07/2022	11.65	HPD06 Kylie	I Musson	
RWRM-BH020	1	06/07/2022	2.80	HPD06 Kylie	I Musson	
	-	07/07/2022	6.00	HPD06 Kylie	I Musson	No test due to pocket collapsing

2.2 High Pressure Dilatometer (HPD)

The HPD is a cylindrical 95mm diameter probe which is inserted into a cored 99 diameter test pocket, drilled using a T6-H core barrel. The HPD is therefore termed a pre-bored type instrument. The probe, approximately 1.5m in length, has a central section which is covered by a rubber membrane. Pressure applied to the inside of the instrument, via compressed air, forces the membrane to expand against the test pocket wall. The radial displacement of the inside boundary of the membrane is measured at six points equally distributed around the centre of the expanding section, by free moving arms. This displacement, and the pressure necessary to cause the movement, is continuously monitored by transducers contained within the instrument. The HPD is linked to the ground surface via a combined pressure hose and electrical power/communication umbilical cable which connects the instrument to the pressure source and readout unit.

Analogue to digital conversion of the displacement and pressure transducers is carried out within the pressuremeter electronics package. The pressuremeter output comprises a multiplexed signal which connects through the pressuremeter interface unit to the USB port of a laptop computer. Software, supplied by Cambridge Insitu Ltd, is used to record the data, convert the received signals to engineering units (using the pressure and displacement transducer calibrations) and display these in real time on the laptop computer during testing to allow control of the test by the operator. Plotting these readings of displacement against pressure produces a loading curve for the material being tested. A number of mathematical analyses are applied to translate this loading curve into material strength and stiffness parameters.

The testing on this project was undertaken using a single probe manufactured by Cambridge Insitu Ltd. Details of the instrument are provided below. Corrections measured for membrane stiffness (essentially resistance to inflation in air) were carried out during the testing program.

Table 2. *Pressuremeter instrument details.*

Instrument	Diameter (mm)	Pressure Capacity (MPa)	Displacement Measurement	ID & Serial No.
HPD	95	20	6 arms at 60° 3 opposite pairs	Kylie (HPD06)

2.3 HPD Testing Procedure

The boreholes were constructed using a rotary drilling rig by conventional rotary coring at nominal 146mm diameter, using water flush, to approximately 1.5m above the scheduled pressuremeter test depth. A 2 to 3m long section was then drilled using a T6-H size core barrel to provide a test pocket of nominal diameter 99.2mm. The HPD was inserted into the test pocket as soon as practicably possible using 2⅜ API drill rods, lowered in via the drilling rig winch.

The pressuremeter tests were carried out in a stress-controlled manner using a manually operated gas control box to pressurise the HPD at an appropriate rate for the ground conditions. During the tests a number of unload-reload loops were performed. Before carrying out the loops, a short holding period was maintained to allow reduction of creep on the ground. The loading was continued until either the ground had failed, maximum arm displacement had occurred, or if at lower pressure, expansion around the probe was uneven, such that in the opinion of the operator, continuation of the loading would result in risk of damage to the probe. Upon unloading and deflation of the membrane, the instrument was withdrawn.

3.0 TEST INTERPRETATION

3.1 Introduction

The pressure / cavity strain curve has been analysed to determine various material parameters, as appropriate, including:

Cavity reference pressure	p_o
Initial shear modulus	G_i
Yield	P_{yield}
Unload-reload shear modulus	G_{ur}
Undrained shear strength	s_u
Limit Pressure	P_L

The analysis methodologies used have followed the industry accepted practice for interpretation of pressuremeter tests (e.g., Clarke, 1996; Mair & Wood, 1987). The nature of the material tested can result in some limitations in the application and appropriateness of the interpretation methods. Any such limitations, if present, are discussed below and should be considered when selecting material parameters for engineering design purposes.

3.2 Description of Material Tested

An indication of the geology at the depth of each test completed is provided on the plots in Appendix A. The ground conditions encountered in the boreholes were typically sandy gravelly silty CLAY. For more detail refer to the Causeway Geotech Ltd report, Project No. 21-1682.

3.3 Cavity Reference Pressure

The act of drilling into undisturbed ground relieves the in situ horizontal stress, which is then effectively restored as the instrument membrane is initially pressurised. During this initial loading, a linear pressure / displacement response is anticipated as the pressure is increased and then exceeds the cavity reference pressure. With the HPD instrument, the direct correlation between the cavity reference pressure and in situ horizontal stress is problematic and should be treated with caution. This is due to the large potential for disturbance during test pocket formation and probable relaxation or stress relief of the ground following drilling of the open test pocket.

Marsland and Randolph (1977) proposed that in the vicinity of in situ horizontal stress, soil behaves elastically and therefore the initial loading curve is linear. This elastic behaviour will cease when the undrained shear strength of the soil in the cavity wall is reached, and hence

the loading curve will then begin to curve away from linearity. The point at which the loading curve becomes non-linear (or the onset of yield, P_{yield}), represents the in situ horizontal stress plus the undrained shear strength at this point:

$$P_{yield} = \sigma_{ho} + s_u.$$

The analysis method used to determine the undrained shear strength assumes the material is a perfectly elastic prior to failure and perfectly plastic post failure.

3.4 Shear Modulus

A pressuremeter test, in an elastic, perfectly plastic material, imparts a pure shear failure, hence it is normal to report shear modulus in preference to an elastic modulus. Shear modulus is determined from the initial loading curve, and from unload reload loops, performed at intervals during the test progression. The relationship used to determine shear modulus (G) is below, where ε_c is the cavity strain range:

$$G = \frac{1}{2}\frac{dp}{d\varepsilon c}$$

Note is made that often in clays and sands some hysteresis is generally evident, and it is possible to determine a secant shear modulus from the reloading portion of an unload reload loop. A high degree of consistency is often possible when plotting secant shear modulus results from individual tests. This may be further extended to a series of tests in a geological formation by normalising via undrained shear strength, or in situ stress. The various plots for both initial loading shear modulus (G_i) and the shear modulus derived from unload reload loops (G_{ur}) are presented graphically in the test results.

Individual unload reload loops can also be analysed to determine small strain stiffness parameters. This is achieved by taking a secant modulus from the base of the loop, to the individual points on the reloading curve. Plotting the cavity strain range against modulus, gives an indication of how stiffness varies with strain. Further, a Bolton and Whittle (1999) analysis can be performed to investigate the non-linear elastic / plastic behaviour.

The secant modulus (G) can be converted to an undrained elastic (Youngs) modulus (E_u) by use of the following relationship:

$$E_u = 2.G(1 + \upsilon) \qquad \text{Where } \upsilon = \text{Poisson's ratio}$$

The Poisson's ratio can be either undrained (υ_u) or drained (υ'). For undrained elastic soil (clay) a υ_u value of 0.5 can be taken. For drained conditions in any soil, the value of υ' is

typically 0.1 to 0.3. The Poisson's ratio for weak rocks is also generally taken as 0.1 to 0.3, with the difference between drained or undrained behaviour being relatively insignificant (Mair and Wood, 1987).

Plots of calculated secant modulus values at varying shear strain % are provided within the analysis results. It is noted that any user of this analysis should satisfy themselves that it is appropriate to the material tested.

3.5 Strength

Undrained shear strength has been determined using Gibson and Anderson (1961) for the loading portion of the test curve. This is the generally accepted method for the determination of strength and are based on the assumption of an elastic - perfectly plastic material. The analysis of Gibson and Anderson (1961) also provides a Limit Pressure (P_L). This is a limiting pressure defined as the pressure at which the change in volume (ΔV) divided by the current volume (V) is equal to one. While this is not achieved in practice, it can be determined by extrapolation. Note is also made that the definition of P_L is different to that associated with a Ménard Limit Pressure, and the two should not be interchanged.

3.6 Summary of Results

Summary tables of the analysis results for each borehole location are presented in Appendix A, followed by the individual full graphical analyses for the tests completed.

4.0 REFERENCES

Bolton, M.D. & Whittle, R.W. (1999) A non-linear elastic/perfectly plastic analysis for plane strain undrained expansion tests. *Géotechnique*, Vol. 49, No. 1, pp. 133-141.

BS EN ISO 22476-5 (2012) Geotechnical investigation and testing - Field testing. Part 5: Flexible dilatometer test. British Standards Institution.

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Clarke, B.G. (1996) Pressuremeters in geotechnical design. London: Blackie Academic and Professional.

Gibson, R.E. & Anderson, W.F. (1961) In situ measurement of soil properties with the pressuremeter. *Civil Engineering and Public Works Review*, Vol. 56, No. 658 May, pp. 615-618.

Mair, R.J. & Wood, D.M. (1987) Pressuremeter testing: methods and interpretation. CIRIA Ground Engineering Report: In-situ Testing. London.

Marsland, A. & Randolph, M.F. (1977) Comparison of the results from pressuremeter tests and large in situ plate tests in London Clay. *Géotechnique*, Vol. 27, No. 2, pp. 217-243.

APPENDIX A

Test Data Analysis

Description	Figure No.
Pressuremeter Results Summary	All Boreholes
Pressuremeter Shear Modulus Plot & Undrained Shear Strength Plot	Figure 1
Pressuremeter Cavity Reference Pressure, Yield & Maximum Pressure Plot	Figure 2
Pressuremeter Test Analysis	
RWRM-BH008A	T01 & T02
RWRM-BH014	T01 & T02
RWRM-BH020	T01

Pressuremeter Results Summary

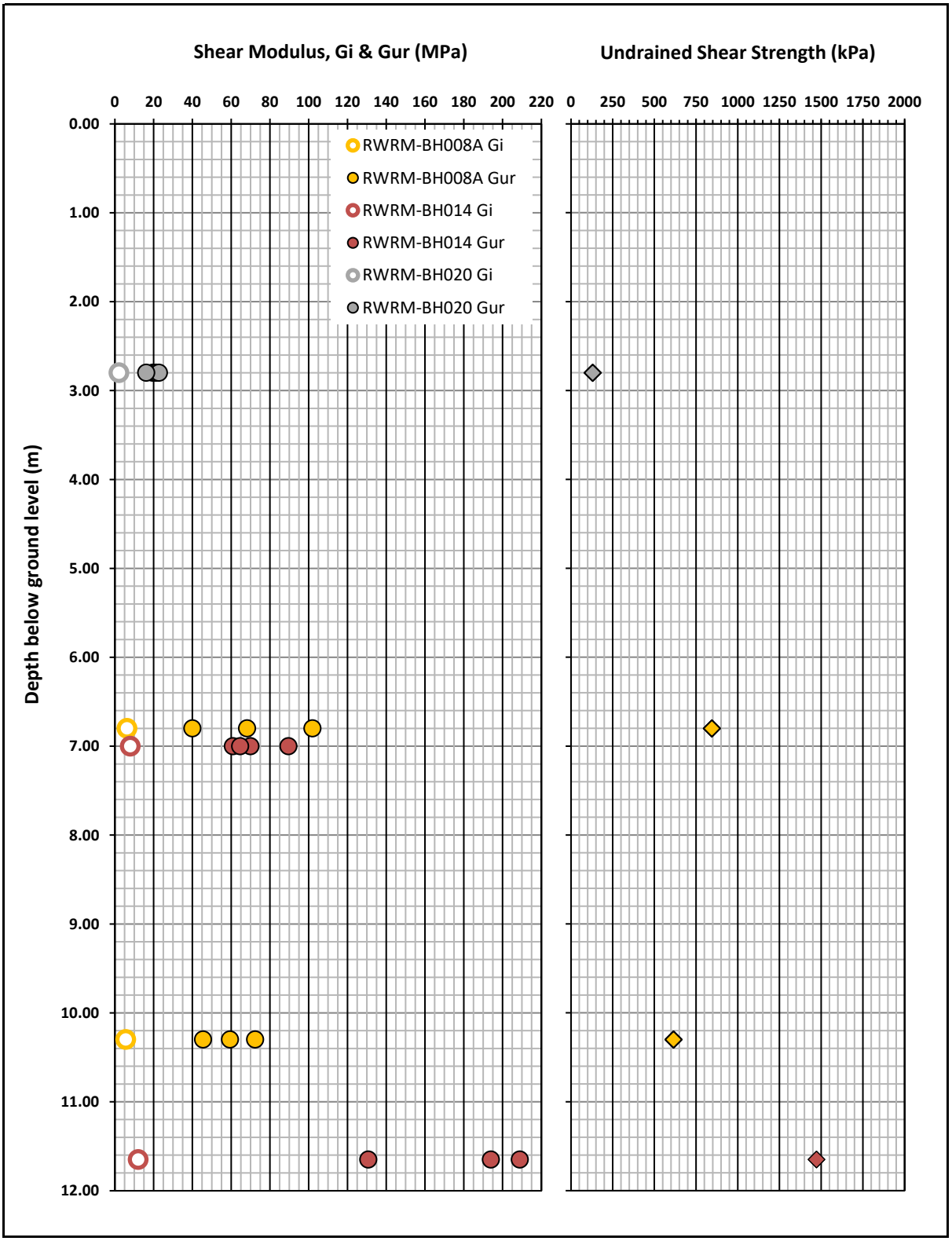
IN SITU
SITE INVESTIGATION

Project	WSP GI Lot 1 - RWRM Section Only
Client	Causeway Geotech Ltd
Project No.	P1220109
Table No.	All Boreholes

Test ID	Depth (m)	Material description from borehole log	Max. test pressure (kPa)	po (kPa)	Undrained strength (kPa)			G_i (MPa)	Loop No.	G_{ur} (MPa)	e_c (%)	Non linear stiffness		Secant shear modulus			
					$S_{u\ (M\&R)}$	$S_{u\ (loading)}$	P_L					α (MPa)	β	Shear strain 1%	0.1%	0.01%	0.001%
RWRM-BH008A																	
1	6.80	Very stiff brown slightly sandy slightly gravelly CLAY.	1589	227	845	845	2775	6.3	1	40	0.139	4.891	0.700	20	39	78	155
									2	68	0.113	9.653	0.732	33	61	114	211
									3	102	0.124	16.592	0.750	52	93	165	293
2	10.30	Very stiff light brown slightly sandy gravelly CLAY.	1663	728	614	614	2721	5.6	1	45	0.189	7.006	0.720	25	48	92	175
									2	72	0.181	12.389	0.741	41	74	135	245
									3	59	0.448	11.418	0.733	39	72	133	246
RWRM-BH014																	
1	7.00	Very stiff brown slightly gravelly sandy CLAY with medium cobble content.	1511	210	No material yield			7.9	1	61	0.087	6.679	0.705	26	51	101	200
									2	70	0.098	9.543	0.729	33	62	115	215
									3	90	0.119	15.264	0.757	47	82	143	250
									4	65	0.409	13.916	0.749	44	79	140	249
2	11.65	Very stiff brown slightly gravelly sandy silty CLAY with low cobble content.	3078	671	1472	1472	4900	12.1	1	131	0.058	14.313	0.729	50	93	173	323
									2	209	0.088	31.077	0.755	96	169	297	521
									3	268	0.087	37.049	0.753	115	204	360	636
									4	194	0.244	33.385	0.753	104	184	326	576
RWRM-BH020																	
1	2.80	Firm brown occasionally light grey slightly sandy CLAY.	277	125	130	130	619	2.1	1	20	0.100	3.138	0.750	10	18	31	56
									2	21	0.096	3.798	0.766	11	19	33	56
									3	23	0.075	3.926	0.776	11	18	31	52
									4	16	0.343	2.895	0.722	10	20	38	71

Pressuremeter Shear Modulus & Undrained Shear Strength Plot

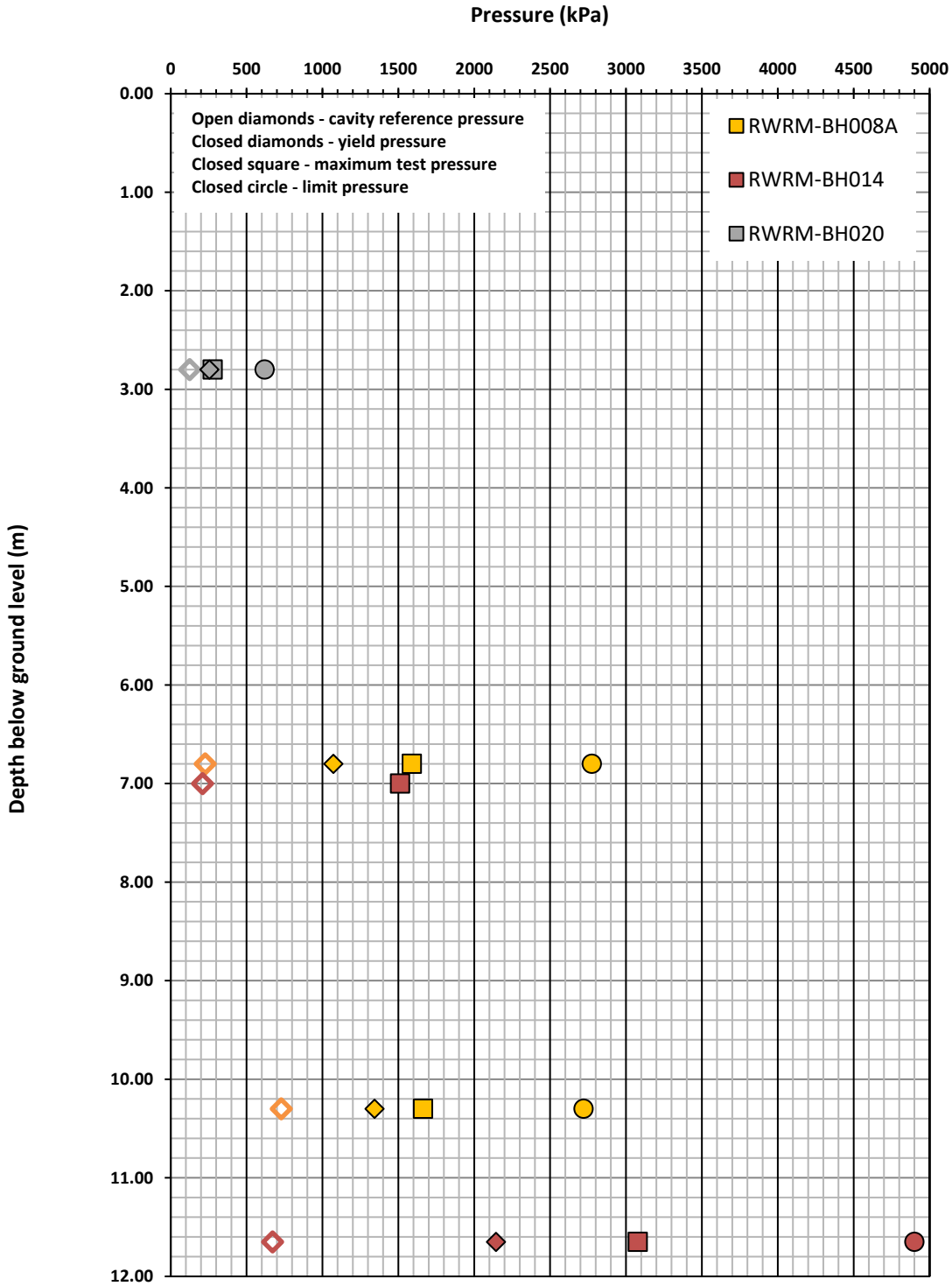
IN SITU SITE INVESTIGATION



Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**1**
Client	Causeway Geotech Ltd		
Project No.	P1220109		

Pressuremeter Cavity Reference Pressure, Yield & Maximum Test Pressure Plot

IN SITU SITE INVESTIGATION

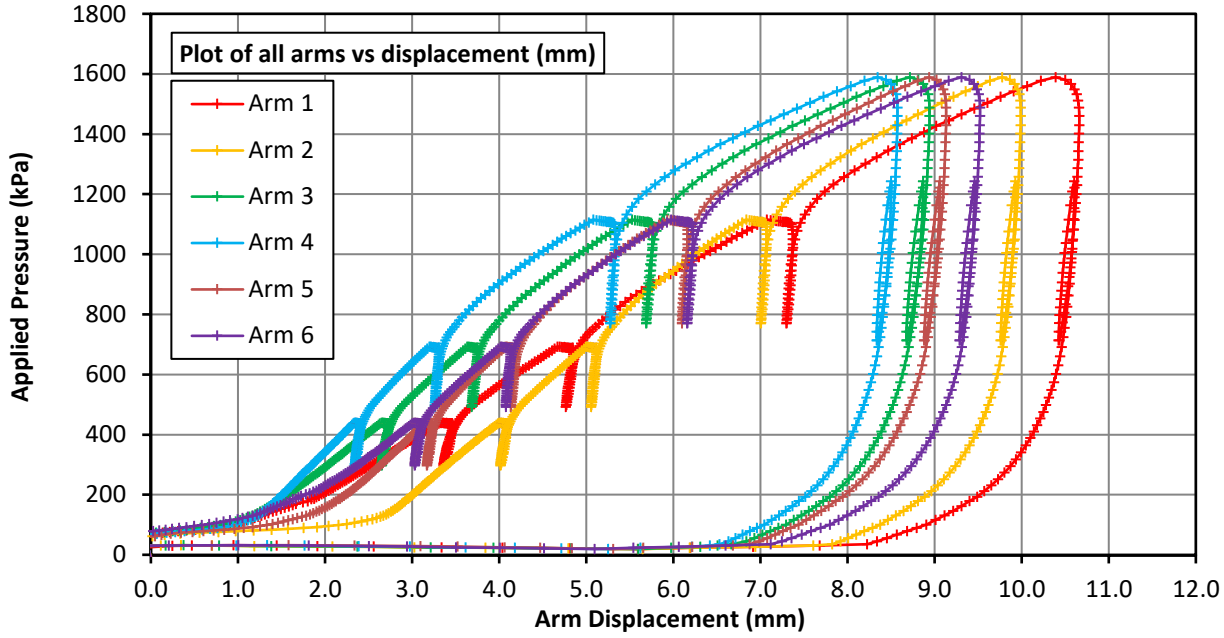


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**2**
Client	Causeway Geotech Ltd		
Project No.	P1220109		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	07/07/2022		**Test No.**	1
Borehole	RWRM-BH008A		**Test Depth (m)**	6.80
Coordinates (m)	570879.13 (E)	670024.42 (N)	**Elevation (m)**	32.72



Material description from borehole log:

Gravelly CLAY.

Test pocket conditions:

Total core recovery:	70 %	Test pocket depth range:	
Solid core recovery:	- %	From: 6.00 m	to: 7.80 m
Rock quality designation:	- %	Flush: Water	

Test comment:

The test pocket was good with arms lifting off at 1.6 to 3.1mm. The po was estimated to be at 227kPa, with the following loading section being relatively short. Material yield was interpreted at 1072kPa, with the test taken to a maximum pressure of 1589kPa. The displacement-pressure response shown by the arms was slightly variable with some dilation. Analysis of three unload reload loops provides increases modulus values of 40 to 102MPa. Derived undrained shear strength analysis provides a value of 845kPa.

Test details: **Instrument:** Kylie (HPD06)

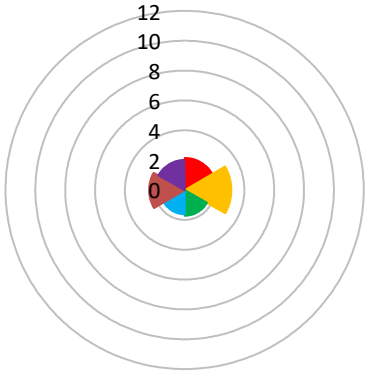
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	6.00 m	Arm 1:	-2425.5	132.4	TPC A:	-2382.9	113.4
Water level:	0.10 m	Arm 2:	-2379.5	130.5	TPC B:	-2457.0	120.7
		Arm 3:	-2306.3	133.1	Membrane:		
Test time:		Arm 4:	-2427.1	127.7	Stiffness	30.3	kPa
Start (probe in):	12:05 hrs	Arm 5:	-2325.3	126.4	Slope	11.2	kPa/mm
Finish (probe out):	13:55 hrs	Arm 6:	-2285.1	131.0	Compliance	1.5	mm/GPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 01**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

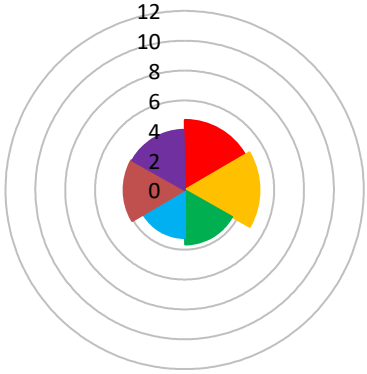
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

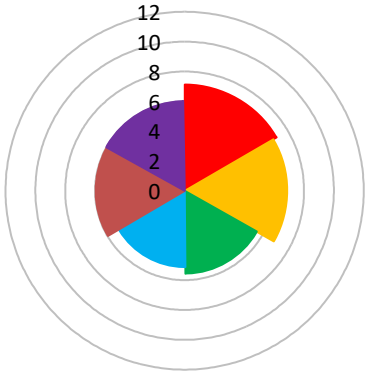
Test Date	07/07/2022	Test No.	1
Borehole	RWRM-BH008A	Test Depth (m)	6.80



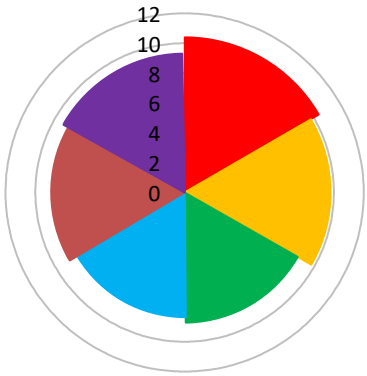
Arm expansion at:	0	% cavity strain
Cavity reference pressure:	232	kPa
Arm 1 at:	2.1	mm
Arm 2 at:	3.1	mm
Arm 3 at:	1.7	mm
Arm 4 at:	1.6	mm
Arm 5 at:	2.4	mm
Arm 6 at:	2.0	mm



Arm expansion at:	4	% cavity strain
Test pressure:	693	kPa
Arm 1 at:	4.7	mm
Arm 2 at:	5.0	mm
Arm 3 at:	3.7	mm
Arm 4 at:	3.2	mm
Arm 5 at:	4.1	mm
Arm 6 at:	4.0	mm



Arm expansion at:	8	% cavity strain
Test pressure:	1113	kPa
Arm 1 at:	7.1	mm
Arm 2 at:	6.9	mm
Arm 3 at:	5.6	mm
Arm 4 at:	5.1	mm
Arm 5 at:	6.0	mm
Arm 6 at:	6.0	mm



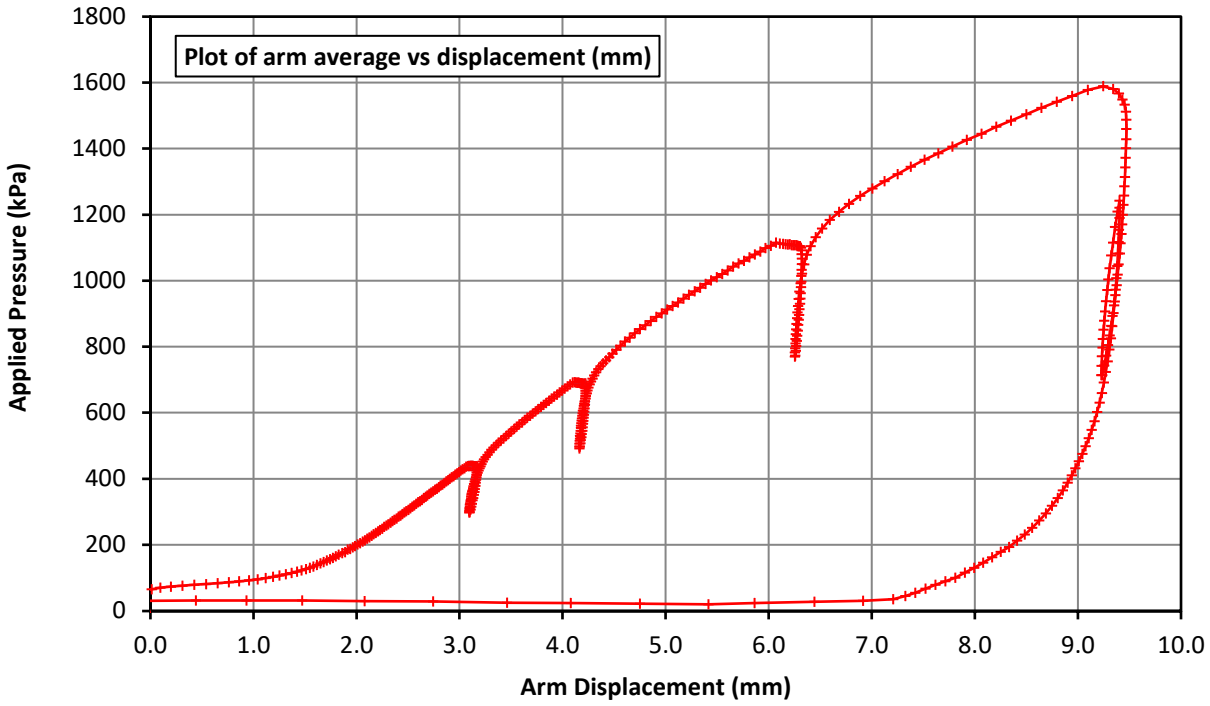
Arm expansion at:	14	% cavity strain
Maximum test pressure:	1589	kPa
Arm 1 at:	10.4	mm
Arm 2 at:	9.8	mm
Arm 3 at:	8.7	mm
Arm 4 at:	8.3	mm
Arm 5 at:	8.9	mm
Arm 6 at:	9.3	mm

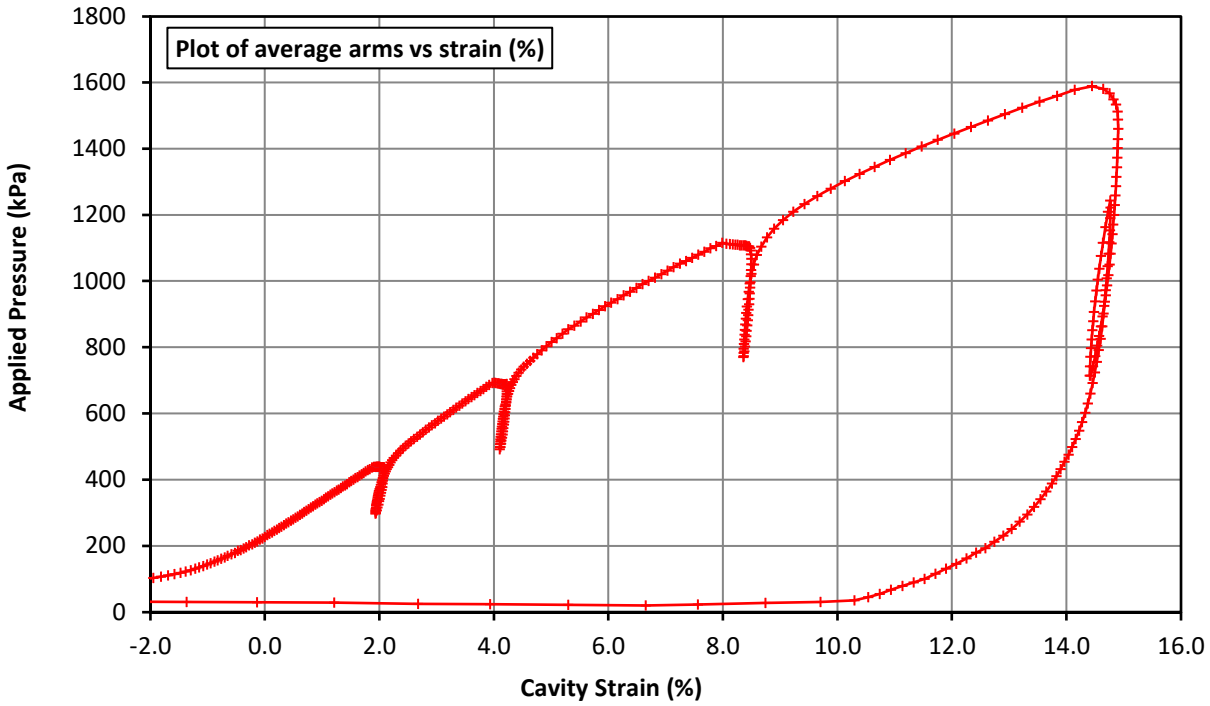
Project	WSP GI Lot 1 - RWRM Section Only	Figure No.	RWRM-BH008A T01 - 02
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



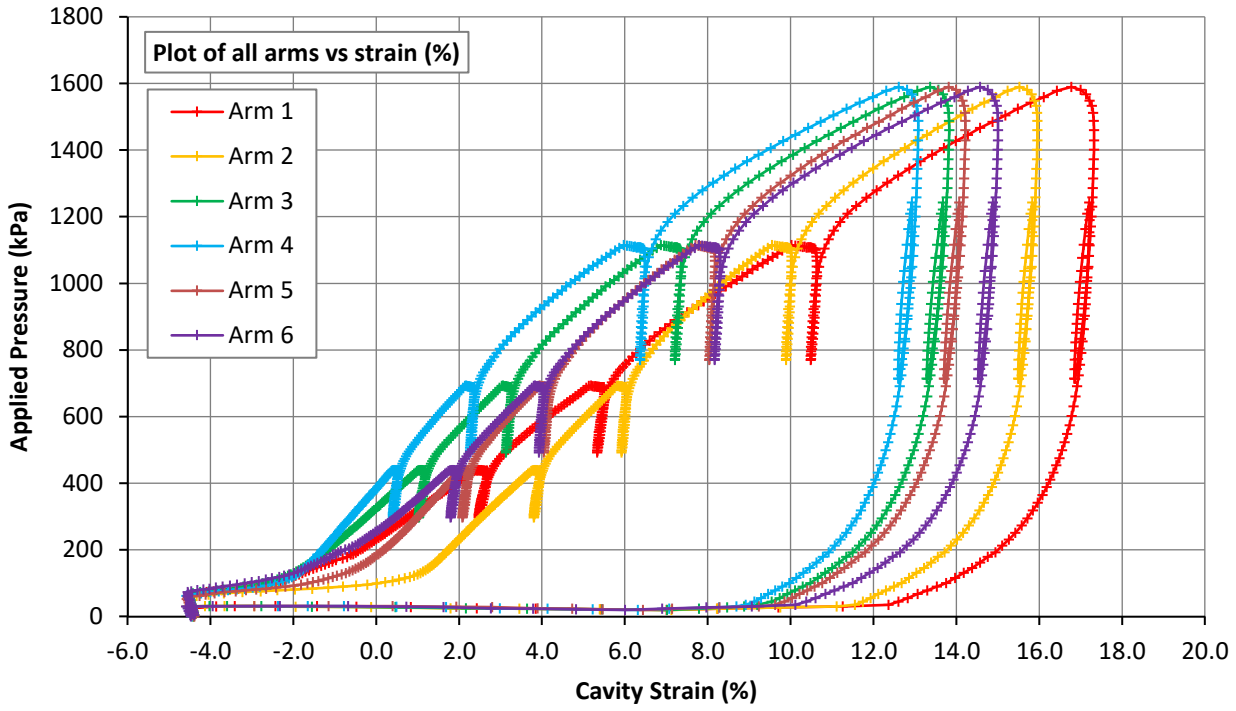


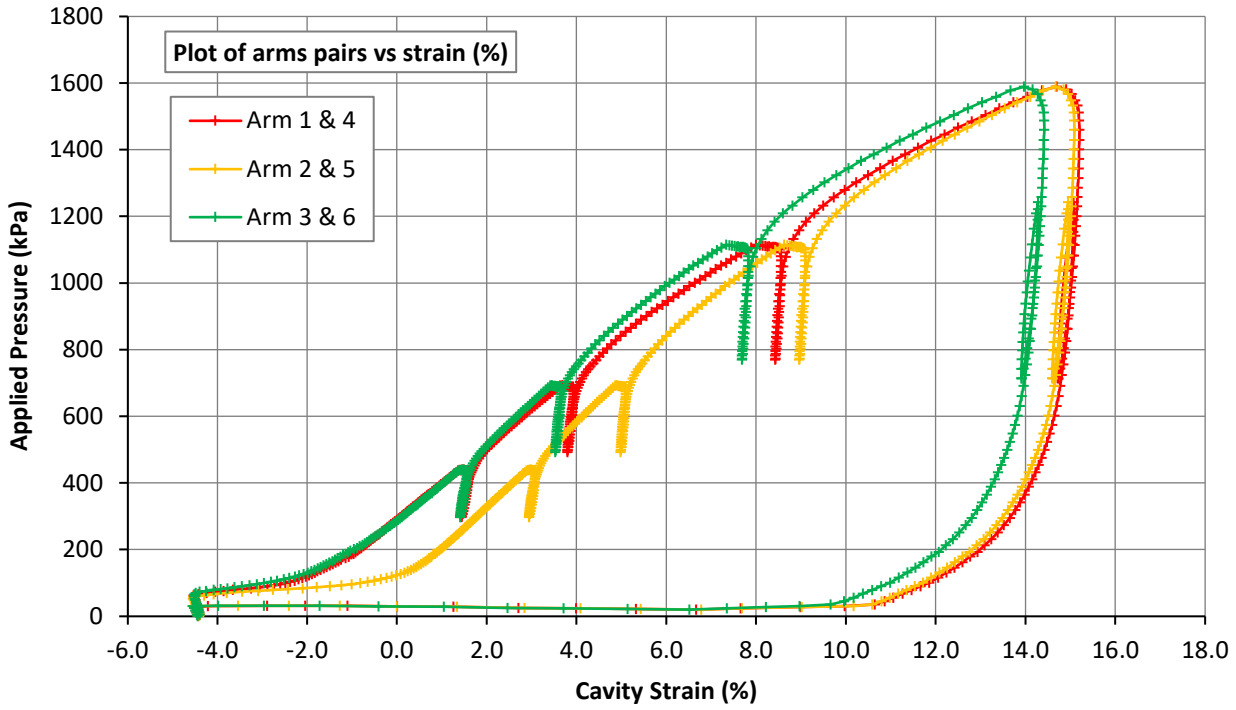
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 03**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



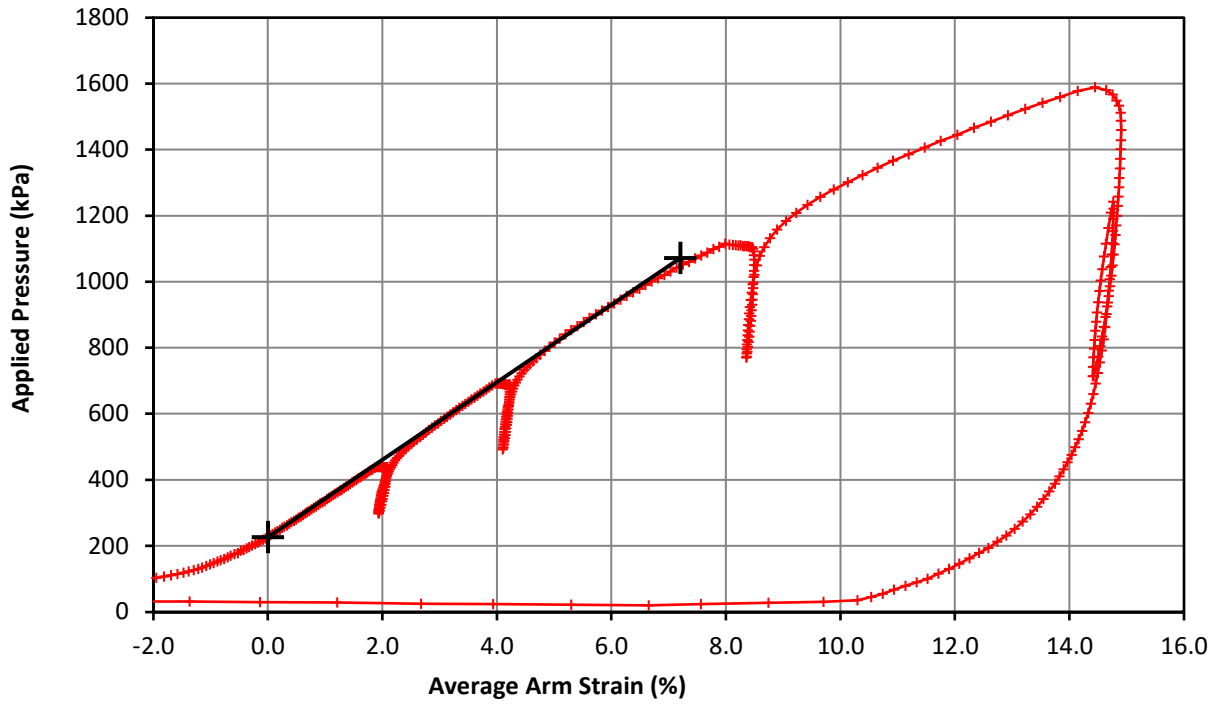


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 04**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

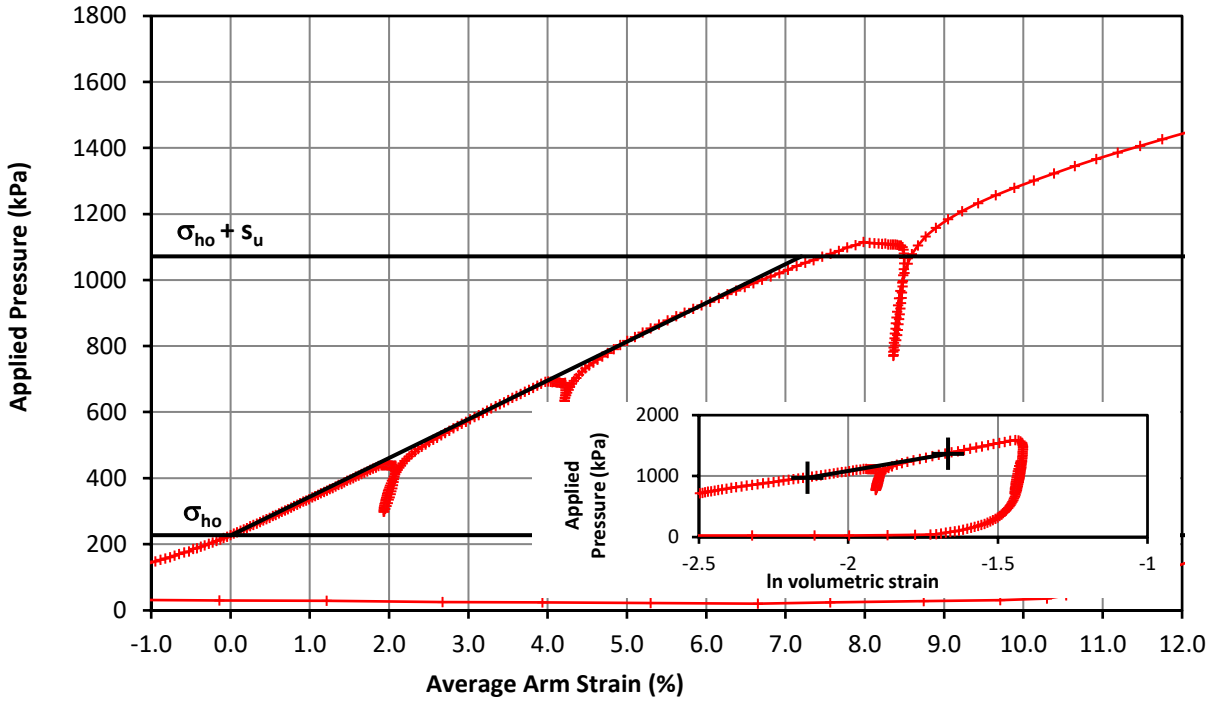
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



Initial Modulus	Shear Modulus	6.3 MPa



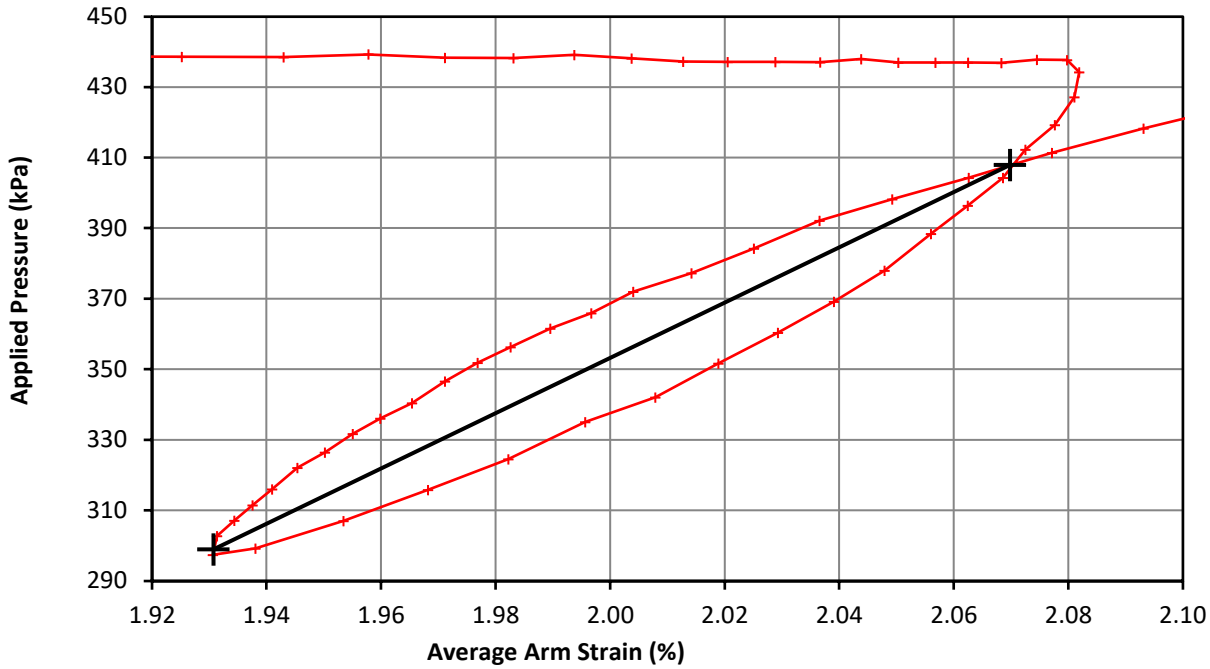
Marsland & Randolph	In situ horizontal stress	227 kPa
	Undrained Strength	845 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 05**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

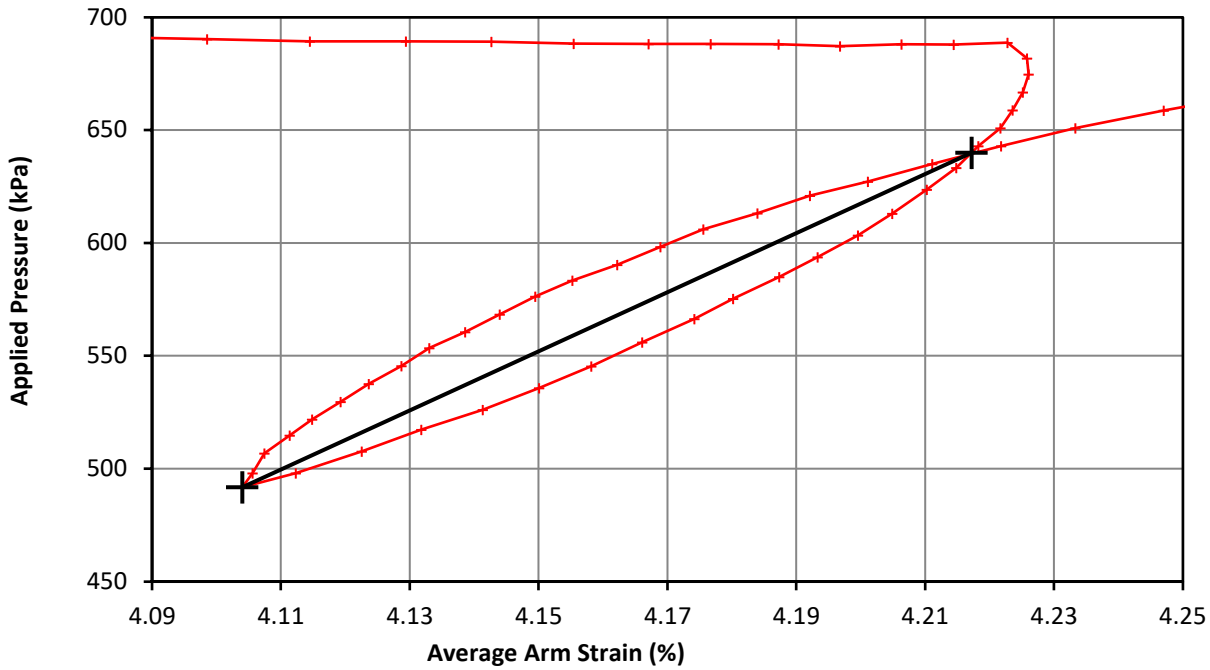
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



Loop 1	Shear Modulus	40.0	MPa
	Cavity Strain Range	0.139	%



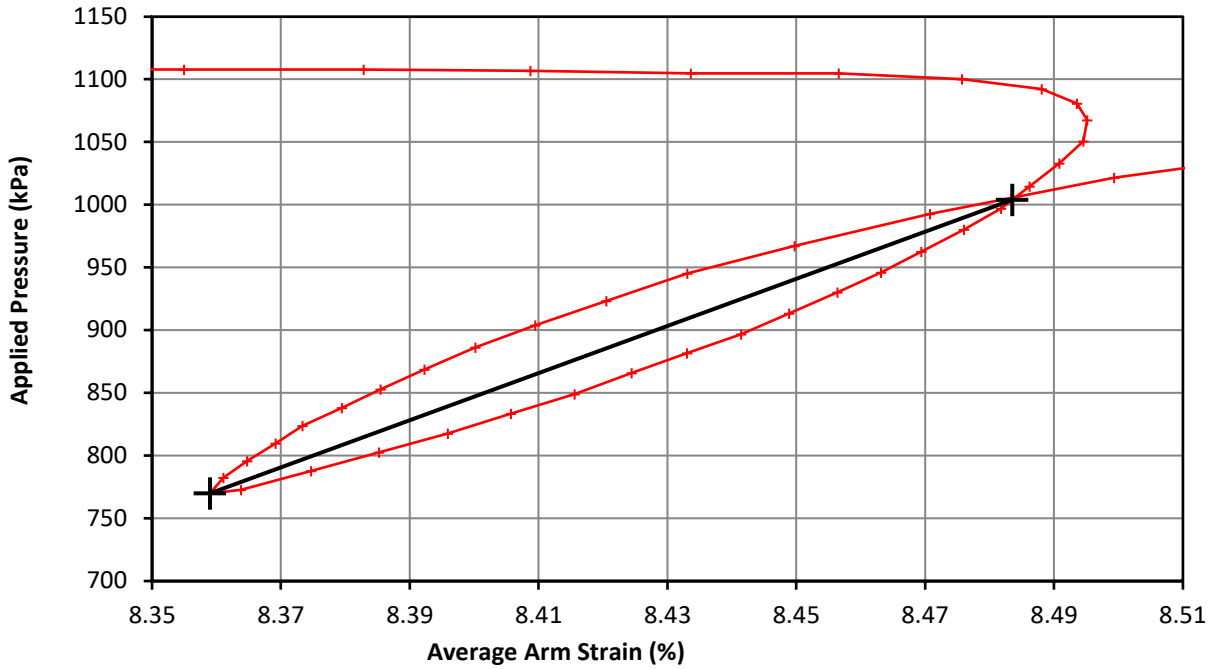
Loop 2	Shear Modulus	68.2	MPa
	Cavity Strain Range	0.113	%

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 06**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



Loop 3	Shear Modulus	101.9 MPa
	Cavity Strain Range	0.124 %

Loop 4	Shear Modulus	0.0 MPa
	Cavity Strain Range	0.000 %

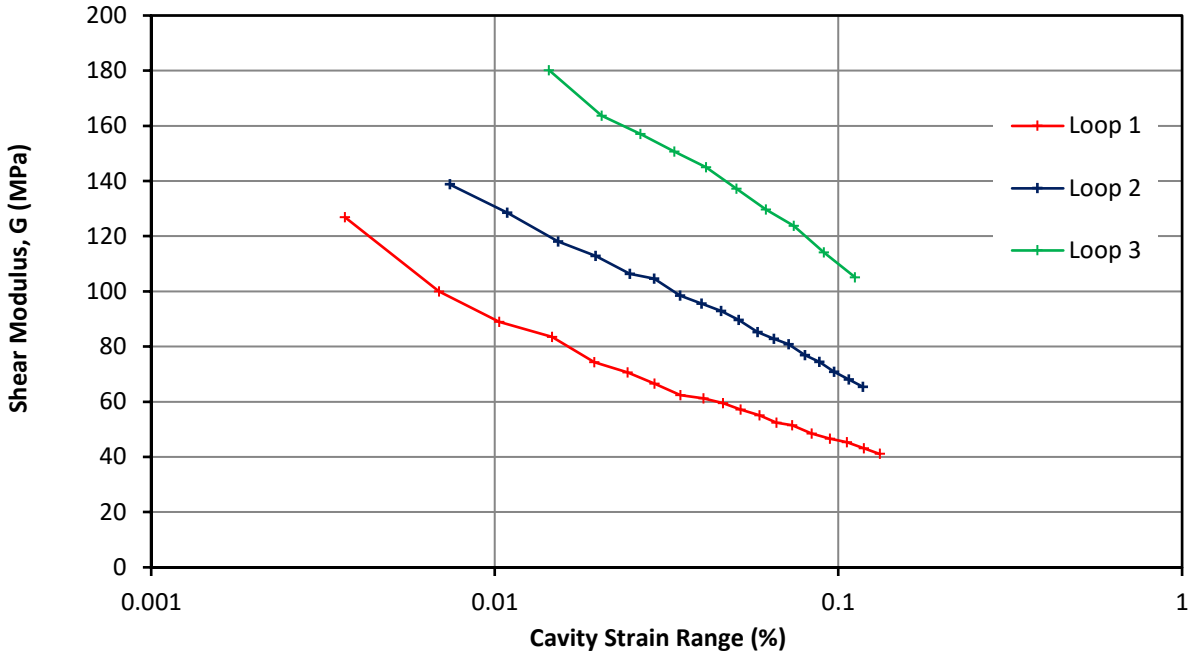
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 07**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

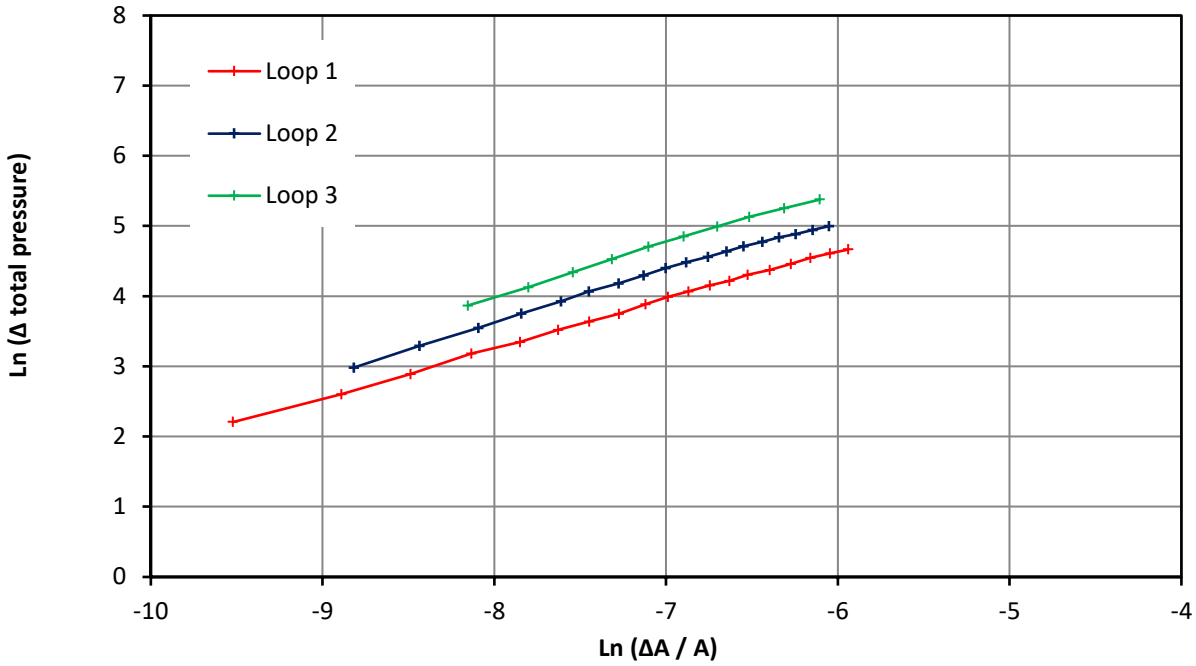
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80





Loop 1		Loop 2		Loop 3	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.700	6.991 (MPa)	0.732	13.185 (MPa)	0.750	22.108 (MPa)

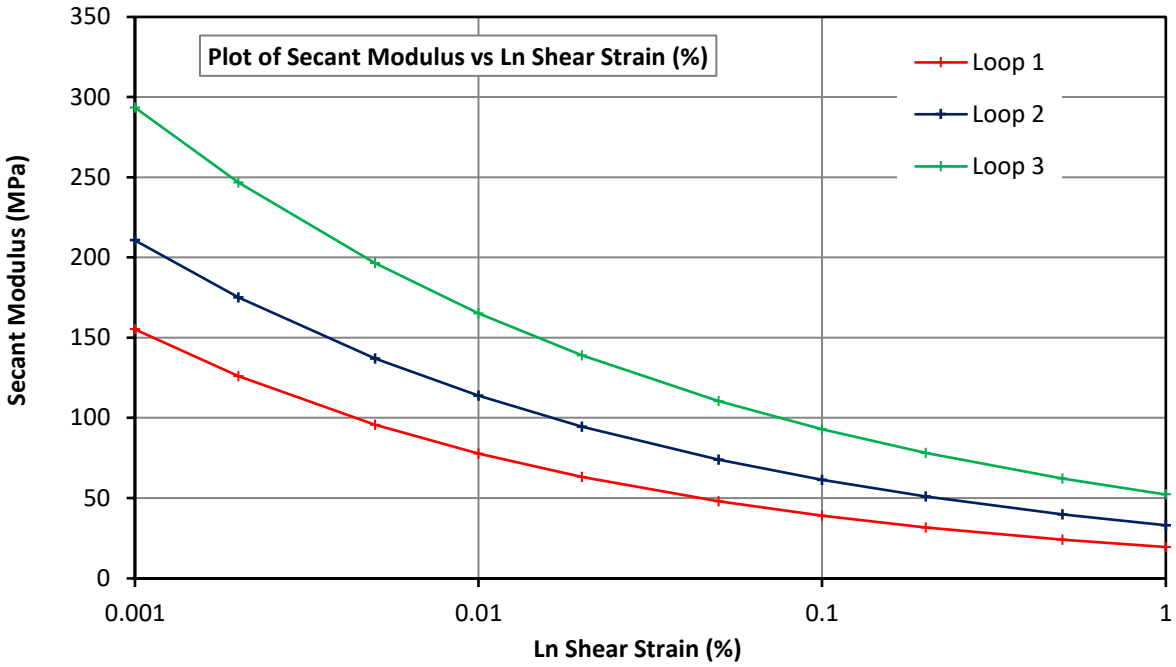
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 08**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



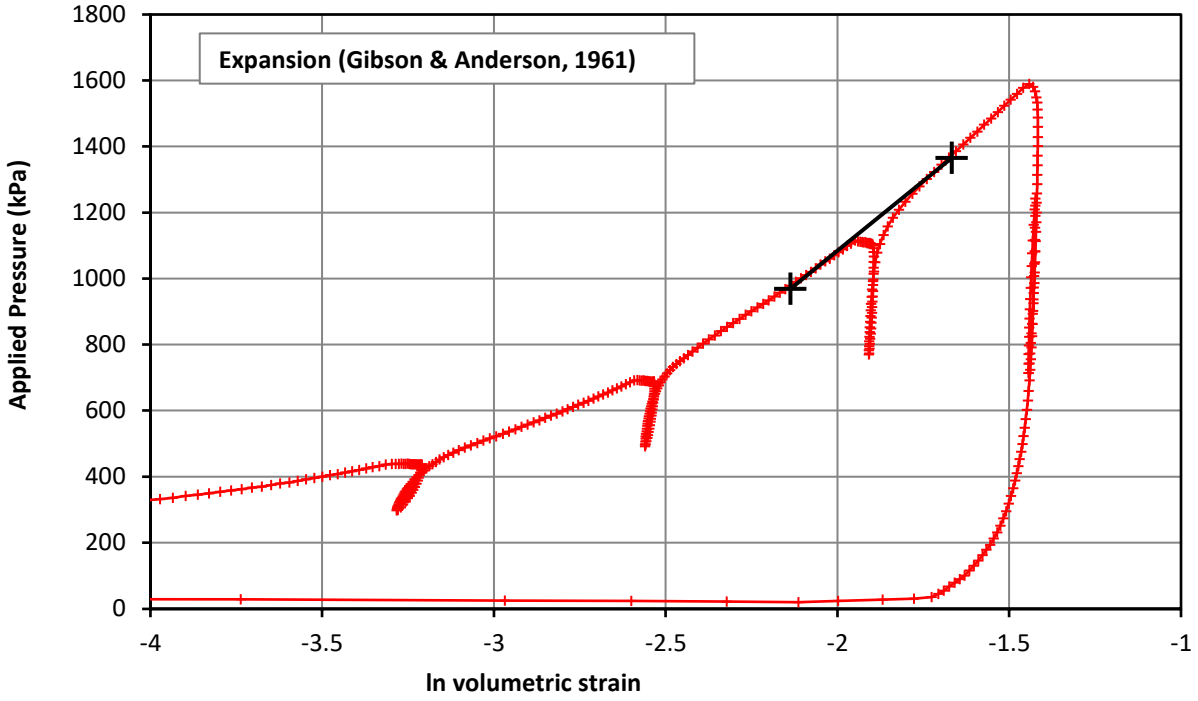
Shear Strain	Loop 1	Loop 2	Loop 3
0.001%	**155**	**211**	**293**
0.002%	126	175	247
0.005%	96	137	196
0.010%	**78**	**114**	**165**
0.020%	63	94	139
0.050%	48	74	111
0.100%	**39**	**61**	**93**
0.200%	32	51	78
0.500%	24	40	62
1.000%	**20**	**33**	**52**

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 09**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	07/07/2022	**Test No.**	1
Borehole	RWRM-BH008A	**Test Depth (m)**	6.80



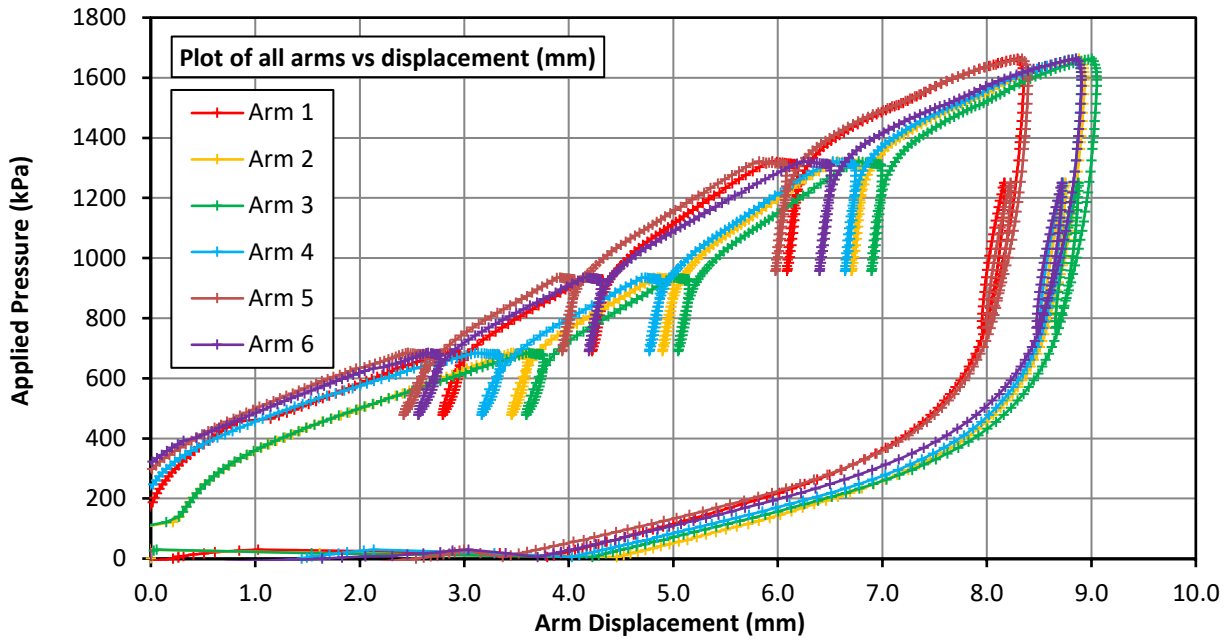
Strength (loading)	Undrained Shear	845 kPa
	Limit Pressure	2775 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T01 - 10**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	08/07/2022		**Test No.**	2
Borehole	RWRM-BH008A		**Test Depth (m)**	10.30
Coordinates (m)	570879.13 (E)	670024.42 (N)	**Elevation (m)**	32.72



Material description from borehole log:

Very stiff light brown slightly sandy gravelly CLAY.

Test pocket conditions:

Total core recovery:	37 %	Test pocket depth range:	
Solid core recovery:	- %	From: 9.40 m	to: 10.90 m
Rock quality designation:	- %	Flush: Water	

Test comment:

The test pocket was squeezed and disturbed with some dilation during initial loading. Lift off is interpreted at 3.0 to 4.1mm. The po was estimated to be at 728kPa, with the following loading section being relatively short. Material yield was interpreted at 1342kPa, with the test taken to a maximum pressure of 1663kPa. The displacement-pressure response shown by the arms was reasonably consistent, albeit at slightly varying expansions. Analysis of three unload reload loops provides modulus values of 46 to 72MPa. Derived undrained shear strength analysis provides a value of 614kPa.

Test details: **Instrument:** Kylie (HPD06)

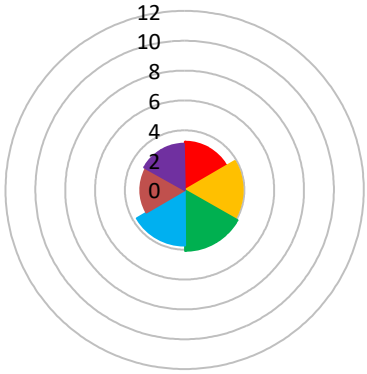
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	9.40 m	Arm 1:	-2423.1	132.4	TPC A:	-2385.6	113.4
Water level:	0.10 m	Arm 2:	-2383.5	130.5	TPC B:	-2460.3	120.7
		Arm 3:	-2313.3	133.1	Membrane:		
Test time:		Arm 4:	-2428.1	127.7	Stiffness	30.3 kPa	
Start (probe in):	11:15 hrs	Arm 5:	-2316.1	126.4	Slope	11.2 kPa/mm	
Finish (probe out):	12:55 hrs	Arm 6:	-2281.7	131.0	Compliance	1.5 mm/GPa	

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 01**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

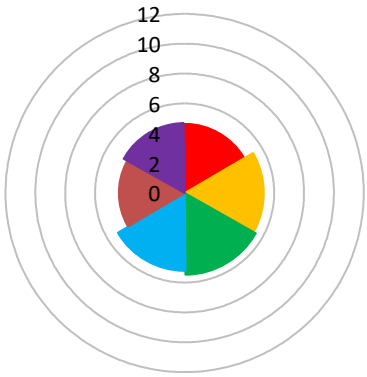
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

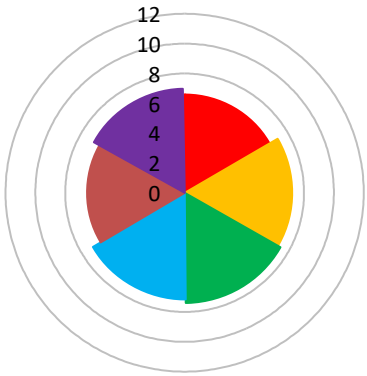
Test Date	08/07/2022	Test No.	2
Borehole	RWRM-BH008A	Test Depth (m)	10.30



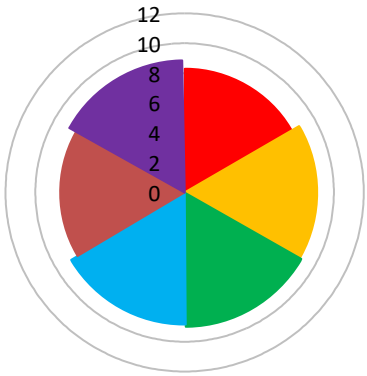
Arm expansion at:	0	% cavity strain
Cavity reference pressure:	743	kPa
Arm 1 at:	3.2	mm
Arm 2 at:	3.9	mm
Arm 3 at:	4.1	mm
Arm 4 at:	3.7	mm
Arm 5 at:	3.0	mm
Arm 6 at:	3.1	mm



Arm expansion at:	3	% cavity strain
Test pressure:	1023	kPa
Arm 1 at:	4.6	mm
Arm 2 at:	5.3	mm
Arm 3 at:	5.5	mm
Arm 4 at:	5.2	mm
Arm 5 at:	4.4	mm
Arm 6 at:	4.7	mm



Arm expansion at:	7	% cavity strain
Test pressure:	1409	kPa
Arm 1 at:	6.6	mm
Arm 2 at:	7.2	mm
Arm 3 at:	7.4	mm
Arm 4 at:	7.1	mm
Arm 5 at:	6.5	mm
Arm 6 at:	7.0	mm



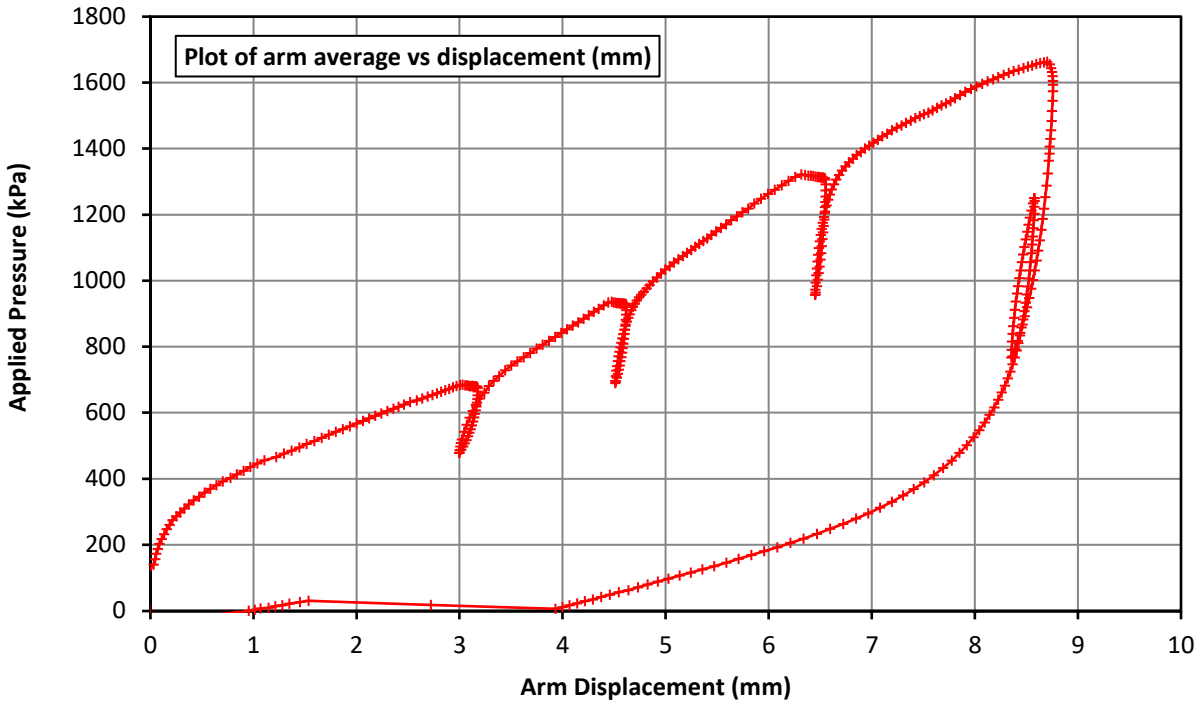
Arm expansion at:	10	% cavity strain
Maximum test pressure:	1663	kPa
Arm 1 at:	8.3	mm
Arm 2 at:	8.9	mm
Arm 3 at:	9.0	mm
Arm 4 at:	8.9	mm
Arm 5 at:	8.3	mm
Arm 6 at:	8.9	mm

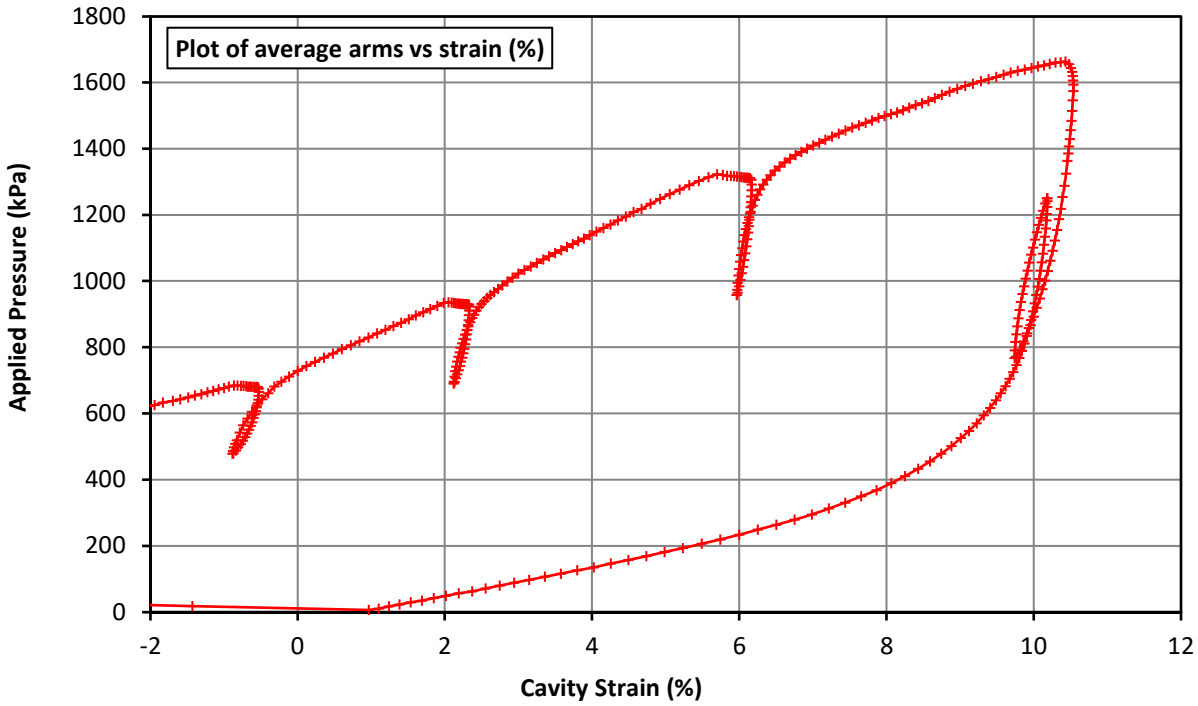
Project	WSP GI Lot 1 - RWRM Section Only	Figure No.	RWRM-BH008A T02 - 02
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



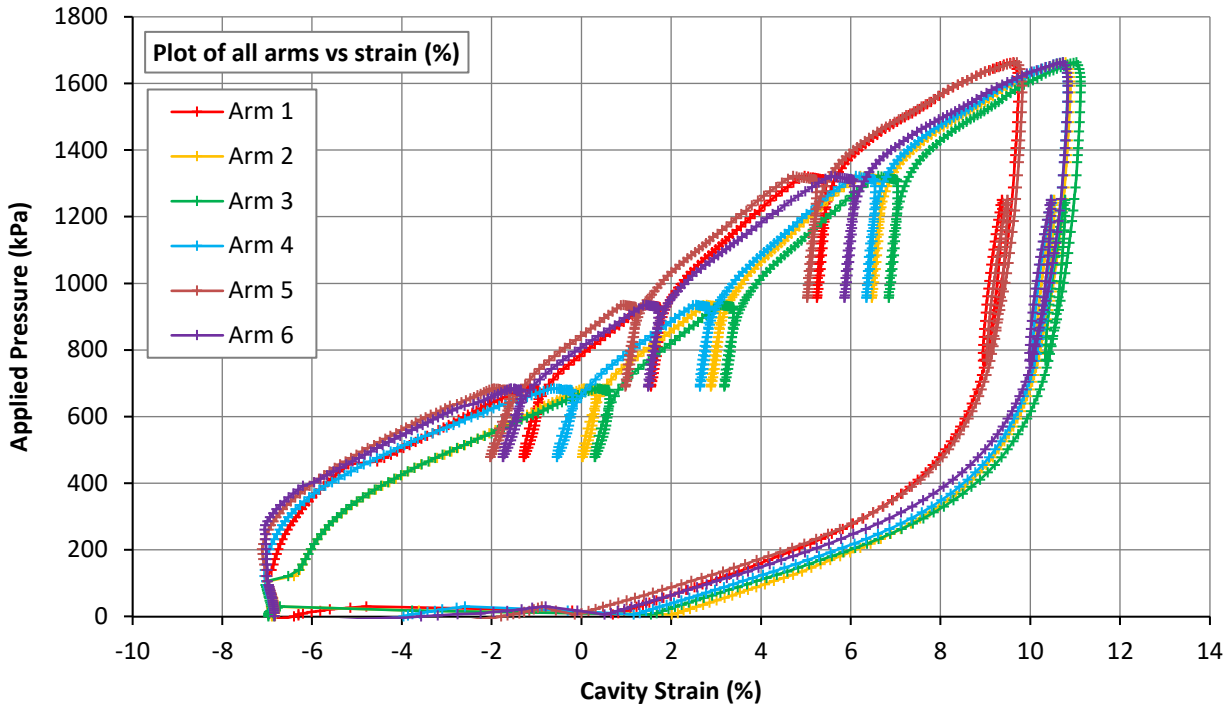


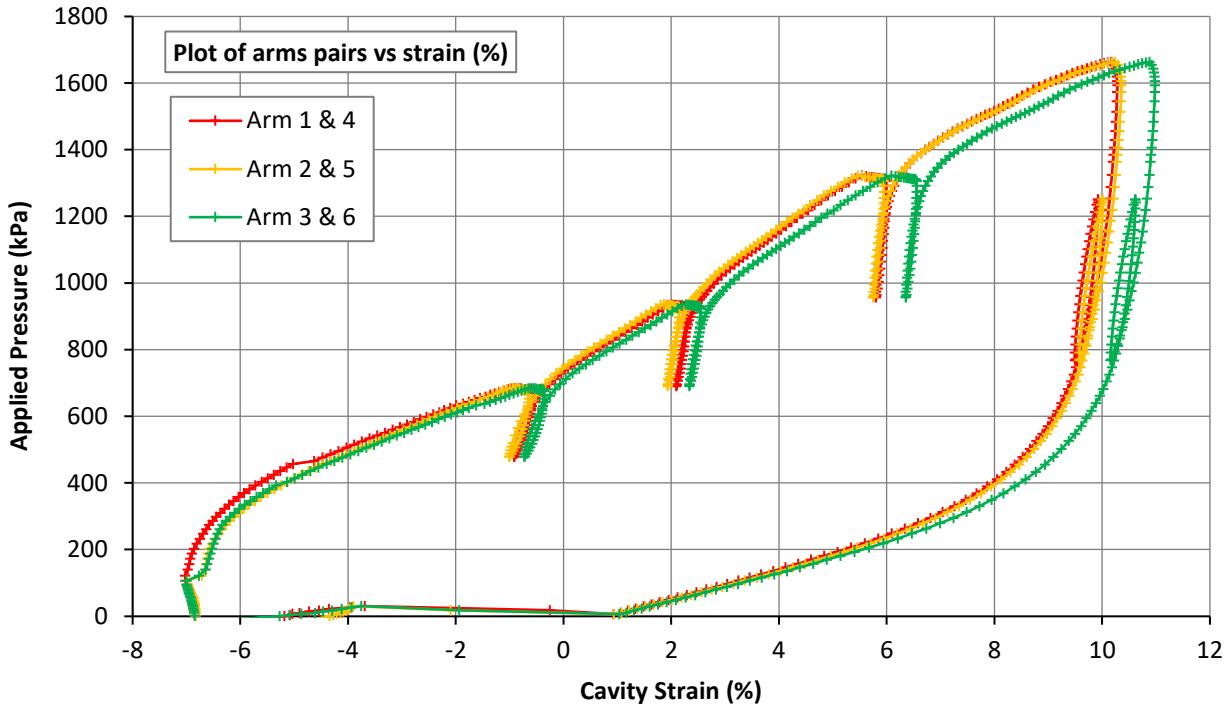
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 03**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



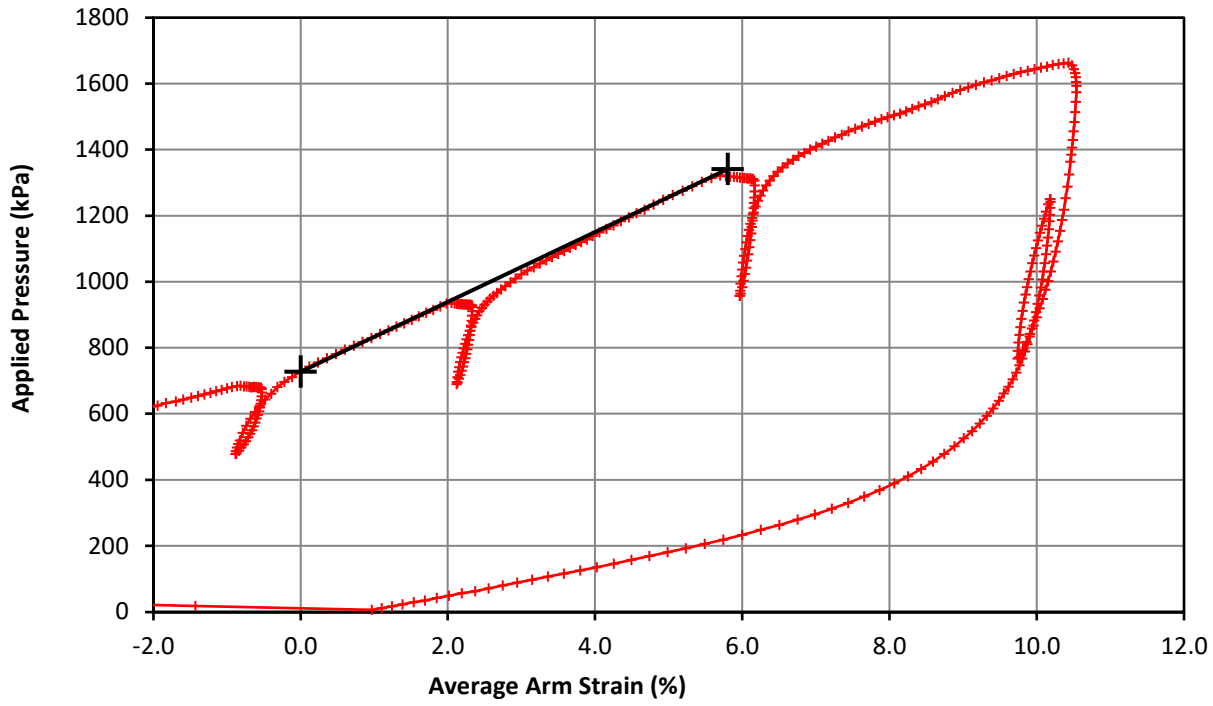


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 04**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

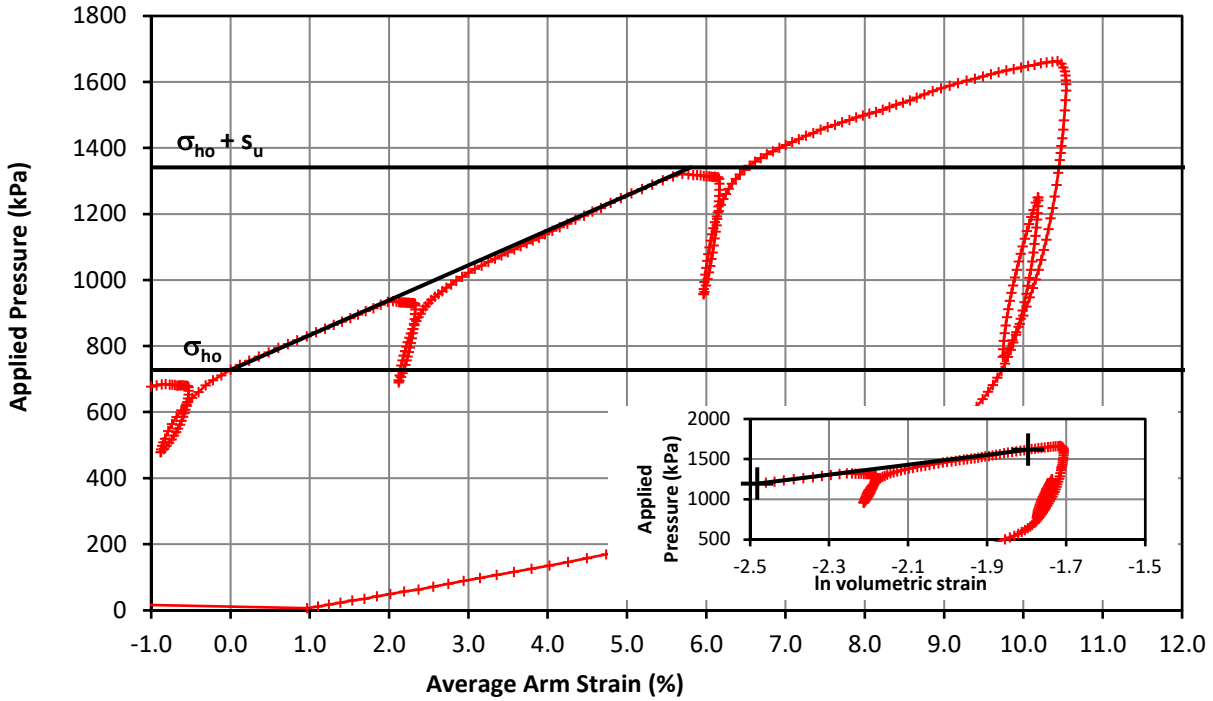
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



Initial Modulus	Shear Modulus	5.6 MPa



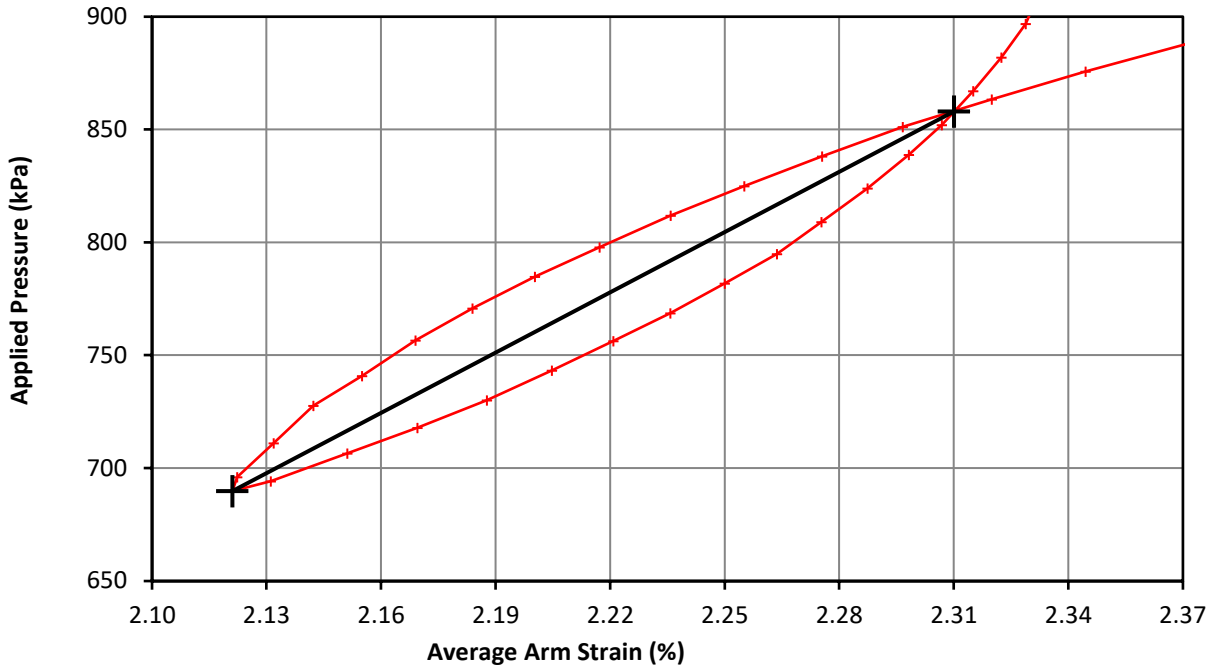
Marsland & Randolph	In situ horizontal stress	728 kPa
	Undrained Strength	614 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 05**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

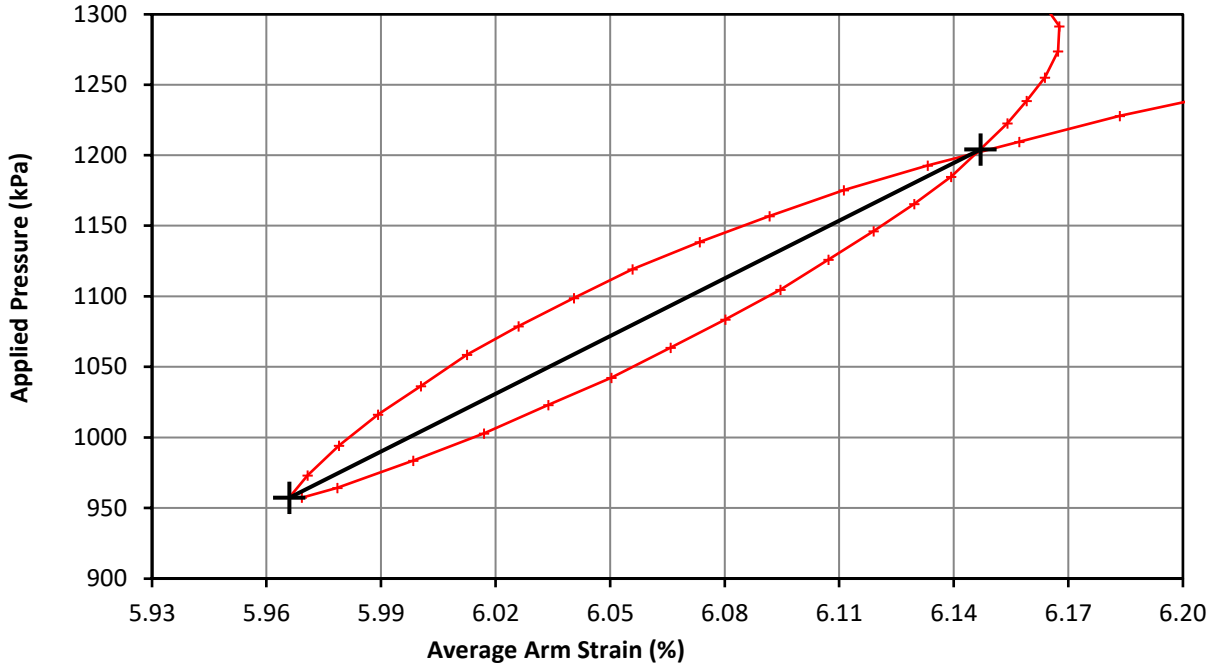
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



Loop 1	Shear Modulus	45.5	MPa
	Cavity Strain Range	0.189	%



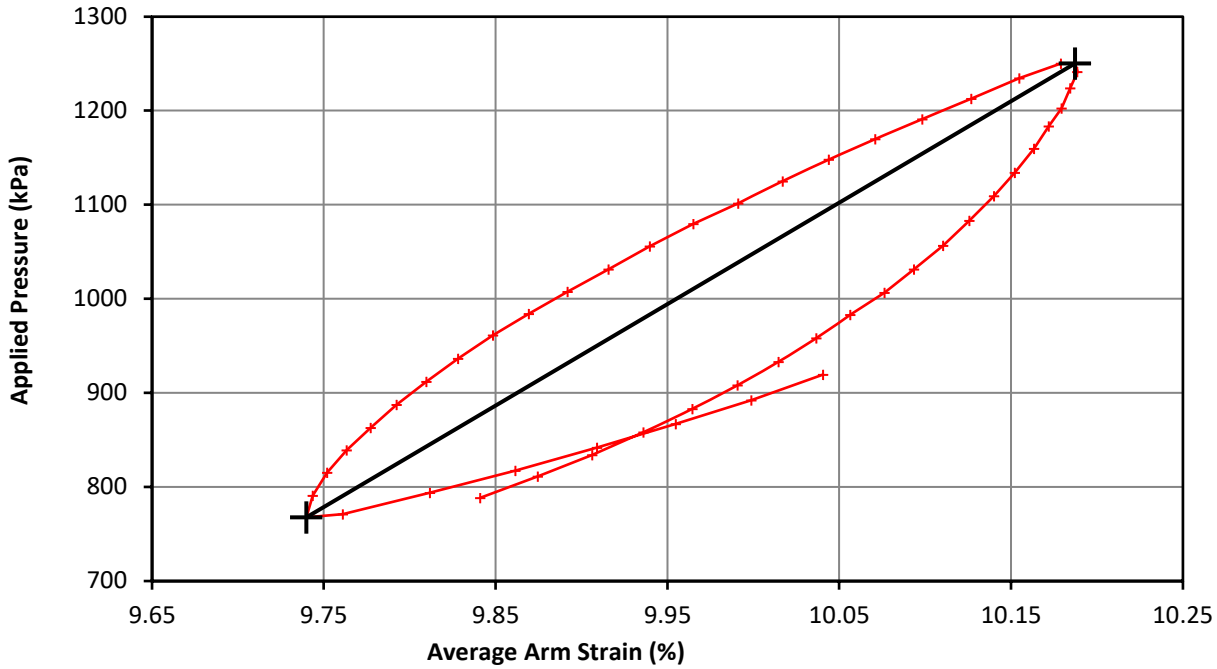
Loop 2	Shear Modulus	72.4	MPa
	Cavity Strain Range	0.181	%

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 06**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



Loop 3	Shear Modulus	59.4 MPa
	Cavity Strain Range	0.448 %

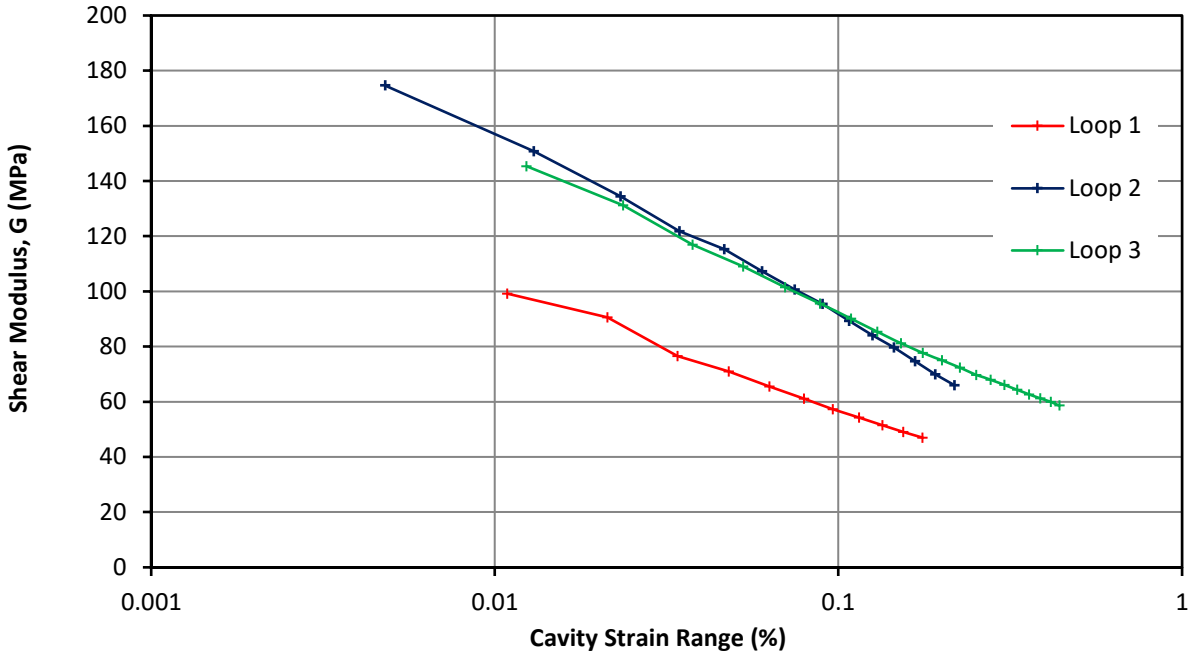
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 07**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

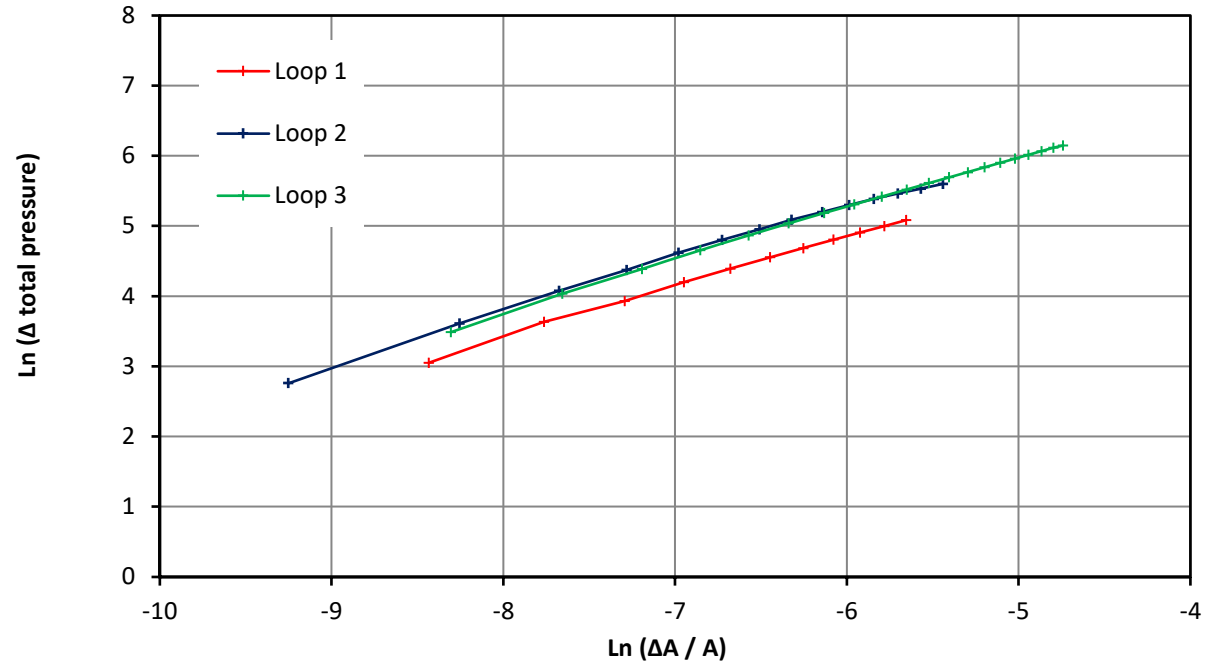
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30





Loop 1		Loop 2		Loop 3	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.720	9.724 (MPa)	0.741	16.724 (MPa)	0.733	15.567 (MPa)

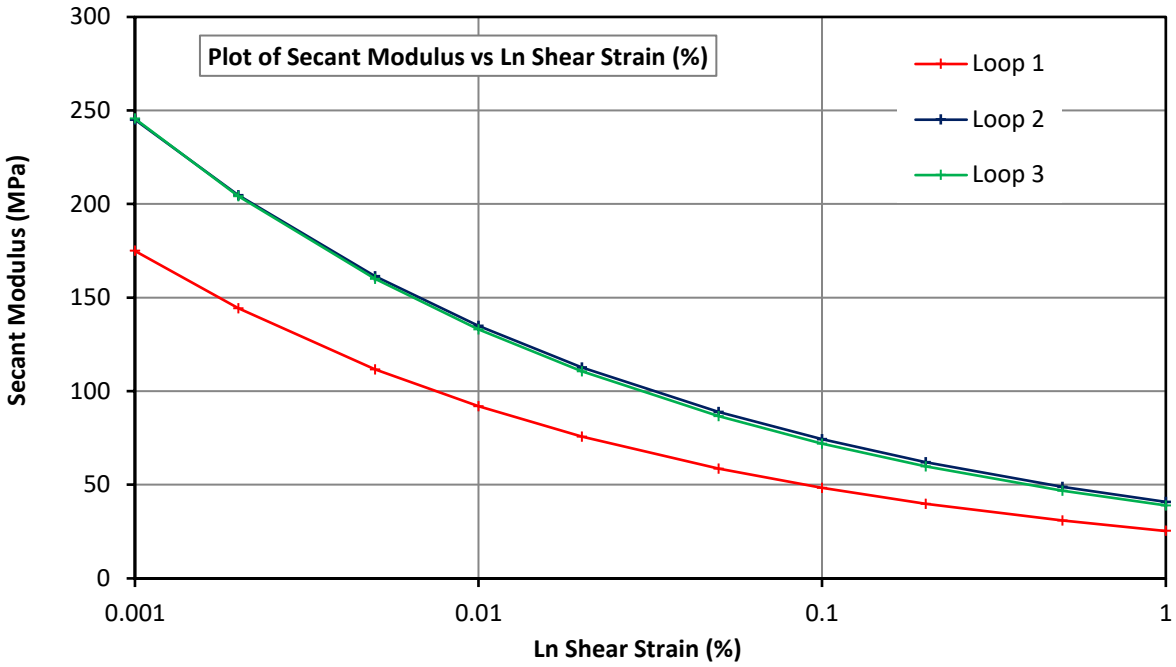
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 08**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



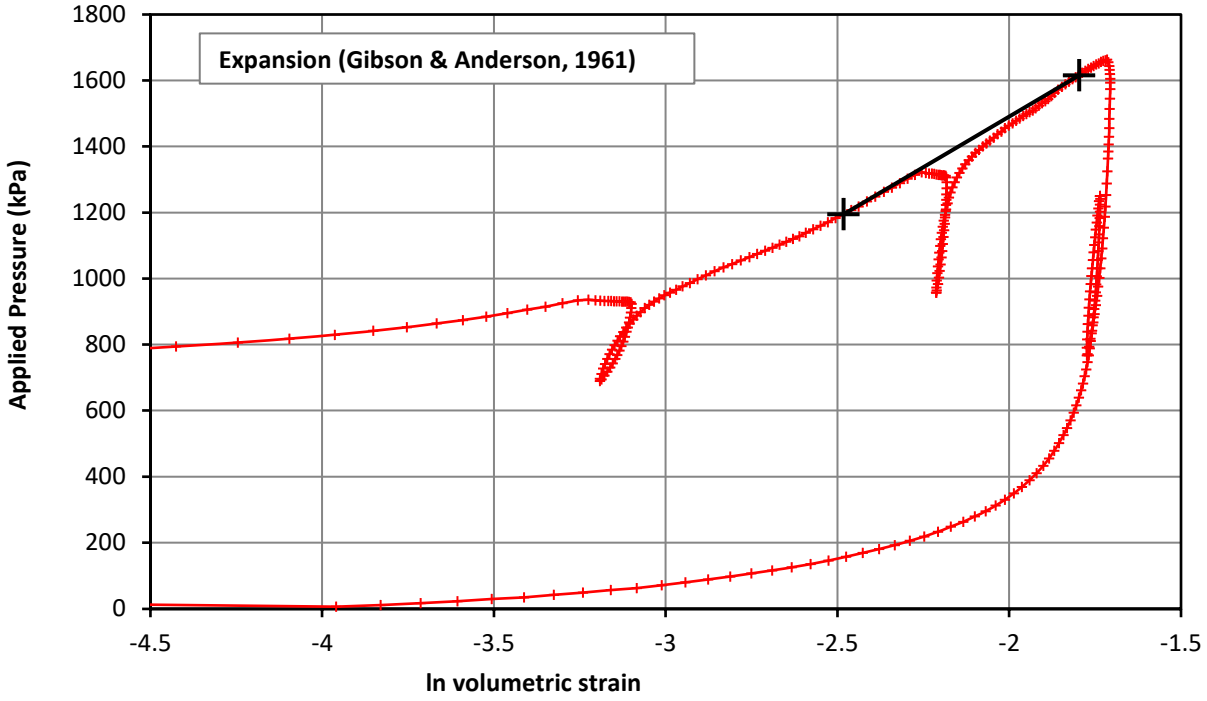
Shear Strain	Loop 1	Loop 2	Loop 3
0.001%	**175**	**245**	**246**
0.002%	144	205	204
0.005%	112	161	160
0.010%	**92**	**135**	**133**
0.020%	76	113	111
0.050%	59	89	87
0.100%	**48**	**74**	**72**
0.200%	40	62	60
0.500%	31	49	47
1.000%	**25**	**41**	**39**

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 09**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	08/07/2022	**Test No.**	2
Borehole	RWRM-BH008A	**Test Depth (m)**	10.30



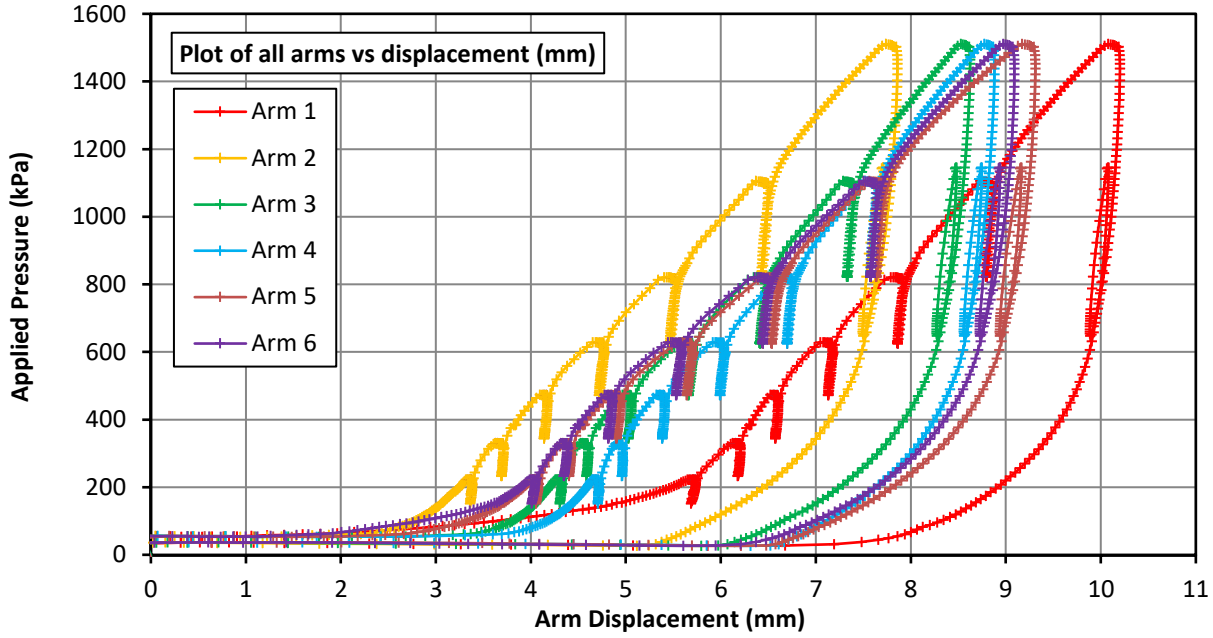
Strength (loading)	Undrained Shear	614 kPa
	Limit Pressure	2721 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH008A T02 - 10**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	05/07/2022		**Test No.**	1
Borehole	RWRM-BH014		**Test Depth (m)**	7.00
Coordinates (m)	570973.407 (E)	670035.37 (N)	**Elevation (m)**	37.07



Material description from borehole log:

Very stiff brown slightly gravelly sandy CLAY with medium cobble content.

Test pocket conditions:

Total core recovery:	- %	Test pocket depth range:	
Solid core recovery:	- %	From: 6.00 m	to: 8.00 m
Rock quality designation:	- %	Flush: Water	

Test comment:

The test pocket was oversize with arms lifting off at 3.3 to 5.6mm. The po was estimated to be at 210kPa, with the following loading section being relatively long. Material yield was not observed, although some onset of movement may be interpreted at 760kPa on arms 5, 6 & 1. The test was taken to a maximum pressure of 1511kPa. The displacement-pressure response shown by the arms was slightly variable. Analysis of four unload reload loops provides modulus values of 61 to 90MPa. Some early loops were ignored.

Test details: **Instrument:** Kylie (HPD06)

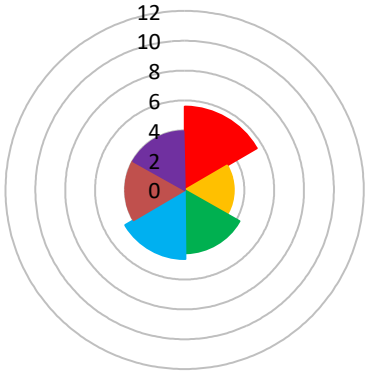
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	6.00 m	Arm 1:	-2426.9	132.4	TPC A:	-2380.5	113.4
Water level:	0.40 m	Arm 2:	-2393.9	130.5	TPC B:	-2456.8	120.7
		Arm 3:	-2316.1	133.1	Membrane:		
Test time:		Arm 4:	-2437.2	127.7	Stiffness	30.3	kPa
Start (probe in):	13:15 hrs	Arm 5:	-2333.3	126.4	Slope	11.2	kPa/mm
Finish (probe out):	15:15 hrs	Arm 6:	-2287.5	131.0	Compliance	1.5	mm/GPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 01**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

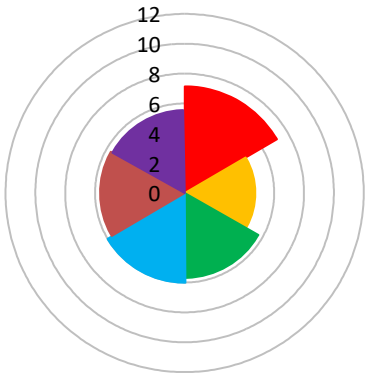
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

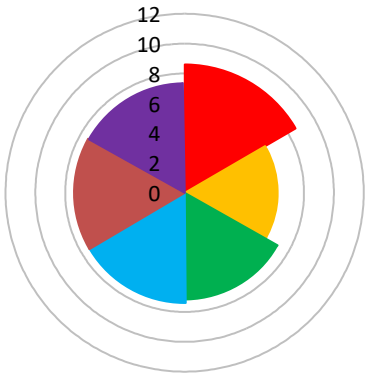
Test Date	05/07/2022	Test No.	1
Borehole	RWRM-BH014	Test Depth (m)	7.00



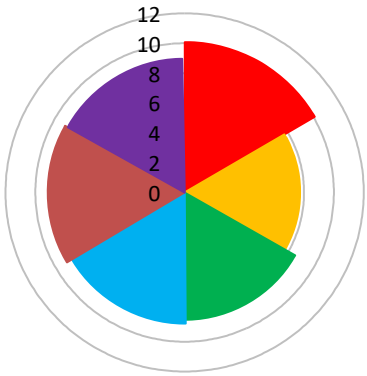
Arm expansion at:	0	% cavity strain
Cavity reference pressure:	214	kPa
Arm 1 at:	5.6	mm
Arm 2 at:	3.3	mm
Arm 3 at:	4.2	mm
Arm 4 at:	4.6	mm
Arm 5 at:	4.0	mm
Arm 6 at:	3.9	mm



Arm expansion at:	3	% cavity strain
Test pressure:	539	kPa
Arm 1 at:	7.1	mm
Arm 2 at:	4.7	mm
Arm 3 at:	5.7	mm
Arm 4 at:	6.0	mm
Arm 5 at:	5.7	mm
Arm 6 at:	5.6	mm



Arm expansion at:	6	% cavity strain
Test pressure:	1065	kPa
Arm 1 at:	8.6	mm
Arm 2 at:	6.2	mm
Arm 3 at:	7.2	mm
Arm 4 at:	7.4	mm
Arm 5 at:	7.4	mm
Arm 6 at:	7.3	mm



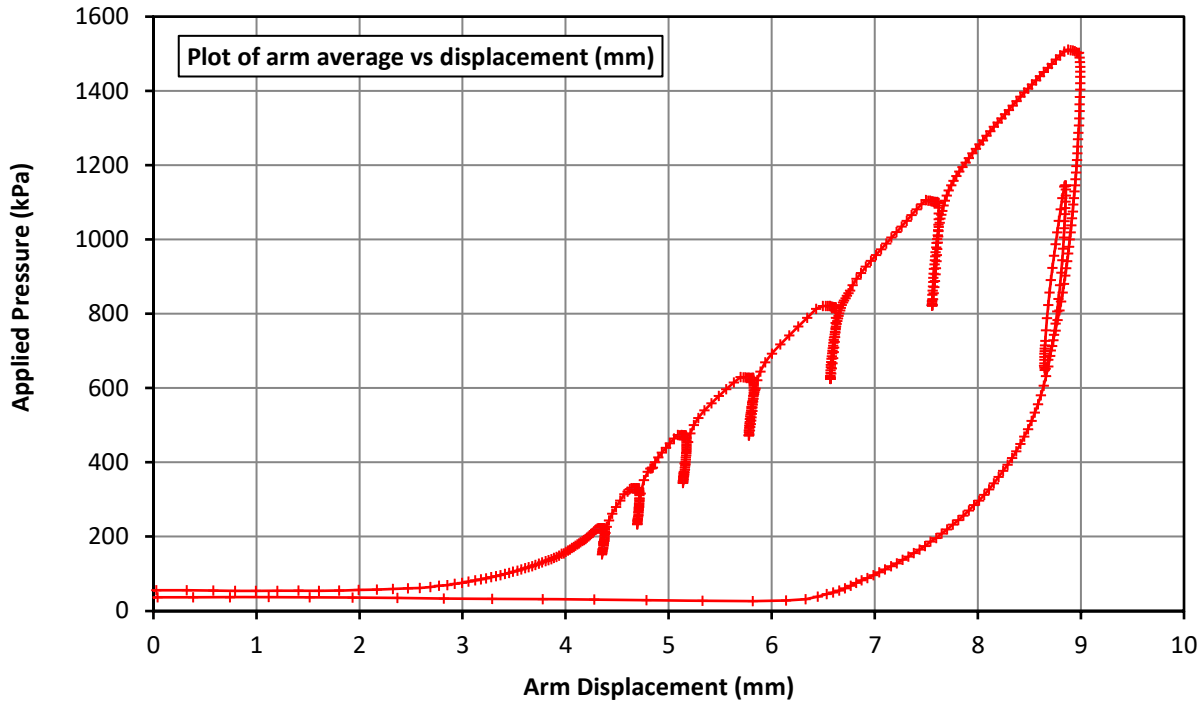
Arm expansion at:	9	% cavity strain
Maximum test pressure:	1511	kPa
Arm 1 at:	10.1	mm
Arm 2 at:	7.7	mm
Arm 3 at:	8.5	mm
Arm 4 at:	8.8	mm
Arm 5 at:	9.2	mm
Arm 6 at:	9.0	mm

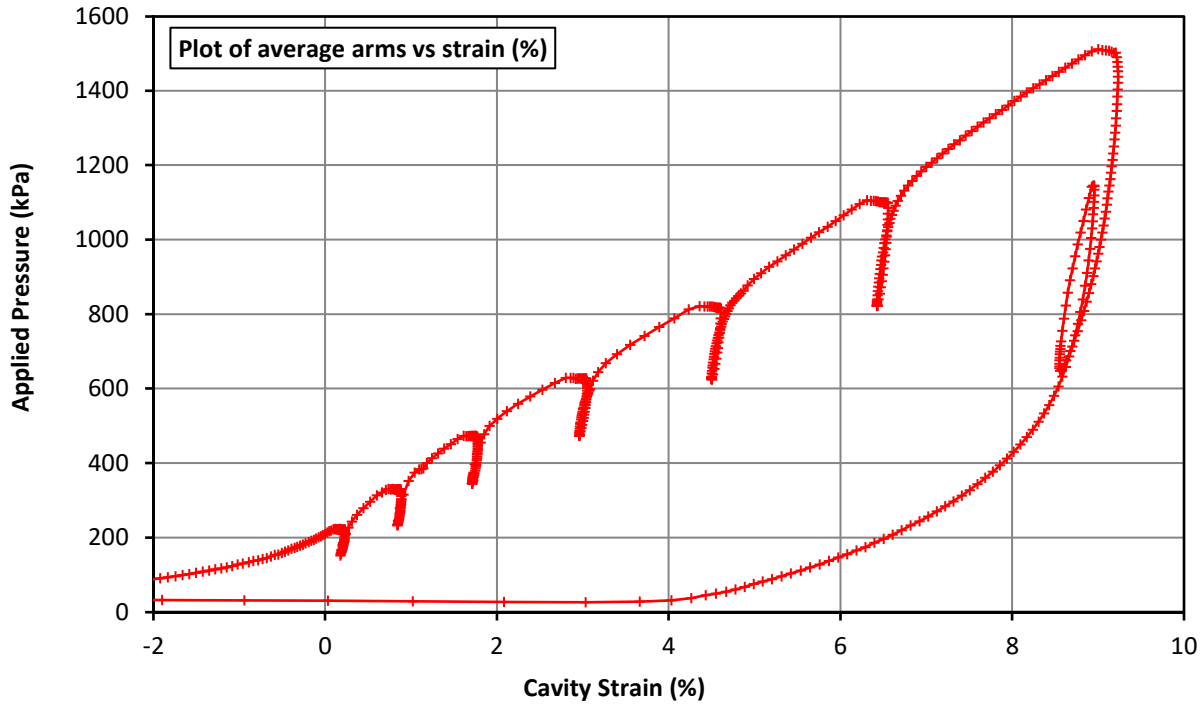
Project	WSP GI Lot 1 - RWRM Section Only	Figure No.	RWRM-BH014 T01 - 02
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



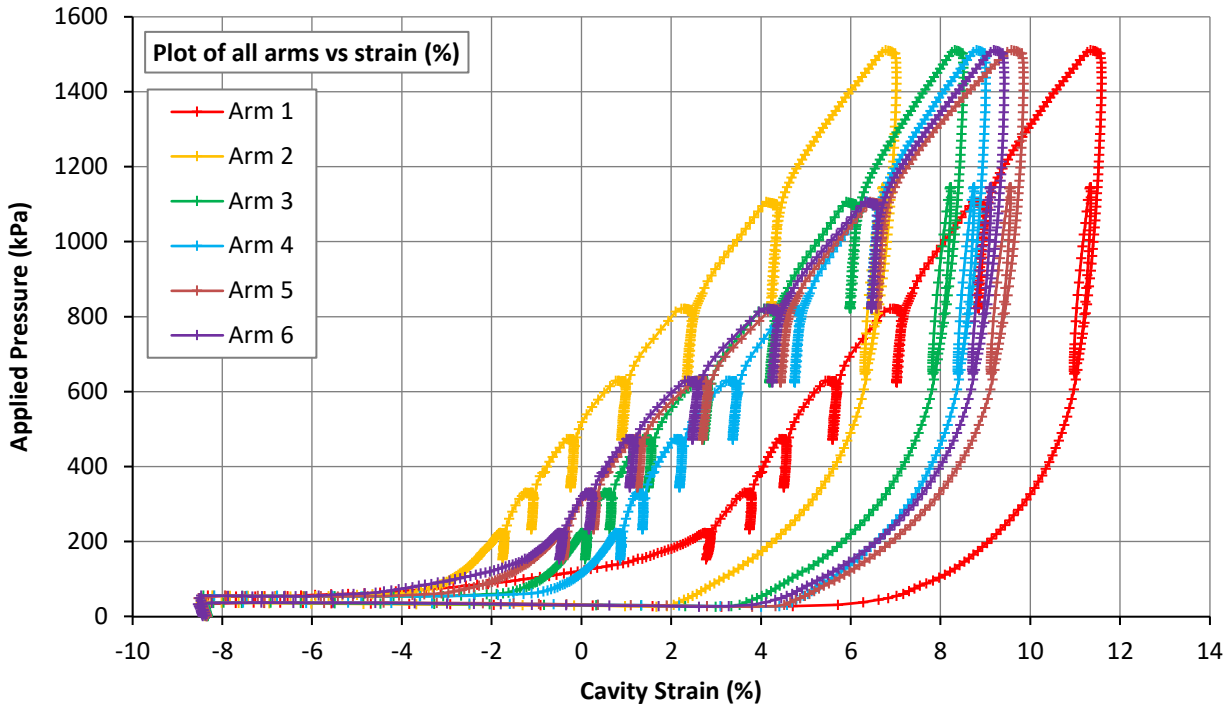


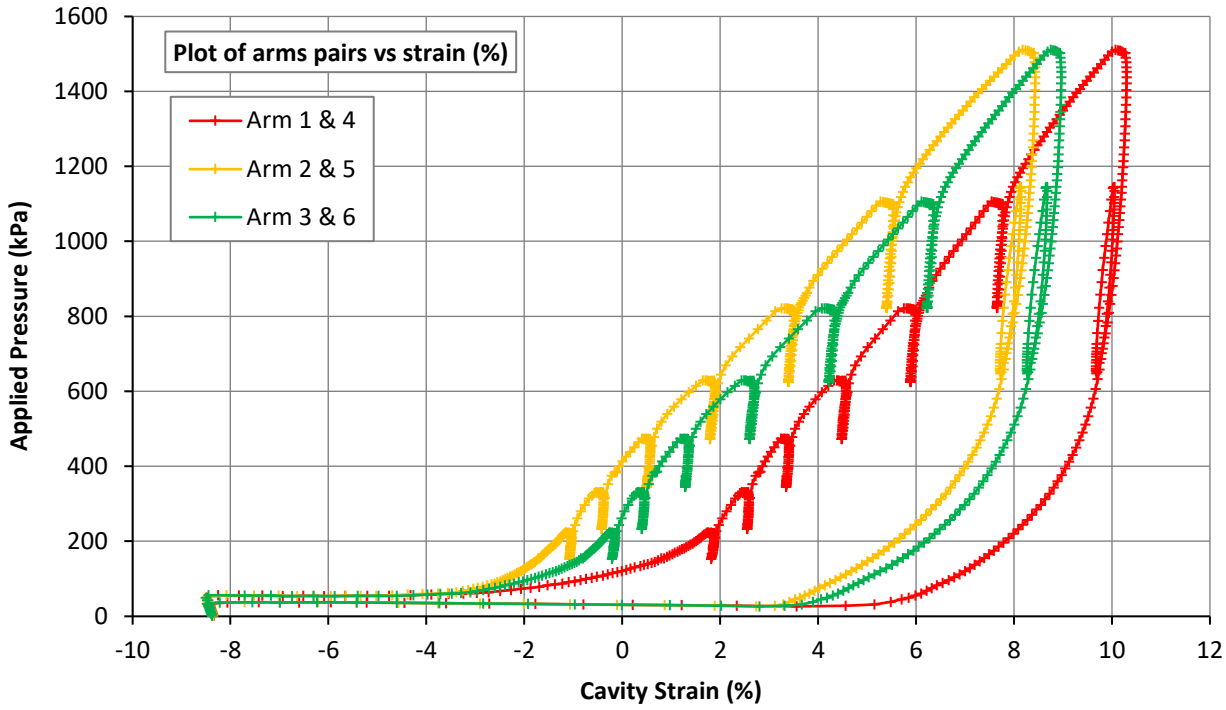
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 03**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



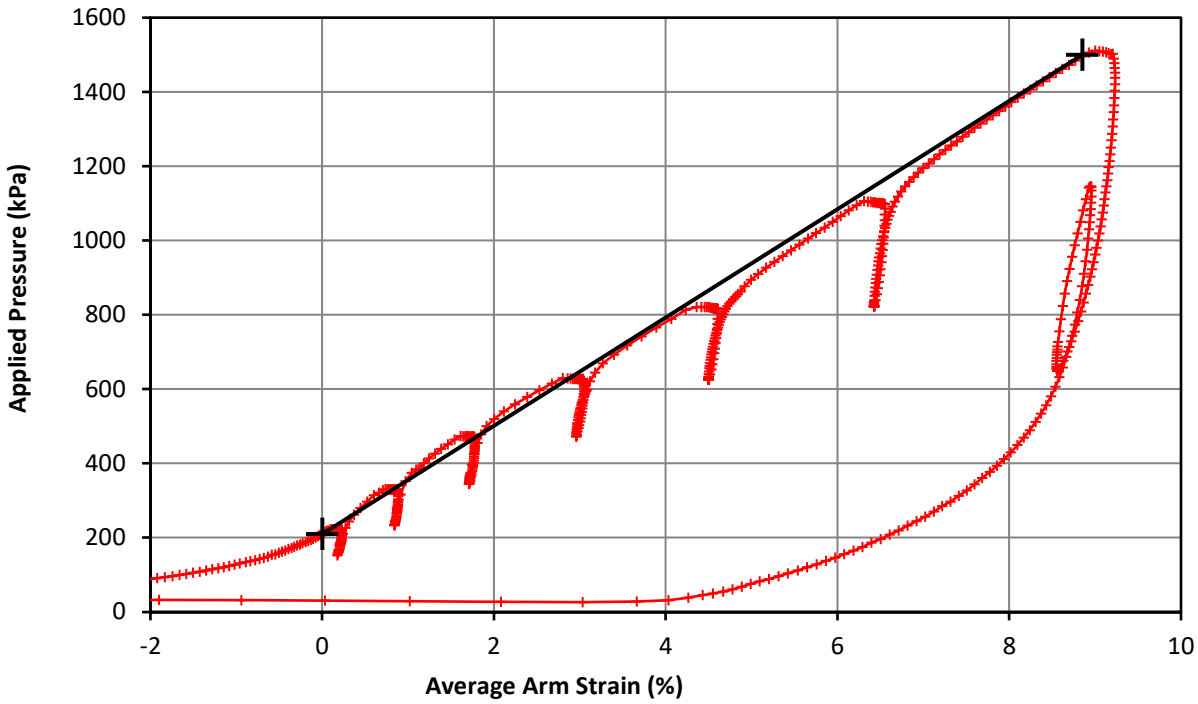


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 04**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



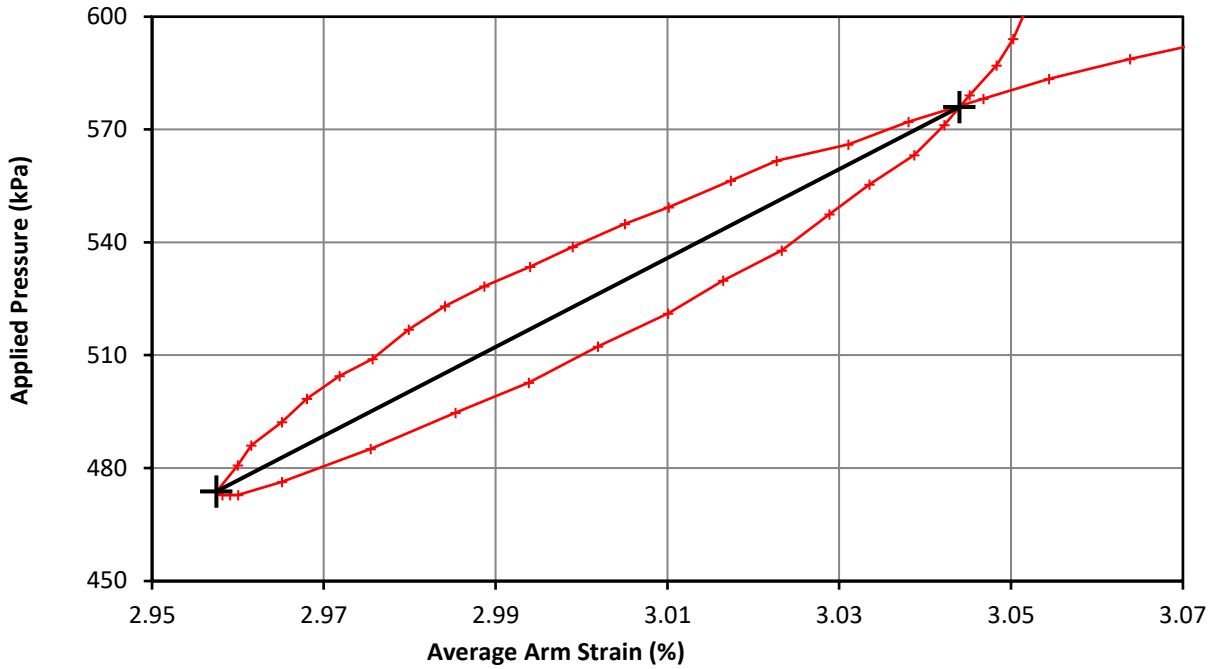
Initial Modulus	Shear Modulus	7.9	MPa
Cavity Reference Pressure		210	MPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 05**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

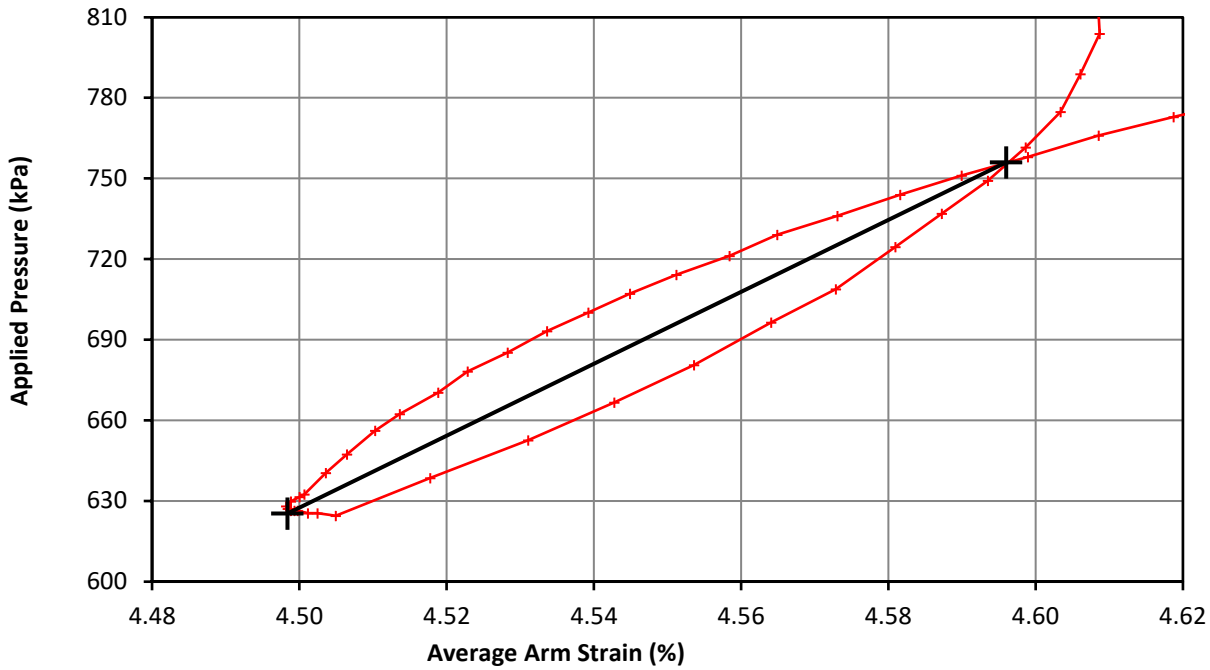
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



Loop 1	Shear Modulus	60.9	MPa
	Cavity Strain Range	0.087	%



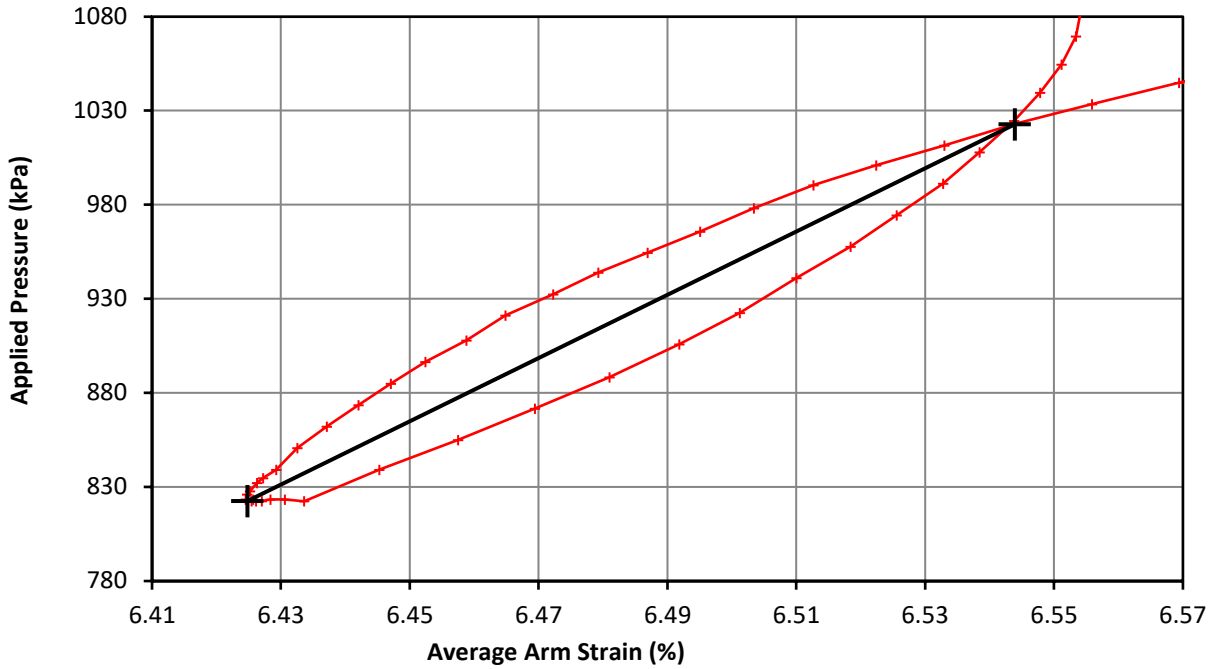
Loop 2	Shear Modulus	70.0	MPa
	Cavity Strain Range	0.098	%

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 06**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

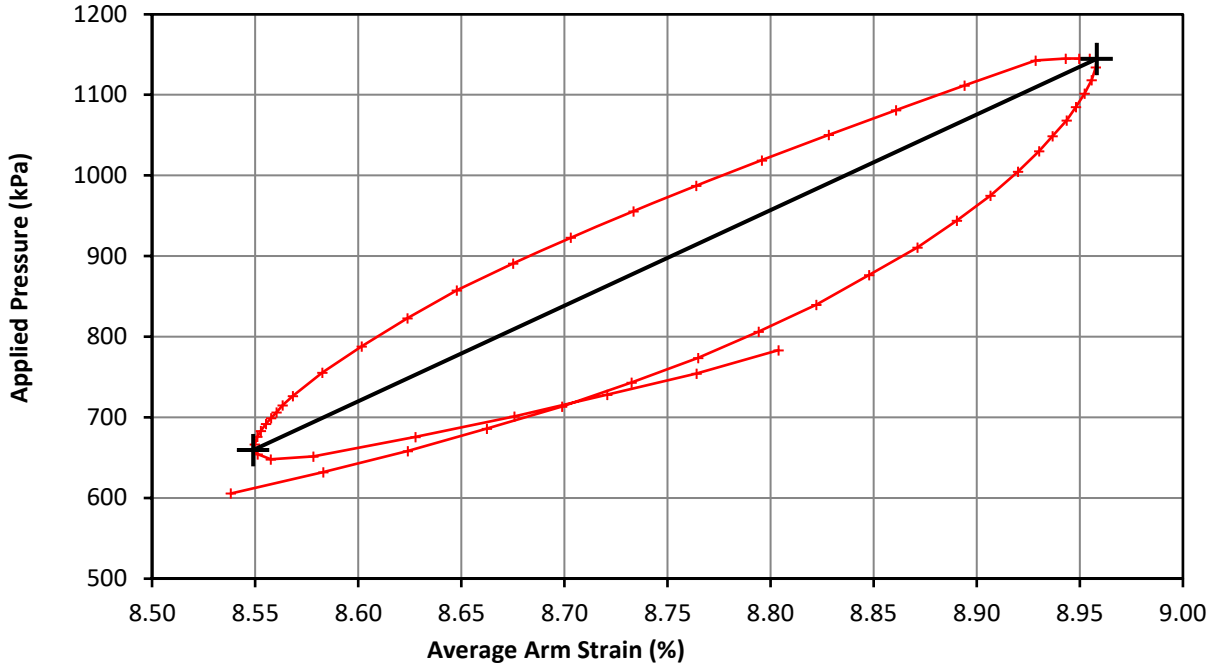
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



Loop 3	Shear Modulus	89.6 MPa
	Cavity Strain Range	0.119 %



Loop 4	Shear Modulus	64.6 MPa
	Cavity Strain Range	0.409 %

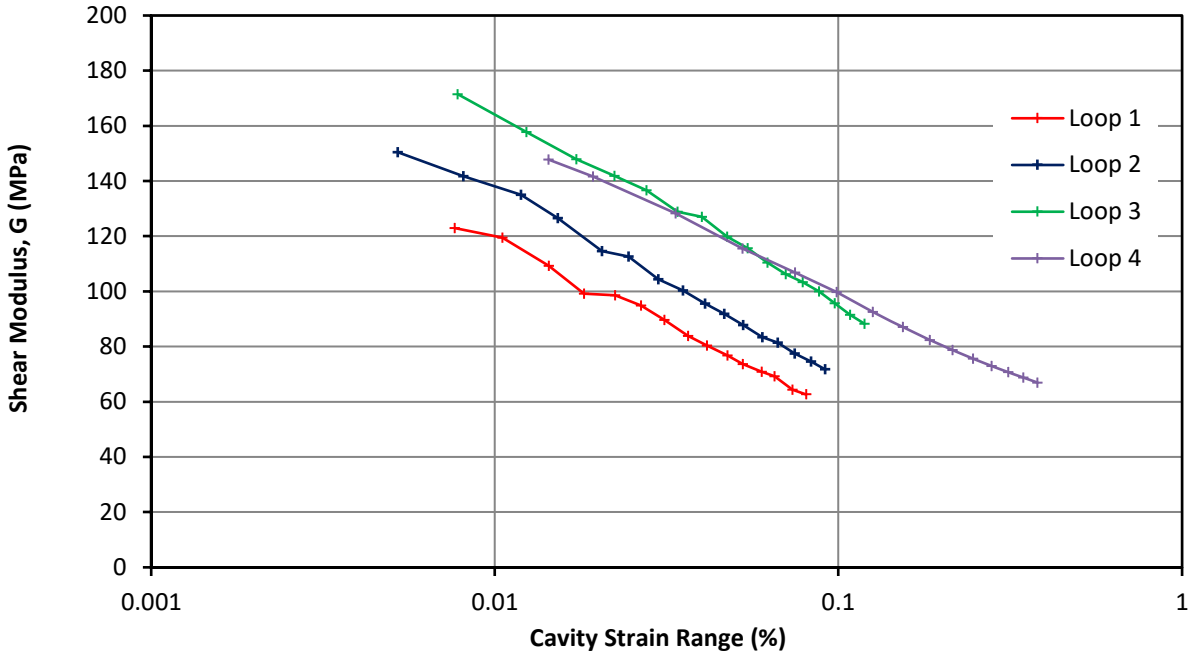
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 07**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

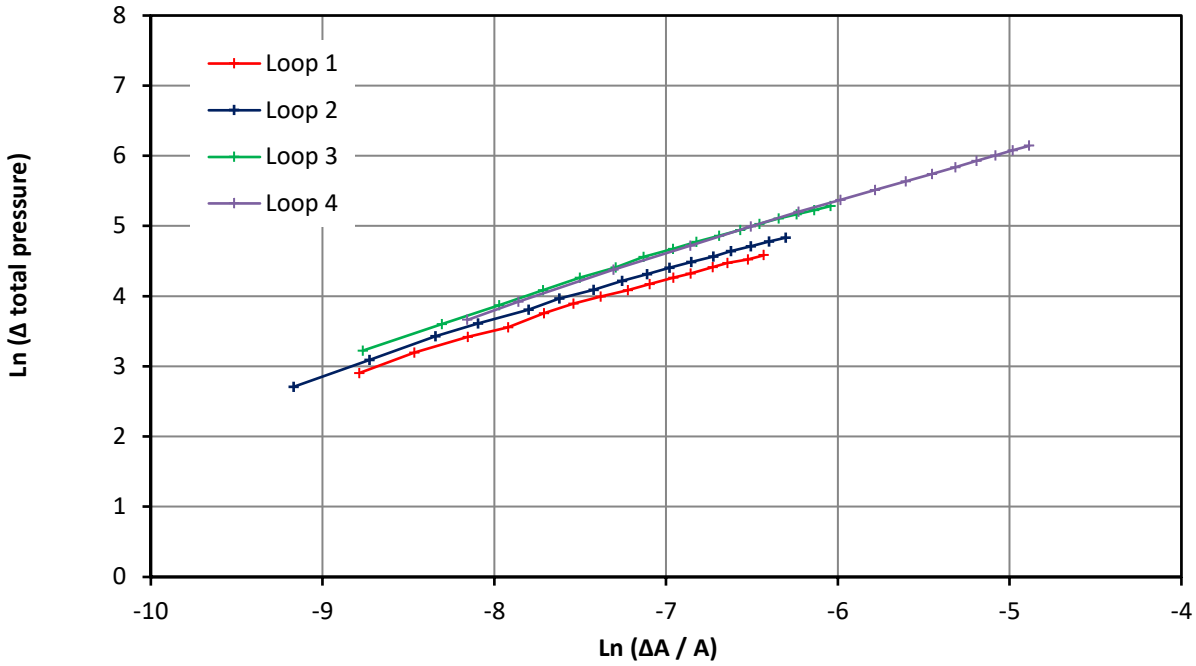
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00





Loop 1		Loop 2		Loop 3		Loop 4	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.705	9.478 (MPa)	0.729	13.082 (MPa)	0.757	20.161 (MPa)	0.749	18.572 (MPa)

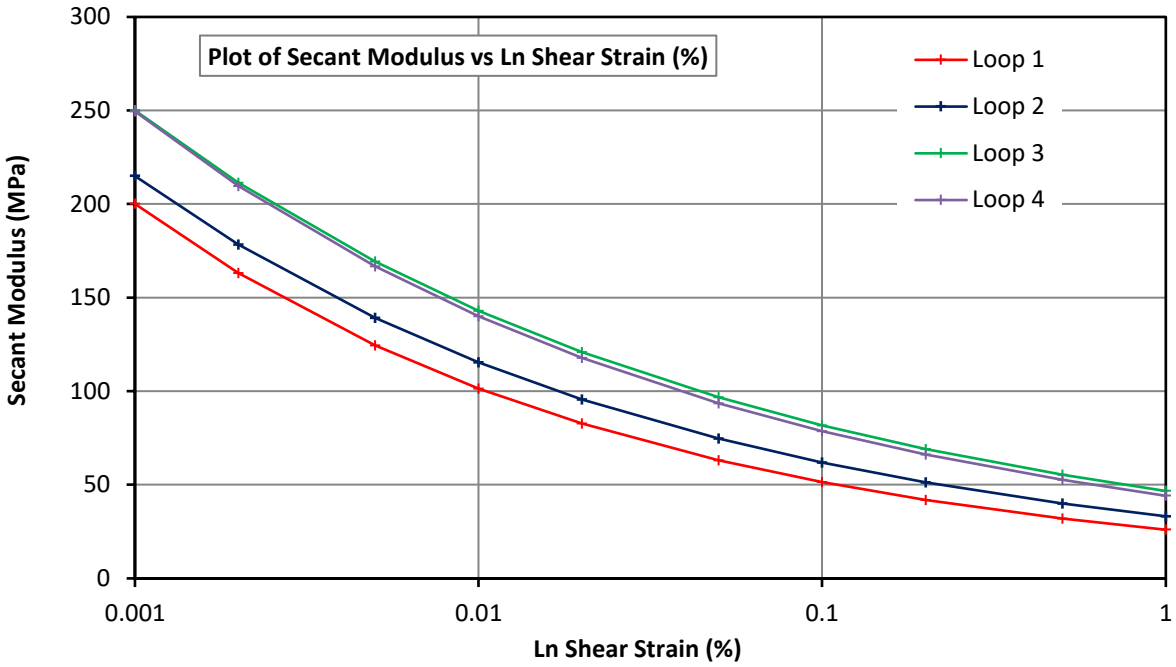
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 08**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	05/07/2022	**Test No.**	1
Borehole	RWRM-BH014	**Test Depth (m)**	7.00



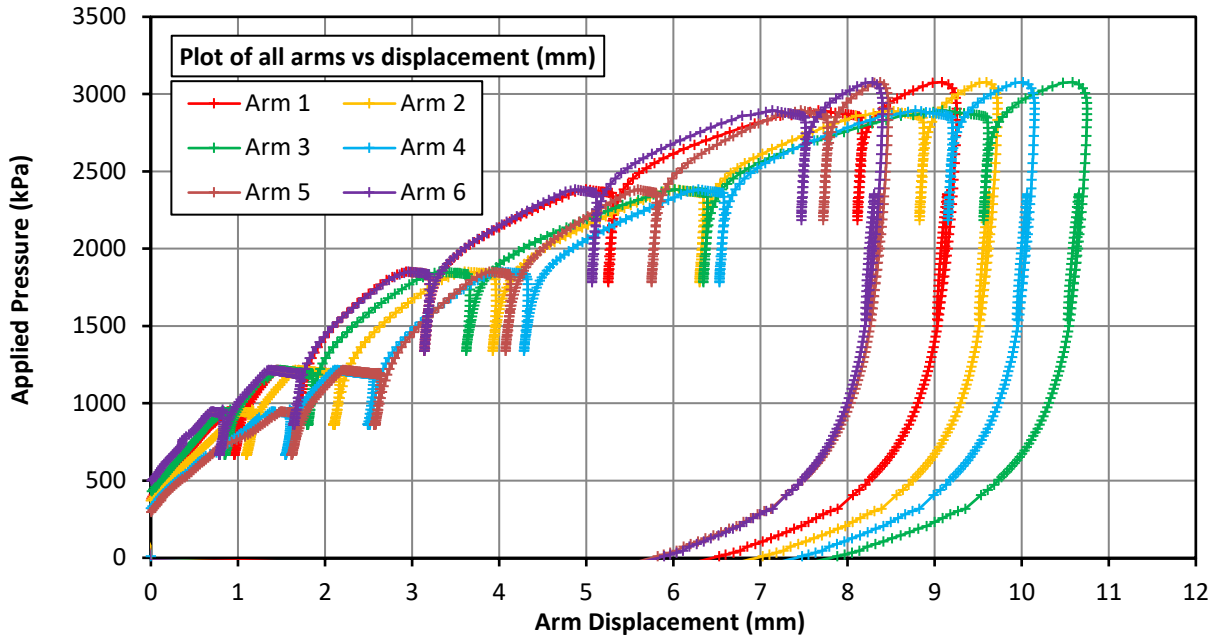
Shear Strain	Loop 1	Loop 2	Loop 3	Loop 4
0.001%	**200**	**215**	**250**	**249**
0.002%	163	178	211	210
0.005%	124	139	169	167
0.010%	**101**	**115**	**143**	**140**
0.020%	83	96	121	118
0.050%	63	75	97	94
0.100%	**51**	**62**	**82**	**79**
0.200%	42	51	69	66
0.500%	32	40	55	53
1.000%	**26**	**33**	**47**	**44**

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T01 - 09**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022		**Test No.**	2
Borehole	RWRM-BH014		**Test Depth (m)**	11.65
Coordinates (m)	570973.407 (E)	670035.37 (N)	**Elevation (m)**	37.07



Material description from borehole log:

Very stiff brown slightly gravelly sandy silty CLAY with low cobble content.

Test pocket conditions:

Total core recovery:	0 %	Test pocket depth range:	
Solid core recovery:	- %	From: 11.00 m	to: 12.50 m
Rock quality designation:	- %	Flush: Water	

Test comment:

The test pocket was squeezed with arms lifting off at 0.3 to 0.8mm. The po was estimated to be at 671kPa, with the following loading section being relatively short. Material yield was interpreted at 2143kPa, with the test taken to a maximum pressure of 3078kPa. The displacement-pressure response shown by the arms was variable throughout. Analysis of four unload reload loops provides modulus values of 131 to 268MPa. Derived undrained shear strength analysis provides a value of 1472kPa.

Test details: **Instrument:** Kylie (HPD06)

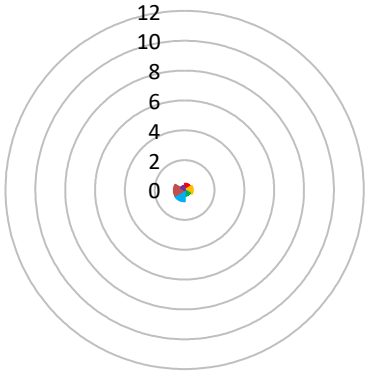
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	11.00 m	Arm 1:	-2424.0	132.4	TPC A:	-2383.2	113.4
Water level:	0.50 m	Arm 2:	-2396.6	130.5	TPC B:	-2459.1	120.7
		Arm 3:	-2318.8	133.1	Membrane:		
Test time:		Arm 4:	-2435.5	127.7	Stiffness	30.3	kPa
Start (probe in):	10:05 hrs	Arm 5:	-2330.0	126.4	Slope	11.2	kPa/mm
Finish (probe out):	12:40 hrs	Arm 6:	-2282.1	131.0	Compliance	1.5	mm/GPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 01**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

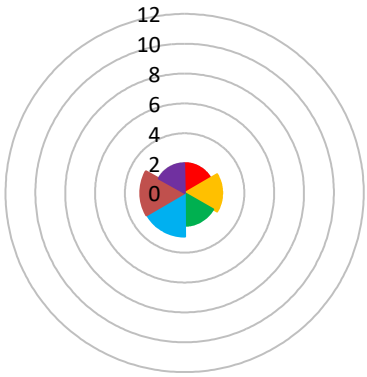
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

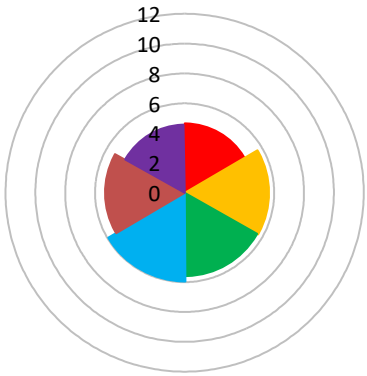
Test Date	06/07/2022	Test No.	2
Borehole	RWRM-BH014	Test Depth (m)	11.65



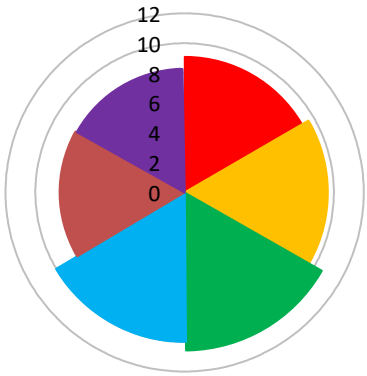
Arm expansion at:	0	% cavity strain
Cavity reference pressure:	682	kPa
Arm 1 at:	0.4	mm
Arm 2 at:	0.5	mm
Arm 3 at:	0.4	mm
Arm 4 at:	0.8	mm
Arm 5 at:	0.7	mm
Arm 6 at:	0.3	mm



Arm expansion at:	4	% cavity strain
Test pressure:	1427	kPa
Arm 1 at:	2.0	mm
Arm 2 at:	2.5	mm
Arm 3 at:	2.2	mm
Arm 4 at:	2.9	mm
Arm 5 at:	3.0	mm
Arm 6 at:	2.0	mm



Arm expansion at:	10	% cavity strain
Test pressure:	2316	kPa
Arm 1 at:	4.7	mm
Arm 2 at:	5.7	mm
Arm 3 at:	5.6	mm
Arm 4 at:	5.9	mm
Arm 5 at:	5.3	mm
Arm 6 at:	4.6	mm



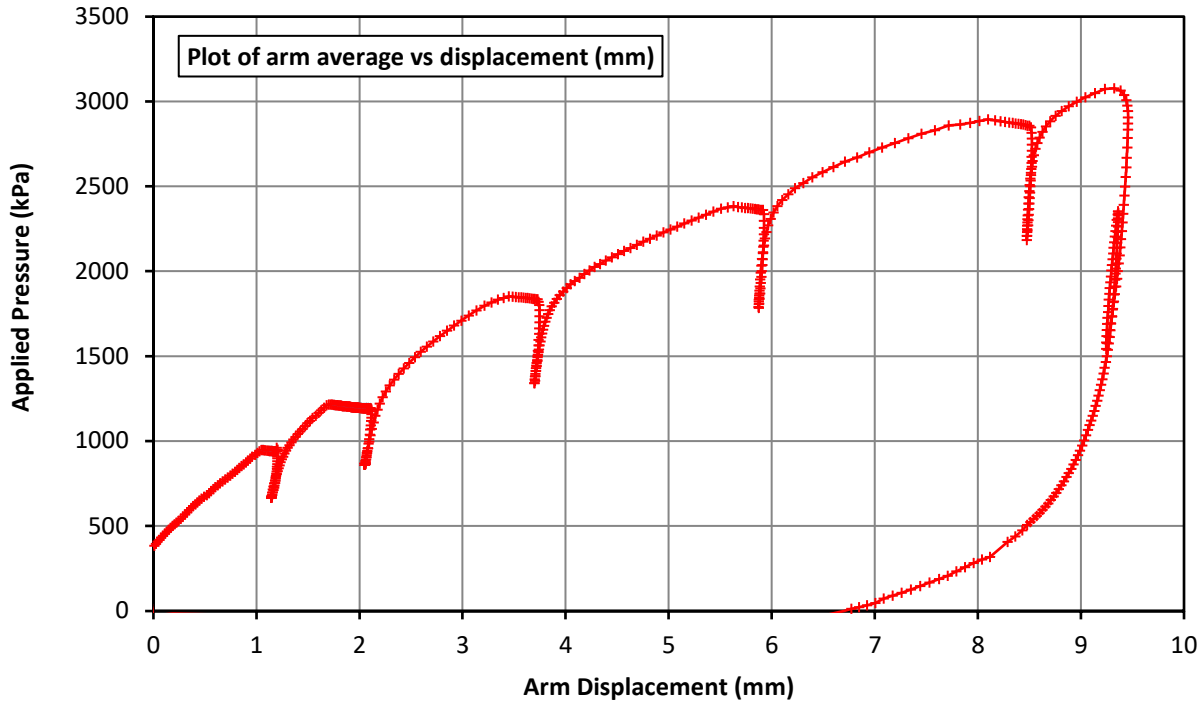
Arm expansion at:	19	% cavity strain
Maximum test pressure:	3078	kPa
Arm 1 at:	9.1	mm
Arm 2 at:	9.6	mm
Arm 3 at:	10.6	mm
Arm 4 at:	10.0	mm
Arm 5 at:	8.4	mm
Arm 6 at:	8.3	mm

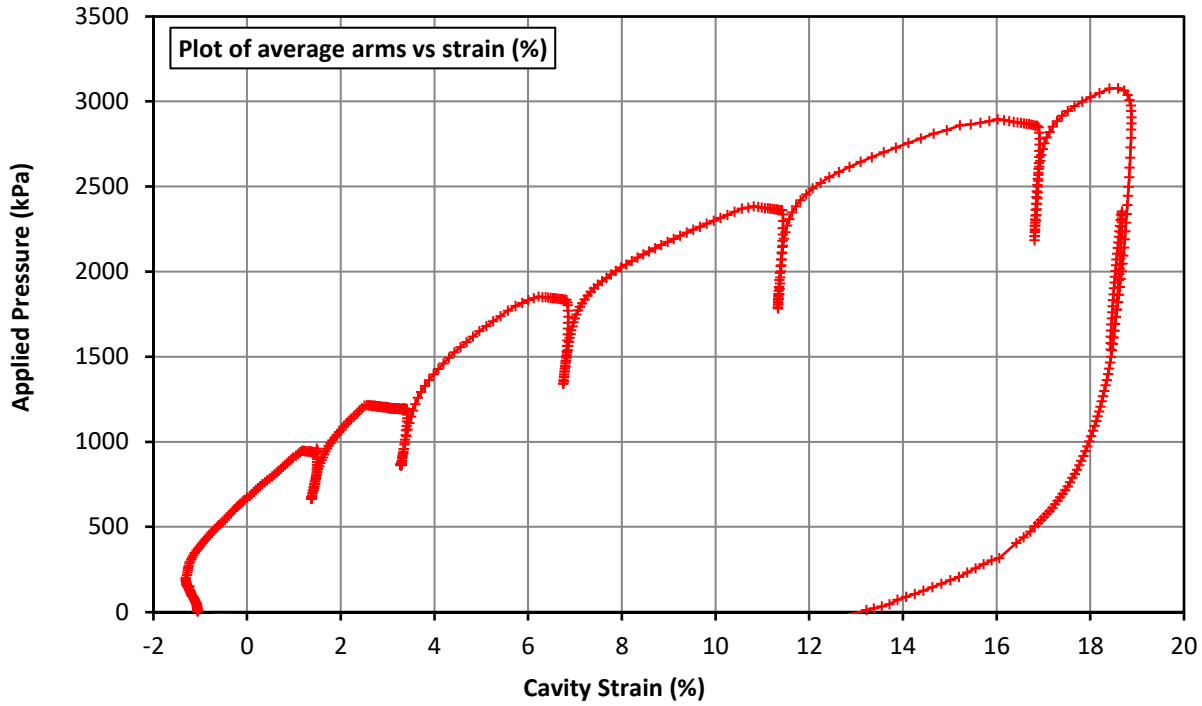
Project	WSP GI Lot 1 - RWRM Section Only	Figure No.	RWRM-BH014 T02 - 02
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



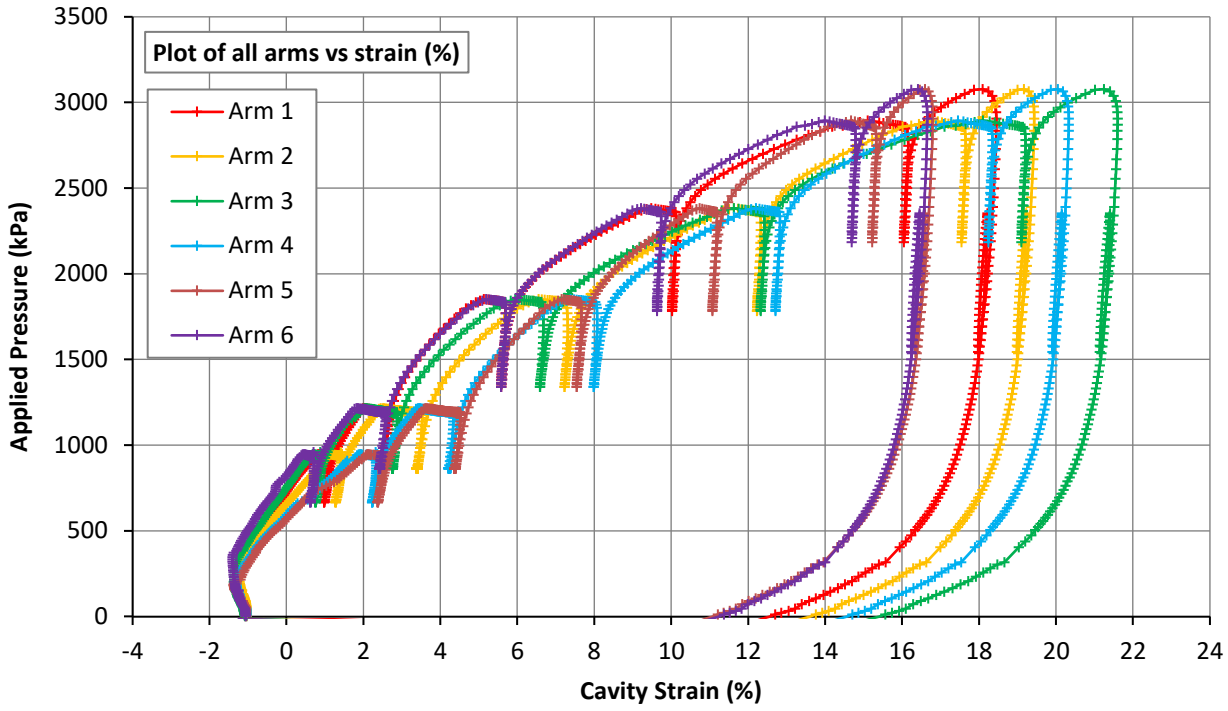


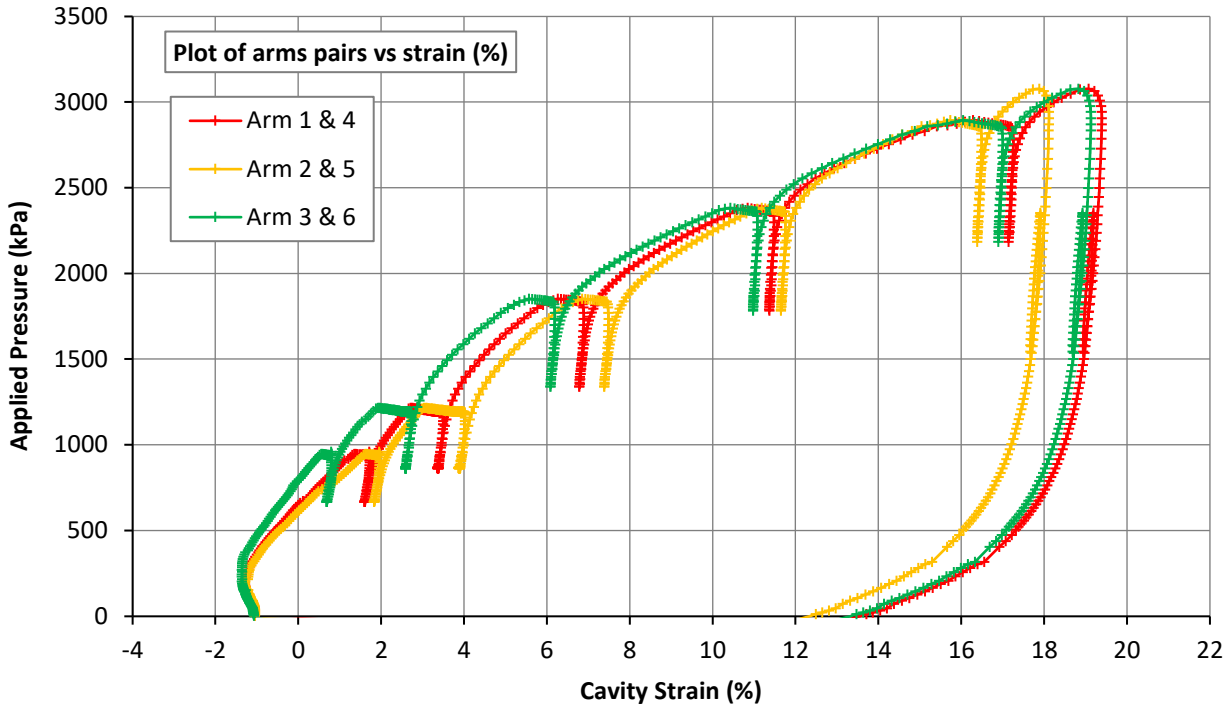
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 03**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



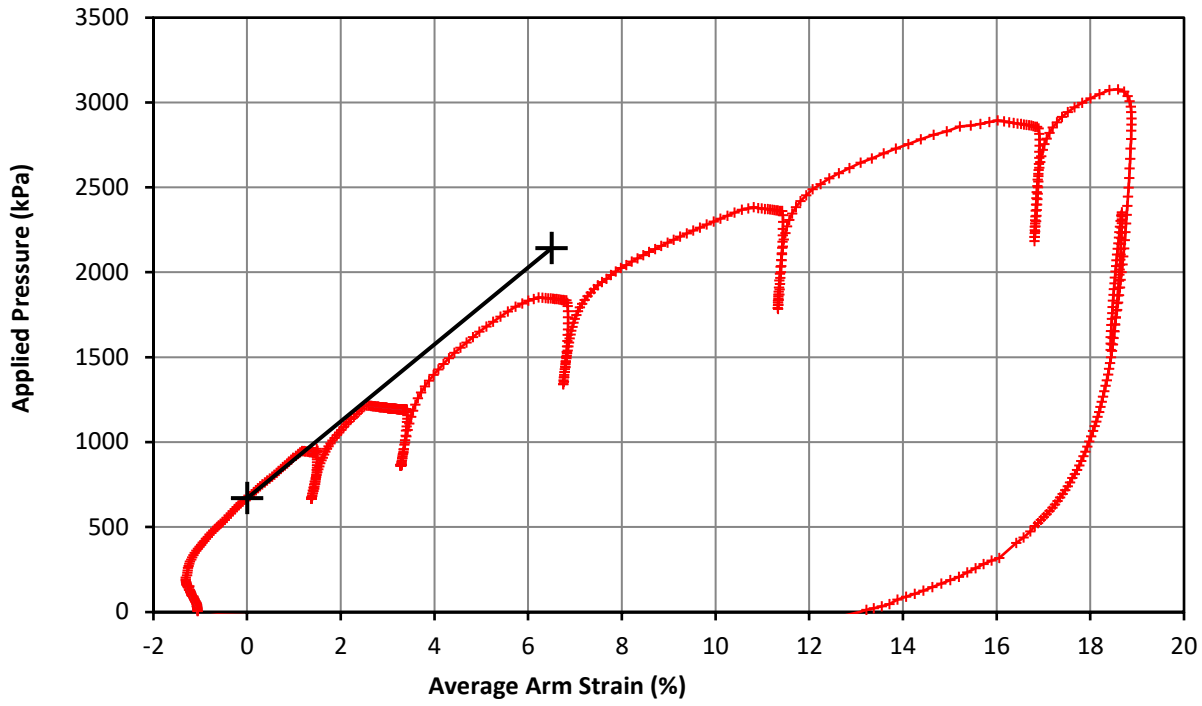


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 04**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

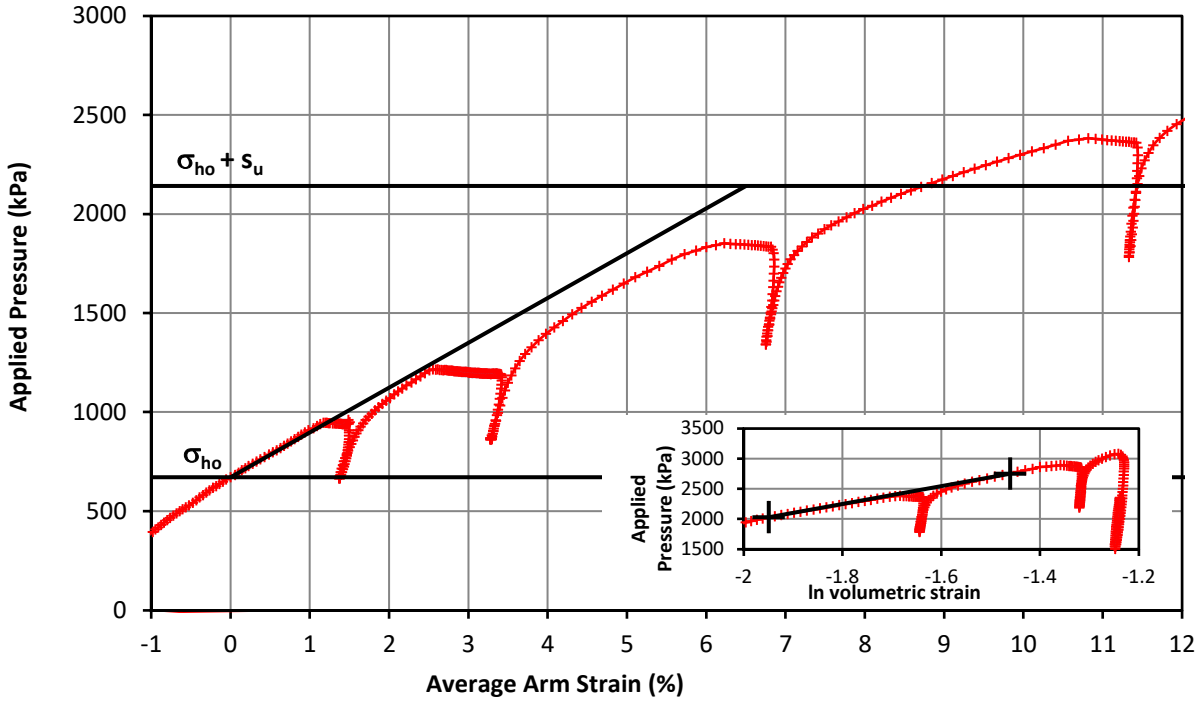
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



Initial Modulus	Shear Modulus	12.1 MPa



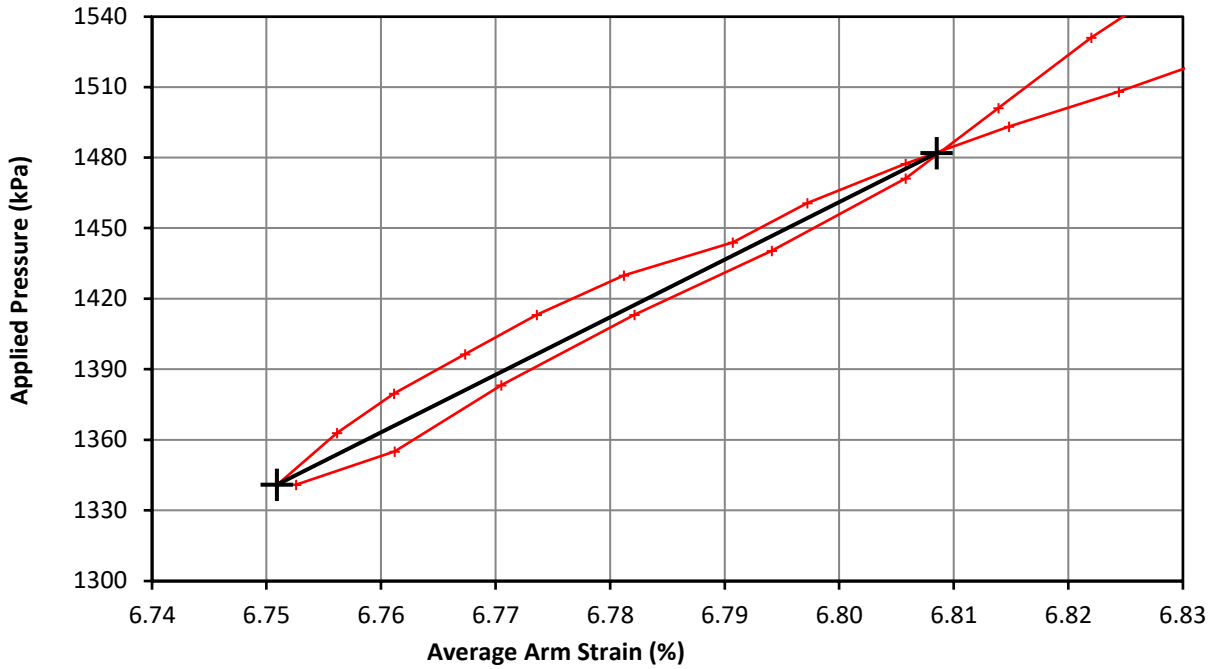
Marsland & Randolph	In situ horizontal stress	671 kPa
	Undrained Strength	1472 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 05**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

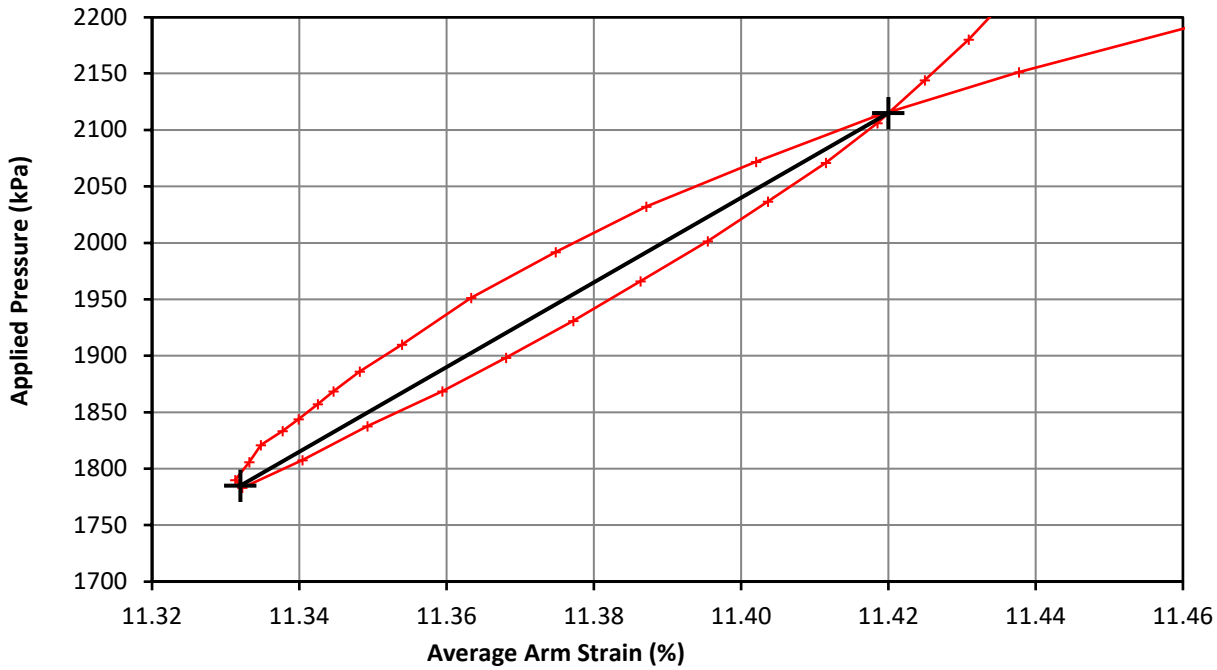
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



Loop 1	Shear Modulus	130.7	MPa
	Cavity Strain Range	0.058	%



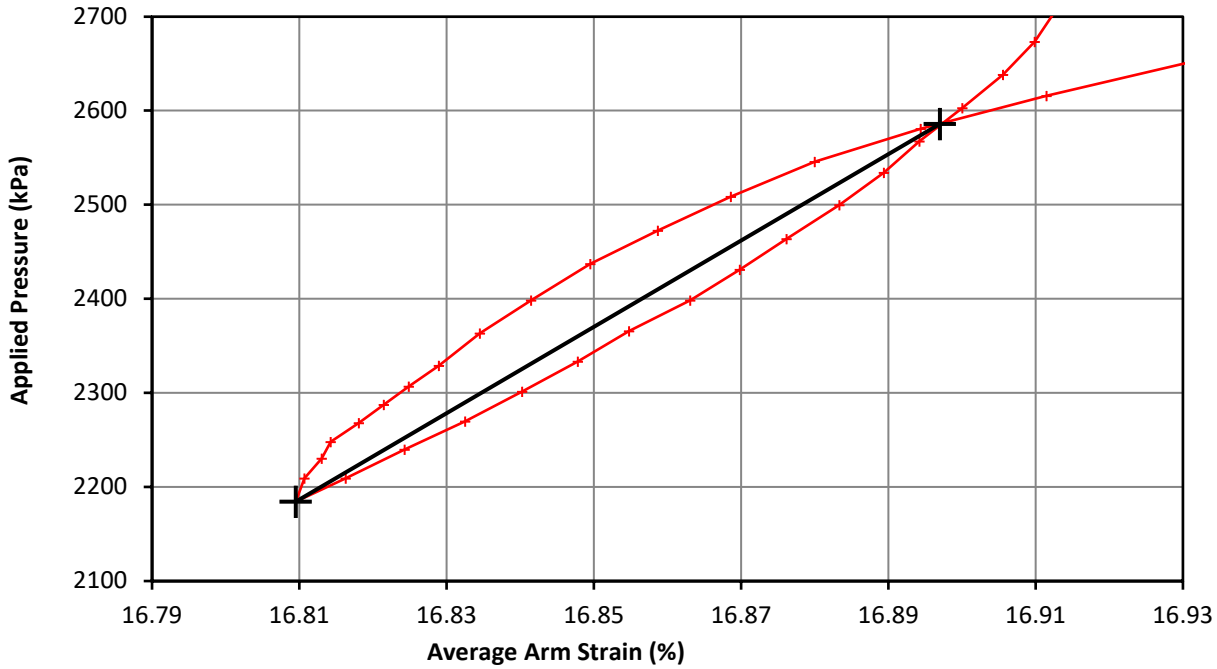
Loop 2	Shear Modulus	208.9	MPa
	Cavity Strain Range	0.088	%

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 06**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

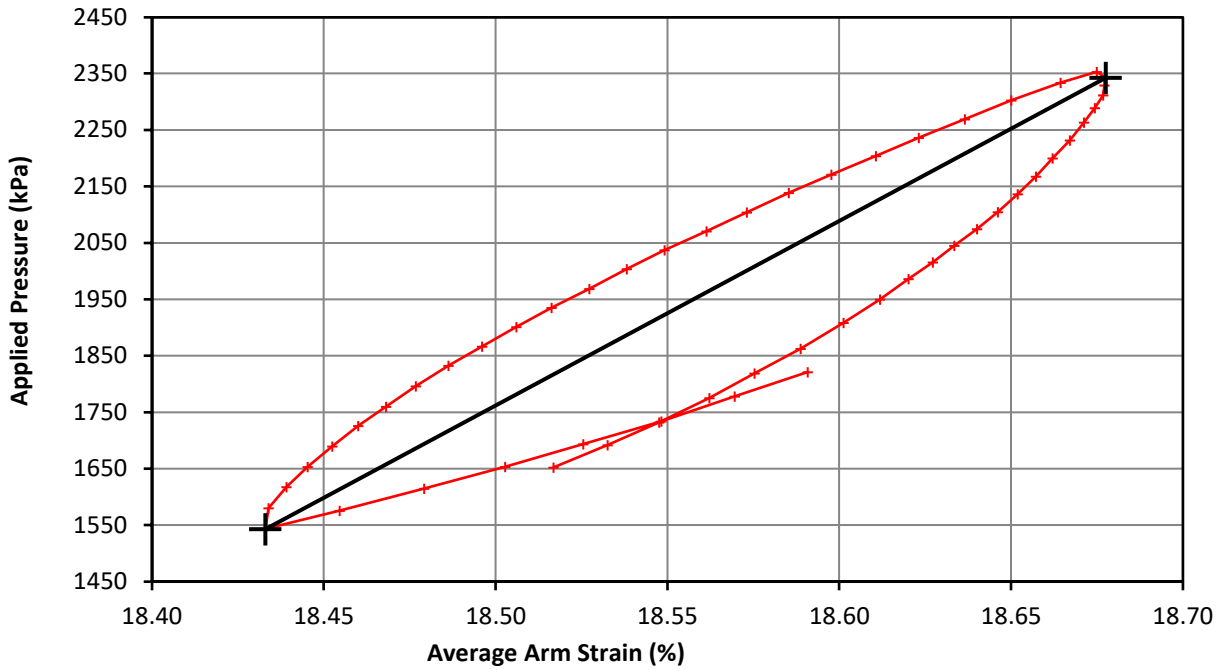
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



Loop 3	Shear Modulus	268.3 MPa
	Cavity Strain Range	0.087 %



Loop 4	Shear Modulus	194.0 MPa
	Cavity Strain Range	0.244 %

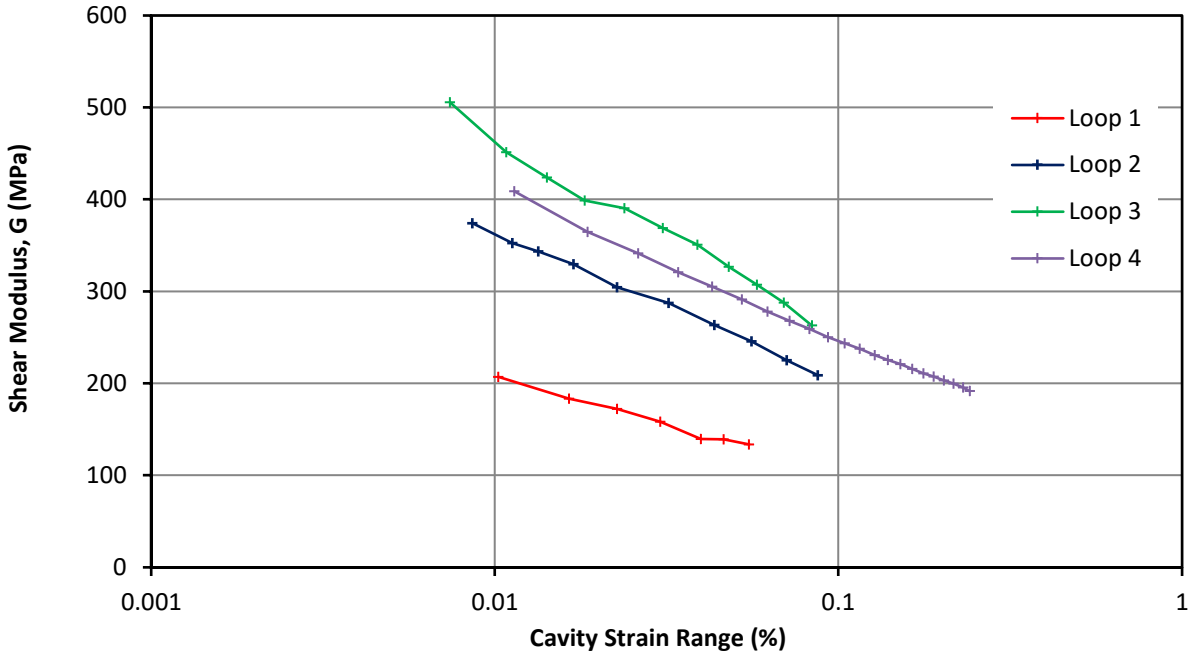
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 07**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

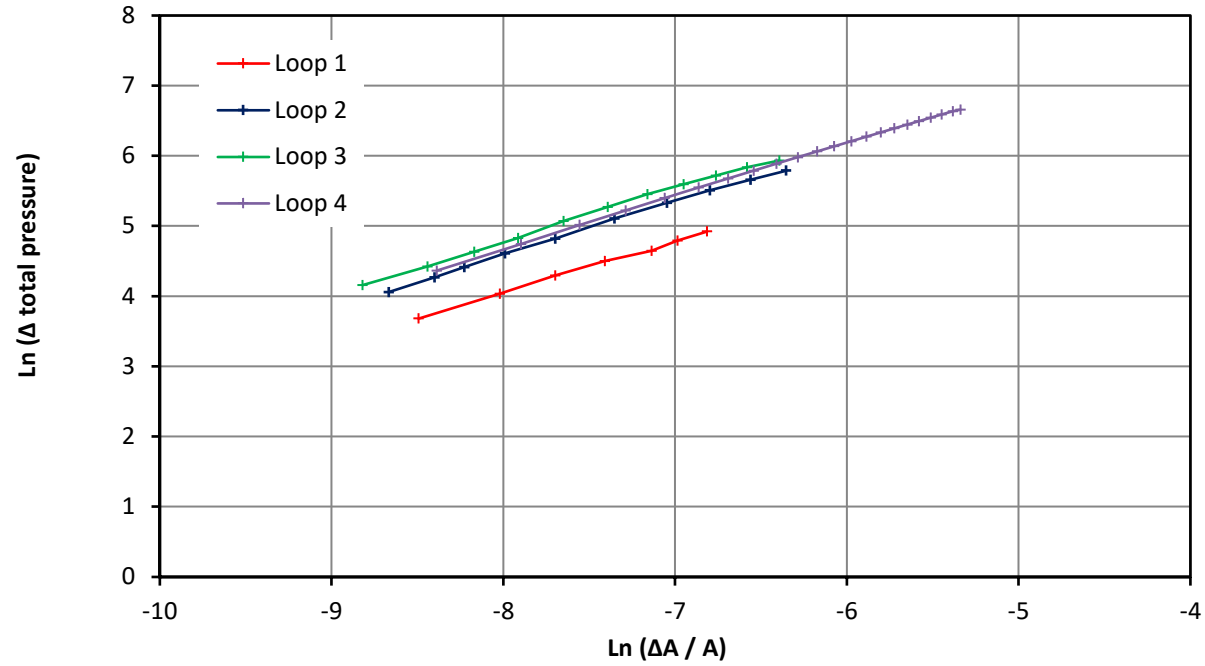
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65





Loop 1		Loop 2		Loop 3		Loop 4	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.729	19.628 (MPa)	0.755	41.159 (MPa)	0.753	49.195 (MPa)	0.753	44.361 (MPa)

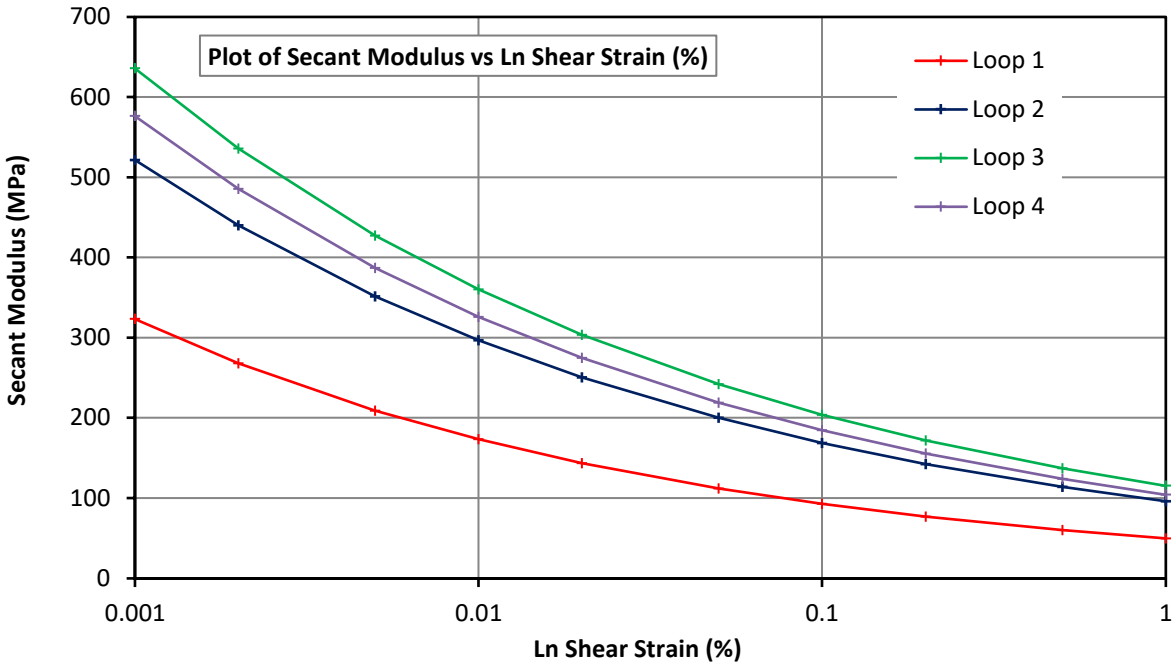
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 08**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



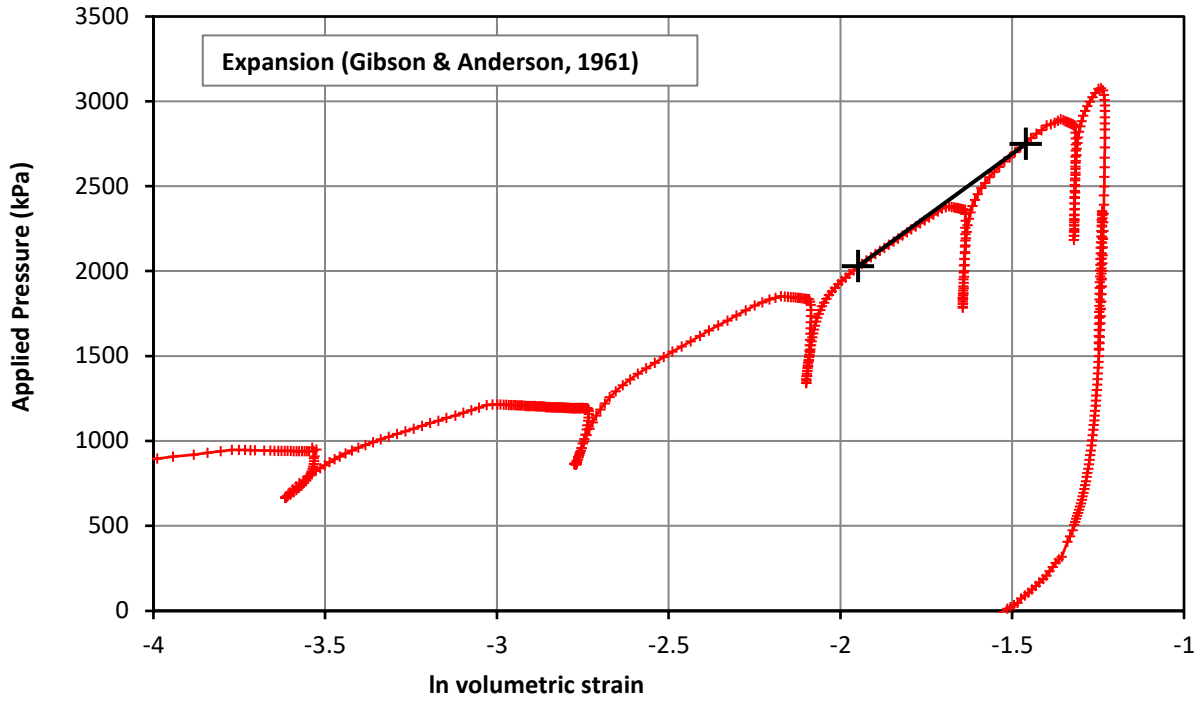
Shear Strain	Loop 1	Loop 2	Loop 3	Loop 4
0.001%	**323**	**521**	**636**	**576**
0.002%	268	440	536	486
0.005%	209	352	427	387
0.010%	**173**	**297**	**360**	**326**
0.020%	144	250	303	275
0.050%	112	200	242	219
0.100%	**93**	**169**	**204**	**184**
0.200%	77	142	172	155
0.500%	60	114	137	124
1.000%	**50**	**96**	**115**	**104**

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 09**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	2
Borehole	RWRM-BH014	**Test Depth (m)**	11.65



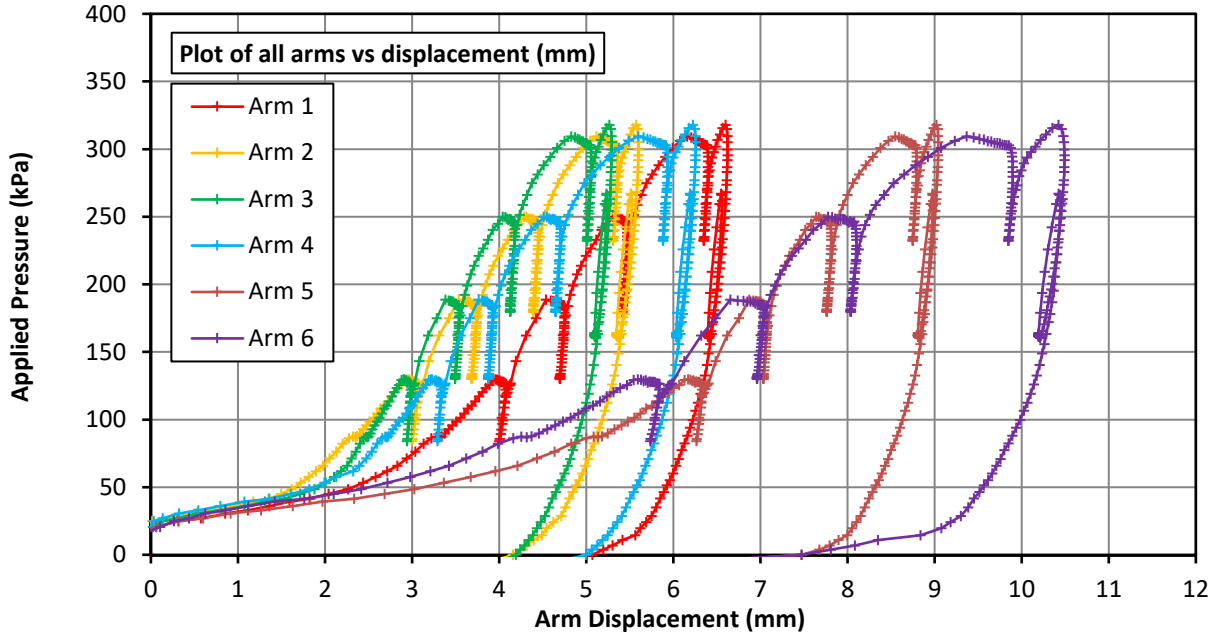
Strength (loading)	Undrained Shear	1472	kPa
	Limit Pressure	4900	kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH014 T02 - 10**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022		**Test No.**	1
Borehole	RWRM-BH020		**Test Depth (m)**	2.80
Coordinates (m)	571069.47 (E)	670075.81 (N)	**Elevation (m)**	33.58



Material description from borehole log:

Firm brown occasionally light grey slightly sandy CLAY.

Test pocket conditions:

Total core recovery:	100 %	Test pocket depth range:	
Solid core recovery:	- %	From: 1.50 m	to: 3.50 m
Rock quality designation:	- %	Flush: Water	

Test comment:

The test pocket was oversize and disturbed with arms lifting off at 2.9 to 6.1mm. The po was estimated to be at 125kPa, with the following loading section being relatively short. Material yield was interpreted at 255kPa, with the test taken to a maximum pressure of 277kPa. The displacement-pressure response shown by the arms was variable, with arms 5 & 6 in disturbed material. Analysis of four unload reload loops provides modulus values of 16 to 23MPa. Derived undrained shear strength analysis provides a value of 130kPa.

Test details: **Instrument:** Kylie (HPD06)

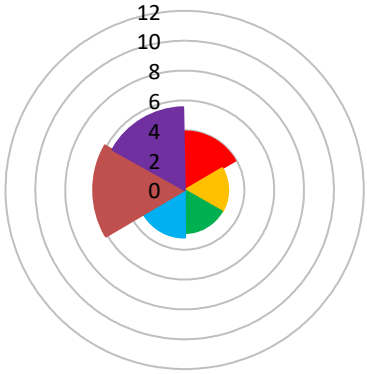
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	1.40 m	Arm 1:	-2431.9	132.4	TPC A:	-2382.4	113.4
Water level:	0.00 m	Arm 2:	-2369.4	130.5	TPC B:	-2455.9	120.7
		Arm 3:	-2303.9	133.1	Membrane:		
Test time:		Arm 4:	-2428.7	127.7	Stiffness	30.3	kPa
Start (probe in):	13:35 hrs	Arm 5:	-2331.6	126.4	Slope	11.2	kPa/mm
Finish (probe out):	15:10 hrs	Arm 6:	-2297.2	131.0	Compliance	1.5	mm/GPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 01**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

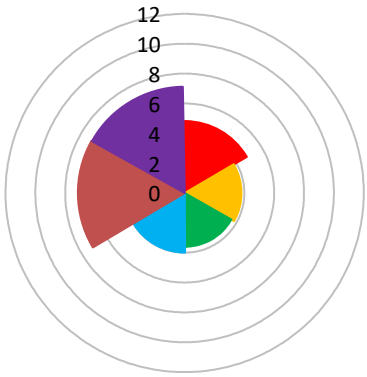
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

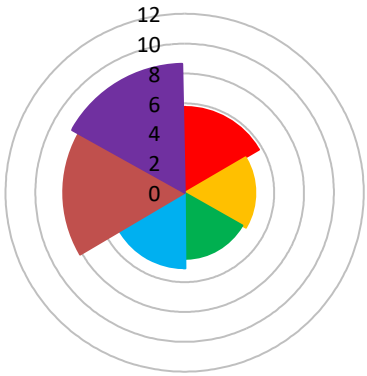
Test Date	06/07/2022	Test No.	1
Borehole	RWRM-BH020	Test Depth (m)	2.80



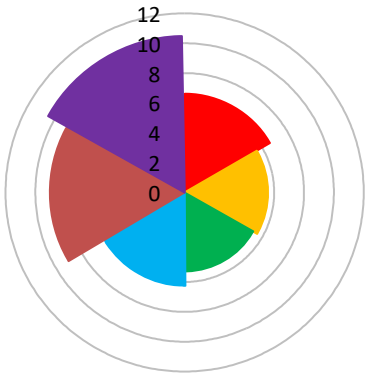
Arm expansion at:	0.0	% cavity strain
Cavity reference pressure:	129	kPa
Arm 1 at:	3.9	mm
Arm 2 at:	2.9	mm
Arm 3 at:	2.9	mm
Arm 4 at:	3.2	mm
Arm 5 at:	6.1	mm
Arm 6 at:	5.5	mm



Arm expansion at:	2	% cavity strain
Test pressure:	192	kPa
Arm 1 at:	4.8	mm
Arm 2 at:	3.8	mm
Arm 3 at:	3.6	mm
Arm 4 at:	4.0	mm
Arm 5 at:	7.2	mm
Arm 6 at:	7.1	mm



Arm expansion at:	4	% cavity strain
Test pressure:	281	kPa
Arm 1 at:	5.8	mm
Arm 2 at:	4.7	mm
Arm 3 at:	4.4	mm
Arm 4 at:	5.1	mm
Arm 5 at:	8.1	mm
Arm 6 at:	8.7	mm



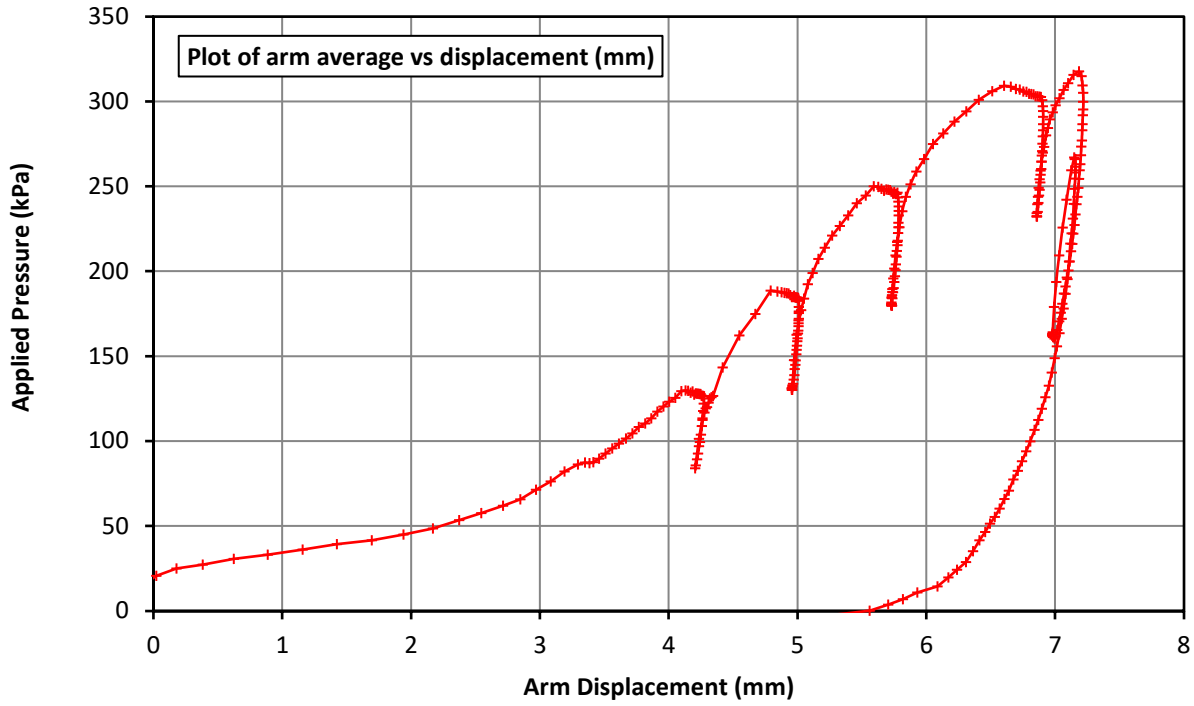
Arm expansion at:	6	% cavity strain
Maximum test pressure:	277	kPa
Arm 1 at:	6.6	mm
Arm 2 at:	5.6	mm
Arm 3 at:	5.3	mm
Arm 4 at:	6.2	mm
Arm 5 at:	9.0	mm
Arm 6 at:	10.5	mm

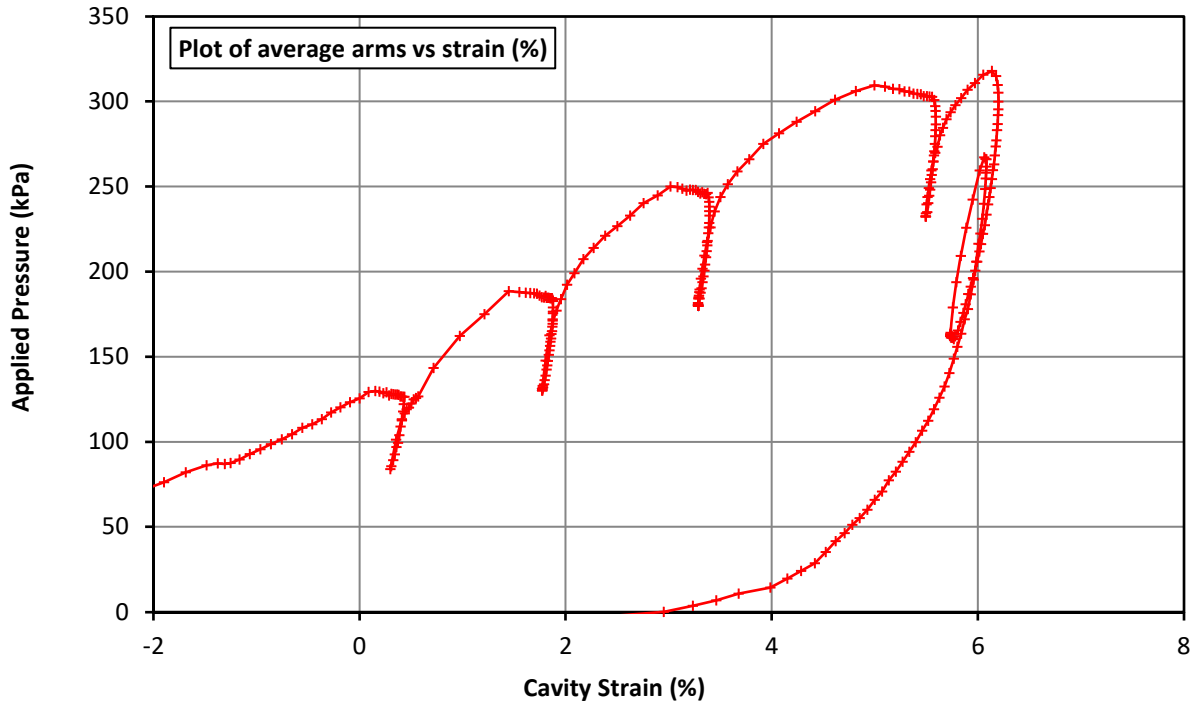
Project	WSP GI Lot 1 - RWRM Section Only	Figure No.	RWRM-BH020 T01 - 02
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



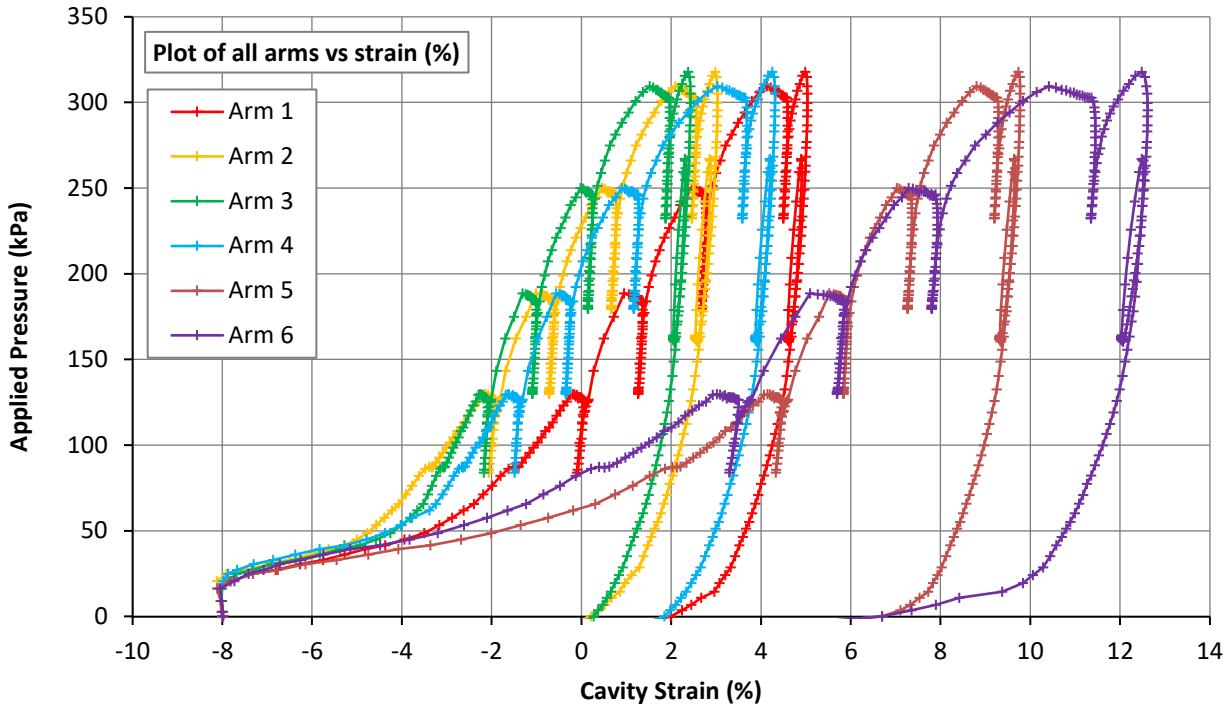


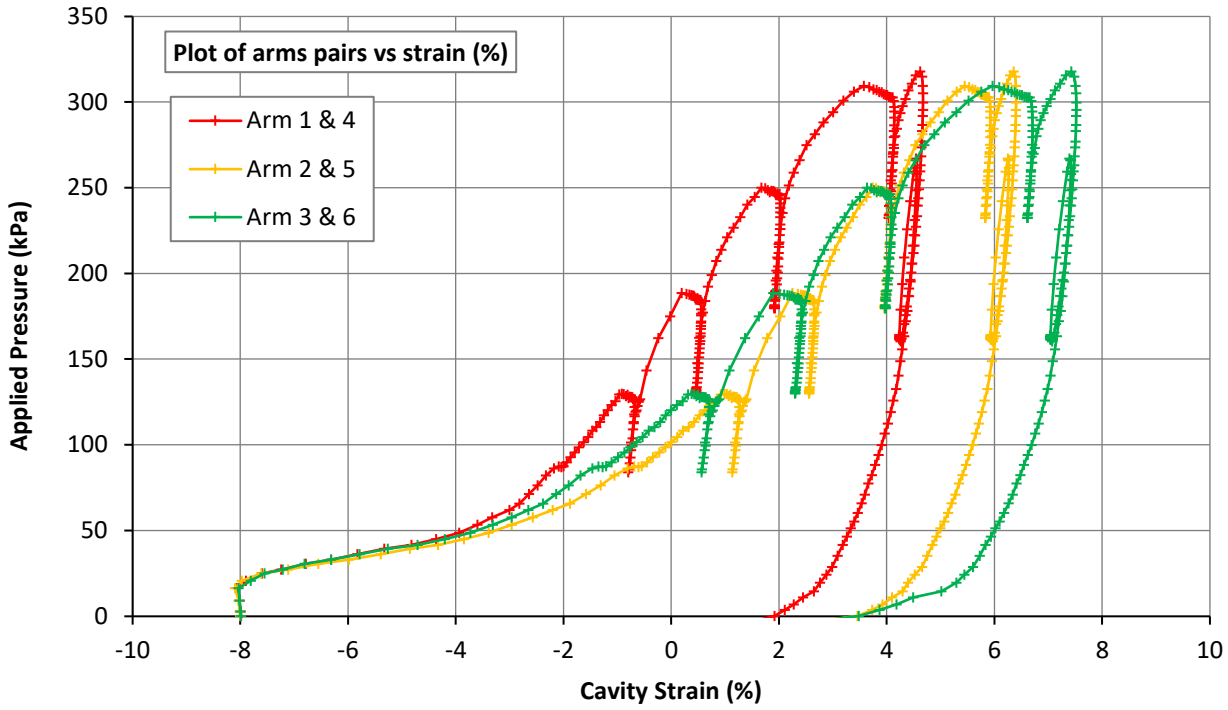
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 03**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



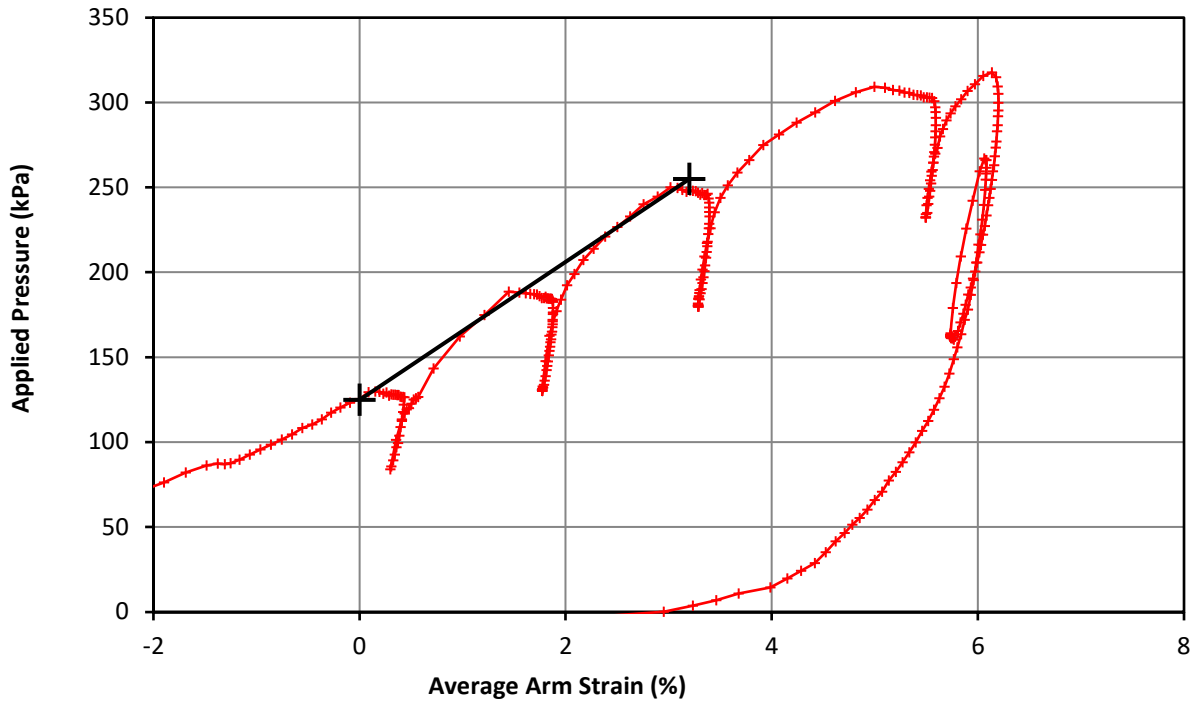


Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 04**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

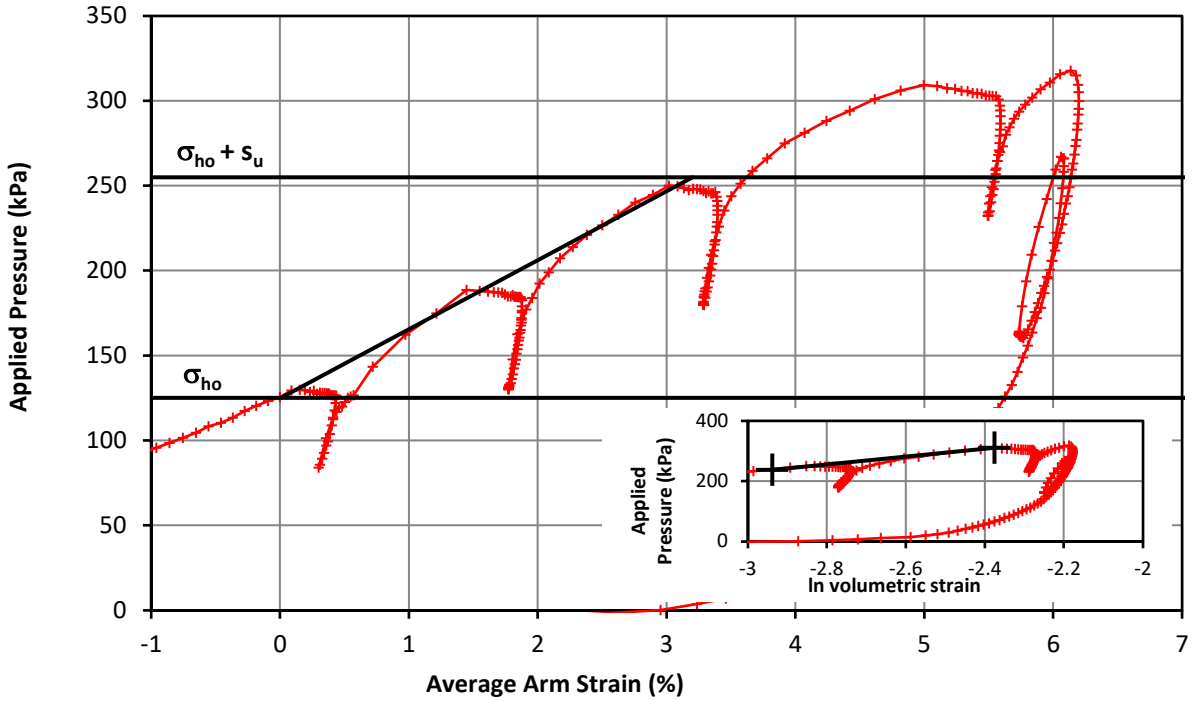
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



Initial Modulus	Shear Modulus	2.1 MPa



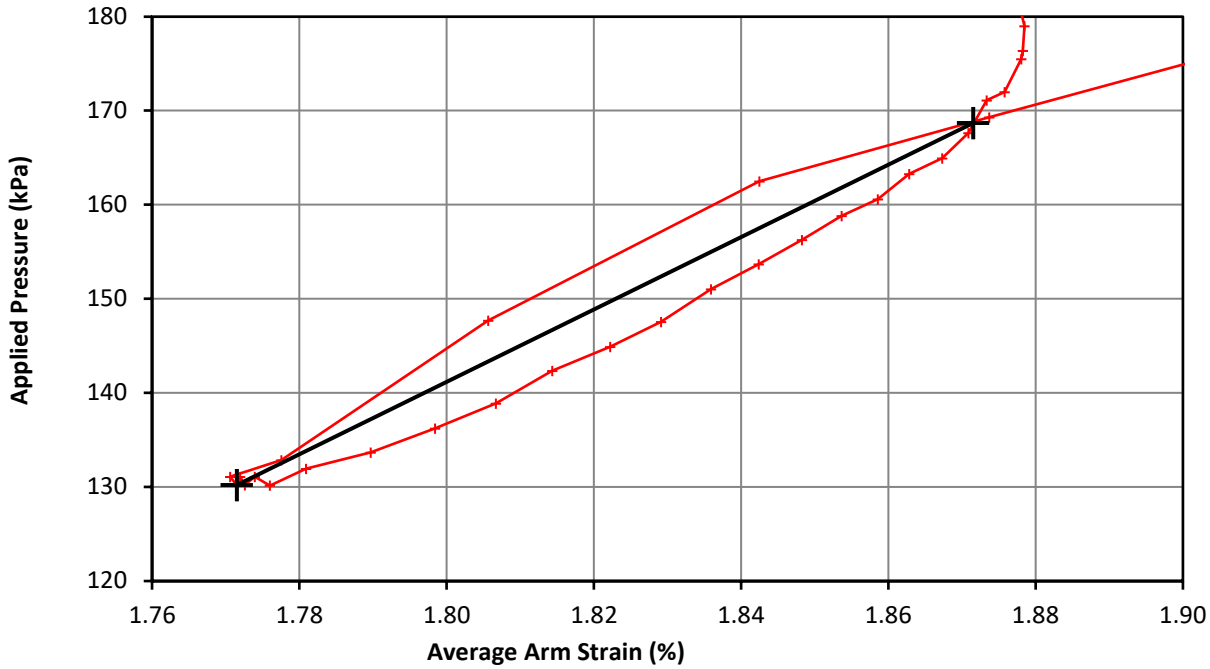
Marsland & Randolph	In situ horizontal stress	125 kPa
	Undrained Strength	130 kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 05**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

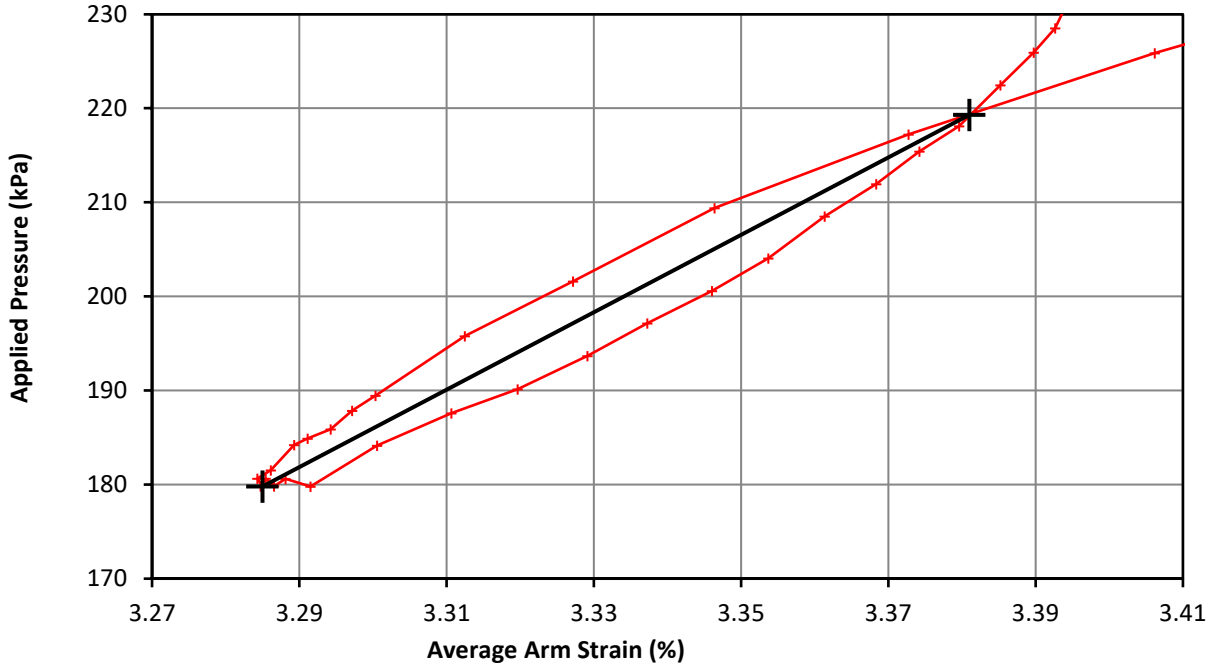
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



Loop 1	Shear Modulus	19.6	MPa
	Cavity Strain Range	0.100	%



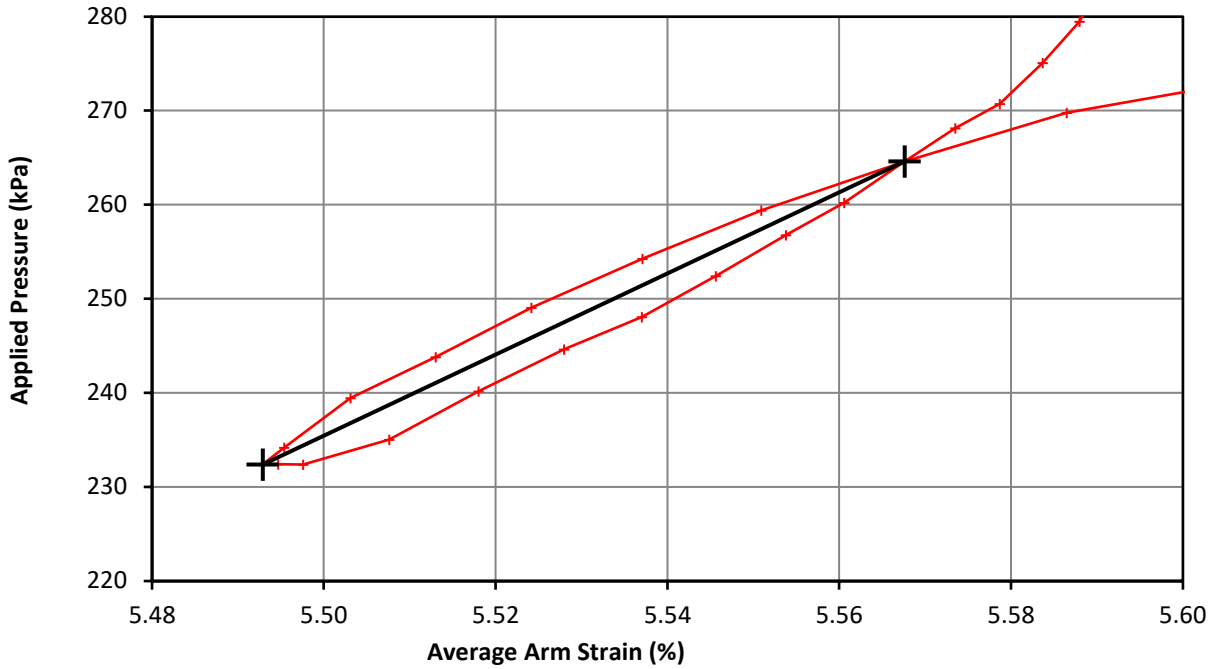
Loop 2	Shear Modulus	21.3	MPa
	Cavity Strain Range	0.096	%

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 06**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

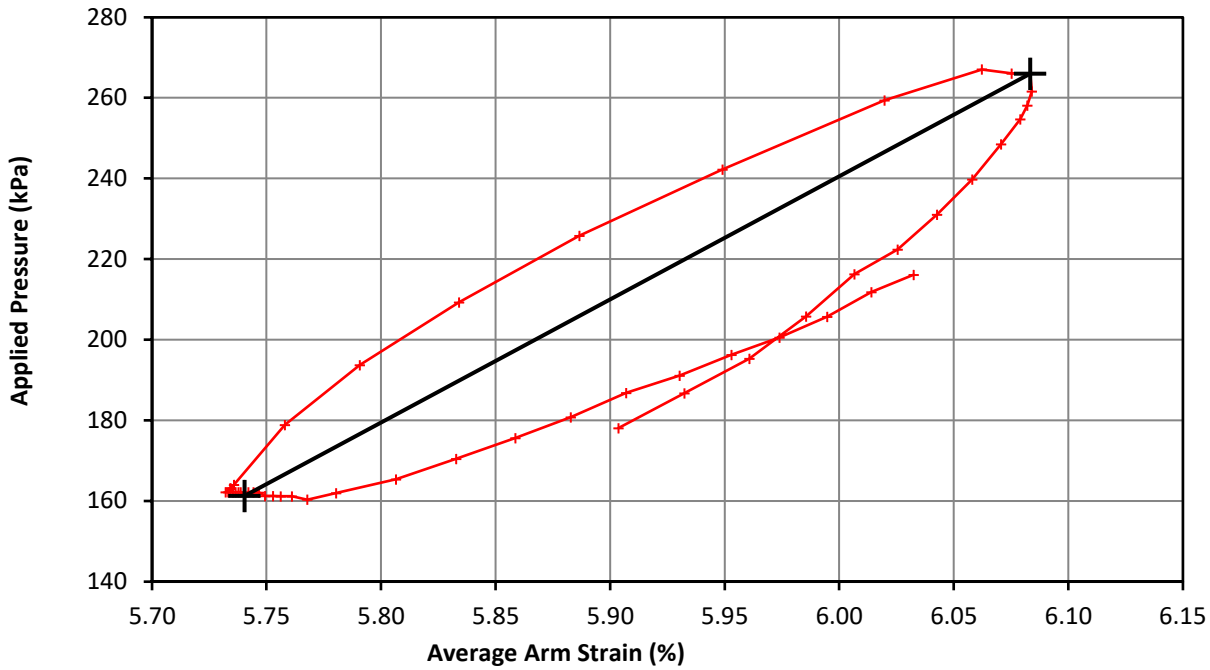
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



Loop 3	Shear Modulus	22.8	MPa
	Cavity Strain Range	0.075	%



Loop 4	Shear Modulus	16.2	MPa
	Cavity Strain Range	0.343	%

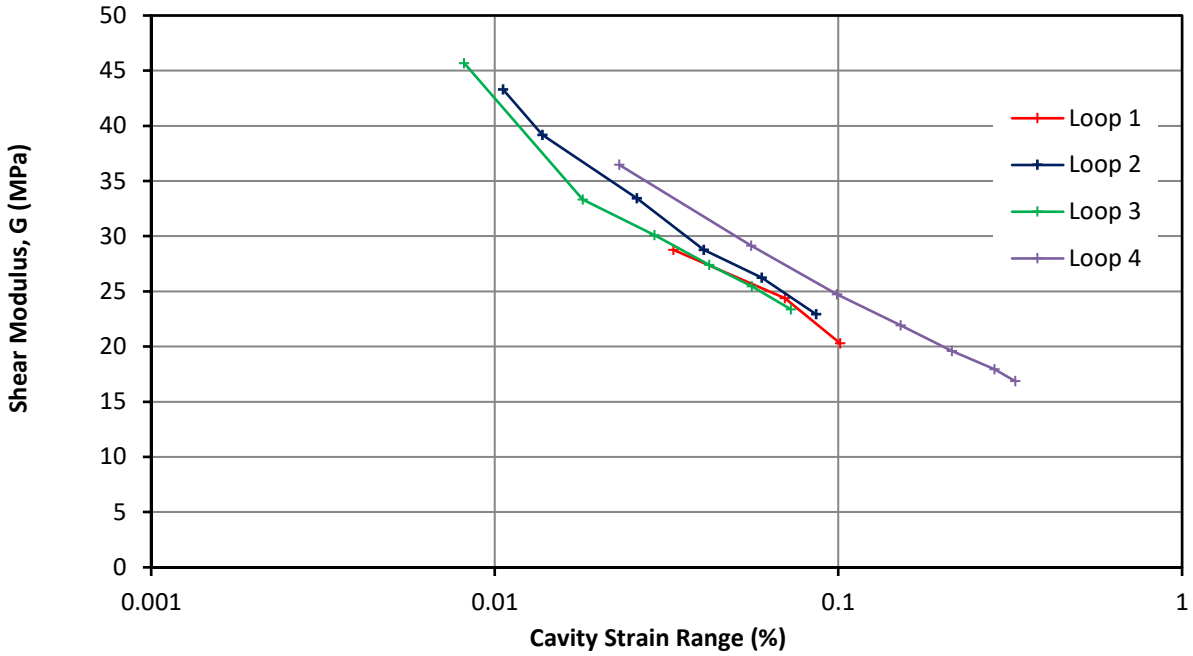
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 07**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

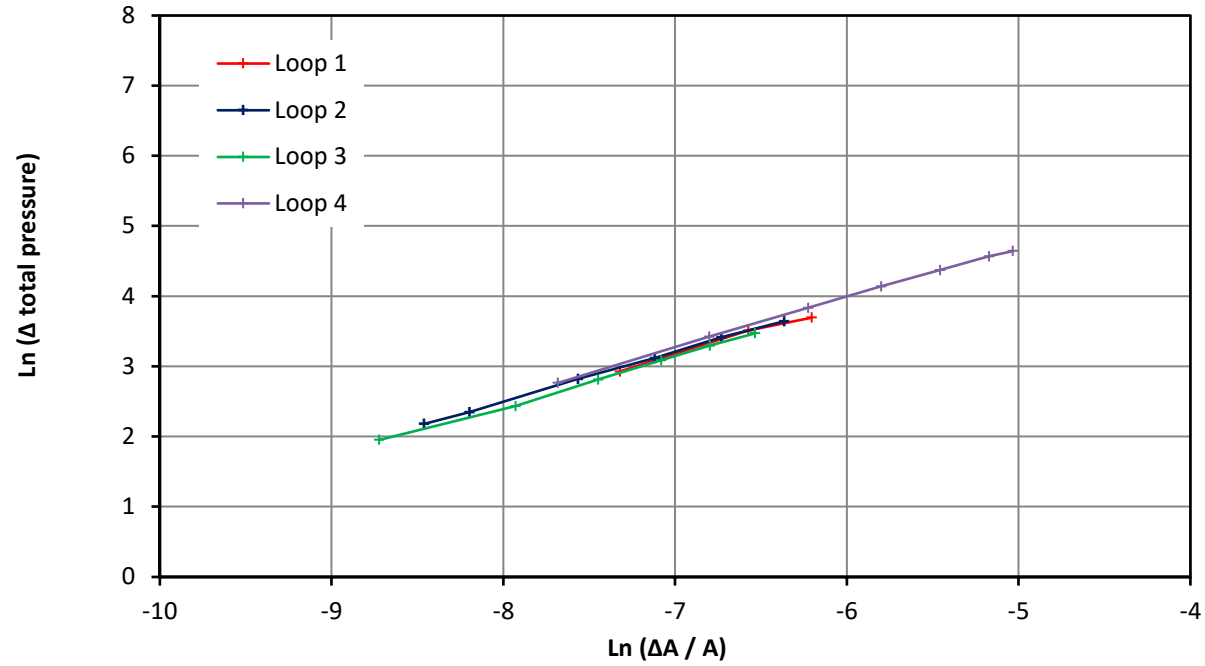
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80





Loop 1		Loop 2		Loop 3		Loop 4	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.701	3.224 (MPa)	0.706	3.457 (MPa)	0.706	3.213 (MPa)	0.711	3.824 (MPa)

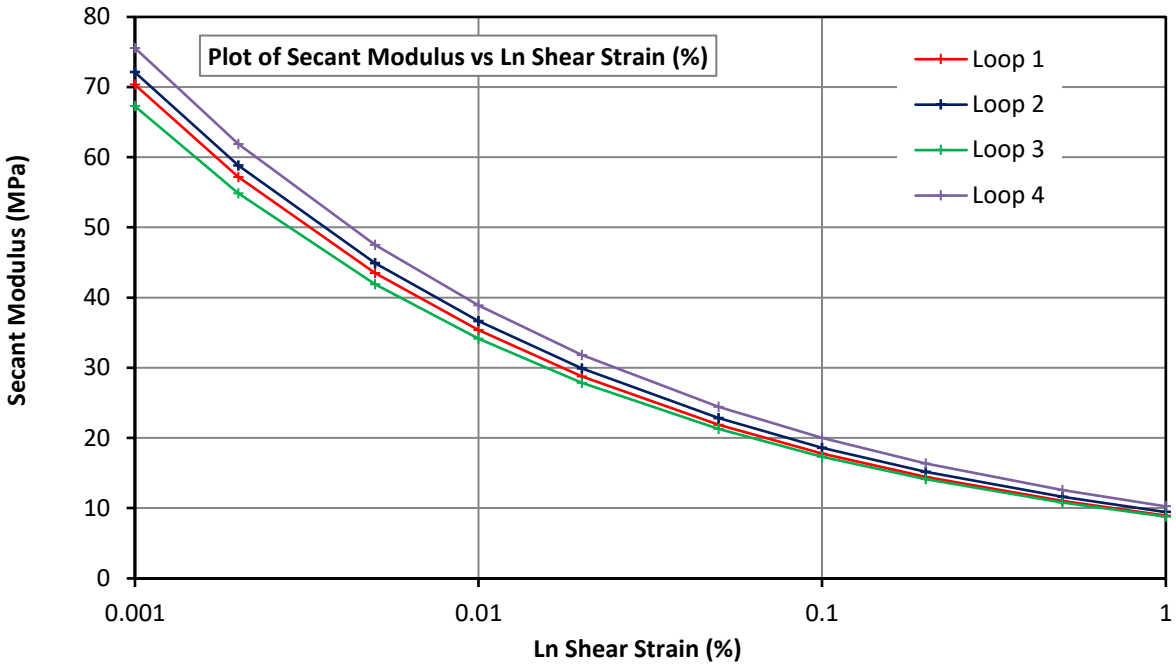
Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 08**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



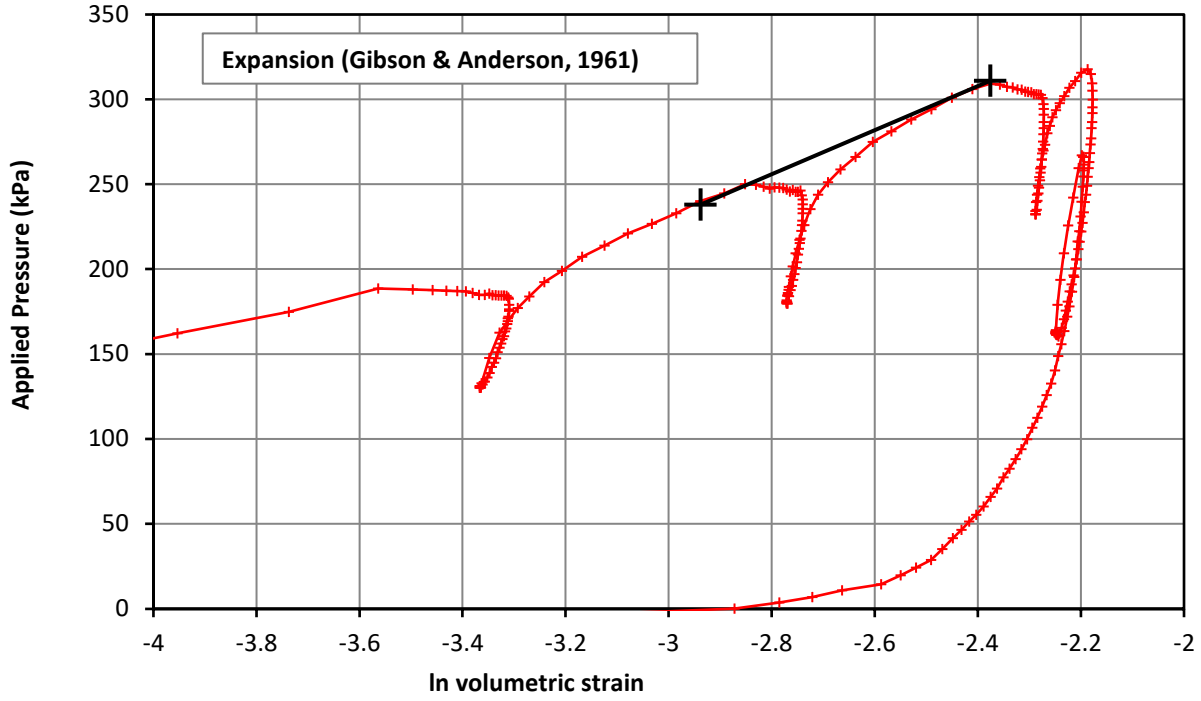
Shear Strain	Loop 1	Loop 2	Loop 3	Loop 4
0.001%	**70**	**72**	**67**	**76**
0.002%	57	59	55	62
0.005%	43	45	42	47
0.010%	**35**	**37**	**34**	**39**
0.020%	29	30	28	32
0.050%	22	23	21	24
0.100%	**18**	**19**	**17**	**20**
0.200%	14	15	14	16
0.500%	11	12	11	13
1.000%	**9**	**9**	**9**	**10**

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 09**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	06/07/2022	**Test No.**	1
Borehole	RWRM-BH020	**Test Depth (m)**	2.80



Strength (loading)	Undrained Shear	130	kPa
	Limit Pressure	619	kPa

Project	WSP GI Lot 1 - RWRM Section Only	**Figure No.**	**RWRM-BH020 T01 - 10**
Client	Causeway Geotech Ltd		
Project No.	P1200109		

APPENDIX B

Calibrations

Description
Kylie (HPD06)

HPD-95 ISSI

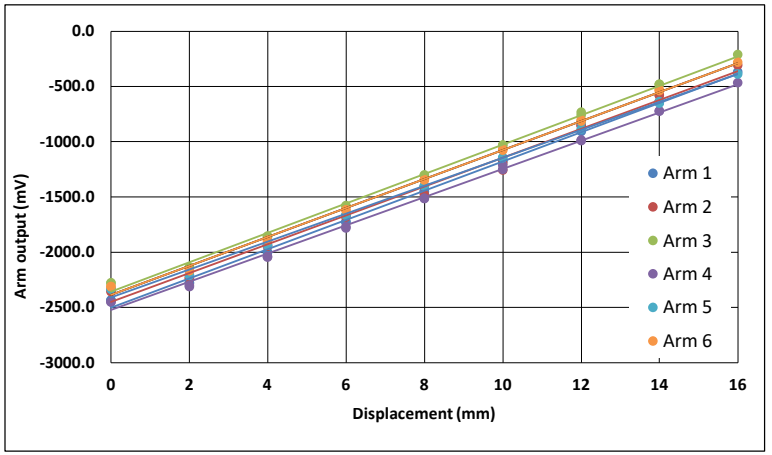
HPD06 - Kylie

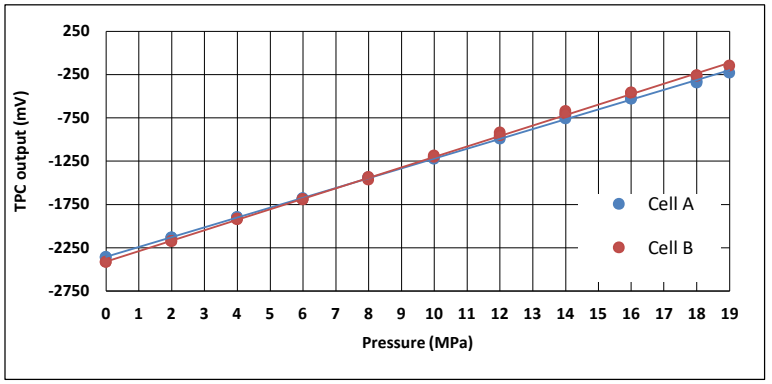
IN SITU
SITE INVESTIGATION

Arms	13/01/2022					
Displacement	Arm 1	Arm 2	Arm 3	Arm 4	Arm 5	Arm 6
mm	mV	mV	mV	mV	mV	mV
0	-2432.0	-2357.3	-2276.9	-2451.1	-2333.0	-2310.8
2	-2276.9	-2232.2	-2136.4	-2311.6	-2207.4	-2167.9
4	-2000.1	-1946.0	-1853.9	-2040.0	-1934.5	-1893.1
6	-1728.4	-1669.0	-1577.5	-1770.5	-1665.0	-1618.5
8	-1449.7	-1403.2	-1299.9	-1513.5	-1400.8	-1347.2
10	-1173.5	-1257.9	-1031.1	-1214.1	-1143.3	-1076.9
12	-904.7	-853.5	-759.6	-984.4	-887.3	-815.2
14	-642.3	-582.7	-481.0	-722.6	-650.4	-537.7
16	-367.1	-307.6	-212.2	-465.5	-388.5	-279.8
14	-636.5	-577.3	-480.4	-722.1	-636.7	-530.1
12	-906.8	-852.8	-732.2	-989.4	-825.2	-802.4
10	-1177.1	-1195.7	-1030.6	-1251.5	-1144.3	-1070.0
8	-1450.0	-1477.4	-1305.9	-1516.0	-1402.9	-1343.0
6	-1724.5	-1681.8	-1580.6	-1780.2	-1666.1	-1615.2
4	-2002.3	-1942.0	-1859.0	-2045.6	-1939.3	-1890.5
2	-2281.1	-2235.8	-2138.9	-2300.9	-2210.5	-2167.7
0	-2432.9	-2344.8	-2280.1	-2452.1	-2334.7	-2311.1
Slope (mV/mm)	132.4	130.5	133.1	127.7	126.4	131.0
Zero (mV)	-2502.0	-2448.3	-2357.4	-2522.1	-2408.5	-2384.8

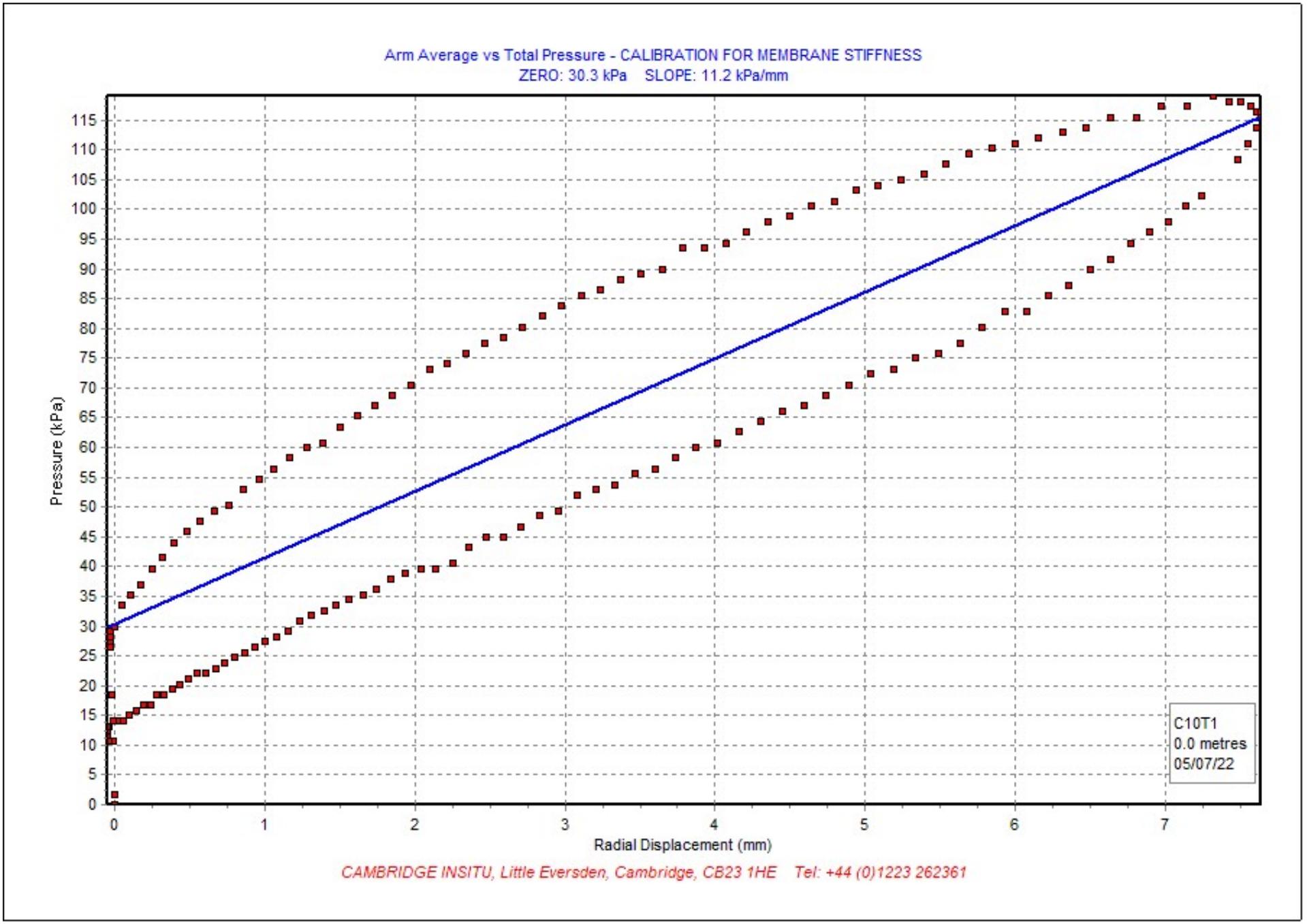
Pressure Cells	13/01/2022			
Pressure	Cell A		Cell B	
MPa	V	mV	V	mV
0	-2.35860	-2358.60	-2.41450	-2414.50
2	-2.13530	-2135.30	-2.17600	-2176.00
4	-1.89650	-1896.50	-1.91480	-1914.80
6	-1.68750	-1687.50	-1.69450	-1694.50
8	-1.44530	-1445.30	-1.46470	-1464.70
10	-1.22590	-1225.90	-1.20270	-1202.70
12	-0.97450	-974.50	-0.92114	-921.14
14	-0.71650	-716.50	-0.67460	-674.60
16	-0.52950	-529.50	-0.46230	-462.30
18	-0.32770	-327.70	-0.26060	-260.60
19	-0.22850	-228.50	-0.14950	-149.50
18	-0.34350	-343.50	-0.26670	-266.70
16	-0.53120	-531.20	-0.46060	-460.60
14	-0.76000	-760.00	-0.70410	-704.10
12	-0.99320	-993.20	-0.95380	-953.80
10	-1.21340	-1213.40	-1.18820	-1188.20
8	-1.43760	-1437.60	-1.43560	-1435.60
6	-1.67870	-1678.70	-1.69010	-1690.10
4	-1.90020	-1900.20	-1.92345	-1923.45
2	-2.13450	-2134.50	-2.17450	-2174.50
0	-2.35870	-2358.70	-2.41490	-2414.90
Slope (mV/MPa)		113.4		120.7
Zero (mV)		-2354.3		-2408.4

System Complaince	1.5 mm/Gpa





Calibrated by:	D Cooper
Calibrated at:	Rotherham
Checked by:	J Holt
Date:	13/01/2022


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 30.3 kPa SLOPE: 11.2 kPa/mm
Pressure (kPa)
Radial Displacement (mm)
C10T1
0.0 metres
05/07/22
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

CAUSEWAY GEOTECH

APPENDIX 2G

GEOPHYSICS REPORT



AGP21220_01

Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1 for Causeway Geotech Ltd.

5TH October 2022

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Gorey
Co. Wexford

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E: info@apexgeophysics.ie
W: www.apexgeophysics.com

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP21220		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
EURGEOL DR. YVONNE O'CONNELL P.GEO, PH.D., M.SC. (GEOPHYSICS)	TONY LOMBARD M.SC (GEOPHYSICS)	V.01	5TH OCTOBER 2022

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1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Causeway Geotech Ltd. on behalf of Ervia to carry out a geophysical survey at selected pipeline locations for the Water Supply Project – Eastern & Midlands Region Contract 1.

The objectives of the geophysical survey are to provide information on the overburden thickness and depth to rock; cohesive strength of the overburden; bedrock lithology; bedrock excavatability; presence of silt and sand lenses; soft ground; and backfilled areas.

The geophysical investigation was carried out between the 24th May and the 5th July 2022 and consisted of 2D Electrical Resistivity Tomography and 2D Seismic Refraction profiling at 16 locations.

The results of the geophysical surveys are detailed in this report and presented on the drawings in Appendix B.

The findings of the geophysical investigation should be reviewed on completion of the direct investigation.

Where bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, any rotary core drilling, strength testing and trial excavation pits using a high-powered excavator such as a CAT 336E or more powerful model. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction. A more detailed discussion of velocity and excavatability is contained in Appendix D.

Foundation design for any structures should take into account the presence of possible open fissures/cavities in the limestone bedrock. Any cavities exposed during stripping of topsoil or excavation of rock should be backfilled in the appropriate manner for karstified limestone areas as advised by a competent geotechnical engineer.

To minimise the risk of subsidence in areas where any karstified limestone is near surface, drains should be sealed, and surface water disposed of away from these areas. Prior to construction a surface water management plan is advised to avoid re-activation of any karst features due to changes in the surface water flow.

2. INTRODUCTION

APEX Geophysics Limited was requested by Causeway Geotech Ltd. on behalf of Ervia to carry out a geophysical survey at selected pipeline locations for the Water Supply Project – Eastern & Midlands Region Contract 1.

The objectives of the geophysical survey are to provide information on the following:

- overburden thickness and depth to rock;
- cohesive strength of the overburden;
- bedrock lithology;
- bedrock excavatability;
- presence of silt and sand lenses;
- soft ground;
- backfilled areas.

2.1 Site Background

The geophysical investigation was carried out at 16 locations between Birdhill and Cloughjordan, Co. Tipperary (Fig 2.1).

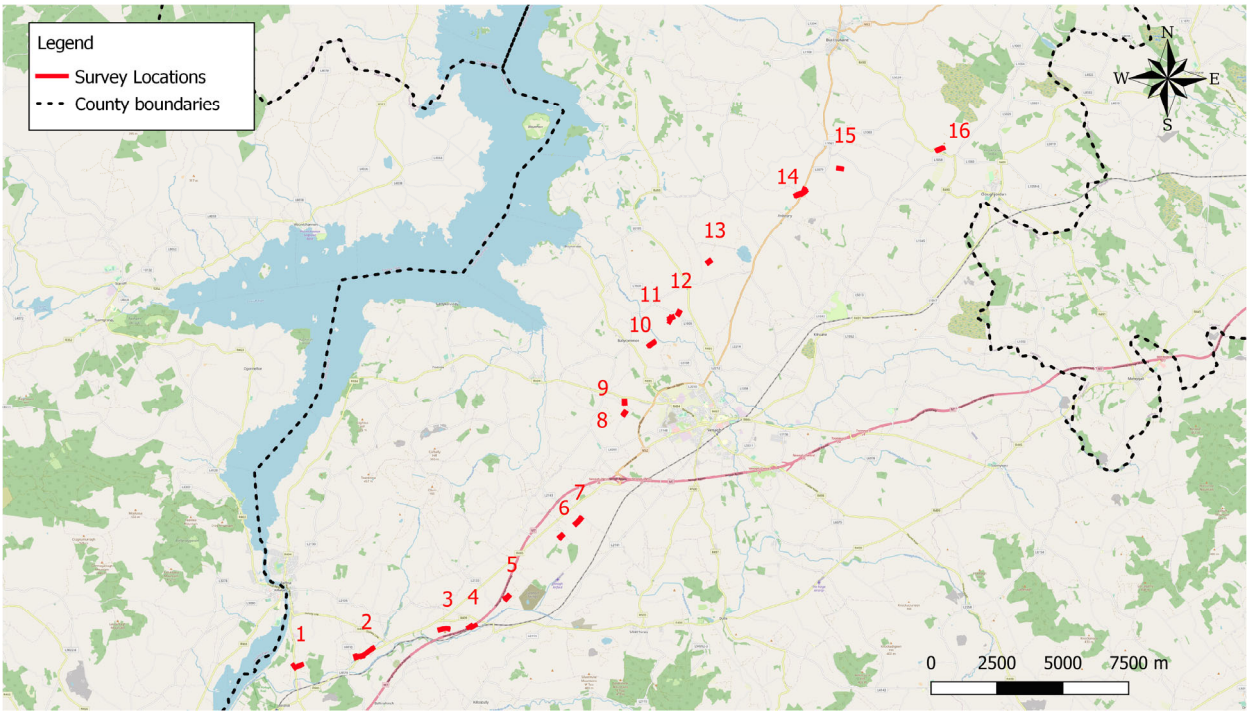


Fig 2.1: Geophysical survey locations 1-16 indicated.

2.1.1 Soils

The Geological Survey of Ireland (GSI) Quaternary soils map for the area (GSIc, 2019) indicates that the survey locations are predominantly centred around areas of alluvium with Locations 1 to 8 in areas of till derived from sandstones and Locations 9 to 16 in areas of till derived from limestone. Some lacustrine sediments and gravels also occur (Fig. 2.2). The soils are listed in the table below. The historical 6 inch sheets for each site were also examined for soil and rock outcrop descriptions.

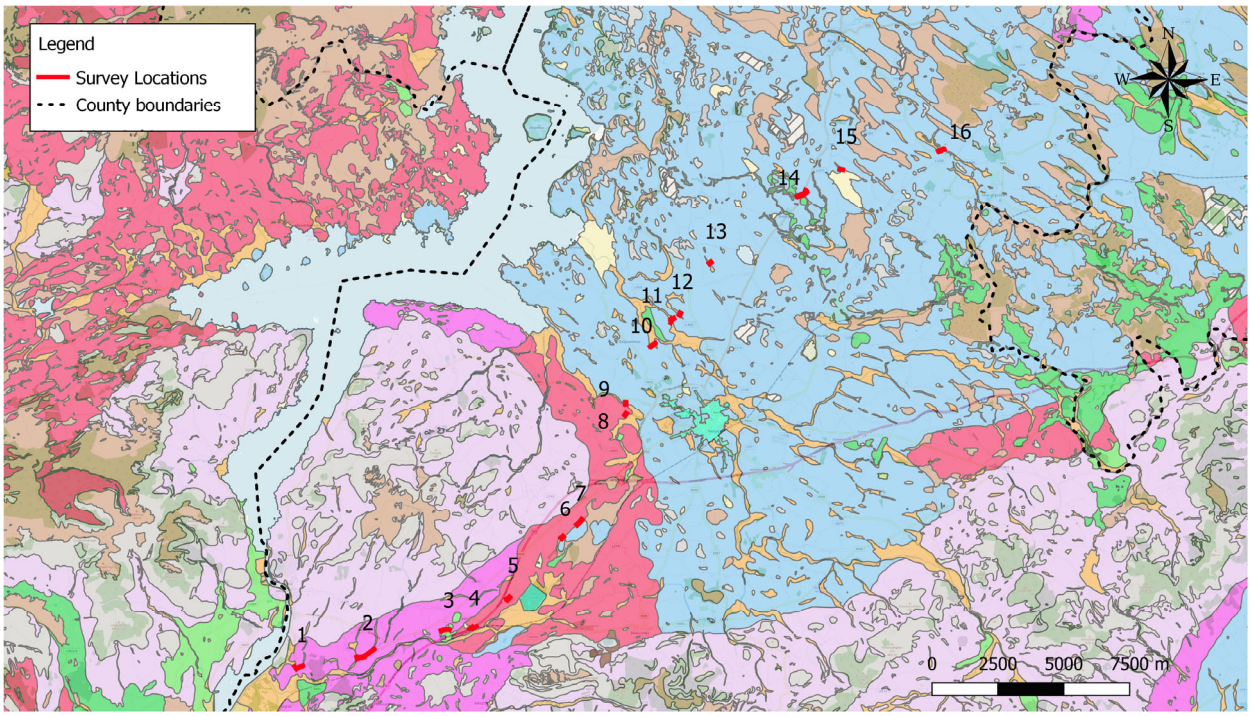


Fig 2.2: The GSI Quaternary sediments map with survey locations marked in red.

Location No.	Location area	Quaternary Sediments
1	Kilmaglasderry	Alluvium & Till derived from Lower Palaeozoic and Devonian sandstones
2	Kilmastulla	Alluvium & Till derived from Lower Palaeozoic and Devonian sandstones
3	Ballinteenoe; Gortnaskehy	Alluvium, Till derived from Devonian sandstones & Gravels derived from Devonian
4	Kilnacranna	Till derived from Devonian sandstones & Lacustrine sediments
5	Castlecranna	Till derived from Devonian sandstones
6	Ballyhisky	Till derived from Devonian sandstones & Peat
7	Carrigatogher (Abbott)	Alluvium & Till derived from Devonian sandstones
8	Tullamore	Alluvium & Till derived from Devonian sandstones
9	Tullamore, Belleen Lower	Alluvium & Till derived from limestones
10	Ballycommon; Ballyhimikin	Alluvium & Till derived from limestones
11	Ballyannymore & Ballyanny Lwr.	Alluvium & Till derived from limestones
12	Ballyanny Lower	Alluvium & Till derived from limestones
13	Loughourna	Alluvium & Till derived from limestones
14	Ardcrony; Lisgarriff	Alluvium, Till derived from limestones & Gravels derived from limestones
15	Ballylusky	Alluvium, Till derived from limestones & Lacustrine sediments
16	Modreeny	Alluvium & Till derived from limestones

2.1.2 Geology

The GSI 1:100k Bedrock Geology map (GSI, 2018) indicates that the survey locations are underlain by 6 lithological formations (Fig. 2.3 and listed in the table below). Faulting in the area is predominantly NE-SW and NNW-SSE.

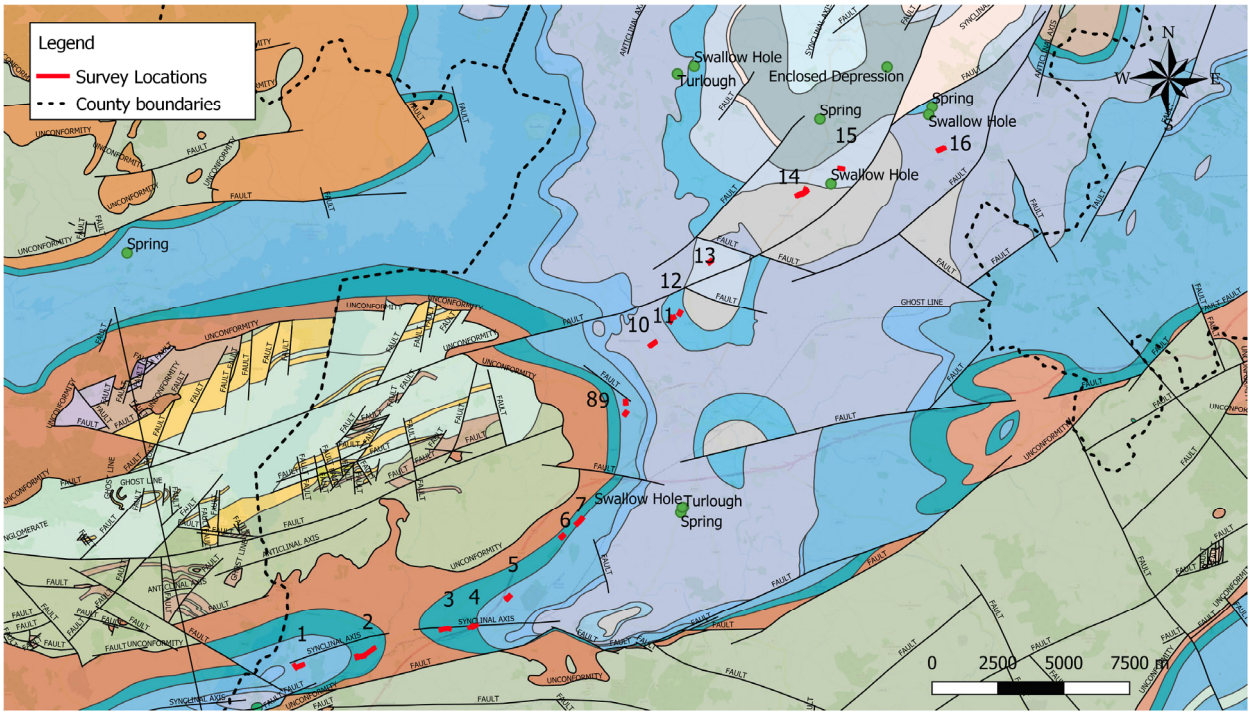


Fig 2.3: The GSI bedrock map with survey locations marked in red.

Loc. No.	Location area	Bedrock Geology
1	Kilmaglasderry	Ballysteen Formation - dark muddy limestone, shale
2	Kilmastulla	Lower Limestone Shale - sandstone, mudstone & thin limestone
3	Ballinteenoe; Gortnaskehy	Lower Limestone Shale - sandstone, mudstone & thin limestone
4	Kilnacranna	Lower Limestone Shale - sandstone, mudstone & thin limestone
5	Castlecranna	Ballysteen Formation - dark muddy limestone, shale
6	Ballyhisky	Lower Limestone Shale - sandstone, mudstone & thin limestone
7	Carrigatogher (Abbott)	Lower Limestone Shale - sandstone, mudstone & thin limestone/Ballysteen Formation - dark muddy limestone, shale
8	Tullamore	Ballysteen Formation - dark muddy limestone, shale
9	Tullamore, Belleen Lower	Ballysteen Formation - dark muddy limestone, shale
10	Ballycommon; Ballyhimikin	Waulsortian Limestones - massive unbedded lime-mudstone
11	Ballyannymore & Ballyanny	Oldcourt cherty Limestone
12	Ballyanny Lower	Oldcourt cherty Limestone
13	Loughourna	Terryglass Formation - grey calcarenitic & oolitic limestone
14	Ardcrony; Lisgarriff	Lucan Formation - dark limestone & shale (`calp)
15	Ballylusky	Terryglass Formation - grey calcarenitic & oolitic limestone
16	Modreeny	Waulsortian Limestones - massive unbedded lime-mudstone

A number of karst features are mapped within the Waulsortian and Terryglass Formations (turloughs, springs and swallow holes) however none are located at any of the survey locations.

2.1.3 Groundwater Vulnerability

The groundwater vulnerability rating across the survey locations (GSIb, 2019) varies from 'Low' to 'High' (Fig. 2.4). The rating at each of the survey locations is listed in the table below.

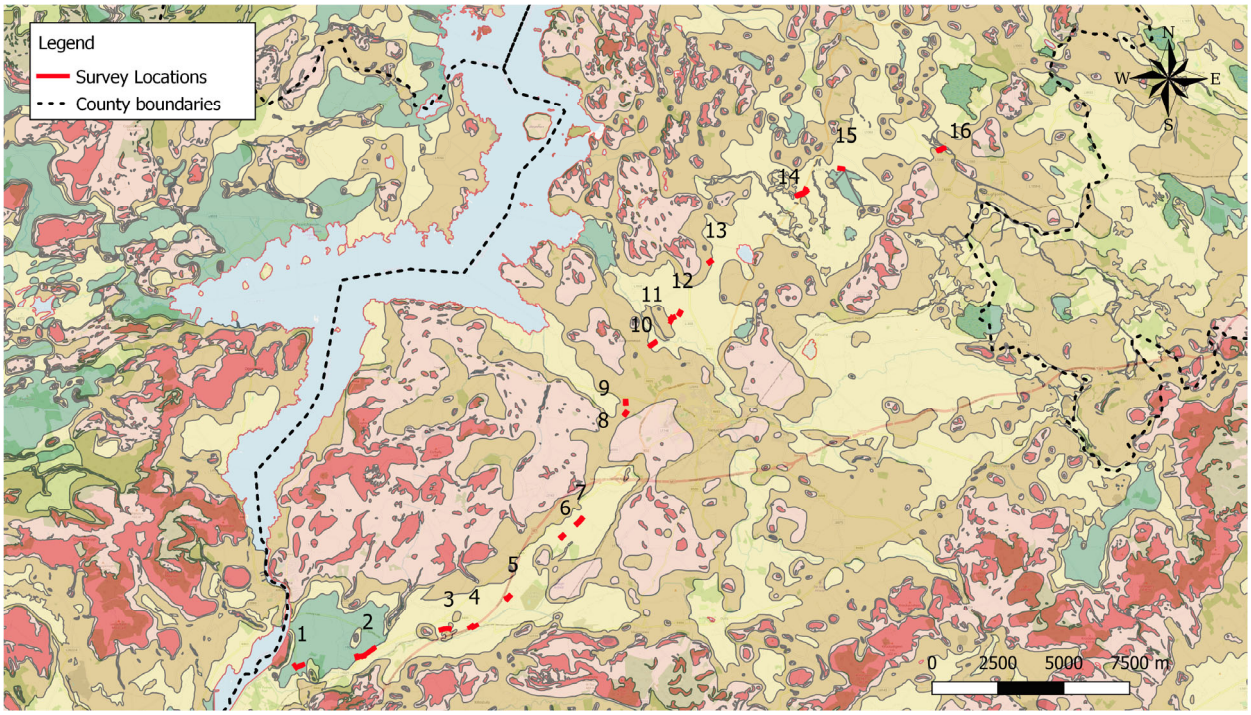


Fig 2.4: The GSI groundwater vulnerability classification map with survey locations marked in red.

Location No.	Location area	Groundwater Vulnerability
1	Kilmaglasderry	Low
2	Kilmastulla	Low - Moderate
3	Ballinteenoe; Gortnaskehy	Moderate
4	Kilnacranna	Moderate
5	Castlecranna	Moderate
6	Ballyhisky	Moderate
7	Carrigatogher (Abbott)	Moderate
8	Tullamore	High
9	Tullamore, Belleen Lower	High
10	Ballycommon; Ballyhimikin	Moderate
11	Ballyannymore & Ballyanny Lwr.	Moderate
12	Ballyanny Lower	Moderate
13	Loughourna	High
14	Ardcrony; Lisgarriff	Moderate - High
15	Ballylusky	Low - Moderate
16	Modreeny	Moderate

2.1.4 Aquifers

The bedrock aquifer classification (GSIa, 2019) indicates 5 bedrock aquifer types across the survey locations (Fig. 2.5). The classification at each of the survey locations is listed in the table below.

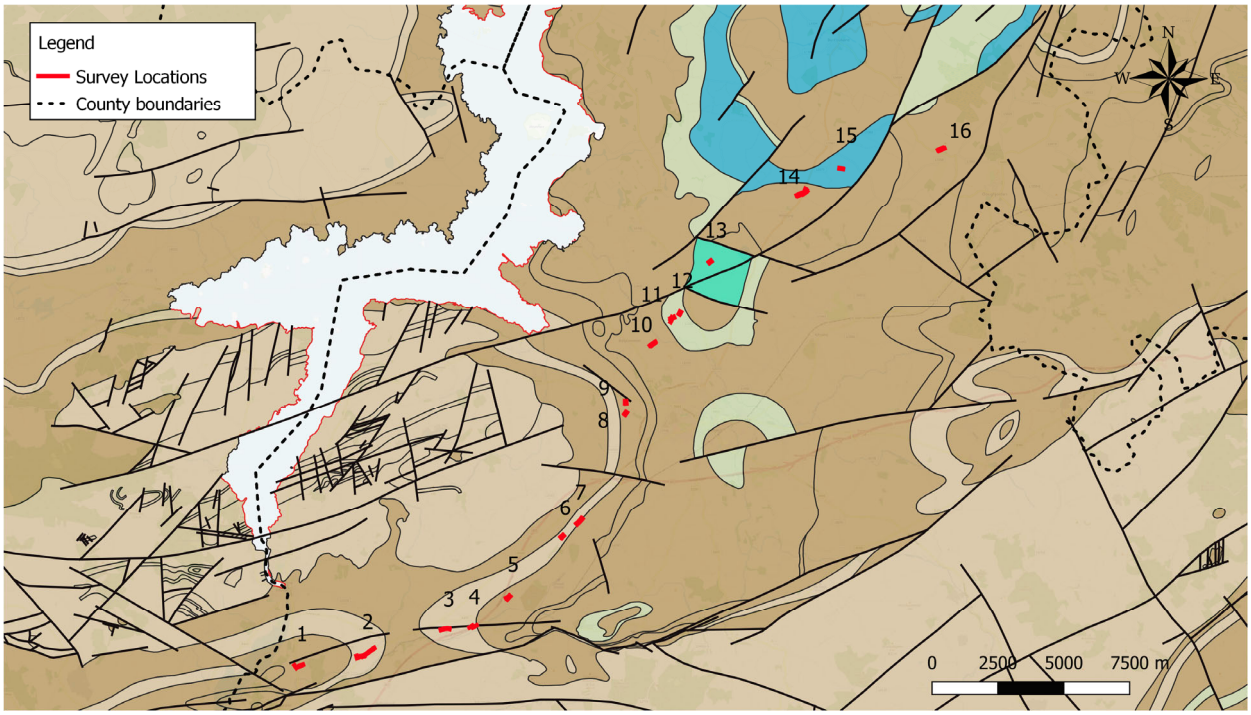


Fig 2.5: The GSI aquifer classification map with survey locations marked in re.

Location No.	Location area	Aquifer Classification
1	Kilmaglasderry	Locally important aquifer - bedrock which is moderately productive only in local zones
2	Kilmastulla	Poor aquifer - bedrock which is generally unproductive except for local zones
3	Ballinteenoe; Gortnaskehy	Poor aquifer - bedrock which is generally unproductive except for local zones
4	Kilnacranna	Poor aquifer - bedrock which is generally unproductive except for local zones
5	Castlecranna	Locally important aquifer - bedrock which is moderately productive only in local zones
6	Ballyhisky	Poor aquifer - bedrock which is generally unproductive except for local zones
7	Carrigatogher (Abbott)	Poor aquifer - bedrock which is generally unproductive except for local zones
8	Tullamore	Locally important aquifer - bedrock which is moderately productive only in local zones
9	Tullamore, Belleen Lower	Locally important aquifer - bedrock which is moderately productive only in local zones
10	Ballycommon; Ballyhimikin	Locally important aquifer - bedrock which is moderately productive only in local zones
11	Ballyannymore & Ballyanny Lwr.	Locally important aquifer - bedrock which is generally moderately productive
12	Ballyanny Lower	Locally important aquifer - bedrock which is generally moderately productive
13	Loughourna	Locally important aquifer - karstified
14	Ardcrony; Lisgarriff	Locally important aquifer - bedrock which is moderately productive only in local zones
15	Ballylusky	Regionally important aquifer - karstified
16	Modreeny	Locally important aquifer - bedrock which is moderately productive only in local zones

2.2 Survey Rationale

The investigation consisted of 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling as set out in the tender documents:

ERT images the resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity with depth, depending on the length of the profile. Each cross-section will be interpreted to determine the material type along the profile at increasing depth, based on the typical resistivities returned for Irish ground materials.

P-wave Seismic Refraction profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities. This method allows us to profile the depth to the top of the bedrock.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. The methods are briefly discussed in Appendix A.

3. RESULTS

The survey was carried out between the 24th May and the 5th July 2022. The geophysical survey locations are indicated on Drawing AGP21220_Overview (Appendix B).

3.1 ERT

ERT Profiles were acquired at 15 of the 16 survey locations (with the exception of Location 6). The resistivity values have been interpreted in conjunction with the seismic refraction data on the following basis:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey SAND/GRAVEL
500-1000	Silty SAND/GRAVEL
500-1000	SAND/GRAVEL
50-250	MUDSTONE/SHALE (Lucan Formation)
150-400	SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale Formation)
175-1500	LIMESTONE/SHALE (Ballysteen Formation)
400-4000	LIMESTONE (Ballysteen Formation)
250-3500	LIMESTONE (Terryglass Formation)
175-20000	LIMESTONE (Waulsortian)
150-25000	LIMESTONE (Oldcourt Formation)

Five soil types have been distinguished based on variations in resistivity values; very low resistivity silt/clay; higher resistivity sandy gravelly clay; and high resistivity silty/clayey sand/gravel and sand/gravel.

Variations in bedrock resistivity occur across the different bedrock lithologies from low resistivity mudstone/shale (50-250 Ohm-m) to high resistivity (up to 25,000 Ohm-m) 'clean' limestone.

3.2 Seismic Refraction P-wave Velocity Profiling

P-wave seismic refraction spreads were acquired at all survey locations. The results are contained in Appendix C. The P-wave seismic velocities can broadly be interpreted as follows:

Seismic Velocity (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
<1000	Soil	Very Soft-Soft-Firm/Very Loose - Loose-Medium Dense	Diggable
	Highly Weathered Rock	Poor	Diggable – *Rippable
1000-1800	Soil	Firm-Stiff/ Medium Dense-Dense	Diggable
	Moderately Weathered Rock	Poor-Fair	*Rippable – Marginally Rippable
1800-2400	Soil	Very Stiff/ Vey Dense	Diggable
	Moderately to Slightly Weathered Rock	Fair-Good	Break/Blast
>2400	Slightly Weathered – Fresh Bedrock	Good	Break/Blast

**the cut-off velocity for excavatability will be lower where it applies to trenches.*

3.3 Results & Interpretation

3.3.1 Location 1

The survey area is located close to the Ballina Road, in the townland of Kilmaglasderry and consists of open agricultural fields (Fig. 3.3.1a). Topography across the surveyed area ranges from 29.5 mOD to 37.7 mOD.

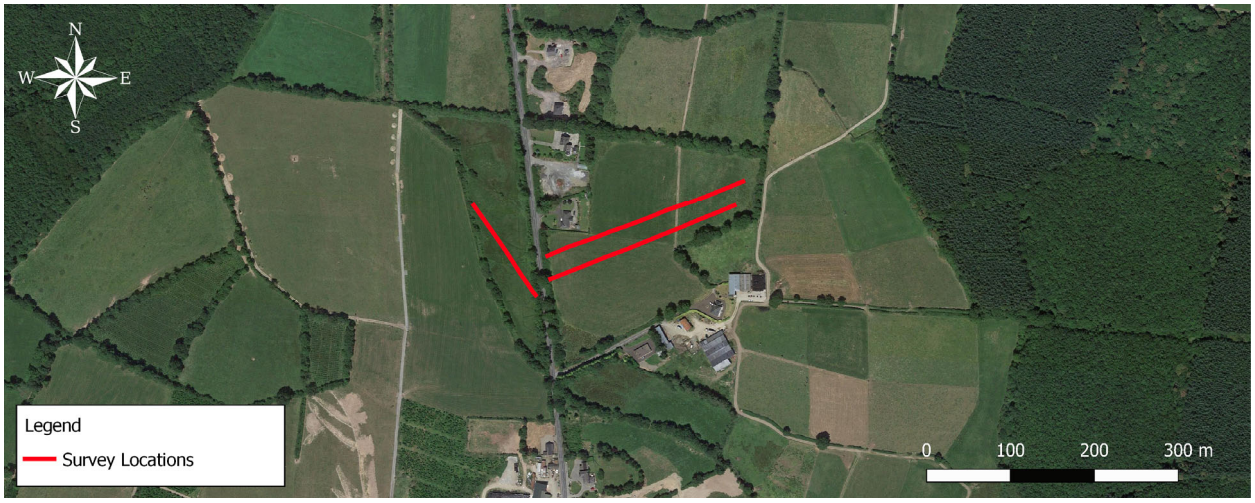


Fig 3.3.1a: Locations marked with red line.

The soils across the survey area are mapped as till derived from Lower Palaeozoic and Devonian sandstones with alluvium in the west (Fig. 3.3.1b) overlying dark muddy limestone and shale of the Ballysteen Formation.



Fig 3.3.1b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 5 ERT profiles (R32 – R36) and 12 SR profiles S82 – S93. The results are presented on **Drawing AGP21220_01** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
500-1000	Silty Sand/Gravel
175-1500	LIMESTONE/SHALE (Ballysteen Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	139-370	205	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2	333-1483	805	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
3	1860-2311	2065	Soils	Very Stiff/ Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Fair	Break/Blast
4	3500-4835	4165	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	139-370	50-250	Sandy gravelly SILT/CLAY	Very Soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very Loose-Loose	
		500-1000	Silty Sand/Gravel		
2	333-1483	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
3	1860-2311	50-250	Sandy gravelly SILT/CLAY	Very Stiff	Diggable
		50-250	Sandy gravelly SILT/CLAY		
		250-500	Clayey Sand/Gravel	Very Dense	
4	3500-4835	175-1500	Slightly weathered – Fresh LIMESTONE/SHALE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.4 – 1.5 m, average 0.6 m) of soft sandy gravelly SILT/CLAY with loose clayey and/or silty SAND/GRAVEL.
- underlain by a thicker layer (0.4 – 4.0 m, average 1.8 m) of firm to stiff sandy gravelly SILT/CLAY with medium dense to dense clayey and/or silty SAND/GRAVEL in the southwest of R32 and R35.
- underlain by a thick layer of predominantly very stiff SILT/CLAY and sandy gravelly SILT/CLAY with some very dense clayey and/or silty SAND/GRAVEL in the southwest of R32 and R35.
- underlain by slightly weathered/fractured to fresh limestone/shale at depths > 10.4 m bgl (at levels below 24 mOD).

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the very stiff sandy gravelly SILT/CLAY. The seismic velocities indicate that any weathered rock will be moderately to slightly weathered and any excavation will require breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting.

3.3.2 Location 2

The survey area is located in the townland of Kilmastulla, north of the R445 and consists of open agricultural fields (Fig. 3.3.2a). Topography across the surveyed area ranges from 45.8 mOD to 59 mOD.

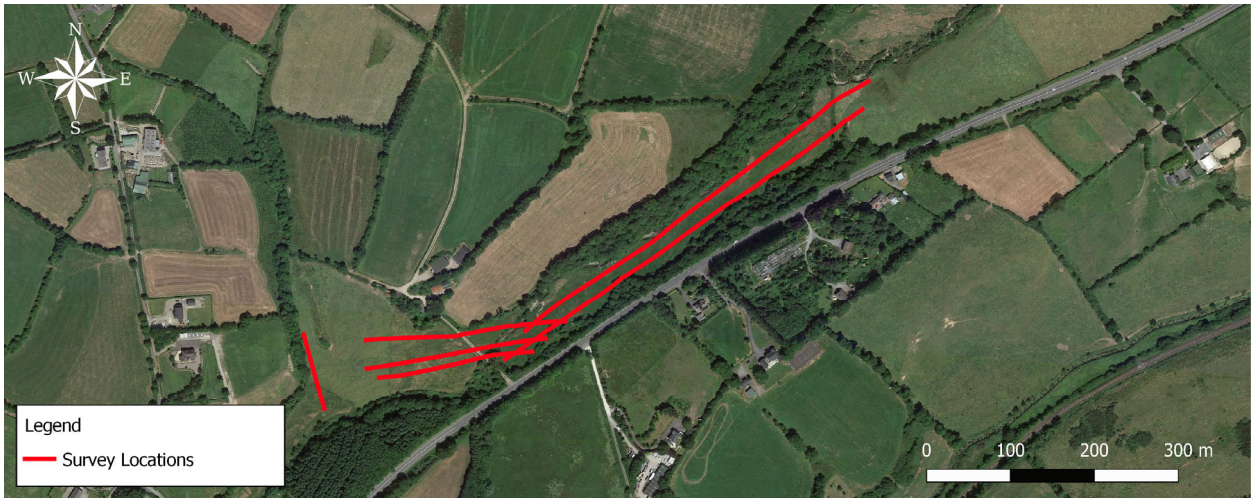


Fig 3.3.2a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with some till derived from Lower Palaeozoic and Devonian sandstones to the west and northeast (Fig. 3.3.2b) overlying sandstone, mudstone and thin limestone of the Lower Limestone Shale.

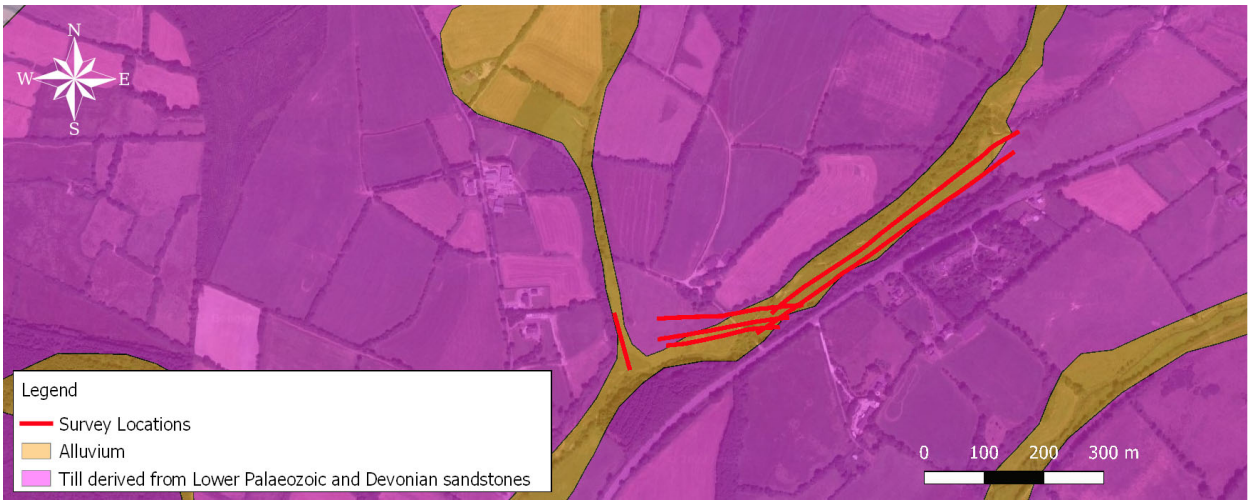


Fig 3.3.2b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 5 ERT profiles (R38 – R42) and 21 SR profiles S94 – S126. The results are presented on **Drawing AGP21220_02A and 02B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
500-1000	Silty Sand/Gravel
150-400	SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale Formation)

The seismic data indicated up to 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	133-344	205	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2*	225-471	345	Soils	Soft-Firm/ Loose-Medium Dense	Diggable
3	309-1273	620	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
4	1775-2367	2025	Soils	Very Stiff/ Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Poor-Fair	Break/Blast.

*Layer 2 is only present on S111, S112 & S118

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	133-344	50-250	Sandy gravelly SILT/CLAY	Very Soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very Loose-Loose	
		500-1000	Silty Sand/Gravel		
2	225-471	250-500	Clayey Sand/Gravel	Loose	Diggable
		500-1000	Silty Sand/Gravel		
3	309-1273	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
4	1775-2367	50-250	Sandy gravelly SILT/CLAY	Very Stiff	Diggable
5	-	150-400	SANDSTONE/MUDSTONE/LIMESTONE		Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.2 – 1.5 m, average 0.6 m) of very soft to soft sandy gravelly SILT/CLAY with very loose to loose clayey and/or silty SAND/GRAVEL.
- Layer 2 where present is thin (0.7 – 1.8 m, average 1.2 m) and comprises of loose clayey and/or silty SAND/GRAVEL.
- underlain by a thicker layer (0.2 – 3.7 m, average 1.9 m) of firm to stiff sandy gravelly SILT/CLAY and/or medium dense to dense clayey and/or silty SAND/GRAVEL.
- underlain by a thick layer (generally > 10 m thick) of very stiff sandy gravelly SILT/CLAY.
- underlain by sandstone/mudstone/limestone bedrock at depths > 6.8 m bgl (average depth 8.7 m bgl) (at levels below 42.8 mOD). This layer is beyond the depth of investigation of the seismic survey and as such no rock quality and excavatability has been determined.

In addition, no weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the very stiff sandy gravelly SILT/CLAY. The seismic velocities of this layer would indicate that any weathered rock will be moderately to slightly weathered and any excavation will require breaking/blasting.

3.3.3 Location 3

The survey area is located in between the townlands of Ballinteenoe and Gortnaskehy, north of the M7 Nenagh-Limerick motorway and consists of open agricultural fields (Fig. 3.3.3a). Topography across the surveyed area ranges from 65.6 mOD to 68.7 mOD.

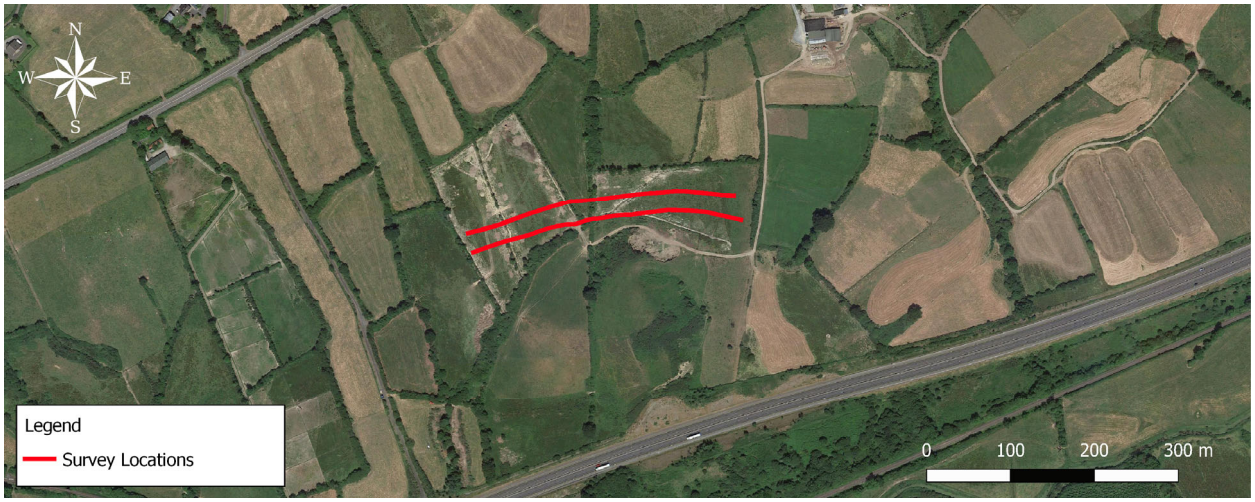


Fig 3.3.3a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with till in the west and gravels in the east (Fig. 3.3.3b). The soils are underlain by Lower Limestone Shale sandstone, mudstone and thin limestone.



Fig 3.3.3b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 2 ERT profiles (R12 – R13) and 10 SR profiles S35 – S44. The results are presented on **Drawing AGP21220_03** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
500-1000	Silty Sand/Gravel
150-400	SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale Formation)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-356	220	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2	367-1570	790	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
3	1991-2366	2125	Soils	Very Stiff/ Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Fair	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-356	50-250	Sandy gravelly SILT/CLAY	Very Soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very Loose-Loose	
		500-1000	Silty Sand/Gravel		
2	367-1570	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
3	1991-2366	50-250	Sandy gravelly SILT/CLAY	Very Stiff	Diggable
		250-500	Clayey Sand/Gravel	Very Dense	
		500-1000	Silty Sand/Gravel		
4		150-400	SANDSTONE/MUDSTONE/LIMESTONE		Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.4 – 0.9 m, average 0.7 m) of predominantly very soft to soft sandy gravelly SILT/CLAY with loose clayey SAND/GRAVEL in the extreme east of both profiles.
- underlain by a thicker layer (1.0 – 3.9 m, average 2.1 m) firm to stiff sandy gravelly SILT/CLAY with medium dense to dense clayey and/or silty SAND/GRAVEL in the extreme east of both profiles.
- underlain by a thick layer of predominantly very stiff sandy gravelly SILT/CLAY with some very dense clayey and/or silty SAND/GRAVEL in the extreme east of both profiles.
- underlain by sandstone/mudstone/limestone bedrock at depths > 8.5 m bgl (at levels below 59.6 mOD). This layer is beyond the depth of investigation of the seismic survey and as such no rock quality and excavatability has been determined.

In addition, no weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the very stiff sandy gravelly SILT/CLAY. The seismic velocities of this layer would indicate that any weathered rock will be moderately to slightly weathered and any excavation will require breaking/blasting.

3.3.4 Location 4

The survey area is located in the townland of Kilnacranna, with one section north of the M7 Nenagh-Limerick motorway and another south of the motorway. The survey area consists of open agricultural fields (Fig. 3.3.4a) and topography across the surveyed area ranges from 53.3 mOD to 54.4 mOD.

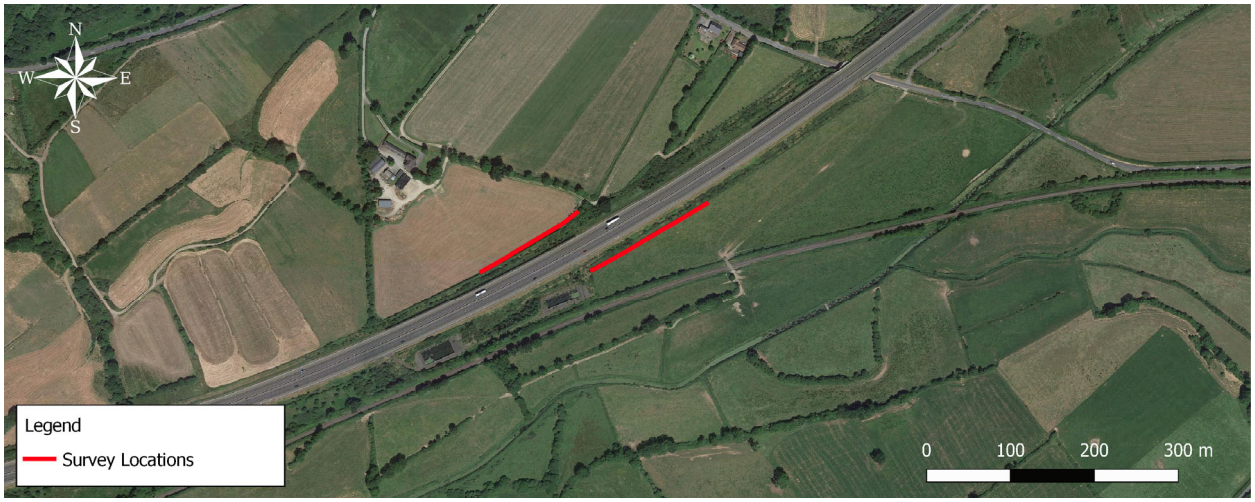


Fig 3.3.4a: Locations marked with red line.

The soils across the survey area are mapped as predominantly till derived from Lower Palaeozoic and Devonian sandstones with lacustrine sediments in the southwest (Fig. 3.3.4b) overlying sandstone, mudstone and thin limestone of the Lower Limestone Shale.

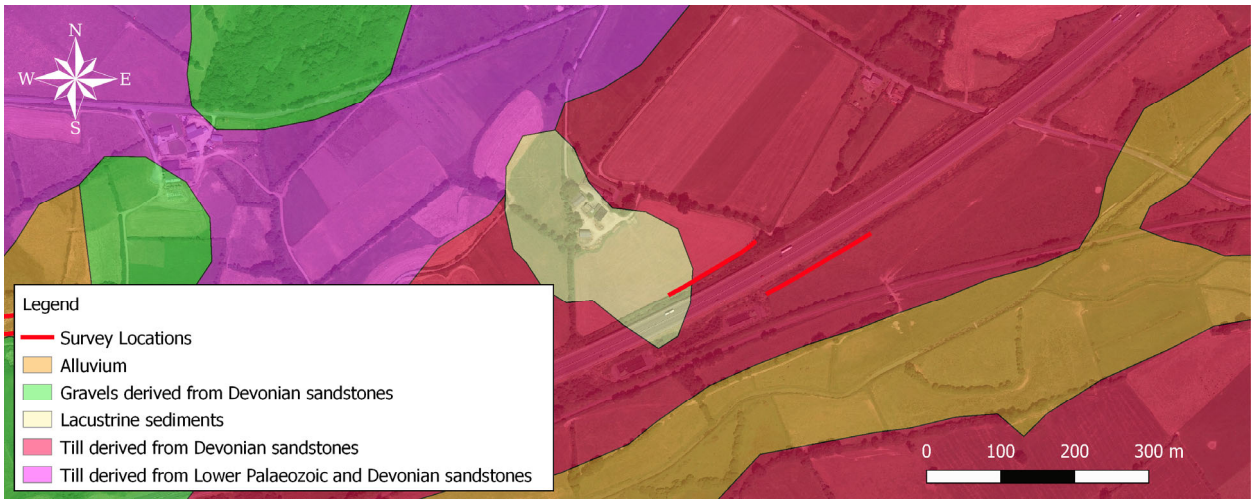


Fig 3.3.4b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 2 ERT profiles (R10 – R11) and 4 SR profiles S33 – S34 and S50 – S51. The results are presented on **Drawing AGP21220_04** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
500-1000	Silty Sand/Gravel
150-400	SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	170-236	205	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2	327-589	410	Soils	Soft-Firm/ Loose-Medium Dense	Diggable
3	606-1517	1080	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
			Highly-Moderately weathered/fractured Bedrock	Poor-Fair	Marginally Rippable
4	3000-4236	3500	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	170-236	250-500	Clayey Sand/Gravel	Very Loose-Loose	Diggable
		500-1000	Silty Sand/Gravel		
2	327-589	250-500	Clayey Sand/Gravel	Loose-Medium Dense	Diggable
		500-1000	Silty Sand/Gravel		
3	606-1517	50-250	SILT/CLAY	Firm-Stiff	Diggable
		50-250	Sandy gravelly SILT/CLAY		
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
4	3000-4236	150-400	Slightly weathered – Fresh SANDSTONE/MUDSTONE/LIMESTONE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.4 – 0.7 m, average 0.5 m) of very loose to loose clayey and/or silty SAND/GRAVEL.
- underlain by a thicker layer (0.9 – 3.0 m, average 2.0 m) of loose to medium dense clayey and/or silty SAND/GRAVEL.
- underlain by a thick layer (6.0 – 11.9 m, average 8.4 m) of medium dense to dense clayey and/or silty SAND/GRAVEL and firm to stiff sandy gravelly SILT/CLAY with some firm to stiff SILT/CLAY interpreted to the southwest of R11.
- underlain by slightly to fresh sandstone/mudstone/limestone bedrock at depths from 8.5 to 14.6 m bgl (average depth 10.9 m bgl). The interpreted bedrock level varies from 39.3 to 45.1 mOD.

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the firm to stiff sandy gravelly SILT/CLAY. The seismic velocities indicate that any weathered rock will be highly to moderately weathered and will be marginally rippable.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting.

3.3.5 Location 5

The survey area is located in the townland of Castlecranna, east of the M7 Nenagh-Limerick motorway. The survey area consists of open agricultural fields (Fig. 3.3.5a) and topography across the surveyed area ranges from 54.4 mOD to 55.5 mOD.



Fig 3.3.5a: Locations marked with red line.

The soils across the survey area are mapped as till derived from Devonian sandstones (Fig. 3.3.4b) over dark muddy limestone, shale of the Ballysteen Formation.



Fig 3.3.5b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R45 – R47) and 8 SR profiles S132 – S139. The results are presented on **Drawing AGP21220_05** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
500-1000	Silty Sand/Gravel
175-1500	LIMESTONE/SHALE (Ballysteen Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	160-500	215	Soils	Very Soft-Firm/Very Loose-Medium Dense	Diggable
2	421-1401	850	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
3	1000-2399	1970	Soils	Very Stiff/ Very Dense	Diggable
			Moderately-Slightly weathered/fractured Bedrock	Poor-Fair	Break/Blast.
4	2418-3500	3115	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	160-500	50-250	Sandy gravelly SILT/CLAY	Very Soft-Firm	Diggable
		250-500	Clayey Sand/Gravel	Very Loose- Medium Dense	
		500-1000	Silty Sand/Gravel		
2	421-1401	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
3	1000-2399	50-250	Sandy gravelly SILT/CLAY	Very Stiff	Diggable
4	2418-3500	175-1500	Slightly weathered – Fresh LIMESTONE/SHALE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.5 – 1.6 m, average 0.8 m) of very soft to firm sandy gravelly SILT/CLAY with very loose to medium dense clayey and/or silty SAND/GRAVEL.
- underlain by a layer of firm to stiff sandy gravelly SILT/CLAY with medium dense to dense clayey and/or silty SAND/GRAVEL.
- underlain by a thick layer of very stiff sandy gravelly SILT/CLAY.
- underlain by slightly weathered to fresh limestone/shale at depths > 2.9 m bgl (at levels below 52 mOD).

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the very stiff sandy gravelly SILT/CLAY. The seismic velocities of this layer indicate that any weathered/fractured rock will be moderately to slightly weathered and any excavation will require breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.6 Location 6

The survey area is located in the townland of Ballyhisky c. 900m east of the M7 Nenagh-Limerick motorway. The survey area consists of open agricultural fields (Fig. 3.3.6a) and topography ranges from 52.0 mOD to 52.9 mOD.



Fig 3.3.6a: Locations marked with red line.

The soils across the survey area are mapped as till derived from Devonian sandstones in the northeast and cut over raised peat in the southwest (Fig. 3.3.6b) overlying sandstone, mudstone & thin limestone of the Lower Limestone Shale.



Fig 3.3.6b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 6 SR profiles S76 – S78 and S170 – S172. The results are presented on **Drawing AGP21220_06** (Appendix B).

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	195-433	280	Soils	Soft /Loose	Diggable
2	1000-2206	1580	Soils	Stiff-Very Stiff/ Dense-Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Poor-Fair	Break/Blast.
3	2075-5245	3605	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.6 – 1.1 m, average 0.8 m) of soft or loose soils.
- underlain by a thicker layer (0.4 – 8.8 m, average 3.6 m) of stiff to very stiff or dense to very dense soils. This layer may also comprise of weathered/fractured rock. The seismic velocities indicate that any weathered rock will be moderately to slightly weathered and any excavation will require breaking/blasting.
- underlain by slightly weathered/fractured to fresh bedrock at depths from 1.2 to 9.4 m bgl (average depth 4.4 m bgl). Interpreted bedrock level varies from 42.6 to 51.3 mOD. The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting.

It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.7 Location 7

The survey area is located in the townland of Carrigatogher (Abbott), c. 1100 m east of the M7 Nenagh-Limerick motorway. The survey area consists of open agricultural fields (Fig. 3.3.7a) and topography ranges from 49.2 mOD to 53.0 mOD.



Fig 3.3.7a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with till derived from Devonian sandstones in the northeast (Fig. 3.3.4b) over predominantly sandstone, mudstone and thin limestone of the Lower Limestone Shale with Ballysteen Formation dark muddy limestone, shale underlying the east.

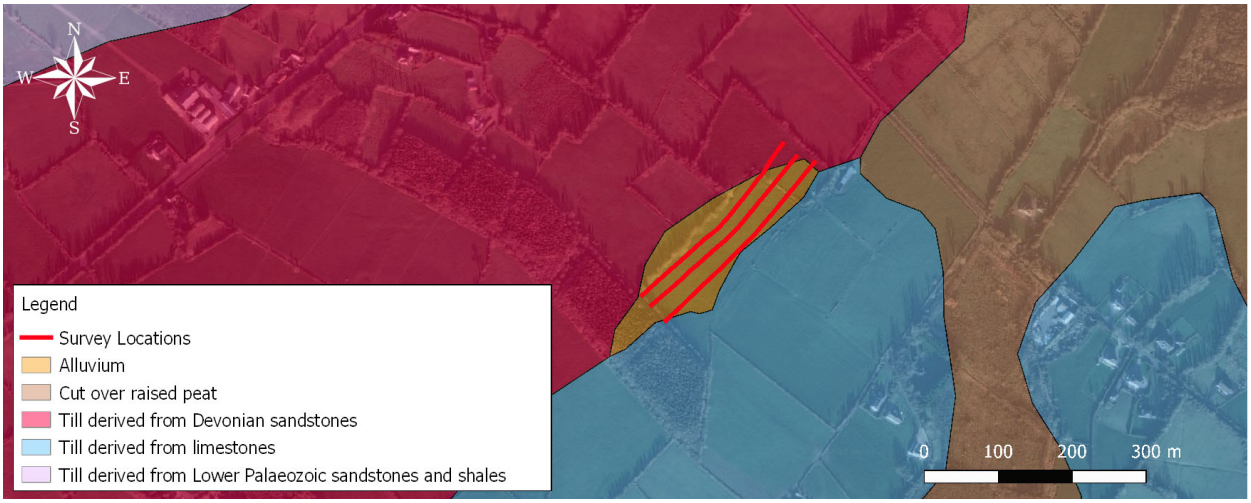


Fig 3.3.7b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R51 – R53) and 18 SR profiles S146 – S63. The results are presented on **Drawing AGP21220_07A & 07B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
150-400	SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale Formation)
175-1500	LIMESTONE (Ballysteen Formation)

The seismic data indicated up to 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	115-333	185	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2*	508-1333	1010	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
3	1000-2164	1605	Soils	Stiff-Very Stiff/ Dense-Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Fair	Marginally Rippable-Break/Blast.
4	2690-4245	3635	Slightly weathered – Fresh Bedrock	Good	Break/Blast

*Layer 2 is only present on S152 & S160

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	115-333	25-50	SILT/CLAY	Very Soft-Soft	Diggable
		50-250	Sandy gravelly SILT/CLAY		
2	508-1333	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
3	1000-2164	25-50	SILT/CLAY	Stiff-Very Stiff	Diggable
		50-250	Sandy gravelly SILT/CLAY		
4	2690-4245	150-400	Slightly weathered – Fresh SANDSTONE/MUDSTONE/LIMESTONE	Good	Break/Blast
		175-1500	Slightly weathered – Fresh LIMESTONE/SHALE		

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.6 – 1.0 m, average 0.9 m) of very soft to soft sandy gravelly SILT/CLAY or SILT/CLAY.
- layer 2 has been interpreted only in the southwest of the surveyed area (S152 & S160) and comprises of an average of 1.1 m of firm to stiff sandy gravelly SILT/CLAY.
- underlain by a thicker layer (0.4 – 6.2 m, average 2.8 m) of stiff to very stiff sandy gravelly SILT/CLAY or SILT/CLAY.
- underlain by slightly weathered/fractured to fresh sandstone/mudstone/limestone or limestone/shale bedrock at depths > 2.4 m bgl (at levels below 49.6 mOD).

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the stiff to very stiff sandy gravelly SILT/CLAY. The seismic velocities indicate that any weathered rock will be moderately to slightly weathered and will be marginally rippable to requiring breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.8 Location 8

The survey area is located in the townland of Tullamore, c. 900 m west of the N52 Nenagh bypass. The survey area consists of open agricultural fields (Fig. 3.3.8a) and topography ranges from 45.2 mOD in the southwest to 47.2 mOD in the northeast.



Fig 3.3.8a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium and till derived from Devonian sandstones (Fig. 3.3.8b) underlain by sandstone, mudstone and thin limestone of the Lower Limestone Shale with dark muddy limestone and shale of the Ballysteen Formation to the east/northeast.

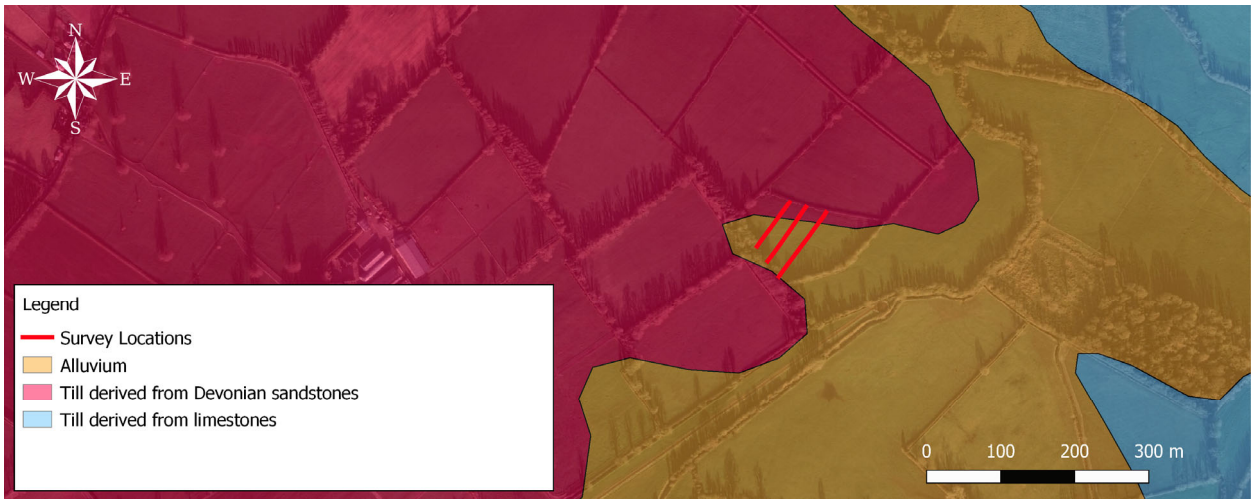


Fig 3.3.8b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R15 – R17) and 5 SR profiles S45 – S49. The results are presented on **Drawing AGP21220_08** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
175-1500	LIMESTONE/SHALE (Ballysteen Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	219-444	265	Soils	Soft /Loose	Diggable
2	471-1541	1000	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
3	1605-2245	2000	Soils	Very Stiff/ Very Dense	Diggable
			Moderately -Slightly weathered/fractured Bedrock	Poor-Fair	Break/Blast
4	3600-4500	4060	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	219-444	50-250	Sandy gravelly SILT/CLAY	Soft	Diggable
2	471-1541	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
3	1605-2245	50-250	Sandy gravelly SILT/CLAY	Very Stiff	Diggable
4	3600-4500	175-1500	Slightly weathered – Fresh LIMESTONE/SHALE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.5 – 1.1 m, average 0.7 m) of soft sandy gravelly SILT/CLAY.
- underlain by a thicker layer (0.2 – 2.6 m, average 1.3 m) firm to stiff sandy gravelly SILT/CLAY.
- underlain by a thick layer (7.3 – 17.8 m, average 12.2m) very stiff sandy gravelly SILT/CLAY.
- underlain by slightly weathered to fresh limestone/shale at depths from 10.5 to 19.3 m bgl (average depth 14.2 m bgl). Interpreted bedrock level varies from 26.2 to 35.9 mOD.

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the very stiff sandy gravelly SILT/CLAY. The seismic velocities for this layer indicate that any weathered rock will be moderately to slightly weathered and any excavation will require breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting.

3.3.9 Location 9

The survey area is located in the townlands of Tullamore and Belleen Lower, south of the R494 and c. 940 m west of the N52 Nenagh bypass. The survey area consists of open agricultural fields (Fig. 3.3.9a) and topography ranges from 45.1 mOD to 47.4 mOD.



Fig 3.3.9a: Locations marked with red line.

The soils across the survey area are mapped as alluvium in the south with till derived from limestones in the north (Fig. 3.3.9b) overlying dark muddy limestone and shale of the Ballysteen Formation.

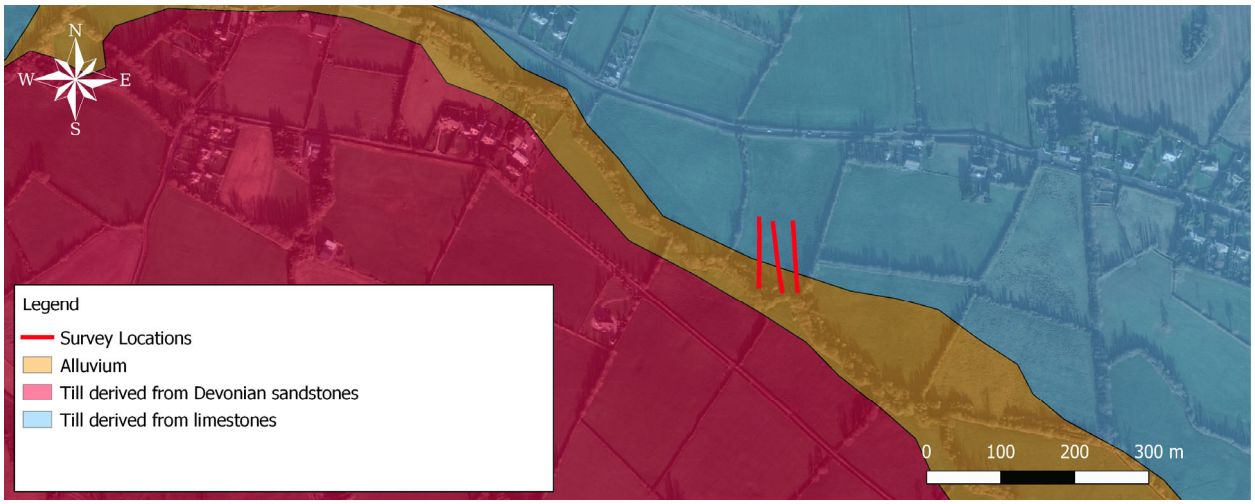


Fig 3.3.9b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R48 – R50) and 6 SR profiles S140 – S145. The results are presented on **Drawing AGP21220_09** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
175-4000	LIMESTONE (Ballysteen Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-265	190	Soils	Very Soft-Soft /Very Loose-Loose	Diggable
2	413-1538	775	Soils	Firm-Stiff/Medium Dense- Dense	Diggable
			Highly-Moderately weathered/fractured Bedrock	Poor-Fair	Rippable-Marginally Ripp.
3	3796-5001	4390	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-265	50-250	Sandy gravelly SILT/CLAY	Very Soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very Loose-Loose	
2	413-1538	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense- Dense	
		400-4000	Highly-Moderately weathered/fractured LIMESTONE	Poor-Fair	Rippable-Marginally Ripp.
3	3796-5001	400-4000	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.6 – 1.0 m, average 0.7 m) of very soft to soft sandy gravelly SILT/CLAY with some very loose to loose clayey SAND/GRAVEL in the south of R50.
- underlain by a thicker layer (1.5 – 4.7 m, average 2.7 m) firm to stiff sandy gravelly SILT/CLAY with some medium dense to dense clayey SAND/GRAVEL along R50.
- underlain by slightly weathered to fresh limestone at depths from 2.2 to 5.6 m bgl (average depth 3.4 m bgl). Interpreted bedrock level varies from 39.9 to 44.2 mOD.

No weathered rock layer has been defined by the geophysical data however there may be some weathered/fractured rock at the base of the firm to stiff sandy gravelly SILT/CLAY and medium dense to dense clayey SAND/GRAVEL. The seismic velocities of this layer indicate that any weathered rock will be highly to moderately weathered/fractured and would be rippable to marginally rippable.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

The Ballysteen Formation is described (GSI, 2019) as comprising of dark muddy limestone and shale. The bedrock resistivities for the Ballysteen Formation at this location (up to 4000 Ohm-m) are higher than observed for the Ballysteen Formation at Locations 1, 5 and 8 where the limestone was typically in the range (175 – 1500 Ohm-m). This would suggest that the limestone is 'cleaner' and may not include any shale at this location.

3.3.10 Location 10

The survey area is located in the townland of Ballycommon southwest of the Nenagh River. The survey area consists of open agricultural fields (Fig. 3.3.10a) and topography ranges from 38.7 mOD to 39.7 mOD.



Fig 3.3.10a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with some till derived from limestones in the southwest (Fig. 3.3.10b) overlying massive, unbedded lime-mudstone of the Waulsortian Limestones.

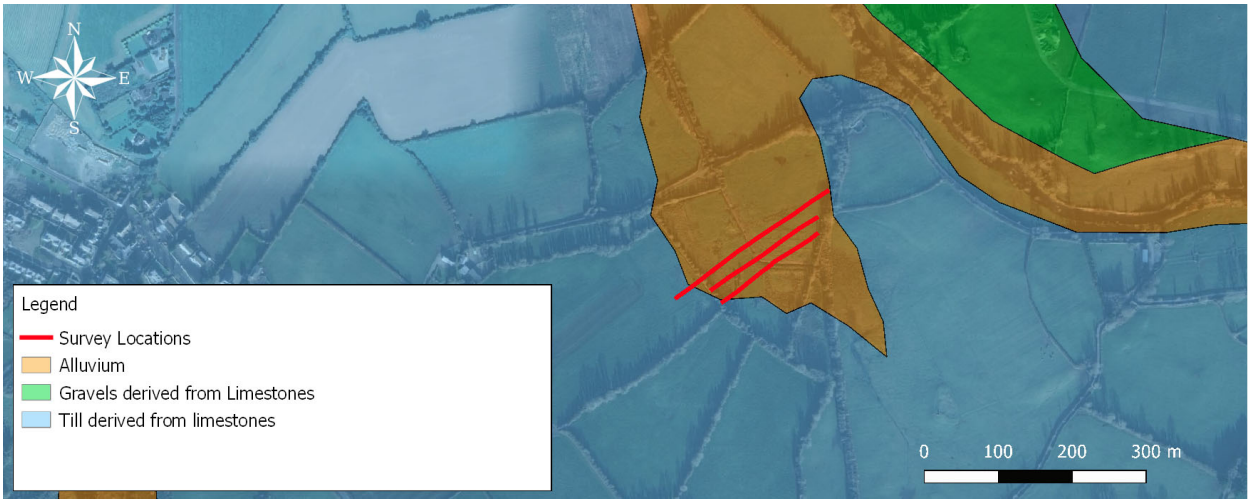


Fig 3.3.10b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 4 ERT profiles (R28 – R31) and 13 SR profiles S66 – S75 and S79 - S81. The results are presented on **Drawings AGP21220_10A and 10B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
<50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
175-20000	LIMESTONE (Waulsortian)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	162-411	255	Soils	Soft-Firm /Loose- Medium Dense	Diggable
2	667-2160	1500	Soils	Firm-Stiff-Very Stiff/ Medium Dense-Dense-Very Dense	Diggable
			Highly-Moderately weathered/karstified Bedrock	Poor-Fair	Rippable-Break/Blast
3	3706-5703	4510	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	162-411	<50	SILT/CLAY	Soft -Firm	Diggable
		50-250	Sandy gravelly SILT/CLAY		
2	667-2160	<50	SILT/CLAY	Firm-Stiff-Very Stiff	Diggable
		50-250	Sandy gravelly SILT/CLAY		
		175 - 250	Highly-Moderately weathered/karstified LIMESTONE	Poor-Fair	Rippable-Break/Blast.
3	3706-5703	250-20000	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

Three subsurface layers have been interpreted comprising of:

1. a thin upper layer (0.6 – 0.9 m, average 0.8 m) of soft to firm SILT/CLAY or sandy gravelly SILT/CLAY.
2. underlain by a thicker layer (1.2 – 5.0 m, average 2.9 m) of firm to stiff to very stiff SILT/CLAY or sandy gravelly SILT/CLAY.
3. underlain by a thin layer (typically 1 m thick) of highly to moderately weathered/karstified limestone at depths > 1.8 m bgl (at levels below 37.46 mOD).
4. underlain by slightly weathered to fresh limestone at depths 2.8 m bgl (at levels below 37 mOD).

As the bedrock comprises of massive un-bedded limestone, the seismic velocities indicate that the weathered/karstified rock layer will vary from rippable to requiring breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.11 Locations 11

The survey area is located in the townlands of Ballyannymore and Ballyanny lower, southwest of the L1608 road. The survey area consists of open agricultural fields (Fig. 3.3.11a) and topography slopes from 41.8 mOD in the northeast to 45.5 mOD towards the southwest.



Fig 3.3.11a: Locations marked with red line.

The soils across the survey area are mapped as alluvium with some till derived from limestones in the northeast (Fig. 3.3.11b) overlying grey limestone and dark chert of the Oldcourt Cherty Limestone Formation.



Fig 3.3.11b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired at Location 11 included 7 ERT profiles (R18 – R24) and 11 SR profiles S52 – S62. The results are presented on **Drawings AGP21220_11A and 11B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
150-25000	LIMESTONE (Oldcourt Formation)

The seismic data indicated up to 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	159-485	255	Soils	Soft-Firm /Loose-Medium Dense	Diggable
2	615-1602	1110	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
			Highly-Moderately weathered/karstified Bedrock	Poor-Fair	Rippable-Marg. Ripp.-
3	1418-2433	1955	Soils	Stiff- Very Stiff/ Dense-Very Dense	Diggable
			Moderately -Slightly weathered/karstified Bedrock	Fair	Marg. Rippable-Break/Blast
4	2362-5830	3910	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	159-485	50-250	Sandy gravelly SILT/CLAY	Soft-Firm	Diggable
		250-500	Clayey Sand/Gravel	Loose-Medium Dense	
		500-1000	Silty Sand/Gravel		
2	615-1602	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		500-1000	Silty Sand/Gravel		
3	1418-2433	50-250	SILT/CLAY	Stiff-Very Stiff	Diggable
		50-250	Sandy gravelly SILT/CLAY		
4	2362-5830	150-25000	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.3 – 1.6 m, average 0.8 m) of predominantly soft SILT/CLAY and sandy gravelly SILT/CLAY with loose clayey and/or silty SAND/GRAVEL in the northeast and southwest.
- Generally underlain by a layer of firm to stiff SILT/CLAY and sandy gravelly SILT/CLAY over stiff to very stiff SILT/CLAY and sandy gravelly SILT/CLAY in the southwest (R19, R23 & R24).
- To the northeast the SILT/CLAY and sandy gravelly SILT/CLAY become stiff to very stiff (R20, R21 & R22).
- Medium dense to dense clayey and/or silty SAND/GRAVEL have been mapped in the northeast and in the southwest (R18). This SAND/GRAVEL layer may also comprise of rippable to marginally rippable, highly to moderately weathered/karstified limestone in the northeast (R20, R21 & R22).
- Slightly weathered/fractured to fresh limestone bedrock has been interpreted at depths from 1.2 to 12.5 m bgl. Interpreted bedrock level varies from 32 to 44 mOD.

No weathered rock layer has been defined however there may be some weathered rock at the base of the stiff to very stiff sandy gravelly SILT/CLAY which the seismic velocities indicate would be moderately to slightly weathered/karstified and any excavation would require breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.12 Locations 12

The survey area is located in the townland of Ballyanny lower, east of the L1608 road and west of the R493 road. The survey area consists of open agricultural fields (Fig. 3.3.12a) and topography is relatively flat, ranging from 45.1 mOD to 46.6 mOD.



Fig 3.3.12a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with till derived from limestones in the northeast (Fig. 3.3.12b) overlying grey limestone and dark chert of the Oldcourt Cherty Limestone Formation.



Fig 3.3.12b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired at Location 12 included 3 ERT profiles (R25 – R27) and 3 SR profiles S63 – S65. The results are presented on **Drawing AGP21220_12** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
150-25000	LIMESTONE (Oldcourt Formation)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	195-297	240	Soils	Soft /Loose	Diggable
2	800-1695	1260	Soils	Firm-Stiff/Medium Dense-Dense	Diggable
			Highly - Moderately weathered/fractured Bedrock	Poor-Fair	Marginally Rippable.
3	3766-4989	4515	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	195-297	50-250	Sandy gravelly SILT/CLAY	Soft	Diggable
		250-500	Clayey Sand/Gravel	Loose	
2	800-1695	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
3	3766-4989	150-25000	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

The subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.6 – 0.9 m, average 0.8 m) of soft sandy gravelly SILT/CLAY with loose clayey SAND/GRAVEL in the east.
- underlain by a thicker layer of firm to stiff sandy gravelly SILT/CLAY with medium dense to dense clayey SAND/GRAVEL in the east.
- underlain by slightly weathered/fractured to fresh limestone at depths from 1.7 to 4.9 m bgl). Interpreted bedrock level varies from 40.8 to 44.6 mOD.

No weathered rock layer has been defined by the geophysical data however the resistivity values and seismic velocities indicate that layer 2 may comprise of weathered/fractured limestone which the seismic velocities indicate will be marginally rippable to requiring breaking/blasting. This should be confirmed by trial pitting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.13 Location 13

The survey area is located in the townland of Loughourna, c. 1 km east of the R493 road. The survey area consists of open agricultural fields (Fig. 3.3.13a) and topography slopes upwards from southwest to northeast ranging from 68.3 mOD to 72.4 mOD.



Fig 3.3.13a: Locations marked with red line.

The soils across the survey area are mapped as predominantly till derived from limestones with alluvium to the southwest (Fig. 3.3.13b) overlying grey calcarenitic and oolitic limestone of the Terryglass Formation.



Fig 3.3.13b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R54 - R56) and 6 SR profiles S164 – S169. The results are presented on **Drawing AGP21220_13** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
300-3500	LIMESTONE (Terryglass Formation)

The seismic data indicated 4 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	182-286	225	Soils	Very soft-Soft /Very loose-Loose	Diggable
2	333-889	555	Soils	Soft-Firm /Loose- Medium Dense	Diggable
3	821-1564	1215	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
			Highly-Moderately weathered/karstified Bedrock	Poor-Fair	Rippable-Marginally Ripp.
4	3433-5509	4740	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	182-286	50-250	Sandy gravelly SILT/CLAY	Very soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very loose-Loose	
2	333-889	50-250	Sandy gravelly SILT/CLAY	Soft-Firm	Diggable
		250-500	Clayey Sand/Gravel	Loose- Medium Dense	
3	821-1564	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
4	3433-5509	300-3500	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

Five subsurface layers have been interpreted as comprising of:

- a thin upper layer (0.3 – 1.4 m, average 0.6 m) of soft sandy gravelly SILT/CLAY with loose clayey SAND/GRAVEL to the northeast.
- underlain by a thicker layer (0.7 – 2.6 m, average 1.4 m) of soft to firm sandy gravelly SILT/CLAY with loose to medium dense clayey SAND/GRAVEL to the northeast.
- underlain by a thick layer of firm to stiff sandy gravelly SILT/CLAY with medium dense to dense clayey SAND/GRAVEL to the northeast.
- underlain by slightly weathered/fractured to fresh limestone at depths from 5.0 to 9.3 m bgl. Interpreted bedrock level varies from 60.5 to 66.7 mOD.

No weathered rock layer has been defined by the geophysical data however there may be some weathered/karstified rock at the base of the layer 3. The seismic velocities indicate that any weathered rock will be highly to moderately weathered rock ranging from rippable to marginally rippable.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.14 Location 14

The survey area is located in the townlands of Ardcrony, Lisgarriff and Ballylusky, c. 1 km northeast of the village of Ardcrony. The survey area consists of open agricultural fields either side of the N52 (Fig. 3.3.14a) and topography ranges from 70.9 mOD to 87.3 mOD.

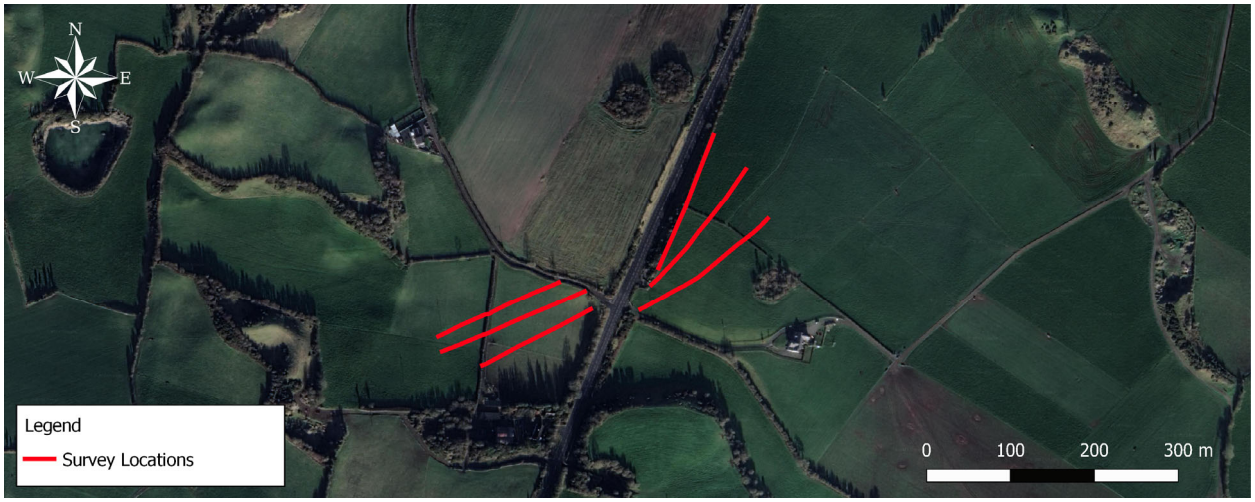


Fig 3.3.14a: Locations marked with red lines.

The soils across the survey area are mapped as alluvium and till with gravels derived from limestones towards the southwest (Fig. 3.3.14b). The soils are underlain by dark limestone & shale of the Lucan Formation.

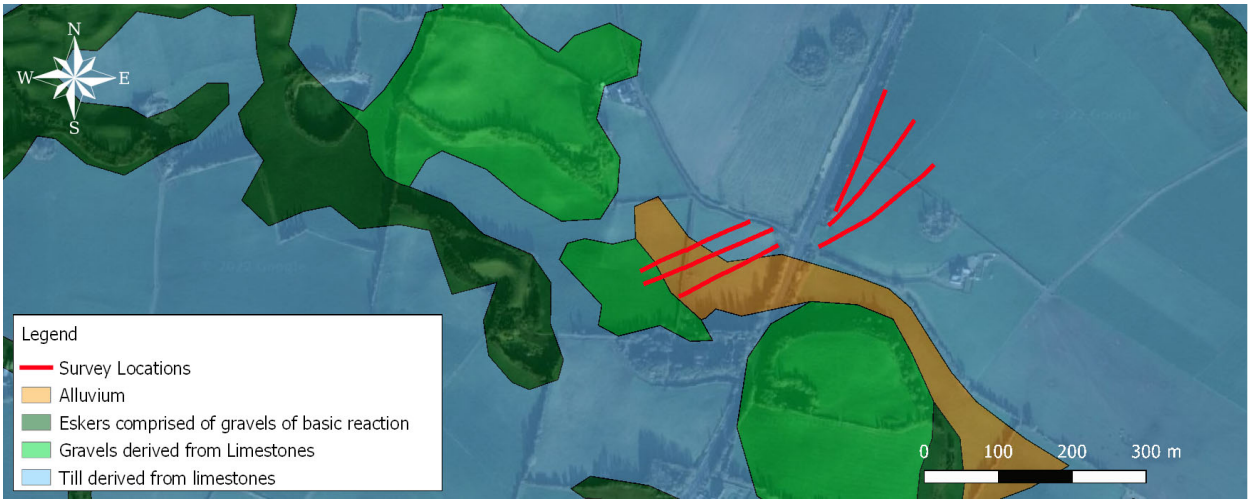


Fig 3.3.14b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 6 ERT profiles (R1 - R6) and 20 SR profiles S1 – S20. The results are presented on **Drawing AGP21220_14A and 14B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey SAND/GRAVEL
500-1000	Silty SAND/GRAVEL
1000-2000	SAND/GRAVEL
50-250	SHALE (Lucan Formation)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-367	240	Soils	Very soft-Soft /Very loose-Loose	Diggable
2	407-1549	915	Soils	Firm-Stiff /Medium Dense-Dense	Diggable
3	1448-2760	2120	Soils	Stiff-Very Stiff/ Dense-Very Dense	Diggable
			Moderately-Slightly weathered/fractured Bedrock	Fair	Marginally Ripp.-Break/Blast

The geophysical data indicates differing subsurface layers either side of the N52 with the surveyed area to the southwest indicating predominantly silty sand/gravel and sand/gravel over sandy gravelly silt/clay deposits. To the northeast the geophysical data indicates predominantly clayey sand/gravel and silty sand/gravel over possible shale bedrock. The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	154-367	50-250	Sandy gravelly SILT/CLAY	Very soft-Soft	Diggable
		250-500	Clayey SAND/GRAVEL	Very loose-Loose	
		500-1000	Silty SAND/GRAVEL		
2	407-1549	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey SAND/GRAVEL	Medium Dense-Dense	
		500-1000	Silty SAND/GRAVEL		
		1000-2000	SAND/GRAVEL		
3	1448-2760	50-250	Sandy gravelly SILT/CLAY	Stiff-Very Stiff	Diggable
		250-500	Clayey SAND/GRAVEL	Dense-Very Dense	
		500-1000	Silty SAND/GRAVEL		
		1000-2000	SAND/GRAVEL		
4	2280-2760	50-250	Slightly weathered/fractured SHALE	Fair-Good	Beak/blast

The subsurface layers in the southwest (R1, R2, R6) have been interpreted as comprising of:

- a thin upper layer (0.3 – 1.7 m, average 0.8 m) of predominantly very loose to loose clayey SAND/GRAVEL or silty SAND/GRAVEL with some very soft to soft sandy gravelly SILT/CLAY,
- underlain by a thicker layer (1.4 – 8.3 m, average 4.3 m) of predominantly medium dense to dense clayey SAND/GRAVEL, silty SAND/GRAVEL and SAND/GRAVEL with some firm to stiff sandy gravelly SILT/CLAY,
- underlain by dense to very dense clayey SAND/GRAVEL, silty SAND/GRAVEL and SAND/GRAVEL,
- underlain by a thick layer of stiff to very stiff sandy gravelly SILT/CLAY.

The geophysical data does not suggest the presence of bedrock within the depth of investigation.

The subsurface layers in the northeast (R3, R4, R5) have been interpreted as comprising of:

- a thin upper layer (0.3 – 0.9 m, average 0.7 m of predominantly very loose to loose clayey SAND/GRAVEL or silty SAND/GRAVEL with some very soft to soft sandy gravelly SILT/CLAY,
- underlain by a thicker layer (1.0 – 4.3 m, average 2.2 m) of predominantly medium dense to dense silty SAND/GRAVEL and clayey SAND/GRAVEL with some localised occurrences of firm to stiff sandy gravelly SILT/CLAY,
- underlain by a thick layer of predominantly dense to very dense clayey SAND/GRAVEL,
- underlain by possible slightly weathered/fractured shale at depths > 10.5 m bgl and bedrock levels below 76.5 mOD.

The seismic velocities indicate that any excavation of slightly weathered/fractured shale will require breaking/blasting.

3.3.15 Location 15

The survey area is located in the townland of Ballylusky, c. 1 km east of the N52 road. The survey area consists of open agricultural fields (Fig. 3.3.15a) and topography ranges from 73.1 to 74.3 mOD.



Fig 3.3.15a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with till derived from limestones to the west and lacustrine sediments to the southeast (Fig. 3.3.15b). The soils are underlain by grey calcarenitic and oolitic limestone of the Terryglass Formation.



Fig 3.3.15b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 2 ERT profiles (R43 – R44) and 5 SR profiles S127 – S131. The results are presented on **Drawing AGP21220_15** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
150-250	MUDSTONE/SHALE
250-3500	LIMESTONE (Terryglass Formation)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	150-382	230	Soils	Very soft-Soft /Very loose-Loose	Diggable
2	404-1693	1145	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
			Highly-Moderately weathered/karstified Bedrock	Poor-Fair	Rippable-Marginally Ripp.
3	2468-4134	3050	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	150-382	50-250	Sandy gravelly SILT/CLAY	Very soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very loose-Loose	
2	404-1693	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
3	2468-4134	150-250	Slightly weathered – Fresh MUDSTONE/SHALE	Good	Break/Blast
		250-3500	Slightly weathered – Fresh LIMESTONE		

Four subsurface layers have been interpreted comprising of:

1. a thin upper layer (0.6 – 0.9 m, average 0.8 m) of very soft to soft sandy gravelly SILT/CLAY or very loose to loose clayey SAND/GRAVEL.
2. underlain by a thicker layer (1.2 – 6.4 m, average 3.1 m) of firm to stiff sandy gravelly SILT/CLAY or medium dense to dense clayey SAND/GRAVEL.
3. underlain by slightly weathered to fresh limestone or mudstone/shale at depths from 2.0 to 7.2 m bgl (average depth 3.9 m bgl). Interpreted bedrock level varies from 66.9 to 71.9 mOD.

No weathered rock layer has been defined by the geophysical data however there may be some weathered/karstified rock at the base of layer 2. The seismic velocities indicate that any weathered rock will be highly to moderately weathered rock ranging from rippable to requiring breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.3.16 Location 16

The survey area is located in the townland of Modreeny, c. 2.5 km northwest of Cloughjordan town centre. The survey area consists of open agricultural fields (Fig. 3.3.16a) and topography ranges from 74.2 mOD to 76.3 mOD.



Fig 3.3.16a: Locations marked with red line.

The soils across the survey area are mapped as predominantly alluvium with till derived from limestones to the northeast and southwest (Fig. 3.3.16b) overlying massive, unbedded lime-mudstone of the Waulsortian Limestones.



Fig 3.3.16b: The GSI Quaternary sediments map (locations marked in red).

The geophysical data acquired along these sections included 3 ERT profiles (R7 – R9) and 12 SR profiles S21 – S32. The results are presented on **Drawings AGP21220_16A and 16B** (Appendix B).

Modelled resistivity values in this area have been interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-250	Sandy gravelly SILT/CLAY
250-500	Clayey Sand/Gravel
175-20000	LIMESTONE (Waulsortian)

The seismic data indicated 3 subsurface velocity layers:

Layer	Velocity (m/s)	Ave. (m/s)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	140-324	200	Soils	Very Soft-Soft /Very loose-Loose	Diggable
2	633-2005	1375	Soils	Firm-Stiff/ Medium Dense-Dense	Diggable
			Highly-Moderately weathered/karstified Bedrock	Poor-Fair	Rippable-Break/Blast
3	2419-5725	4215	Slightly weathered – Fresh Bedrock	Good	Break/Blast

The combined results have been summarised as follows:

Layer	Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	140-324	50-250	Sandy gravelly SILT/CLAY	Very Soft-Soft	Diggable
		250-500	Clayey Sand/Gravel	Very loose-Loose	
2	633-2005	50-250	Sandy gravelly SILT/CLAY	Firm-Stiff	Diggable
		250-500	Clayey Sand/Gravel	Medium Dense-Dense	
		175-250	Highly-Moderately weathered/karstified LIMESTONE	Poor-Fair	Rippable-Break/Blast
3	2419-5725	250-10000	Slightly weathered – Fresh LIMESTONE	Good	Break/Blast

Four subsurface layers have been interpreted comprising of:

1. a thin upper layer (0.5 – 1.1 m, average 0.8 m) of very soft to soft sandy gravelly SILT/CLAY or very loose to loose clayey SAND/GRAVEL.
2. underlain by a thicker layer (0.6 – 3.4 m, average 1.9 m) of firm to stiff sandy gravelly SILT/CLAY or medium dense to dense clayey SAND/GRAVEL.
3. underlain by a layer of highly to moderately weathered/karstified limestone (typically 0.9 m thick) at depths from 2.0 to 5.4 m bgl. Interpreted bedrock level varies from 70 to 74 mOD.
4. underlain by slightly weathered to fresh limestone at depths from 2.3 to 6.8 m bgl. Interpreted bedrock level varies from 68.6 to 73.4 mOD.

As the bedrock comprises of massive un-bedded limestone, the seismic velocities indicate that the weathered/karstified rock layer will vary from rippable to requiring breaking/blasting.

The velocities indicate that any excavation of the slightly weathered to fresh rock will require breaking/blasting. It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

Some lower bedrock resistivities coupled with lower bedrock velocities in the southwest of R8 suggest the presence of increased karstification of the bedrock at depths ≥ 6 m bgl. This should be investigated by coring.

4. RECOMMENDATIONS

The findings of the geophysical investigation should be reviewed on completion of the direct investigation.

Where bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, any rotary core drilling, strength testing and trial excavation pits using a high-powered excavator such as a CAT 336E or more powerful model. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction. A more detailed discussion of velocity and excavatability is contained in Appendix D.

Foundation design for any structures should take into account the presence of possible open fissures/cavities in the limestone bedrock. Any cavities exposed during stripping of topsoil or excavation of rock should be backfilled in the appropriate manner for karstified limestone areas as advised by a competent geotechnical engineer.

To minimise the risk of subsidence in areas where any karstified limestone is near surface, drains should be sealed, and surface water disposed of away from these areas. Prior to construction a surface water management plan is advised to avoid re-activation of any karst features due to changes in the surface water flow.

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APPENDIX A: DETAILED METHODOLOGY

A combination of geophysical techniques was used to provide a high quality interpretation and reduce any ambiguities, which may otherwise exist.

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

ERT Profiles were recorded using a Campus Tigre resistivity meter, imaging software, two takeout multicore cables and up to 64 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic Refraction Profiling

Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (2m spacing). Equipment was carried was operated by a two to three person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile (e.g. 46m profile ~16m depth). Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors.

Data Processing

First break picking in digital format was carried out using the FIRSTPIX software program to construct traveltime plots for each spread. The recorded data was processed and interpreted using the GREMIX software program to calculate the thickness of individual velocity units. GREMIX interprets seismic refraction data as a laterally varying layered earth structure. It incorporates the slope-intercept method, parts of the Plus-Minus Method of Hagedoorn (1959), Time-Delay Method, and features the Generalized Reciprocal Method (GRM) of Palmer (1980). Up to four layers can be mapped; one deduced from direct arrivals and three deduced from refractions. Phantoming of all possible travel time pairs can be carried out by adjusting reciprocal times of off shots. Material types were assigned and estimation made of material properties, cross-referenced to other geophysical data.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

Spatial Relocation

All the geophysical investigation locations were acquired using a Trimble Geo 7X high-accuracy GNSS handheld GPS system using the settings listed below. This system allows collection of GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Metres
Altitude units:	Metres
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

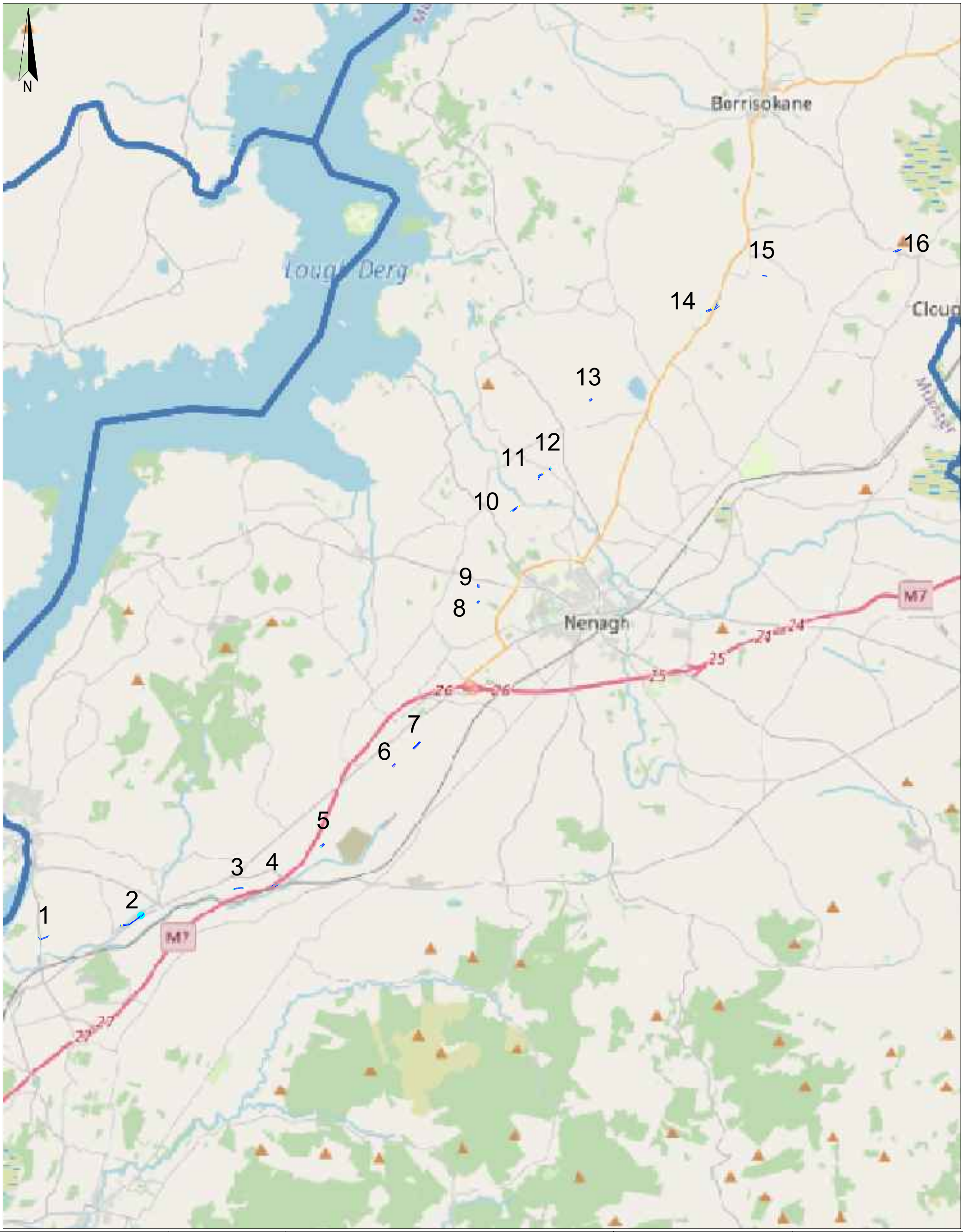
APPENDIX B: DRAWINGS

The information derived from the geophysical investigation is presented in the following drawings:

AGP21220_Overview	Regional Location Map	1:100.000 @ A3
AGP21220_01	Figure 1: Geophysical Locations – Location 1	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 1	1:1000 @ A1
AGP21220_02A	Figure 1: Geophysical Locations – Location 2	1:1250 @ A1
	Figure 2: Geophysical Sections – Location 2	1:1000 @ A1
AGP21220_02B	Figure 1: Geophysical Locations – Location 2	1:1250 @ A1
	Figure 2: Geophysical Sections – Location 2	1:1000 @ A1
AGP21220_03	Figure 1: Geophysical Locations – Location 3	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 3	1:500 @ A1
AGP21220_04	Figure 1: Geophysical Locations – Location 4	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 4	1:500 @ A1
AGP21220_05	Figure 1: Geophysical Locations – Location 5	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 5	1:500 @ A1
AGP21220_06	Figure 1: Geophysical Locations – Location 6	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 6	1:500 @ A1
AGP21220_07A	Figure 1: Geophysical Locations – Location 7	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 7	1:500 @ A1
AGP21220_07B	Figure 1: Geophysical Locations – Location 7	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 7	1:500 @ A1
AGP21220_08	Figure 1: Geophysical Locations – Location 8	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 8	1:500 @ A1
AGP21220_09	Figure 1: Geophysical Locations – Location 9	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 9	1:500 @ A1
AGP21220_10A	Figure 1: Geophysical Locations – Location 10	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 10	1:500 @ A1
AGP21220_10B	Figure 1: Geophysical Locations – Location 10	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 10	1:500 @ A1
AGP21220_11A	Figure 1: Geophysical Locations – Location 11	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 11	1:600 @ A1
AGP21220_11B	Figure 1: Geophysical Locations – Location 11	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 11	1:500 @ A1
AGP21220_12	Figure 1: Geophysical Locations – Location 12	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 12	1:500 @ A1
AGP21220_13	Figure 1: Geophysical Locations – Location 13	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 13	1:500 @ A1
AGP21220_14A	Figure 1: Geophysical Locations – Location 14	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 14	1:600 @ A1
AGP21220_14B	Figure 1: Geophysical Locations – Location 14	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 14	1:600 @ A1
AGP21220_15	Figure 1: Geophysical Locations – Location 15	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 15	1:500 @ A1
AGP21220_16A	Figure 1: Geophysical Locations – Location 16	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 16	1:500 @ A1
AGP21220_16B	Figure 1: Geophysical Locations – Location 16	1:1000 @ A1
	Figure 2: Geophysical Sections – Location 16	1:500 @ A1

GEOPHYSICAL LOCATIONS

SCALE 1:100,000

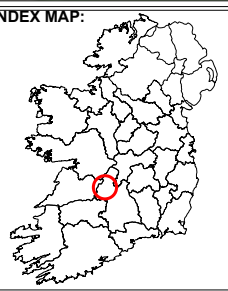


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INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:	IRISH WATER SUPPLY SCHEME EASTERN & MIDLANDS REGION - CONTRACT 1
CLIENT.:	CAUSEWAY GEOTECH LIMITED
DRAWING NO:	AGP21220_Overview
SCALE:	AS INDICATED @ A3
DATE:	05-10-2022

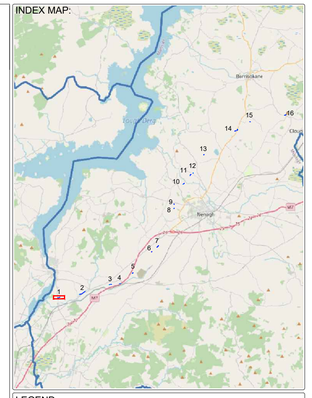
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01	05-10-2022	YOC	TL

FIGURE 1: Geophysical Locations - Location 1

Scale 1:1000



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very Stiff sandy gravelly SILT/CLAY

Very Stiff SILT/CLAY

Very Loose-Loose clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Very Dense clayey SAND/GRAVEL

Very Loose-Loose silty SAND/GRAVEL

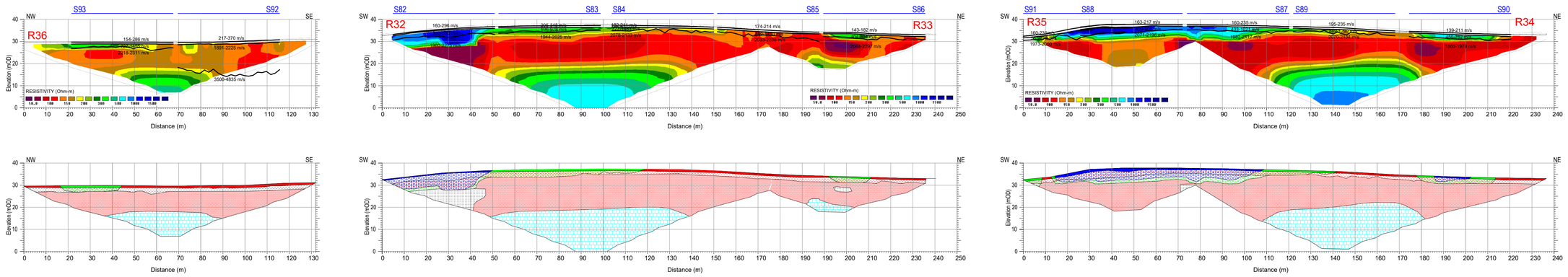
Medium dense - Dense silty SAND/GRAVEL

Very Dense silty SAND/GRAVEL

Slightly Weathered - Fresh LIMESTONE (Ballysteen)

FIGURE 2: Geophysical Sections - Location 1

Scale 1:1000



The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_01

SCALE:
AS SHOWN @ A1

DATE:
05-10-2022

DRAWN:	CHECKED:
YOC	---

REVISION:	DATE:	DRAWN:	CHECKED:
01	05-10-2022	YOC	TL

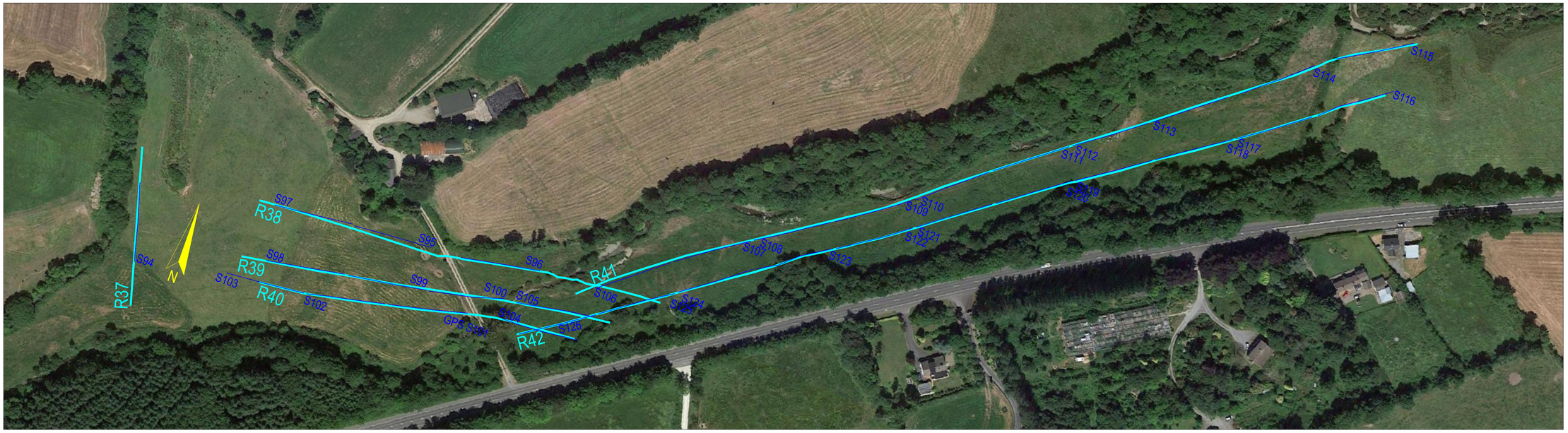
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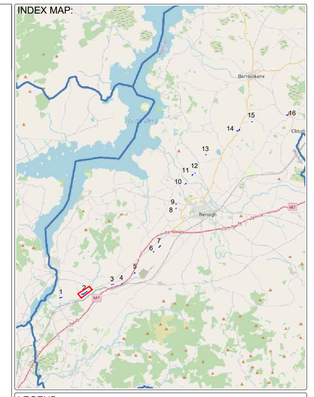
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FIGURE 1: Geophysical Locations - Location 2

Scale 1:1250





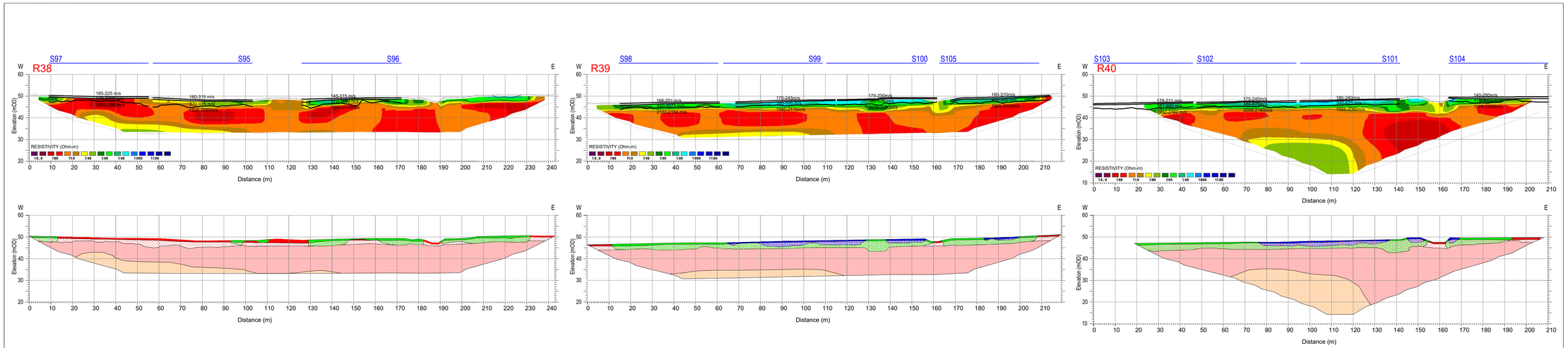
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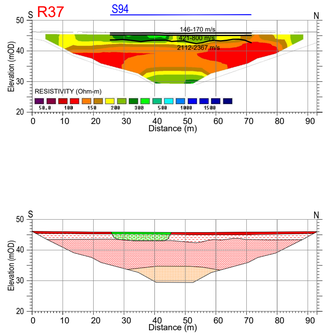
R1 — 2D resistivity profile

S1 — Seismic refraction profile

FIGURE 2: Geophysical Sections - Location 2

Scale 1:1000





Seismic refraction layer with interpreted P-wave velocity

- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Loose clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Loose-Loose silty SAND/GRAVEL
- Loose silty SAND/GRAVEL
- Medium dense-Dense silty SAND/GRAVEL
- SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_02A

SCALE:
AS SHOWN @ A1

DATE:
05-10-2022

DRAWN:	CHECKED:
YOC	---

REVISION:	DATE:	DRAWN:	CHECKED:
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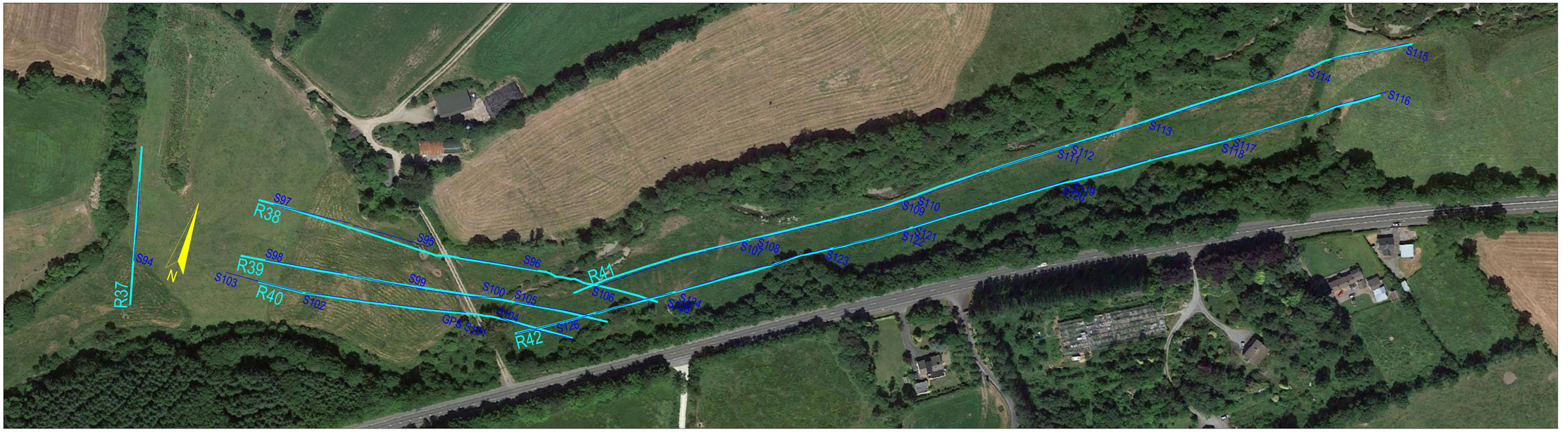
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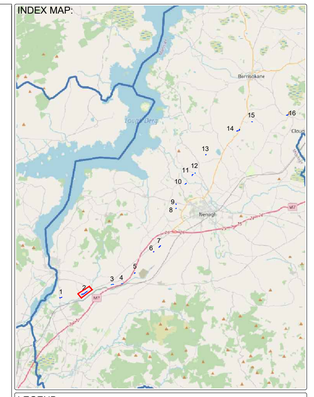
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FIGURE 1: Geophysical Locations - Location 2

Scale 1:1250



INDEX MAP:



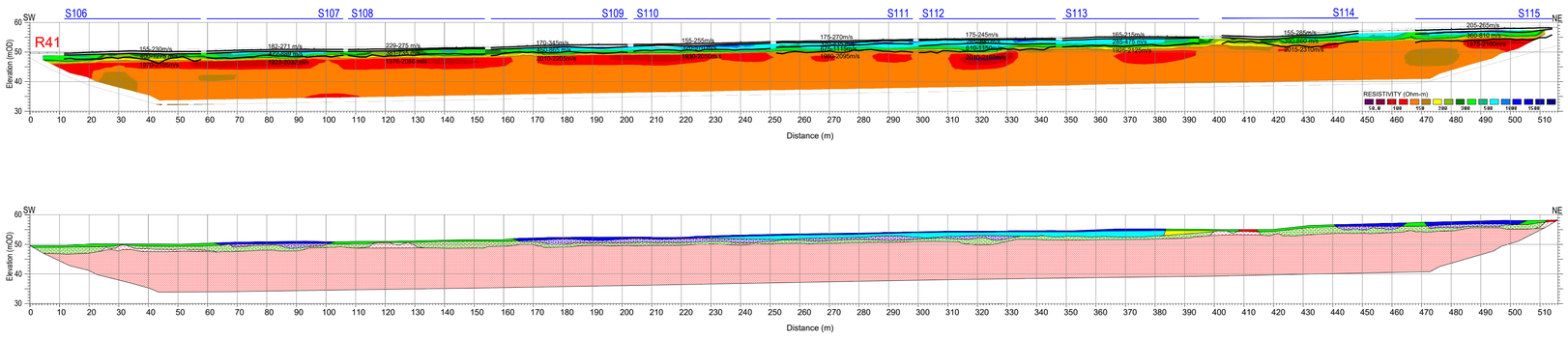
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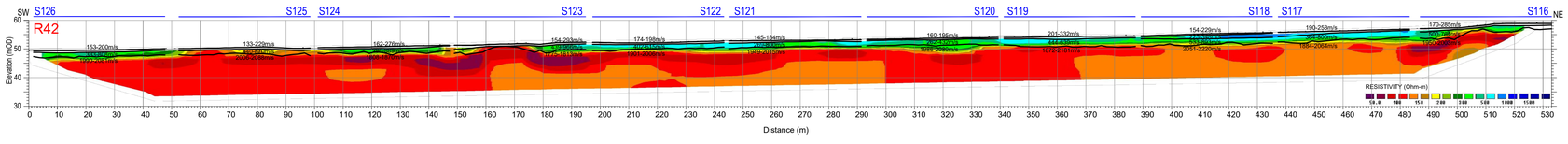
R1 — 2D resistivity profile

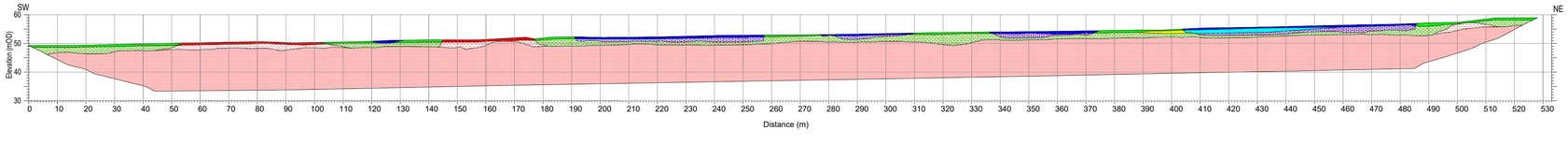
S1 — Seismic refraction profile

FIGURE 2: Geophysical Sections - Location 2

Scale 1:1000







Seismic refraction layer with interpreted P-wave velocity

- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Loose clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Loose-Loose silty SAND/GRAVEL
- Loose silty SAND/GRAVEL
- Medium dense-Dense silty SAND/GRAVEL
- SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_02B

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FIGURE 1: Geophysical Locations - Location 3

Scale 1:1000

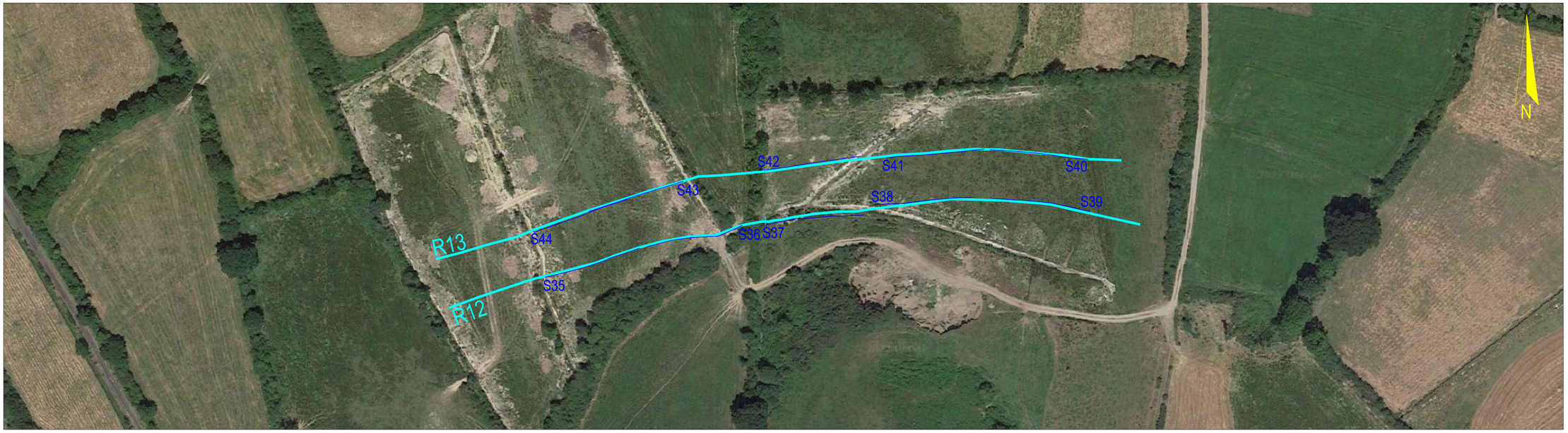
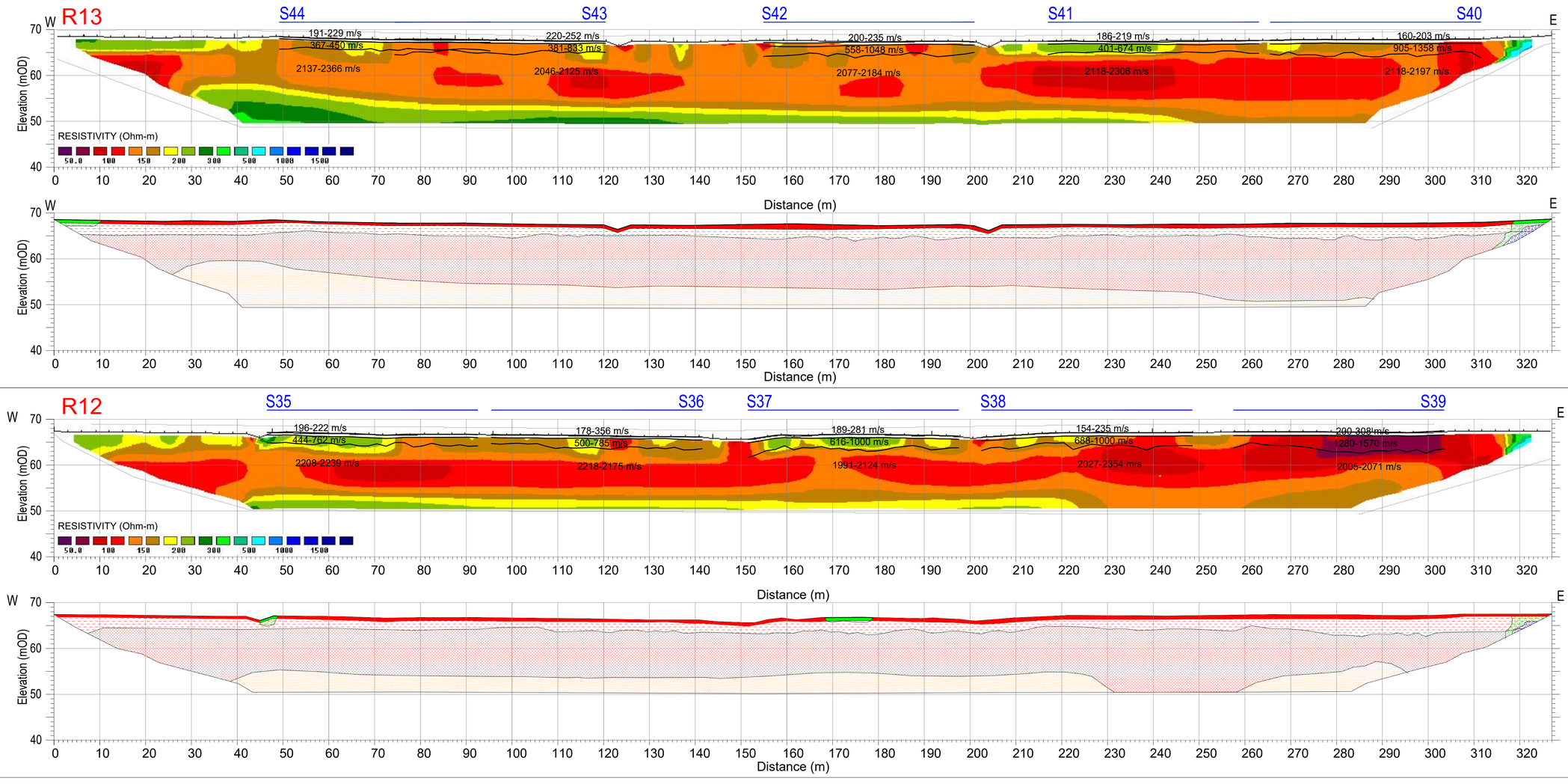
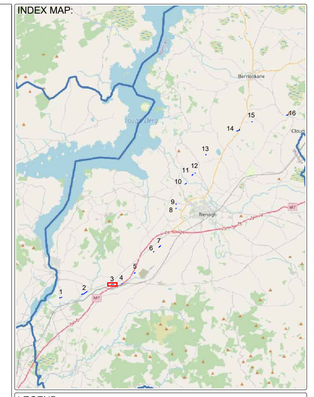


FIGURE 2: Geophysical Sections - Location 3

Scale 1:500



INDEX MAP:



LEGEND:

- R1 — 2D resistivity profile
- S1 — Seismic refraction profile

- Seismic refraction layer with interpreted P-wave velocity
- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Dense clayey SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Very Dense silty SAND/GRAVEL
- SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_03

SCALE:
AS SHOWN @ A1

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FIGURE 1: Geophysical Locations - Location 4

Scale 1:1000

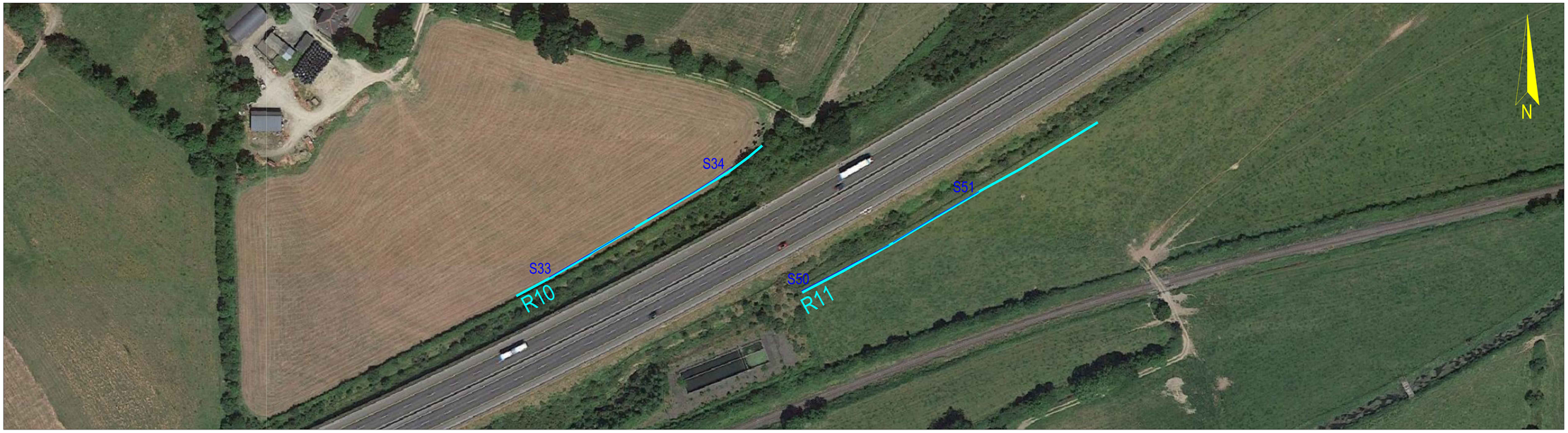
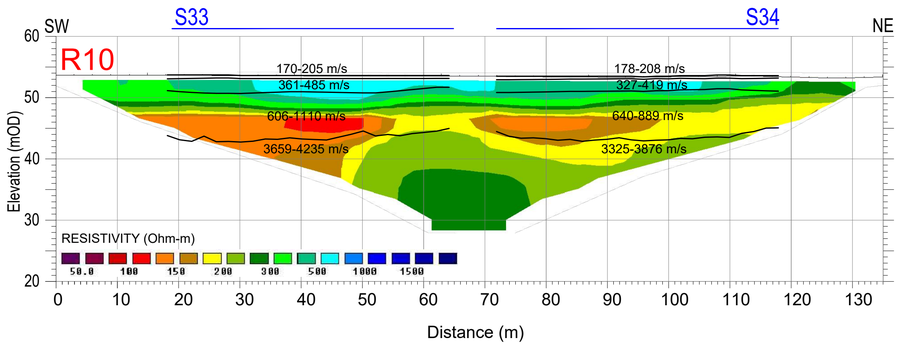
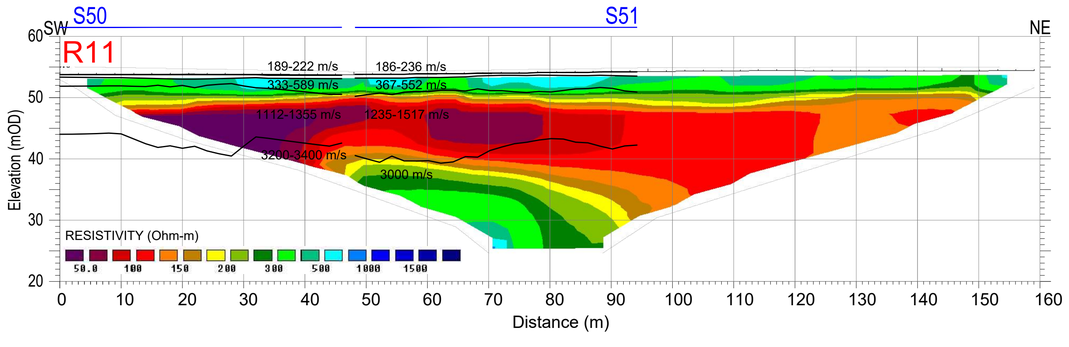
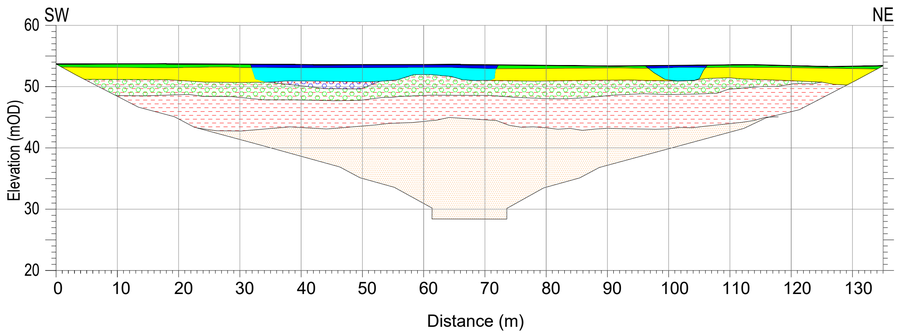


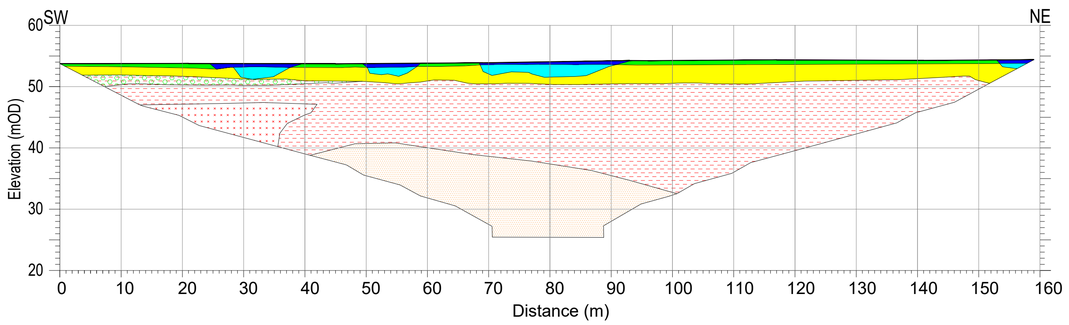
FIGURE 2: Geophysical Sections - Location 4

Scale 1:500

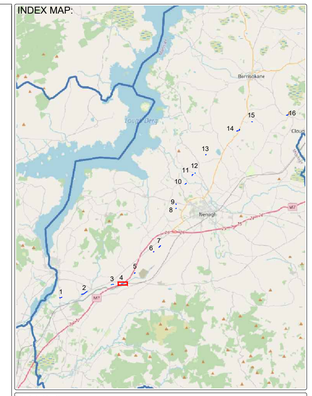








INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

- Very Loose-Loose clayey SAND/GRAVEL
- Loose - Medium dense clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Loose-Loose silty SAND/GRAVEL
- Loose-Medium dense silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Firm-Stiff sandy gravelly SILT/CLAY
- Firm-Stiff SILT/CLAY
- Slightly Weathered - Fresh SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_04

SCALE:
AS SHOWN @ A1

DATE:
05-10-2022

DRAWN:	YOC	CHECKED:	---

REVISION:	DATE:	DRAWN:	CHECKED:
01	05-10-2022	YOC	TL

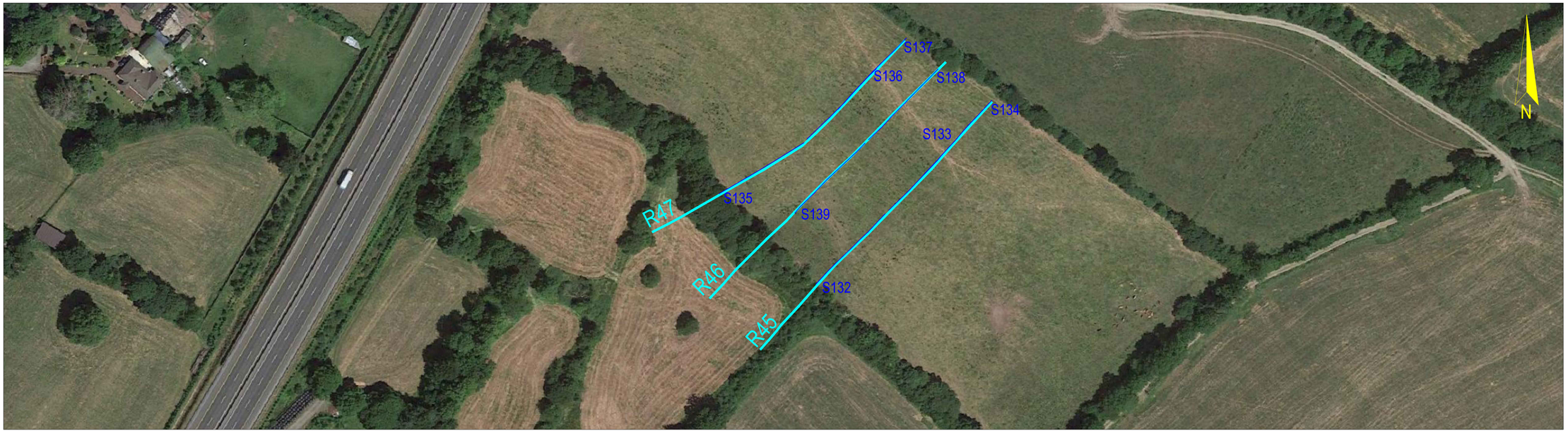
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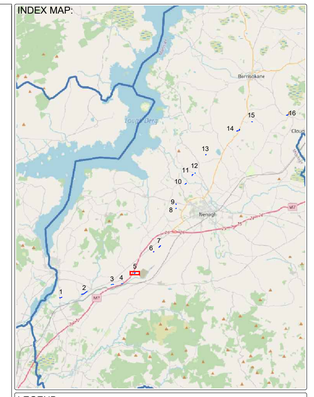
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FIGURE 1: Geophysical Locations - Location 5

Scale 1:1000



INDEX MAP:



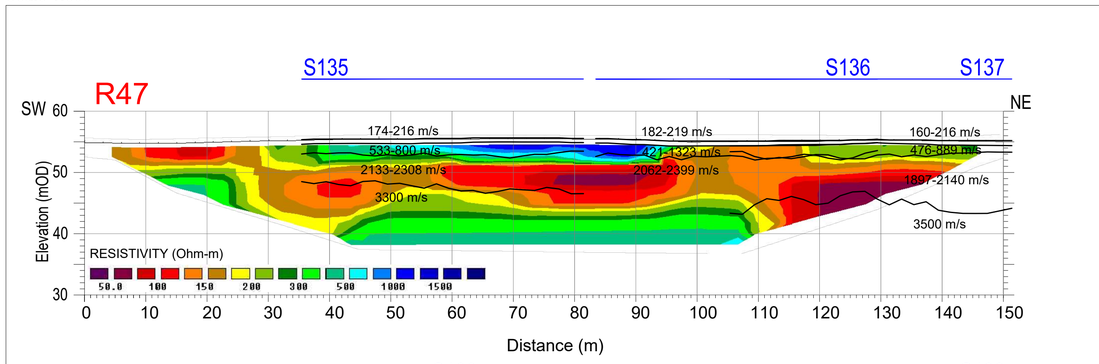
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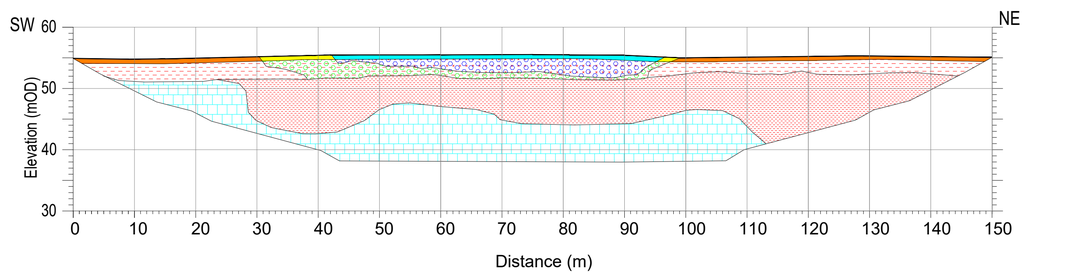
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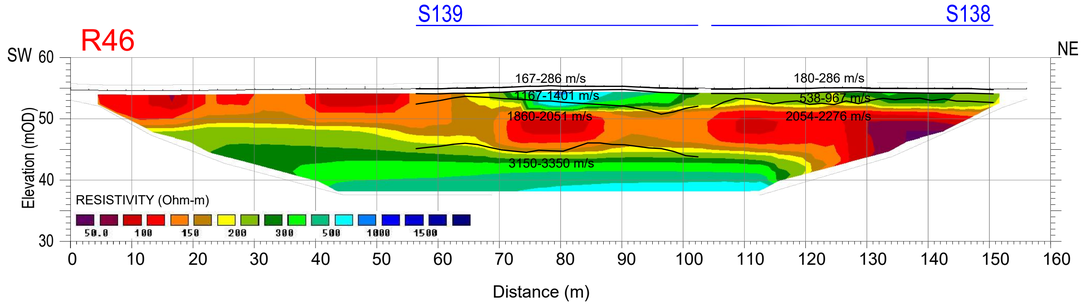
S1 — Seismic refraction profile

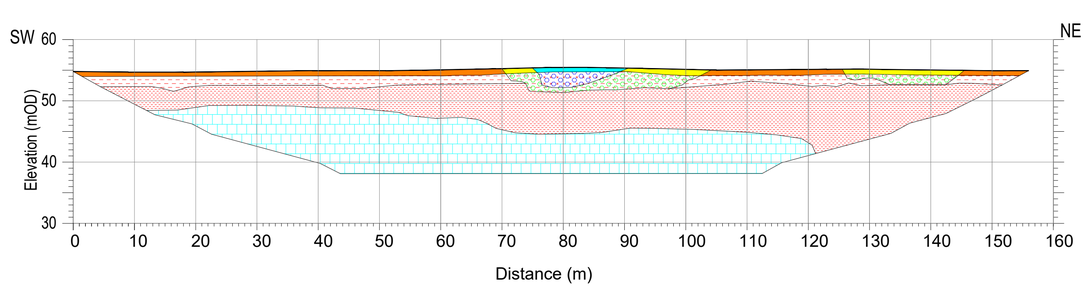
FIGURE 2: Geophysical Sections - Location 5

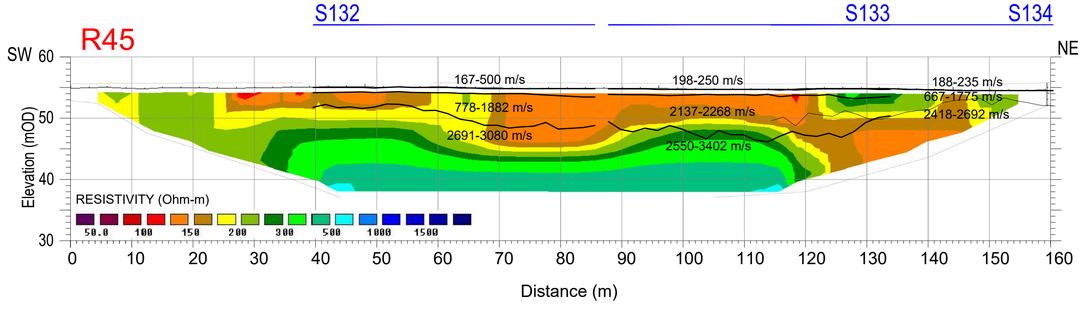
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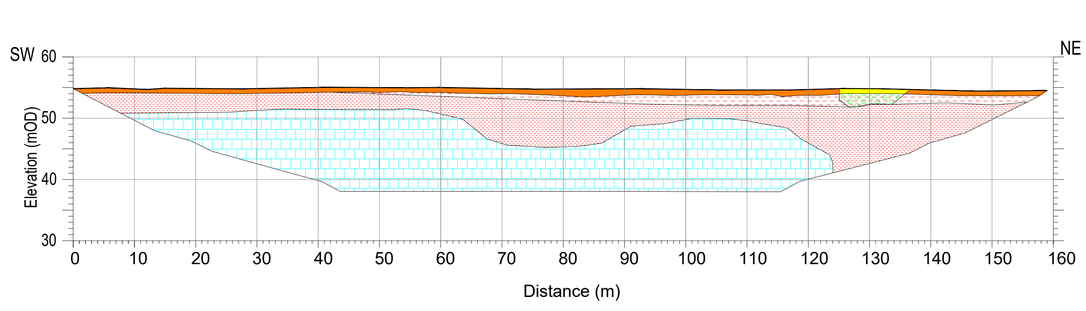












Seismic refraction layer with interpreted P-wave velocity

Very soft-Firm sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very stiff sandy gravelly SILT/CLAY

Very loose - Medium dense clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Loose-Medium dense silty SAND/GRAVEL

Medium dense - Dense silty SAND/GRAVEL

Slightly Weathered - Fresh LIMESTONE (Ballysteen)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_05

SCALE:
AS SHOWN @ A1

DATE:
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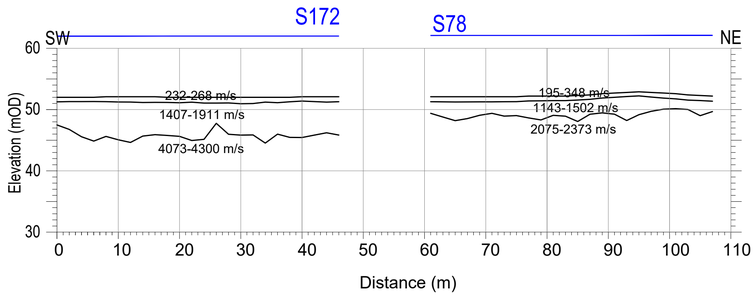
FIGURE 1: Geophysical Locations - Location 6

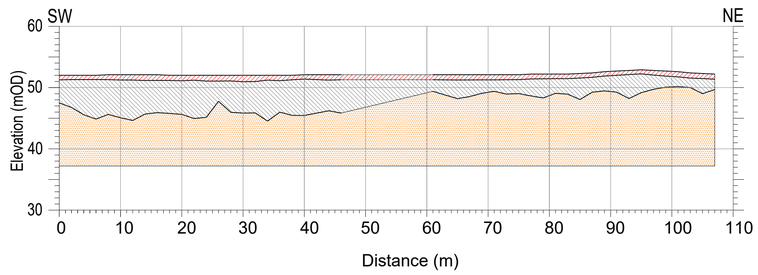
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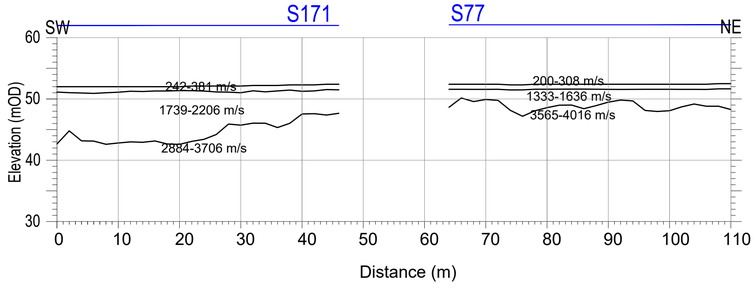


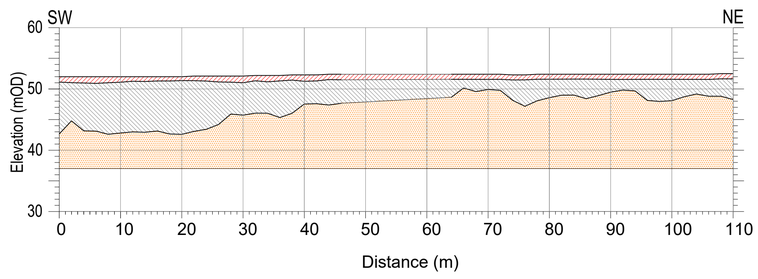
FIGURE 2: Geophysical Sections - Location 6

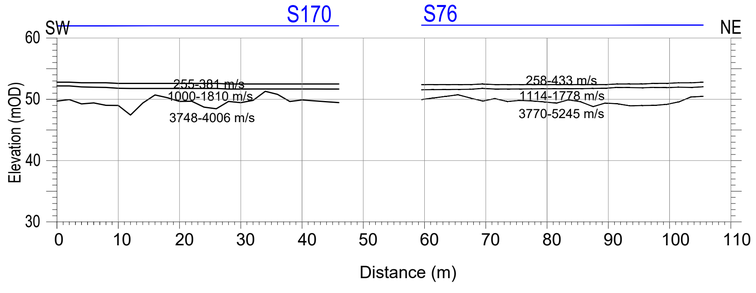
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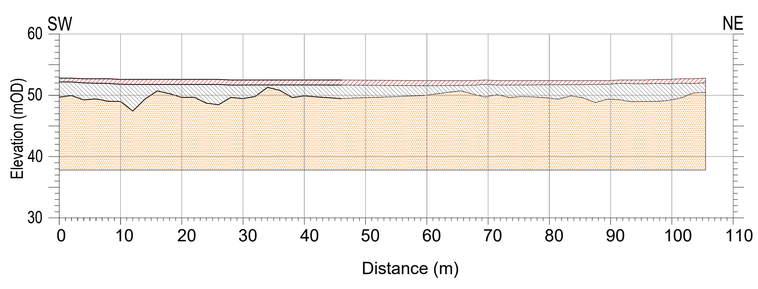




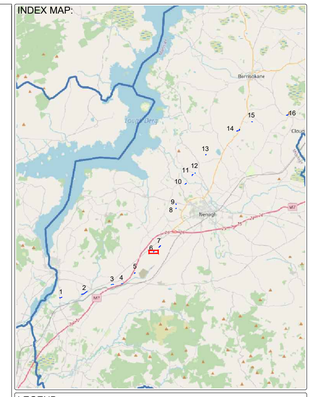








INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Soft/Loose SOILS

Stiff-Very Stiff/Dense-Very Dense SOILS and/or Moderately - Slightly Weathered/Fractured SANDSTONE/MUDSTONE/LIMESTONE

Slightly Weathered - Fresh SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_06

SCALE:
AS SHOWN @ A1

DATE:
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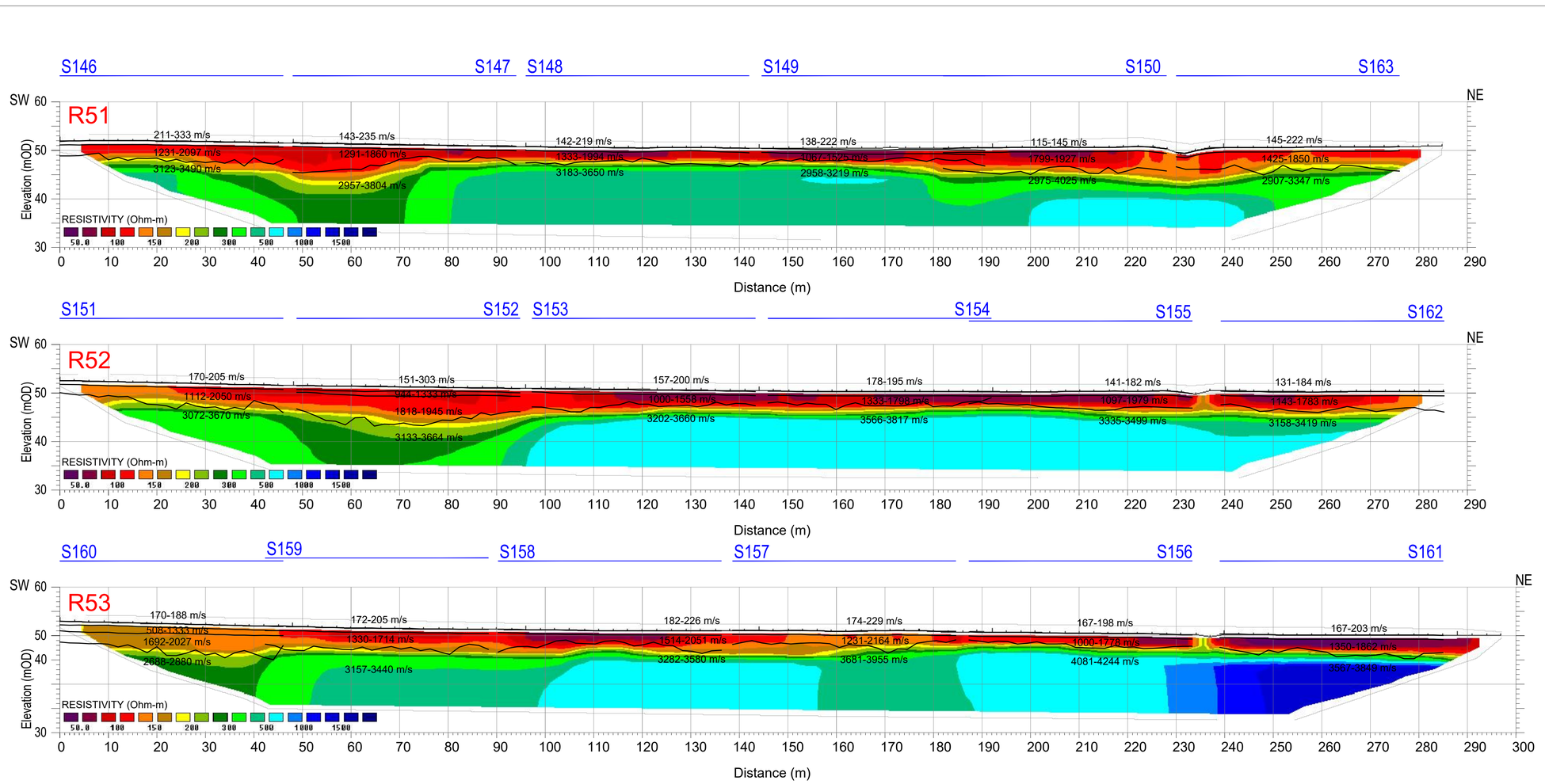
FIGURE 1: Geophysical Locations - Location 7

Scale 1:1000

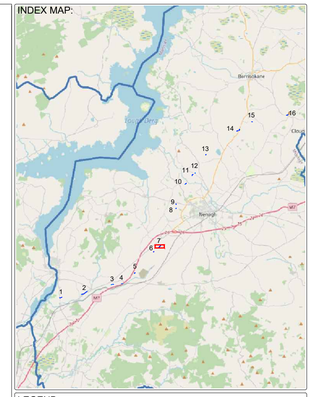


FIGURE 2: Geophysical Sections - Location 7

Scale 1:500



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft SILT/CLAY

Stiff-Very Stiff SILT/CLAY

Very soft-Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Stiff-Very Stiff sandy gravelly SILT/CLAY

Slightly Weathered - Fresh SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)

Slightly Weathered - Fresh LIMESTONE (Ballysteen)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_07A

SCALE:
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DATE:
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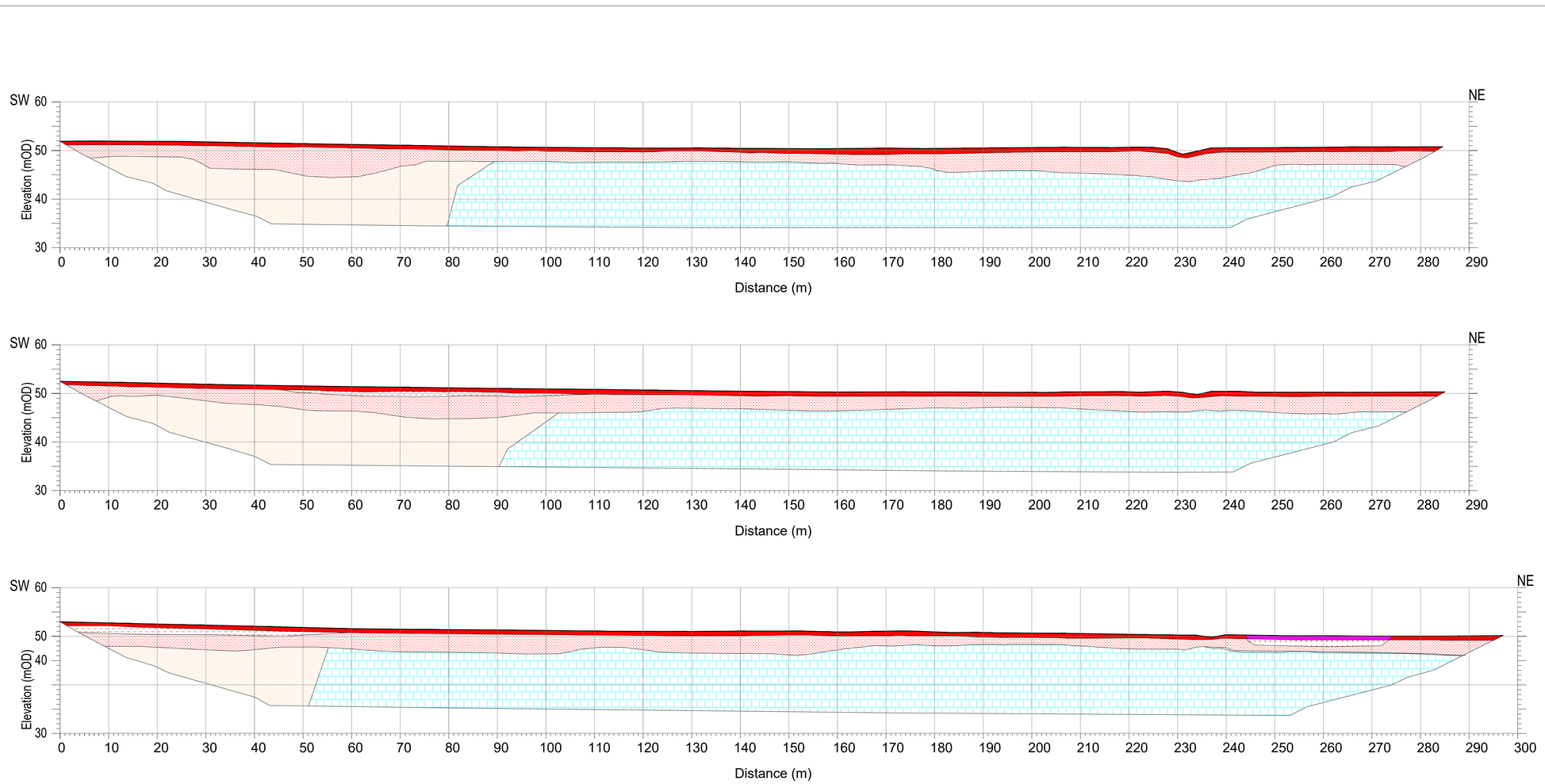
FIGURE 1: Geophysical Locations - Location 7

Scale 1:1000

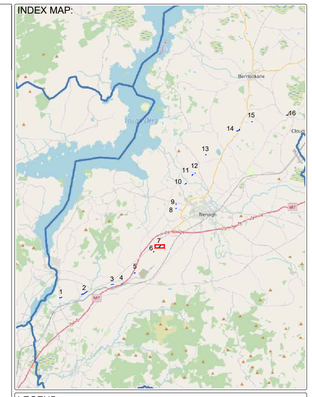


FIGURE 2: Geophysical Sections - Location 7

Scale 1:500



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity (1km-1km m/s)

- Very soft-Soft SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff sandy gravelly SILT/CLAY
- Slightly Weathered - Fresh SANDSTONE/MUDSTONE/LIMESTONE (Lower Limestone Shale)
- Slightly Weathered - Fresh LIMESTONE (Ballysteen)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_07B

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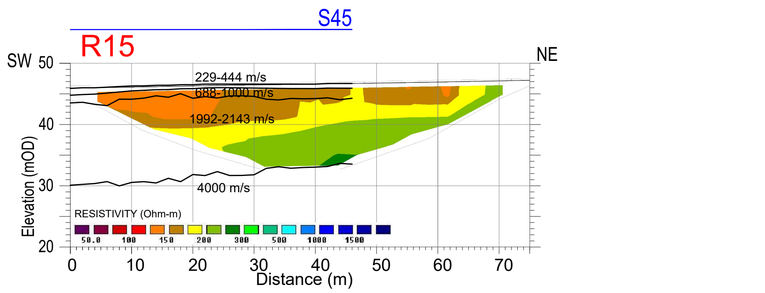
FIGURE 1: Geophysical Locations - Location 8

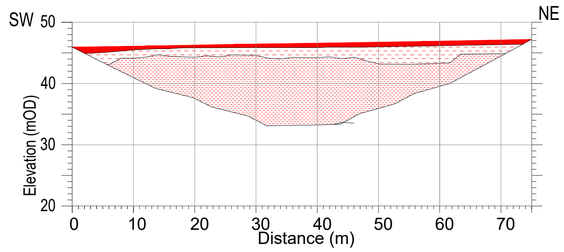
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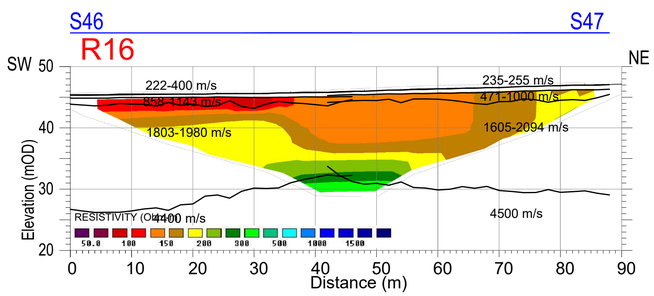


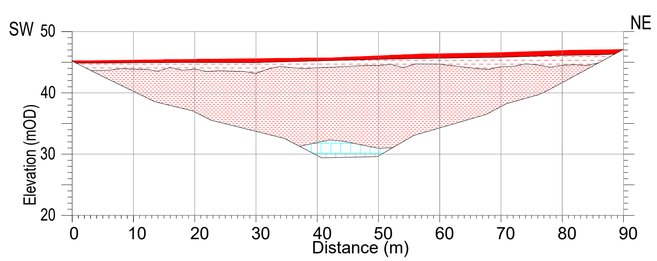
FIGURE 2: Geophysical Sections - Location 8

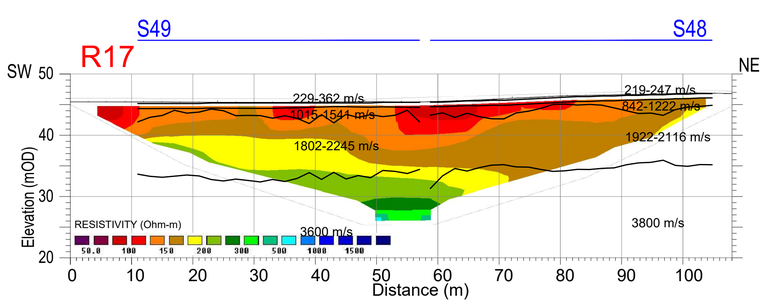
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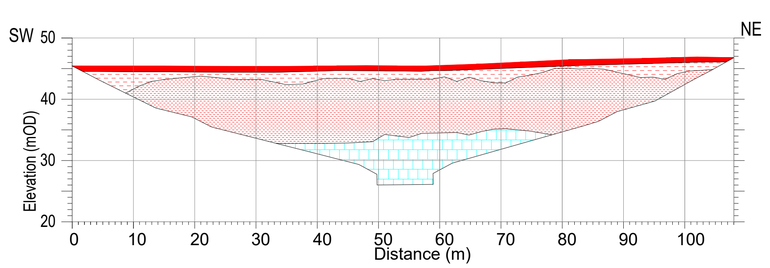




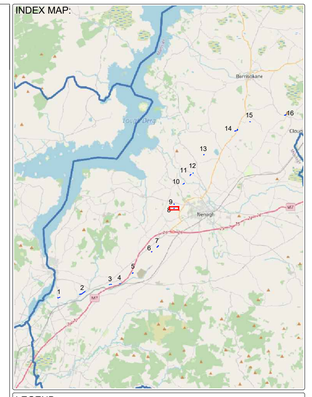








INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very Stiff sandy gravelly SILT/CLAY

Slightly Weathered - Fresh LIMESTONE (Ballysteen)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_08

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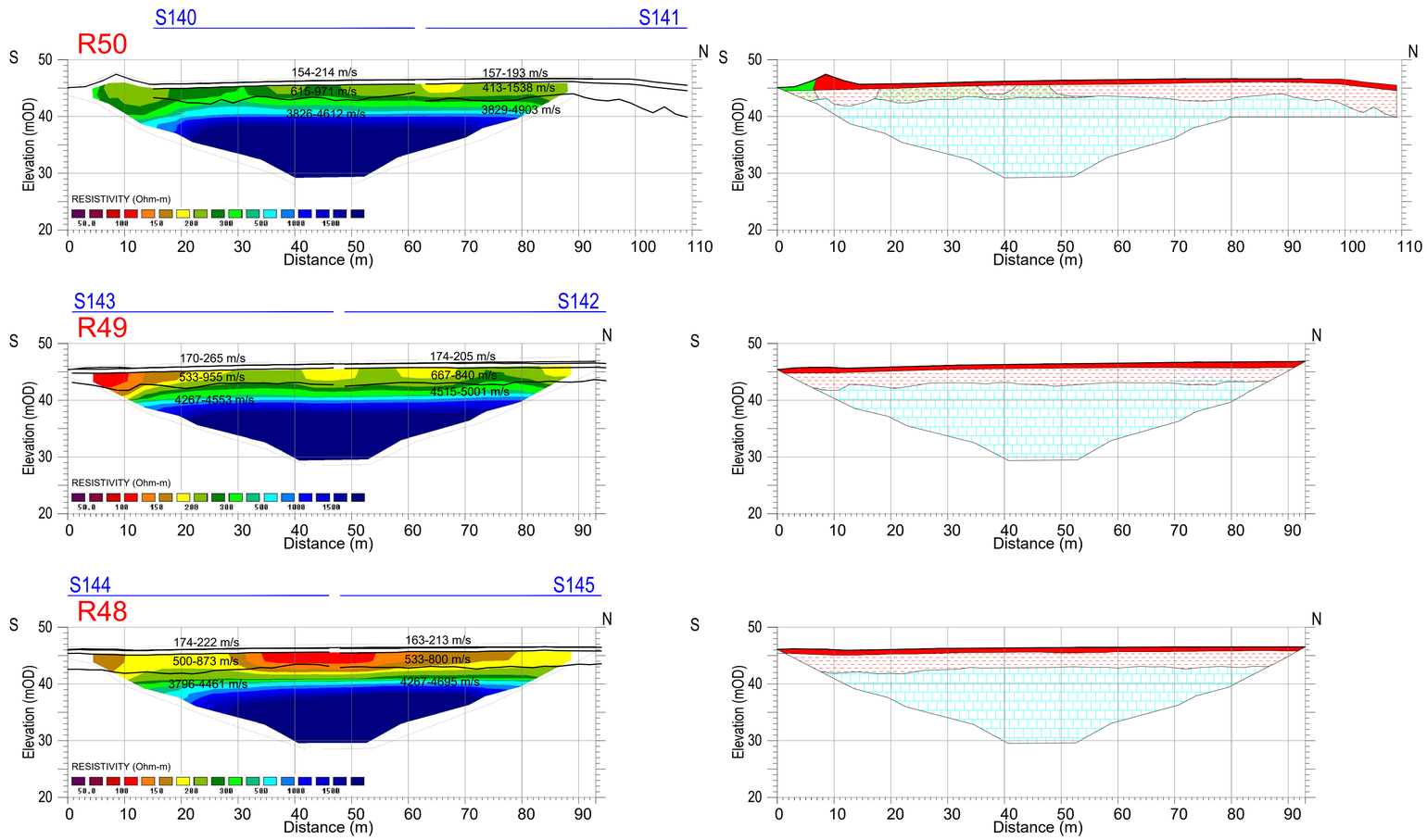
FIGURE 1: Geophysical Locations - Location 9

Scale 1:1000

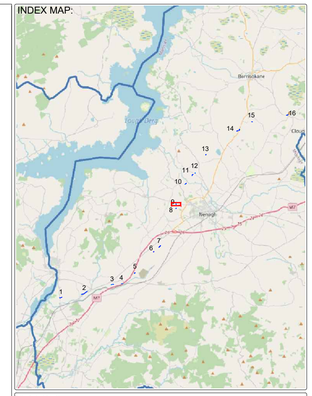


FIGURE 2: Geophysical Sections - Location 9

Scale 1:500



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very Loose-Loose clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Slightly Weathered - Fresh LIMESTONE (Ballysteen)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_09

SCALE:
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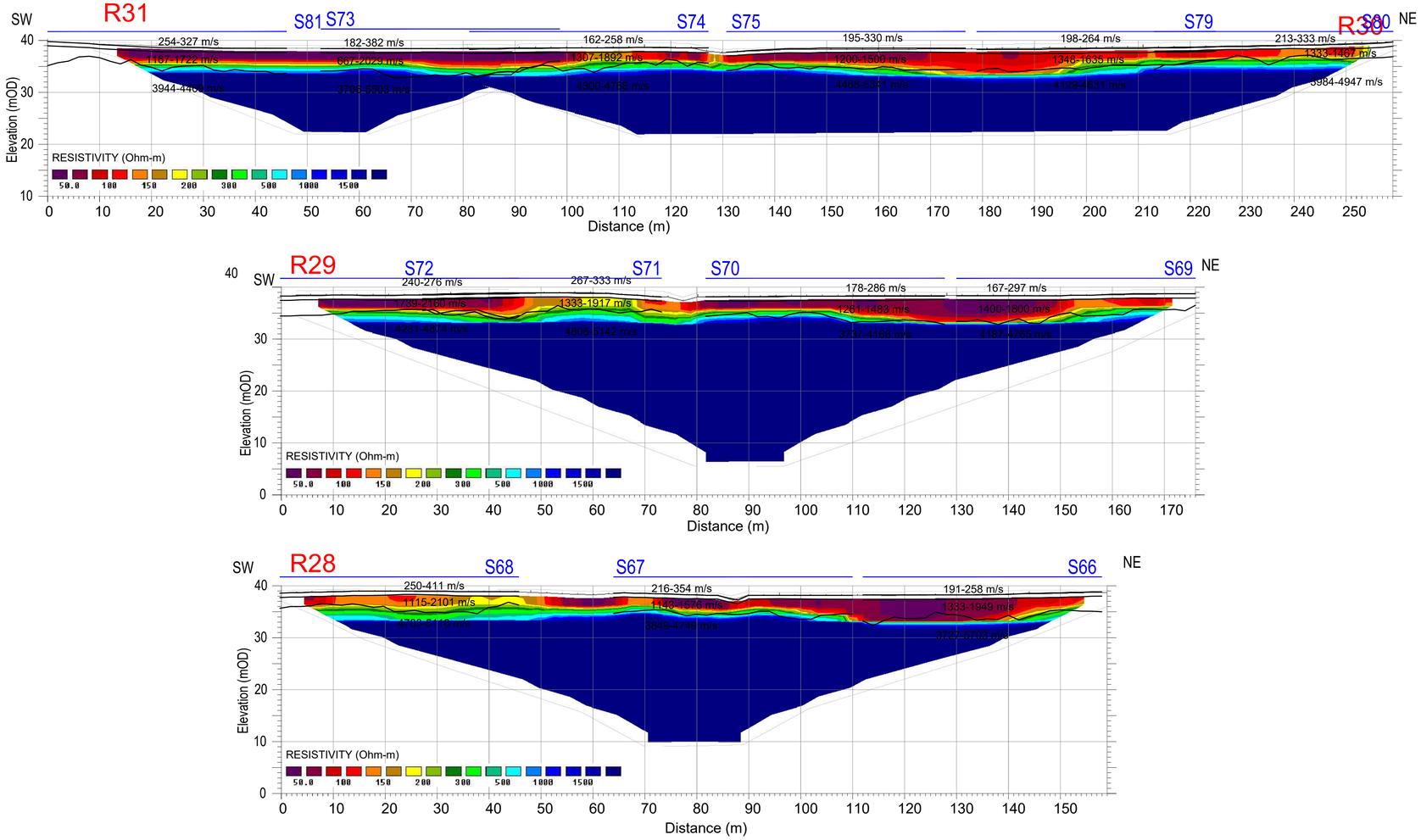
FIGURE 1: Geophysical Locations - Location 10

Scale 1:1000

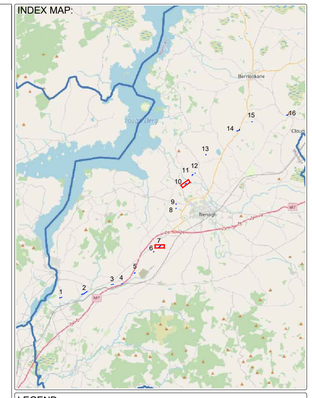


FIGURE 2: Geophysical Sections - Location 10

Scale 1:500



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Soft-Firm SILT/CLAY

Firm-Stiff SILT/CLAY

Soft-Firm sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Highly -Moderately Weathered/Karstified LIMESTONE

Slightly Weathered - Fresh LIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_10A

SCALE:
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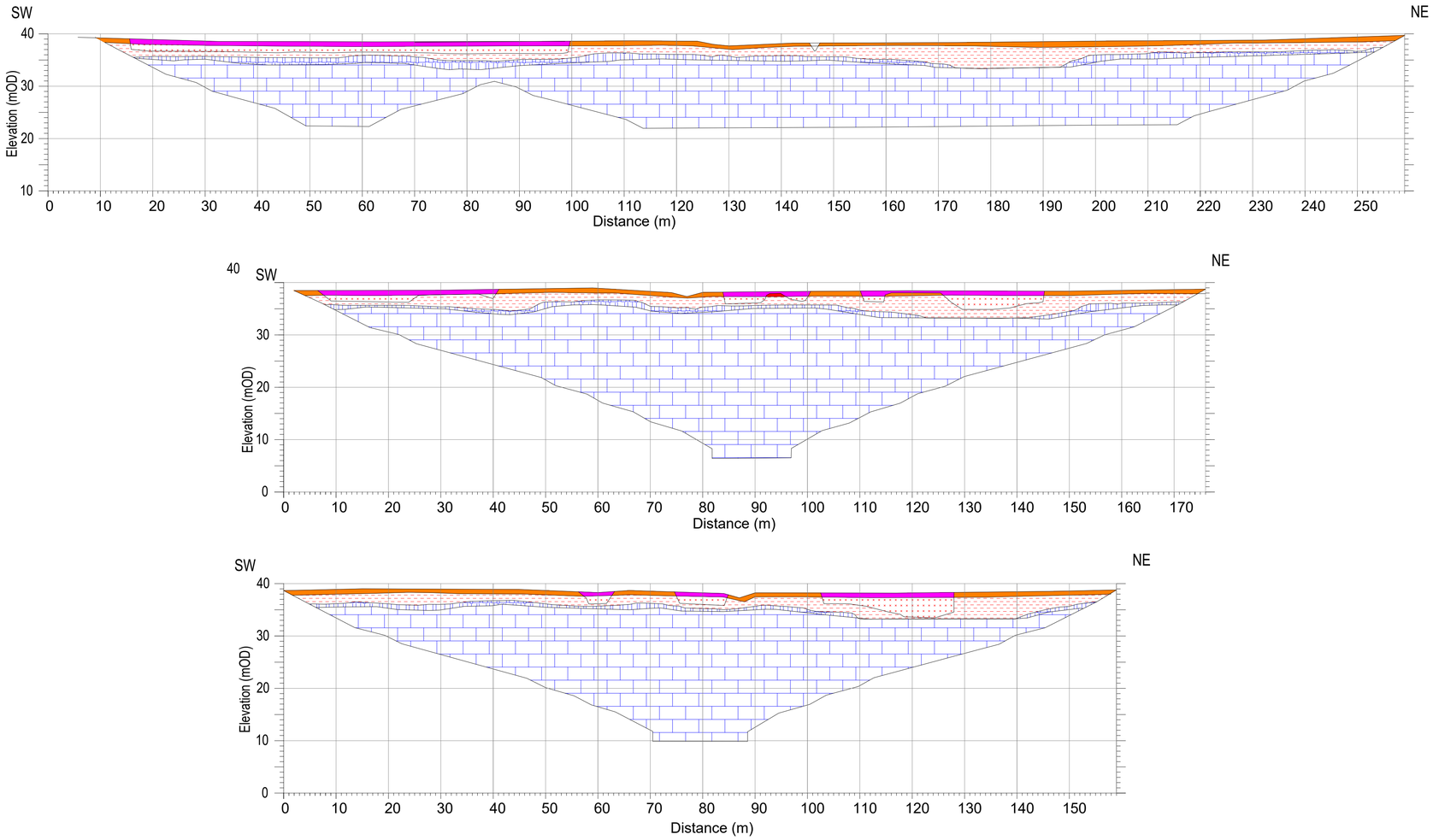
FIGURE 1: Geophysical Locations - Location 10

Scale 1:1000

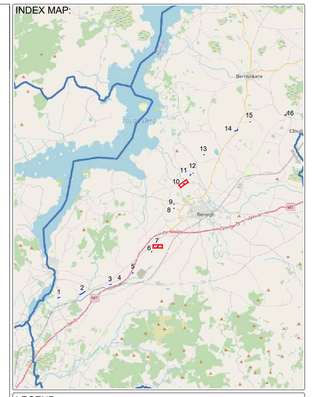


FIGURE 2: Geophysical Sections - Location 10

Scale 1:500



INDEX MAP:



LEGEND:

R1: 2D resistivity profile

S1: Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Soft-Firm SILT/CLAY

Firm-Stiff SILT/CLAY

Soft-Firm sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Highly -Moderately Weathered/Karstified LIMESTONE

Slightly Weathered - Fresh LIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_10B

SCALE:
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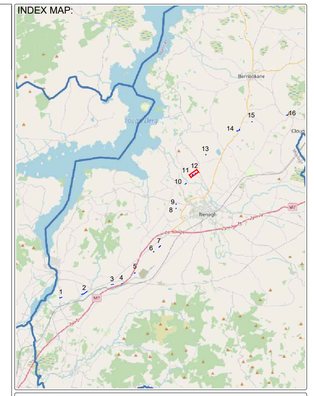
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FIGURE 1: Geophysical Locations - Location 11

Scale 1:1000



INDEX MAP:



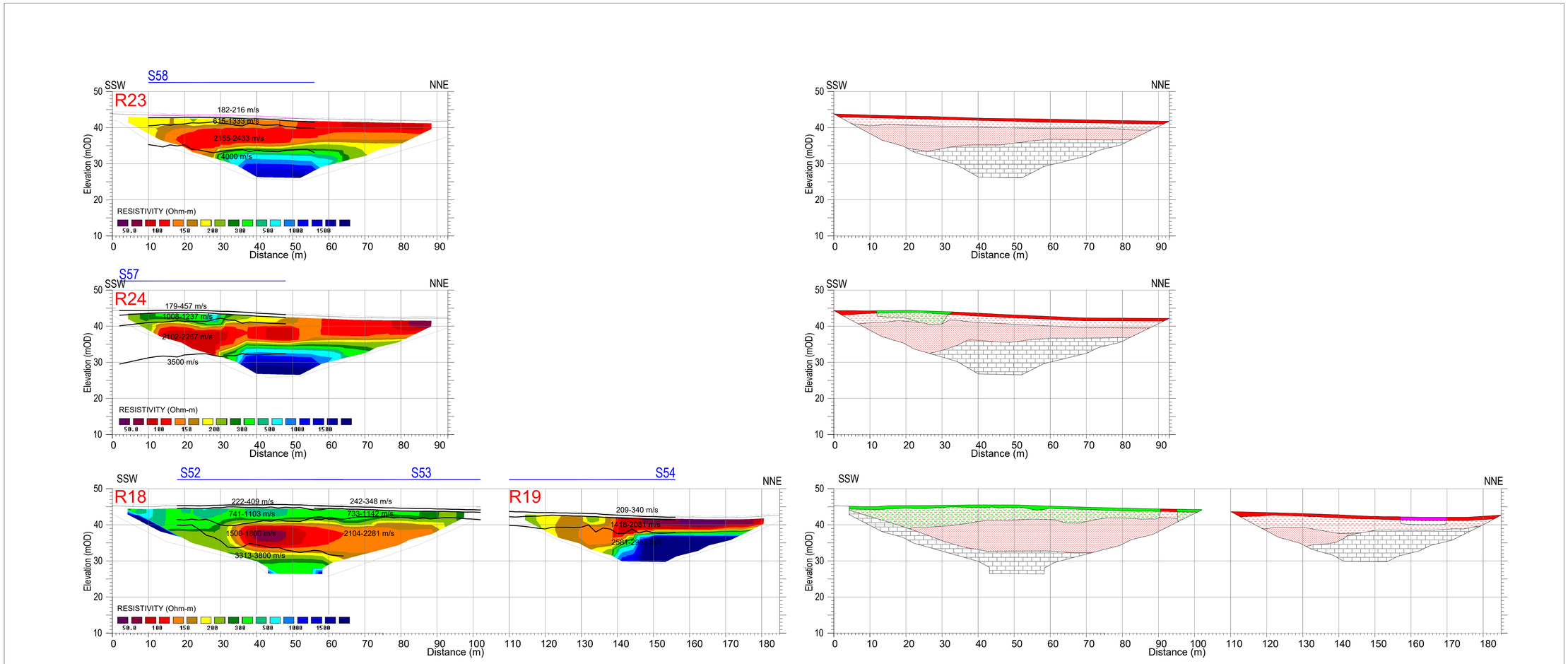
LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

FIGURE 2: Geophysical Sections - Location 11

Scale 1:600



Seismic refraction layer with interpreted P-wave velocity

- Soft-Firm SILT/CLAY
- Firm-Stiff SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Soft-Firm sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff sandy gravelly SILT/CLAY
- Loose-Medium Dense clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Loose silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Slightly Weathered - Fresh LIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

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IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_11A

SCALE:
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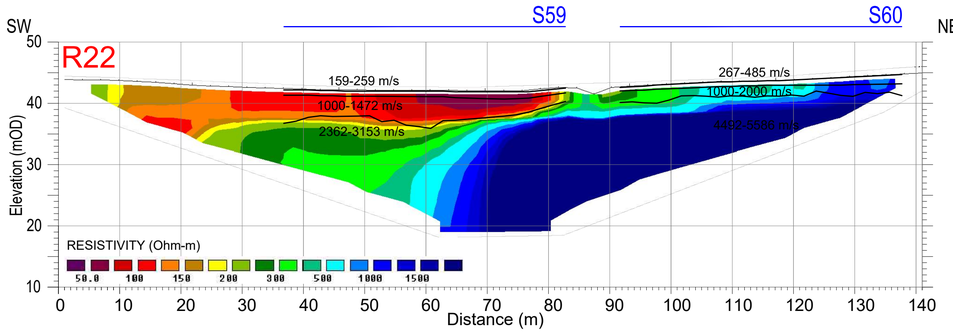
FIGURE 1: Geophysical Locations - Location 11

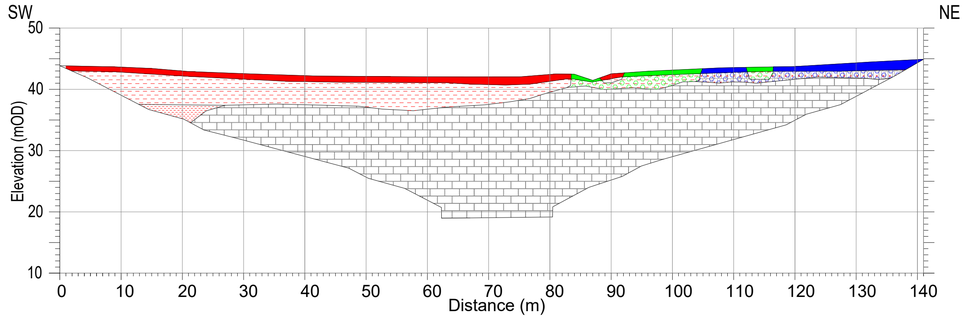
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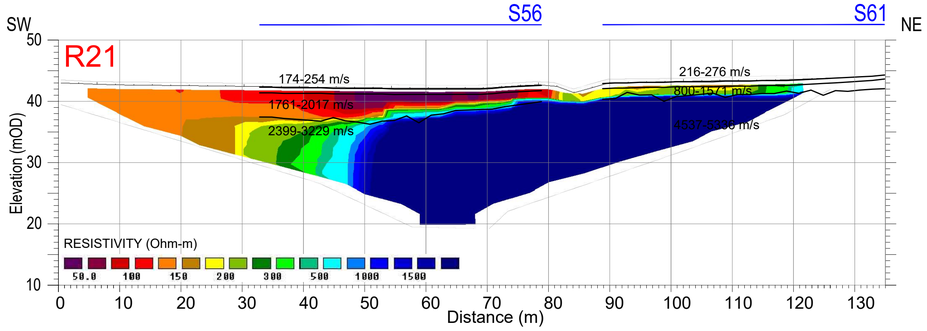


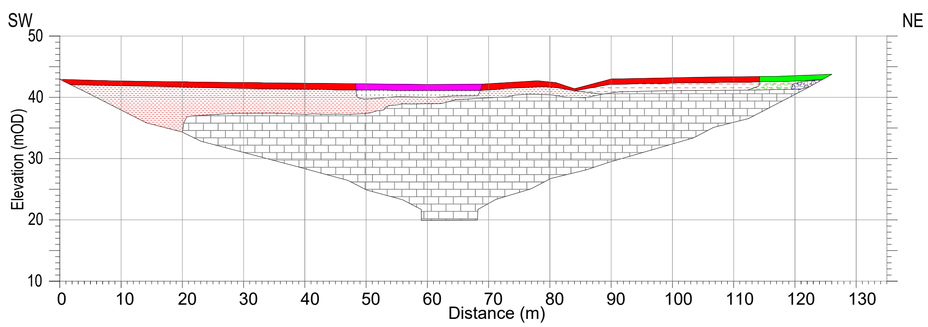
FIGURE 2: Geophysical Sections - Location 11

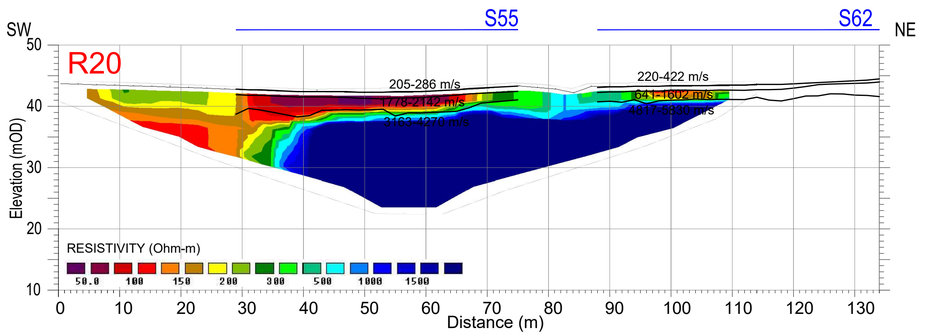
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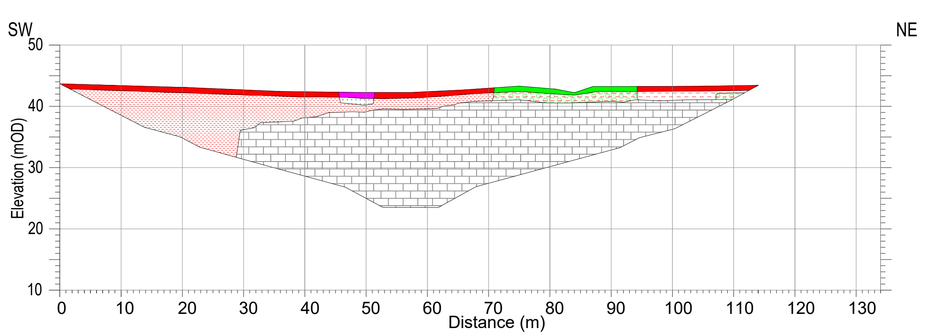




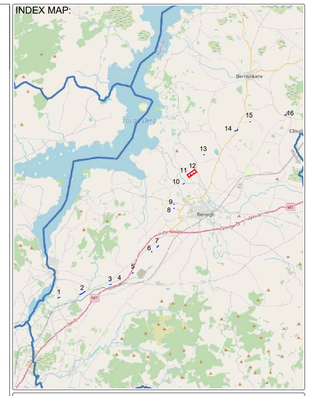








INDEX MAP:



LEGEND:

- R1 — 2D resistivity profile
- S1 — Seismic refraction profile

- Seismic refraction layer with interpreted P-wave velocity
- Soft-Firm SILT/CLAY
- Firm-Stiff SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Soft-Firm sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff sandy gravelly SILT/CLAY
- Loose-Medium Dense clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Loose silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Slightly Weathered - Fresh LIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_11B

SCALE:
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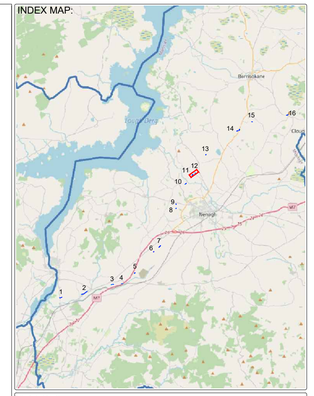
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FIGURE 1: Geophysical Locations - Location 12

Scale 1:1000



INDEX MAP:



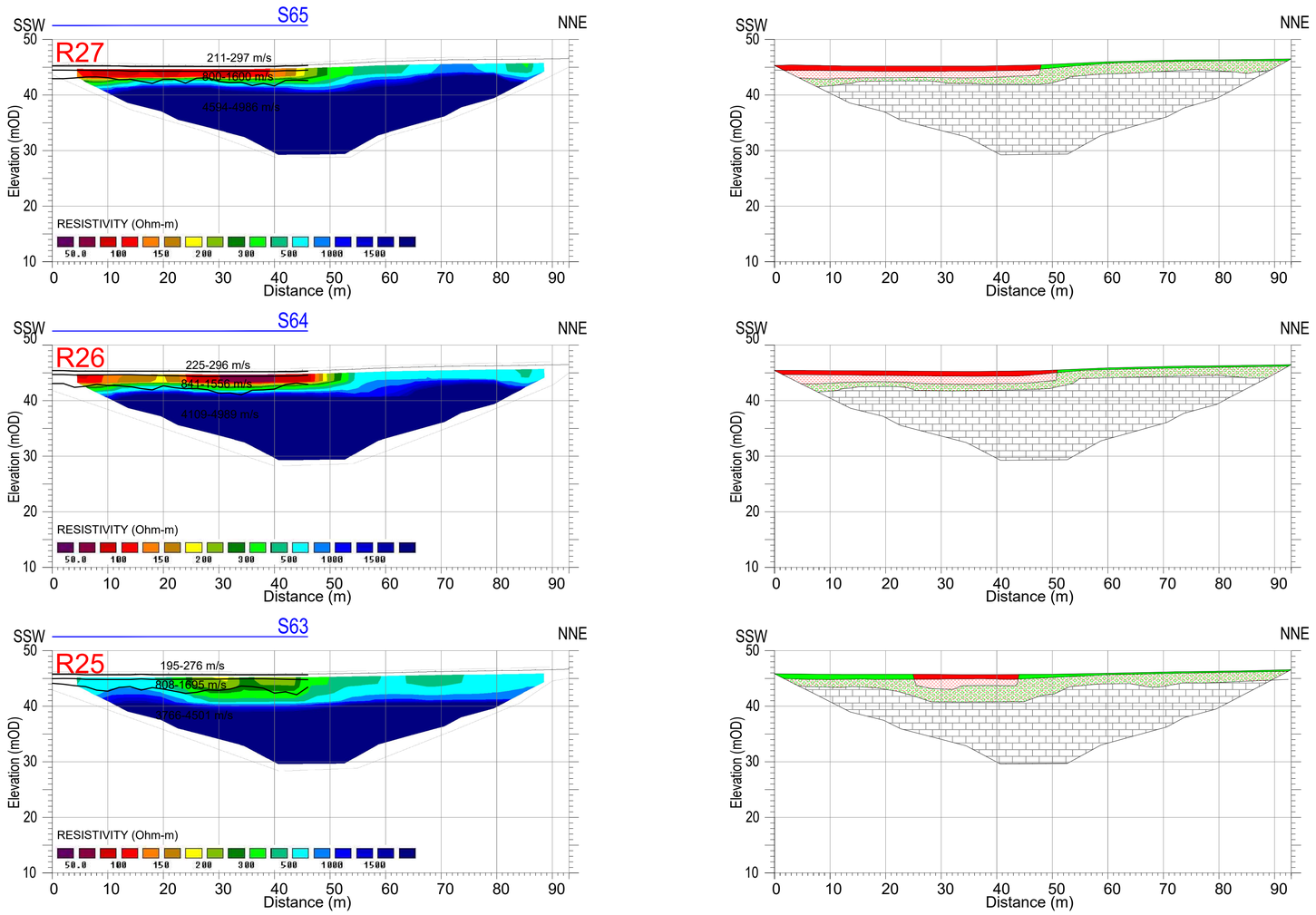
LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

FIGURE 2: Geophysical Sections - Location 12

Scale 1:500



Seismic refraction layer with interpreted P-wave velocity

Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Loose clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Slightly Weathered - Fresh LIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_12

SCALE:
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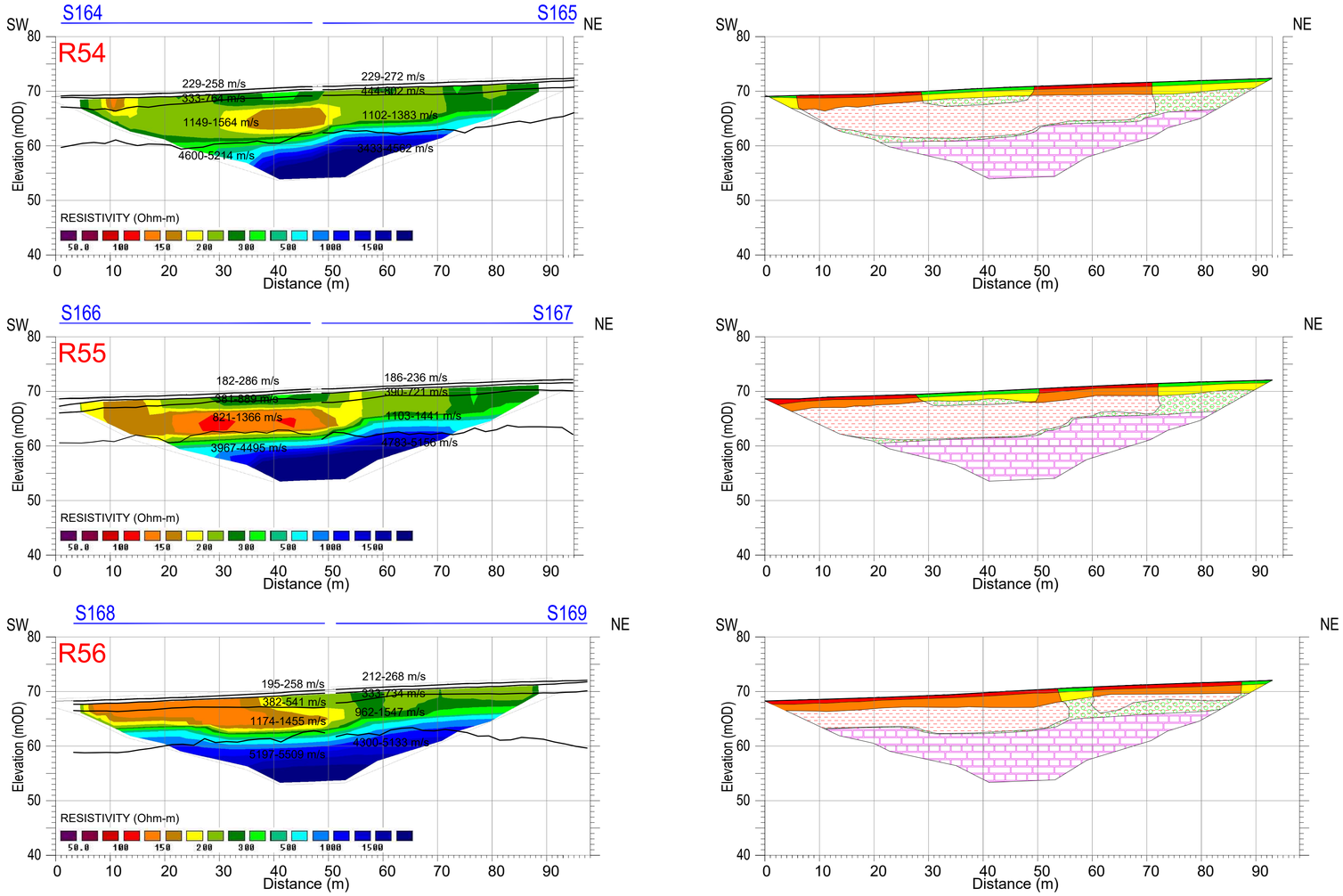
FIGURE 1: Geophysical Locations - Location 13

Scale 1:1000

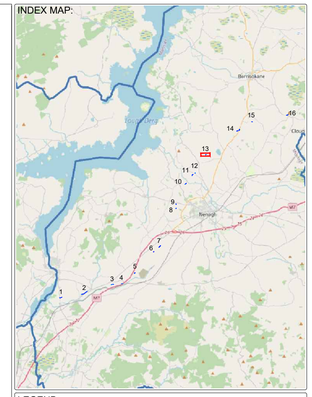


FIGURE 2: Geophysical Sections - Location 13

Scale 1:500



INDEX MAP:



LEGEND:

- R1: 2D resistivity profile
- S1: Seismic refraction profile

- Seismic refraction layer with interpreted P-wave velocity
- Very soft-Soft sandy gravelly SILT/CLAY
- Soft-Firm sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Loose - Medium dense clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Slightly Weathered - Fresh LIMESTONE (Terryglass)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
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GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_13

SCALE:
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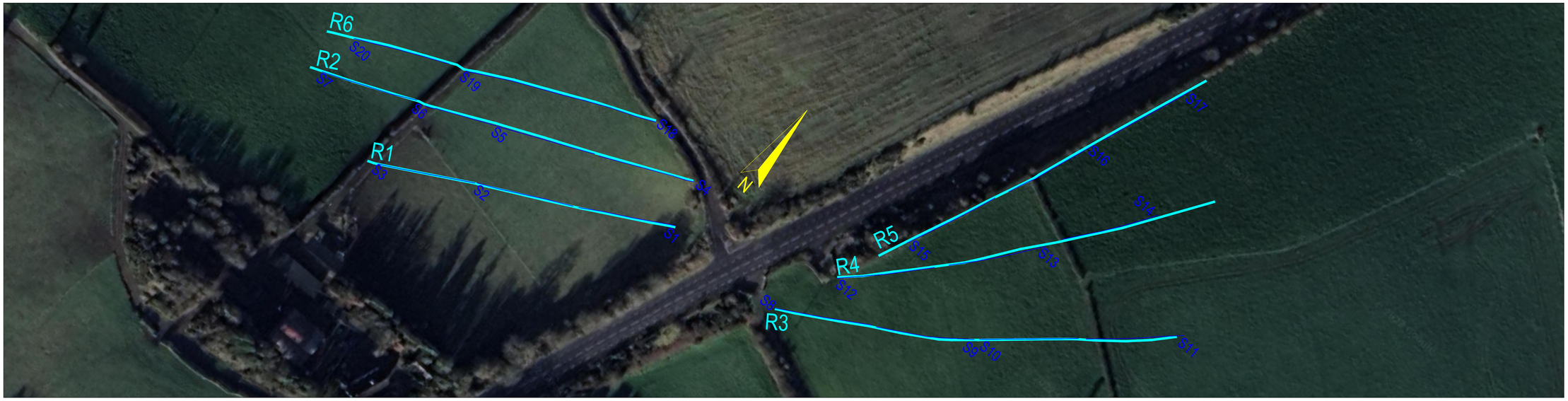
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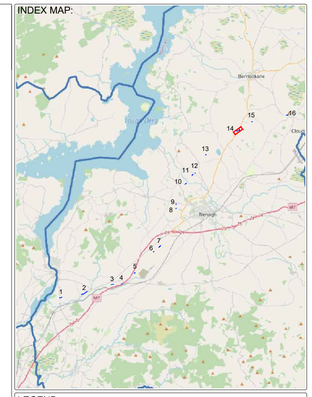
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FIGURE 1: Geophysical Locations - Location 14

Scale 1:1000



INDEX MAP:



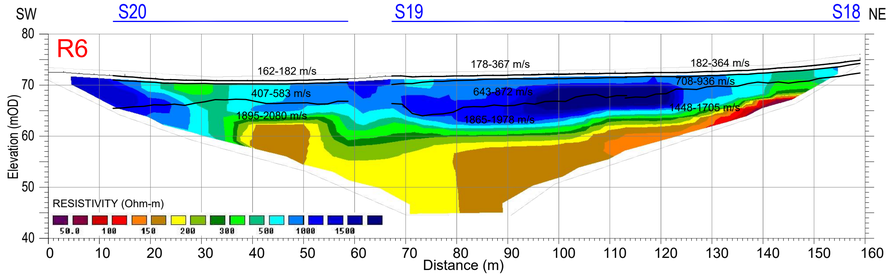
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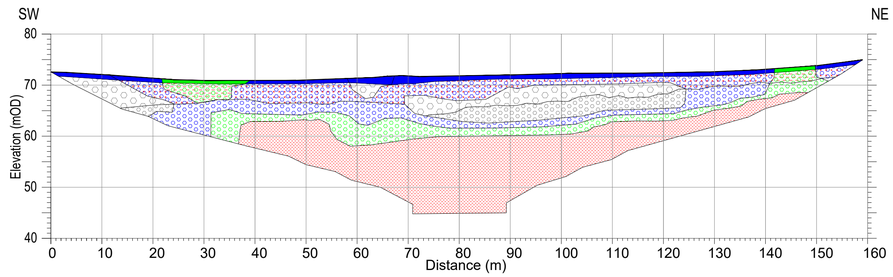
R1 — 2D resistivity profile

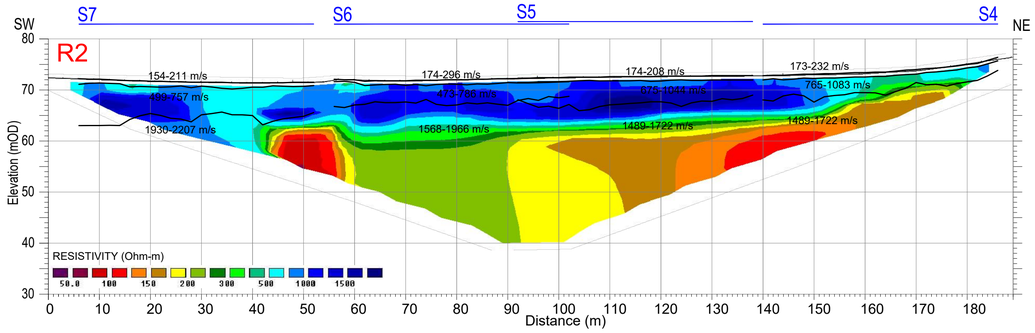
S1 — Seismic refraction profile

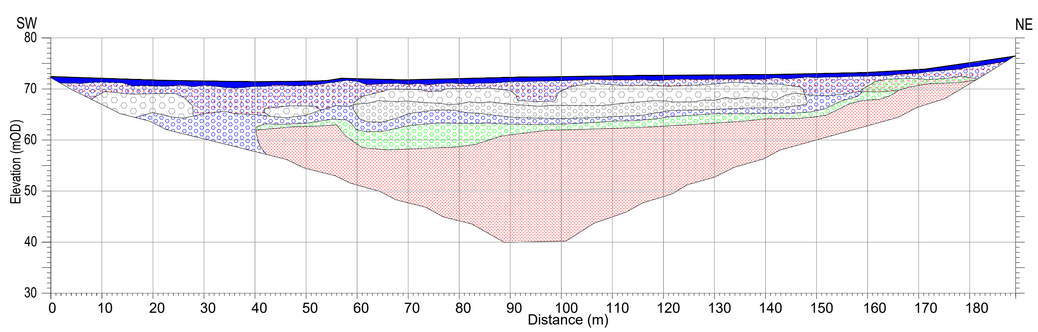
FIGURE 2: Geophysical Sections - Location 14

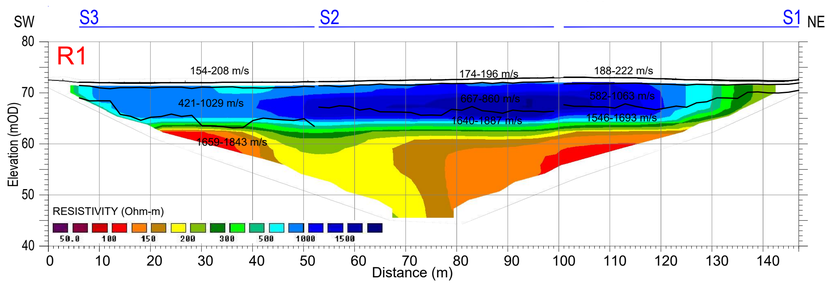
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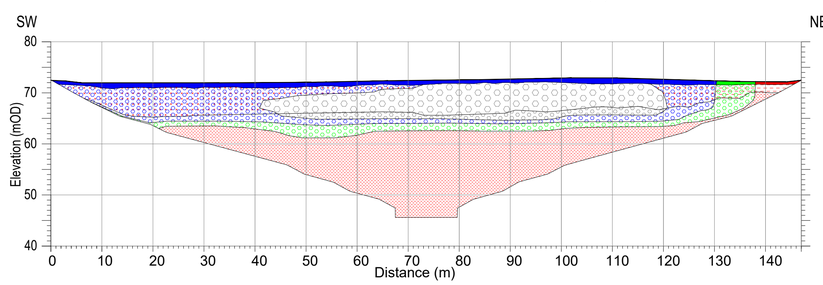












Seismic refraction layer with interpreted P-wave velocity

- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Dense clayey SAND/GRAVEL
- Very Loose-Loose silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Very Dense silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Dense-Very Dense silty SAND/GRAVEL
- Slightly Weathered MUDSTONE/SHALE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_14A

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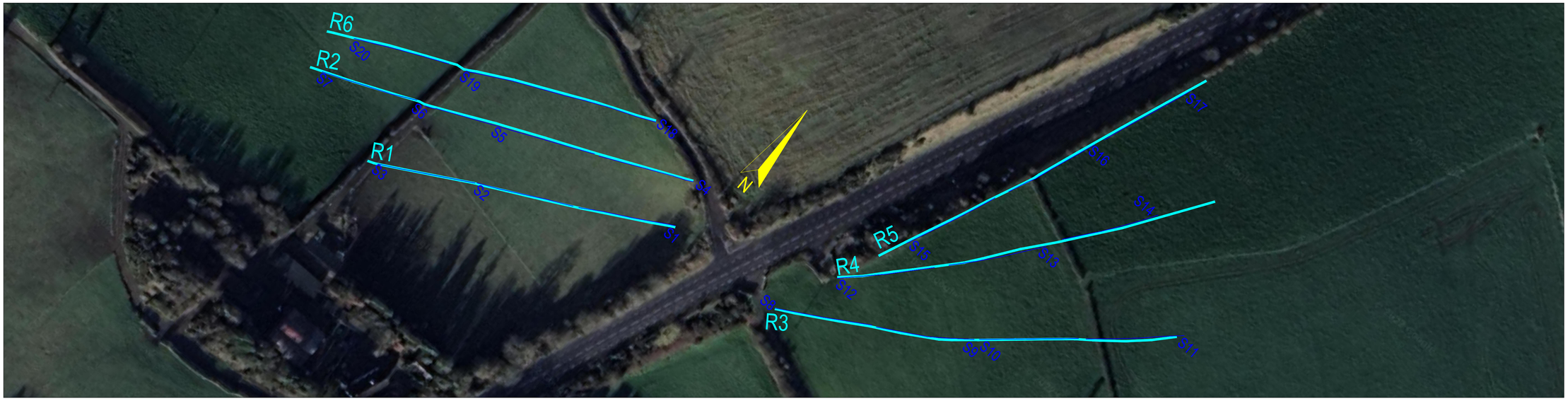
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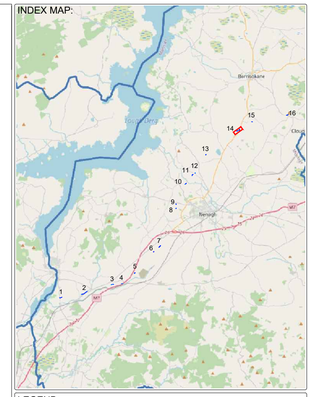
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FIGURE 1: Geophysical Locations - Location 14

Scale 1:1000



INDEX MAP:



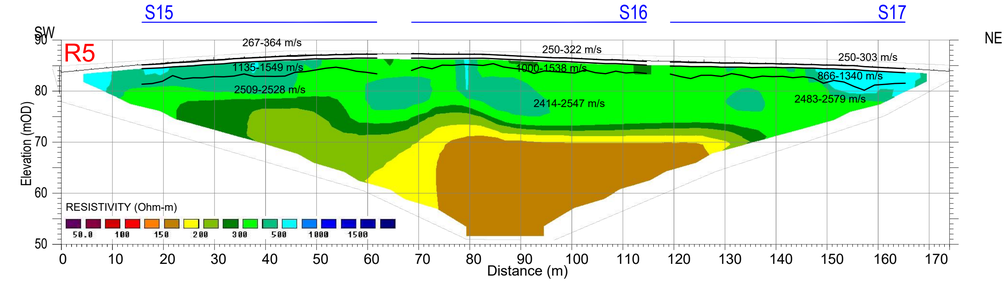
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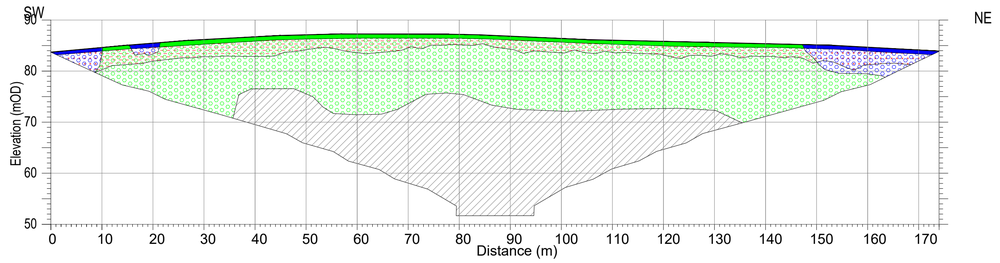
R1 — 2D resistivity profile

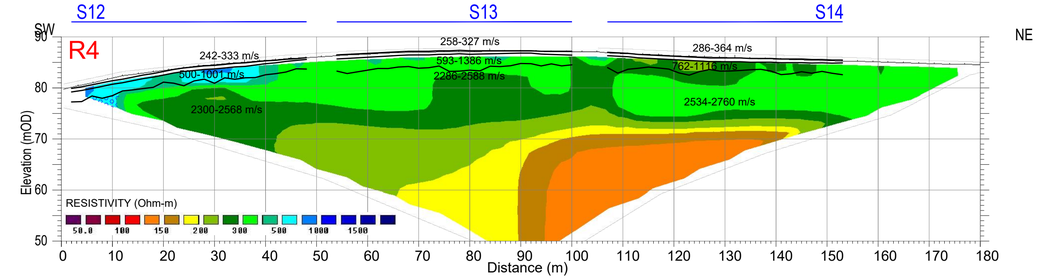
S1 — Seismic refraction profile

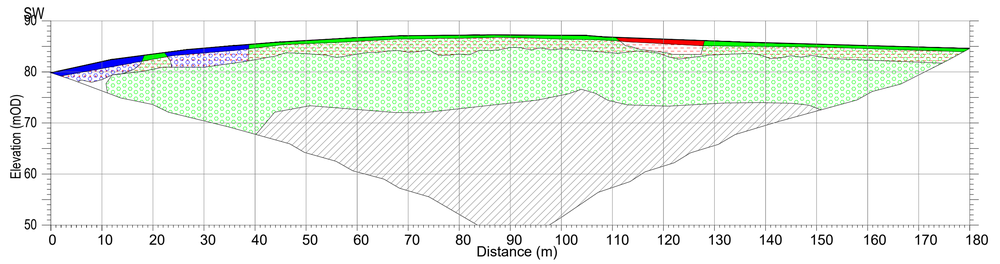
FIGURE 2: Geophysical Sections - Location 14

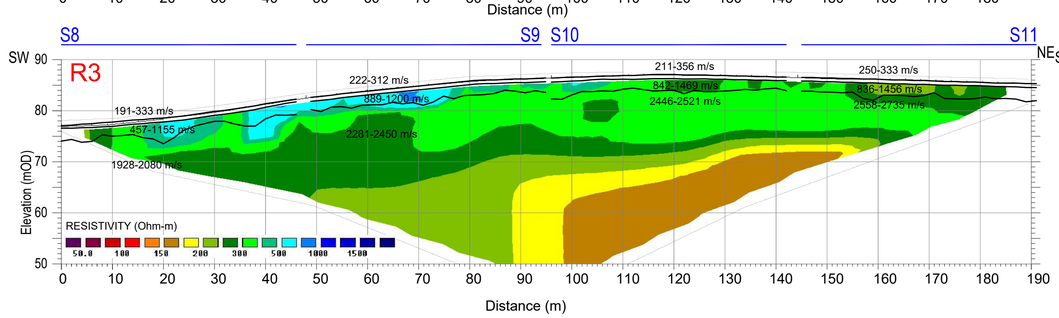
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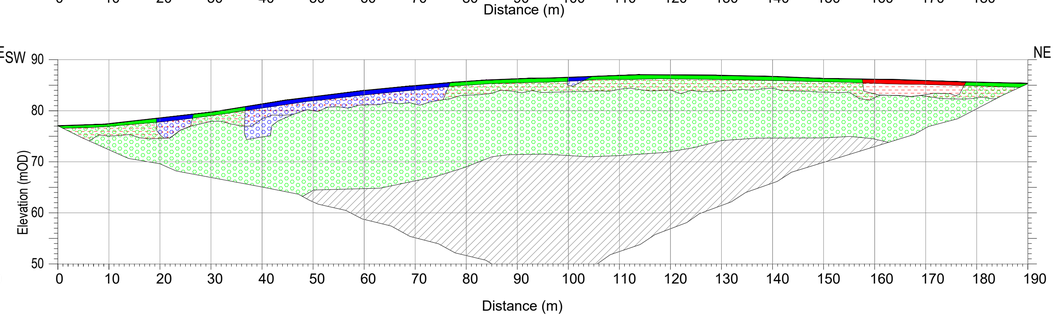












Seismic refraction layer with interpreted P-wave velocity

- Very soft-Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Very Stiff sandy gravelly SILT/CLAY
- Very Loose-Loose clayey SAND/GRAVEL
- Medium dense - Dense clayey SAND/GRAVEL
- Very Dense clayey SAND/GRAVEL
- Very Loose-Loose silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Very Dense silty SAND/GRAVEL
- Medium dense - Dense silty SAND/GRAVEL
- Dense-Very Dense silty SAND/GRAVEL
- Slightly Weathered MUDSTONE/SHALE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

PROJECT:
IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

DRAWING NUMBER:
AGP21220_14B

SCALE:
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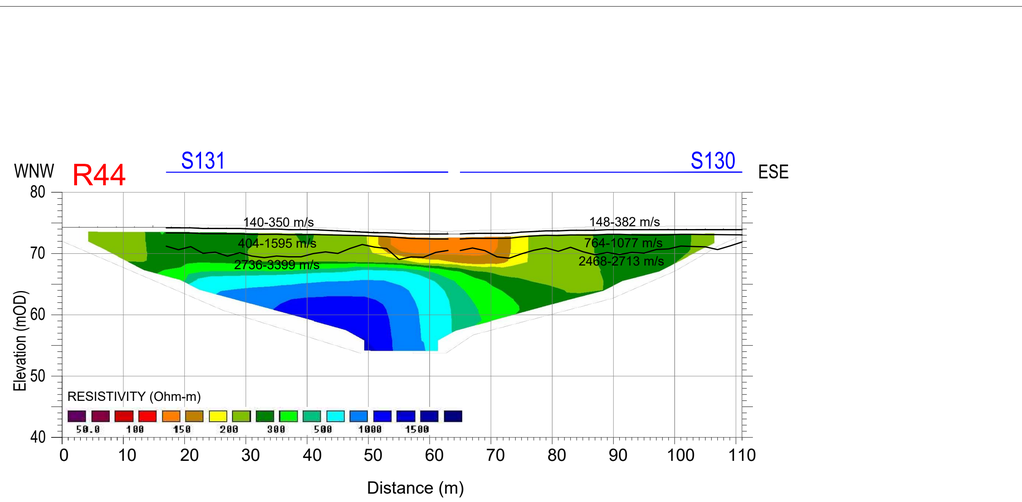
FIGURE 1: Geophysical Locations - Location 15

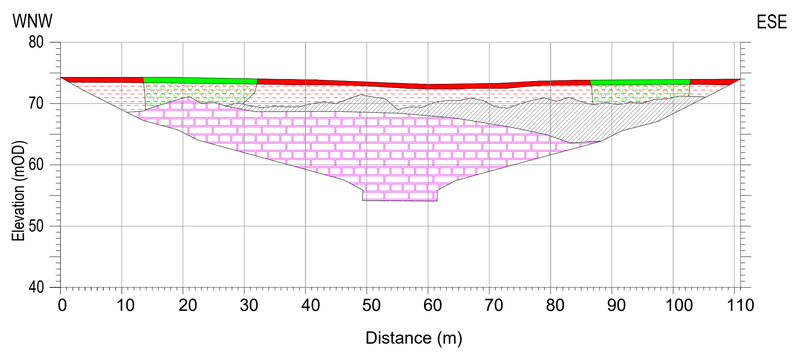
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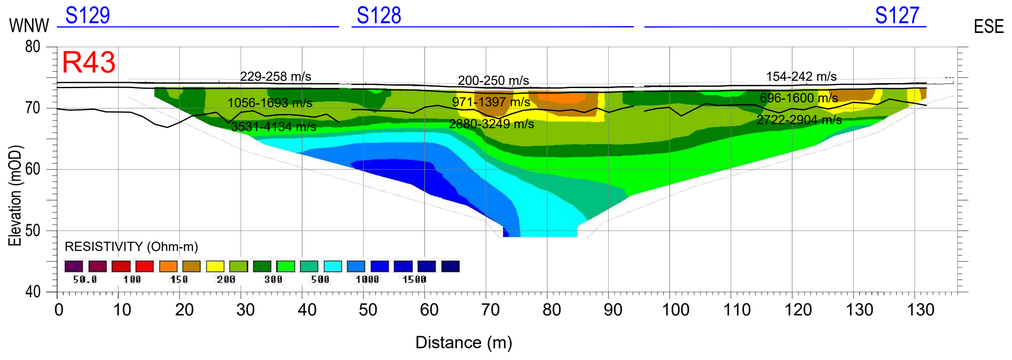


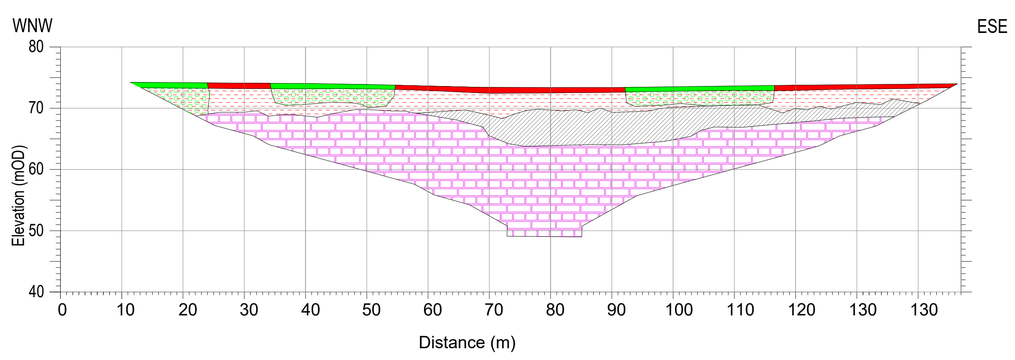
FIGURE 2: Geophysical Sections - Location 15

Scale 1:500

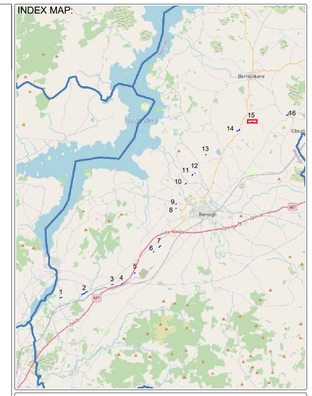








INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very Loose-Loose clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Slightly Weathered - Fresh MUDSTONE/SHALE

Slightly Weathered - Fresh LIMESTONE (Terryglass)

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

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IRISH WATER SUPPLY SCHEME
EASTERN & MIDLANDS REGION - CONTRACT 1
GEOPHYSICAL SURVEY

CLIENT:
CAUSEWAY GEOTECH LIMITED

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SCALE:
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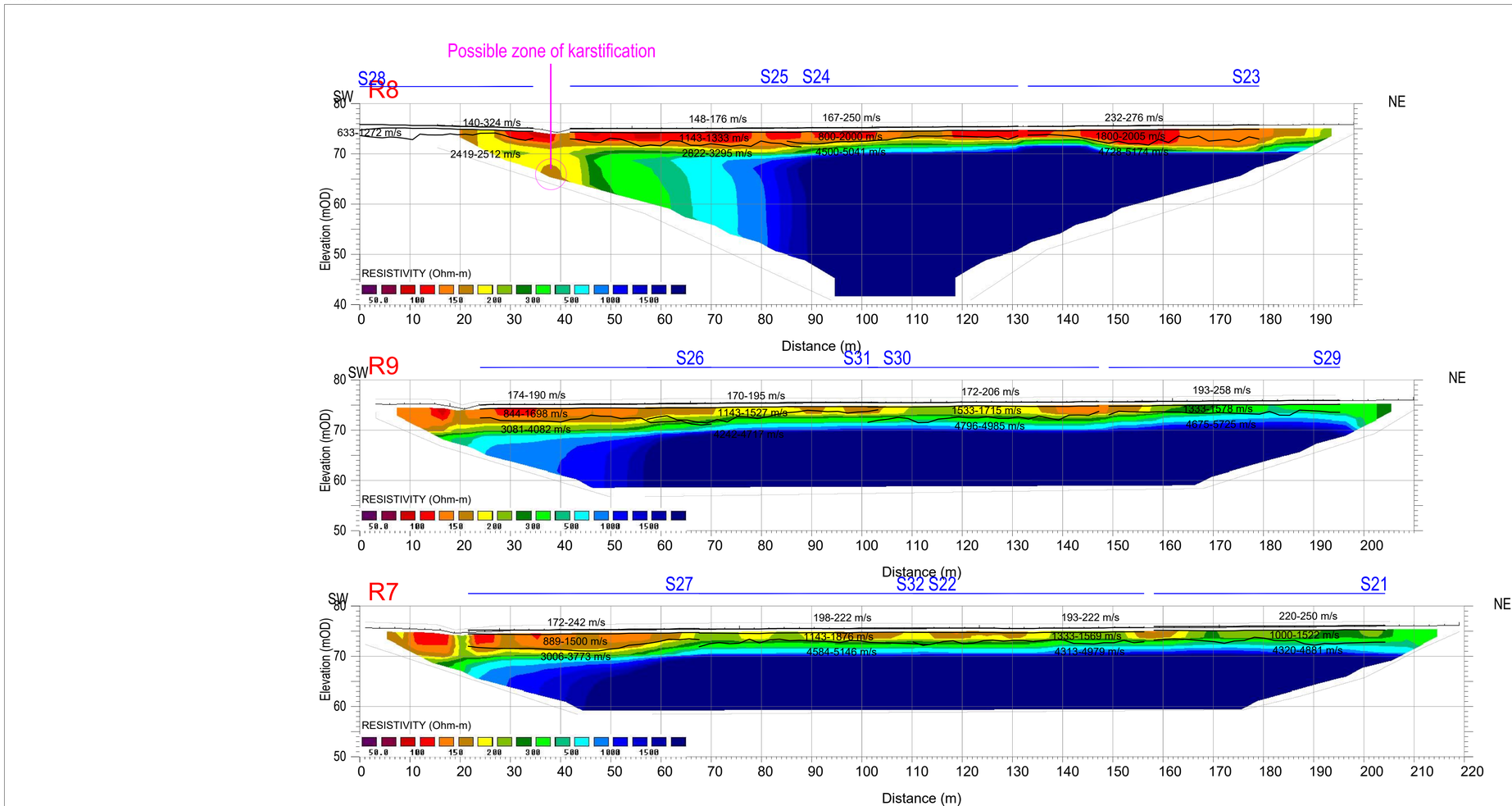
FIGURE 1: Geophysical Locations - Location 16

Scale 1:1000



FIGURE 2: Geophysical Sections - Location 16

Scale 1:500



INDEX MAP:



LEGEND:

R1 2D resistivity p

S1 Seismic refrac

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft sandy gravelly SILT/CLA

Firm-Stiff sandy gravelly SILT/CLAY

Very Loose-Loose clayey SAND/GRA

Medium dense - Dense clayey SAND/

Highly -Moderately Weathered/Karstified LIMESTONE

Slighlty Weathered - Fresh/LIMESTONE

The information displayed conjunction with AGP212 Geophysical Investigation Project - Eastern & Midland Causeway Geotech Ltd., 5th October 2022

PROJECT: IRISH WATER SUPPL EASTERN & MIDLAND GEOPHYSICAL SURV

CLIENT: CAUSEWAY GEOTEC

DRAWING NUMBER: AGP21220_16A

SCALE: AS SHOWN @ A1

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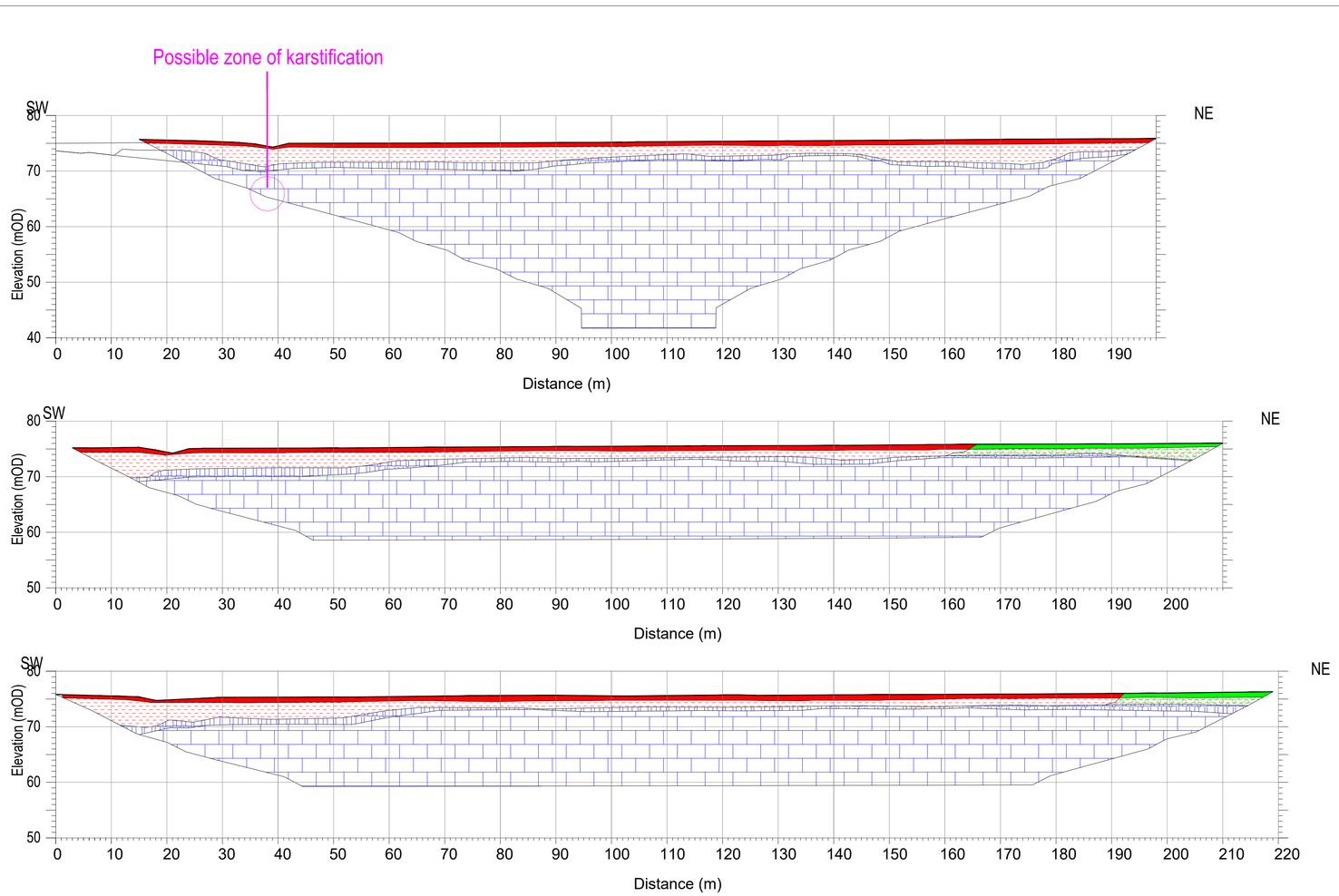
FIGURE 1: Geophysical Locations - Location 16

Scale 1:1000

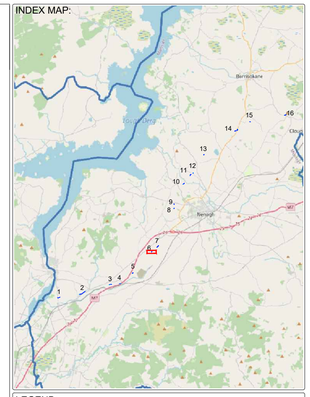


FIGURE 2: Geophysical Sections - Location 16

Scale 1:500



INDEX MAP:



LEGEND:

R1 — 2D resistivity profile

S1 — Seismic refraction profile

Seismic refraction layer with interpreted P-wave velocity

Very soft-Soft sandy gravelly SILT/CLAY

Firm-Stiff sandy gravelly SILT/CLAY

Very Loose-Loose clayey SAND/GRAVEL

Medium dense - Dense clayey SAND/GRAVEL

Highly -Moderately Weathered/Karstified LIMESTONE

Slightly Weathered - FreshLIMESTONE

The information displayed here is to be used in conjunction with AGP21220_01 Report on the Geophysical Investigation for the Water Supply Project - Eastern & Midlands Region Contract 1, for Causeway Geotech Ltd., APEX Geophysics Ltd. 5th October 2022

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IRISH WATER SUPPLY SCHEME
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APPENDIX C: SEISMIC REFRACTION DATA

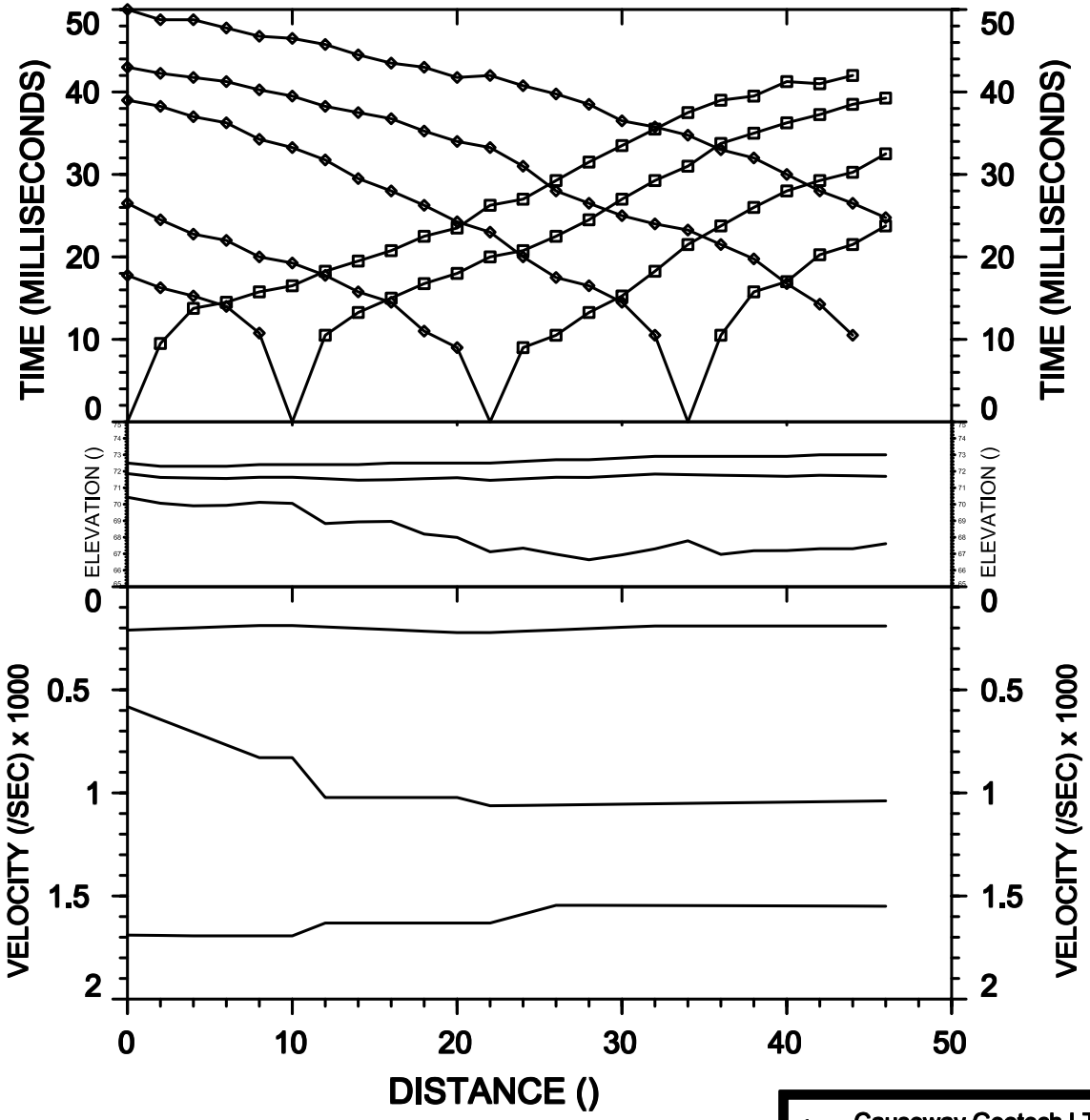


Plate: 10a

for: Causeway Geotech LTD	AGP21220
by: Strata Geophysical, Inc.	
Data SetS1R / Date: 24/05/22	Tipperary
Equipment: / Spread: S1	Azimuth:

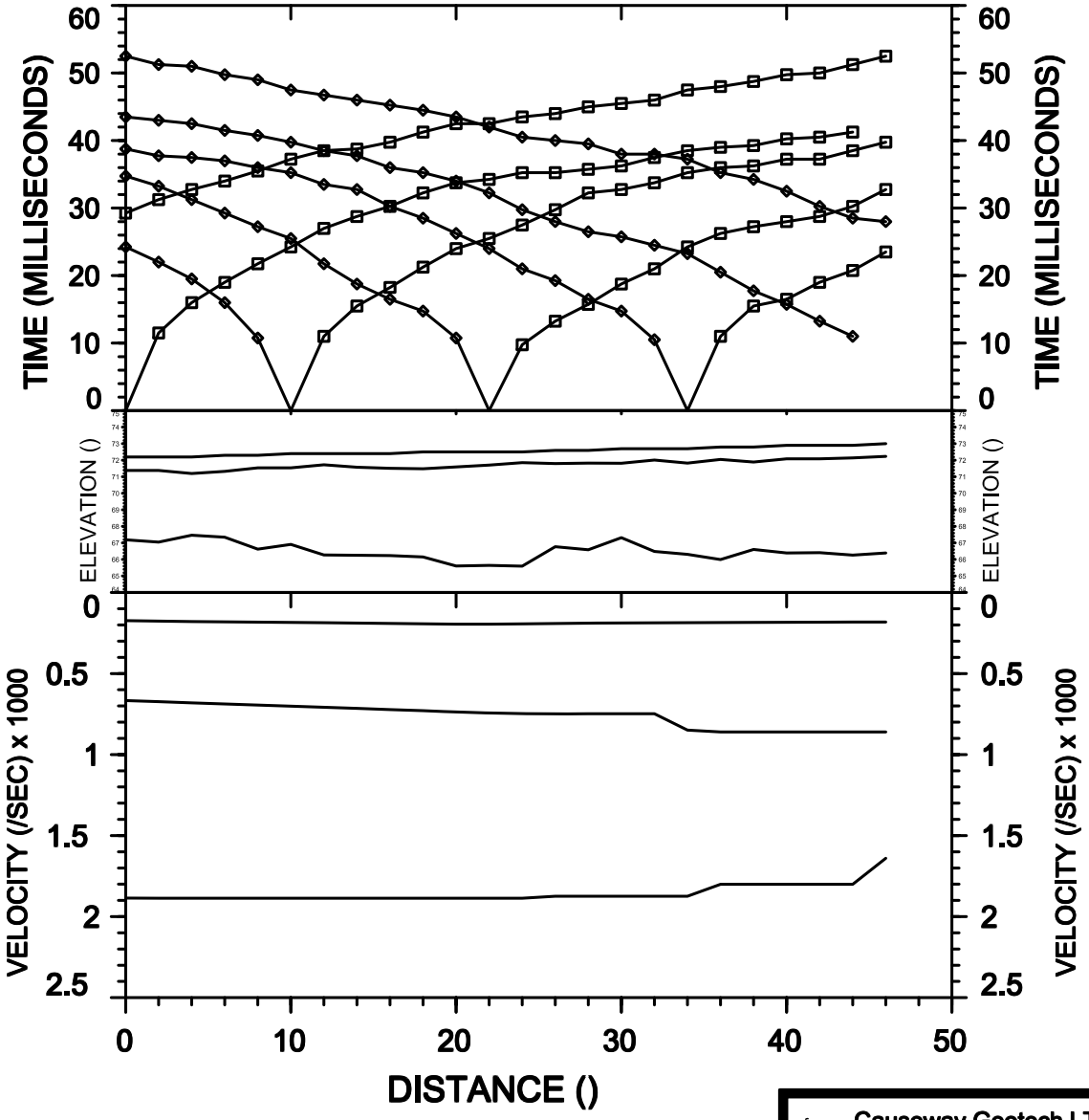


Plate: 10a

for: Causeway Geotech LTD	AGP21220
by: Strata Geophysical, Inc.	
Data SetS2R / Date: 24/05/22	Tipperary
Equipment: / Spread: S2	Azimuth:

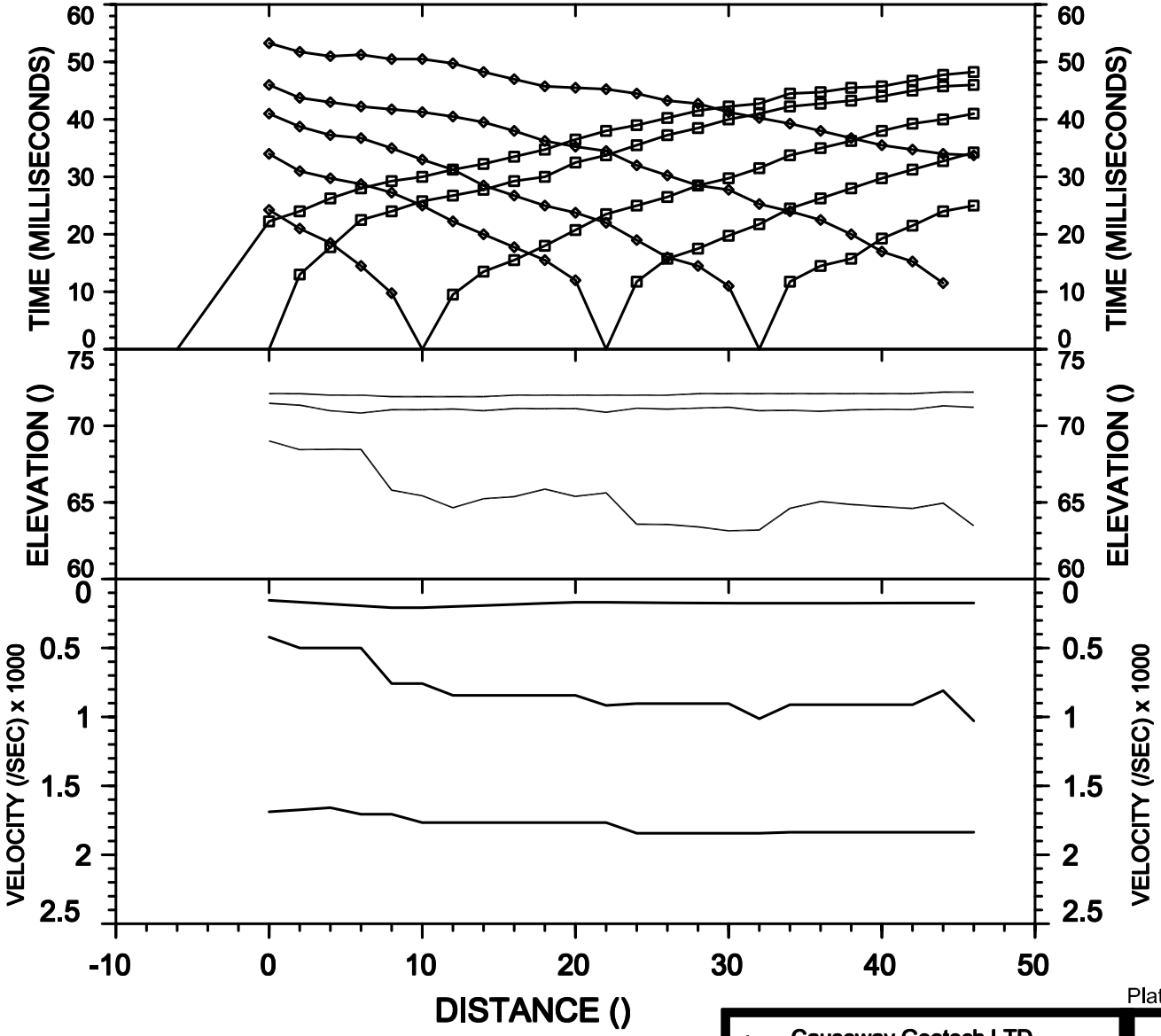


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS3	Date: 24/05/22	
Equipment:	Spread: S3	Azimuth:

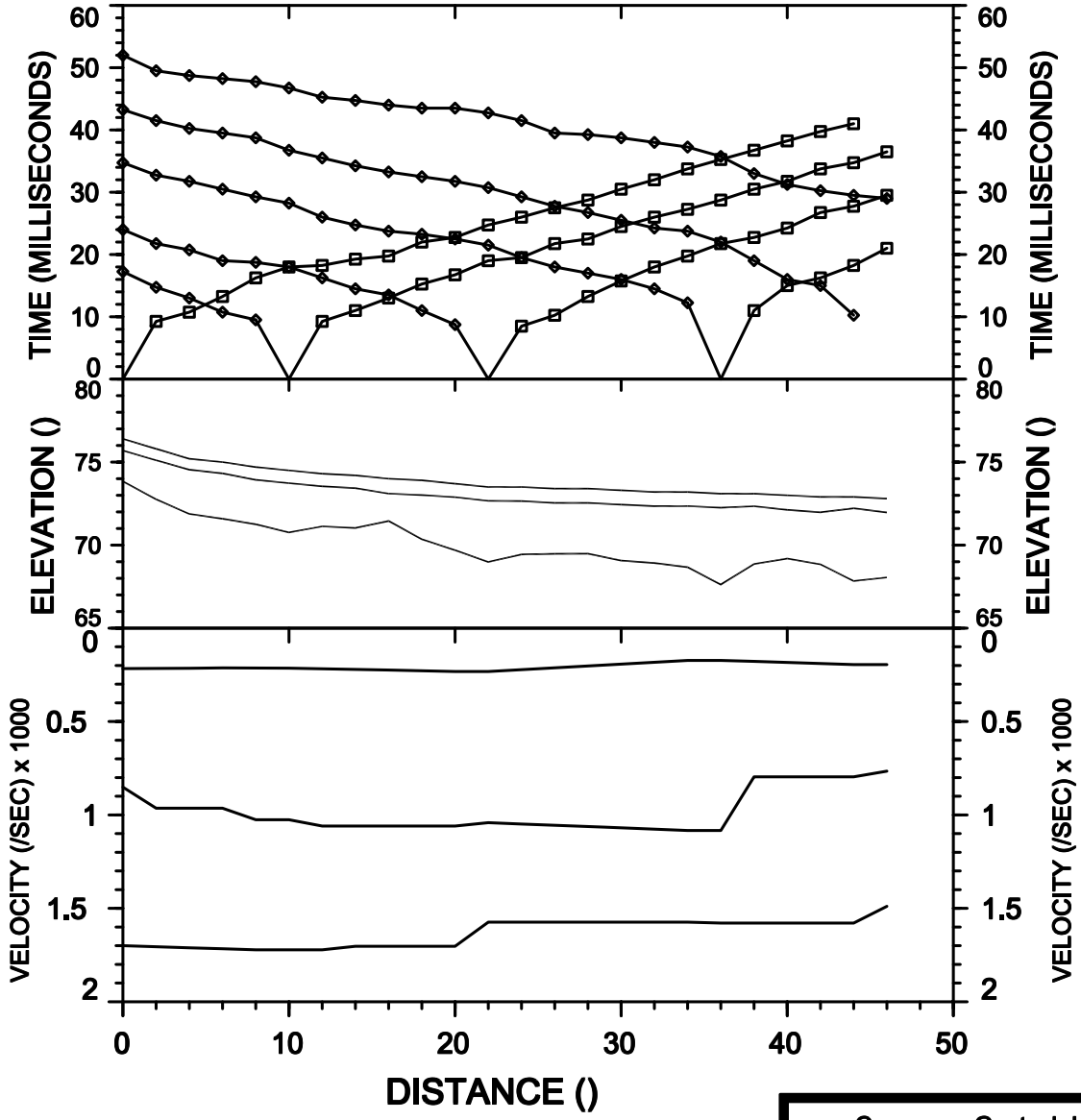


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS4	Date: 24/05/22	
Equipment:	Spread: S4	Azimuth:

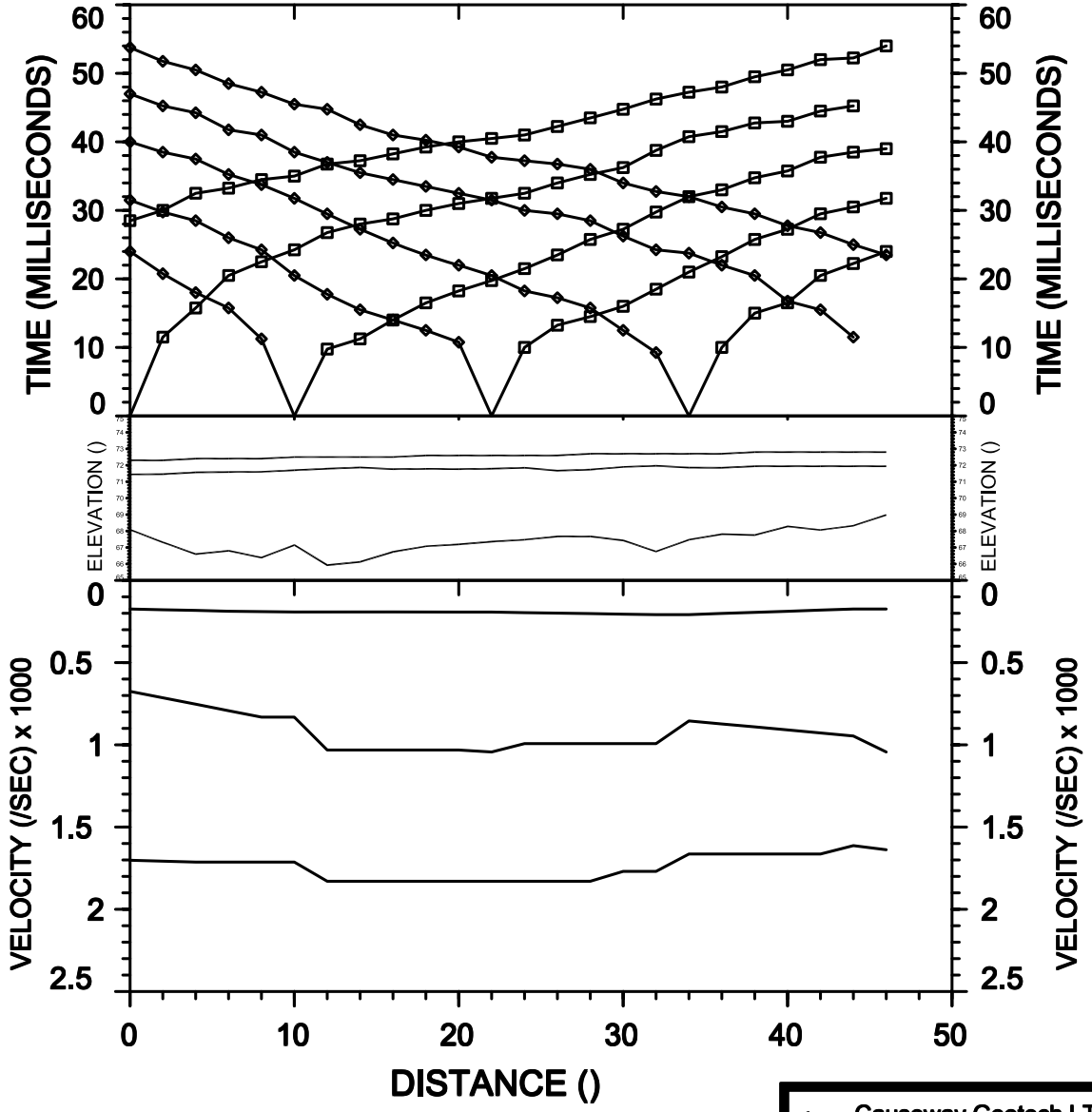


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS5	Date: 24/05/22	
Equipment:	Spread: S5	Azimuth:

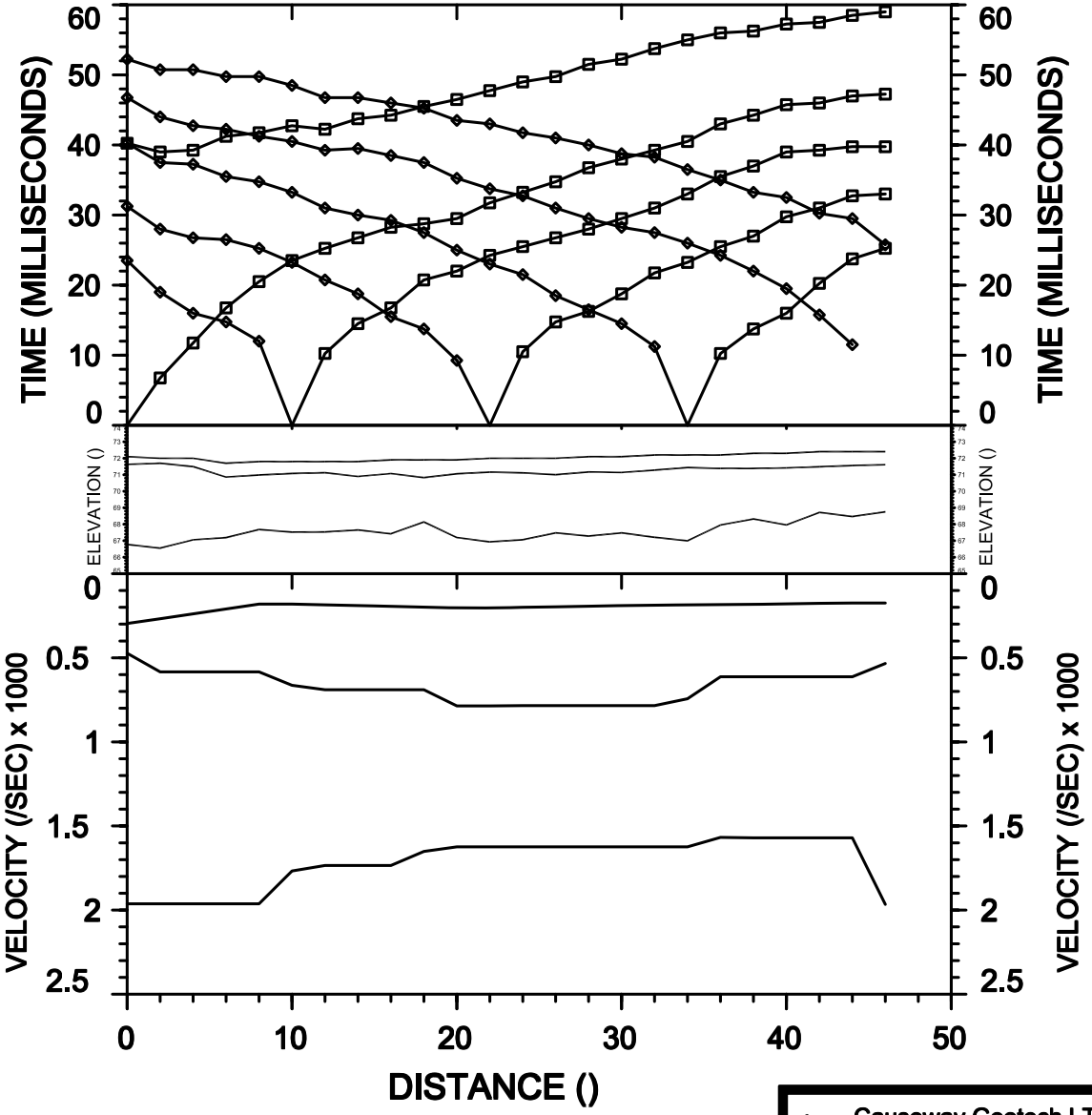


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS6	Date: 24/05/22	
Equipment:	Spread: S6	Azimuth:

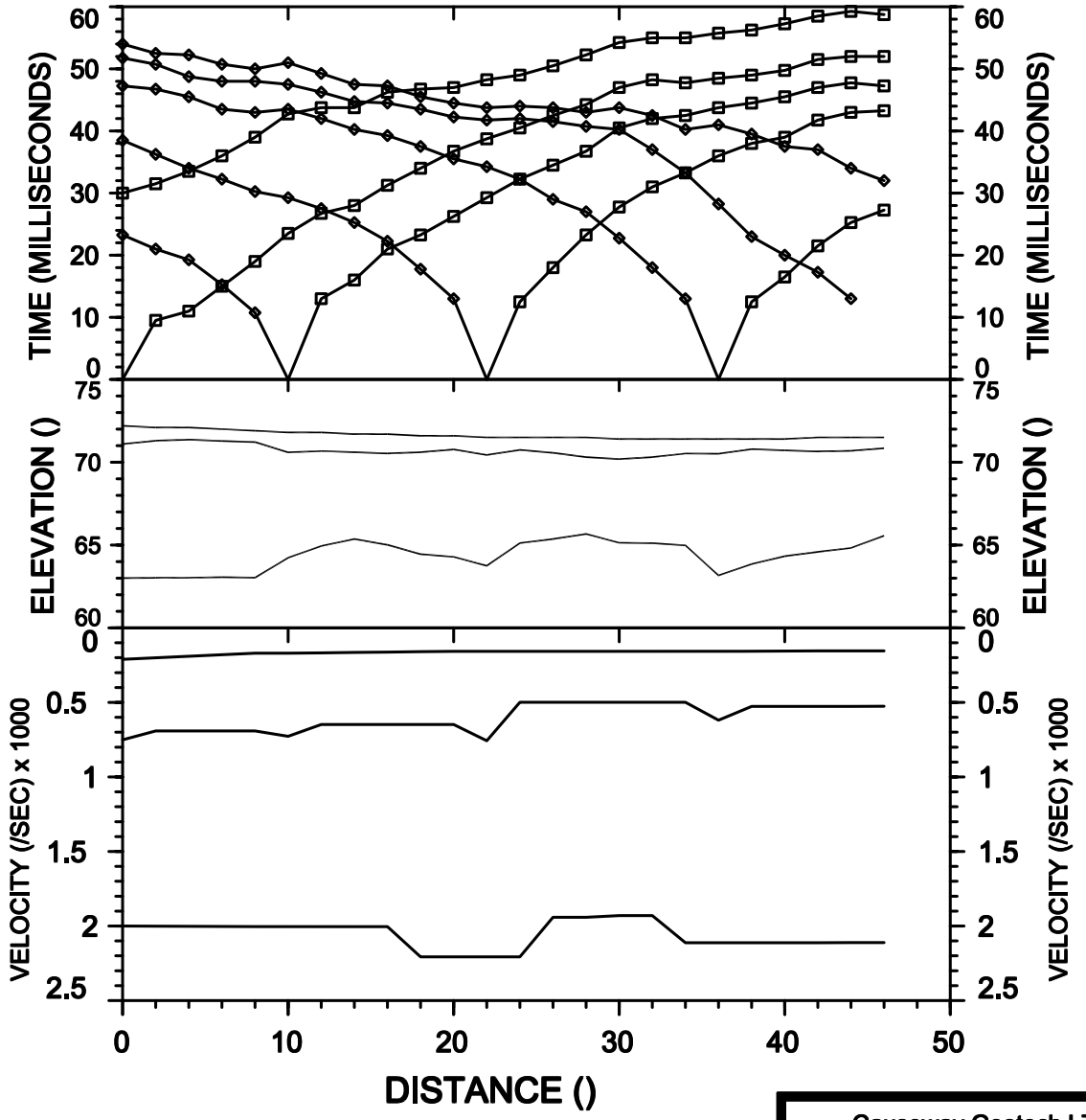


Plate: 10a

for: Causeway Geotech LTD	AGP21220
by: Strata Geophysical, Inc.	Tipperary
Data SetS7 / Date: 24/05/22	
Equipment: / Spread: S7	Azimuth:

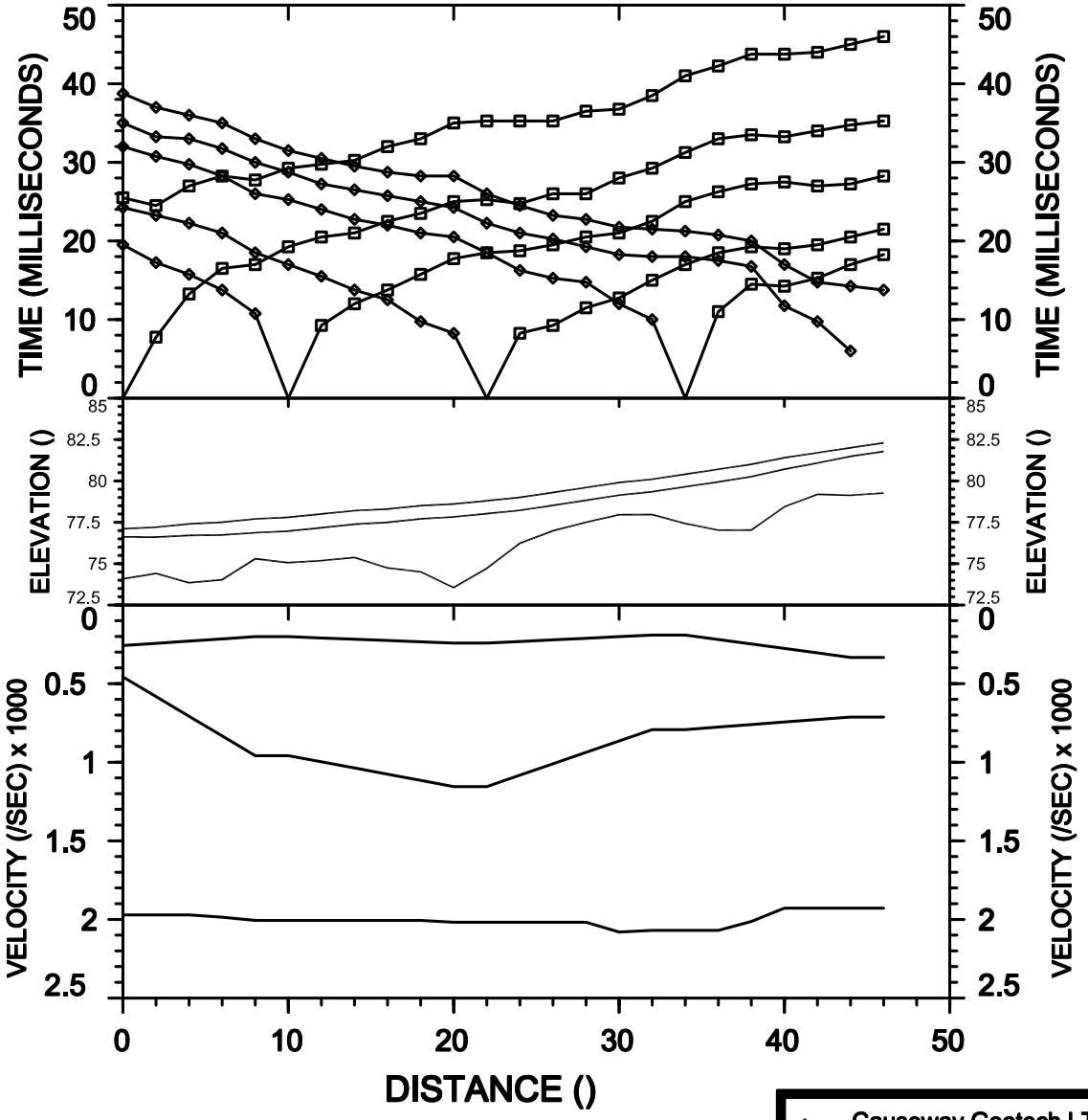


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS8	Date: 25/05/2022	
Equipment:	Spread: S8	Azimuth:

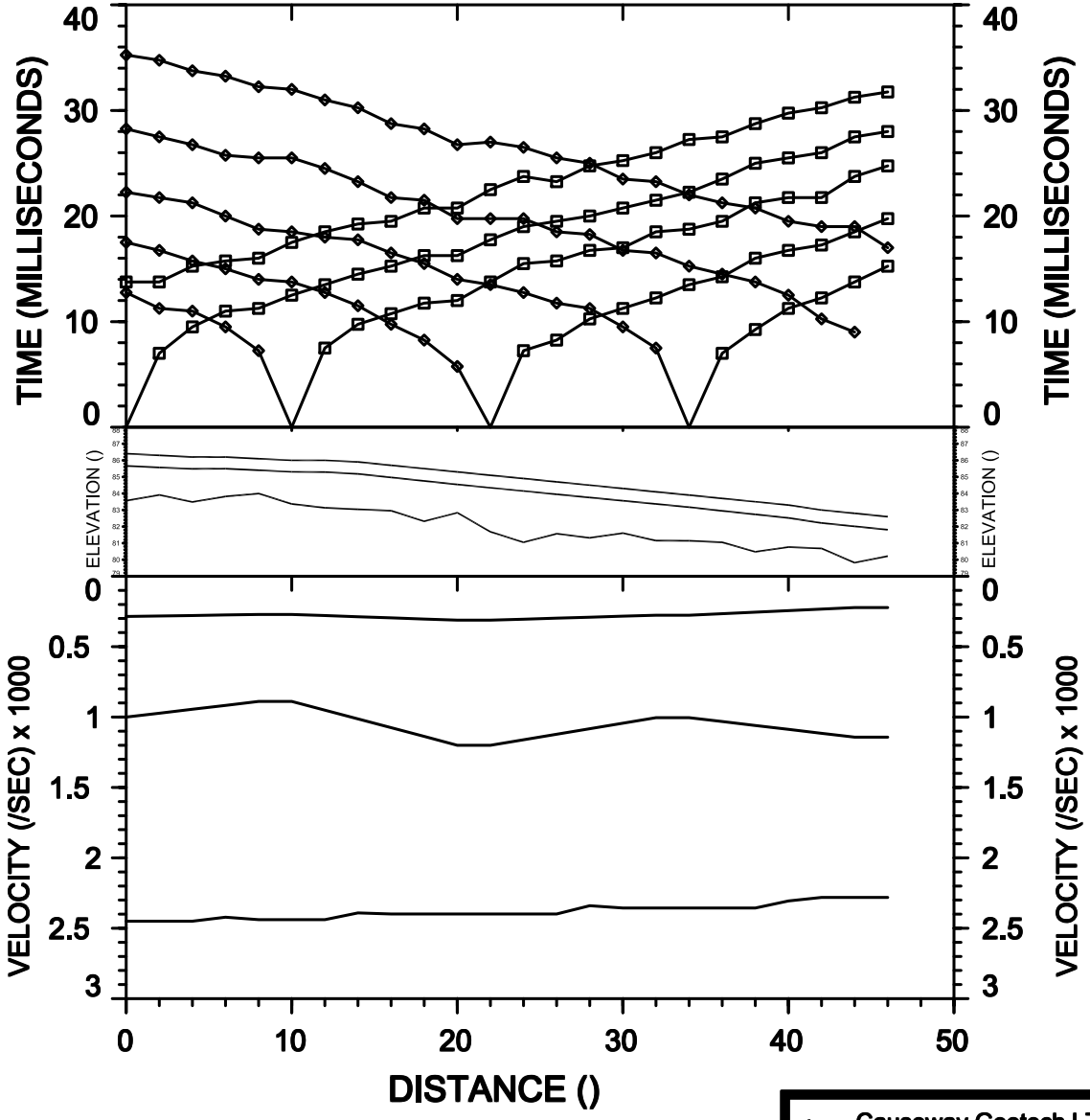


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS9	Date: 25/05/2022	
Equipment:	Spread: S9	Azimuth:

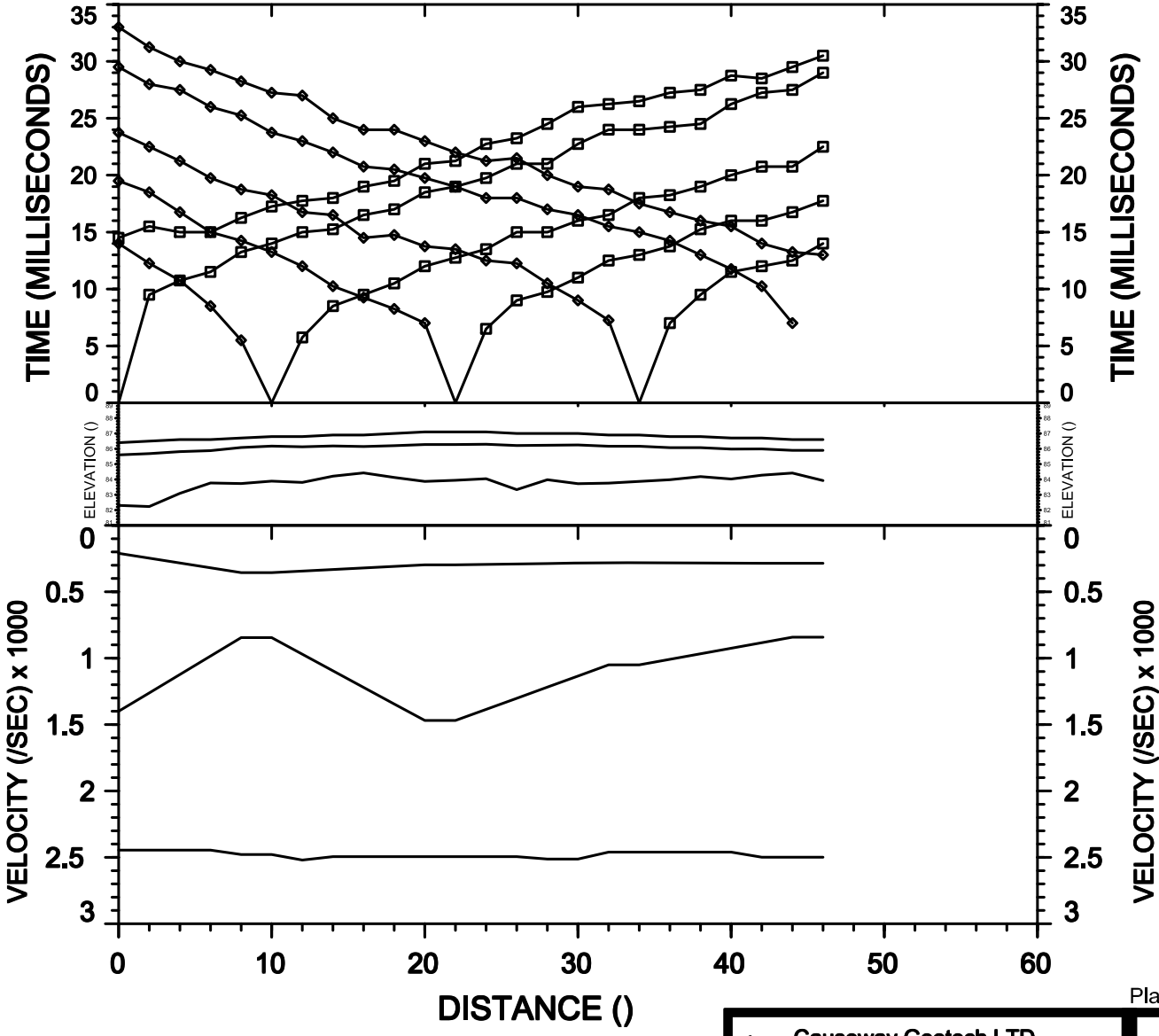


Plate: 10a

for: Causeway Geotech LTD		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS10R	Date: 25/05/2022	
Equipment:	Spread: S10	Azimuth:

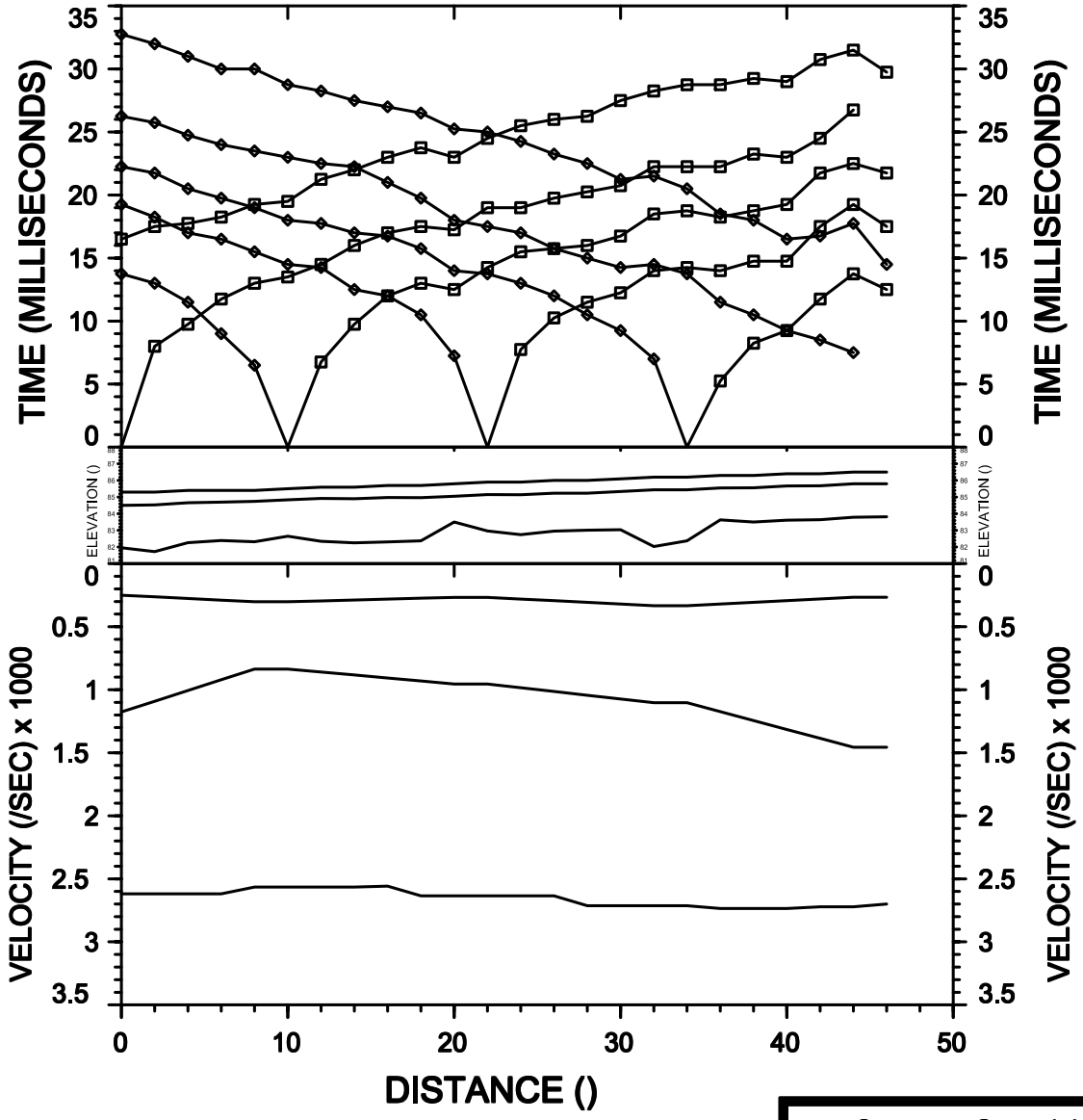


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS11R / Date: 25/05/22	
Equipment: Geode / Spread: S11	Azimuth:

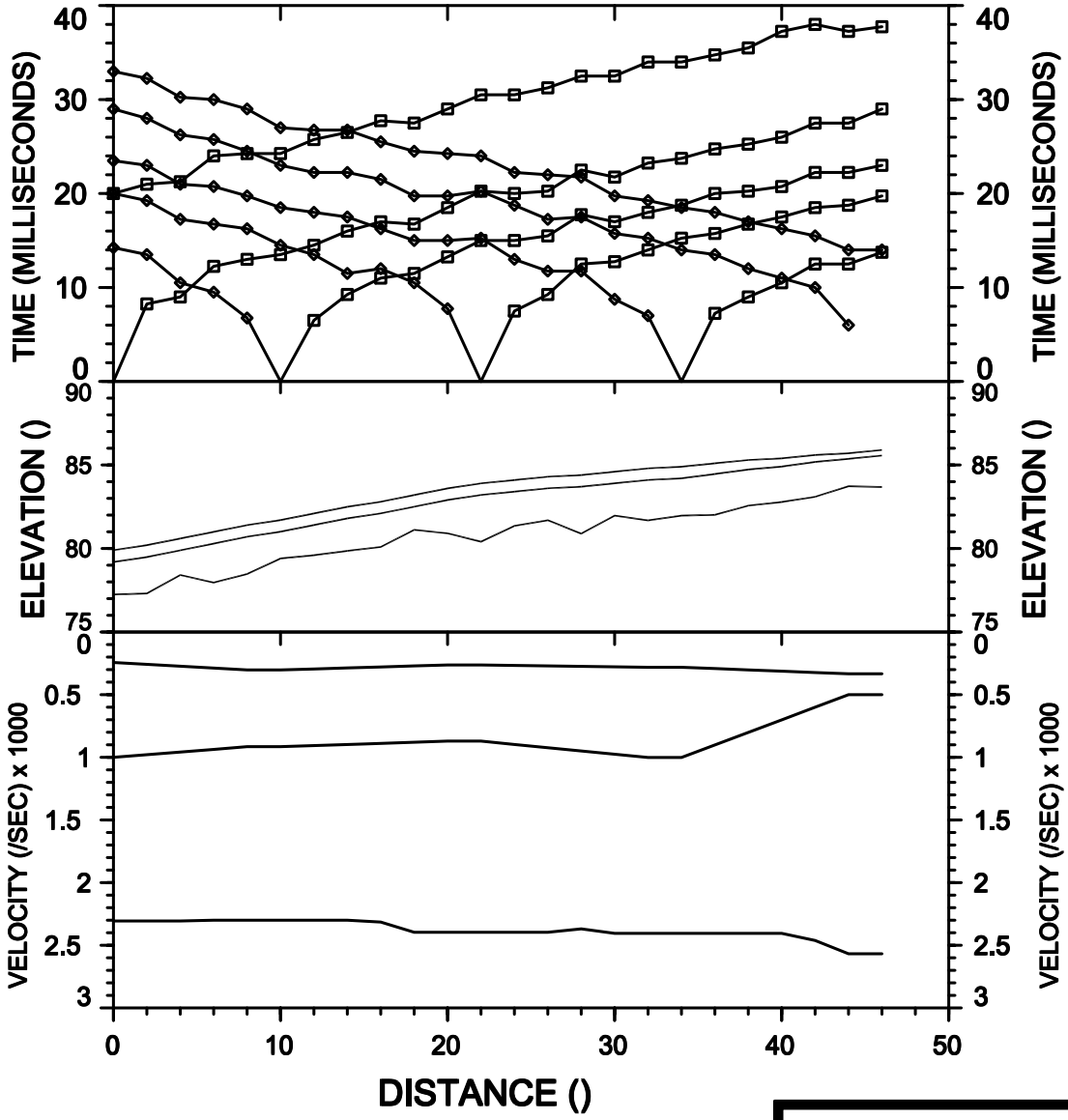


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS12	Date: 25/05/22	
Equipment: Geode	Spread: S12	Azimuth:

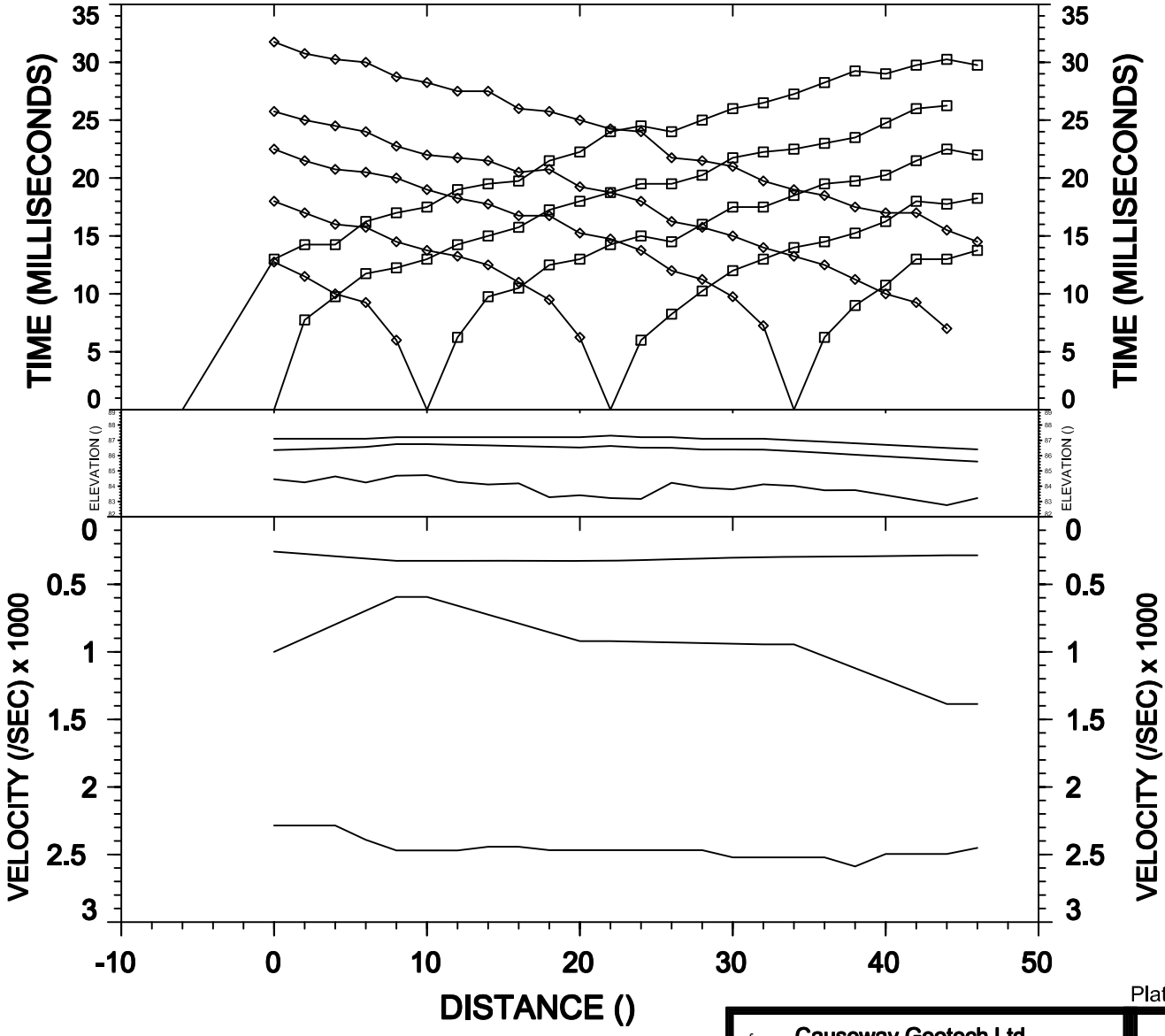


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS13R / Date: 25/05/22	
Equipment: Geode / Spread: S13	Azimuth:

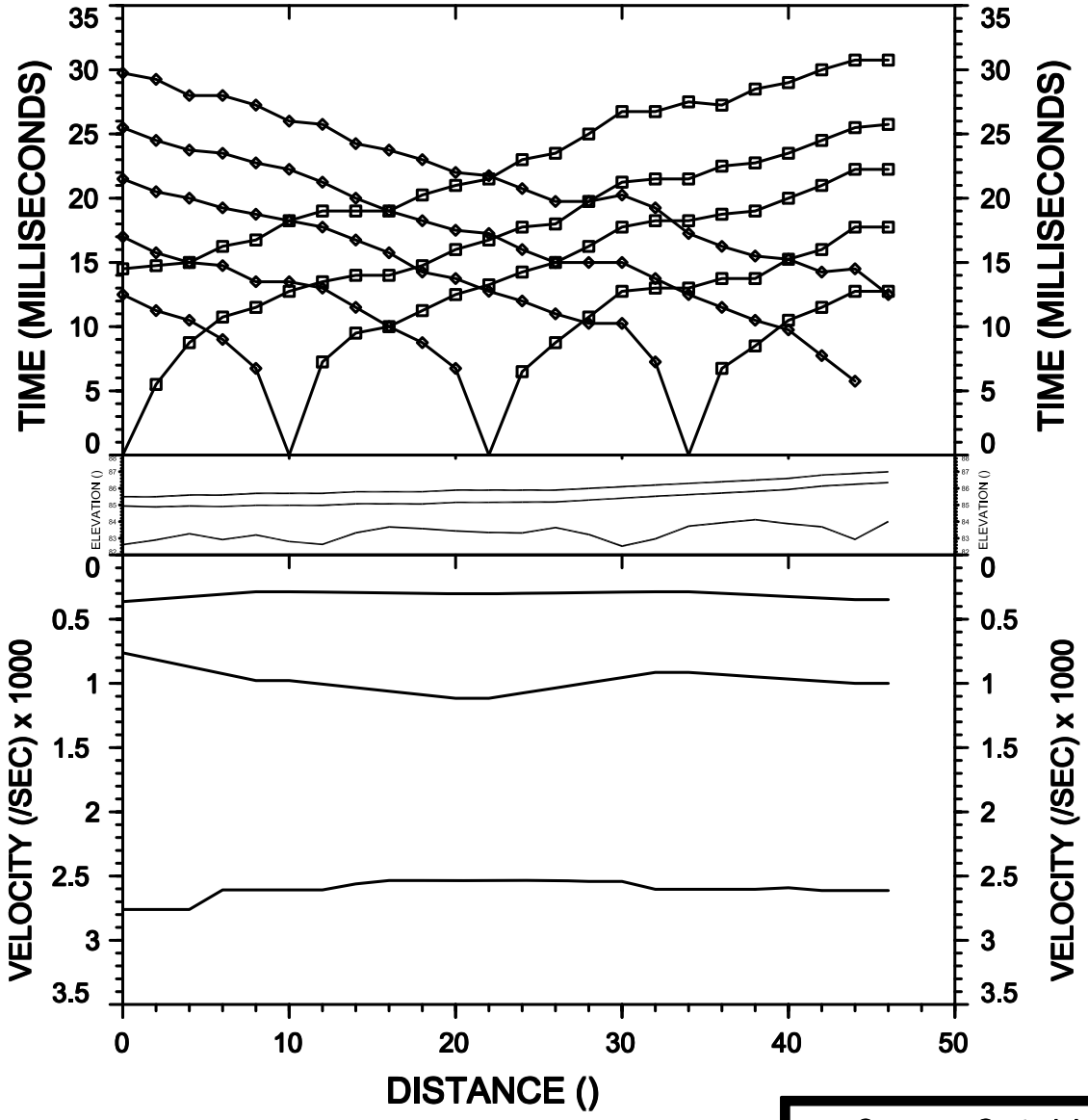


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS14 / Date: 25/05/22	
Equipment: Geode / Spread: S14	Azimuth:

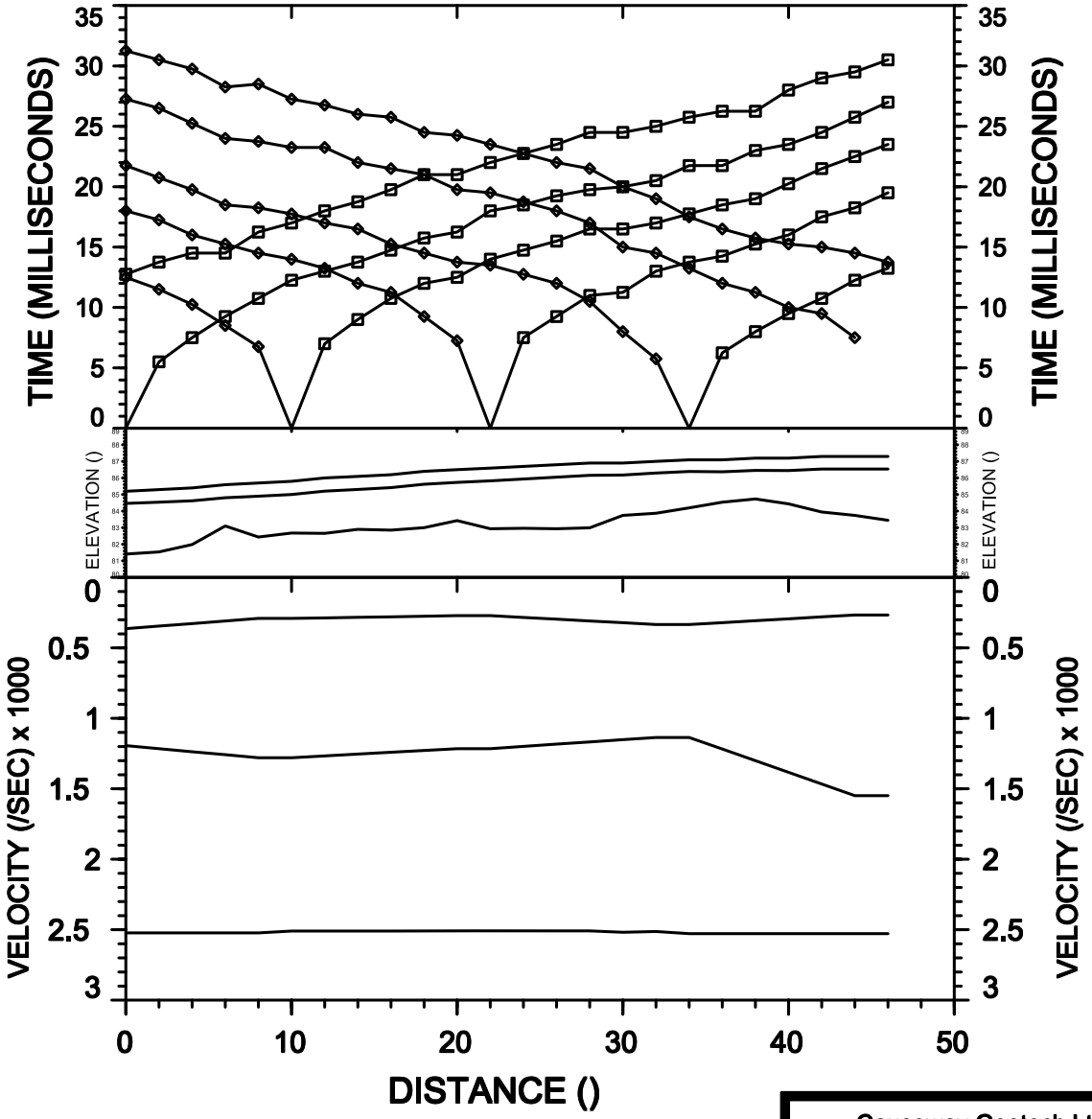


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS15R / Date: 25/05/22	
Equipment: Geode / Spread: S15	Azimuth:

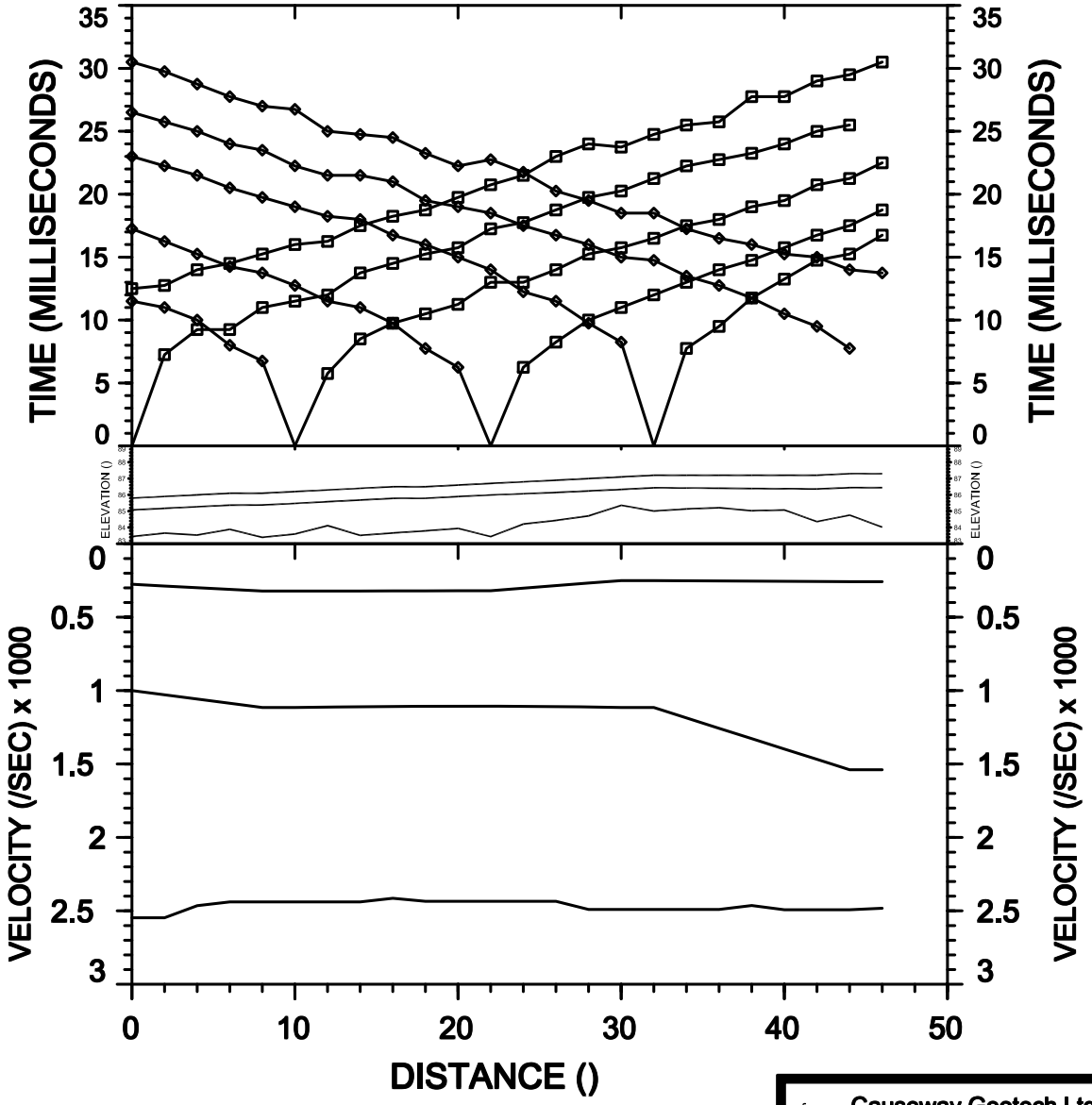


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS16 / Date: 25/05/22	
Equipment: Geode / Spread: S16	Azimuth:

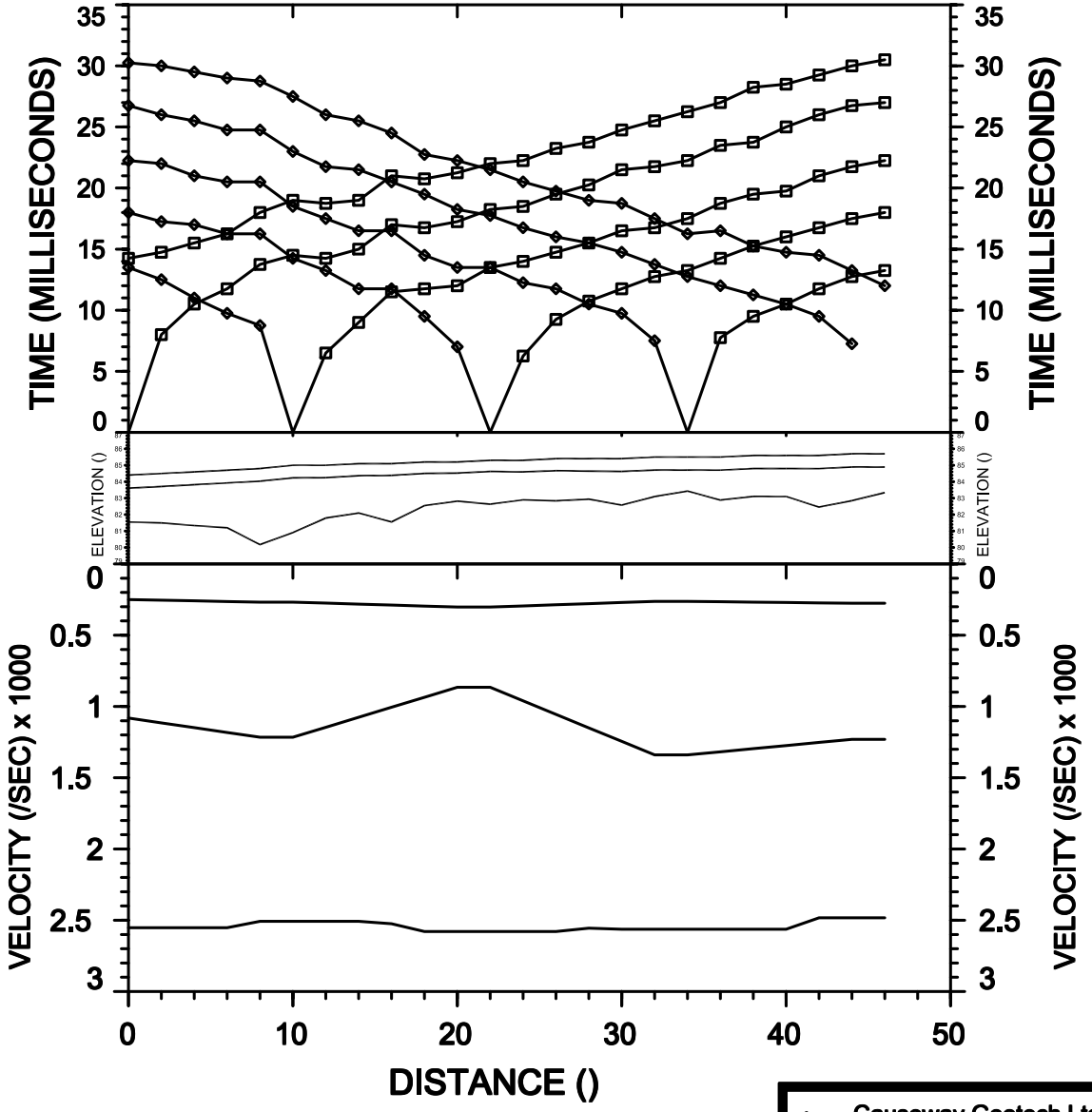


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS17 / Date: 25/05/22	
Equipment: Geode / Spread: S17	Azimuth:

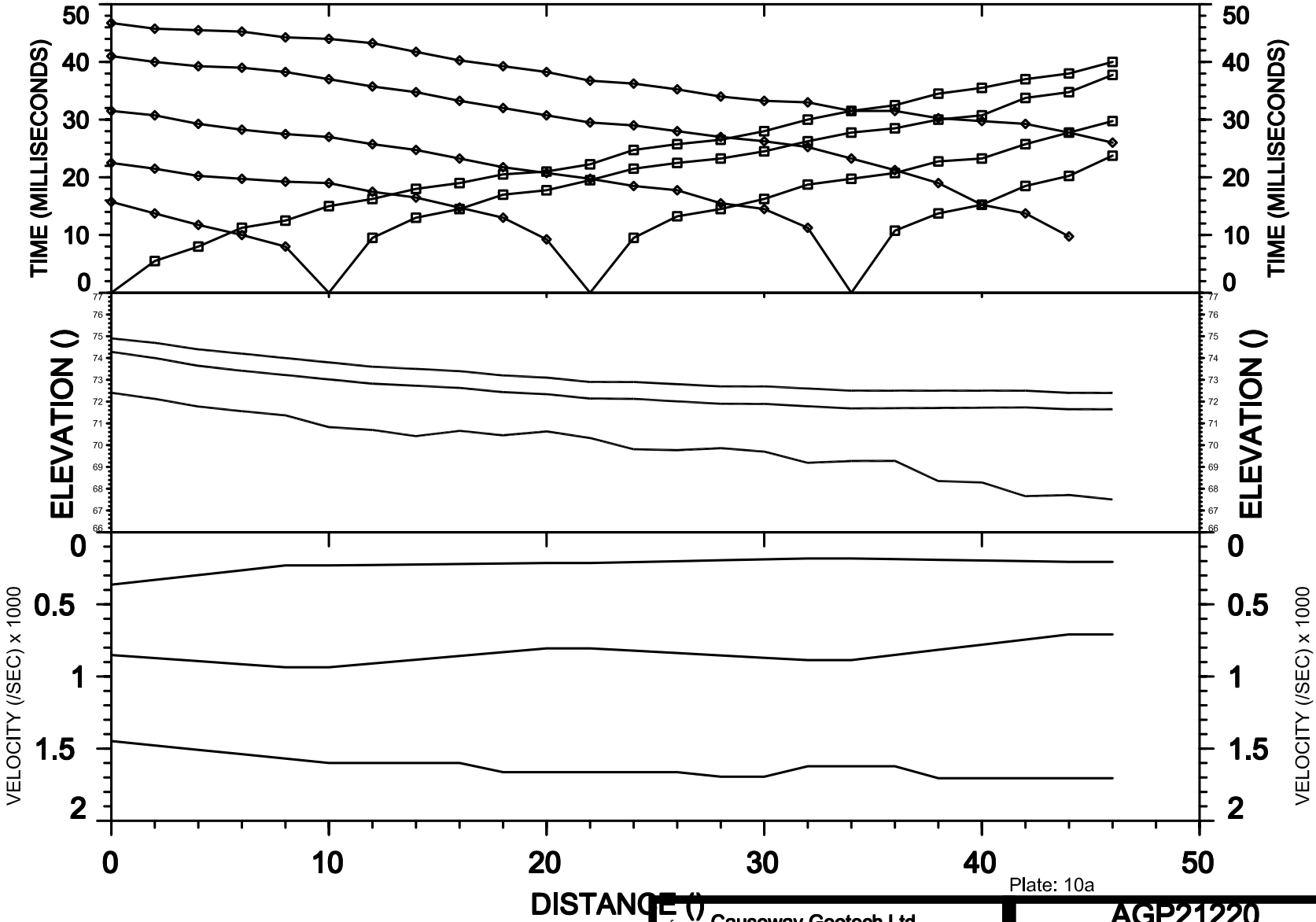


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS18	Date: 26/05/22	Tipperary
Equipment: Geode	Spread: S18	Azimuth:

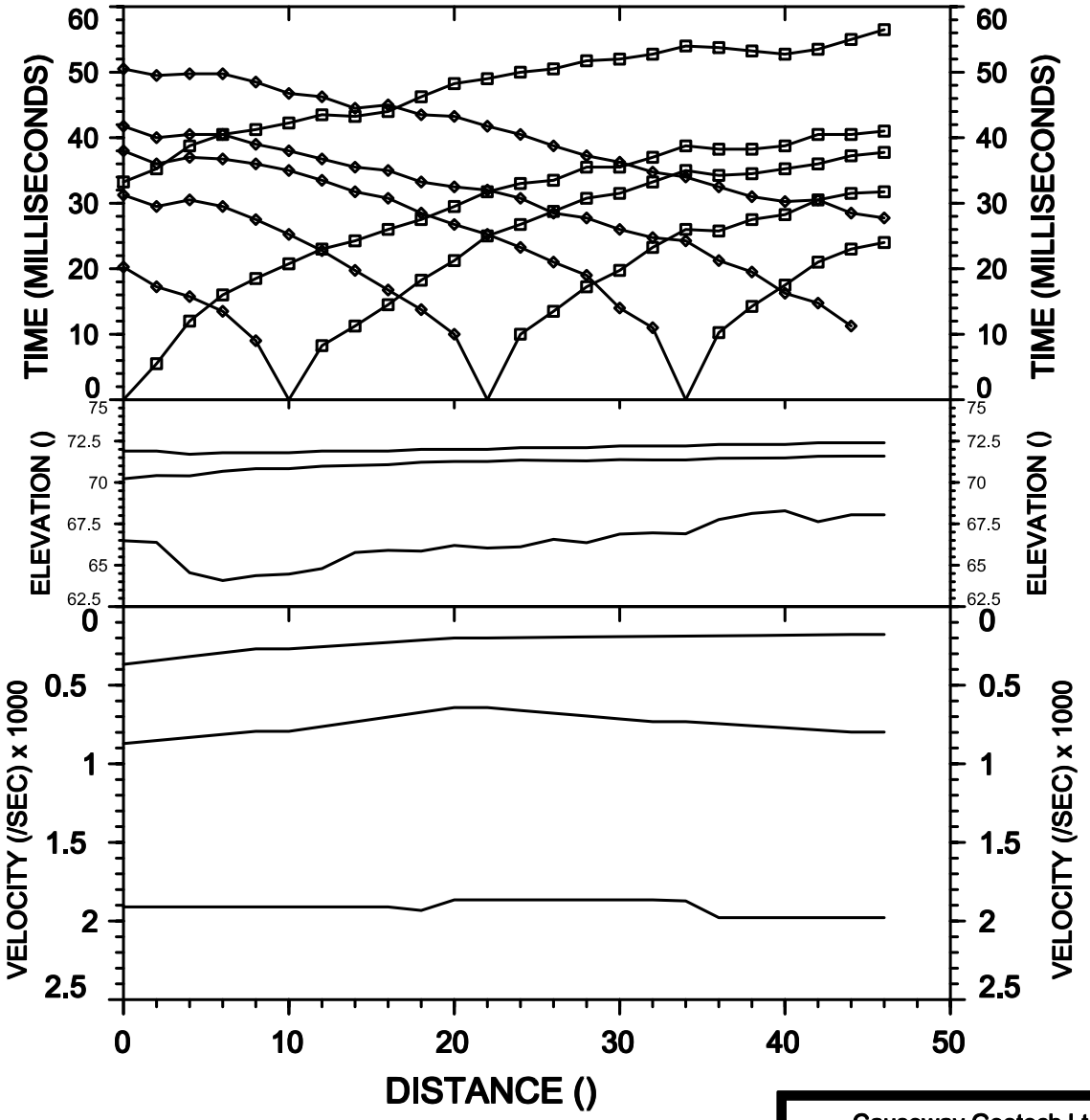


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS19R / Date: 26/05/22	
Equipment: Geode / Spread: S19	Azimuth:

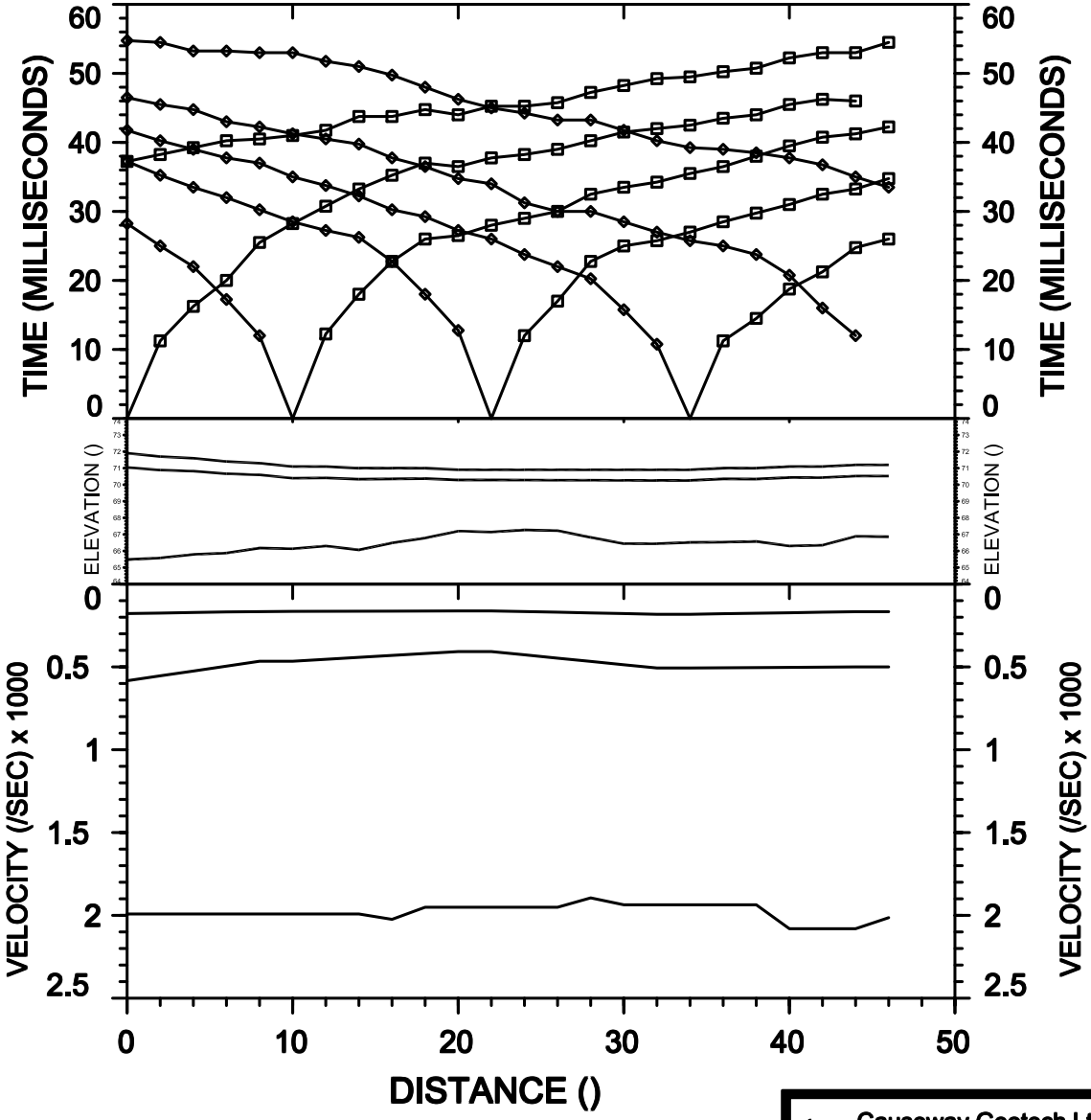


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS20 / Date: 26/05/22	
Equipment: Geode / Spread: S20	Azimuth:

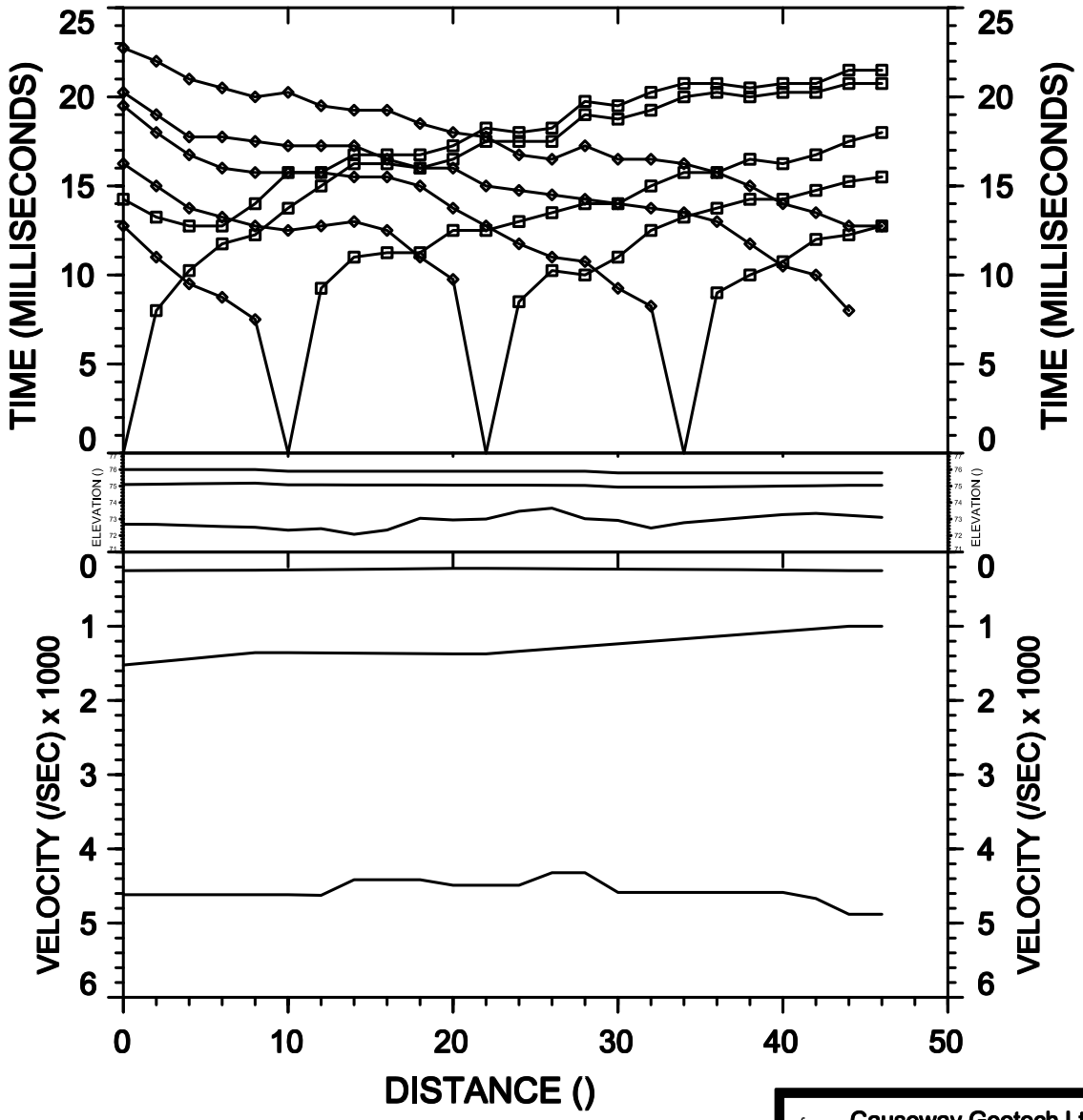


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS21R / Date: 26/05/22	
Equipment: Geode / Spread: S21	Azimuth:

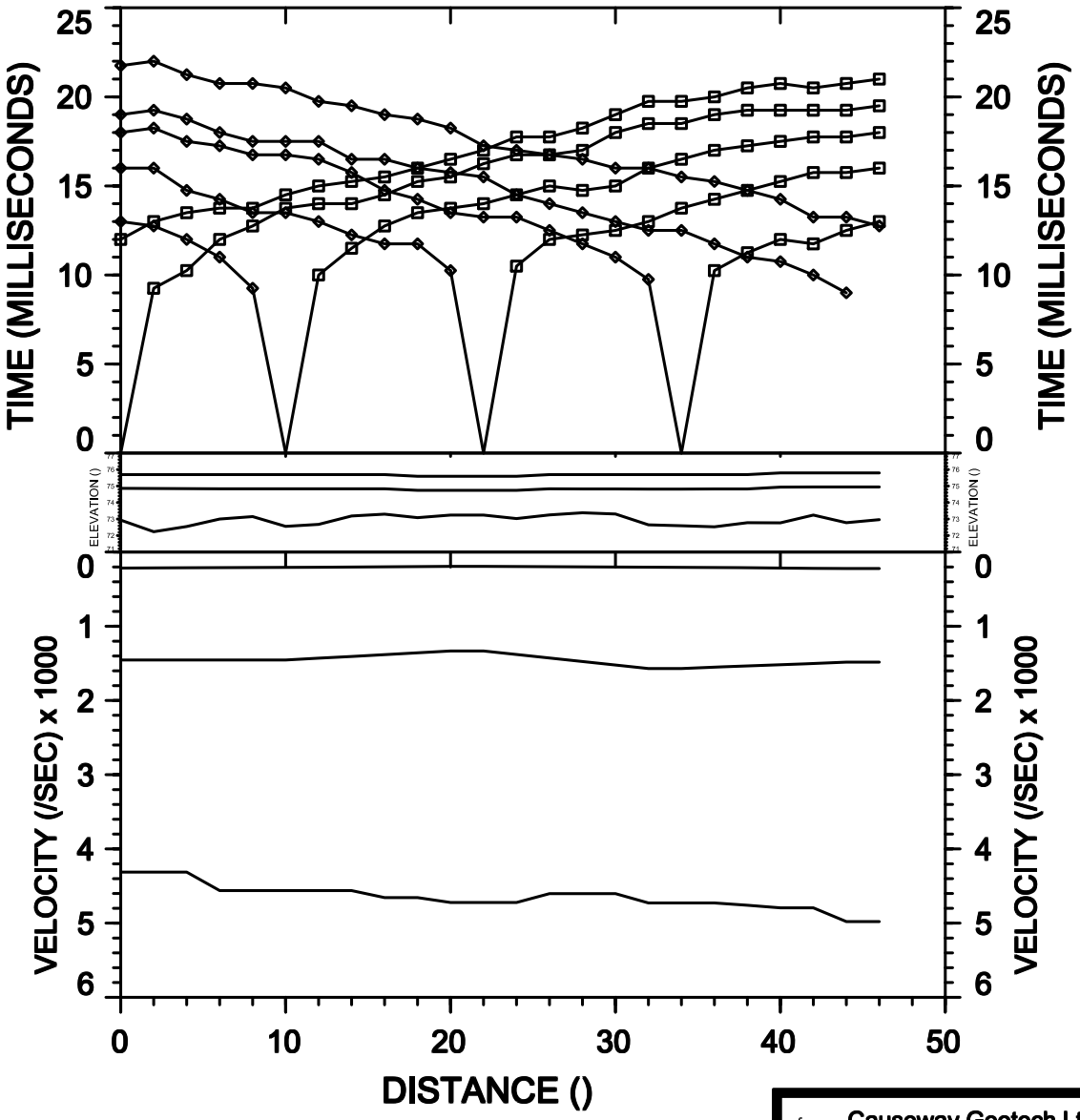


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS22R / Date: 26/05/22	
Equipment: Geode / Spread: S22	Azimuth:

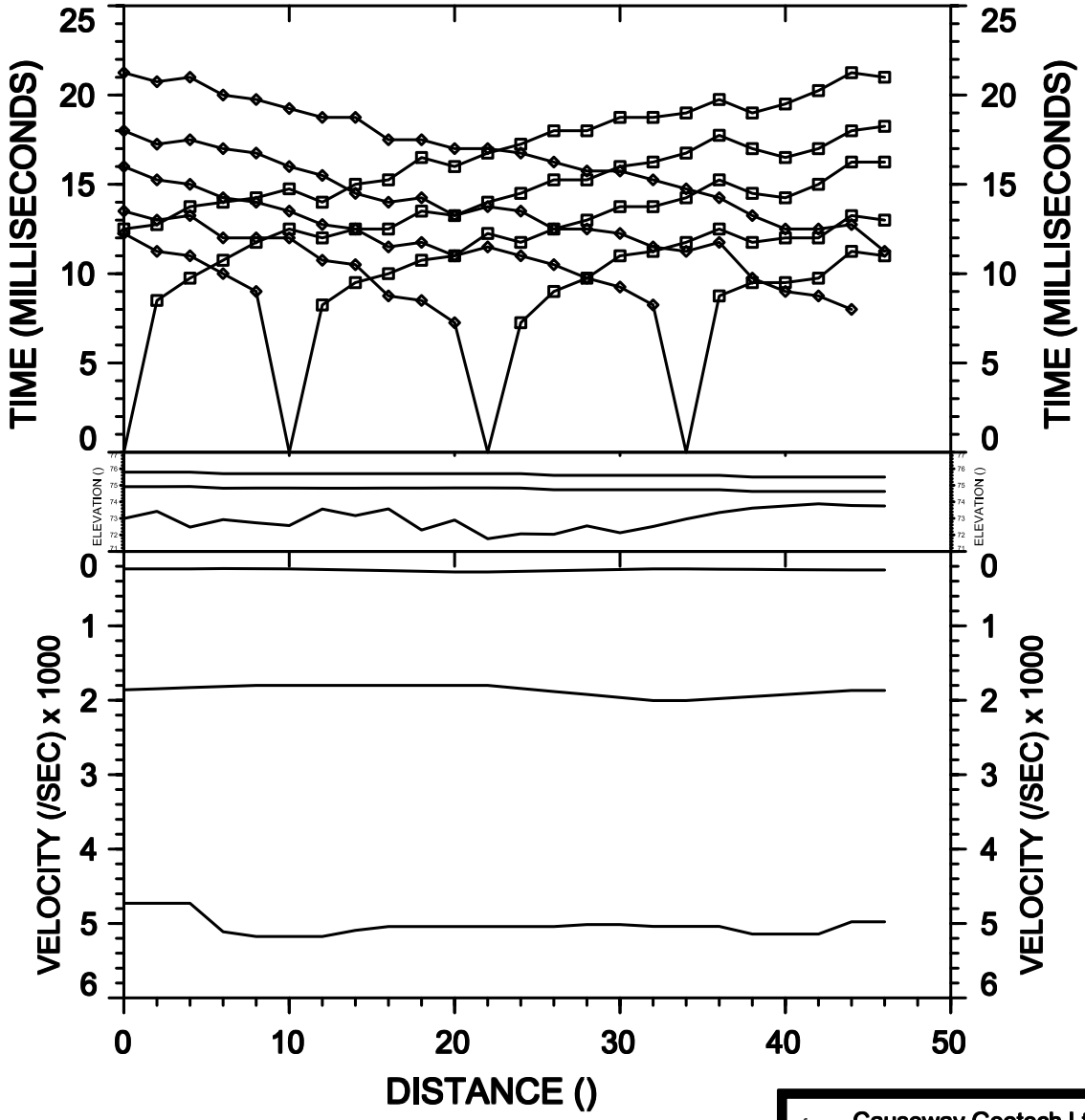


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS23R / Date: 26/05/22	
Equipment: Geode / Spread: S23	Azimuth:

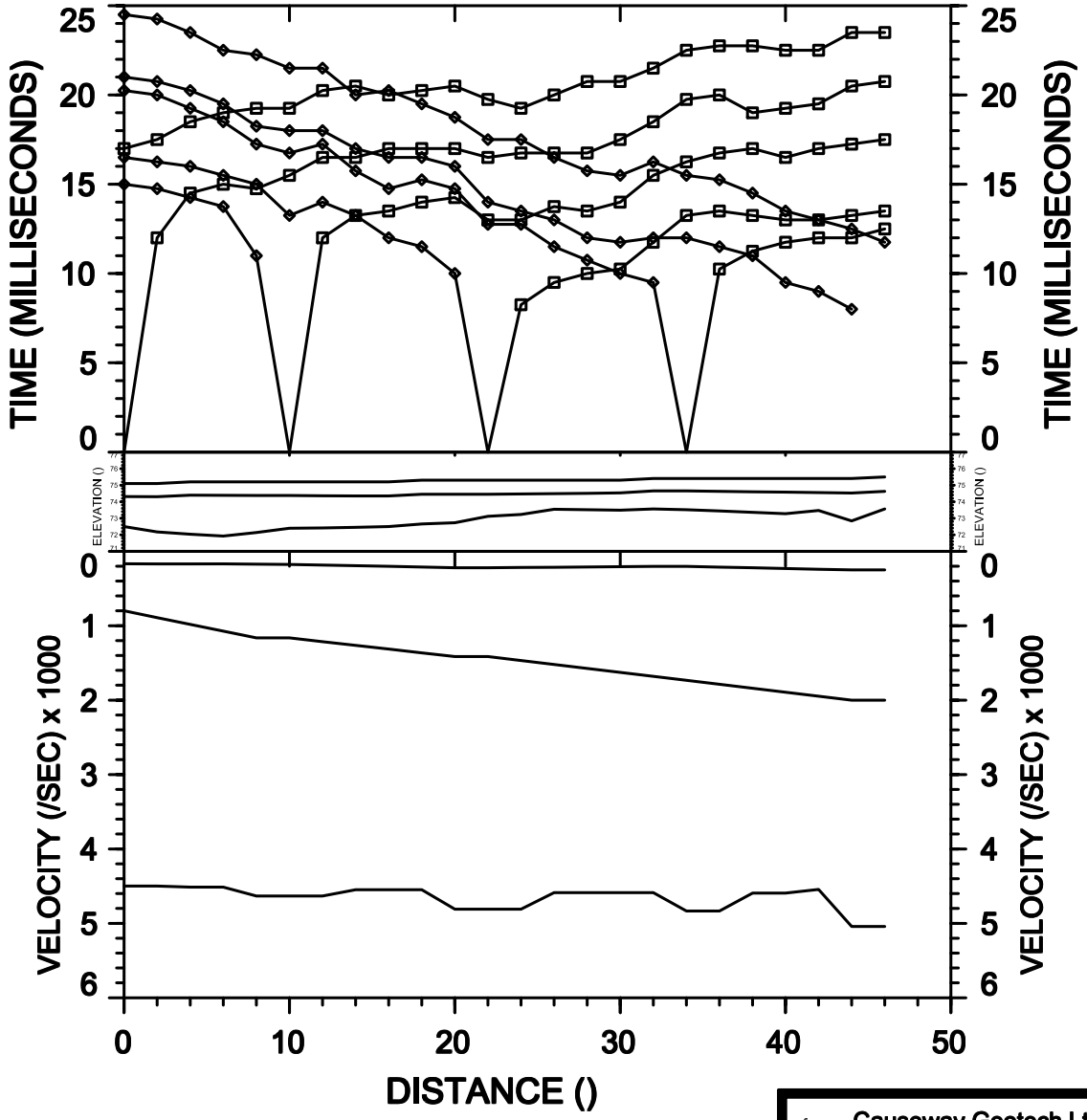


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS24R	Date: 26/05/22	
Equipment: Geode	Spread: S24	Azimuth:

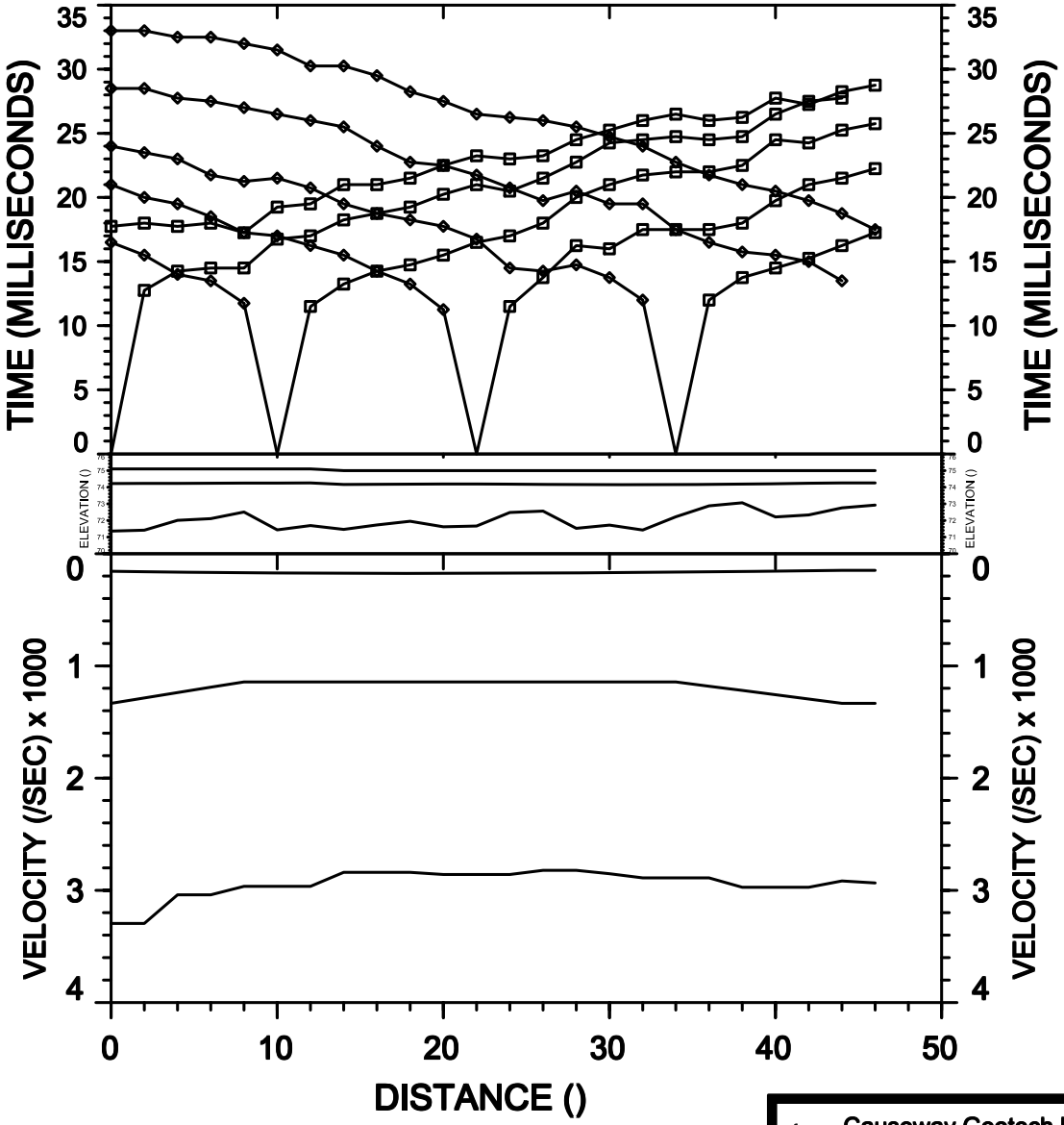


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS25R / Date: 26/05/22	
Equipment: Geode / Spread: S25	Azimuth:

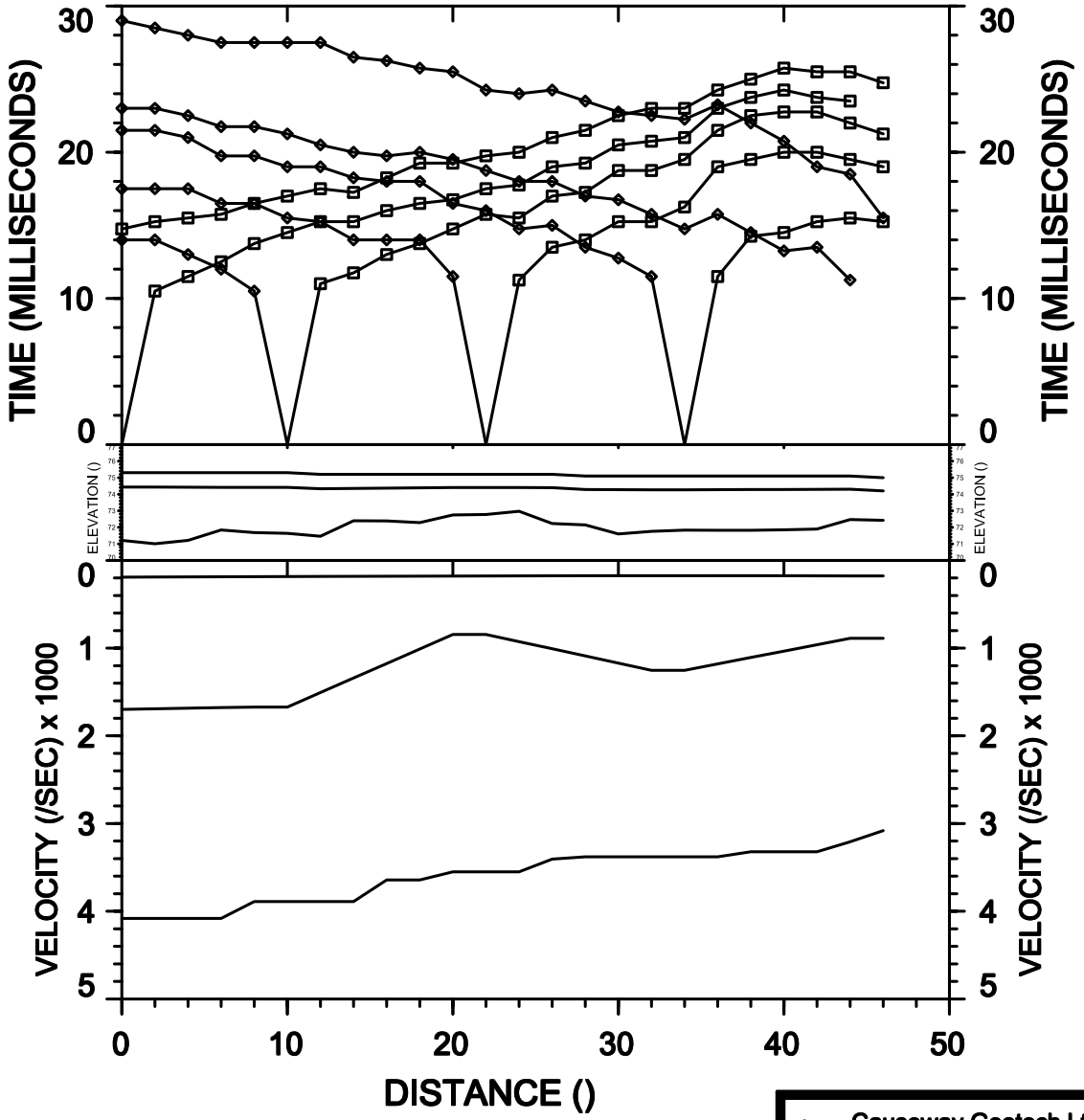


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS26R / Date: 26/05/22	
Equipment: Geode / Spread: S26	Azimuth:

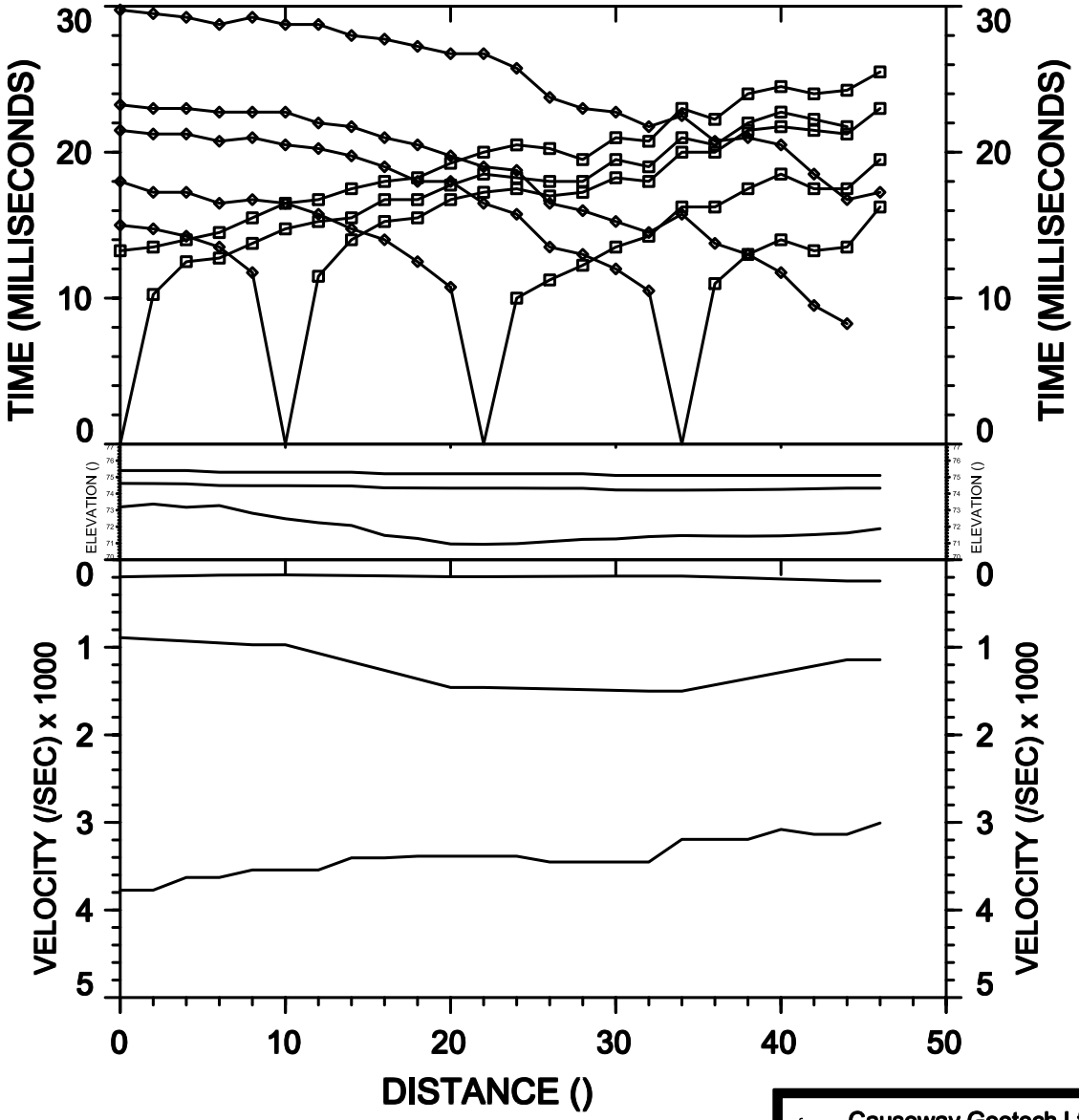


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS27R / Date: 26/05/22	
Equipment: Geode / Spread: S27	Azimuth:

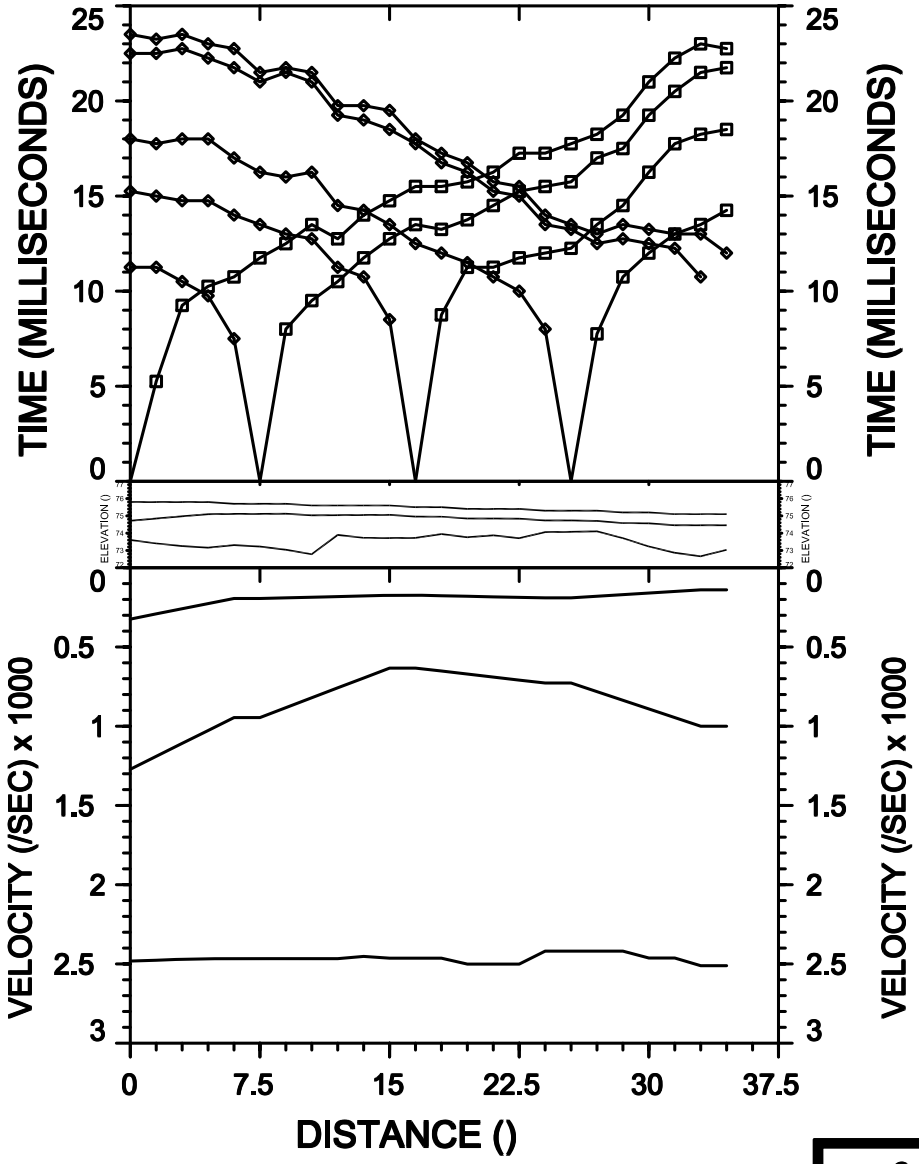


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS28	Date: 26/05/22	
Equipment: Geode	Spread: S28	Azimuth:

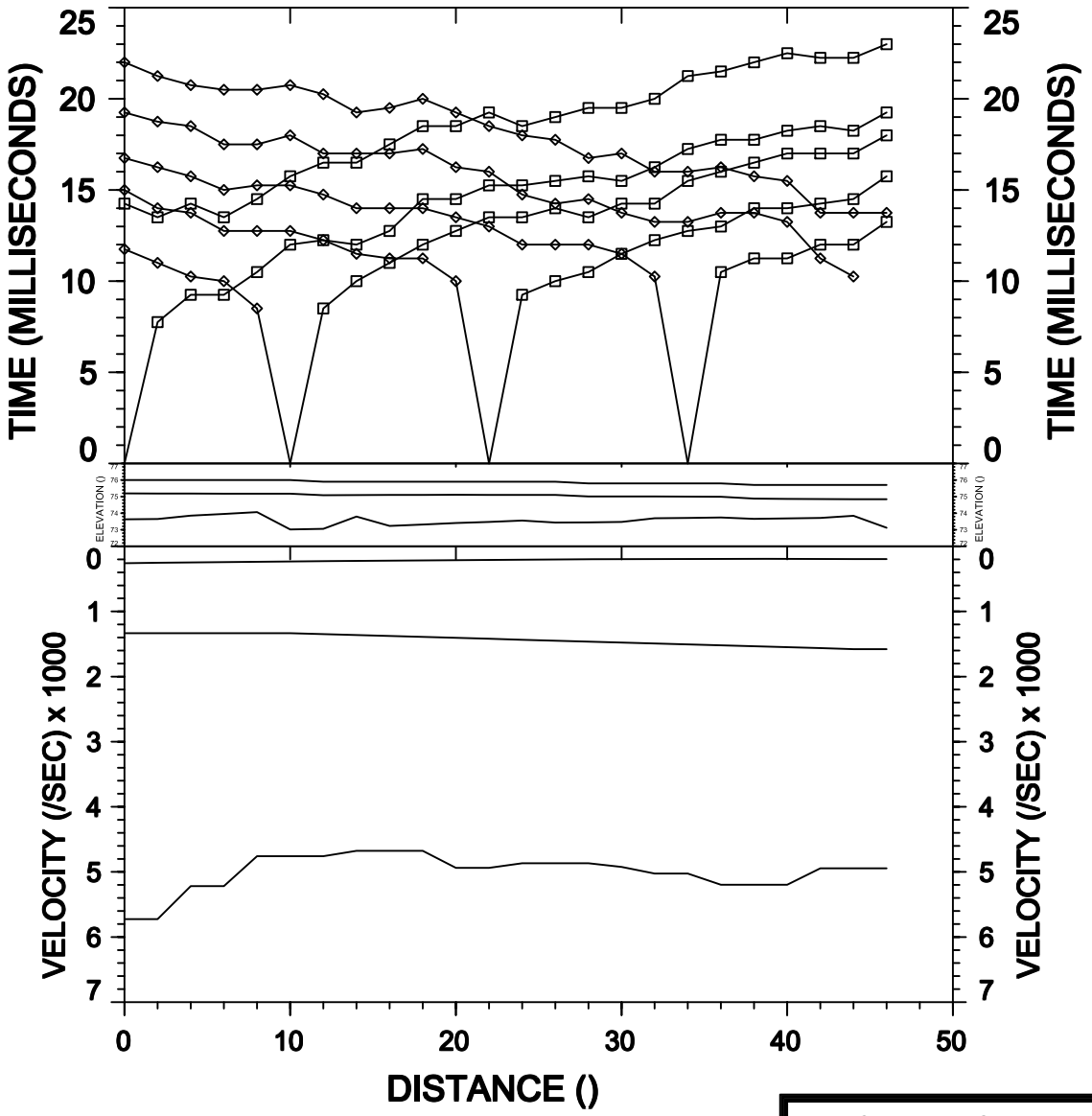


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS29R / Date: 27/05/22	
Equipment: Geode / Spread: S29	Azimuth:

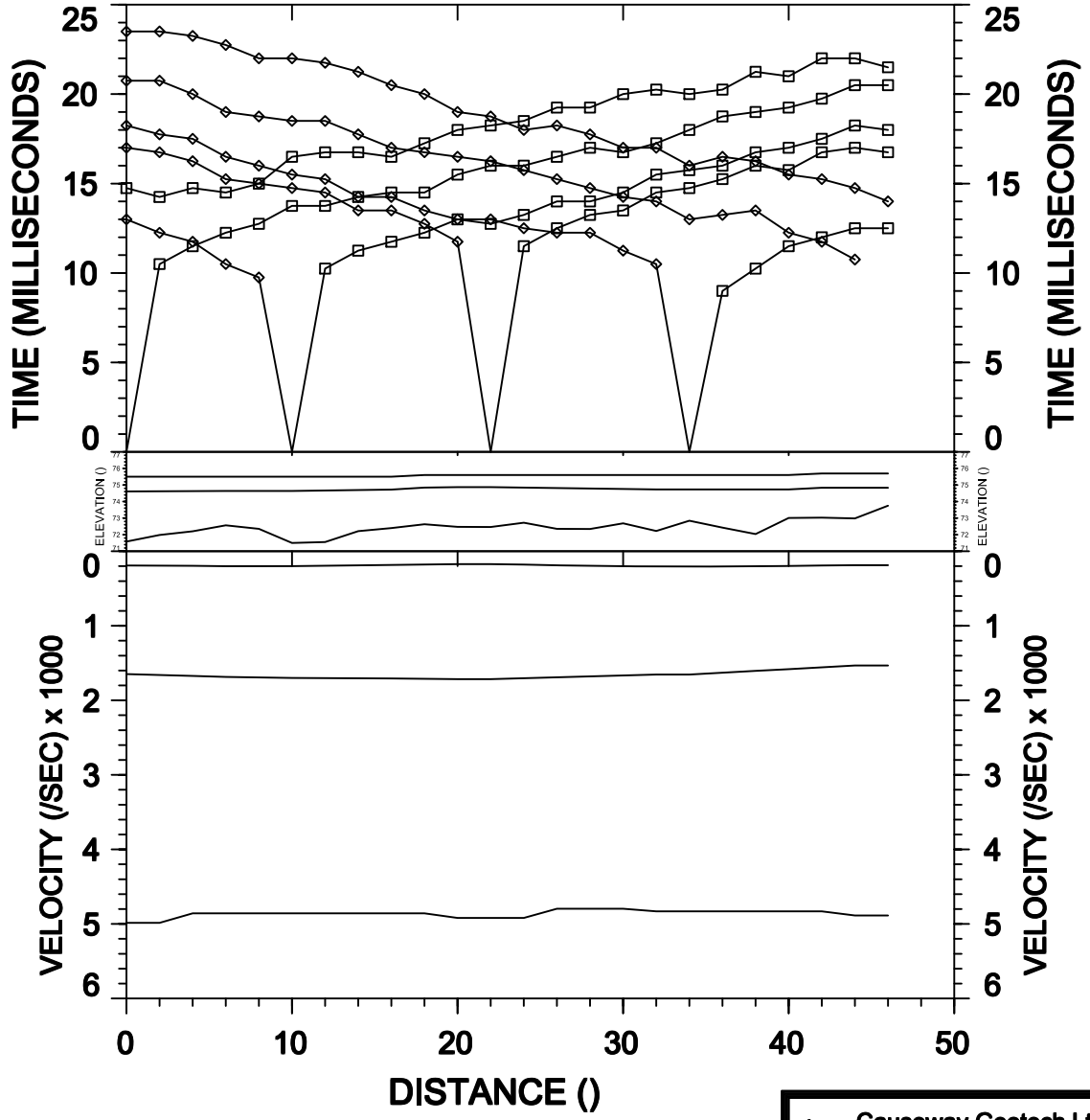


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS30R / Date: 27/05/22	
Equipment: Geode / Spread: S30	Azimuth:

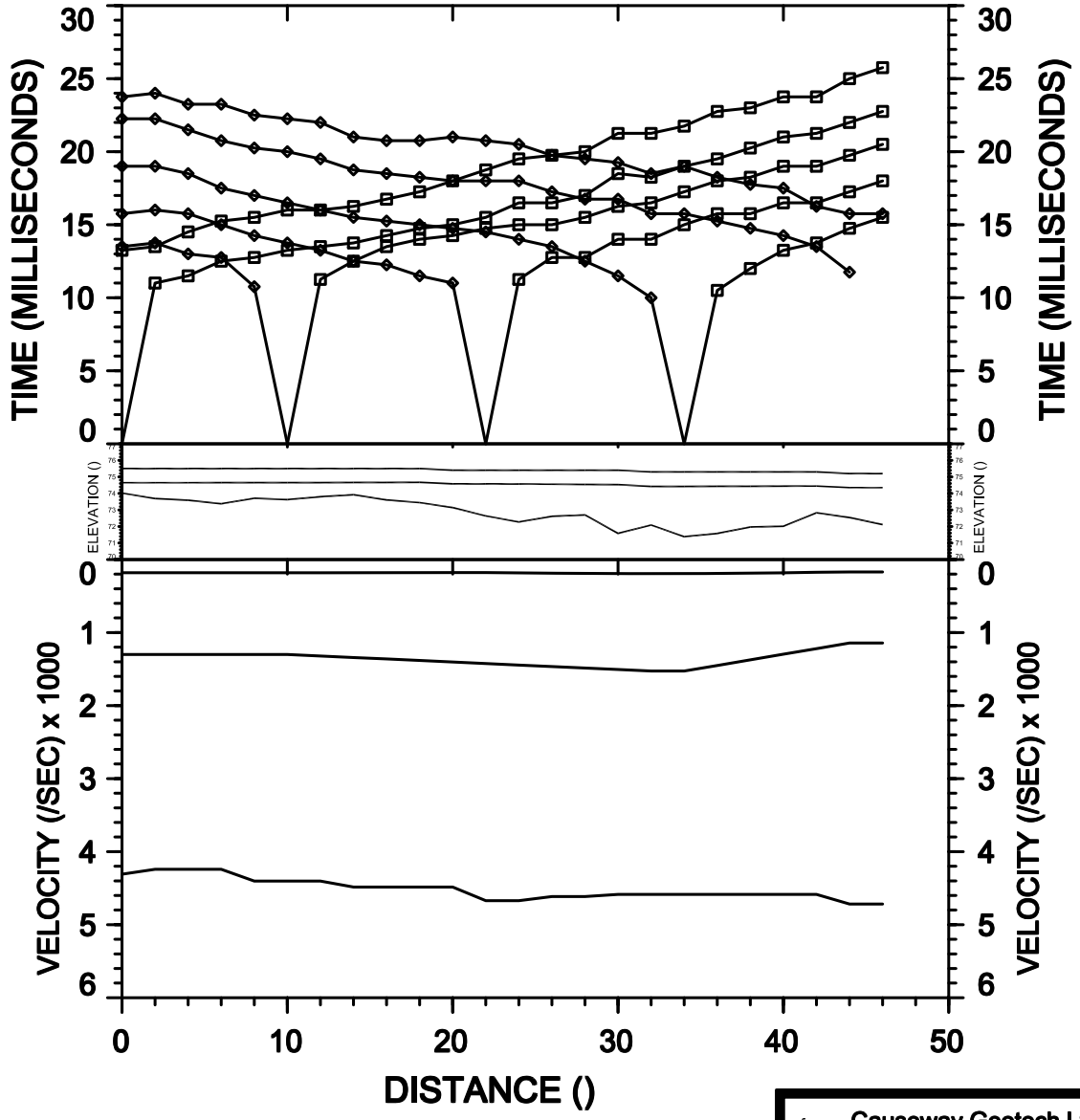


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS31 / Date: 27/05/22	
Equipment: Geode / Spread: S31	Azimuth:

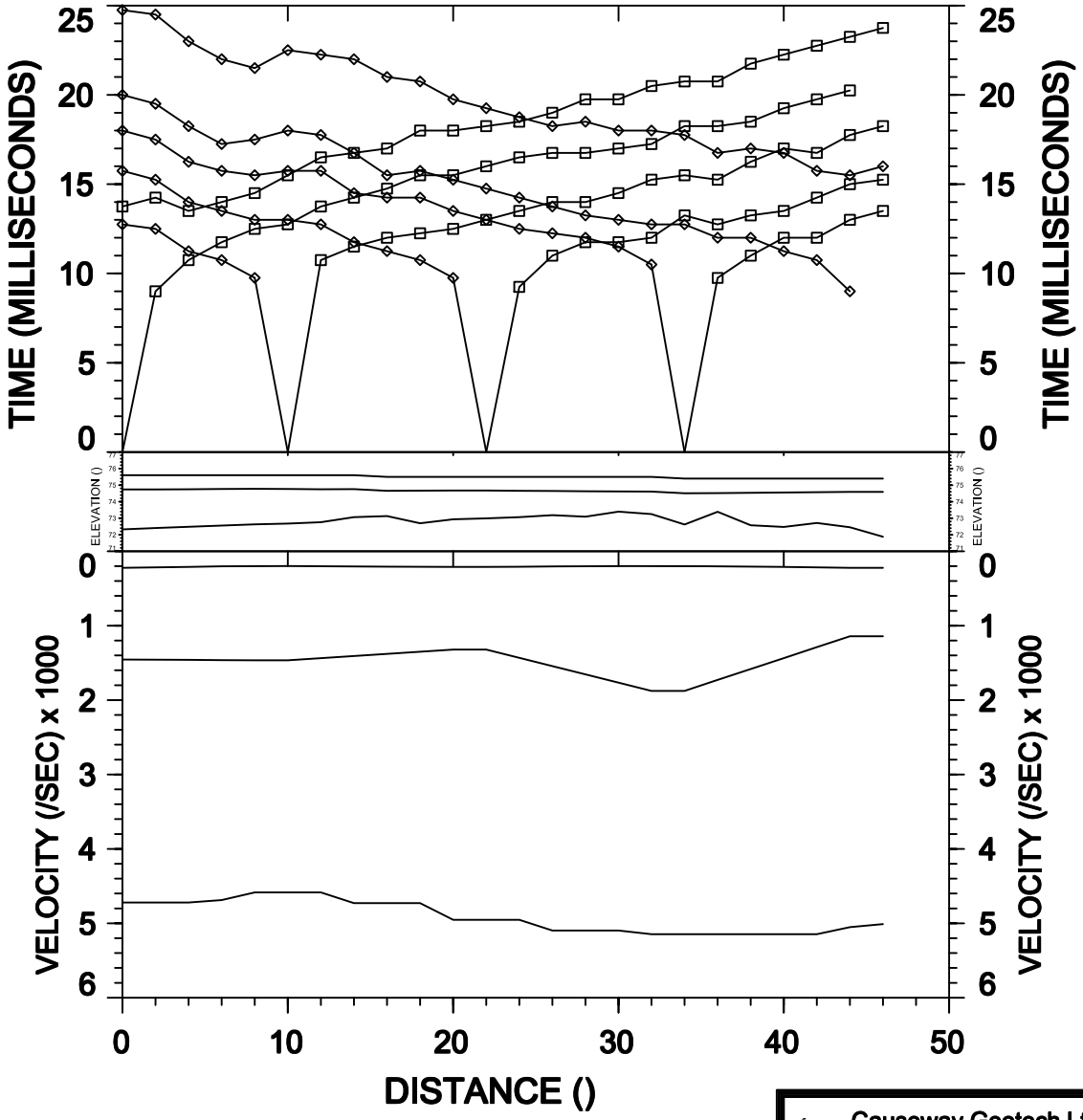


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS32R / Date: 27/05/22	
Equipment: Geode / Spread: S32	Azimuth:

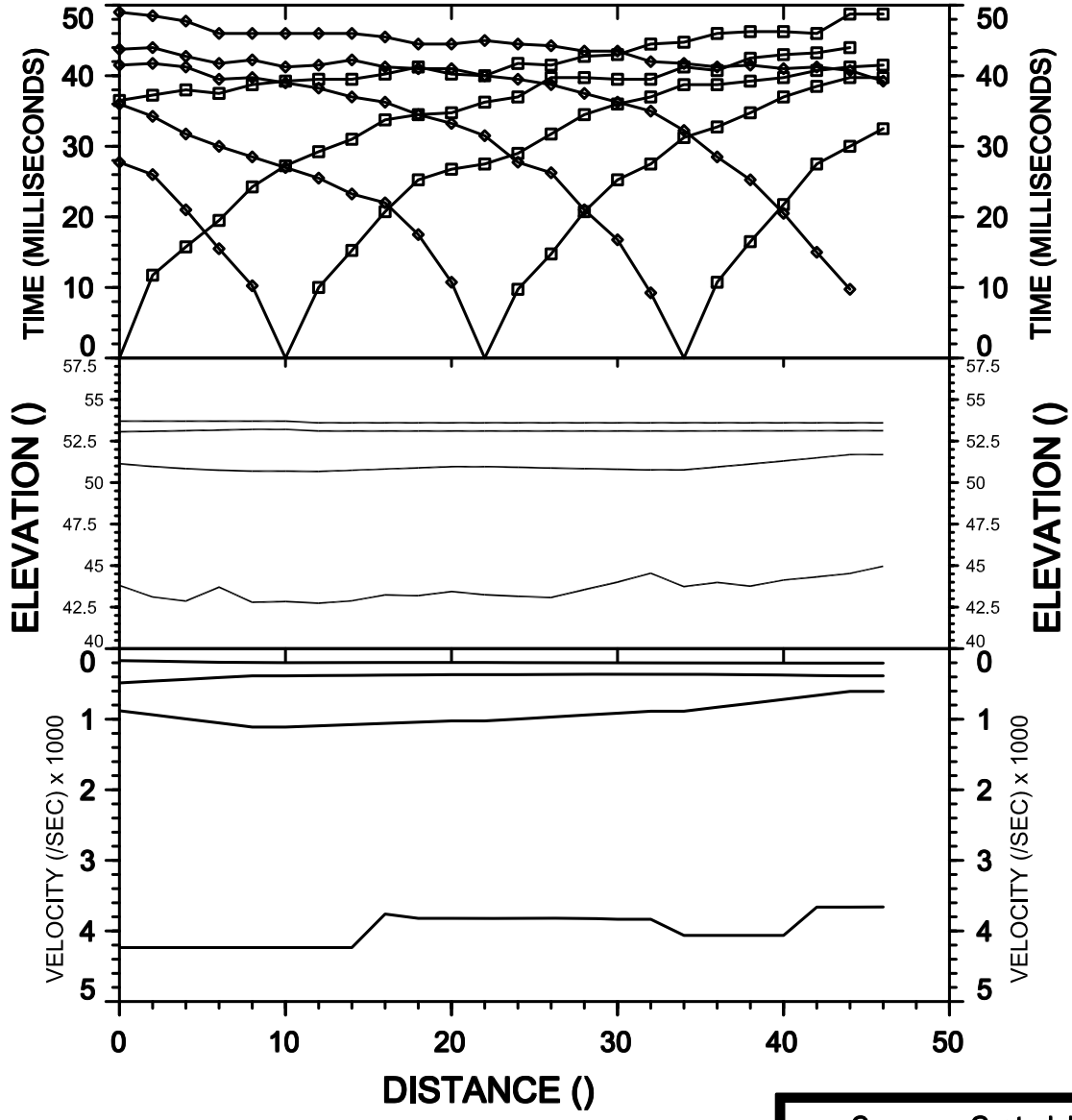


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS33 / Date: 27/05/22	
Equipment: Geode / Spread: S33	Azimuth:

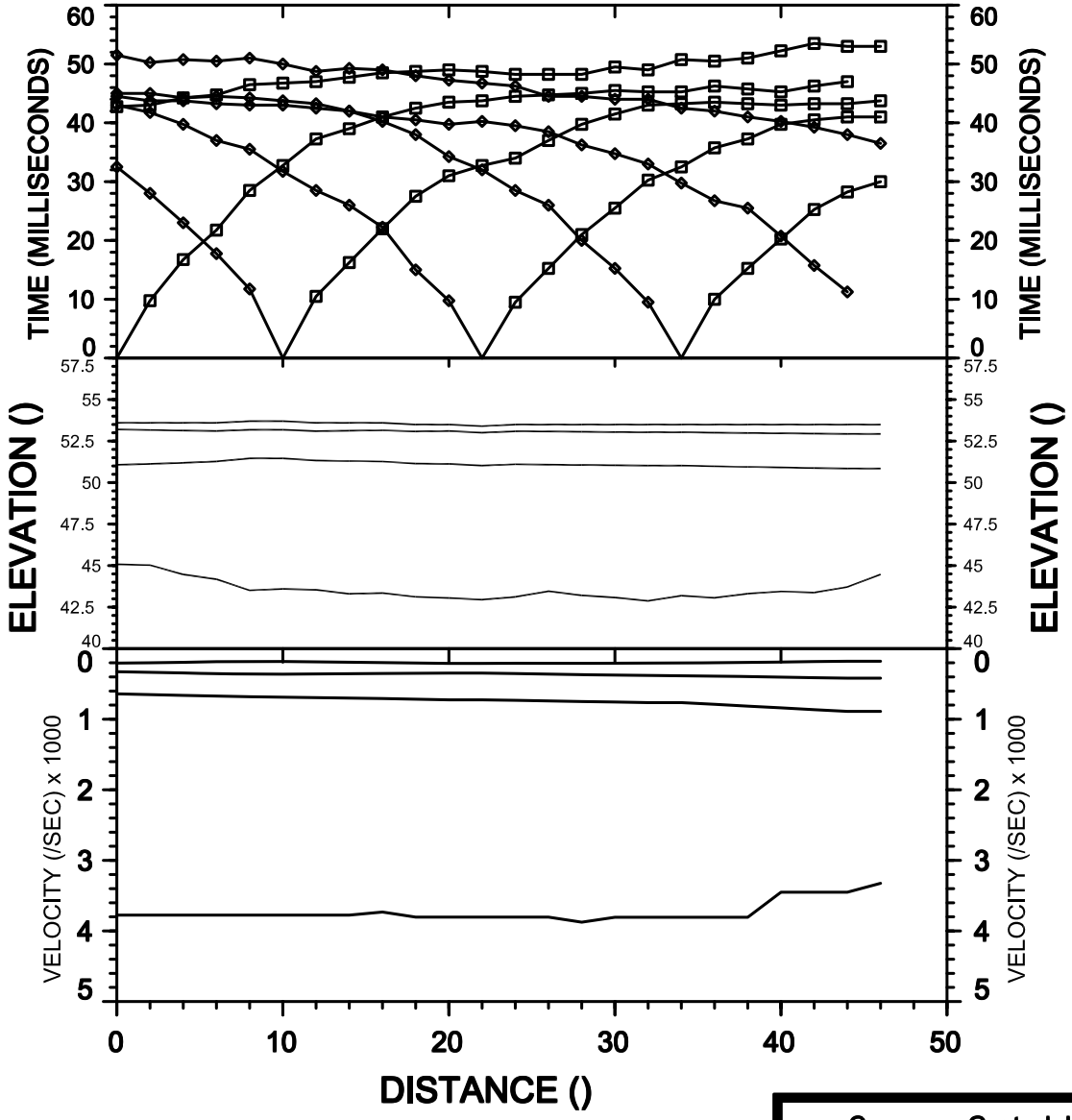


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS34 / Date: 27/05/22	
Equipment: Geode / Spread: S34	Azimuth:

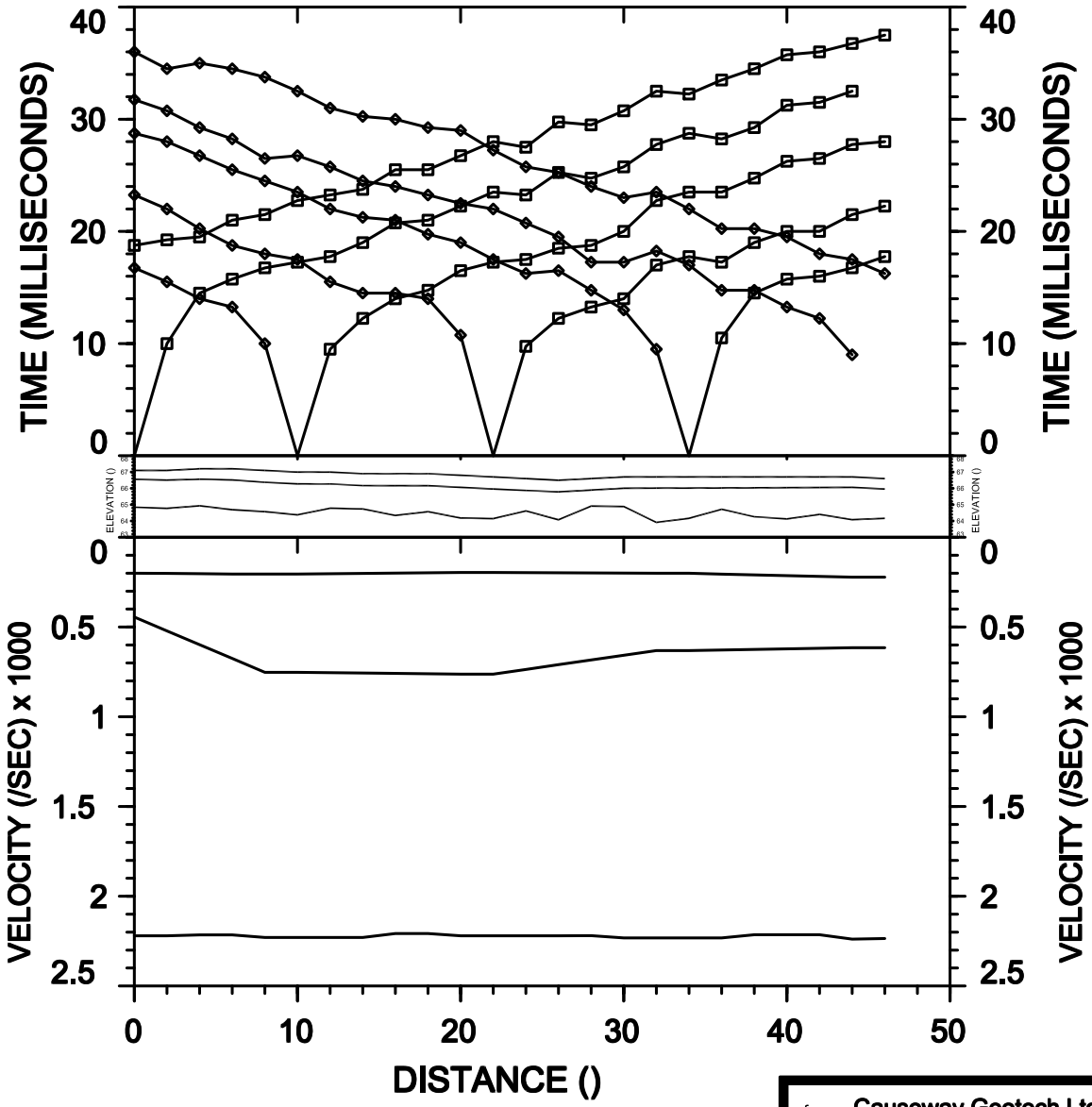


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS35	Date: 31/05/22	
Equipment: Geode	Spread: S35	Azimuth:

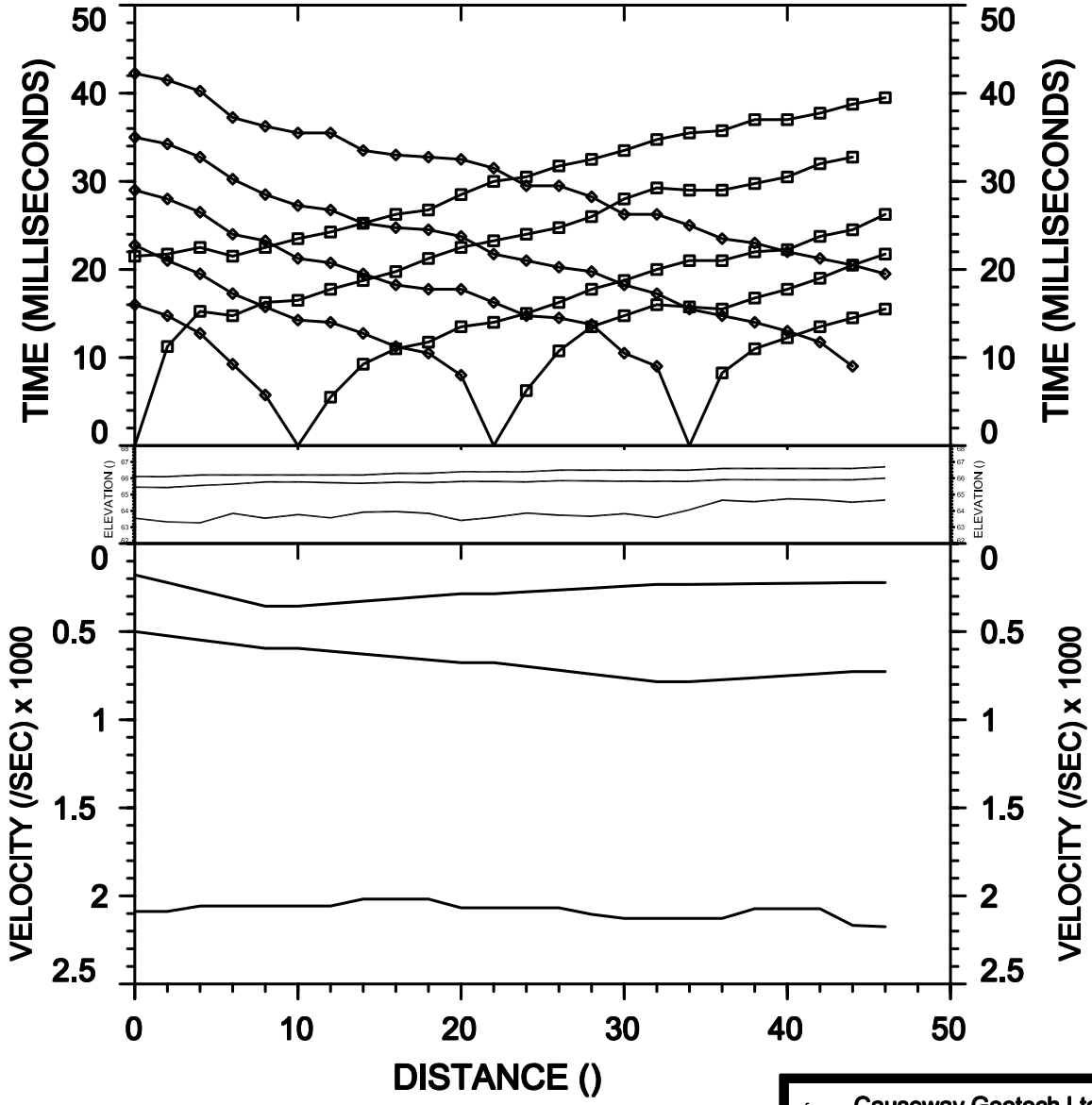


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS36 / Date: 31/05/22	
Equipment: Geode / Spread: S36	Azimuth:

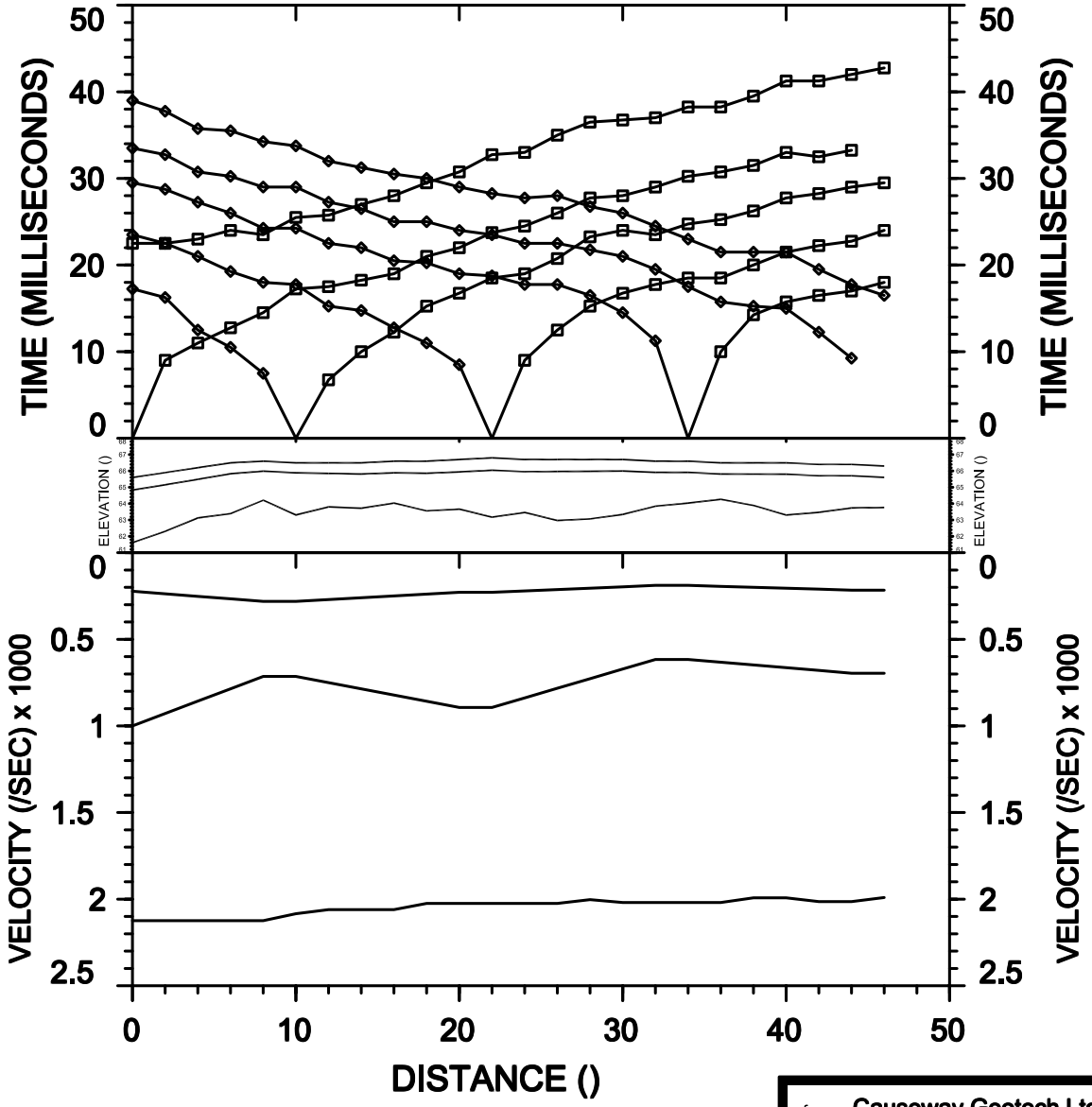


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS37 / Date: 31/05/22	
Equipment: Geode / Spread: S37	Azimuth:

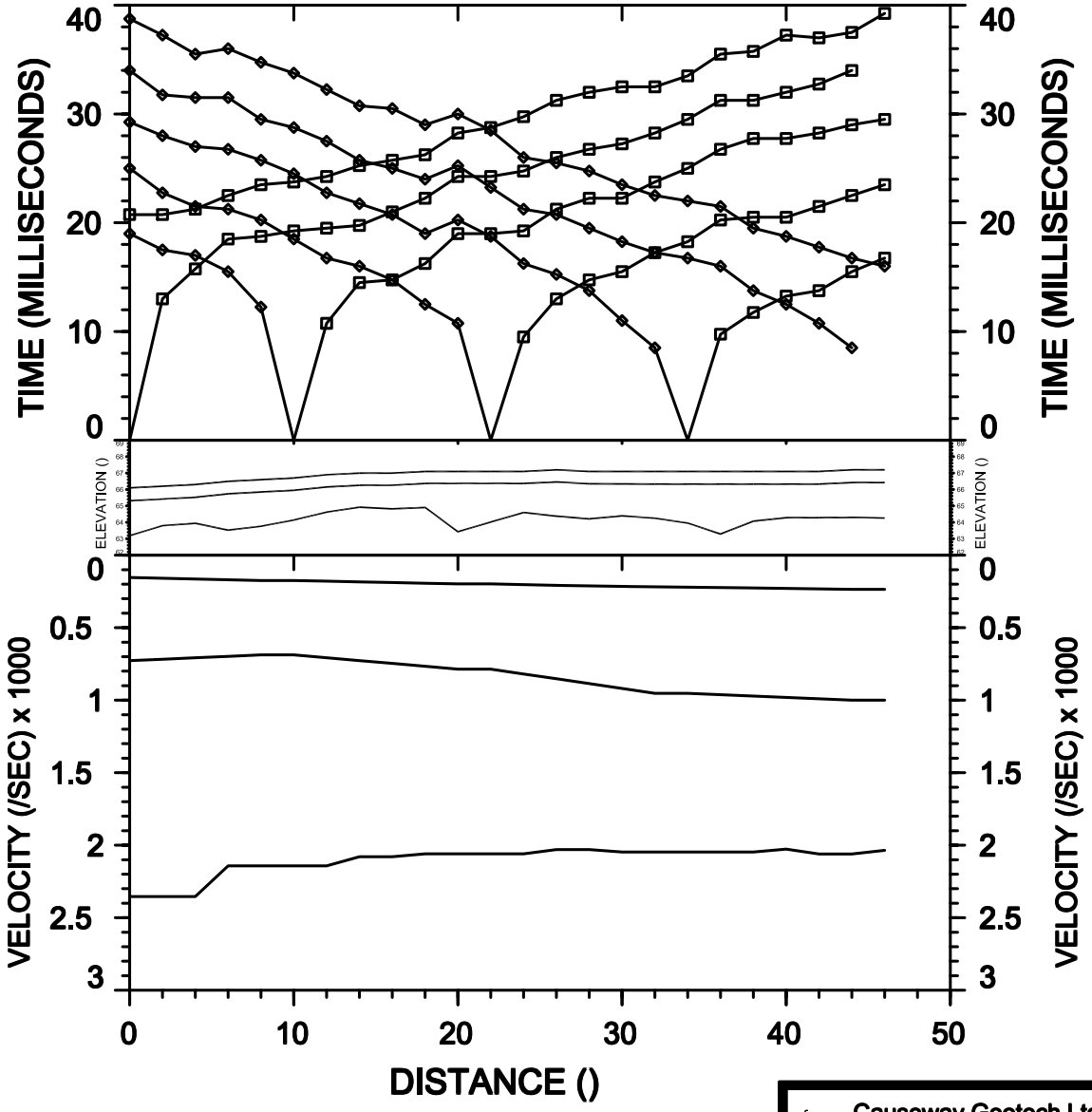


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS38 / Date: 31/05/22	
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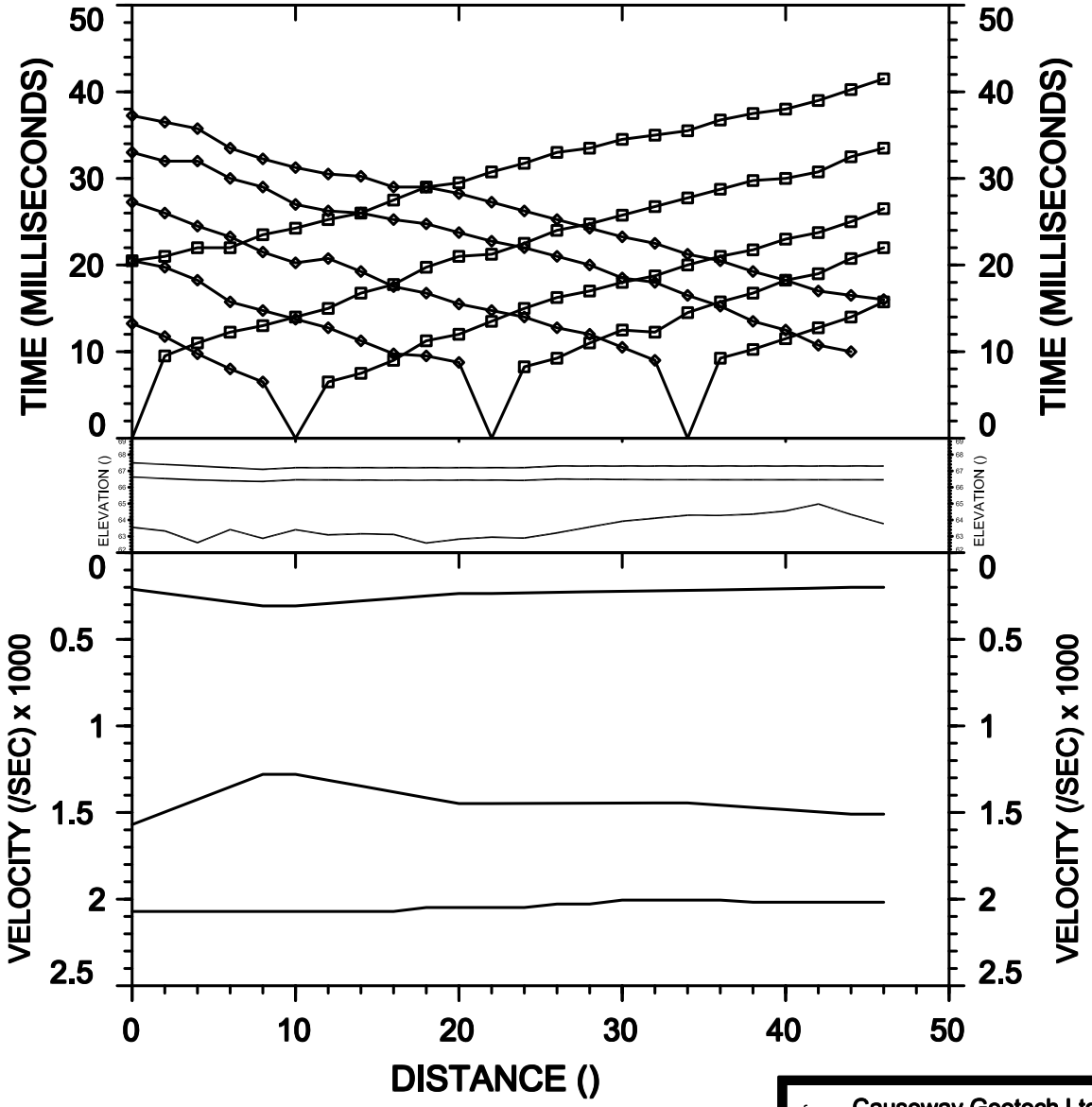


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS39 / Date: 31/05/22	
Equipment: Geode / Spread: S39	Azimuth:

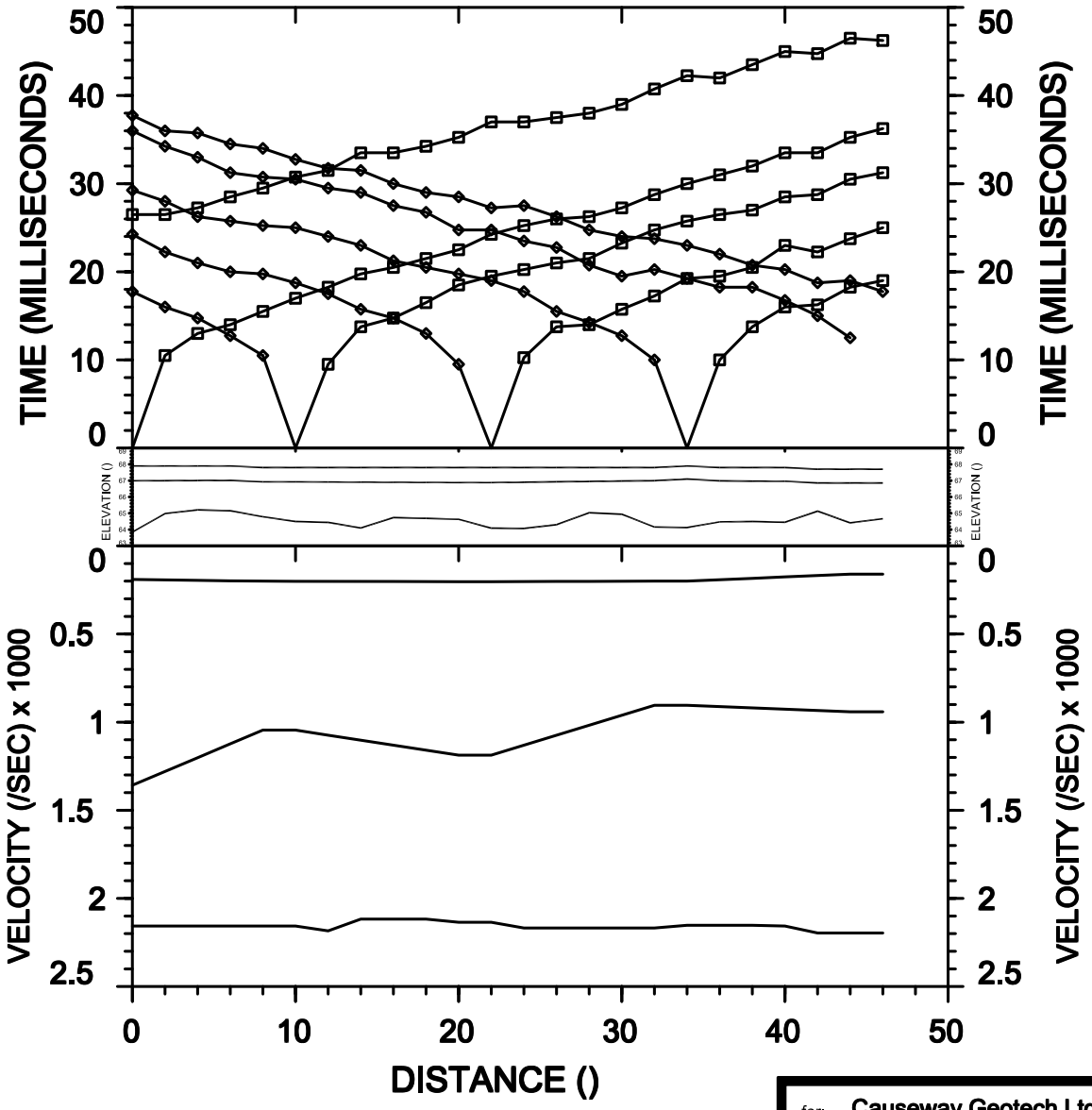


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS40 / Date: 31/05/22	
Equipment: Geode / Spread: S40	Azimuth:

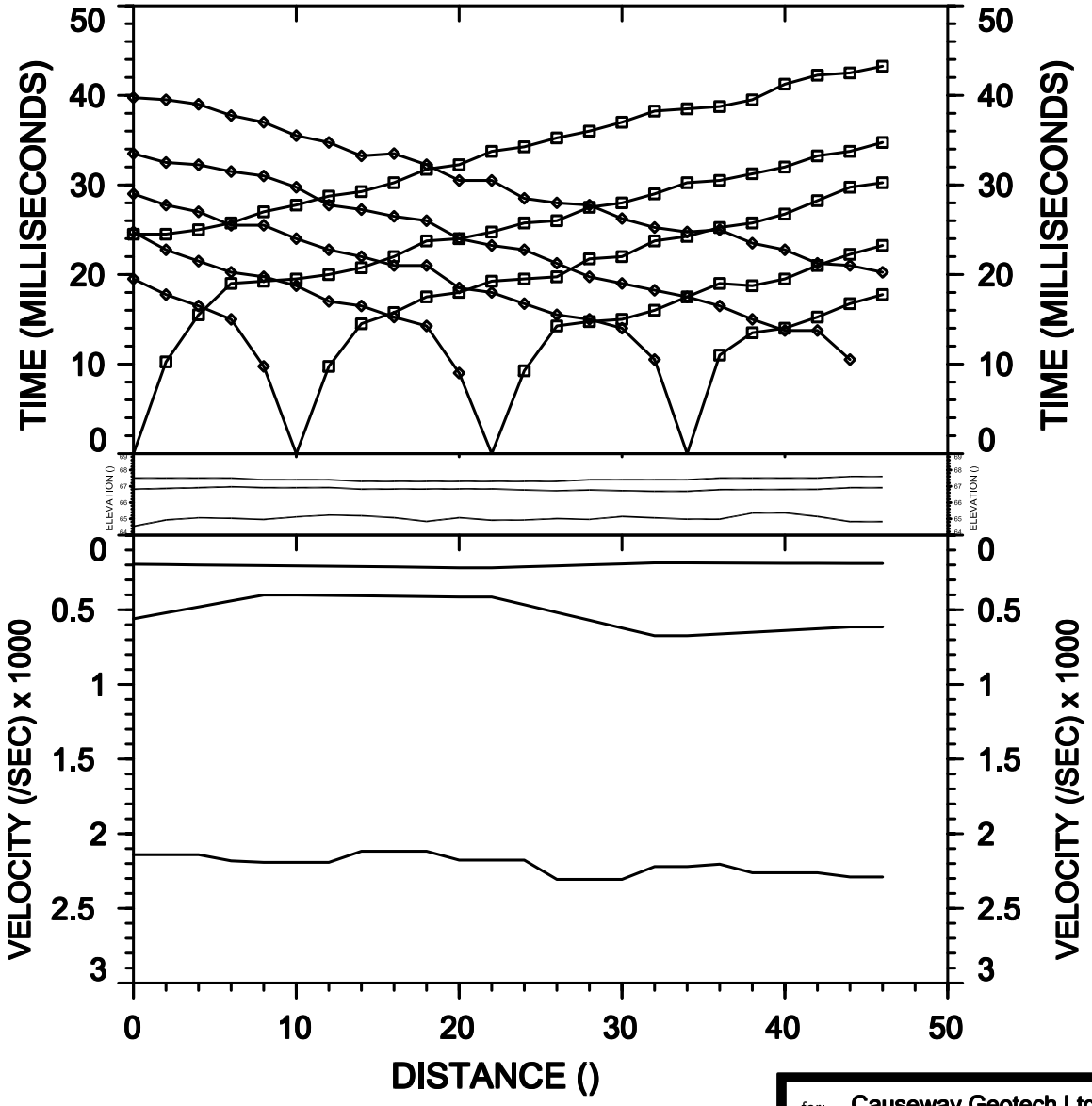


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS41 / Date: 31/05/22	
Equipment: Geode / Spread: S41	Azimuth:

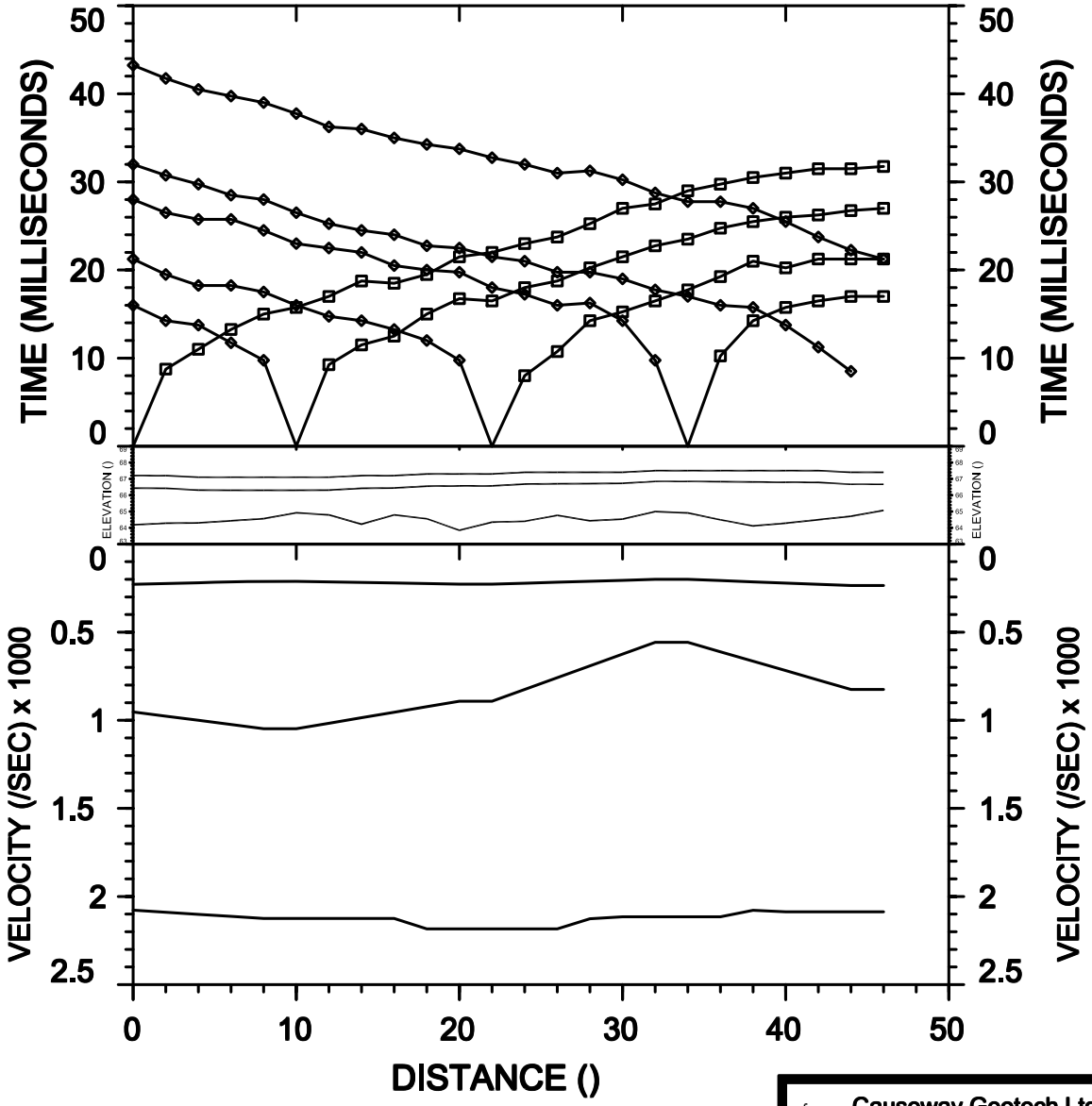


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS42 / Date: 31/05/22	
Equipment: Geode / Spread: S42	Azimuth:

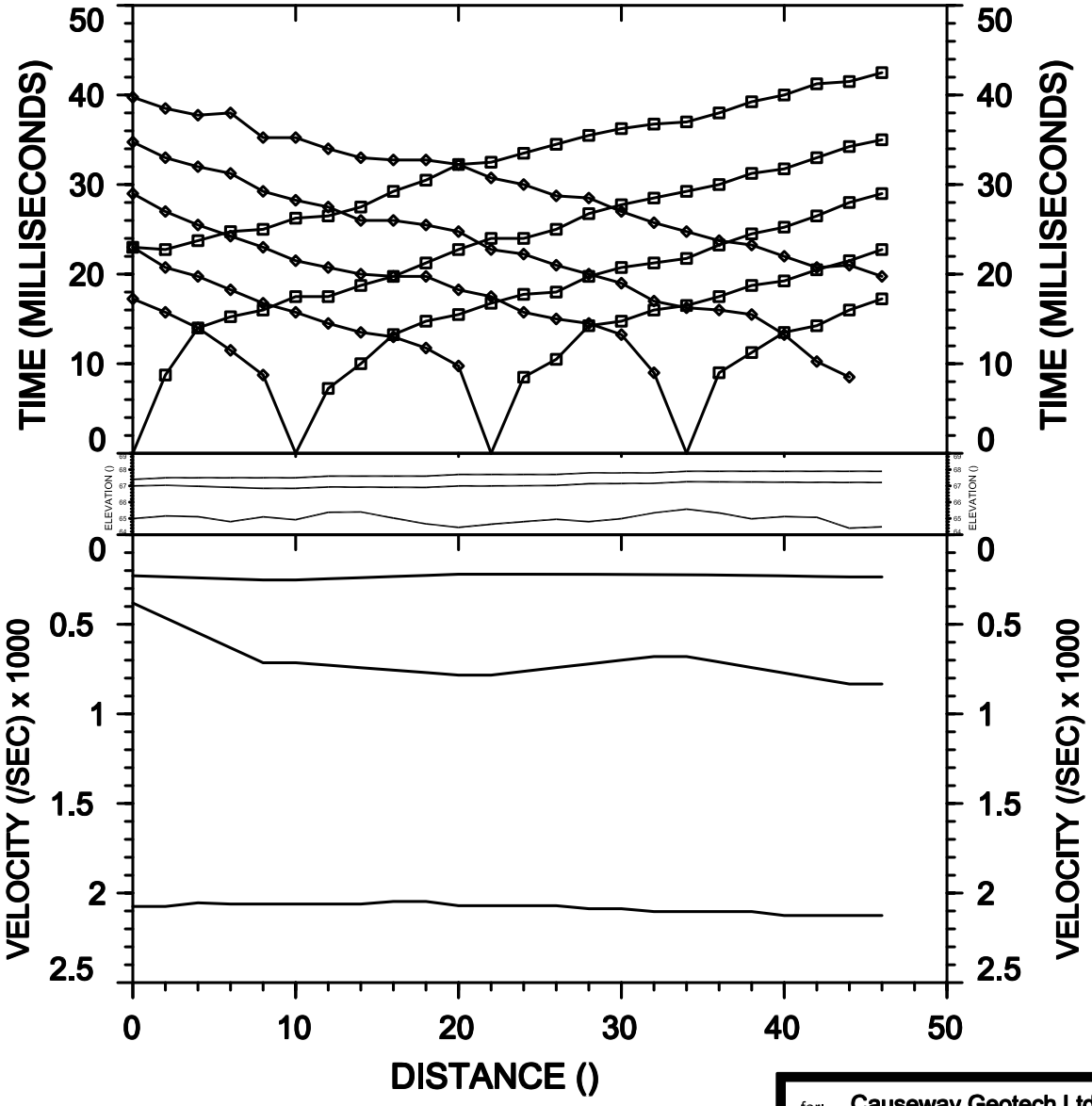


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS43	Date: 31/05/22	
Equipment: Geode	Spread: S43	Azimuth:

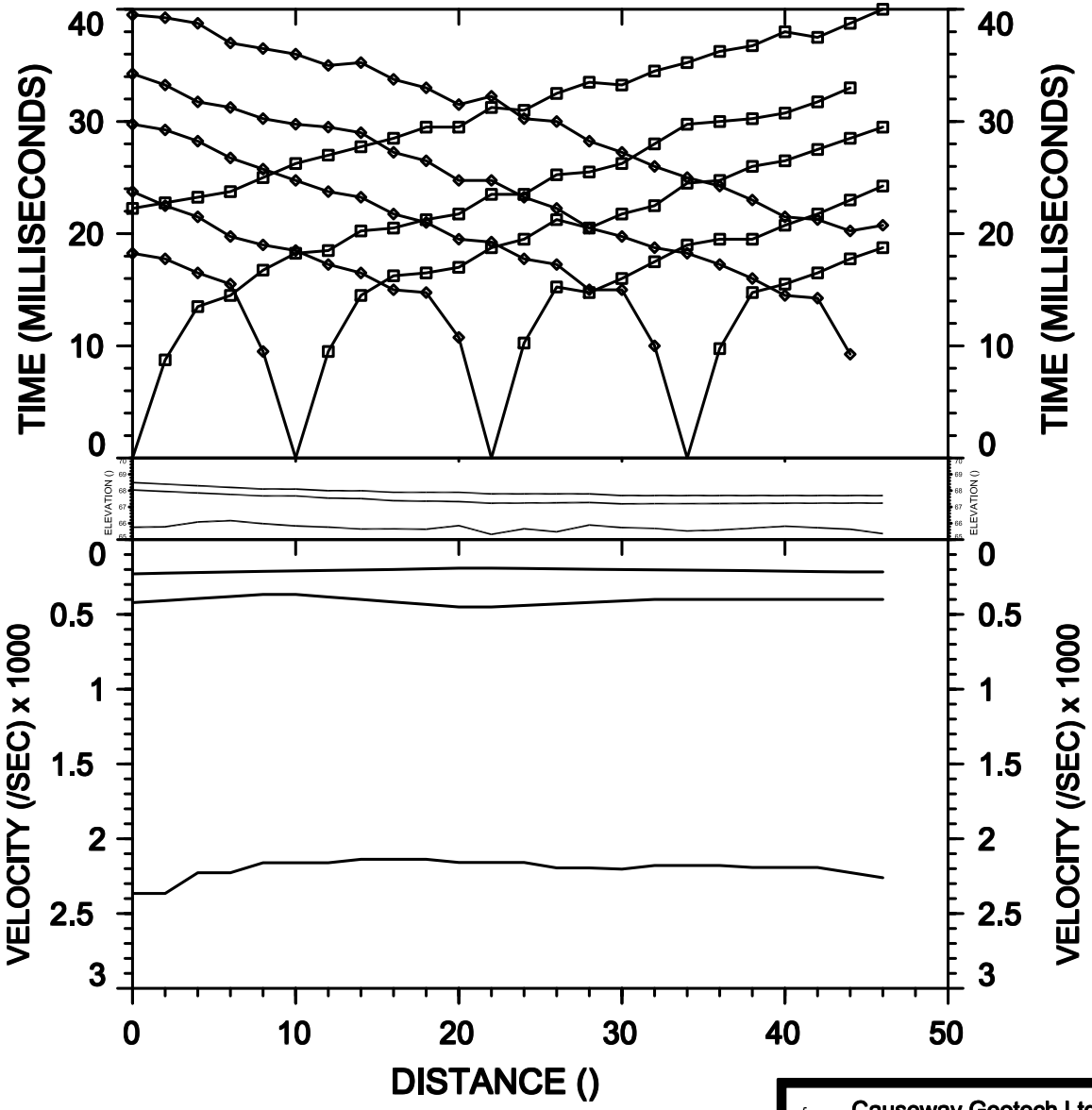


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS44	Date: 01/06/22	
Equipment: Geode	Spread: S44	Azimuth:

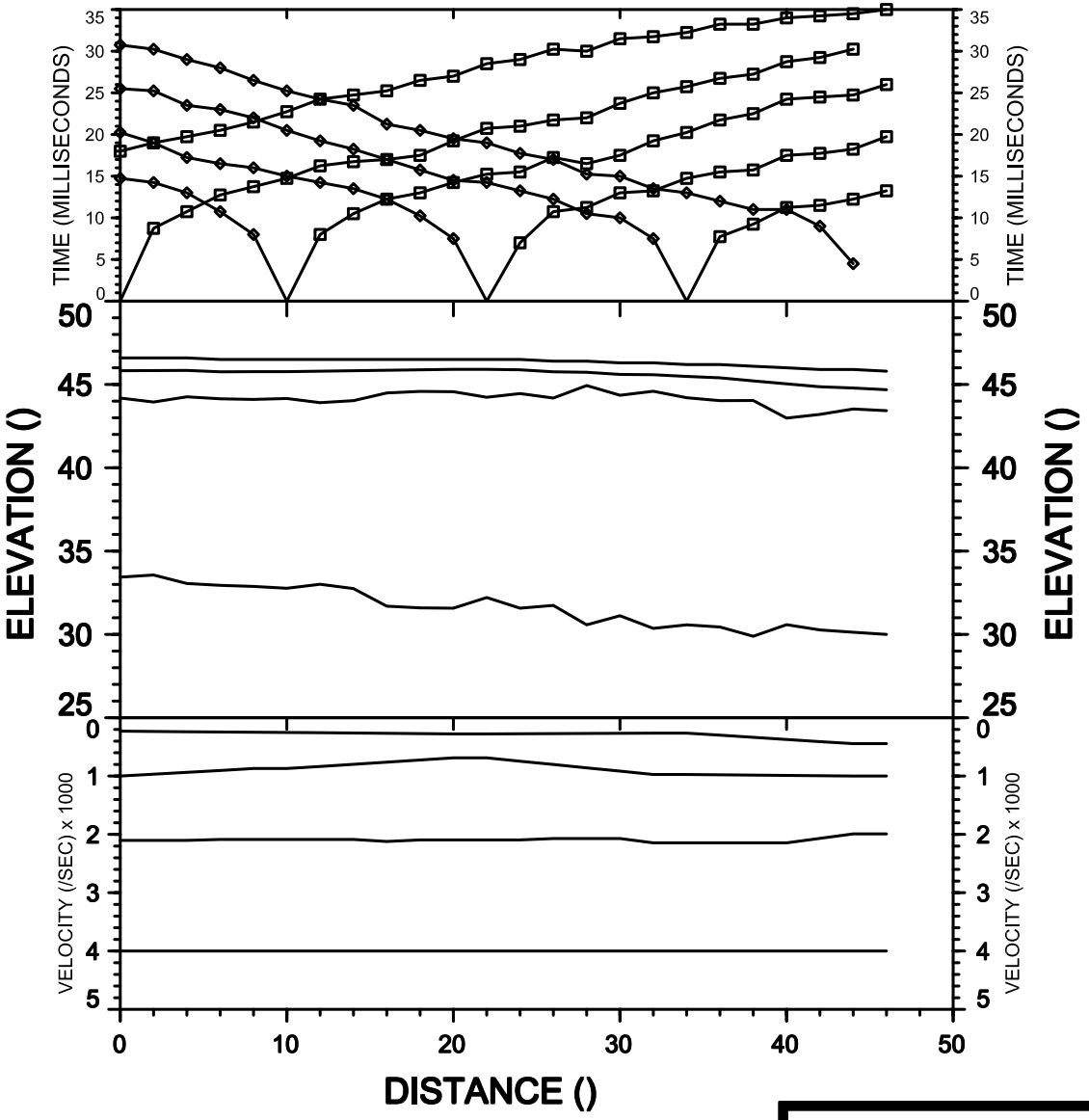


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS45R / Date: 01/06/22	
Equipment: Geode / Spread: S45	Azimuth:

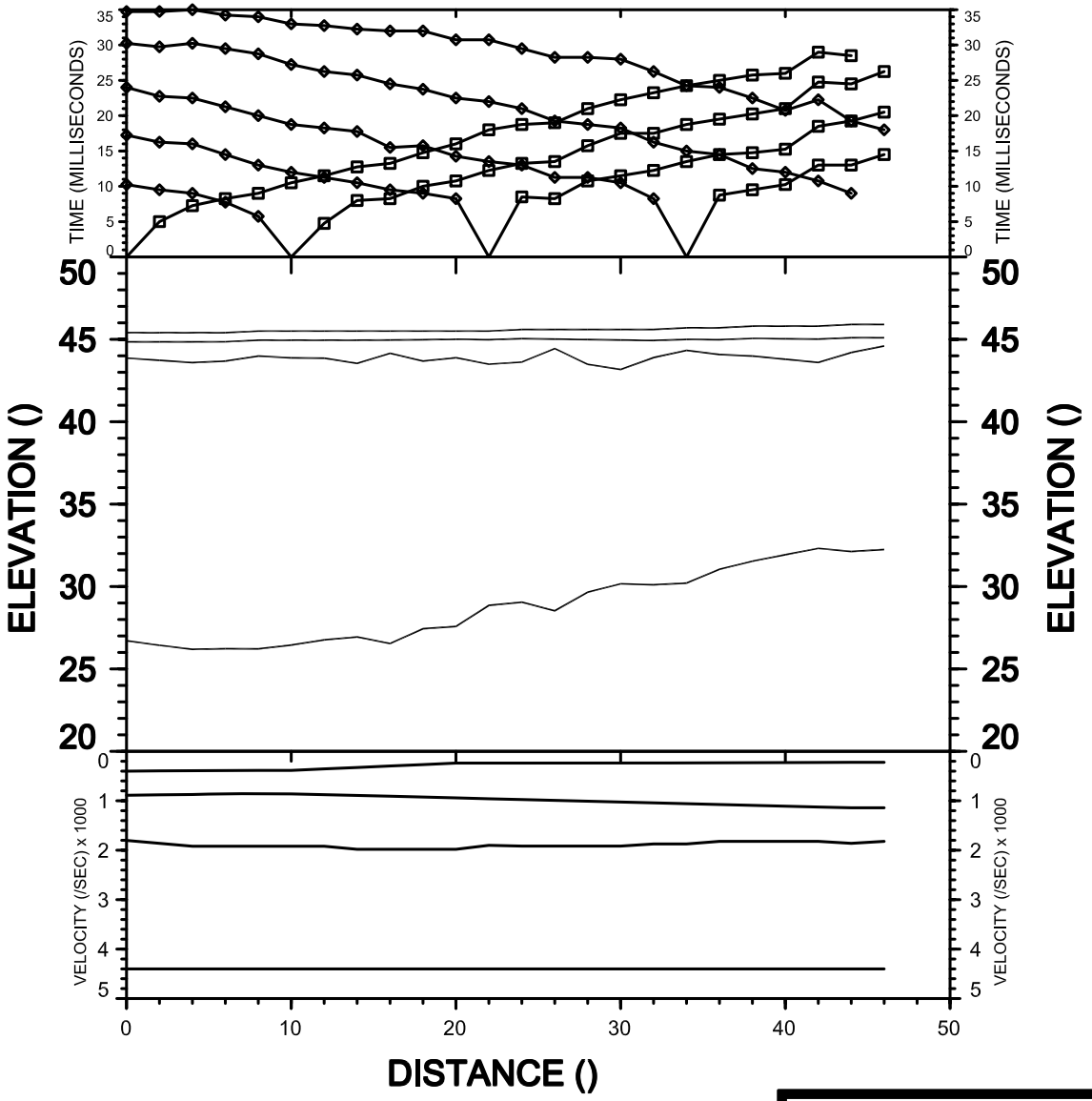


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS46 / Date: 01/06/22	
Equipment: Geode / Spread: S46	Azimuth:

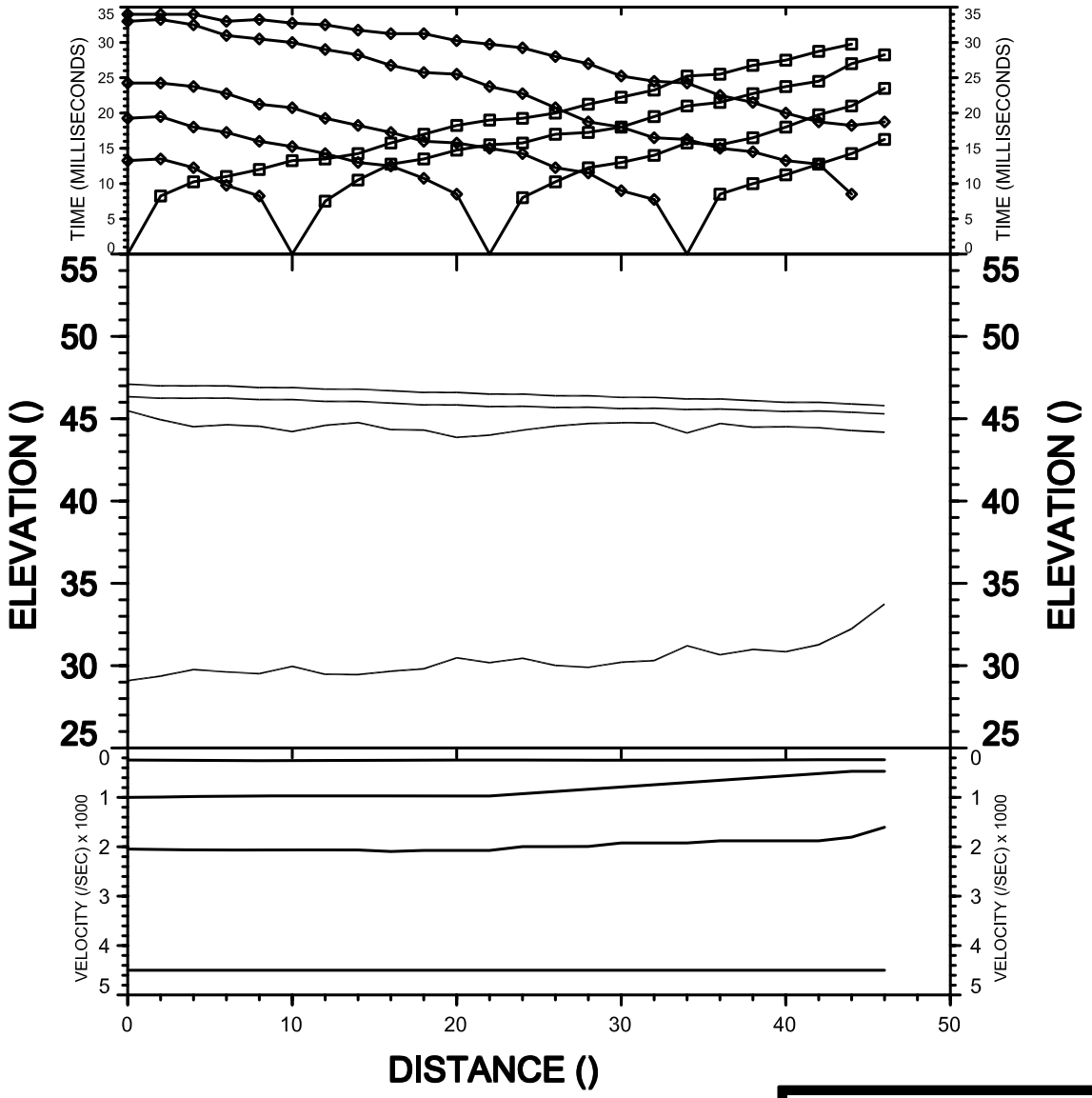


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS47 / Date: 01/06/22	
Equipment: Geode / Spread: S47	Azimuth:

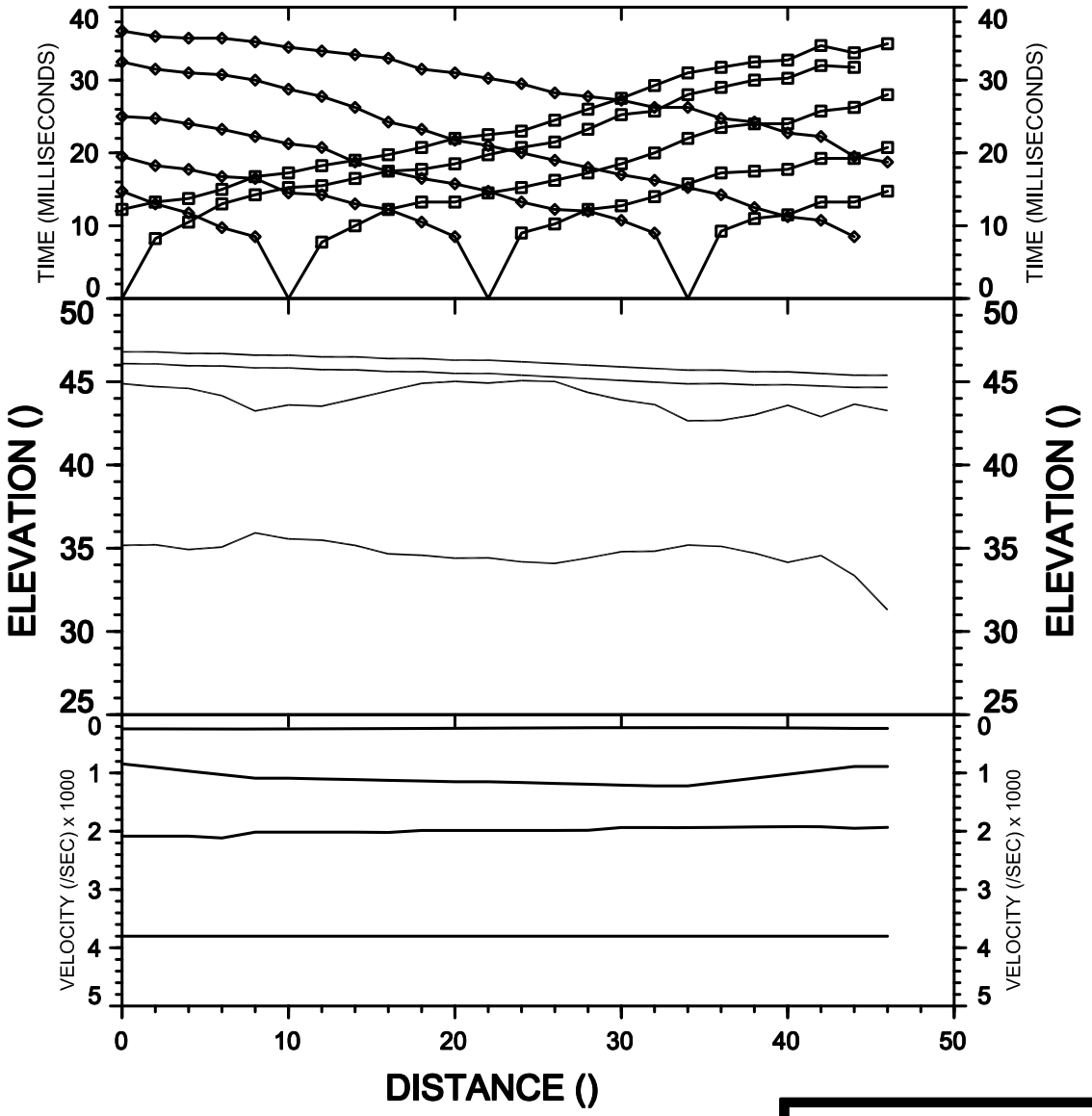


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS48 / Date: 01/06/22	
Equipment: Geode / Spread: S48	Azimuth:

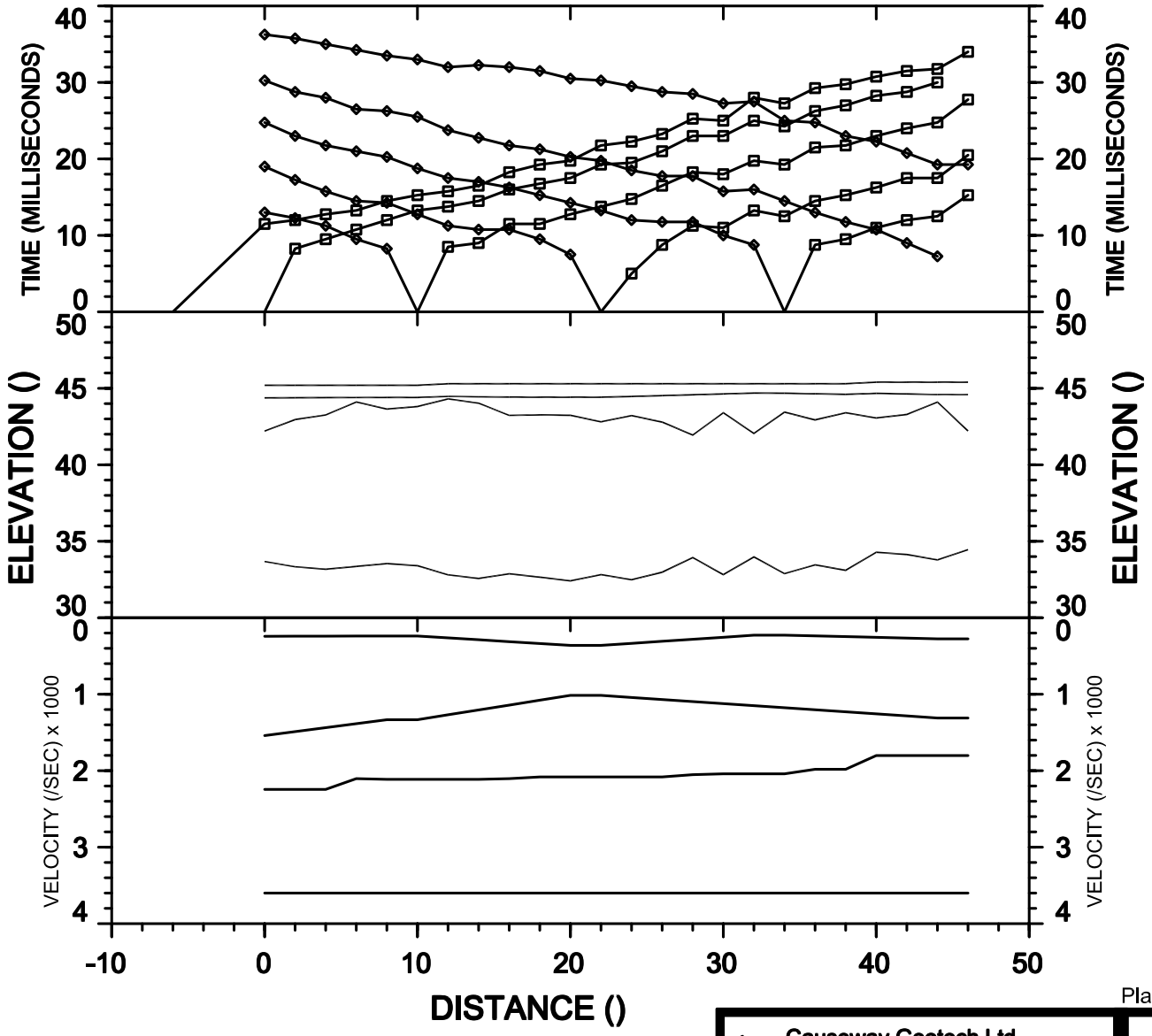


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS49 / Date: 01/06/22	
Equipment: Geode / Spread: S49	Azimuth:

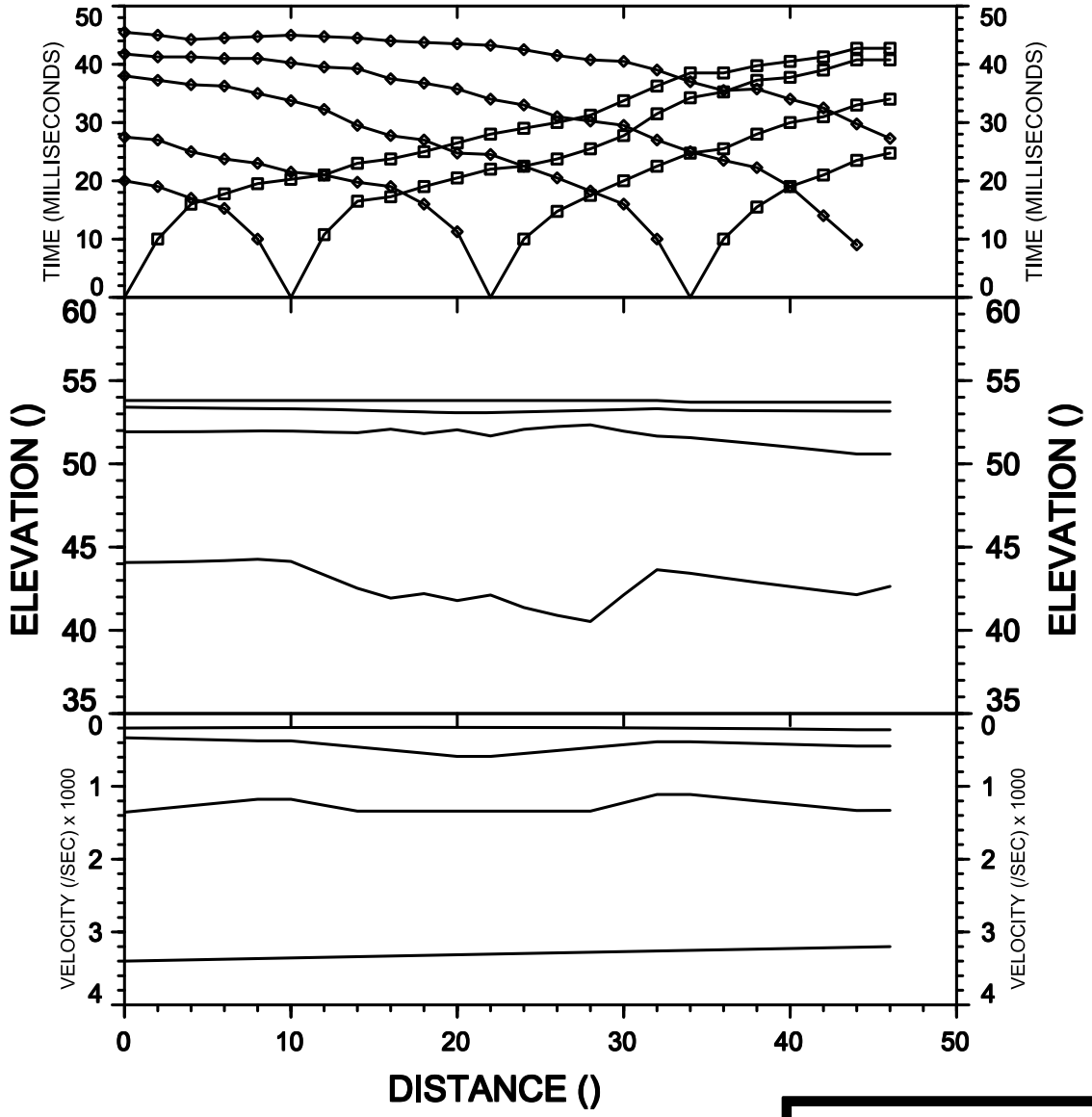


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS50R / Date: 01/06/22	
Equipment: Geode / Spread: S50	Azimuth:

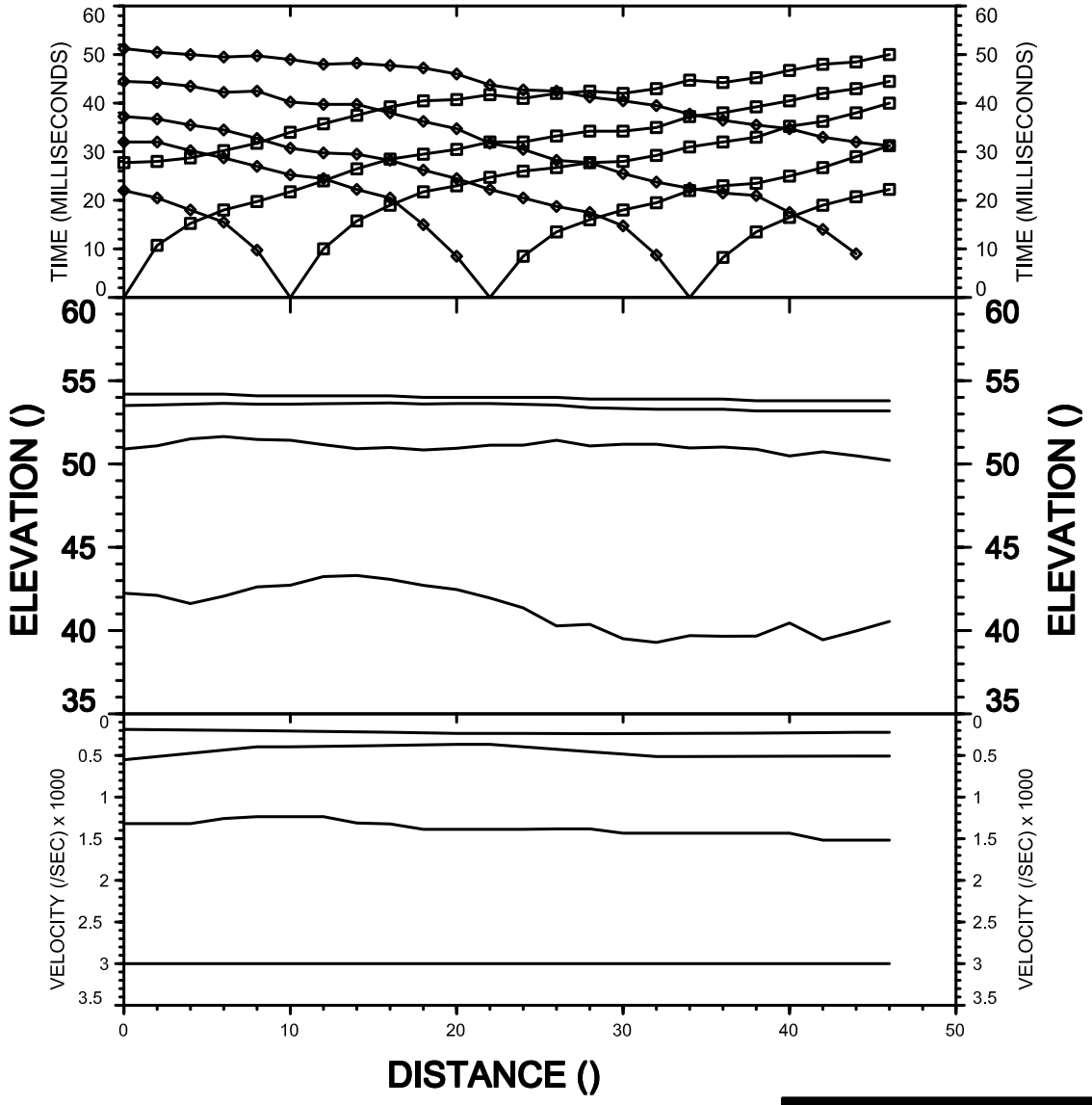


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS51R / Date: 01/06/22	
Equipment: Geode / Spread: S51	Azimuth:

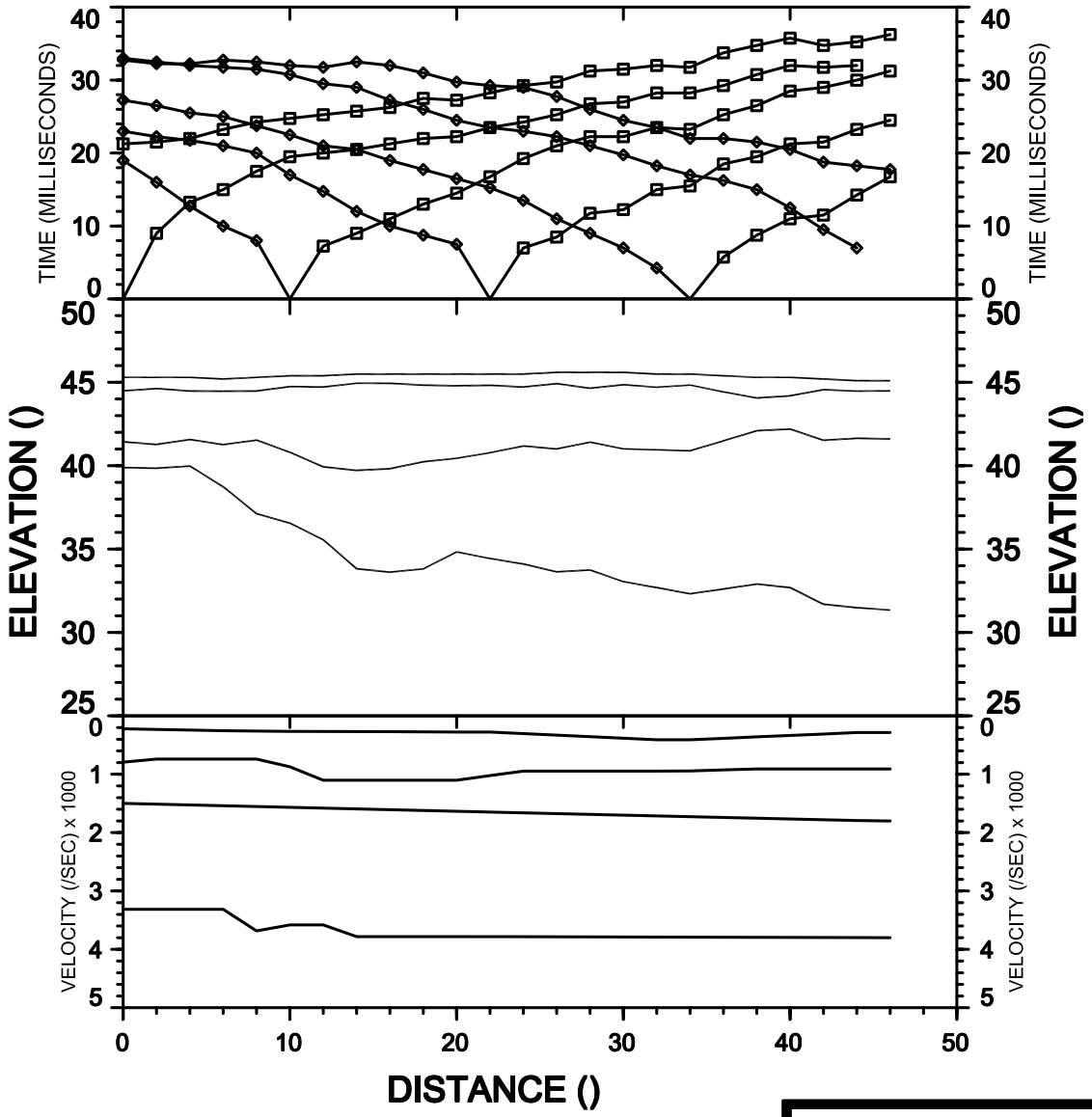


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS52 / Date: 02/06/22	
Equipment: Geode / Spread: S52	Azimuth:

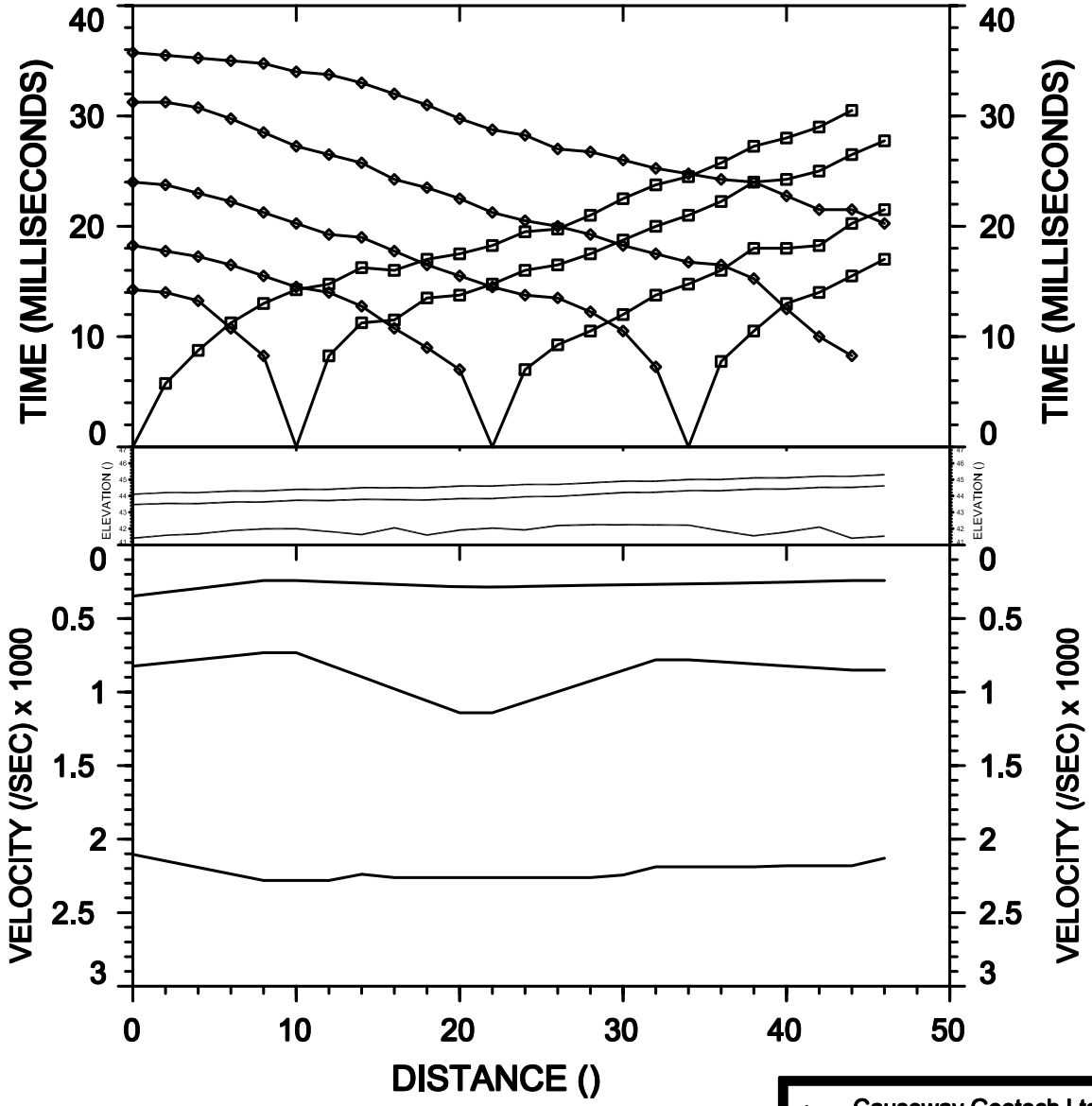


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS53 / Date: 02/06/22	
Equipment: Geode / Spread: S53	Azimuth:

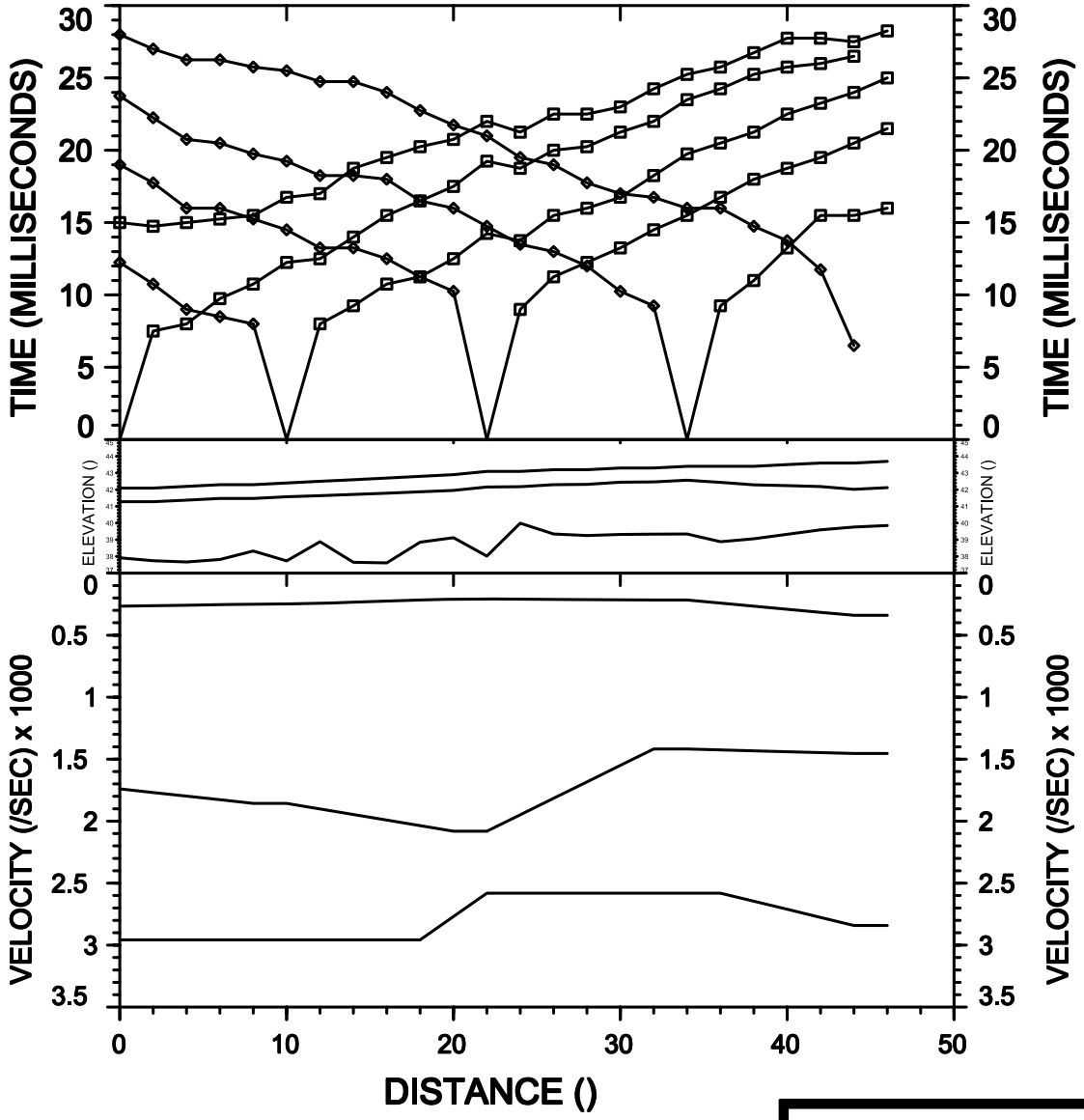


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS54R	Date: 02/06/22	
Equipment: Geode	Spread: S54	Azimuth:

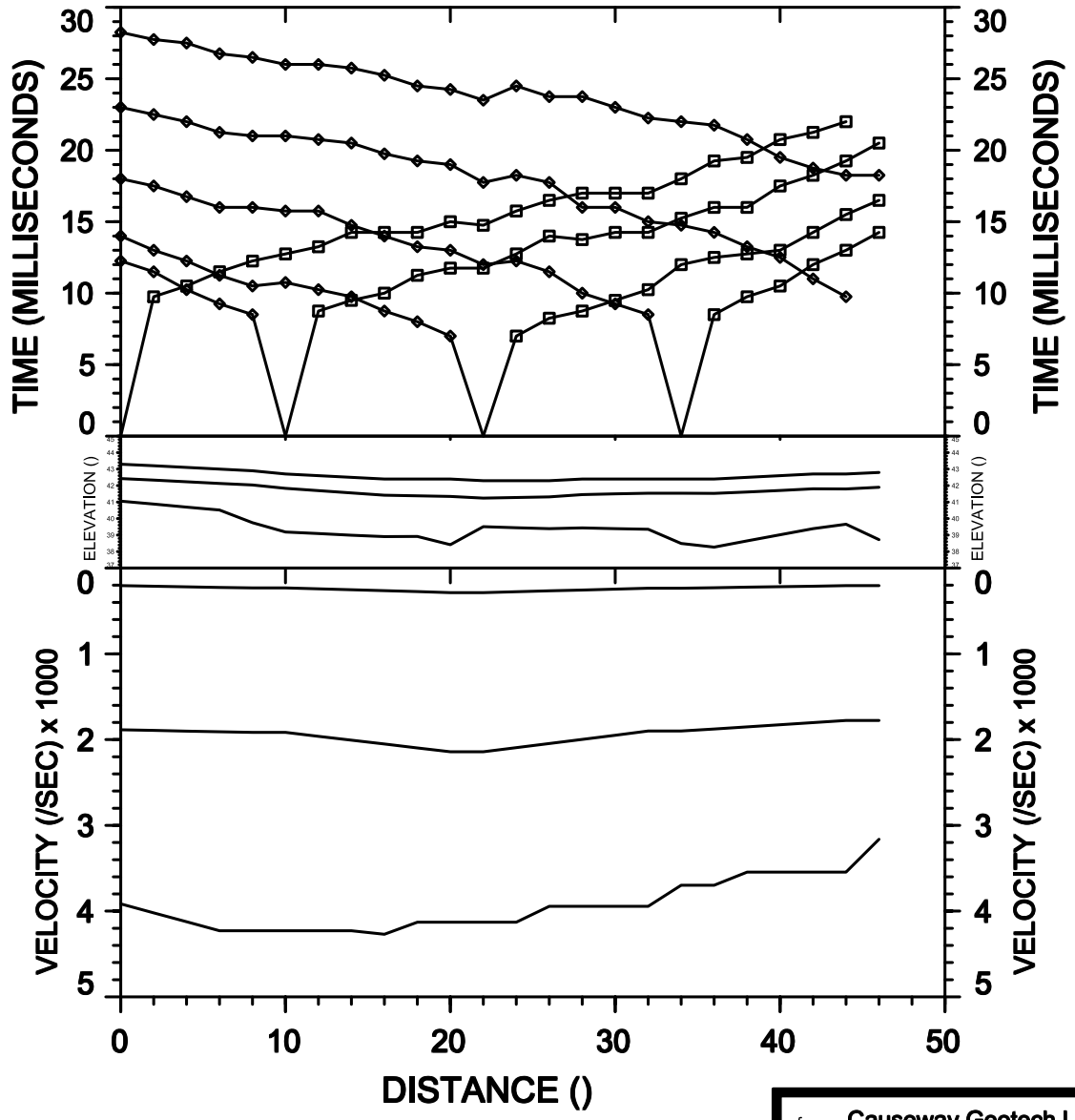


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS55R / Date: 02/06/22	
Equipment: Geode / Spread: S55	Azimuth:

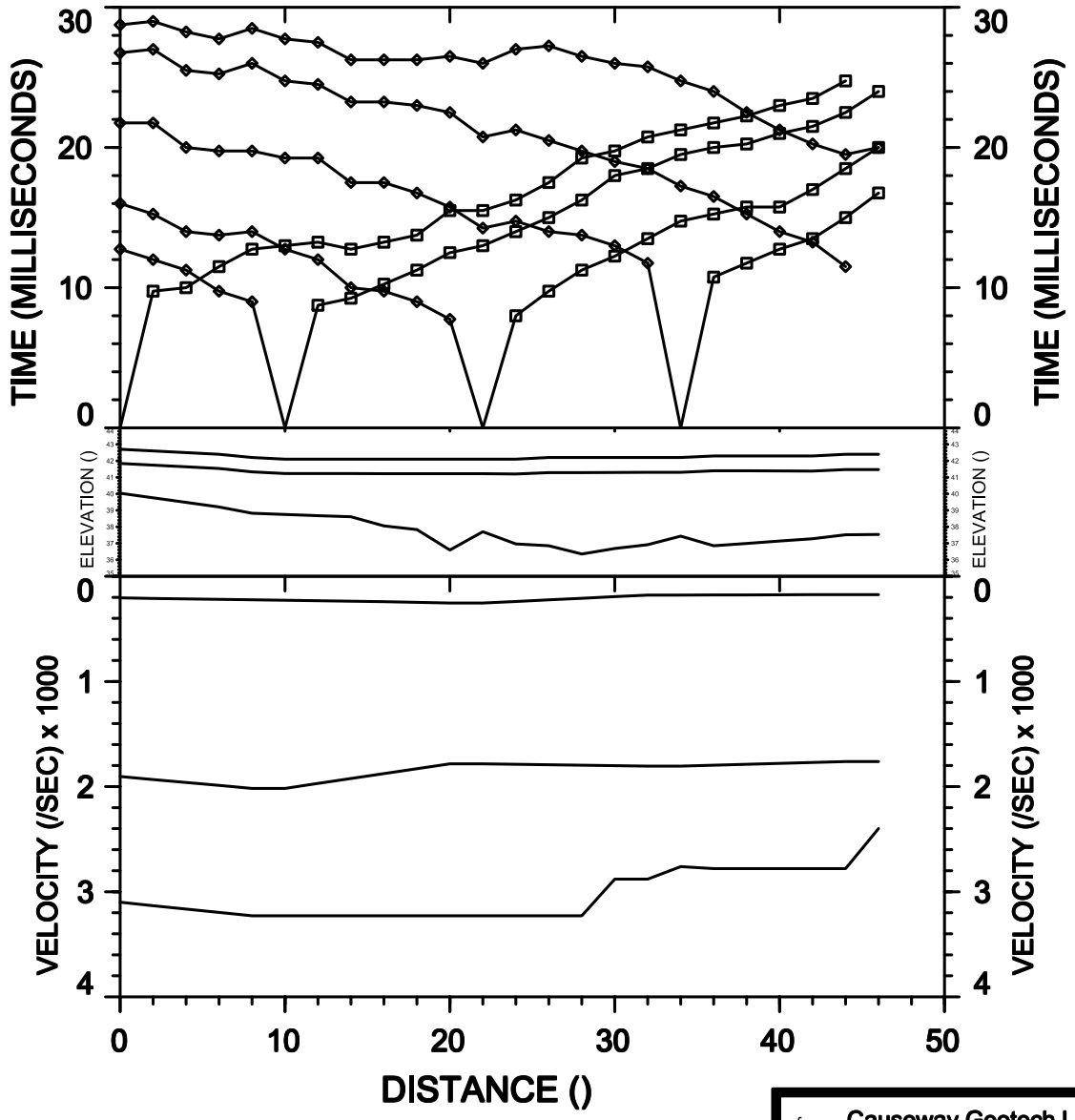


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS56R	Date: 02/06/22
Equipment: Geode	Spread: S56
	Azimuth:

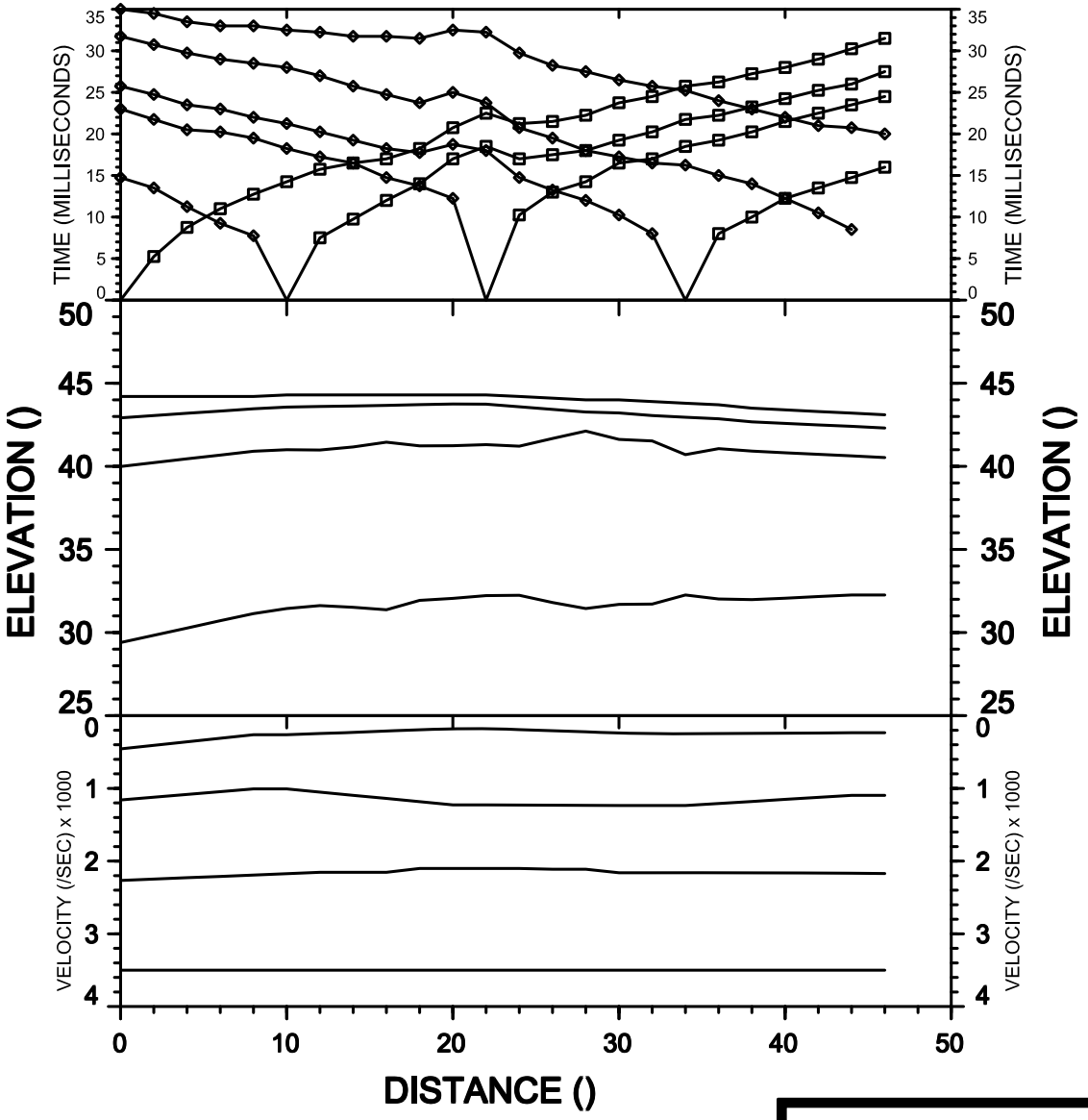


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS57R / Date: 02/06/22	
Equipment: Geode / Spread: S57	Azimuth:

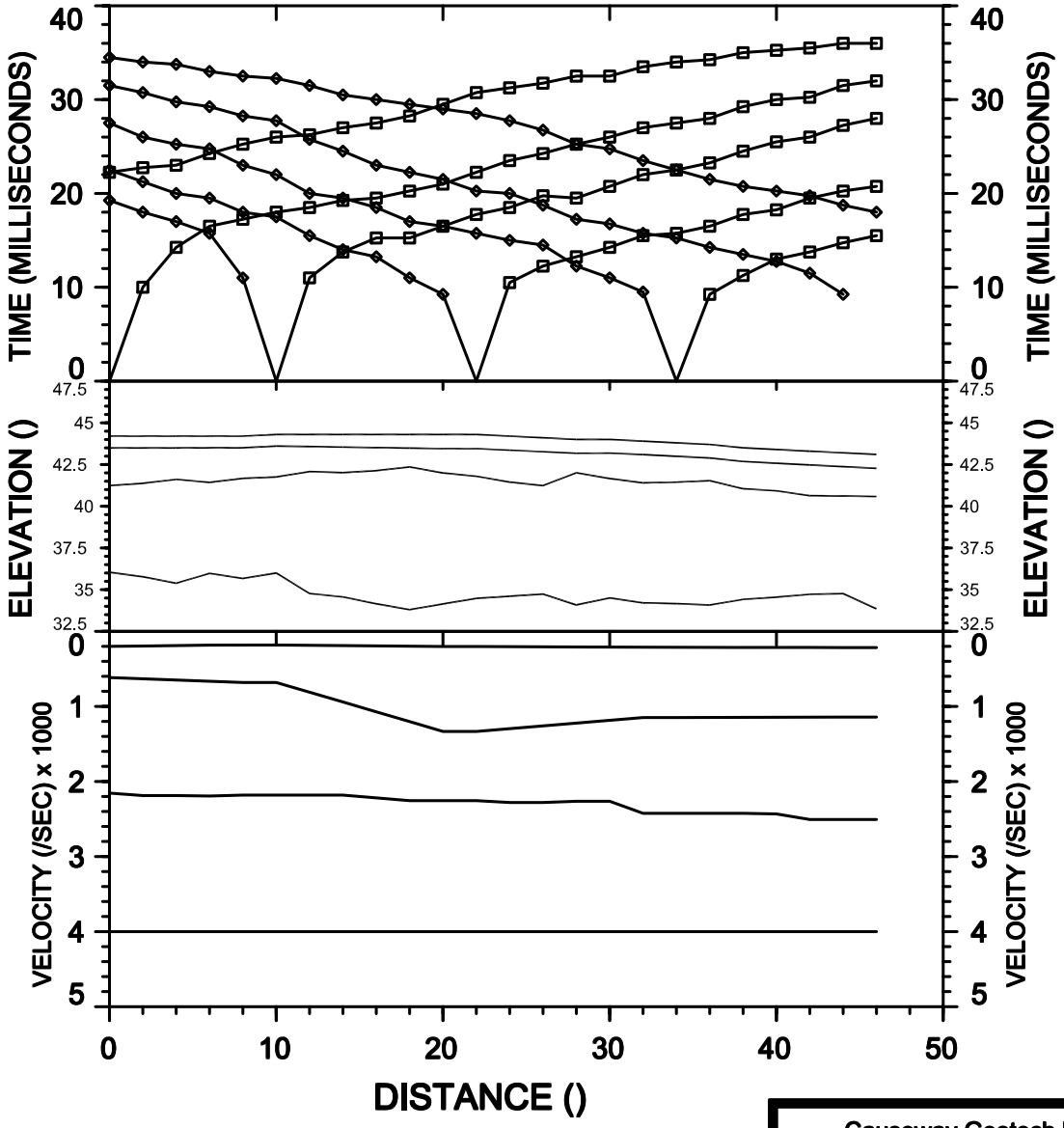


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS58 / Date: 02/06/22	
Equipment: Geode / Spread: S58	Azimuth:

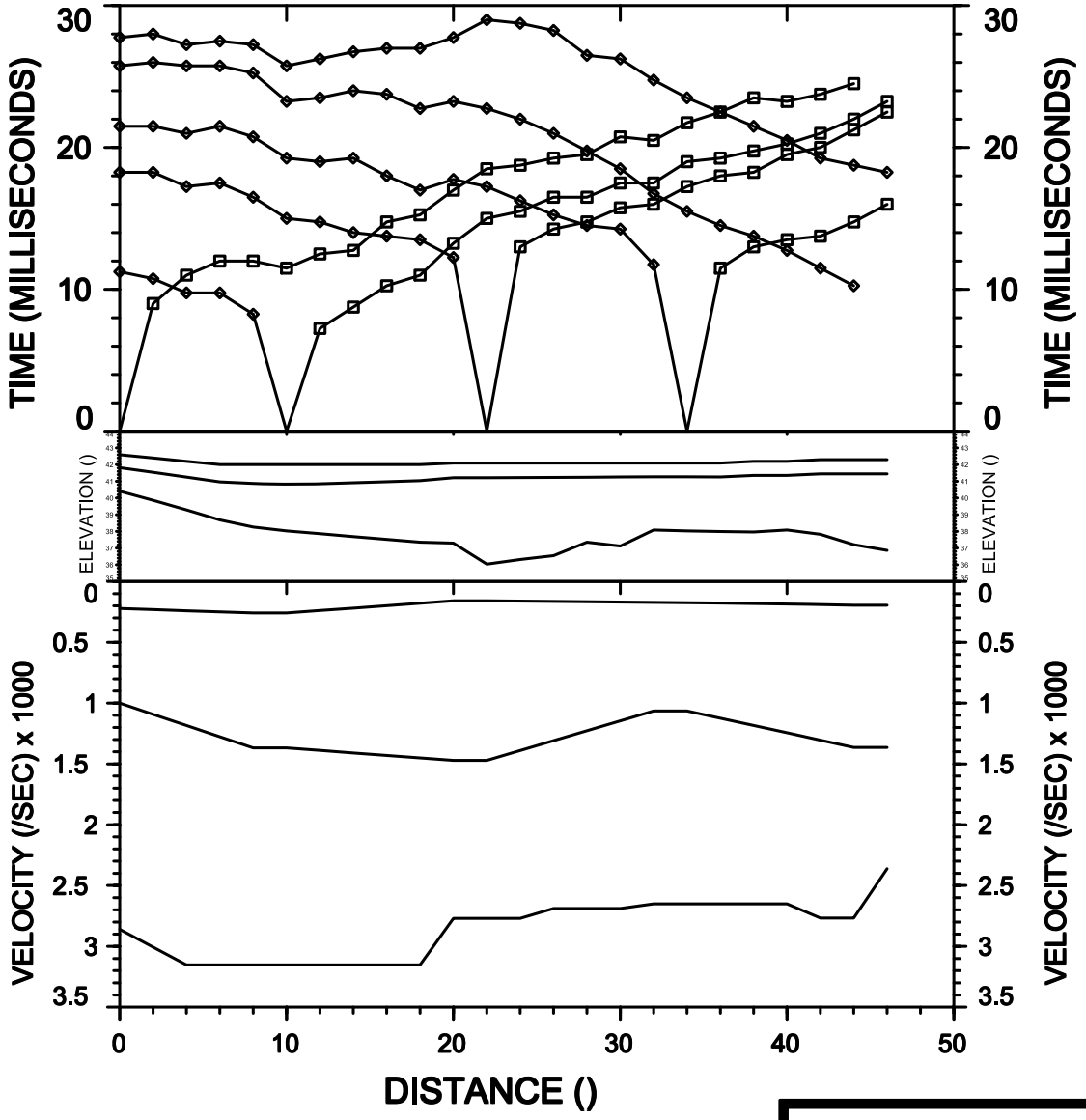


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS59R / Date: 02/06/22	
Equipment: Geode / Spread: S59	Azimuth:

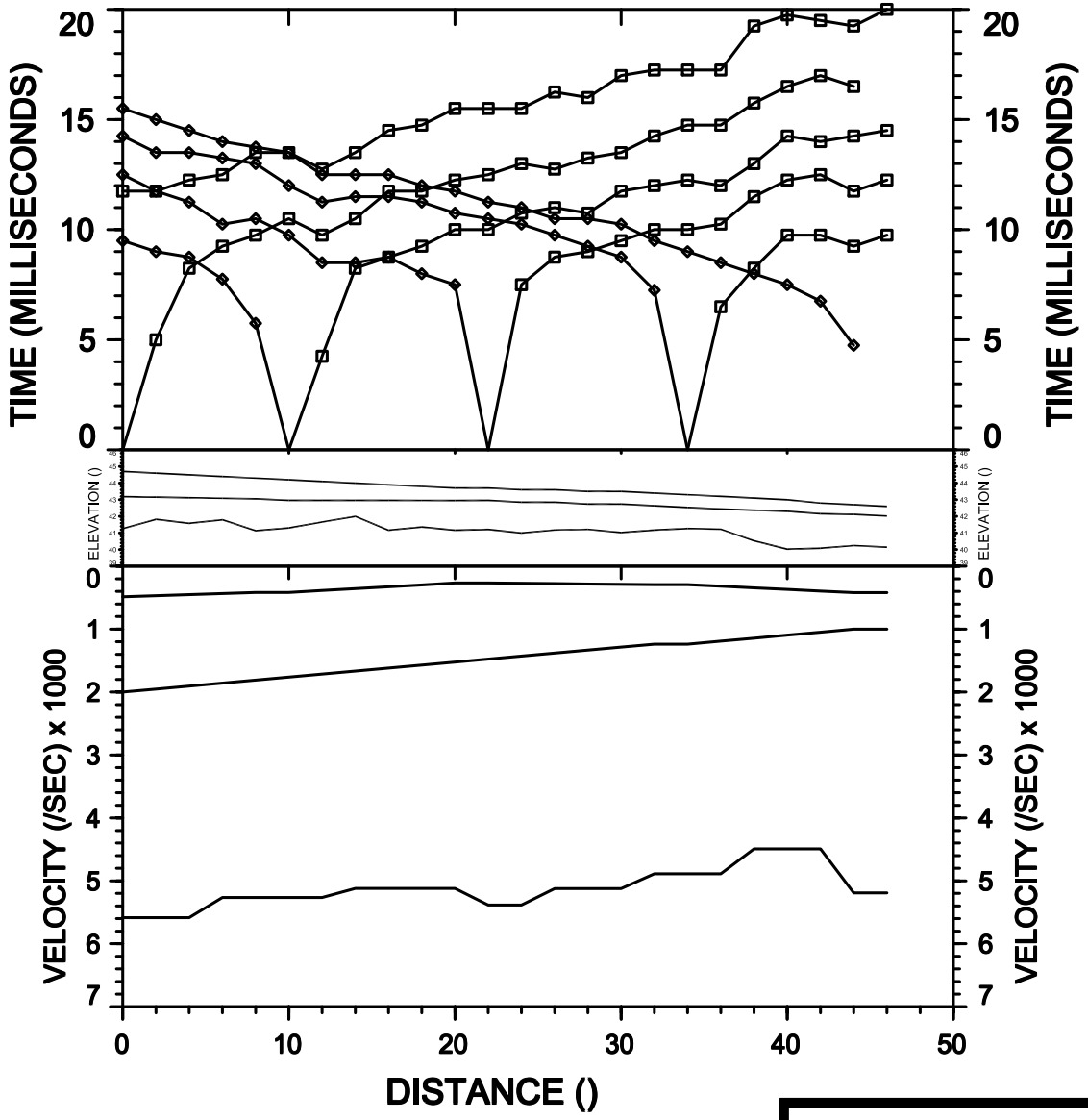


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS60 / Date: 02/06/22	
Equipment: Geode / Spread: S60	Azimuth:

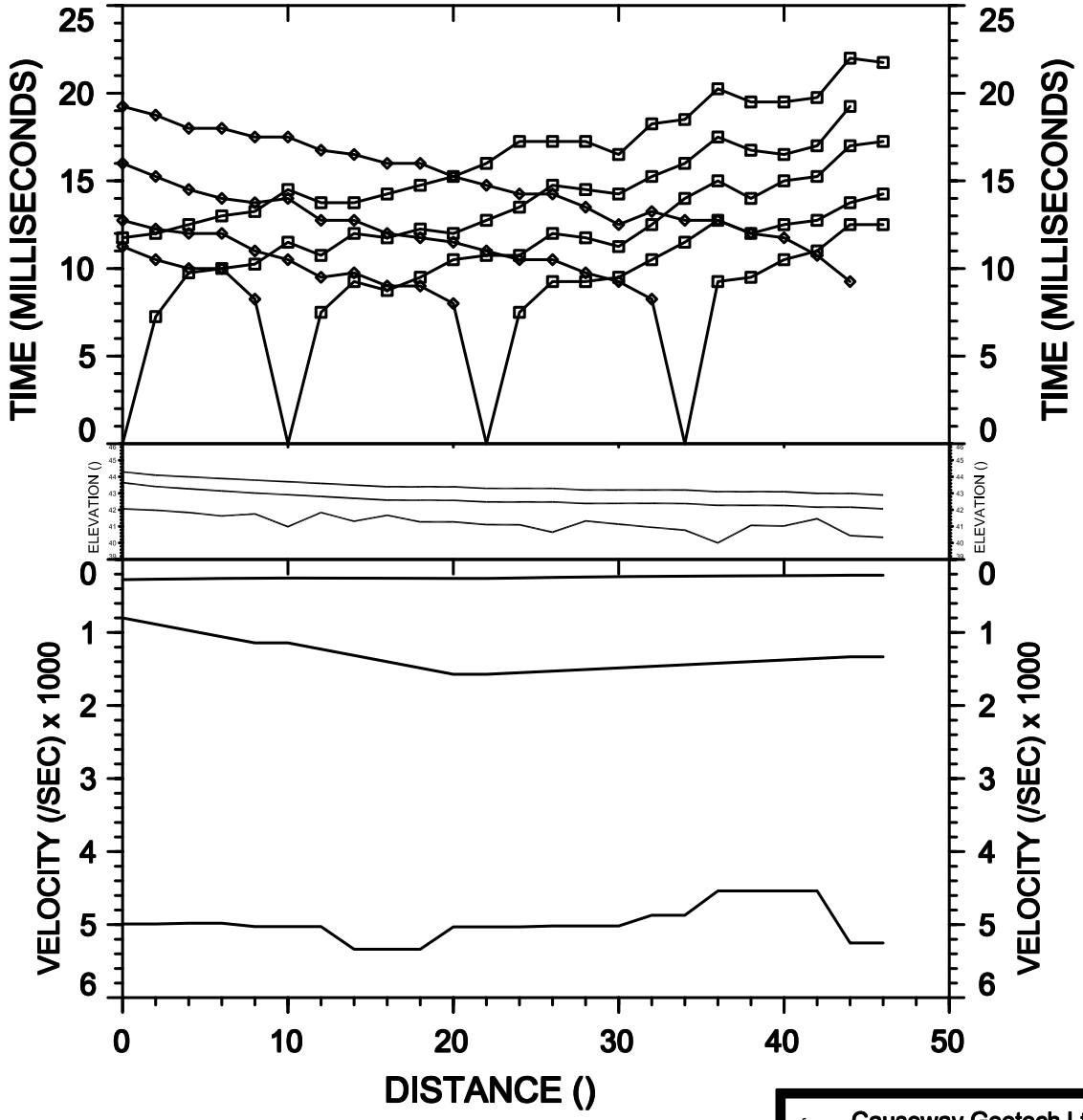


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS61 / Date: 02/06/22	
Equipment: Geode / Spread: S61	Azimuth:

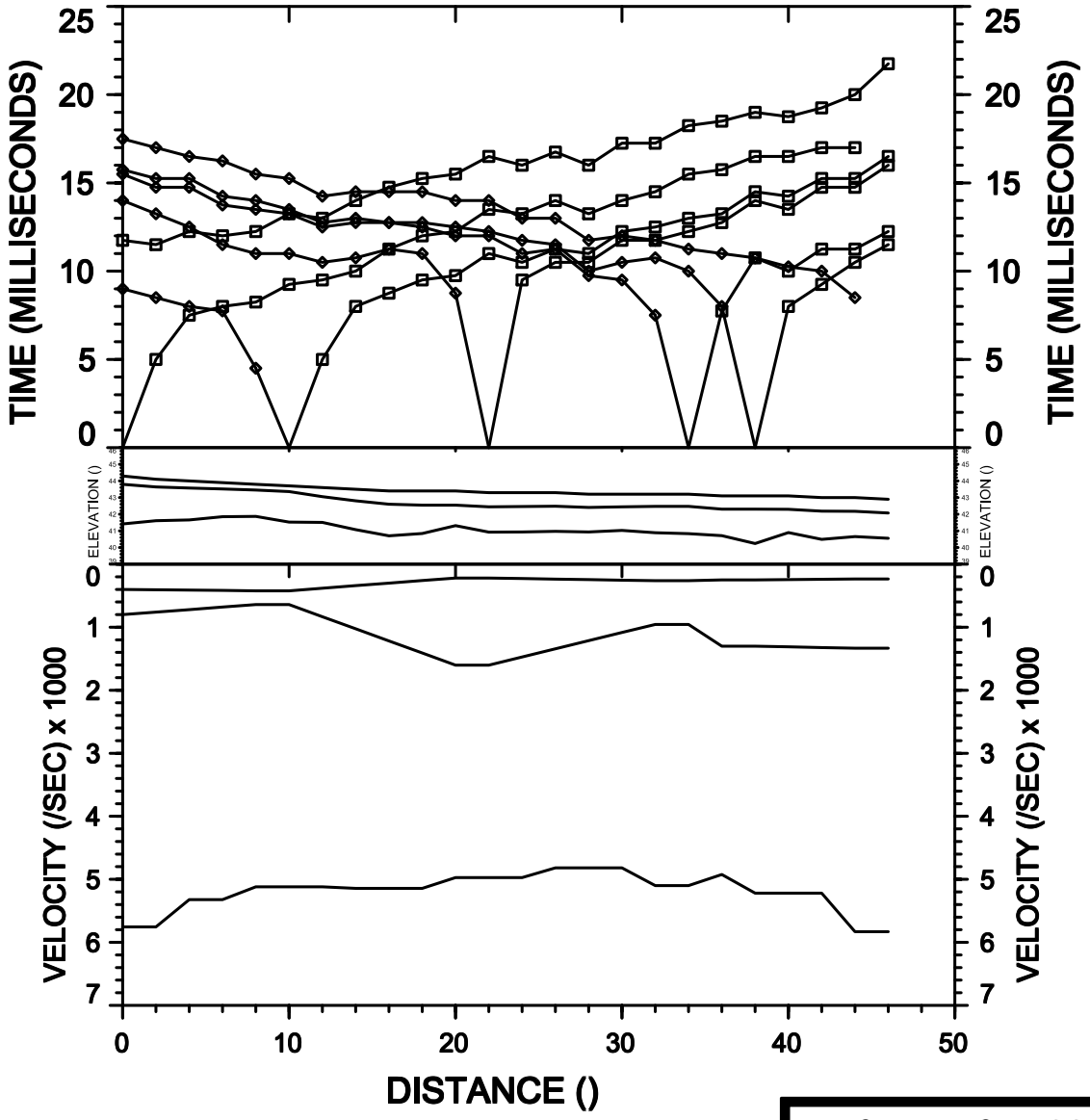


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS62R	Date: 02/06/22
Equipment: Geode	Spread: S62
	Azimuth:

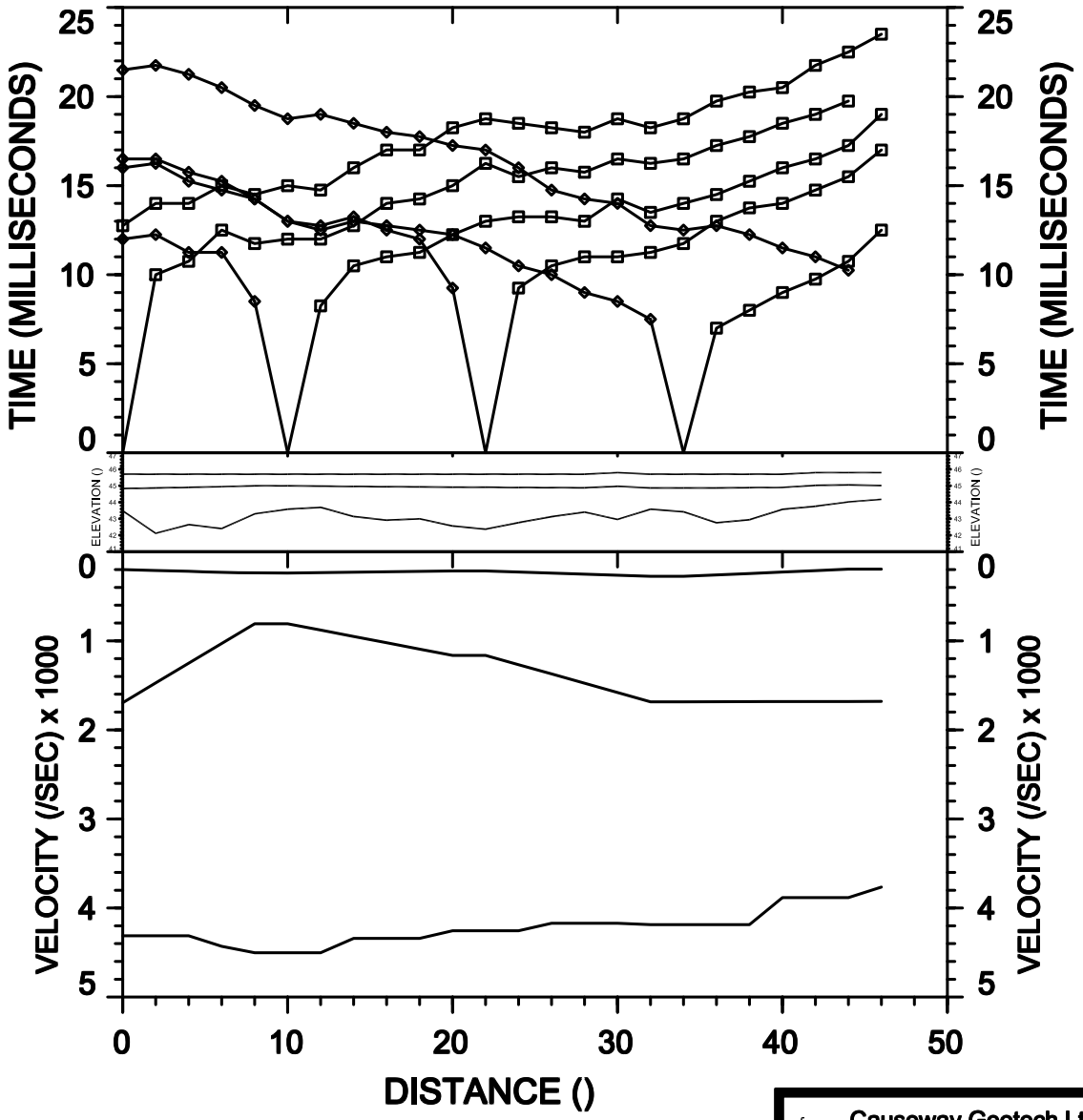


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS63 / Date: 03/06/22	
Equipment: Geode / Spread: S63	Azimuth:

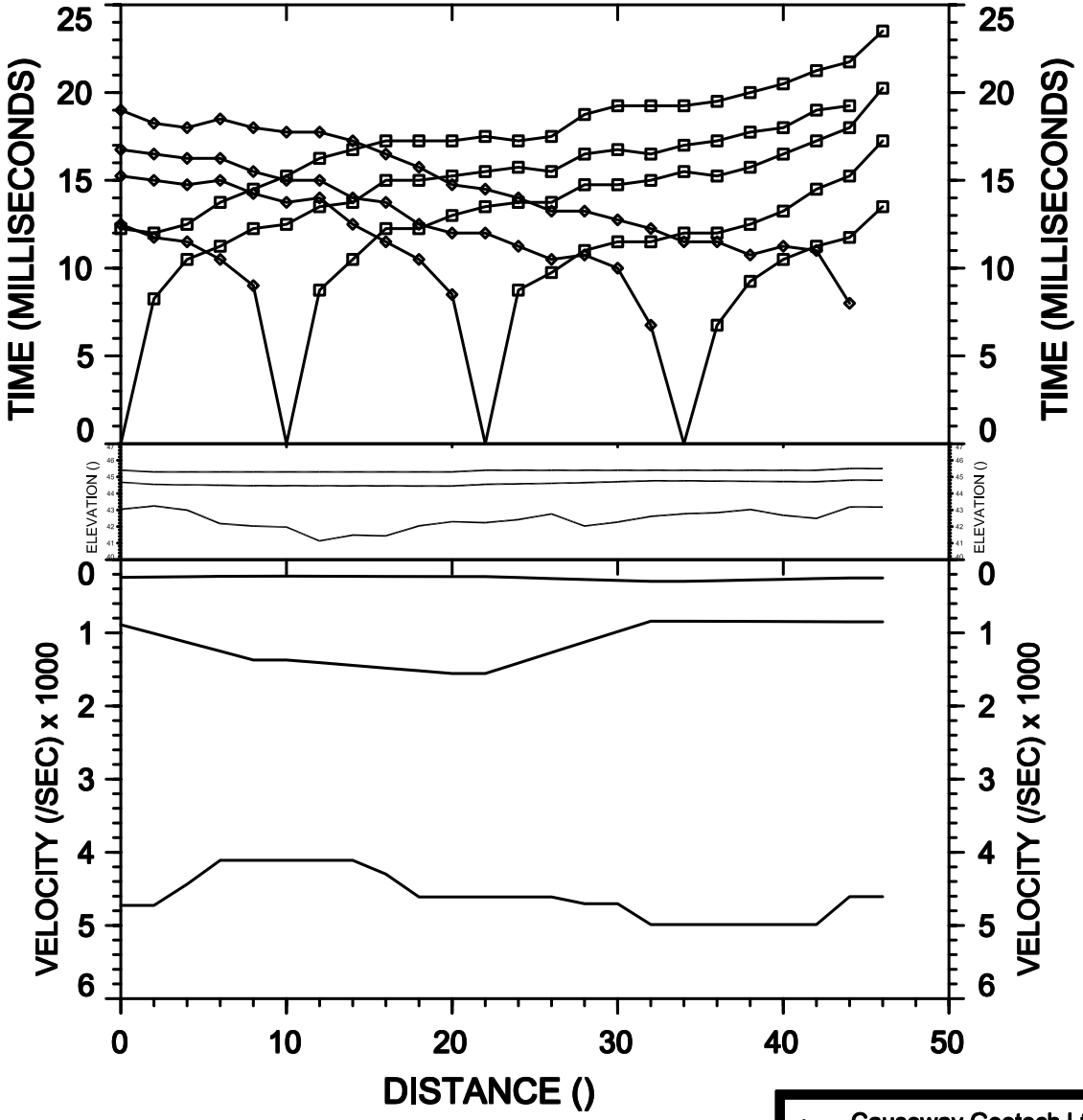


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS64 / Date: 03/06/22	
Equipment: Geode / Spread: S64	Azimuth:

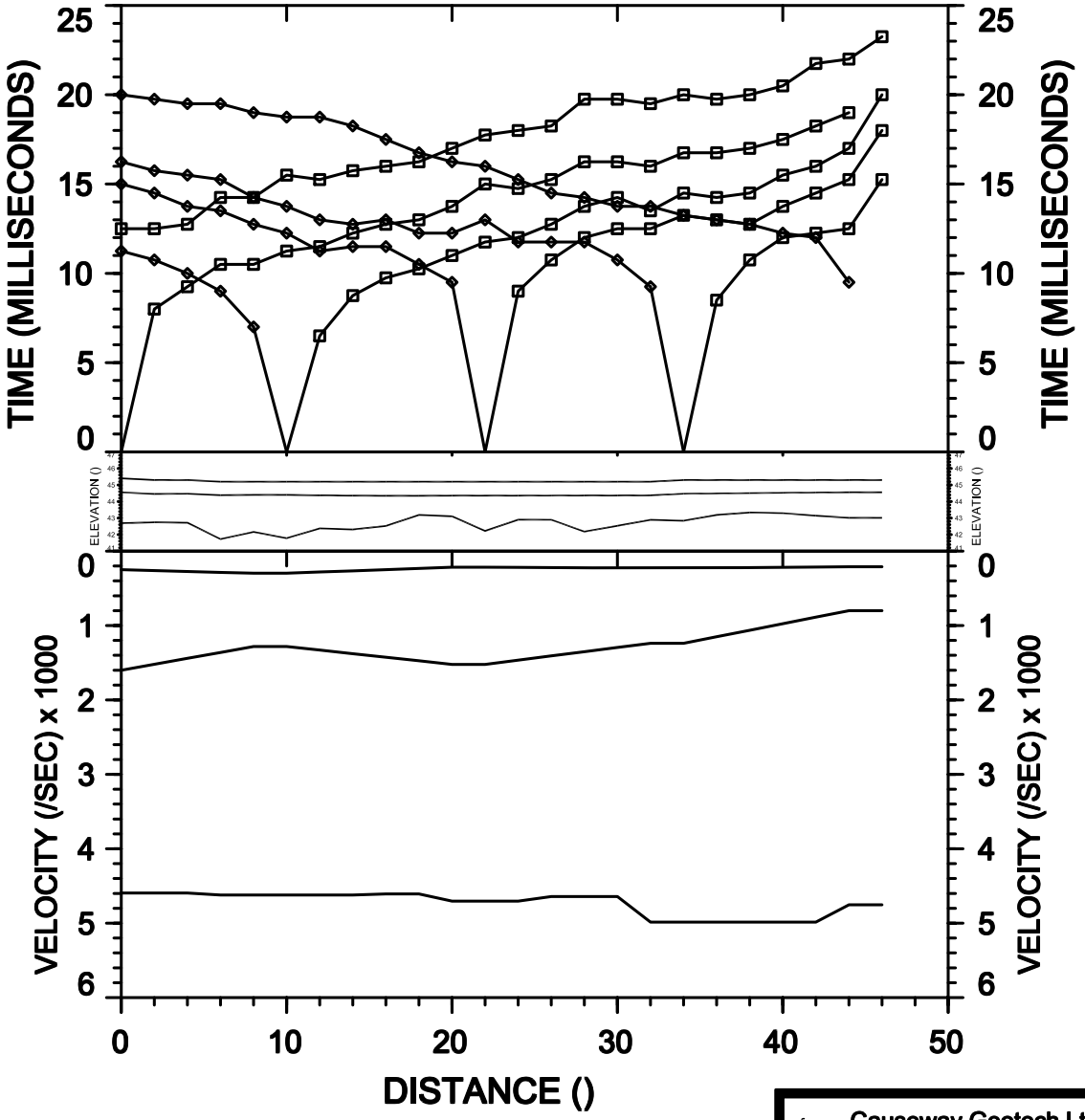


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS65 / Date: 03/06/22	
Equipment: Geode / Spread: S65	Azimuth:

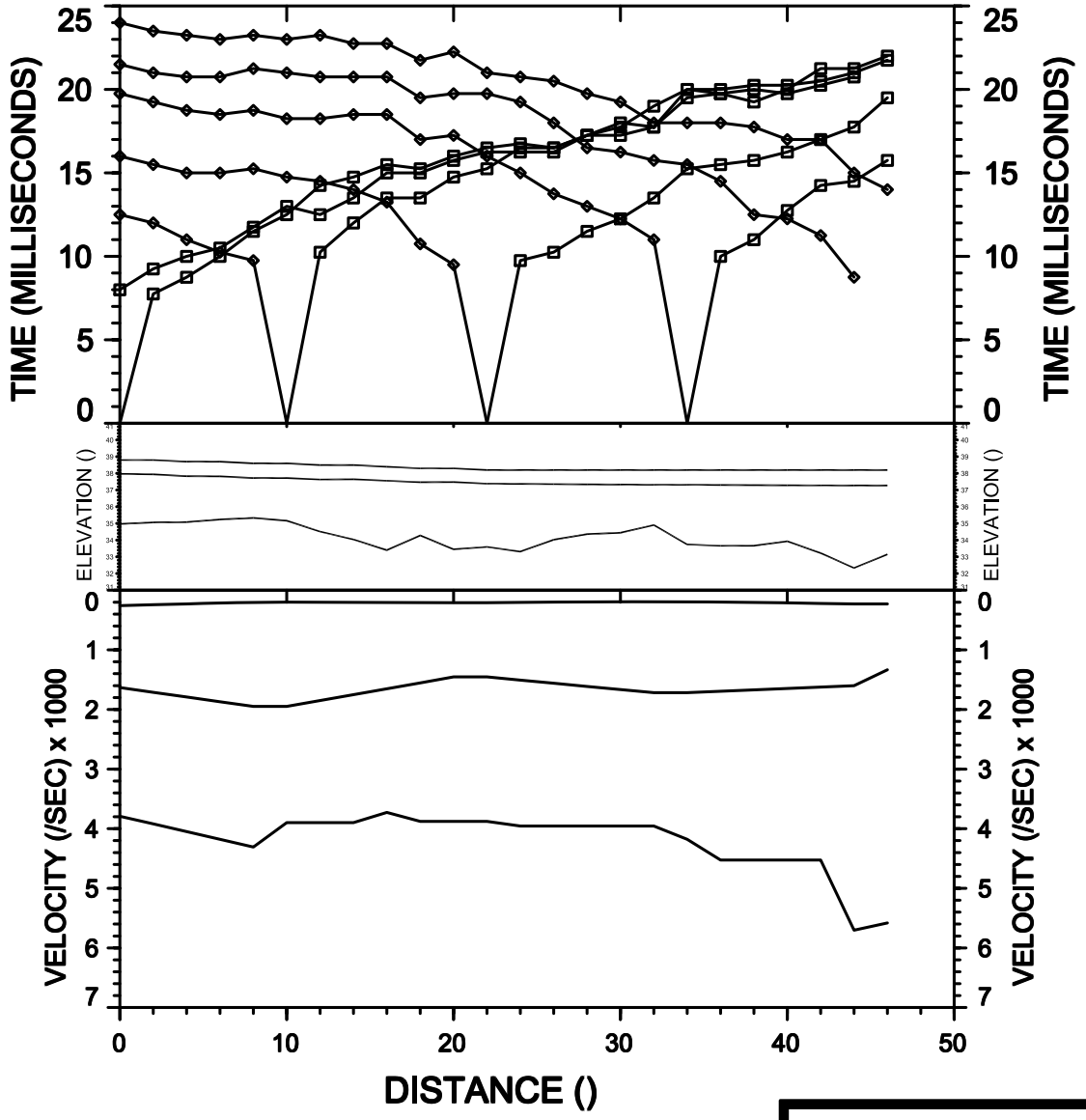


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS66 / Date: 08/06/22	
Equipment: Geode / Spread: S66	Azimuth:

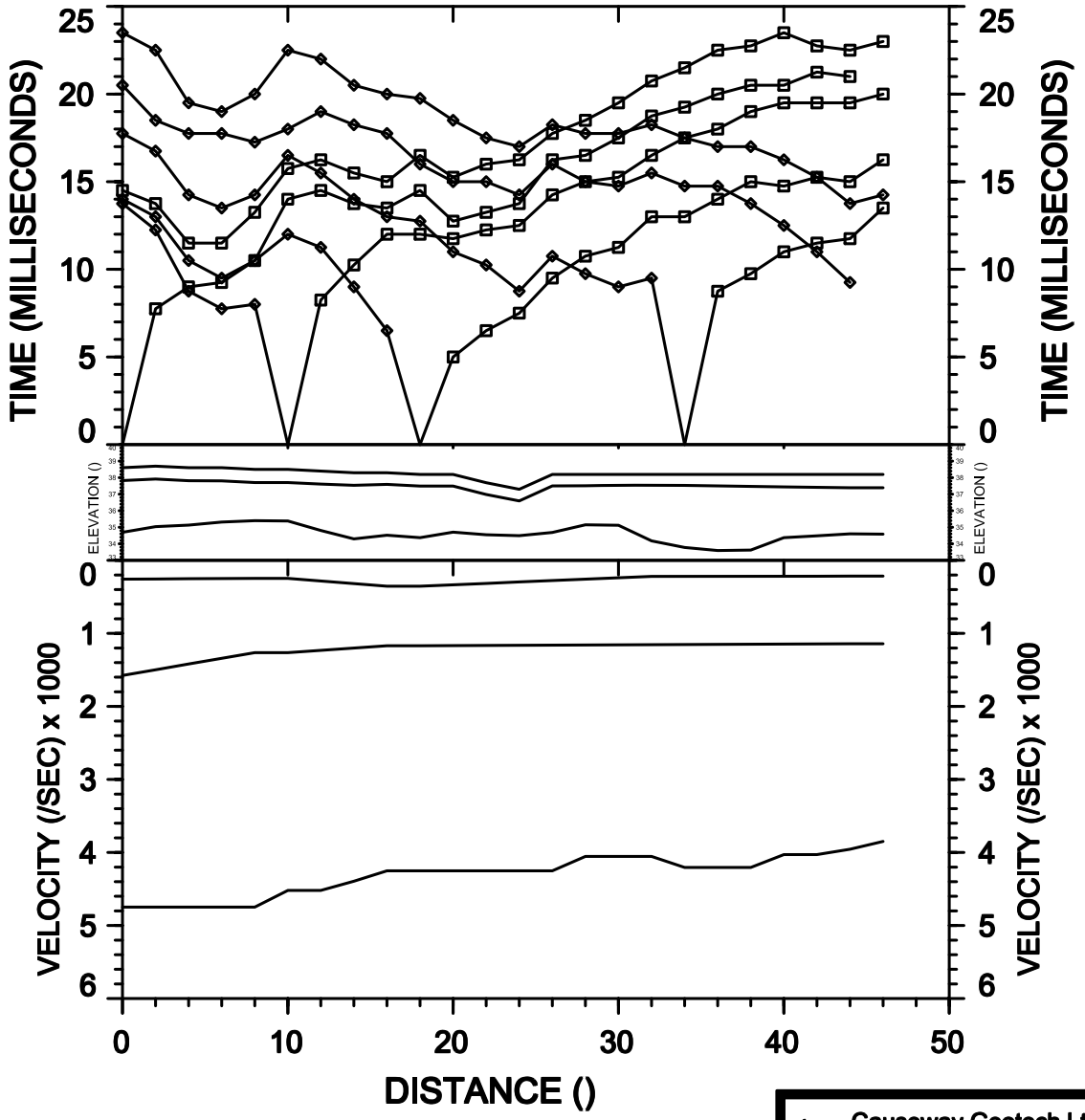


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS67R / Date: 08/06/22	
Equipment: Geode / Spread: S67	Azimuth:

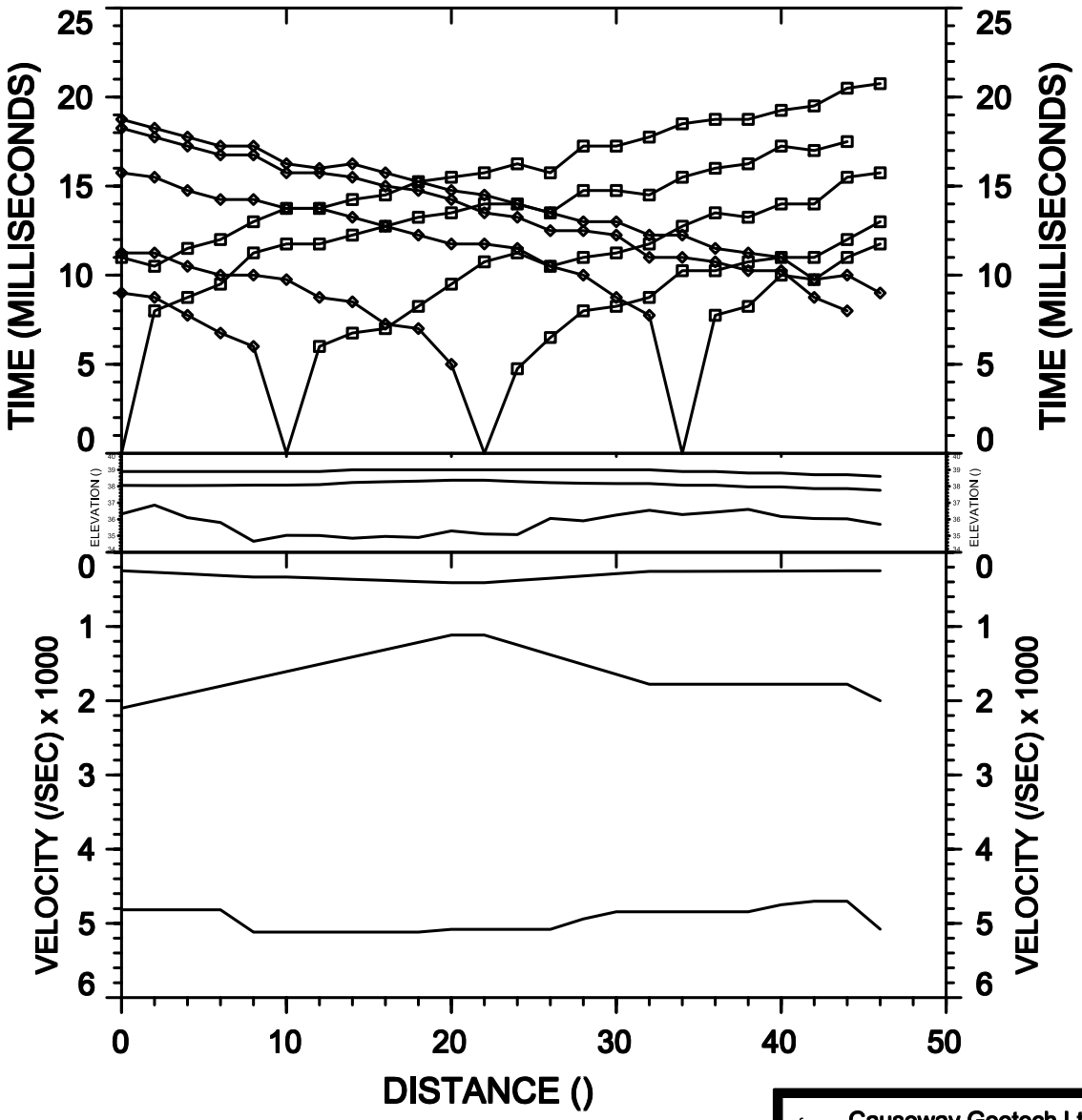


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS68R / Date: 08/06/22	
Equipment: Geode / Spread: S68	Azimuth:

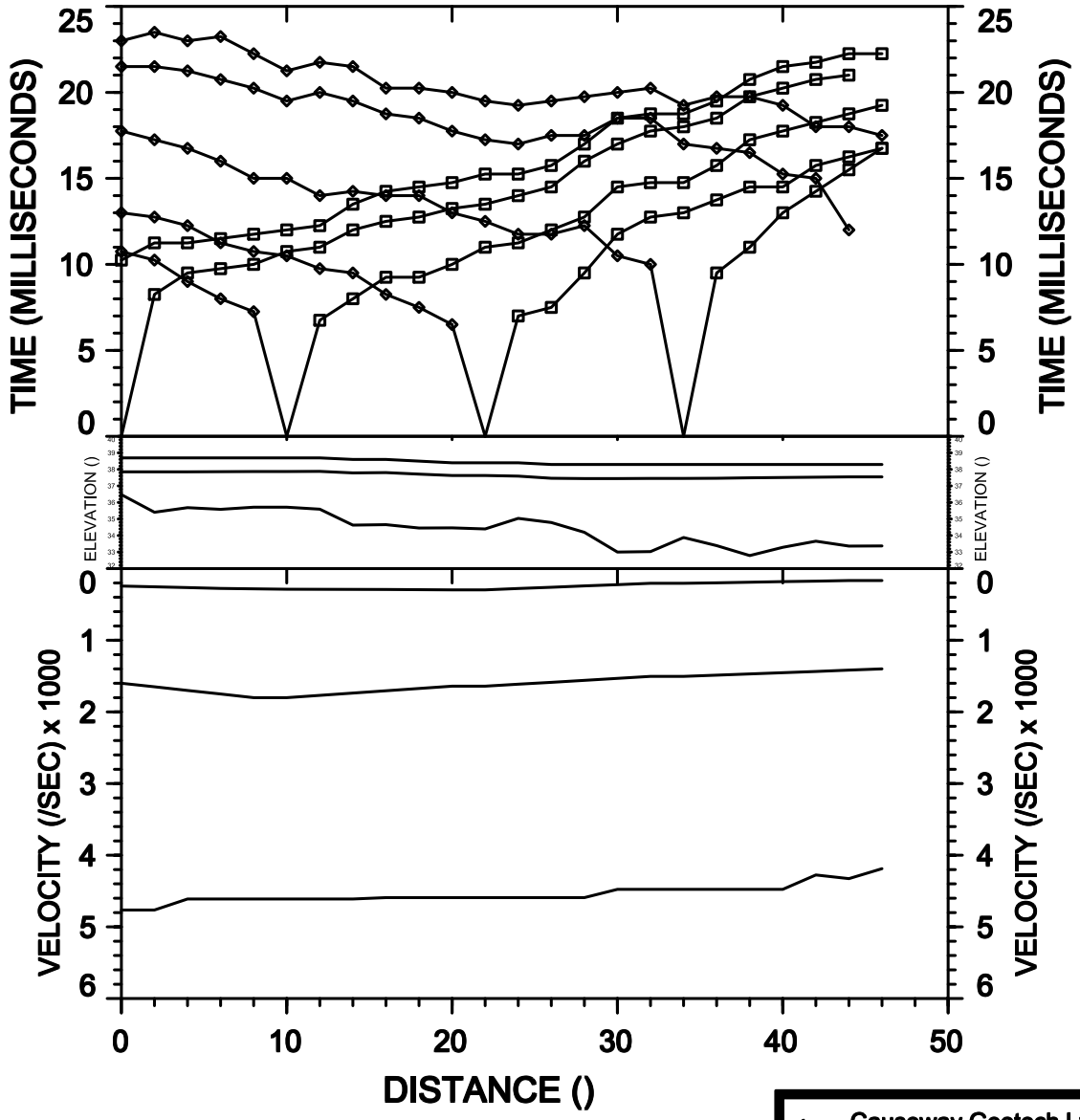


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS69R / Date: 08/06/22	
Equipment: Geode / Spread: S69	Azimuth:

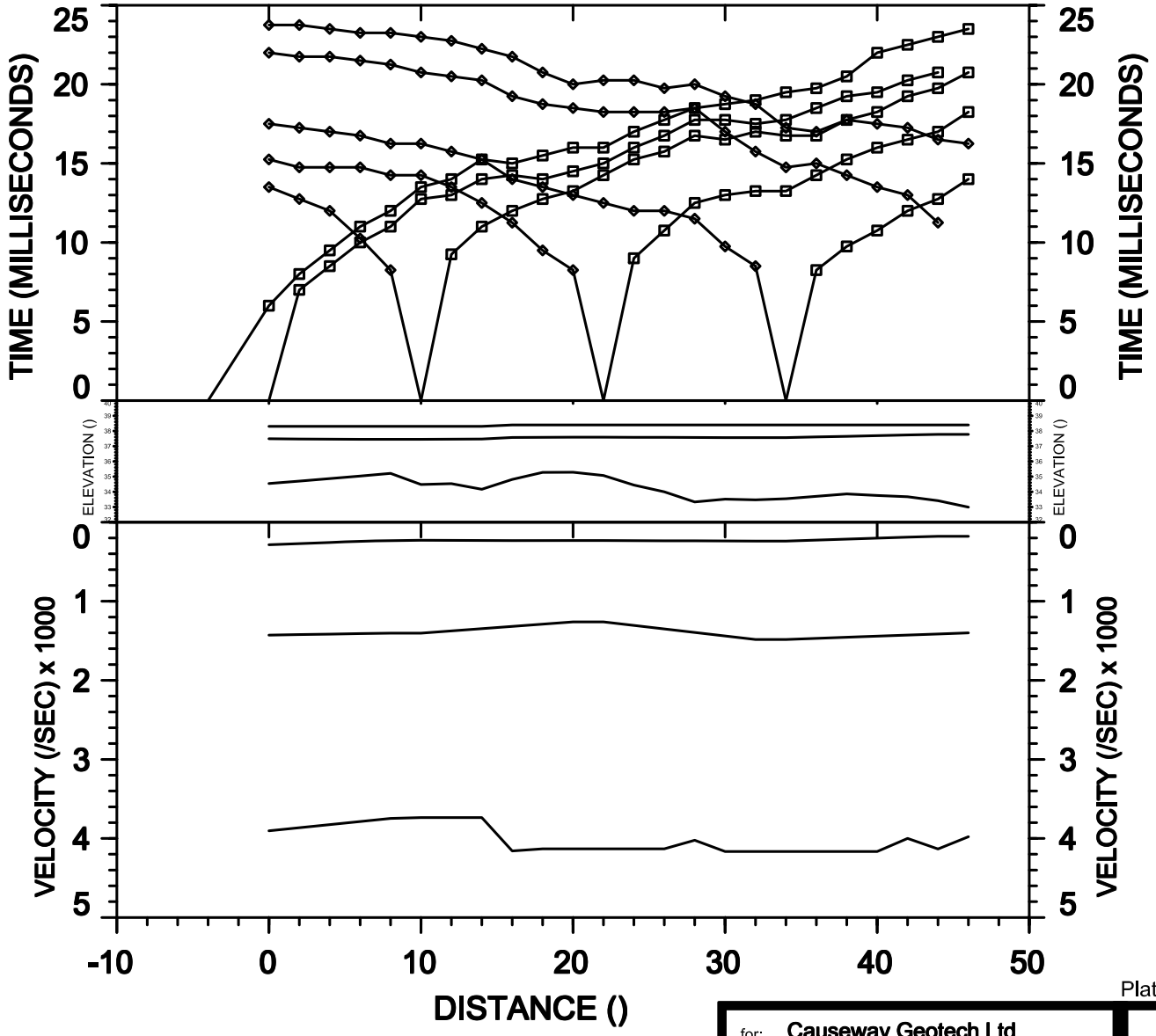


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS70R	Date: 08/06/22	
Equipment: Geode	Spread: S70	Azimuth:

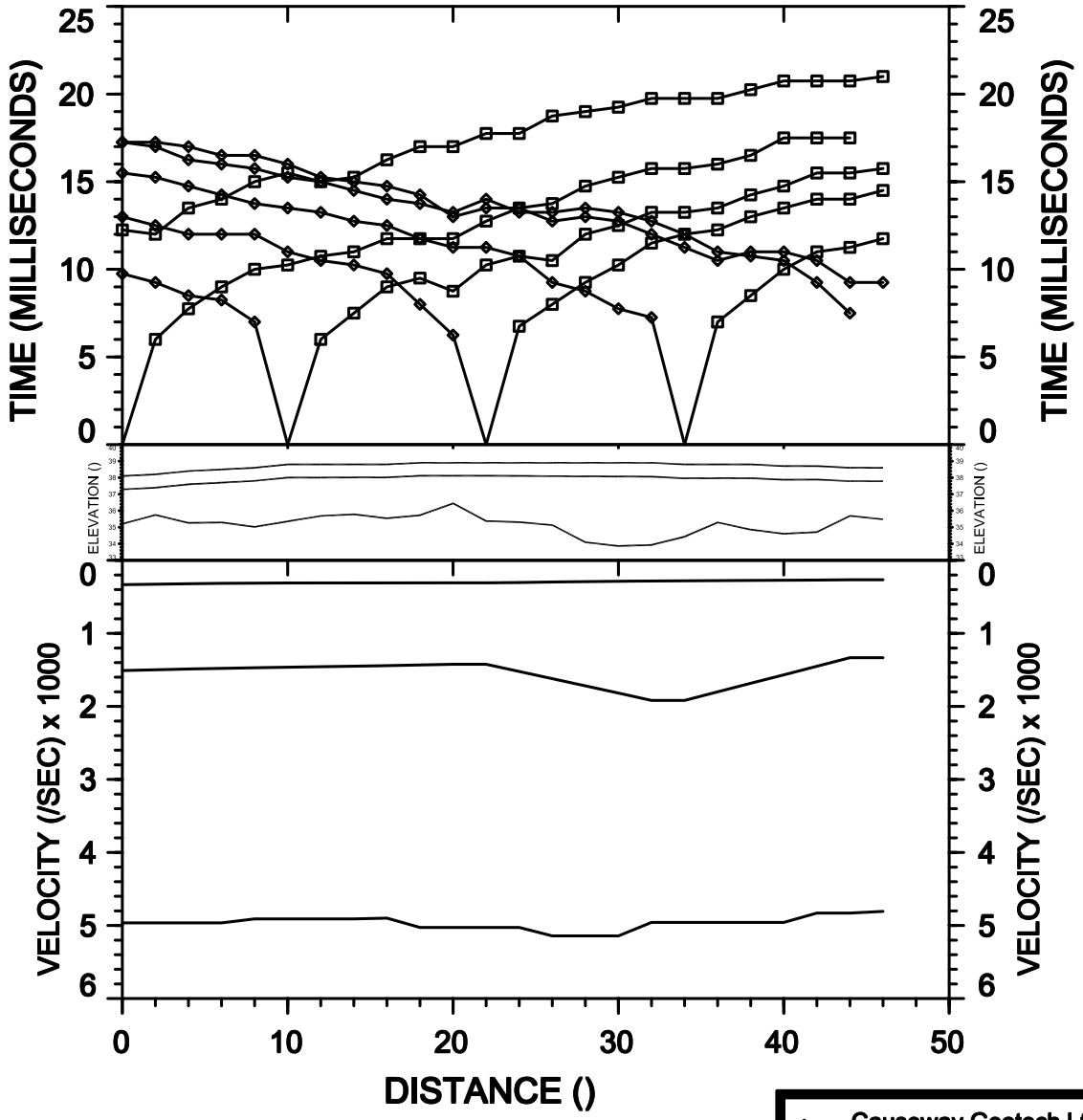


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS71 / Date: 08/06/22	
Equipment: Geode / Spread: S71	Azimuth:

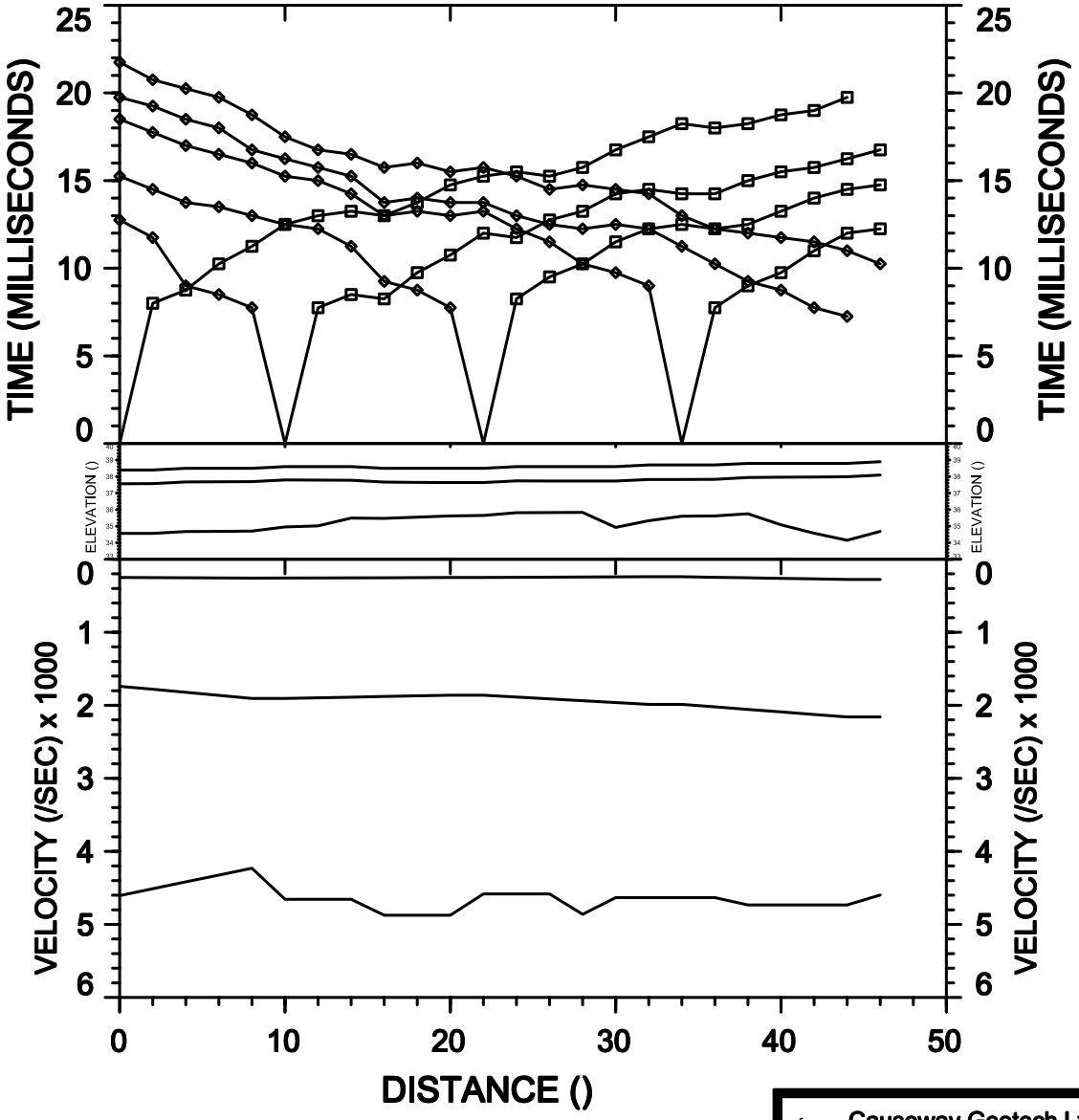


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS72R / Date: 08/06/22	
Equipment: Geode / Spread: S72	Azimuth:

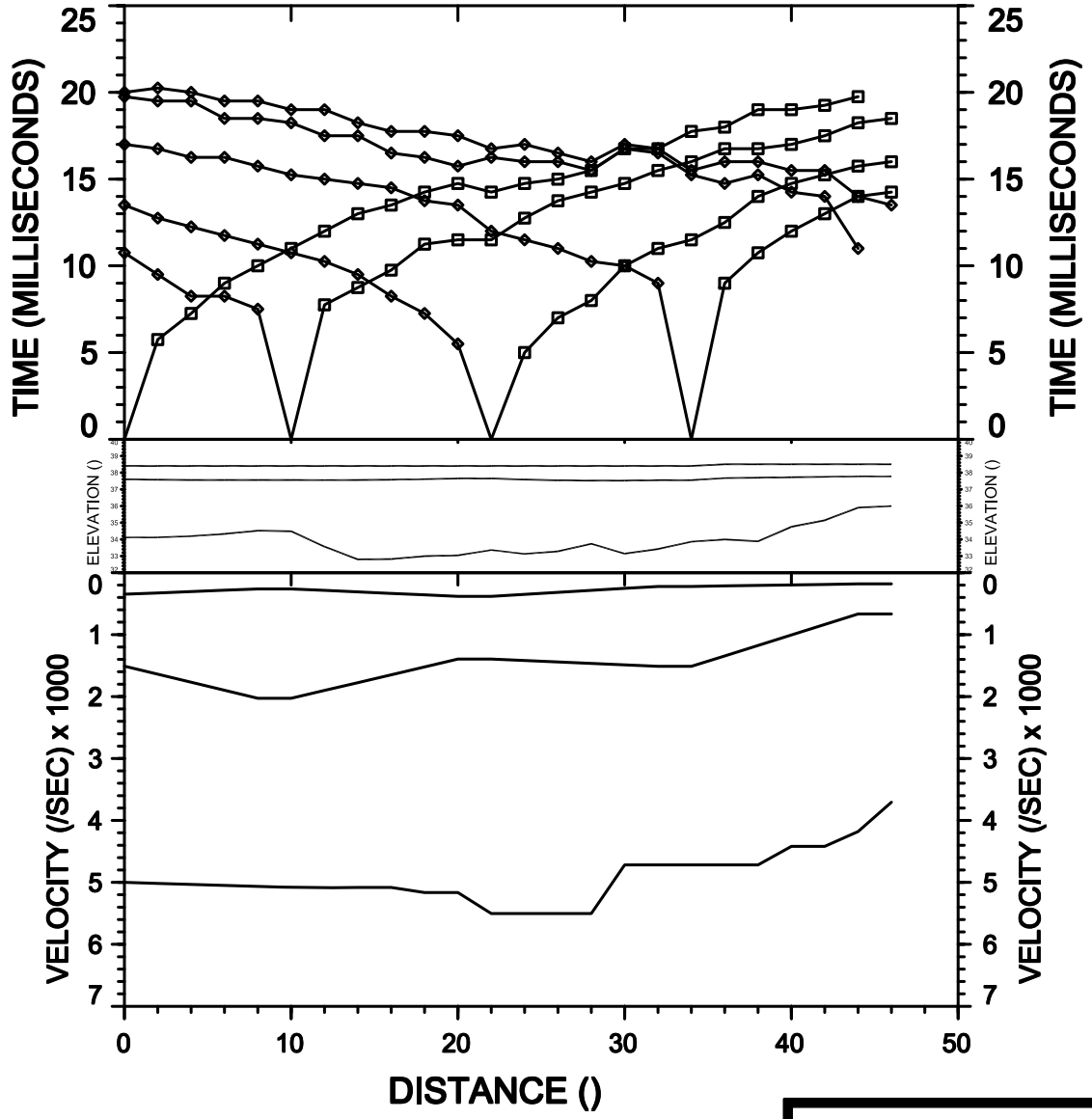


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS73	Date: 08/06/22	
Equipment: Geode	Spread: S73	Azimuth:

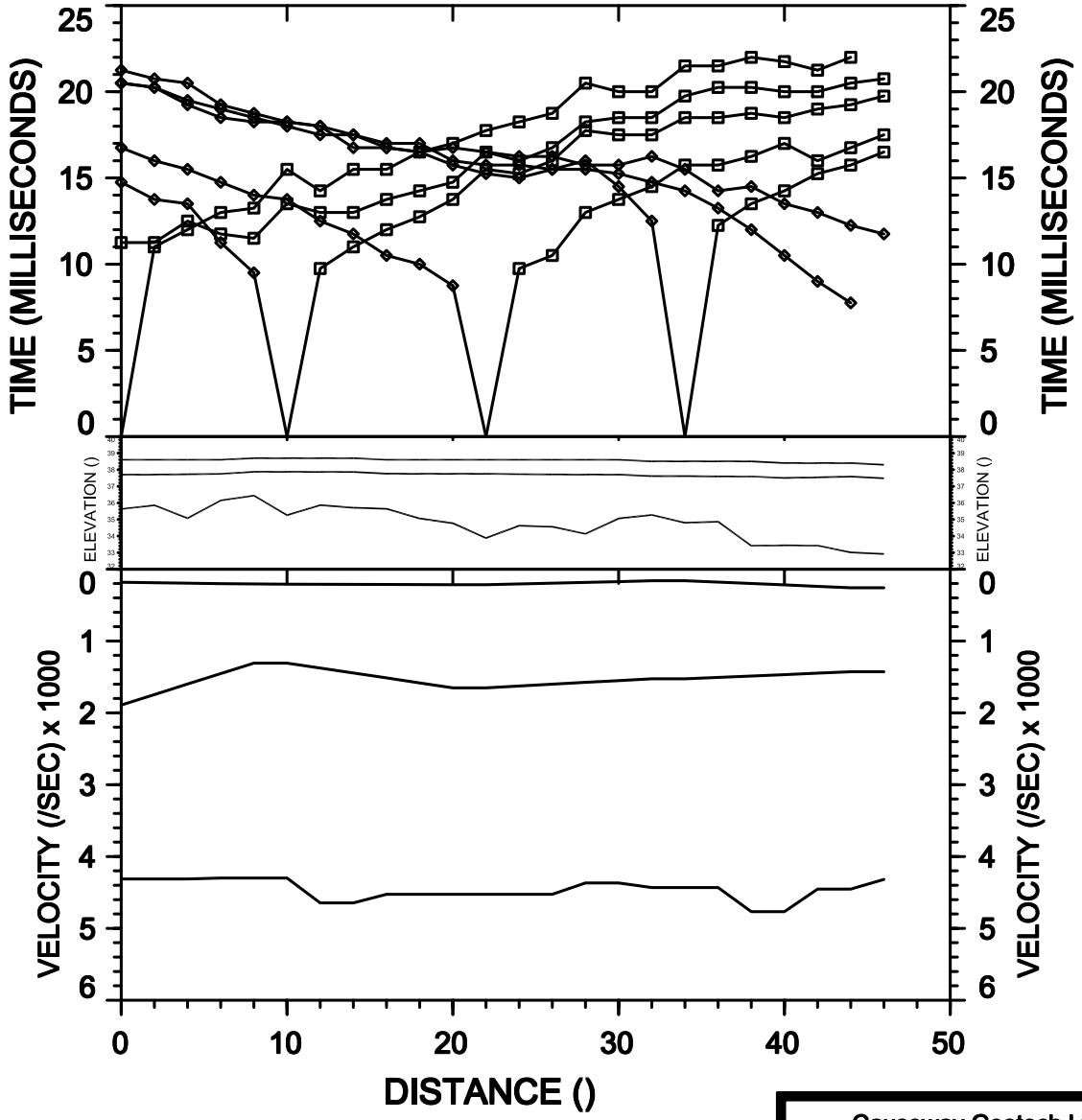


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS74	Date: 08/06/22	
Equipment: Geode	Spread: S74	Azimuth:

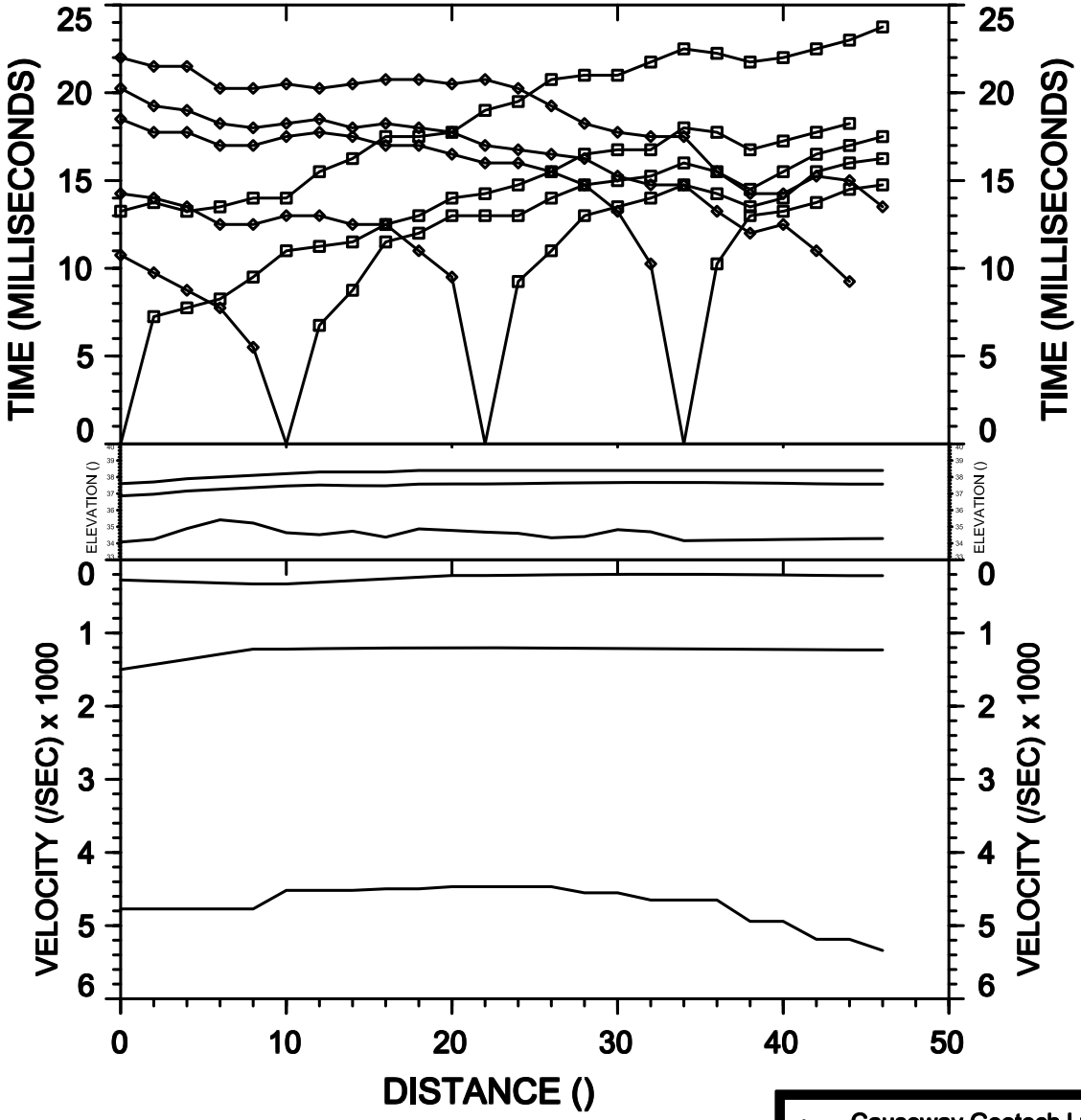


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS75R / Date: 09/06/22	
Equipment: Geode / Spread: S75	Azimuth:

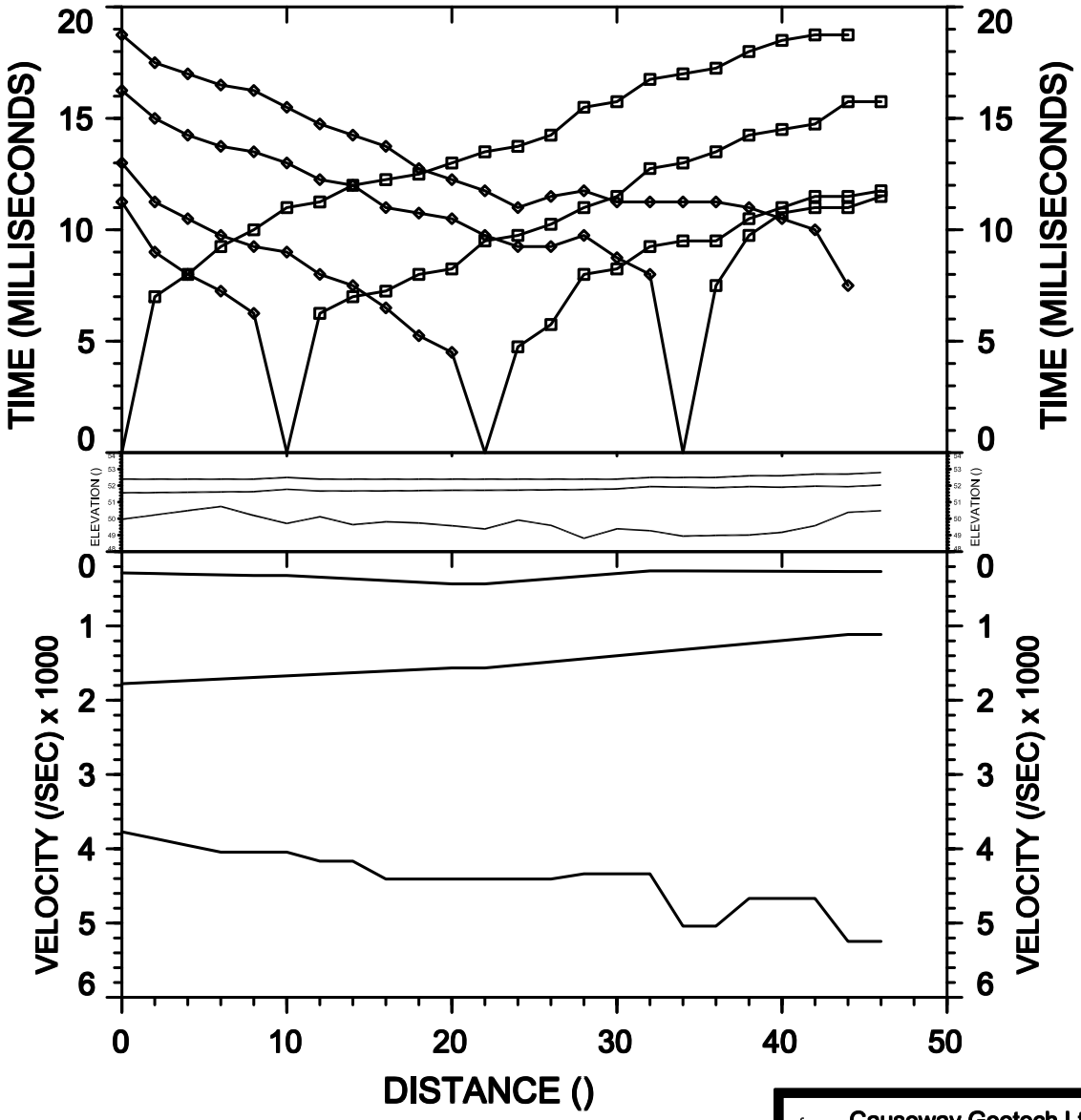


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS76 / Date: 09/06/22	
Equipment: Geode / Spread: S76	Azimuth:

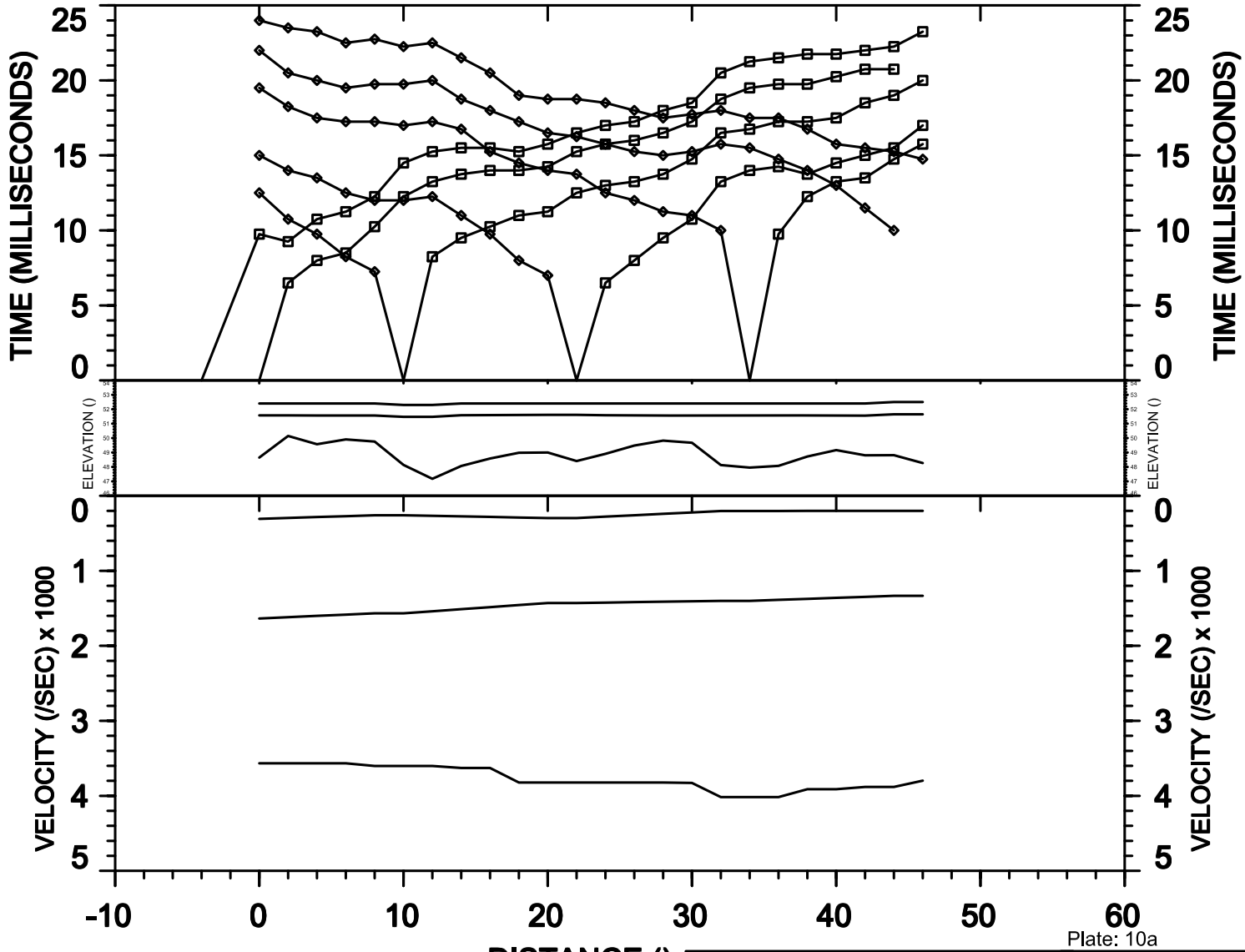


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS77	Date: 09/06/22	
Equipment: Geode	Spread: S77	Azimuth:

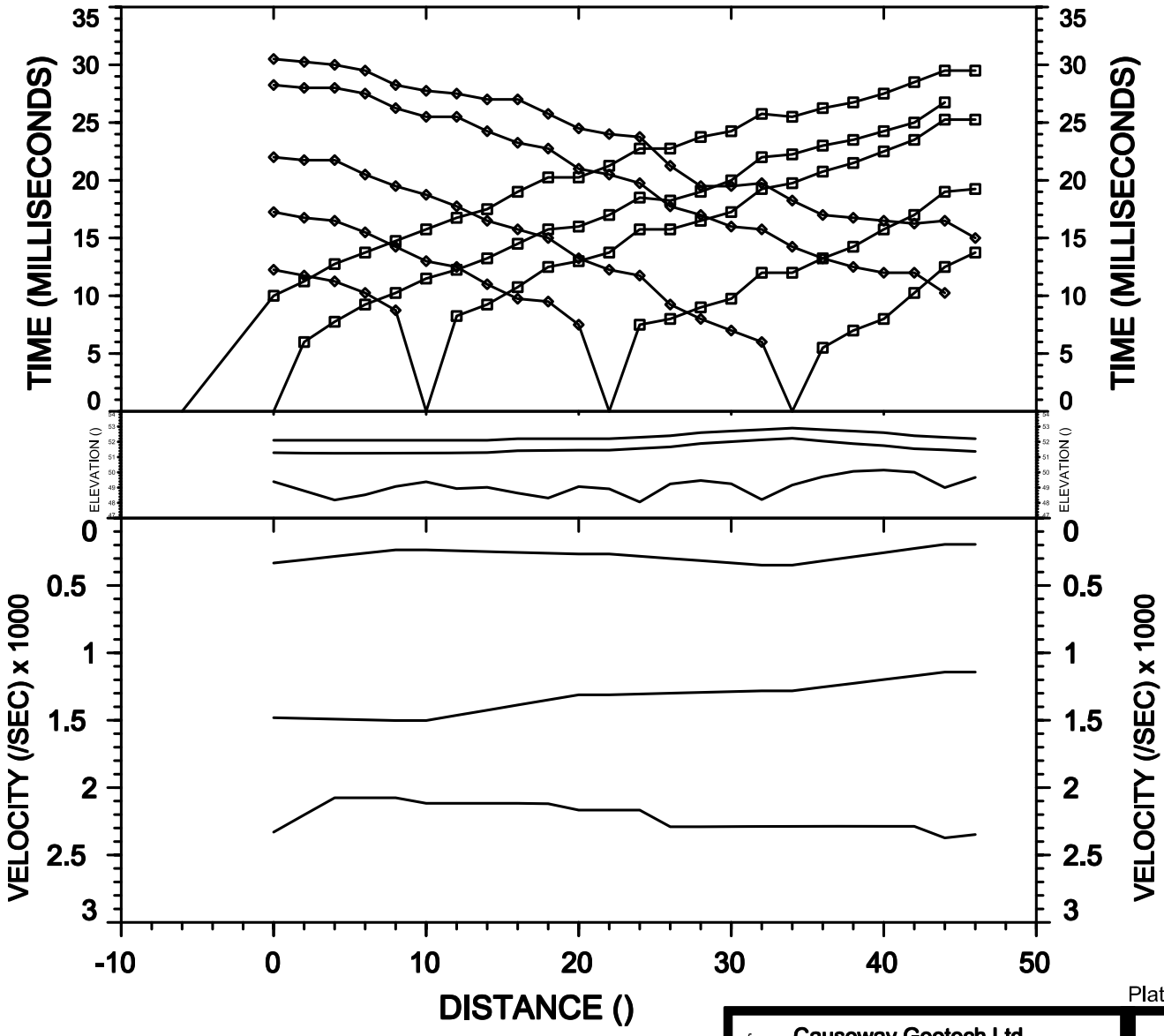


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS78 / Date: 09/06/22	
Equipment: Geode / Spread: S78	Azimuth:

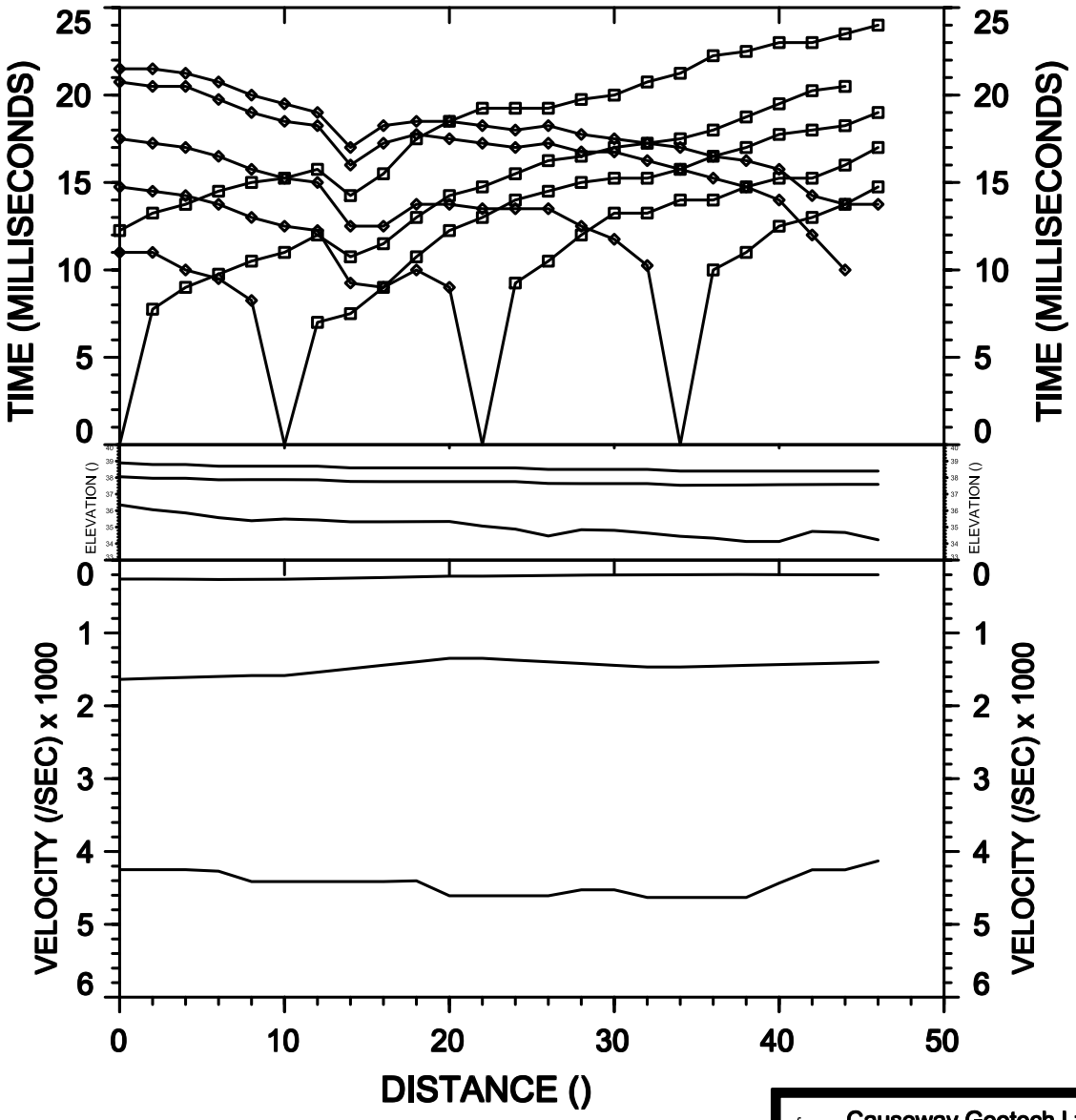


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS79R / Date: 09/06/22	
Equipment: Geode / Spread: S79	Azimuth:

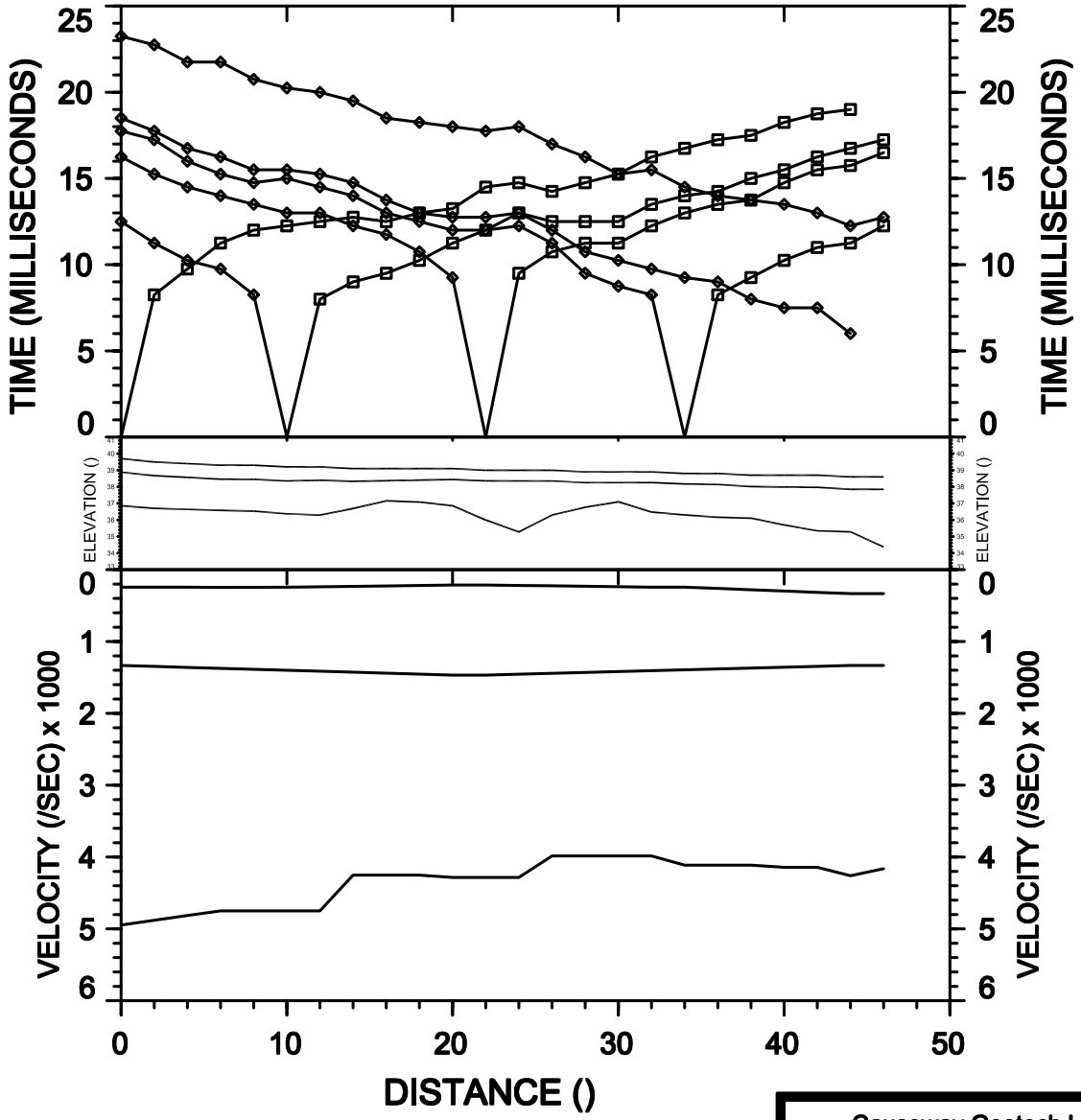


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS80 / Date: 09/06/22	
Equipment: Geode / Spread: S80	Azimuth:

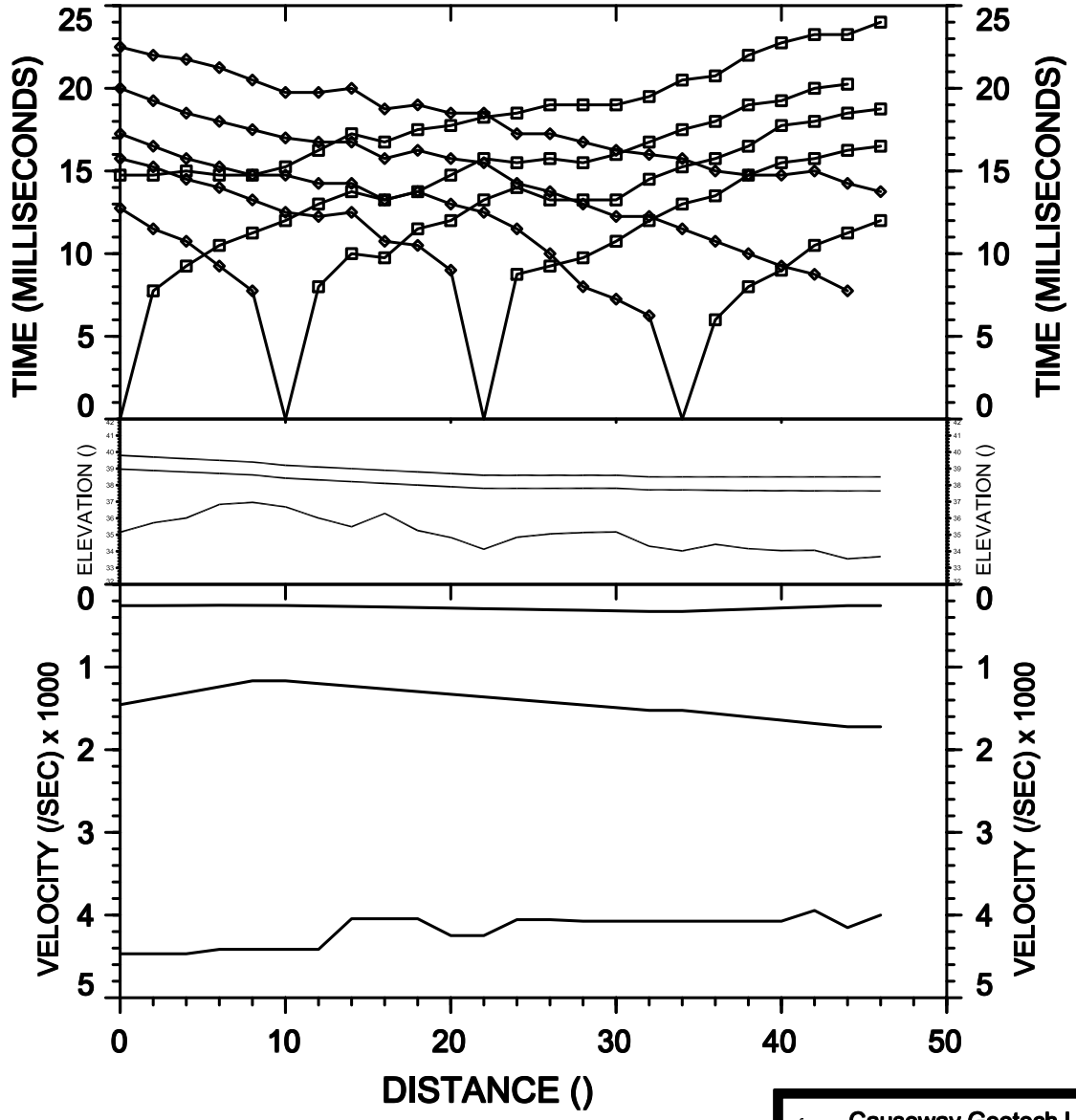


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS81 / Date: 09/06/22	
Equipment: Geode / Spread: S81	Azimuth:

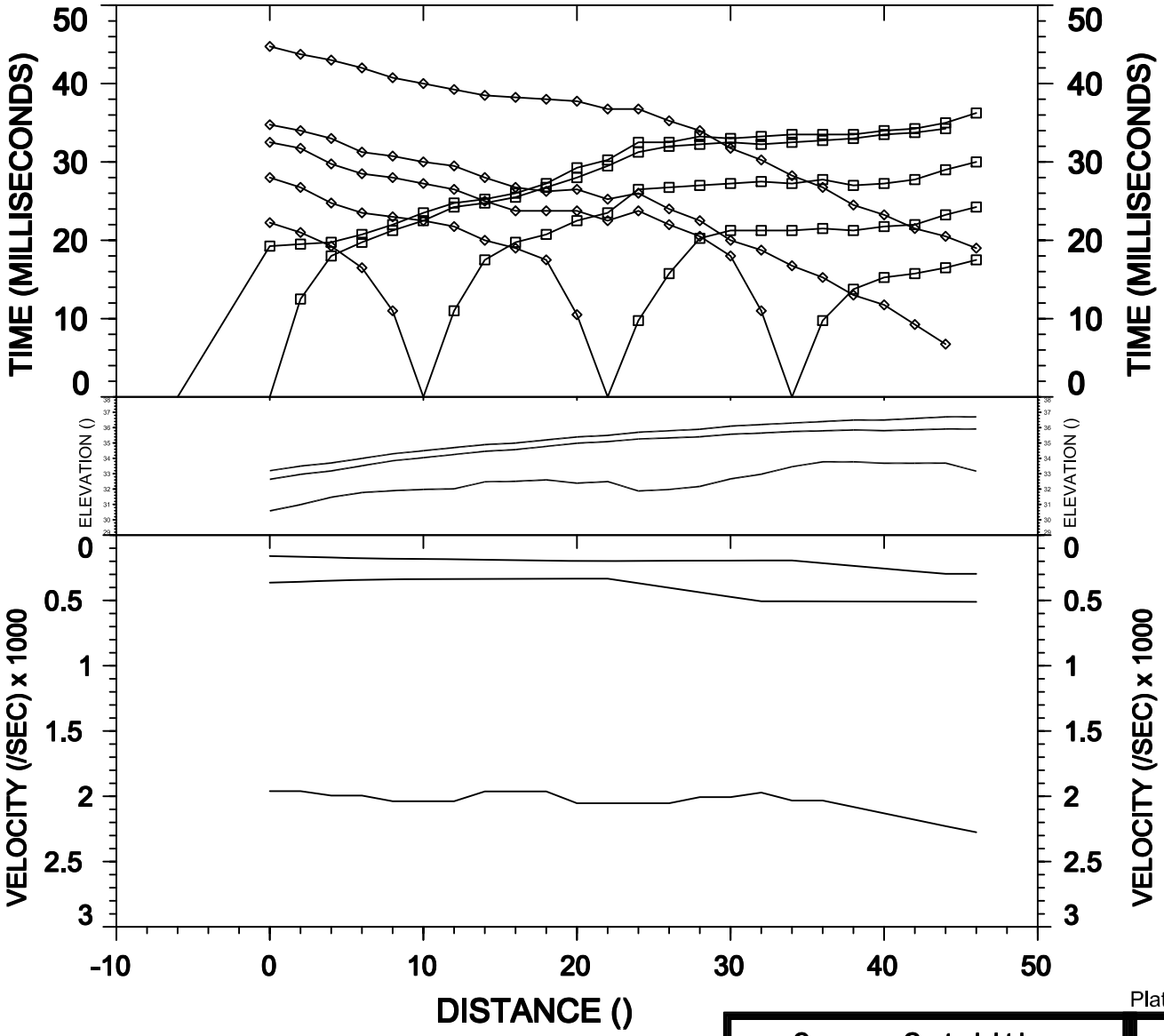


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS82	Date: 09/06/22	
Equipment: Geode	Spread: S82	Azimuth:

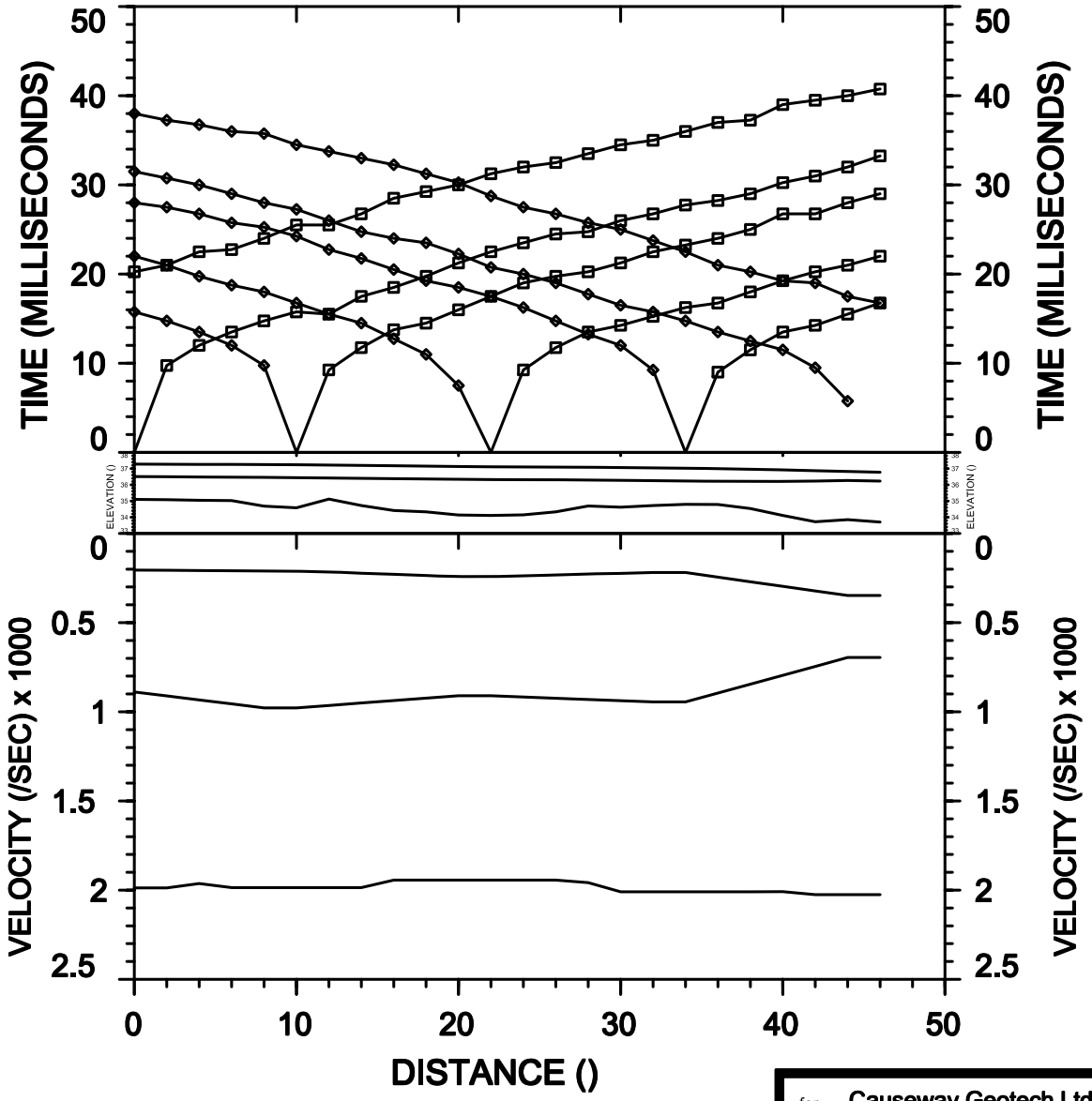


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS83R / Date: 09/06/22	
Equipment: Geode / Spread: S83	Azimuth:

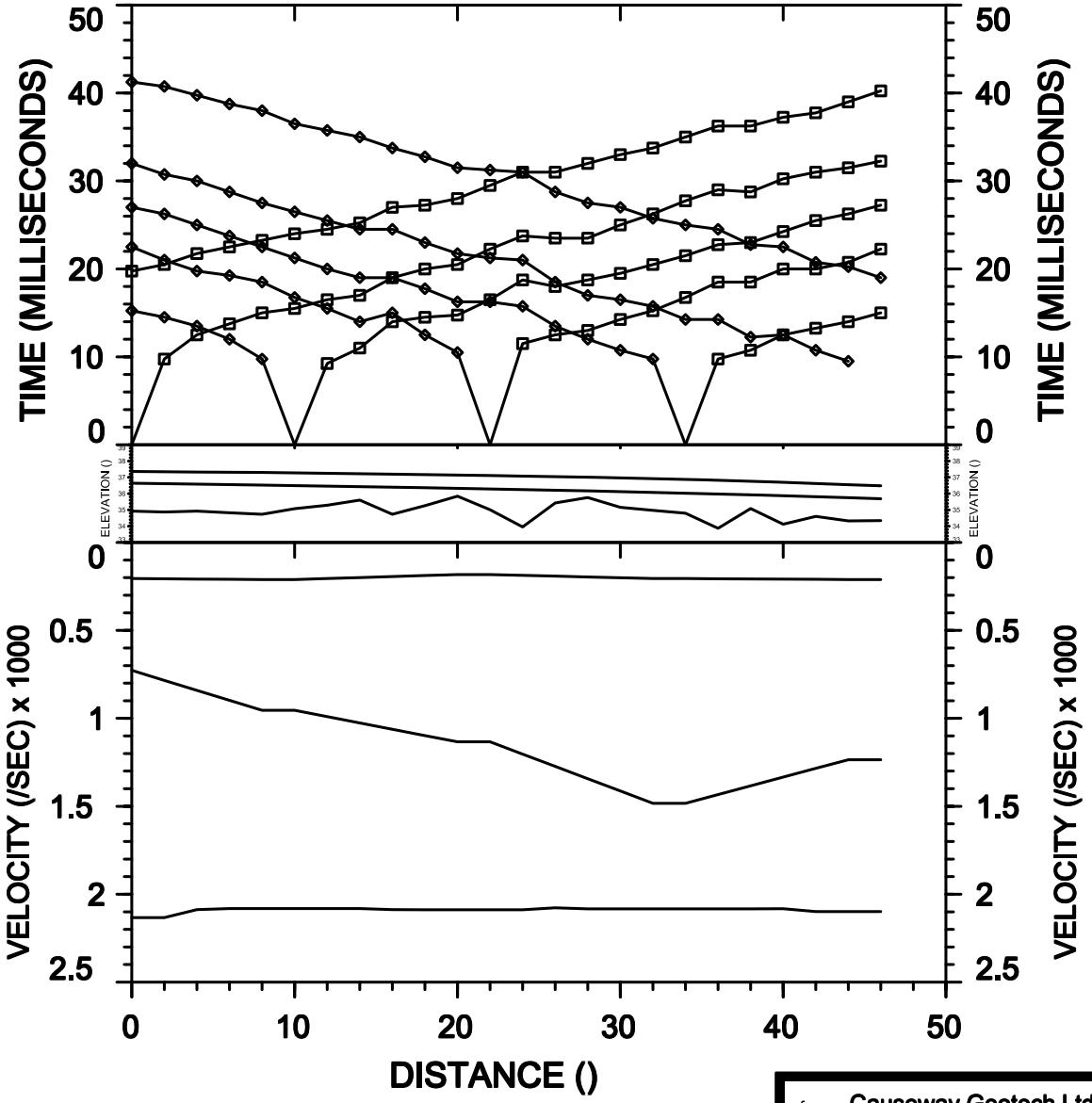


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS84R / Date: 09/06/22	
Equipment: Geode / Spread: S84	Azimuth:

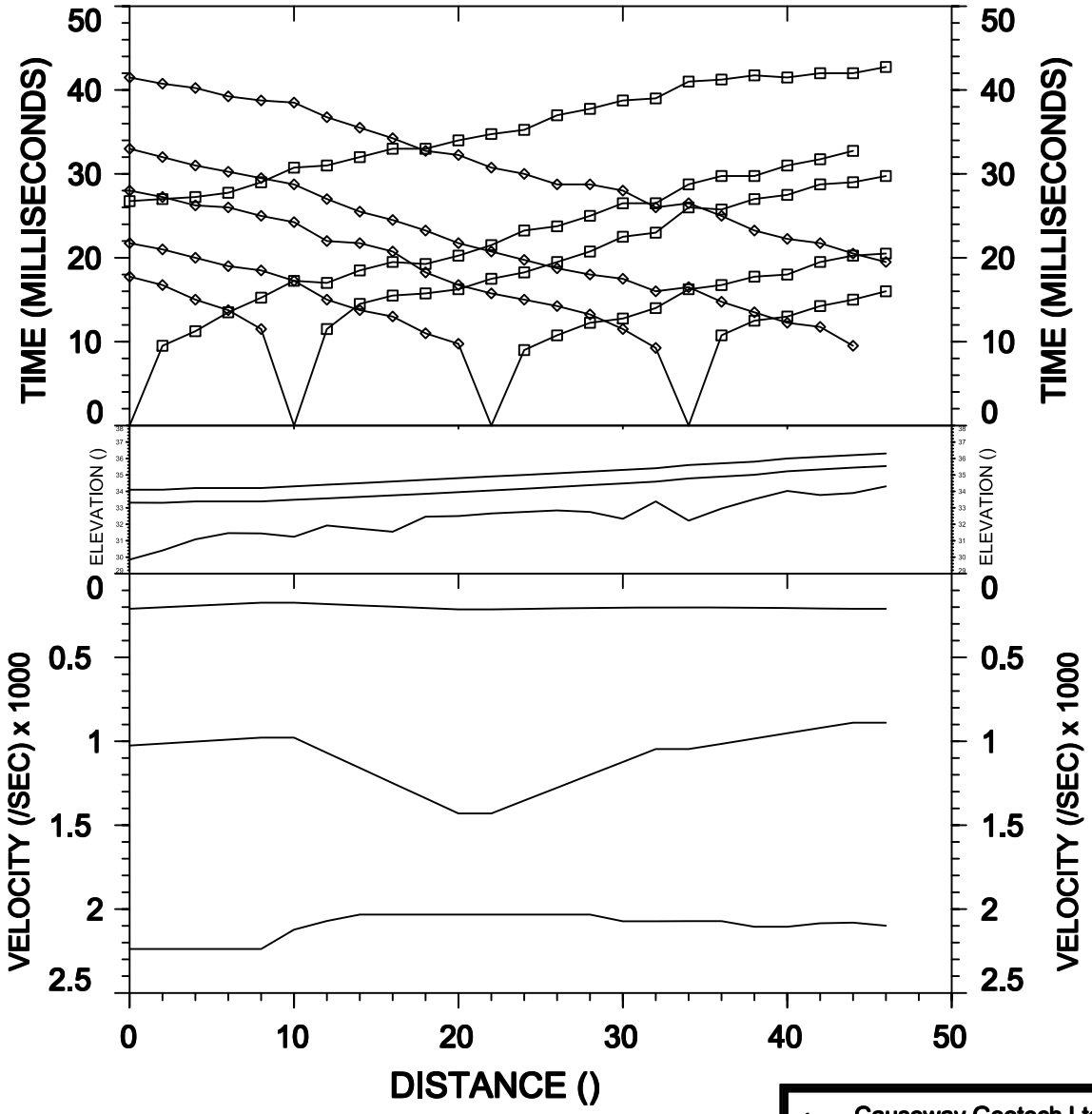


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS85 / Date: 09/06/22	
Equipment: Geode / Spread: S85	Azimuth:

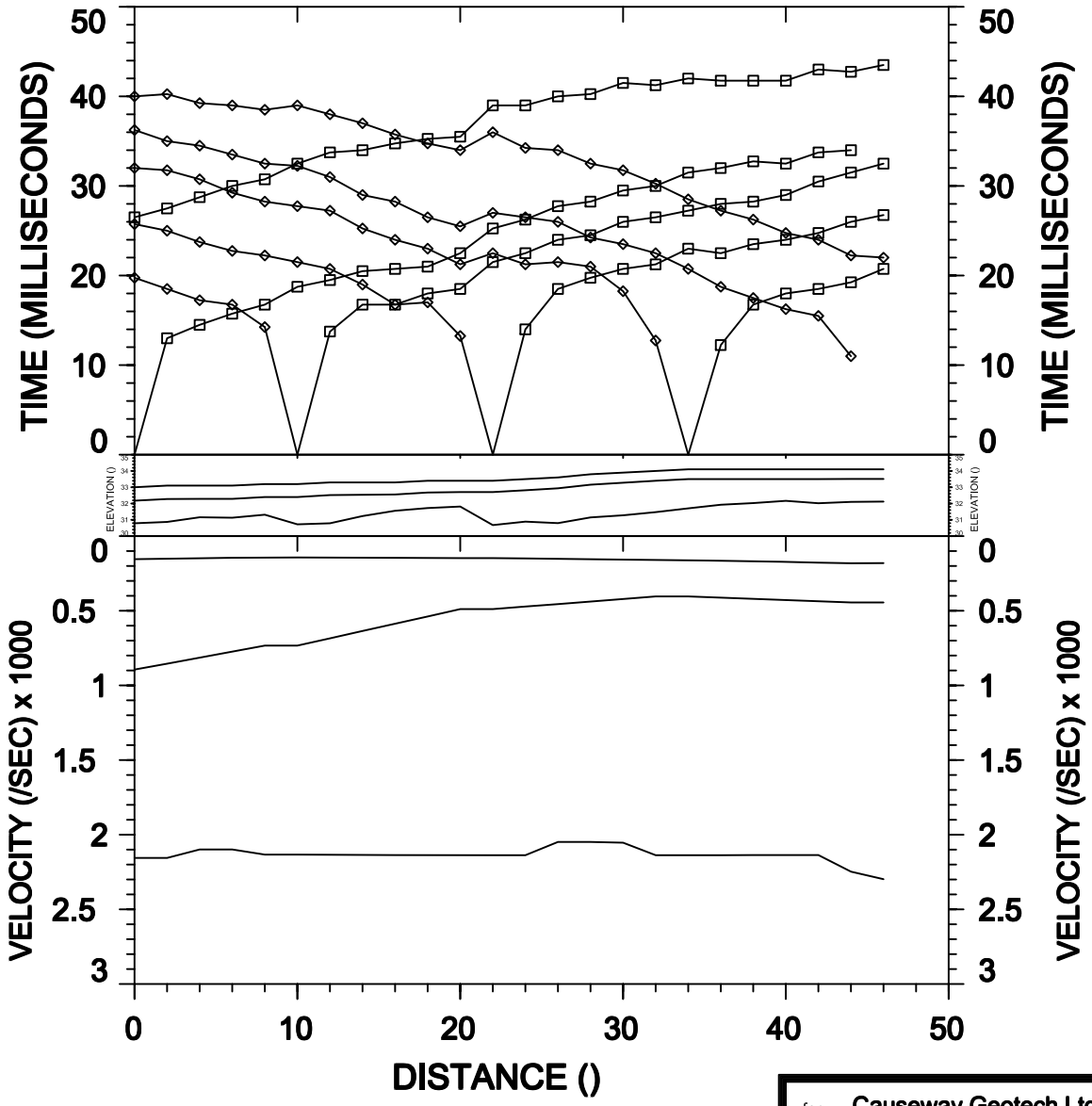


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS86R	Date: 09/06/22	
Equipment: Geode	Spread: S86	Azimuth:

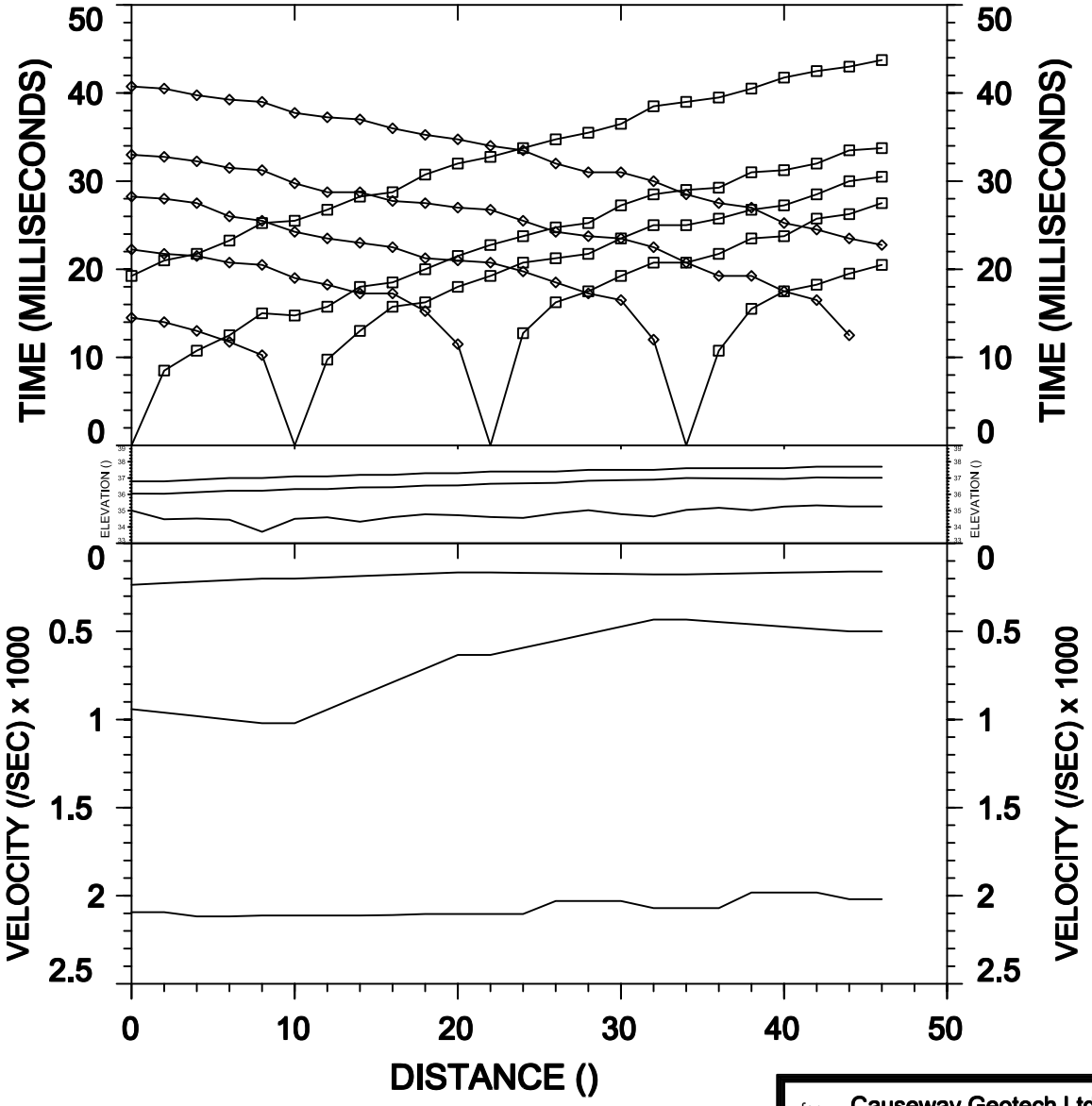


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS87R	Date: 10/06/22	
Equipment: Geode	Spread: S87	Azimuth:

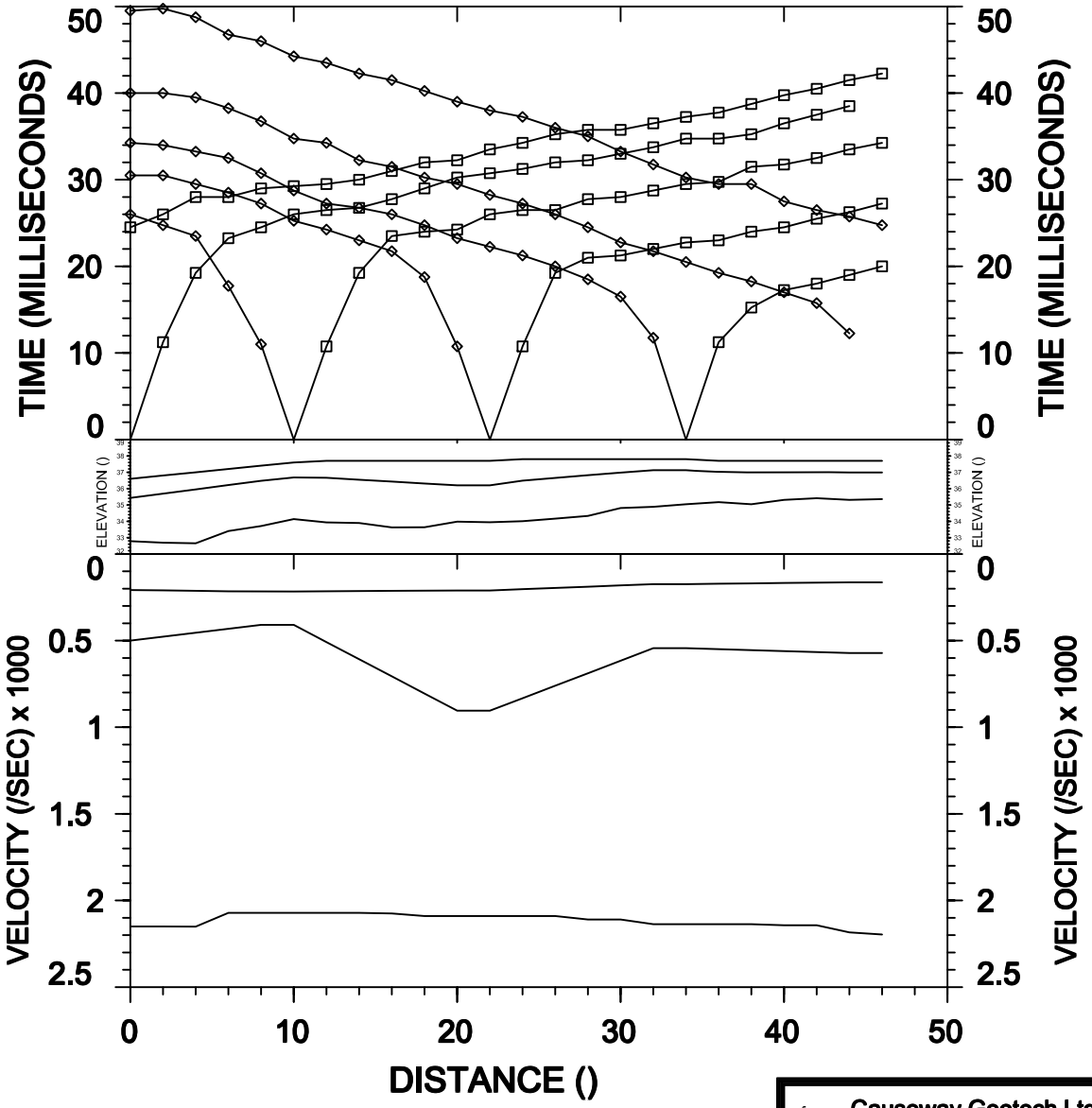


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS88	Date: 10/06/22	
Equipment: Geode	Spread: S88	Azimuth:

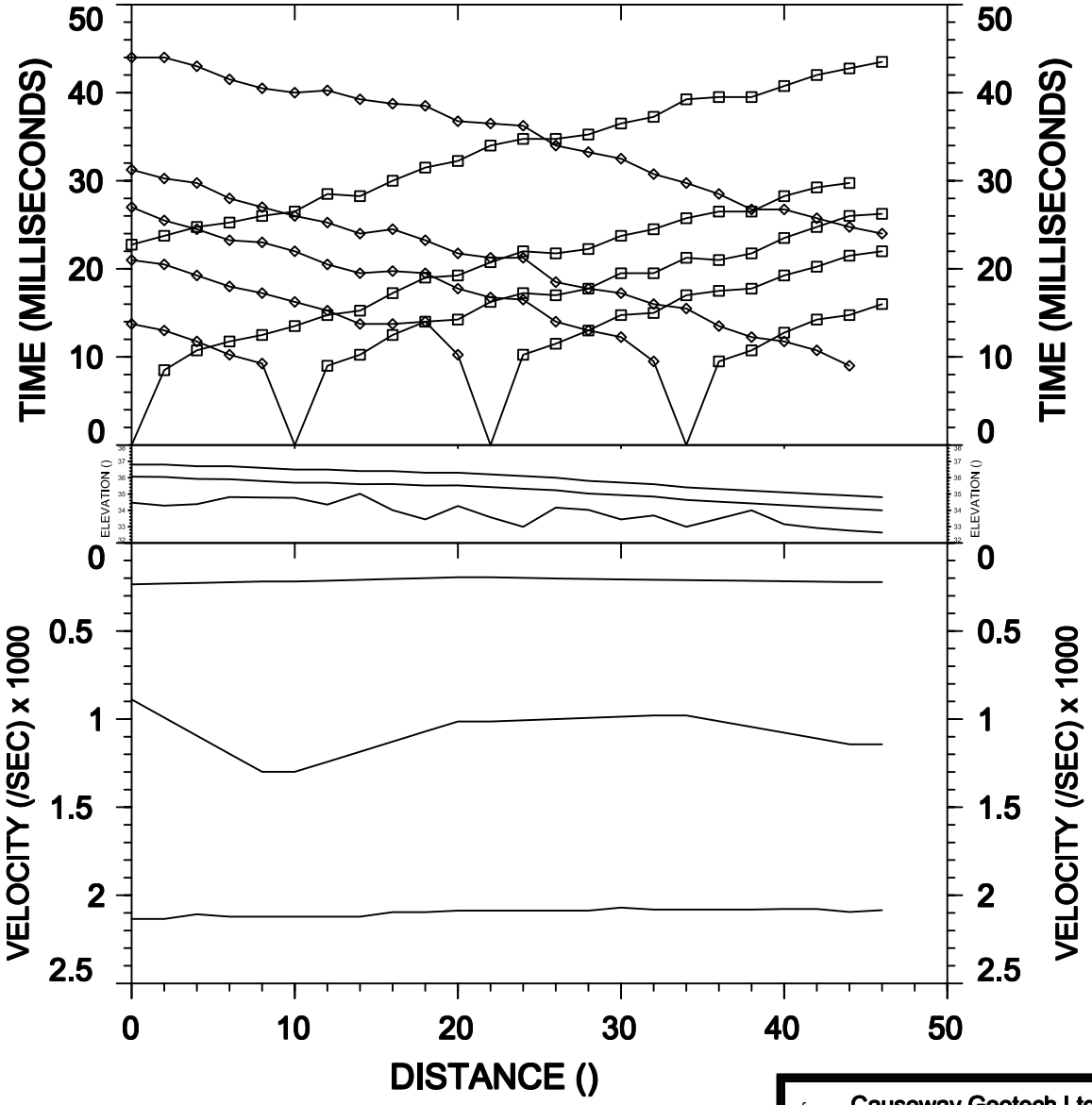


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS89	Date: 10/06/22	Tipperary
Equipment: Geode	Spread: S89	Azimuth:

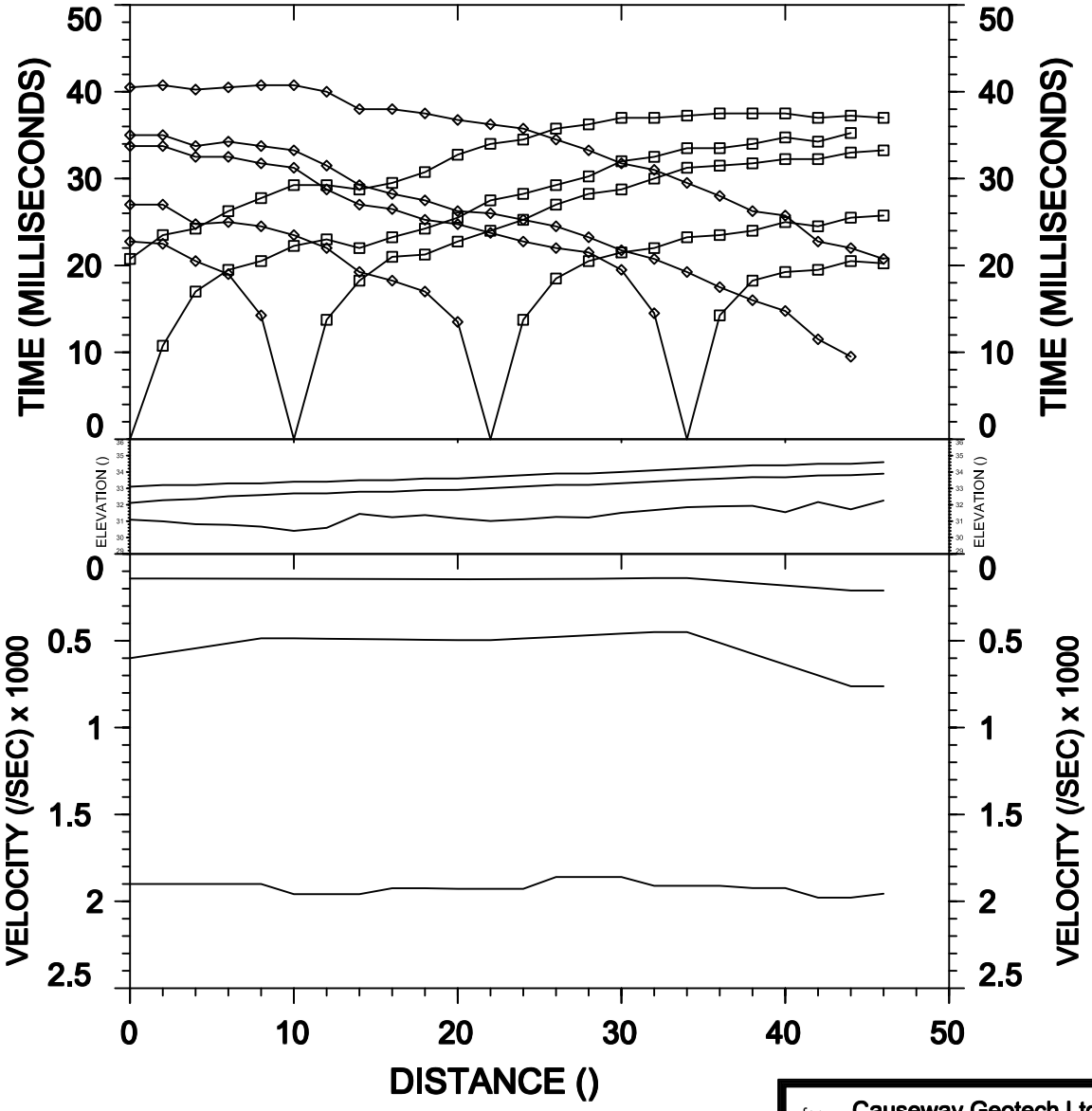


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS90R / Date: 10/06/22	
Equipment: Geode / Spread: S90	Azimuth:

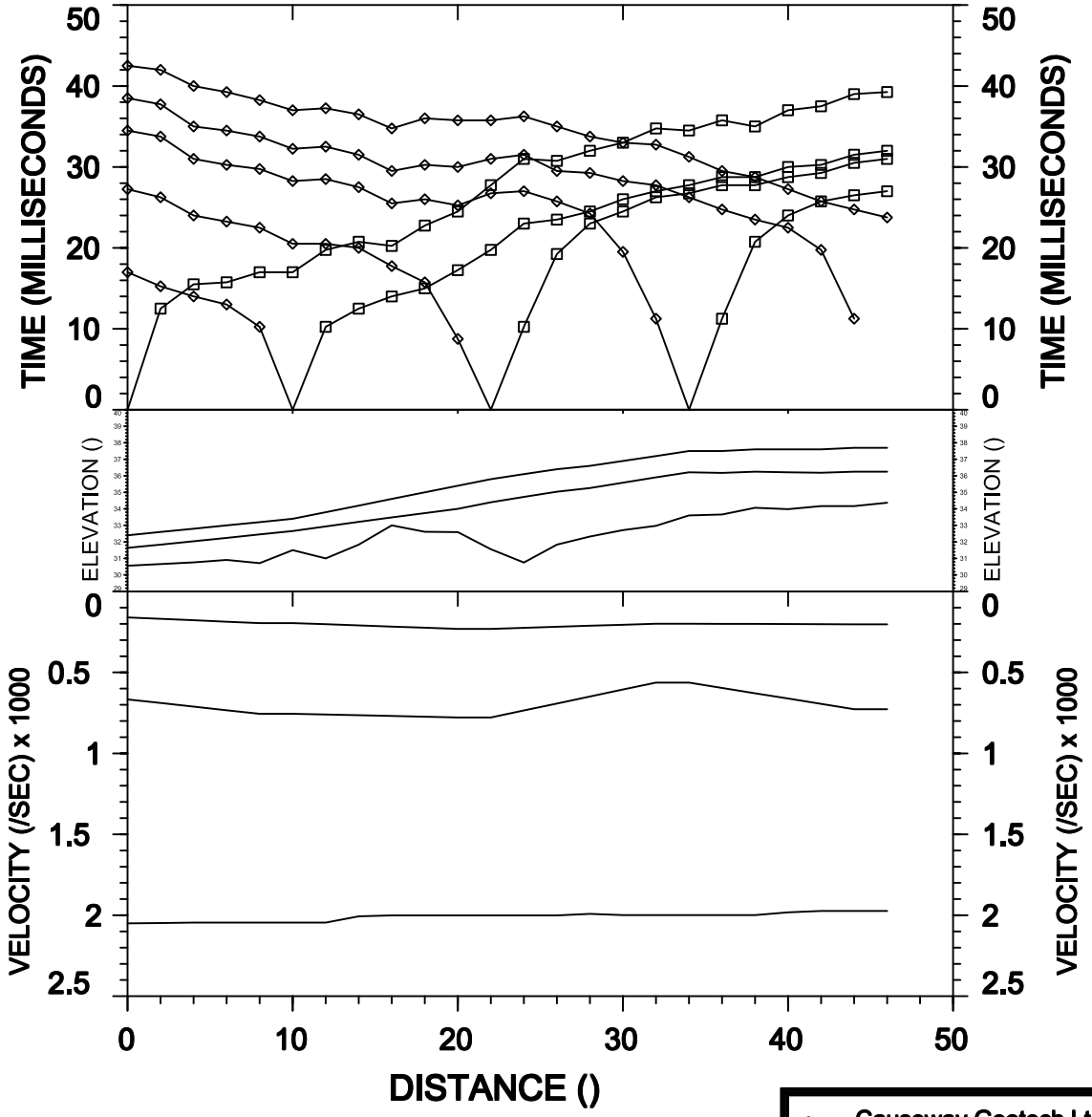


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS91 / Date: 10/06/22	
Equipment: Geode / Spread: S91	Azimuth:

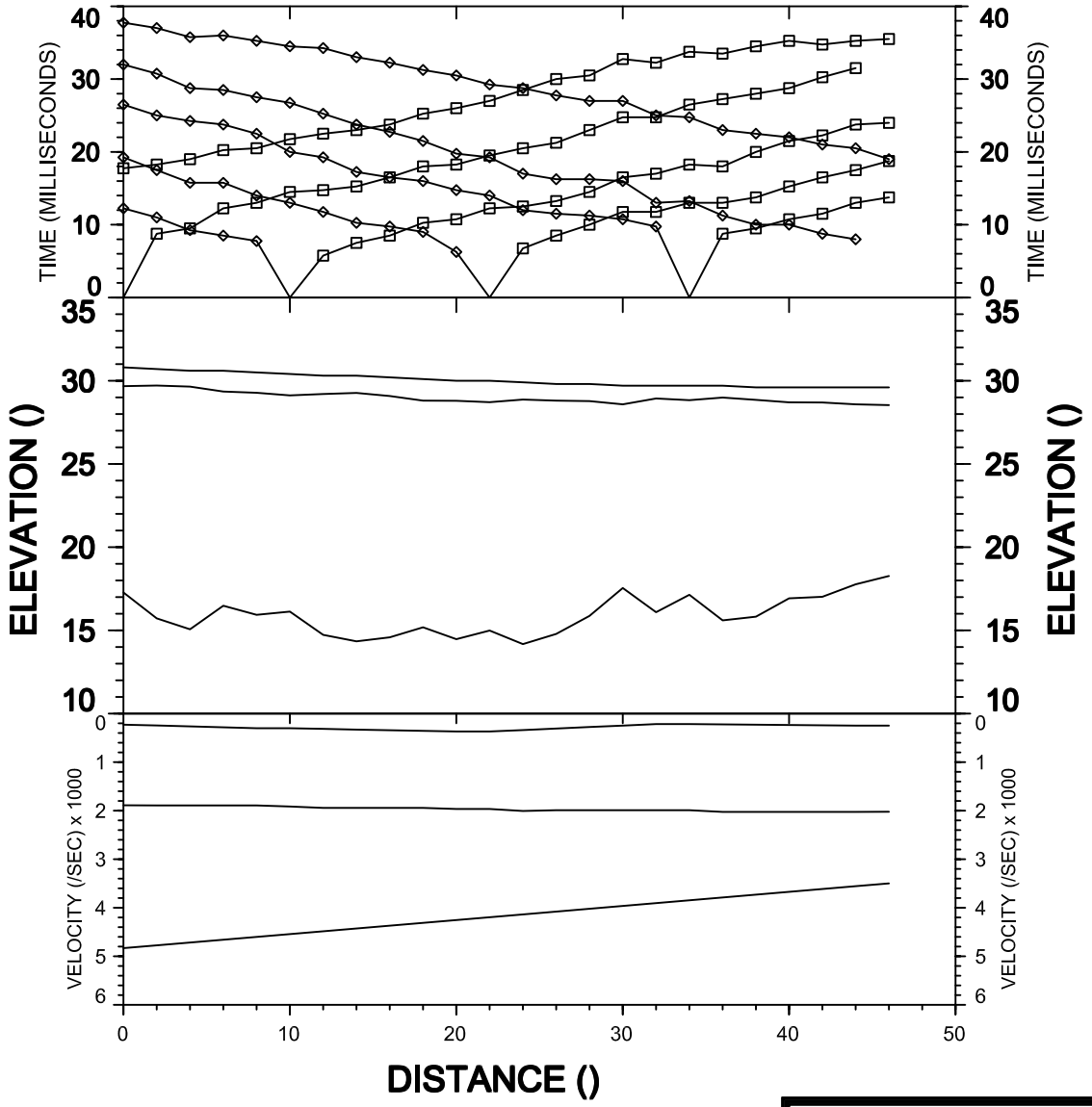


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS92 / Date: 13/06/22	
Equipment: Geode / Spread: S92	Azimuth:

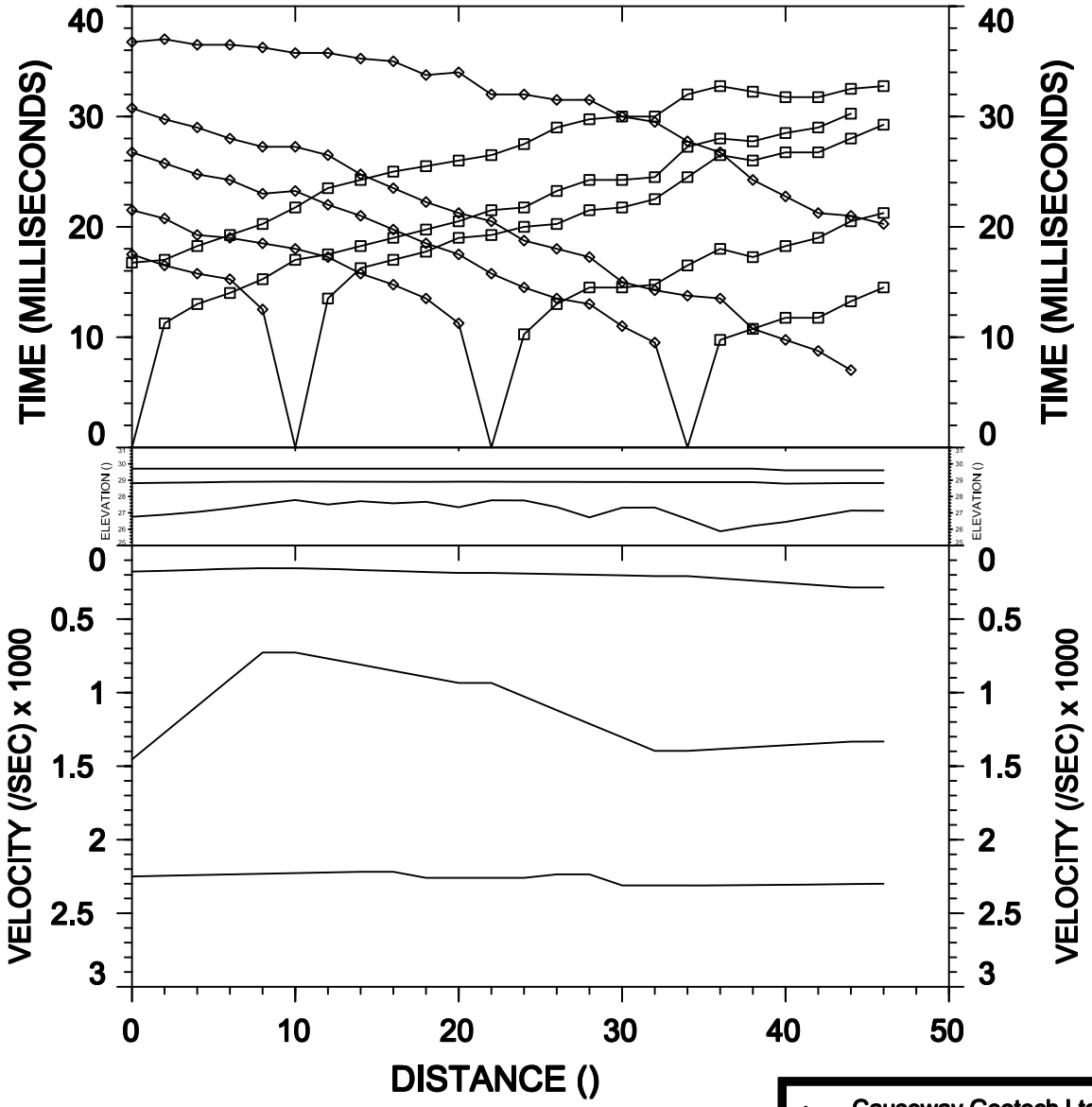


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS93 / Date: 13/06/22	
Equipment: Geode / Spread: S93	Azimuth:

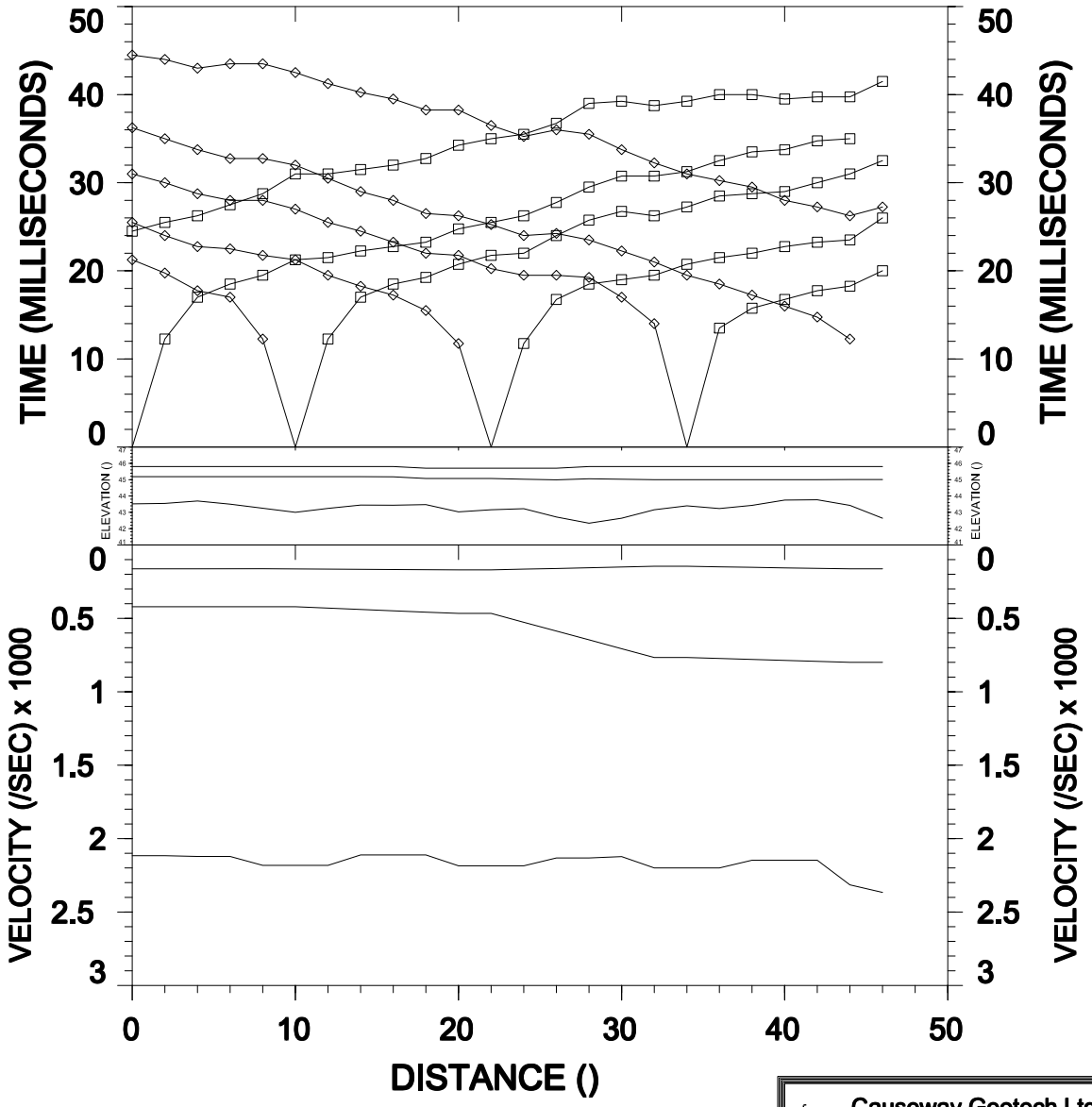


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS94R	Date: 13/06/22	
Equipment: Geode	Spread: S94	Azimuth:

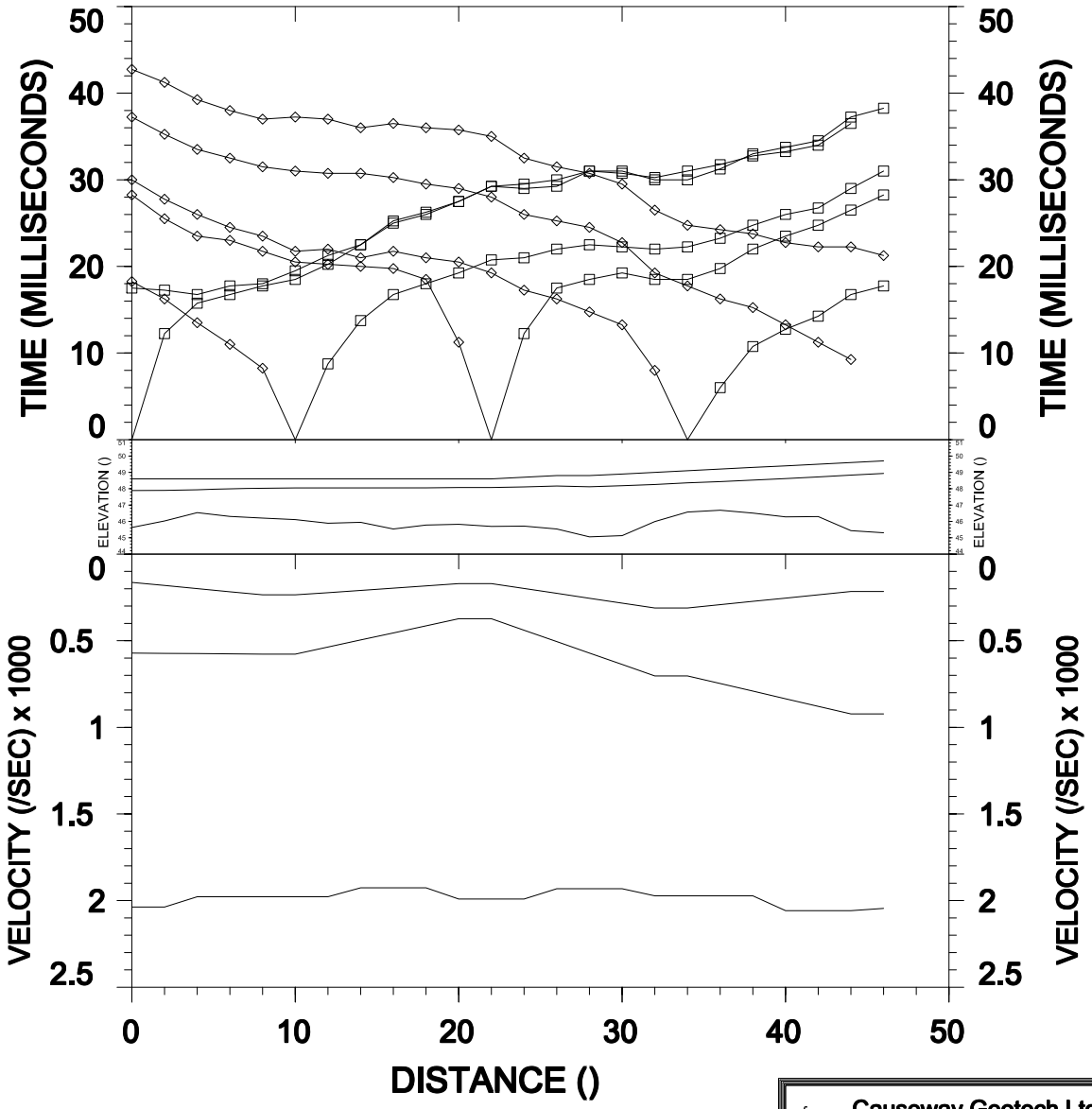


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS95 / Date: 13/06/22	
Equipment: Geode / Spread: S95	Azimuth:

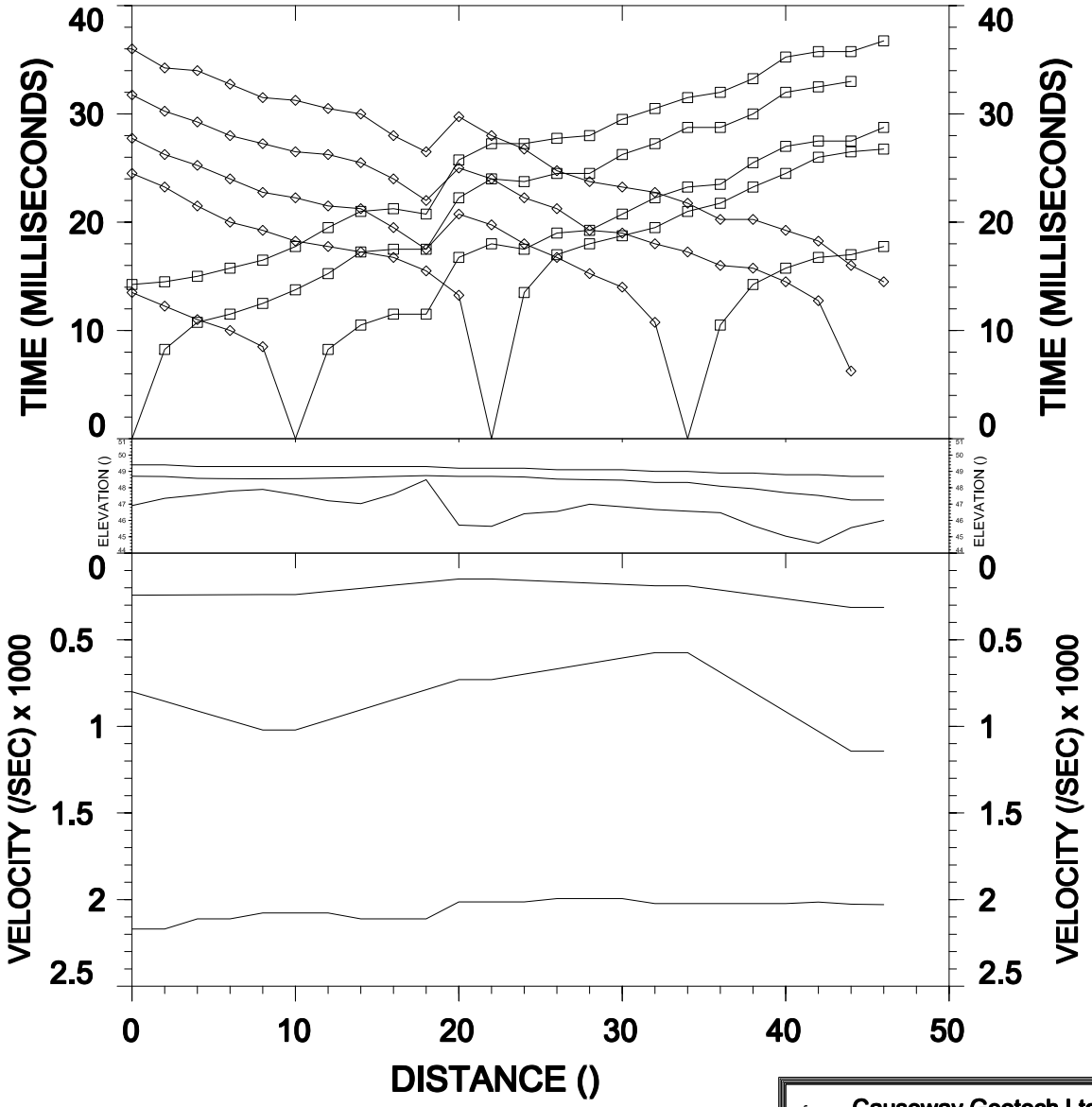


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS96	Date: 14/06/22	
Equipment: Geode	Spread: S96	Azimuth:

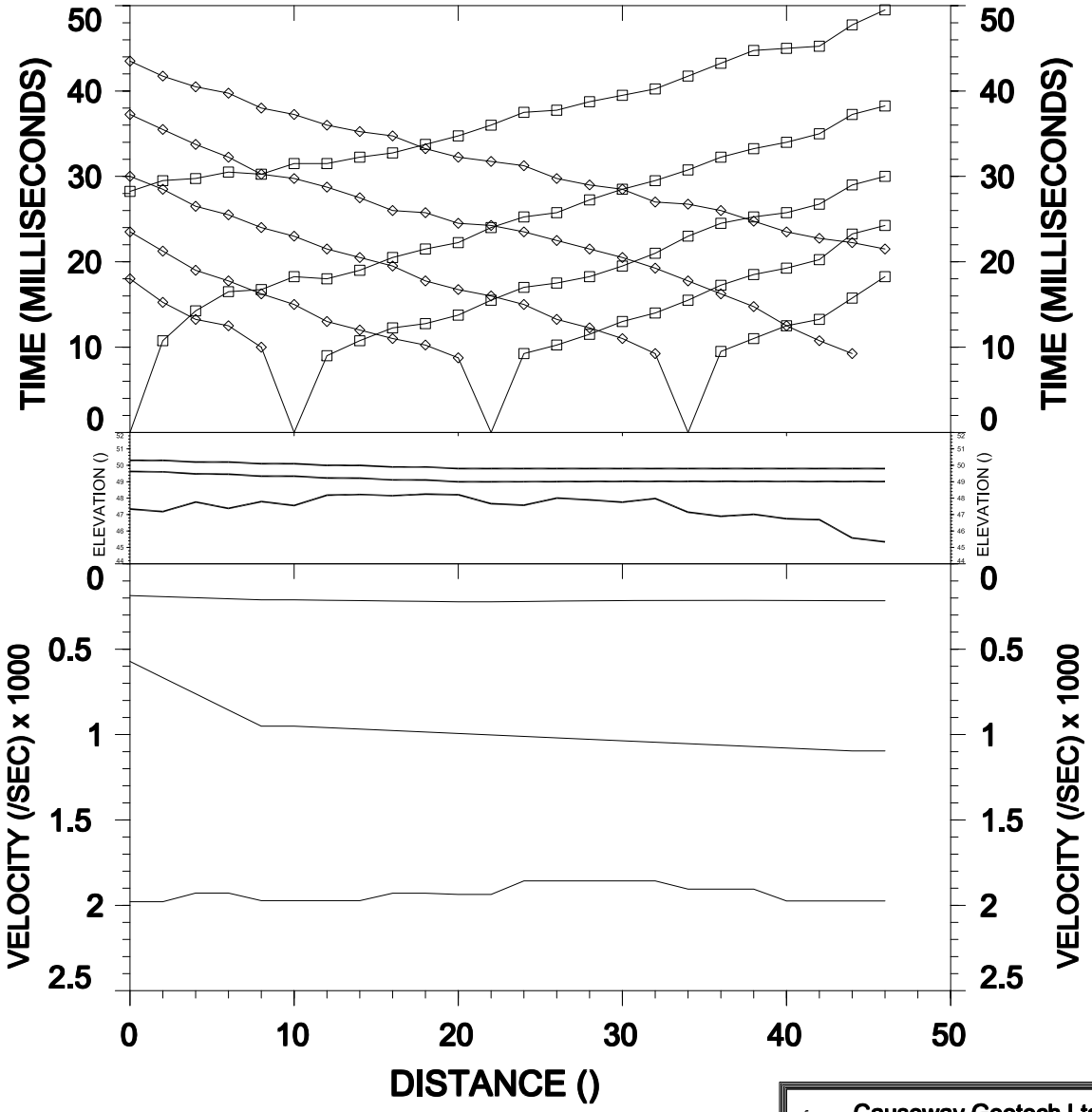


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS97	Date: 14/06/22	Tipperary
Equipment: Geode	Spread: S97	Azimuth:

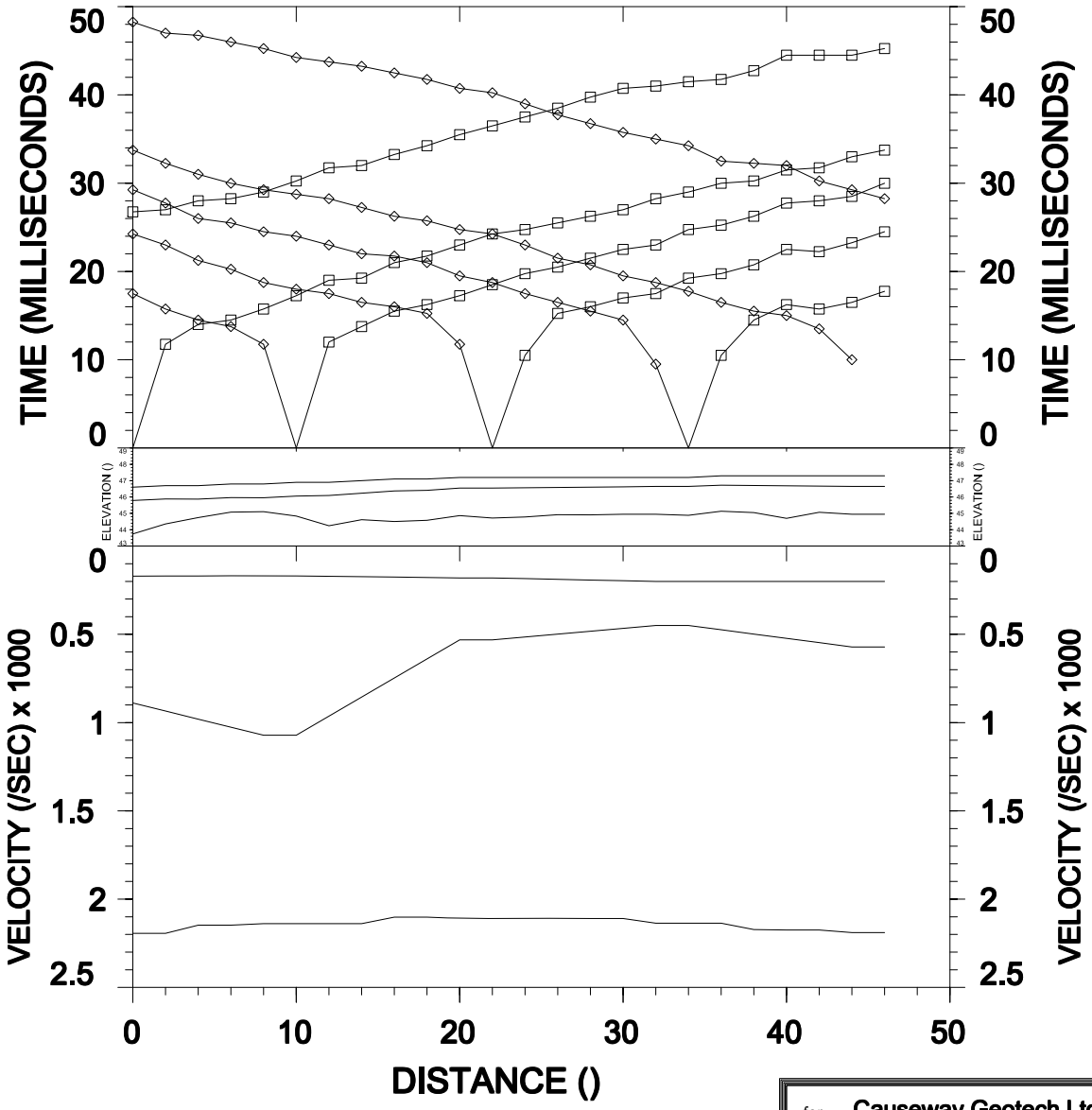


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS98R	Date: 14/06/22	
Equipment: Geode	Spread: S98	Azimuth:

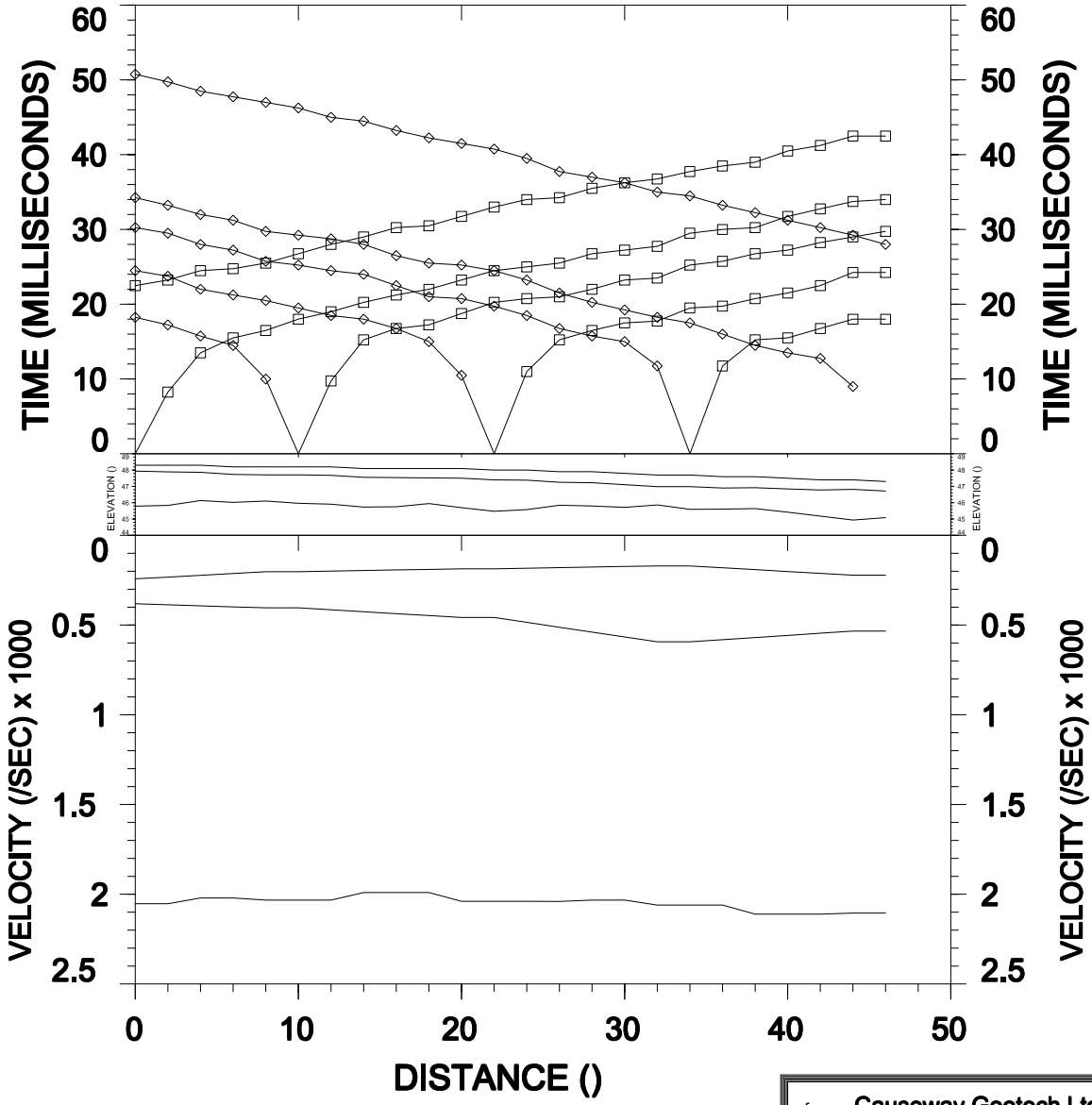


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS99	Date: 14/06/22	Tipperary
Equipment: Geode	Spread: S99	Azimuth:

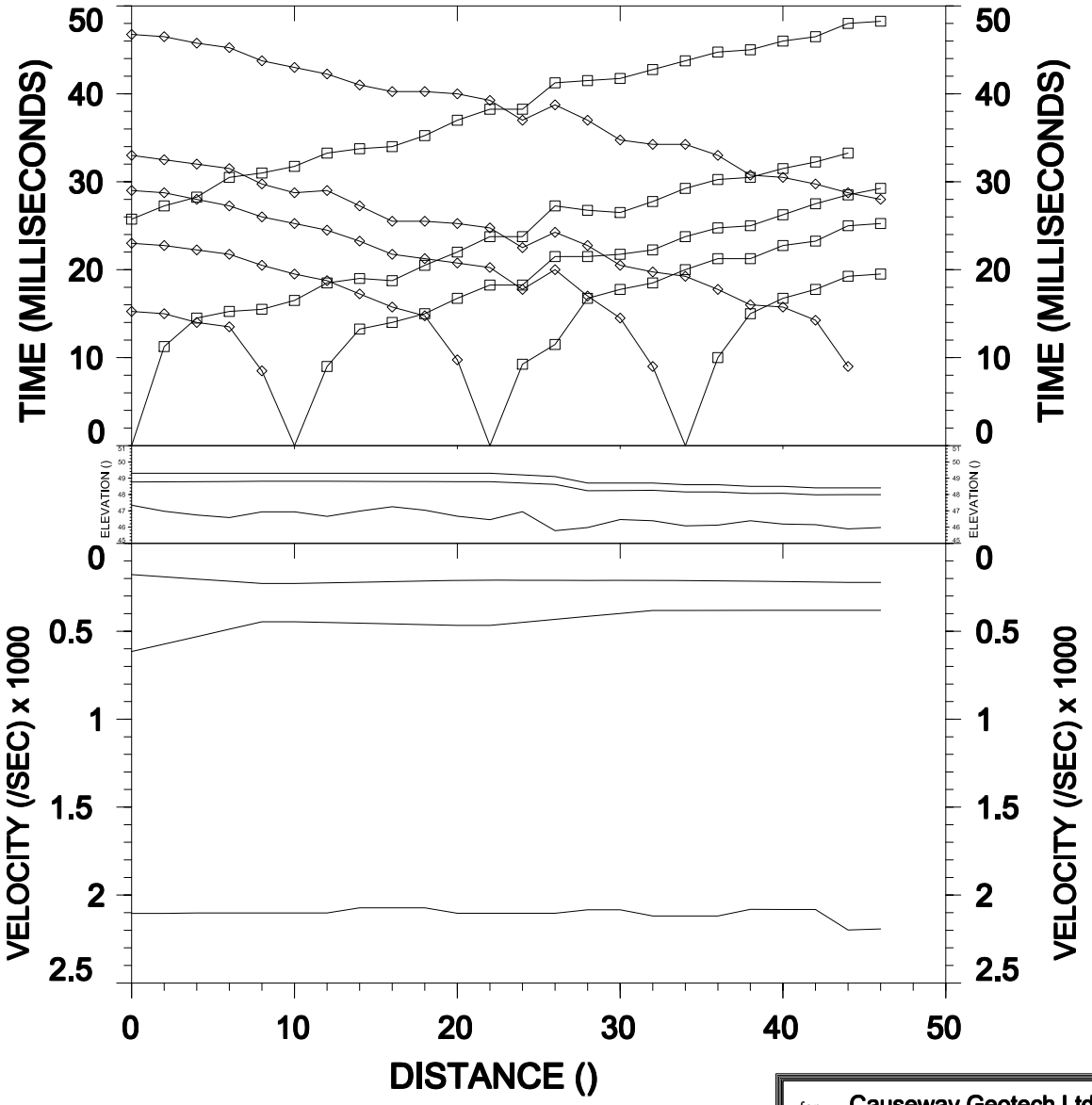


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS100	Date: 14/06/22	Tipperary
Equipment: Geode	Spread: S100	Azimuth:

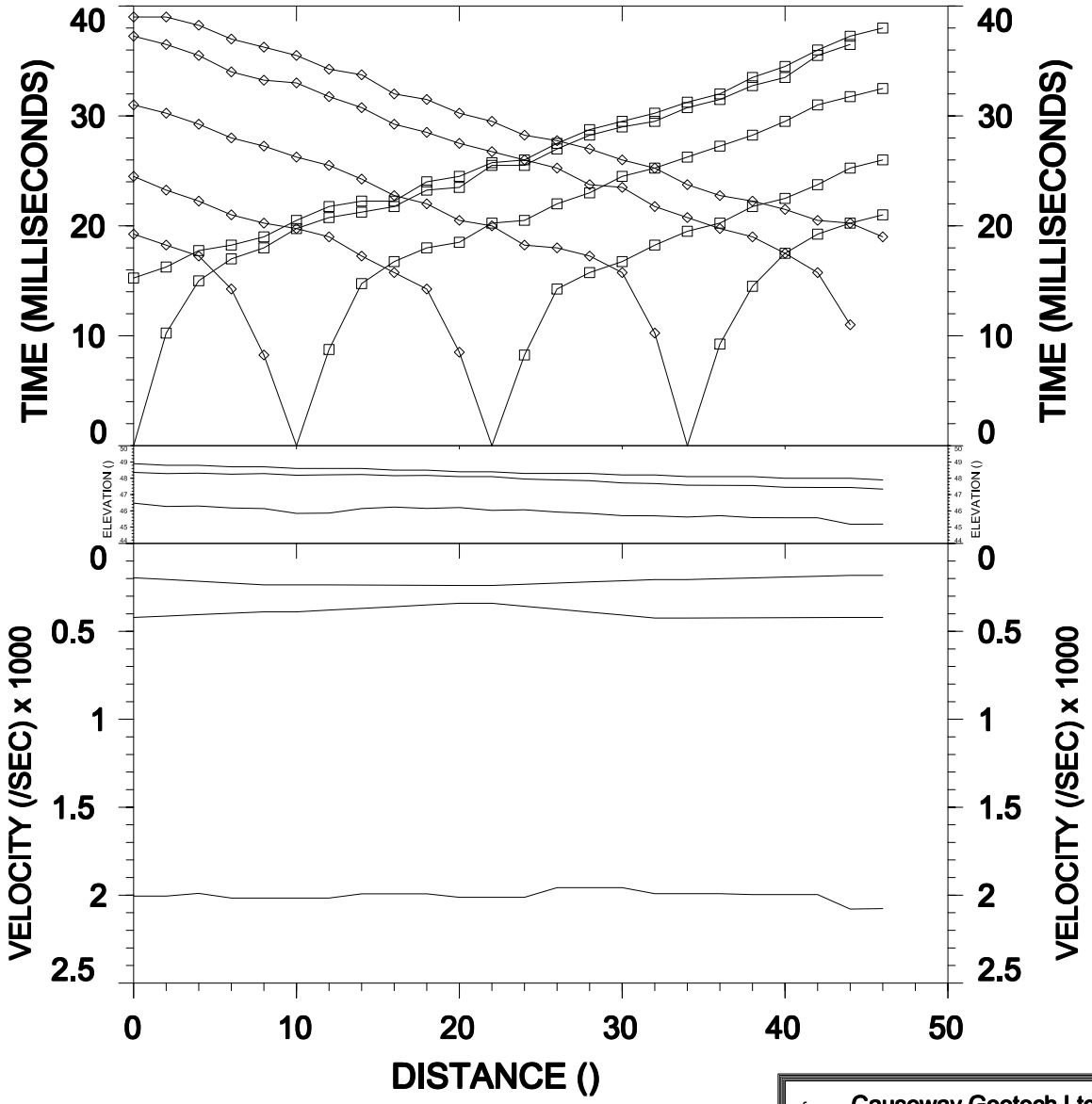


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS101	Date: 14/06/22	
Equipment: Geode	Spread: S101	Azimuth:

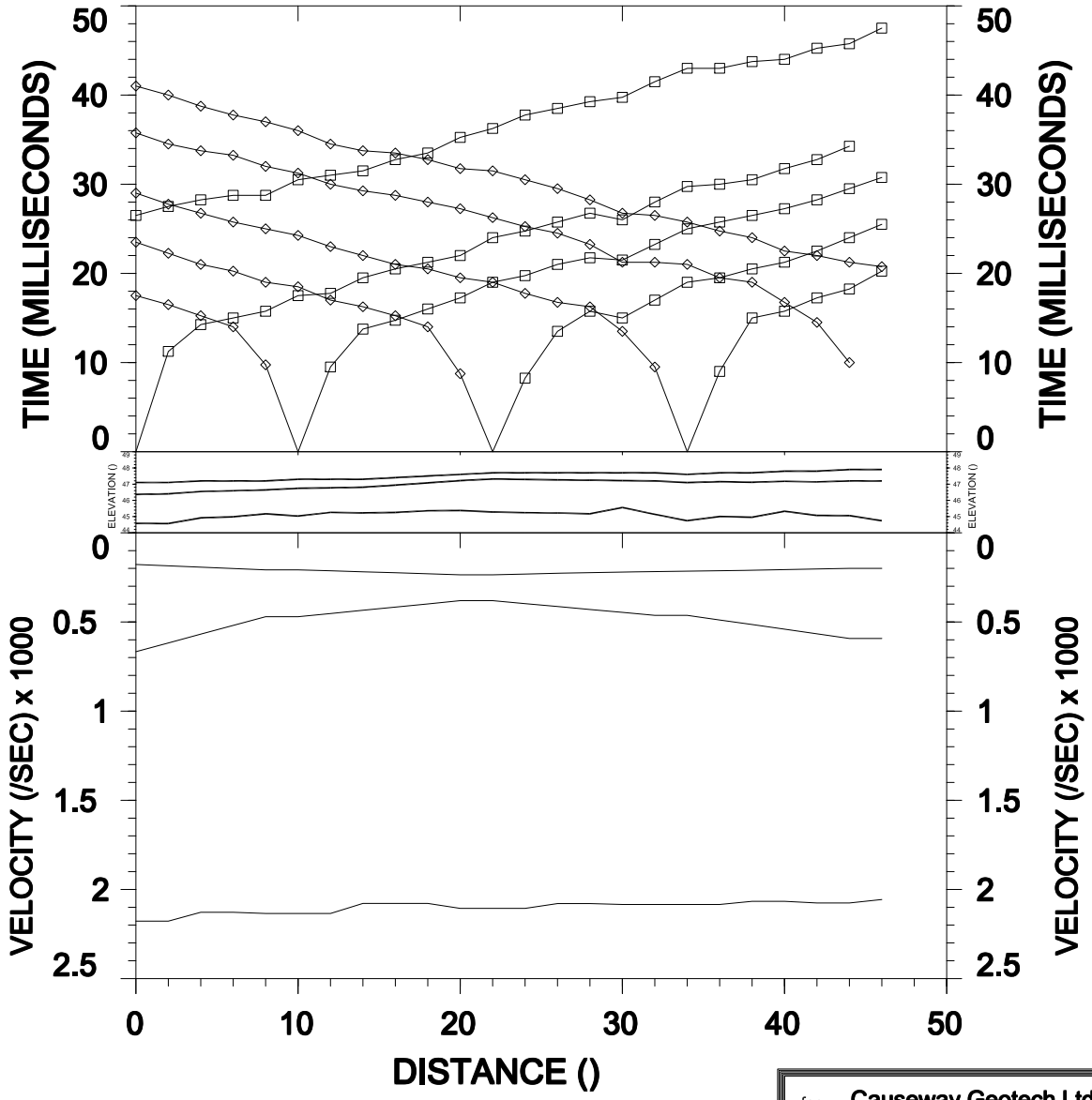


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS102	Date: 14/06/22	Tipperary
Equipment: Geode	Spread: S102	Azimuth:

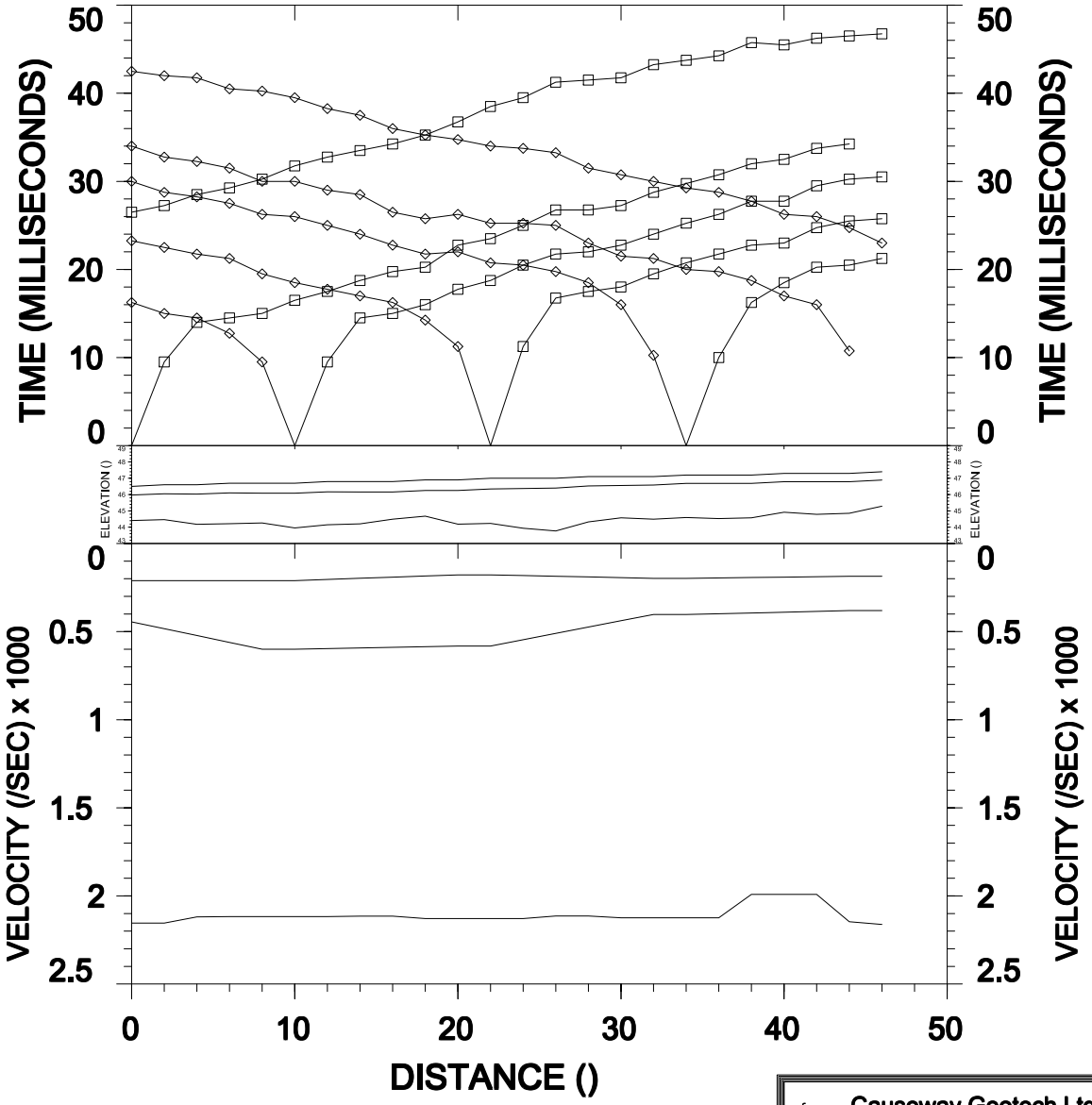


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS103R / Date: 14/06/22	
Equipment: Geode / Spread: S103	Azimuth:

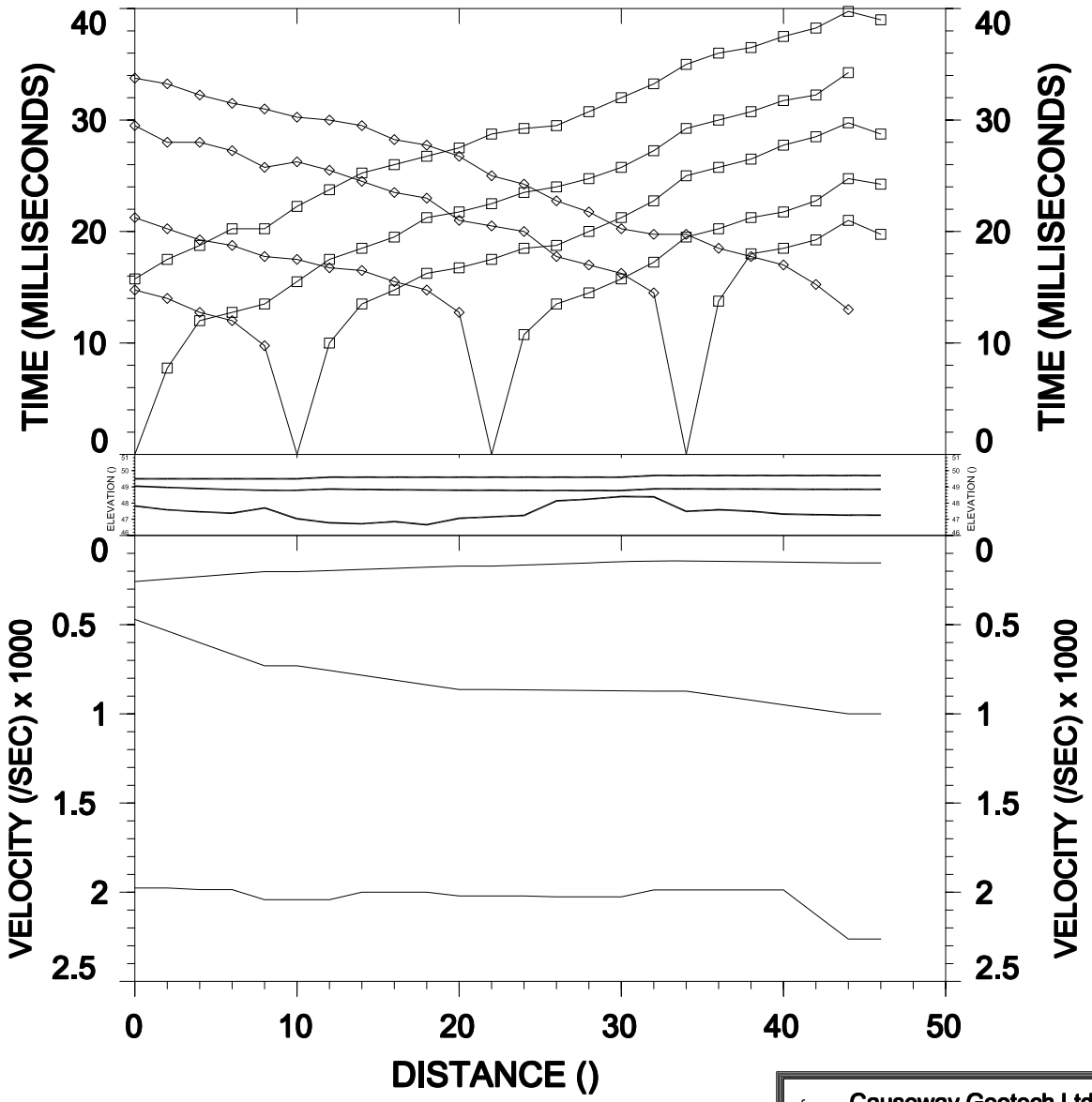


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS104	Date: 15/06/22	Tipperary
Equipment: Geode	Spread: S104	Azimuth:

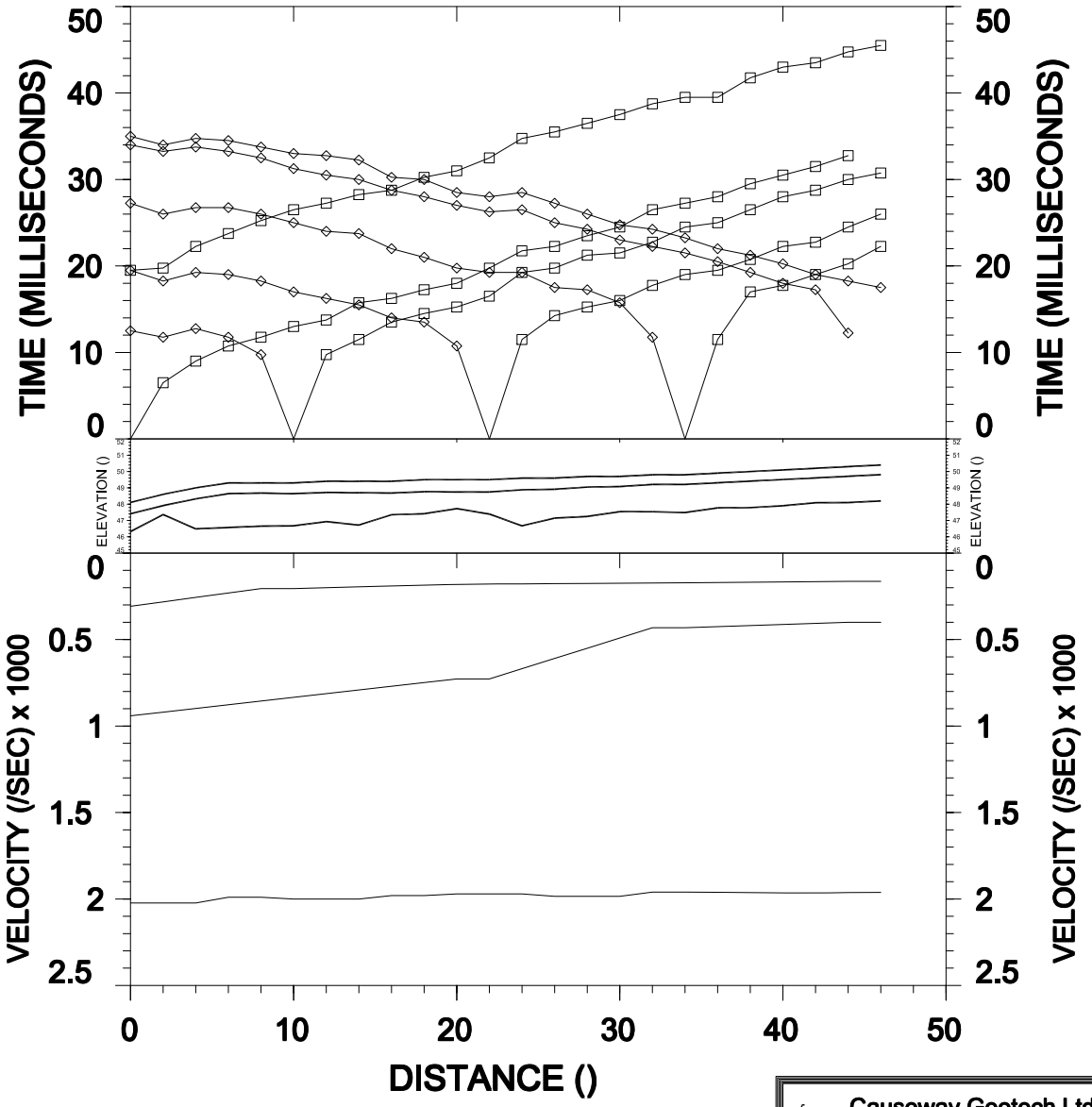


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS105	Date: 15/06/22	
Equipment: Geode	Spread: S105	Azimuth:

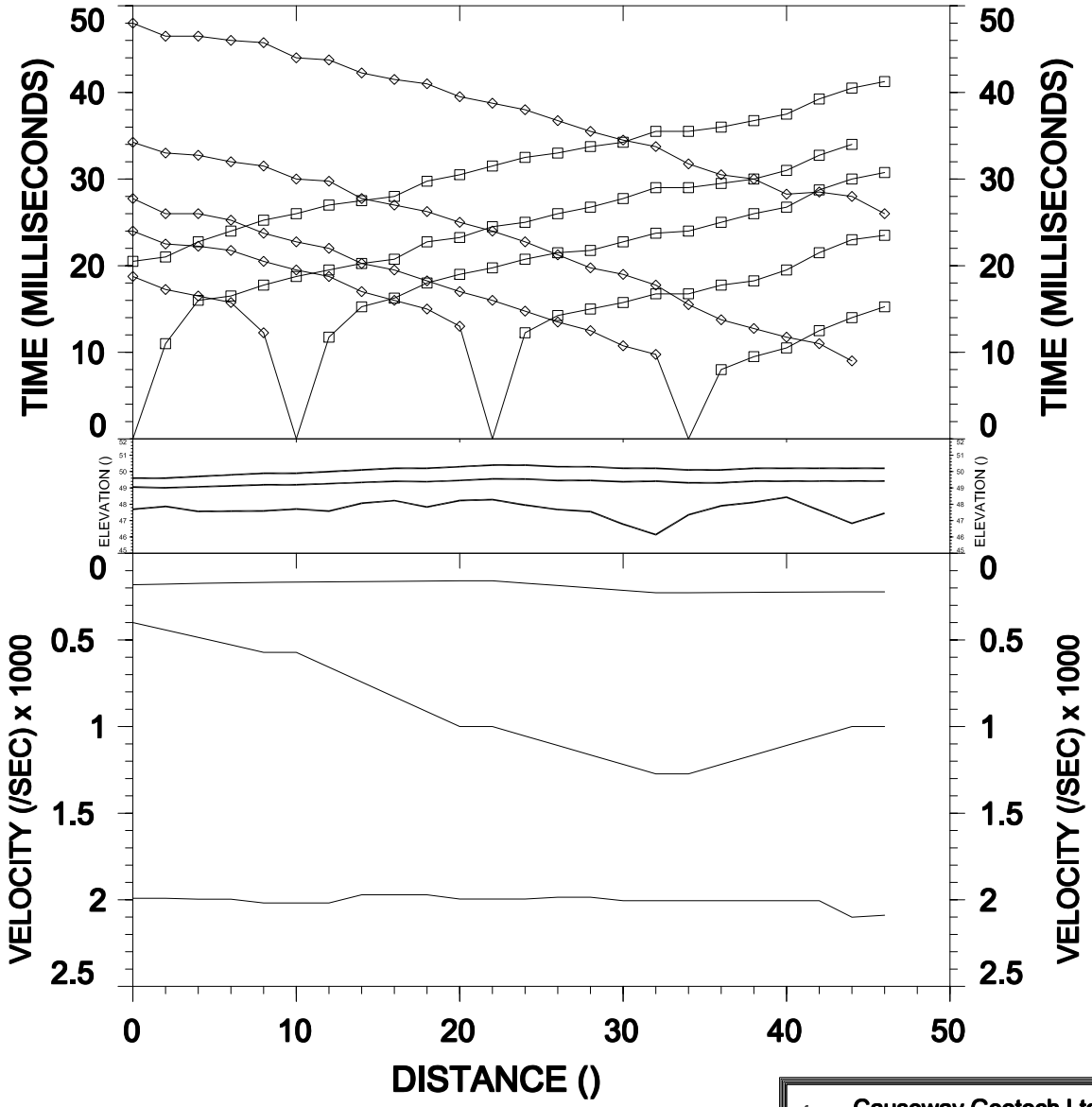


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS106	Date: 15/06/22	
Equipment: Geode	Spread: S106	Azimuth:

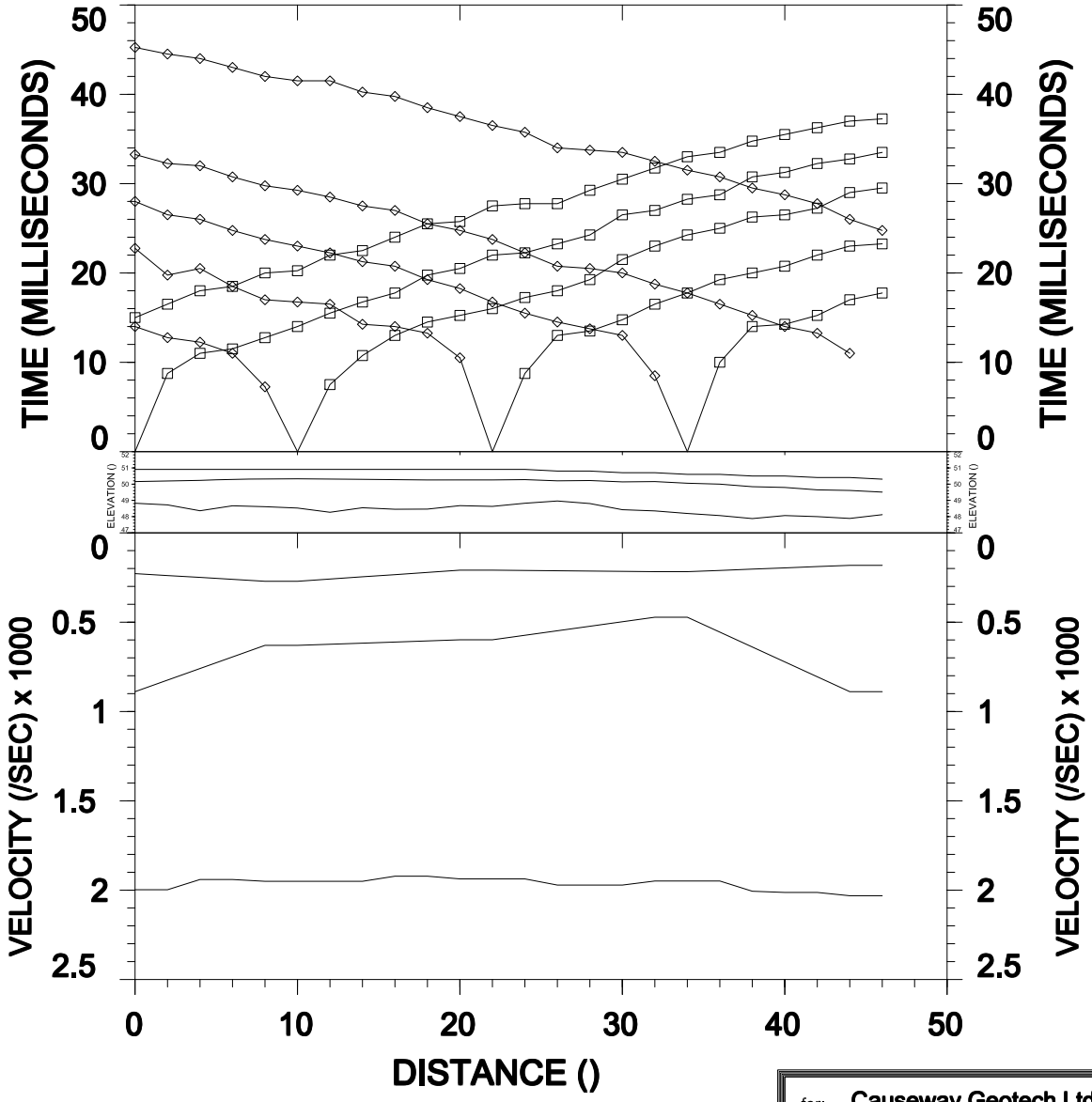


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS107R / Date: 15/06/22	
Equipment: Geode / Spread: S107	Azimuth:

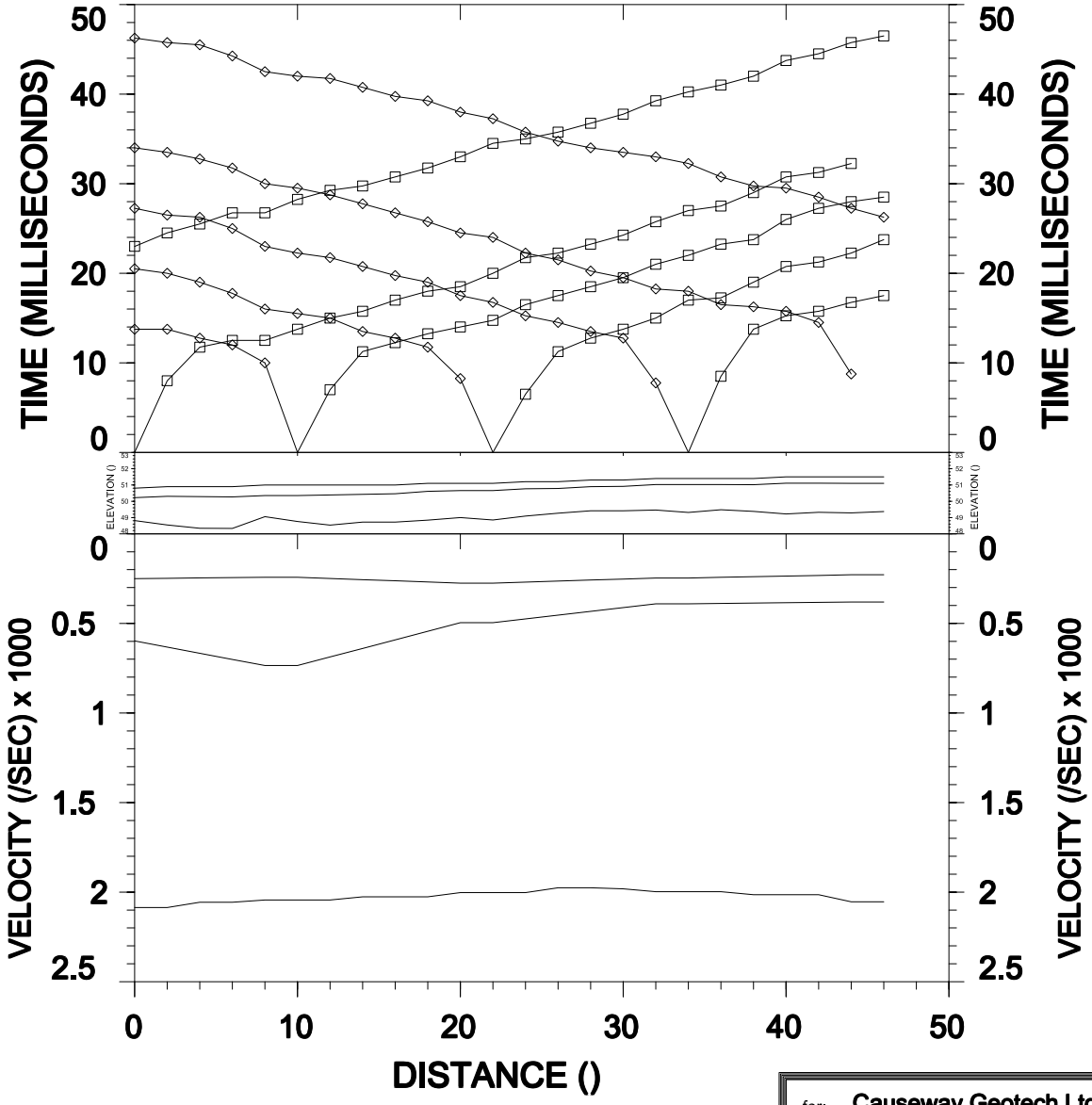
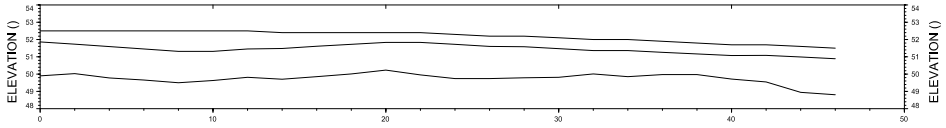


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS108R / Date: 15/06/22	
Equipment: Geode / Spread: S108	Azimuth:



DISTANCE ()

Plate: 10a

for: **Causeway Geotech Ltd**		**AGP21220**
by: Strata Geophysical, Inc.		**Tipperary Tipperary**
Data SetS109	Date: 15/06/22	
Equipment: Geode	**Spread: S109**	**Azimuth:**

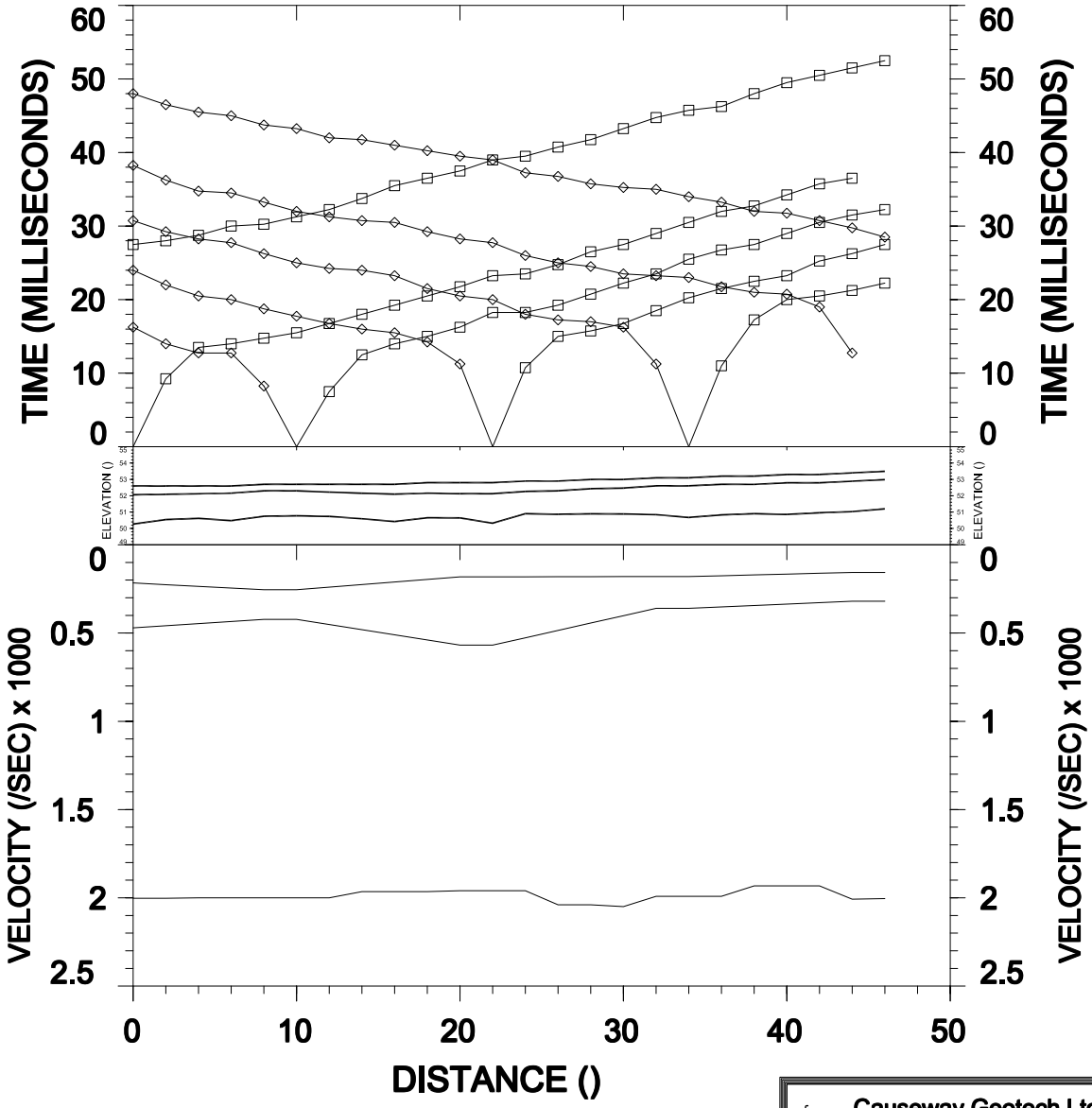


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS110 / Date: 15/06/22	
Equipment: Geode / Spread: S110	Azimuth:

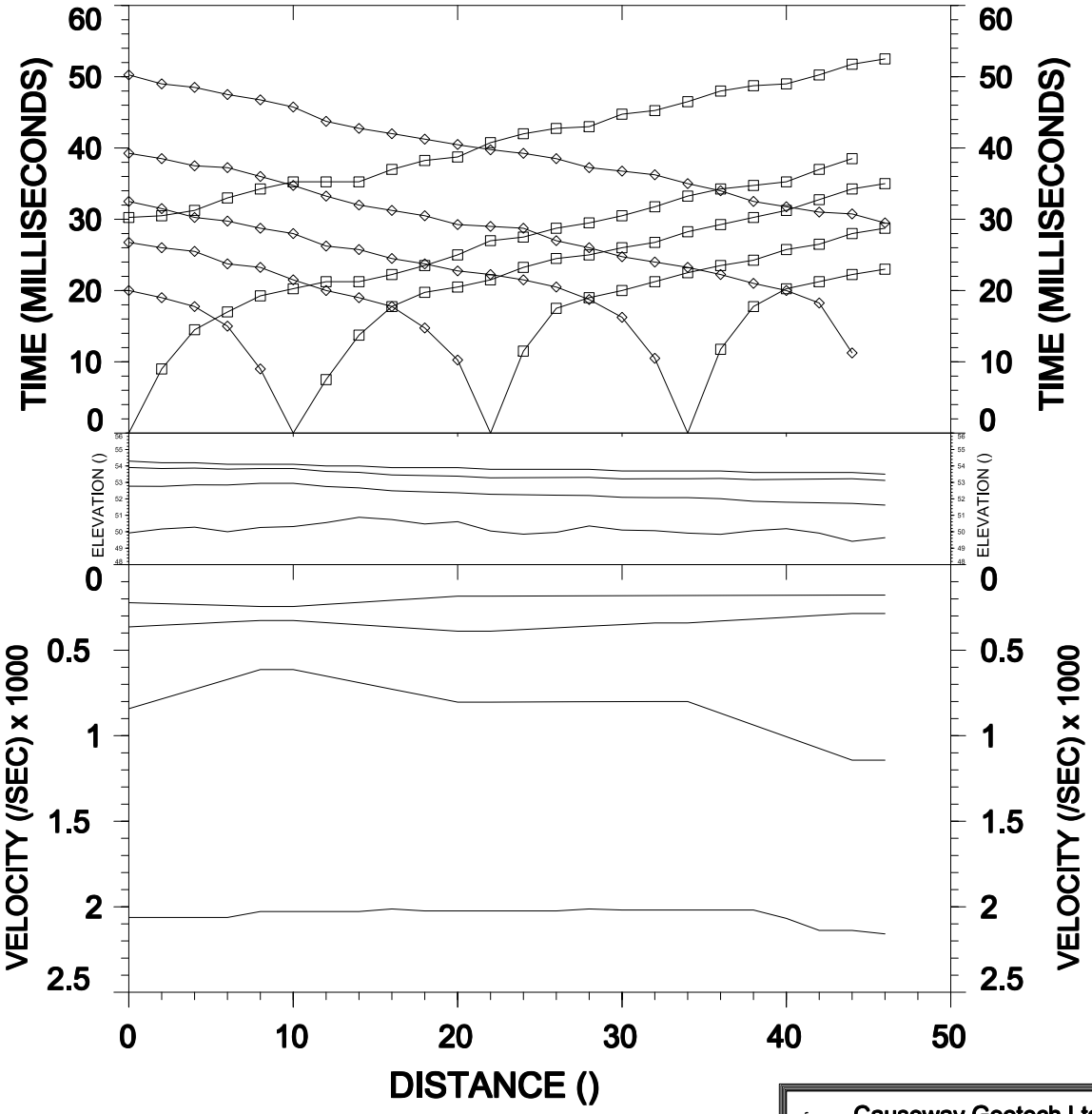


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS111 / Date: 15/06/22	
Equipment: Geode / Spread: S111	Azimuth:

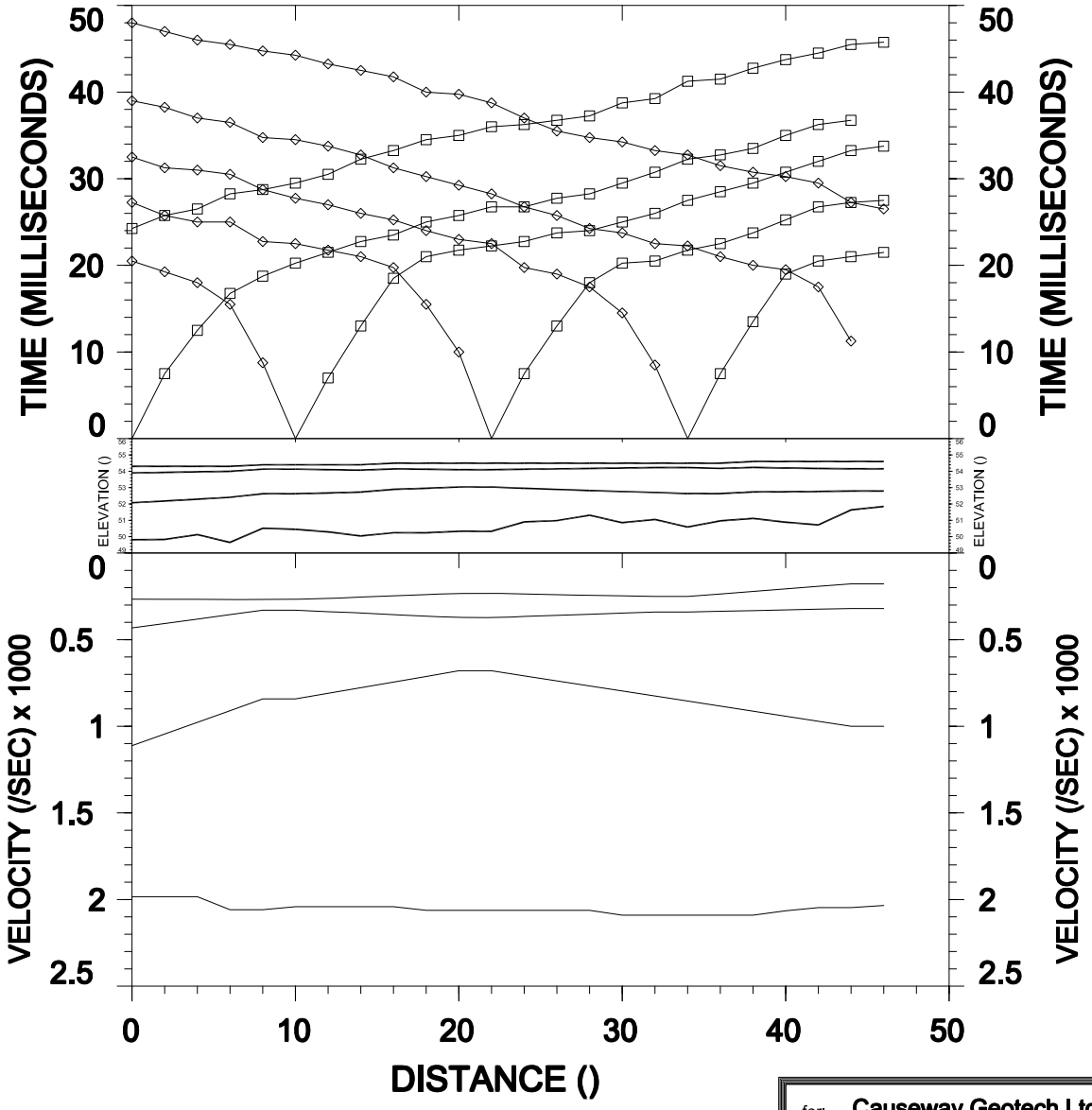


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS112	Date: 15/06/22	
Equipment: Geode	Spread: S112	Azimuth:

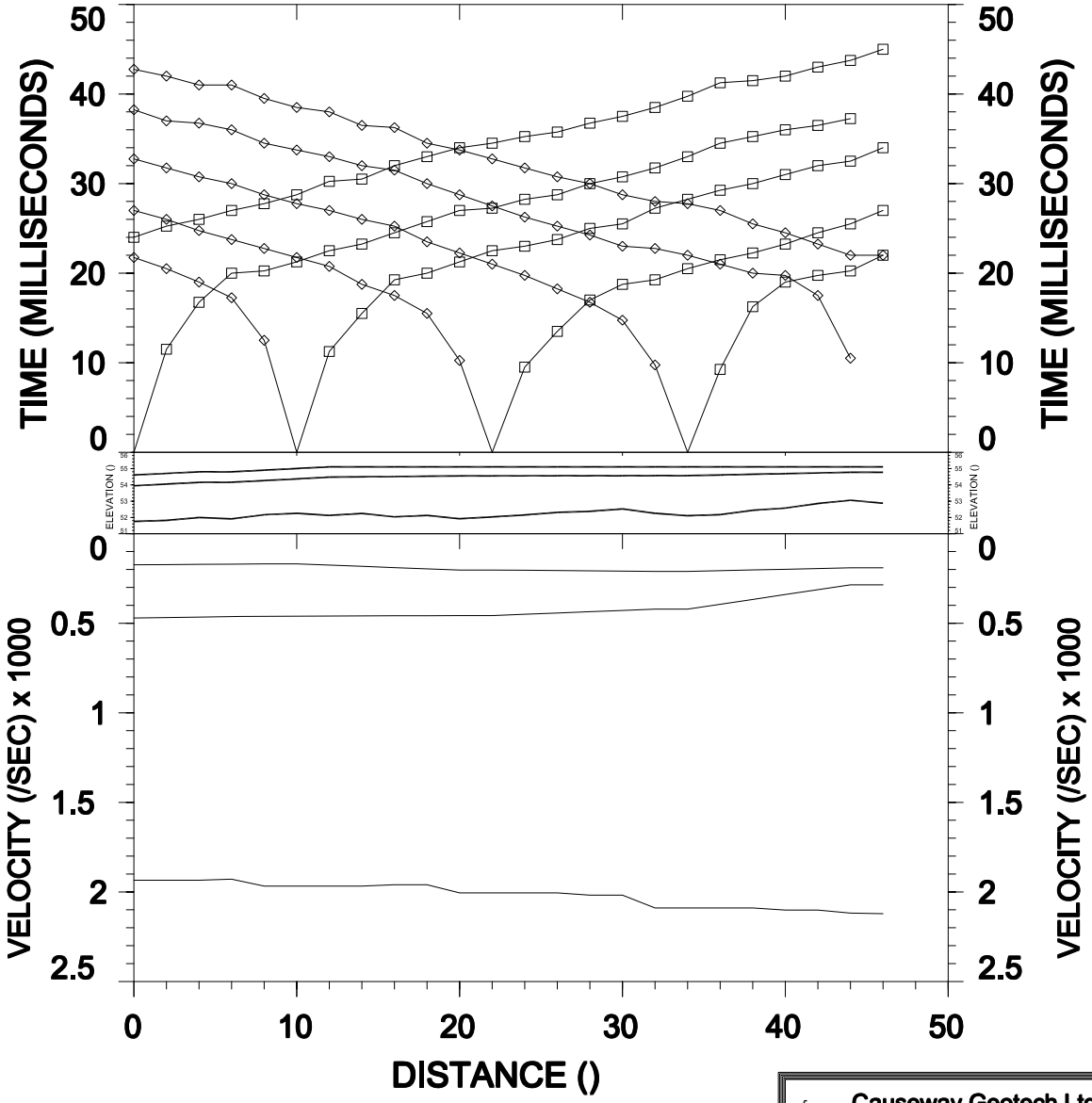


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS113	Date: 16/06/22	Tipperary
Equipment: Geode	Spread: S113	Azimuth:

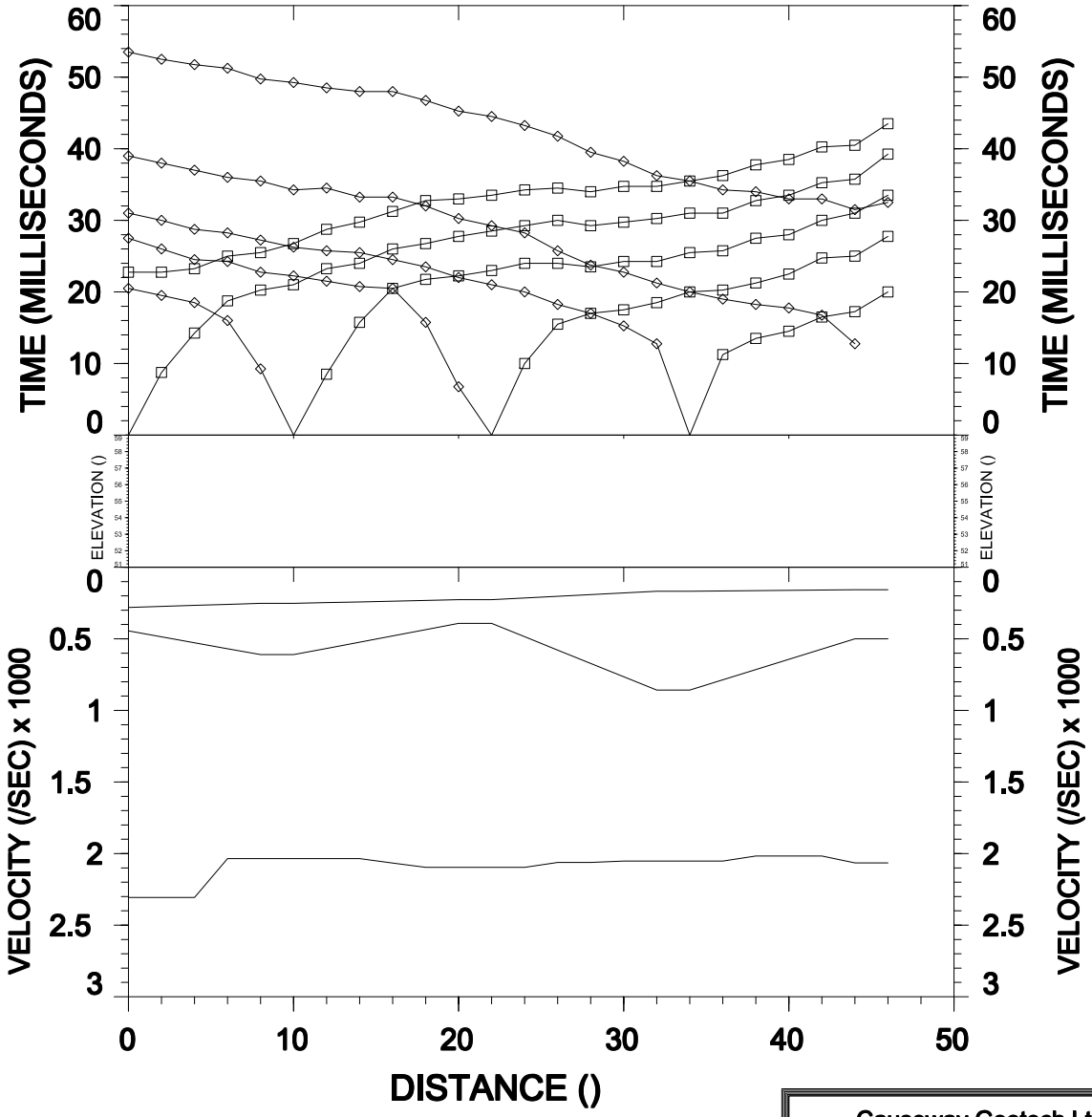


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS114	Date: 16/06/22	Tipperary
Equipment: Geode	Spread: S114	Azimuth:

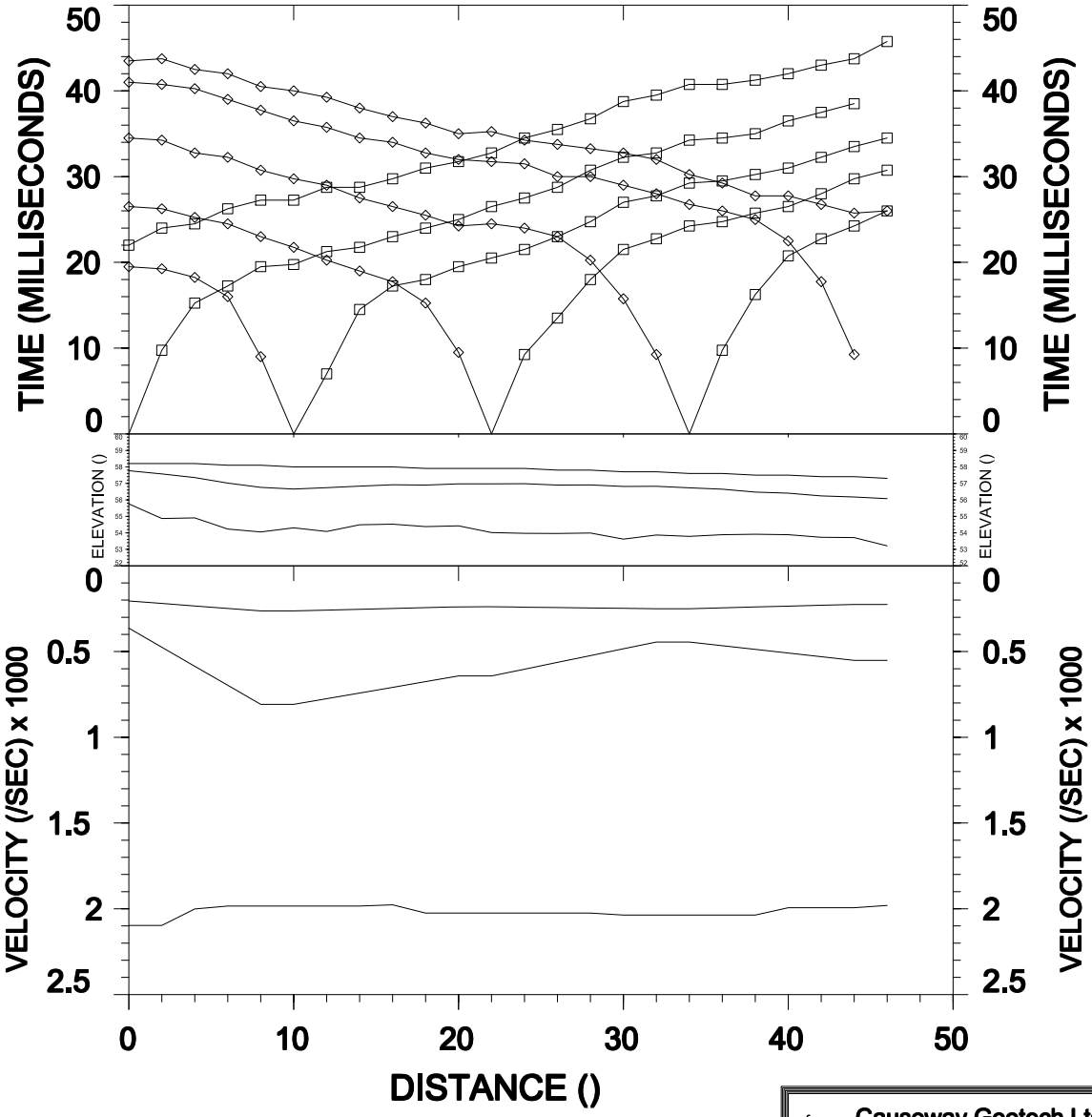


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS115 / Date: 16/06/22	
Equipment: Geode / Spread: S115	Azimuth:

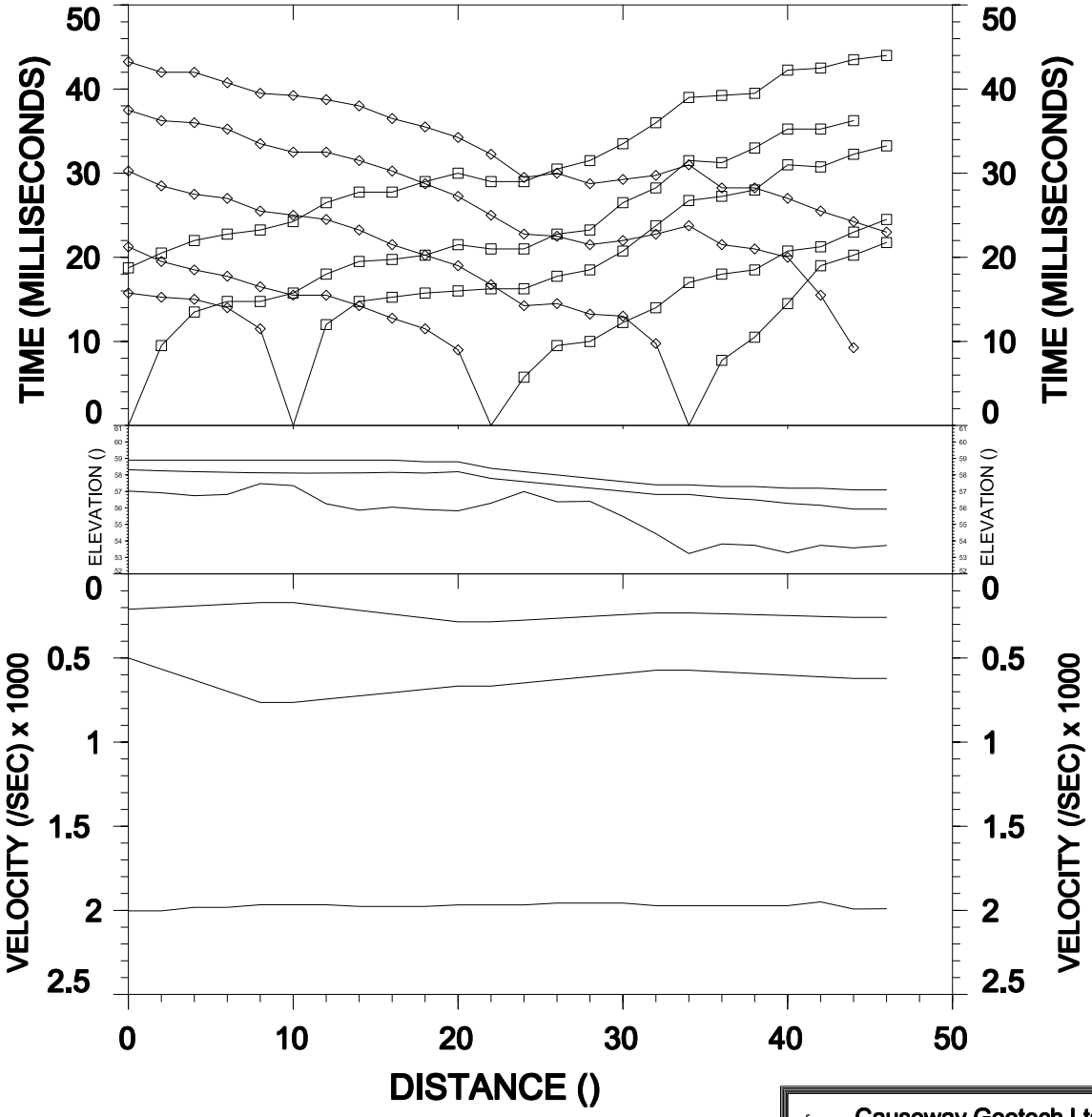


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS116 / Date: 16/06/22	
Equipment: Geode / Spread: S116	Azimuth:

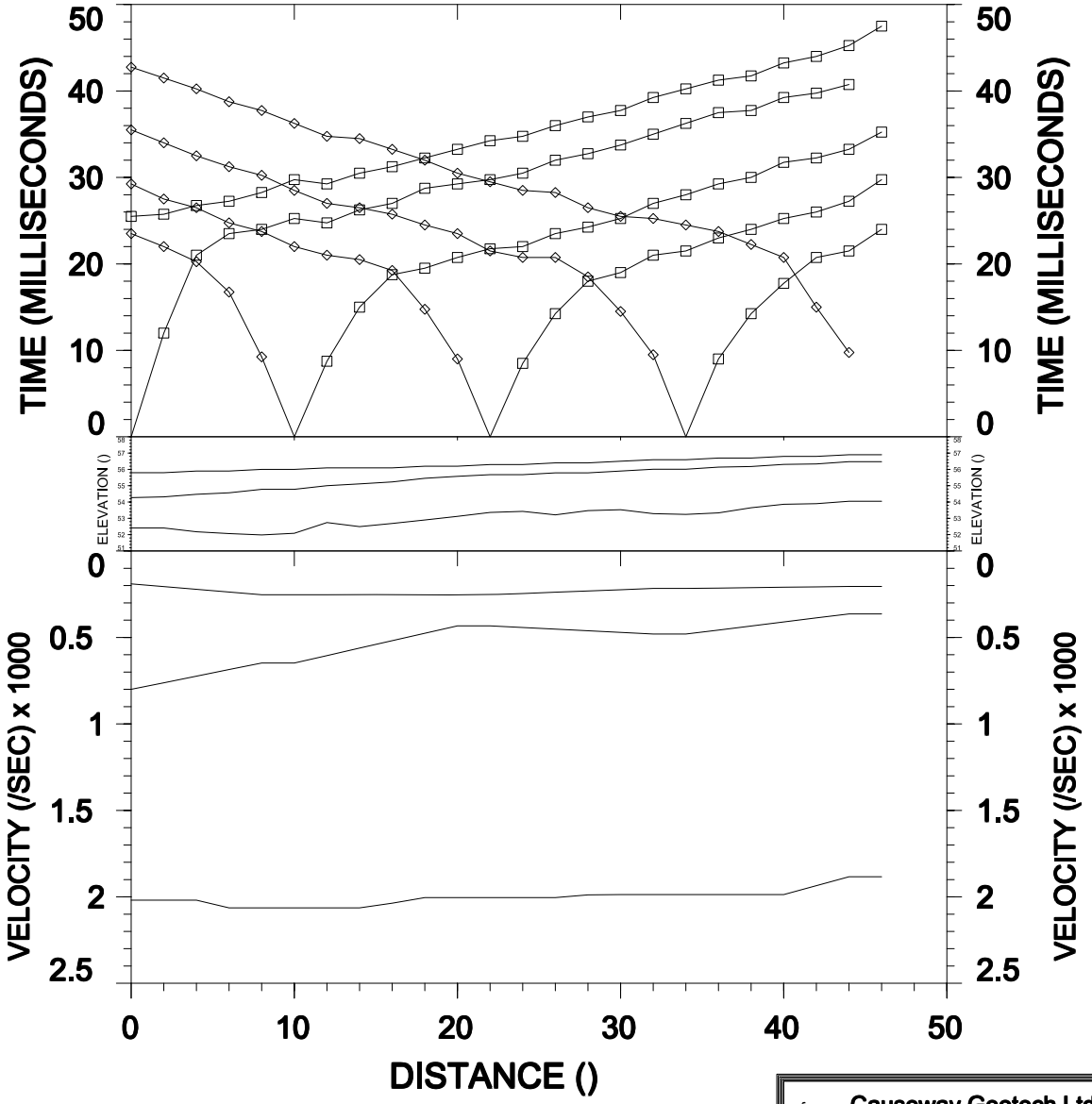


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS117 / Date: 16/06/22	
Equipment: Geode / Spread: S117	Azimuth:

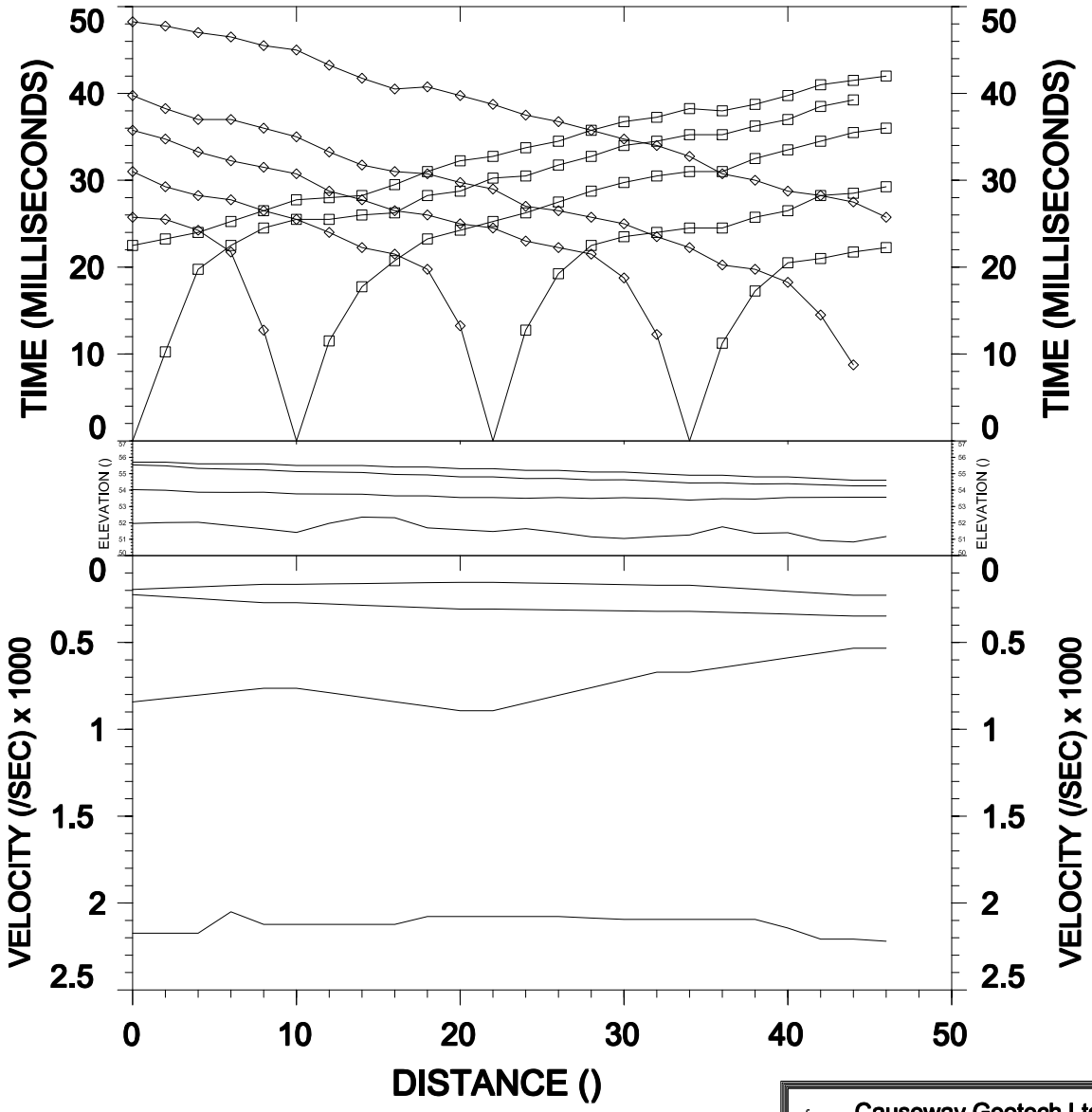


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS118 / Date: 16/06/22	
Equipment: Geode / Spread: S118	Azimuth:

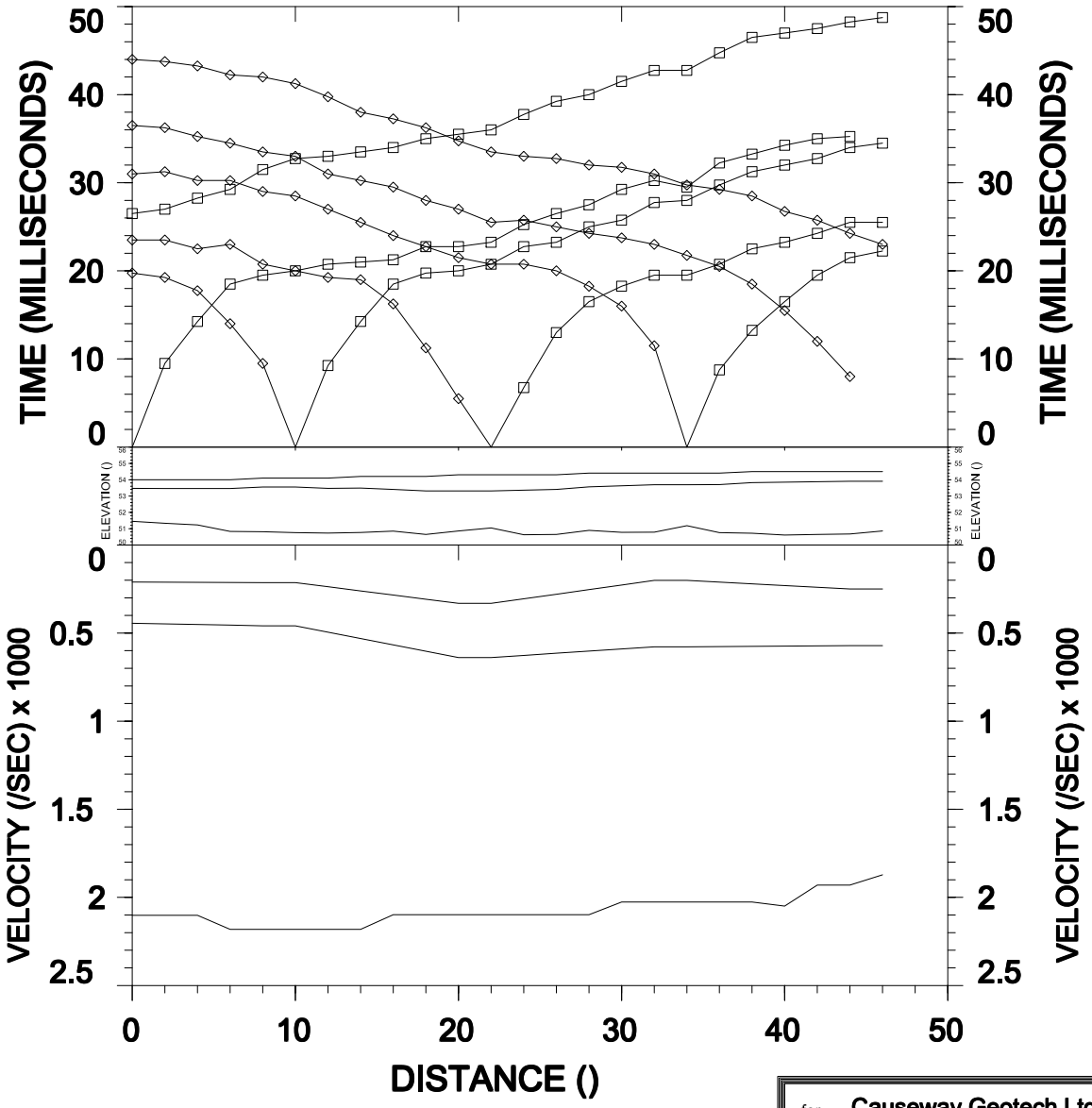


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary
Data SetS119 / Date: 16/06/22	Tipperary
Equipment: Geode / Spread: S119	Azimuth:

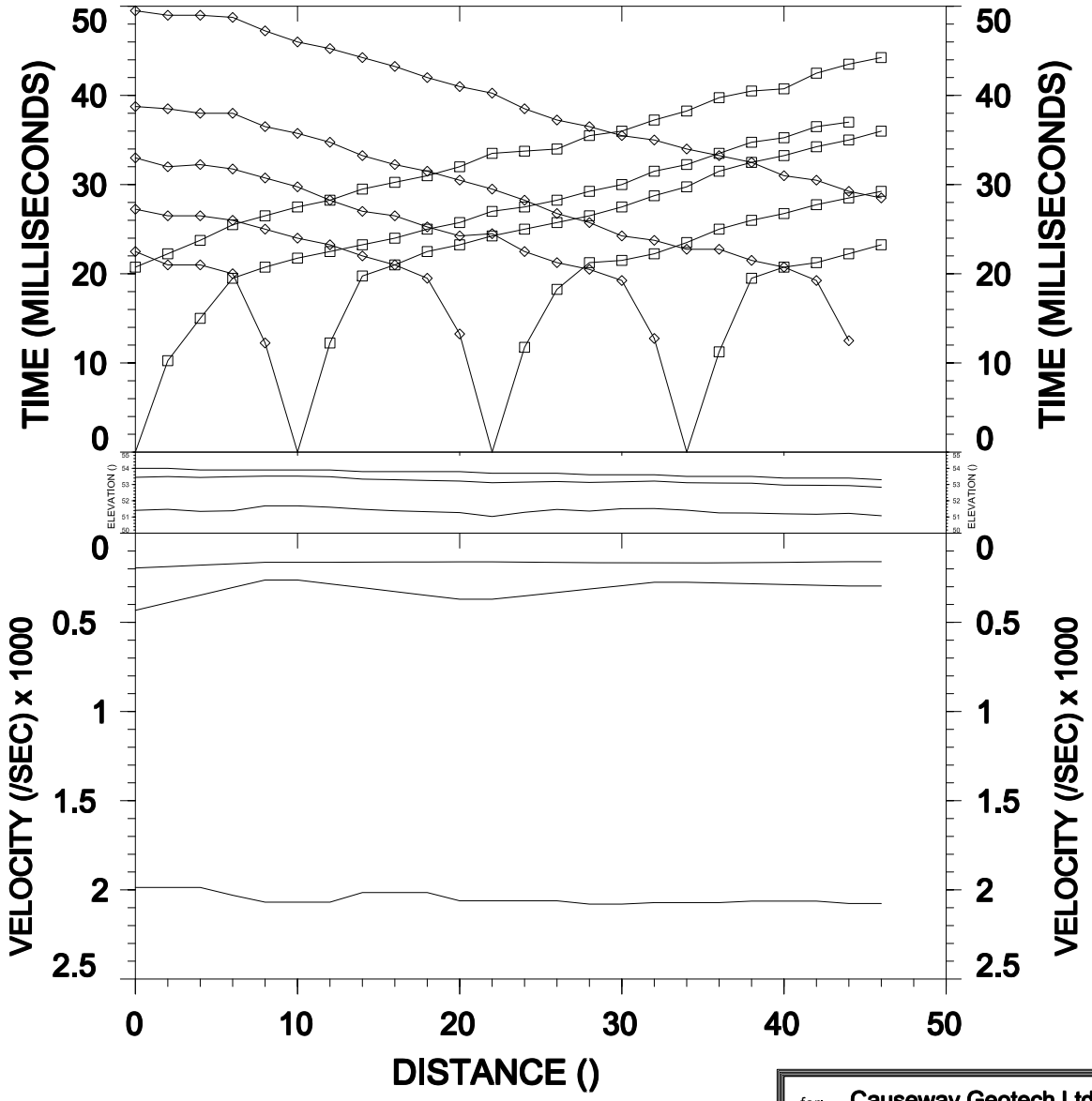


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS120 / Date: 16/06/22	
Equipment: Geode / Spread: S120	Azimuth:

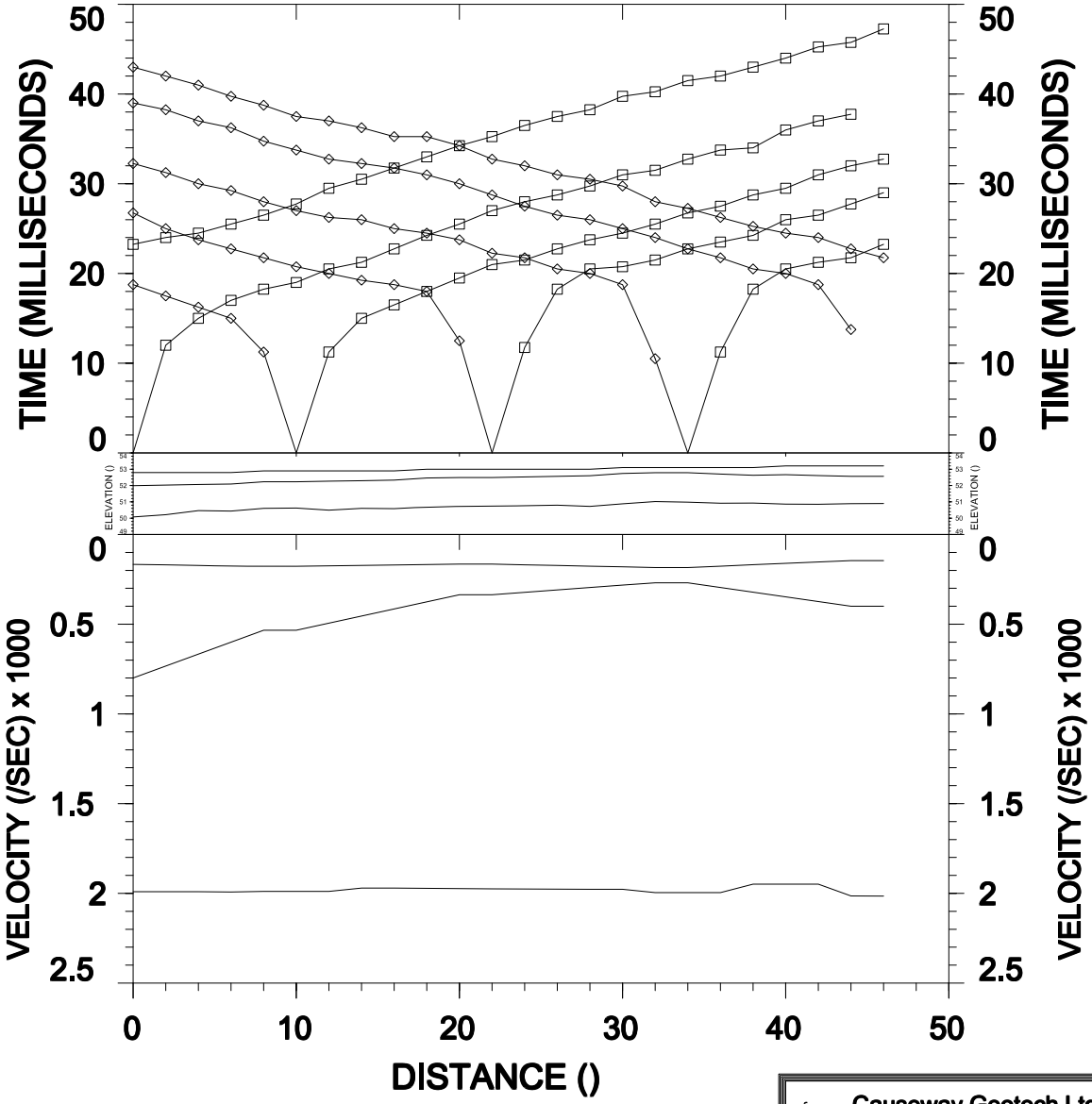


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS121 / Date: 16/06/22	
Equipment: Geode / Spread: S121	Azimuth:

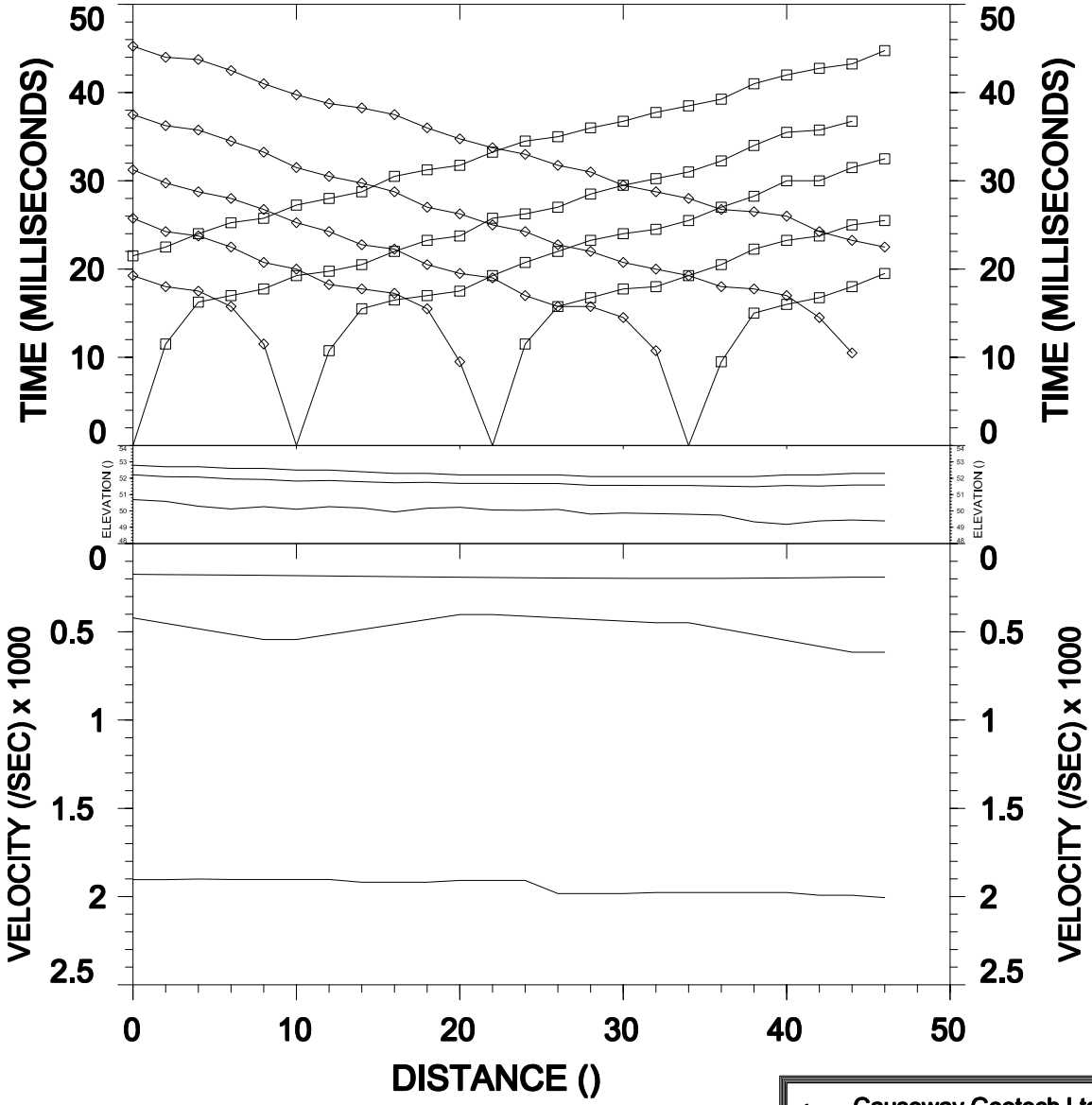


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS122 / Date: 16/06/22	
Equipment: Geode / Spread: S122	Azimuth:

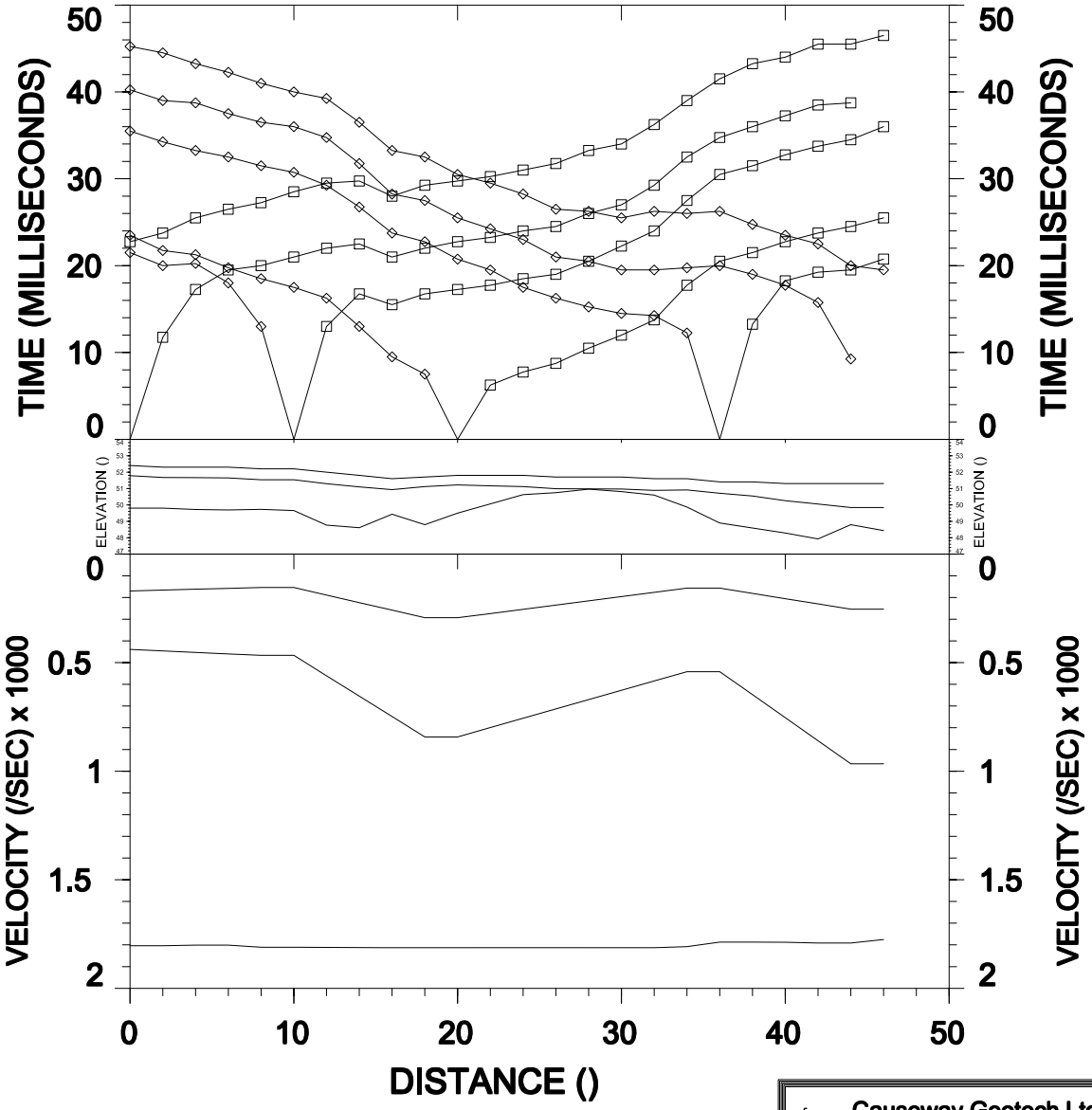


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS123 / Date: 16/06/22	
Equipment: Geode / Spread: S123	Azimuth:

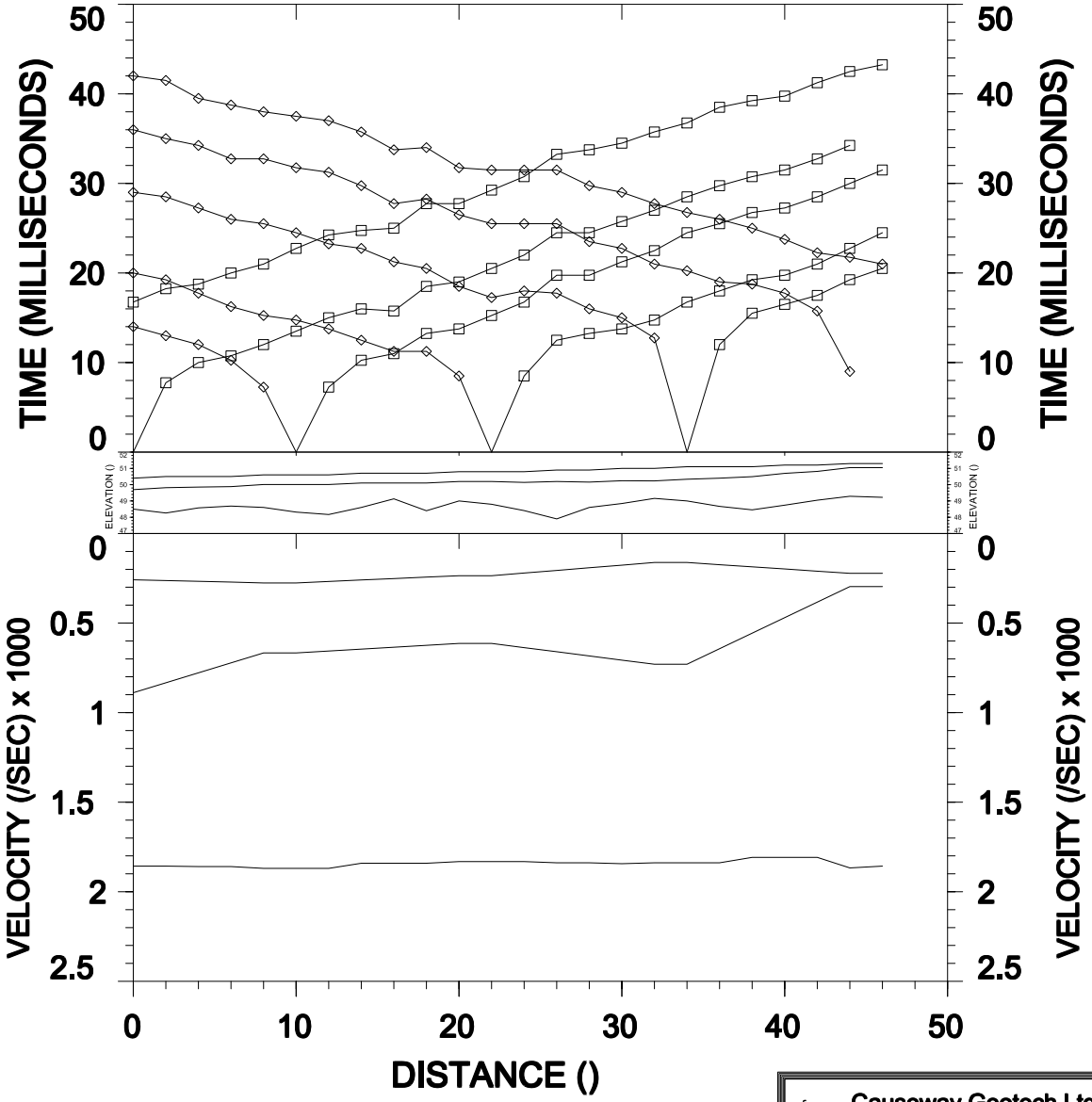


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS124 / Date: 16/06/22	
Equipment: Geode / Spread: S124	Azimuth:

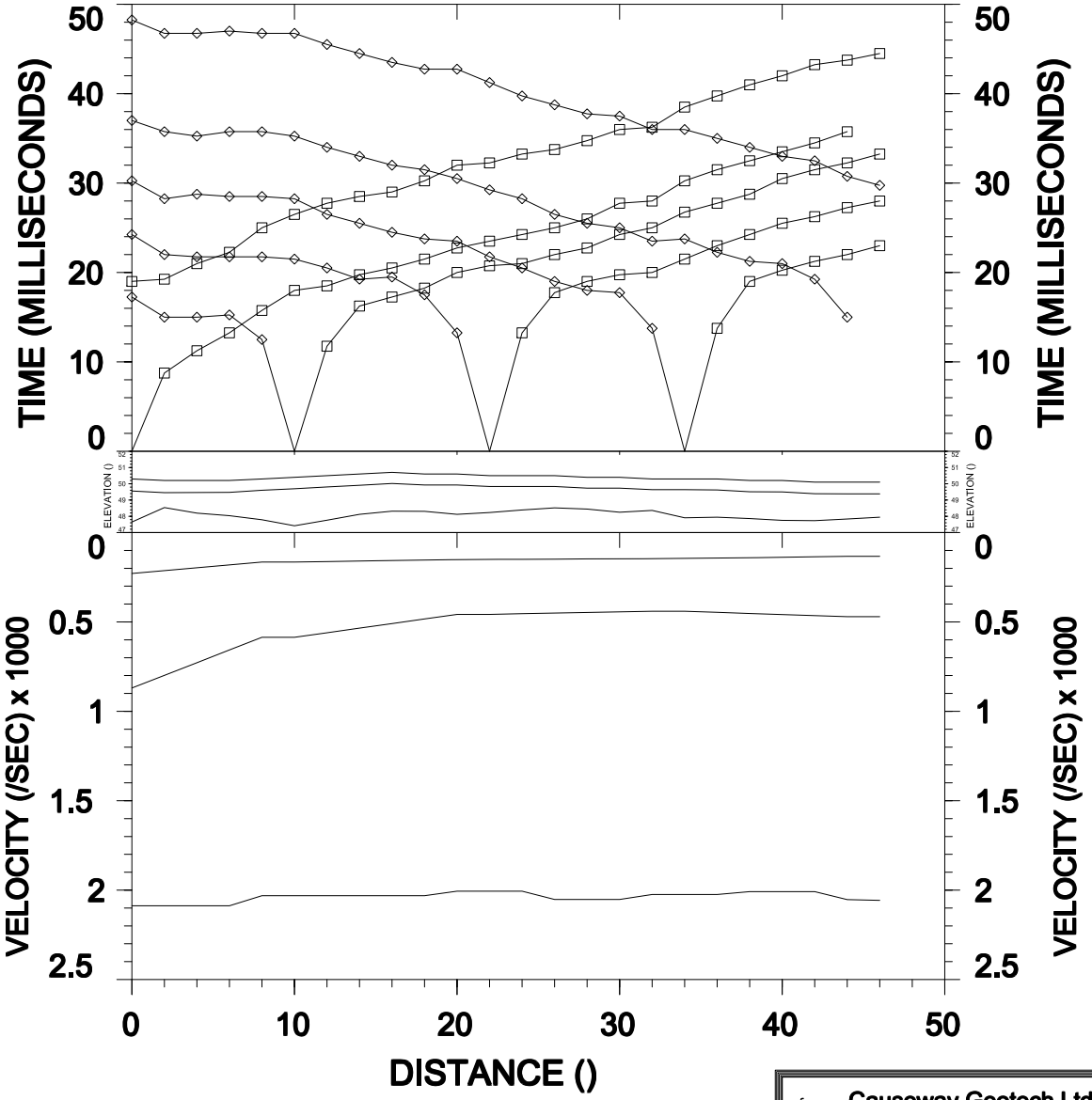


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS125 / Date: 16/06/22	
Equipment: Geode / Spread: S125	Azimuth:

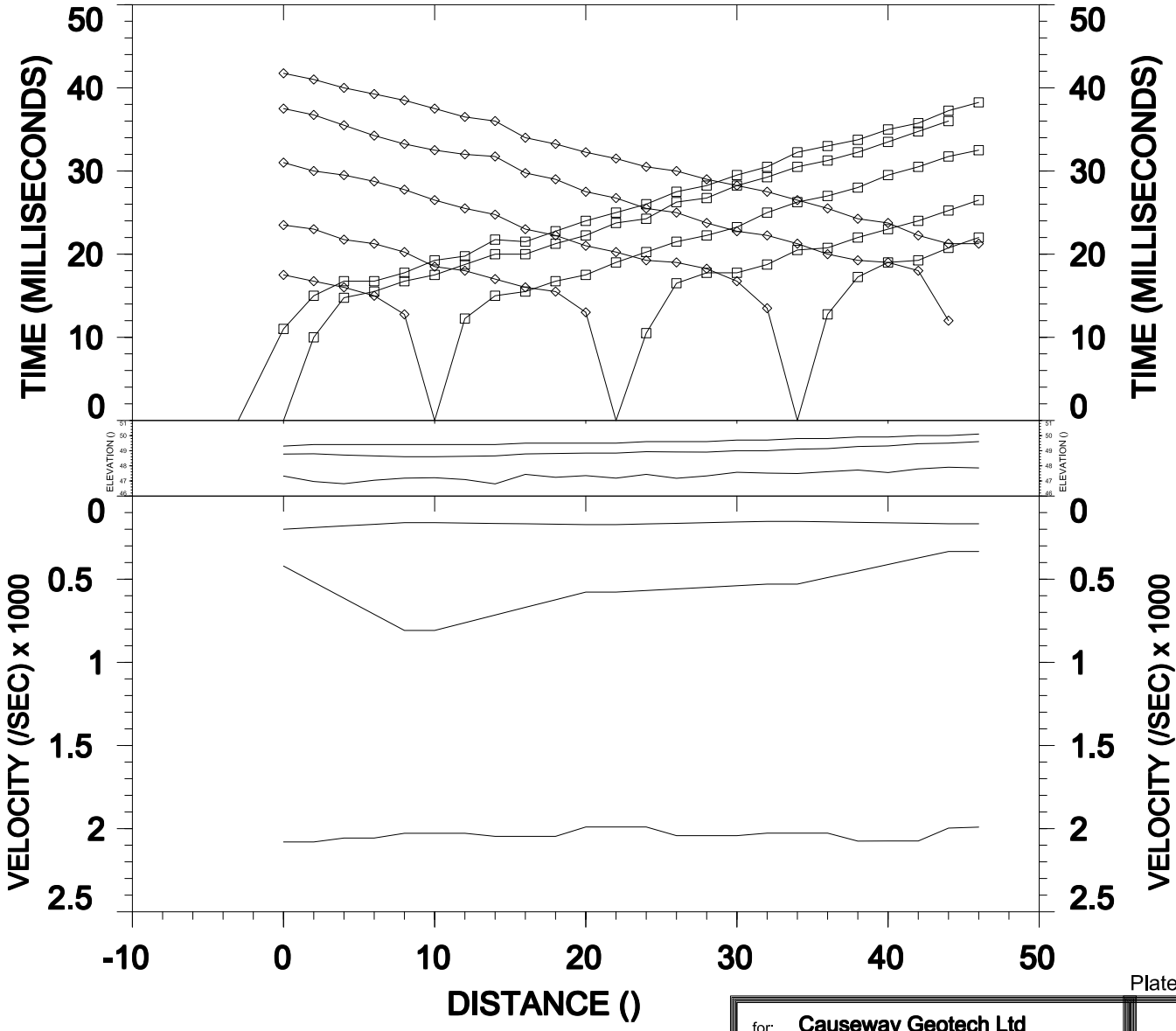


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS126 / Date: 16/06/22	
Equipment: Geode / Spread: S126	Azimuth:

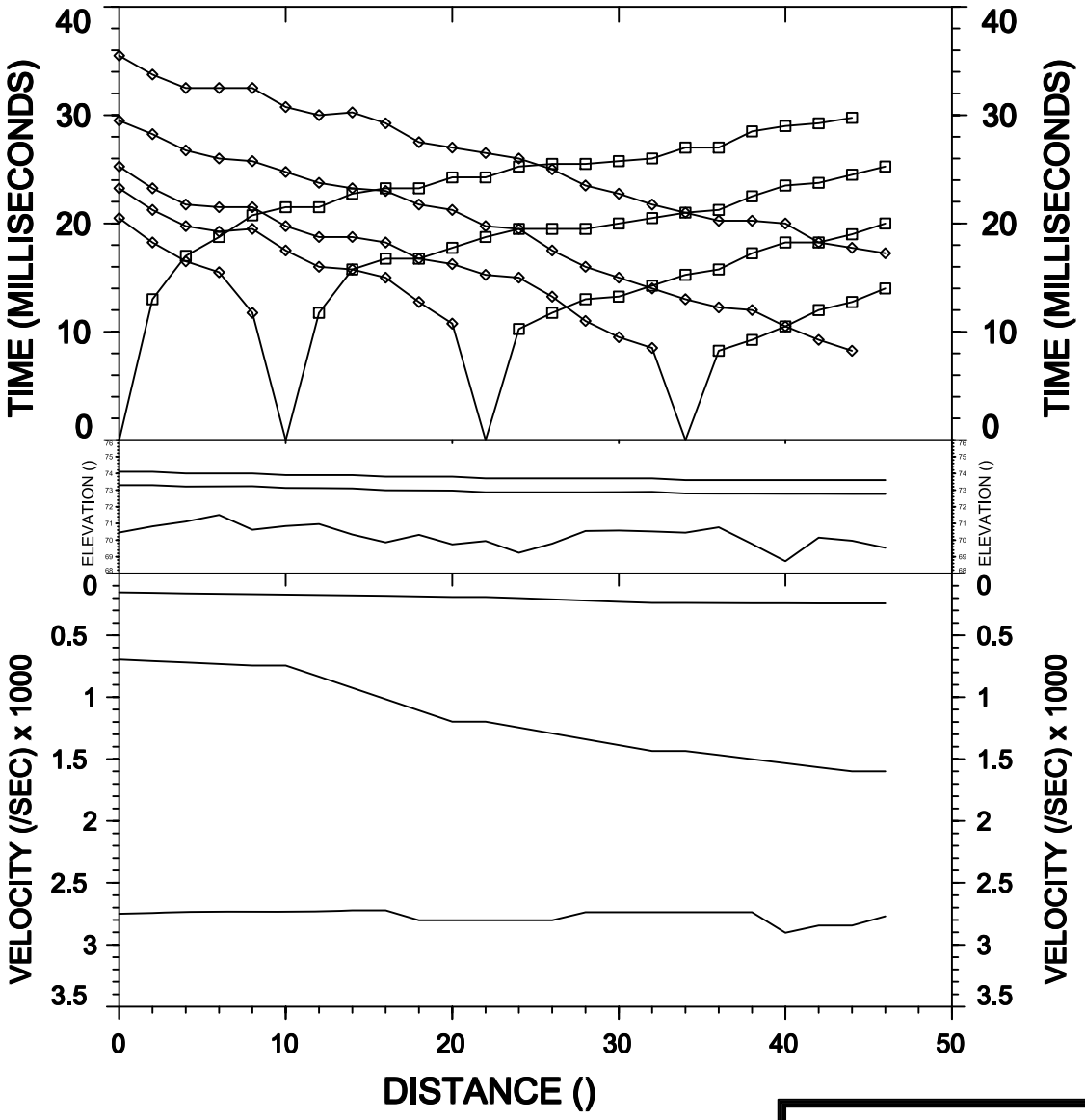


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS127 / Date: 17/06/22	
Equipment: Geode / Spread: S127	Azimuth:

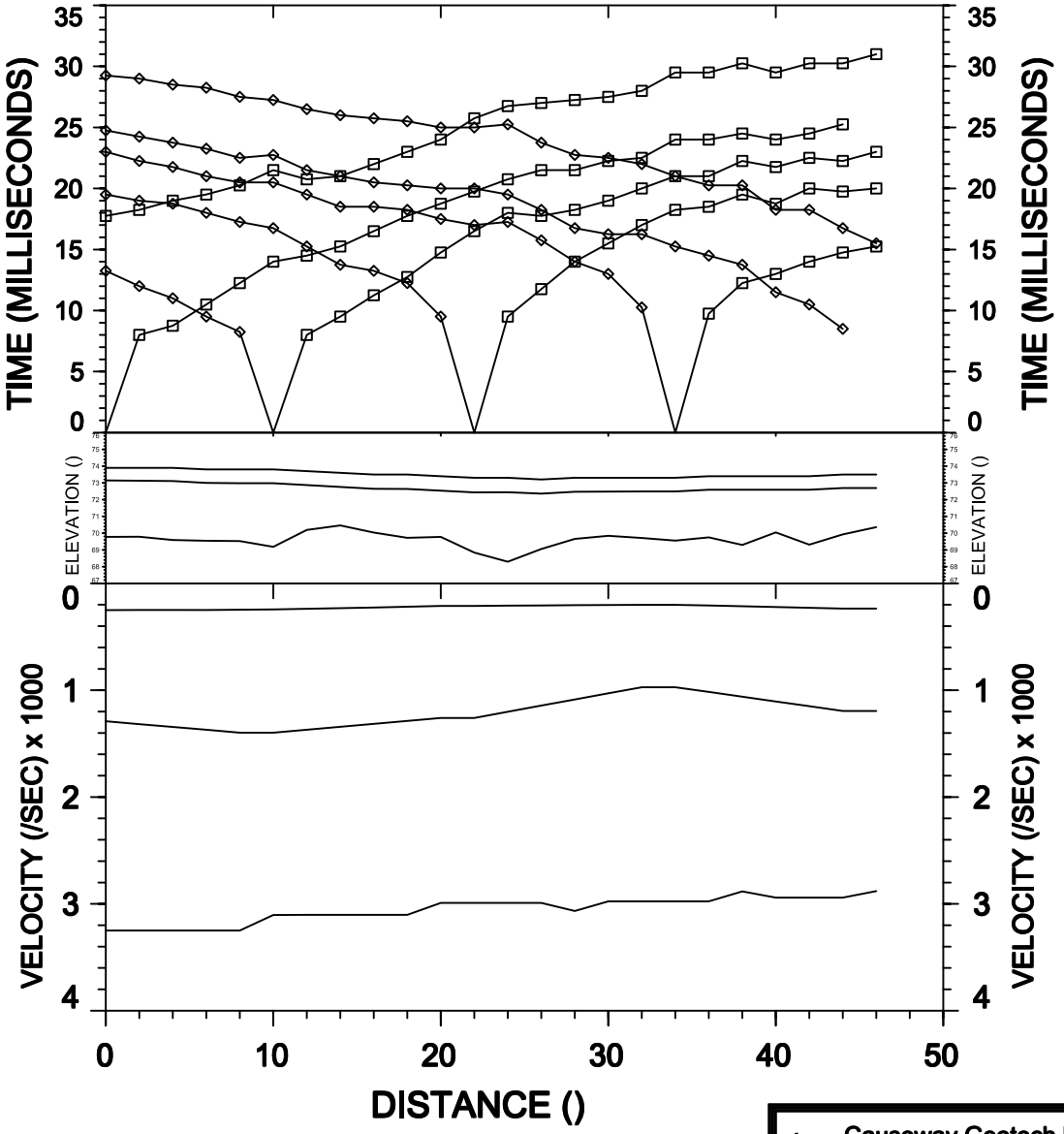


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS128 / Date: 17/06/22	
Equipment: Geode / Spread: S128	Azimuth:

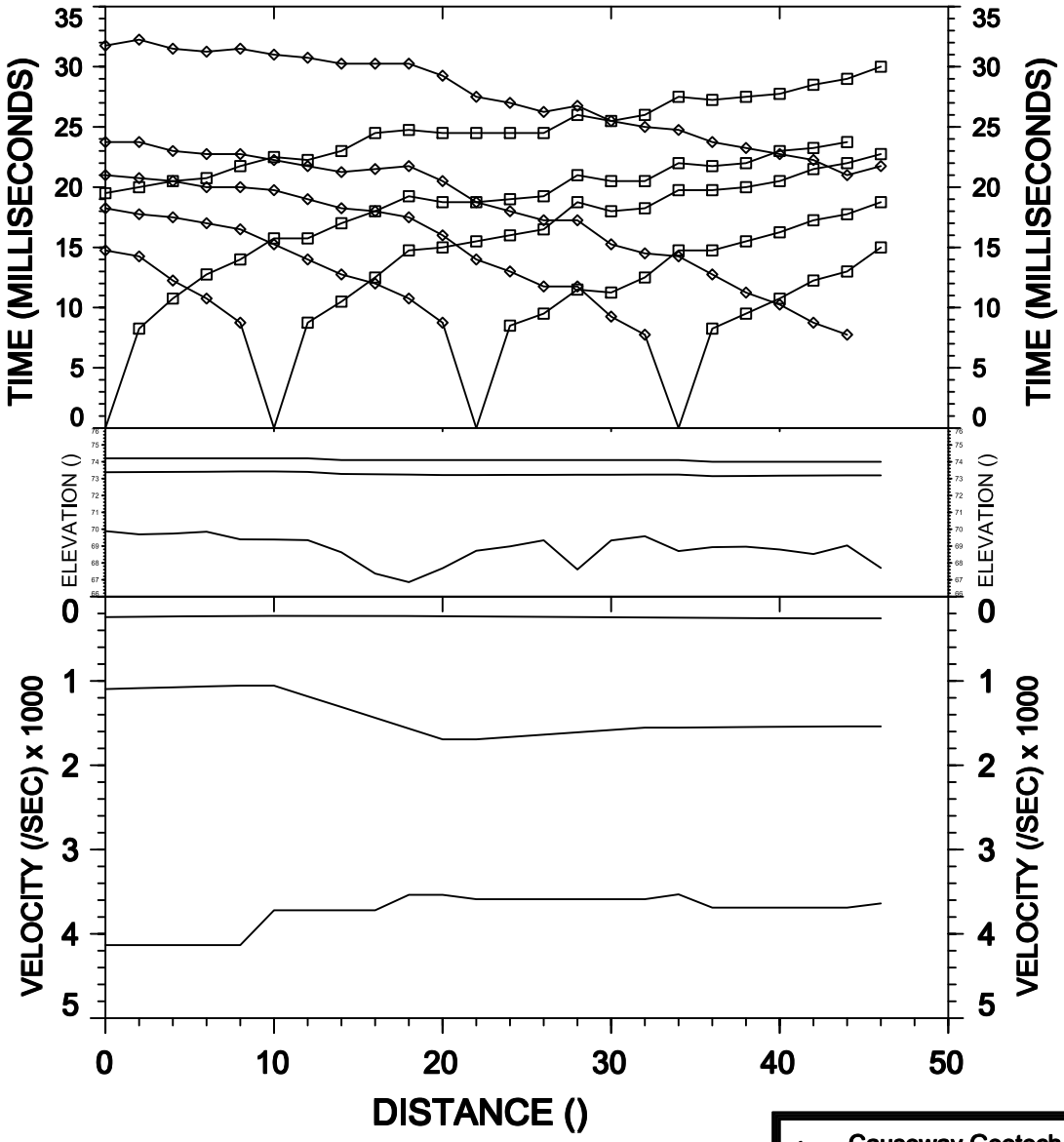


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS129 / Date: 17/06/22	
Equipment: Geode / Spread: S129	Azimuth:

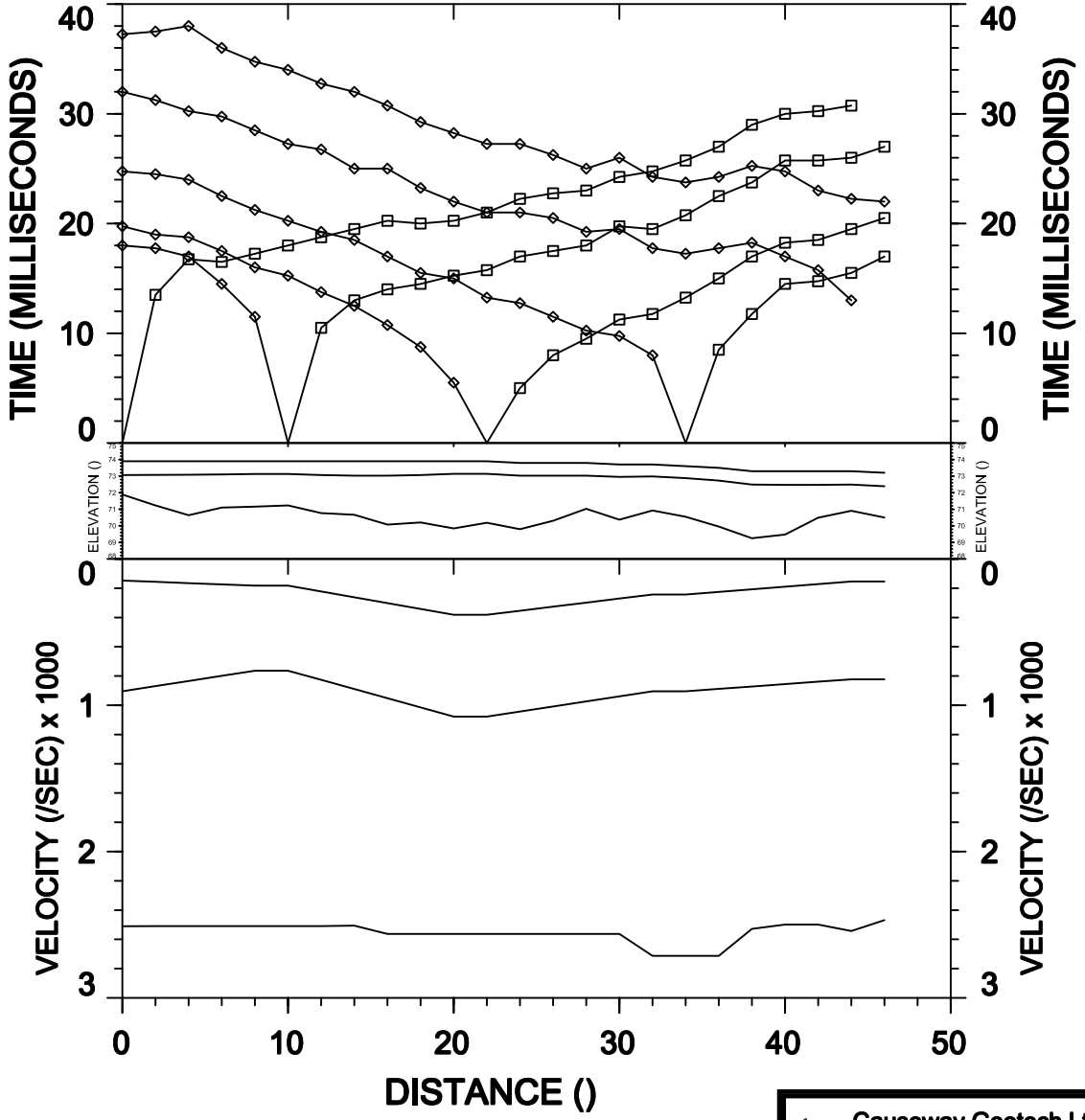


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS130 / Date: 17/06/22	
Equipment: Geode / Spread: S130	Azimuth:

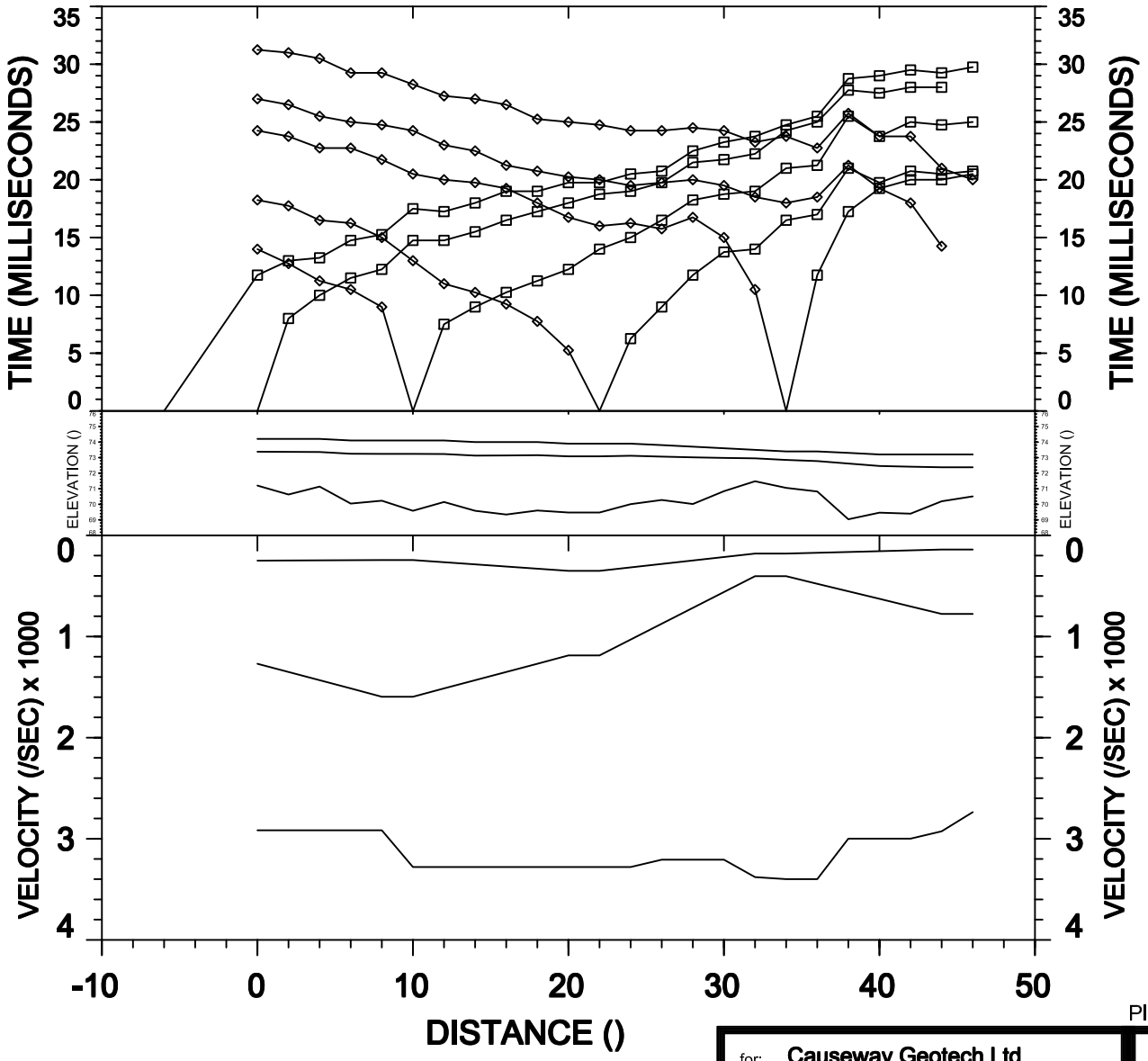


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS131 / Date: 17/06/22	
Equipment: Geode / Spread: S131	Azimuth:

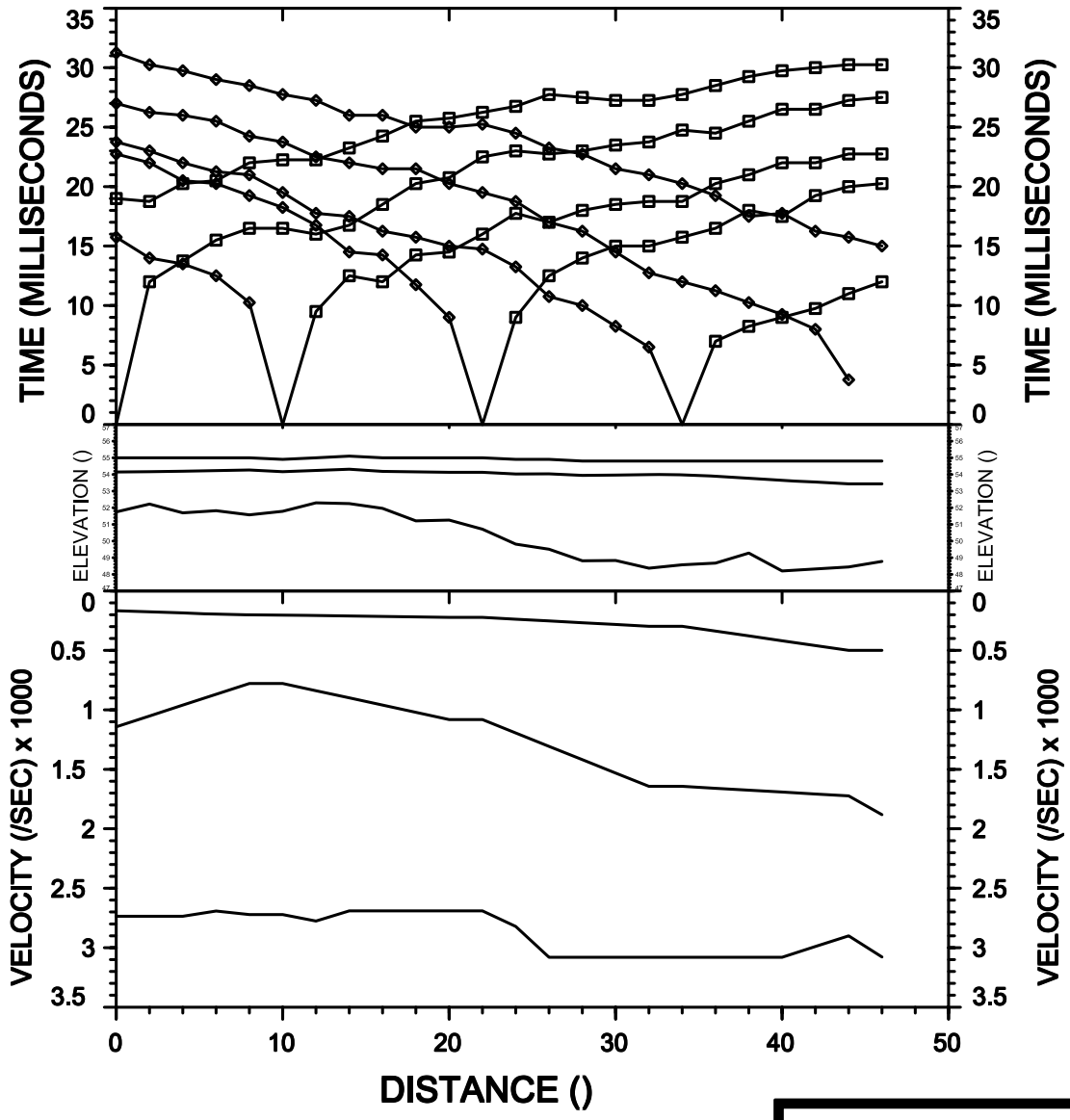


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS132 / Date: 27/06/2022	
Equipment: Geode / Spread: S132	Azimuth:

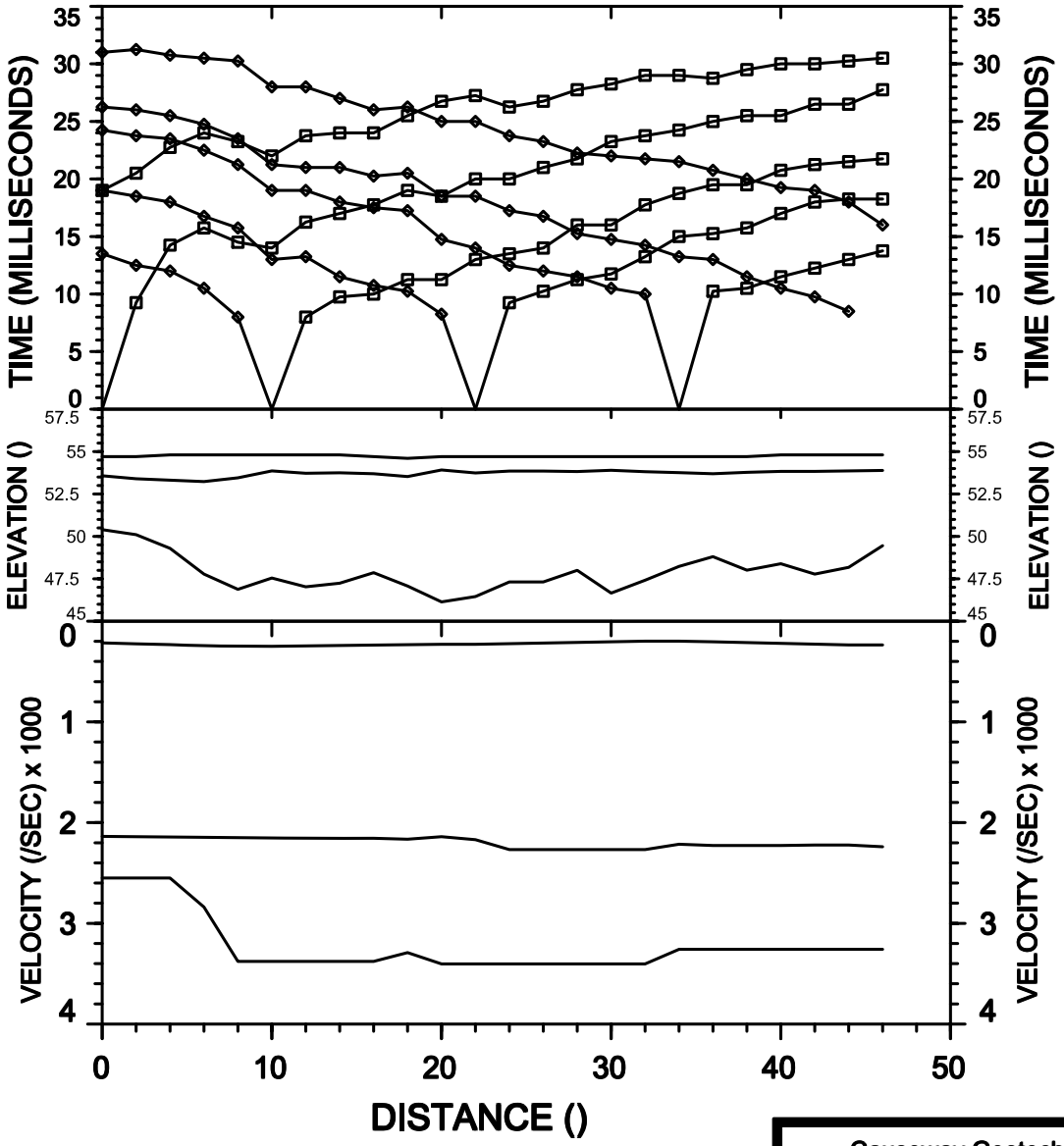


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS133 / Date: 27/06/2022	
Equipment: Geode / Spread: S133	Azimuth:

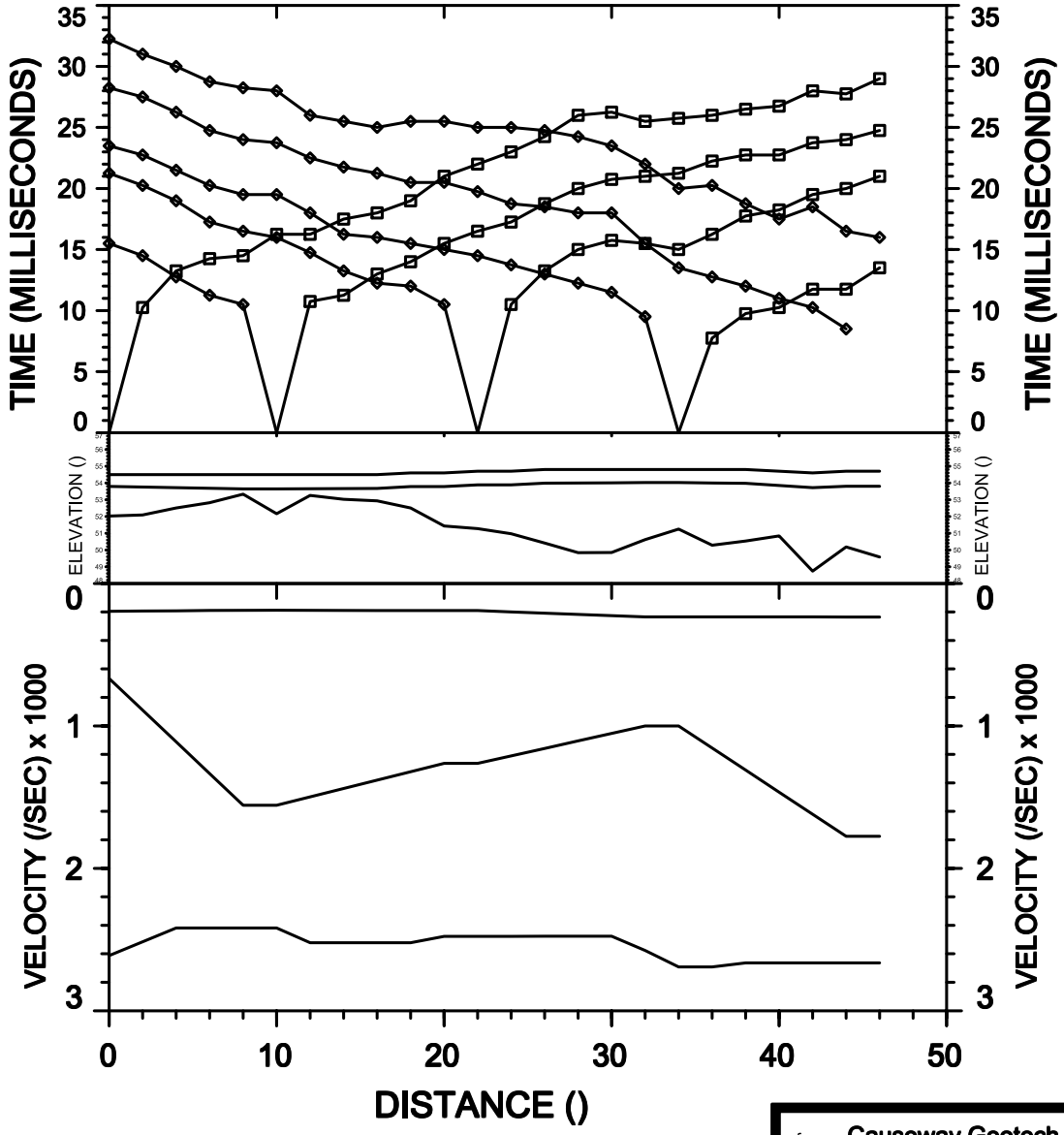


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS134R / Date: 27/06/22	
Equipment: Geode / Spread: S134	Azimuth:

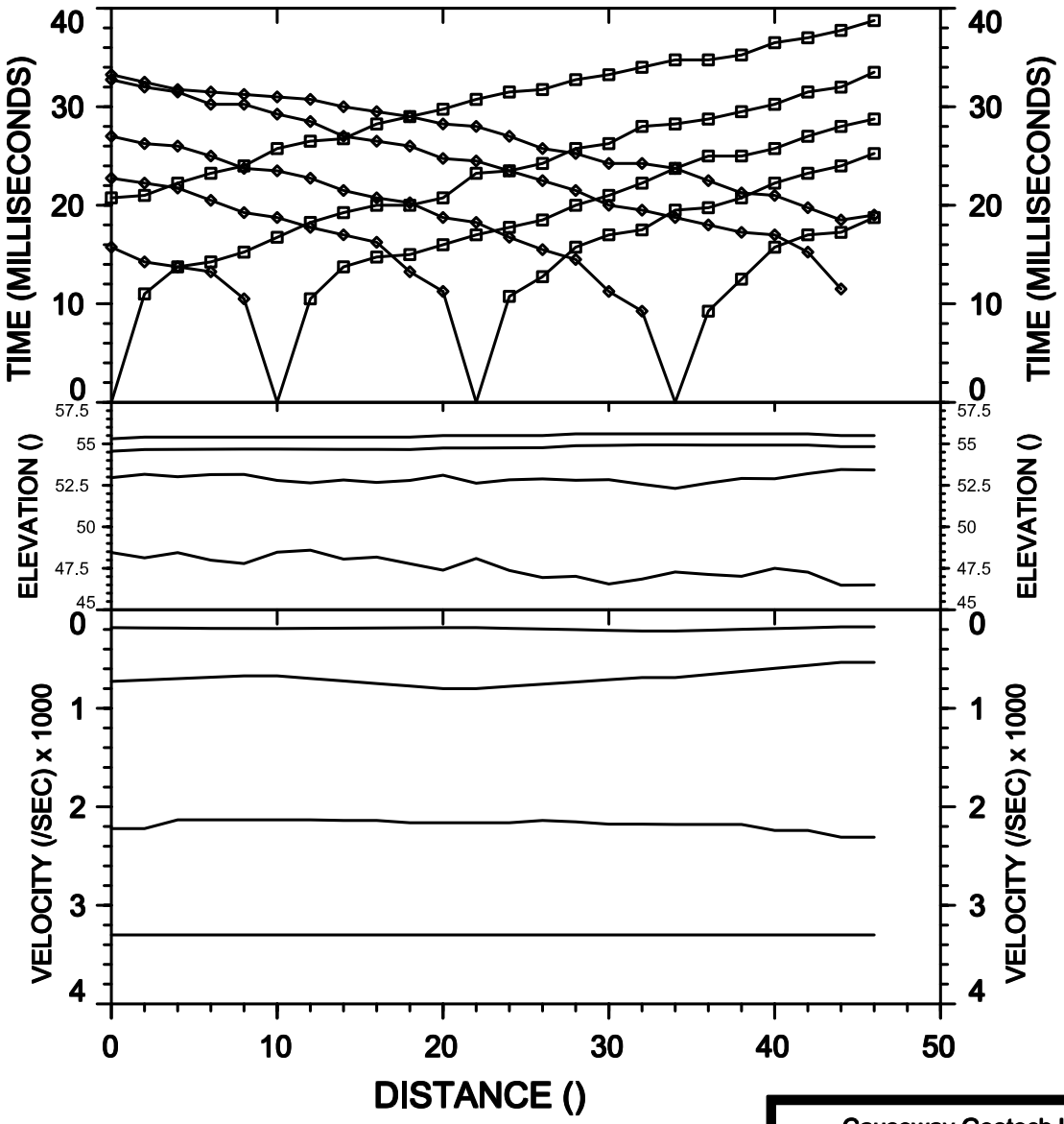


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS135 / Date: 28/06/2022	
Equipment: Geode / Spread: S135	Azimuth:

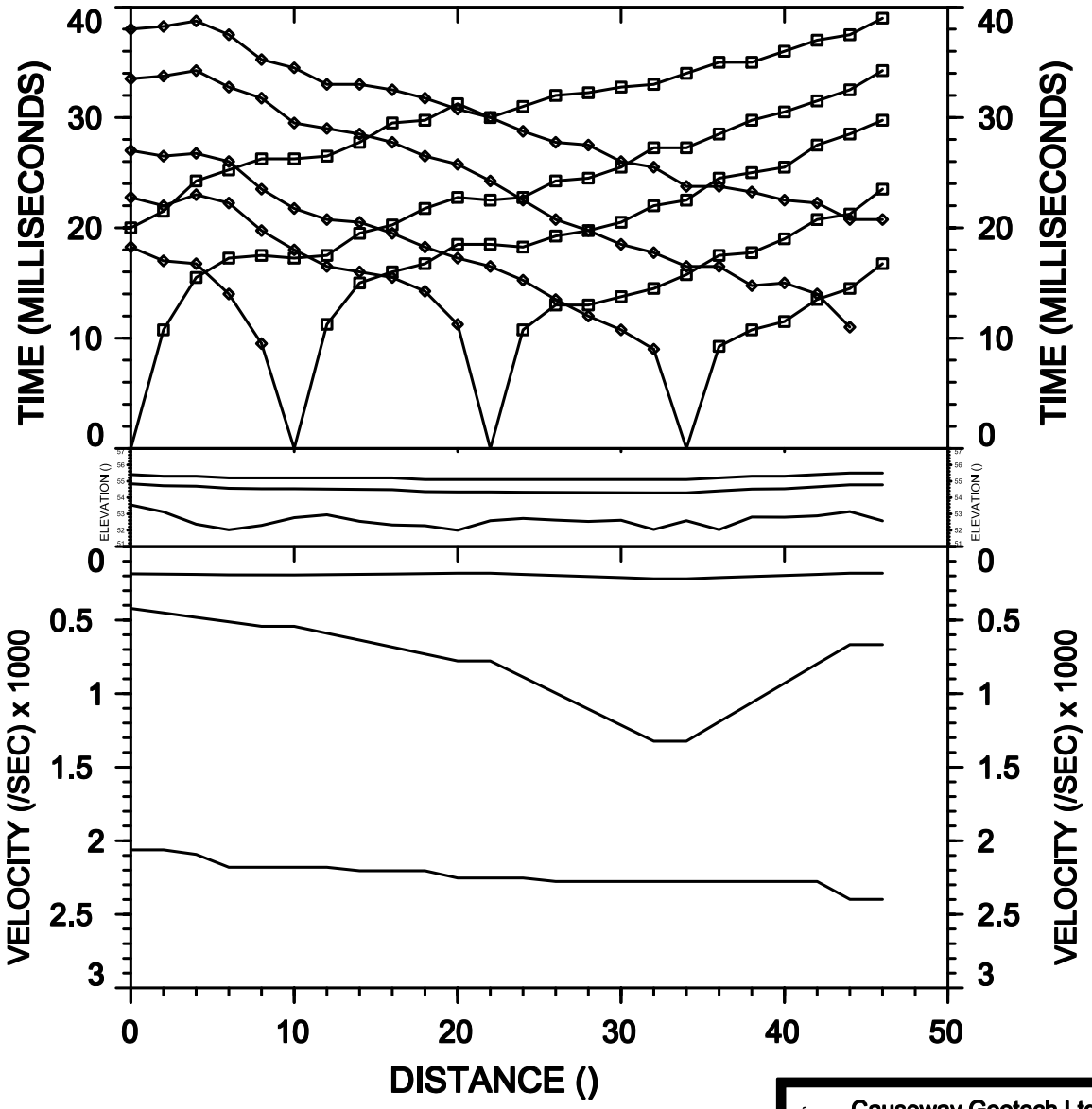


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS136 / Date: 28/06/2022	
Equipment: Geode / Spread: S136	Azimuth:

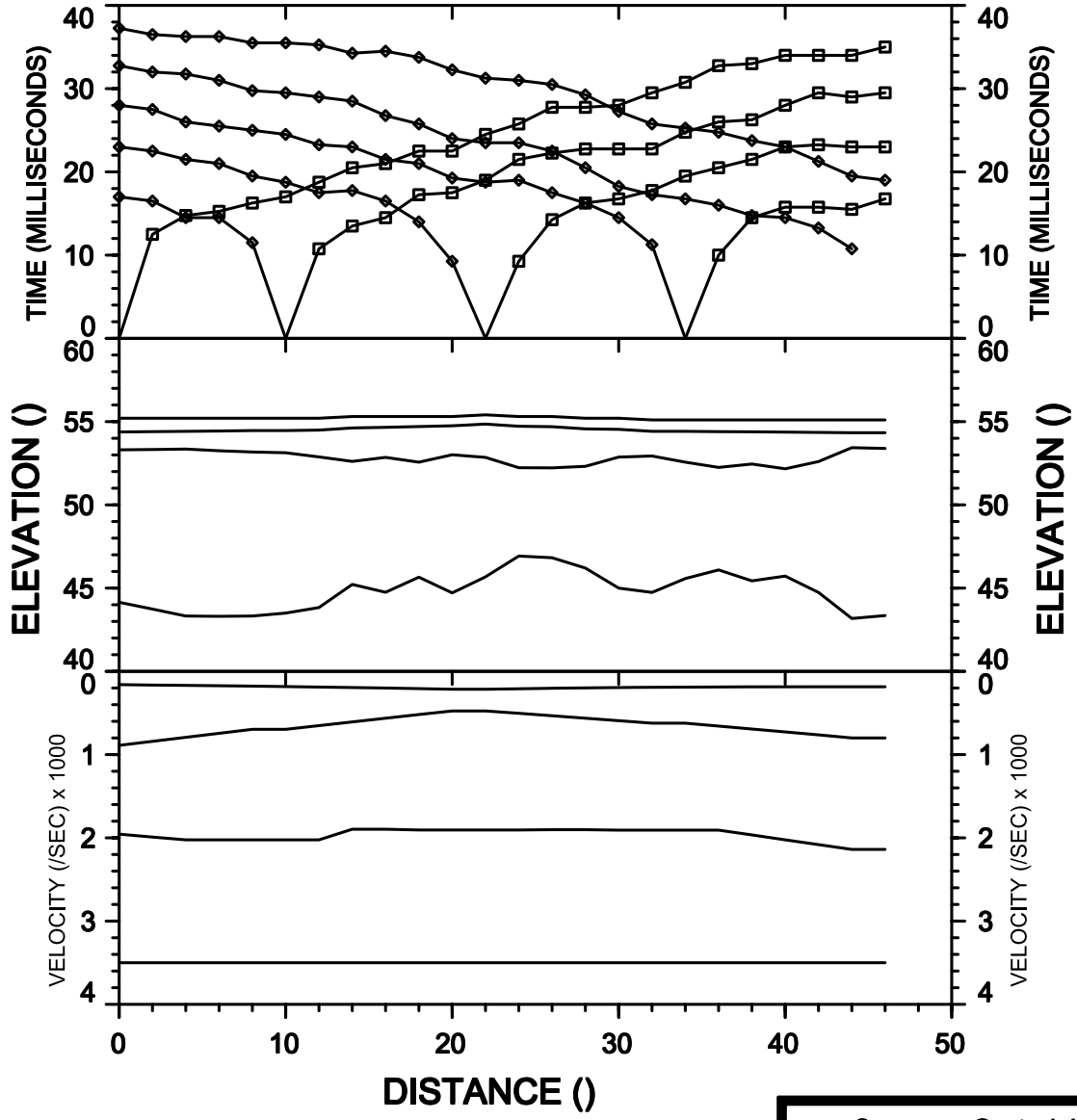


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS137R / Date: 28/06/2022	
Equipment: Geode / Spread: S137	Azimuth:

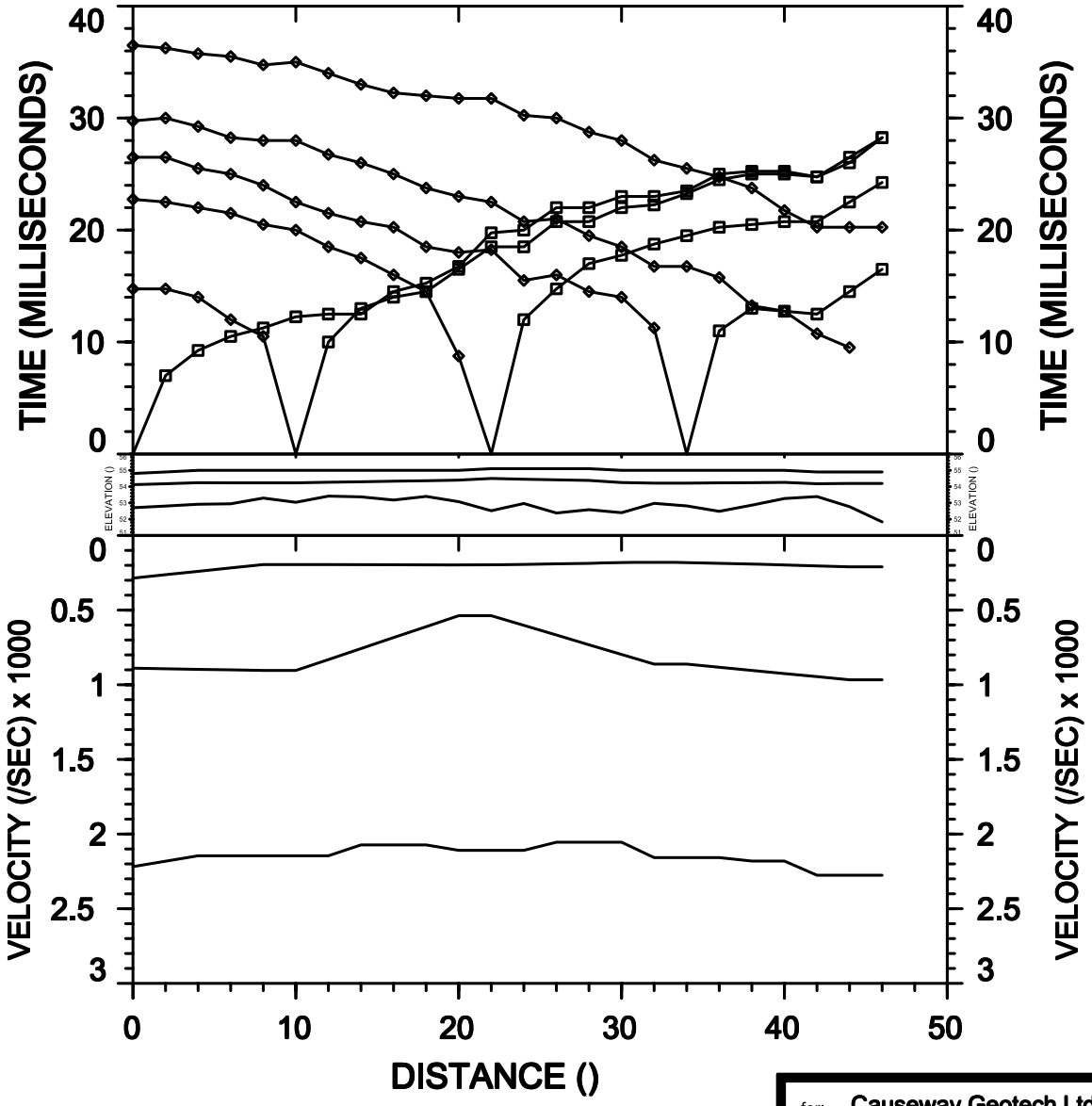


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS138 / Date: 28/06/2022	
Equipment: Geode / Spread: S138	Azimuth:

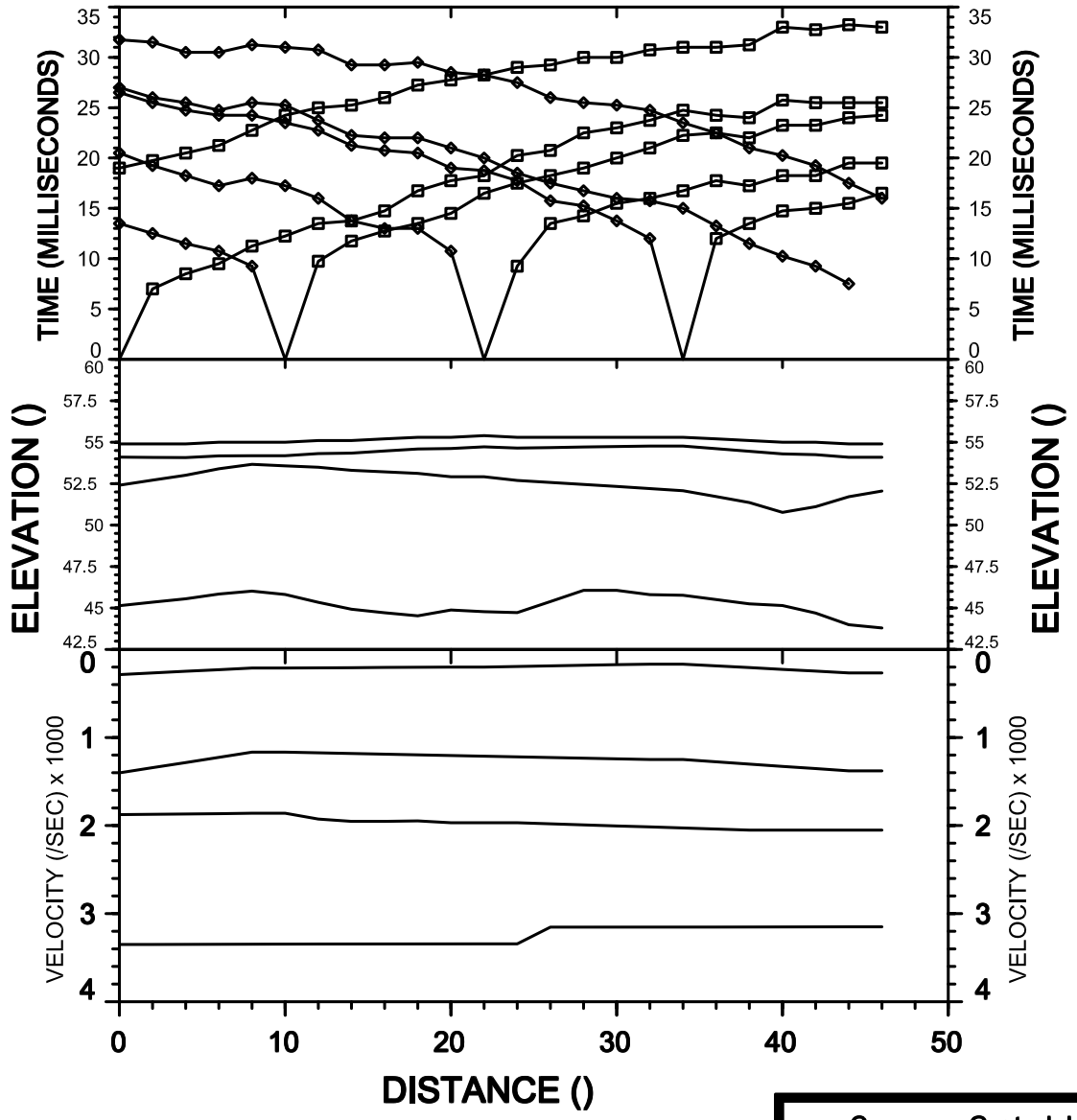


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS139R / Date: 28/06/2022	
Equipment: Geode / Spread: S139	Azimuth:

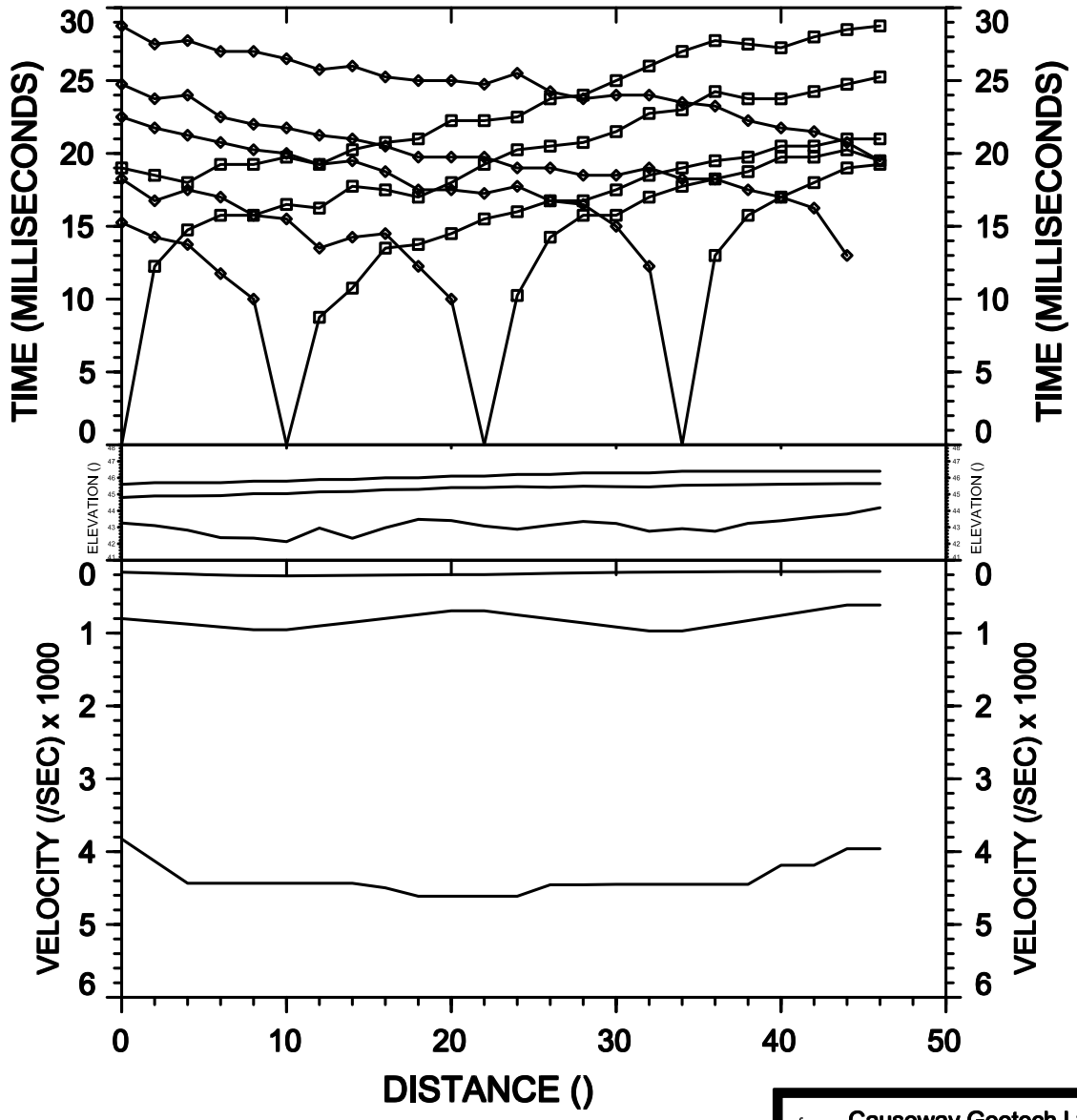


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS140 / Date: 28/06/2022	
Equipment: Geode / Spread: S140	Azimuth:

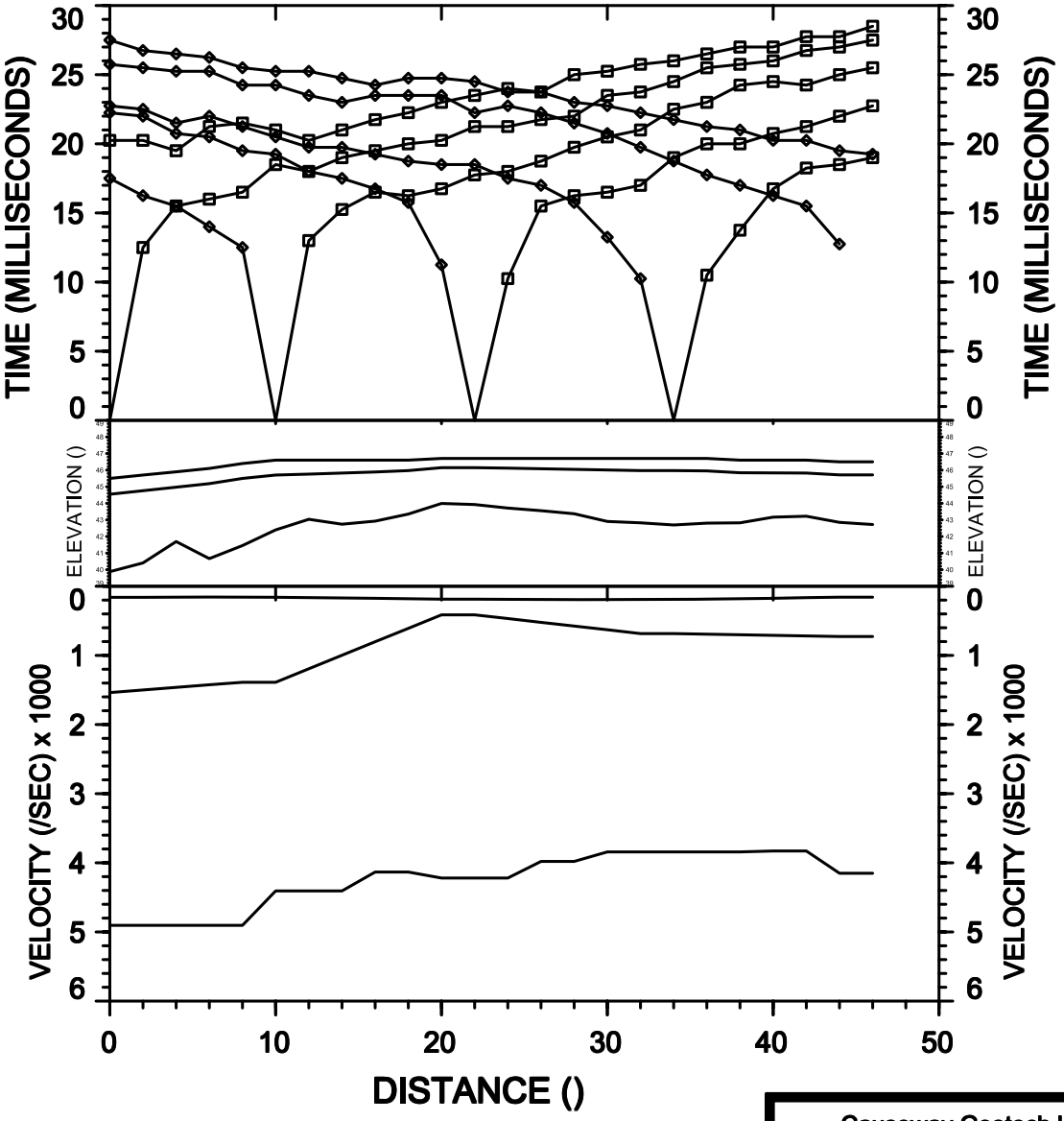


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS141R / Date: 28/06/2022	
Equipment: Geode / Spread: S141	Azimuth:

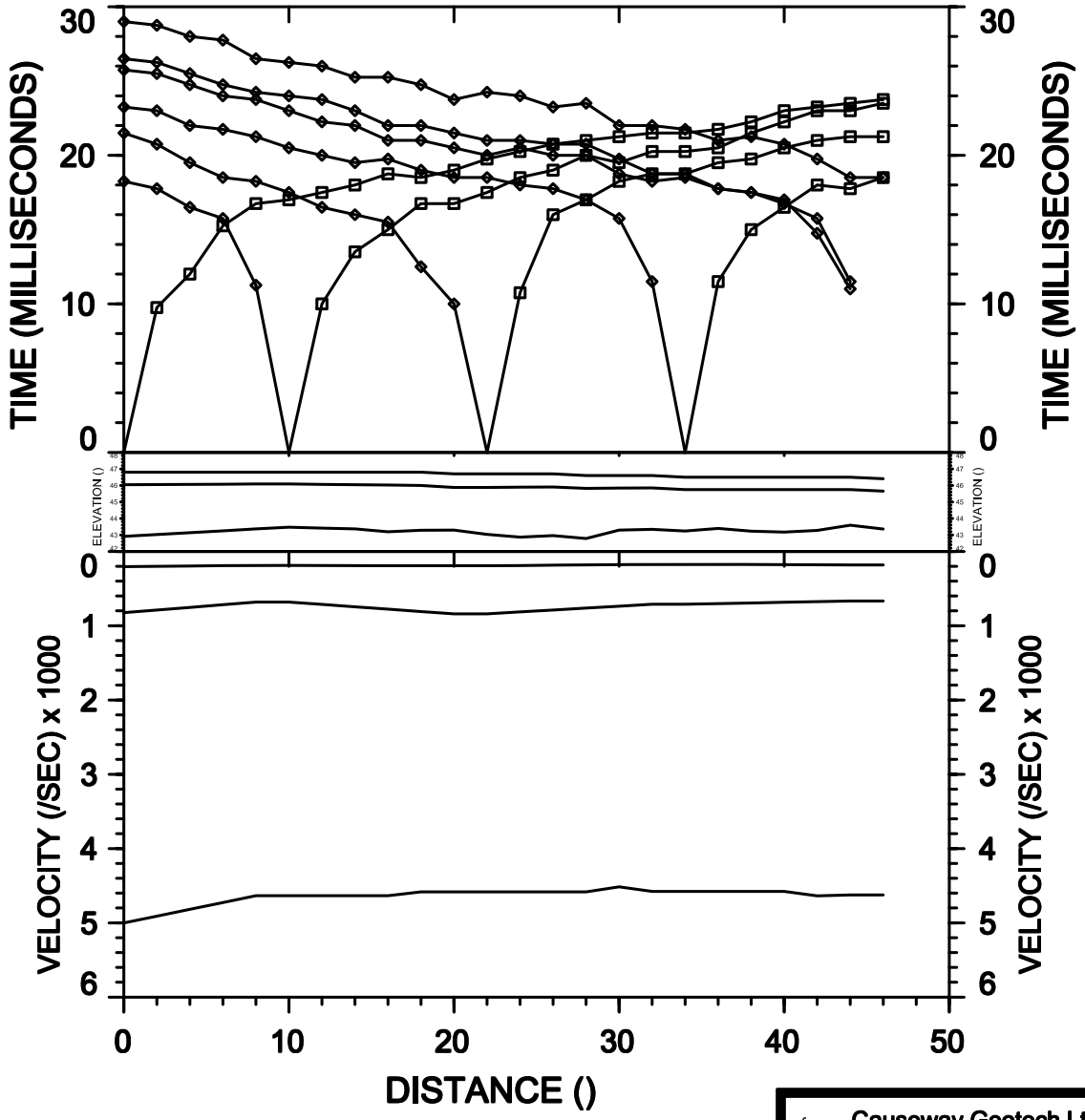


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS142R	Date: 28/06/2022	
Equipment: Geode	Spread: S142	Azimuth:

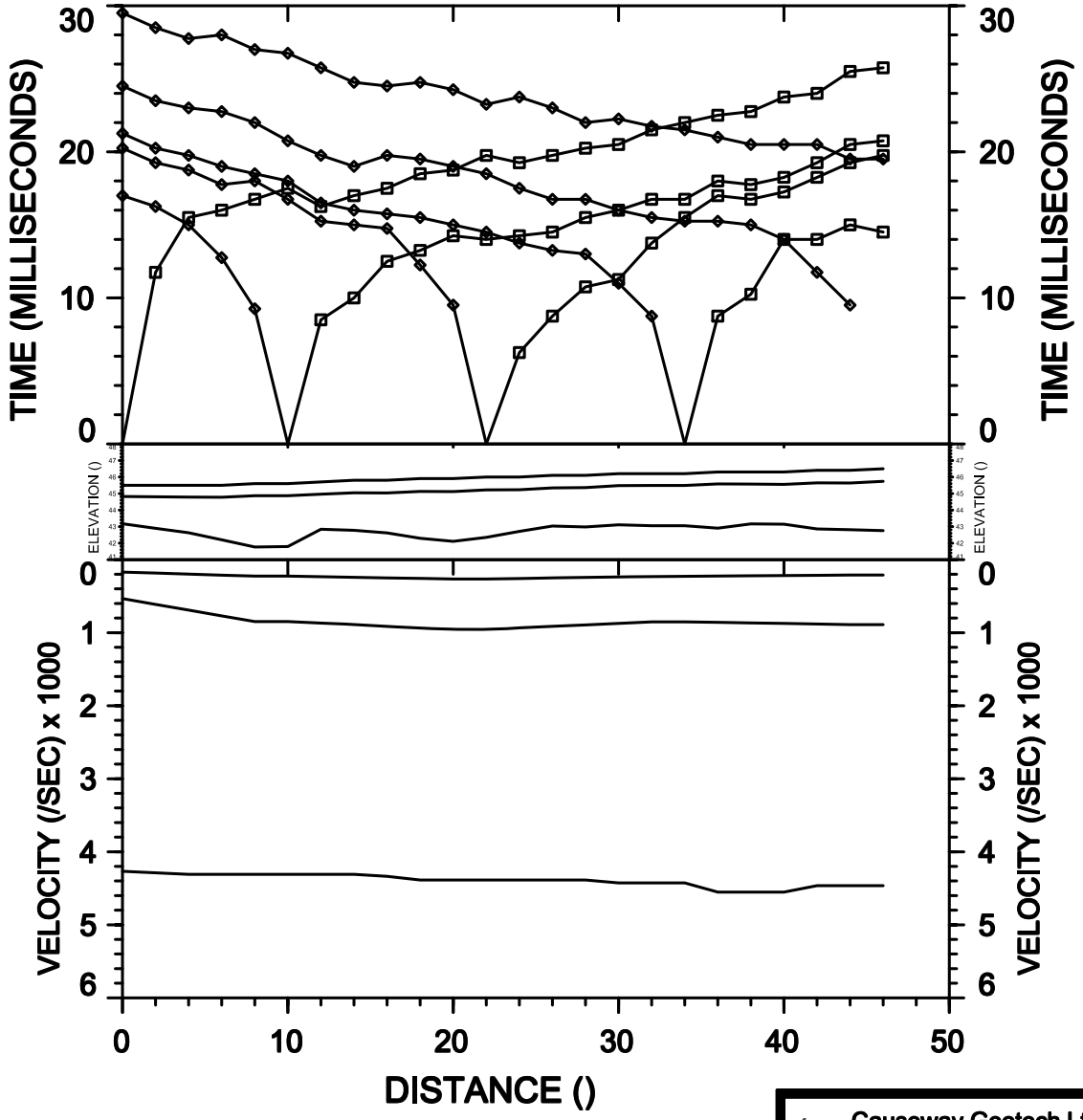


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS143 / Date: 28/06/2022	
Equipment: Geode / Spread: S143	Azimuth:

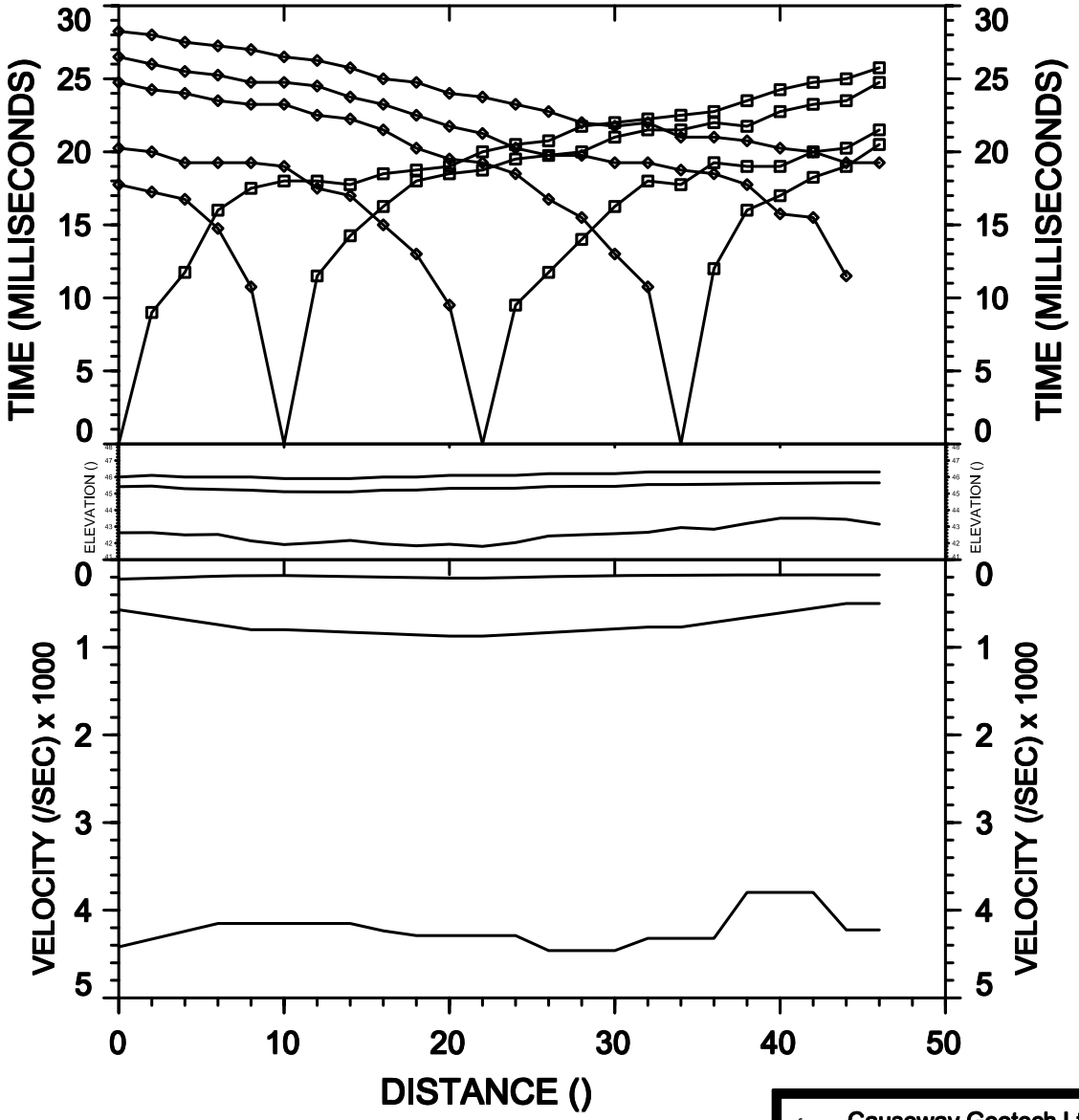


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS144	Date: 28/06/2022	
Equipment: Geode	Spread: S144	Azimuth:

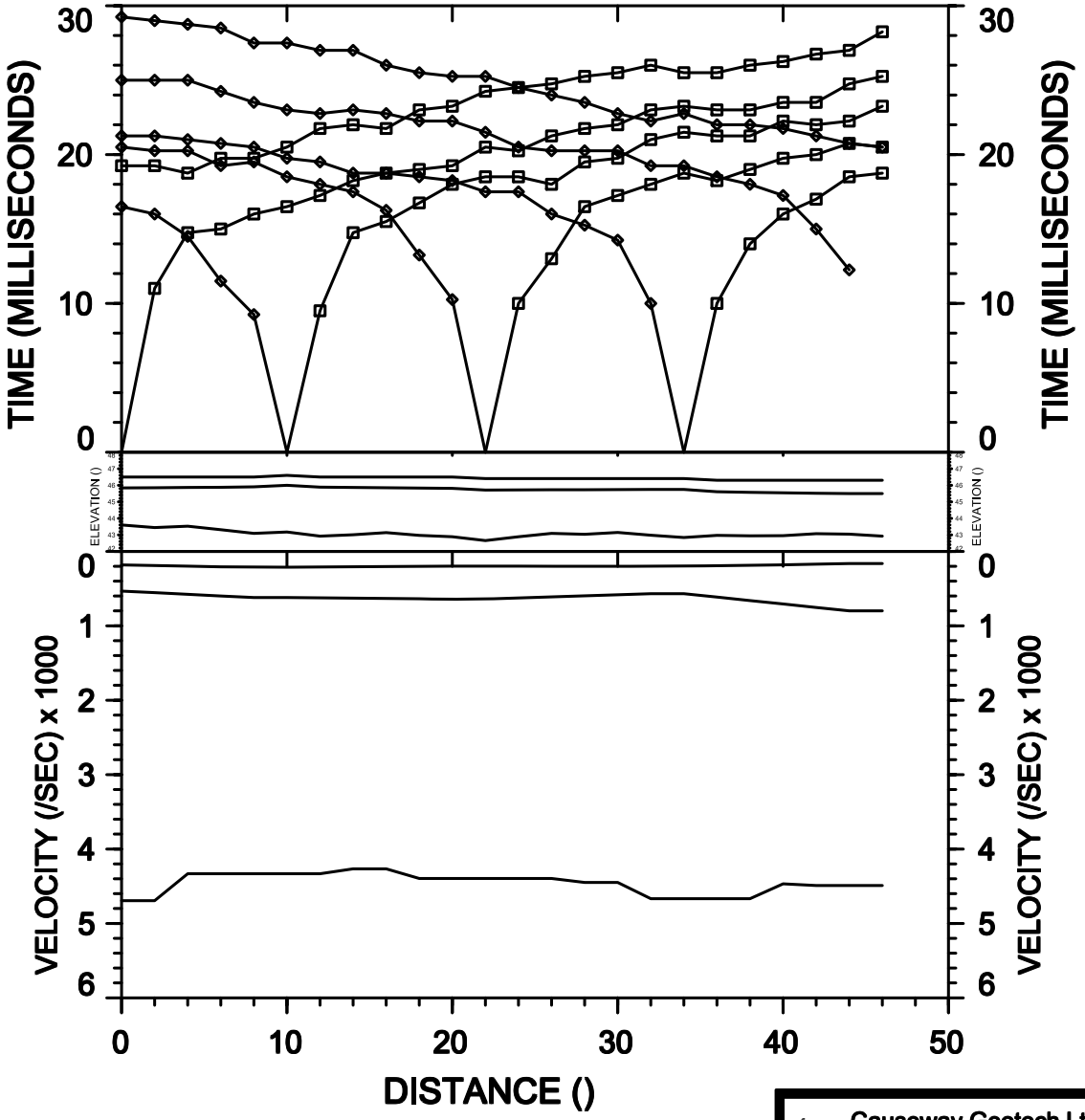


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS145 / Date: 28/06/2022	
Equipment: Geode / Spread: S145	Azimuth:

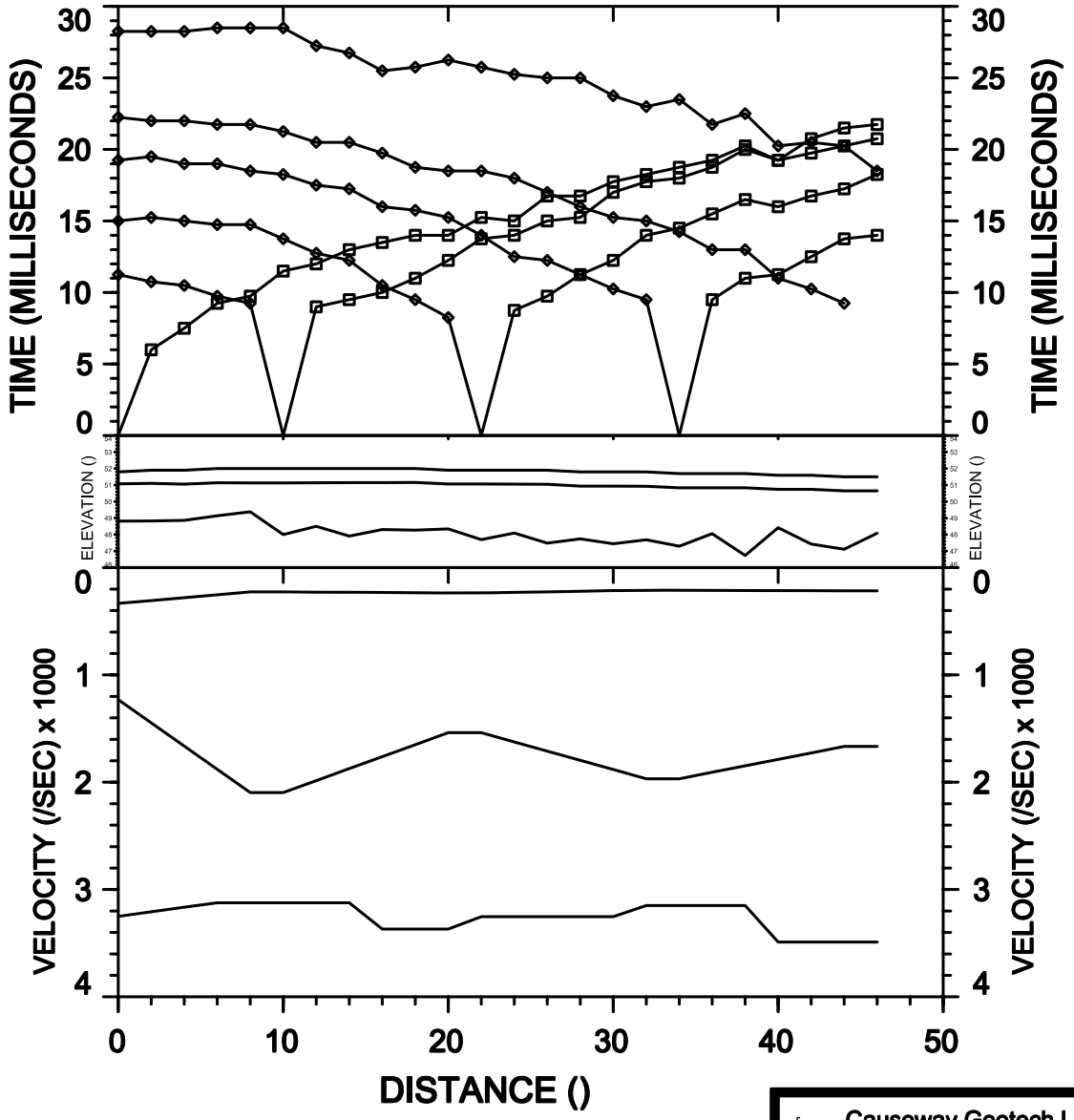


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS146	Date: 29/06/2022	
Equipment: Geode	Spread: S146	Azimuth:

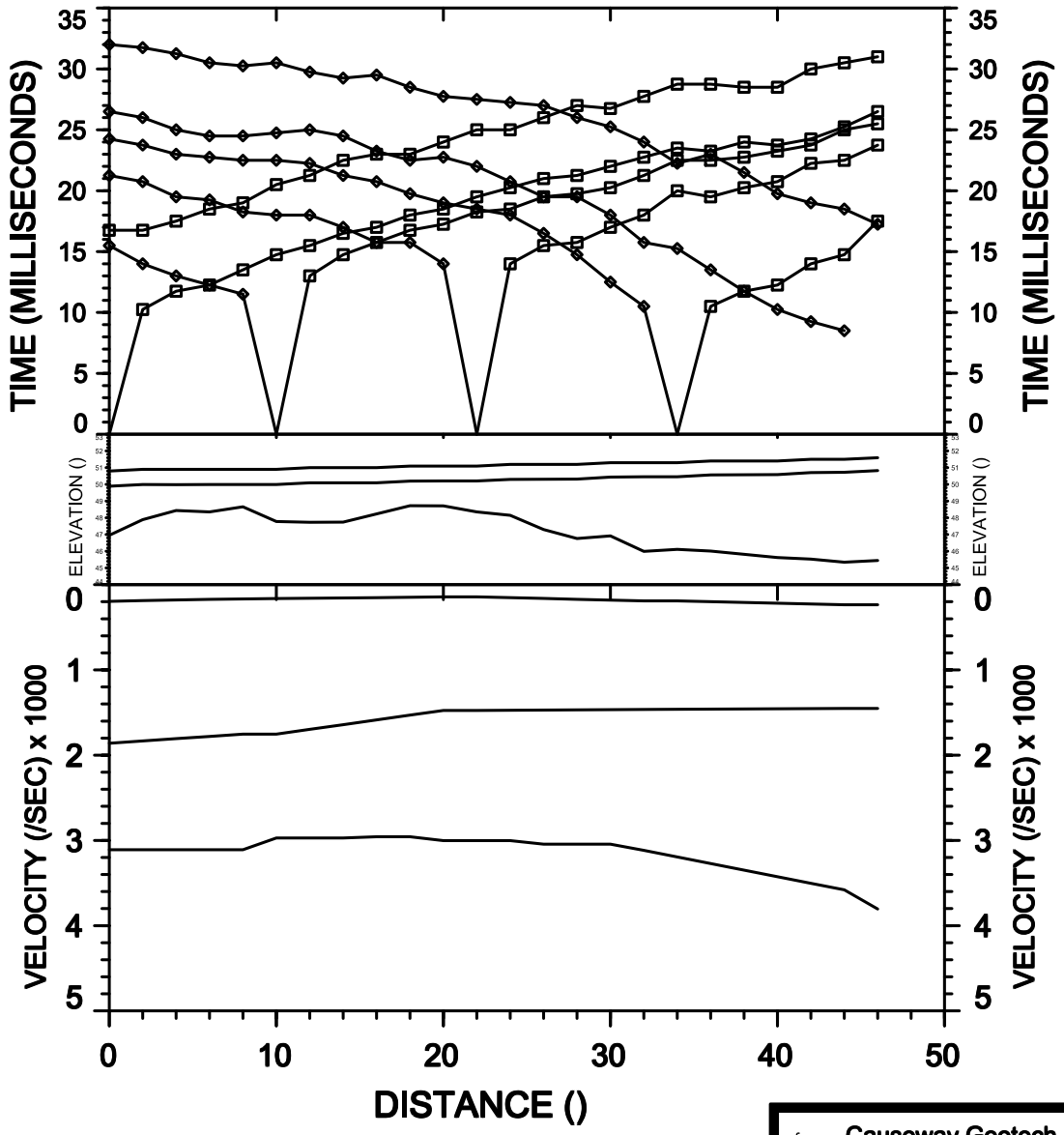


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS147R / Date: 29/06/2022	
Equipment: Geode / Spread: S147	Azimuth:

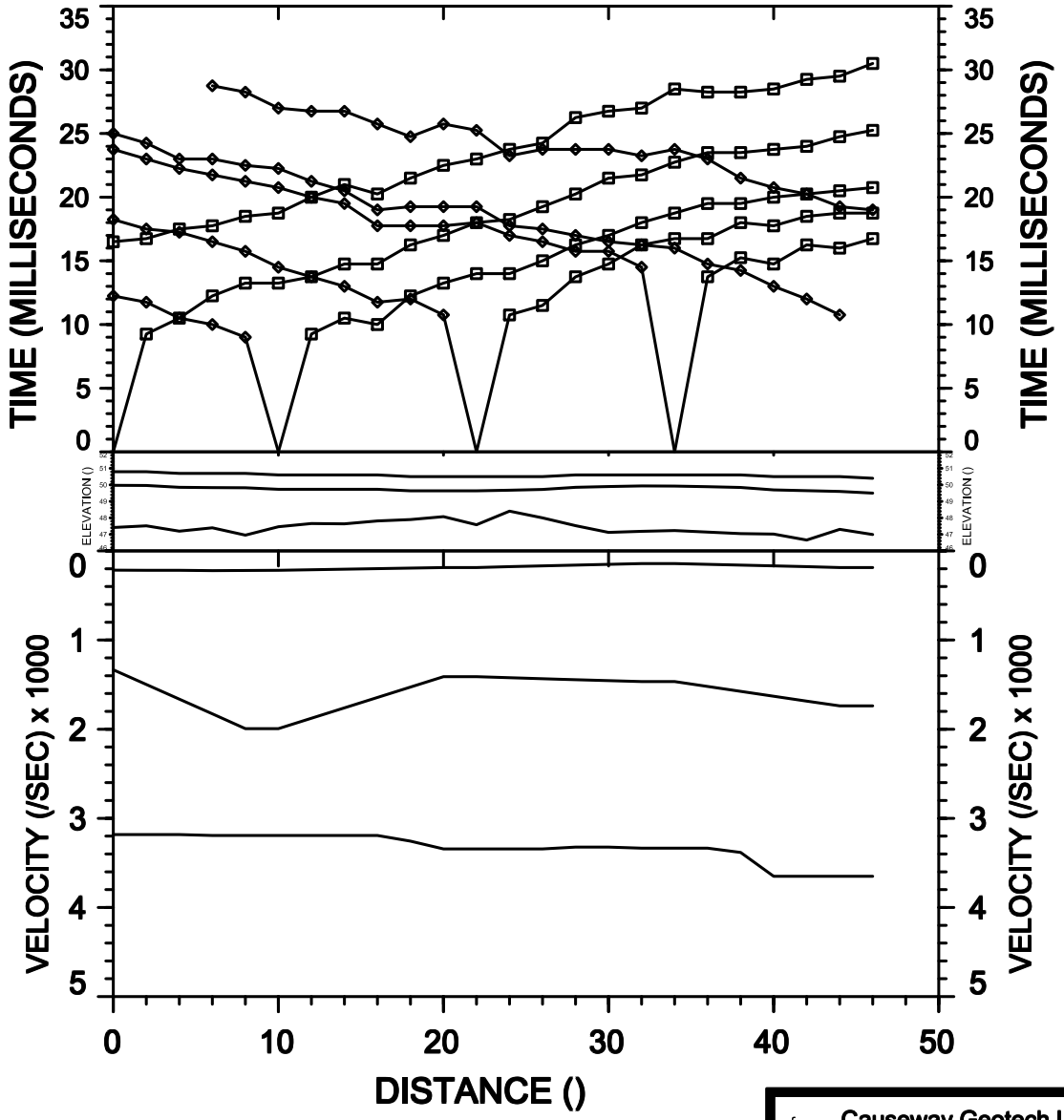


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS148R / Date: 29/06/2022	
Equipment: Geode / Spread: S148	Azimuth:

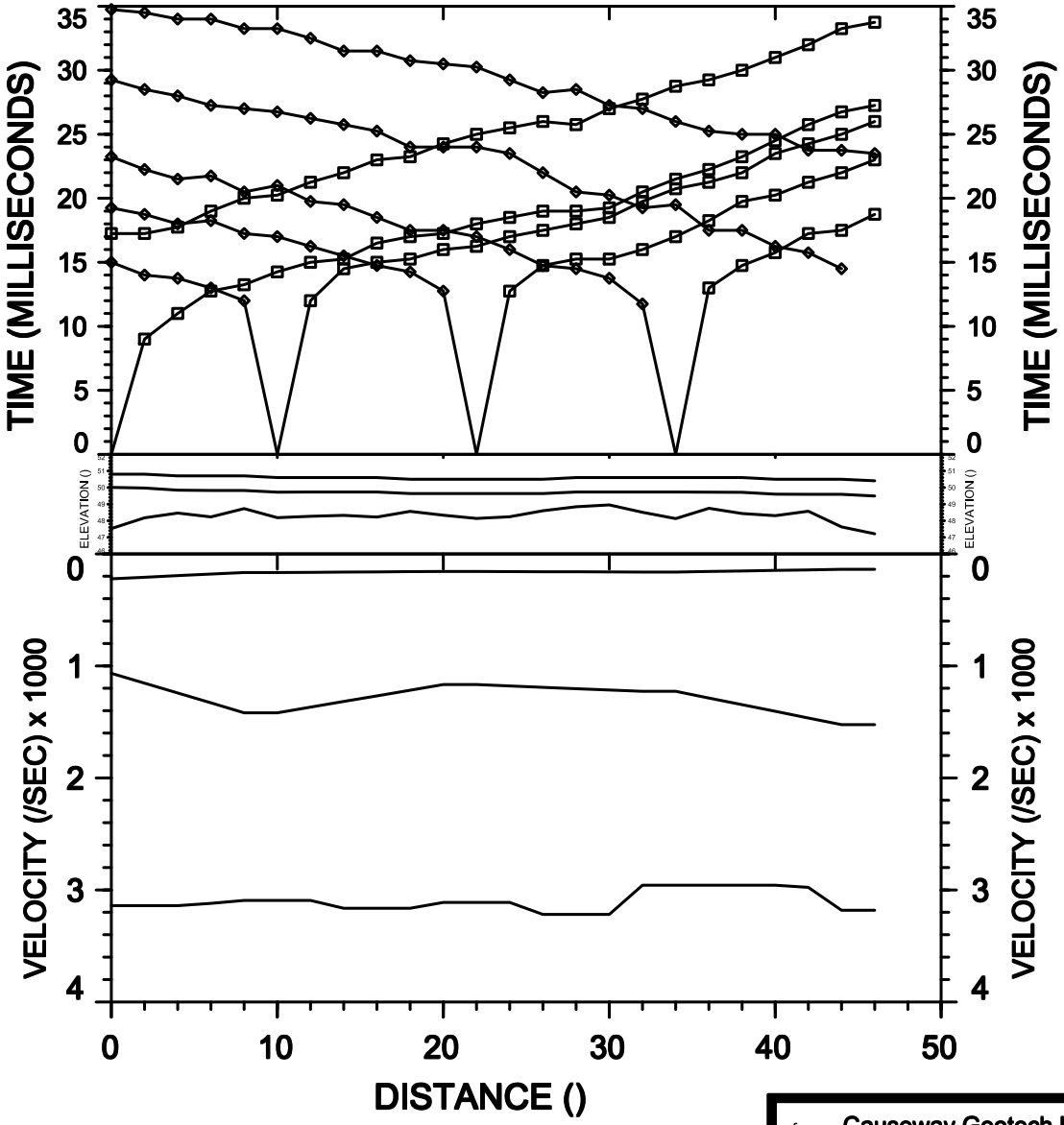


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS149 / Date: 29/06/2022	
Equipment: Geode / Spread: S149	Azimuth:

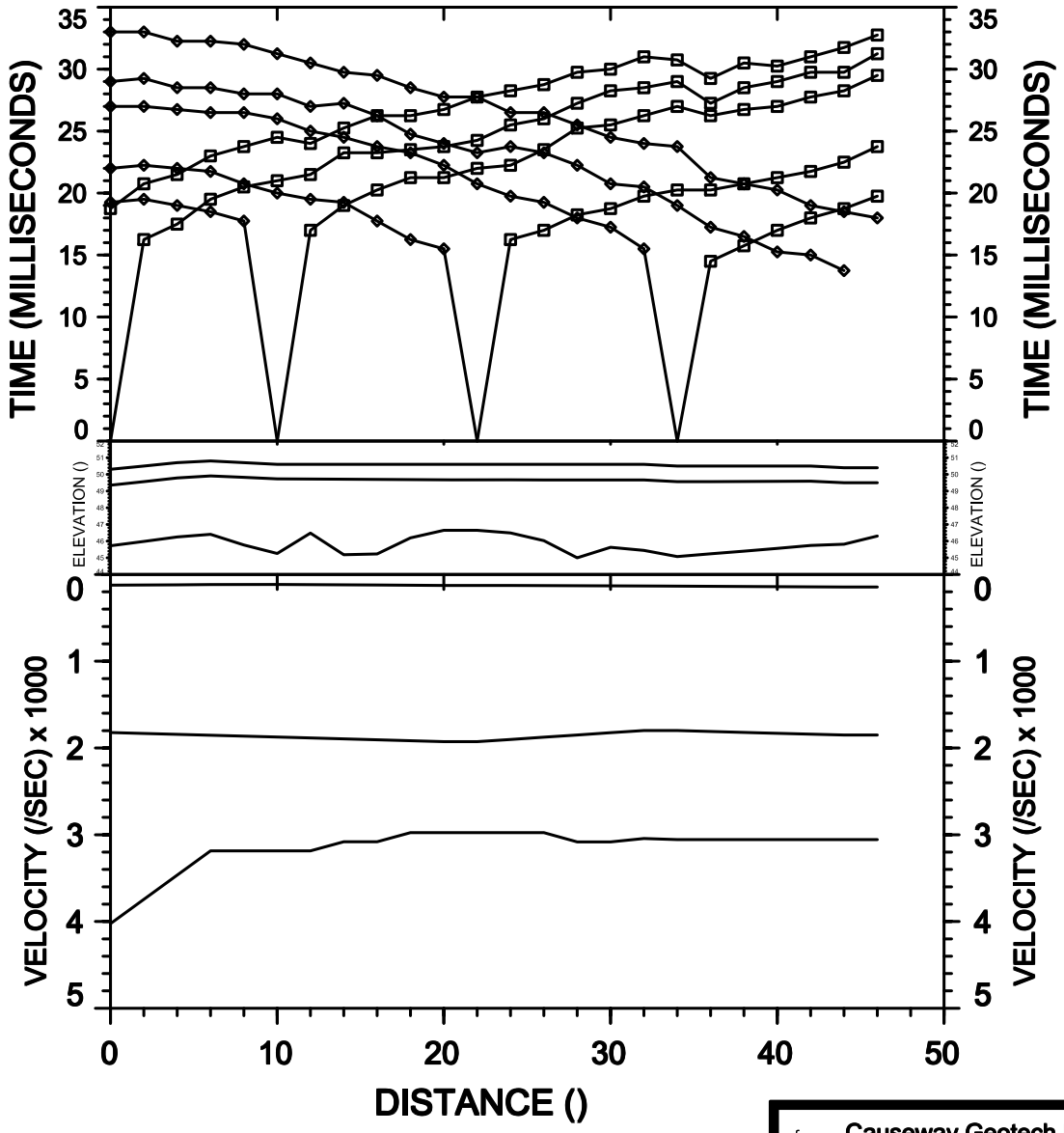


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS150R / Date: 29/06/2022	
Equipment: Geode / Spread: S150	Azimuth:

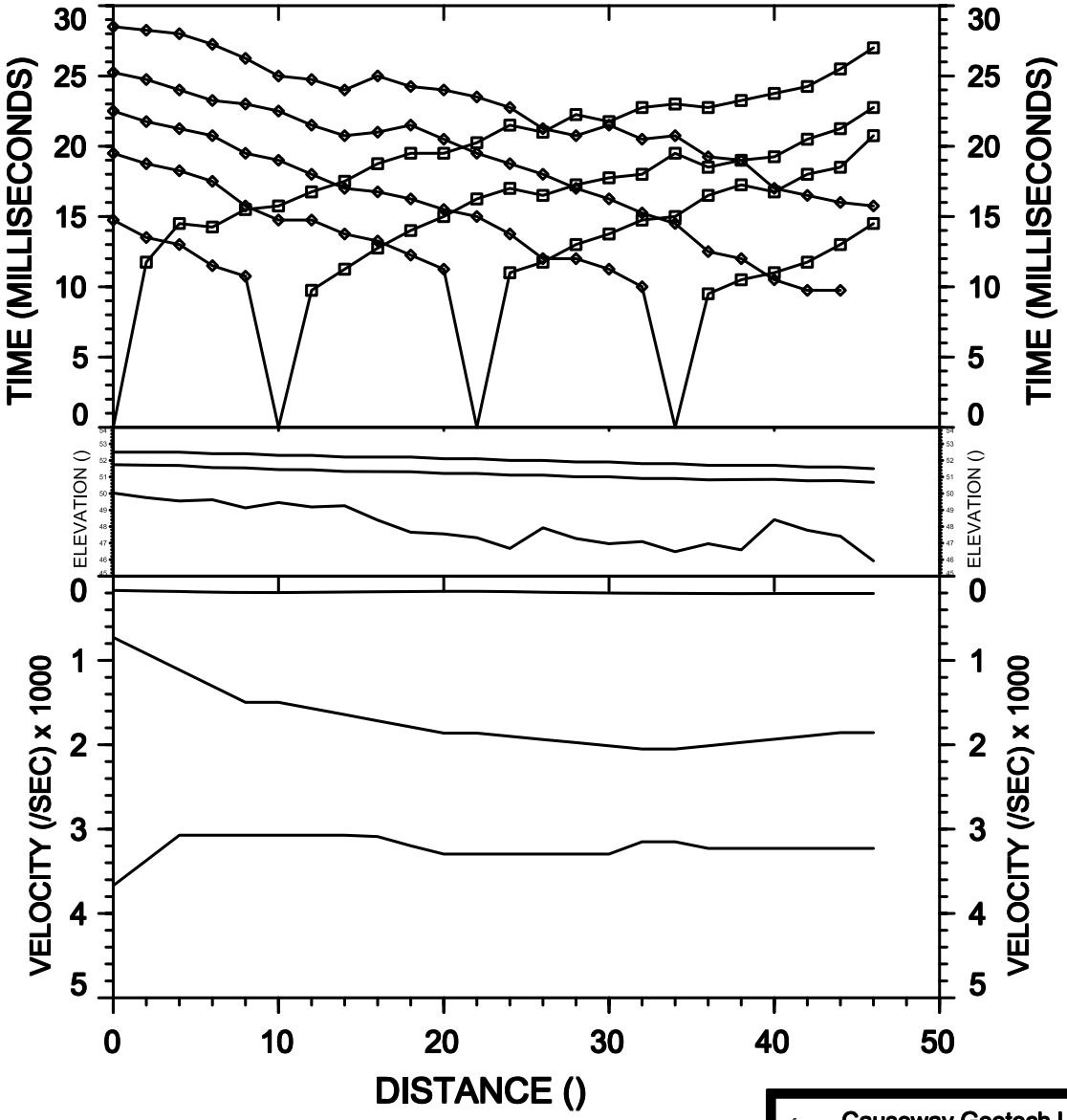


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS151 / Date: 30/06/2022	
Equipment: Geode / Spread: S151	Azimuth:

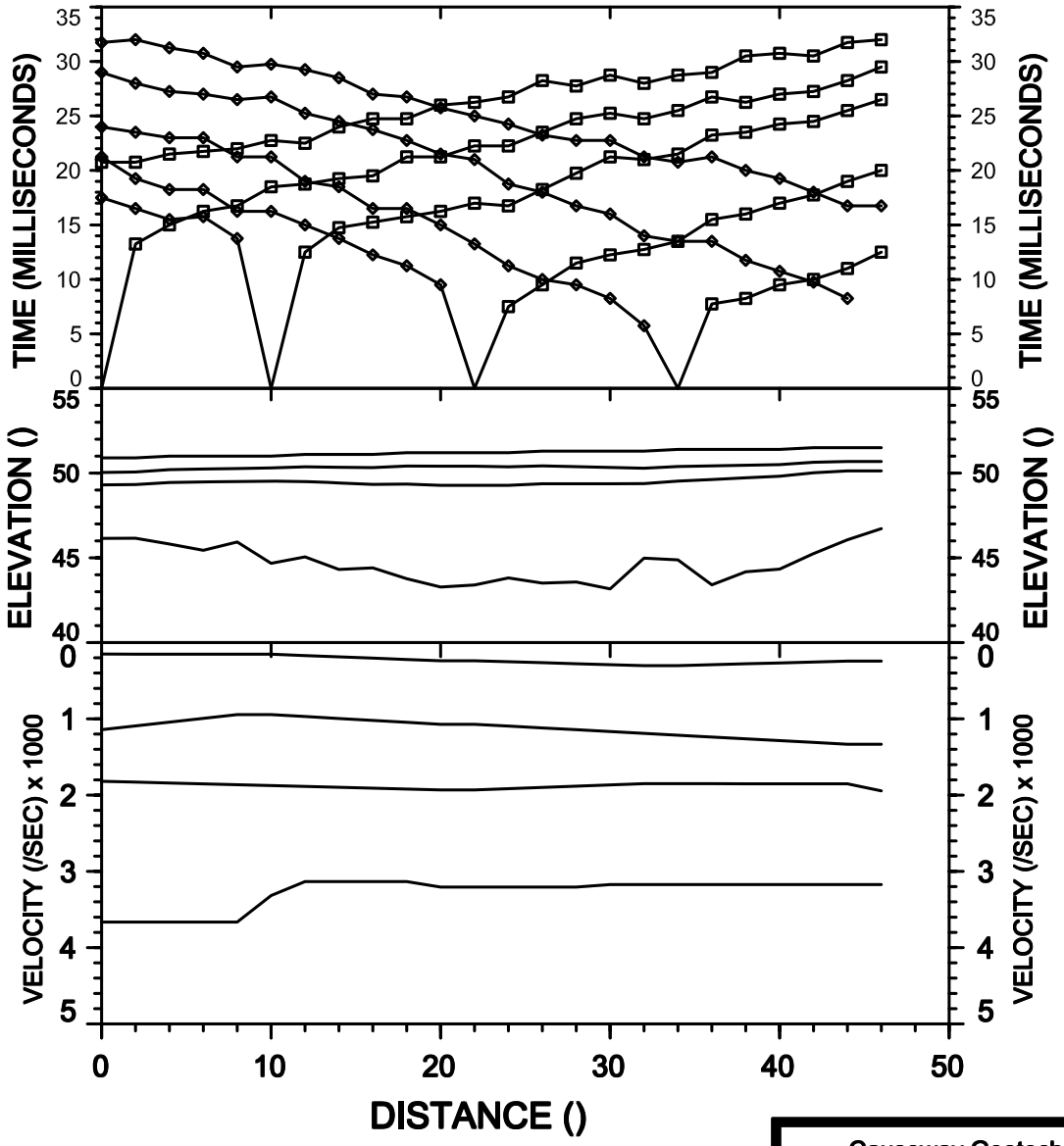


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS152R / Date: 30/06/2022	
Equipment: Geode / Spread: S152	Azimuth:

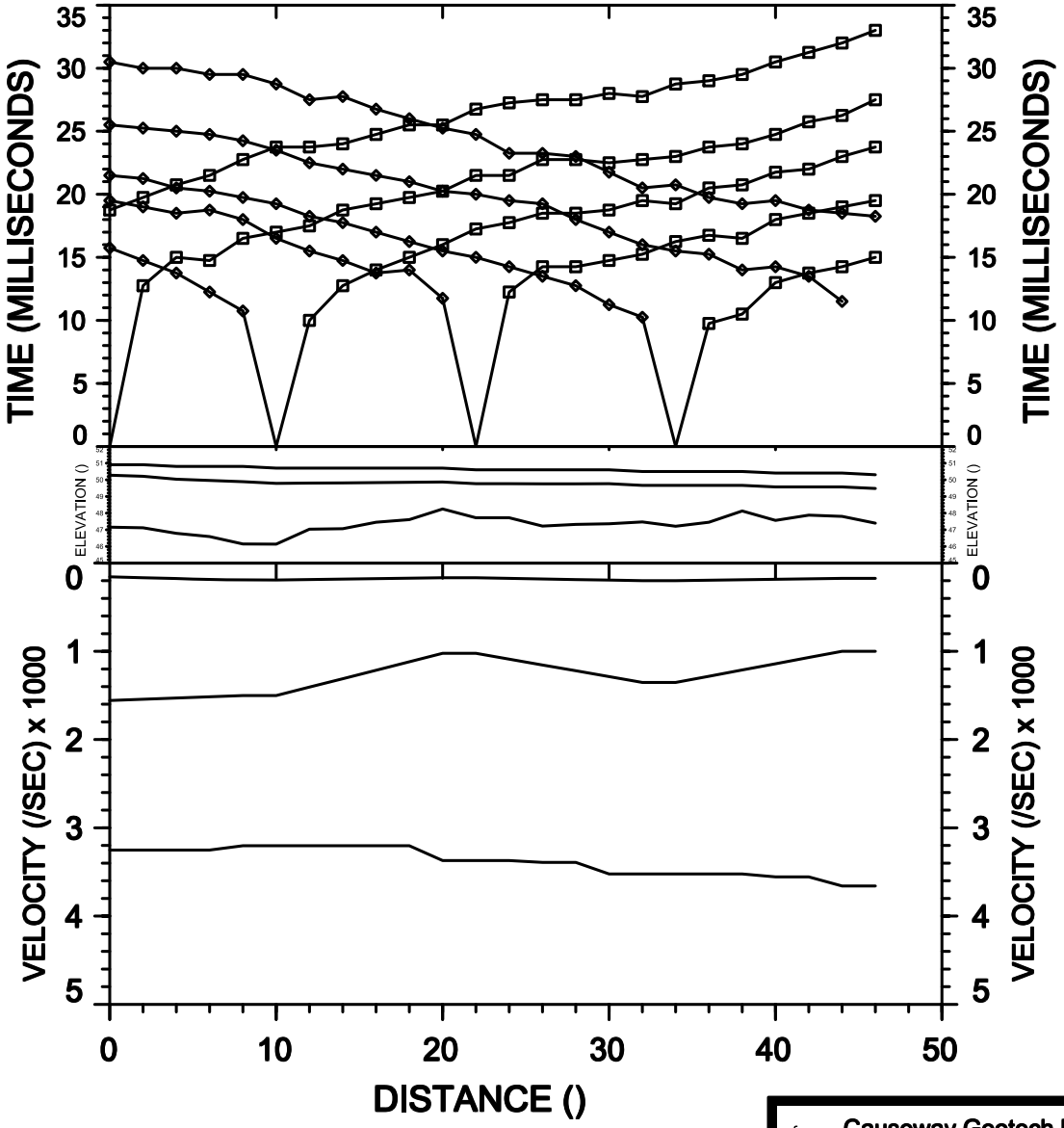


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary
Data SetS153R	Date: 30/06/2022	Tipperary
Equipment: Geode	Spread: S153	Azimuth:

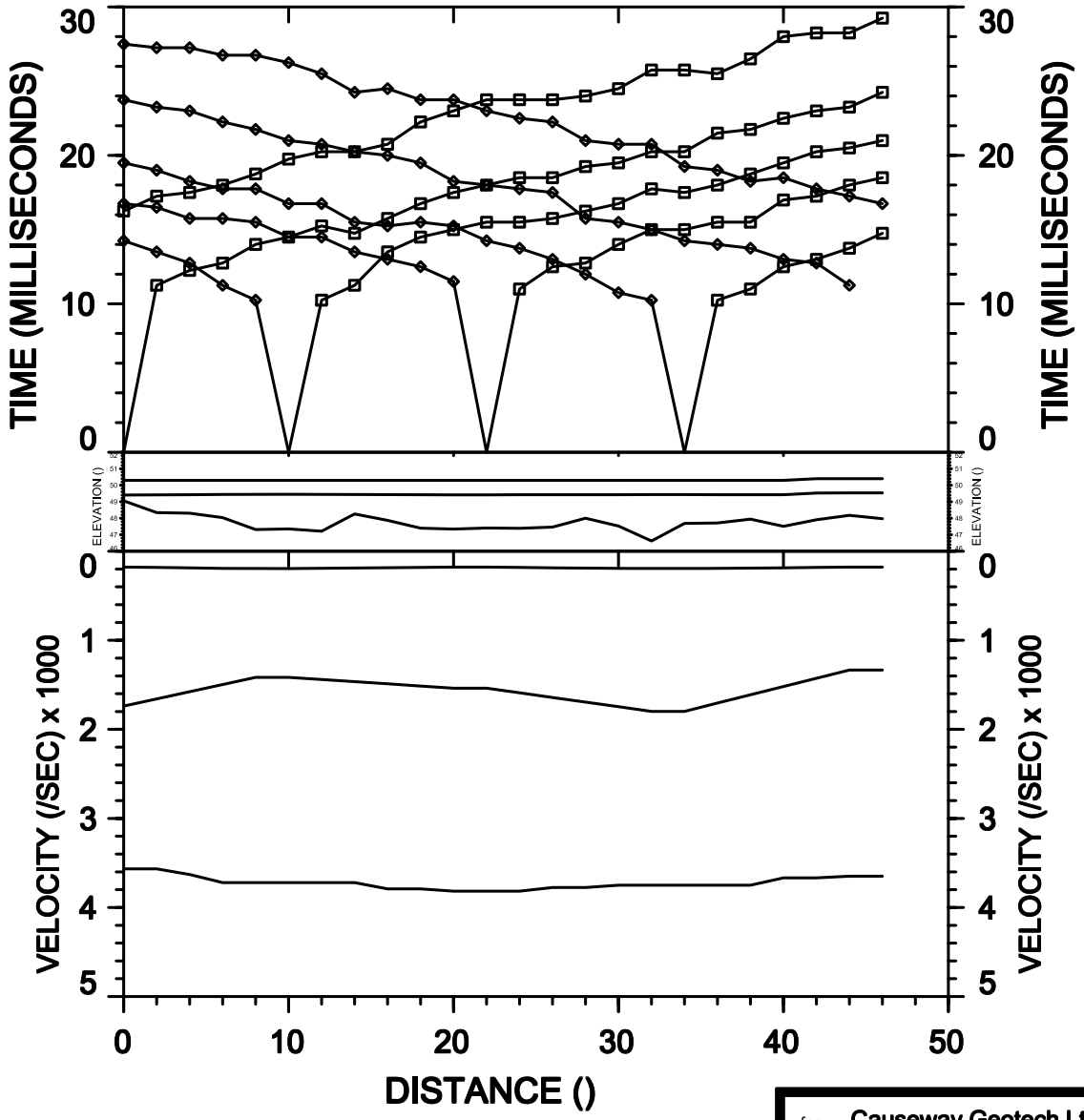


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS154 / Date: 30/06/2022	
Equipment: Geode / Spread: S154	Azimuth:

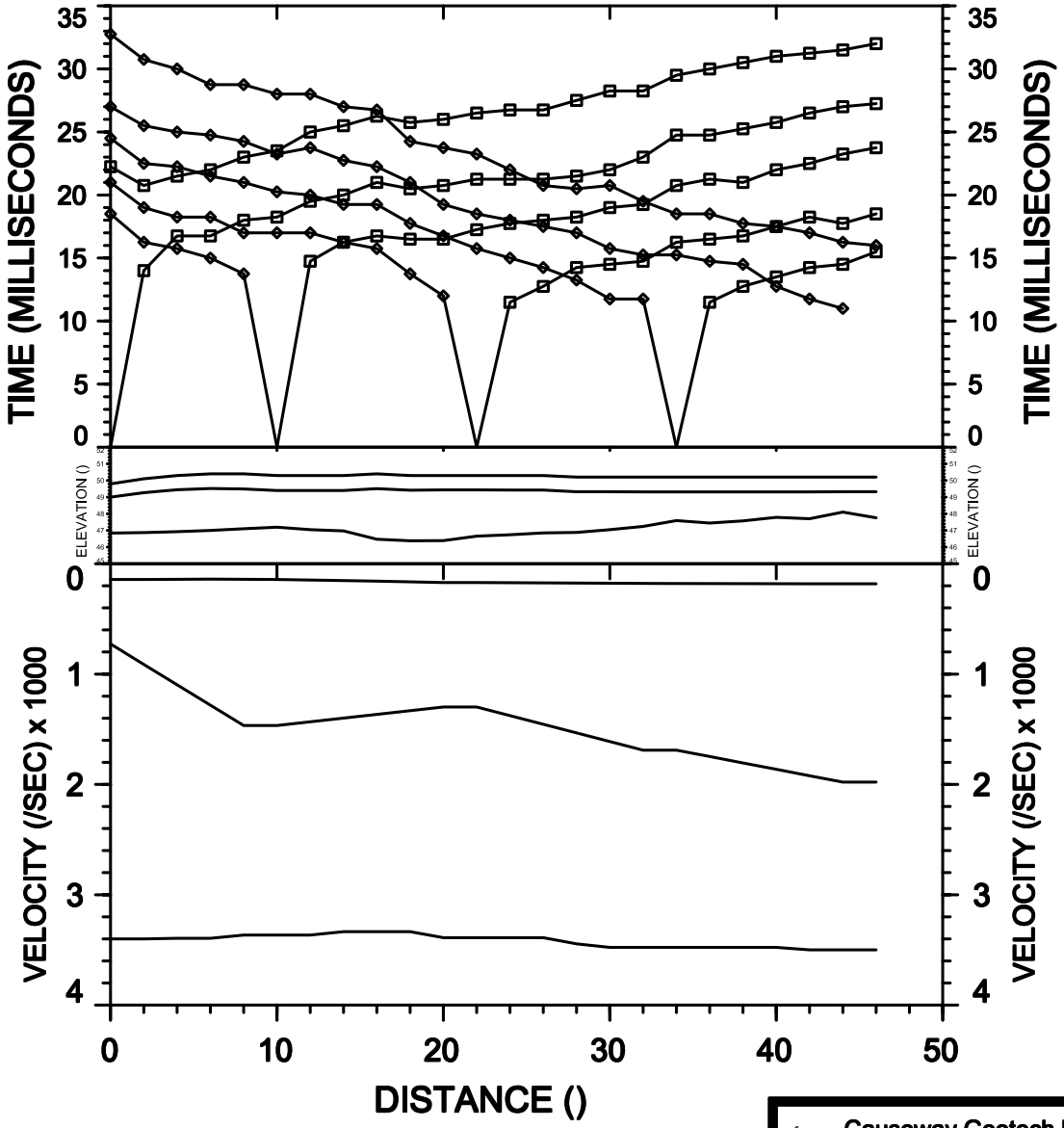


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS155R / Date: 30/06/2022	
Equipment: Geode / Spread: S155	Azimuth:

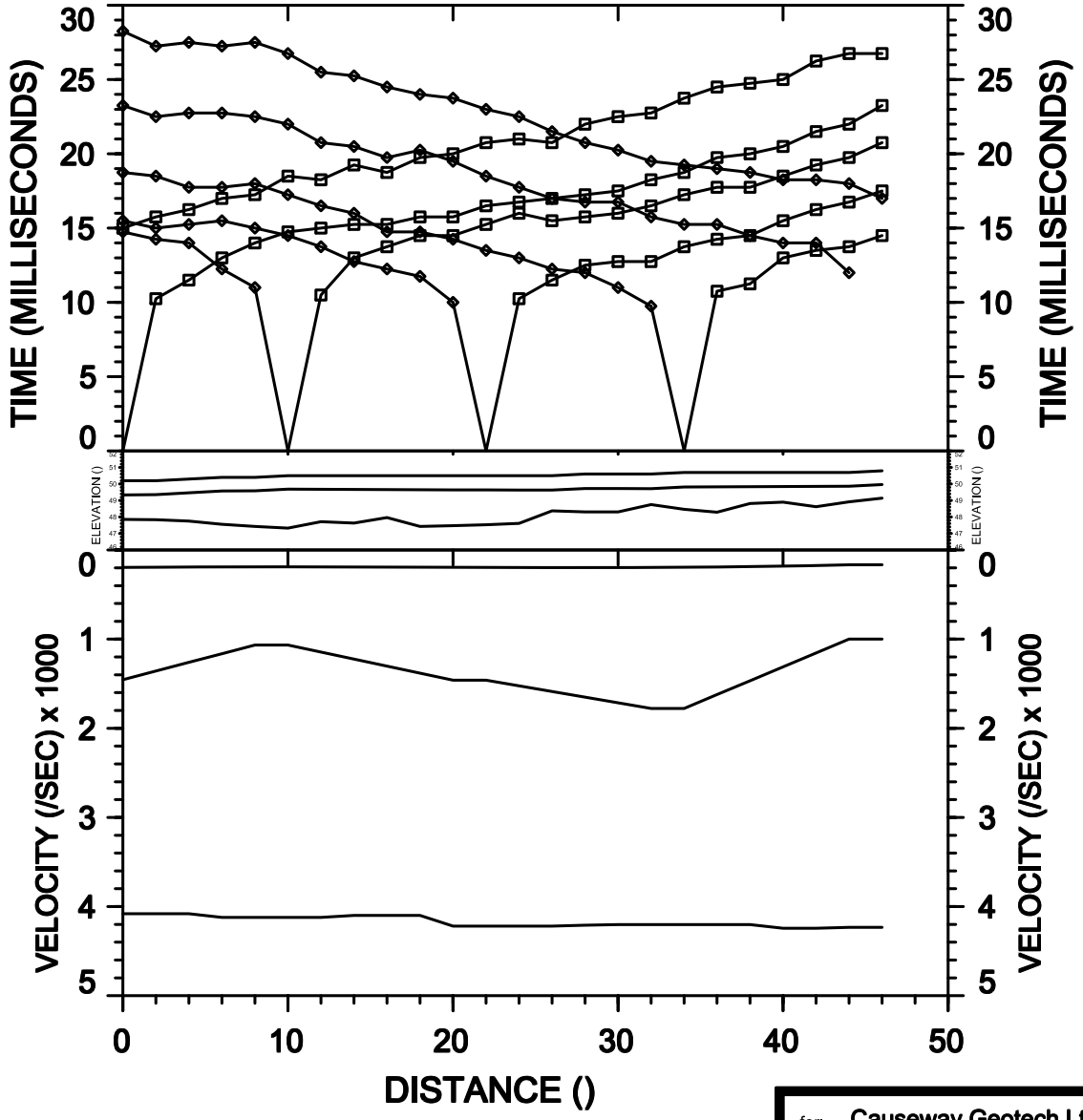


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS156 / Date: 30/06/2022	
Equipment: Geode / Spread: S156	Azimuth:

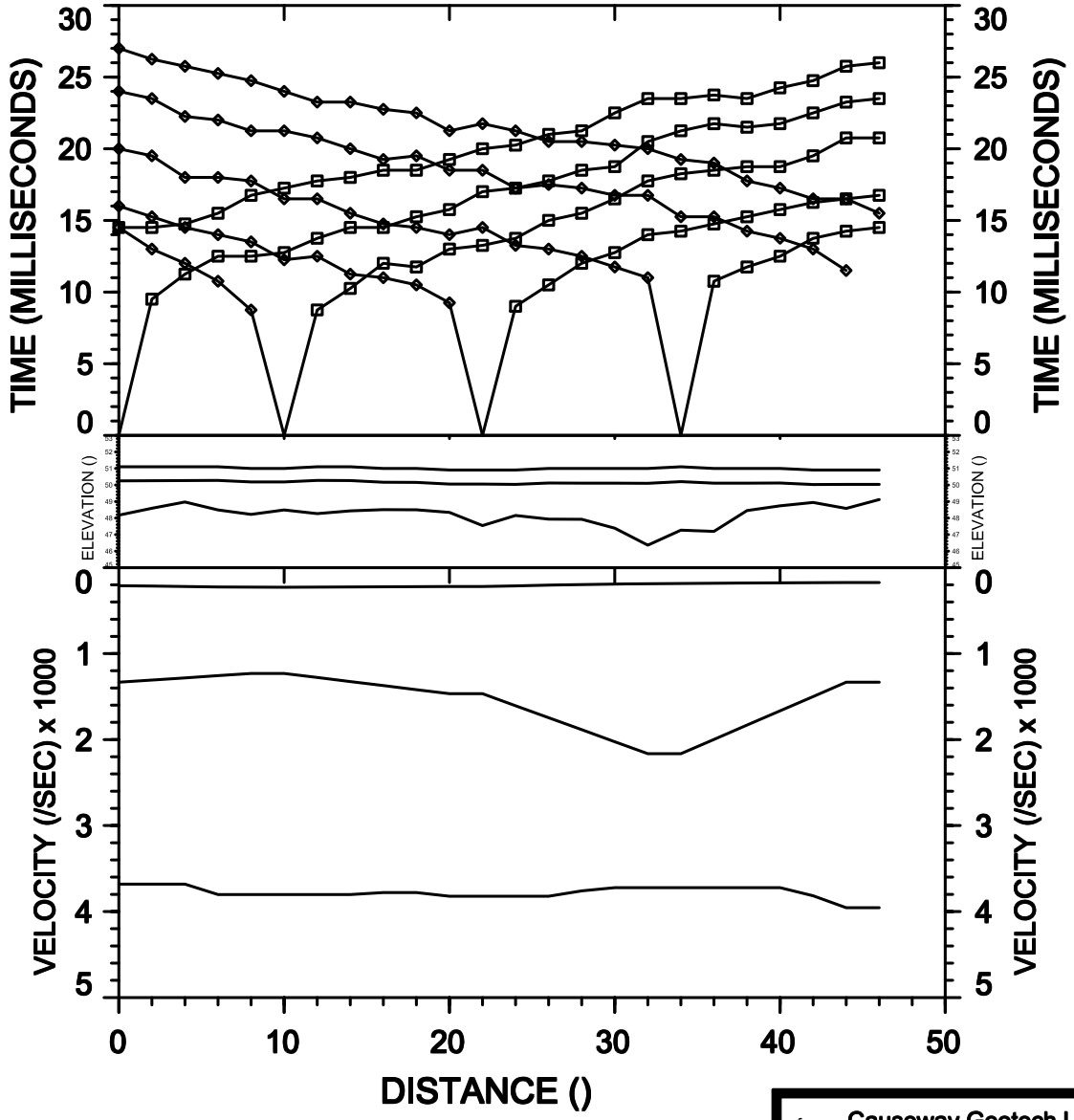


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary
Data SetS157 / Date: 30/06/2022	Tipperary
Equipment: Geode / Spread: S157	Azimuth:

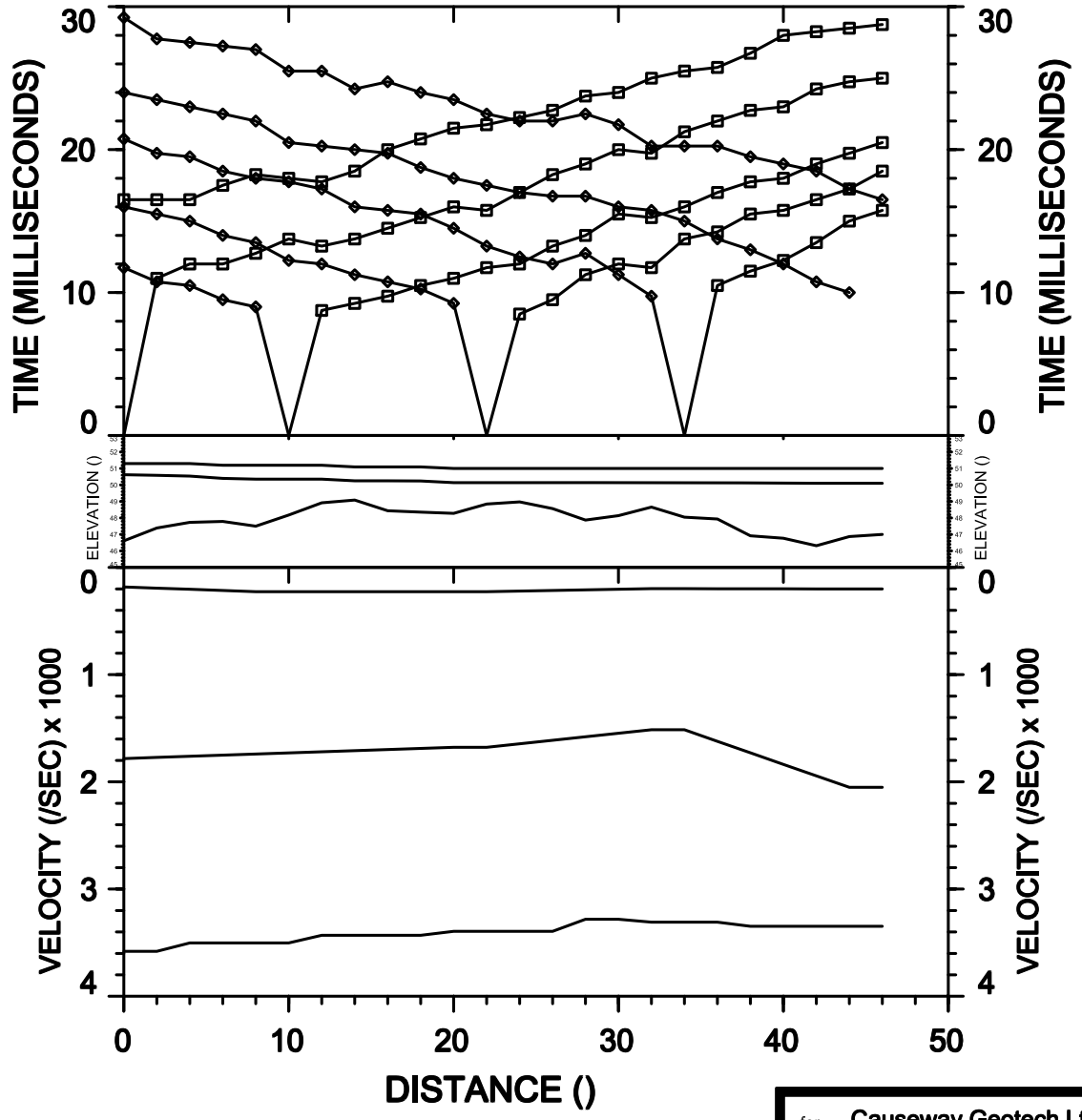


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS158R / Date: 30/06/2022	
Equipment: Geode / Spread: S158	Azimuth:

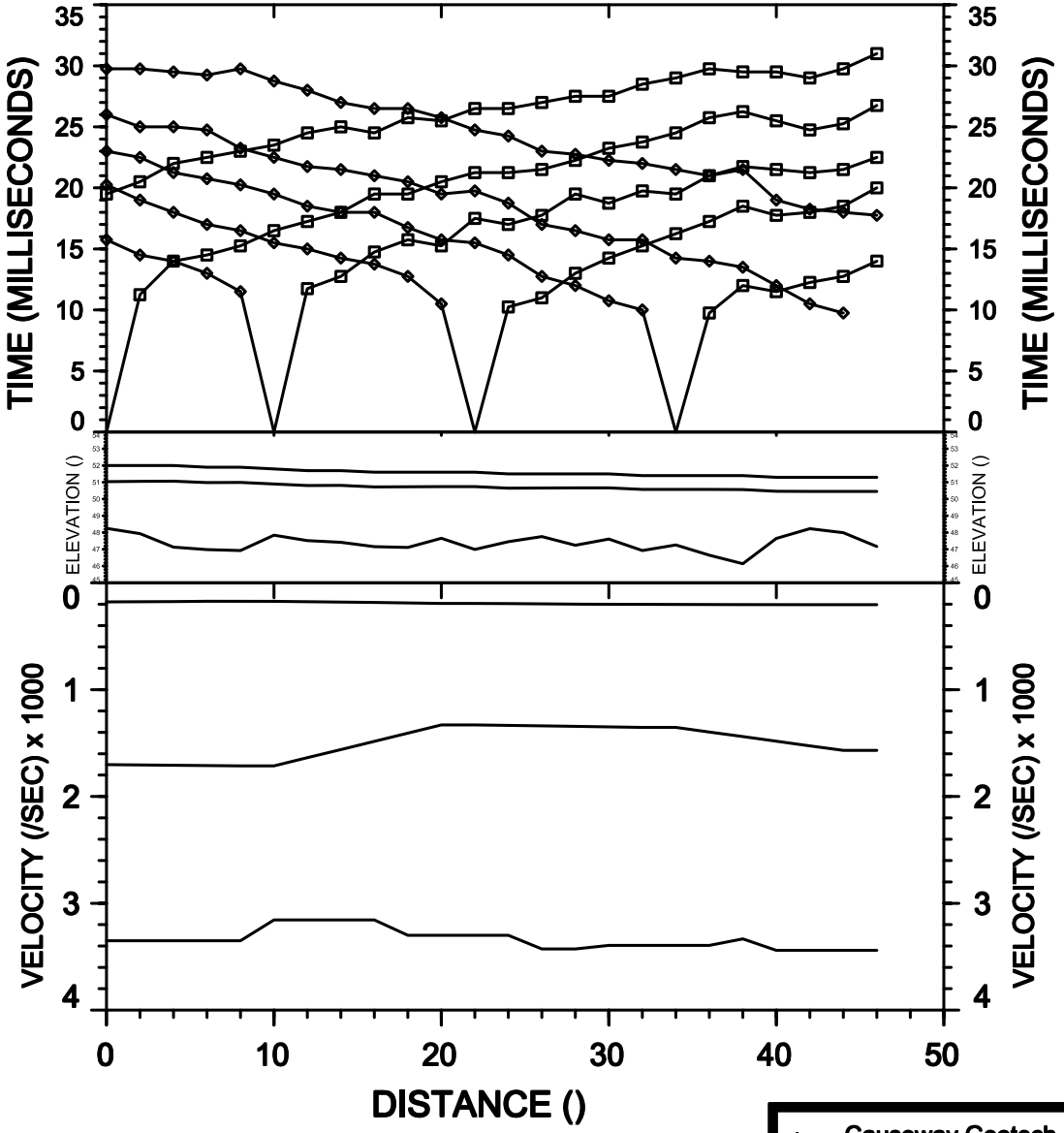


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS159R / Date: 30/06/2022	
Equipment: Geode / Spread: S159	Azimuth:

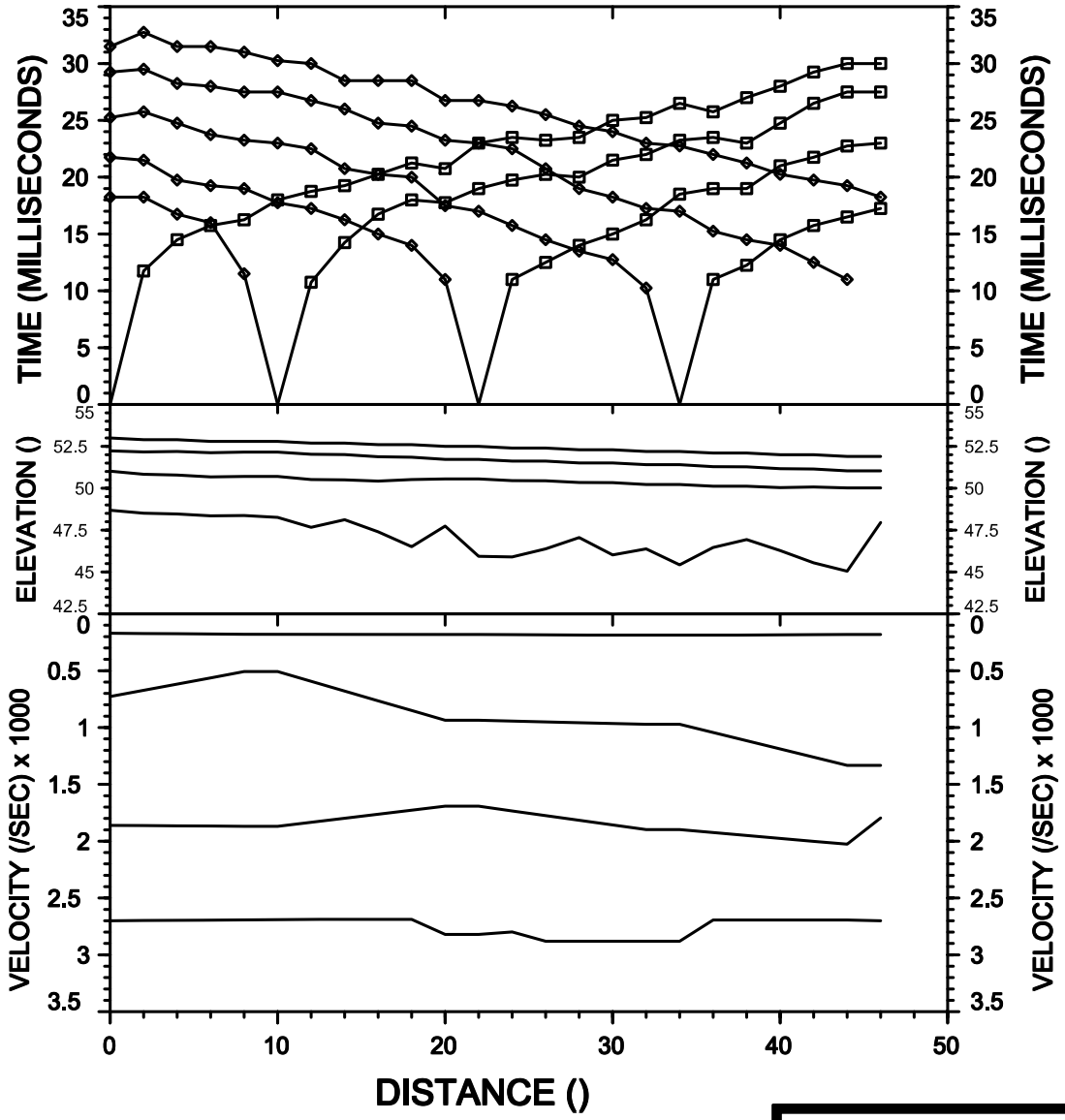


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS160 / Date: 30/06/2022	
Equipment: Geode / Spread: S160	Azimuth:

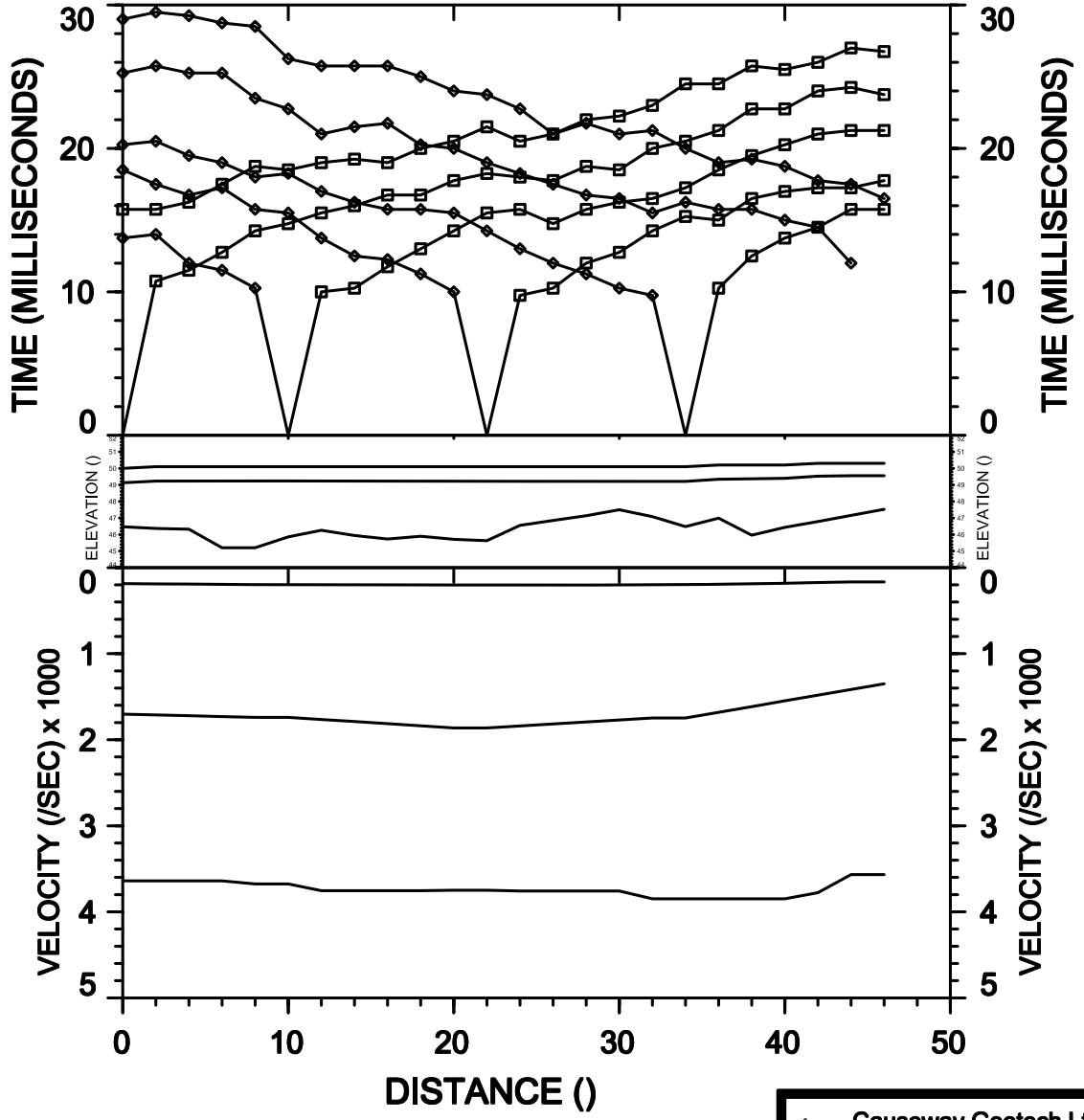


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS161R	Date: 30/06/2022	
Equipment: Geode	Spread: S161	Azimuth:

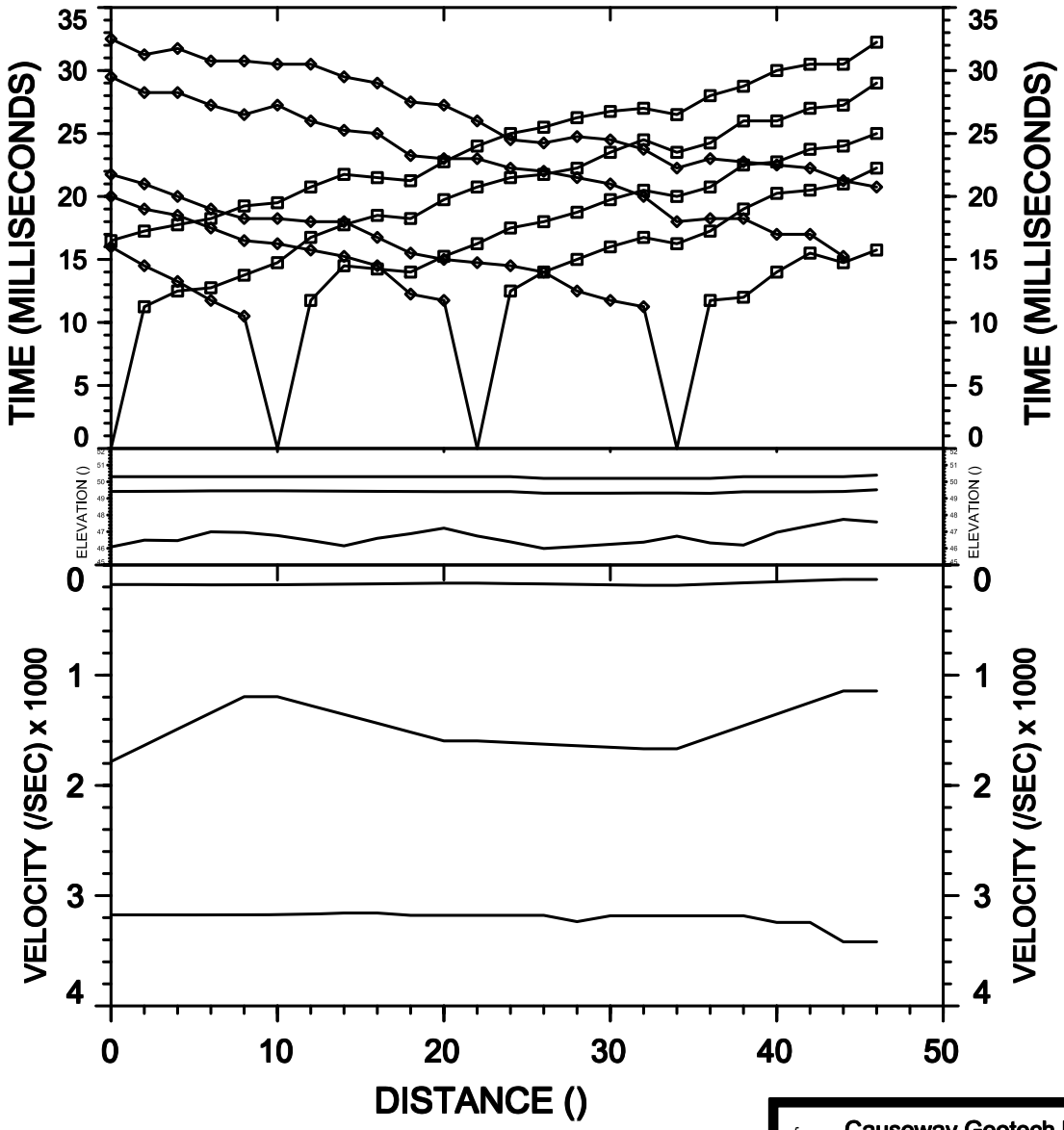


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS162R / Date: 30/06/2022	
Equipment: Geode / Spread: S162	Azimuth:

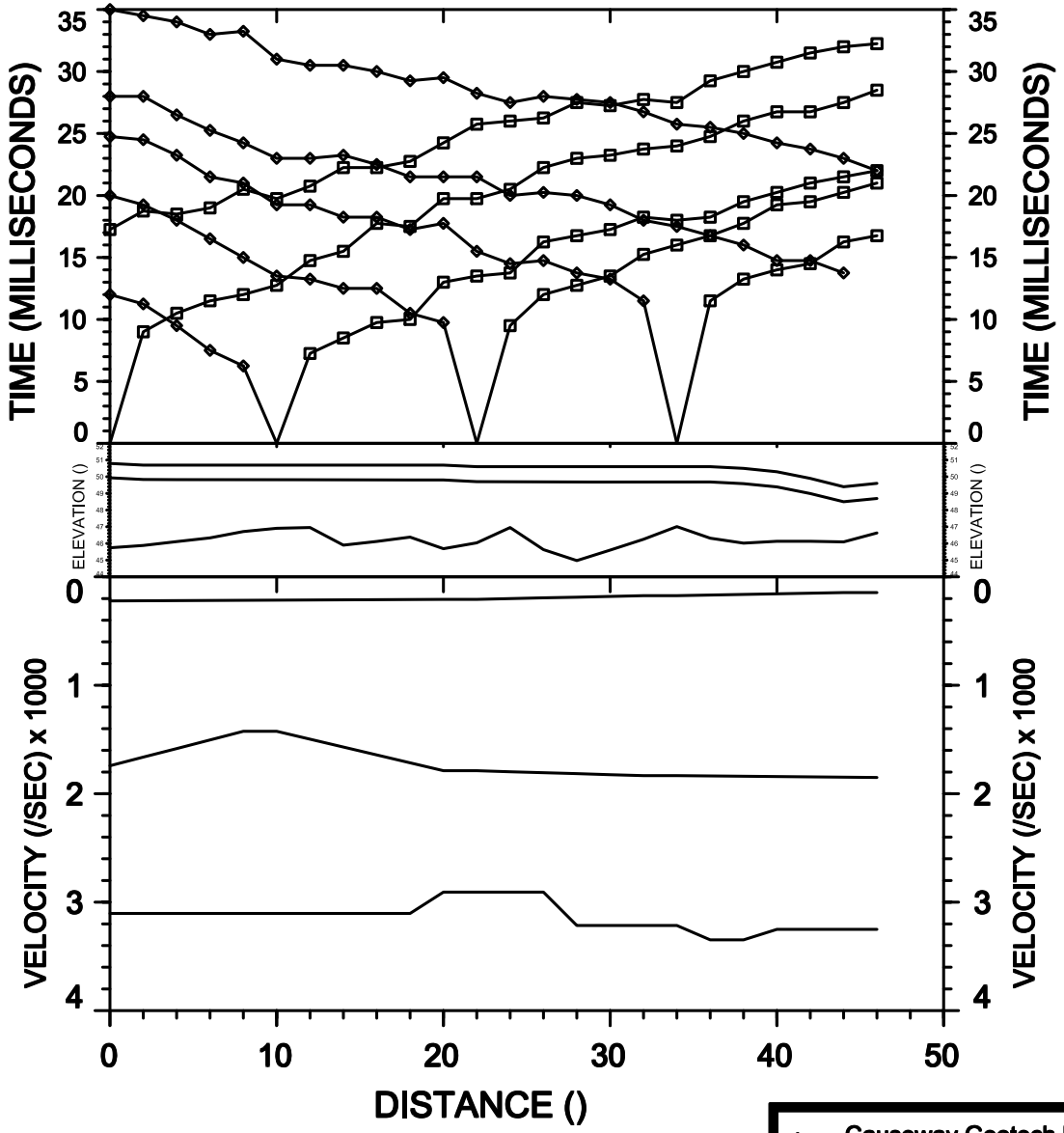


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS163R / Date: 30/06/2022	
Equipment: Geode / Spread: S163	Azimuth:

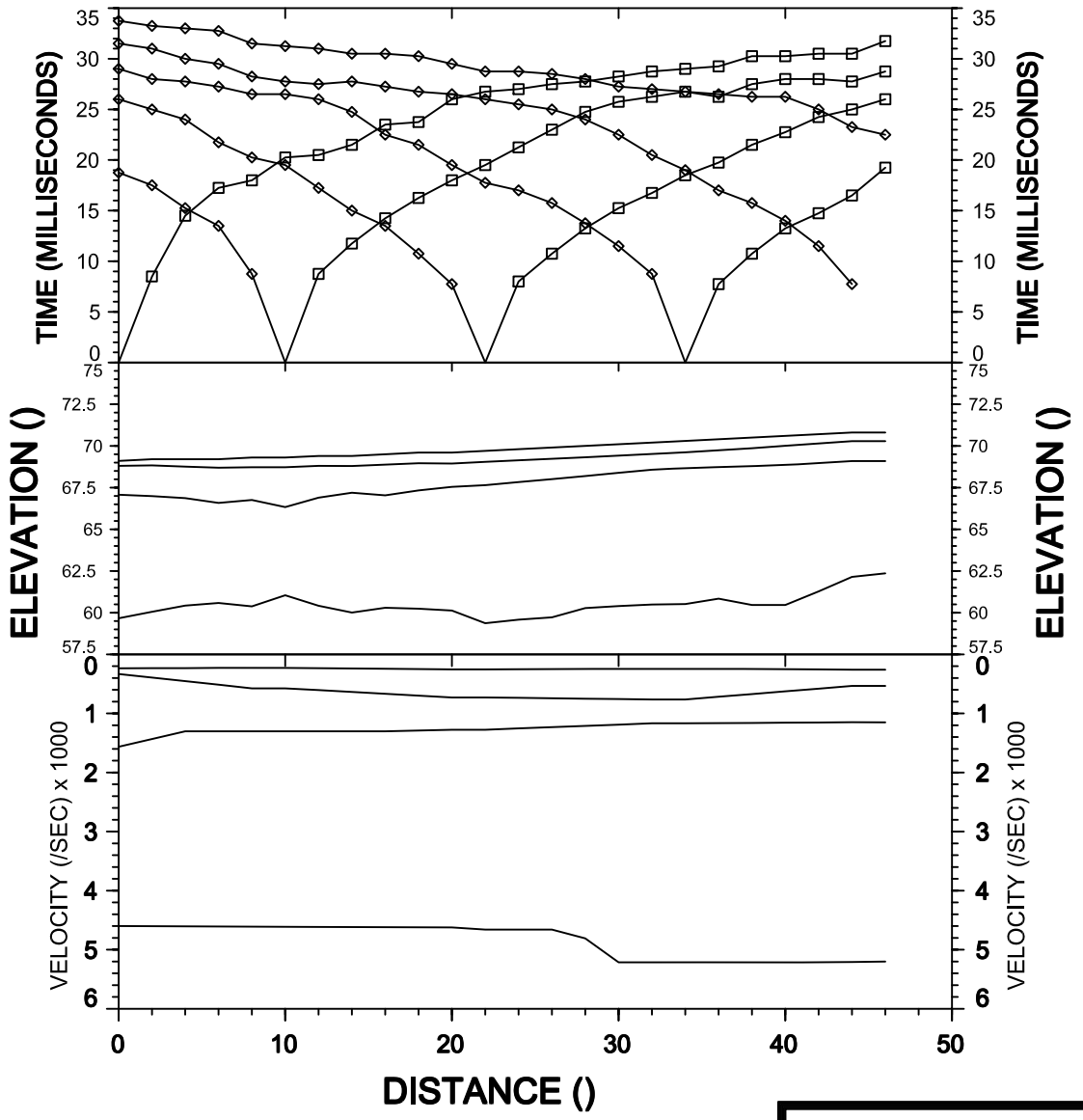


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS164 / Date: 4/7/22	
Equipment: Geode / Spread: S164	Azimuth:

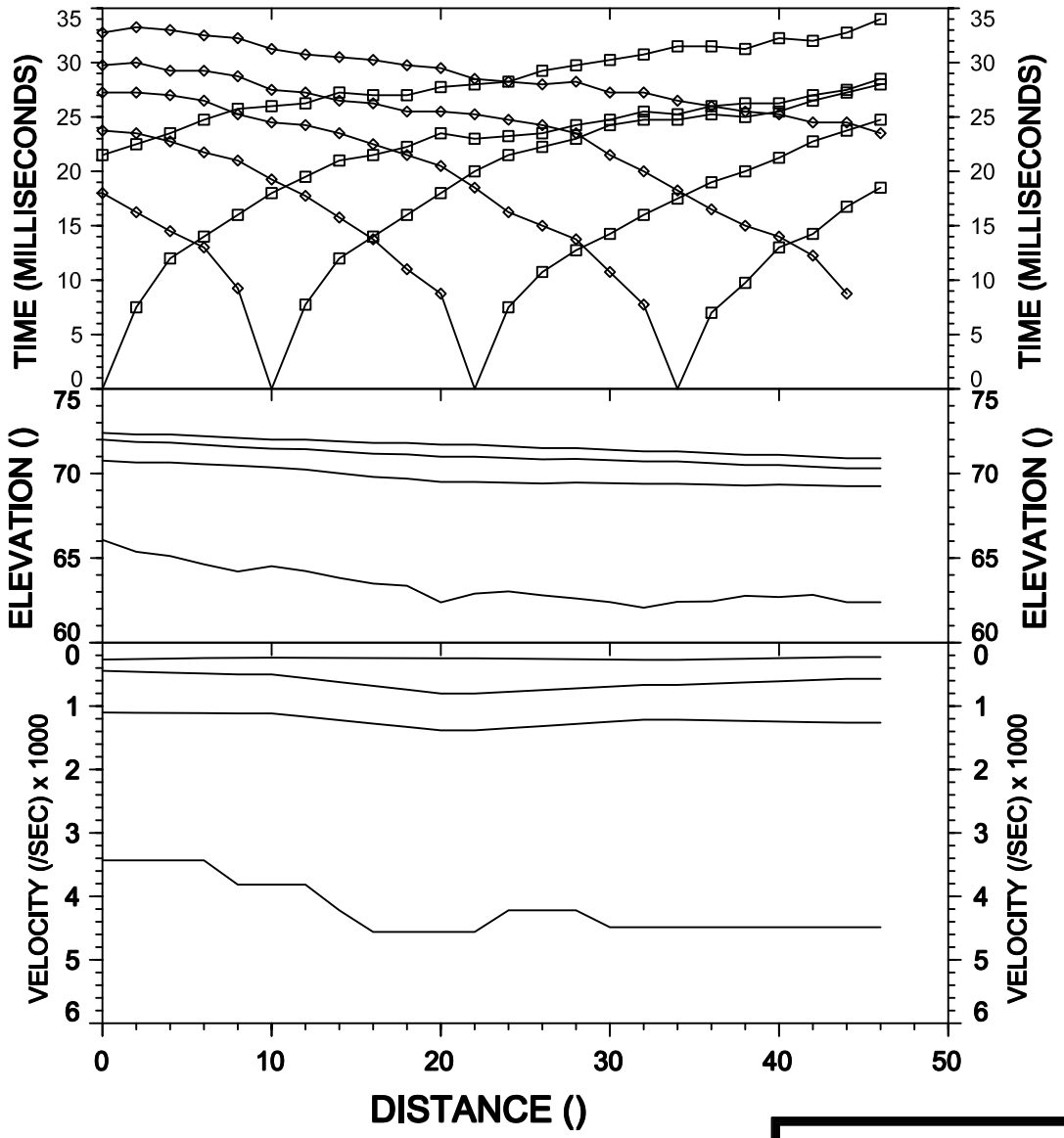


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS165 / Date: 4/7/22	
Equipment: Geode / Spread: S165	Azimuth:

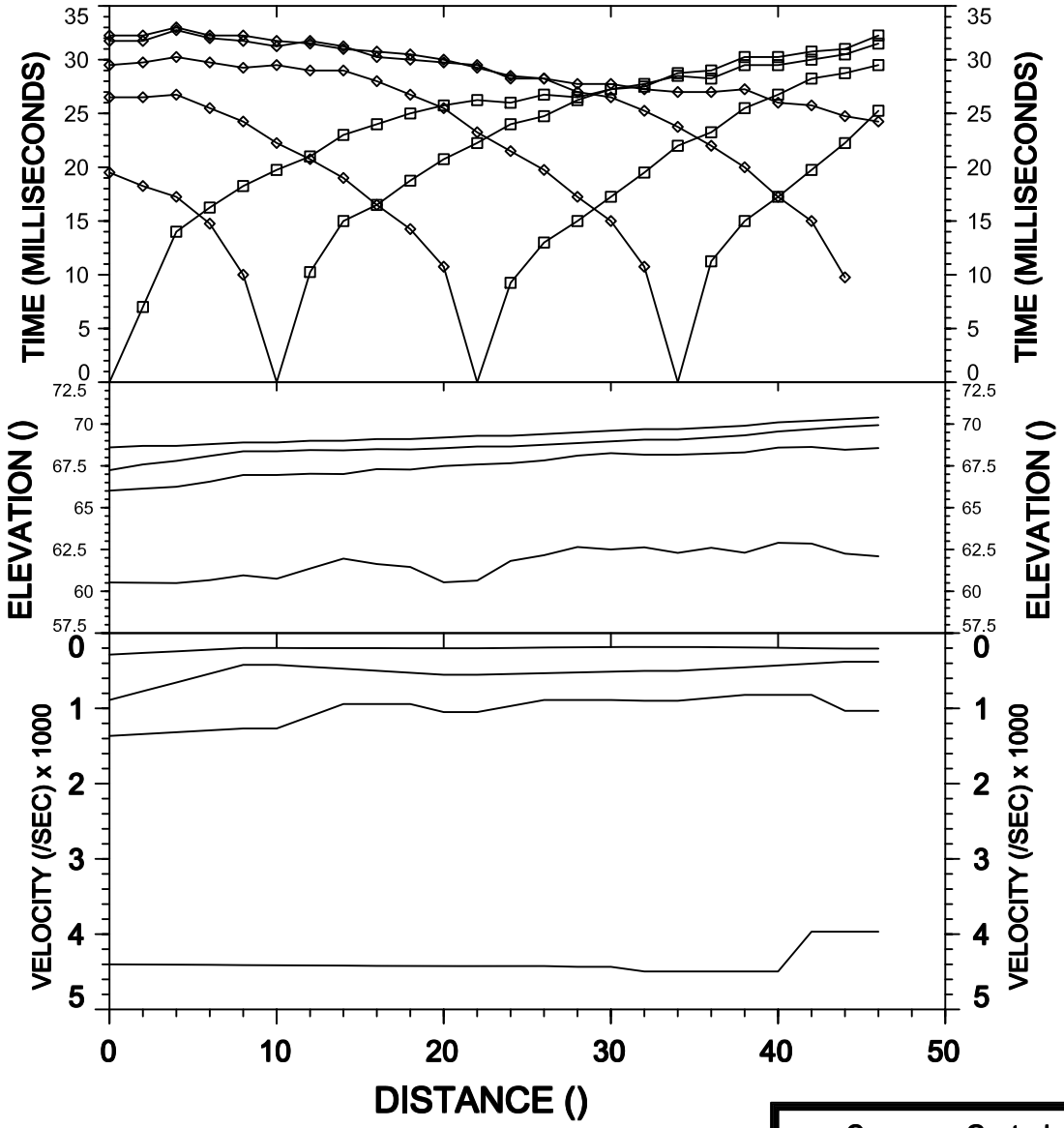


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS166 / Date: 4/7/22	
Equipment: Geode / Spread: S166	Azimuth:

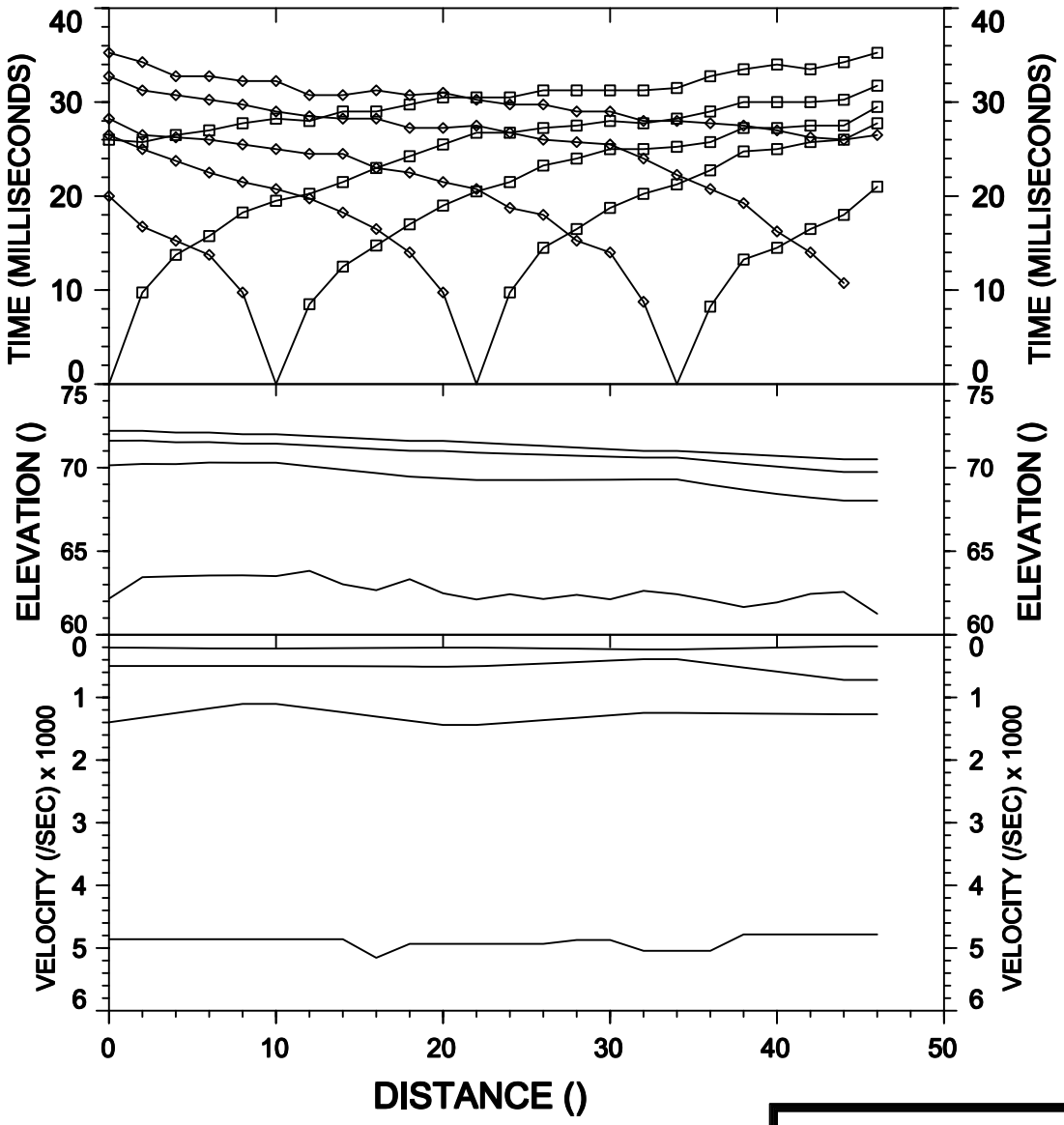


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS167 / Date: 4/7/22	
Equipment: Geode / Spread: S167	Azimuth:

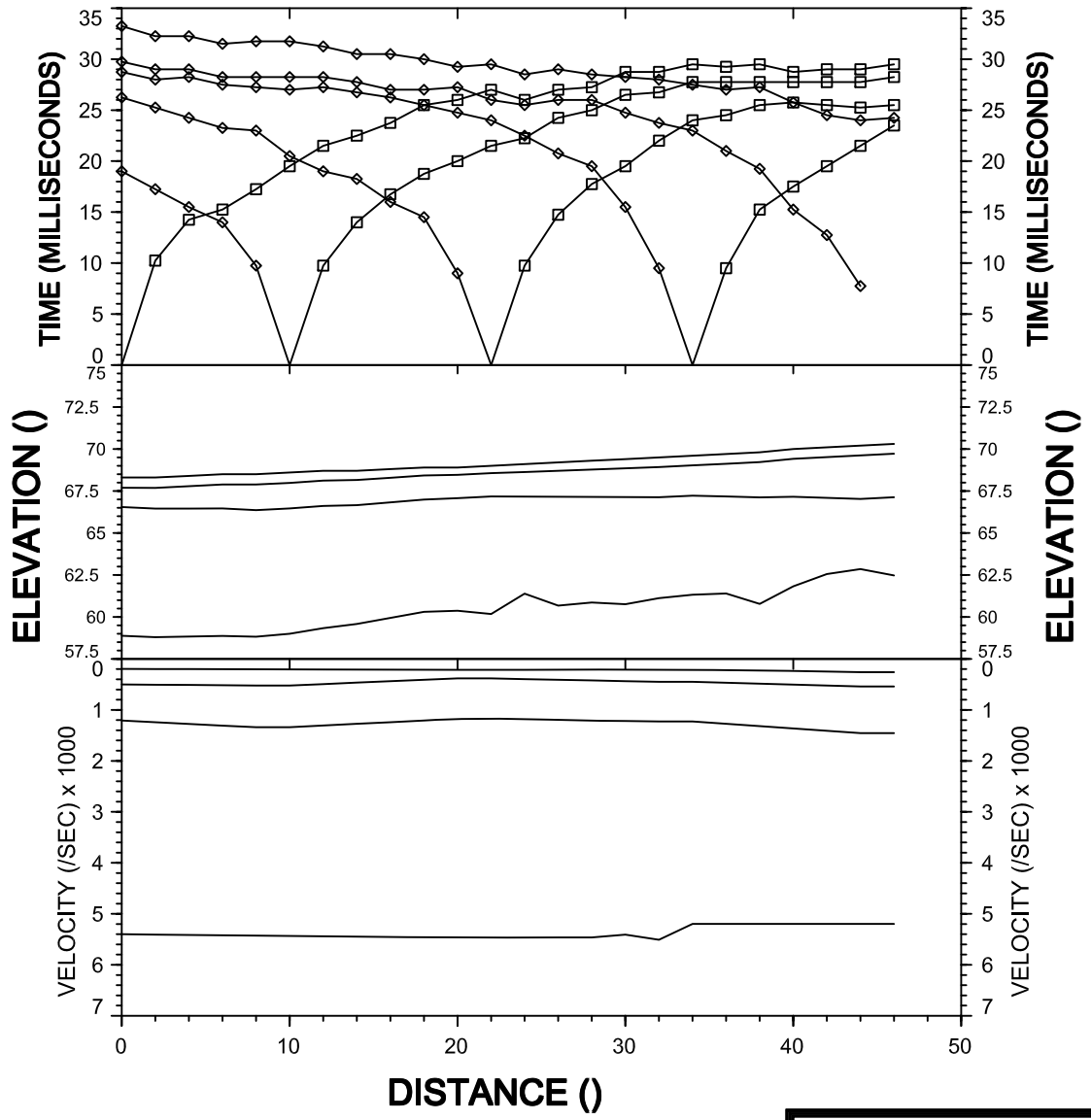


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS168 / Date: 4/7/22	
Equipment: Geode / Spread: S168	Azimuth:

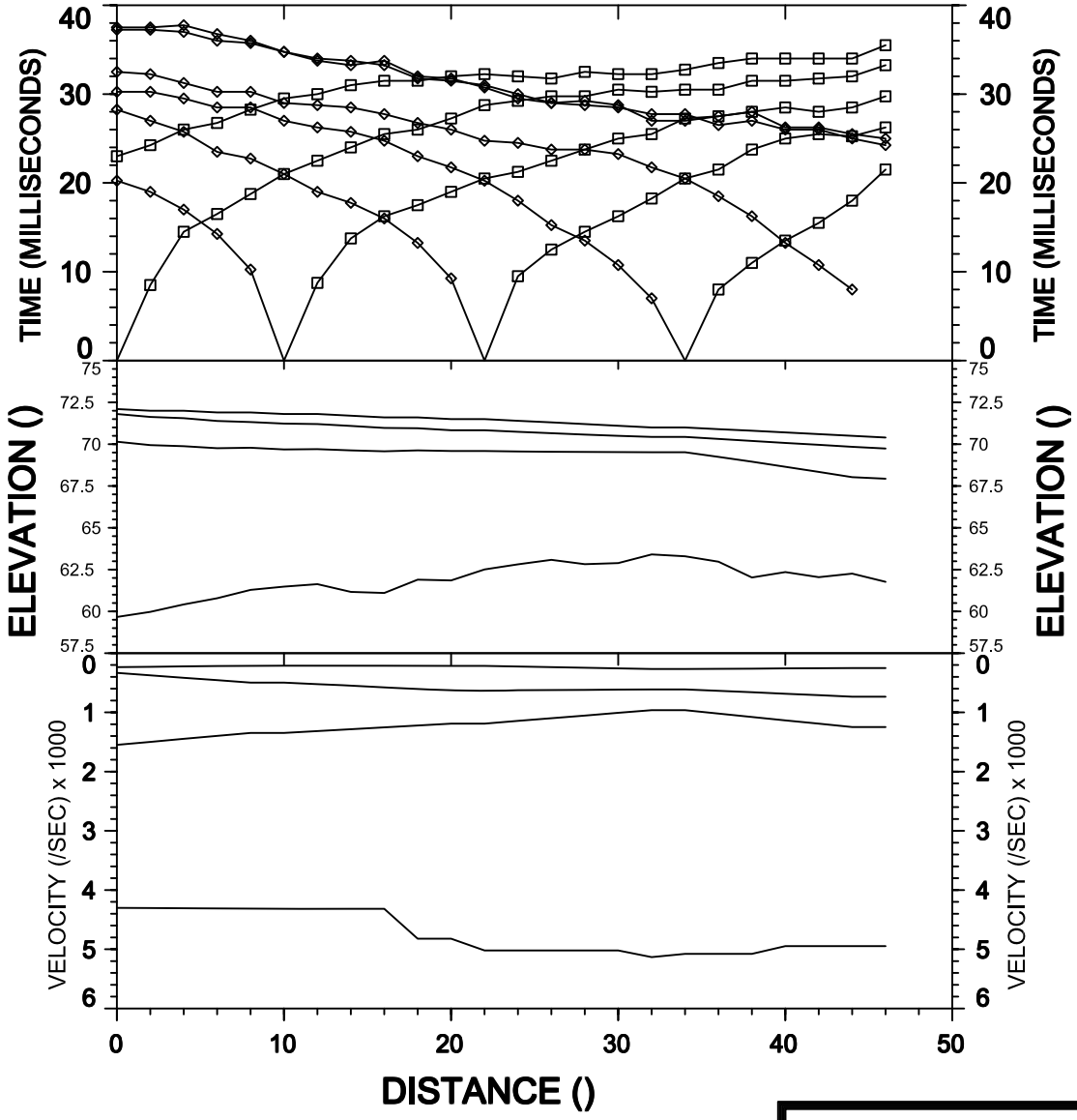


Plate: 10a

for: Causeway Geotech Ltd		AGP21220
by: Strata Geophysical, Inc.		Tipperary Tipperary
Data SetS169	Date: 4/7/22	
Equipment: Geode	Spread: S169	Azimuth:

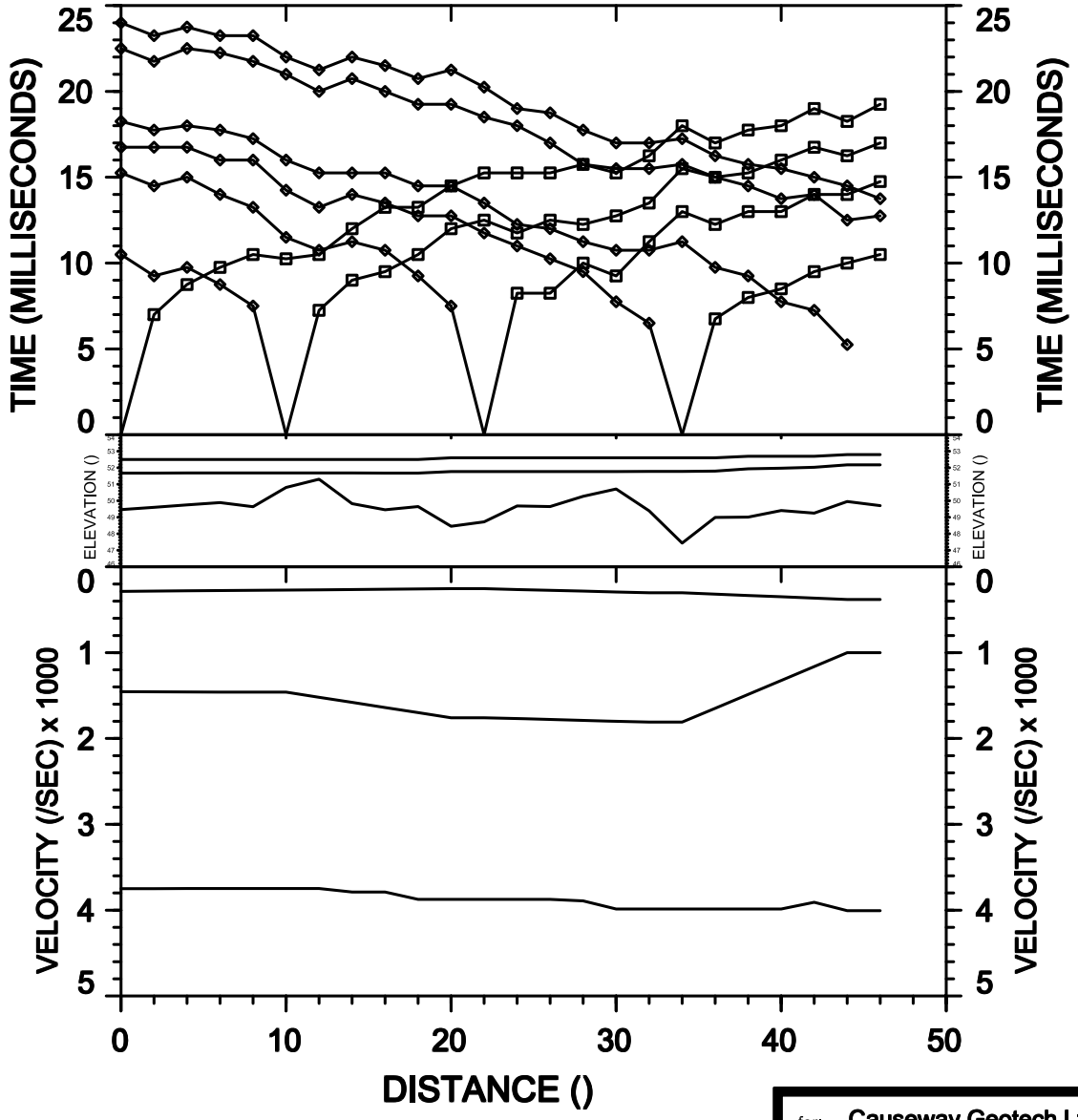


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS170 / Date: 4/7/22	
Equipment: Geode / Spread: S170	Azimuth:

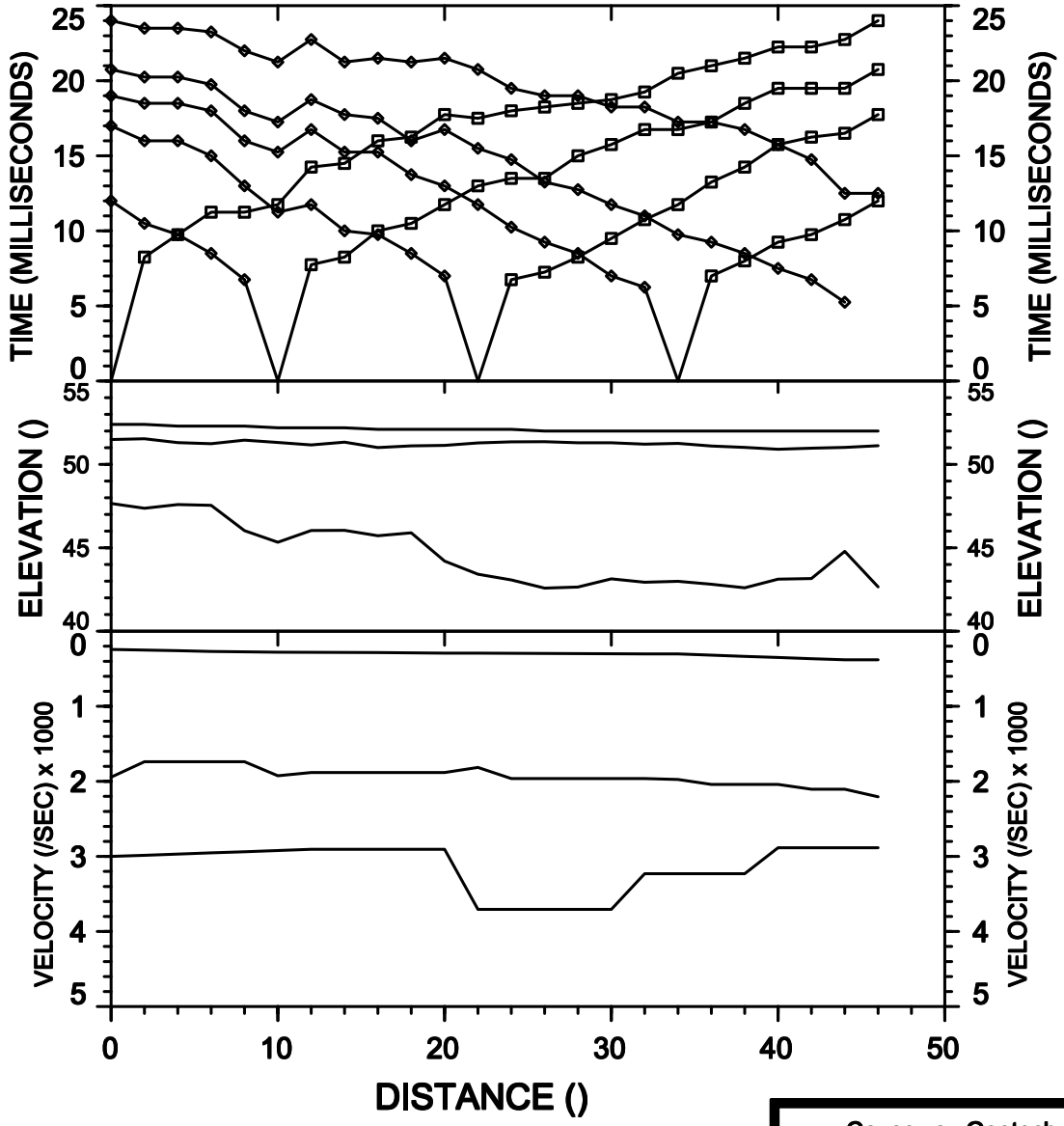


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS171 / Date: 4/7/22	
Equipment: Geode / Spread: S171	Azimuth:

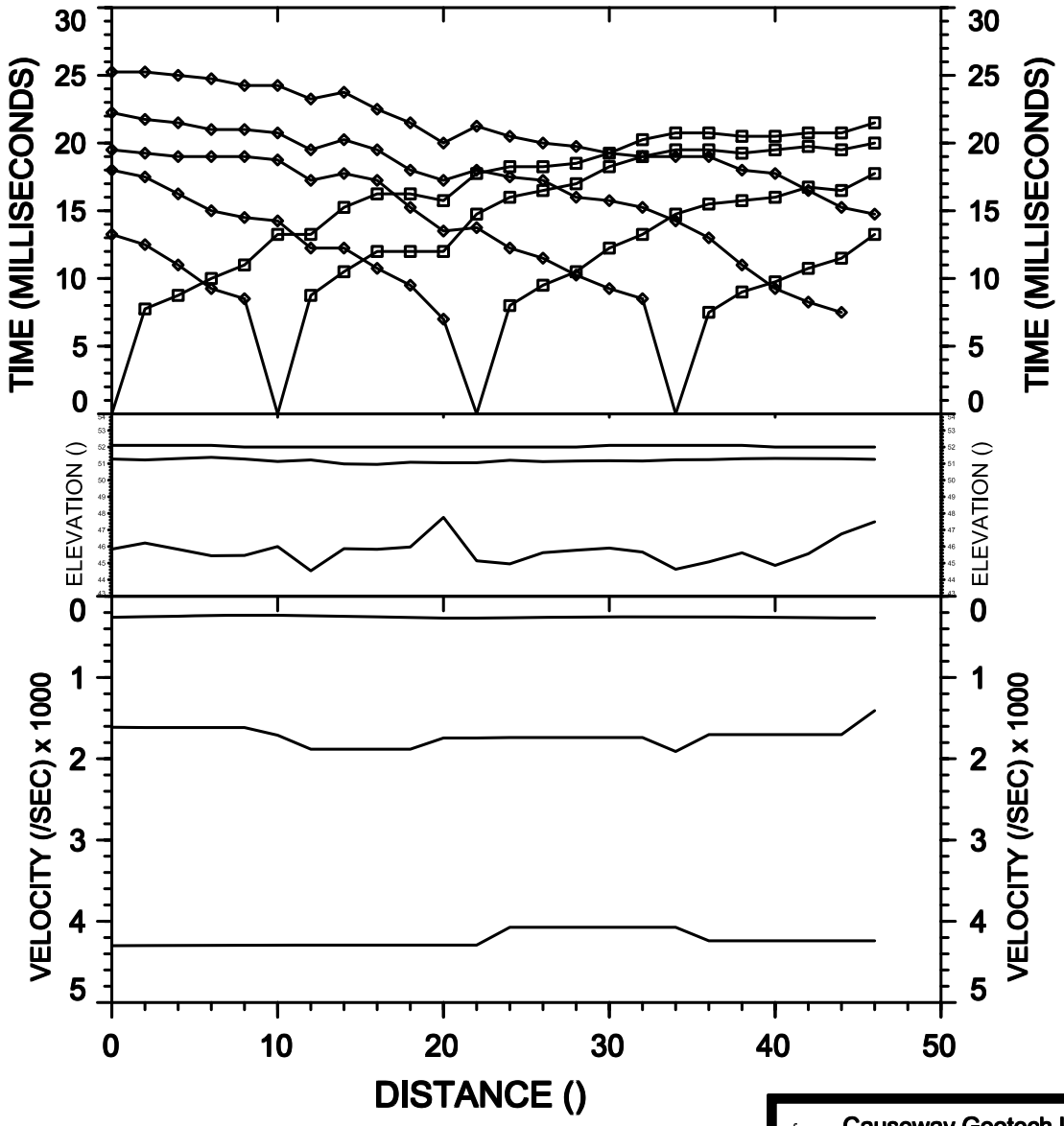


Plate: 10a

for: Causeway Geotech Ltd	AGP21220
by: Strata Geophysical, Inc.	Tipperary Tipperary
Data SetS172 / Date: 4/7/22	
Equipment: Geode / Spread: S172	Azimuth:

APPENDIX D: EXCAVATABILITY

The seismic velocity of a rock formation is related to characteristics of the rock mass which include rock hardness and strength, degree of weathering and discontinuities. Usually the velocity is just one of several parameters used in the assessment of excavatability. The excavatability of a rock formation is favoured by the following factors:

- Open fractures, faults and other planes of weakness of any kind
- Weathering
- Brittleness and crystalline nature
- High degree of stratification or lamination
- Large grain size
- Low compressive strength

Weaver (1975) presented a comprehensive rippability rating chart (Fig.1) in which the p-wave velocity value and the relevant geological factors could be entered and assigned appropriate weightings. The total weighted index was found to correlate very well with actual rippability.

Fig.1 Rippability Rating Chart

Rock class	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock
Seismic velocity (m/s)	>2150	2150-1850	1850-1500	1500-1200	1200-450
Rating	26	24	20	12	5
Rock hardness	Extremely hard rock	Very hard rock	Hard rock	Soft rock	Very soft rock
Rating	10	5	2	1	0
Rock weathering	Unweathered	Slightly weathered	Weathered	Highly weathered	Completely weathered
Rating	9	7	5	3	1
Joint spacing (mm)	>3000	3000-1000	1000-300	300-50	<50
Rating	30	25	20	10	5
Joint continuity	Non continuous	Slightly continuous	Continuous-no gouge	Continuous-some gouge	Continuous-with gouge
Rating	5	5	3	0	0
Joint gouge	No separation	Slight separation	Separation <1mm	Gouge <5mm	Gouge >5mm
Rating	5	5	4	3	1
Strike and dip orientation	Very unfavourable	Unfavourable	Slightly unfavourable	Favourable	Very favourable
Rating	15	13	10	5	3
Total rating	100-90	90-70*	70-50	50-25	<25
Rippability assessment	Blasting	Extremely hard ripping and blasting	Very hard ripping	Hard ripping	Easy ripping
Tractor horsepower		770/385	385/270	270/180	180
Tractor kilowatts		575/290	290/200	200/135	135

CAUSEWAY GEOTECH

APPENDIX 2H

LABORATORY TEST RESULTS



HEAD OFFICE
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Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

14 November 2022

Project Name:	Eastern and Midlands Region WSP - GI - Lot 1
Project No.:	21-1682
Client:	Ervia
Engineer:	Mott MacDonald

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.

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: Eastern and Midlands Region WSP - GI - Lot 1

Report Reference: Raw Water Rising Main (RWRM) - INTERIM

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

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	105
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	101
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	122
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	110
SOIL	Moisture Condition Value at natural moisture content	BS 1377-4: 1990: Cl 5.4	10
SOIL	California Bearing Ratio (CBR)	BS 1377-4: 1990: Cl 7	6
SOIL	California Bearing Ratio (CBR)/ moisture content relationship	BS 1377-4: 1990: Cl 7	1
SOIL	Consolidation properties in oedometer - Using 5 pressures (up to 5 days total duration)	BS 1377-5: 1990: Cl 3: 1	26
	Extra over days (more than initial 5 days)		43
SOIL	Dry density/moisture content relationship (2.5kg rammer)	BS 1377-4: 1990: CI 3.3 & 3.4	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	29
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377-7: 1990: Cl 8	13

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 Eurofins Chemtest Ltd *(UKAS 2183)*	BRE Test - Suite B		20
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	Organic Matter Content		1
SOIL – Subcontracted to Eurofins Chemtest Ltd (UKAS 2183)	Loss of Ignition		1

Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH001	10	1.00		D	Greyish brown sandy slightly gravelly clayey SILT.			19.0	39	40 -1pt	29	11		MI
RWRM-BH001	13	4.00		D	Greyish brown sandy slightly gravelly silty CLAY.			12.0	68	20 -1pt	12	8		CL
RWRM-BH001	15	8.00		D	Greyish brown sandy slightly gravelly silty CLAY.			10.0	65	20 -1pt	13	7		CL
RWRM-BH002	15	5.00		D	Greyish brown sandy slightly gravelly silty CLAY.			11.0	70	20 -1pt	10	10		CL
RWRM-BH006	1	2.20	3.70	C	Brownish grey sandy gravelly silty CLAY.			4.6	67	23 -1pt	14	9		CL
RWRM-BH007	13	2.00		D	Brownish grey slightly gravelly clayey fine to coarse SAND.			26.0	81	23 -1pt	13	10		CL
RWRM-BH007	15	5.20		D	Brownish grey sandy slightly gravelly silty CLAY.			16.0	72	24 -1pt	12	12		CL
RWRM-BH007	1	10.50	12.00	C	Brownish grey sandy slightly gravelly silty CLAY.			10.0	70	28 -1pt	13	15		CL
RWRM-BH007	6	15.00	16.50	C	Brownish grey sandy slightly gravelly silty CLAY.			8.5	71	25 -1pt	14	11		CL
RWRM-BH007	8	16.50	18.00	C	Brownish grey sandy slightly gravelly silty CLAY.			6.8	61	20 -1pt	12	8		CL
RWRM-BH008	14	4.00		D	Brownish grey sandy gravelly silty CLAY.			13.0	63	22 -1pt	14	8		CL
RWRM-BH008A	2	3.00	4.50	C	Brownish grey sandy slightly gravelly silty CLAY.			12.0	63	25 -1pt	15	10		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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

10/03/2022 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH008A	5	4.50	6.00	C	Brownish grey sandy slightly gravelly silty CLAY.			10.0	83	30 -1pt	17	13		CL
RWRM-BH008A	8	10.90	12.40	C	Brownish grey sandy slightly gravelly silty CLAY.			13.0	74	30 -1pt	17	13		CL
RWRM-BH009	2	0.70	1.20	B	Brownish grey gravelly silty fine to coarse SAND.			15.0	37	32 -1pt	26	6		ML
RWRM-BH009	4	1.70	3.00	B	Brownish grey sandy gravelly silty CLAY with cobbles.			11.0	74	27 -1pt	15	12		CL
RWRM-BH009	8	6.00	7.50	B	Brownish grey sandy slightly gravelly silty CLAY.			12.0	74	27 -1pt	21	6		ML/CL
RWRM-BH009	1	7.50	9.00	C	Brownish grey sandy slightly gravelly silty CLAY.			9.2	65	25 -1pt	14	11		CL
RWRM-BH009	4	10.50	12.00	C	Brownish grey sandy slightly gravelly silty CLAY.			10.0	71	26 -1pt	14	12		CL
RWRM-BH009	5	12.00	13.50	C	Brownish grey sandy slightly gravelly silty CLAY.			10.0	70	20 -1pt	13	7		CL
RWRM-BH009	7	16.50	18.00	C	Brownish grey sandy gravelly silty CLAY.			4.9	66	23 -1pt	11	12		CL
RWRM-BH009	9	18.00	19.50	C	Brownish grey sandy slightly gravelly silty CLAY.			6.6	65	22 -1pt	13	9		CL
RWRM-BH010	3	2.80	3.00	B	Brown sandy gravelly silty CLAY.			11.0	73	24 -1pt	14	10		CL
RWRM-BH010	1	4.50	6.00	C	Brown sandy slightly gravelly silty CLAY.			9.7	62	21 -1pt	13	8		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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

10/03/2022 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH010	2	6.00	7.50	C	Brown sandy slightly gravelly silty CLAY.			9.0	72	27 -1pt	14	13		CL
RWRM-BH010	5	10.50	12.00	C	Brown sandy gravelly silty CLAY.			8.1	71	25 -1pt	14	11		CL
RWRM-BH010	7	16.50	18.00	C	Brown sandy slightly gravelly silty CLAY.			10.0	67	27 -1pt	13	14		CL
RWRM-BH011	13	4.00		D	Brown sandy gravelly silty CLAY.			12.0	72	24 -1pt	17	7		CL
RWRM-BH011	14	5.00		D	Brown sandy gravelly silty CLAY.			12.0	71	24 -1pt	13	11		CL
RWRM-BH011	1	7.50	9.00	C	Brownish grey sandy slightly gravelly silty CLAY.			9.0	76	27 -1pt	16	11		CL
RWRM-BH011	4	10.50	12.00	C	Brownish grey sandy slightly gravelly silty CLAY.			9.0	73	30 -1pt	16	14		CL
RWRM-BH011	6	13.50	15.00	C	Brownish grey sandy slightly gravelly silty CLAY.			8.4	67	25 -1pt	13	12		CL
RWRM-BH011	7	16.50	18.00	C	Brownish grey sandy slightly gravelly silty CLAY.			10.0	67	28 -1pt	17	11		CL
RWRM-BH012	12	3.00		D	Brown sandy slightly gravelly silty CLAY.			11.0	73	24 -1pt	12	12		CL
RWRM-BH012	15	6.00		D	Brown sandy slightly gravelly silty CLAY.			14.0	68	20 -1pt	12	8		CL
RWRM-BH012	23	9.00		D	Brown sandy slightly gravelly silty CLAY.			13.0	75	26 -1pt	13	13		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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

10/03/2022 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH012	1	14.20	15.70	C	Brown sandy gravelly silty CLAY.			8.1	74	26 -1pt	13	13		CL
RWRM-BH012	3	17.20	18.70	C	Brown sandy slightly gravelly silty CLAY.			9.7	76	26 -1pt	14	12		CL
RWRM-BH012	4	18.70	20.20	C	Brown sandy slightly gravelly silty CLAY.			9.2	76	24 -1pt	14	10		CL
RWRM-BH013	14	1.00	1.20	D	Brownish grey sandy slightly gravelly silty CLAY.			14.0	76	26 -1pt	15	11		CL
RWRM-BH013	19	4.00		D	Brownish grey sandy slightly gravelly silty CLAY.			10.0	74	26 -1pt	14	12		CL
RWRM-BH013	23	7.20		D	Brownish grey sandy slightly gravelly silty CLAY.			13.0	75	26 -1pt	13	13		CL
RWRM-BH013	24	8.20		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	79	26 -1pt	14	12		CL
RWRM-BH013	25	9.20		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	76	27 -1pt	15	12		CL
RWRM-BH013	1	12.70	14.20	C	Brown sandy slightly gravelly silty CLAY with cobbles.			5.3	71	26 -1pt	14	12		CL
RWRM-BH013	3	15.70	17.20	C	Brown sandy slightly gravelly silty CLAY.			9.3	72	26 -1pt	14	12		CL
RWRM-BH014	9	1.20		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	63	25 -1pt	16	9		CL
RWRM-BH014	12	4.20		D	Brownish grey sandy slightly gravelly silty CLAY.			15.0	69	24 -1pt	10	14		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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

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10/03/2022 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH014	1	8.00	9.50	C	Brown sandy slightly gravelly silty CLAY.			8.6	73	26 -1pt	13	13		CL
RWRM-BH014	5	12.50	14.00	C	Brown sandy slightly gravelly silty CLAY.			9.9	71	26 -1pt	13	13		CL
RWRM-BH015	12	3.00		D	Brown sandy slightly gravelly silty CLAY.			10.0	65	24 -1pt	12	12		CL
RWRM-BH015	15	6.00		D	Brown sandy slightly gravelly silty CLAY.			8.7	68	24 -1pt	14	10		CL
RWRM-BH015	23	10.50		D	Brown sandy slightly gravelly silty CLAY.			15.0	71	24 -1pt	13	11		CL
RWRM-BH015	3	15.00	16.50	C	Brown sandy slightly gravelly silty CLAY.			9.3	76	25 -1pt	14	11		CL
RWRM-BH016	11	3.00		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	73	25 -1pt	14	11		CL
RWRM-BH016	21	9.00		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	69	25 -1pt	13	12		CL
RWRM-BH016	1	9.70	11.20	C	Brownish grey sandy slightly gravelly clayey SILT.			8.5	75	20 -1pt	16	4		ML
RWRM-BH016	4	15.70	17.20	C	Brownish grey sandy slightly gravelly silty CLAY.			12.0	74	27 -1pt	17	10		CL
RWRM-BH017	6	1.00		D	Brownish grey sandy slightly gravelly silty CLAY.			17.0	64	25 -1pt	14	11		CL
RWRM-BH017	17	4.00		D	Brownish grey sandy slightly gravelly silty CLAY.			14.0	71	24 -1pt	14	10		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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	

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Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk / dry Mg/m3		*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
RWRM-BH017	20	7.50		D	Brownish grey sandy slightly gravelly silty CLAY.			26.0	98	36 -1pt	20	16		CI
RWRM-BH017	26	10.50		D	Brownish grey sandy slightly gravelly silty CLAY.			13.0	74	25 -1pt	14	11		CL
RWRM-BH017	3	15.70	17.20	C	Brownish grey sandy slightly gravelly silty CLAY.			8.6	71	25 -1pt	16	9		CL
RWRM-BH018	9	1.00		D	Brownish grey sandy slightly gravelly silty CLAY.			30.0	59	38 -1pt	20	18		CI
RWRM-BH018	10	2.00		D	Brownish grey sandy slightly gravelly silty CLAY.			21.0	63	31 -1pt	17	14		CL
RWRM-BH018	11	3.00		D	Brownish grey sandy slightly gravelly silty CLAY.			16.0	68	25 -1pt	14	11		CL
RWRM-BH018	20	7.50		D	Brownish grey sandy slightly gravelly silty CLAY.			19.0	90	28 -1pt	22	6		ML/CL
RWRM-BH018	22	10.50		D	Brownish grey sandy slightly gravelly silty CLAY.			16.0	66	24 -1pt	13	11		CL
RWRM-BH018	1	12.70	14.20	C	Brownish grey sandy slightly gravelly silty CLAY.			9.7	69	26 -1pt	16	10		CL
RWRM-BH018	4	17.20	18.70	C	Brownish grey sandy slightly gravelly silty CLAY.			8.0	77	27 -1pt	18	9		CL
RWRM-BH019	6	1.00		D	Brownish grey sandy slightly gravelly silty CLAY.			17.0	78	20 -1pt	15	5		ML
RWRM-BH019	7	2.00		D	Brownish grey sandy slightly gravelly silty CLAY.			14.0	72	25 -1pt	14	11		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 6

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	

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Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH019	15	4.00		D	Brownish grey sandy slightly gravelly silty CLAY.			13.0	73	25 -1pt	14	11		CL
RWRM-BH019	17	6.00		D	Brownish grey sandy slightly gravelly silty CLAY.			16.0	97	33 -1pt	18	15		CL
RWRM-BH019	1	9.00	10.50	C	Brownish grey sandy slightly gravelly silty CLAY.			12.0	73	27 -1pt	15	12		CL
RWRM-BH019	3	12.00	13.50	C	Brownish grey sandy slightly gravelly silty CLAY.			11.0	68	26 -1pt	15	11		CL
RWRM-BH020	1	9.00	10.50	C	Brown sandy gravelly silty CLAY with cobbles.			6.5	62	27 -1pt	14	13		CL
RWRM-BH020	4	12.00	13.50	C	Brown sandy slightly gravelly silty CLAY.			8.8	75	23 -1pt	12	11		CL
RWRM-BH020	5	16.50	18.00	C	Brown sandy slightly gravelly silty CLAY.			8.3	74	26 -1pt	14	12		CL
RWRM-BH021	13	4.00		D	Brownish grey sandy slightly gravelly silty CLAY.			35.0	99	48 -1pt	22	26		CI
RWRM-BH021	15	6.00		D	Brownish grey sandy slightly gravelly silty CLAY.			12.0	73	23 -1pt	14	9		CL
RWRM-BH021	1	12.00	13.50	C	Brown sandy slightly gravelly silty CLAY.			9.6	67	27 -1pt	14	13		CL
RWRM-BH021	23	12.00		D	Brownish grey sandy slightly gravelly silty CLAY.			10.0	75	24 -1pt	14	10		CL
RWRM-BH021	2	13.50	15.00	C	Brown sandy slightly gravelly silty CLAY.			6.6	75	26 -1pt	14	12		CL

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LAB 01R Version 6

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	

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Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-BH021	3	16.50	18.00	C	Brown sandy slightly gravelly silty CLAY.			9.5	75	28 -1pt	15	13		CL
RWRM-BH022	12	3.00		D	Greyish brown slightly sandy silty CLAY.			27.0	98	45 -1pt	22	23		CI
RWRM-BH022	13	4.00		D	Greyish brown sandy slightly gravelly silty CLAY.			12.0	68	23 -1pt	13	10		CL
RWRM-BH022	15	6.00		D	Greyish brown sandy slightly gravelly silty CLAY.			13.0	77	20 -1pt	12	8		CL
RWRM-DS001	4	1.40		D	Brown sandy slightly gravelly silty CLAY.			19.0	92	29 -1pt	18	11		CL
RWRM-DS001	5	2.70		D	Light grey sandy slightly gravelly silty CLAY.			10.0	55	22 -1pt	13	9		CL
RWRM-DS002	5	2.00		D	Brown slightly sandy silty CLAY.			14.0	92	30 -1pt	17	13		CL
RWRM-DS-006	6	4.00		D	Greyish brown sandy slightly gravelly silty CLAY.			12.0	67	24 -1pt	15	9		CL
RWRM-DS-007	4	1.23		D	Greyish brown sandy slightly gravelly silty CLAY.			16.0	69	25 -1pt	14	11		CL
RWRM-TP002	2	0.60	1.40	B	Brownish grey slightly gravelly clayey fine to coarse SAND.			30.0	86	33 -1pt	22	11		CL
RWRM-TP002	3	1.40	1.90	B	Greenish grey sandy slightly gravelly silty CLAY.			20.0						
RWRM-TP002	4	1.90	3.10	B	Greenish grey sandy slightly gravelly silty CLAY with cobbles.			9.3	51	22 -1pt	14	8		CL

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LAB 01R Version 6

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	

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Summary of Classification Test Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Density bulk	Density dry	w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
RWRM-TP003	1	0.25	0.90	B	Brownish grey slightly sandy slightly silty subangular fine to coarse GRAVEL with cobbles.			8.1						
RWRM-TP003	2	0.90	1.30	B	Brownish grey sandy clayey subangular fine to coarse GRAVEL.			9.4						
RWRM-TP003	3	1.30	2.30	B	Brownish grey gravelly silty fine to coarse SAND.			11.0						
RWRM-TP007	3	0.50		D	Brownish grey silty CLAY.			23.0	98	52 -1pt	24	28		CH
RWRM-BH027	2	2.30	2.60	C	Brown sandy gravelly silty CLAY.			18.0	56	30 -1pt	20	10		CL
RWRM-BH027	3	5.20		C	Brown sandy gravelly silty CLAY.			9.7	67	30 -1pt	20	10		CL
RWRM-BH028	1	3.00	3.65	C	Greyish brown sandy slightly gravelly silty CLAY.			11.0	61	29 -1pt	16	13		CL
RWRM-BH028	3	4.60	5.15	C	Greyish brown sandy slightly gravelly silty CLAY.			11.0	69	28 -1pt	15	13		CL
RWRM-BH028	5	6.65	7.05	C	Greyish brown sandy slightly gravelly silty CLAY.			10.0	62	27 -1pt	15	12		CL

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LAB 01R Version 6

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	

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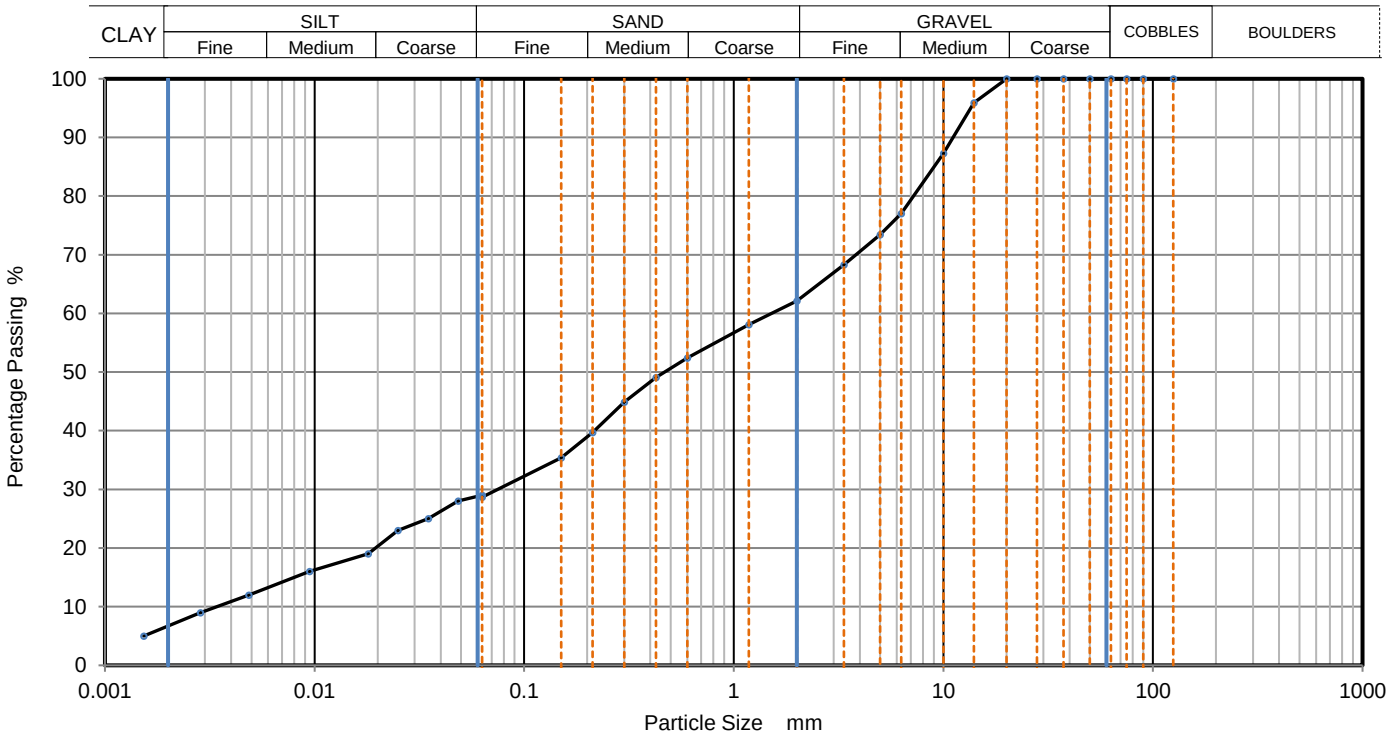
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UKAS TESTING

10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062149



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	29
90	100	0.04837	28
75	100	0.03490	25
63	100	0.02501	23
50	100	0.01802	19
37.5	100	0.00948	16
28	100	0.00485	12
20	100	0.00285	9
14	96	0.00153	5
10	87		
6.3	77		
5	73		
3.35	68		
2	62		
1.18	58		
0.6	52	Particle density	(assumed)
0.425	49	2.65	Mg/m3
0.3	45		
0.212	40		
0.15	35		
0.063	29		

Dry Mass of sample, g: 590

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	37.9
Sand	33.4
Silt	21.8
Clay	6.9

Grading Analysis		
D100	mm	
D60	mm	1.51
D30	mm	0.0747
D10	mm	0.00326
Uniformity Coefficient		460
Curvature Coefficient		1.1

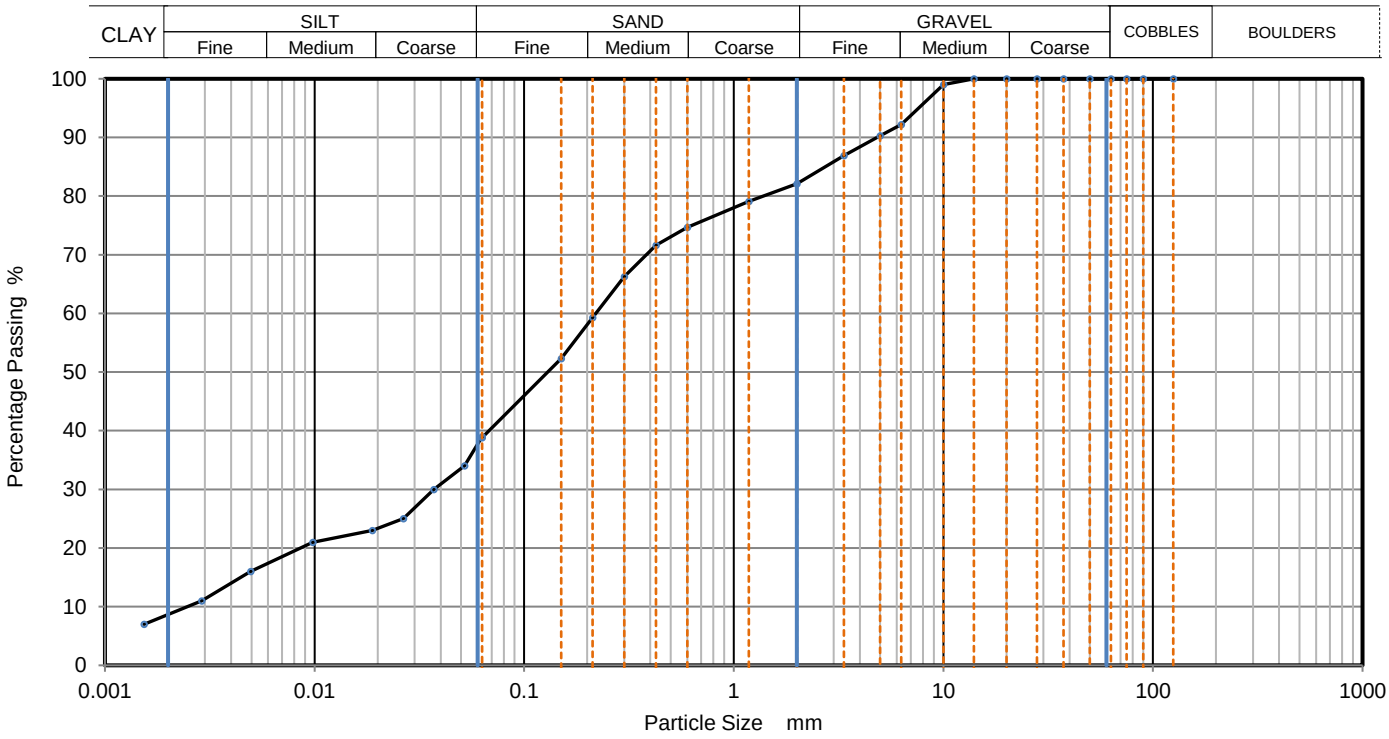
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	2	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062155



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	39
90	100	0.05188	34
75	100	0.03711	30
63	100	0.02654	25
50	100	0.01887	23
37.5	100	0.00980	21
28	100	0.00495	16
20	100	0.00289	11
14	100	0.00154	7
10	99		
6.3	92		
5	90		
3.35	87		
2	82		
1.18	79		
0.6	75	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	66		
0.212	59		
0.15	52		
0.063	39		

Dry Mass of sample, g: 545

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.9
Sand	43.3
Silt	30.0
Clay	8.8

Grading Analysis		
D100	mm	
D60	mm	0.22
D30	mm	0.038
D10	mm	0.00238
Uniformity Coefficient		92
Curvature Coefficient		2.8

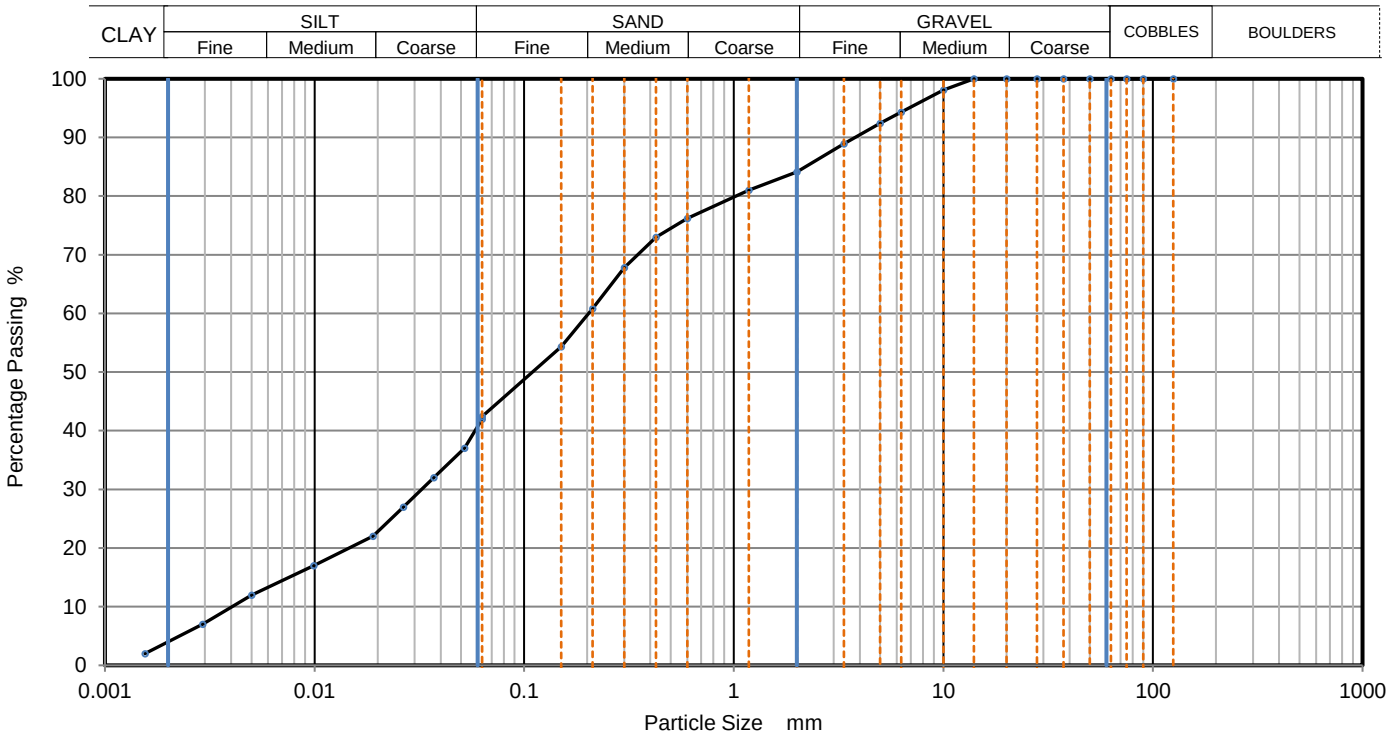
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.80
				Base	10.00
Specimen Reference	2	Specimen Depth	9.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062160



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05188	37
75	100	0.03711	32
63	100	0.02654	27
50	100	0.01897	22
37.5	100	0.00990	17
28	100	0.00501	12
20	100	0.00292	7
14	100	0.00155	2
10	98		
6.3	94		
5	92		
3.35	89		
2	84		
1.18	81		
0.6	76	Particle density	(assumed)
0.425	73	2.65	Mg/m3
0.3	68		
0.212	61		
0.15	54		
0.063	42		

Dry Mass of sample, g: 557

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.9
Sand	41.7
Silt	37.9
Clay	4.5

Grading Analysis		
D100	mm	
D60	mm	0.203
D30	mm	0.0315
D10	mm	0.00383
Uniformity Coefficient		53
Curvature Coefficient		1.3

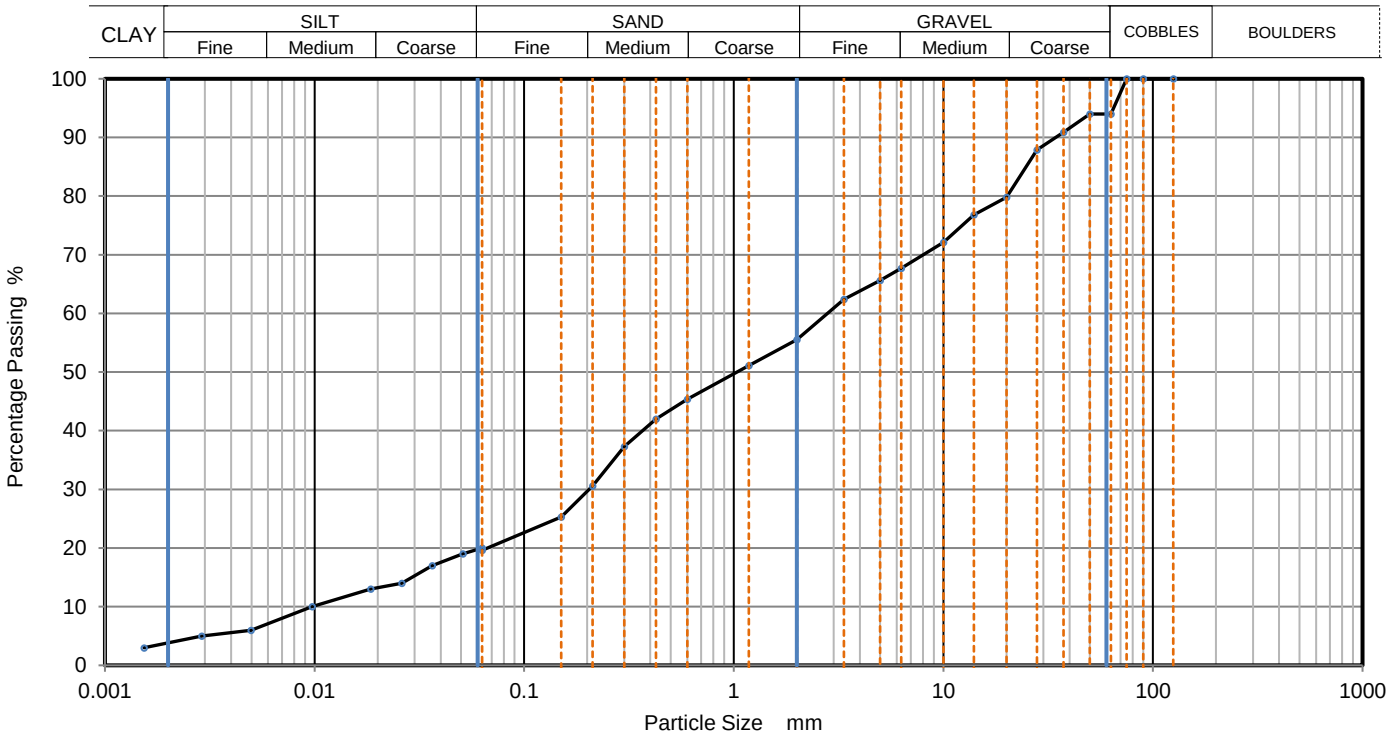
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Greyish brown sandy gravelly silty CLAY.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022061070



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	20
90	100	0.05096	19
75	100	0.03647	17
63	94	0.02609	14
50	94	0.01855	13
37.5	91	0.00974	10
28	88	0.00498	6
20	80	0.00289	5
14	77	0.00154	3
10	72		
6.3	68		
5	66		
3.35	62		
2	56		
1.18	51		
0.6	45	Particle density	(assumed)
0.425	42	2.65	Mg/m3
0.3	37		
0.212	31		
0.15	25		
0.063	20		

Dry Mass of sample, g: 15053

Sample Proportions	% dry mass
Cobbles	6.0
Gravel	38.5
Sand	35.9
Silt	15.6
Clay	4.0

Grading Analysis		
D100	mm	
D60	mm	2.8
D30	mm	0.204
D10	mm	0.00926
Uniformity Coefficient		300
Curvature Coefficient		1.6

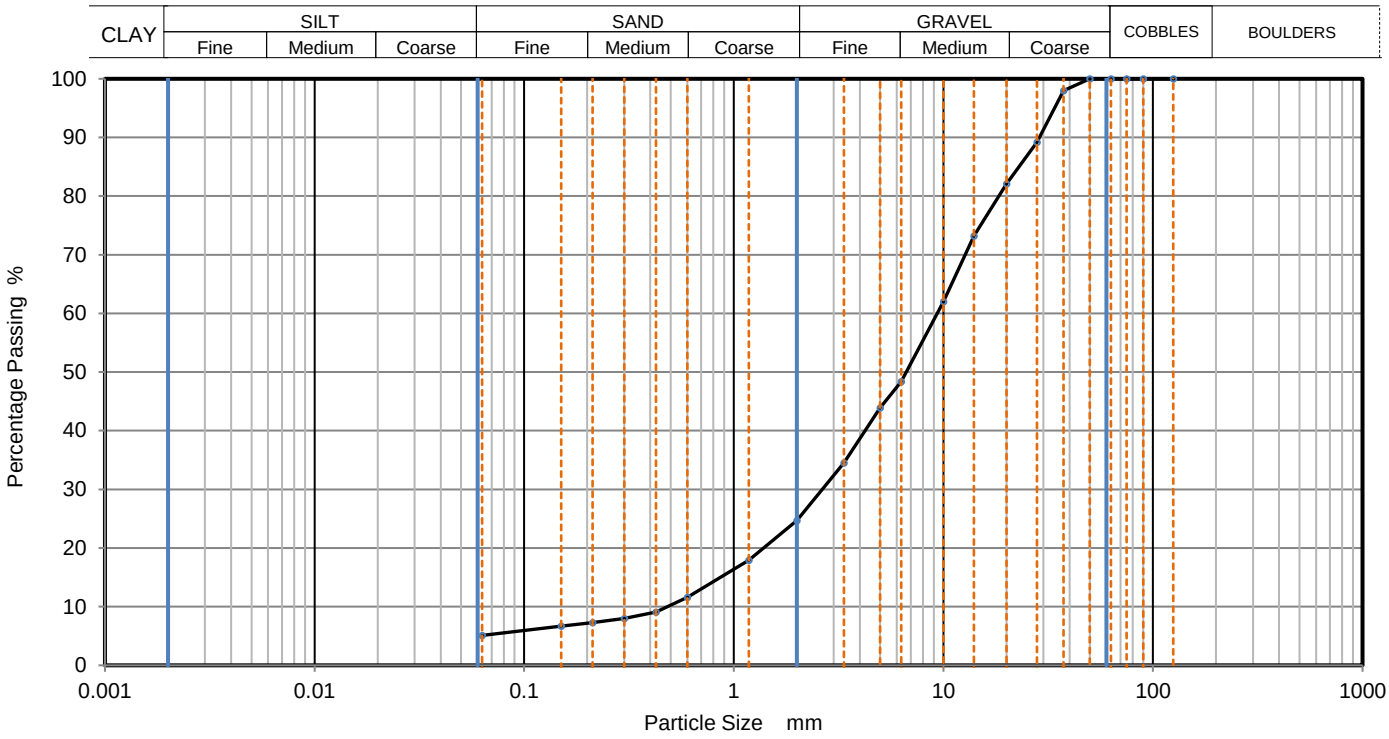
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Specimen Description	Greyish brown gravelly slightly clayey fine to coarse SAND.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	2	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022061072



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	89		
20	82		
14	73		
10	62		
6.3	48		
5	44		
3.35	35		
2	25		
1.18	18		
0.6	12		
0.425	9		
0.3	8		
0.212	7		
0.15	7		
0.063	5		

Dry Mass of sample, g: 4116

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	75.3
Sand	19.6
Fines <0.063mm	5.0

Grading Analysis		
D100	mm	
D60	mm	9.35
D30	mm	2.64
D10	mm	0.483
Uniformity Coefficient		19
Curvature Coefficient		1.5

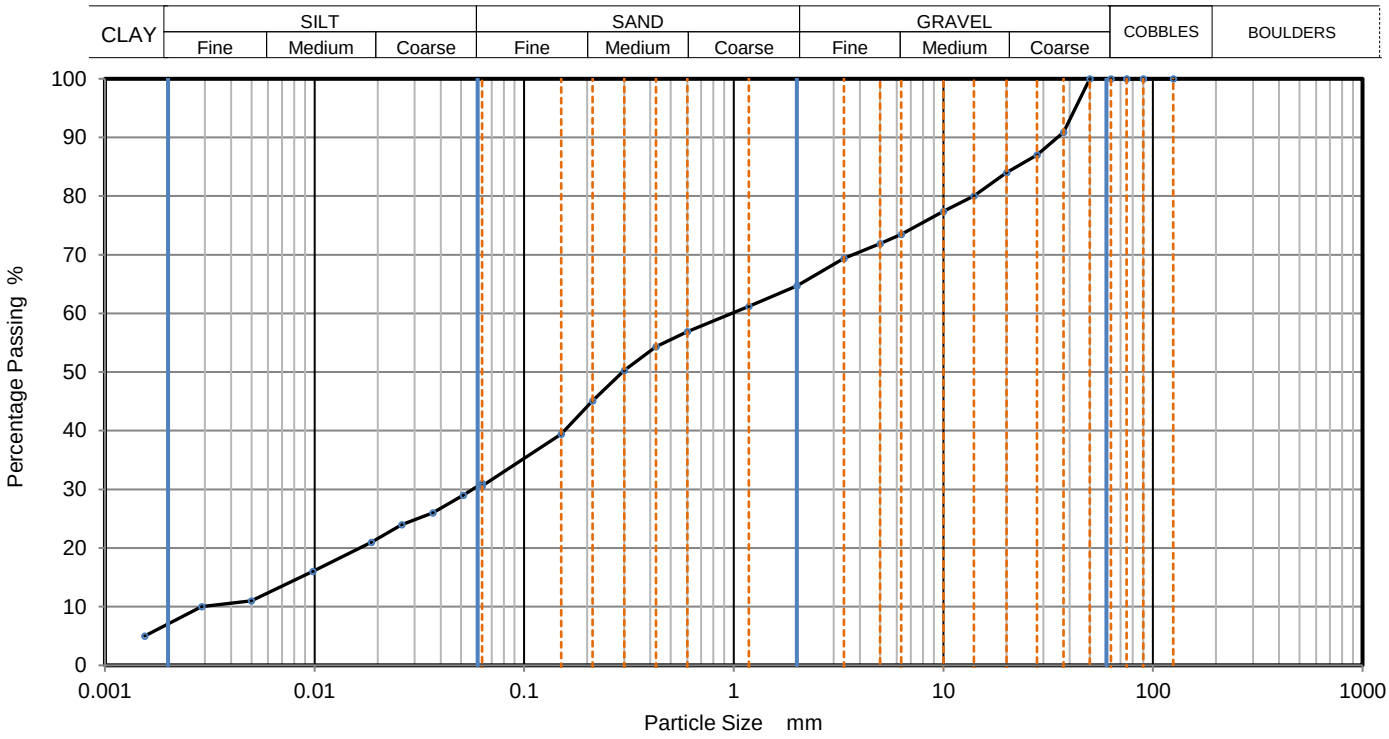
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Specimen Description	Greyish brown sandy gravelly silty CLAY.			Sample Depth (m) Top	4.80
				Base	5.00
Specimen Reference	2	Specimen Depth	4.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022061073



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	31
90	100	0.05129	29
75	100	0.03671	26
63	100	0.02611	24
50	100	0.01868	21
37.5	91	0.00981	16
28	87	0.00499	11
20	84	0.00290	10
14	80	0.00155	5
10	77		
6.3	74		
5	72		
3.35	69		
2	65		
1.18	61		
0.6	57	Particle density	(assumed)
0.425	54	2.65	Mg/m3
0.3	50		
0.212	45		
0.15	39		
0.063	31		

Dry Mass of sample, g: 3609

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	35.3
Sand	34.0
Silt	23.9
Clay	6.8

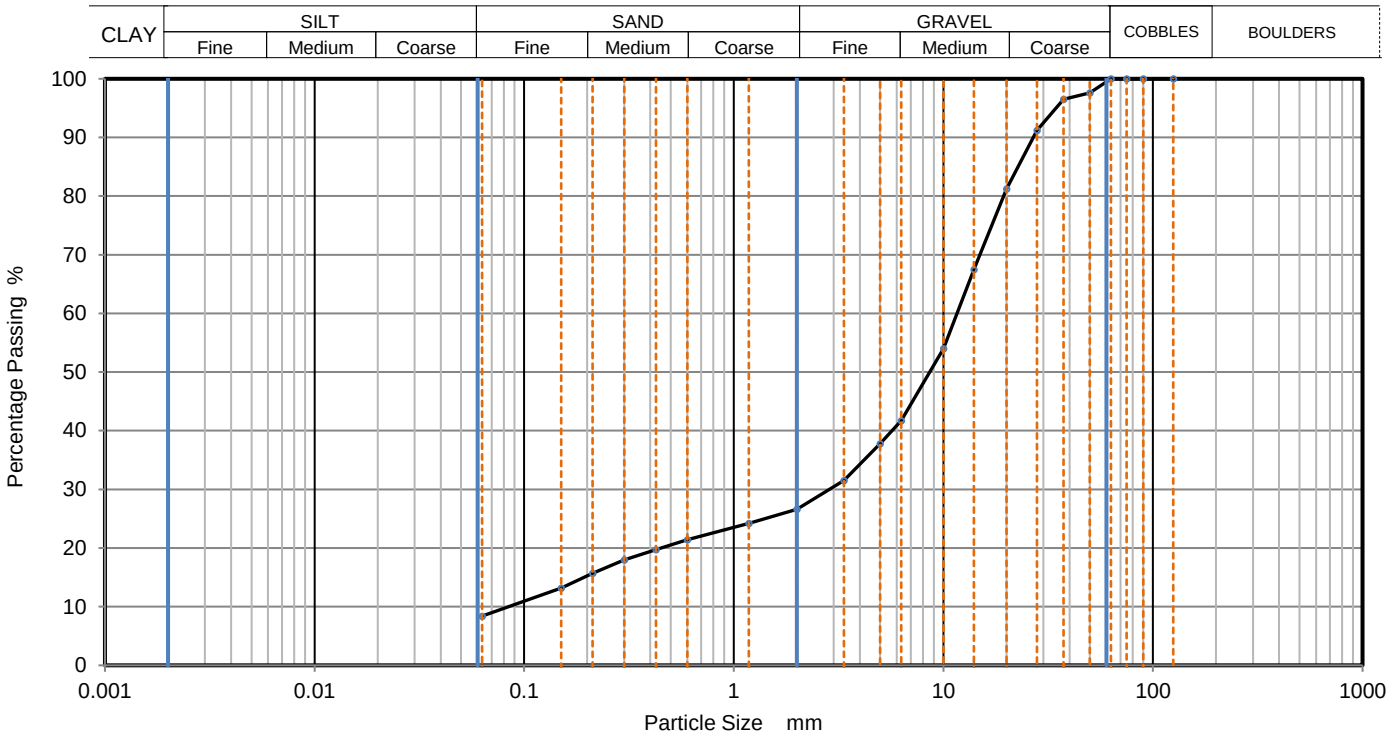
Grading Analysis		
D100	mm	
D60	mm	0.977
D30	mm	0.0582
D10	mm	0.00324
Uniformity Coefficient		300
Curvature Coefficient		1.1

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		21-1682
				Borehole/Pit No.		RWRM-BH002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		13
Specimen Description	Greyish brown slightly sandy slightly clayey subangular fine to coarse GRAVEL.			Sample Depth (m)	Top	9.00
					Base	10.00
Specimen Reference	2	Specimen Depth	9 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID		Caus2022061076



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	98		
37.5	97		
28	91		
20	81		
14	68		
10	54		
6.3	42		
5	38		
3.35	32		
2	27		
1.18	24		
0.6	21		
0.425	20		
0.3	18		
0.212	16		
0.15	13		
0.063	8		

Dry Mass of sample, g	16115

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	73.4
Sand	18.2
Fines <0.063mm	8.0

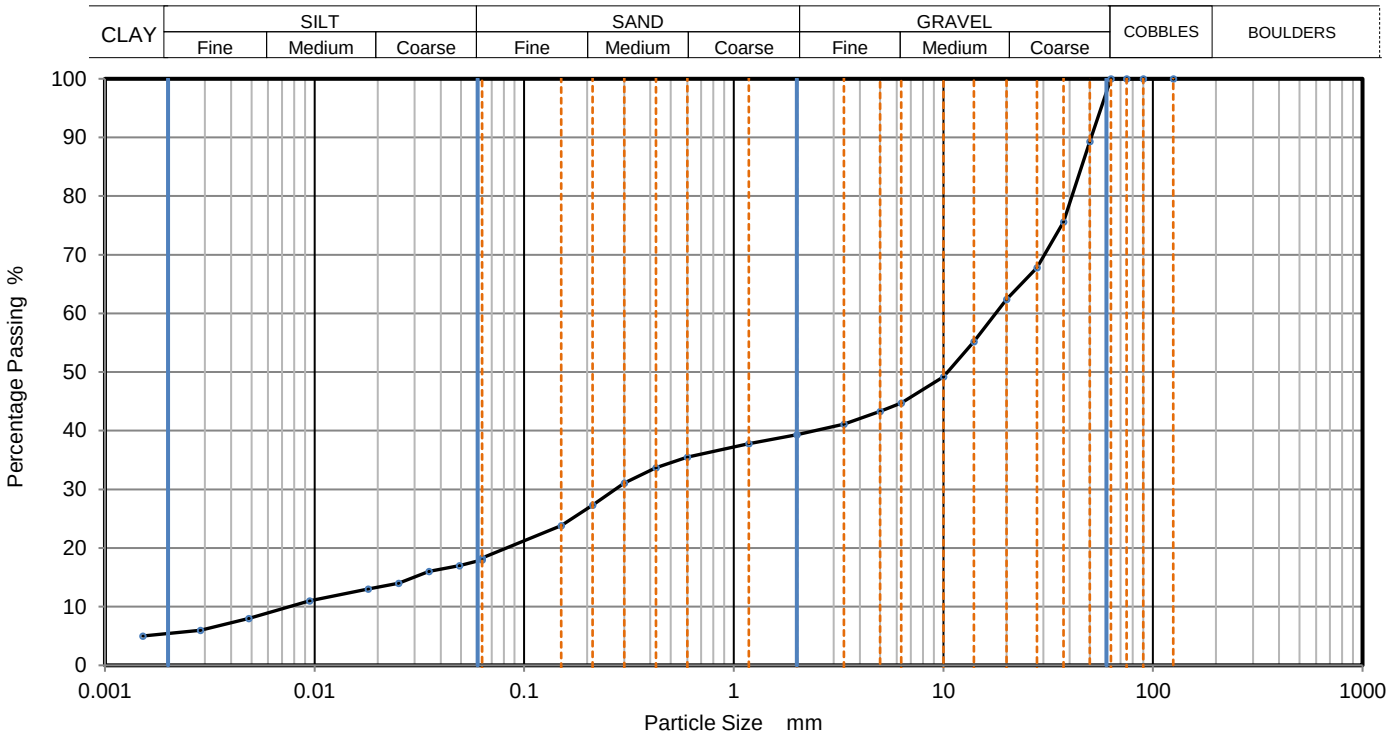
Grading Analysis		
D100	mm	
D60	mm	11.6
D30	mm	2.87
D10	mm	0.0845
Uniformity Coefficient		140
Curvature Coefficient		8.4

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		21-1682
				Borehole/Pit No.		RWRM-BH006
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		1
Specimen Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m)	Top	2.20
					Base	3.70
Specimen Reference	6	Specimen Depth	2.2 m	Sample Type		C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022082913



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	18
90	100	0.04903	17
75	100	0.03513	16
63	100	0.02517	14
50	89	0.01802	13
37.5	76	0.00948	11
28	68	0.00485	8
20	62	0.00285	6
14	55	0.00152	5
10	49		
6.3	45		
5	43		
3.35	41		
2	39		
1.18	38		
0.6	36	Particle density	(assumed)
0.425	34	2.65	Mg/m3
0.3	31		
0.212	27		
0.15	24		
0.063	18		

Dry Mass of sample, g: 12197

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	60.7
Sand	21.1
Silt	12.9
Clay	5.3

Grading Analysis		
D100	mm	
D60	mm	17.8
D30	mm	0.271
D10	mm	0.00769
Uniformity Coefficient		2300
Curvature Coefficient		0.54

Remarks

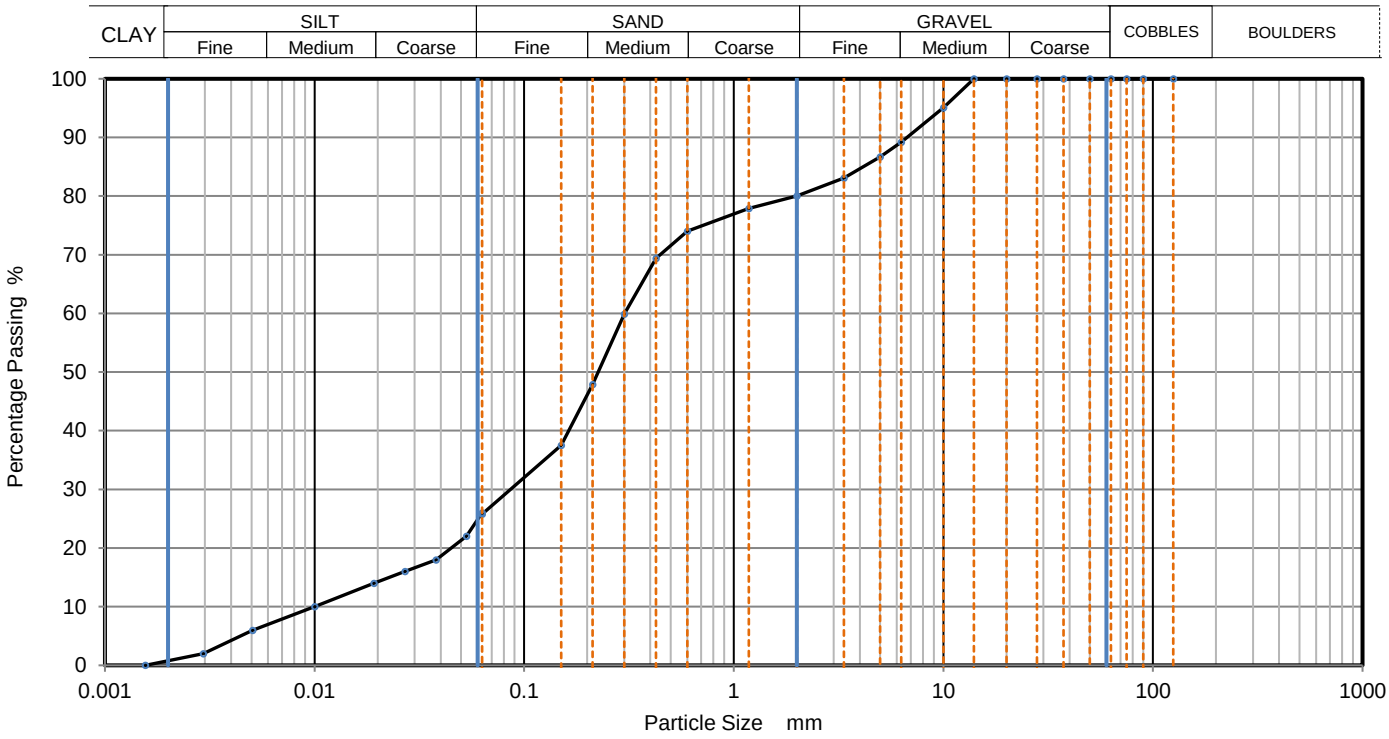
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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UKAS TESTING

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey slightly gravelly clayey fine to coarse SAND.			Sample Depth (m) Top	1.00
				Base	1.20
Specimen Reference	2	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071447



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	26
90	100	0.05308	22
75	100	0.03795	18
63	100	0.02698	16
50	100	0.01918	14
37.5	100	0.01001	10
28	100	0.00506	6
20	100	0.00295	2
14	100	0.00156	0
10	95		
6.3	89		
5	87		
3.35	83		
2	80		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	60		
0.212	48		
0.15	38		
0.063	26		

Dry Mass of sample, g: 507

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.0
Sand	54.1
Silt	25.1
Clay	0.8

Grading Analysis		
D100	mm	
D60	mm	0.302
D30	mm	0.0858
D10	mm	0.0101
Uniformity Coefficient		30
Curvature Coefficient		2.4

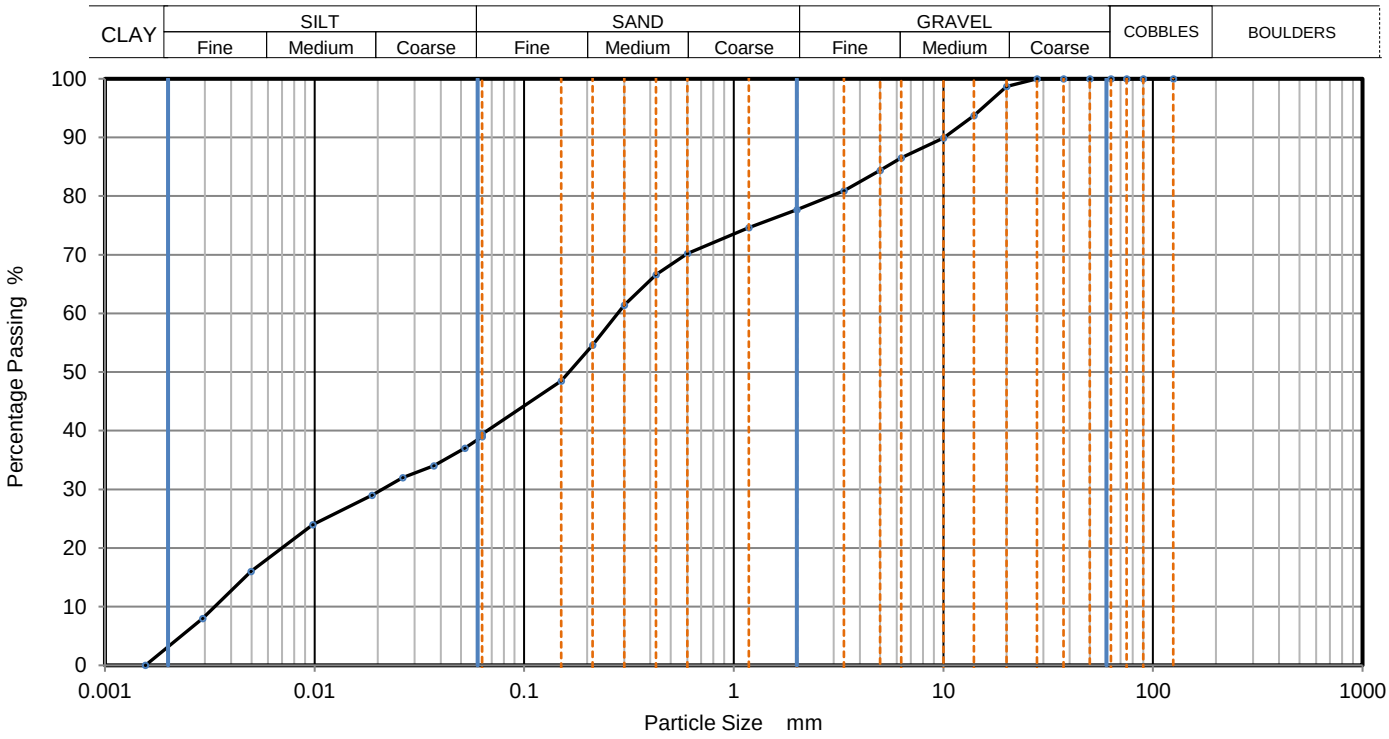
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.00
				Base	3.30
Specimen Reference	2	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071449



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	39
90	100	0.05218	37
75	100	0.03711	34
63	100	0.02639	32
50	100	0.01877	29
37.5	100	0.00980	24
28	100	0.00498	16
20	99	0.00292	8
14	94	0.00156	0
10	90		
6.3	87		
5	84		
3.35	81		
2	78		
1.18	75		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	61		
0.212	55		
0.15	49		
0.063	39		

Dry Mass of sample, g: 2150

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.3
Sand	38.3
Silt	36.3
Clay	3.1

Grading Analysis		
D100	mm	
D60	mm	0.279
D30	mm	0.0217
D10	mm	0.00337
Uniformity Coefficient		83
Curvature Coefficient		0.5

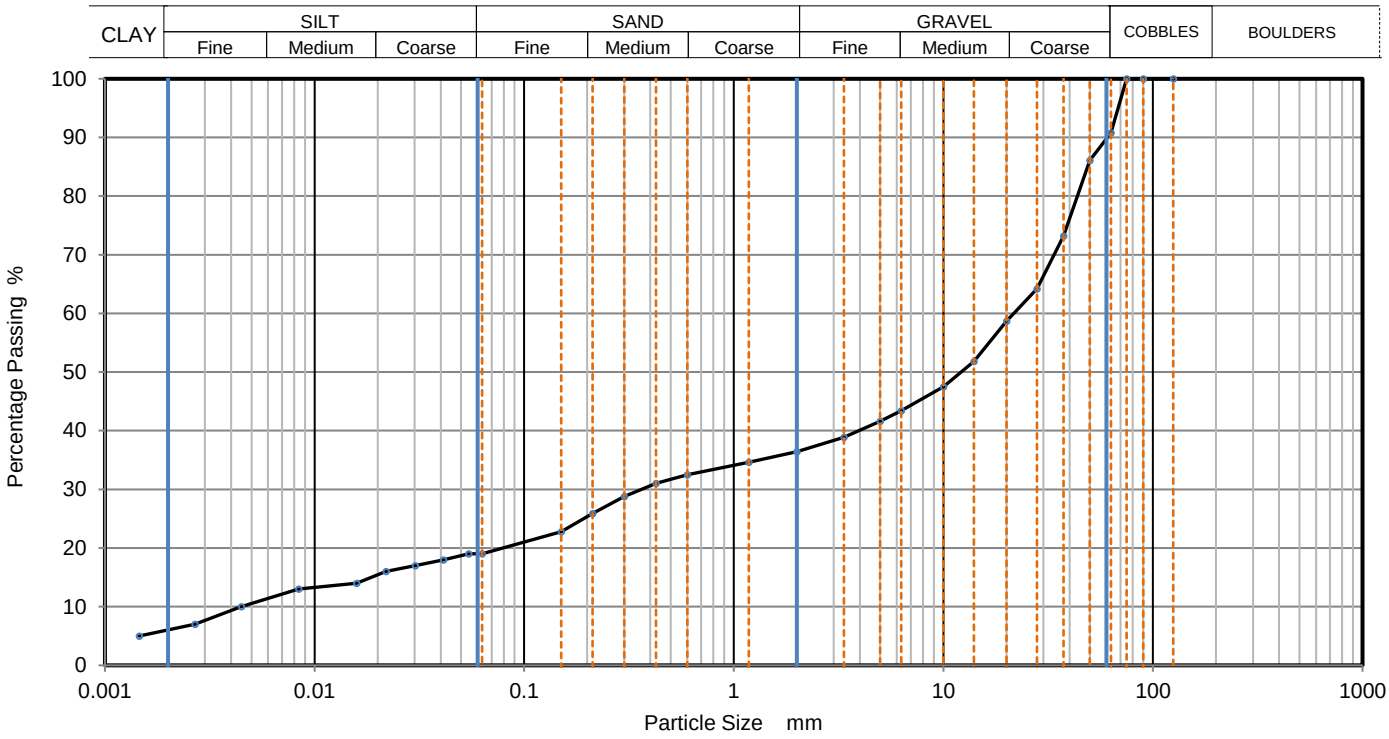
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey slightly sandy clayey subangular fine to coarse GRAVEL.			Sample Depth (m) Top	4.00
				Base	4.30
Specimen Reference	2	Specimen Depth	4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071451



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05428	19
90	100	0.04115	18
75	100	0.03019	17
63	91	0.02191	16
50	86	0.01588	14
37.5	73	0.00839	13
28	64	0.00448	10
20	59	0.00269	7
14	52	0.00146	5
10	48		
6.3	43		
5	42		
3.35	39		
2	36		
1.18	35		
0.6	33	Particle density	(assumed)
0.425	31	2.65	Mg/m3
0.3	29		
0.212	26		
0.15	23		
0.063	19		

Dry Mass of sample, g: 8970

Sample Proportions	% dry mass
Cobbles	9.2
Gravel	54.4
Sand	17.4
Silt	12.6
Clay	6.4

Grading Analysis		
D100	mm	
D60	mm	21.6
D30	mm	0.363
D10	mm	0.00473
Uniformity Coefficient		4600
Curvature Coefficient		1.3

Remarks

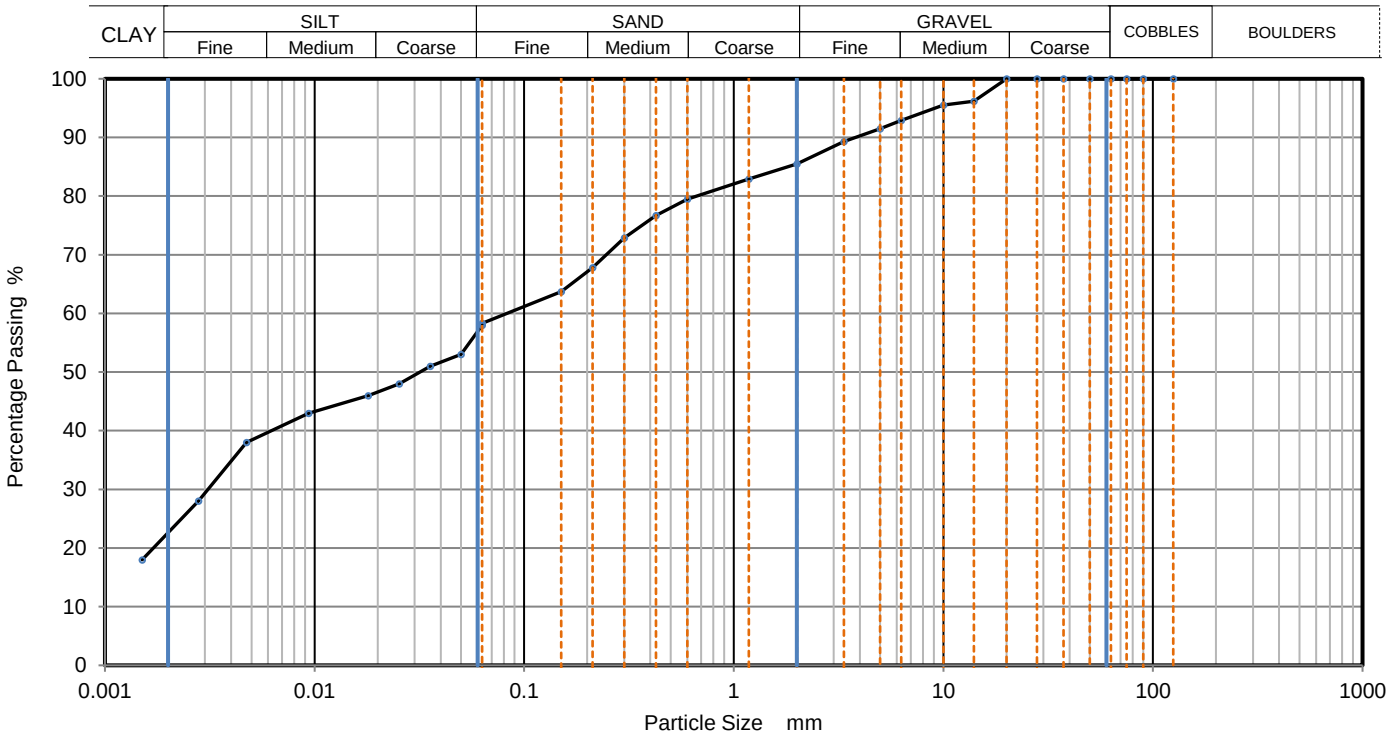
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UKAS TESTING

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.80
				Base	5.00
Specimen Reference	2	Specimen Depth	4.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071452



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	58
90	100	0.05002	53
75	100	0.03559	51
63	100	0.02532	48
50	100	0.01802	46
37.5	100	0.00936	43
28	100	0.00474	38
20	100	0.00280	28
14	96	0.00150	18
10	96		
6.3	93		
5	92		
3.35	89		
2	86		
1.18	83		
0.6	80	Particle density	(assumed)
0.425	77	2.65	Mg/m3
0.3	73		
0.212	68		
0.15	64		
0.063	58		

Dry Mass of sample, g: 500

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.5
Sand	27.2
Silt	35.9
Clay	22.4

Grading Analysis		
D100	mm	
D60	mm	0.0824
D30	mm	0.00312
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

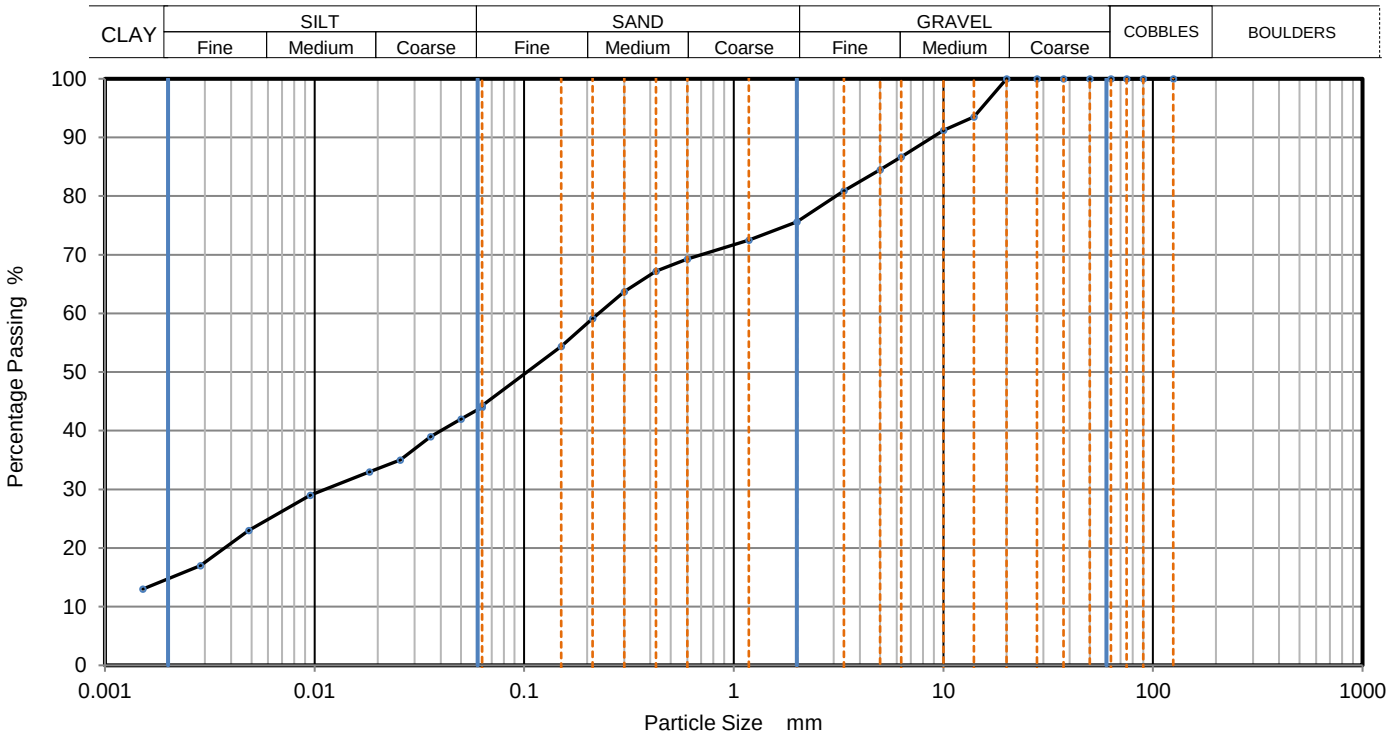
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.50
				Base	12.00
Specimen Reference	6	Specimen Depth	10.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082563



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.05001	42
75	100	0.03582	39
63	100	0.02564	35
50	100	0.01824	33
37.5	100	0.00953	29
28	100	0.00485	23
20	100	0.00285	17
14	94	0.00152	13
10	91		
6.3	87		
5	85		
3.35	81		
2	76		
1.18	73		
0.6	69	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	64		
0.212	59		
0.15	54		
0.063	44		

Dry Mass of sample, g: 558

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	24.4
Sand	31.3
Silt	29.1
Clay	15.2

Grading Analysis		
D100	mm	
D60	mm	0.227
D30	mm	0.0115
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

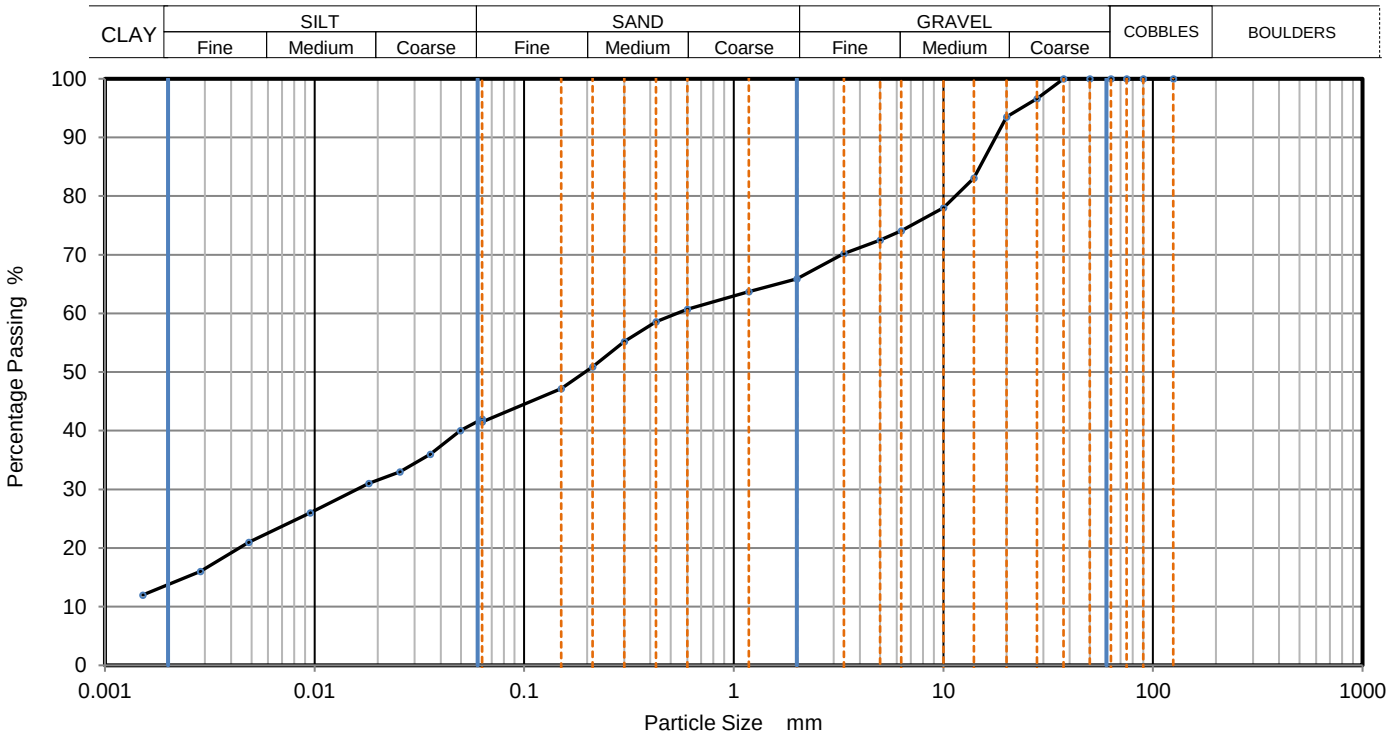
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.00
				Base	16.50
Specimen Reference	6	Specimen Depth	15 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082568



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.04969	40
75	100	0.03559	36
63	100	0.02549	33
50	100	0.01813	31
37.5	100	0.00953	26
28	97	0.00485	21
20	94	0.00285	16
14	83	0.00152	12
10	78		
6.3	74		
5	73		
3.35	70		
2	66		
1.18	64		
0.6	61	Particle density	(assumed)
0.425	59	2.65	Mg/m3
0.3	55		
0.212	51		
0.15	47		
0.063	42		

Dry Mass of sample, g: 2627

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	34.1
Sand	24.4
Silt	27.9
Clay	13.6

Grading Analysis		
D100	mm	
D60	mm	0.539
D30	mm	0.0158
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

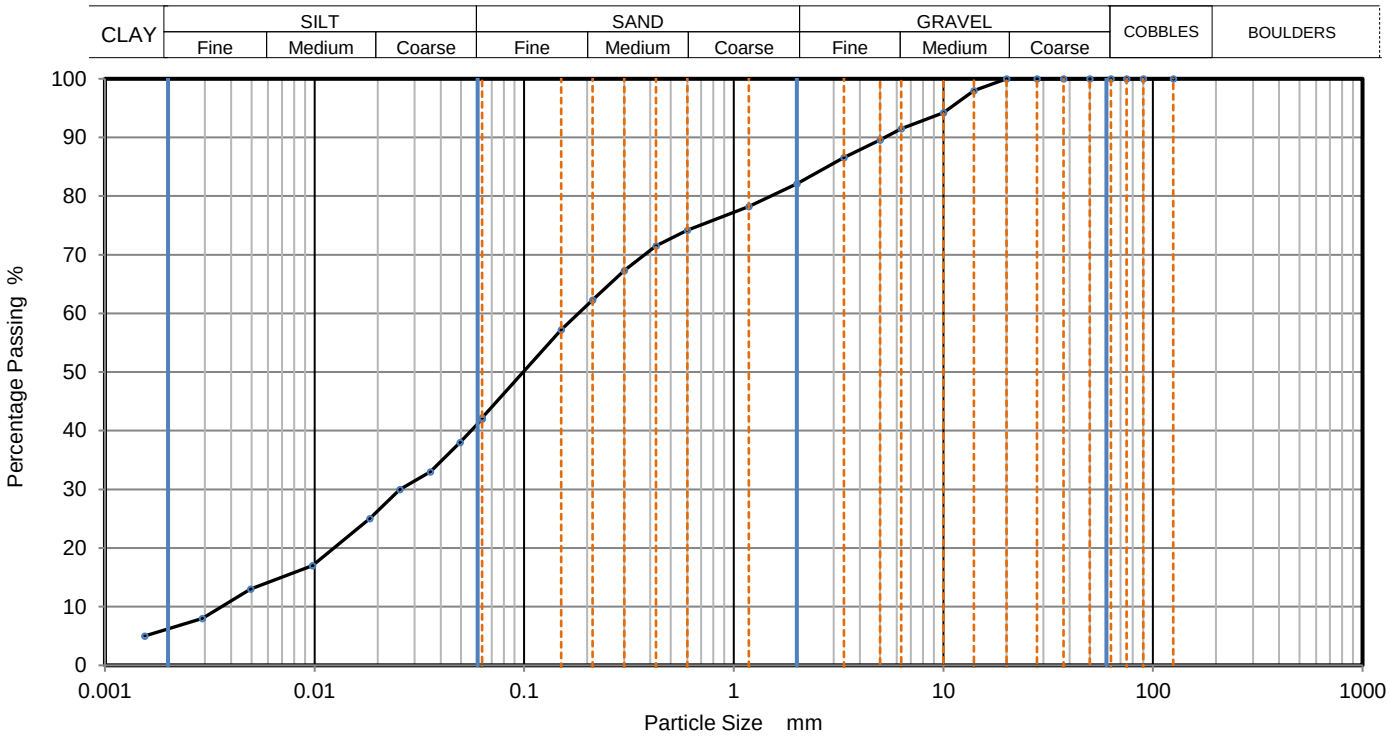
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	6	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082570



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.04936	38
75	100	0.03559	33
63	100	0.02549	30
50	100	0.01835	25
37.5	100	0.00976	17
28	100	0.00496	13
20	100	0.00291	8
14	98	0.00155	5
10	94		
6.3	92		
5	90		
3.35	87		
2	82		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	67		
0.212	62		
0.15	57		
0.063	42		

Dry Mass of sample, g: 514

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.9
Sand	40.0
Silt	36.1
Clay	6.0

Grading Analysis		
D100	mm	
D60	mm	0.181
D30	mm	0.0263
D10	mm	0.00373
Uniformity Coefficient		49
Curvature Coefficient		1

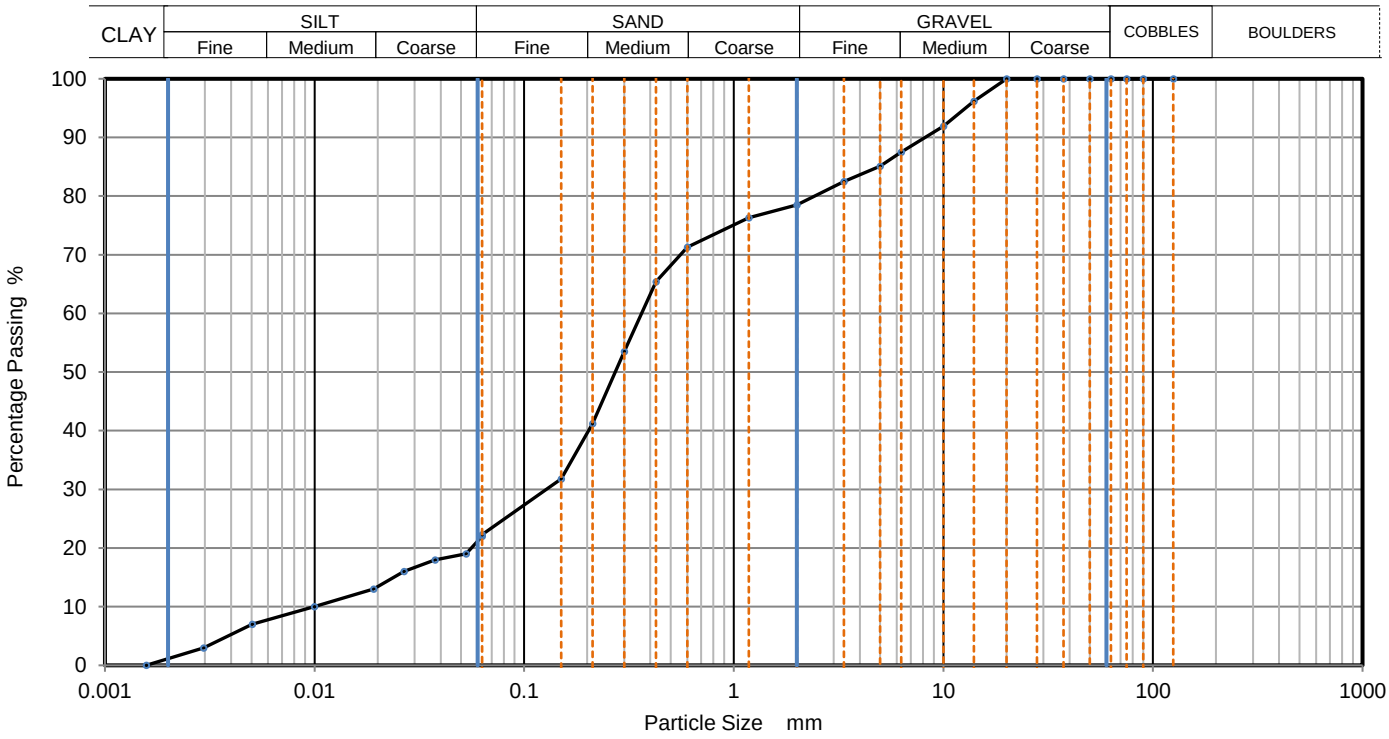
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH008
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey slightly gravelly slightly silty fine to coarse SAND.			Sample Depth (m) Top	1.00
				Base	1.20
Specimen Reference	3	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070532



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	22
90	100	0.05284	19
75	100	0.03758	18
63	100	0.02672	16
50	100	0.01911	13
37.5	100	0.00998	10
28	100	0.00504	7
20	100	0.00296	3
14	96	0.00157	0
10	92		
6.3	88		
5	85		
3.35	83		
2	79		
1.18	76		
0.6	71	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	54		
0.212	41		
0.15	32		
0.063	22		

Dry Mass of sample, g: 527

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.5
Sand	56.2
Silt	21.2
Clay	1.1

Grading Analysis		
D100	mm	
D60	mm	0.363
D30	mm	0.127
D10	mm	0.00909
Uniformity Coefficient		40
Curvature Coefficient		4.9

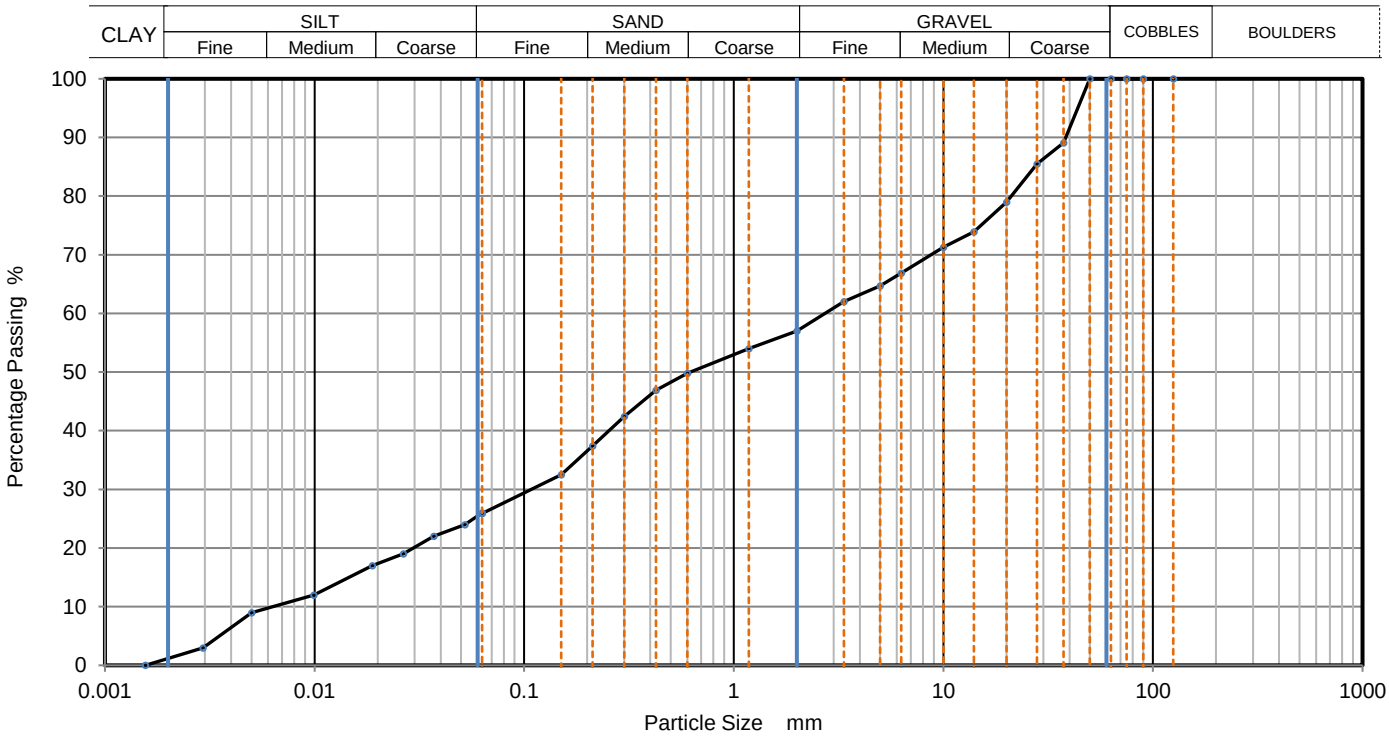
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH008
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Specimen Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Base	4.20
Specimen Reference	3	Specimen Depth	4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070534



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	26
90	100	0.05218	24
75	100	0.03711	22
63	100	0.02654	19
50	100	0.01887	17
37.5	89	0.00990	12
28	86	0.00501	9
20	79	0.00293	3
14	74	0.00156	0
10	71		
6.3	67		
5	65		
3.35	62		
2	57		
1.18	54		
0.6	50	Particle density	(assumed)
0.425	47	2.65	Mg/m3
0.3	42		
0.212	37		
0.15	33		
0.063	26		

Dry Mass of sample, g: 2476

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	43.0
Sand	31.1
Silt	24.5
Clay	1.4

Grading Analysis		
D100	mm	
D60	mm	2.73
D30	mm	0.108
D10	mm	0.00656
Uniformity Coefficient		420
Curvature Coefficient		0.66

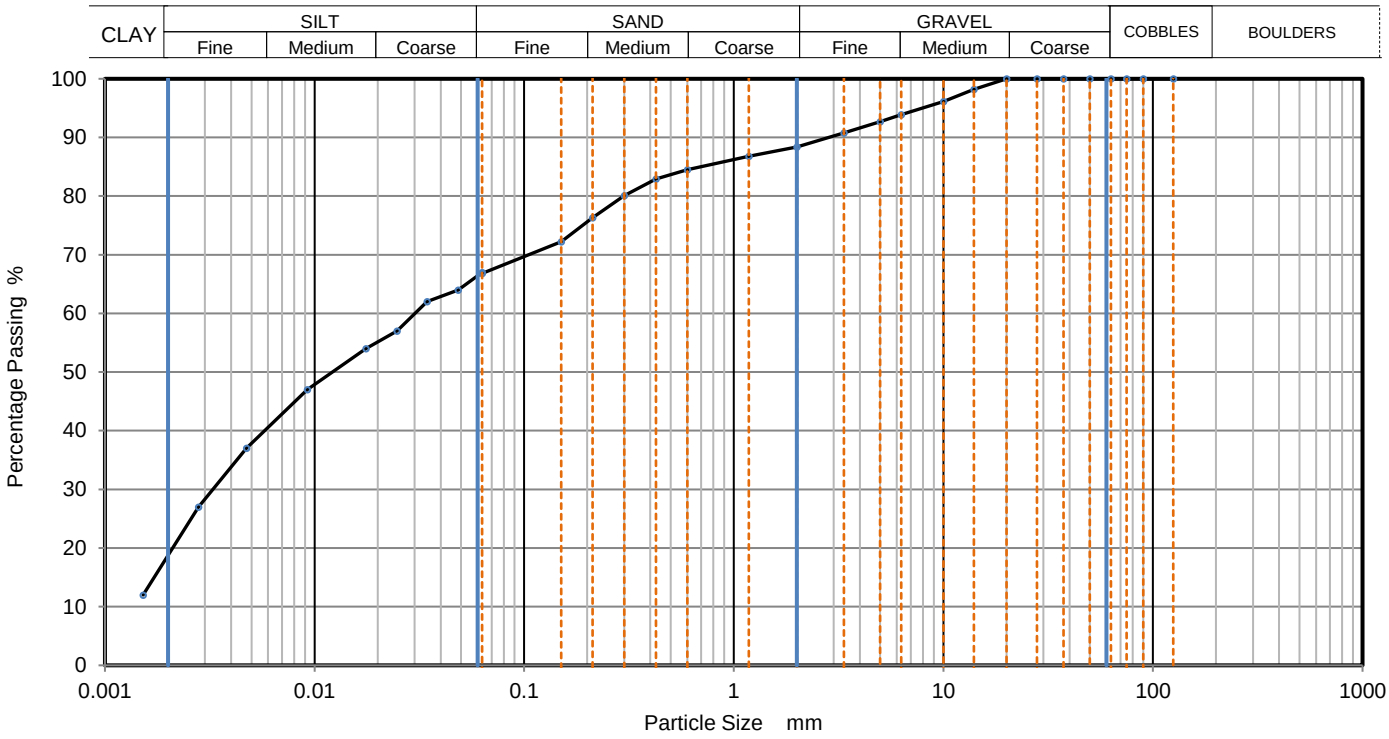
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH008
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	11
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.50
				Base	9.70
Specimen Reference	3	Specimen Depth	9.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070537



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	67
90	100	0.04843	64
75	100	0.03447	62
63	100	0.02470	57
50	100	0.01757	54
37.5	100	0.00925	47
28	100	0.00474	37
20	100	0.00280	27
14	98	0.00152	12
10	96		
6.3	94		
5	93		
3.35	91		
2	88		
1.18	87		
0.6	85	Particle density	(assumed)
0.425	83	2.65	Mg/m3
0.3	80		
0.212	76		
0.15	72		
0.063	67		

Dry Mass of sample, g: 528

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	11.6
Sand	21.6
Silt	47.8
Clay	19.0

Grading Analysis		
D100	mm	
D60	mm	0.0304
D30	mm	0.00324
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

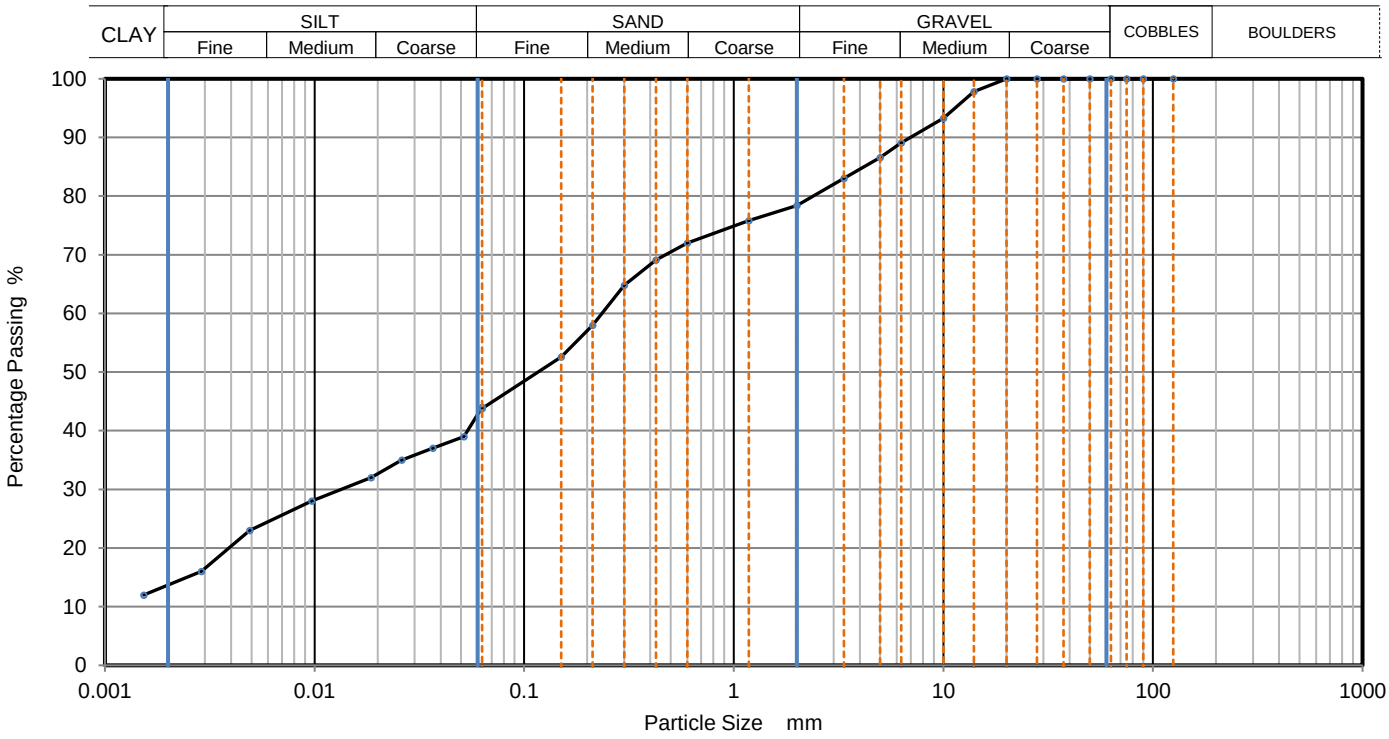
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.00
				Base	4.50
Specimen Reference	6	Specimen Depth	3 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082915



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.05160	39
75	100	0.03671	37
63	100	0.02611	35
50	100	0.01857	32
37.5	100	0.00970	28
28	100	0.00491	23
20	100	0.00288	16
14	98	0.00153	12
10	93		
6.3	89		
5	87		
3.35	83		
2	78		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	65		
0.212	58		
0.15	53		
0.063	44		

Dry Mass of sample, g: 554

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.6
Sand	34.6
Silt	30.3
Clay	13.5

Grading Analysis		
D100	mm	
D60	mm	0.235
D30	mm	0.0135
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

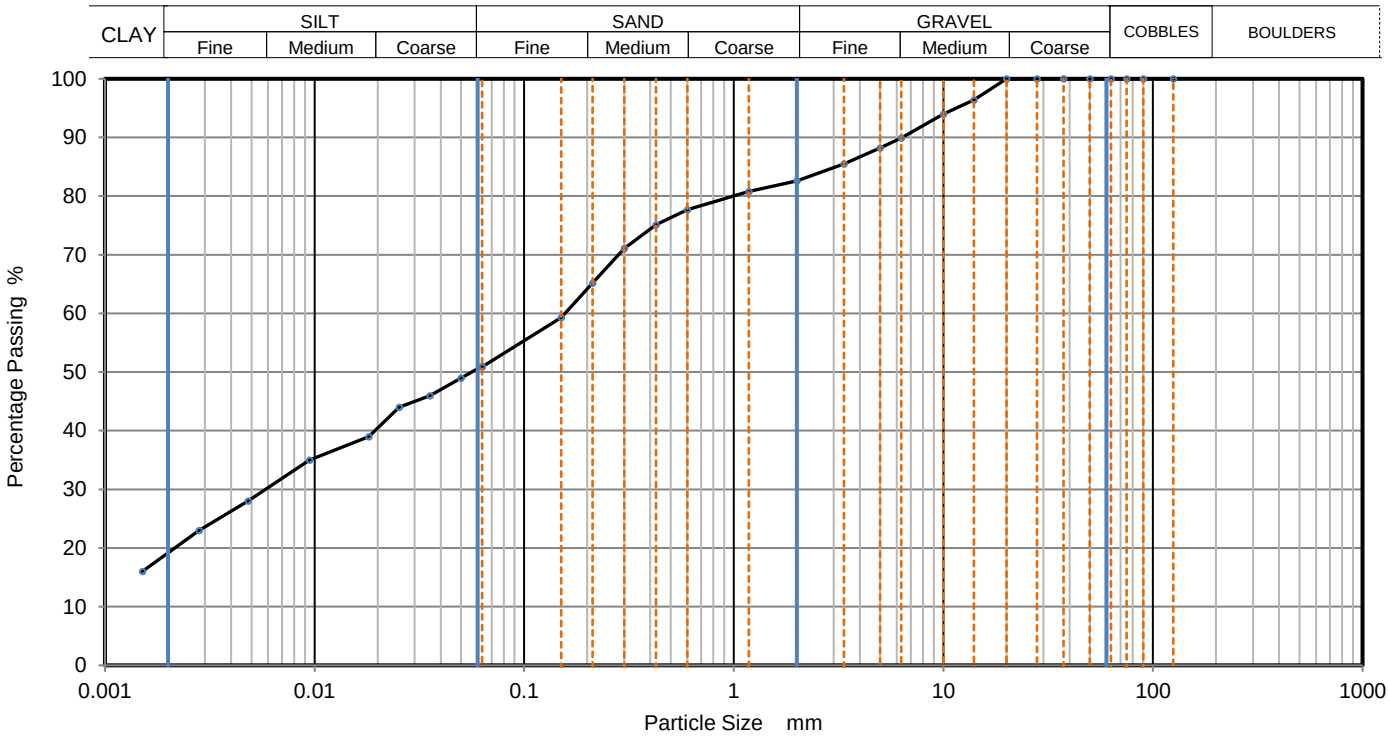
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.50
				Base	6.00
Specimen Reference	6	Specimen Depth	4.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082918



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.05000	49
75	100	0.03559	46
63	100	0.02532	44
50	100	0.01813	39
37.5	100	0.00948	35
28	100	0.00482	28
20	100	0.00282	23
14	96	0.00151	16
10	94		
6.3	90		
5	88		
3.35	86		
2	83		
1.18	81		
0.6	78	Particle density	(assumed)
0.425	75	2.65	Mg/m3
0.3	71		
0.212	65		
0.15	59		
0.063	51		

Dry Mass of sample, g: 552

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.4
Sand	31.7
Silt	31.6
Clay	19.3

Grading Analysis		
D100	mm	
D60	mm	0.156
D30	mm	0.006
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

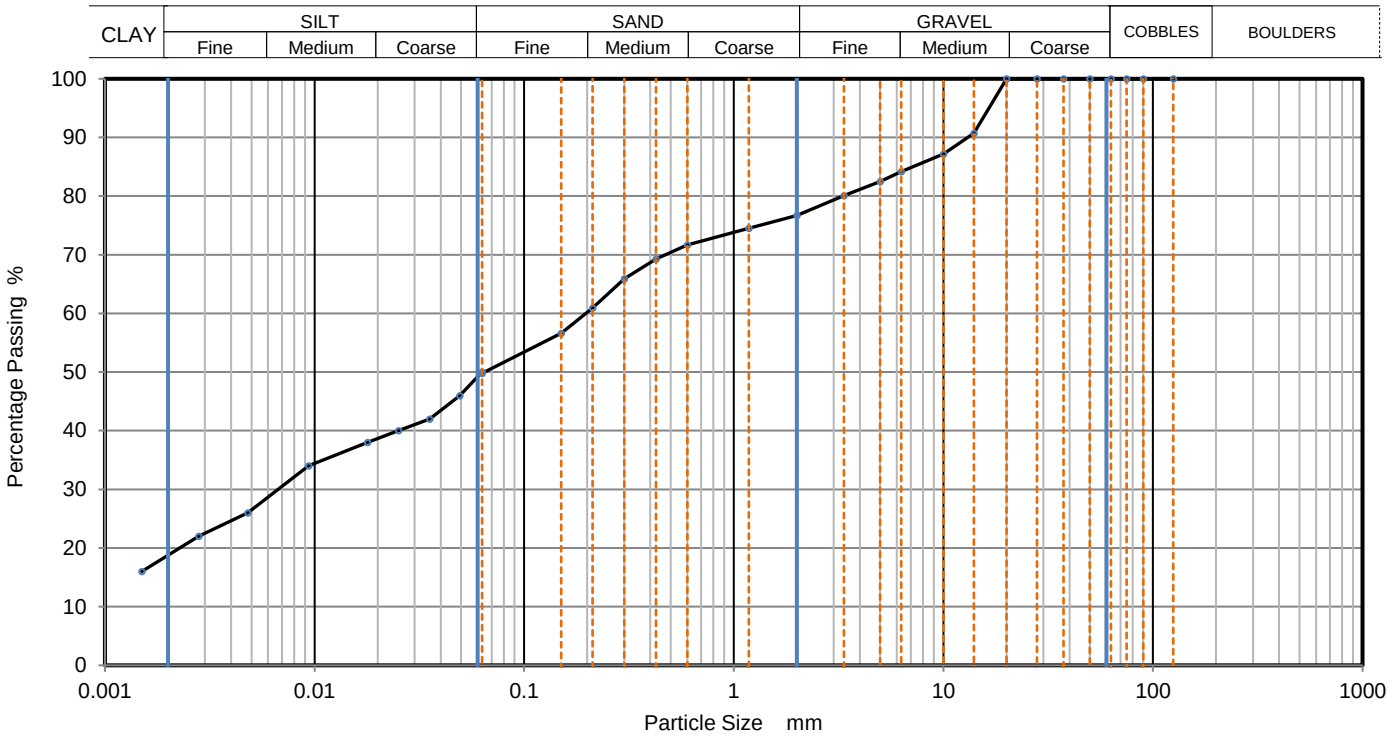
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.90
				Base	12.40
Specimen Reference	6	Specimen Depth	10.9 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082921



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	50
90	100	0.04935	46
75	100	0.03536	42
63	100	0.02516	40
50	100	0.01791	38
37.5	100	0.00936	34
28	100	0.00479	26
20	100	0.00280	22
14	91	0.00150	16
10	87		
6.3	84		
5	83		
3.35	80		
2	77		
1.18	75		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	66		
0.212	61		
0.15	57		
0.063	50		

Dry Mass of sample, g: 565

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.3
Sand	26.9
Silt	31.1
Clay	18.7

Grading Analysis		
D100	mm	
D60	mm	0.197
D30	mm	0.00677
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

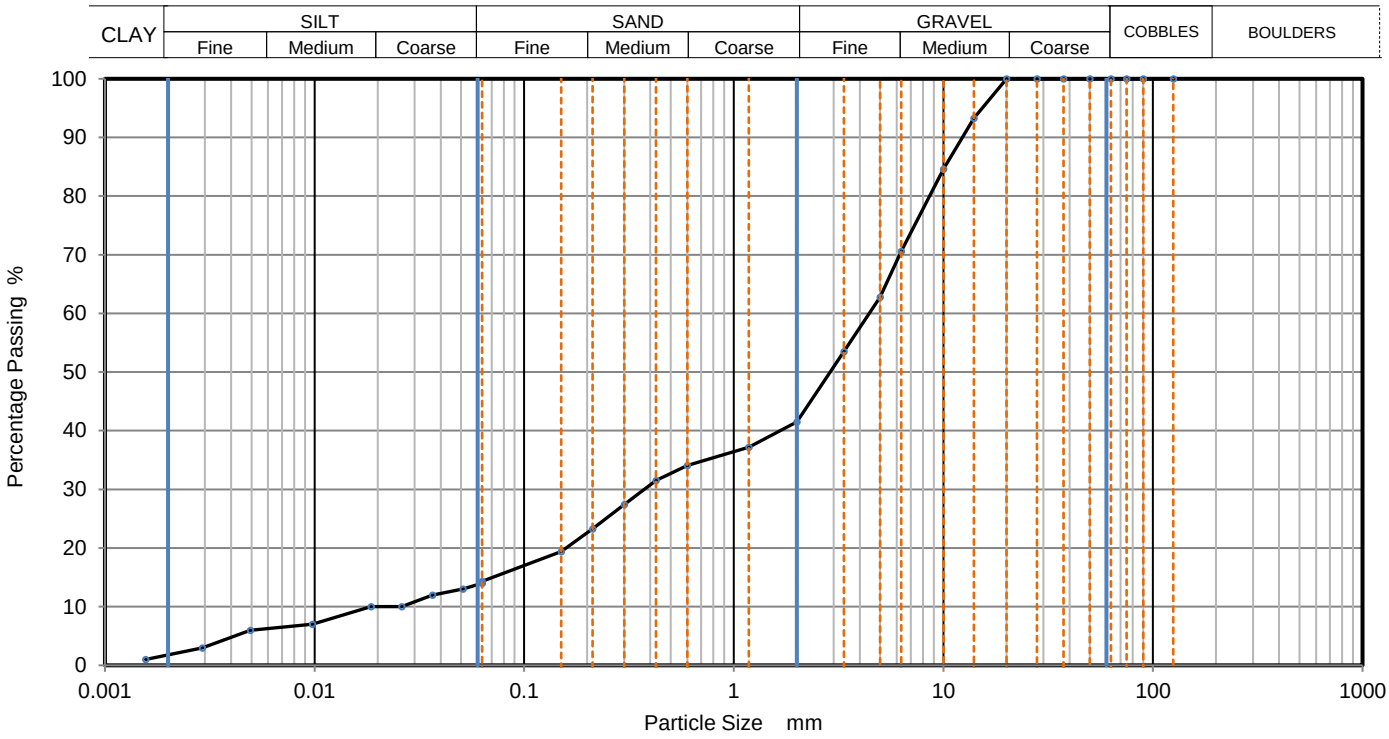
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey gravelly silty fine to coarse SAND.			Sample Depth (m) Top	0.70
				Base	1.20
Specimen Reference	7	Specimen Depth	0.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070538



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	14
90	100	0.05097	13
75	100	0.03649	12
63	100	0.02611	10
50	100	0.01857	10
37.5	100	0.00976	7
28	100	0.00493	6
20	100	0.00291	3
14	93	0.00156	1
10	85		
6.3	71		
5	63		
3.35	54		
2	42		
1.18	37		
0.6	34	Particle density	(assumed)
0.425	32	2.65	Mg/m3
0.3	27		
0.212	23		
0.15	19		
0.063	14		

Dry Mass of sample, g: 535

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	58.5
Sand	27.3
Silt	12.4
Clay	1.8

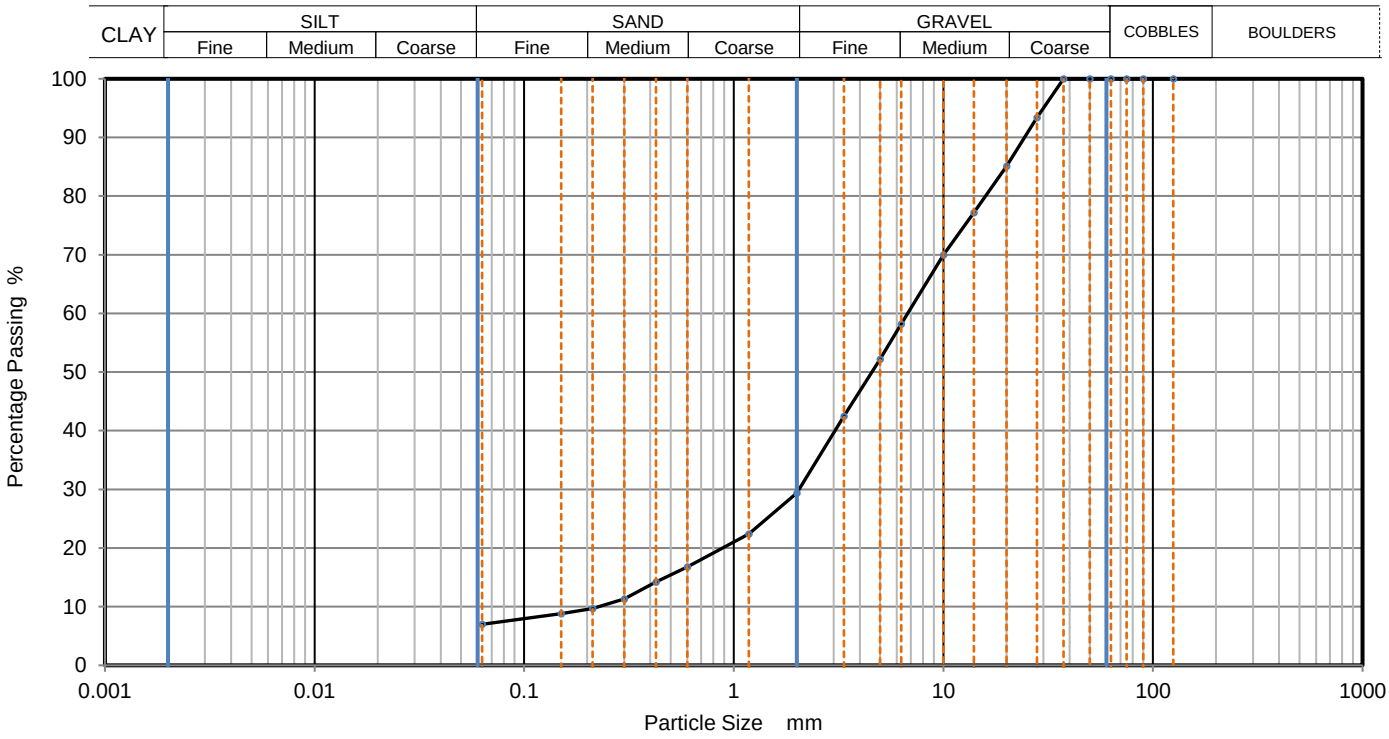
Grading Analysis		
D100	mm	
D60	mm	4.44
D30	mm	0.374
D10	mm	0.0235
Uniformity Coefficient		190
Curvature Coefficient		1.3

Remarks

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CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		3
Specimen Description	Brownish grey gravelly slightly silty fine to coarse SAND.				Sample Depth (m)	Top	1.20
						Base	1.70
Specimen Reference	3	Specimen Depth	1.2	m	Sample Type		B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus2022070539



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	70		
6.3	58		
5	52		
3.35	43		
2	29		
1.18	22		
0.6	17		
0.425	14		
0.3	11		
0.212	10		
0.15	9		
0.063	7		

Dry Mass of sample, g	2442

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	70.6
Sand	22.4
Fines <0.063mm	7.0

Grading Analysis		
D100	mm	
D60	mm	6.75
D30	mm	2.05
D10	mm	0.226
Uniformity Coefficient		30
Curvature Coefficient		2.7

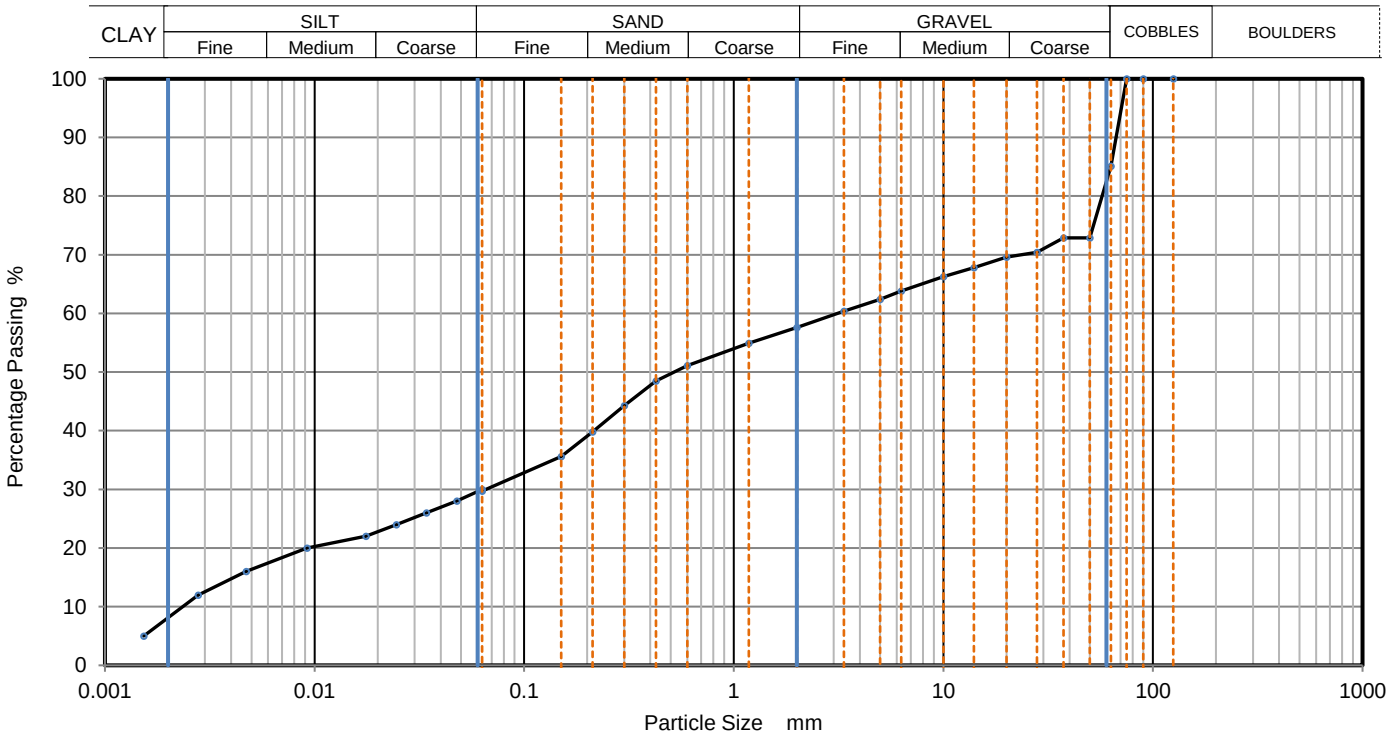
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy gravelly silty CLAY with cobbles.			Sample Depth (m) Top	1.70
				Base	3.00
Specimen Reference	7	Specimen Depth	1.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070540



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	30
90	100	0.04770	28
75	100	0.03420	26
63	85	0.02452	24
50	73	0.01757	22
37.5	73	0.00919	20
28	70	0.00471	16
20	70	0.00278	12
14	68	0.00153	5
10	66		
6.3	64		
5	62		
3.35	60		
2	58		
1.18	55		
0.6	51	Particle density	(assumed)
0.425	49	2.65	Mg/m3
0.3	44		
0.212	40		
0.15	36		
0.063	30		

Dry Mass of sample, g: 6143

Sample Proportions	% dry mass
Cobbles	14.9
Gravel	27.6
Sand	27.9
Silt	21.4
Clay	8.2

Grading Analysis		
D100	mm	
D60	mm	3.1
D30	mm	0.0658
D10	mm	0.0023
Uniformity Coefficient		1300
Curvature Coefficient		0.61

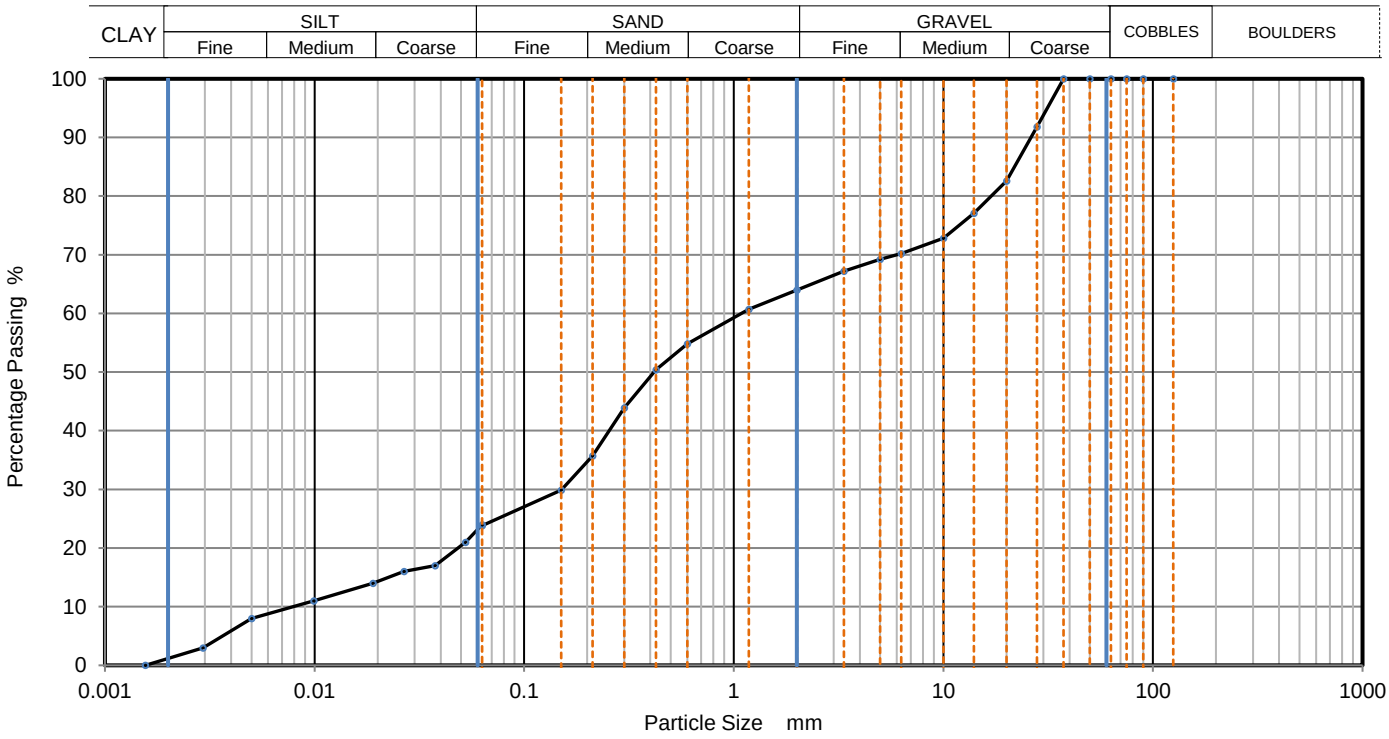
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Specimen Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Base	4.90
Specimen Reference	3	Specimen Depth	4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070542



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	24
90	100	0.05248	21
75	100	0.03753	17
63	100	0.02669	16
50	100	0.01897	14
37.5	100	0.00990	11
28	92	0.00501	8
20	83	0.00293	3
14	77	0.00156	0
10	73		
6.3	70		
5	69		
3.35	67		
2	64		
1.18	61		
0.6	55	Particle density	(assumed)
0.425	50	2.65	Mg/m3
0.3	44		
0.212	36		
0.15	30		
0.063	24		

Dry Mass of sample, g: 2500

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	36.0
Sand	40.2
Silt	22.6
Clay	1.2

Grading Analysis		
D100	mm	
D60	mm	1.09
D30	mm	0.151
D10	mm	0.00781
Uniformity Coefficient		140
Curvature Coefficient		2.7

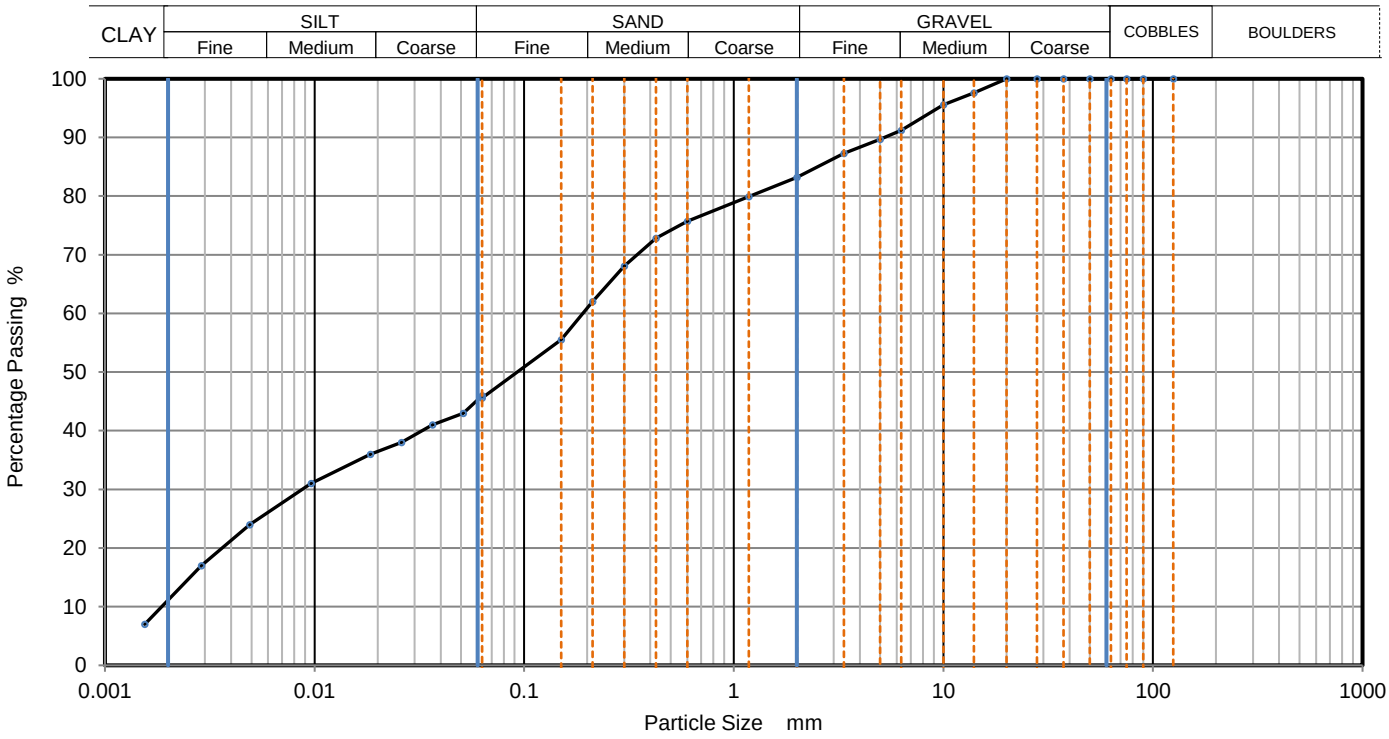
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	6.00
				Base	7.50
Specimen Reference	7	Specimen Depth	6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070544



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05129	43
75	100	0.03649	41
63	100	0.02596	38
50	100	0.01846	36
37.5	100	0.00965	31
28	100	0.00491	24
20	100	0.00288	17
14	98	0.00155	7
10	96		
6.3	91		
5	90		
3.35	87		
2	83		
1.18	80		
0.6	76	Particle density	(assumed)
0.425	73	2.65	Mg/m3
0.3	68		
0.212	62		
0.15	56		
0.063	46		

Dry Mass of sample, g: 532

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.8
Sand	37.6
Silt	34.4
Clay	11.2

Grading Analysis		
D100	mm	
D60	mm	0.191
D30	mm	0.00862
D10	mm	0.00186
Uniformity Coefficient		100
Curvature Coefficient		0.21

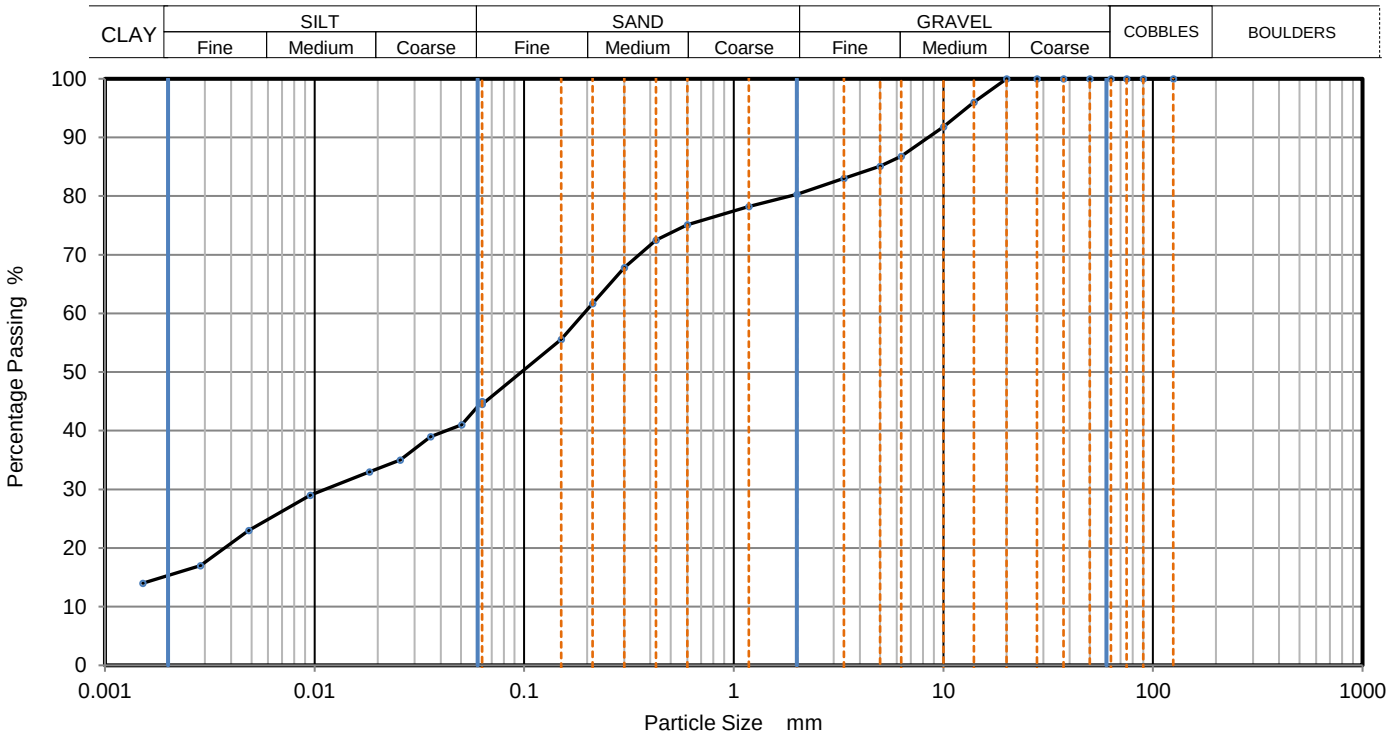
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.50
				Base	9.00
Specimen Reference	6	Specimen Depth	7.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082571



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05033	41
75	100	0.03582	39
63	100	0.02564	35
50	100	0.01824	33
37.5	100	0.00953	29
28	100	0.00485	23
20	100	0.00285	17
14	96	0.00152	14
10	92		
6.3	87		
5	85		
3.35	83		
2	80		
1.18	78		
0.6	75	Particle density	(assumed)
0.425	73	2.65	Mg/m3
0.3	68		
0.212	62		
0.15	56		
0.063	45		

Dry Mass of sample, g: 577

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.7
Sand	35.7
Silt	29.4
Clay	15.2

Grading Analysis		
D100	mm	
D60	mm	0.193
D30	mm	0.0112
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

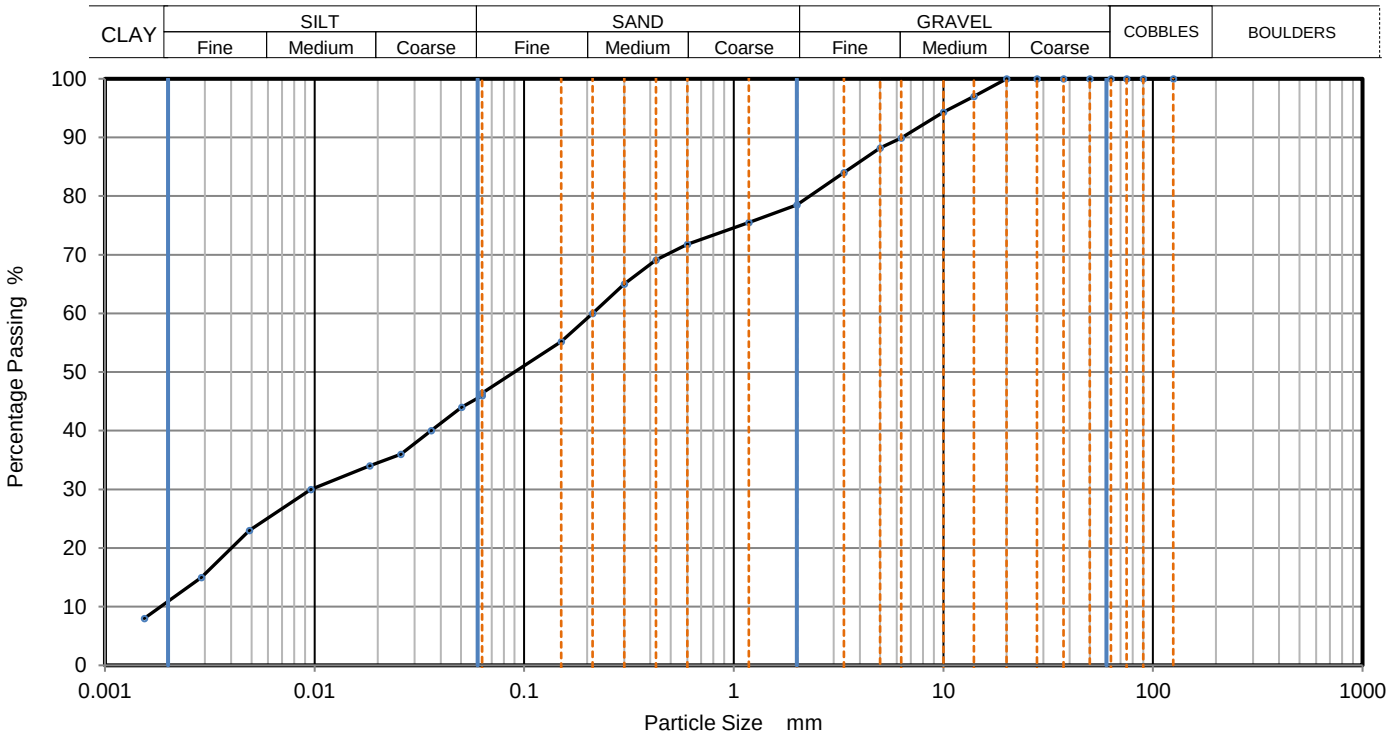
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.50
				Base	12.00
Specimen Reference	7	Specimen Depth	10.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082574



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05033	44
75	100	0.03604	40
63	100	0.02580	36
50	100	0.01835	34
37.5	100	0.00959	30
28	100	0.00488	23
20	100	0.00288	15
14	97	0.00154	8
10	94		
6.3	90		
5	88		
3.35	84		
2	79		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	65		
0.212	60		
0.15	55		
0.063	46		

Dry Mass of sample, g: 519

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.5
Sand	32.1
Silt	35.3
Clay	11.1

Grading Analysis		
D100	mm	
D60	mm	0.213
D30	mm	0.0103
D10	mm	0.0018
Uniformity Coefficient		120
Curvature Coefficient		0.28

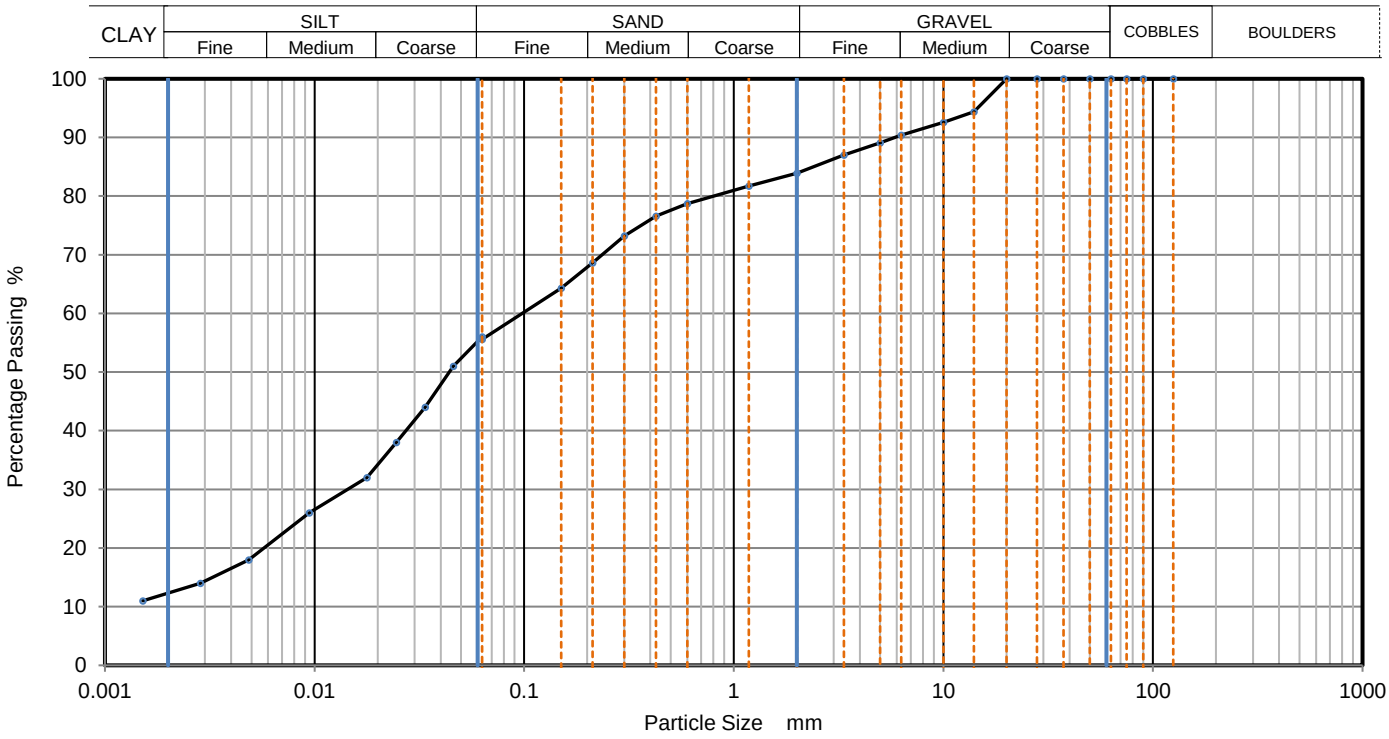
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					**21-1682**
Borehole/Pit No.					RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Base	13.50
Specimen Reference	6	Specimen Depth	12 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082575



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	56
90	100	0.04597	51
75	100	0.03373	44
63	100	0.02452	38
50	100	0.01780	32
37.5	100	0.00942	26
28	100	0.00485	18
20	100	0.00285	14
14	94	0.00152	11
10	93		
6.3	90		
5	89		
3.35	87		
2	84		
1.18	82		
0.6	79	Particle density	(assumed)
0.425	77	2.65	Mg/m3
0.3	73		
0.212	69		
0.15	64		
0.063	56		

Dry Mass of sample, g: 532

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.1
Sand	28.3
Silt	43.8
Clay	11.8

Grading Analysis		
D100	mm	
D60	mm	0.098
D30	mm	0.0151
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

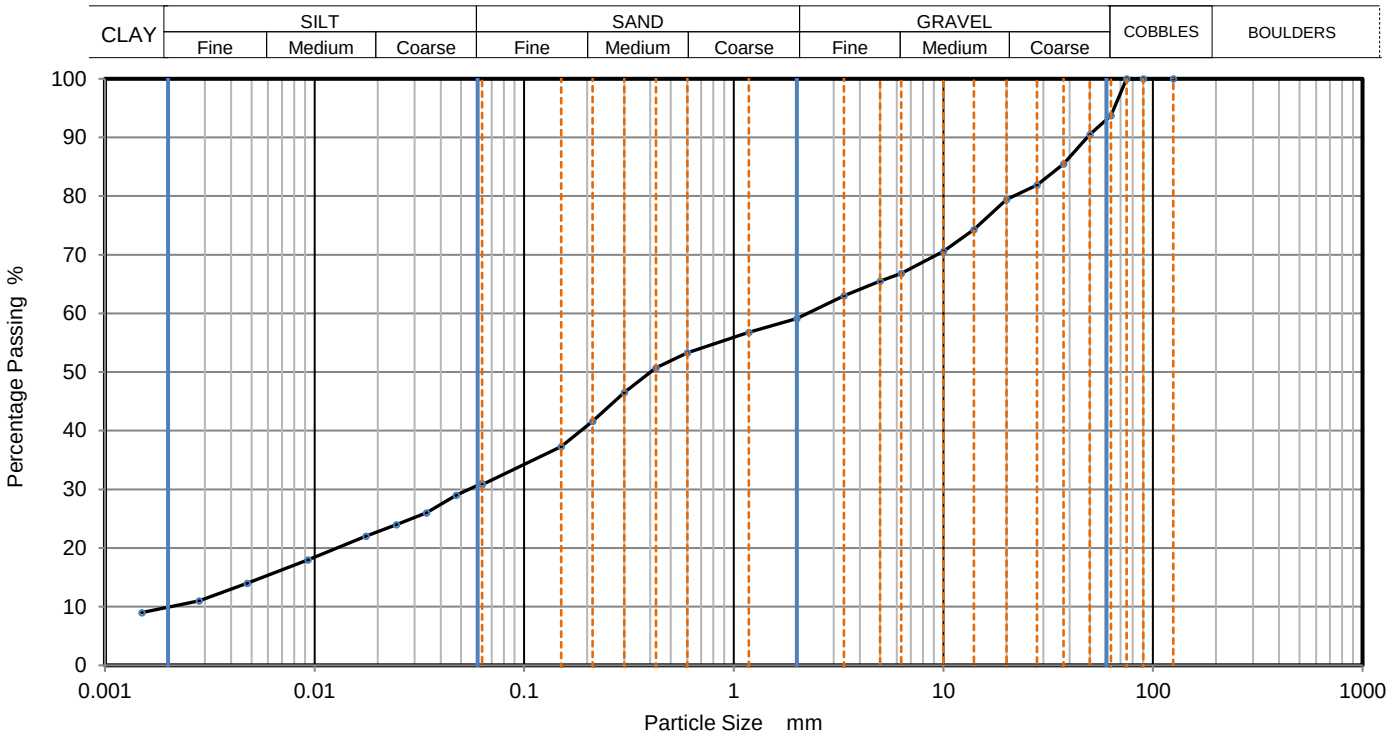
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	7
Specimen Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	6	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082577



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06276	31
90	100	0.04736	29
75	100	0.03420	26
63	94	0.02452	24
50	91	0.01757	22
37.5	86	0.00931	18
28	82	0.00477	14
20	79	0.00282	11
14	74	0.00150	9
10	71		
6.3	67		
5	66		
3.35	63		
2	59		
1.18	57		
0.6	53	Particle density	(assumed)
0.425	51	2.65	Mg/m3
0.3	47		
0.212	42		
0.15	37		
0.063	31		

Dry Mass of sample, g: 15750

Sample Proportions	% dry mass
Cobbles	6.3
Gravel	34.6
Sand	28.3
Silt	21.3
Clay	9.5

Grading Analysis		
D100	mm	
D60	mm	2.26
D30	mm	0.0558
D10	mm	0.00232
Uniformity Coefficient		970
Curvature Coefficient		0.59

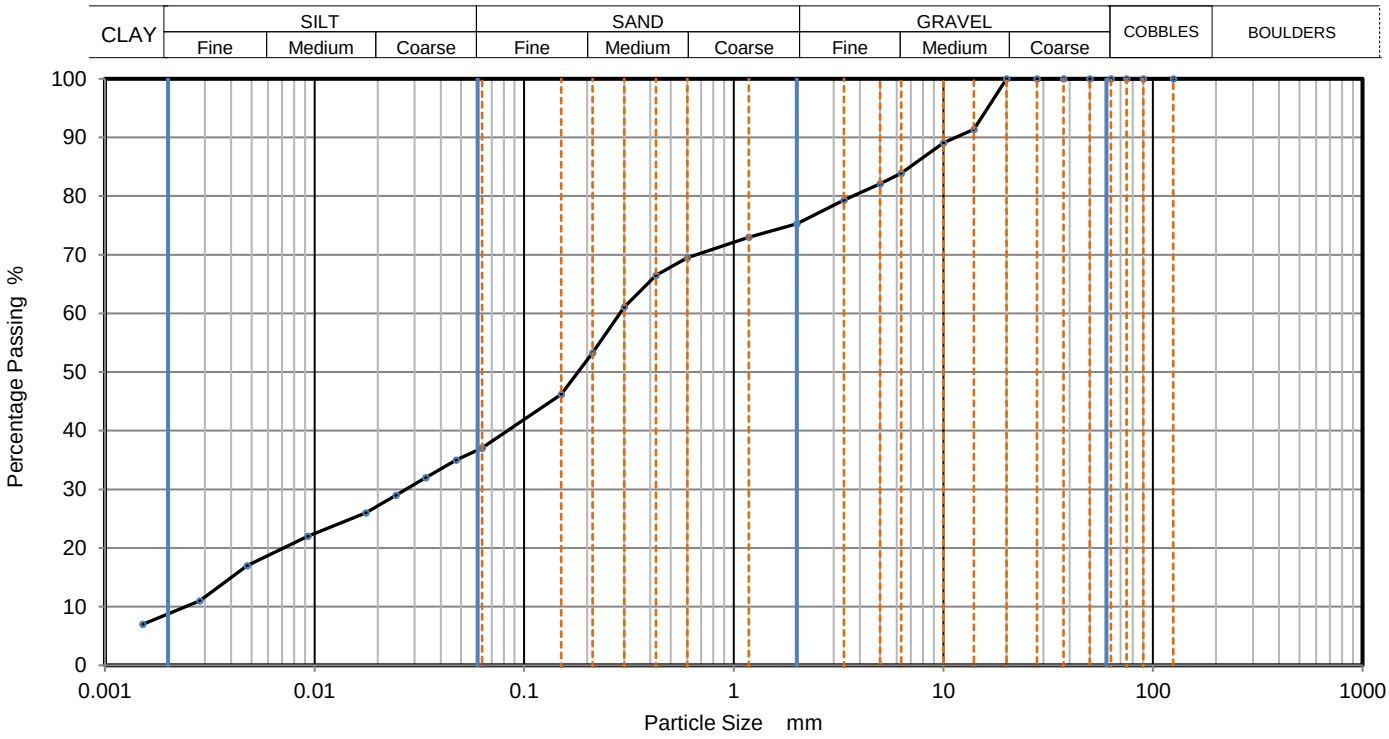
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	18.00
				Base	19.50
Specimen Reference	6	Specimen Depth	18 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082579



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06275	37
90	100	0.04735	35
75	100	0.03396	32
63	100	0.02451	29
50	100	0.01756	26
37.5	100	0.00930	22
28	100	0.00477	17
20	100	0.00283	11
14	91	0.00152	7
10	89		
6.3	84		
5	82		
3.35	79		
2	75		
1.18	73		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	61		
0.212	53		
0.15	46		
0.063	37		

Dry Mass of sample, g: 559

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	24.7
Sand	38.2
Silt	28.3
Clay	8.8

Grading Analysis		
D100	mm	
D60	mm	0.286
D30	mm	0.0275
D10	mm	0.00248
Uniformity Coefficient		120
Curvature Coefficient		1.1

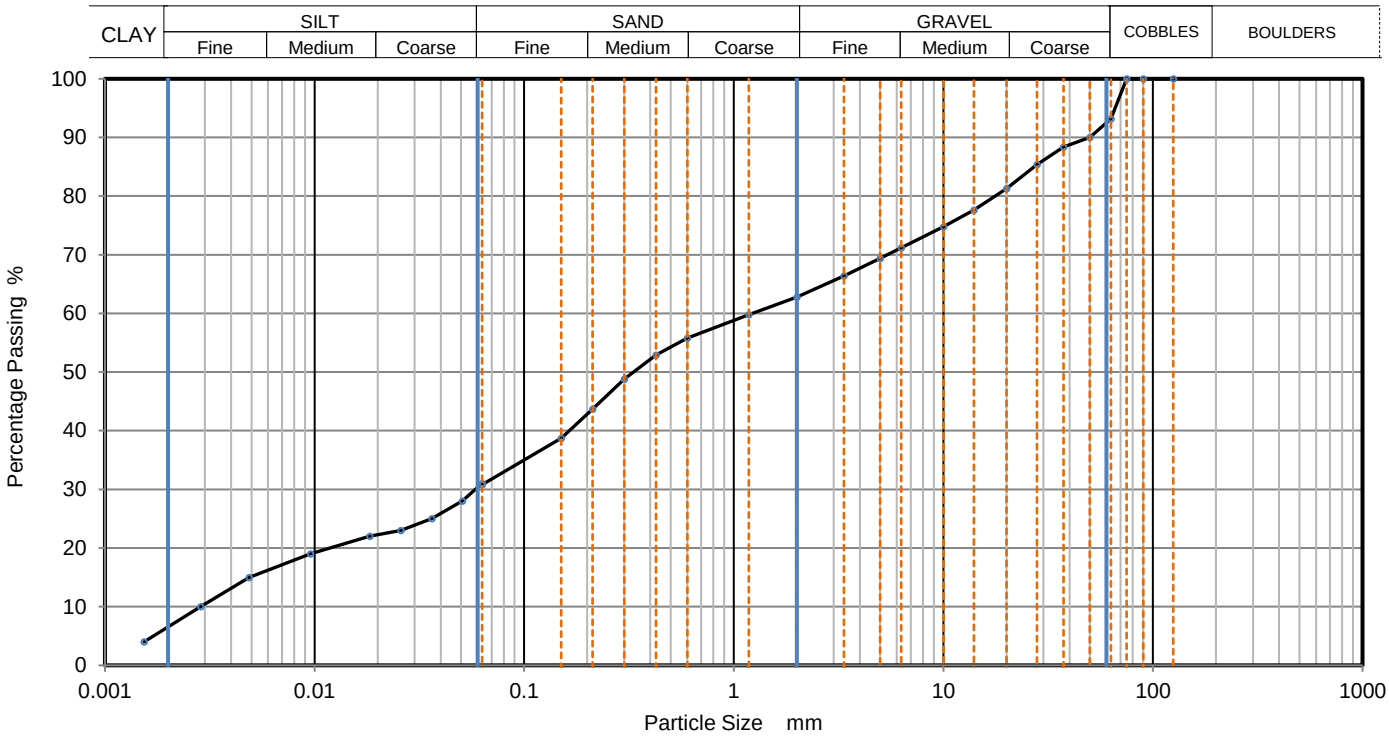
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Greyish brown sandy gravelly silty CLAY with some cobbles.			Sample Depth (m) Top	1.00
				Base	1.20
Specimen Reference	2	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071454



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	31
90	100	0.05065	28
75	100	0.03625	25
63	93	0.02579	23
50	90	0.01834	22
37.5	88	0.00958	19
28	85	0.00487	15
20	81	0.00286	10
14	78	0.00154	4
10	75		
6.3	71		
5	69		
3.35	66		
2	63		
1.18	60		
0.6	56	Particle density	(assumed)
0.425	53	2.65	Mg/m3
0.3	49		
0.212	44		
0.15	39		
0.063	31		

Dry Mass of sample, g: 7519

Sample Proportions	% dry mass
Cobbles	6.8
Gravel	30.3
Sand	32.0
Silt	24.0
Clay	6.9

Grading Analysis		
D100	mm	
D60	mm	1.23
D30	mm	0.0594
D10	mm	0.00278
Uniformity Coefficient		440
Curvature Coefficient		1

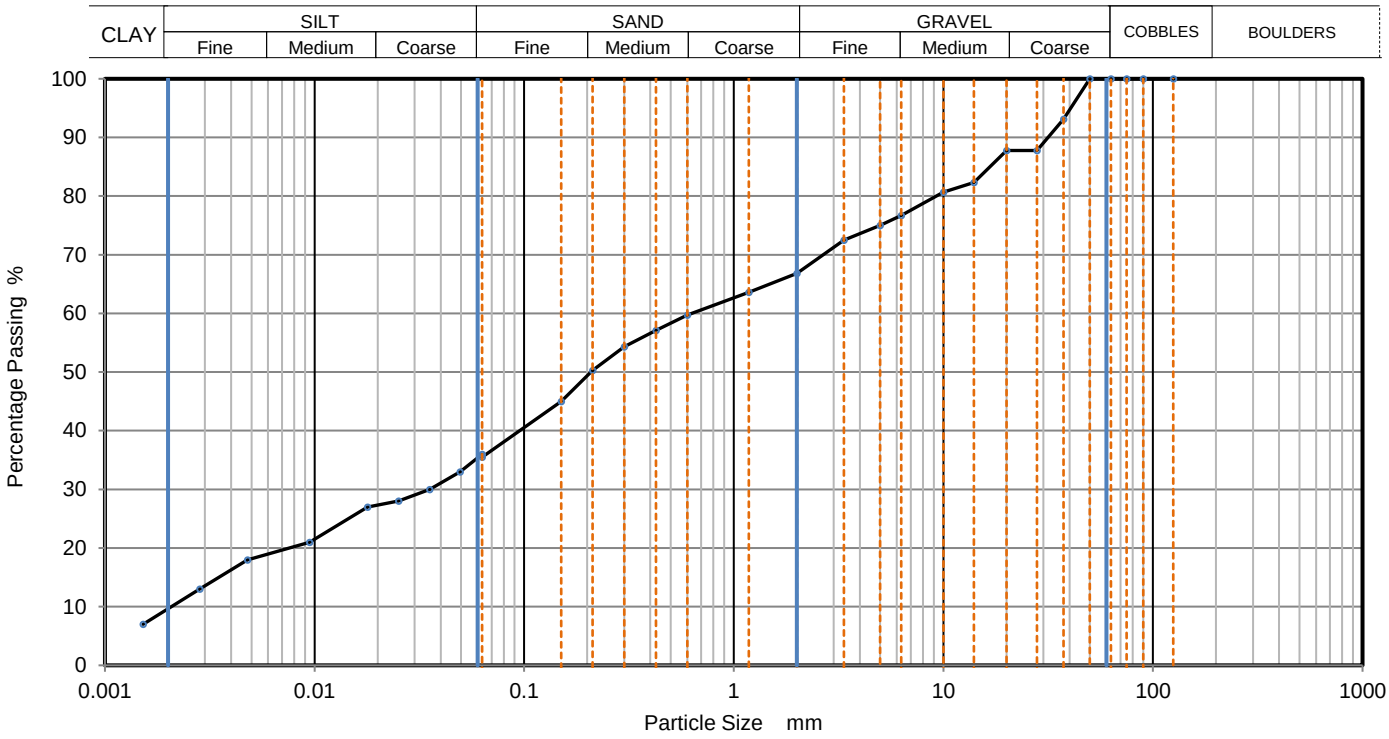
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	2.80
				Base	3.00
Specimen Reference	6	Specimen Depth	2.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071455



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	36
90	100	0.04939	33
75	100	0.03537	30
63	100	0.02517	28
50	100	0.01791	27
37.5	93	0.00947	21
28	88	0.00479	18
20	88	0.00283	13
14	82	0.00152	7
10	81		
6.3	77		
5	75		
3.35	73		
2	67		
1.18	64		
0.6	60	Particle density	(assumed)
0.425	57	2.65	Mg/m3
0.3	54		
0.212	50		
0.15	45		
0.063	36		

Dry Mass of sample, g: 3681

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	33.2
Sand	31.3
Silt	25.9
Clay	9.6

Grading Analysis		
D100	mm	
D60	mm	0.627
D30	mm	0.0361
D10	mm	0.00209
Uniformity Coefficient		300
Curvature Coefficient		1

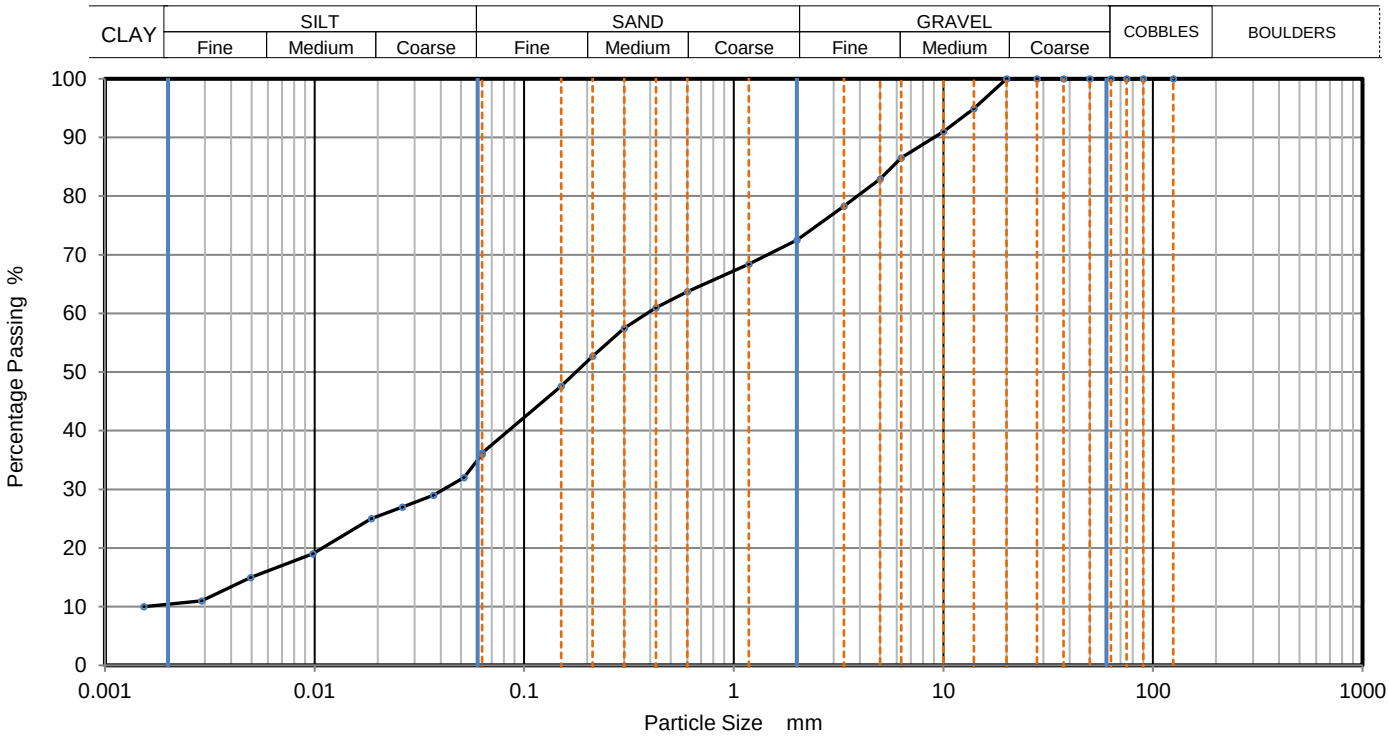
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.50
				Base	6.00
Specimen Reference	9	Specimen Depth	4.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082584



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	36
90	100	0.05160	32
75	100	0.03693	29
63	100	0.02627	27
50	100	0.01868	25
37.5	100	0.00981	19
28	100	0.00496	15
20	100	0.00290	11
14	95	0.00153	10
10	91		
6.3	87		
5	83		
3.35	78		
2	73		
1.18	68		
0.6	64	Particle density	(assumed)
0.425	61	2.65	Mg/m3
0.3	58		
0.212	53		
0.15	48		
0.063	36		

Dry Mass of sample, g: 547

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	27.5
Sand	36.3
Silt	25.9
Clay	10.3

Grading Analysis		
D100	mm	
D60	mm	0.385
D30	mm	0.0418
D10	mm	0.00179
Uniformity Coefficient		210
Curvature Coefficient		2.5

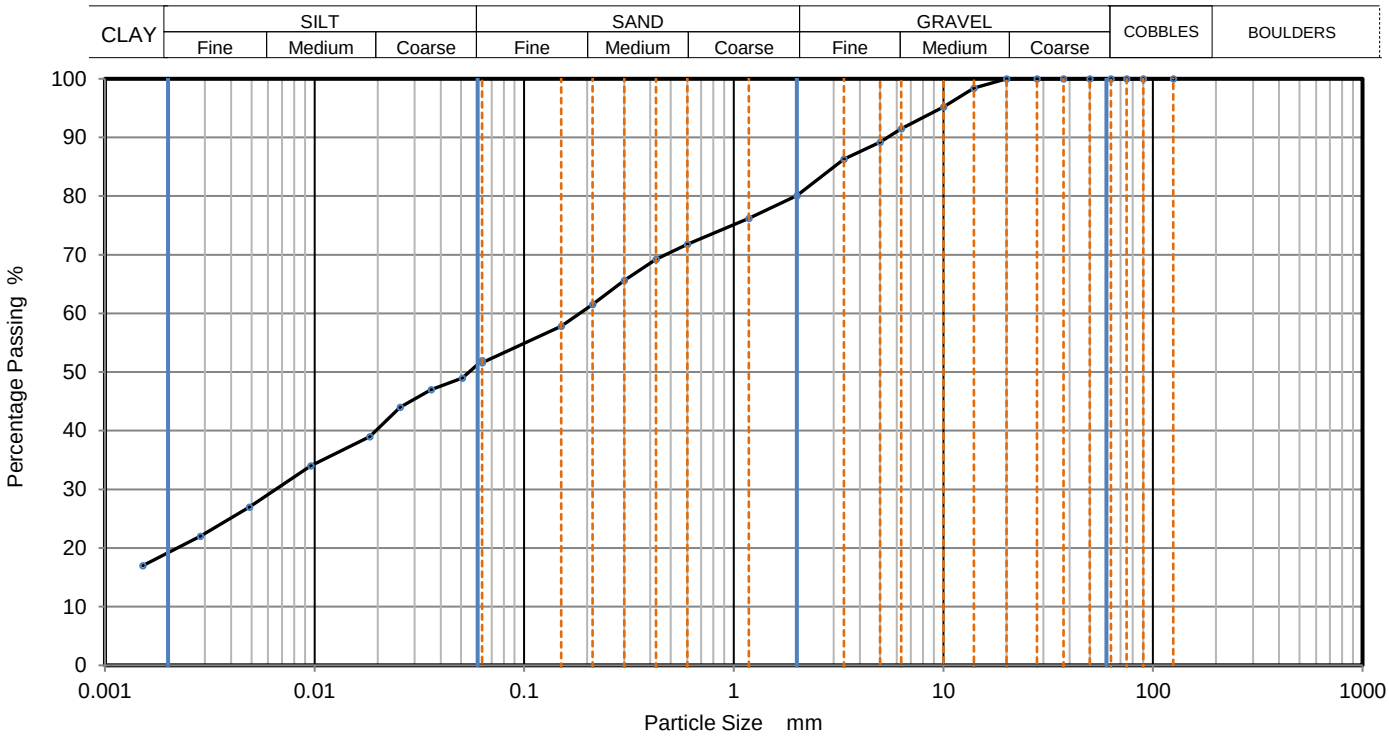
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	6.00
				Base	7.50
Specimen Reference	11	Specimen Depth	6 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082585



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	52
90	100	0.05065	49
75	100	0.03604	47
63	100	0.02564	44
50	100	0.01835	39
37.5	100	0.00959	34
28	100	0.00488	27
20	100	0.00285	22
14	98	0.00152	17
10	95		
6.3	92		
5	89		
3.35	86		
2	80		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	66		
0.212	62		
0.15	58		
0.063	52		

Dry Mass of sample, g: 611

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.9
Sand	28.5
Silt	32.2
Clay	19.4

Grading Analysis		
D100	mm	
D60	mm	0.185
D30	mm	0.00641
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

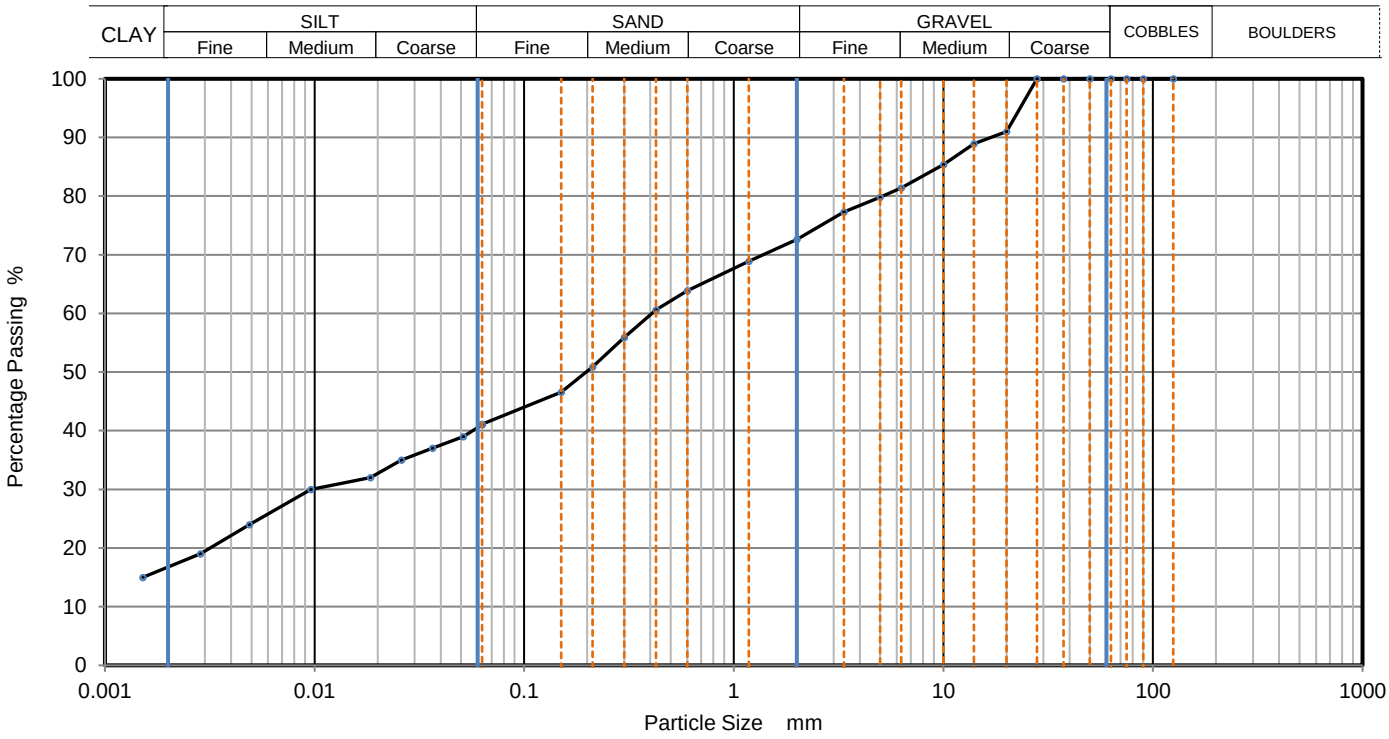
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	10.50
				Base	12.00
Specimen Reference	9	Specimen Depth	10.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082588



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.05129	39
75	100	0.03649	37
63	100	0.02596	35
50	100	0.01846	32
37.5	100	0.00959	30
28	100	0.00488	24
20	91	0.00285	19
14	89	0.00152	15
10	85		
6.3	81		
5	80		
3.35	77		
2	73		
1.18	69		
0.6	64	Particle density	(assumed)
0.425	61	2.65	Mg/m3
0.3	56		
0.212	51		
0.15	47		
0.063	41		

Dry Mass of sample, g: 2747

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	27.4
Sand	31.5
Silt	24.1
Clay	17.0

Grading Analysis		
D100	mm	
D60	mm	0.407
D30	mm	0.00931
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

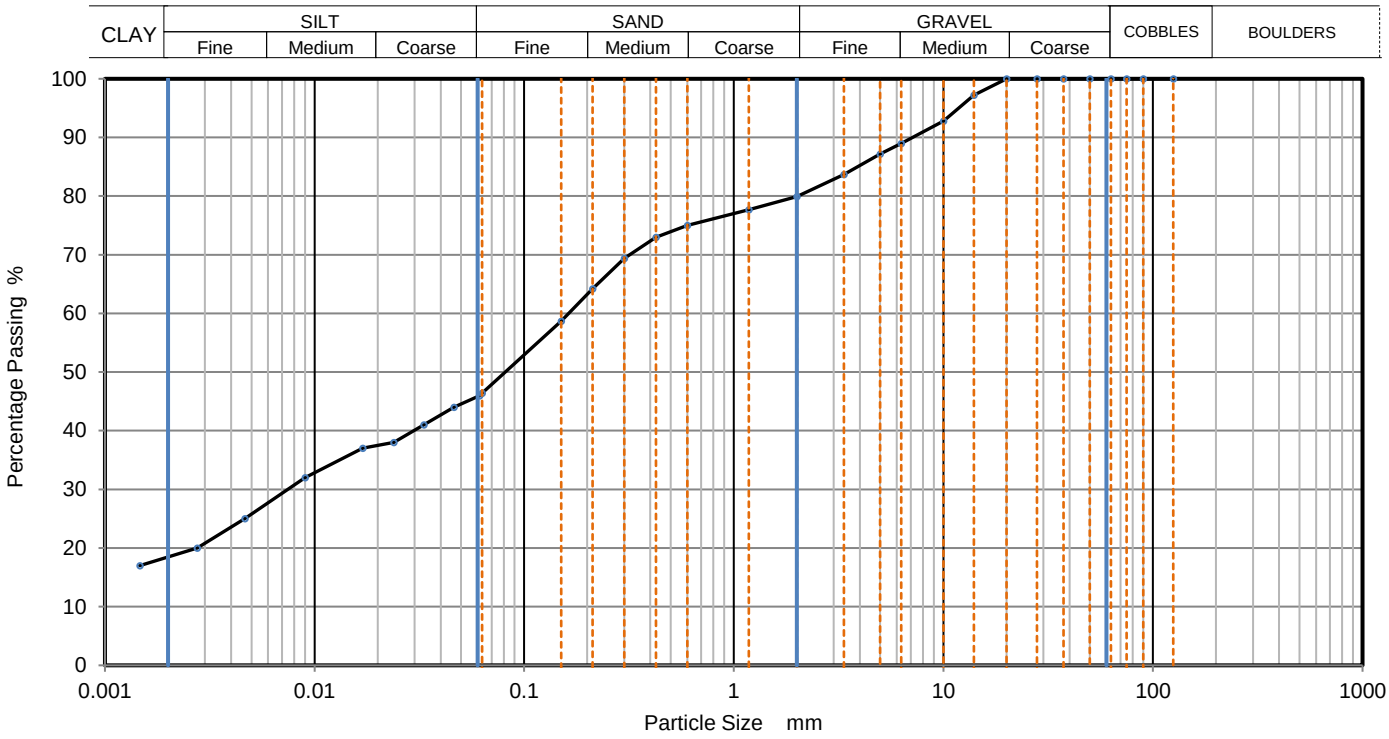
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	7
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	9	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082590



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06135	46
90	100	0.04632	44
75	100	0.03324	41
63	100	0.02385	38
50	100	0.01698	37
37.5	100	0.00901	32
28	100	0.00465	25
20	100	0.00275	20
14	97	0.00147	17
10	93		
6.3	89		
5	87		
3.35	84		
2	80		
1.18	78		
0.6	75	Particle density	(assumed)
0.425	73	2.65	Mg/m3
0.3	69		
0.212	64		
0.15	59		
0.063	46		

Dry Mass of sample, g: 576

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.1
Sand	33.6
Silt	27.8
Clay	18.5

Grading Analysis		
D100	mm	
D60	mm	0.163
D30	mm	0.00752
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

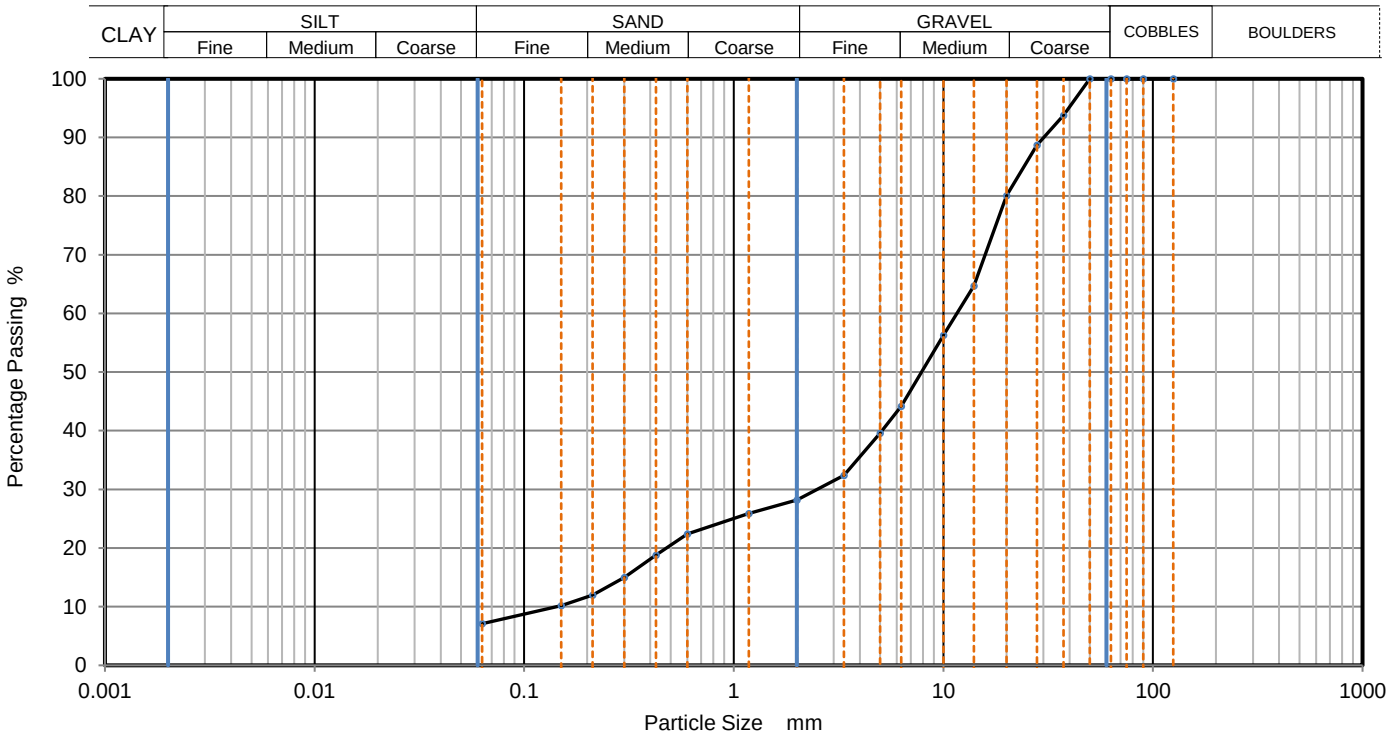
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey slightly sandy slightly silty subangular fine to coarse GRAVEL.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022071456



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	89		
20	80		
14	65		
10	56		
6.3	44		
5	40		
3.35	32		
2	28		
1.18	26		
0.6	22		
0.425	19		
0.3	15		
0.212	12		
0.15	10		
0.063	7		

Dry Mass of sample, g: 15806

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	71.8
Sand	21.0
Fines <0.063mm	7.0

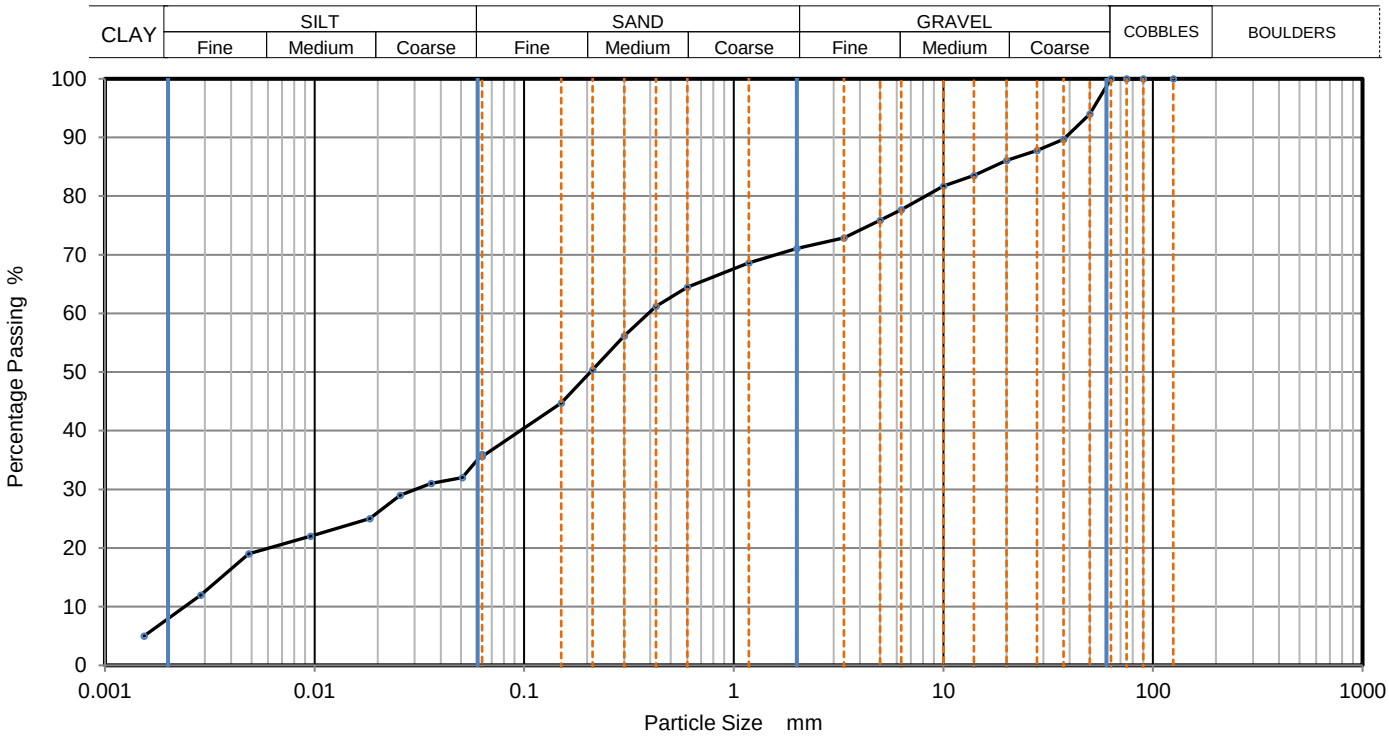
Grading Analysis		
D100	mm	
D60	mm	11.6
D30	mm	2.5
D10	mm	0.144
Uniformity Coefficient		81
Curvature Coefficient		3.8

Remarks

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CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	1.80
				Base	2.00
Specimen Reference	2	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071458



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	36
90	100	0.05065	32
75	100	0.03603	31
63	100	0.02563	29
50	94	0.01834	25
37.5	90	0.00958	22
28	88	0.00485	19
20	86	0.00286	12
14	84	0.00154	5
10	82		
6.3	78		
5	76		
3.35	73		
2	71		
1.18	69		
0.6	65	Particle density (assumed)	
0.425	61	2.65 Mg/m3	
0.3	56		
0.212	50		
0.15	45		
0.063	36		

Dry Mass of sample, g: 3233

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.9
Sand	35.5
Silt	27.6
Clay	8.0

Grading Analysis		
D100	mm	
D60	mm	0.392
D30	mm	0.0325
D10	mm	0.00241
Uniformity Coefficient		160
Curvature Coefficient		1.1

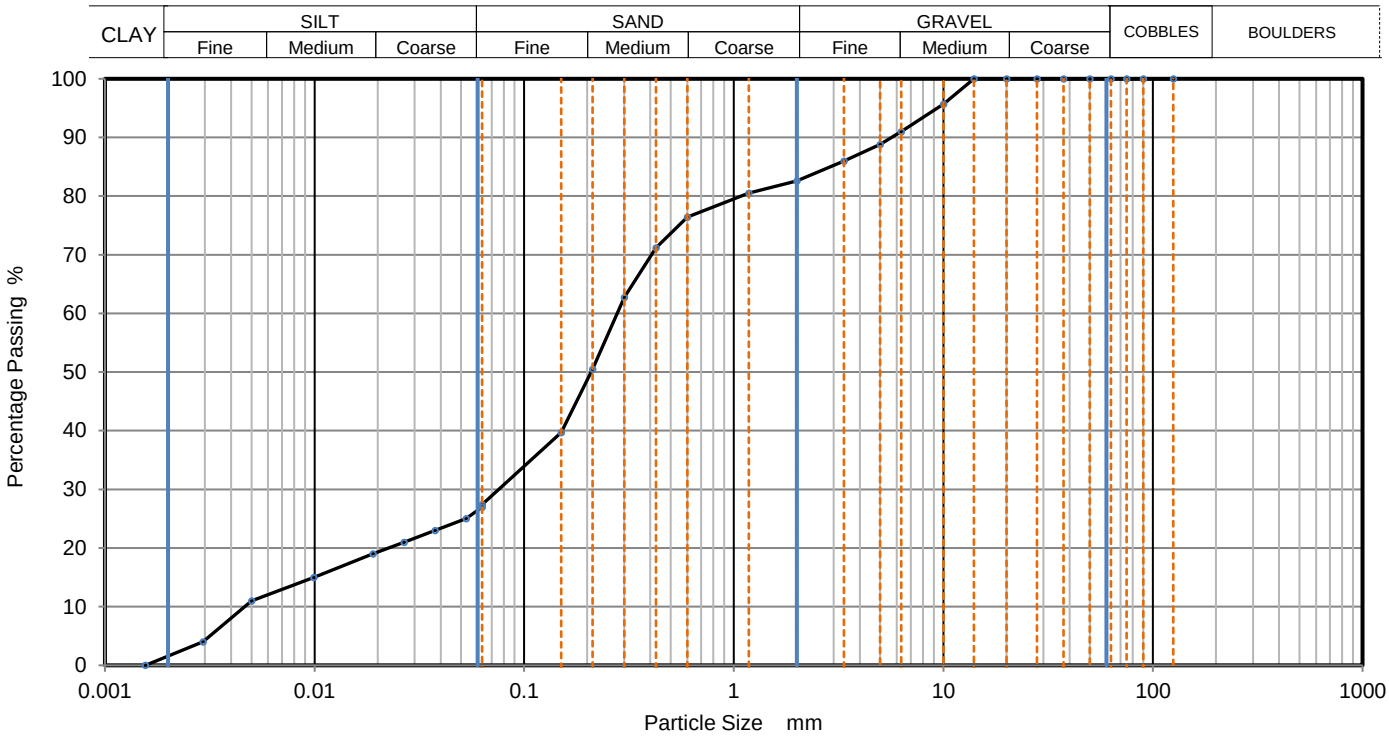
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brown slightly gravelly clayey fine to coarse SAND.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	2	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071459



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	27
90	100	0.05278	25
75	100	0.03753	23
63	100	0.02669	21
50	100	0.01897	19
37.5	100	0.00990	15
28	100	0.00501	11
20	100	0.00293	4
14	100	0.00156	0
10	96		
6.3	91		
5	89		
3.35	86		
2	83		
1.18	81		
0.6	76	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	63		
0.212	51		
0.15	40		
0.063	27		

Dry Mass of sample, g: 271

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.4
Sand	55.2
Silt	25.7
Clay	1.7

Grading Analysis		
D100	mm	
D60	mm	0.278
D30	mm	0.0758
D10	mm	0.00478
Uniformity Coefficient		58
Curvature Coefficient		4.3

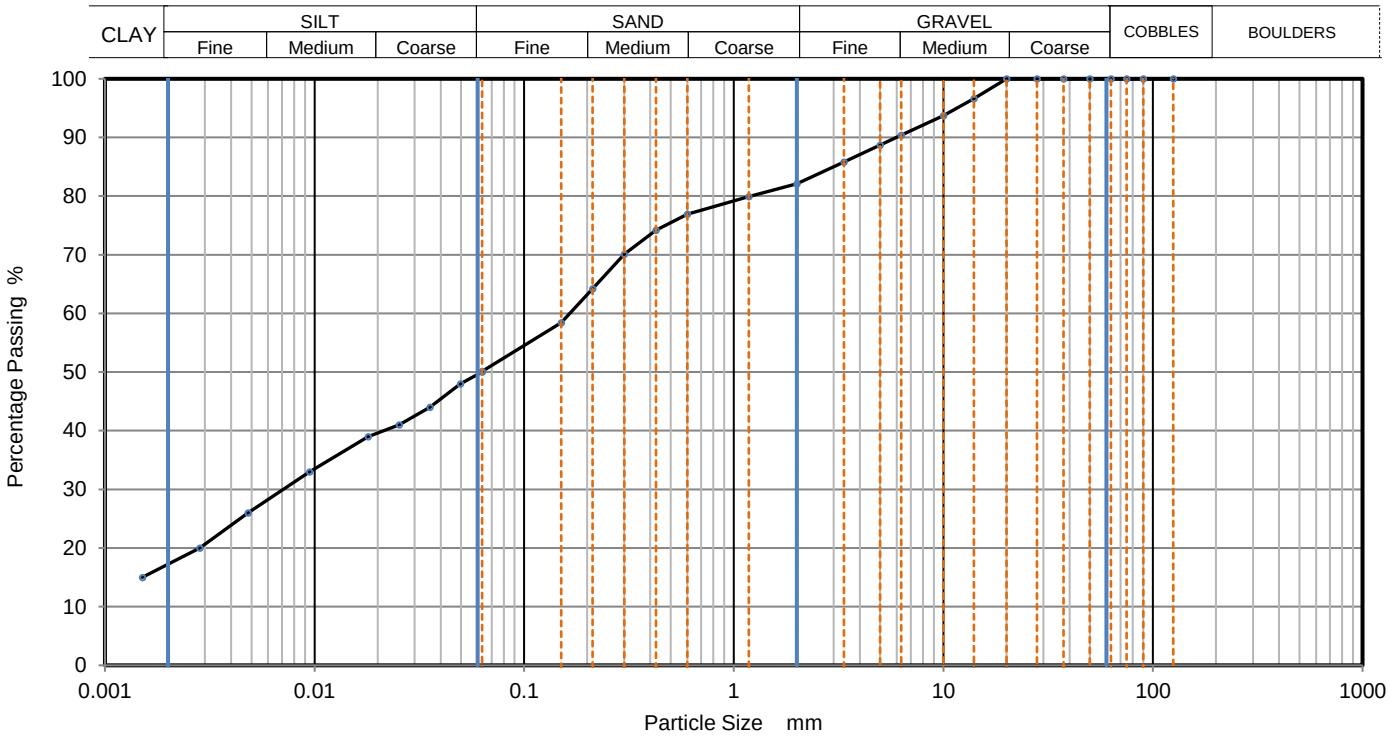
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.50
				Base	9.00
Specimen Reference	6	Specimen Depth	7.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082924



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	50
90	100	0.04968	48
75	100	0.03559	44
63	100	0.02532	41
50	100	0.01802	39
37.5	100	0.00948	33
28	100	0.00482	26
20	100	0.00283	20
14	97	0.00151	15
10	94		
6.3	90		
5	89		
3.35	86		
2	82		
1.18	80		
0.6	77	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	70		
0.212	64		
0.15	58		
0.063	50		

Dry Mass of sample, g: 538

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.9
Sand	32.0
Silt	32.9
Clay	17.2

Grading Analysis		
D100	mm	
D60	mm	0.165
D30	mm	0.00719
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

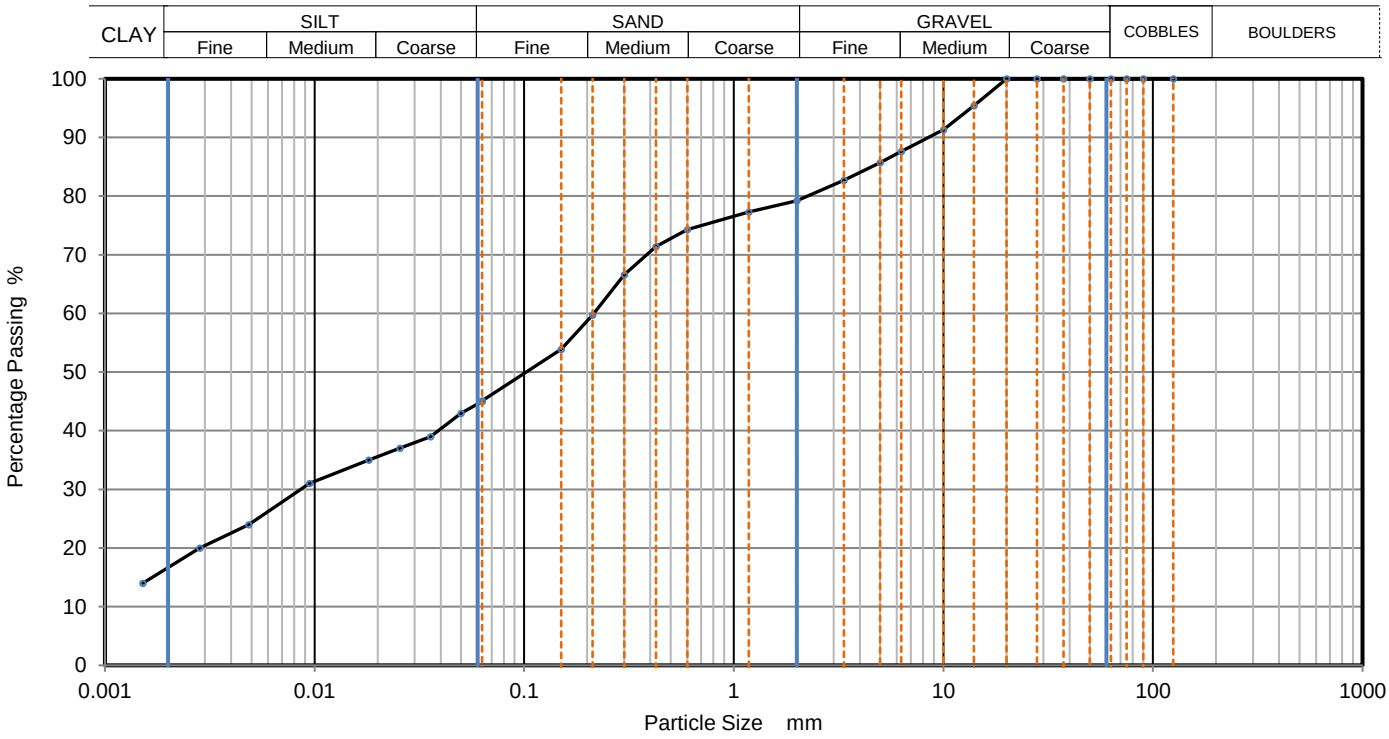
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.50
				Base	12.00
Specimen Reference	6	Specimen Depth	10.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082927



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05001	43
75	100	0.03582	39
63	100	0.02549	37
50	100	0.01813	35
37.5	100	0.00948	31
28	100	0.00485	24
20	100	0.00283	20
14	95	0.00152	14
10	91		
6.3	88		
5	86		
3.35	83		
2	79		
1.18	77		
0.6	74	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	67		
0.212	60		
0.15	54		
0.063	45		

Dry Mass of sample, g: 541

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.8
Sand	34.1
Silt	28.8
Clay	16.3

Grading Analysis		
D100	mm	
D60	mm	0.215
D30	mm	0.00843
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

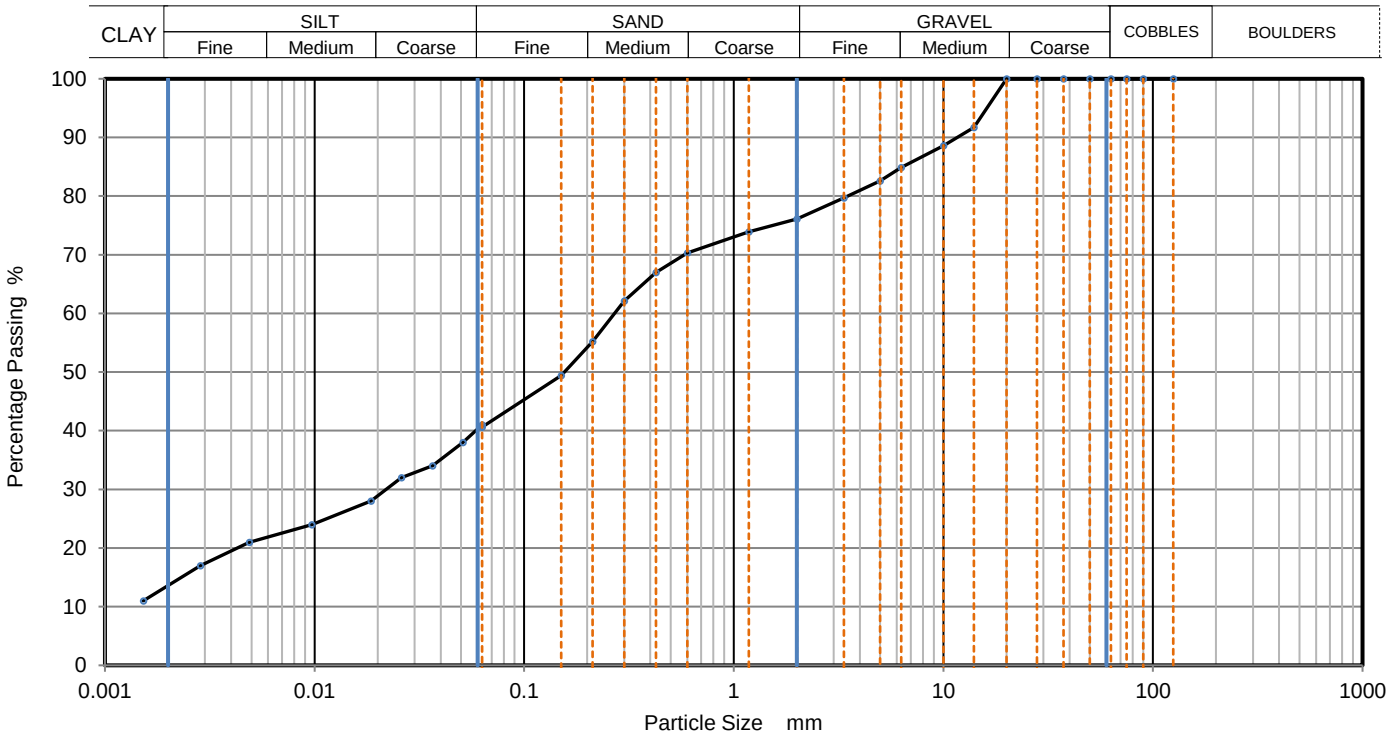
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	13.50
				Base	15.00
Specimen Reference	6	Specimen Depth	13.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082929



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.05096	38
75	100	0.03648	34
63	100	0.02595	32
50	100	0.01857	28
37.5	100	0.00970	24
28	100	0.00488	21
20	100	0.00285	17
14	92	0.00152	11
10	89		
6.3	85		
5	83		
3.35	80		
2	76		
1.18	74		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	62		
0.212	55		
0.15	49		
0.063	41		

Dry Mass of sample, g: 528

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.9
Sand	35.5
Silt	27.1
Clay	13.5

Grading Analysis		
D100	mm	
D60	mm	0.27
D30	mm	0.0221
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

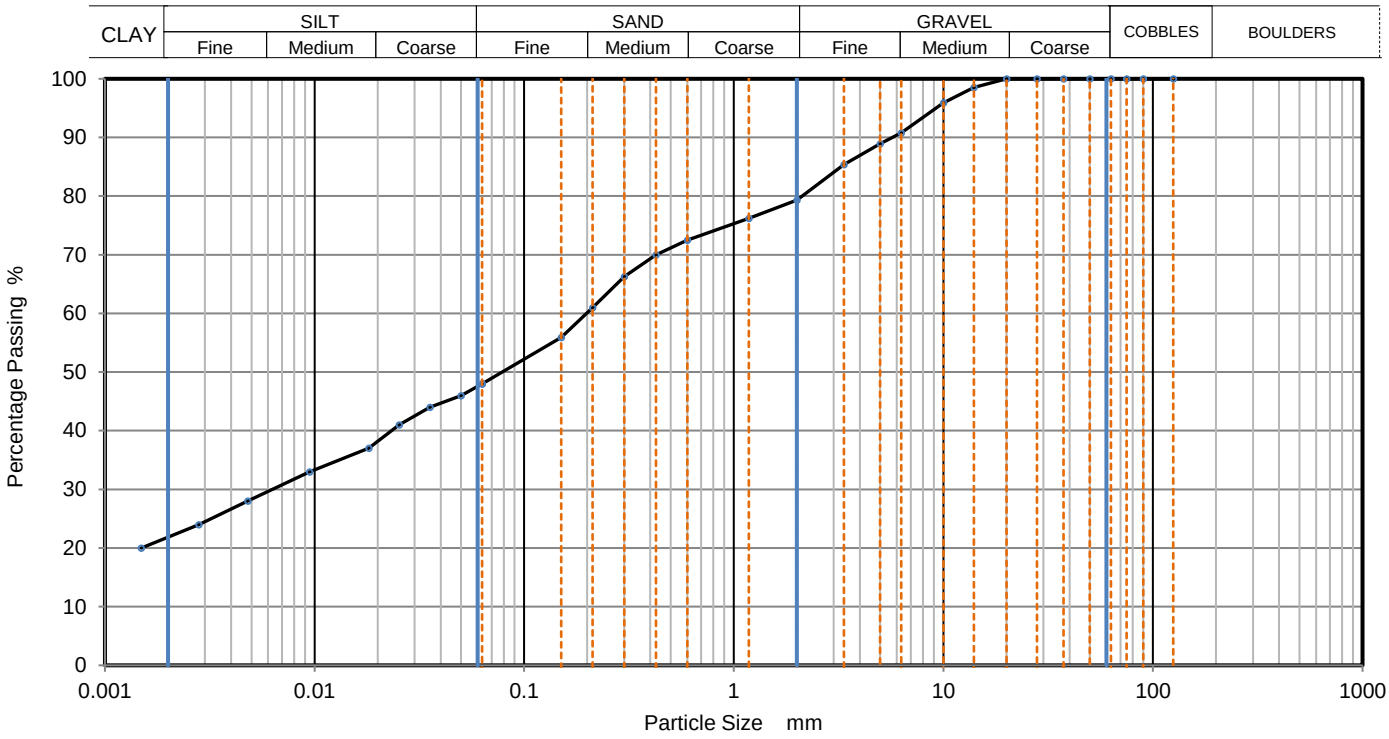
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	7
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	6	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082930



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.05000	46
75	100	0.03559	44
63	100	0.02532	41
50	100	0.01813	37
37.5	100	0.00948	33
28	100	0.00479	28
20	100	0.00280	24
14	99	0.00149	20
10	96		
6.3	91		
5	89		
3.35	85		
2	79		
1.18	76		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	66		
0.212	61		
0.15	56		
0.063	48		

Dry Mass of sample, g: 557

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.7
Sand	31.3
Silt	26.3
Clay	21.7

Grading Analysis		
D100	mm	
D60	mm	0.198
D30	mm	0.00619
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

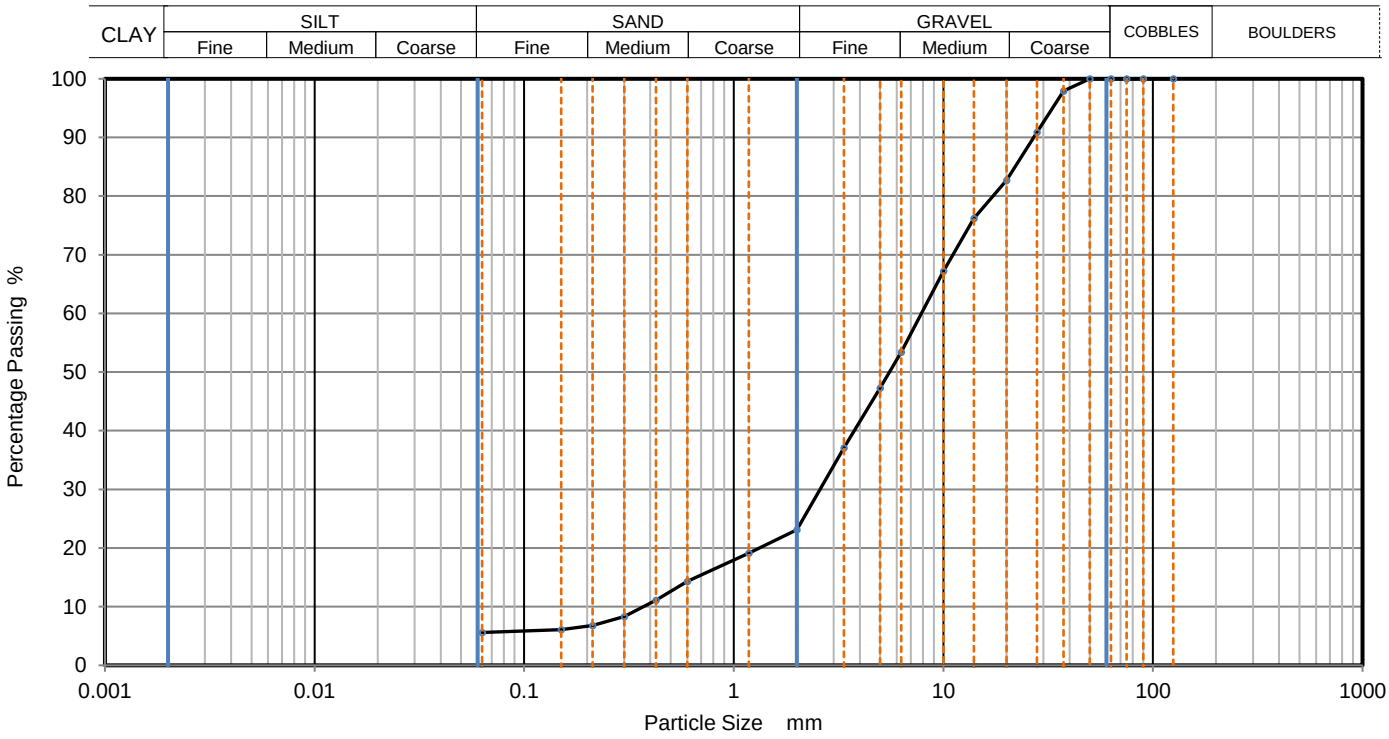
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brown gravelly slightly silty fine to coarse SAND.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022071463



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	91		
20	83		
14	76		
10	67		
6.3	53		
5	47		
3.35	37		
2	23		
1.18	19		
0.6	14		
0.425	11		
0.3	8		
0.212	7		
0.15	6		
0.063	6		

Dry Mass of sample, g: 5234

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	76.9
Sand	17.5
Fines <0.063mm	6.0

Grading Analysis		
D100	mm	
D60	mm	7.86
D30	mm	2.58
D10	mm	0.37
Uniformity Coefficient		21
Curvature Coefficient		2.3

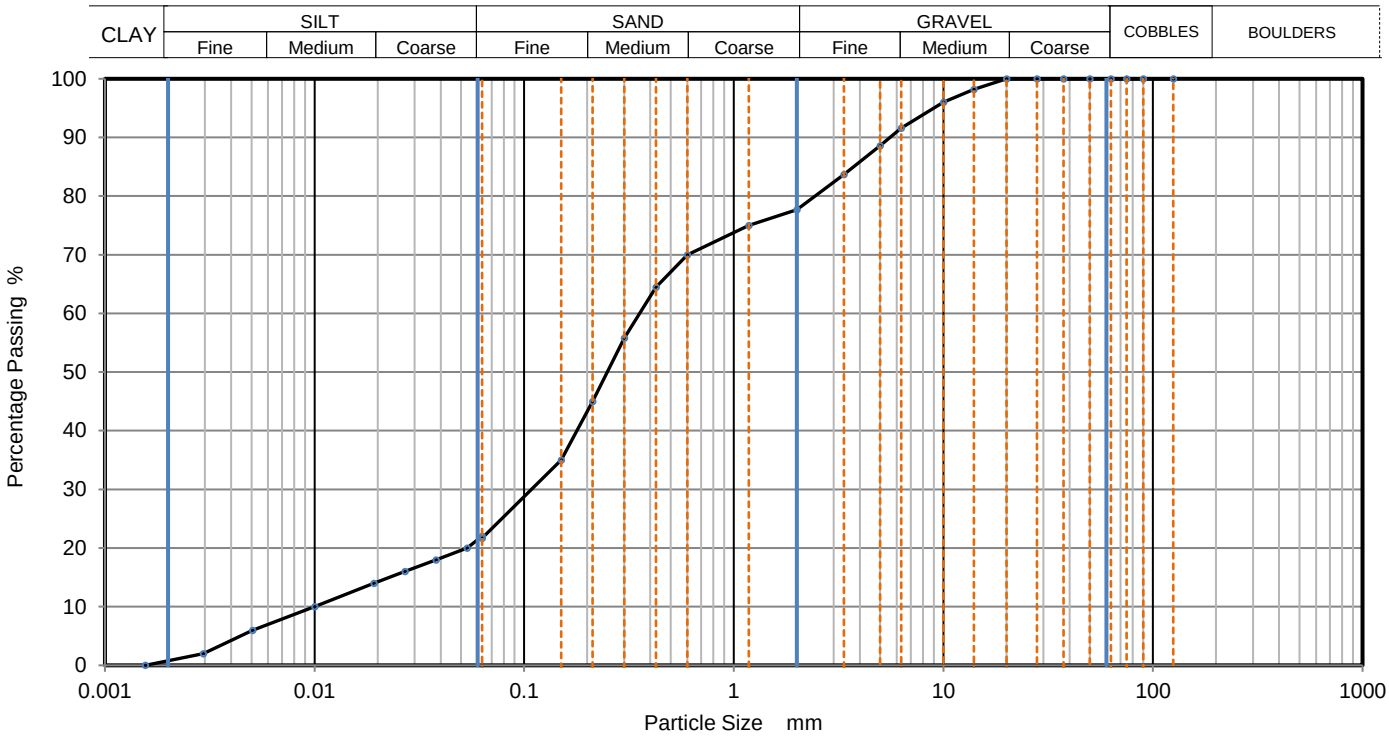
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown slightly gravelly clayey fine to coarse SAND.			Sample Depth (m) Top	1.80
				Base	2.00
Specimen Reference	2	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071464



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	22
90	100	0.05337	20
75	100	0.03795	18
63	100	0.02698	16
50	100	0.01918	14
37.5	100	0.01001	10
28	100	0.00506	6
20	100	0.00295	2
14	98	0.00156	0
10	96		
6.3	92		
5	89		
3.35	84		
2	78		
1.18	75		
0.6	70	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	56		
0.212	45		
0.15	35		
0.063	22		

Dry Mass of sample, g: 494

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.3
Sand	56.0
Silt	20.9
Clay	0.8

Grading Analysis		
D100	mm	
D60	mm	0.355
D30	mm	0.108
D10	mm	0.0102
Uniformity Coefficient		35
Curvature Coefficient		3.2

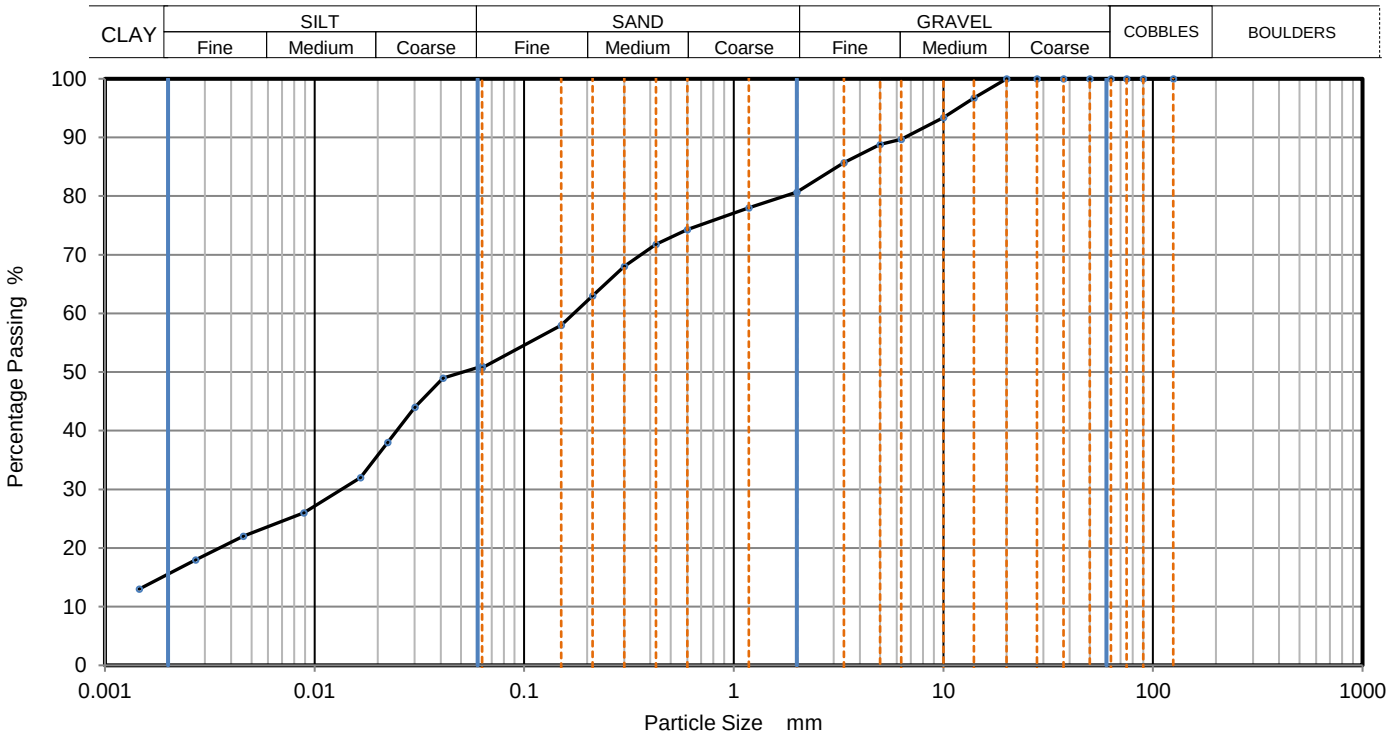
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	26
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.00
				Base	10.50
Specimen Reference	2	Specimen Depth	10 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071470



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.04104	49
75	100	0.03008	44
63	100	0.02235	38
50	100	0.01654	32
37.5	100	0.00890	26
28	100	0.00457	22
20	100	0.00270	18
14	97	0.00146	13
10	93		
6.3	90		
5	89		
3.35	86		
2	81		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	68		
0.212	63		
0.15	58		
0.063	51		

Dry Mass of sample, g: 501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.3
Sand	30.1
Silt	35.0
Clay	15.6

Grading Analysis		
D100	mm	
D60	mm	0.172
D30	mm	0.0134
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

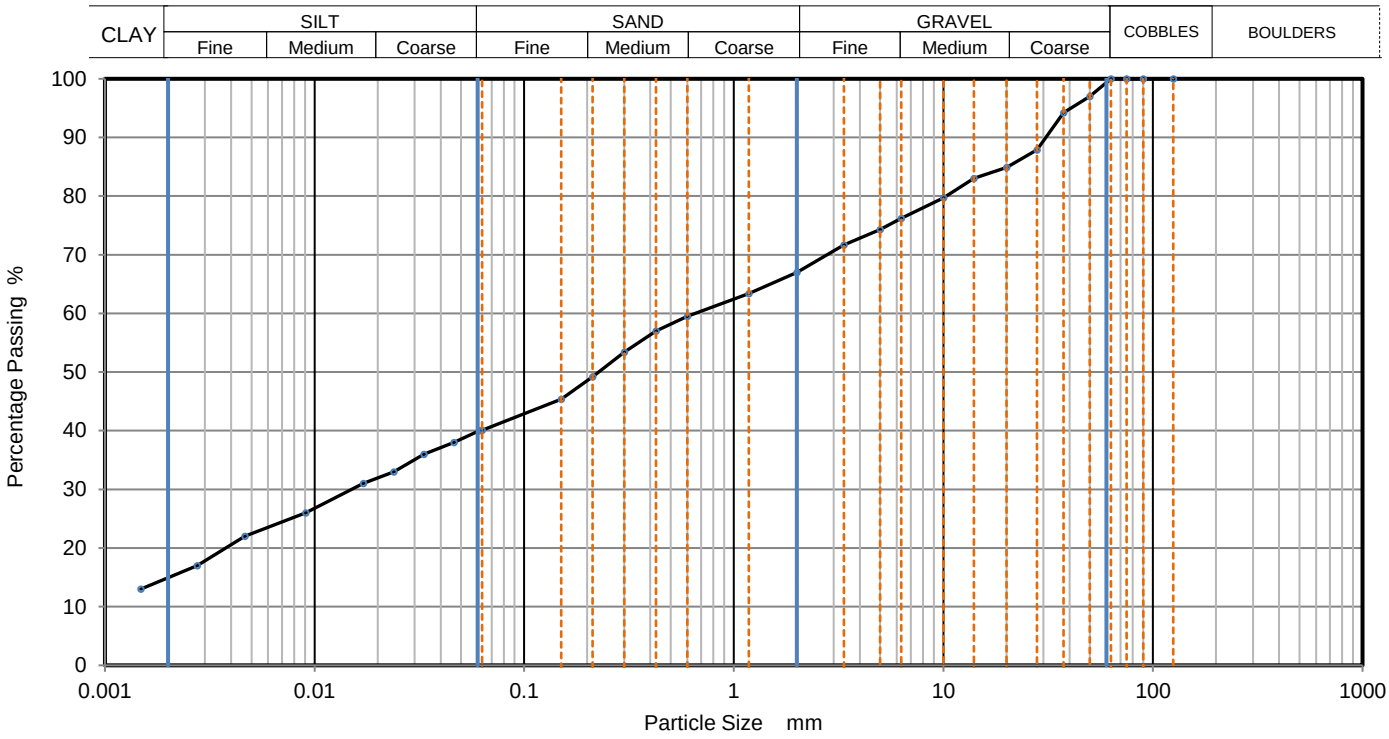
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	14.20
				Base	15.70
Specimen Reference	9	Specimen Depth	14.2 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082591



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06135	40
90	100	0.04632	38
75	100	0.03324	36
63	100	0.02385	33
50	97	0.01710	31
37.5	94	0.00907	26
28	88	0.00465	22
20	85	0.00275	17
14	83	0.00148	13
10	80		
6.3	76		
5	74		
3.35	72		
2	67		
1.18	63		
0.6	60	Particle density	(assumed)
0.425	57	2.65	Mg/m3
0.3	53		
0.212	49		
0.15	45		
0.063	40		

Dry Mass of sample, g: 10656

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	33.0
Sand	27.0
Silt	25.2
Clay	14.8

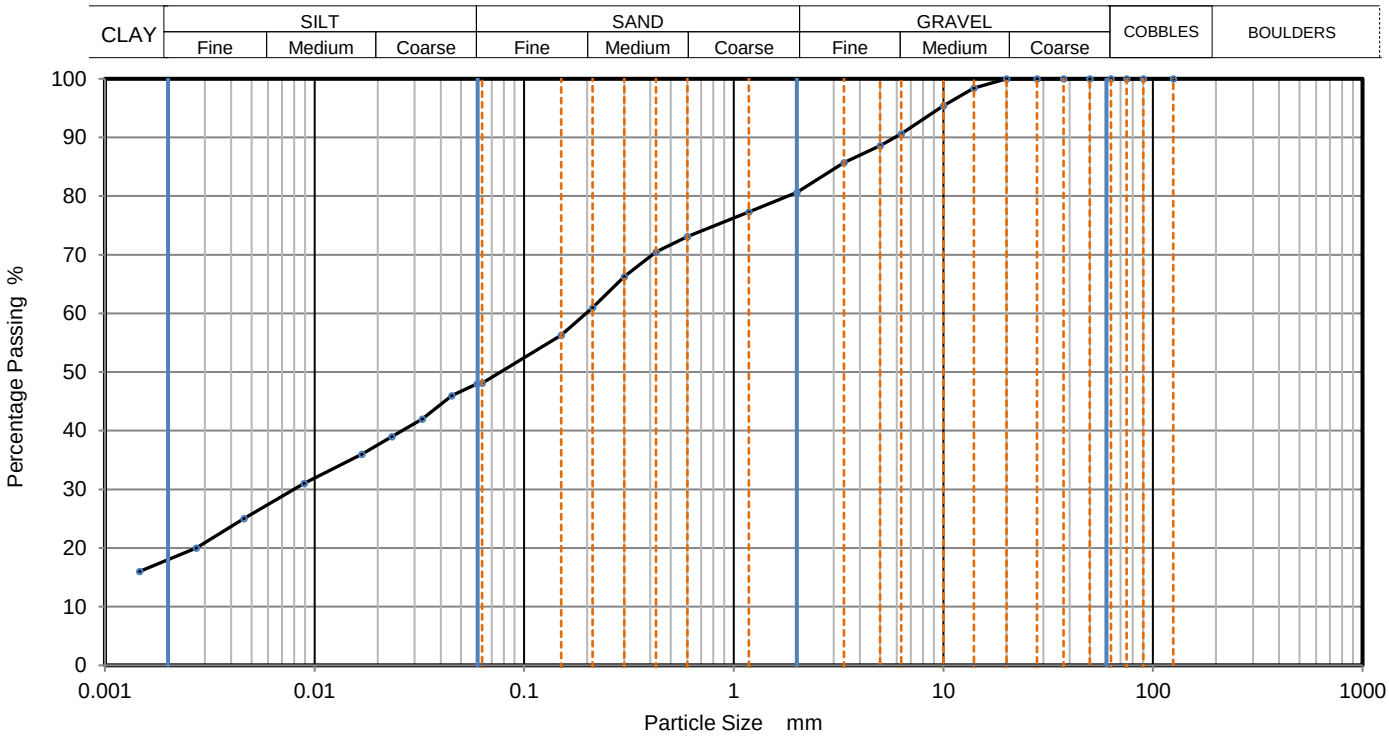
Grading Analysis		
D100	mm	
D60	mm	0.651
D30	mm	0.015
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		3
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	17.20
					Base	18.70
Specimen Reference	9	Specimen Depth	17.2 m	Sample Type		C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022082593



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05964	48
90	100	0.04507	46
75	100	0.03262	42
63	100	0.02341	39
50	100	0.01680	36
37.5	100	0.00892	31
28	100	0.00461	25
20	100	0.00273	20
14	98	0.00146	16
10	95		
6.3	91		
5	89		
3.35	86		
2	81		
1.18	77		
0.6	73	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	66		
0.212	61		
0.15	56		
0.063	48		

Dry Mass of sample, g: 554

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.4
Sand	32.5
Silt	30.5
Clay	17.6

Grading Analysis		
D100	mm	
D60	mm	0.197
D30	mm	0.0079
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

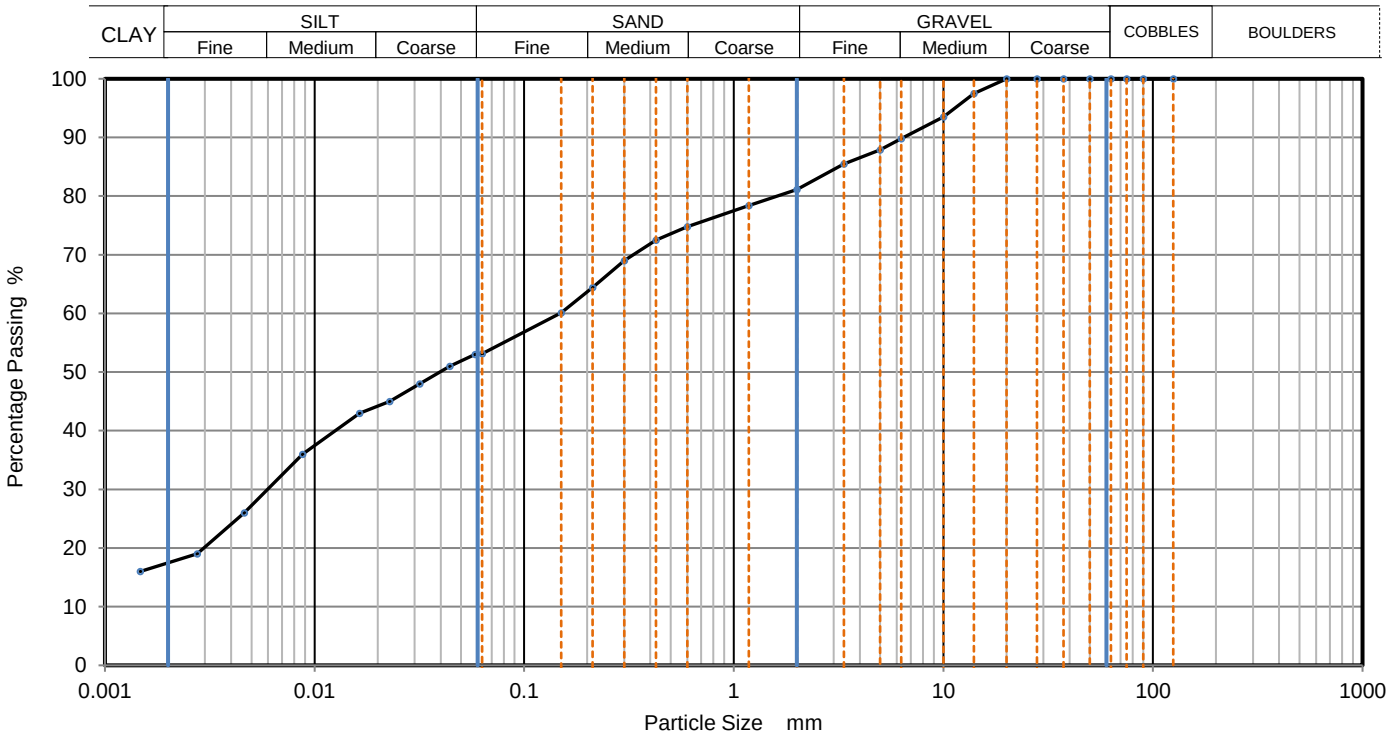
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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UKAS TESTING

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	18.70
				Base	20.20
Specimen Reference	9	Specimen Depth	18.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082594



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05843	53
90	100	0.04418	51
75	100	0.03175	48
63	100	0.02281	45
50	100	0.01638	43
37.5	100	0.00877	36
28	100	0.00462	26
20	100	0.00275	19
14	98	0.00147	16
10	94		
6.3	90		
5	88		
3.35	86		
2	81		
1.18	78		
0.6	75	Particle density	(assumed)
0.425	73	2.65	Mg/m3
0.3	69		
0.212	64		
0.15	60		
0.063	53		

Dry Mass of sample, g: 547

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	18.9
Sand	28.0
Silt	35.7
Clay	17.4

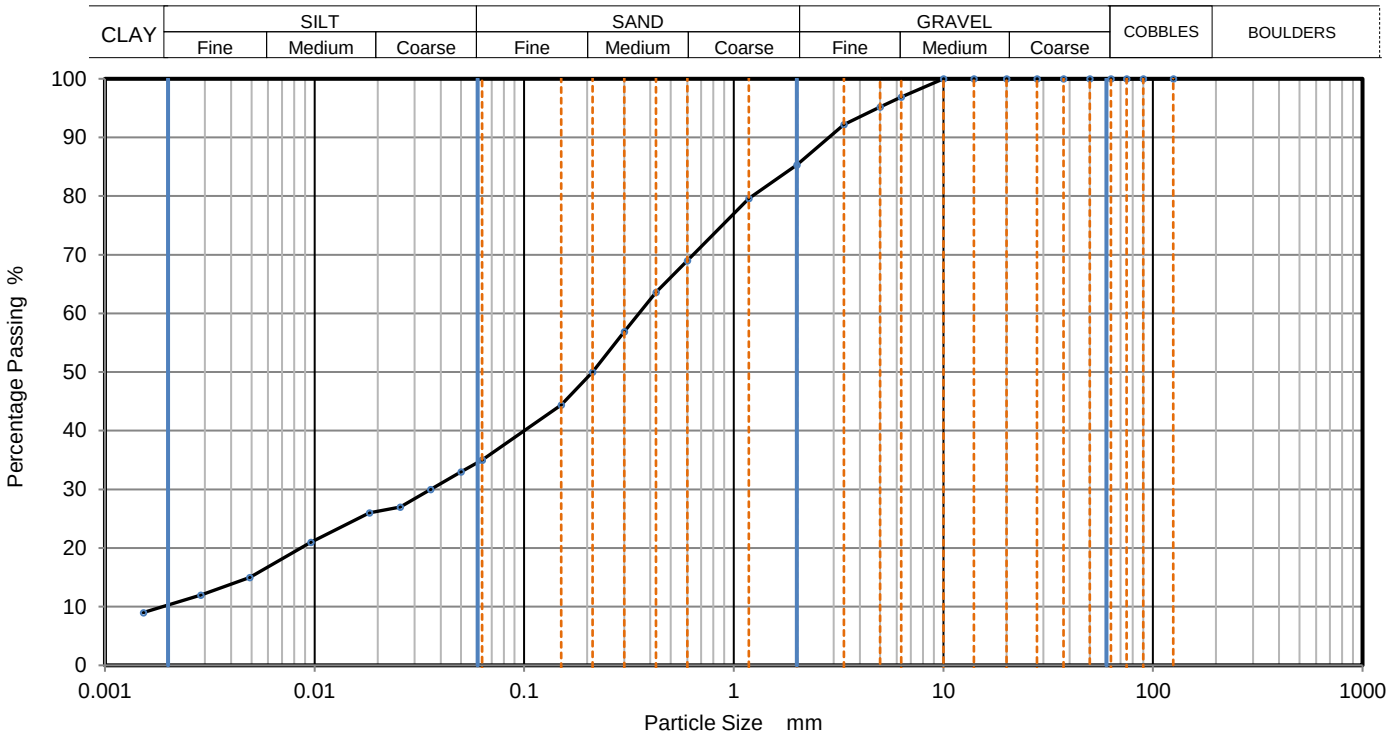
Grading Analysis		
D100	mm	
D60	mm	0.148
D30	mm	0.00596
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	0.10
					Base	1.20
Specimen Reference	2	Specimen Depth	0.1 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022062179



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	35
90	100	0.05001	33
75	100	0.03582	30
63	100	0.02564	27
50	100	0.01824	26
37.5	100	0.00959	21
28	100	0.00491	15
20	100	0.00286	12
14	100	0.00152	9
10	100		
6.3	97		
5	95		
3.35	92		
2	85		
1.18	80		
0.6	69	Particle density	(assumed)
0.425	64	2.65	Mg/m3
0.3	57		
0.212	50		
0.15	44		
0.063	35		

Dry Mass of sample, g: 205

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.7
Sand	50.3
Silt	24.6
Clay	10.4

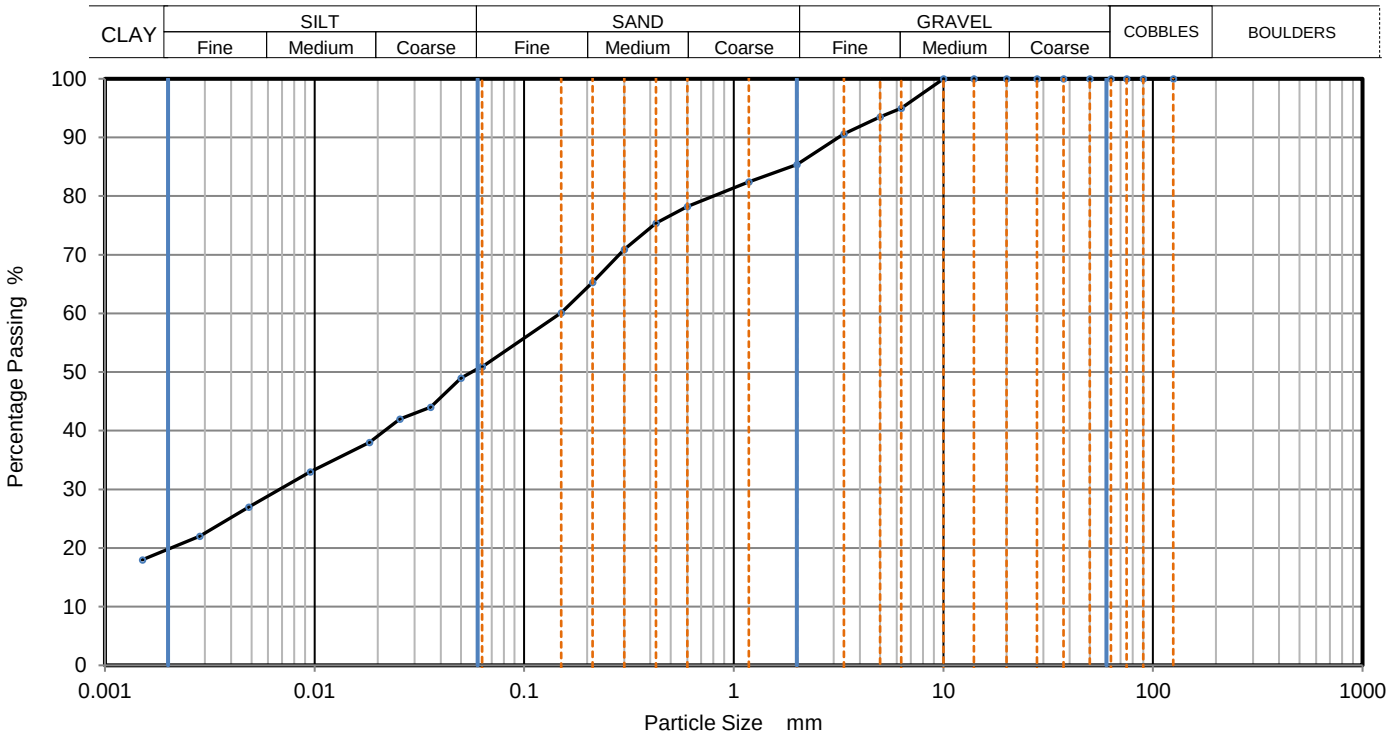
Grading Analysis		
D100	mm	
D60	mm	0.352
D30	mm	0.0341
D10	mm	0.00182
Uniformity Coefficient		190
Curvature Coefficient		1.8

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	**21-1682**
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.00
				Base	4.00
Specimen Reference	2	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062182



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.05001	49
75	100	0.03582	44
63	100	0.02549	42
50	100	0.01824	38
37.5	100	0.00953	33
28	100	0.00485	27
20	100	0.00283	22
14	100	0.00151	18
10	100		
6.3	95		
5	94		
3.35	91		
2	85		
1.18	82		
0.6	78	Particle density	(assumed)
0.425	75	2.65	Mg/m3
0.3	71		
0.212	65		
0.15	60		
0.063	51		

Dry Mass of sample, g: 216

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.6
Sand	34.5
Silt	31.2
Clay	19.7

Grading Analysis		
D100	mm	
D60	mm	0.149
D30	mm	0.00689
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

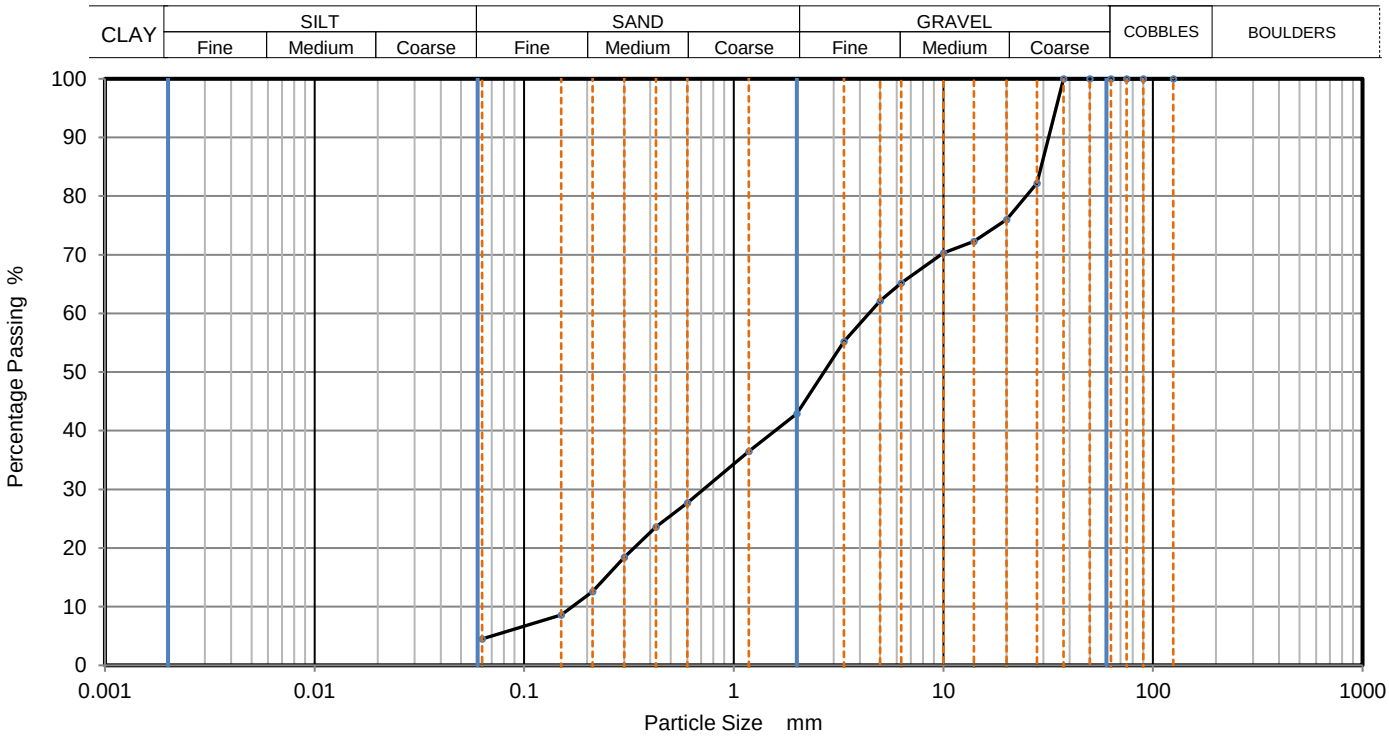
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Specimen Description	Brownish grey gravelly silty fine to coarse SAND.			Sample Depth (m) Top	5.00
				Base	6.60
Specimen Reference	2	Specimen Depth	5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022062184



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	82		
20	76		
14	72		
10	70		
6.3	65		
5	62		
3.35	55		
2	43		
1.18	37		
0.6	28		
0.425	24		
0.3	18		
0.212	13		
0.15	9		
0.063	5		

Dry Mass of sample, g: 2612

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	57.1
Sand	38.4
Fines <0.063mm	4.0

Grading Analysis		
D100	mm	
D60	mm	4.43
D30	mm	0.717
D10	mm	0.169
Uniformity Coefficient		26
Curvature Coefficient		0.68

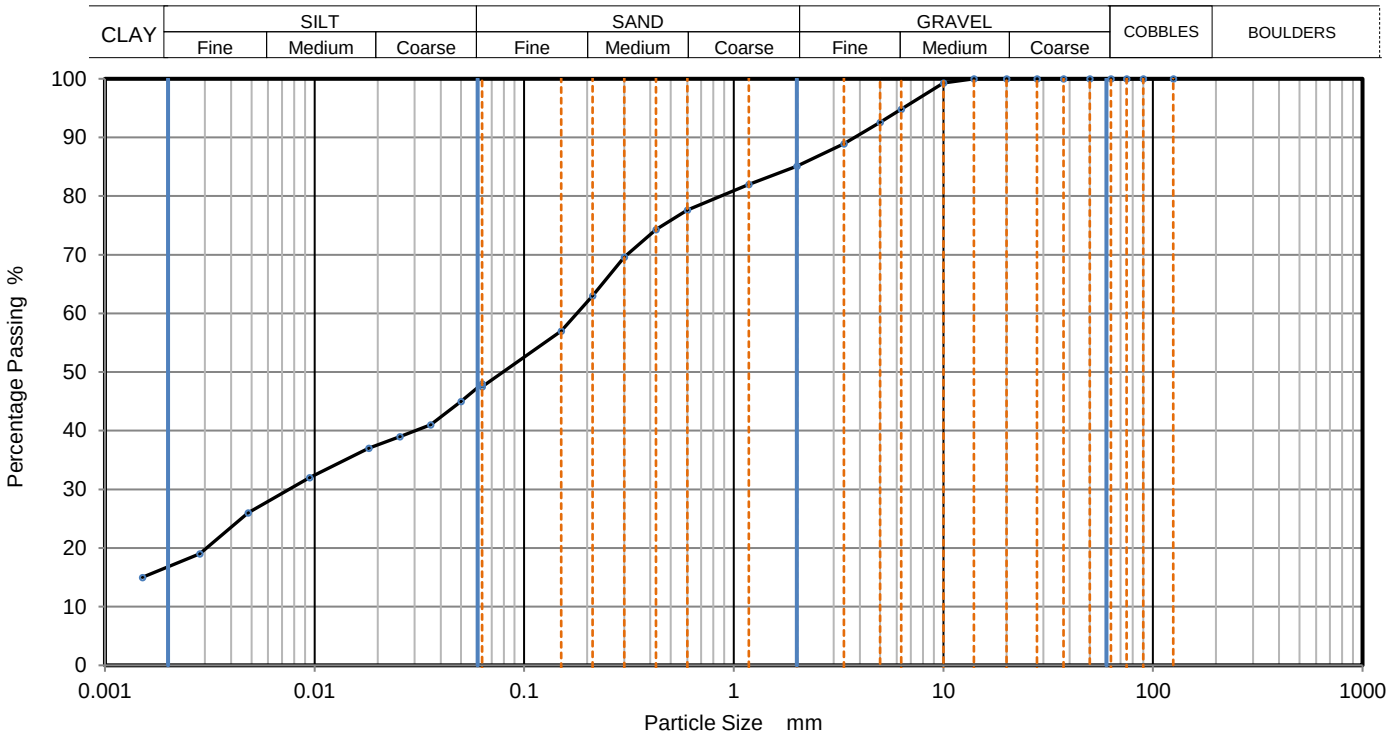
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	11
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	6.60
				Base	8.00
Specimen Reference	2	Specimen Depth	6.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062185



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.05000	45
75	100	0.03581	41
63	100	0.02548	39
50	100	0.01813	37
37.5	100	0.00948	32
28	100	0.00482	26
20	100	0.00283	19
14	100	0.00151	15
10	99		
6.3	95		
5	93		
3.35	89		
2	85		
1.18	82		
0.6	78	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	70		
0.212	63		
0.15	57		
0.063	48		

Dry Mass of sample, g: 213

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.9
Sand	37.6
Silt	30.4
Clay	17.1

Grading Analysis		
D100	mm	
D60	mm	0.178
D30	mm	0.00739
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

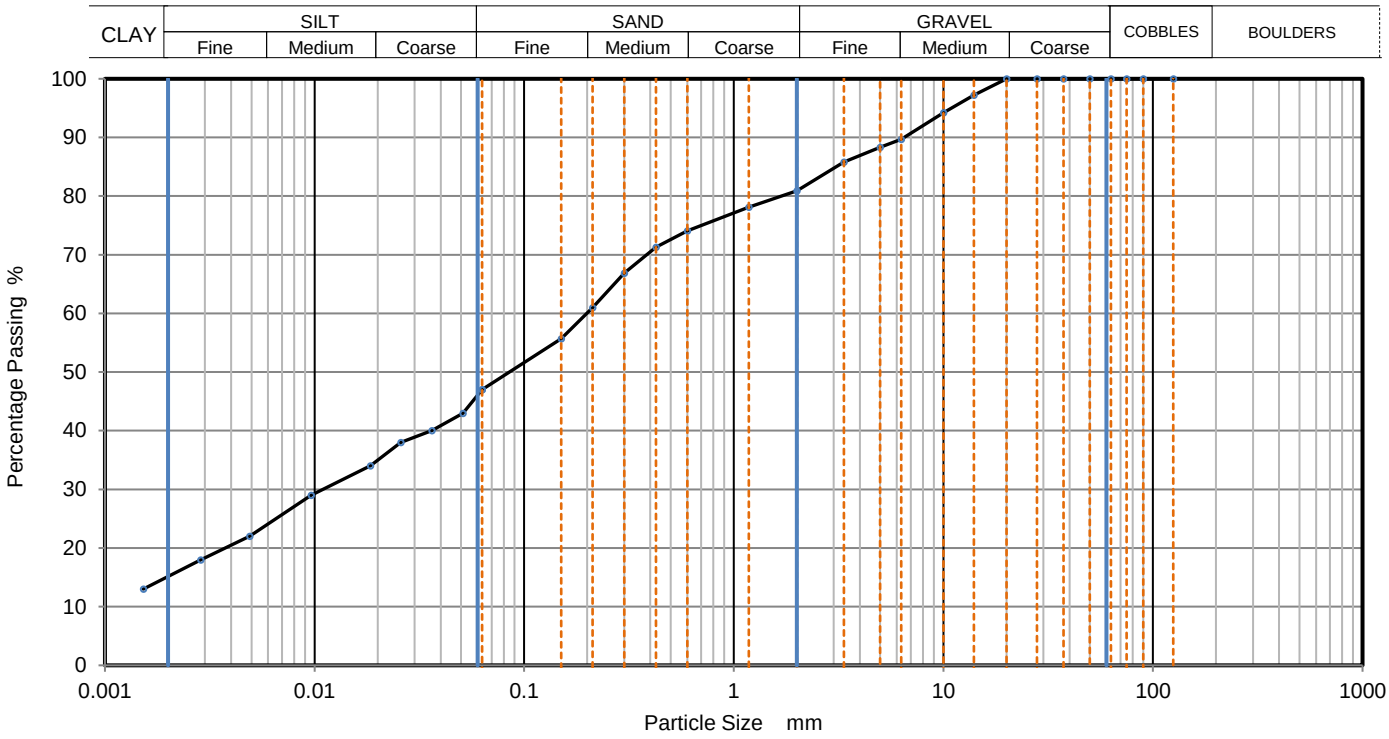
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	13
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.00
				Base	11.50
Specimen Reference	2	Specimen Depth	10 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062190



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.05097	43
75	100	0.03627	40
63	100	0.02580	38
50	100	0.01846	34
37.5	100	0.00965	29
28	100	0.00491	22
20	100	0.00286	18
14	97	0.00152	13
10	94		
6.3	90		
5	88		
3.35	86		
2	81		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	67		
0.212	61		
0.15	56		
0.063	47		

Dry Mass of sample, g: 206

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.1
Sand	33.9
Silt	31.6
Clay	15.4

Grading Analysis		
D100	mm	
D60	mm	0.198
D30	mm	0.011
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

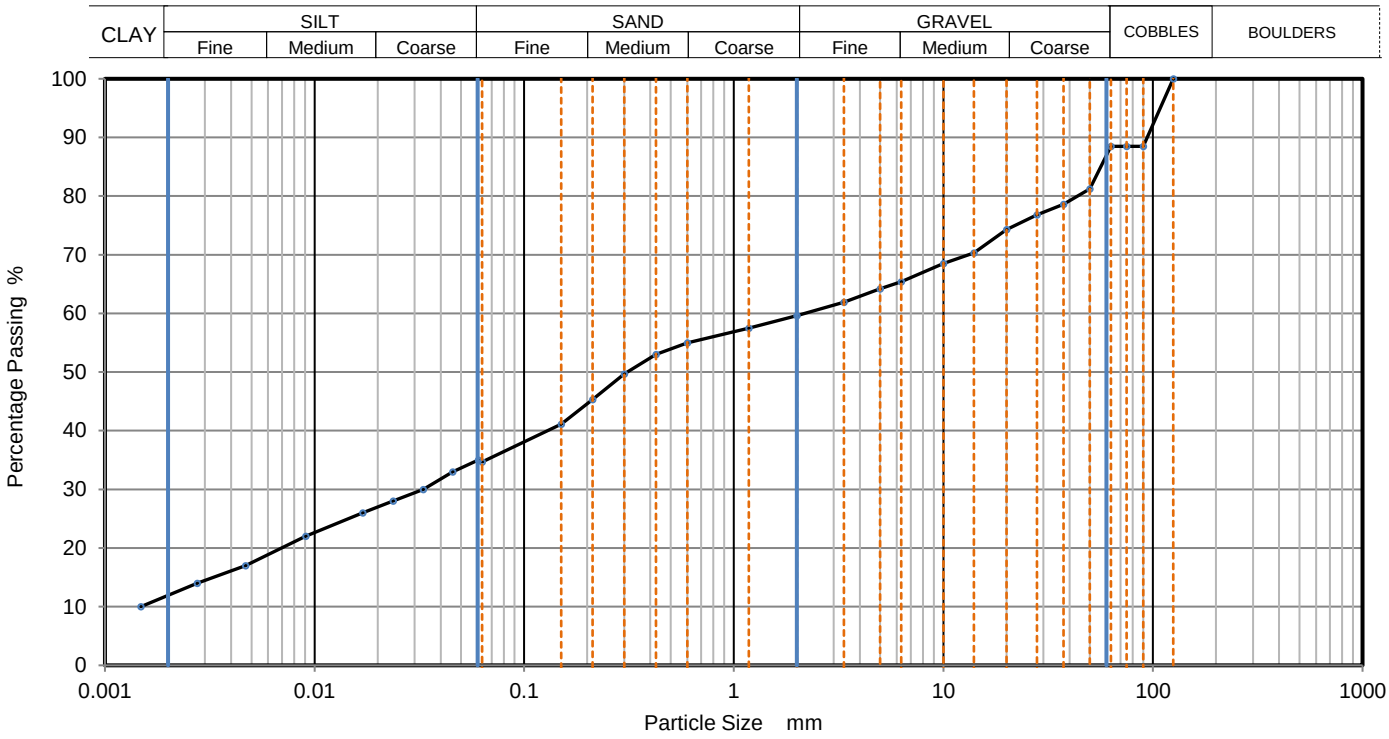
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy slightly gravelly silty CLAY with cobbles.			Sample Depth (m) Top	12.70
				Sample Depth (m) Base	14.20
Specimen Reference	9	Specimen Depth	12.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082595



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06039	35
90	89	0.04562	33
75	89	0.03300	30
63	89	0.02368	28
50	81	0.01698	26
37.5	79	0.00907	22
28	77	0.00468	17
20	74	0.00275	14
14	70	0.00148	10
10	69		
6.3	65		
5	64		
3.35	62		
2	60		
1.18	58		
0.6	55	Particle density	(assumed)
0.425	53	2.65	Mg/m3
0.3	50		
0.212	45		
0.15	41		
0.063	35		

Dry Mass of sample, g: 13231

Sample Proportions	% dry mass
Cobbles	11.5
Gravel	28.9
Sand	24.9
Silt	22.6
Clay	12.1

Grading Analysis		
D100	mm	125
D60	mm	2.19
D30	mm	0.0329
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

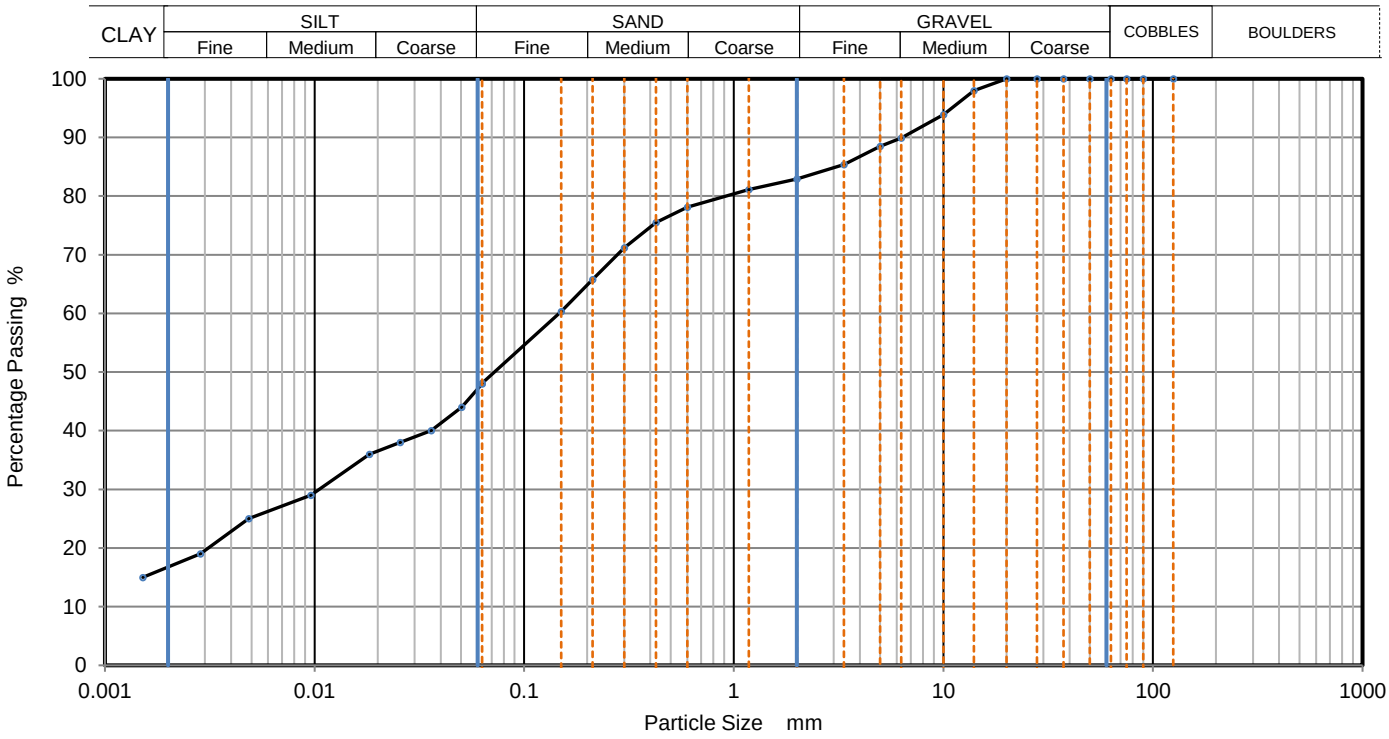
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.70
				Base	17.20
Specimen Reference	9	Specimen Depth	15.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082597



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.05033	44
75	100	0.03604	40
63	100	0.02564	38
50	100	0.01824	36
37.5	100	0.00959	29
28	100	0.00485	25
20	100	0.00285	19
14	98	0.00152	15
10	94		
6.3	90		
5	89		
3.35	85		
2	83		
1.18	81		
0.6	78	Particle density	(assumed)
0.425	76	2.65	Mg/m3
0.3	71		
0.212	66		
0.15	60		
0.063	48		

Dry Mass of sample, g: 558

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.1
Sand	34.8
Silt	31.6
Clay	16.5

Grading Analysis		
D100	mm	
D60	mm	0.146
D30	mm	0.0103
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

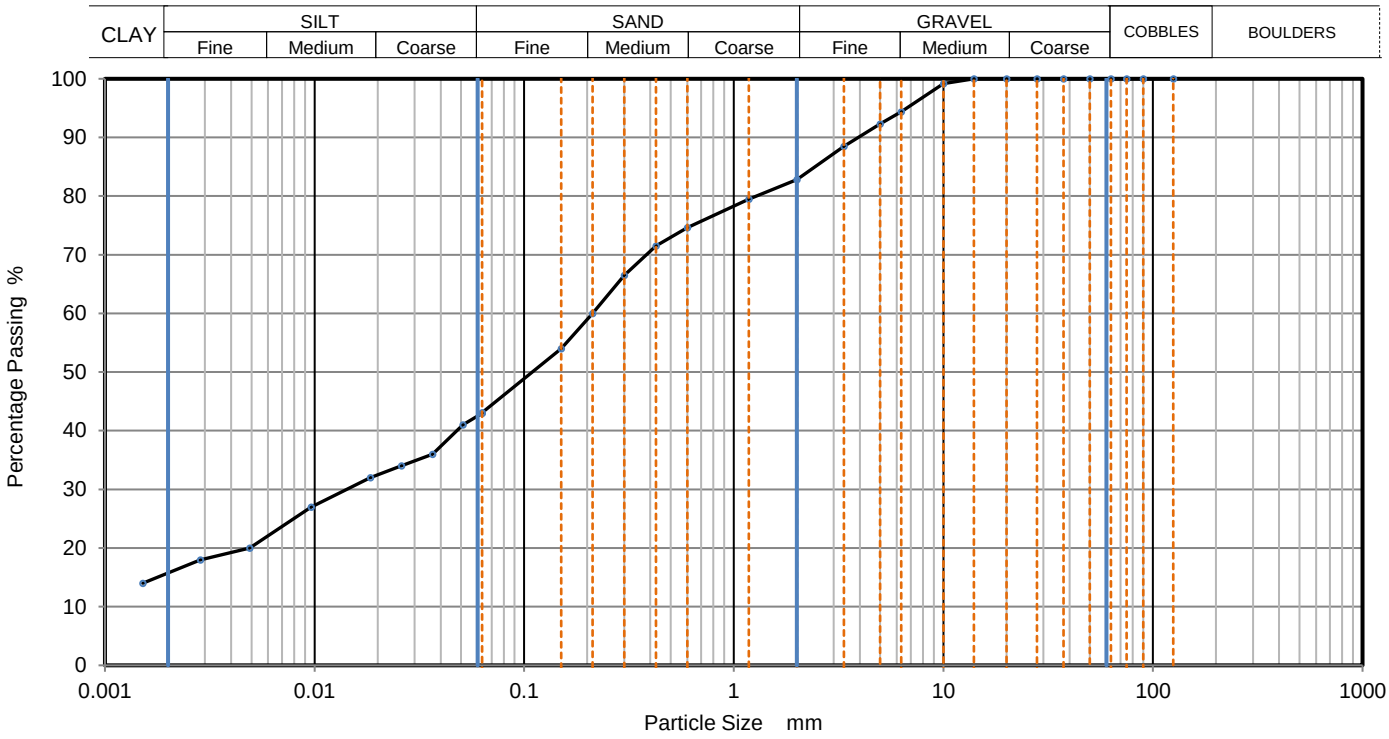
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.20
				Base	2.00
Specimen Reference	2	Specimen Depth	1.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062191



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.05096	41
75	100	0.03648	36
63	100	0.02595	34
50	100	0.01846	32
37.5	100	0.00965	27
28	100	0.00491	20
20	100	0.00285	18
14	100	0.00152	14
10	99		
6.3	94		
5	92		
3.35	89		
2	83		
1.18	80		
0.6	75	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	67		
0.212	60		
0.15	54		
0.063	43		

Dry Mass of sample, g: 203

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.2
Sand	39.7
Silt	27.5
Clay	15.6

Grading Analysis		
D100	mm	
D60	mm	0.211
D30	mm	0.0144
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

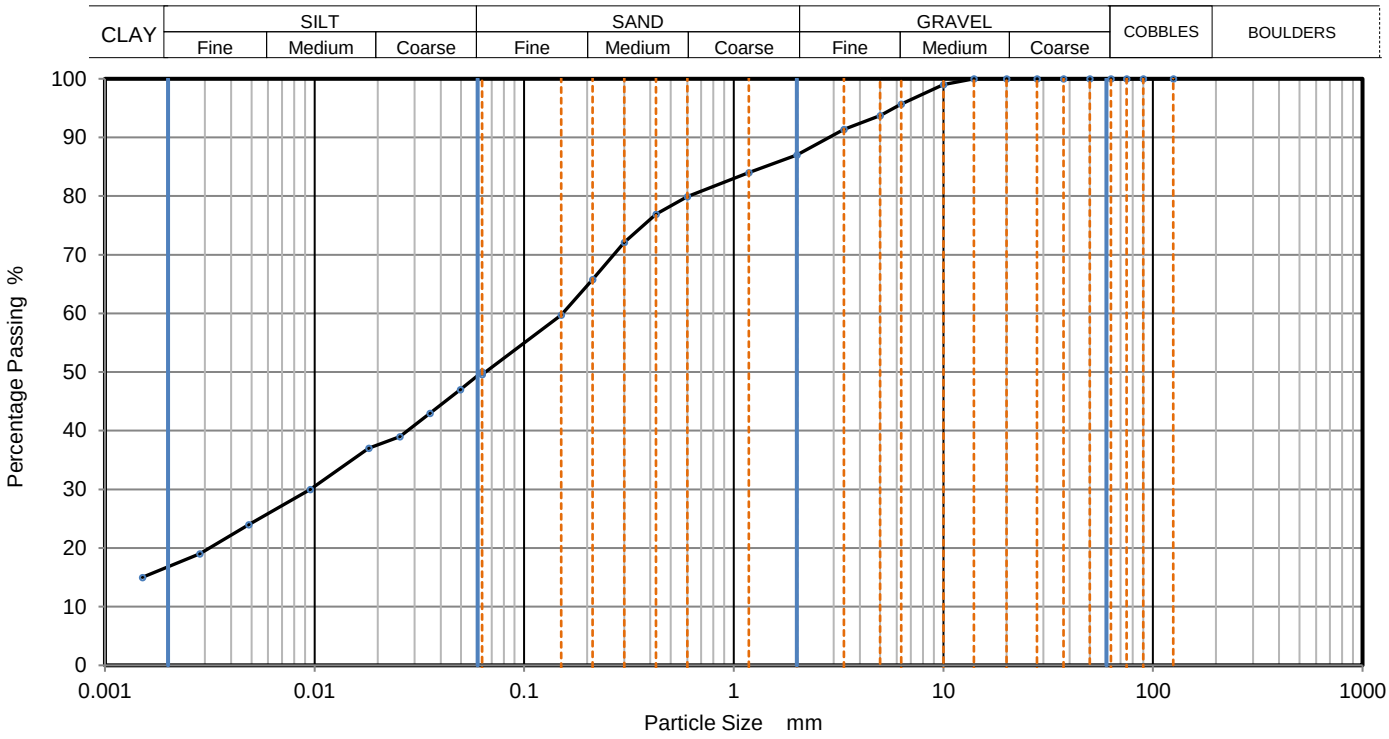
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Base	5.00
Specimen Reference	2	Specimen Depth	4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022062197



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	50
90	100	0.04968	47
75	100	0.03559	43
63	100	0.02548	39
50	100	0.01813	37
37.5	100	0.00953	30
28	100	0.00485	24
20	100	0.00283	19
14	100	0.00151	15
10	99		
6.3	96		
5	94		
3.35	91		
2	87		
1.18	84		
0.6	80	Particle density	(assumed)
0.425	77	2.65	Mg/m3
0.3	72		
0.212	66		
0.15	60		
0.063	50		

Dry Mass of sample, g: 206

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	13.0
Sand	37.3
Silt	32.7
Clay	17.0

Grading Analysis		
D100	mm	
D60	mm	0.153
D30	mm	0.00934
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

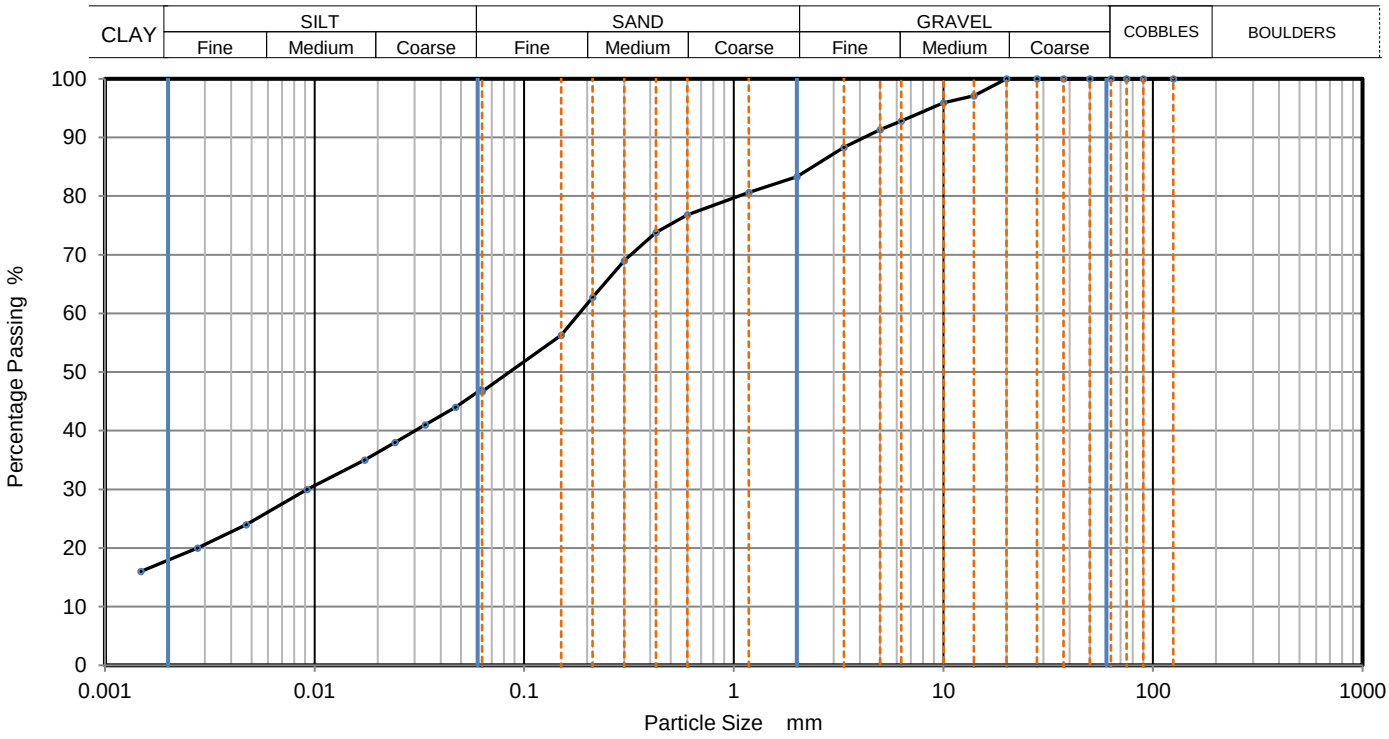
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.00
				Base	9.50
Specimen Reference	9	Specimen Depth	8 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082598



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06230	47
90	100	0.04701	44
75	100	0.03373	41
63	100	0.02418	38
50	100	0.01734	35
37.5	100	0.00919	30
28	100	0.00471	24
20	100	0.00277	20
14	97	0.00148	16
10	96		
6.3	93		
5	91		
3.35	88		
2	83		
1.18	81		
0.6	77	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	69		
0.212	63		
0.15	56		
0.063	47		

Dry Mass of sample, g: 550

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.7
Sand	36.6
Silt	29.1
Clay	17.6

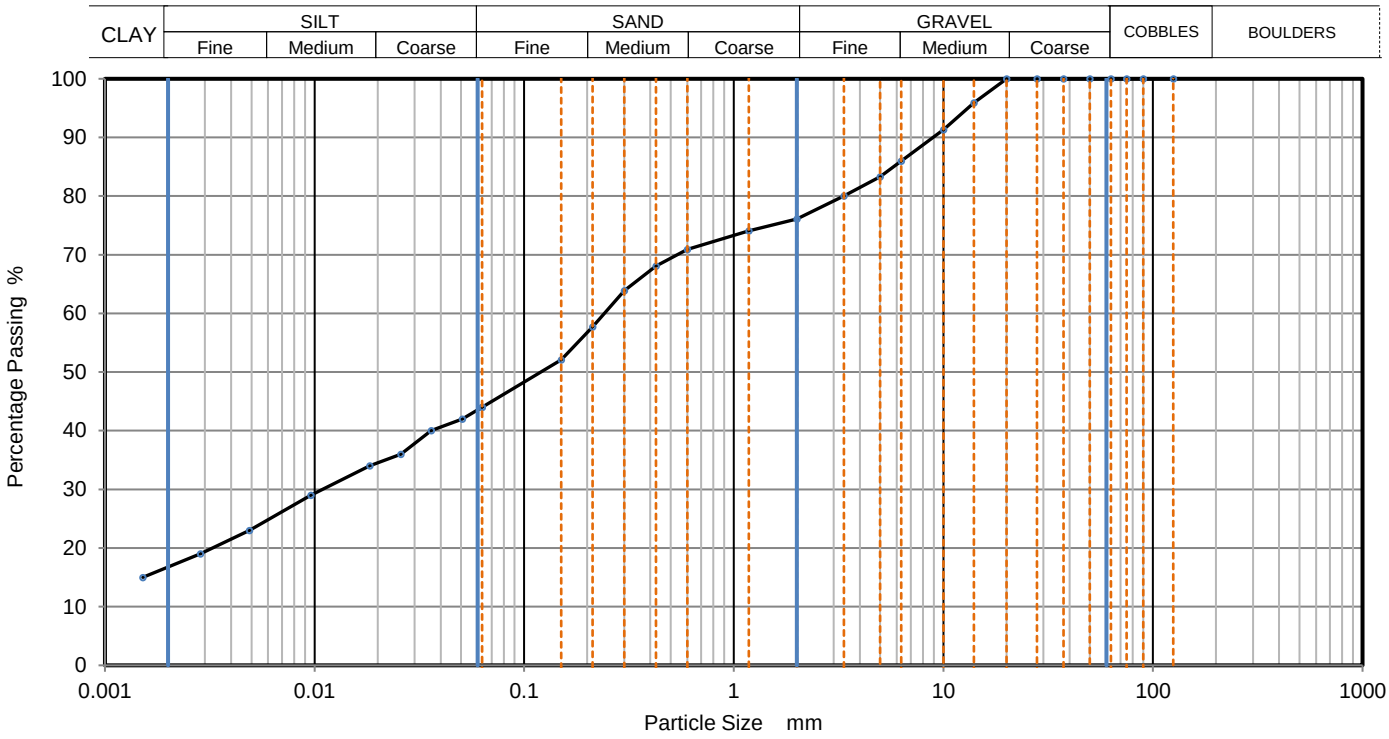
Grading Analysis		
D100	mm	
D60	mm	0.183
D30	mm	0.00948
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		5
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	12.50
					Base	14.00
Specimen Reference	9	Specimen Depth	12.5 m	Sample Type		C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus20220825102



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.05065	42
75	100	0.03604	40
63	100	0.02580	36
50	100	0.01835	34
37.5	100	0.00959	29
28	100	0.00488	23
20	100	0.00285	19
14	96	0.00152	15
10	91		
6.3	86		
5	83		
3.35	80		
2	76		
1.18	74		
0.6	71	Particle density	(assumed)
0.425	68	2.65	Mg/m3
0.3	64		
0.212	58		
0.15	52		
0.063	44		

Dry Mass of sample, g: 566

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.9
Sand	32.1
Silt	27.5
Clay	16.5

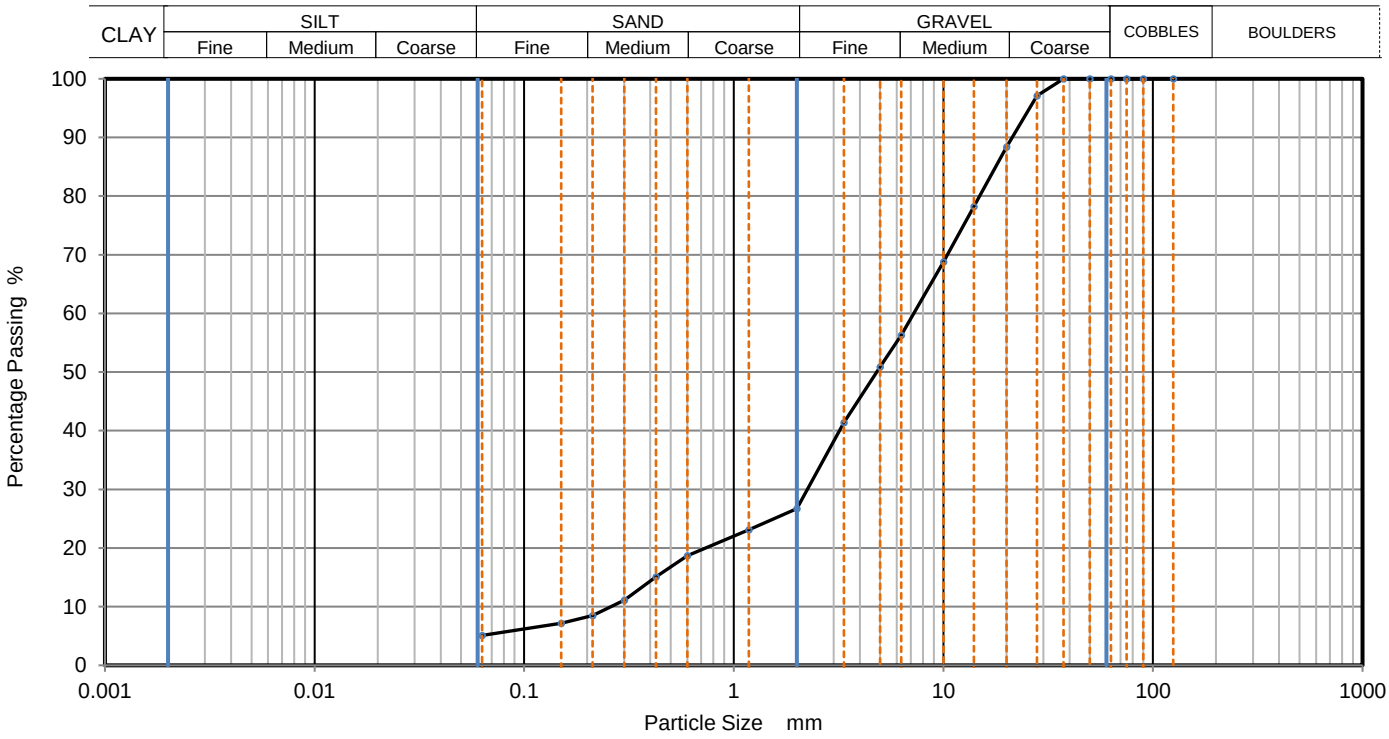
Grading Analysis		
D100	mm	
D60	mm	0.241
D30	mm	0.0106
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brown gravelly slightly clayey fine to coarse SAND.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022071471



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	88		
14	78		
10	69		
6.3	56		
5	51		
3.35	41		
2	27		
1.18	23		
0.6	19		
0.425	15		
0.3	11		
0.212	9		
0.15	7		
0.063	5		

Dry Mass of sample, g	2902

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	73.3
Sand	21.6
Fines <0.063mm	5.0

Grading Analysis		
D100	mm	
D60	mm	7.22
D30	mm	2.24
D10	mm	0.259
Uniformity Coefficient		28
Curvature Coefficient		2.7

Remarks

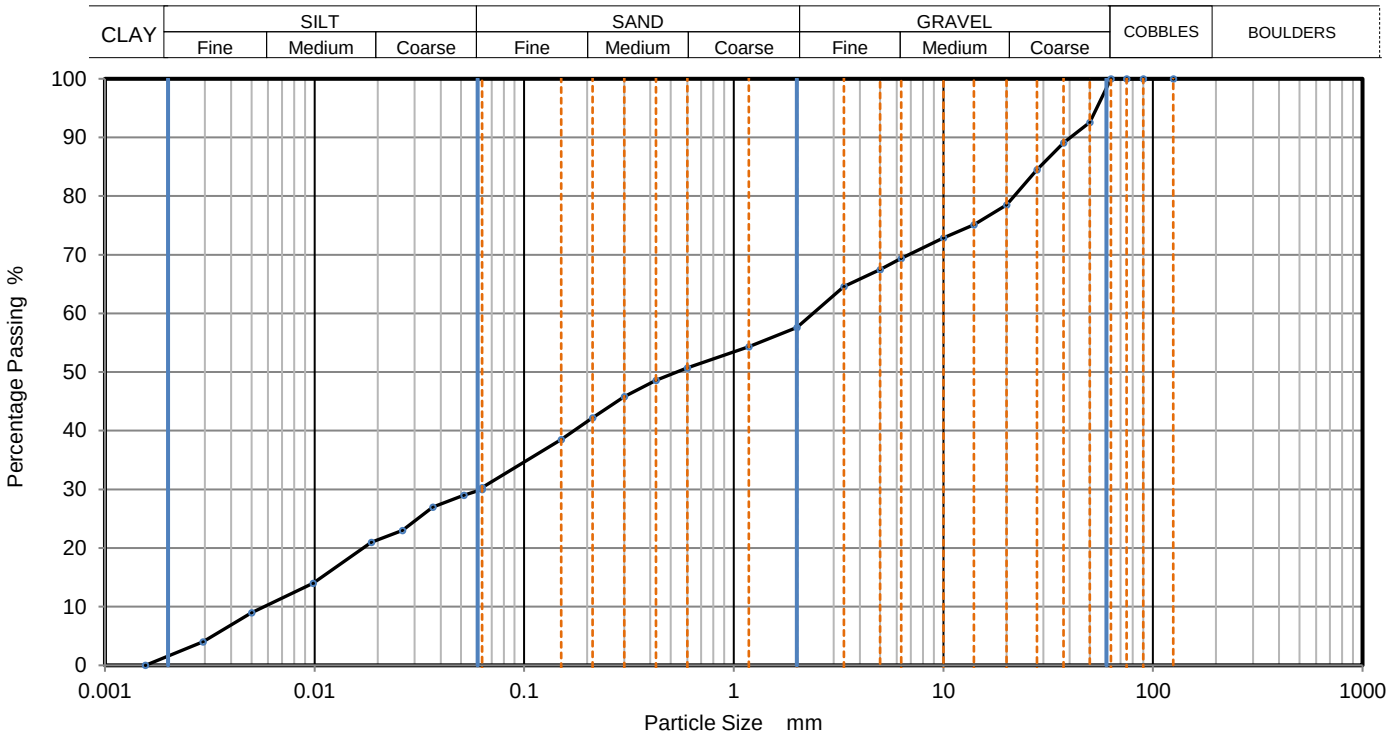
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

UKAS TESTING

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	2.80
				Base	3.00
Specimen Reference	2	Specimen Depth	2.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071473



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	30
90	100	0.05157	29
75	100	0.03668	27
63	100	0.02624	23
50	93	0.01866	21
37.5	89	0.00985	14
28	85	0.00501	9
20	79	0.00293	4
14	75	0.00156	0
10	73		
6.3	69		
5	68		
3.35	65		
2	58		
1.18	54		
0.6	51	Particle density	(assumed)
0.425	49	2.65	Mg/m3
0.3	46		
0.212	42		
0.15	39		
0.063	30		

Dry Mass of sample, g: 4477

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	42.4
Sand	27.3
Silt	28.9
Clay	1.4

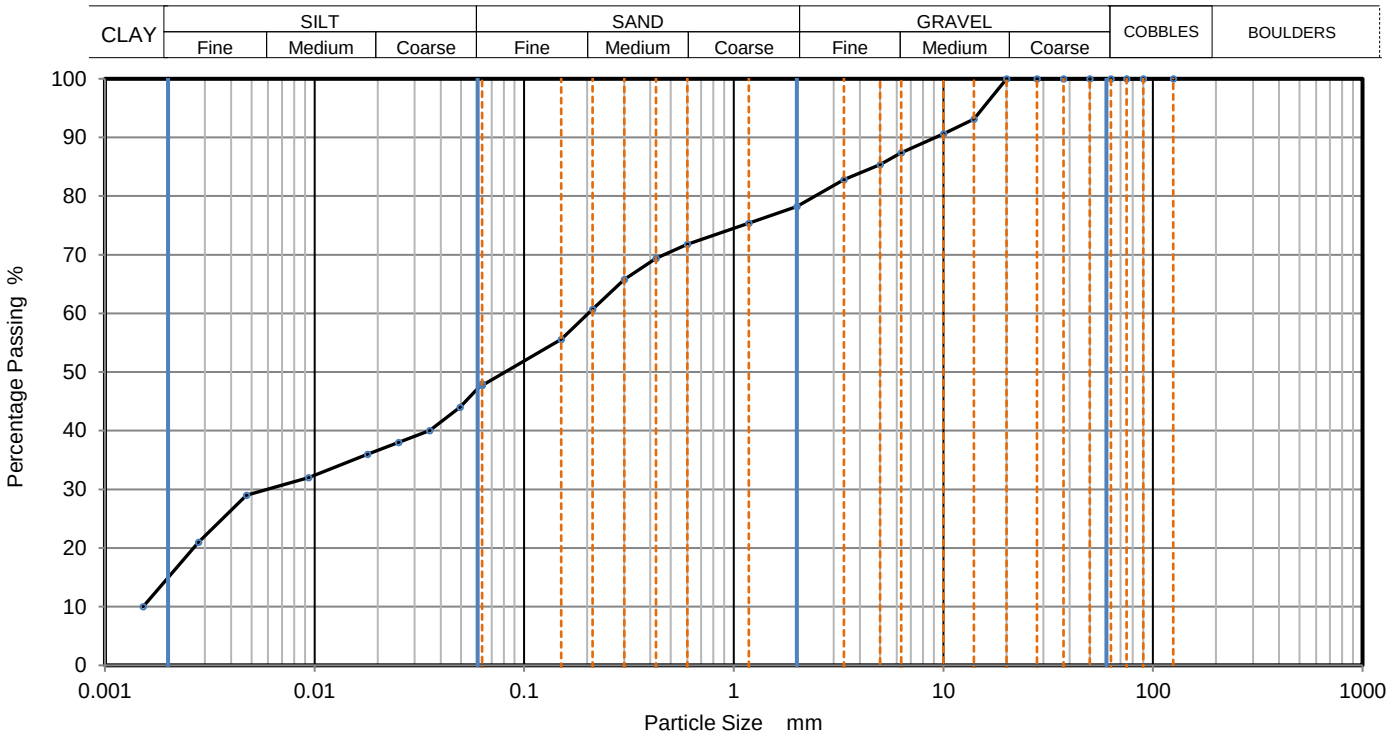
Grading Analysis		
D100	mm	
D60	mm	2.38
D30	mm	0.0608
D10	mm	0.00574
Uniformity Coefficient		420
Curvature Coefficient		0.27

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		21-1682
				Borehole/Pit No.		RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		20
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	10.00
					Base	10.50
Specimen Reference	2	Specimen Depth	10 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022071479



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.04939	44
75	100	0.03537	40
63	100	0.02517	38
50	100	0.01791	36
37.5	100	0.00936	32
28	100	0.00474	29
20	100	0.00280	21
14	93	0.00152	10
10	91		
6.3	87		
5	85		
3.35	83		
2	78		
1.18	75		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	66		
0.212	61		
0.15	56		
0.063	48		

Dry Mass of sample, g: 510

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.8
Sand	30.5
Silt	33.0
Clay	14.7

Grading Analysis		
D100	mm	
D60	mm	0.202
D30	mm	0.00606
D10	mm	0.00156
Uniformity Coefficient		130
Curvature Coefficient		0.12

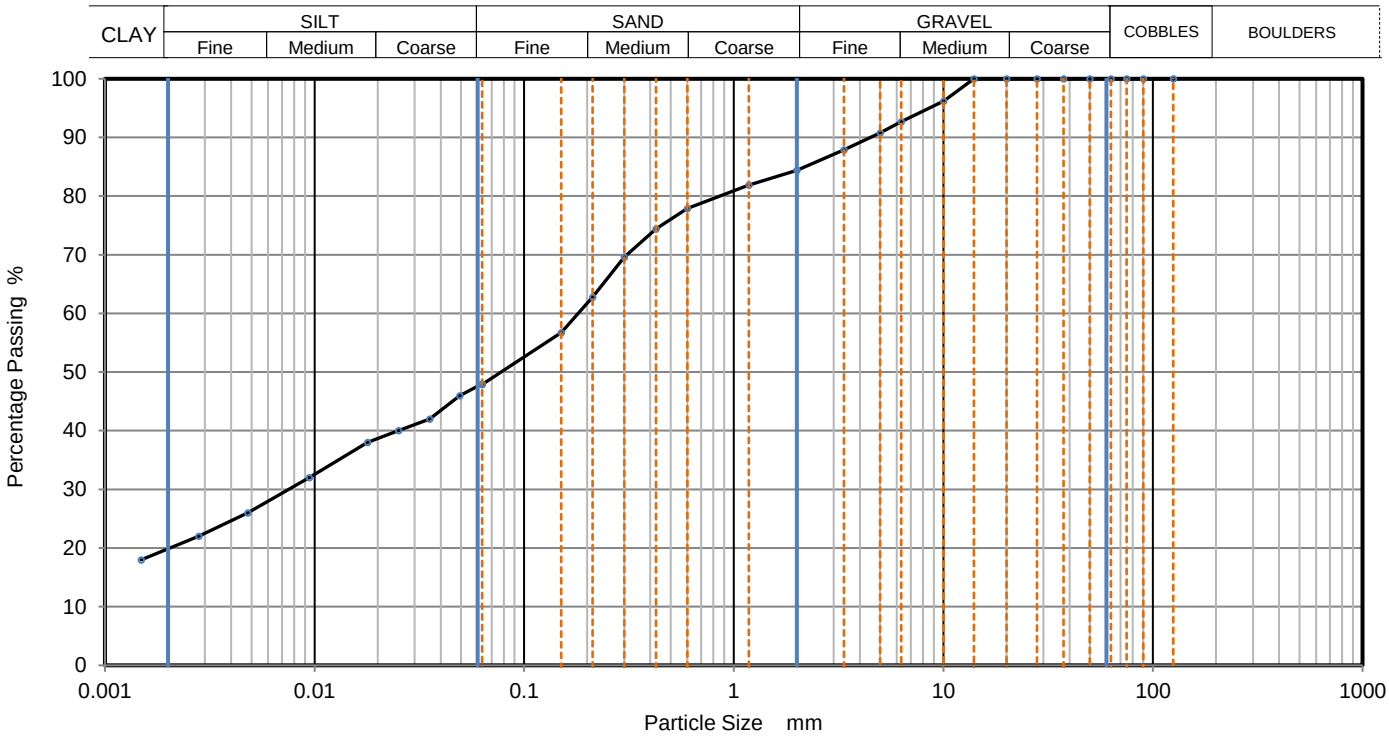
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		3
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	15.00
					Base	16.50
Specimen Reference	9	Specimen Depth	15 m	Sample Type		C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus20220825105



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.04935	46
75	100	0.03536	42
63	100	0.02516	40
50	100	0.01791	38
37.5	100	0.00942	32
28	100	0.00479	26
20	100	0.00280	22
14	100	0.00149	18
10	96		
6.3	93		
5	91		
3.35	88		
2	84		
1.18	82		
0.6	78	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	70		
0.212	63		
0.15	57		
0.063	48		

Dry Mass of sample, g: 572

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.6
Sand	36.4
Silt	28.2
Clay	19.8

Grading Analysis		
D100	mm	
D60	mm	0.181
D30	mm	0.00757
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

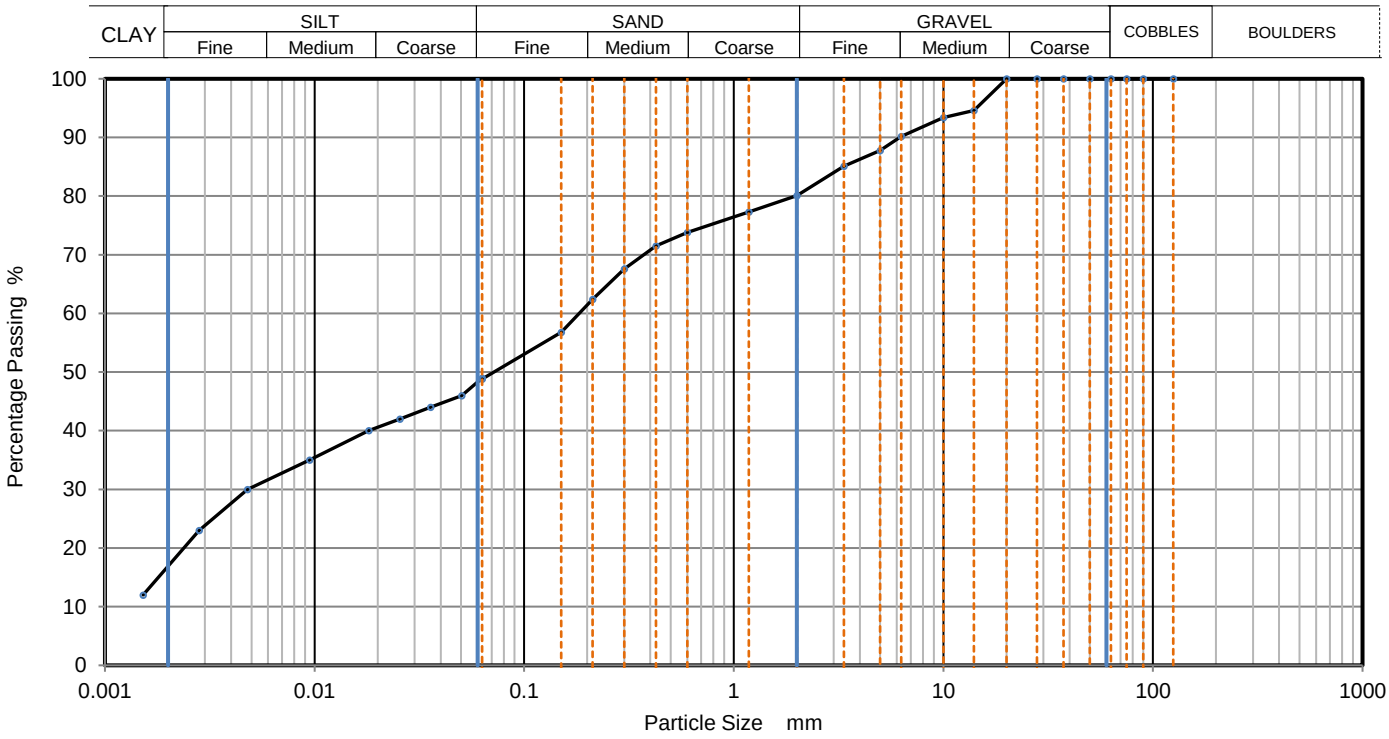
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	3	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070545



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	49
90	100	0.05034	46
75	100	0.03581	44
63	100	0.02548	42
50	100	0.01813	40
37.5	100	0.00947	35
28	100	0.00479	30
20	100	0.00281	23
14	95	0.00152	12
10	93		
6.3	90		
5	88		
3.35	85		
2	80		
1.18	77		
0.6	74	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	68		
0.212	62		
0.15	57		
0.063	49		

Dry Mass of sample, g: 531

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.9
Sand	31.3
Silt	32.0
Clay	16.8

Grading Analysis		
D100	mm	
D60	mm	0.183
D30	mm	0.00471
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

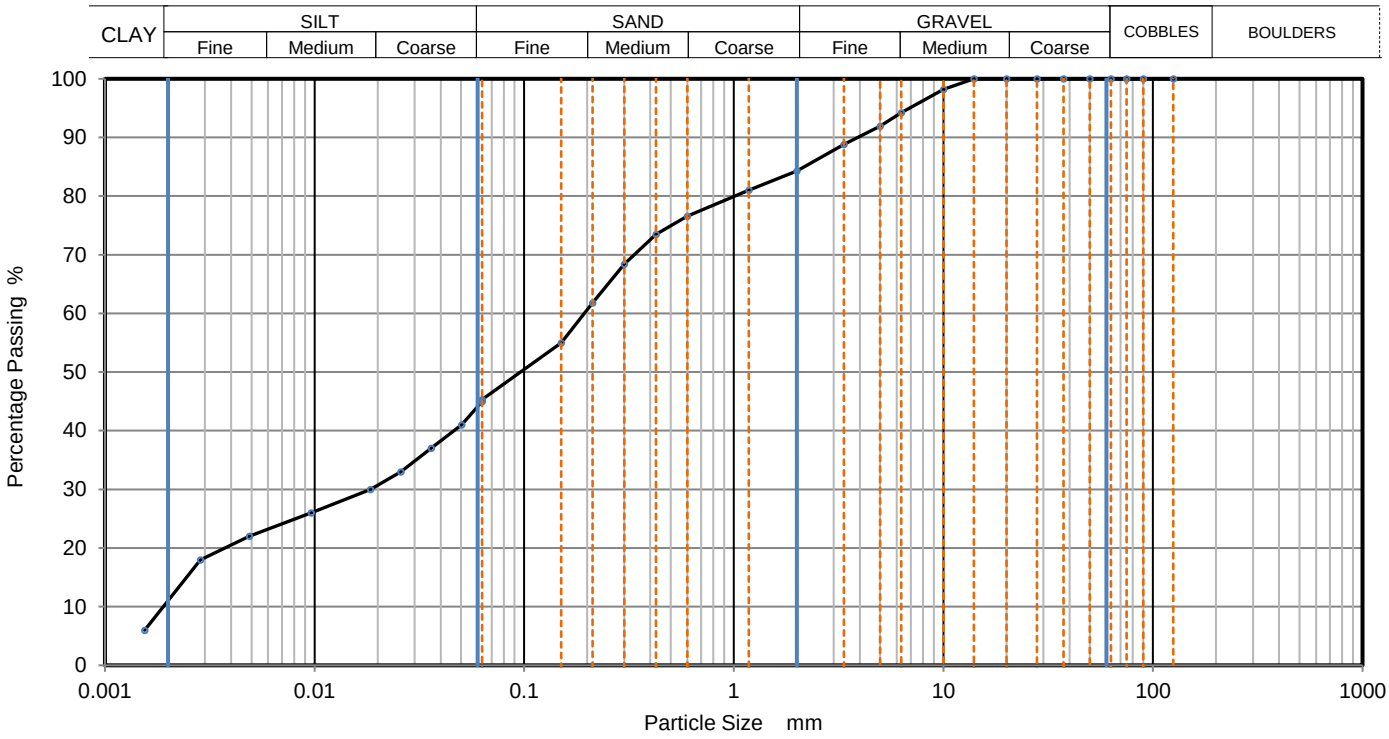
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.80
				Base	3.00
Specimen Reference	3	Specimen Depth	2.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070549



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05033	41
75	100	0.03604	37
63	100	0.02580	33
50	100	0.01846	30
37.5	100	0.00965	26
28	100	0.00488	22
20	100	0.00285	18
14	100	0.00155	6
10	98		
6.3	94		
5	92		
3.35	89		
2	84		
1.18	81		
0.6	77	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	68		
0.212	62		
0.15	55		
0.063	45		

Dry Mass of sample, g: 415

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.7
Sand	39.0
Silt	34.4
Clay	10.9

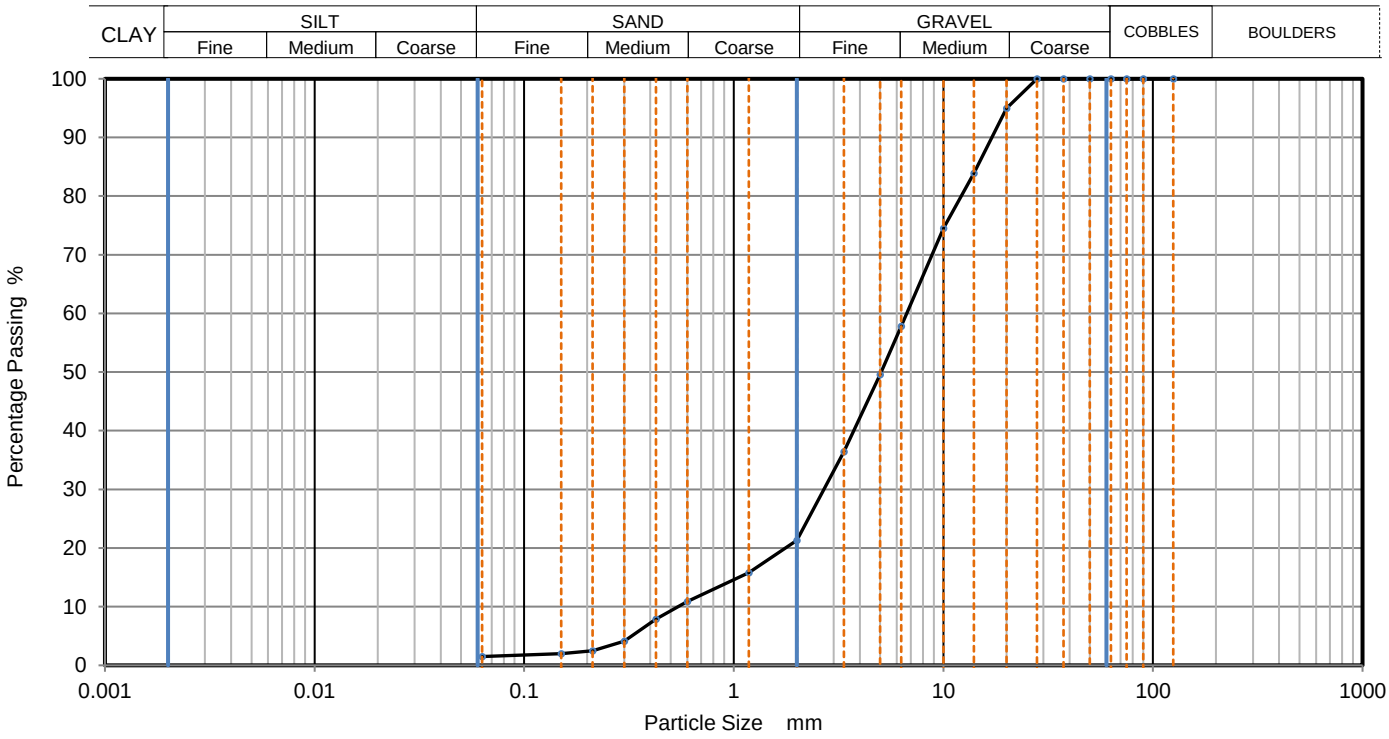
Grading Analysis		
D100	mm	
D60	mm	0.193
D30	mm	0.0192
D10	mm	0.00191
Uniformity Coefficient		100
Curvature Coefficient		1

Remarks

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		7
Specimen Description	Brownish grey gravelly slightly silty fine to coarse SAND.				Sample Depth (m)	Top	5.80
						Base	6.00
Specimen Reference	3	Specimen Depth	5.8	m	Sample Type		B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID		Caus2022070553



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	84		
10	75		
6.3	58		
5	50		
3.35	36		
2	21		
1.18	16		
0.6	11		
0.425	8		
0.3	4		
0.212	3		
0.15	2		
0.063	2		

Dry Mass of sample, g	2653

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	78.7
Sand	19.8
Fines <0.063mm	2.0

Grading Analysis		
D100	mm	
D60	mm	6.7
D30	mm	2.69
D10	mm	0.544
Uniformity Coefficient		12
Curvature Coefficient		2

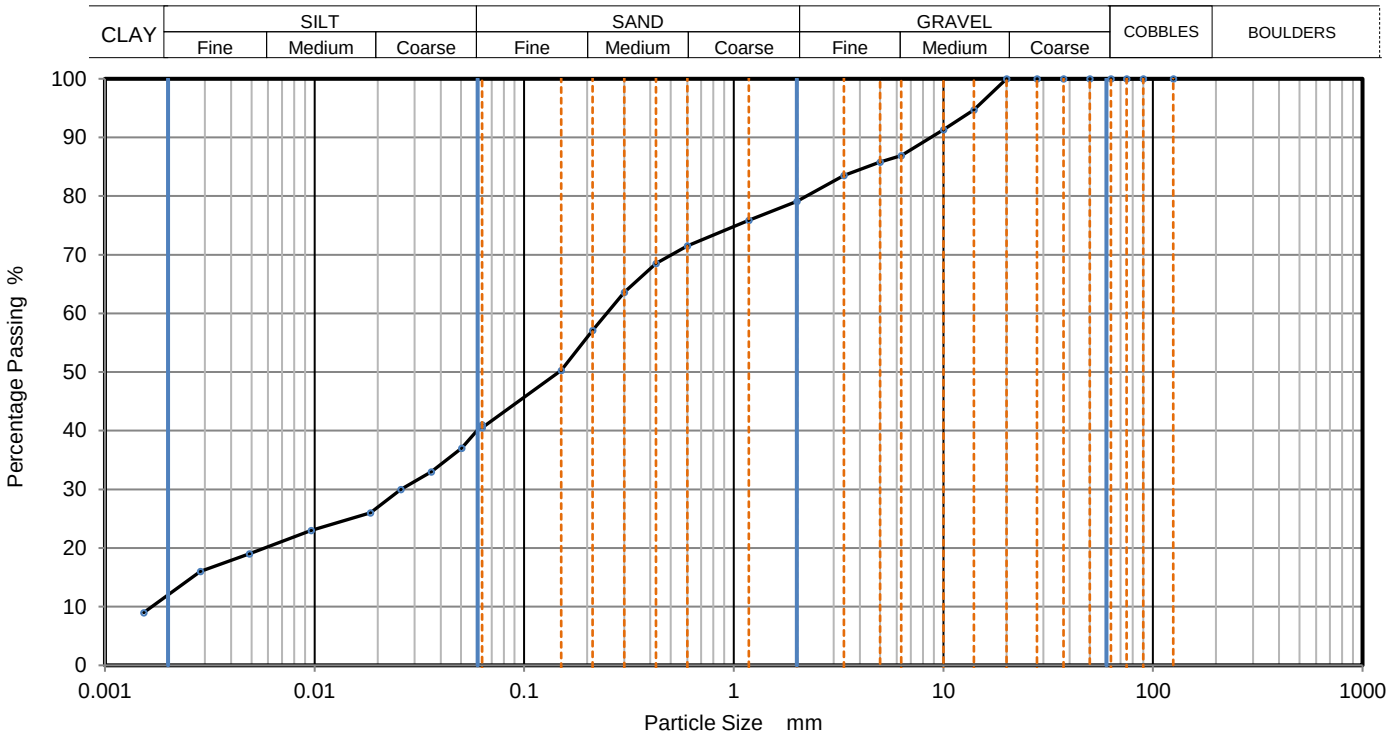
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					**21-1682**
Borehole/Pit No.					RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	18
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.50
				Base	9.00
Specimen Reference	3	Specimen Depth	8.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070555



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.05033	37
75	100	0.03604	33
63	100	0.02580	30
50	100	0.01846	26
37.5	100	0.00965	23
28	100	0.00488	19
20	100	0.00285	16
14	95	0.00153	9
10	91		
6.3	87		
5	86		
3.35	84		
2	79		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	64		
0.212	57		
0.15	50		
0.063	41		

Dry Mass of sample, g: 532

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.9
Sand	38.5
Silt	28.8
Clay	11.8

Grading Analysis		
D100	mm	
D60	mm	0.247
D30	mm	0.026
D10	mm	0.0017
Uniformity Coefficient		150
Curvature Coefficient		1.6

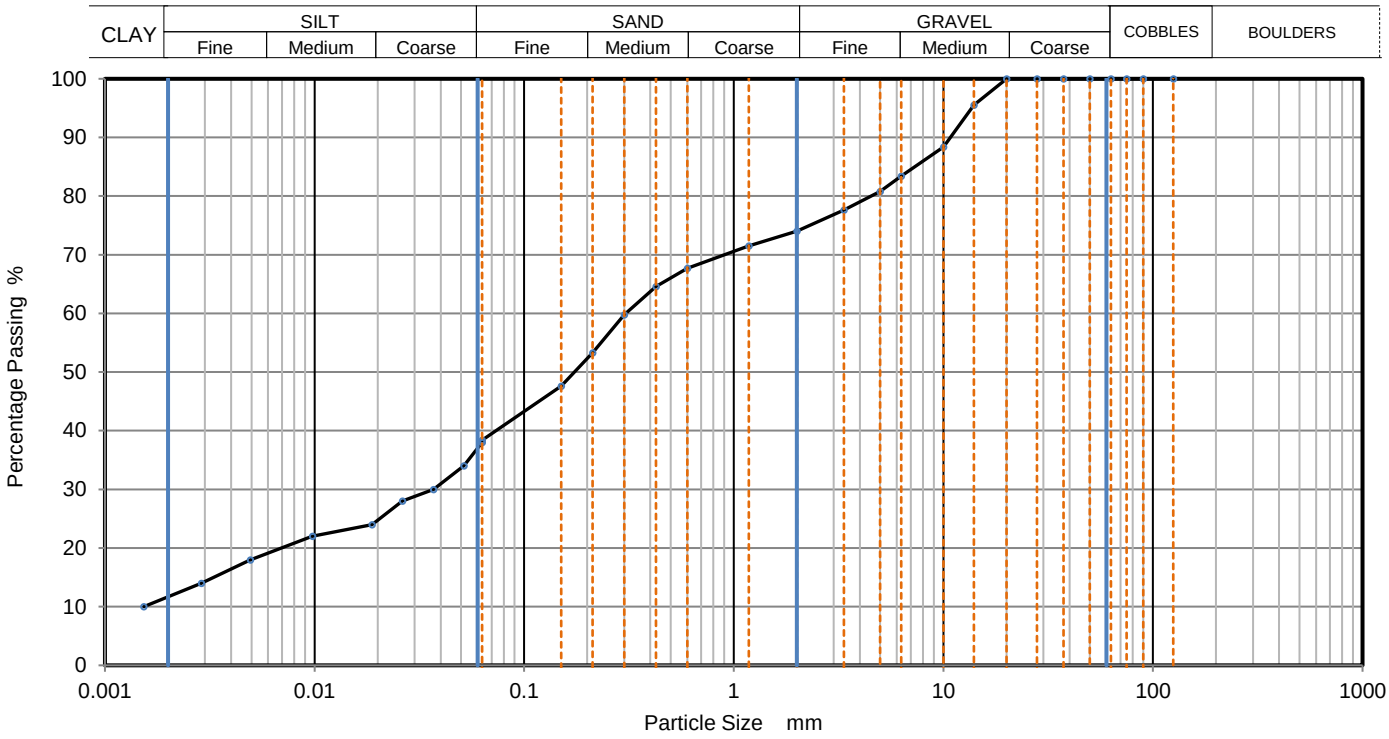
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly clayey SILT.			Sample Depth (m) Top	9.70
				Base	11.20
Specimen Reference	6	Specimen Depth	9.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082936



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	38
90	100	0.05160	34
75	100	0.03693	30
63	100	0.02627	28
50	100	0.01879	24
37.5	100	0.00976	22
28	100	0.00493	18
20	100	0.00288	14
14	96	0.00153	10
10	88		
6.3	83		
5	81		
3.35	78		
2	74		
1.18	72		
0.6	68	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	60		
0.212	53		
0.15	48		
0.063	38		

Dry Mass of sample, g: 557

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.0
Sand	35.6
Silt	26.6
Clay	11.8

Grading Analysis		
D100	mm	
D60	mm	0.304
D30	mm	0.035
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

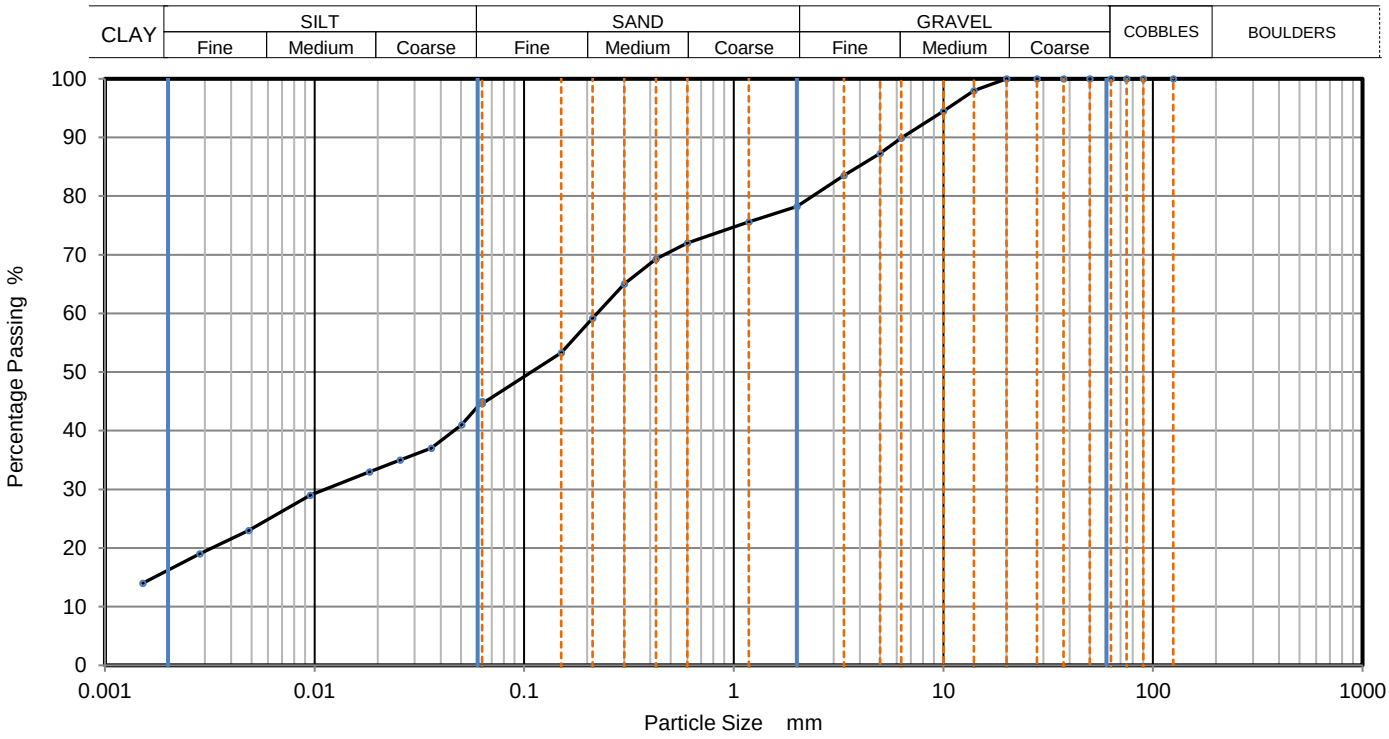
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.70
				Base	17.20
Specimen Reference	6	Specimen Depth	15.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082939



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	45
90	100	0.05033	41
75	100	0.03604	37
63	100	0.02564	35
50	100	0.01824	33
37.5	100	0.00953	29
28	100	0.00485	23
20	100	0.00283	19
14	98	0.00152	14
10	95		
6.3	90		
5	87		
3.35	84		
2	78		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	65		
0.212	59		
0.15	53		
0.063	45		

Dry Mass of sample, g: 583

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.8
Sand	33.6
Silt	28.4
Clay	16.2

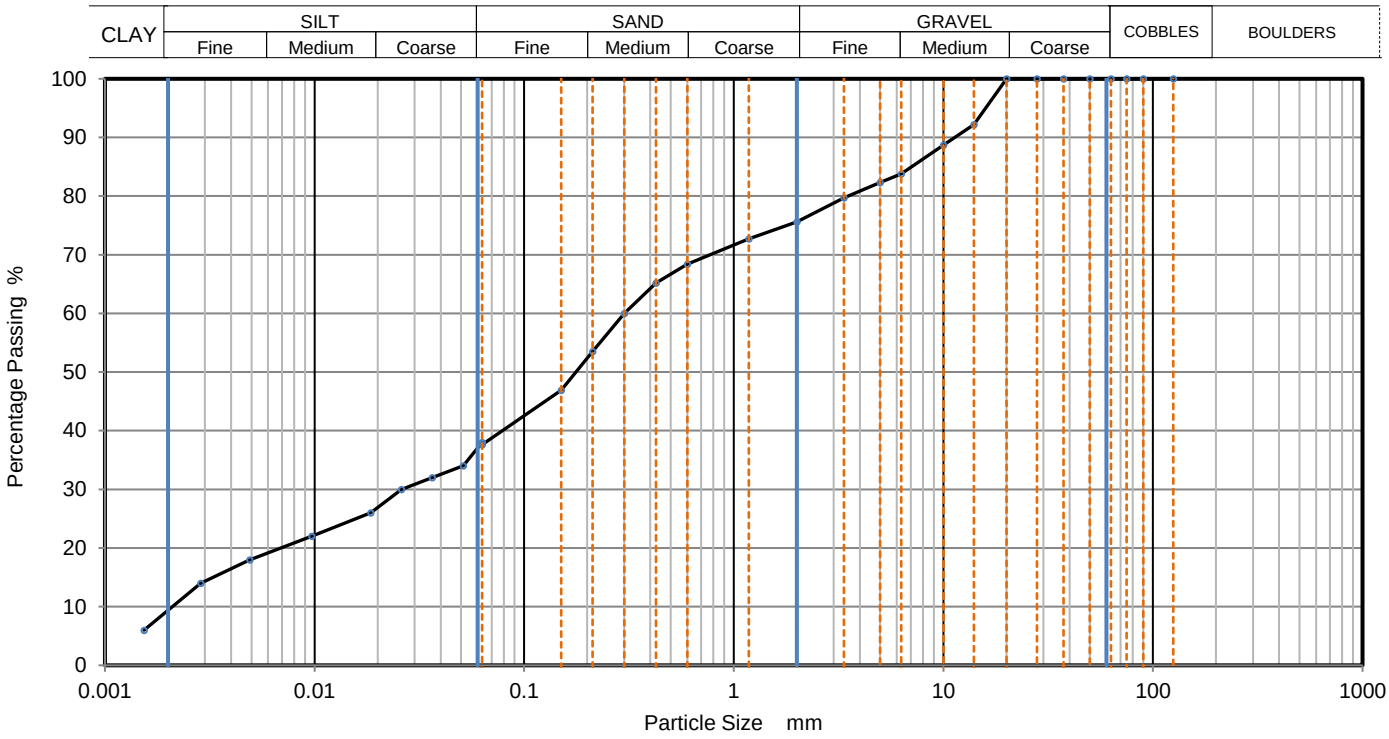
Grading Analysis		
D100	mm	
D60	mm	0.222
D30	mm	0.0111
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	0.80
					Base	1.00
Specimen Reference	3	Specimen Depth	0.8 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022070557



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	38
90	100	0.05127	34
75	100	0.03647	32
63	100	0.02594	30
50	100	0.01855	26
37.5	100	0.00969	22
28	100	0.00490	18
20	100	0.00286	14
14	92	0.00154	6
10	89		
6.3	84		
5	82		
3.35	80		
2	76		
1.18	73		
0.6	68	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	60		
0.212	54		
0.15	47		
0.063	38		

Dry Mass of sample, g: 525

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	24.4
Sand	38.0
Silt	28.3
Clay	9.3

Grading Analysis		
D100	mm	
D60	mm	0.3
D30	mm	0.0274
D10	mm	0.00211
Uniformity Coefficient		140
Curvature Coefficient		1.2

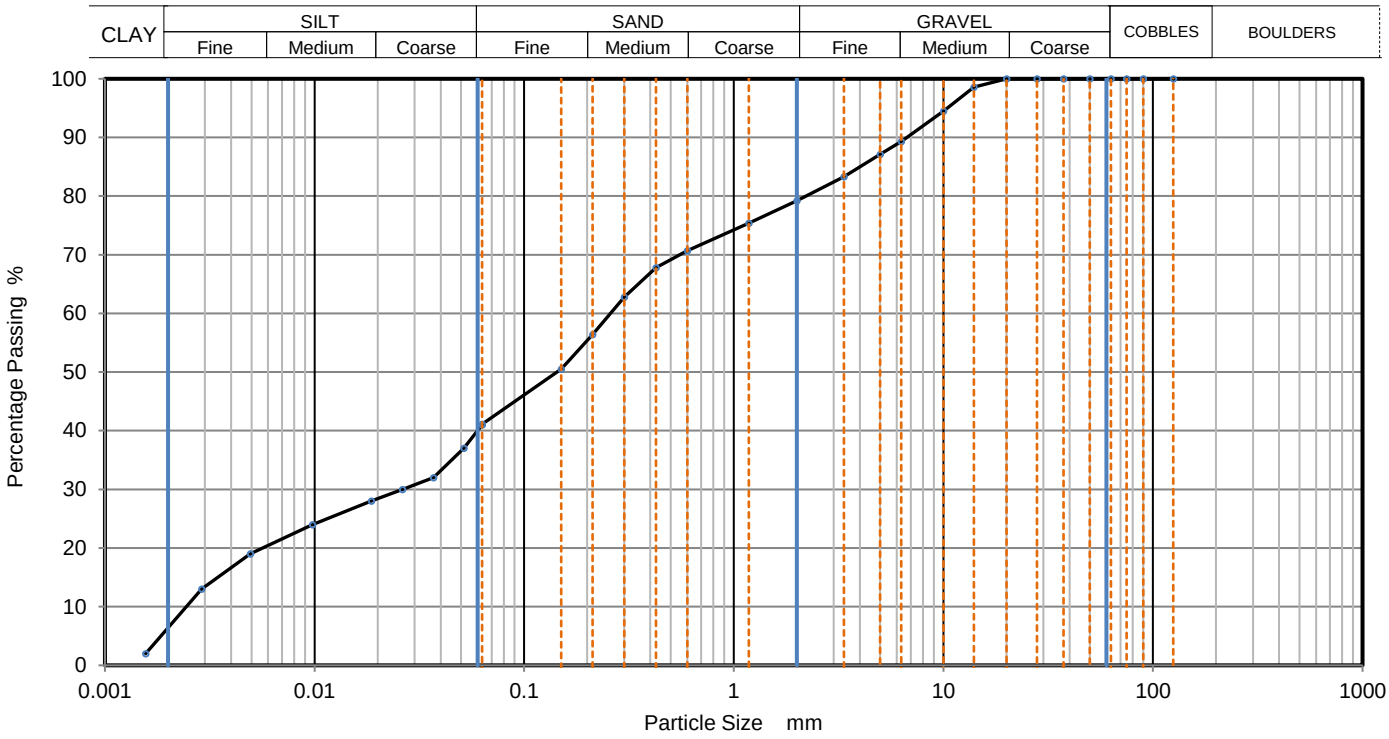
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	11
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	3	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070562



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.05160	37
75	100	0.03693	32
63	100	0.02627	30
50	100	0.01868	28
37.5	100	0.00976	24
28	100	0.00493	19
20	100	0.00290	13
14	99	0.00156	2
10	95		
6.3	89		
5	87		
3.35	83		
2	79		
1.18	75		
0.6	71	Particle density	(assumed)
0.425	68	2.65	Mg/m3
0.3	63		
0.212	56		
0.15	51		
0.063	41		

Dry Mass of sample, g: 532

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.8
Sand	38.2
Silt	34.5
Clay	6.5

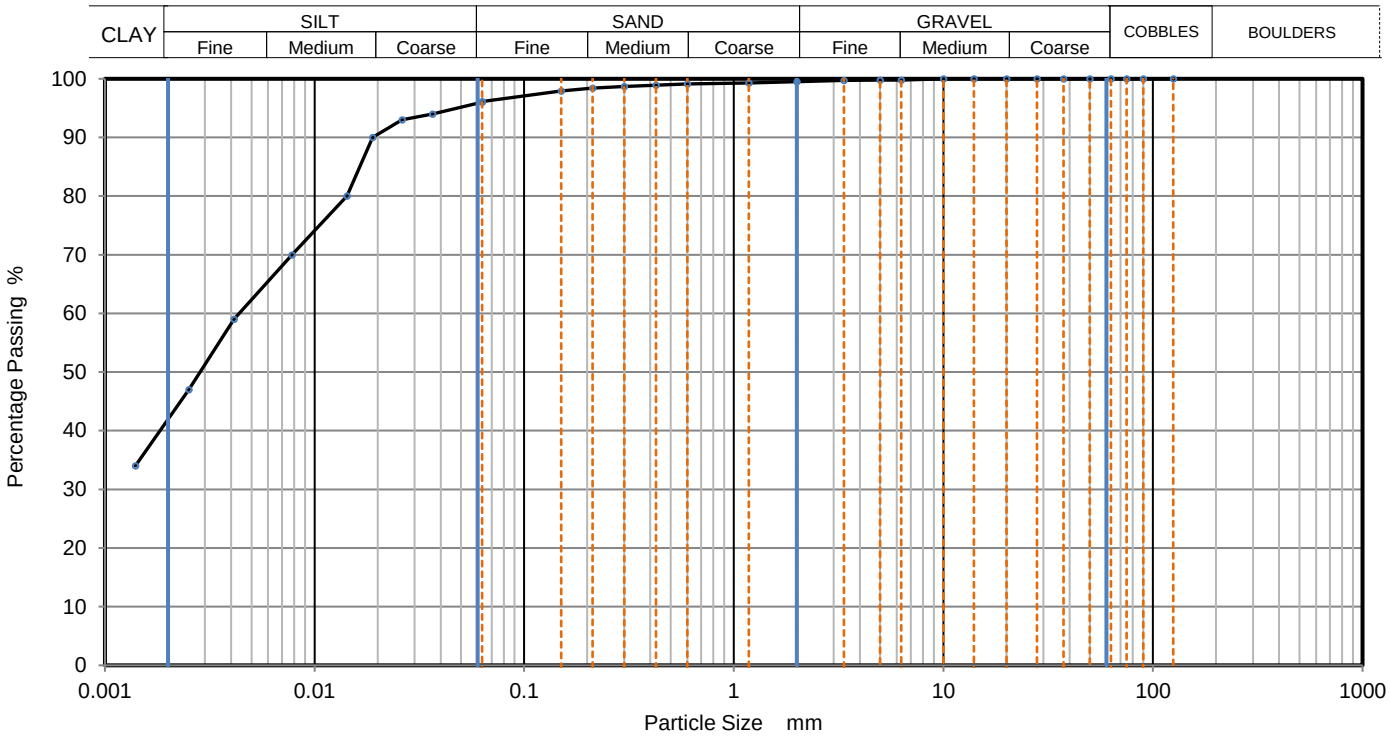
Grading Analysis		
D100	mm	
D60	mm	0.258
D30	mm	0.0251
D10	mm	0.00244
Uniformity Coefficient		110
Curvature Coefficient		1

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	**21-1682**
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	14
Specimen Description	Brownish grey slightly sandy silty CLAY.			Sample Depth (m) Top	7.00
				Base	7.50
Specimen Reference	3	Specimen Depth	7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070566



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	96
90	100	0.03658	94
75	100	0.02618	93
63	100	0.01894	90
50	100	0.01427	80
37.5	100	0.00779	70
28	100	0.00413	59
20	100	0.00251	47
14	100	0.00140	34
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	99		
0.212	98		
0.15	98		
0.063	96		

Dry Mass of sample, g: 319

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.5
Sand	3.4
Silt	53.9
Clay	42.2

Grading Analysis		
D100	mm	
D60	mm	0.00446
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

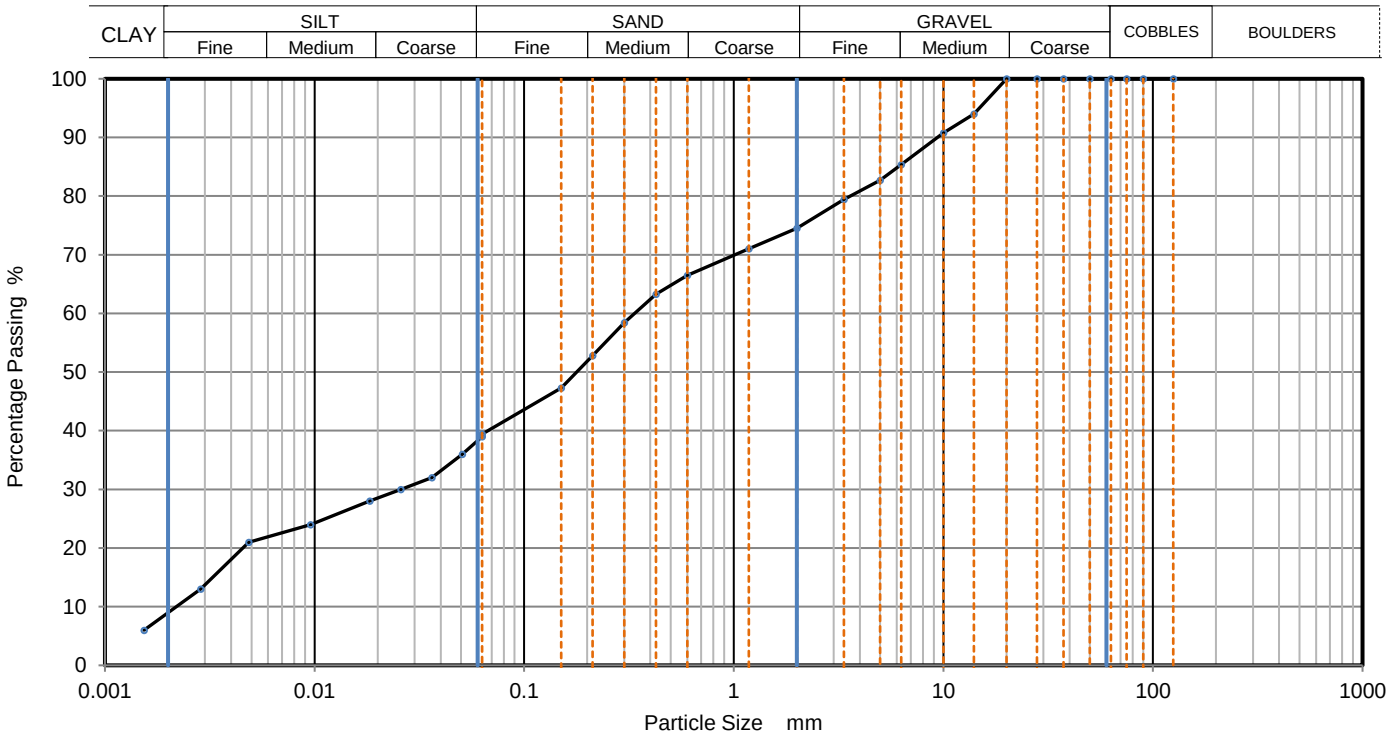
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Stephen.Watson

UKAS TESTING

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	15
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.50
				Base	9.00
Specimen Reference	3	Specimen Depth	8.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070569



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	39
90	100	0.05065	36
75	100	0.03625	32
63	100	0.02579	30
50	100	0.01834	28
37.5	100	0.00958	24
28	100	0.00485	21
20	100	0.00286	13
14	94	0.00154	6
10	91		
6.3	85		
5	83		
3.35	79		
2	75		
1.18	71		
0.6	67	Particle density	(assumed)
0.425	63	2.65	Mg/m3
0.3	58		
0.212	53		
0.15	47		
0.063	39		

Dry Mass of sample, g: 563

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	25.5
Sand	35.1
Silt	30.6
Clay	8.8

Grading Analysis		
D100	mm	
D60	mm	0.336
D30	mm	0.0257
D10	mm	0.00221
Uniformity Coefficient		150
Curvature Coefficient		0.89

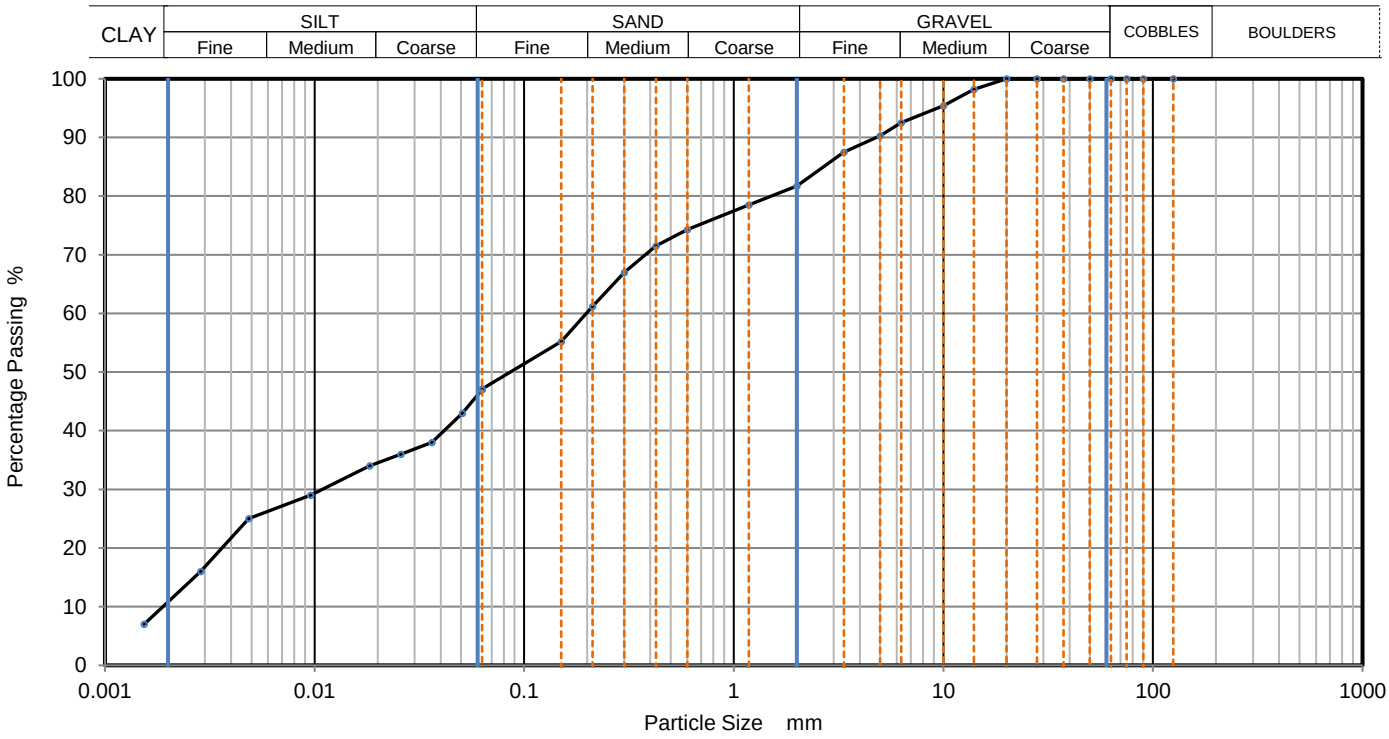
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	24
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.00
				Base	10.50
Specimen Reference	3	Specimen Depth	10 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070570



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.05065	43
75	100	0.03625	38
63	100	0.02579	36
50	100	0.01834	34
37.5	100	0.00958	29
28	100	0.00485	25
20	100	0.00286	16
14	98	0.00154	7
10	95		
6.3	93		
5	90		
3.35	88		
2	82		
1.18	79		
0.6	74	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	67		
0.212	61		
0.15	55		
0.063	47		

Dry Mass of sample, g: 549

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	18.3
Sand	34.6
Silt	36.6
Clay	10.5

Grading Analysis		
D100	mm	
D60	mm	0.197
D30	mm	0.0108
D10	mm	0.00193
Uniformity Coefficient		100
Curvature Coefficient		0.31

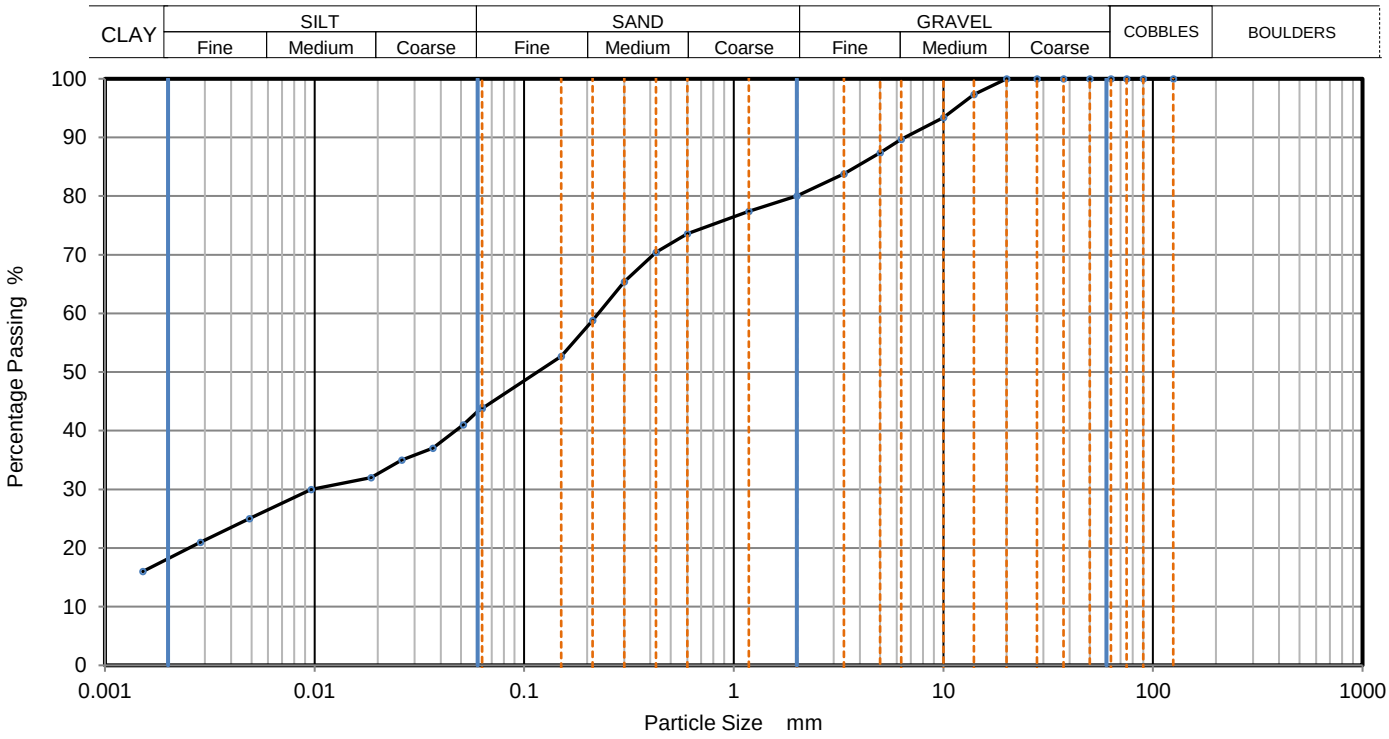
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.70
				Base	17.20
Specimen Reference	6	Specimen Depth	15.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082942



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.05129	41
75	100	0.03671	37
63	100	0.02611	35
50	100	0.01857	32
37.5	100	0.00965	30
28	100	0.00488	25
20	100	0.00285	21
14	97	0.00152	16
10	93		
6.3	90		
5	87		
3.35	84		
2	80		
1.18	77		
0.6	74	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	59		
0.15	53		
0.063	44		

Dry Mass of sample, g: 569

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.0
Sand	36.2
Silt	25.6
Clay	18.2

Grading Analysis		
D100	mm	
D60	mm	0.225
D30	mm	0.00973
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

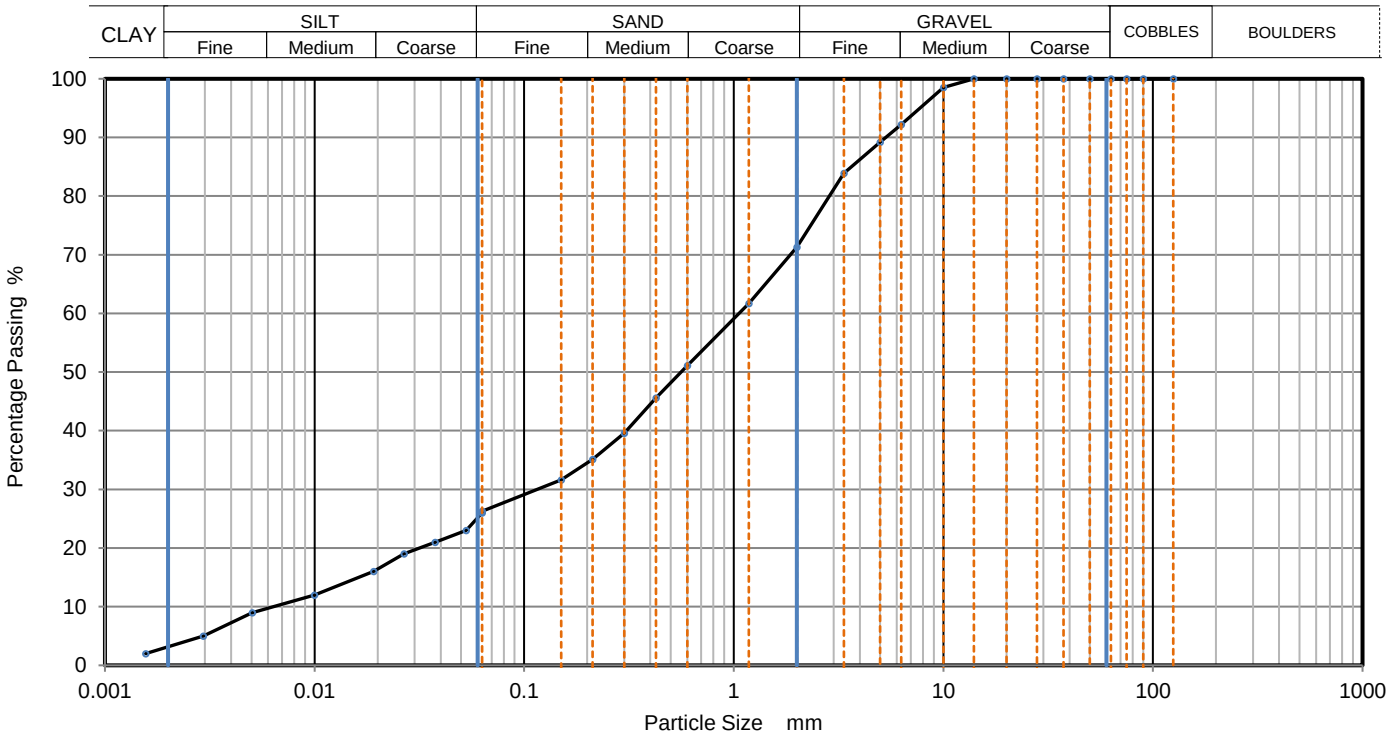
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	3	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070573



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	26
90	100	0.05284	23
75	100	0.03758	21
63	100	0.02672	19
50	100	0.01911	16
37.5	100	0.00998	12
28	100	0.00504	9
20	100	0.00294	5
14	100	0.00156	2
10	99		
6.3	92		
5	89		
3.35	84		
2	71		
1.18	62		
0.6	51	Particle density	(assumed)
0.425	46	2.65	Mg/m3
0.3	40		
0.212	35		
0.15	32		
0.063	26		

Dry Mass of sample, g: 341

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	28.7
Sand	45.0
Silt	23.2
Clay	3.1

Grading Analysis		
D100	mm	
D60	mm	1.06
D30	mm	0.116
D10	mm	0.00641
Uniformity Coefficient		170
Curvature Coefficient		2

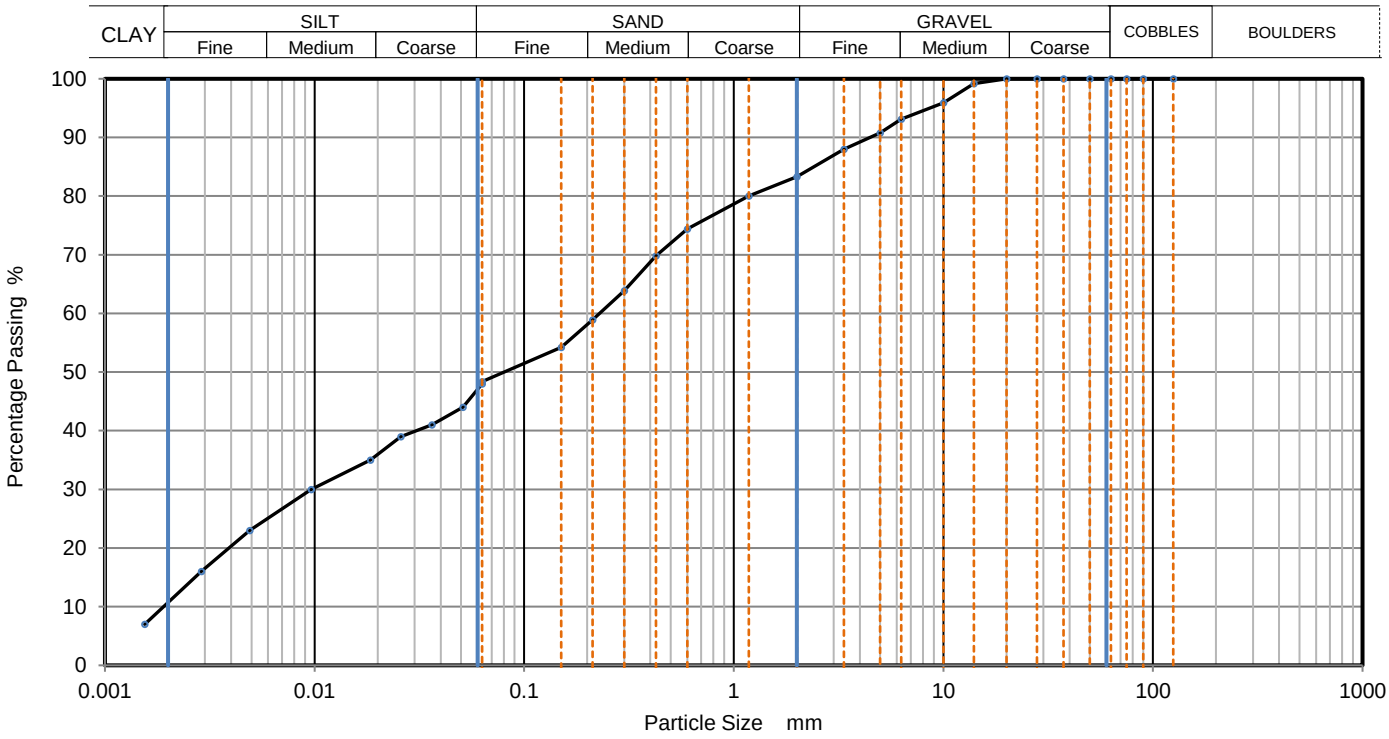
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.80
				Base	2.00
Specimen Reference	3	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070575



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	48
90	100	0.05097	44
75	100	0.03627	41
63	100	0.02580	39
50	100	0.01846	35
37.5	100	0.00965	30
28	100	0.00491	23
20	100	0.00288	16
14	99	0.00155	7
10	96		
6.3	93		
5	91		
3.35	88		
2	83		
1.18	80		
0.6	74	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	64		
0.212	59		
0.15	54		
0.063	48		

Dry Mass of sample, g: 511

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.7
Sand	34.9
Silt	37.7
Clay	10.7

Grading Analysis		
D100	mm	
D60	mm	0.228
D30	mm	0.0097
D10	mm	0.00191
Uniformity Coefficient		120
Curvature Coefficient		0.22

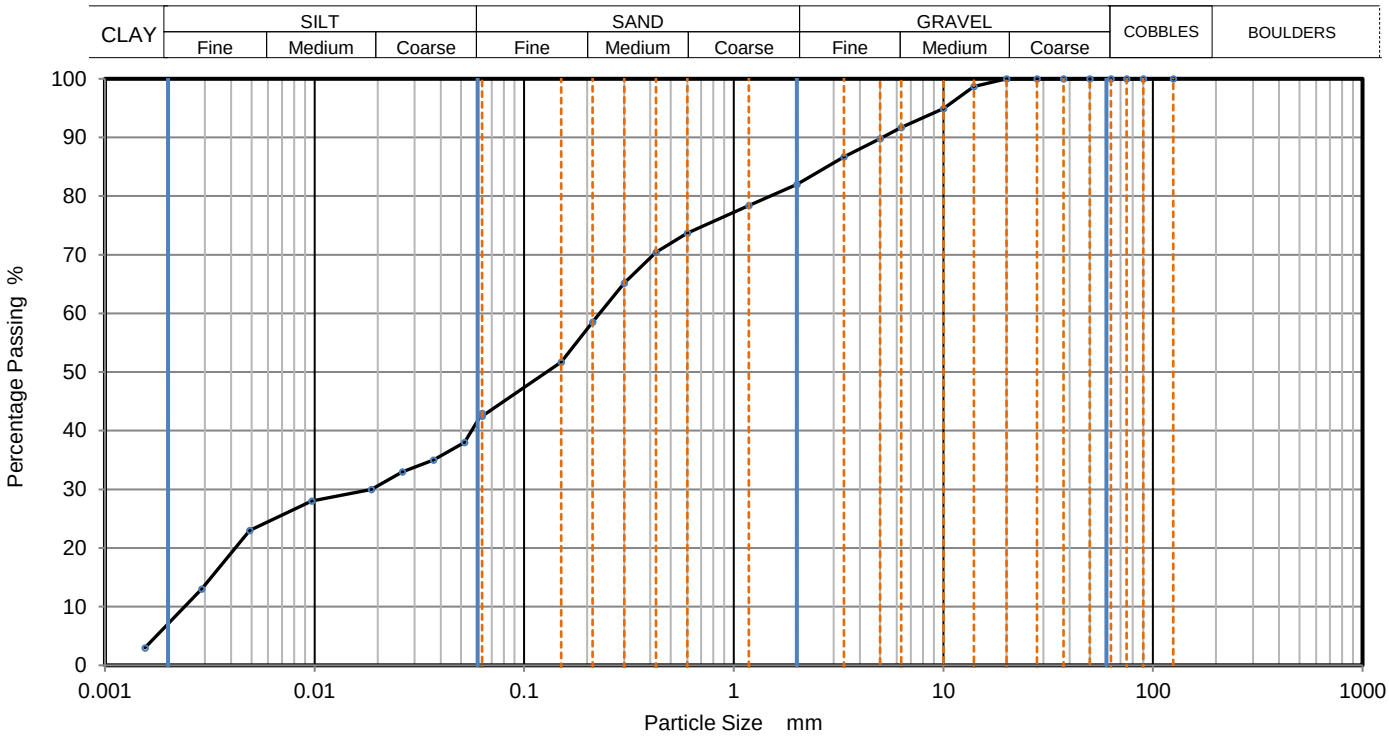
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	3	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070580



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.05188	38
75	100	0.03690	35
63	100	0.02624	33
50	100	0.01866	30
37.5	100	0.00969	28
28	100	0.00490	23
20	100	0.00289	13
14	99	0.00155	3
10	95		
6.3	92		
5	90		
3.35	87		
2	82		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	59		
0.15	52		
0.063	43		

Dry Mass of sample, g: 530

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	18.0
Sand	39.5
Silt	35.9
Clay	6.6

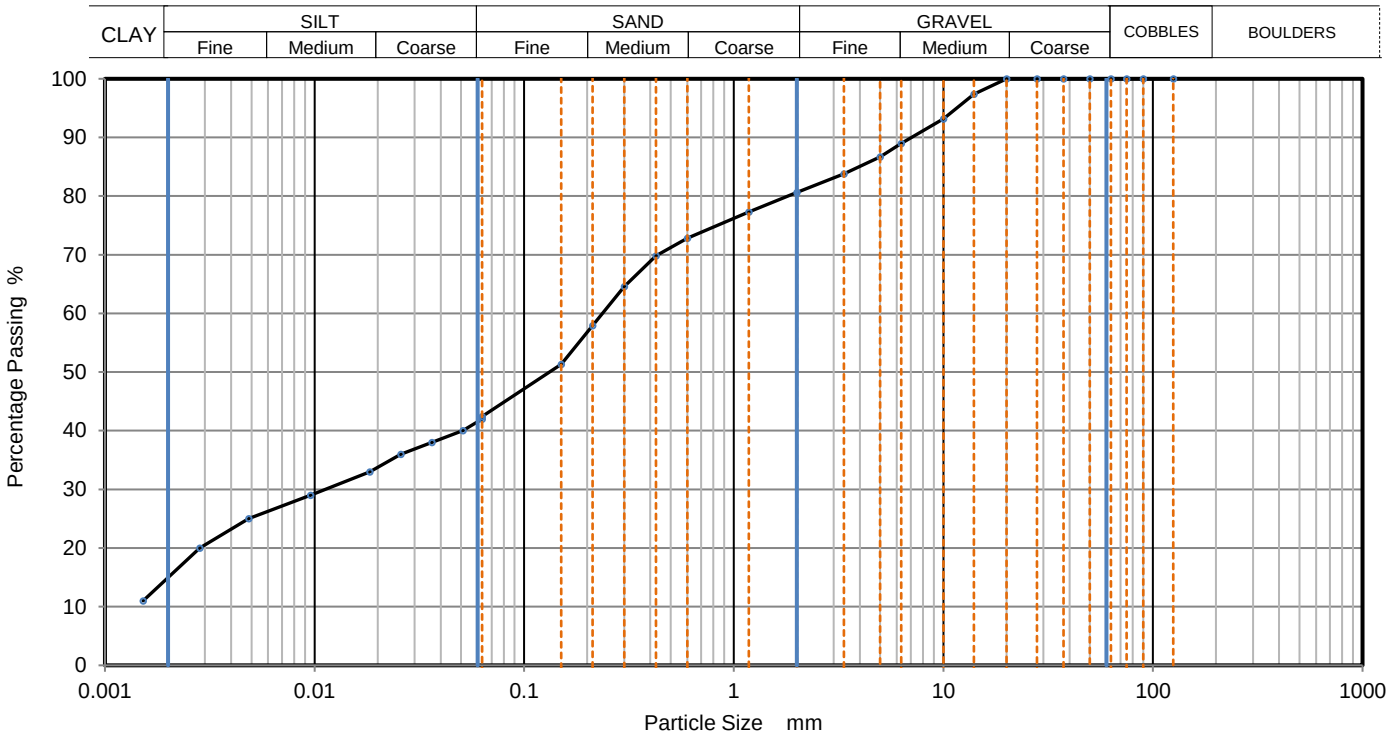
Grading Analysis		
D100	mm	
D60	mm	0.229
D30	mm	
D10	mm	0.00247
Uniformity Coefficient		93
Curvature Coefficient		

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		21-1682
				Borehole/Pit No.		RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		18
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	8.50
					Base	9.00
Specimen Reference	3	Specimen Depth	8.5 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022070583



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05096	40
75	100	0.03625	38
63	100	0.02579	36
50	100	0.01834	33
37.5	100	0.00958	29
28	100	0.00485	25
20	100	0.00283	20
14	97	0.00152	11
10	93		
6.3	89		
5	87		
3.35	84		
2	81		
1.18	77		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	58		
0.15	51		
0.063	42		

Dry Mass of sample, g: 540

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.4
Sand	38.2
Silt	27.3
Clay	15.1

Grading Analysis		
D100	mm	
D60	mm	0.236
D30	mm	0.0111
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

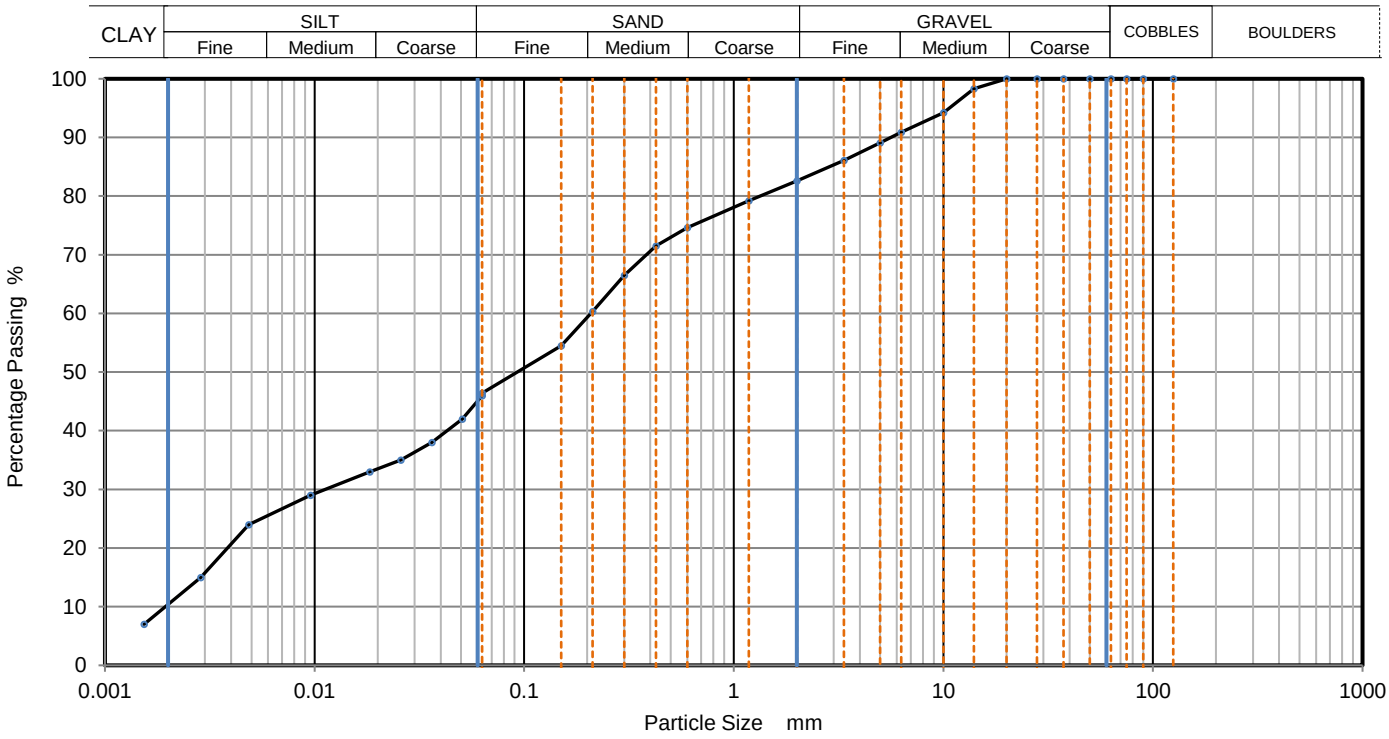
Remarks

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Stephen.Watson

UKAS TESTING

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		19
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	10.00
					Base	10.50
Specimen Reference	3	Specimen Depth	10 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022070585



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05065	42
75	100	0.03625	38
63	100	0.02579	35
50	100	0.01834	33
37.5	100	0.00958	29
28	100	0.00485	24
20	100	0.00286	15
14	98	0.00154	7
10	94		
6.3	91		
5	89		
3.35	86		
2	83		
1.18	79		
0.6	75	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	67		
0.212	60		
0.15	55		
0.063	46		

Dry Mass of sample, g: 544

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.4
Sand	36.2
Silt	36.0
Clay	10.4

Grading Analysis		
D100	mm	
D60	mm	0.209
D30	mm	0.0116
D10	mm	0.00195
Uniformity Coefficient		110
Curvature Coefficient		0.33

Remarks

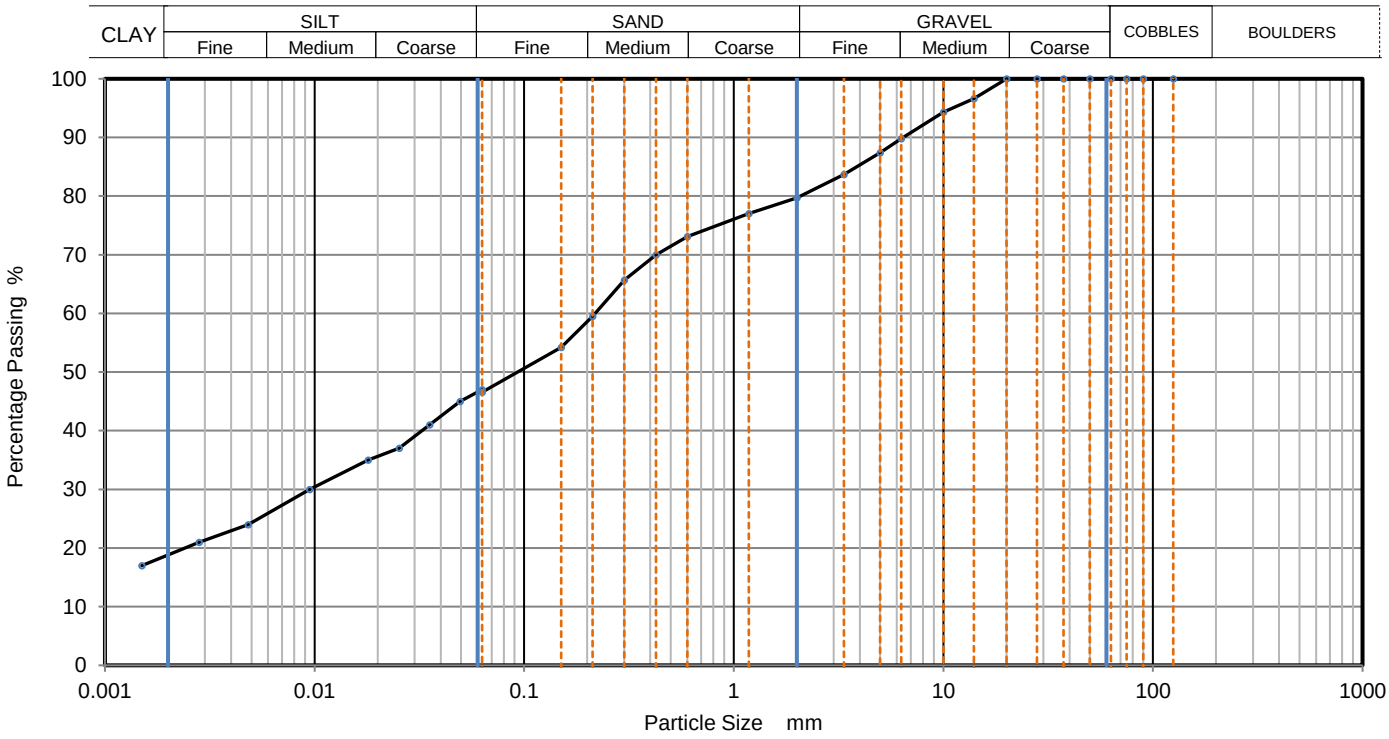
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Stephen.Watson

UKAS TESTING

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.70
				Base	14.20
Specimen Reference	6	Specimen Depth	12.7 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082943



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.04936	45
75	100	0.03536	41
63	100	0.02533	37
50	100	0.01802	35
37.5	100	0.00948	30
28	100	0.00482	24
20	100	0.00282	21
14	97	0.00150	17
10	94		
6.3	90		
5	87		
3.35	84		
2	80		
1.18	77		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	66		
0.212	60		
0.15	54		
0.063	47		

Dry Mass of sample, g: 557

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.3
Sand	33.1
Silt	28.1
Clay	18.5

Grading Analysis		
D100	mm	
D60	mm	0.218
D30	mm	0.00967
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

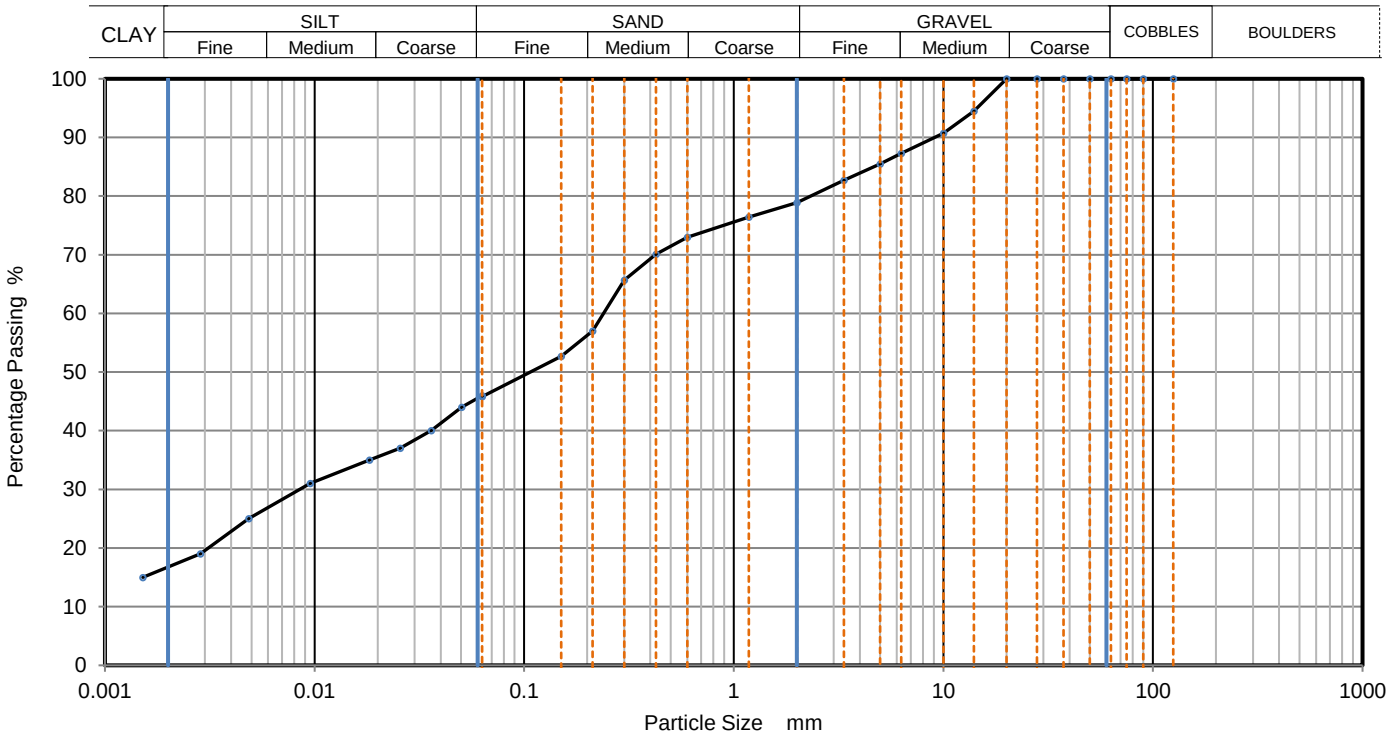
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	17.20
				Base	18.70
Specimen Reference	6	Specimen Depth	17.2 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082946



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	46
90	100	0.05033	44
75	100	0.03604	40
63	100	0.02564	37
50	100	0.01824	35
37.5	100	0.00953	31
28	100	0.00485	25
20	100	0.00285	19
14	95	0.00152	15
10	91		
6.3	87		
5	86		
3.35	83		
2	79		
1.18	76		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	66		
0.212	57		
0.15	53		
0.063	46		

Dry Mass of sample, g: 526

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.1
Sand	33.1
Silt	29.4
Clay	16.4

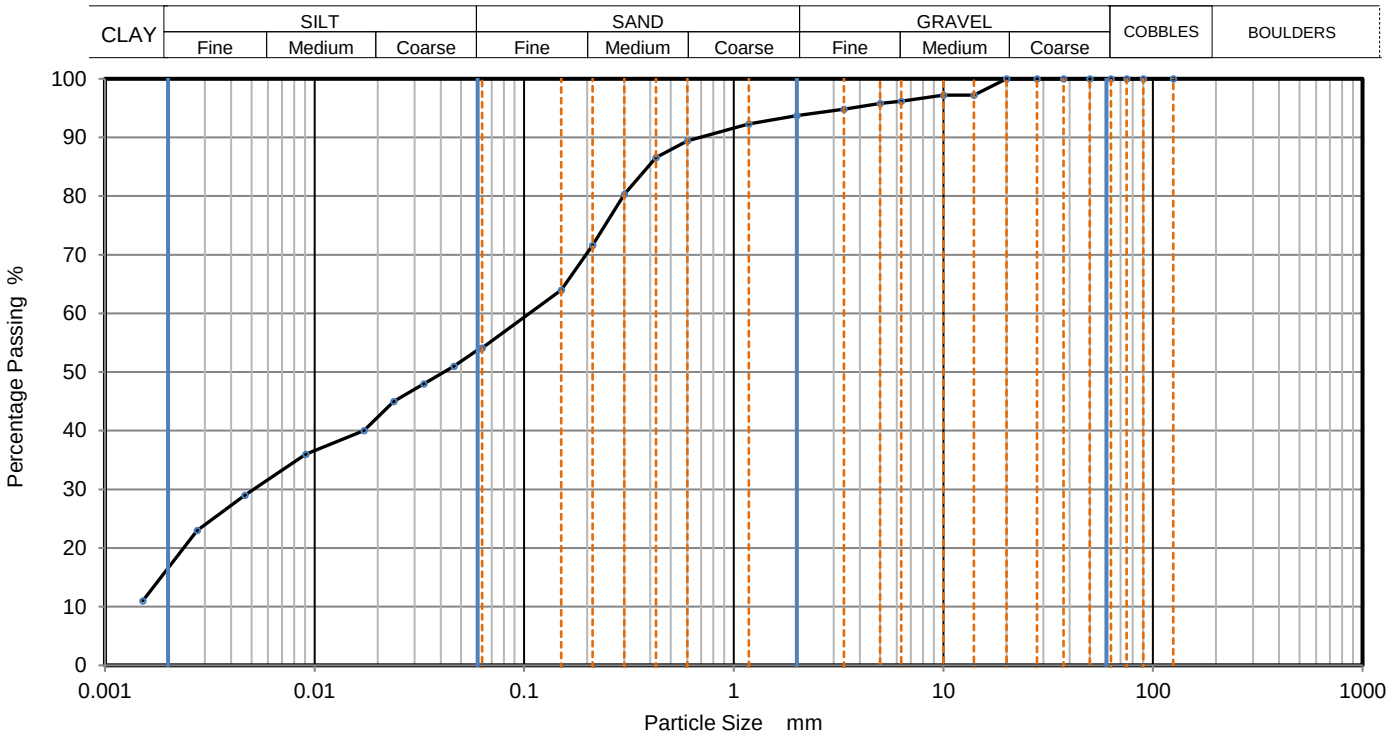
Grading Analysis		
D100	mm	
D60	mm	0.239
D30	mm	0.00835
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		2
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	0.80
					Base	1.00
Specimen Reference	3	Specimen Depth	0.8 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus2022070587



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06135	54
90	100	0.04632	51
75	100	0.03324	48
63	100	0.02385	45
50	100	0.01722	40
37.5	100	0.00907	36
28	100	0.00465	29
20	100	0.00275	23
14	97	0.00152	11
10	97		
6.3	96		
5	96		
3.35	95		
2	94		
1.18	92		
0.6	89	Particle density	(assumed)
0.425	87	2.65	Mg/m3
0.3	80		
0.212	72		
0.15	64		
0.063	54		

Dry Mass of sample, g: 516

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	6.3
Sand	39.6
Silt	37.5
Clay	16.6

Grading Analysis		
D100	mm	
D60	mm	0.105
D30	mm	0.00498
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

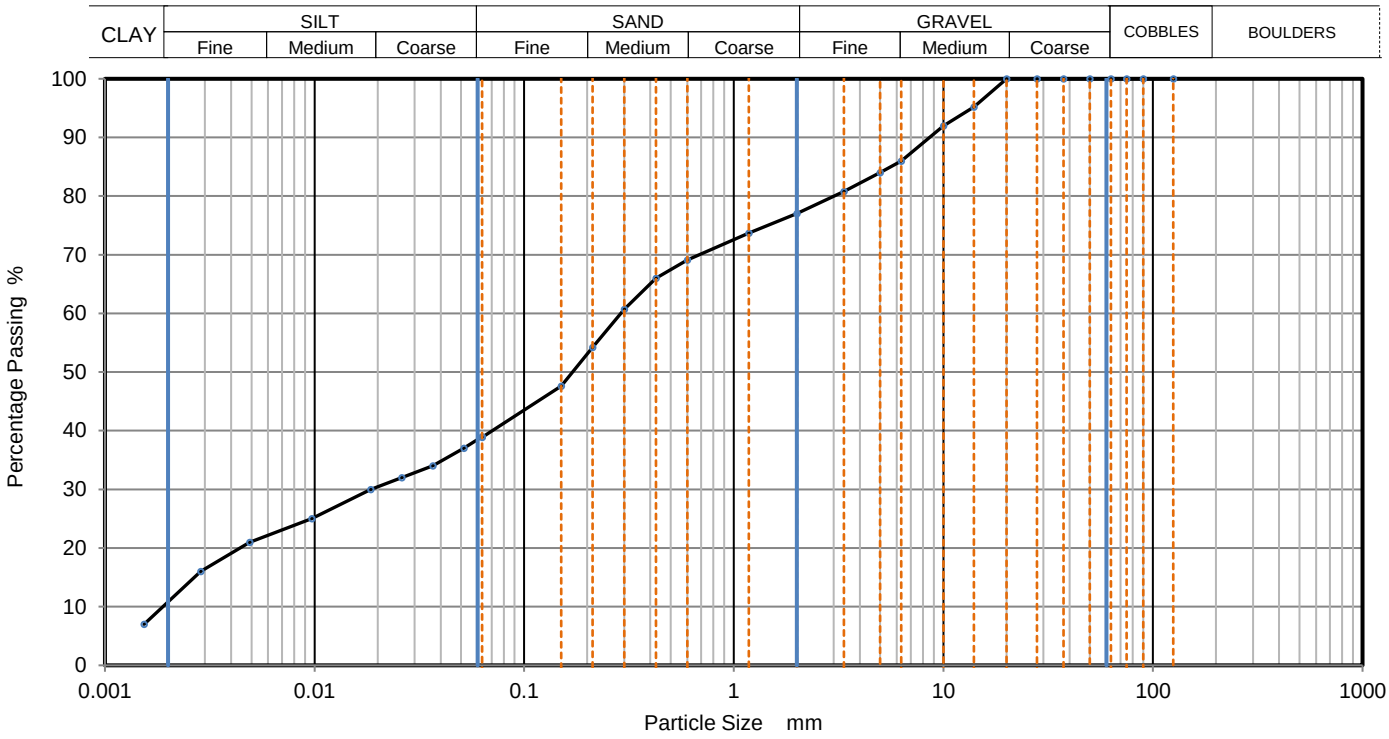
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.80
				Base	2.00
Specimen Reference	3	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070590



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	39
90	100	0.05157	37
75	100	0.03668	34
63	100	0.02609	32
50	100	0.01855	30
37.5	100	0.00969	25
28	100	0.00490	21
20	100	0.00286	16
14	95	0.00154	7
10	92		
6.3	86		
5	84		
3.35	81		
2	77		
1.18	74		
0.6	69	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	61		
0.212	54		
0.15	48		
0.063	39		

Dry Mass of sample, g: 540

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.0
Sand	38.2
Silt	28.0
Clay	10.8

Grading Analysis		
D100	mm	
D60	mm	0.289
D30	mm	0.0193
D10	mm	0.0019
Uniformity Coefficient		150
Curvature Coefficient		0.68

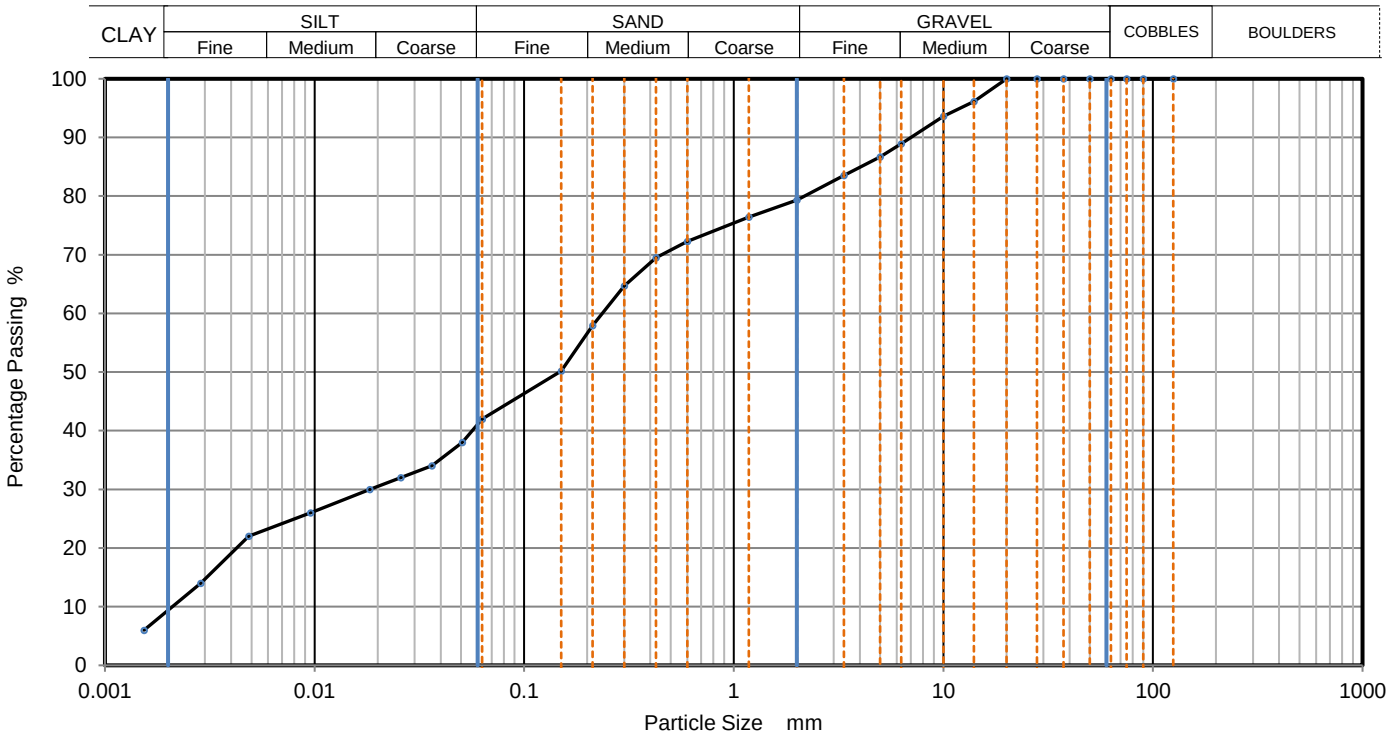
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	3	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070593



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05065	38
75	100	0.03625	34
63	100	0.02579	32
50	100	0.01834	30
37.5	100	0.00958	26
28	100	0.00485	22
20	100	0.00286	14
14	96	0.00154	6
10	94		
6.3	89		
5	87		
3.35	84		
2	79		
1.18	76		
0.6	72	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	58		
0.15	50		
0.063	42		

Dry Mass of sample, g: 551

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.7
Sand	37.2
Silt	32.7
Clay	9.4

Grading Analysis		
D100	mm	
D60	mm	0.236
D30	mm	
D10	mm	0.0021
Uniformity Coefficient		110
Curvature Coefficient		

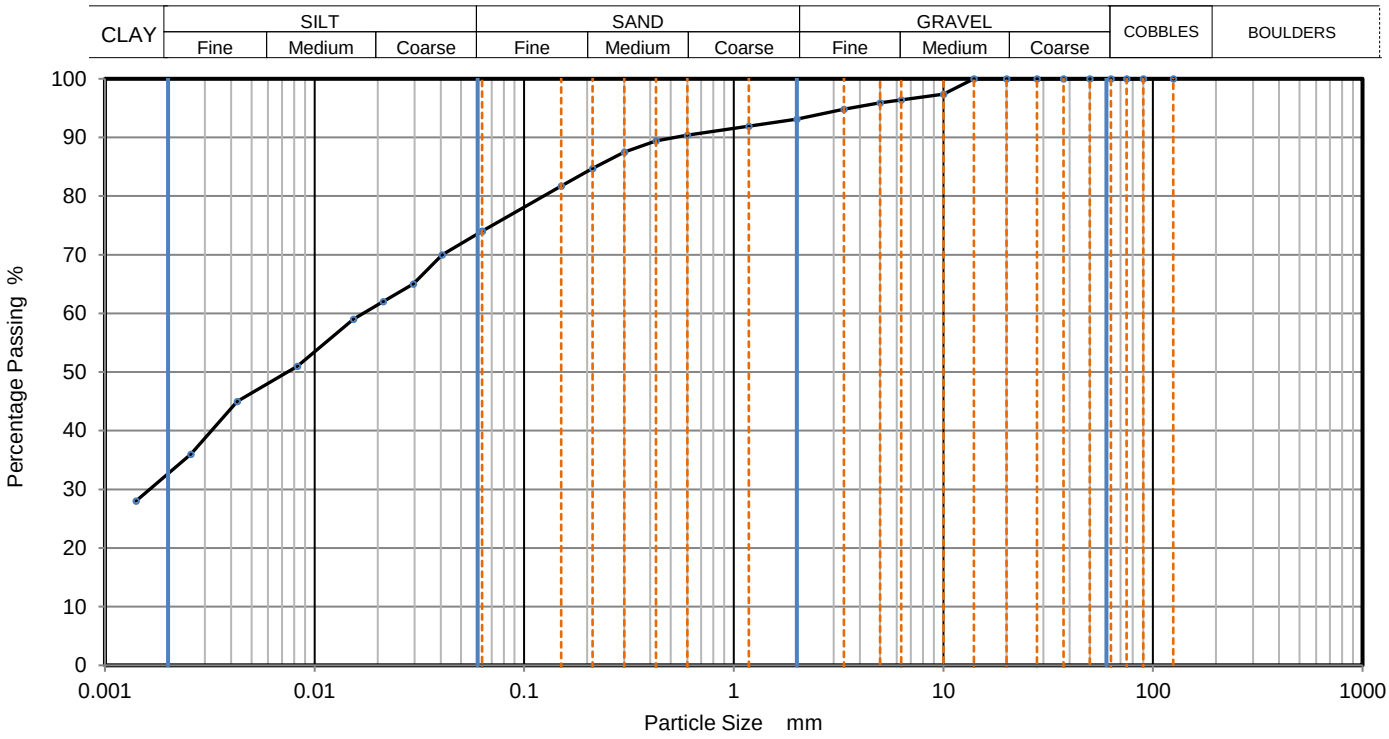
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	12
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	5.80
				Base	6.00
Specimen Reference	3	Specimen Depth	5.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070595



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	74
90	100	0.04065	70
75	100	0.02956	65
63	100	0.02127	62
50	100	0.01530	59
37.5	100	0.00829	51
28	100	0.00427	45
20	100	0.00257	36
14	100	0.00140	28
10	97		
6.3	96		
5	96		
3.35	95		
2	93		
1.18	92		
0.6	90	Particle density	(assumed)
0.425	89	2.65	Mg/m3
0.3	88		
0.212	85		
0.15	82		
0.063	74		

Dry Mass of sample, g: 437

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	6.9
Sand	19.1
Silt	41.3
Clay	32.7

Grading Analysis		
D100	mm	
D60	mm	0.0162
D30	mm	0.00166
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

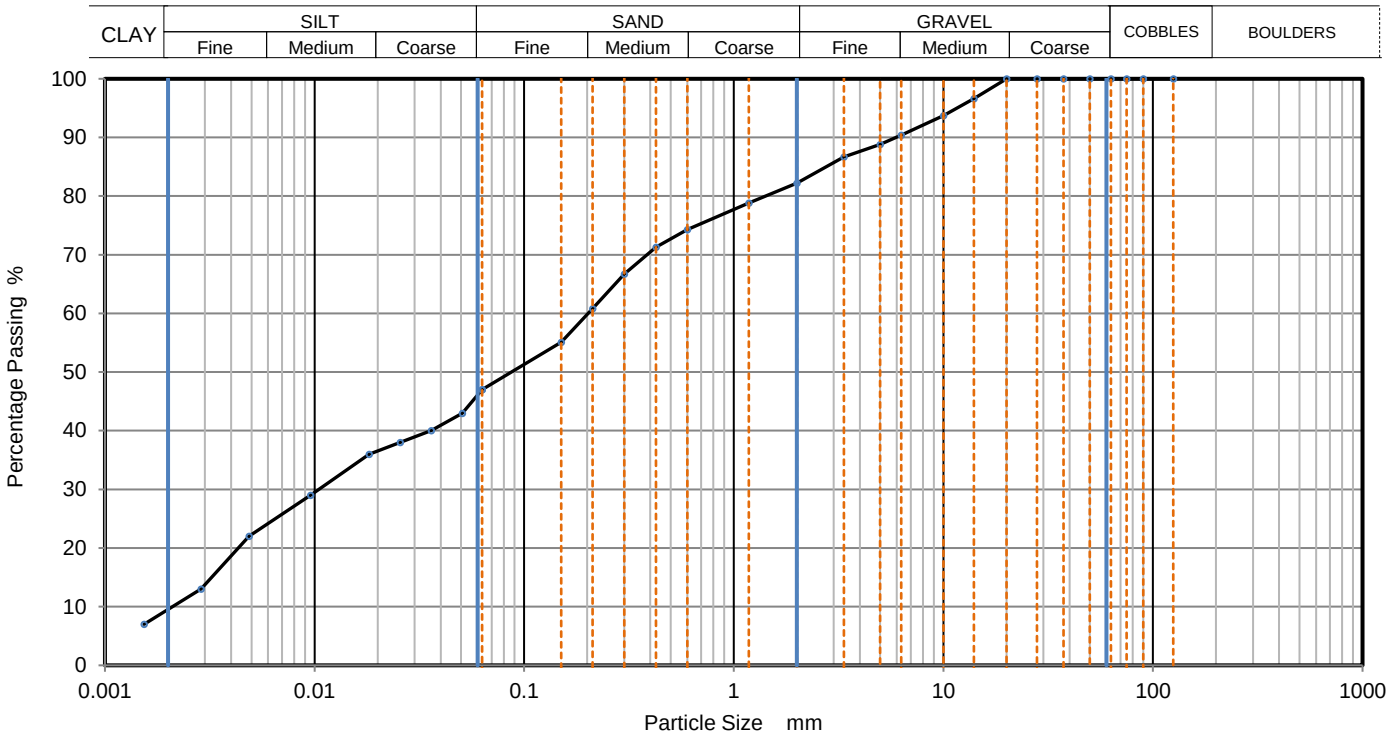
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	14
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.50
				Base	9.00
Specimen Reference	3	Specimen Depth	8.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022070597



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.05065	43
75	100	0.03603	40
63	100	0.02563	38
50	100	0.01823	36
37.5	100	0.00958	29
28	100	0.00487	22
20	100	0.00287	13
14	97	0.00154	7
10	94		
6.3	90		
5	89		
3.35	87		
2	82		
1.18	79		
0.6	74	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	67		
0.212	61		
0.15	55		
0.063	47		

Dry Mass of sample, g: 528

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.8
Sand	35.2
Silt	37.5
Clay	9.5

Grading Analysis		
D100	mm	
D60	mm	0.202
D30	mm	0.0104
D10	mm	0.00209
Uniformity Coefficient		97
Curvature Coefficient		0.26

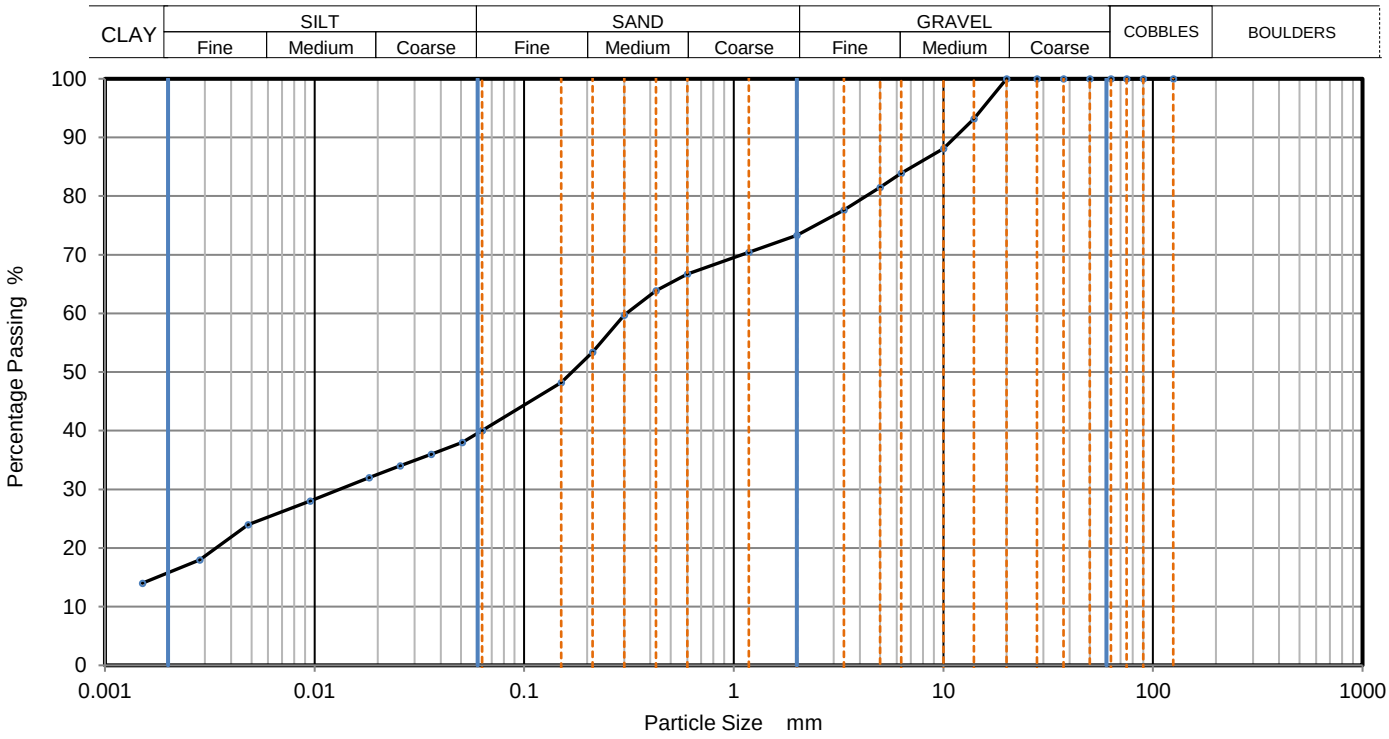
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.00
				Base	10.50
Specimen Reference	6	Specimen Depth	9 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082931



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	40
90	100	0.05064	38
75	100	0.03604	36
63	100	0.02564	34
50	100	0.01824	32
37.5	100	0.00953	28
28	100	0.00482	24
20	100	0.00283	18
14	93	0.00151	14
10	88		
6.3	84		
5	82		
3.35	78		
2	73		
1.18	70		
0.6	67	Particle density	(assumed)
0.425	64	2.65	Mg/m3
0.3	60		
0.212	53		
0.15	48		
0.063	40		

Dry Mass of sample, g: 561

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	26.7
Sand	33.3
Silt	24.2
Clay	15.8

Grading Analysis		
D100	mm	
D60	mm	0.307
D30	mm	0.0132
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

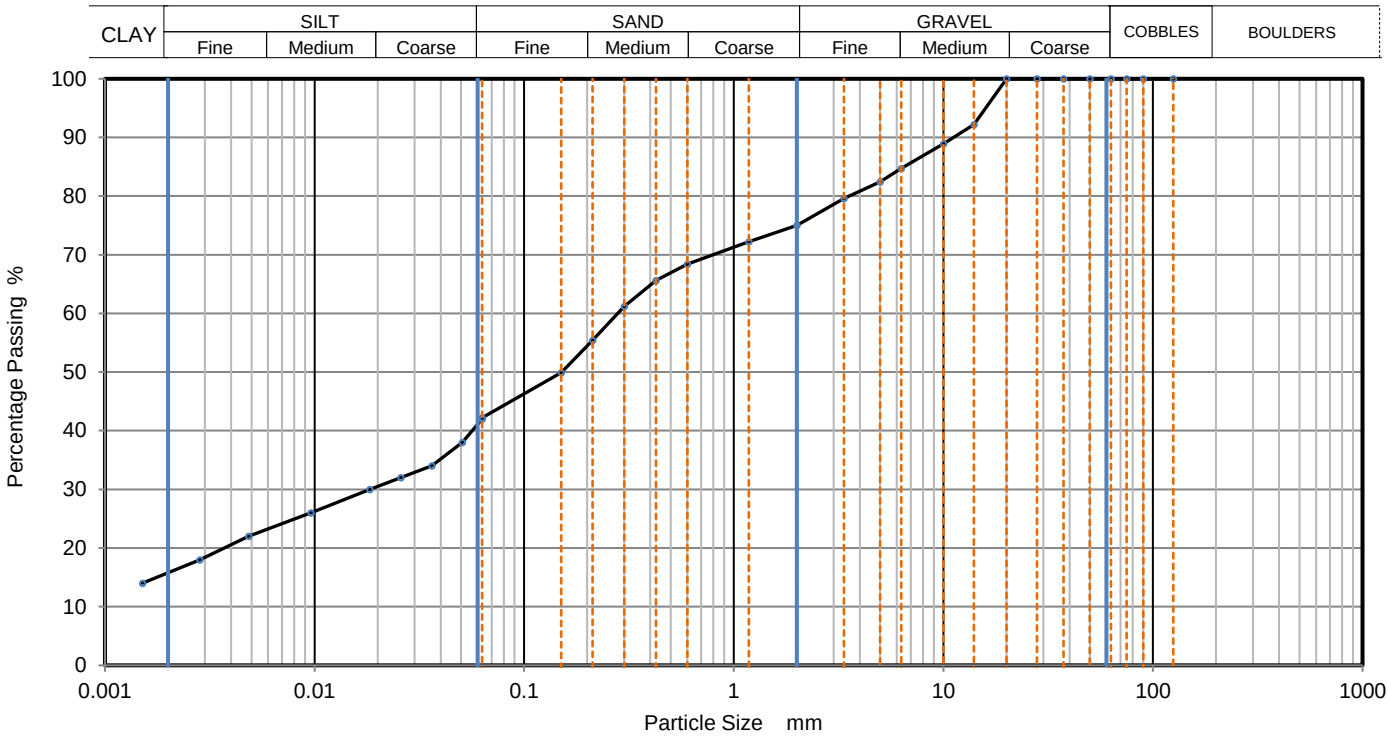
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Base	13.50
Specimen Reference	6	Specimen Depth	12 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022082933



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	42
90	100	0.05064	38
75	100	0.03626	34
63	100	0.02580	32
50	100	0.01835	30
37.5	100	0.00959	26
28	100	0.00485	22
20	100	0.00283	18
14	92	0.00151	14
10	89		
6.3	85		
5	82		
3.35	80		
2	75		
1.18	72		
0.6	68	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	61		
0.212	55		
0.15	50		
0.063	42		

Dry Mass of sample, g: 546

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	25.0
Sand	32.9
Silt	26.2
Clay	15.9

Grading Analysis		
D100	mm	
D60	mm	0.279
D30	mm	0.0179
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

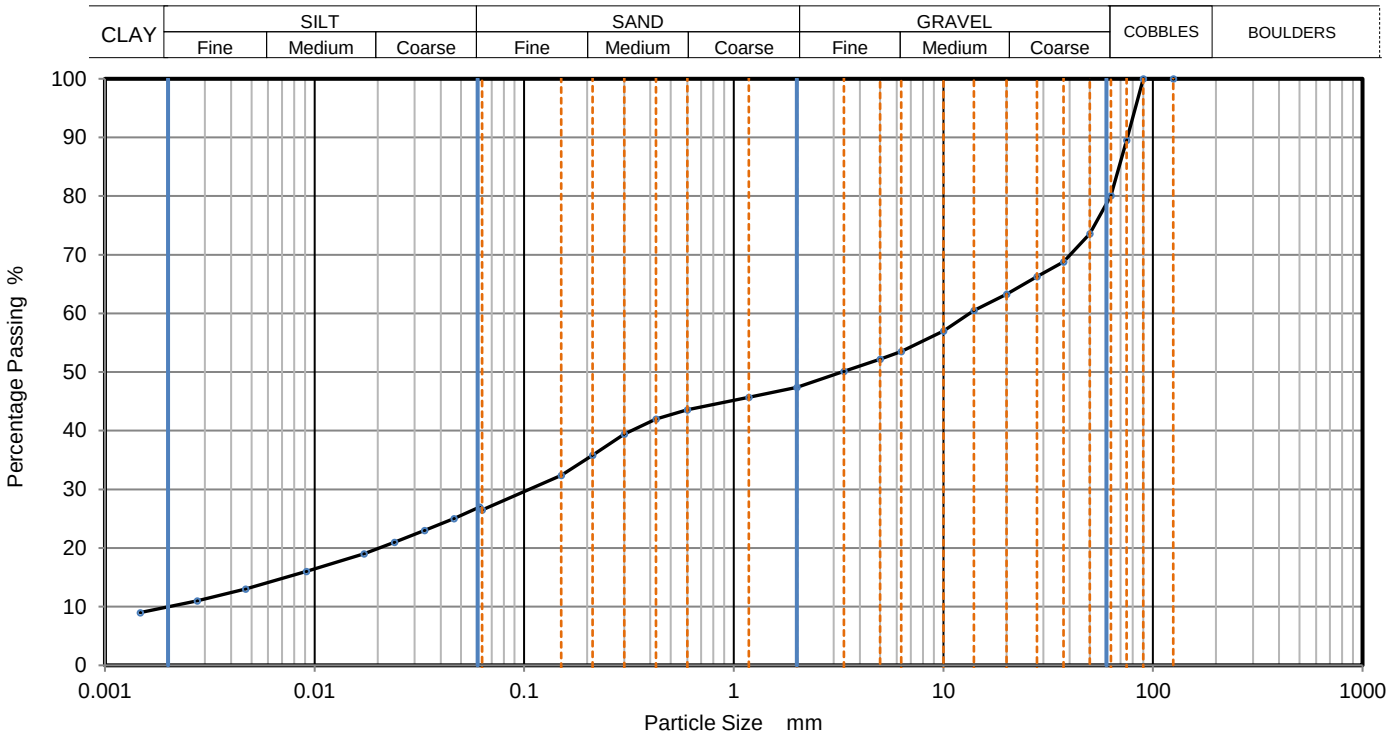
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH020
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy gravelly silty CLAY with cobbles.			Sample Depth (m) Top	9.00
				Base	10.50
Specimen Reference	9	Specimen Depth	9 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220825106



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06134	27
90	100	0.04631	25
75	90	0.03348	23
63	80	0.02401	21
50	74	0.01722	19
37.5	69	0.00913	16
28	66	0.00468	13
20	63	0.00275	11
14	61	0.00147	9
10	57		
6.3	54		
5	52		
3.35	50		
2	47		
1.18	46		
0.6	44	Particle density	(assumed)
0.425	42	2.65	Mg/m3
0.3	39		
0.212	36		
0.15	32		
0.063	27		

Dry Mass of sample, g: 12663

Sample Proportions	% dry mass
Cobbles	19.9
Gravel	32.7
Sand	20.8
Silt	16.9
Clay	9.7

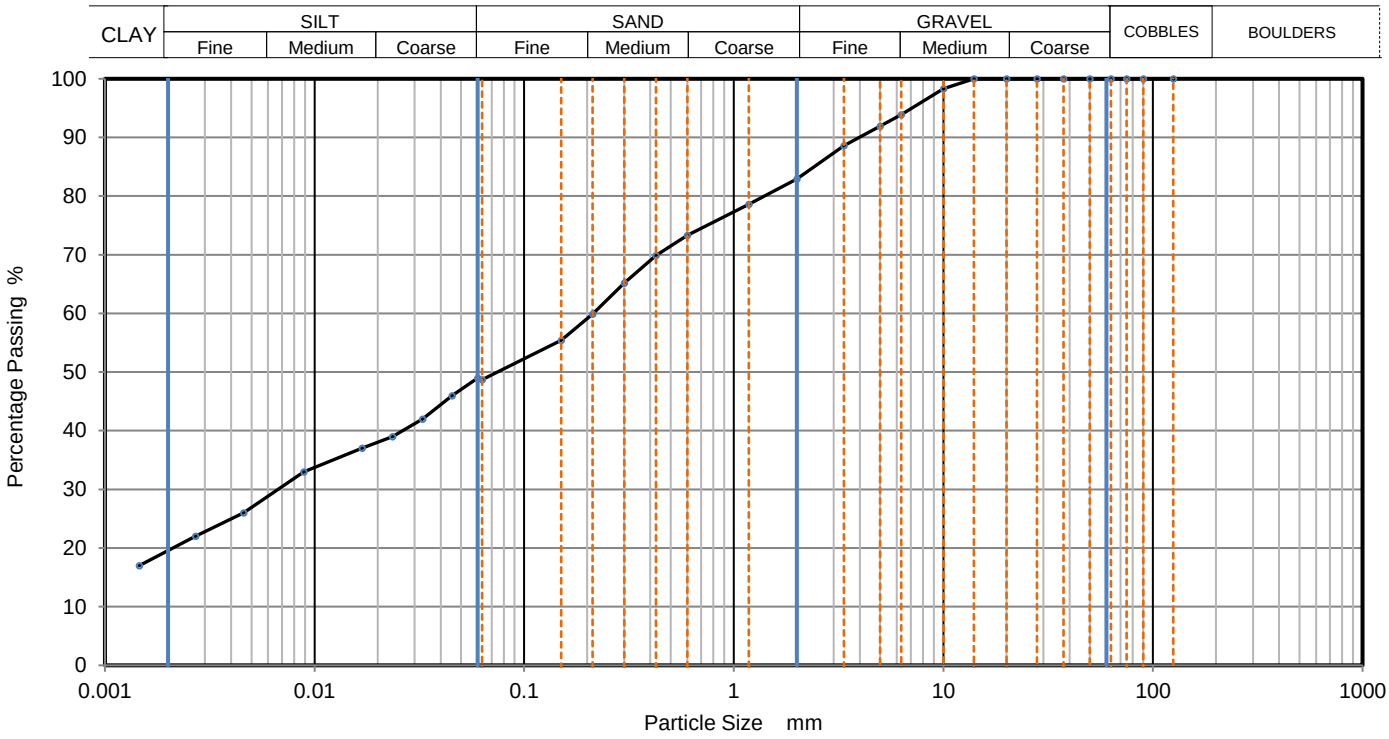
Grading Analysis		
D100	mm	
D60	mm	13.3
D30	mm	0.105
D10	mm	0.00216
Uniformity Coefficient		6200
Curvature Coefficient		0.39

Remarks

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CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH020
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Base	13.50
Specimen Reference	9	Specimen Depth	12 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220825109



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05989	49
90	100	0.04526	46
75	100	0.03275	42
63	100	0.02350	39
50	100	0.01686	37
37.5	100	0.00889	33
28	100	0.00459	26
20	100	0.00270	22
14	100	0.00146	17
10	98		
6.3	94		
5	92		
3.35	89		
2	83		
1.18	79		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	60		
0.15	55		
0.063	49		

Dry Mass of sample, g: 542

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	17.1
Sand	34.2
Silt	28.9
Clay	19.8

Grading Analysis		
D100	mm	
D60	mm	0.213
D30	mm	0.00664
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

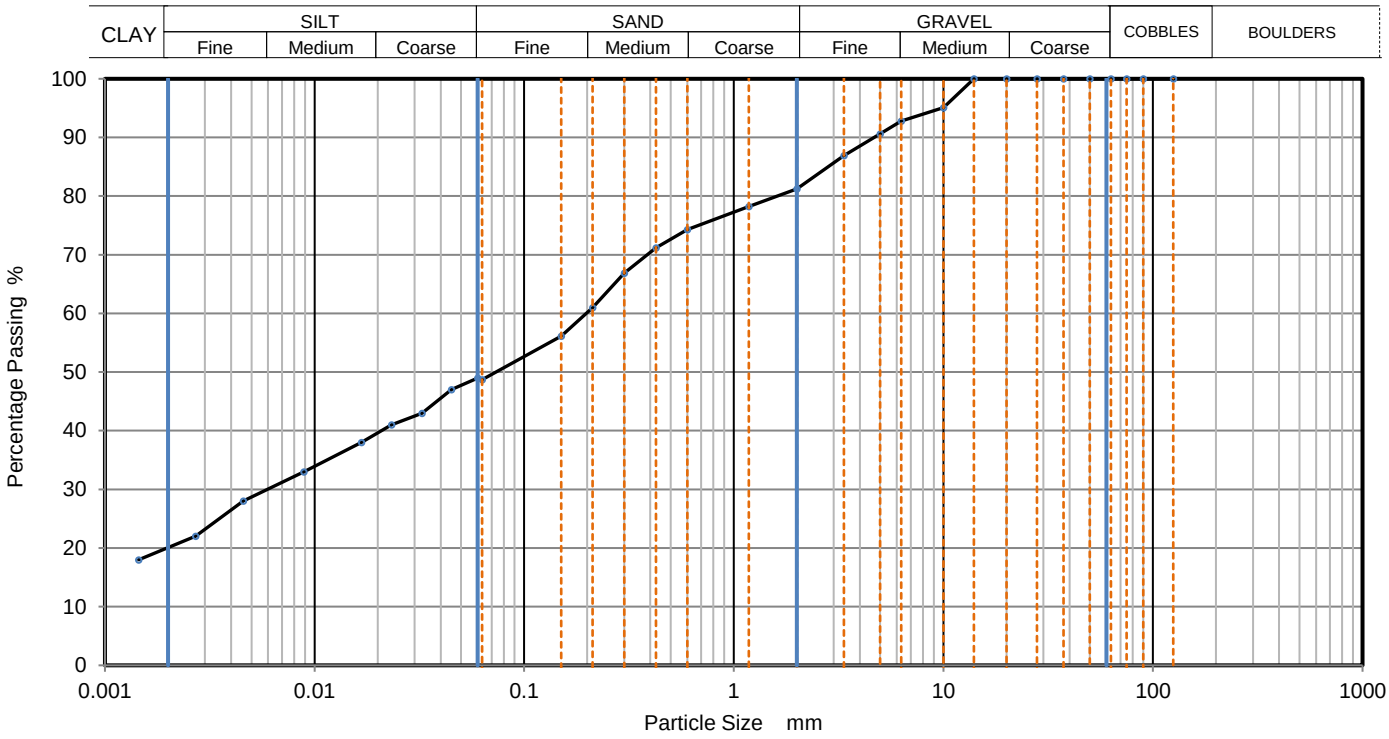
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH020
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	9	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220825110



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05989	49
90	100	0.04490	47
75	100	0.03250	43
63	100	0.02333	41
50	100	0.01674	38
37.5	100	0.00889	33
28	100	0.00456	28
20	100	0.00270	22
14	100	0.00145	18
10	95		
6.3	93		
5	91		
3.35	87		
2	81		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	67		
0.212	61		
0.15	56		
0.063	49		

Dry Mass of sample, g: 548

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	18.8
Sand	32.5
Silt	28.2
Clay	20.5

Grading Analysis		
D100	mm	
D60	mm	0.197
D30	mm	0.00615
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

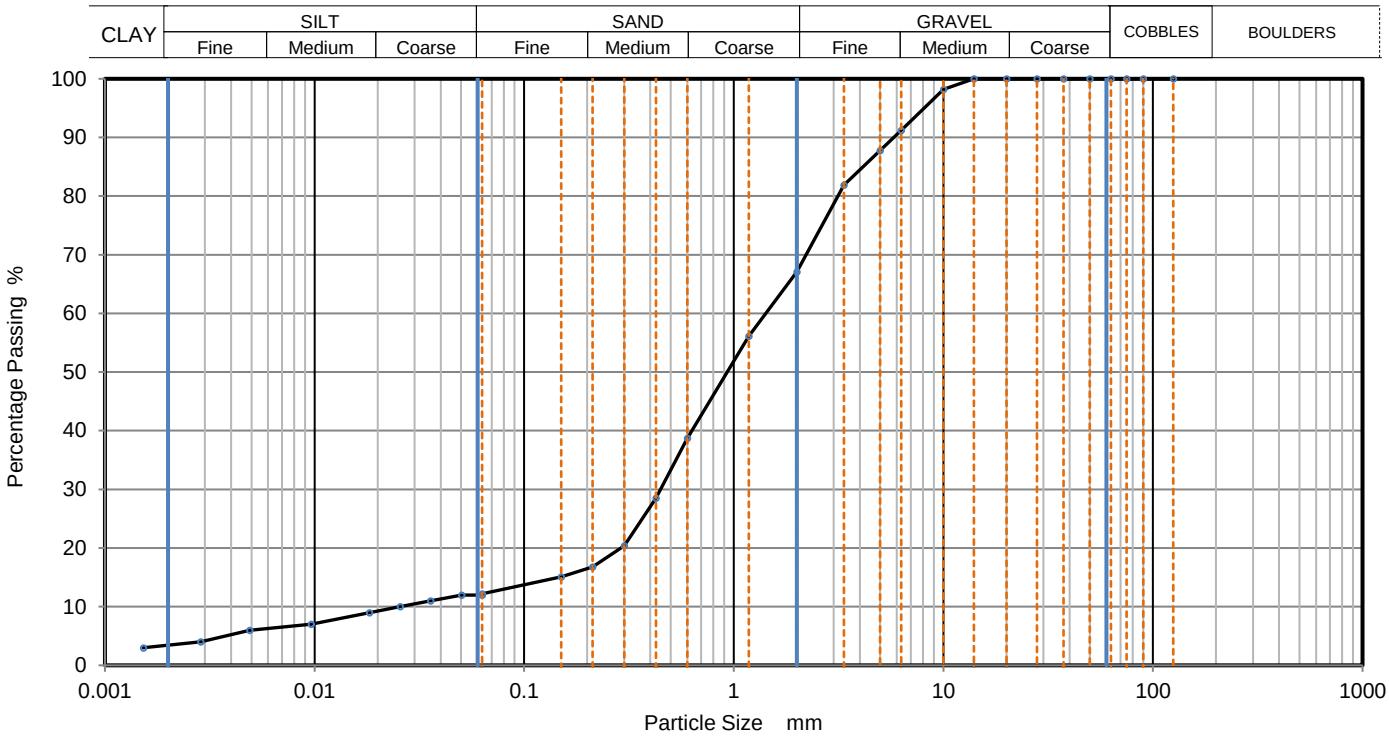
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey slightly gravelly silty fine to coarse SAND.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220621100



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	12
90	100	0.05033	12
75	100	0.03582	11
63	100	0.02564	10
50	100	0.01824	9
37.5	100	0.00965	7
28	100	0.00491	6
20	100	0.00286	4
14	100	0.00152	3
10	98		
6.3	91		
5	88		
3.35	82		
2	67		
1.18	56		
0.6	39	Particle density	(assumed)
0.425	29	2.65	Mg/m3
0.3	20		
0.212	17		
0.15	15		
0.063	12		

Dry Mass of sample, g: 214

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	32.9
Sand	54.9
Silt	8.4
Clay	3.8

Grading Analysis		
D100	mm	
D60	mm	1.42
D30	mm	0.447
D10	mm	0.0258
Uniformity Coefficient		55
Curvature Coefficient		5.4

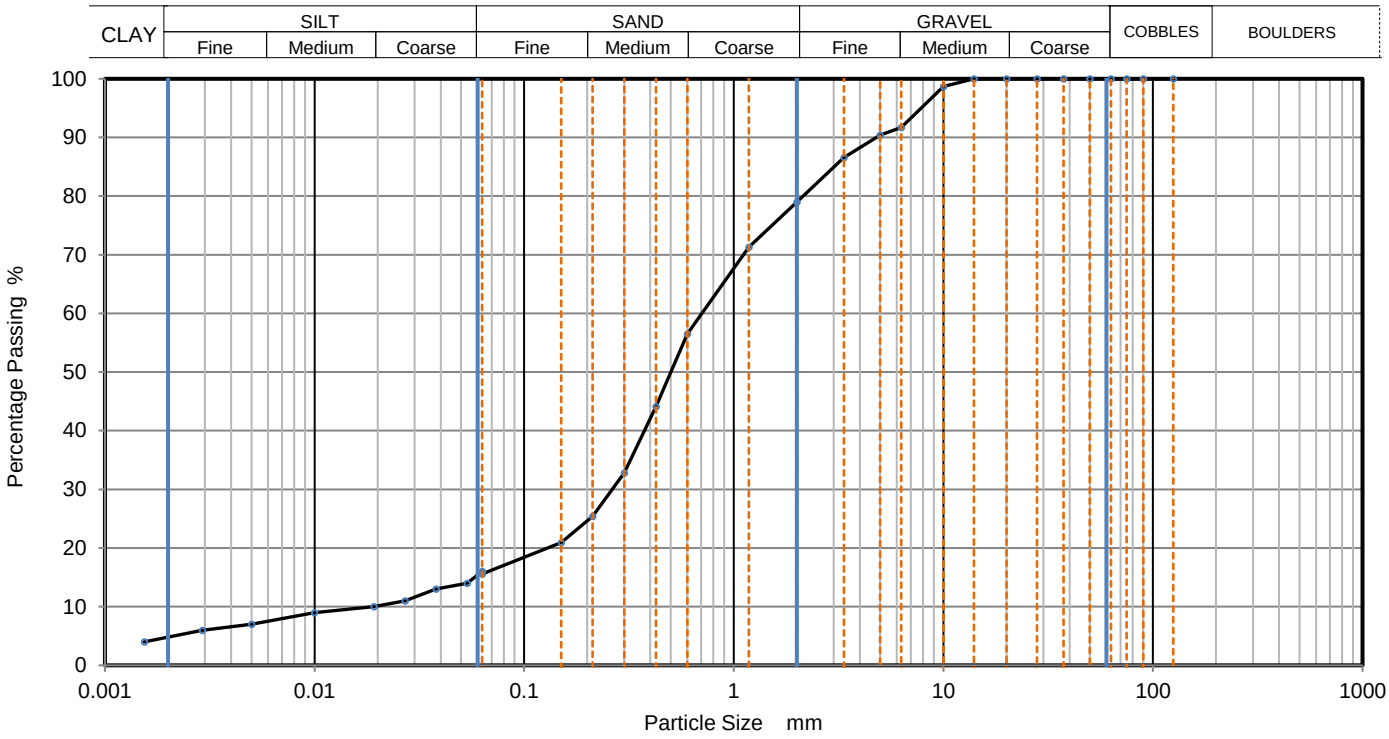
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brownish grey slightly gravelly silty fine to coarse SAND.			Sample Depth (m) Top	1.80
				Base	2.00
Specimen Reference	2	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220621101



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	16
90	100	0.05344	14
75	100	0.03800	13
63	100	0.02702	11
50	100	0.01921	10
37.5	100	0.00997	9
28	100	0.00501	7
20	100	0.00291	6
14	100	0.00154	4
10	99		
6.3	92		
5	90		
3.35	87		
2	79		
1.18	71		
0.6	57	Particle density	(assumed)
0.425	44	2.65	Mg/m3
0.3	33		
0.212	25		
0.15	21		
0.063	16		

Dry Mass of sample, g: 203

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	21.0
Sand	63.4
Silt	10.8
Clay	4.8

Grading Analysis		
D100	mm	
D60	mm	0.703
D30	mm	0.263
D10	mm	0.0196
Uniformity Coefficient		36
Curvature Coefficient		5

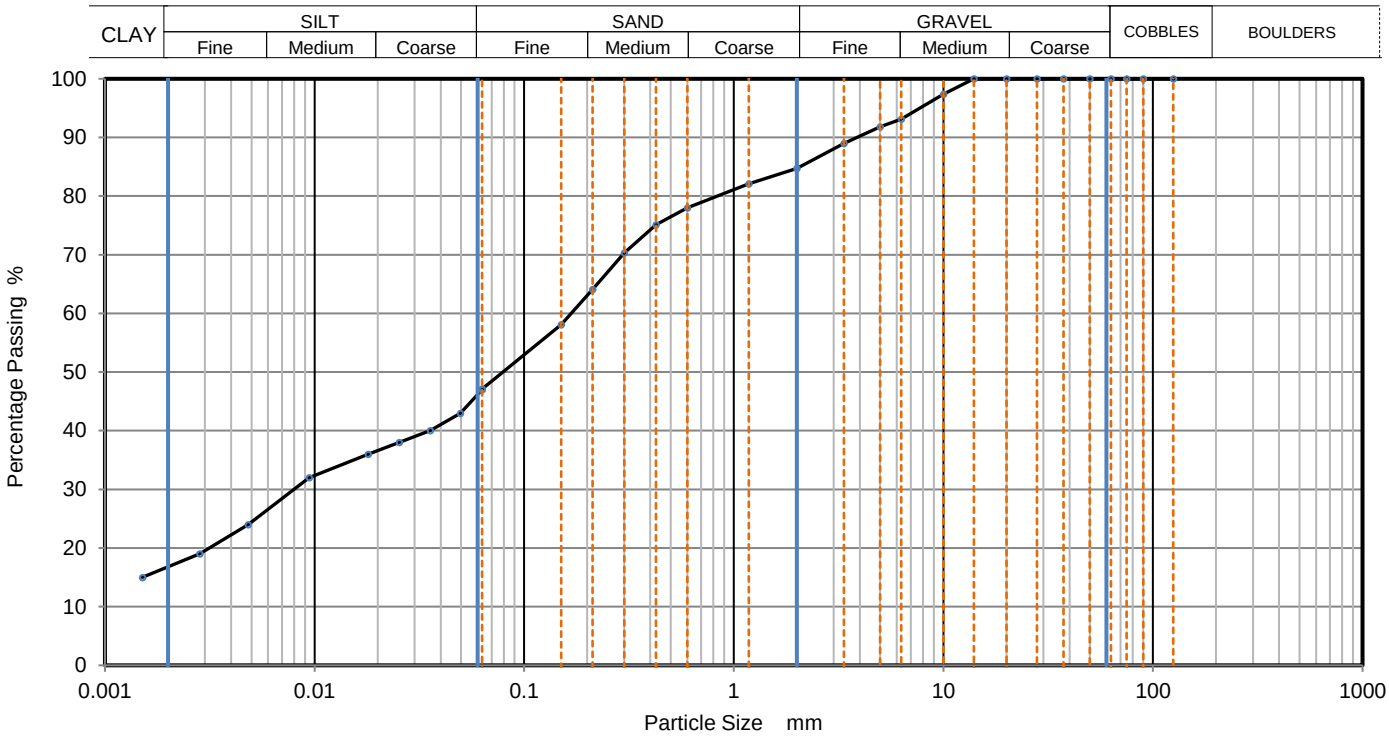
Remarks

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PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	2	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220621102



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.04969	43
75	100	0.03559	40
63	100	0.02533	38
50	100	0.01802	36
37.5	100	0.00942	32
28	100	0.00482	24
20	100	0.00283	19
14	100	0.00151	15
10	97		
6.3	93		
5	92		
3.35	89		
2	85		
1.18	82		
0.6	78	Particle density	(assumed)
0.425	75	2.65	Mg/m3
0.3	70		
0.212	64		
0.15	58		
0.063	47		

Dry Mass of sample, g: 200

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.3
Sand	37.6
Silt	30.3
Clay	16.8

Grading Analysis		
D100	mm	
D60	mm	0.167
D30	mm	0.00787
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

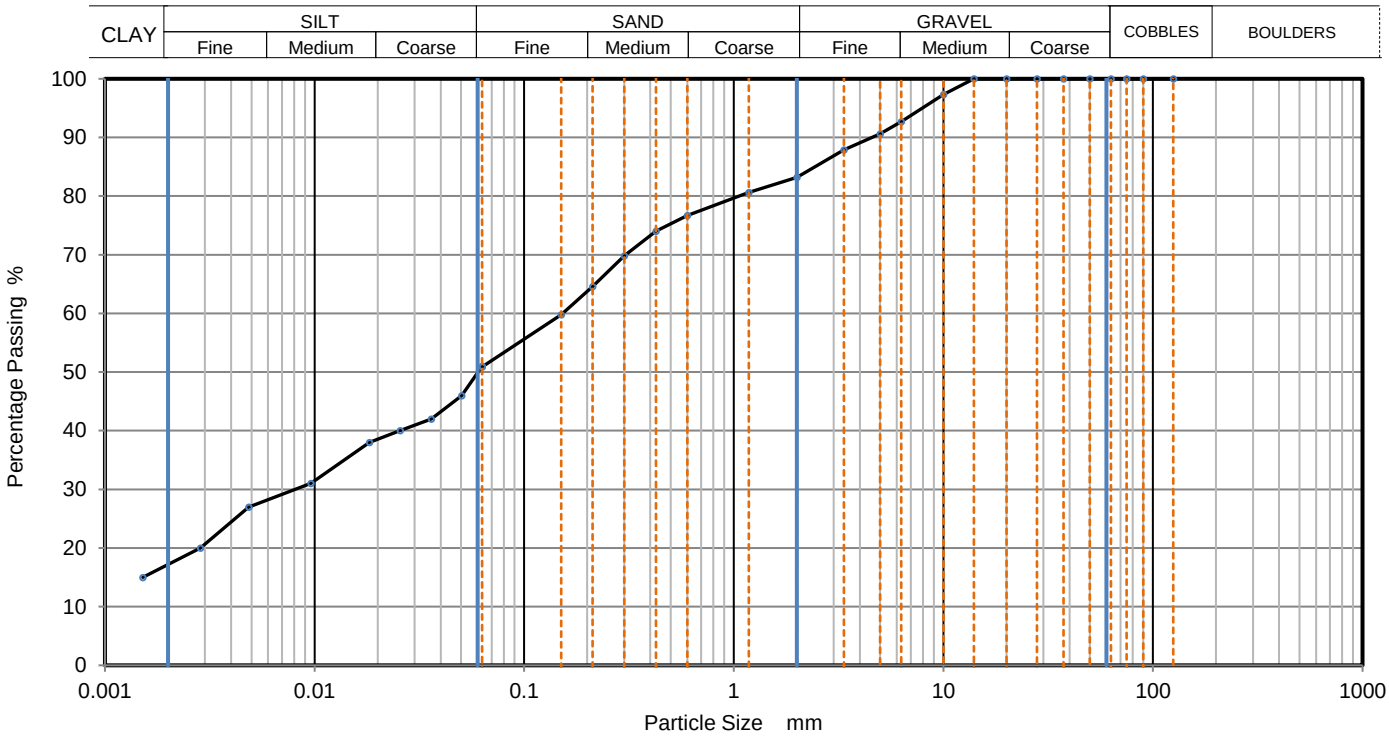
Remarks

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PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	5.80
				Base	6.00
Specimen Reference	2	Specimen Depth	5.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220621105



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.05033	46
75	100	0.03604	42
63	100	0.02564	40
50	100	0.01824	38
37.5	100	0.00959	31
28	100	0.00485	27
20	100	0.00285	20
14	100	0.00152	15
10	97		
6.3	93		
5	91		
3.35	88		
2	83		
1.18	81		
0.6	77	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	70		
0.212	65		
0.15	60		
0.063	51		

Dry Mass of sample, g: 212

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.8
Sand	32.3
Silt	33.5
Clay	17.4

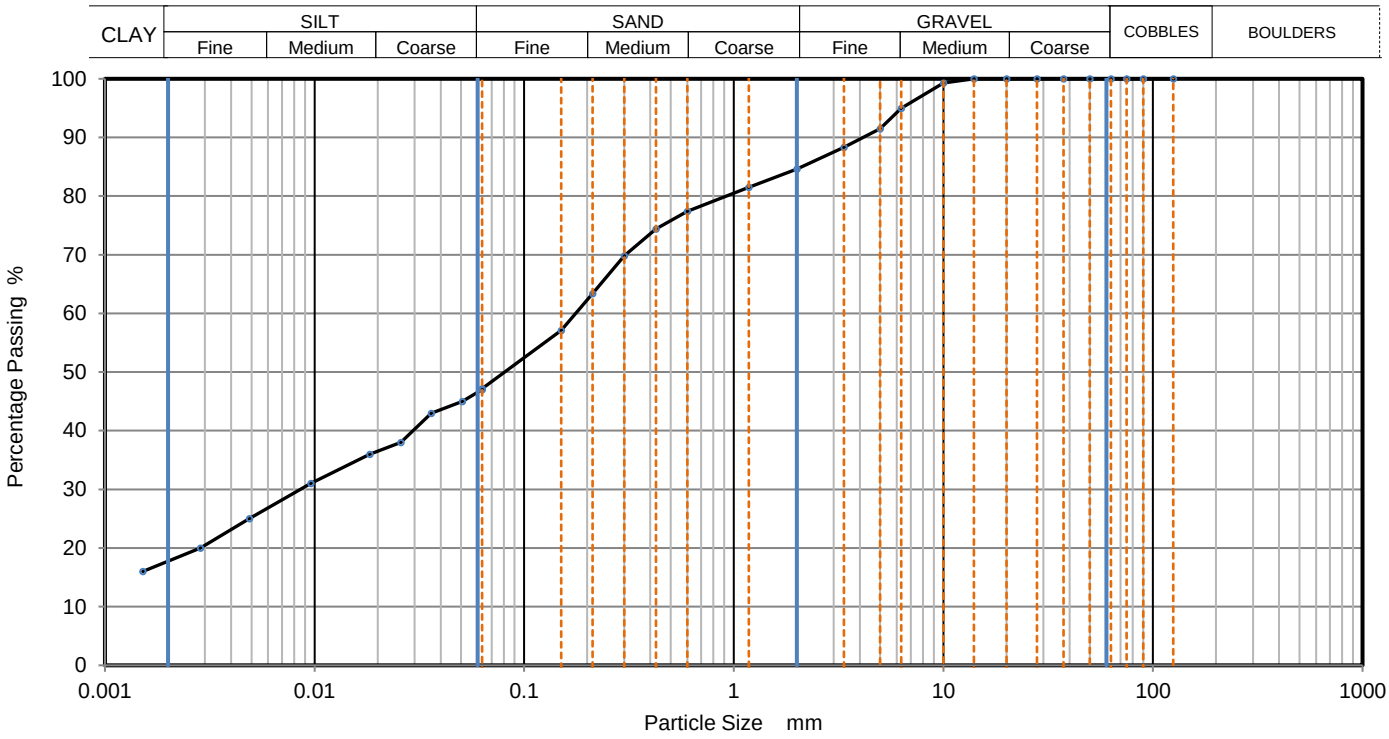
Grading Analysis		
D100	mm	
D60	mm	0.152
D30	mm	0.00824
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	21
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.80
				Base	12.00
Specimen Reference	2	Specimen Depth	11.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220621108



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	47
90	100	0.05065	45
75	100	0.03604	43
63	100	0.02580	38
50	100	0.01835	36
37.5	100	0.00959	31
28	100	0.00488	25
20	100	0.00285	20
14	100	0.00152	16
10	99		
6.3	95		
5	92		
3.35	88		
2	85		
1.18	82		
0.6	77	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	70		
0.212	63		
0.15	57		
0.063	47		

Dry Mass of sample, g: 215

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	15.4
Sand	37.4
Silt	29.5
Clay	17.7

Grading Analysis		
D100	mm	
D60	mm	0.176
D30	mm	0.00828
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

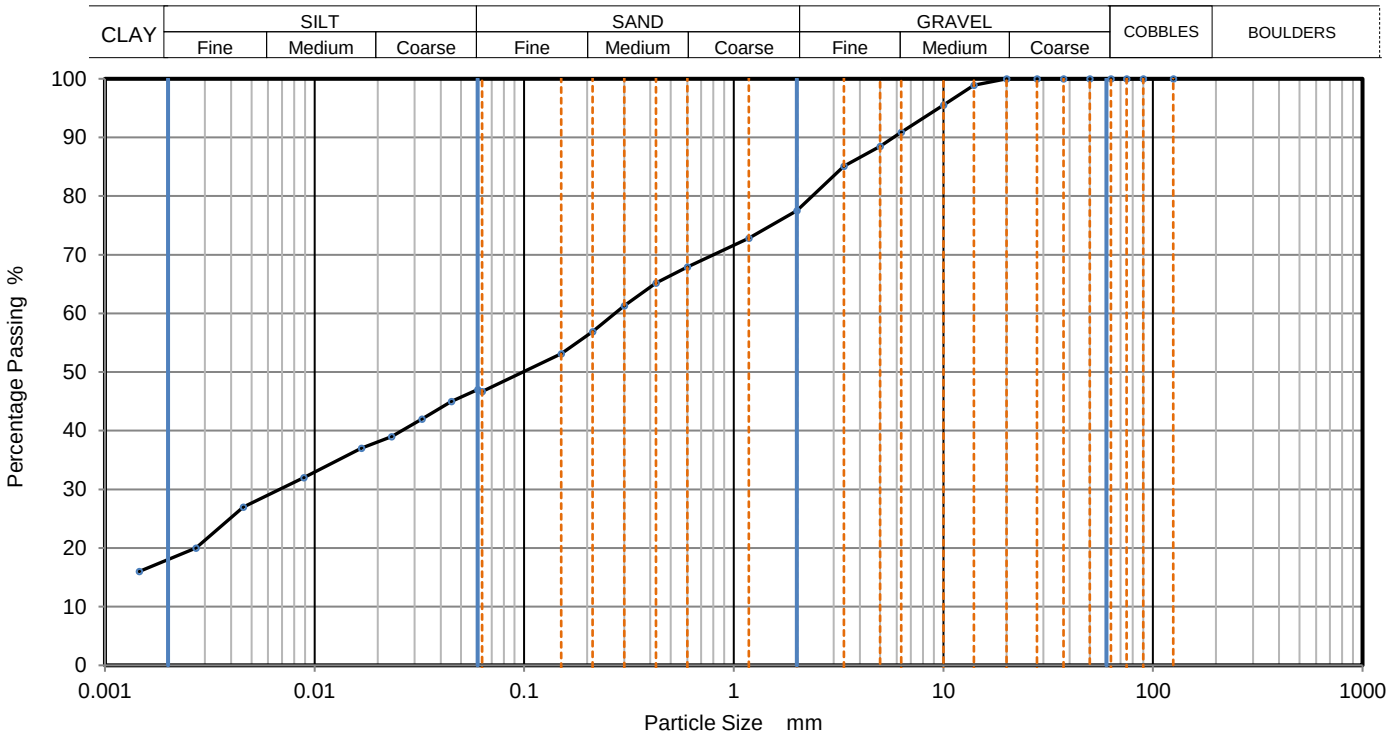
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					**21-1682**
Borehole/Pit No.					RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Base	13.50
Specimen Reference	9	Specimen Depth	12 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220825111



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05989	47
90	100	0.04490	45
75	100	0.03250	42
63	100	0.02333	39
50	100	0.01674	37
37.5	100	0.00889	32
28	100	0.00456	27
20	100	0.00272	20
14	99	0.00146	16
10	96		
6.3	91		
5	89		
3.35	85		
2	78		
1.18	73		
0.6	68	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	61		
0.212	57		
0.15	53		
0.063	47		

Dry Mass of sample, g: 539

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.5
Sand	30.8
Silt	28.4
Clay	18.3

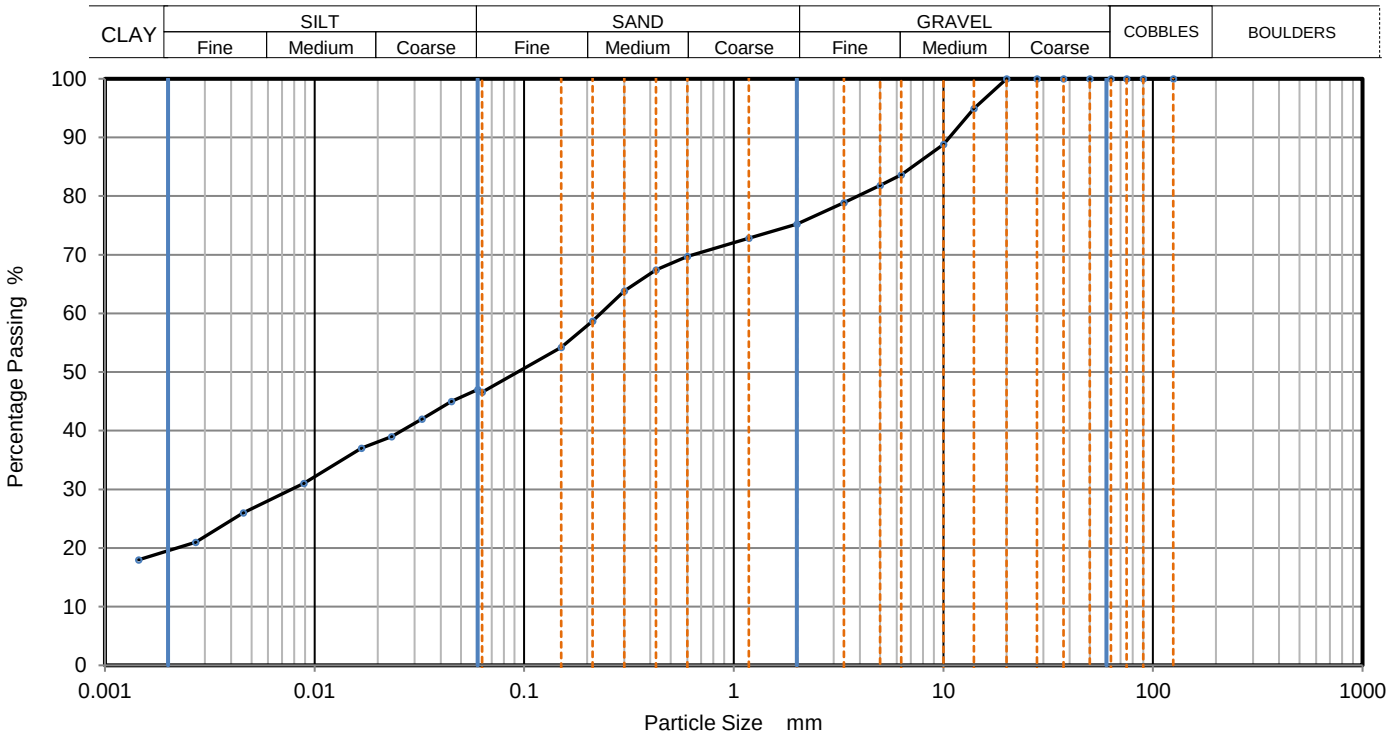
Grading Analysis		
D100	mm	
D60	mm	0.27
D30	mm	0.00724
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		2
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m)	Top	13.50
					Base	15.00
Specimen Reference	9	Specimen Depth	13.5 m	Sample Type		C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID		Caus20220825112



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05989	47
90	100	0.04490	45
75	100	0.03250	42
63	100	0.02333	39
50	100	0.01674	37
37.5	100	0.00889	31
28	100	0.00456	26
20	100	0.00270	21
14	95	0.00145	18
10	89		
6.3	84		
5	82		
3.35	79		
2	75		
1.18	73		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	64		
0.212	59		
0.15	54		
0.063	47		

Dry Mass of sample, g: 552

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	24.8
Sand	28.6
Silt	27.0
Clay	19.6

Grading Analysis		
D100	mm	
D60	mm	0.231
D30	mm	0.0073
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

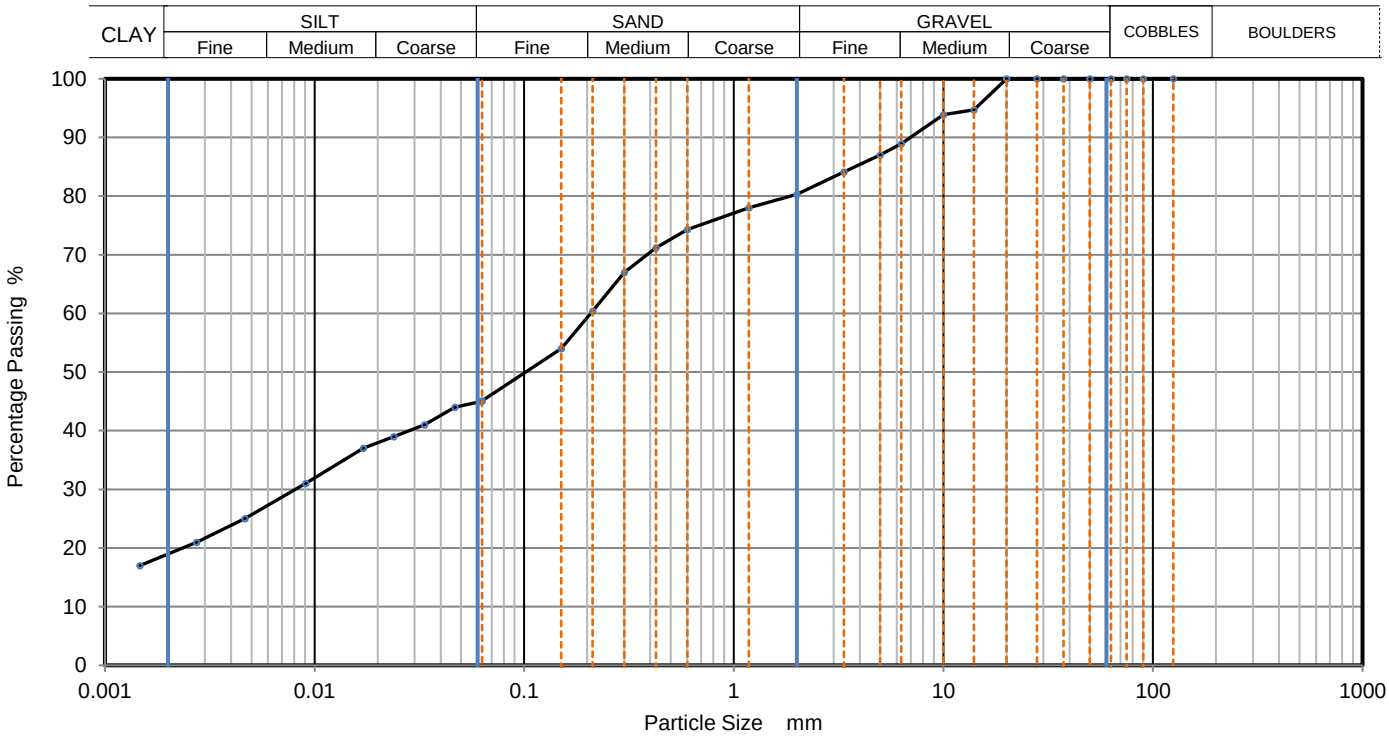
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.50
				Base	18.00
Specimen Reference	9	Specimen Depth	16.5 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220825113



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06229	45
90	100	0.04666	44
75	100	0.03348	41
63	100	0.02384	39
50	100	0.01710	37
37.5	100	0.00907	31
28	100	0.00465	25
20	100	0.00274	21
14	95	0.00147	17
10	94		
6.3	89		
5	87		
3.35	84		
2	80		
1.18	78		
0.6	74	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	67		
0.212	60		
0.15	54		
0.063	45		

Dry Mass of sample, g: 542

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.7
Sand	35.2
Silt	26.1
Clay	19.0

Grading Analysis		
D100	mm	
D60	mm	0.207
D30	mm	0.00805
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

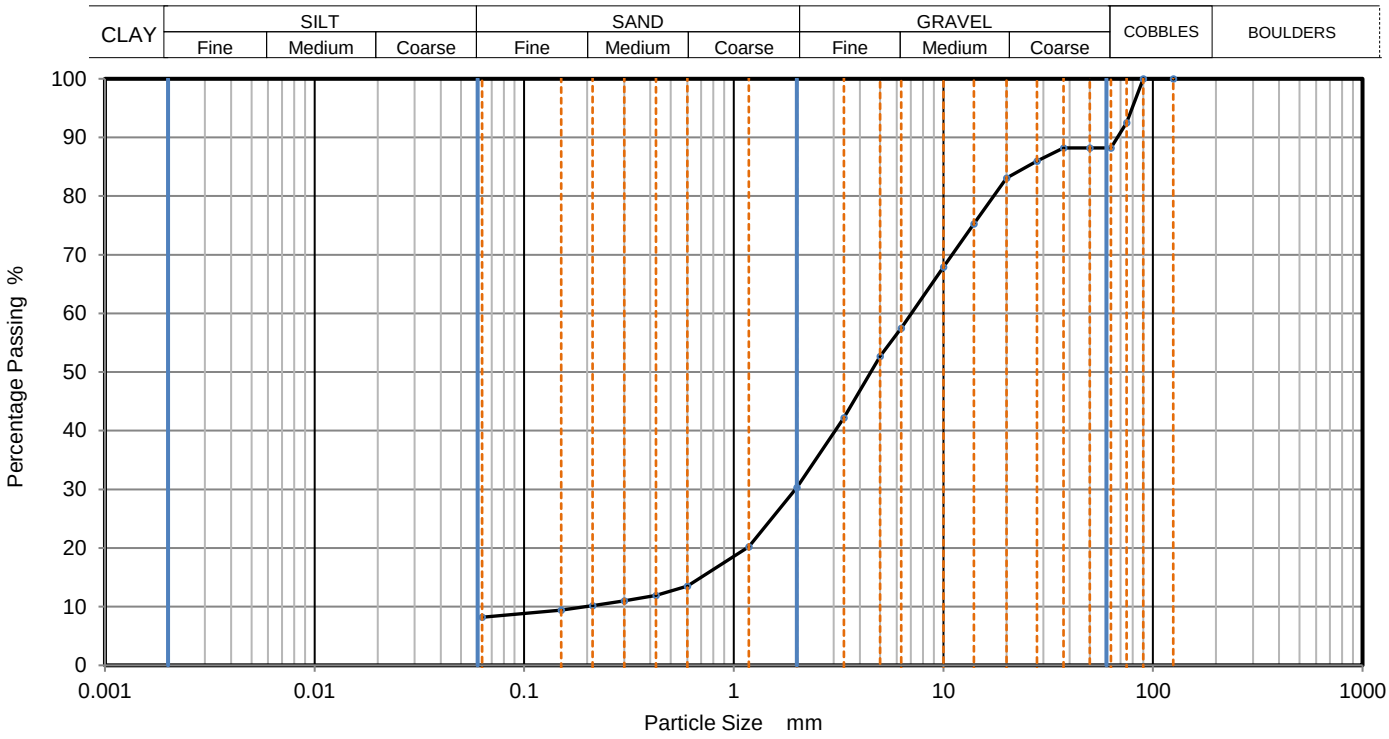
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH022
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey sandy slightly clayey subangular fine to coarse GRAVEL with some cobbles.			Sample Depth (m) Top	0.80
				Base	1.00
Specimen Reference	2	Specimen Depth	0.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022071482



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	93		
63	88		
50	88		
37.5	88		
28	86		
20	83		
14	75		
10	68		
6.3	58		
5	53		
3.35	42		
2	30		
1.18	20		
0.6	14		
0.425	12		
0.3	11		
0.212	10		
0.15	9		
0.063	8		

Dry Mass of sample, g: 14016

Sample Proportions	% dry mass
Cobbles	11.8
Gravel	57.9
Sand	22.1
Fines <0.063mm	8.0

Grading Analysis		
D100	mm	
D60	mm	7.03
D30	mm	1.97
D10	mm	0.195
Uniformity Coefficient		36
Curvature Coefficient		2.8

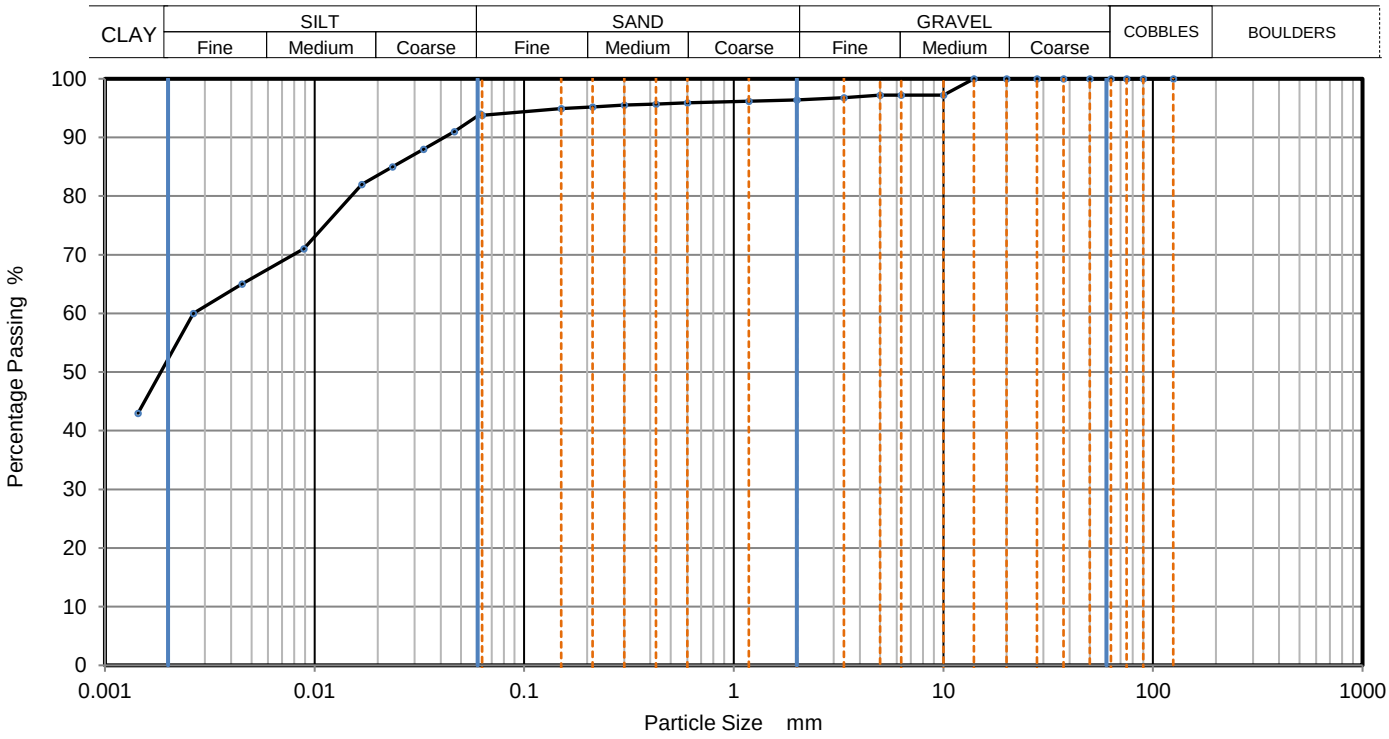
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH022
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Greyish brown slightly sandy silty CLAY.			Sample Depth (m) Top	2.80
				Base	3.00
Specimen Reference	2	Specimen Depth	2.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071483



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06199	94
90	100	0.04644	91
75	100	0.03307	88
63	100	0.02355	85
50	100	0.01677	82
37.5	100	0.00890	71
28	100	0.00451	65
20	100	0.00264	60
14	100	0.00144	43
10	97		
6.3	97		
5	97		
3.35	97		
2	96		
1.18	96		
0.6	96	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	96		
0.212	95		
0.15	95		
0.063	94		

Dry Mass of sample, g: 252

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	3.6
Sand	2.6
Silt	41.9
Clay	51.9

Grading Analysis		
D100	mm	
D60	mm	0.00271
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

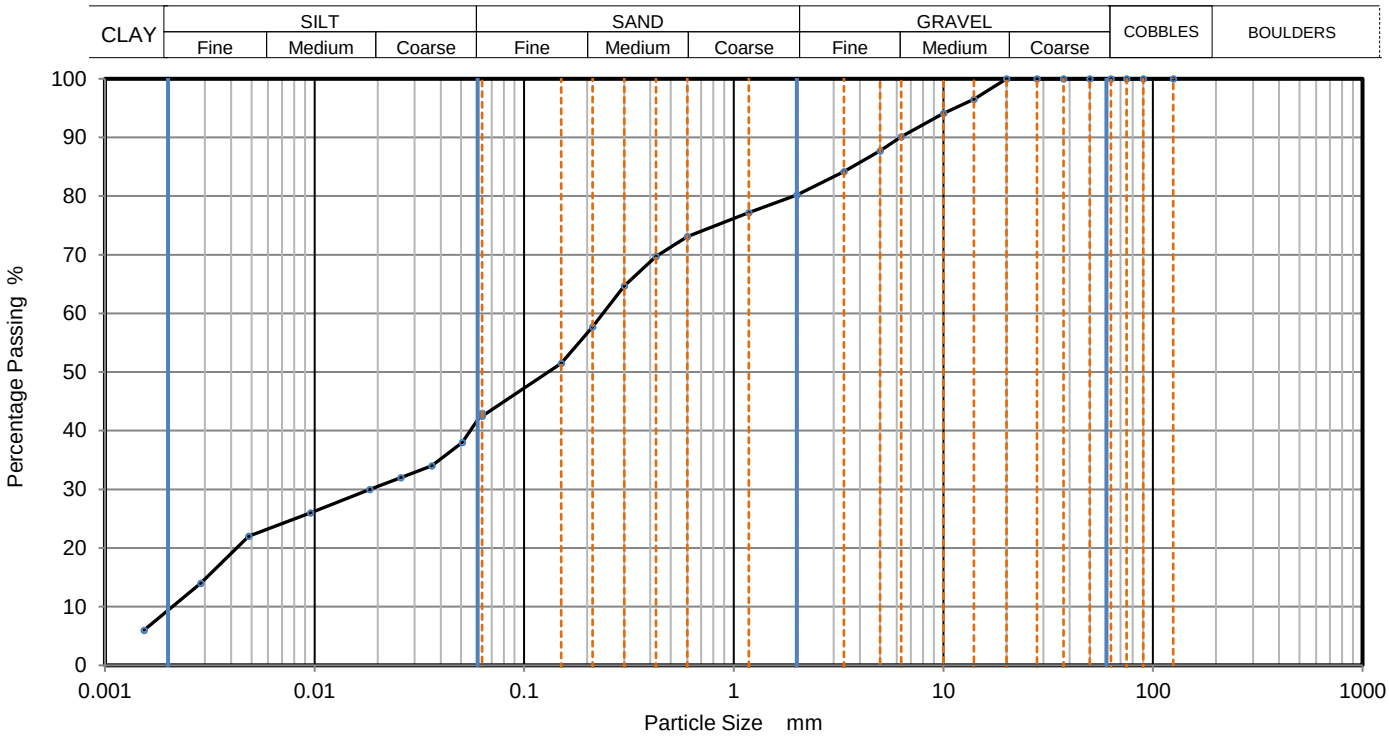
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH022
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.80
				Base	4.00
Specimen Reference	2	Specimen Depth	3.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022071486



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.05065	38
75	100	0.03625	34
63	100	0.02579	32
50	100	0.01834	30
37.5	100	0.00958	26
28	100	0.00485	22
20	100	0.00286	14
14	97	0.00154	6
10	94		
6.3	90		
5	88		
3.35	84		
2	80		
1.18	77		
0.6	73	Particle density	(assumed)
0.425	70	2.65	Mg/m3
0.3	65		
0.212	58		
0.15	52		
0.063	43		

Dry Mass of sample, g: 507

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	19.8
Sand	37.7
Silt	33.0
Clay	9.5

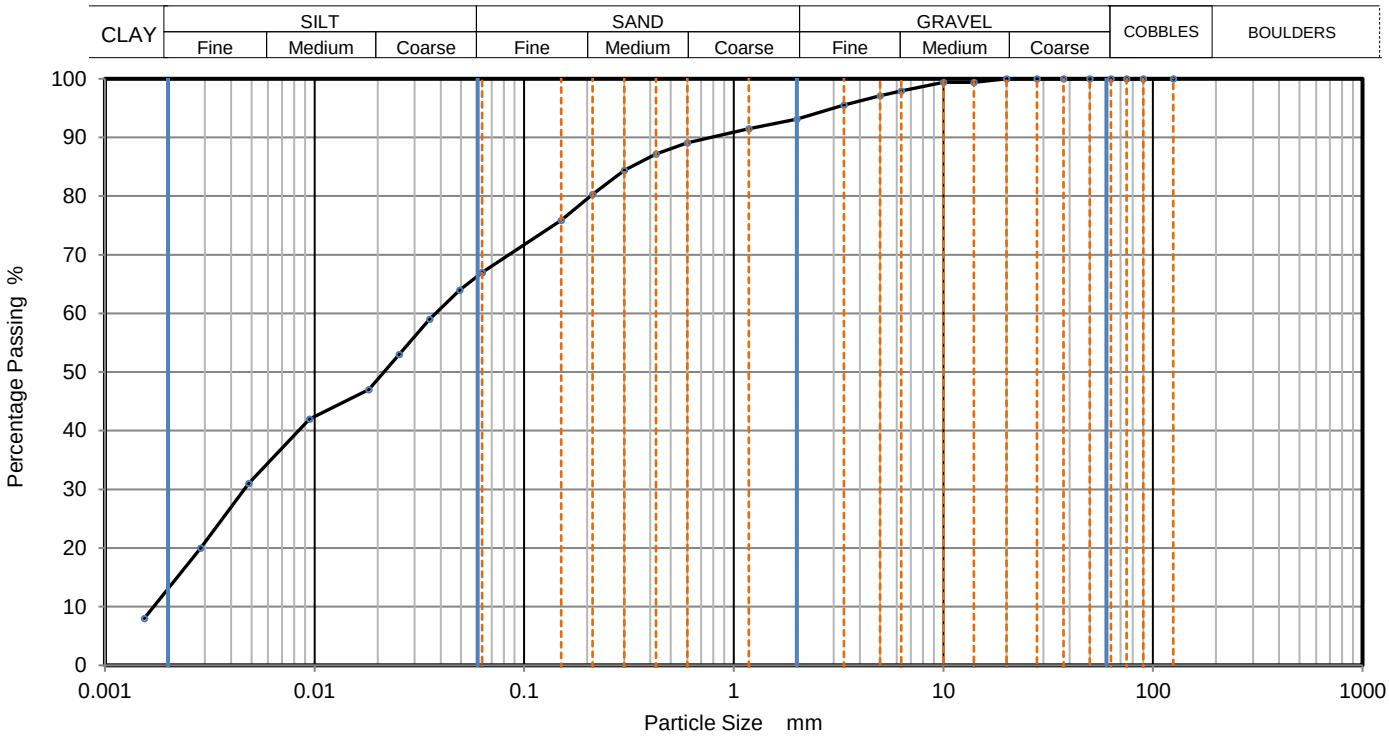
Grading Analysis		
D100	mm	
D60	mm	0.237
D30	mm	0.0173
D10	mm	0.00208
Uniformity Coefficient		110
Curvature Coefficient		0.61

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref		21-1682
					Borehole/Pit No.		RWRM-DS001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		8
Specimen Description	Brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	1.40
						Base	2.70
Specimen Reference	2	Specimen Depth	1.4	m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID		Caus2022090886



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	67
90	100	0.04935	64
75	100	0.03536	59
63	100	0.02532	53
50	100	0.01813	47
37.5	100	0.00948	42
28	100	0.00485	31
20	100	0.00286	20
14	99	0.00154	8
10	99		
6.3	98		
5	97		
3.35	96		
2	93		
1.18	92		
0.6	89	Particle density	(assumed)
0.425	87	2.65	Mg/m3
0.3	84		
0.212	80		
0.15	76		
0.063	67		

Dry Mass of sample, g: 501

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	6.9
Sand	26.1
Silt	53.9
Clay	13.1

Grading Analysis		
D100	mm	
D60	mm	0.0384
D30	mm	0.00469
D10	mm	0.00169
Uniformity Coefficient		23
Curvature Coefficient		0.34

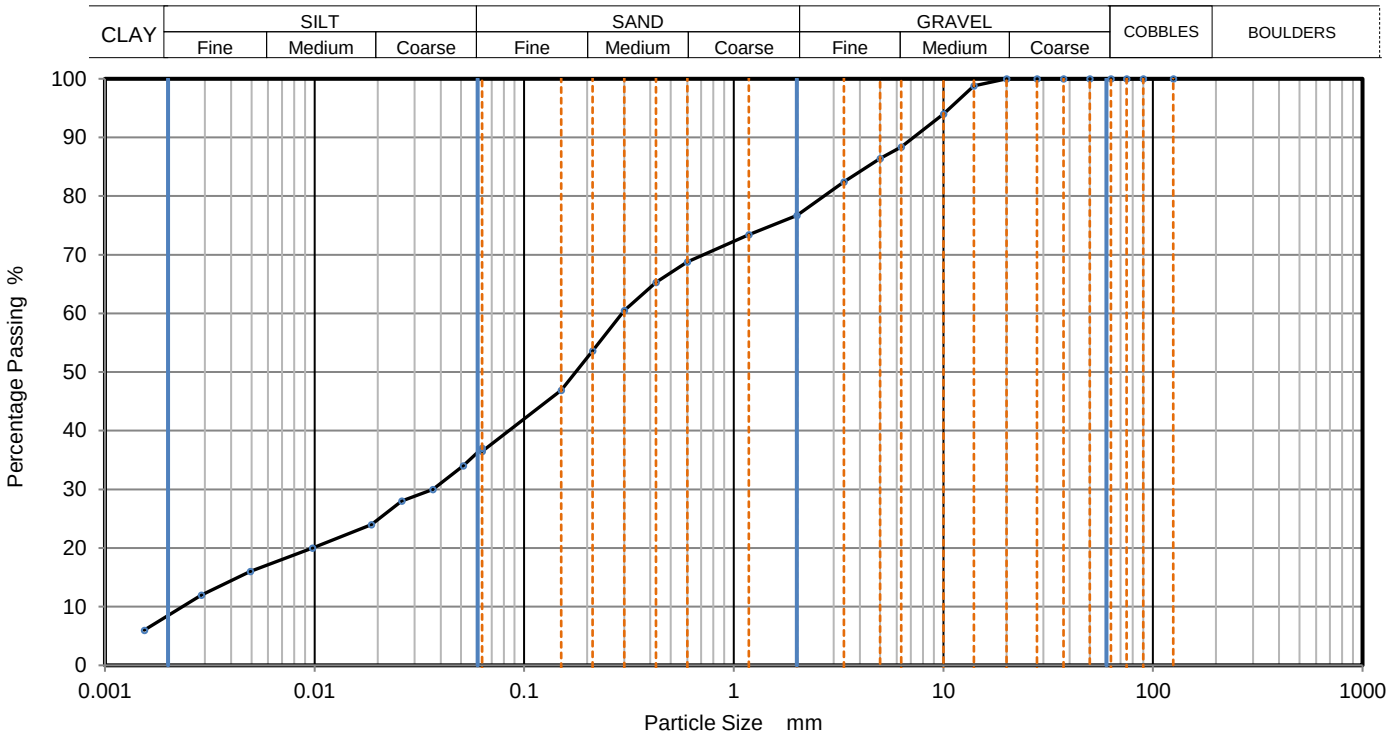
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-DS001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Specimen Description	Light grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.70
				Base	4.00
Specimen Reference	2	Specimen Depth	2.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022090888



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	37
90	100	0.05128	34
75	100	0.03670	30
63	100	0.02611	28
50	100	0.01868	24
37.5	100	0.00976	20
28	100	0.00493	16
20	100	0.00288	12
14	99	0.00154	6
10	94		
6.3	88		
5	86		
3.35	82		
2	77		
1.18	73		
0.6	69	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	61		
0.212	54		
0.15	47		
0.063	37		

Dry Mass of sample, g: 507

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.3
Sand	40.2
Silt	27.9
Clay	8.6

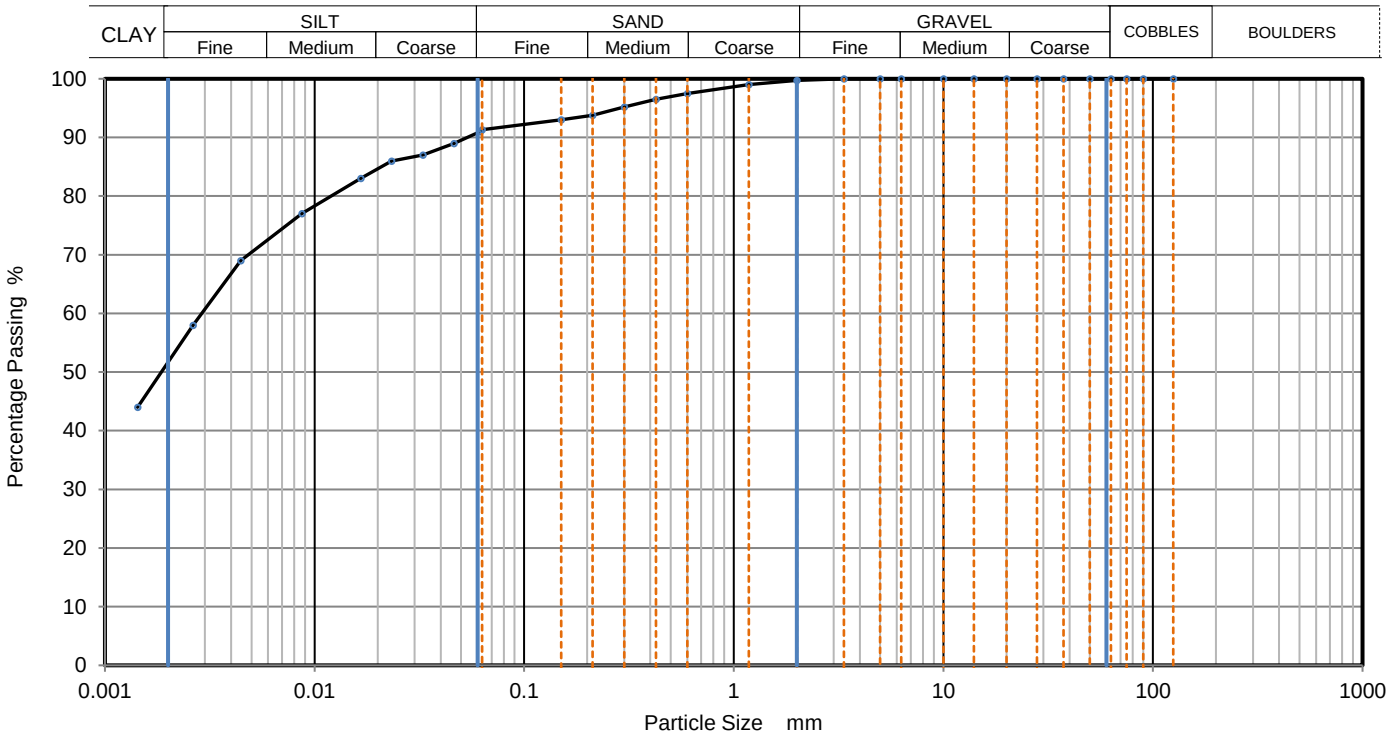
Grading Analysis		
D100	mm	
D60	mm	0.293
D30	mm	0.0342
D10	mm	0.0023
Uniformity Coefficient		130
Curvature Coefficient		1.7

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-DS002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown slightly sandy silty CLAY.			Sample Depth (m) Top	2.00
				Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022090889



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06181	91
90	100	0.04631	89
75	100	0.03287	87
63	100	0.02333	86
50	100	0.01662	83
37.5	100	0.00871	77
28	100	0.00445	69
20	100	0.00264	58
14	100	0.00143	44
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	97	2.65	Mg/m3
0.3	95		
0.212	94		
0.15	93		
0.063	91		

Dry Mass of sample, g: 500

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.3
Sand	8.4
Silt	39.4
Clay	51.9

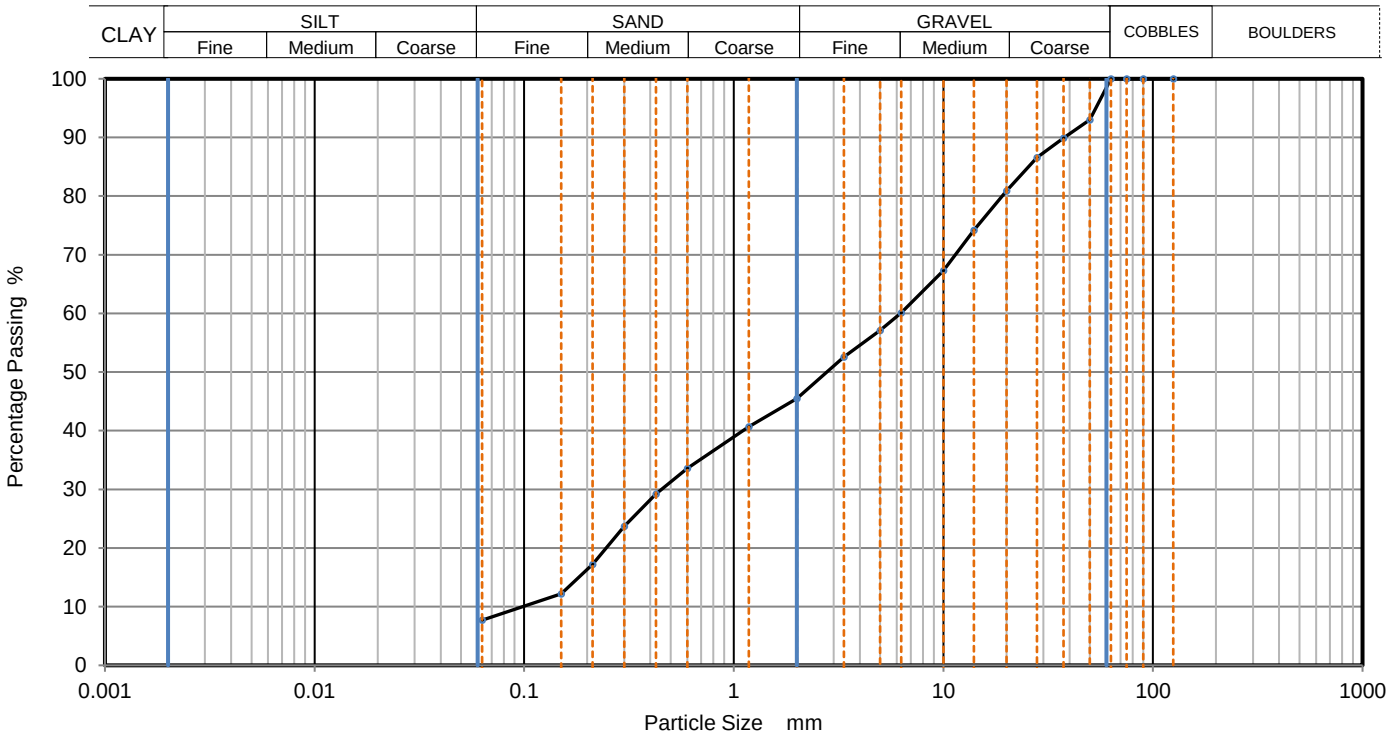
Grading Analysis		
D100	mm	
D60	mm	0.00288
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-DS-006
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Greyish brown gravely slightly clayey fine to coarse SAND.			Sample Depth (m) Top	2.50
				Sample Depth (m) Base	
Specimen Reference	3	Specimen Depth	2.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2022083153



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	93		
37.5	90		
28	87		
20	81		
14	74		
10	67		
6.3	60		
5	57		
3.35	53		
2	46		
1.18	41		
0.6	34		
0.425	29		
0.3	24		
0.212	17		
0.15	12		
0.063	8		

Dry Mass of sample, g	4002

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	54.5
Sand	37.9
Fines <0.063mm	8.0

Grading Analysis		
D100	mm	
D60	mm	6.23
D30	mm	0.452
D10	mm	0.0981
Uniformity Coefficient		64
Curvature Coefficient		0.33

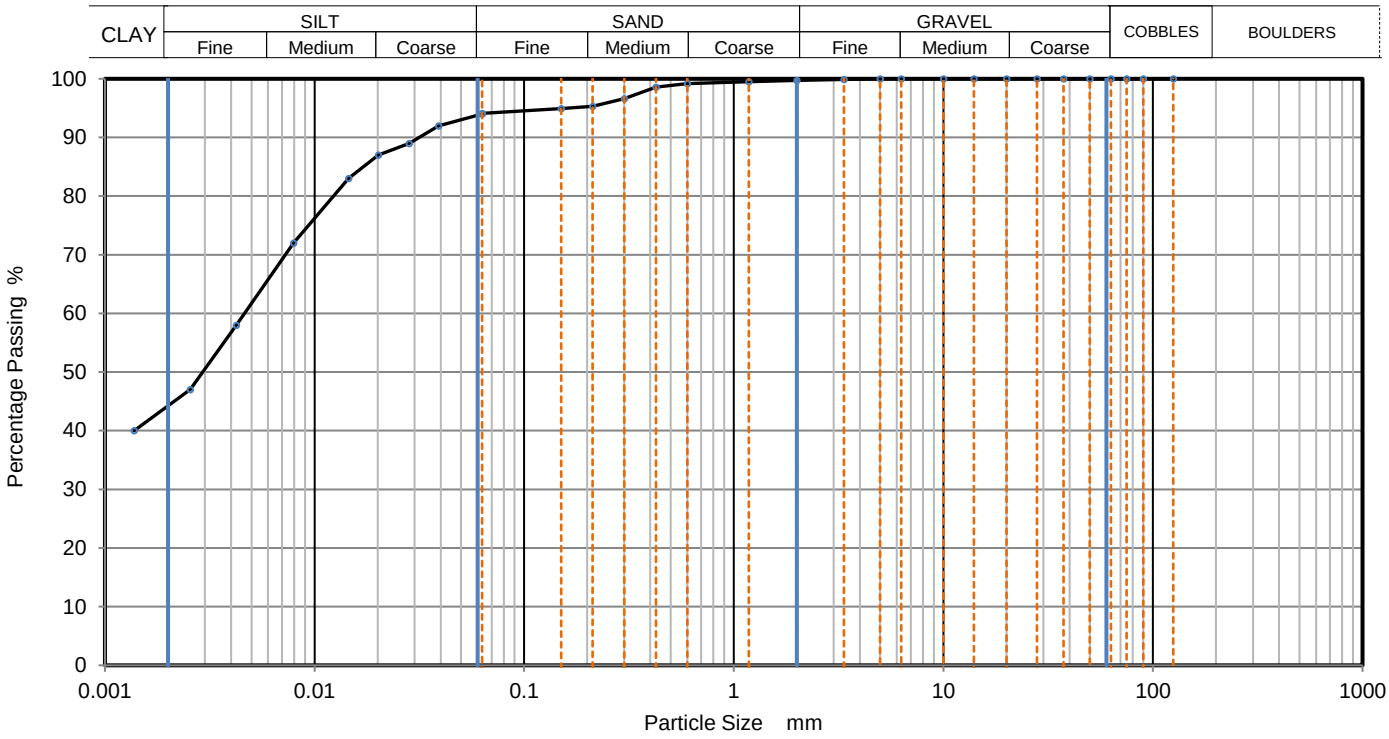
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Joseph

UKAS TESTING

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-DS-006
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Specimen Description	Greyish brown slightly sandy silty CLAY.			Sample Depth (m) Top	3.50
				Sample Depth (m) Base	
Specimen Reference	3	Specimen Depth	3.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022083154



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	94
90	100	0.03913	92
75	100	0.02825	89
63	100	0.02017	87
50	100	0.01455	83
37.5	100	0.00793	72
28	100	0.00423	58
20	100	0.00255	47
14	100	0.00138	40
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	97		
0.212	95		
0.15	95		
0.063	94		

Dry Mass of sample, g: 341

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.3
Sand	5.7
Silt	49.8
Clay	44.2

Grading Analysis		
D100	mm	
D60	mm	0.00463
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

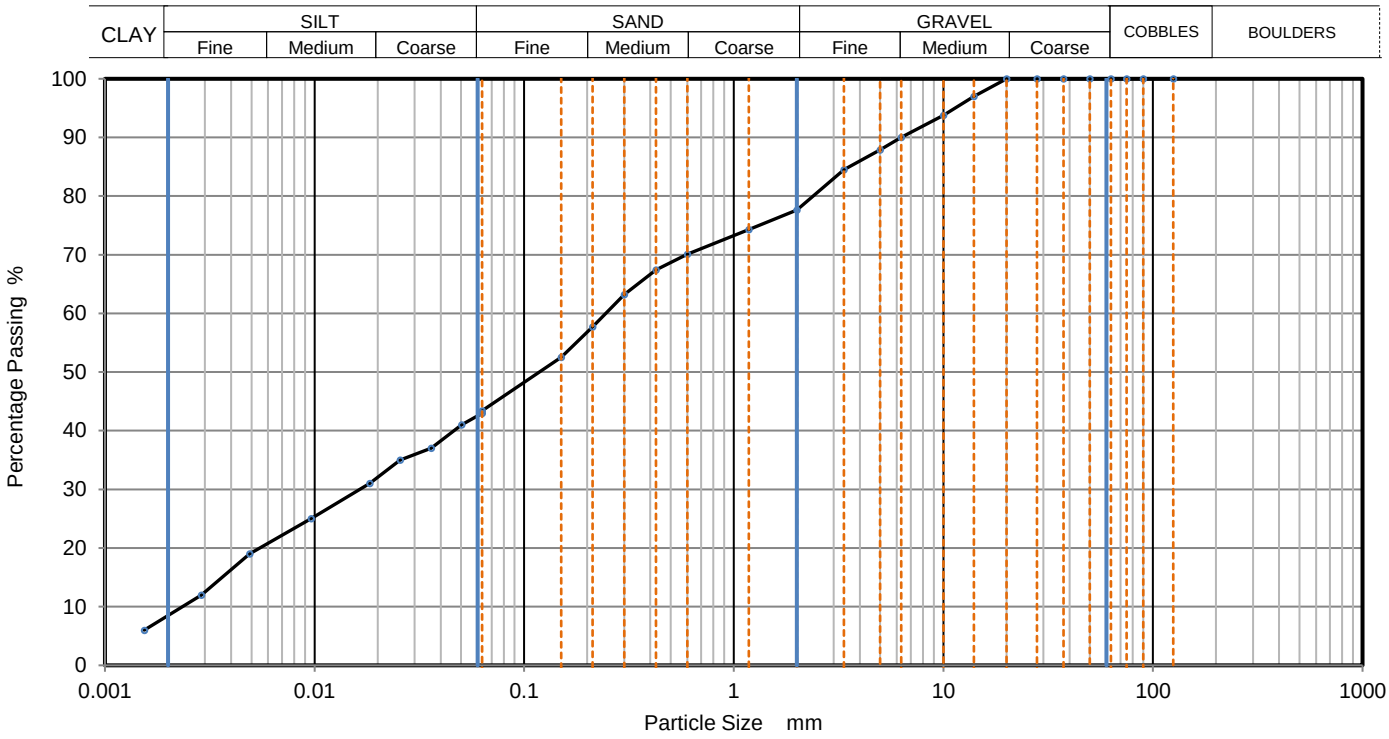
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-DS-007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Greyish brown sandy gravelly silty CLAY.			Sample Depth (m) Top	1.00
				Base	
Specimen Reference	3	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022083156



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	43
90	100	0.05032	41
75	100	0.03604	37
63	100	0.02564	35
50	100	0.01835	31
37.5	100	0.00965	25
28	100	0.00491	19
20	100	0.00288	12
14	97	0.00154	6
10	94		
6.3	90		
5	88		
3.35	85		
2	78		
1.18	74		
0.6	70	Particle density	(assumed)
0.425	67	2.65	Mg/m3
0.3	63		
0.212	58		
0.15	53		
0.063	43		

Dry Mass of sample, g: 528

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.4
Sand	34.2
Silt	34.6
Clay	8.8

Grading Analysis		
D100	mm	
D60	mm	0.245
D30	mm	0.0165
D10	mm	0.00226
Uniformity Coefficient		110
Curvature Coefficient		0.49

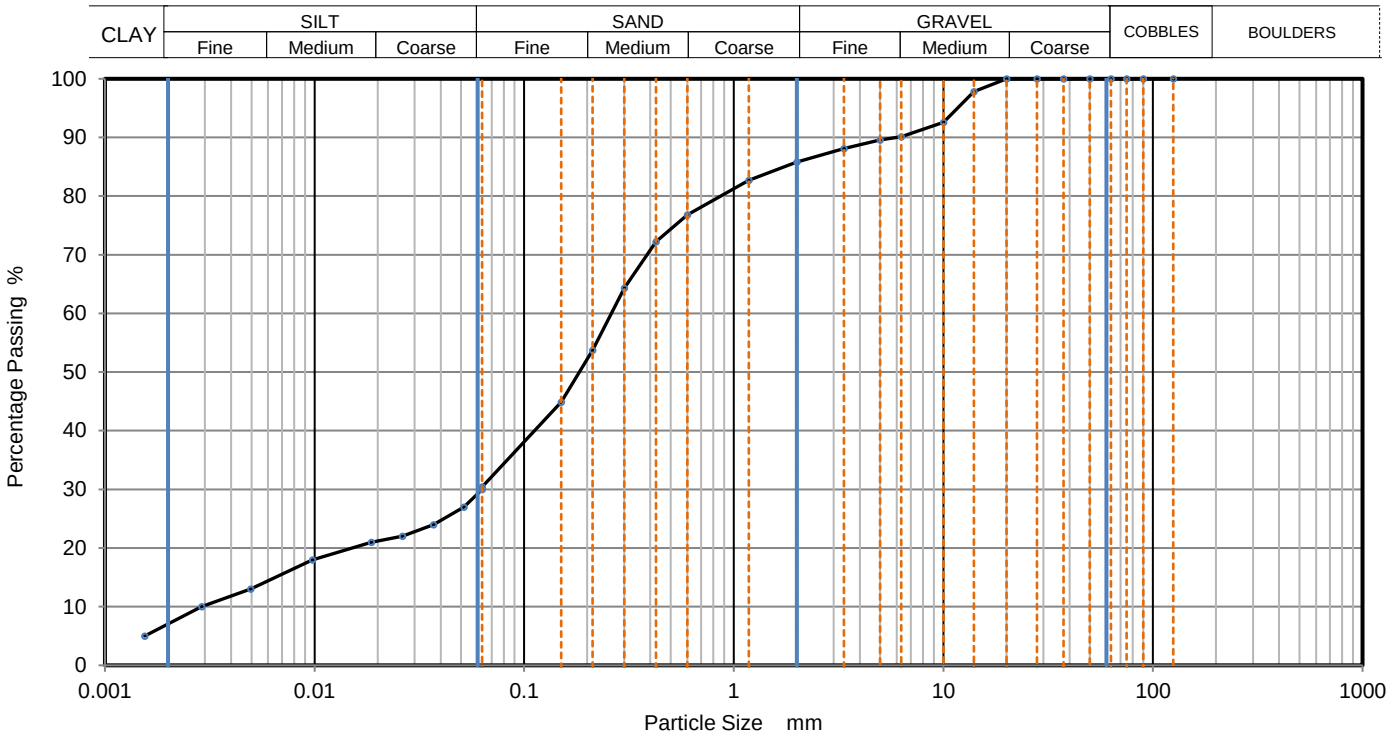
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

Job Ref					21-1682
Borehole/Pit No.					RWRM-TP002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey slightly gravelly clayey fine to coarse SAND.			Sample Depth (m) Top	0.60
				Base	1.40
Specimen Reference	6	Specimen Depth	0.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220908118



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	30
90	100	0.05160	27
75	100	0.03693	24
63	100	0.02627	22
50	100	0.01868	21
37.5	100	0.00976	18
28	100	0.00496	13
20	100	0.00290	10
14	98	0.00155	5
10	93		
6.3	90		
5	90		
3.35	88		
2	86		
1.18	83		
0.6	77	Particle density	(assumed)
0.425	72	2.65	Mg/m3
0.3	64		
0.212	54		
0.15	45		
0.063	30		

Dry Mass of sample, g: 425

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.2
Sand	55.4
Silt	23.6
Clay	6.8

Grading Analysis		
D100	mm	
D60	mm	0.26
D30	mm	0.0614
D10	mm	0.0031
Uniformity Coefficient		84
Curvature Coefficient		4.7

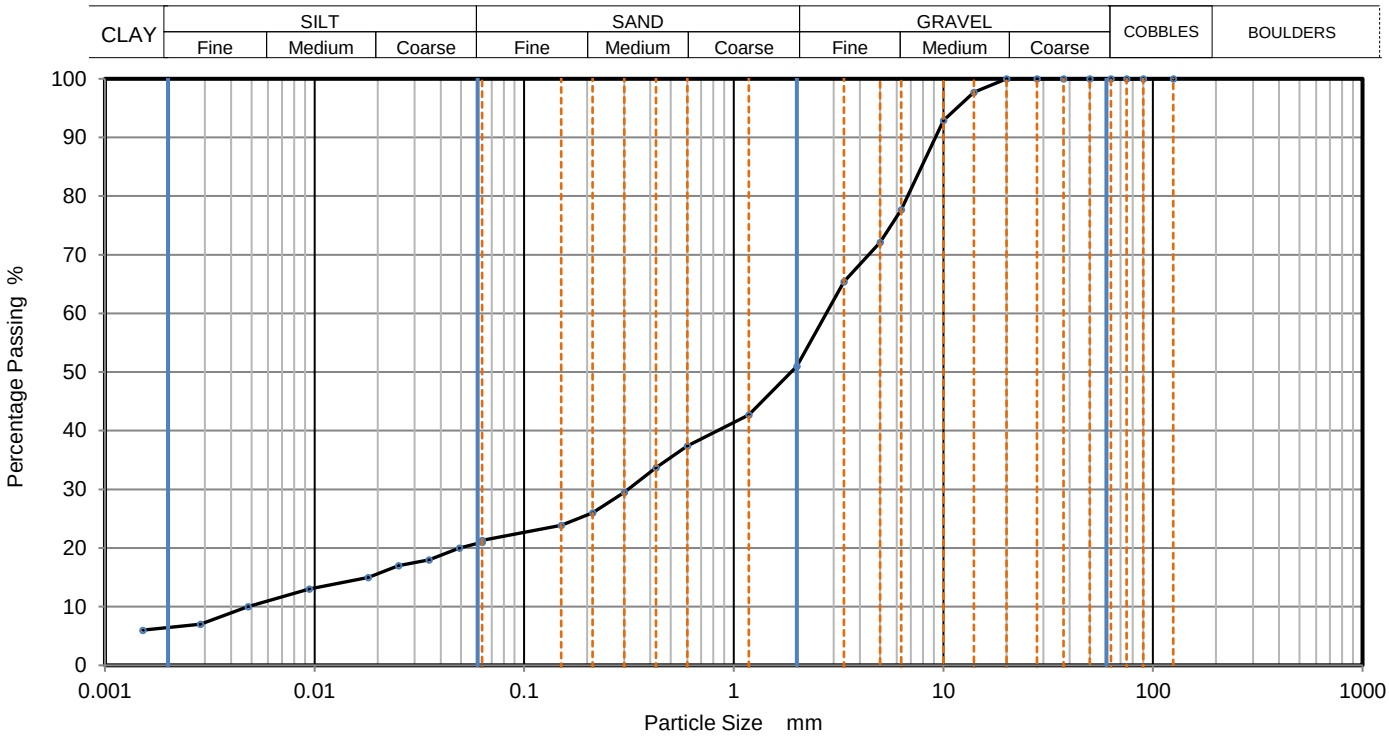
Remarks

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Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-TP002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Greenish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.40
				Base	1.90
Specimen Reference	4	Specimen Depth	1.4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220908119



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	21
90	100	0.04903	20
75	100	0.03513	18
63	100	0.02517	17
50	100	0.01802	15
37.5	100	0.00942	13
28	100	0.00482	10
20	100	0.00285	7
14	98	0.00152	6
10	93		
6.3	78		
5	72		
3.35	65		
2	51		
1.18	43		
0.6	37	Particle density	(assumed)
0.425	34	2.65	Mg/m3
0.3	30		
0.212	26		
0.15	24		
0.063	21		

Dry Mass of sample, g: 456

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	49.0
Sand	29.7
Silt	15.1
Clay	6.2

Grading Analysis		
D100	mm	
D60	mm	2.76
D30	mm	0.312
D10	mm	0.00462
Uniformity Coefficient		600
Curvature Coefficient		7.6

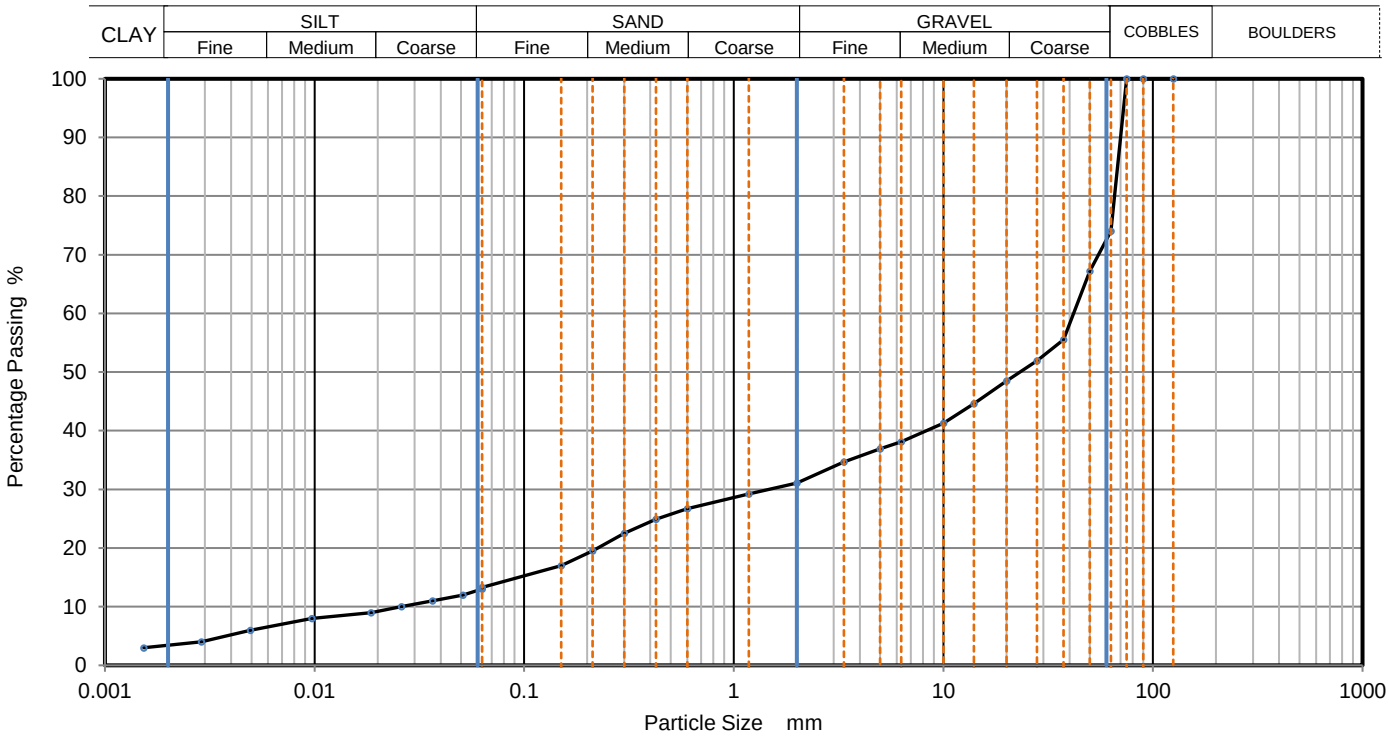
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-TP002
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Specimen Description	Greenish grey sandy slightly gravelly silty CLAY with cobbles.			Sample Depth (m) Top	1.90
				Base	3.10
Specimen Reference	7	Specimen Depth	1.9 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20220908120



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	13
90	100	0.05097	12
75	100	0.03649	11
63	74	0.02596	10
50	67	0.01857	9
37.5	56	0.00970	8
28	52	0.00493	6
20	49	0.00288	4
14	45	0.00153	3
10	41		
6.3	38		
5	37		
3.35	35		
2	31		
1.18	29		
0.6	27	Particle density	(assumed)
0.425	25	2.65	Mg/m3
0.3	23		
0.212	20		
0.15	17		
0.063	13		

Dry Mass of sample, g: 10551

Sample Proportions	% dry mass
Cobbles	26.0
Gravel	42.9
Sand	17.8
Silt	9.6
Clay	3.7

Grading Analysis		
D100	mm	
D60	mm	41.9
D30	mm	1.48
D10	mm	0.0251
Uniformity Coefficient		1700
Curvature Coefficient		2.1

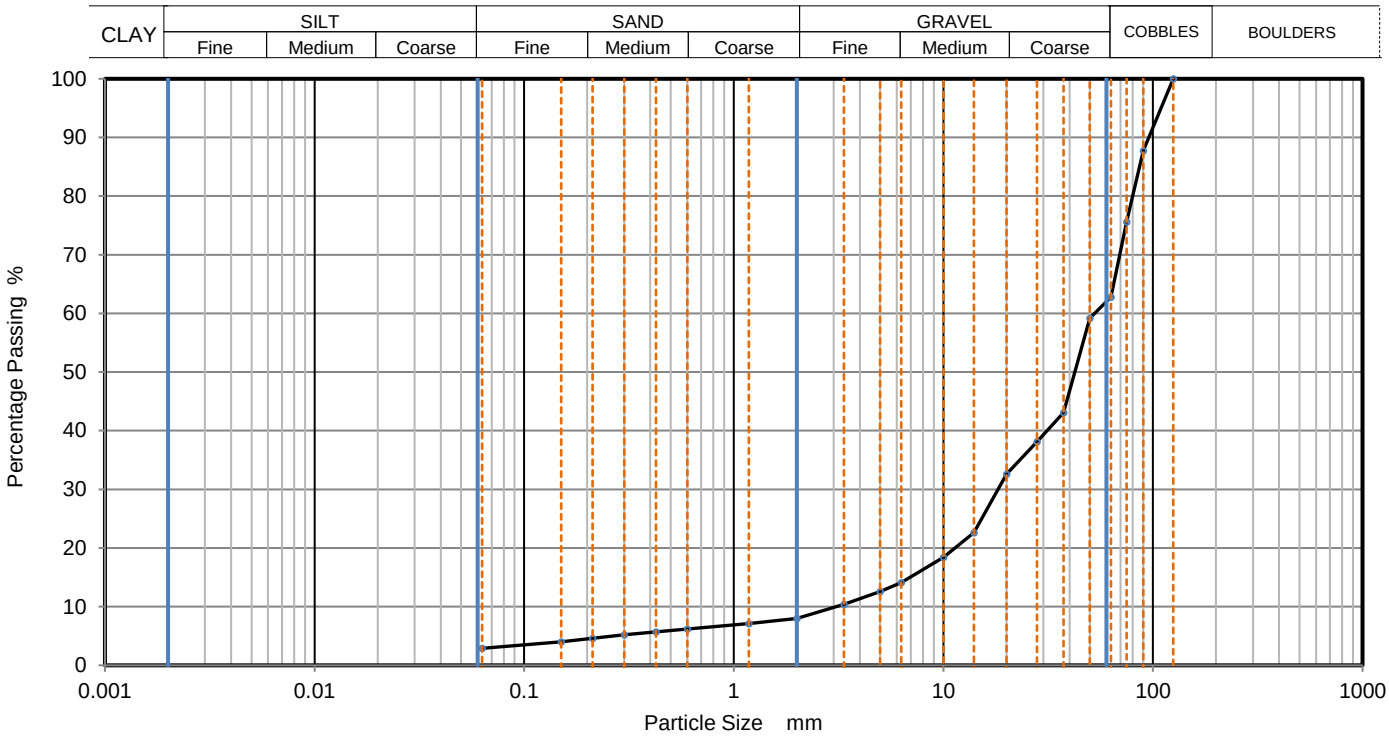
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-TP003
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey slightly sandy slightly silty subangular fine to coarse GRAVEL with cobbles.			Sample Depth (m) Top	0.25
				Base	0.90
Specimen Reference	4	Specimen Depth	0.25 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20220908121



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	88		
75	76		
63	63		
50	59		
37.5	43		
28	38		
20	33		
14	23		
10	18		
6.3	14		
5	13		
3.35	10		
2	8		
1.18	7		
0.6	6		
0.425	6		
0.3	5		
0.212	5		
0.15	4		
0.063	3		

Dry Mass of sample, g: 16848

Sample Proportions	% dry mass
Cobbles	37.2
Gravel	54.8
Sand	5.1
Fines <0.063mm	3.0

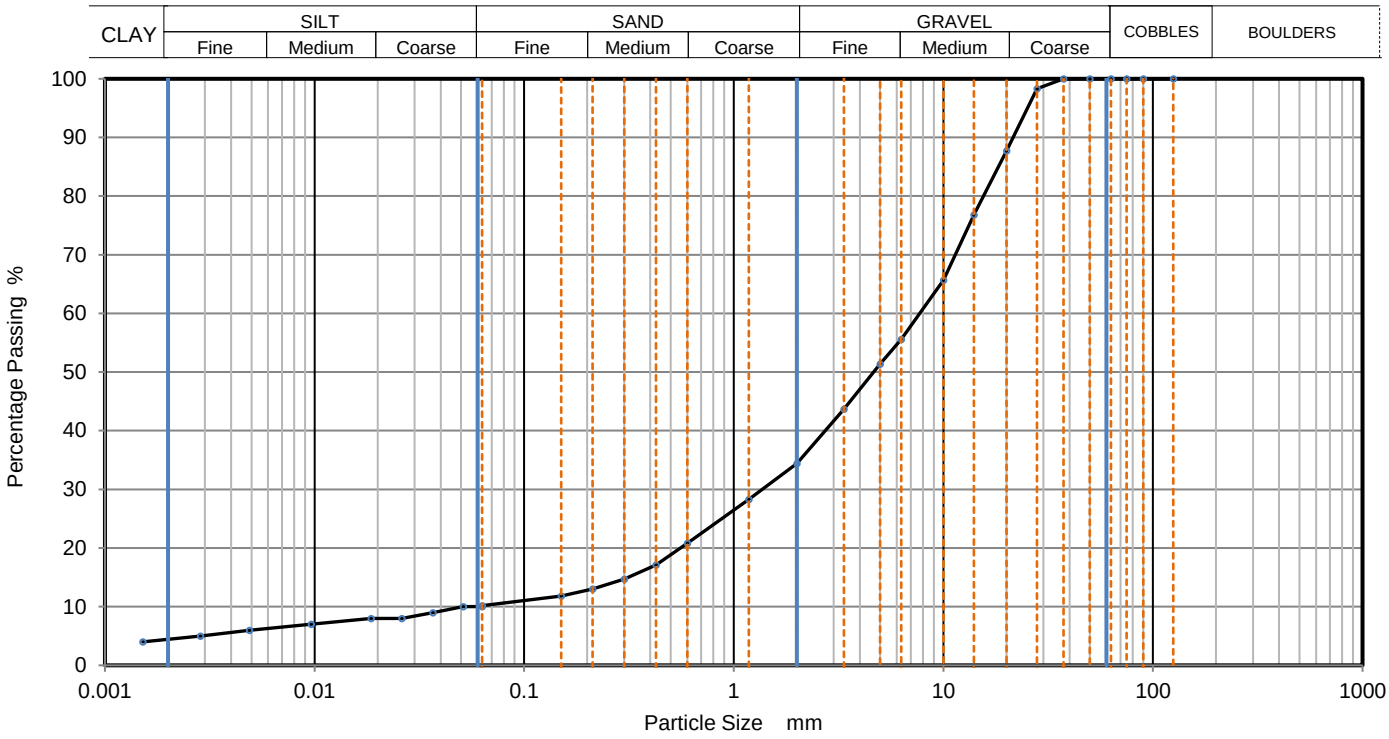
Grading Analysis		
D100	mm	125
D60	mm	52.7
D30	mm	18.3
D10	mm	3.05
Uniformity Coefficient		17
Curvature Coefficient		2.1

Remarks

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Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref		21-1682
					Borehole/Pit No.		RWRM-TP003
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		2
Specimen Description	Brownish grey sandy clayey subangular fine to coarse GRAVEL.				Sample Depth (m)	Top	0.90
						Base	1.30
Specimen Reference	4	Specimen Depth	0.9	m	Sample Type		B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID		Caus20220908122



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	10
90	100	0.05129	10
75	100	0.03671	9
63	100	0.02611	8
50	100	0.01857	8
37.5	100	0.00965	7
28	98	0.00488	6
20	88	0.00285	5
14	77	0.00152	4
10	66		
6.3	56		
5	51		
3.35	44		
2	34		
1.18	28		
0.6	21	Particle density	(assumed)
0.425	17	2.65	Mg/m3
0.3	15		
0.212	13		
0.15	12		
0.063	10		

Dry Mass of sample, g	4273

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	65.6
Sand	24.2
Silt	6.0
Clay	4.2

Grading Analysis		
D100	mm	
D60	mm	7.7
D30	mm	1.37
D10	mm	0.0583
Uniformity Coefficient		130
Curvature Coefficient		4.2

Remarks

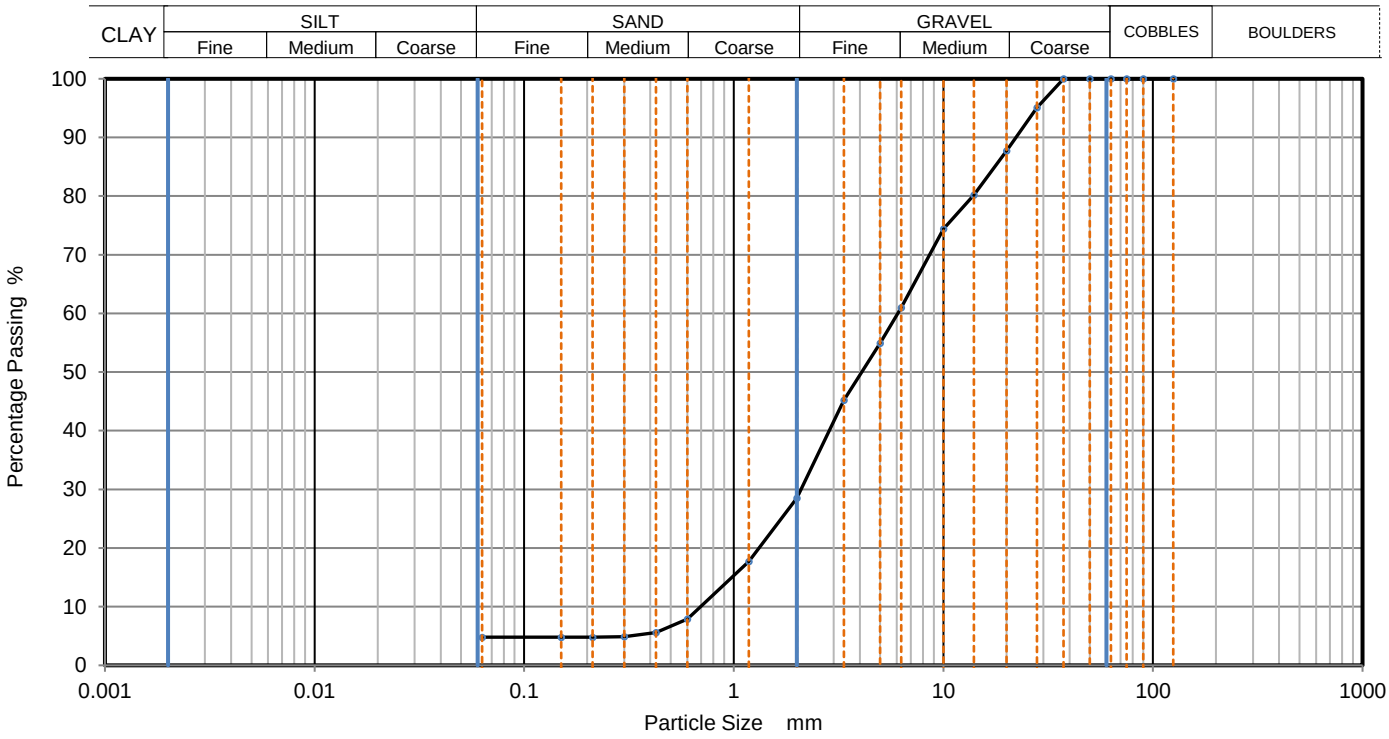
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Approved
Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		21-1682
				Borehole/Pit No.		RWRM-TP003
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.		3
Specimen Description	Brownish grey gravelly silty fine to coarse SAND.			Sample Depth (m)	Top	1.30
					Base	2.30
Specimen Reference	4	Specimen Depth	1.3 m	Sample Type		B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID		Caus20220908123



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	95		
20	88		
14	80		
10	74		
6.3	61		
5	55		
3.35	45		
2	29		
1.18	18		
0.6	8		
0.425	6		
0.3	5		
0.212	5		
0.15	5		
0.063	5		

Dry Mass of sample, g: 3369

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	71.5
Sand	23.8
Fines <0.063mm	5.0

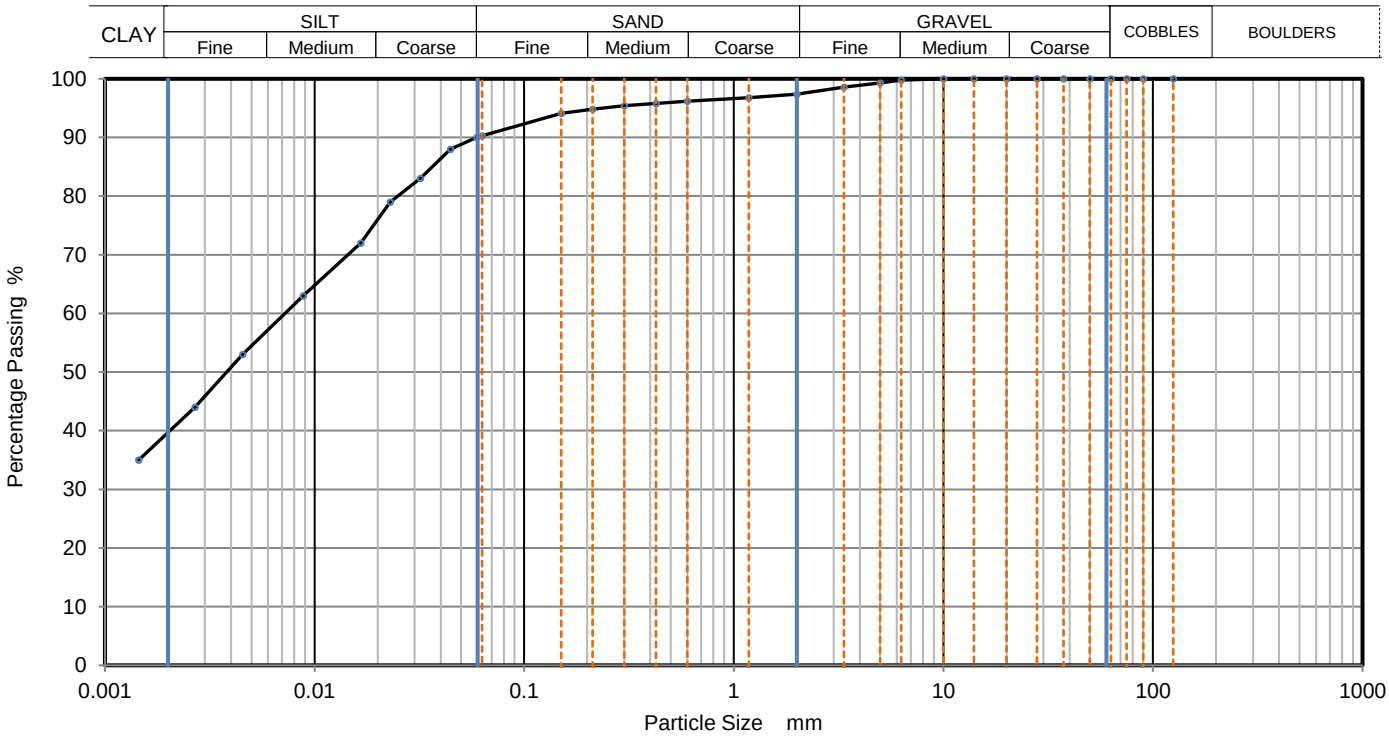
Grading Analysis		
D100	mm	
D60	mm	6.08
D30	mm	2.09
D10	mm	0.694
Uniformity Coefficient		8.8
Curvature Coefficient		1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-TP007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Brownish grey silty CLAY.			Sample Depth (m) Top	0.50
				Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022093080



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05942	90
90	100	0.04455	88
75	100	0.03201	83
63	100	0.02299	79
50	100	0.01662	72
37.5	100	0.00883	63
28	100	0.00454	53
20	100	0.00269	44
14	100	0.00145	35
10	100		
6.3	100		
5	99		
3.35	99		
2	97		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	95		
0.15	94		
0.063	90		

Dry Mass of sample, g: 247

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	2.6
Sand	7.2
Silt	50.6
Clay	39.6

Grading Analysis		
D100	mm	
D60	mm	0.00737
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

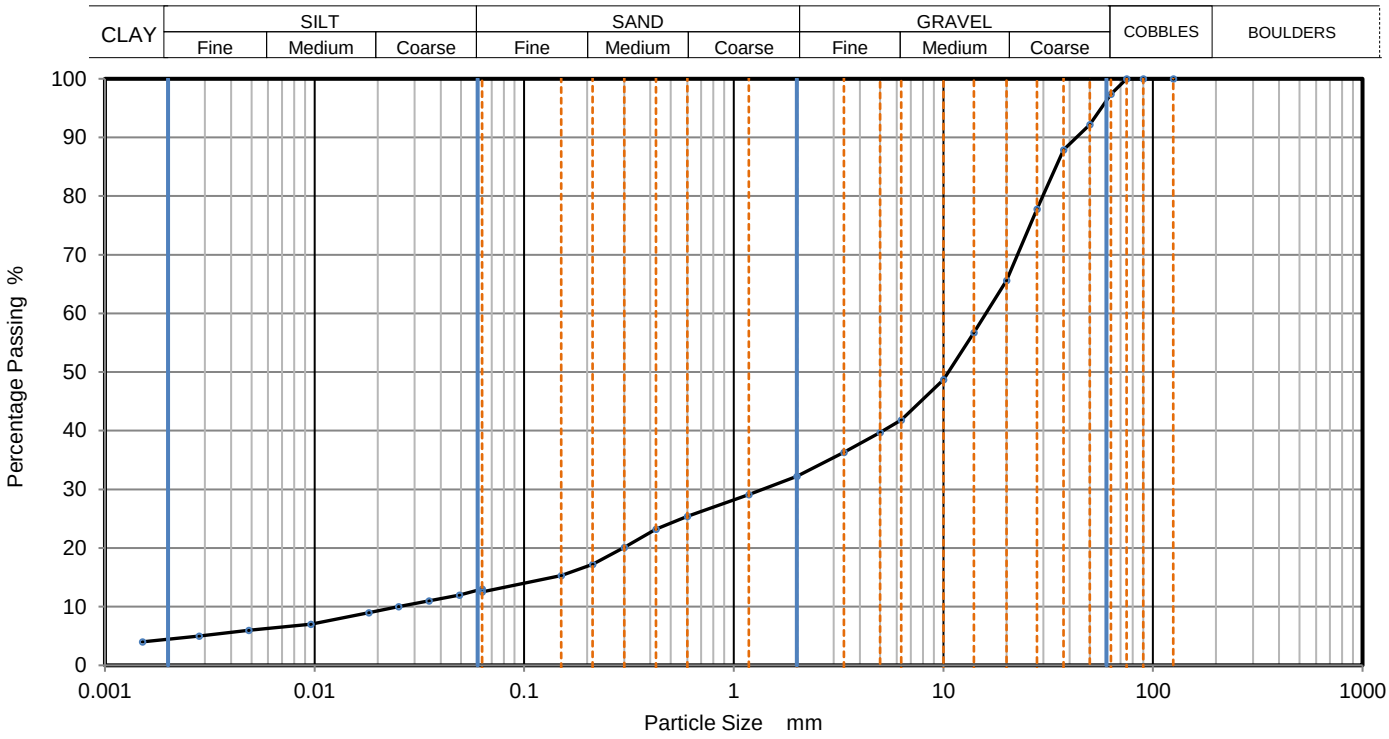
Remarks

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Stephen Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-TP007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Specimen Description	Brownish grey slightly sandy clayey subangular fine to coarse GRAVEL.			Sample Depth (m) Top	1.30
				Base	
Specimen Reference	2	Specimen Depth	1.3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022093082



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	13
90	100	0.04903	12
75	100	0.03513	11
63	97	0.02517	10
50	92	0.01813	9
37.5	88	0.00959	7
28	78	0.00485	6
20	66	0.00282	5
14	57	0.00151	4
10	49		
6.3	42		
5	40		
3.35	36		
2	32		
1.18	29		
0.6	25	Particle density	(assumed)
0.425	23	2.65	Mg/m3
0.3	20		
0.212	17		
0.15	15		
0.063	13		

Dry Mass of sample, g: 15407

Sample Proportions	% dry mass
Cobbles	2.6
Gravel	65.1
Sand	19.8
Silt	8.0
Clay	4.5

Grading Analysis		
D100	mm	
D60	mm	16
D30	mm	1.37
D10	mm	0.0246
Uniformity Coefficient		650
Curvature Coefficient		4.8

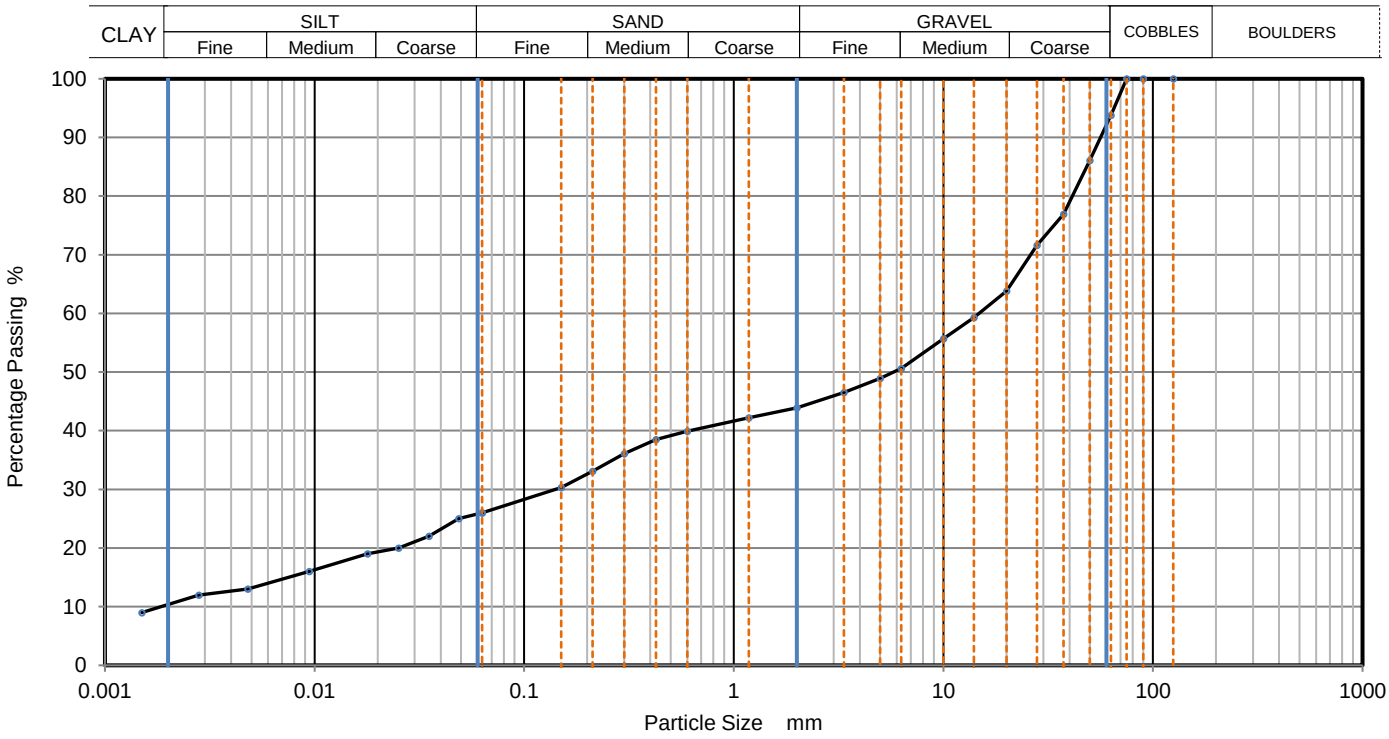
Remarks

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Stephen Watson

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH027
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	5.20
				Sample Depth (m) Base	
Specimen Reference	3	Specimen Depth	5.2 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202210141



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	26
90	100	0.04870	25
75	100	0.03513	22
63	94	0.02517	20
50	86	0.01791	19
37.5	77	0.00942	16
28	72	0.00480	13
20	64	0.00280	12
14	59	0.00150	9
10	56		
6.3	51		
5	49		
3.35	47		
2	44		
1.18	42		
0.6	40	Particle density	(assumed)
0.425	39	2.65	Mg/m3
0.3	36		
0.212	33		
0.15	30		
0.063	26		

Dry Mass of sample, g: 9165

Sample Proportions	% dry mass
Cobbles	6.2
Gravel	50.0
Sand	17.8
Silt	16.0
Clay	10.0

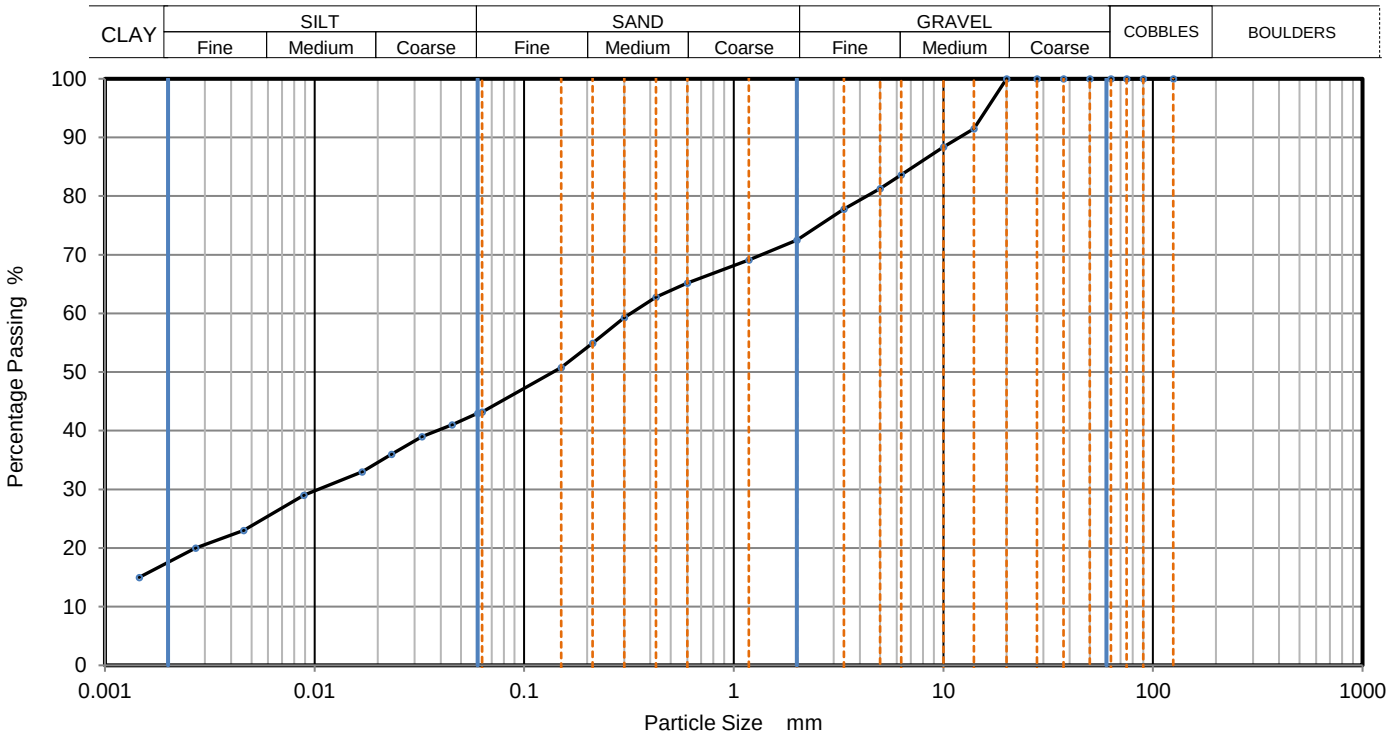
Grading Analysis		
D100	mm	
D60	mm	14.8
D30	mm	0.141
D10	mm	0.002
Uniformity Coefficient		7400
Curvature Coefficient		0.67

Remarks

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Stephen Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH028
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.00
				Base	3.65
Specimen Reference	3	Specimen Depth	3 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022101845



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05989	43
90	100	0.04526	41
75	100	0.03250	39
63	100	0.02333	36
50	100	0.01686	33
37.5	100	0.00889	29
28	100	0.00459	23
20	100	0.00270	20
14	92	0.00146	15
10	88		
6.3	84		
5	81		
3.35	78		
2	73		
1.18	69		
0.6	65	Particle density	(assumed)
0.425	63	2.65	Mg/m3
0.3	59		
0.212	55		
0.15	51		
0.063	43		

Dry Mass of sample, g: 563

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	27.5
Sand	29.3
Silt	25.6
Clay	17.6

Grading Analysis		
D100	mm	
D60	mm	0.322
D30	mm	0.0103
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

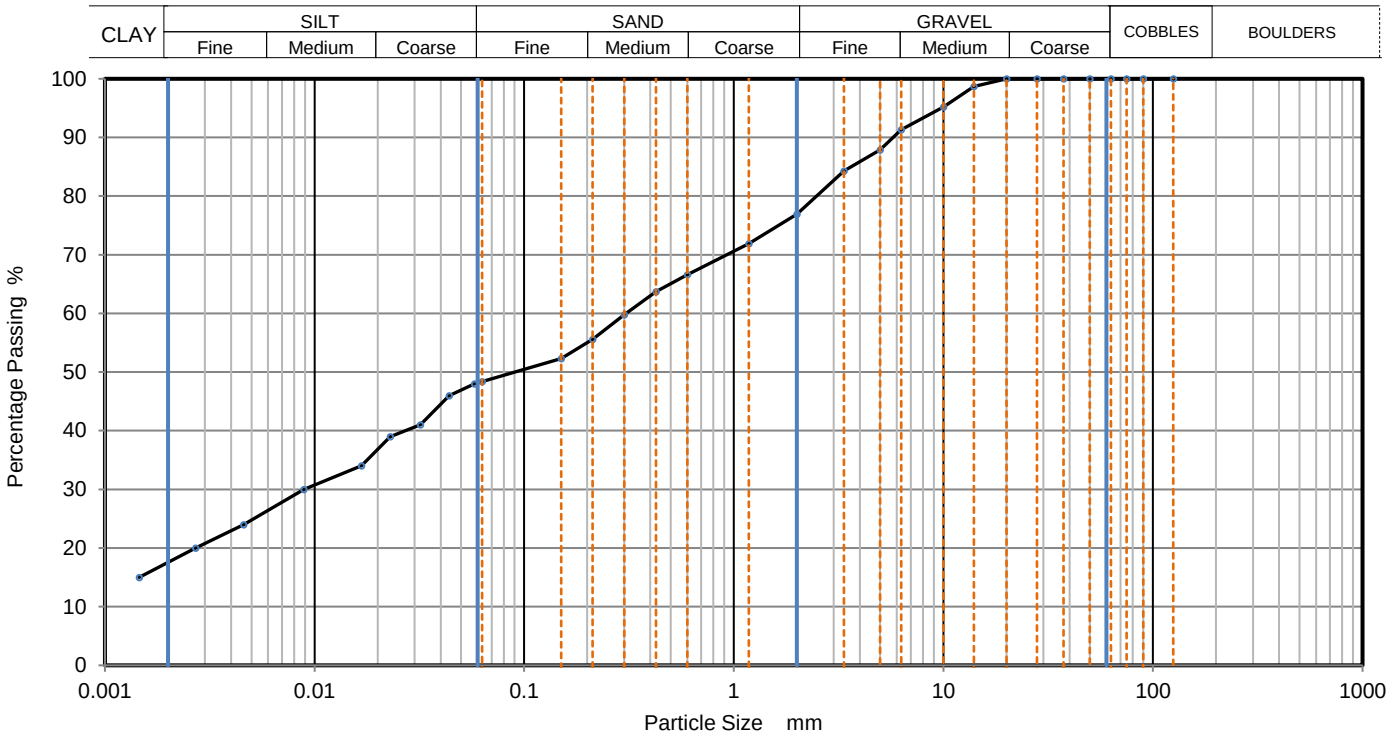
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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Stephen Watson

UKAS TESTING

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1682**
				Borehole/Pit No.	RWRM-BH028
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.60
				Base	5.15
Specimen Reference	3	Specimen Depth	4.6 m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2022101846



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05791	48
90	100	0.04380	46
75	100	0.03200	41
63	100	0.02298	39
50	100	0.01674	34
37.5	100	0.00889	30
28	100	0.00459	24
20	100	0.00270	20
14	99	0.00146	15
10	95		
6.3	91		
5	88		
3.35	84		
2	77		
1.18	72		
0.6	67	Particle density	(assumed)
0.425	64	2.65	Mg/m3
0.3	60		
0.212	56		
0.15	52		
0.063	48		

Dry Mass of sample, g: 539

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.1
Sand	28.4
Silt	30.7
Clay	17.8

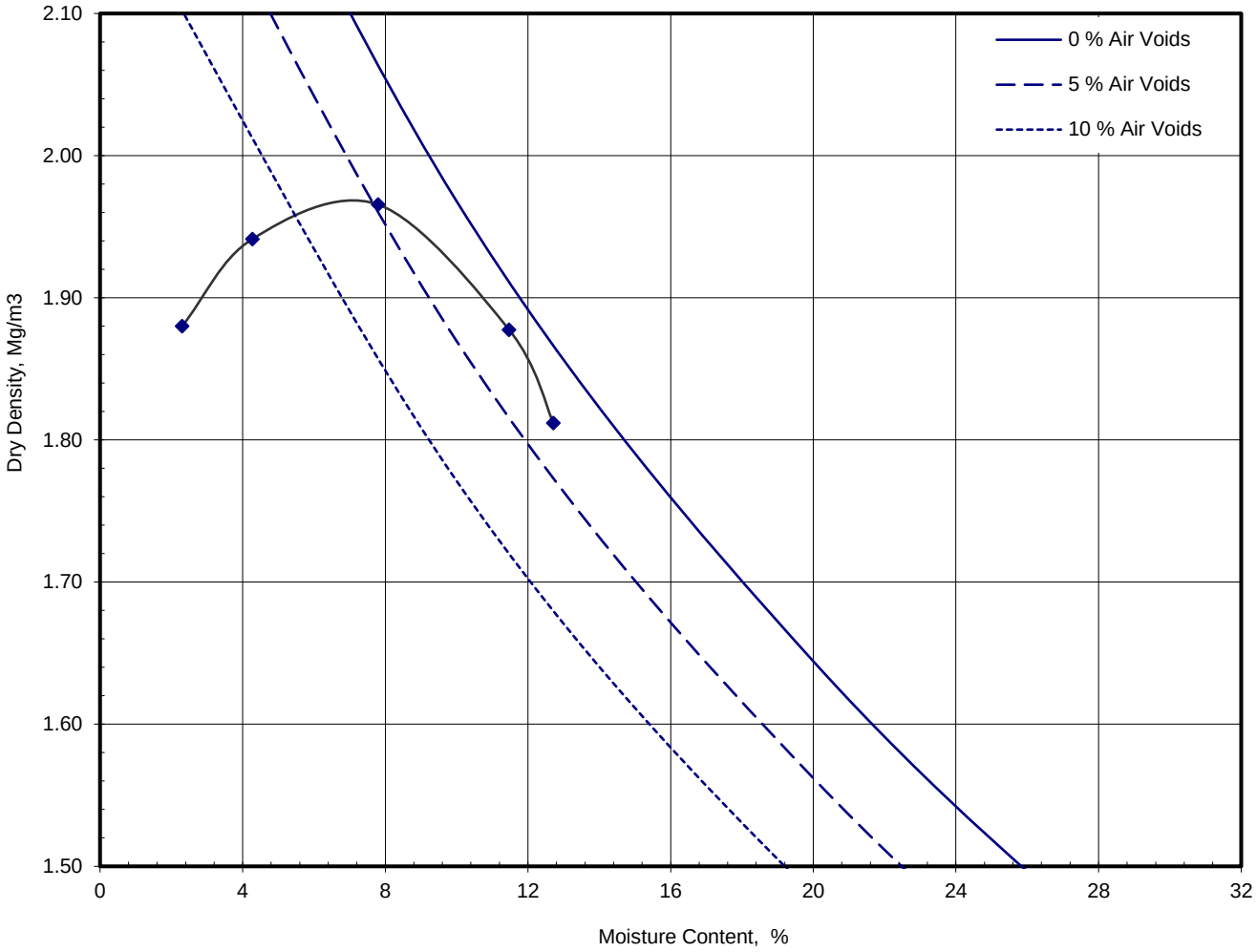
Grading Analysis		
D100	mm	
D60	mm	0.306
D30	mm	0.00949
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen Watson

CAUSEWAY GEOTECH	**Dry Density / Moisture Content Relationship Light Compaction**			Job Ref		**21-1682**
				Borehole / Pit No		RWRM-BH028
Site Name	**Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only**			Sample No		4
Specimen Description	Greyish brown sandy gravelly silty CLAY.			Sample Depth (m)	Top	5.15
					Base	6.65
Specimen Ref.	1	Specimen Depth	m	Sample Type		C
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID		Caus2022101847



Preparation		Material used was air dried
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	1
Material Retained on 20.0 mm Sieve	%	6
Particle Density - Assumed	Mg/m³	2.45

Maximum Dry Density	Mg/m³	**1.97**
Optimum Moisture Content	%	**7.8**

Approved	Remarks	UKAS TESTING 10122
Stephen Watson	LAB 08R - Version 6	

Moisture Condition Value at Natural Moisture Content
Summary of Results

Project No.	Project Name
21-1682	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only

Hole No.	Sample				Specimen Description	Retained on 20mm sieve %	Moisture Content <20mm %	Moisture Condition Value	Method of Interpretation	Remarks
	Ref	Top	Base	Type						
RWRM-BH001	3	1.80	2.00	B	Greyish brown sandy slightly gravelly silty CLAY.	9	9	7.2	Best fit line	
RWRM-BH007	4	12.00	13.50	C	Brownish grey sandy slightly gravelly silty CLAY.	8	9	16.4	Best fit line	
RWRM-BH009	4	10.50	12.00	C	Brownish grey sandy slightly gravelly silty CLAY.	11	9	13.7	Best fit line	
RWRM-BH010	2	6.00	7.50	C	Brown sandy slightly gravelly silty CLAY.	5	9	15.0	Best fit line	
RWRM-BH014	3	2.00	3.00	B	Brownish grey sandy slightly gravelly silty CLAY.	11	12	1.0	Best fit line	
RWRM-BH016	3	1.80	2.00	B	Brownish grey sandy slightly gravelly silty CLAY.	16	13	2.1	Best fit line	
RWRM-BH017	4	2.80	3.00	B	Brownish grey sandy slightly gravelly silty CLAY.	9	13	2.8	Best fit line	
RWRM-BH018	4	2.80	3.00	B	Brownish grey sandy slightly gravelly silty CLAY.	13	12	2.9	Best fit line	
RWRM-BH019	4	2.80	3.00	B	Brownish grey sandy slightly gravelly silty CLAY.	11	14	7.5	Best fit line	
RWRM-TP002	4	1.90	3.10	B	Greenish grey sandy slightly gravelly silty CLAY with cobbles.	0	13	too wet	Best fit line	

LAB 10R - Version 7

Key

Test performed in accordance with BS1377:Part4:1990, clause 5.4 unless annotated otherwise

Date Printed

10/03/2022 00:00

Approved By

Stephen.Watson

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10122

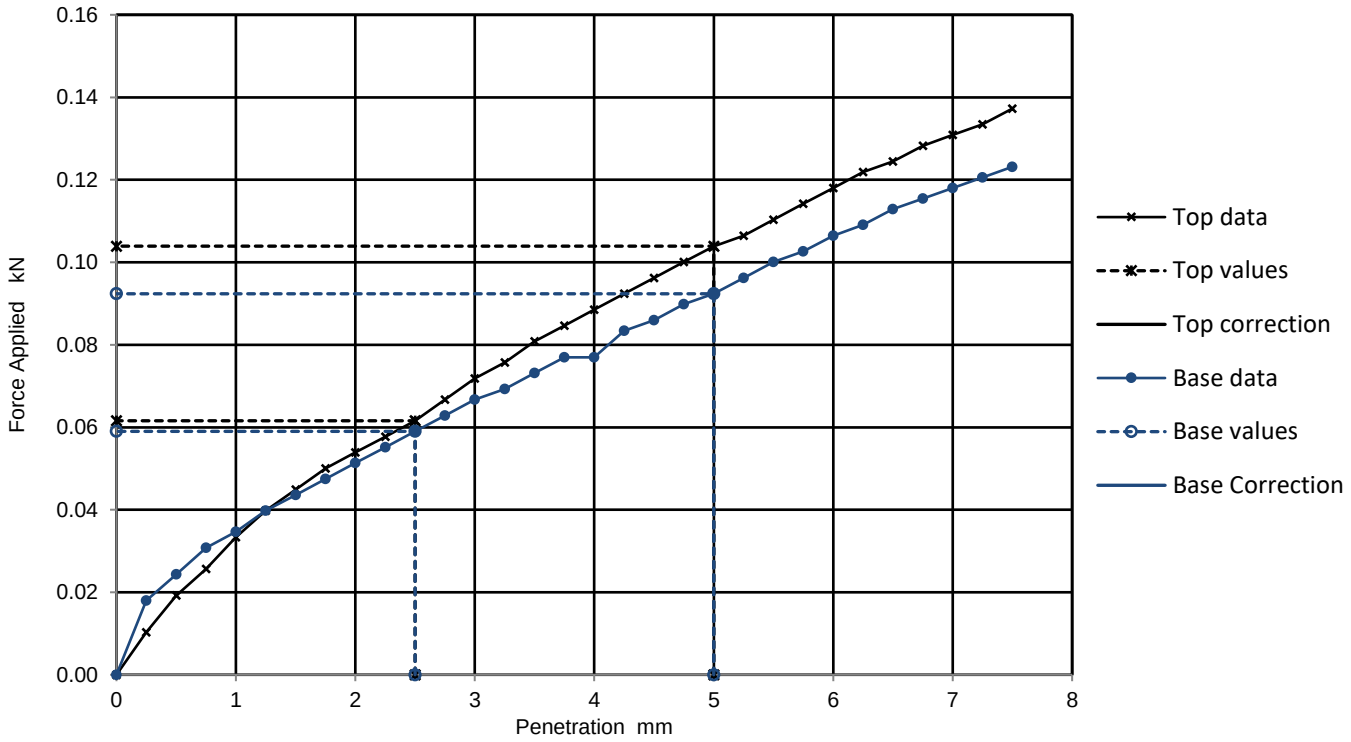
California Bearing Ratio (CBR)

				Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth m	2.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022062153
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		10	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.29	Mg/m3	Surcharge applied	4.5	kg
	Dry density	2.07	Mg/m3		3	kPa
	Moisture content	11	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	0.5	0.5	0.5	0.5	11
BASE	No	0.5	0.5	0.5		10

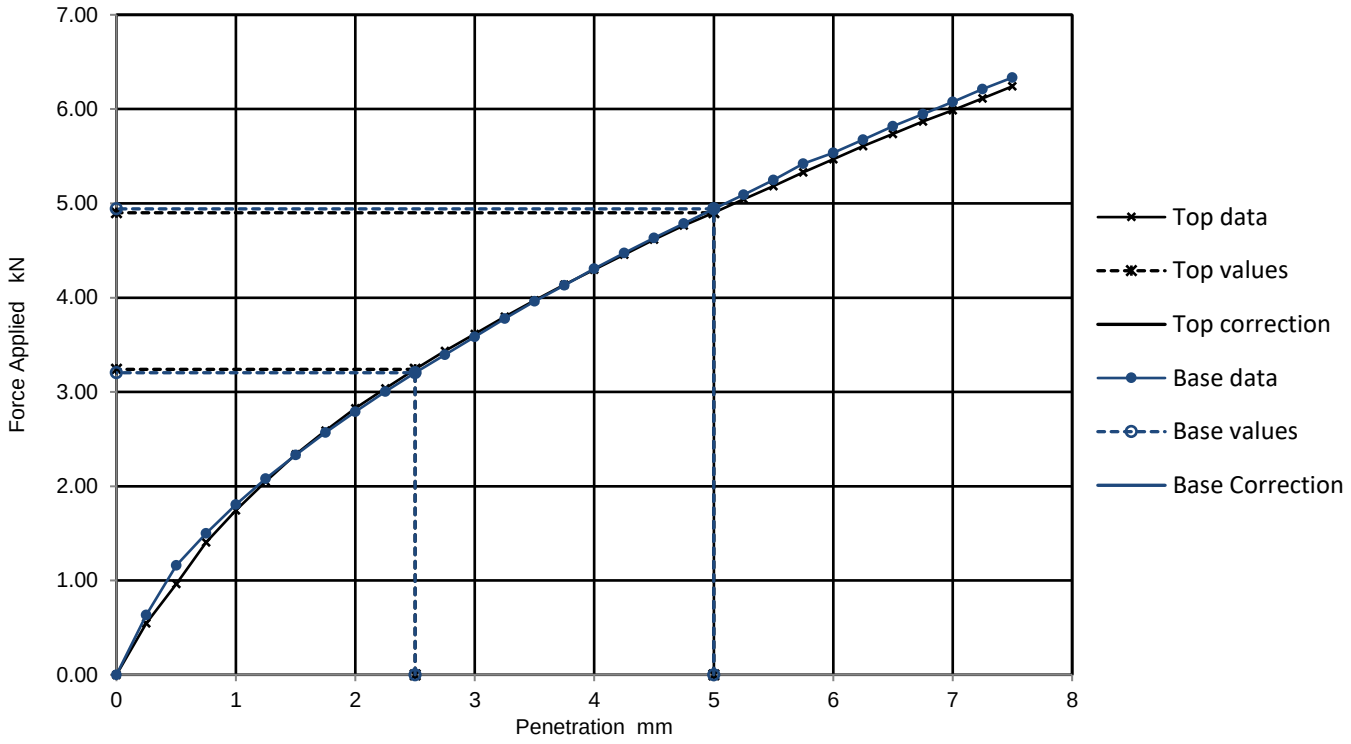
General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Depth m	13.50
Specimen Reference		Specimen Depth	m	Sample Type	C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082567
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		6	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.11	Mg/m3	Surcharge applied	4.5	kg
	Dry density	1.93	Mg/m3		3	kPa
	Moisture content	9	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	25.0	25.0	25.0	25.0	9
BASE	No	24.0	25.0	25.0		9

General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

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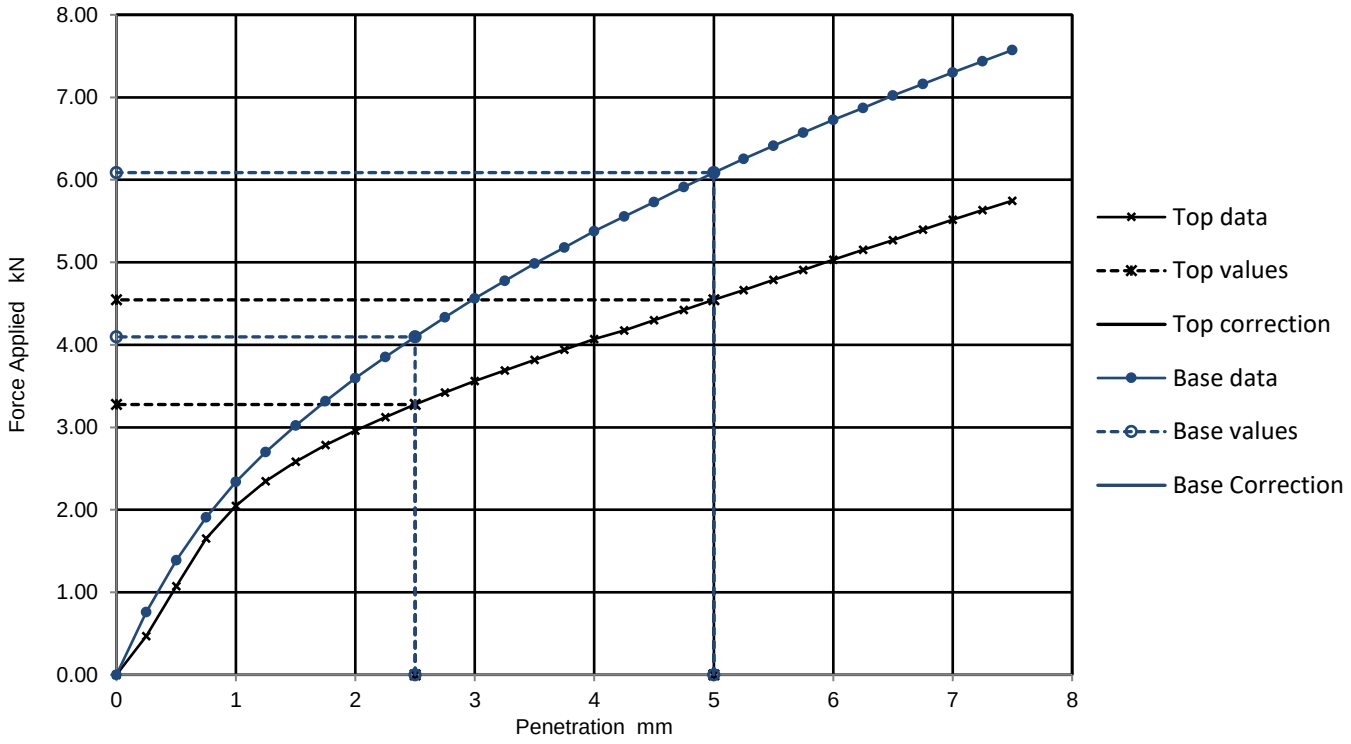
10122

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth m	9.50
Specimen Reference		Specimen Depth	m	Sample Type	C
Specimen Description	Brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220825101
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		9	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.12	Mg/m3	Surcharge applied	4.5	kg
	Dry density	1.95	Mg/m3		3	kPa
	Moisture content	9	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	25.0	23.0	25.0		9
BASE	No	31.0	30.0	31.0		8

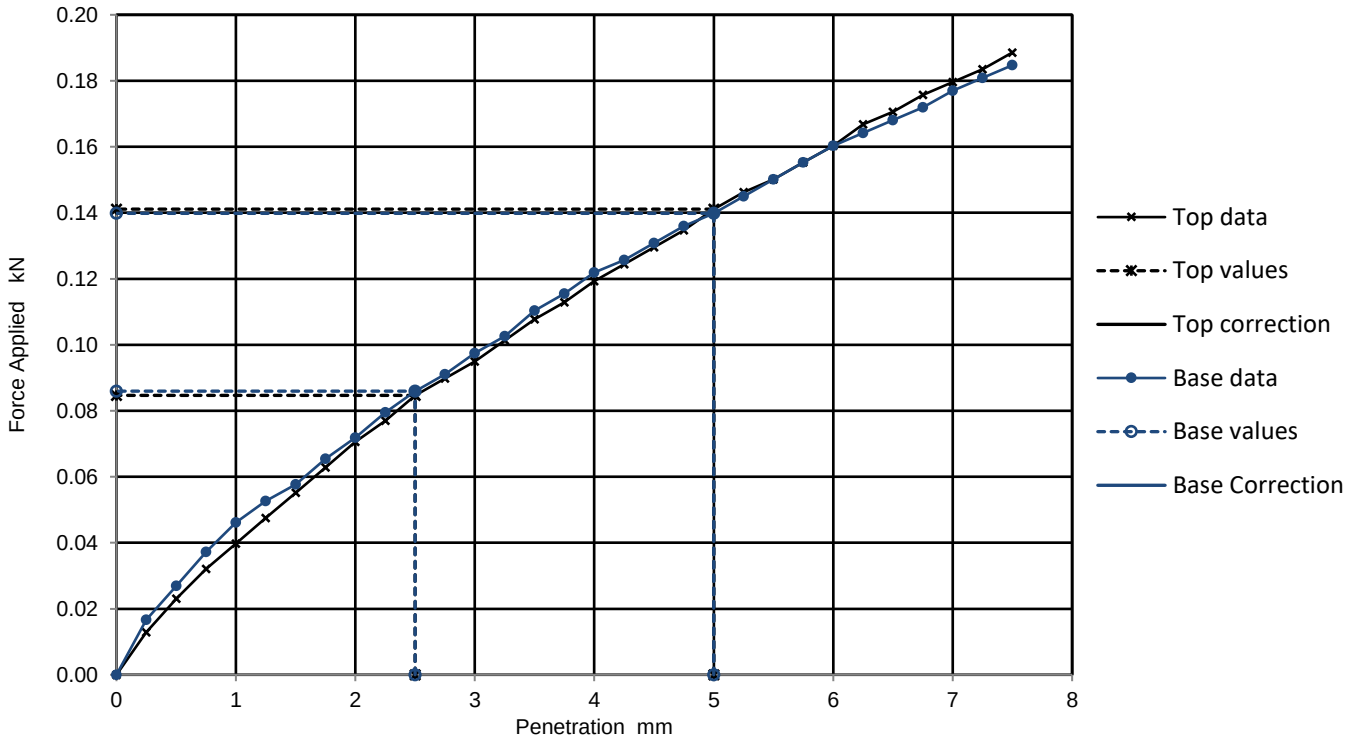
General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Soil Description	Brown sandy slightly gravelly silty CLAY.			Depth m	4.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Specimen Description	Brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022071475
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		8	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.26	Mg/m3	Surcharge applied	4.5	kg
	Dry density	2.03	Mg/m3		3	kPa
	Moisture content	11	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	0.6	0.7	0.7	0.7	11
BASE	No	0.7	0.7	0.7		12

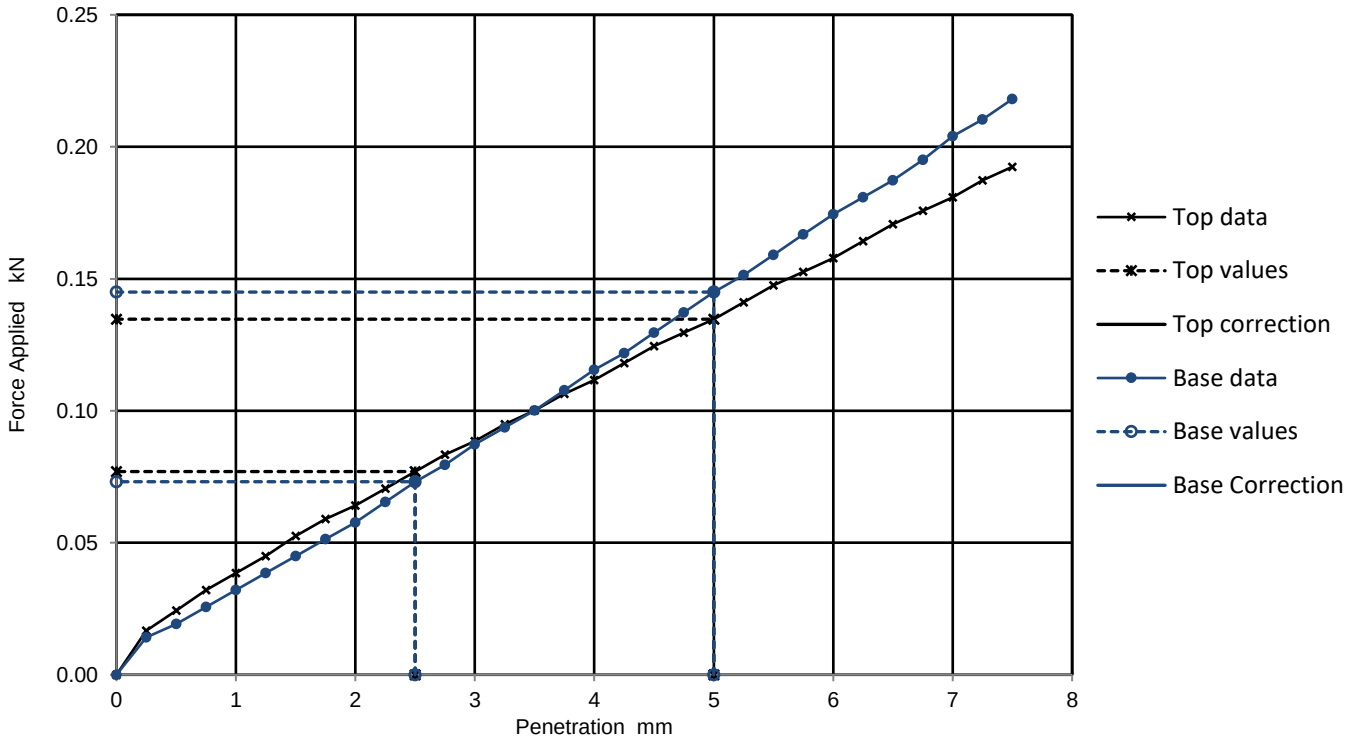
General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Depth m	3.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070551
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		4	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.24	Mg/m3	Surcharge applied	4.5	kg
	Dry density	2.01	Mg/m3		3	kPa
	Moisture content	11	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	0.6	0.7	0.7	0.7	11
BASE	No	0.6	0.7	0.7		12

General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

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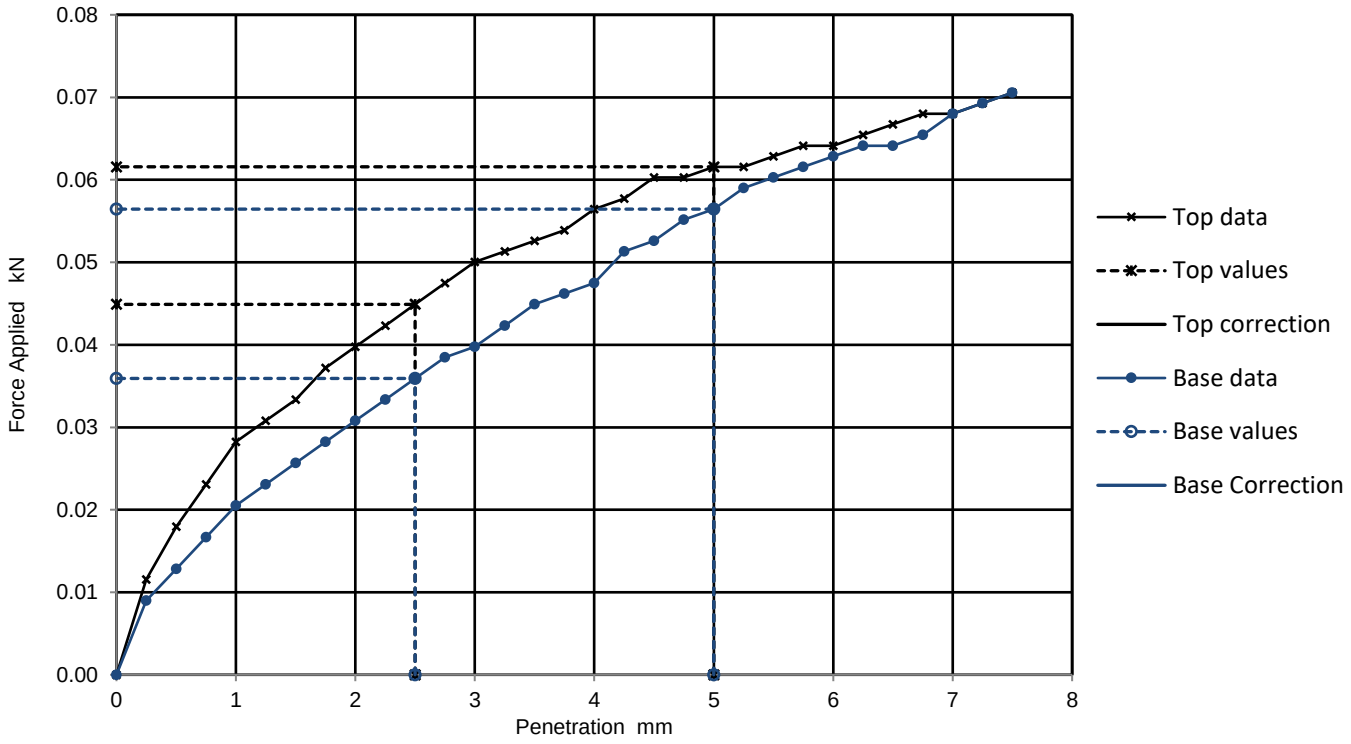
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CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	12
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Depth m	4.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070564
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		23	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	2.23	Mg/m3	Surcharge applied	4.5	kg
	Dry density	1.98	Mg/m3		3	kPa
	Moisture content	12	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	0.3	0.3	0.3	0.3	12
BASE	No	0.3	0.3	0.3		13

General remarks	Test specific remarks	Approved
Tested at natural moisture content.	Average result may be reported if within 10% of the mean CBR value of top and base.	Stephen.Watson

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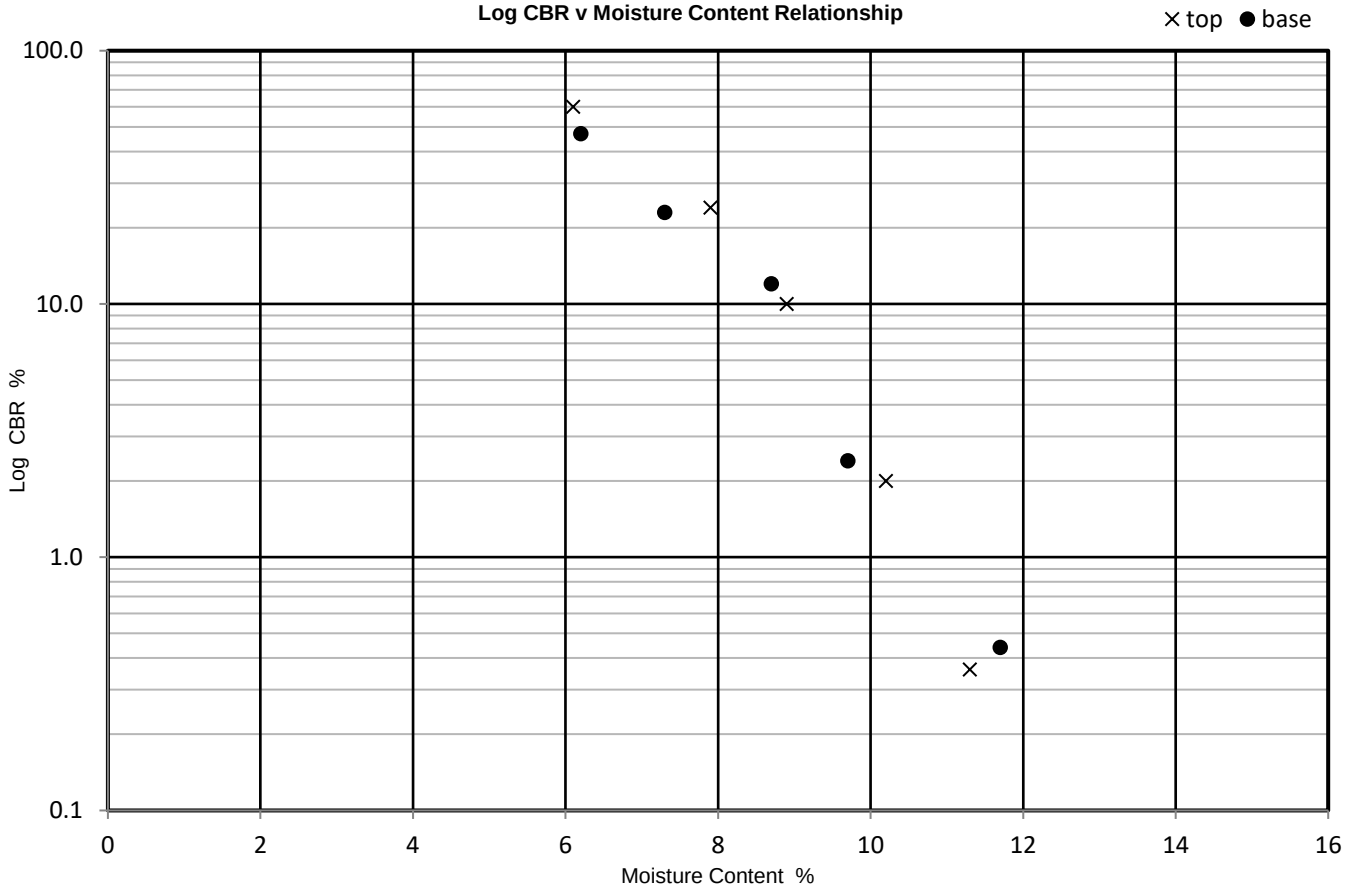
10122

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)** **CBR v Moisture Content Relationship**	Job Ref	21-1682
		Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only	Sample No.	6
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.	Depth m	4.8
Test Method	BS1377 : Part 4 : 1990, clause 7	Sample Type	B
Preparation details	Recompacted with specified standard effort using 2.5kg rammer	KeyLAB ID	Caus2022070581

Specimens listed in ascending order of initial moisture content

Spec Ref	Bulk density	Dry density	Moisture Content			CBR Value		Swell if soaked	Surcharge	Remarks
			Initial	Top	Base	Top	Base			
	Mg/m3	Mg/m3	%	%	%	%	%	mm	kPa	
1	2.14	2.02	6.1	6.1	6.2	60.0	47.0		3	
2	2.21	2.05	7.9	7.9	7.3	24.0	23.0		3	
3	2.26	2.08	8.9	8.9	8.7	10.0	12.0		3	
4	2.29	2.08	10.2	10.2	9.7	2.0	2.4		3	
5	2.24	2.01	11.3	11.3	11.7	0.4	0.4		3	

Log CBR v Moisture Content Relationship



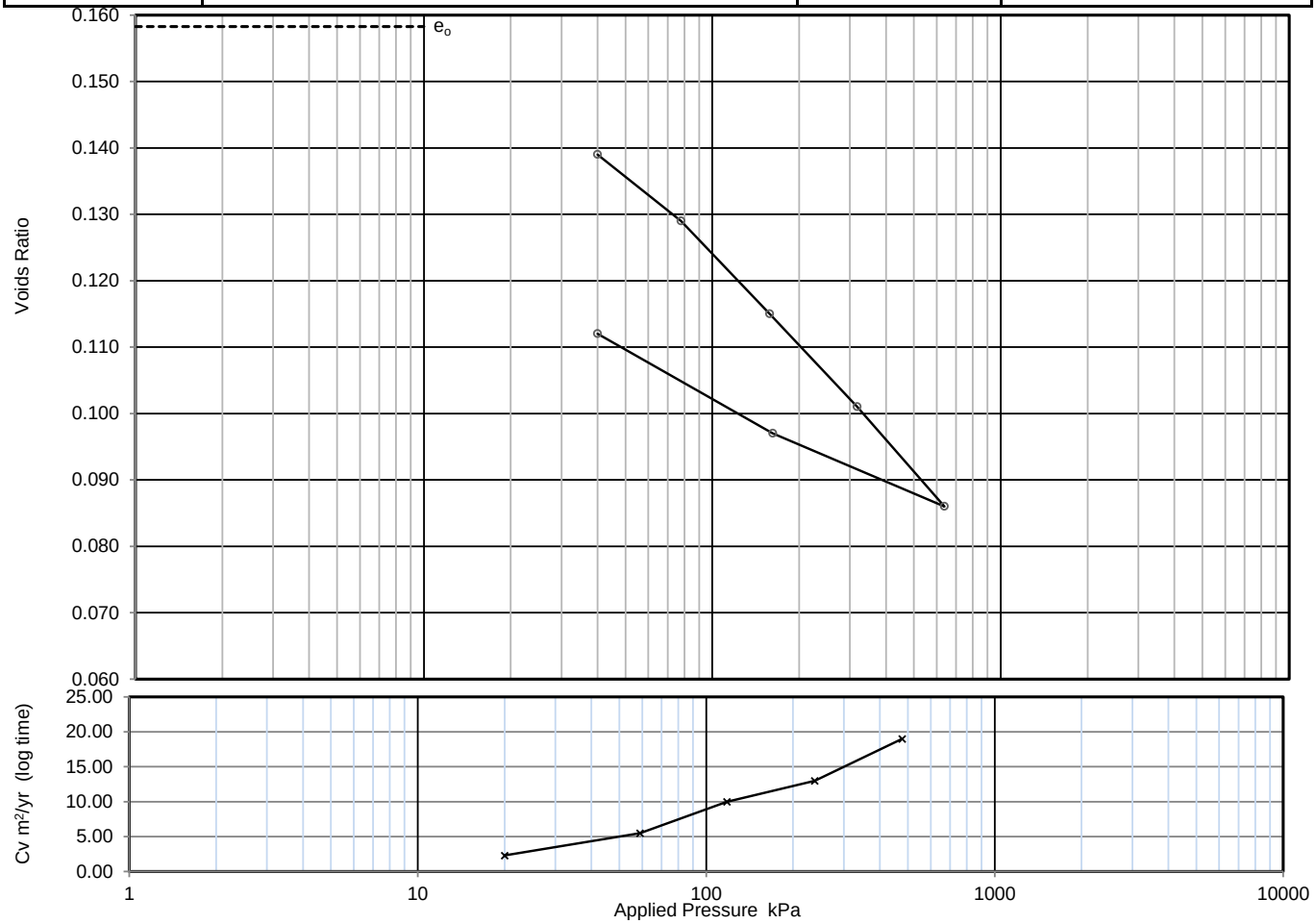
General Remarks

Approved
Stephen.Watson

1

1

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		18
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	4.00
						Bottom	4.4
Specimen Reference	5	Specimen Depth	4.05	m	Sample Type		U
Specimen Description	Greyish brown sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022062157
Test Method	BS1377:Part 5:1990, clause 3				Date started		29/06/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.158	-	-	-	-
40	0.139	0.41	2.3	2.5	0.00051
78	0.129	0.24	5.5	300	0.00025
158	0.115	0.15	10	39	0.00047
318	0.101	0.083	13	180	0.00045
638	0.086	0.041	19	52	0.00052
162	0.097	0.022			
40	0.112	0.11			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	20.00	19.20	mm
Moisture Content	9.3	8.3	%
Bulk density	2.50	2.58	Mg/m3
Dry density	2.29	2.38	Mg/m3
Voids Ratio	0.158	0.112	
Saturation	155	196	%
Average temperature for test	20.0		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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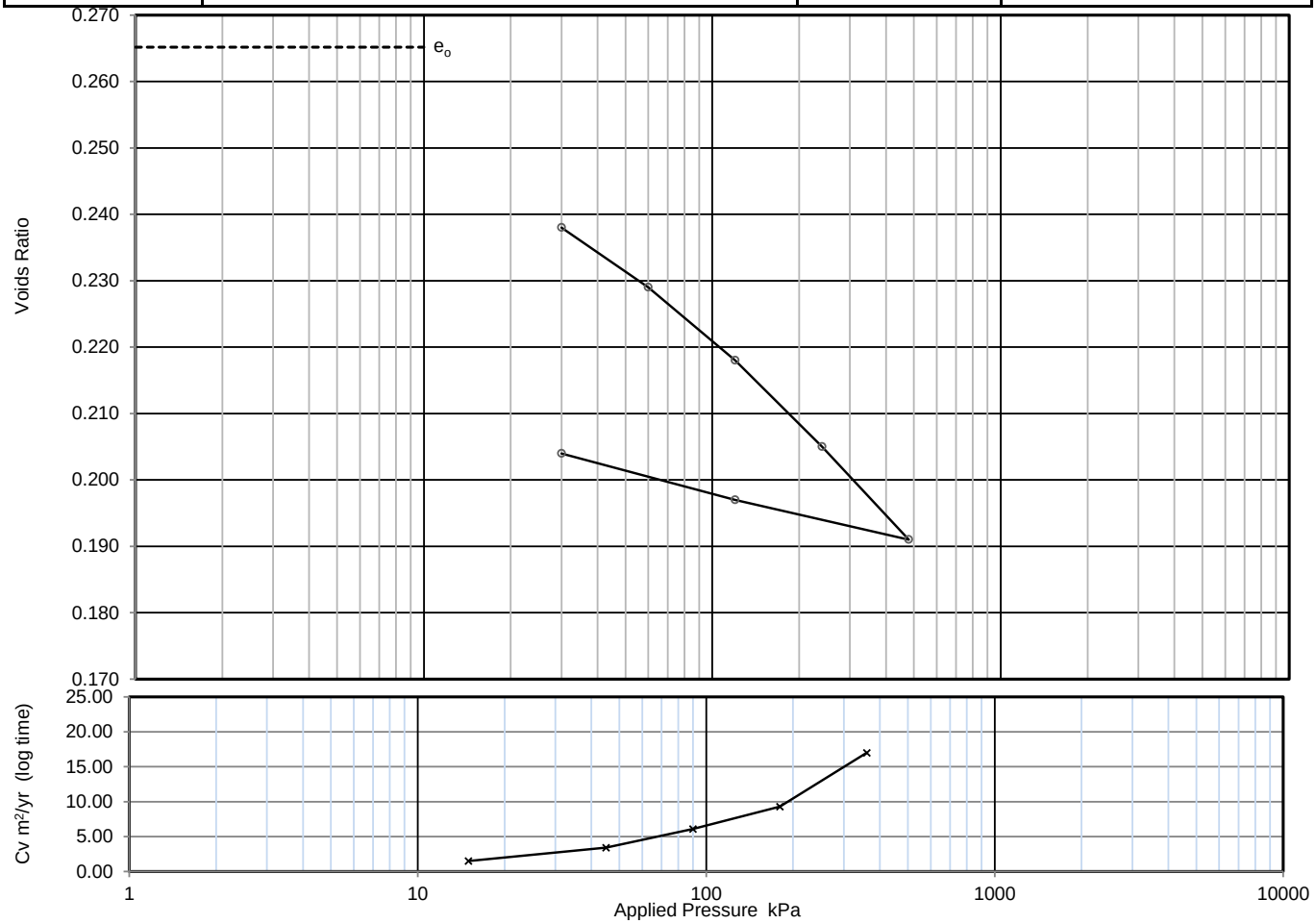
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LAB 13R - Version 6

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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		9
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	3.00
						Bottom	3.45
Specimen Reference	3	Specimen Depth	3.05	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022071450
Test Method	BS1377:Part 5:1990, clause 3				Date started		26/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.265	-	-	-	-
30	0.238	0.71	1.5	1.4	0.00037
60	0.229	0.25	3.4	4	0.00035
120	0.218	0.15	6.1	11	0.00038
240	0.205	0.089	9.3	50	0.00037
480	0.191	0.049	17	35	0.00042
120	0.197	0.014			
30	0.204	0.064			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.03	mm
Moisture Content	12.2	10.6	%
Bulk density	2.35	2.44	Mg/m3
Dry density	2.09	2.20	Mg/m3
Voids Ratio	0.265	0.204	
Saturation	122	138	%
Average temperature for test	20.0		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 :

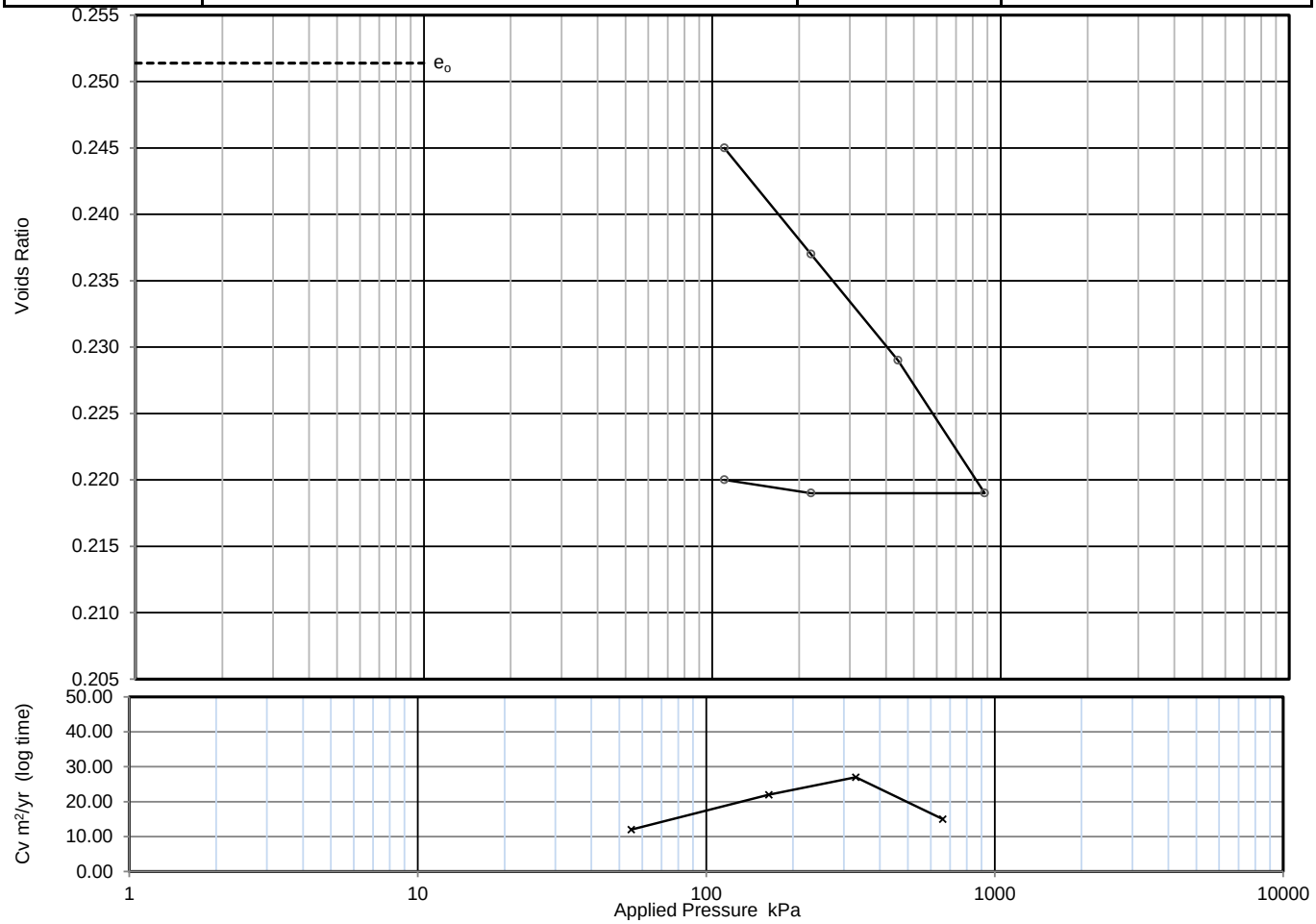
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LAB 13R - Version 6

UKAS TESTING

10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.50
				Bottom	11.6
Specimen Reference	2	Specimen Depth	11.5 m	Sample Type	C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082564
Test Method	BS1377:Part 5:1990, clause 3			Date started	26/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.251	-	-	-	-
110	0.245	0.049	12	44	0.00053
220	0.237	0.053	22	53	0.0003
440	0.229	0.029	27	55	0.00042
880	0.219	0.02	15	44	0.00021
220	0.219	0.00029			
110	0.220	0.011			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.50	mm
Moisture Content	10.3	11.2	%
Bulk density	2.34	2.42	Mg/m3
Dry density	2.12	2.17	Mg/m3
Voids Ratio	0.251	0.220	
Saturation	108	135	%
Average temperature for test	20.0		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

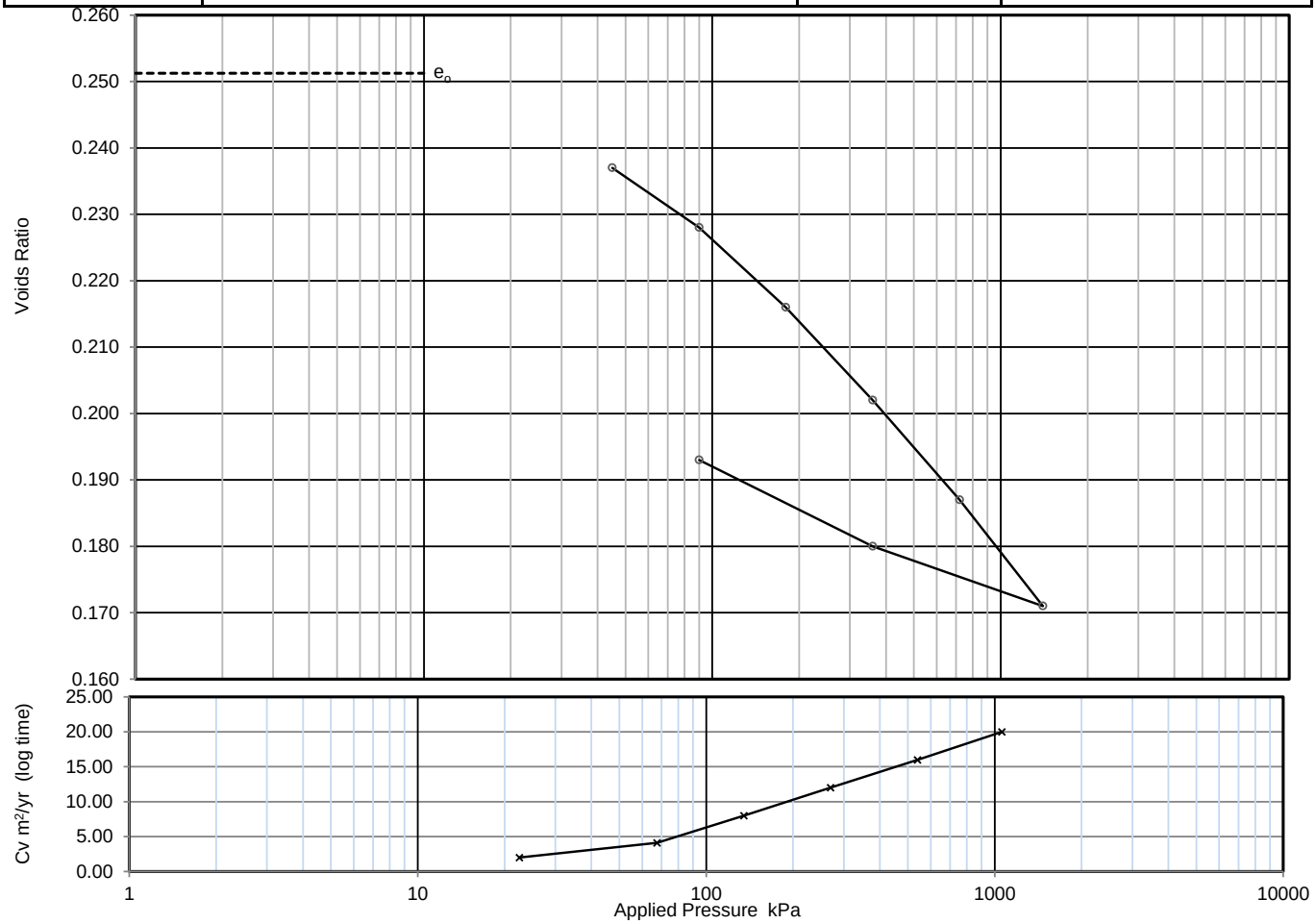
Approved: Stephen.Watson

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LAB 13R - Version 6

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	3.70
						Bottom	
Specimen Reference	2	Specimen Depth	3.7	m	Sample Type		C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082916
Test Method	BS1377:Part 5:1990, clause 3				Date started		07/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.251	-	-	-	-
45	0.237	0.25	2	2.2	0.00033
90	0.228	0.17	4.1	13	0.00029
180	0.216	0.11	8	23	0.00033
360	0.202	0.061	12	27	0.00036
720	0.187	0.035	16	29	0.00043
1,400	0.171	0.02	20	34	0.00054
360	0.180	0.0074			
90	0.193	0.042			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.07	mm
Moisture Content	10.8	9.8	%
Bulk density	2.35	2.44	Mg/m3
Dry density	2.12	2.22	Mg/m3
Voids Ratio	0.251	0.193	
Saturation	114	134	%
Average temperature for test	20.0		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

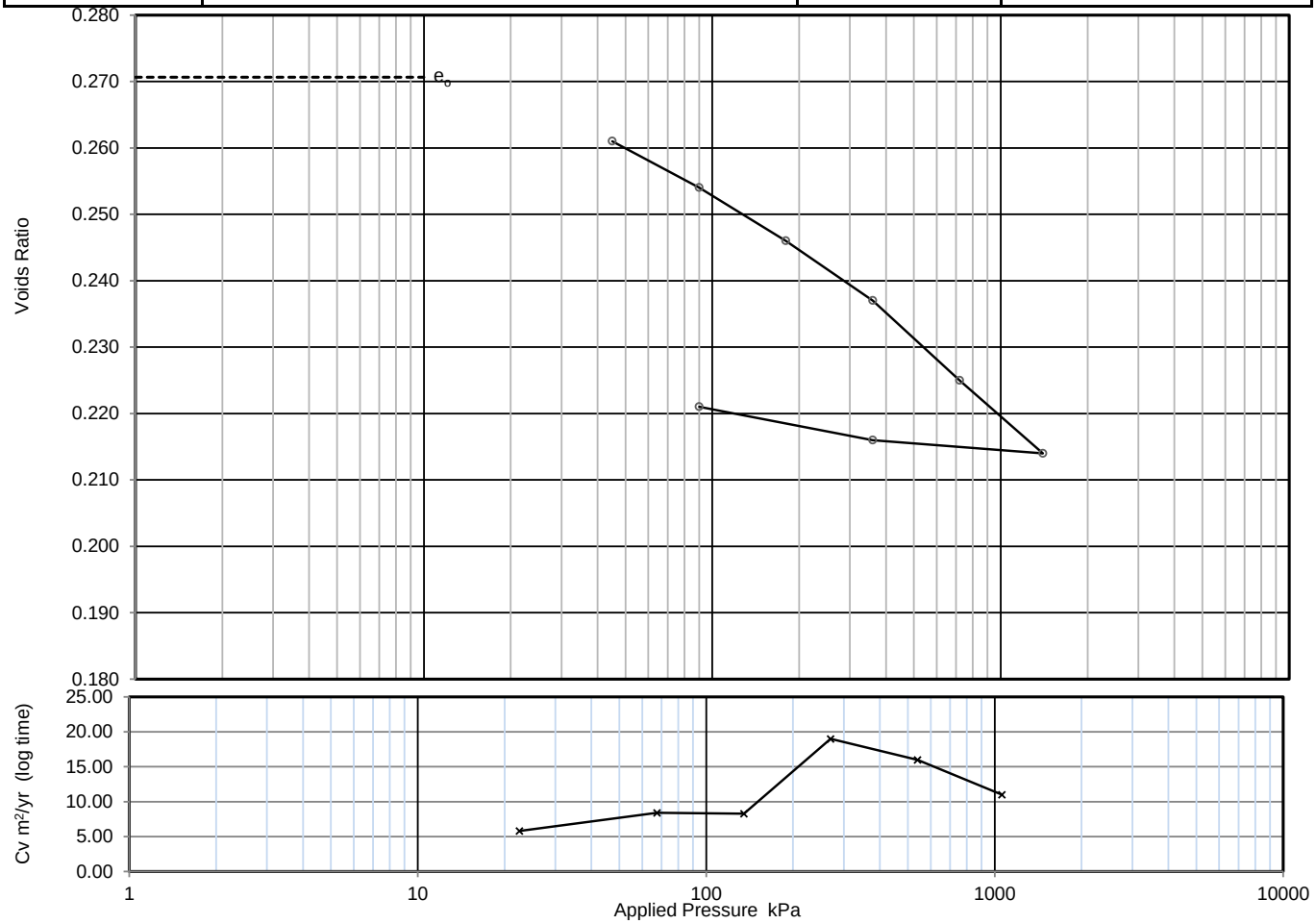
Approved: Stephen.Watson

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LAB 13R - Version 6

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		6
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	5.60
						Bottom	6
Specimen Reference	2	Specimen Depth	5.6	m	Sample Type		C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082919
Test Method	BS1377:Part 5:1990, clause 3				Date started		07/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.271	-	-	-	-
45	0.261	0.17	5.8	13	0.00081
90	0.254	0.11	8.4	35	0.00048
180	0.246	0.072	8.3	35	0.00026
360	0.237	0.042	19	57	0.00038
720	0.225	0.026	16	37	0.00042
1,400	0.214	0.014	11	38	0.00038
360	0.216	0.0022			
90	0.221	0.014			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	19.03	mm
Moisture Content	11.2	11.1	%
Bulk density	2.32	2.41	Mg/m3
Dry density	2.09	2.17	Mg/m3
Voids Ratio	0.271	0.221	
Saturation	110	133	%
Average temperature for test	20.0		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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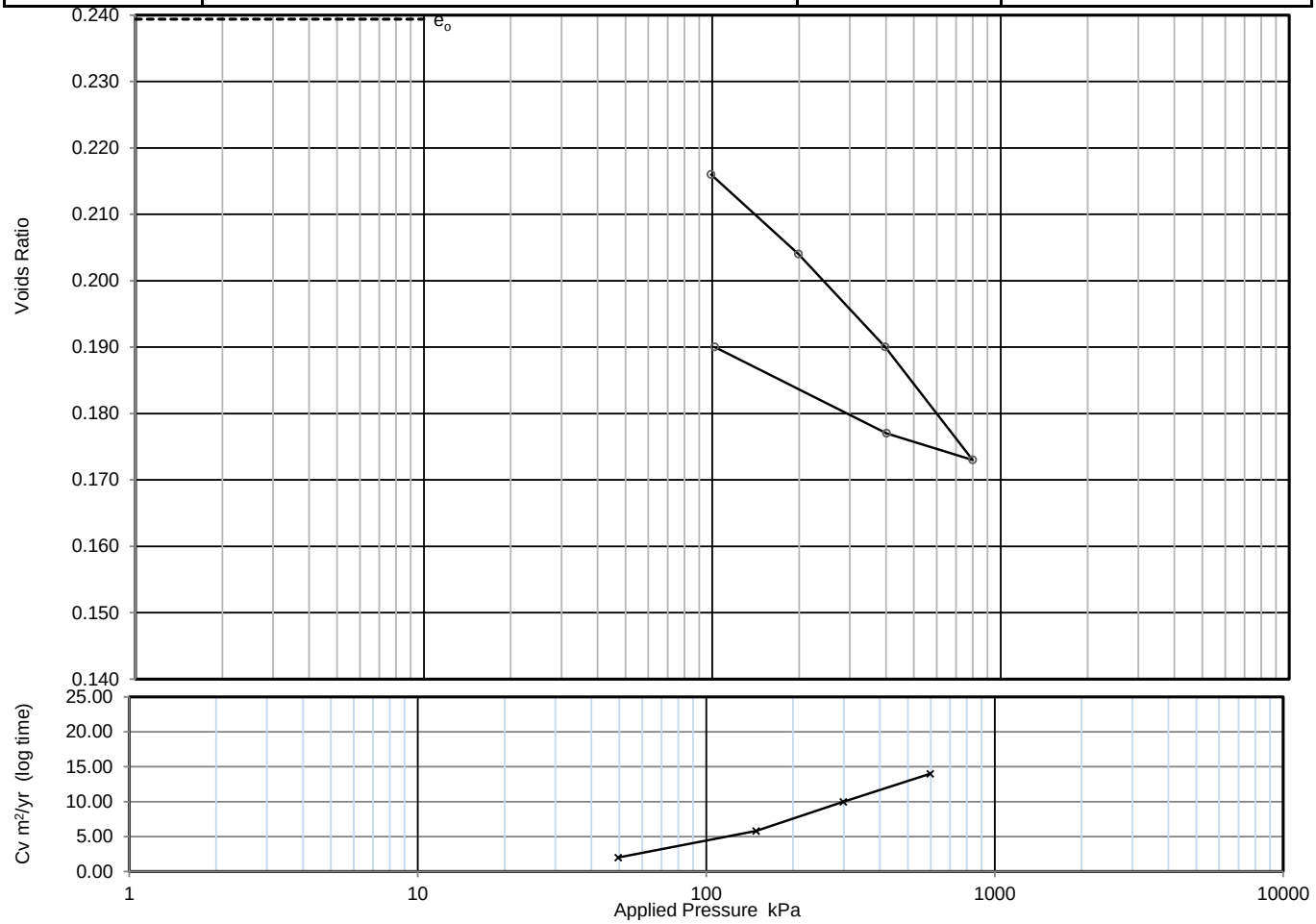
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UKAS TESTING

10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Soil Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	5.00
				Bottom	5.4
Specimen Reference	5	Specimen Depth	5.05 m	Sample Type	U
Specimen Description	Brownish grey sandy gravelly silty CLAY.			KeyLAB ID	Caus2022070543
Test Method	BS1377:Part 5:1990, clause 3			Date started	16/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.239	-	-	-	-
99	0.216	0.19	2	2	0.00032
199	0.204	0.095	5.8	33	0.0005
398	0.190	0.061	10	170	0.00029
799	0.173	0.035	14	160	0.00031
402	0.177	0.0072			
102	0.190	0.037			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.20	mm
Moisture Content	11.6	10.4	%
Bulk density	2.39	2.46	Mg/m3
Dry density	2.14	2.23	Mg/m3
Voids Ratio	0.239	0.190	
Saturation	128	146	%
Average temperature for test	20.0		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 :

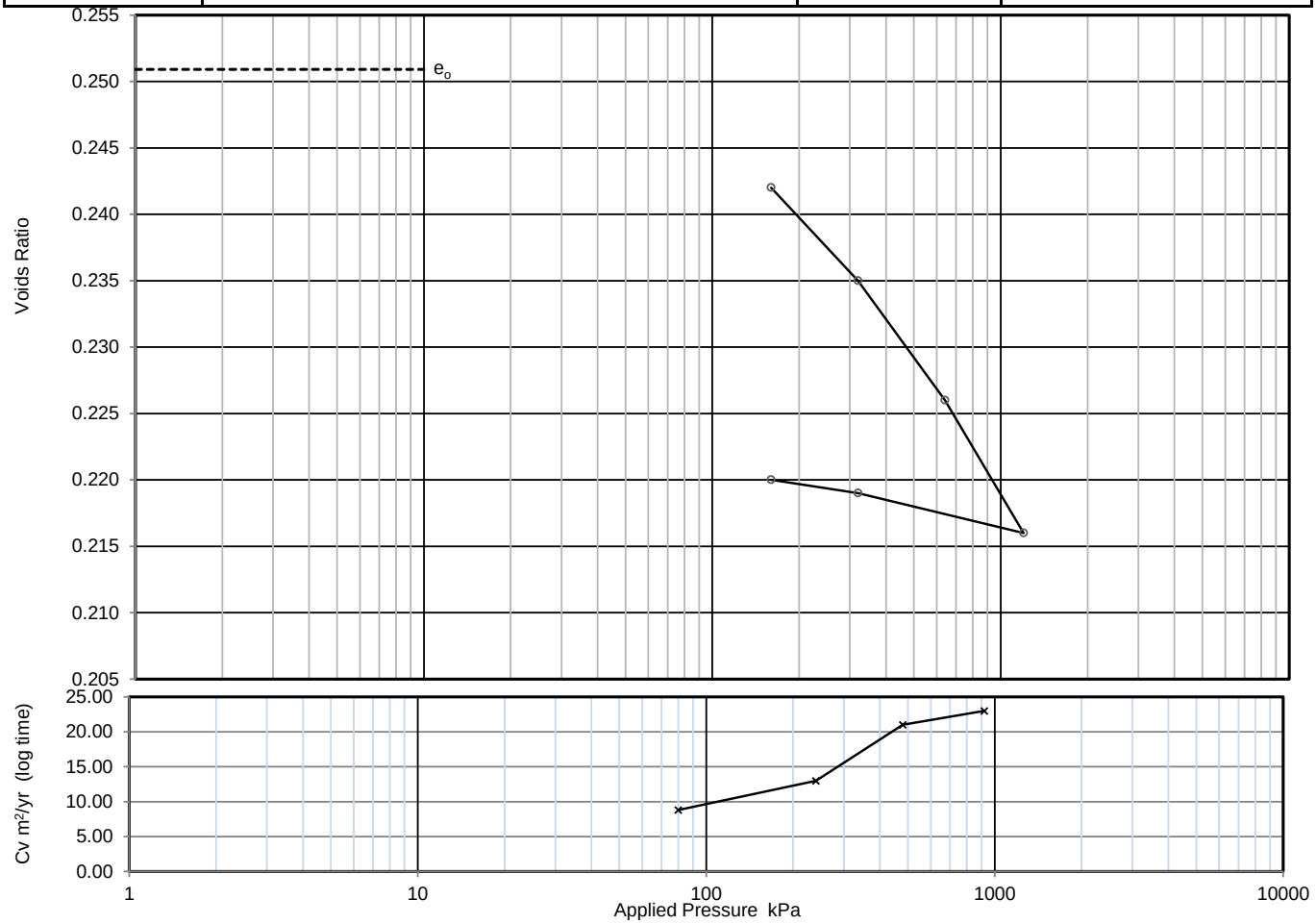
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UKAS TESTING

10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.80
				Bottom	8
Specimen Reference	2	Specimen Depth	7.8 m	Sample Type	C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082572
Test Method	BS1377:Part 5:1990, clause 3			Date started	25/08/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.251	-	-	-	-
160	0.242	0.045	8.8	14	0.00019
320	0.235	0.034	13	46	0.00028
640	0.226	0.023	21	38	0.00042
1,200	0.216	0.014	23	40	0.00046
320	0.219	0.0027			
160	0.220	0.0068			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.51	mm
Moisture Content	10.0	10.4	%
Bulk density	2.33	2.40	Mg/m3
Dry density	2.12	2.17	Mg/m3
Voids Ratio	0.251	0.220	
Saturation	106	125	%
Average temperature for test	20.0		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 :

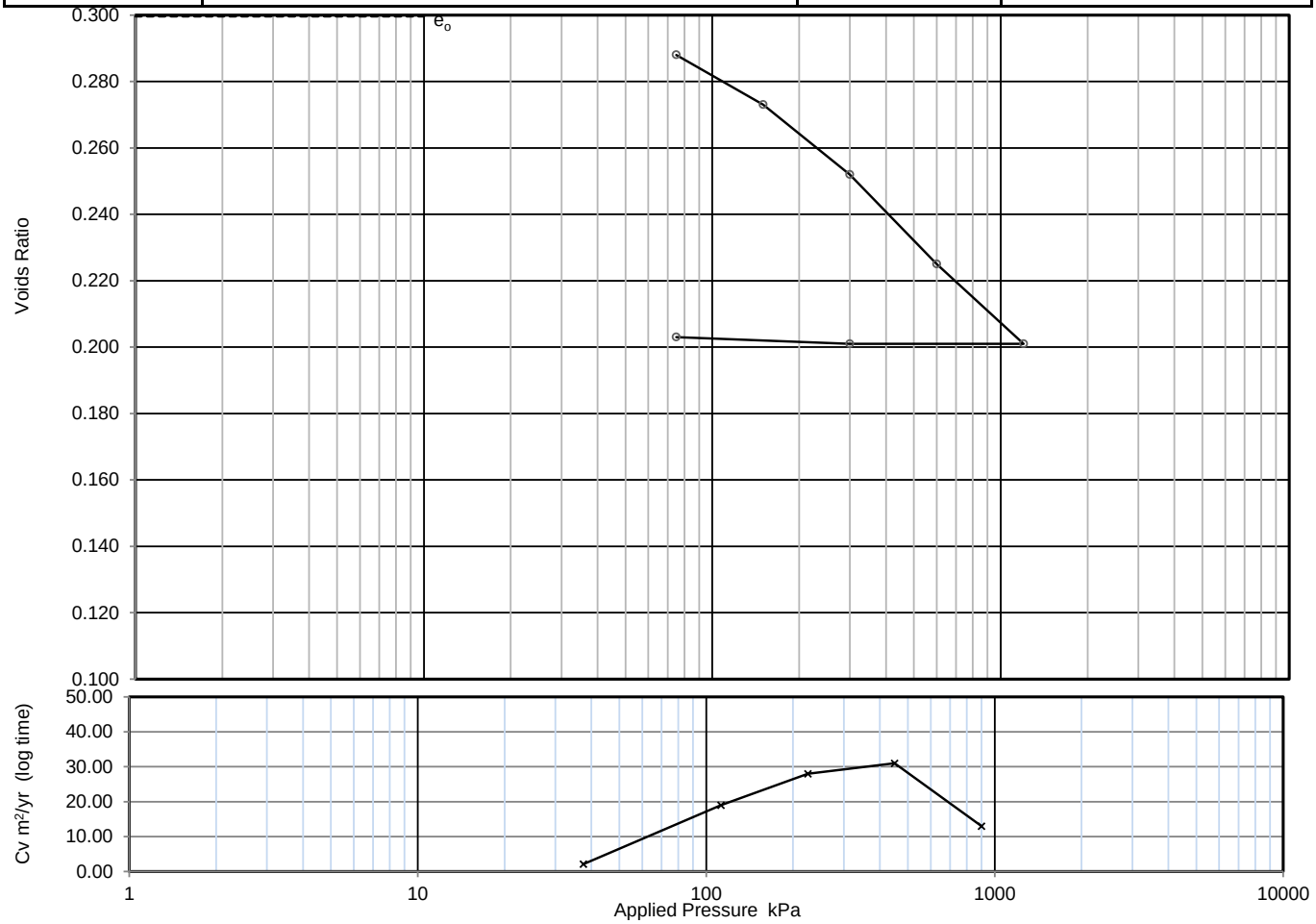
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		3
Soil Description	Brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	8.25
						Bottom	8.4
Specimen Reference	3	Specimen Depth	8.25	m	Sample Type		C
Specimen Description	Brown sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082586
Test Method	BS1377:Part 5:1990, clause 3				Date started		02/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.300	-	-	-	-
75	0.288	0.12	2.1	1.5	0.00058
150	0.273	0.16	19	53	0.0005
300	0.252	0.11	28	53	0.00062
600	0.225	0.071	31	58	0.00074
1,200	0.201	0.033	13	45	0.00086
300	0.201	0.00083			
75	0.203	0.0078			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	18.33	mm
Moisture Content	9.5	8.6	%
Bulk density	2.23	2.40	Mg/m3
Dry density	2.04	2.21	Mg/m3
Voids Ratio	0.300	0.201	
Saturation	84	113	%
Average temperature for test	20.0		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 :

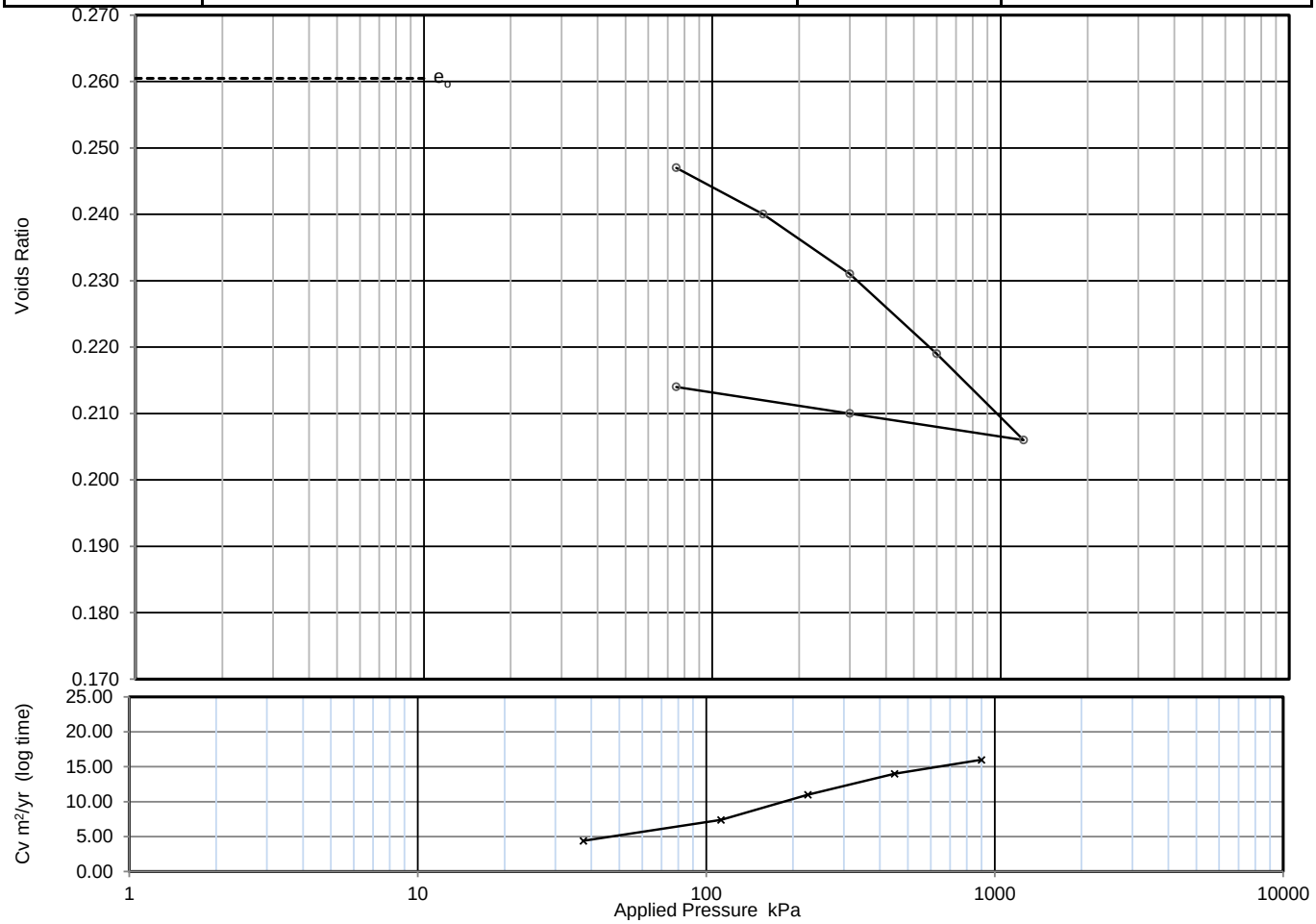
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	8.30
						Bottom	
Specimen Reference	2	Specimen Depth	8.3	m	Sample Type		C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082925
Test Method	BS1377:Part 5:1990, clause 3				Date started		08/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.260	-	-	-	-
75	0.247	0.14	4.4	6.4	0.0005
150	0.240	0.078	7.4	25	0.00038
300	0.231	0.051	11	48	0.00041
600	0.219	0.031	14	36	0.00047
1,200	0.206	0.018	16	36	0.00054
300	0.210	0.0032			
75	0.214	0.015			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.26	mm
Moisture Content	10.8	10.5	%
Bulk density	2.33	2.41	Mg/m3
Dry density	2.10	2.18	Mg/m3
Voids Ratio	0.260	0.214	
Saturation	110	131	%
Average temperature for test	20.0		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 :

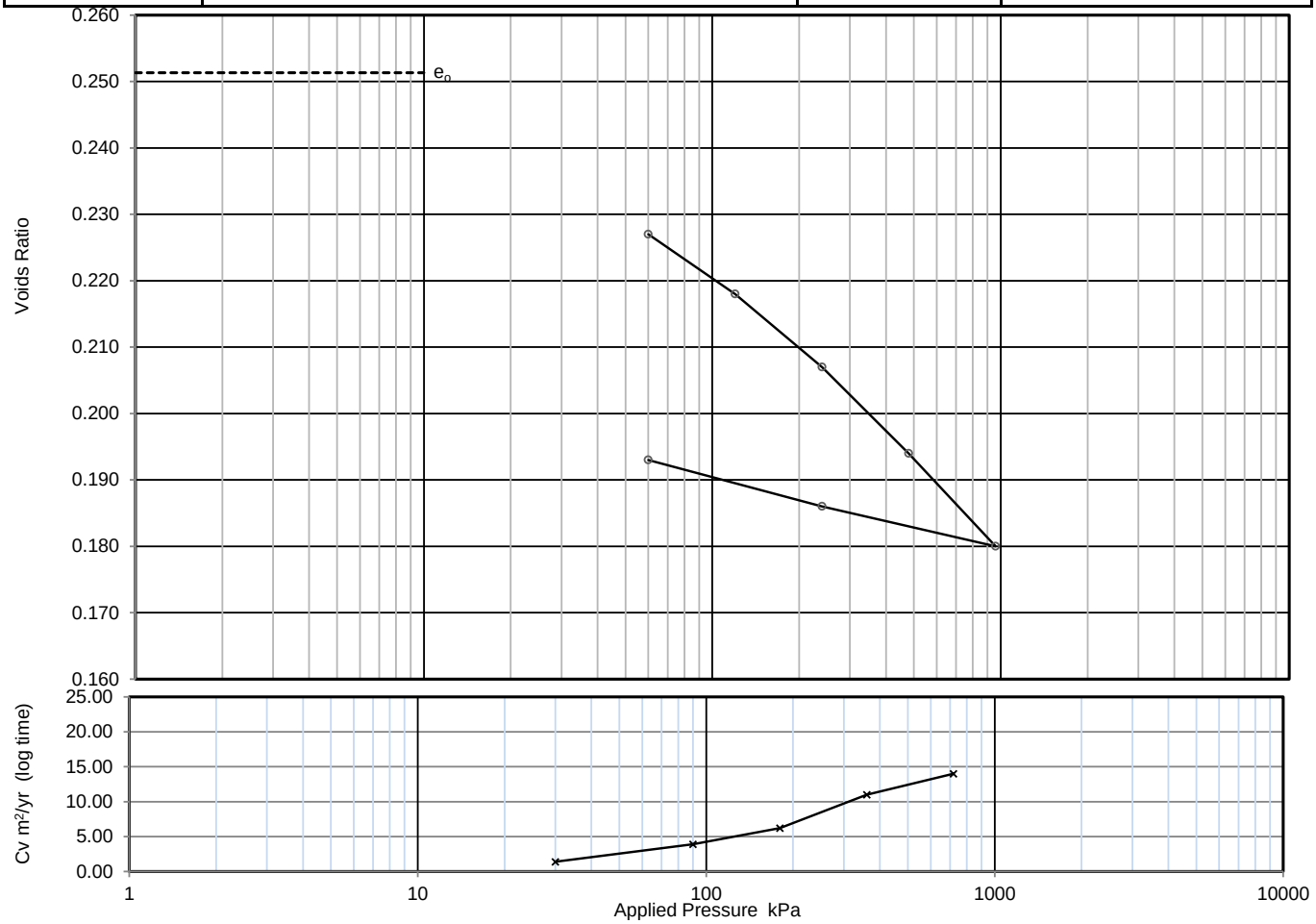
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		18
Soil Description	Brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	6.00
						Bottom	6.45
Specimen Reference	3	Specimen Depth	6.05	m	Sample Type		U
Specimen Description	Brown sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022071466
Test Method	BS1377:Part 5:1990, clause 3				Date started		25/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.251	-	-	-	-
60	0.227	0.32	1.4	1.4	0.00042
120	0.218	0.12	3.9	9.3	0.00029
240	0.207	0.074	6.2	28	0.00044
480	0.194	0.044	11	39	0.00043
960	0.180	0.025	14	32	0.00044
240	0.186	0.0065			
60	0.193	0.035			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.90	-	mm
Height	20.00	19.07	mm
Moisture Content	11.2	9.9	%
Bulk density	2.36	2.44	Mg/m3
Dry density	2.12	2.22	Mg/m3
Voids Ratio	0.251	0.193	
Saturation	118	136	%
Average temperature for test	20.0		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

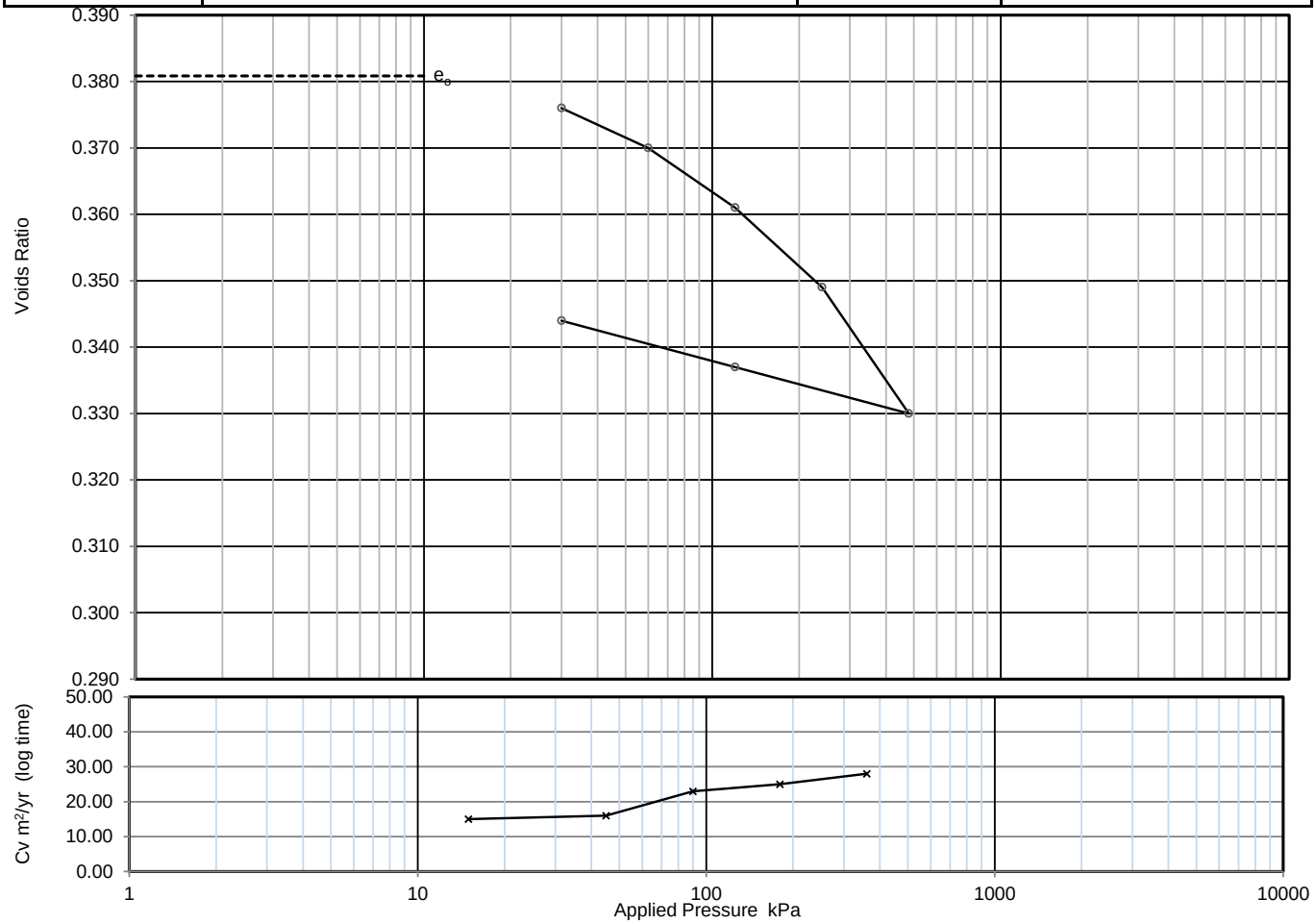
Approved: Stephen.Watson

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UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		1
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	1.20
						Bottom	1.6
Specimen Reference	5	Specimen Depth	1.25	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022062181
Test Method	BS1377:Part 5:1990, clause 3				Date started		



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.381	-	-	-	-
30	0.376	0.11	15	24	0.0003
60	0.370	0.15	16	42	0.00018
120	0.361	0.11	23	47	0.00029
240	0.349	0.077	25	50	0.00023
480	0.330	0.056	28	58	0.00028
120	0.337	0.013			
30	0.344	0.062			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.90	19.37	mm
Moisture Content	14.2	14.6	%
Bulk density	2.19	2.26	Mg/m3
Dry density	1.92	1.97	Mg/m3
Voids Ratio	0.381	0.344	
Saturation	99	112	%
Average temperature for test	20.0		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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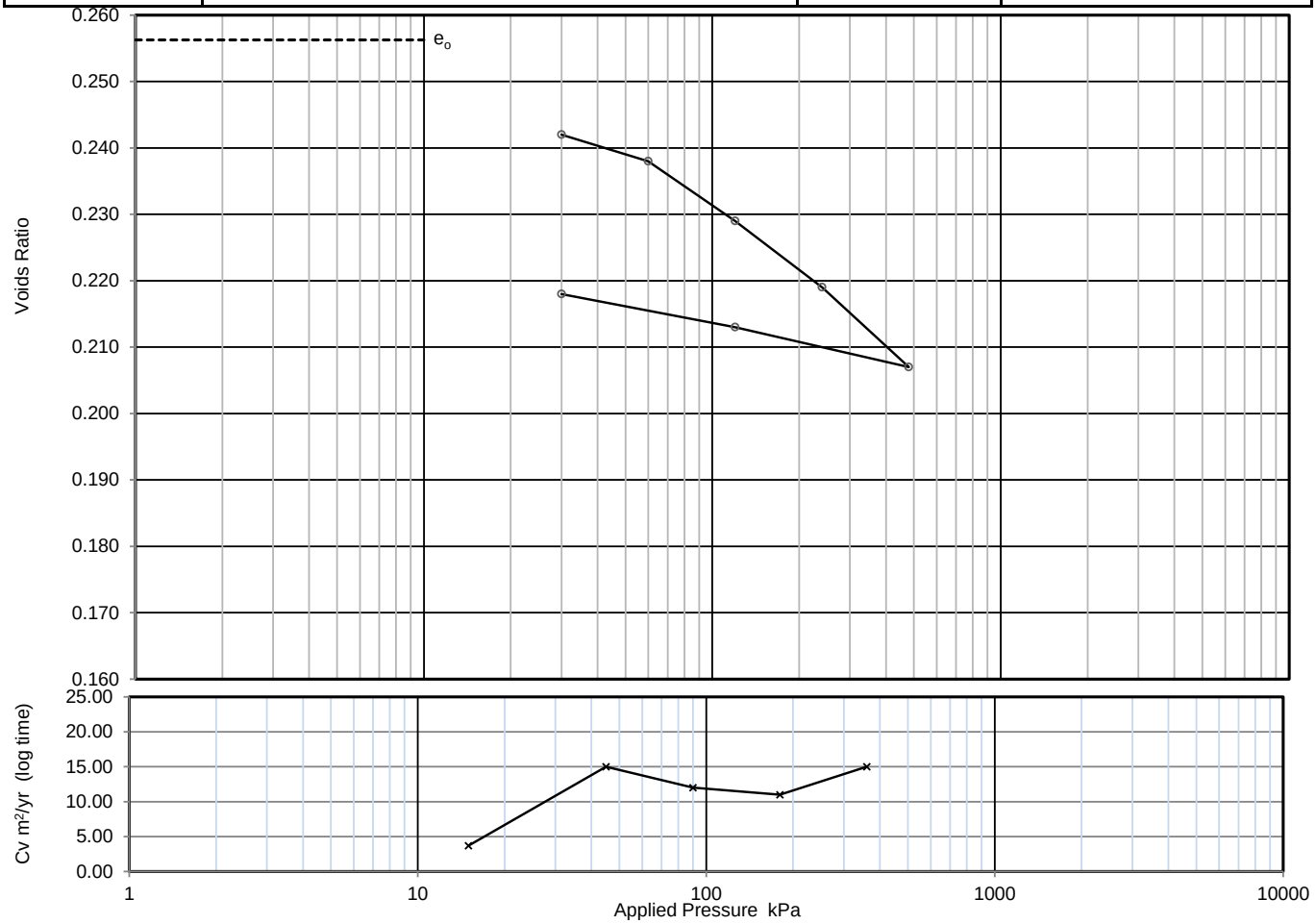
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		19
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	1.20
						Bottom	1.6
Specimen Reference	5	Specimen Depth	1.25	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022062192
Test Method	BS1377:Part 5:1990, clause 3				Date started		29/06/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.256	-	-	-	-
30	0.242	0.38	3.7	3.8	0.00037
60	0.238	0.12	15	57	0.000029
120	0.229	0.11	12	39	0.000047
240	0.219	0.071	11	42	0.00024
480	0.207	0.041	15	38	0.00025
120	0.213	0.015			
30	0.218	0.042			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	20.00	19.39	mm
Moisture Content	12.0	11.0	%
Bulk density	2.36	2.41	Mg/m3
Dry density	2.11	2.18	Mg/m3
Voids Ratio	0.256	0.218	
Saturation	124	134	%
Average temperature for test	20.0		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 :

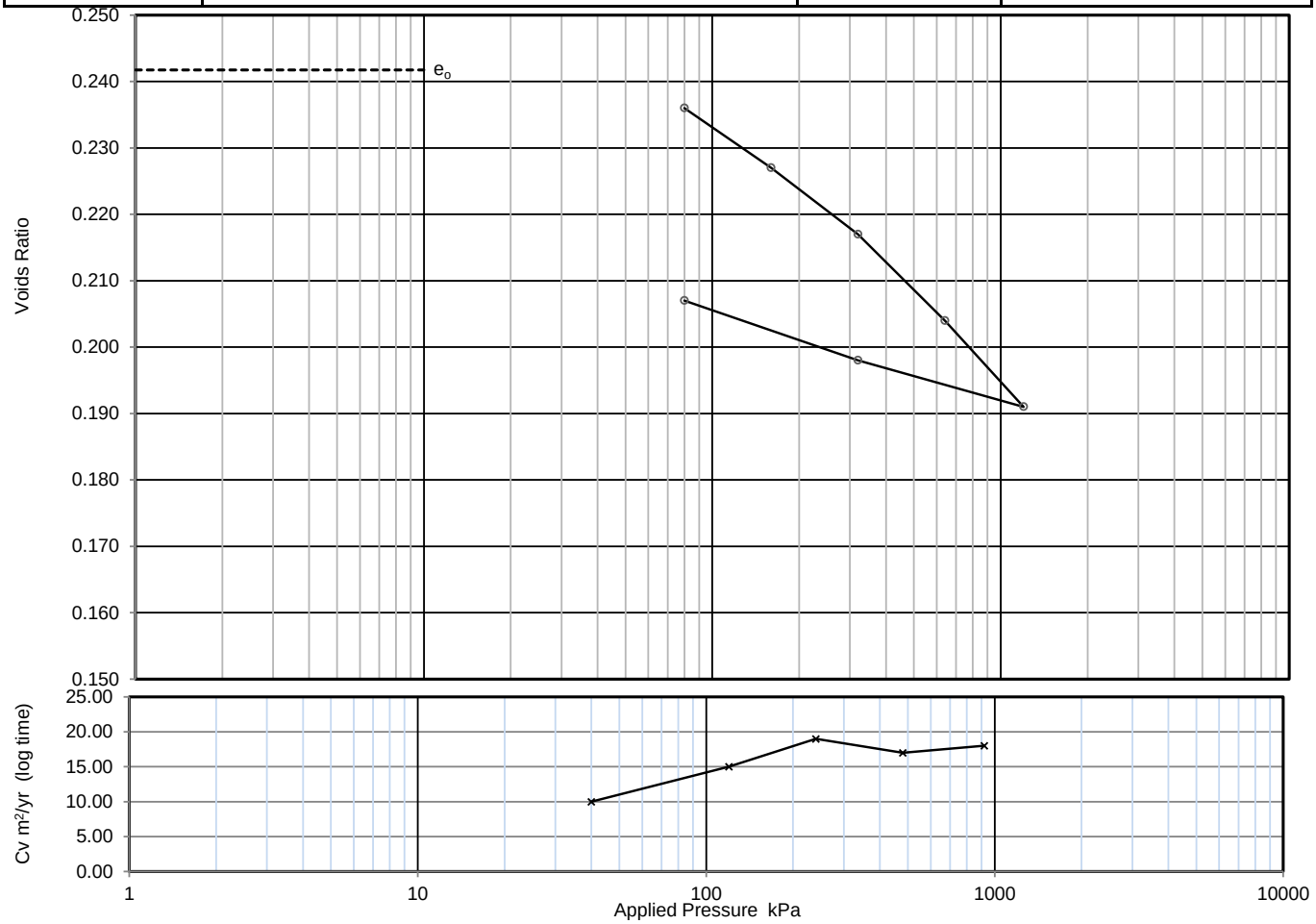
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		2
Soil Description	Brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	8.45
						Bottom	8.6
Specimen Reference	3	Specimen Depth	8.45	m	Sample Type		C
Specimen Description	Brown sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082599
Test Method	BS1377:Part 5:1990, clause 3				Date started		02/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.242	-	-	-	-
80	0.236	0.055	10	25	0.00037
160	0.227	0.091	15	48	0.00014
320	0.217	0.053	19	44	0.00035
640	0.204	0.032	17	44	0.00042
1,200	0.191	0.02	18	39	0.0005
320	0.198	0.0063			
80	0.207	0.031			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	74.90	-	mm
Height	19.90	19.34	mm
Moisture Content	9.9	10.3	%
Bulk density	2.34	2.42	Mg/m3
Dry density	2.13	2.20	Mg/m3
Voids Ratio	0.242	0.207	
Saturation	108	132	%
Average temperature for test	20.0		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 :

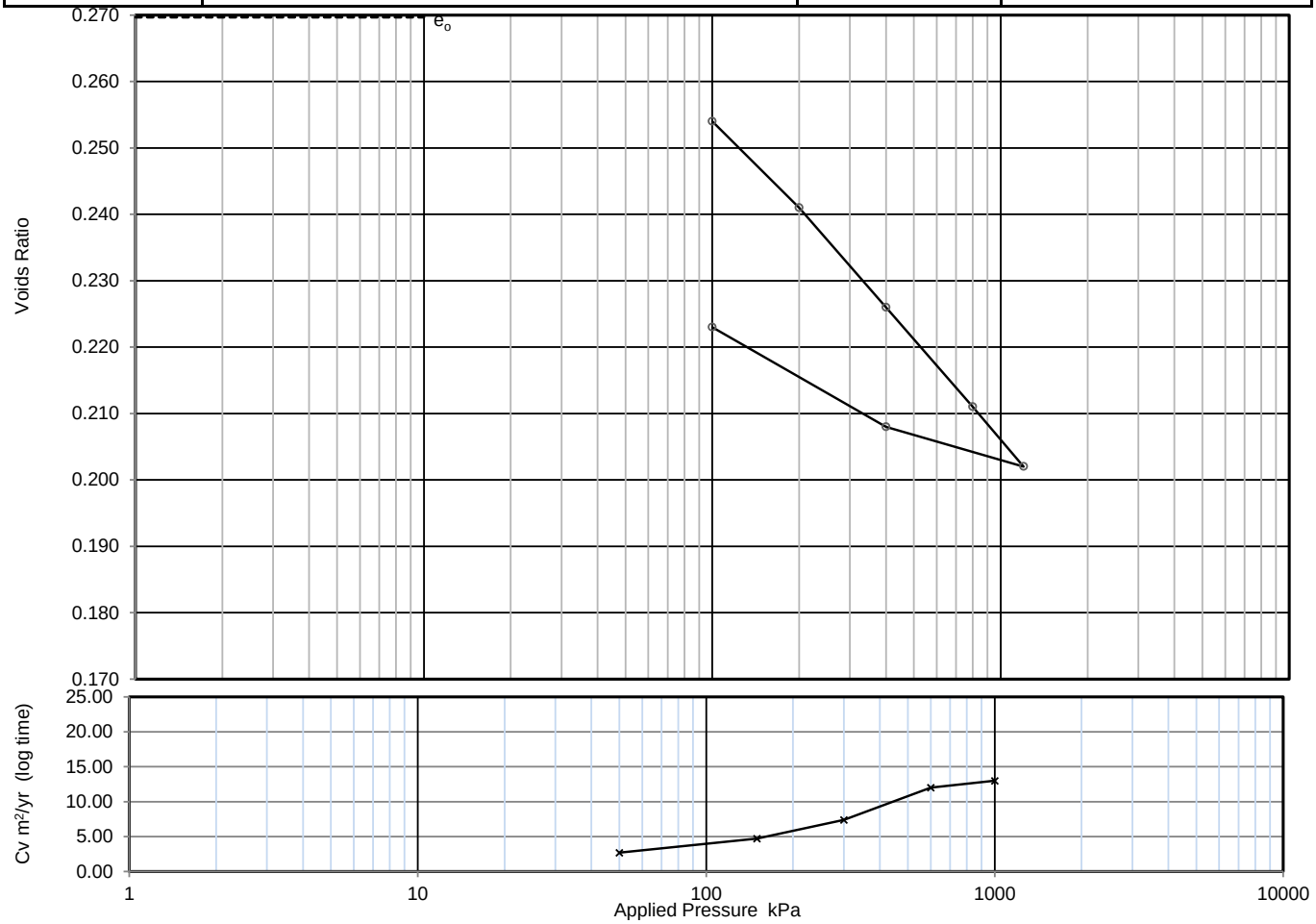
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UKAS TESTING

10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	1
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.75
				Bottom	10.9
Specimen Reference	3	Specimen Depth	10.75 m	Sample Type	C
Specimen Description	Brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220825103
Test Method	BS1377:Part 5:1990, clause 3			Date started	26/08/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.270	-	-	-	-
100	0.254	0.13	2.7	4.3	0.00048
200	0.241	0.1	4.7	14	0.00045
400	0.226	0.06	7.4	21	0.00048
800	0.211	0.031	12	23	0.00047
1,200	0.202	0.019	13	41	0.00057
400	0.208	0.0067			
100	0.223	0.041			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.26	mm
Moisture Content	11.1	10.3	%
Bulk density	2.32	2.39	Mg/m3
Dry density	2.09	2.17	Mg/m3
Voids Ratio	0.270	0.223	
Saturation	109	123	%
Average temperature for test	20.0		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 :

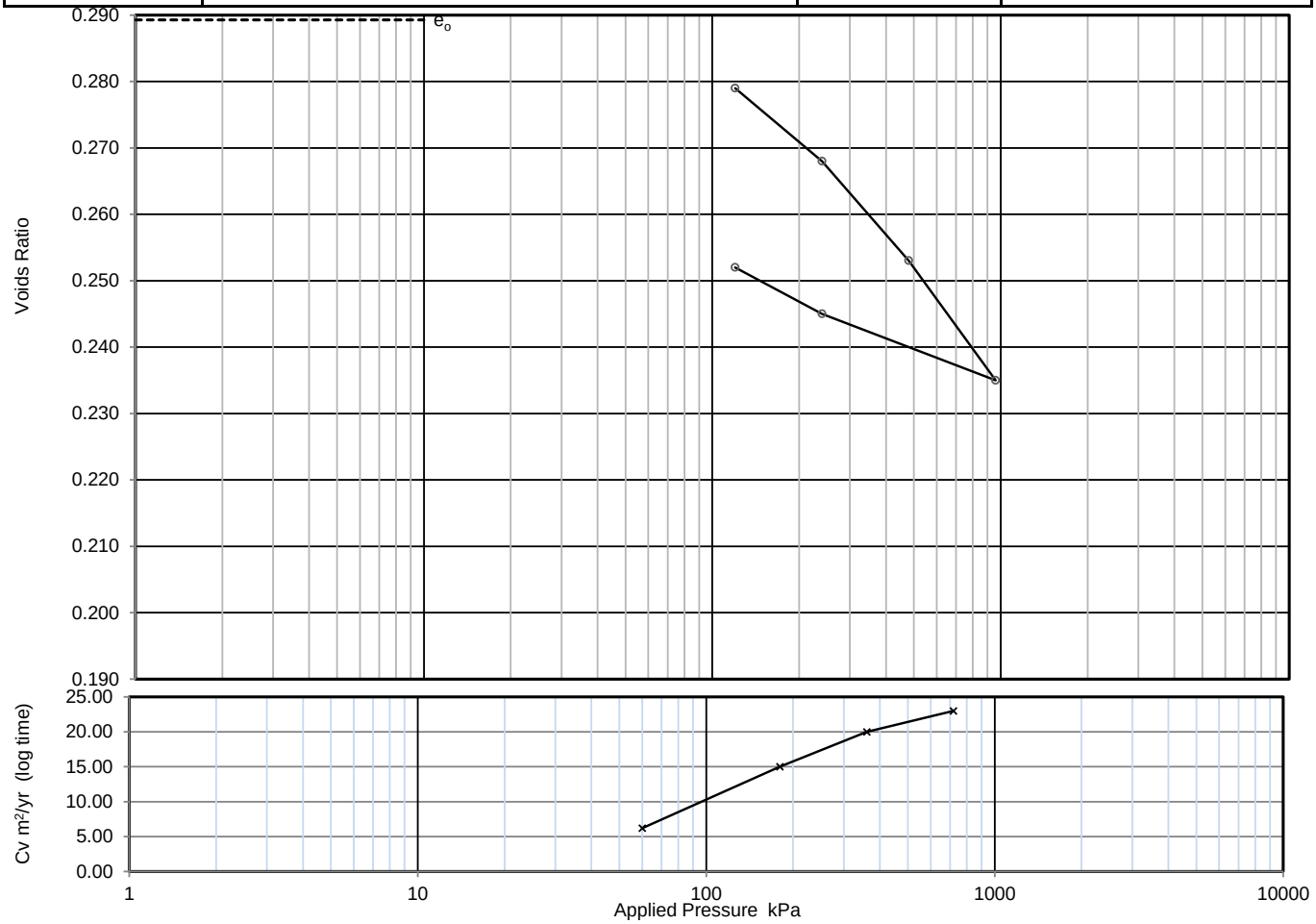
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UKAS TESTING

10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		26
Soil Description	Brown sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	12.00
						Bottom	12.4
Specimen Reference	2	Specimen Depth	12.05	m	Sample Type		U
Specimen Description	Brown sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022071481
Test Method	BS1377:Part 5:1990, clause 3				Date started		21/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.289	-	-	-	-
120	0.279	0.064	6.2	7.5	0.00039
240	0.268	0.077	15	45	0.00039
480	0.253	0.049	20	51	0.00034
960	0.235	0.03	23	55	0.00037
240	0.245	0.012			
120	0.252	0.043			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.42	mm
Moisture Content	10.2	10.6	%
Bulk density	2.26	2.34	Mg/m3
Dry density	2.06	2.12	Mg/m3
Voids Ratio	0.289	0.252	
Saturation	93	111	%
Average temperature for test	20.0		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 :

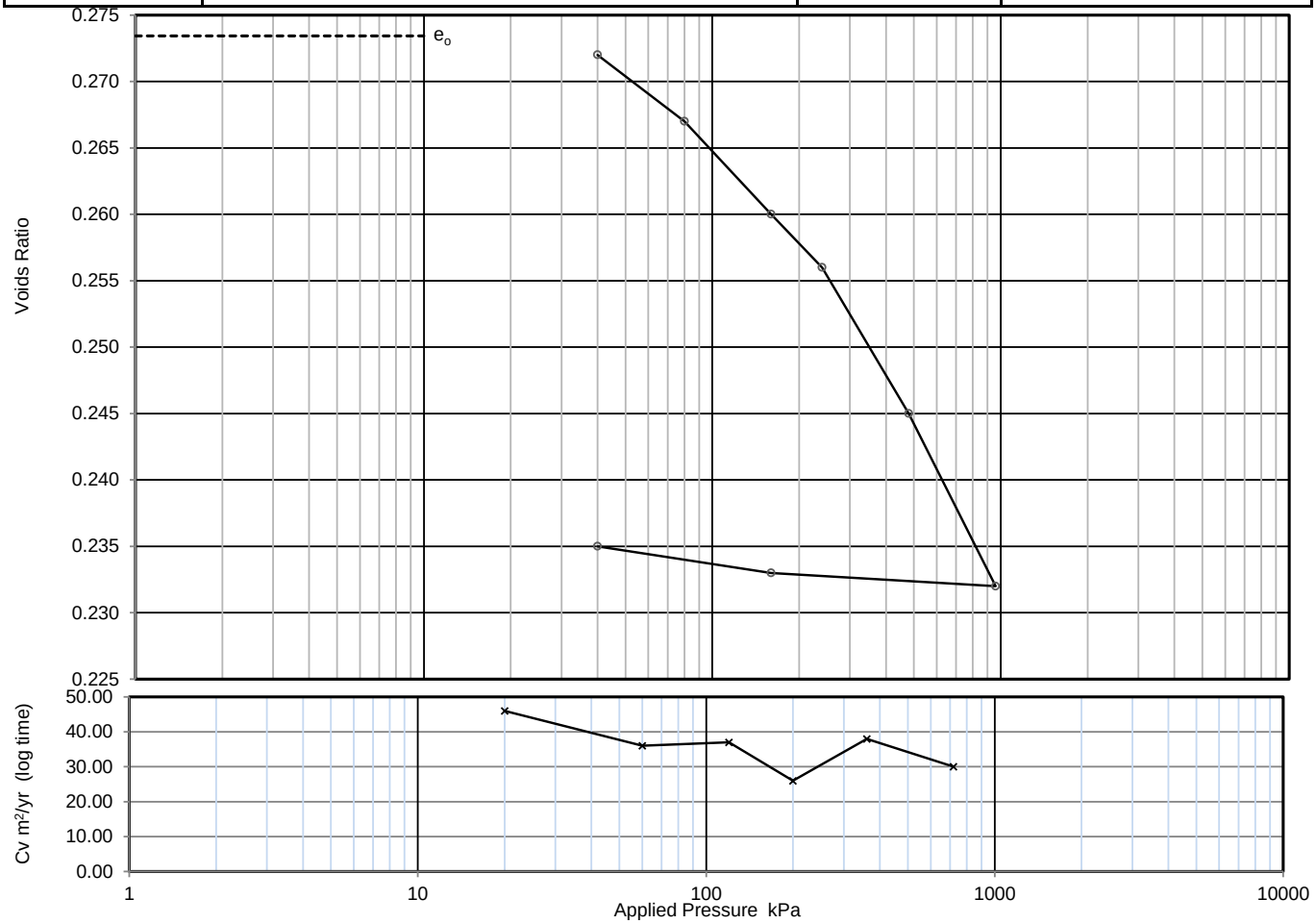
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UKAS TESTING

10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		16
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	4.00
						Bottom	4.45
Specimen Reference	5	Specimen Depth	4.05	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022070552
Test Method	BS1377:Part 5:1990, clause 3				Date started		19/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.273	-	-	-	-
40	0.272	0.028	46	83	0.00022
80	0.267	0.09	36	57	0.00022
160	0.260	0.07	37	54	0.00032
240	0.256	0.045	26	57	0.0003
480	0.245	0.035	38	53	0.00046
960	0.232	0.023	30	59	0.00058
160	0.233	0.0016			
40	0.235	0.0094			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.39	mm
Moisture Content	8.8	10.1	%
Bulk density	2.26	2.36	Mg/m3
Dry density	2.08	2.15	Mg/m3
Voids Ratio	0.273	0.235	
Saturation	85	114	%
Average temperature for test	20.0		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 :

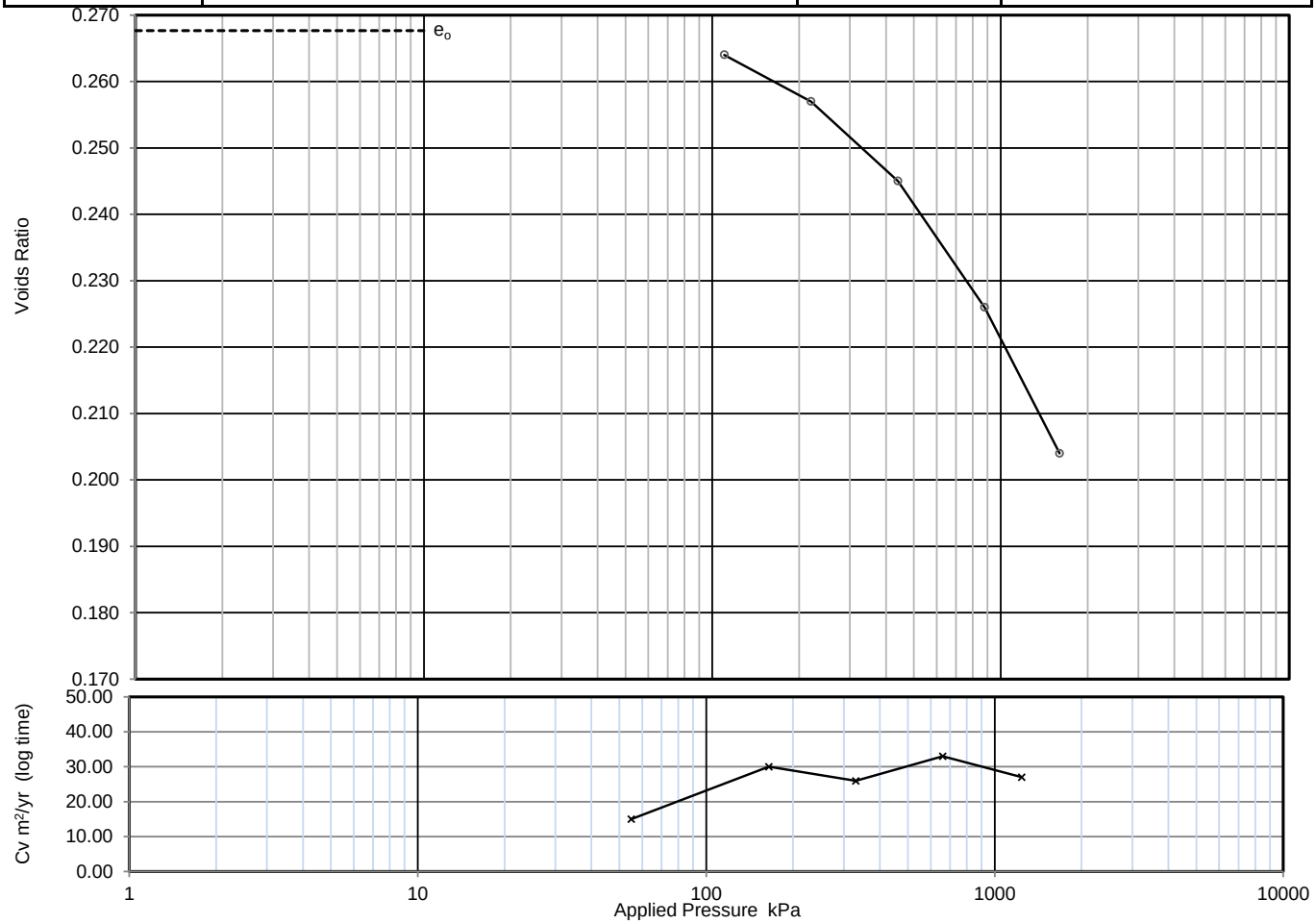
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10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.60
				Bottom	
Specimen Reference	2	Specimen Depth	11.6 m	Sample Type	C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082937
Test Method	BS1377:Part 5:1990, clause 3			Date started	09/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.268	-	-	-	-
110	0.264	0.023	15	81	0.00013
220	0.257	0.055	30	54	0.00027
440	0.245	0.042	26	54	0.00032
880	0.226	0.034	33	48	0.00054
1,600	0.204	0.025	27	51	0.00076

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	18.81	mm
Moisture Content	9.8	10.4	%
Bulk density	2.30	2.43	Mg/m3
Dry density	2.09	2.20	Mg/m3
Voids Ratio	0.268	0.204	
Saturation	97	135	%
Average temperature for test	20.0		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

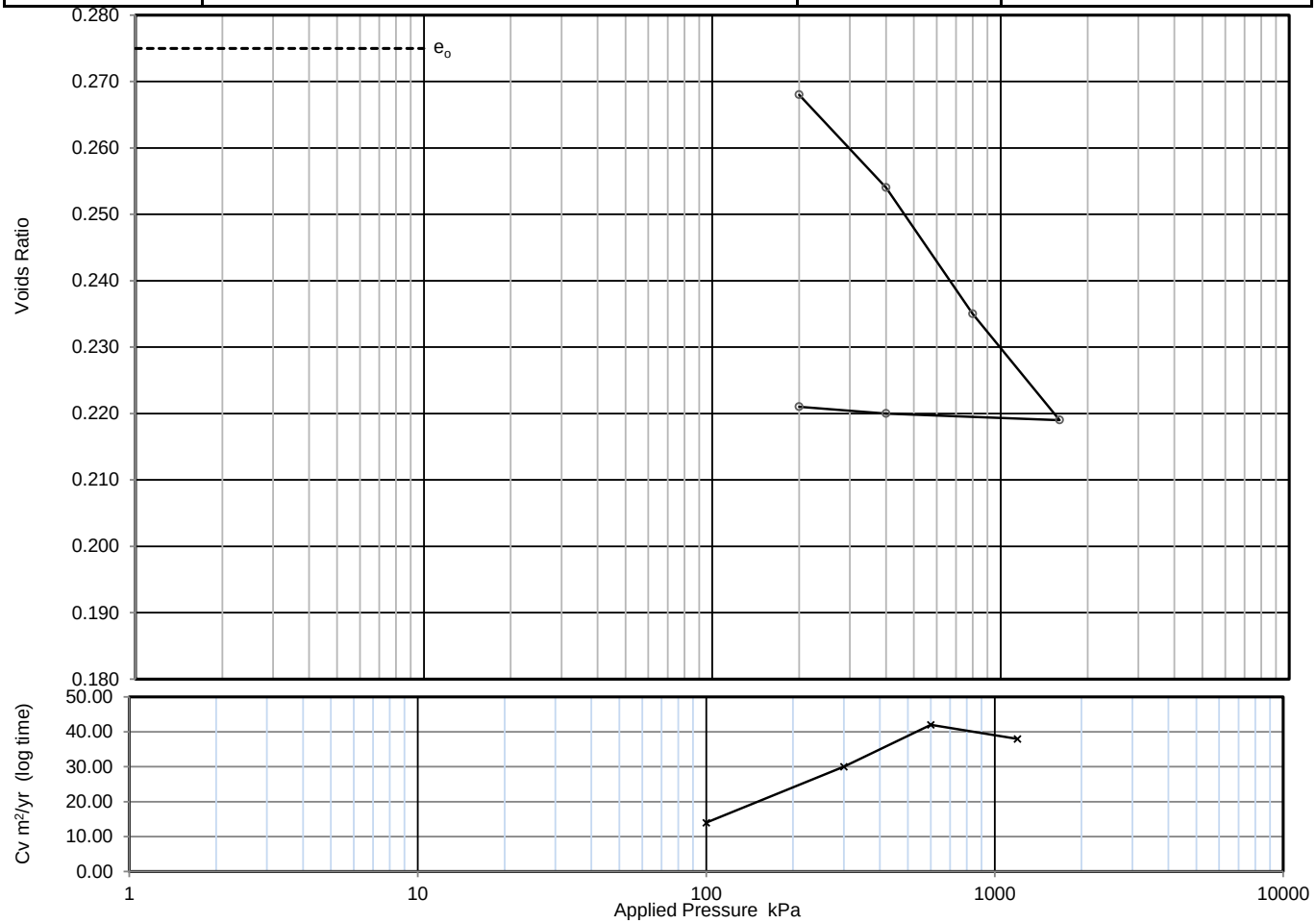
Approved: Stephen.Watson

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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		27
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	10.50
						Bottom	10.9
Specimen Reference	5	Specimen Depth	10.55	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022070571
Test Method	BS1377:Part 5:1990, clause 3				Date started		19/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.275	-	-	-	-
200	0.268	0.026	14	25	0.0011
400	0.254	0.058	30	58	0.0006
800	0.235	0.037	42	95	0.00057
1,600	0.219	0.017	38	89	0.00072
400	0.220	0.00095			
200	0.221	0.0058			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.80	18.97	mm
Moisture Content	9.3	10.2	%
Bulk density	2.27	2.39	Mg/m3
Dry density	2.08	2.17	Mg/m3
Voids Ratio	0.275	0.221	
Saturation	89	123	%
Average temperature for test	20.0		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 :

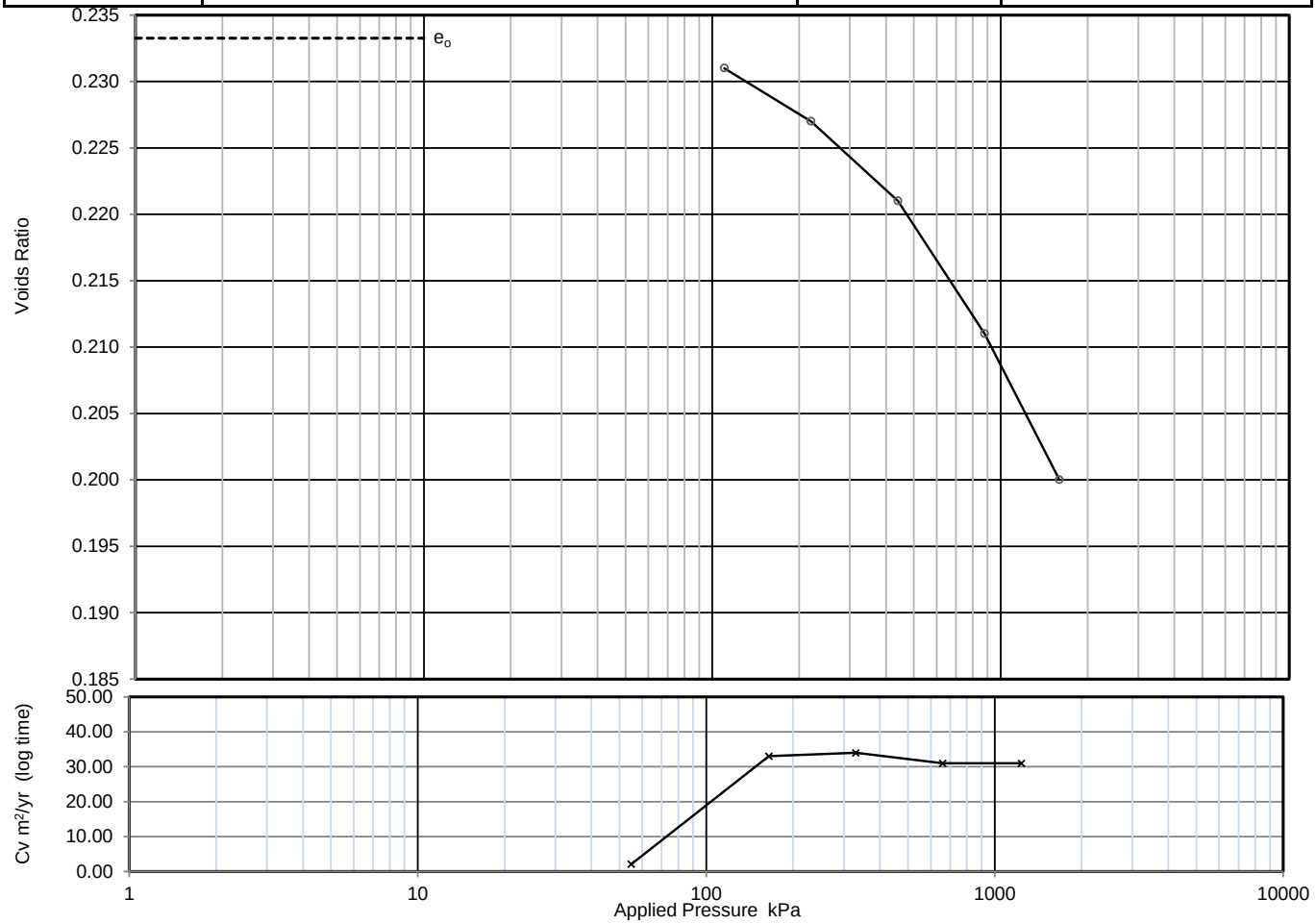
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10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		1
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	11.95
						Bottom	
Specimen Reference	2	Specimen Depth	11.95	m	Sample Type		C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082940
Test Method	BS1377:Part 5:1990, clause 3				Date started		09/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.233	-	-	-	-
110	0.231	0.014	2.1	1.9	0.00015
220	0.227	0.029	33	270	0.00021
440	0.221	0.024	34	170	0.00026
880	0.211	0.019	31	180	0.00028
1,598	0.200	0.013	31	180	0.00058

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.90	19.36	mm
Moisture Content	-63.3	10.4	%
Bulk density	0.79	2.44	Mg/m3
Dry density	2.15	2.21	Mg/m3
Voids Ratio	0.233	0.200	
Saturation	-719	137	%
Average temperature for test	20.0		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

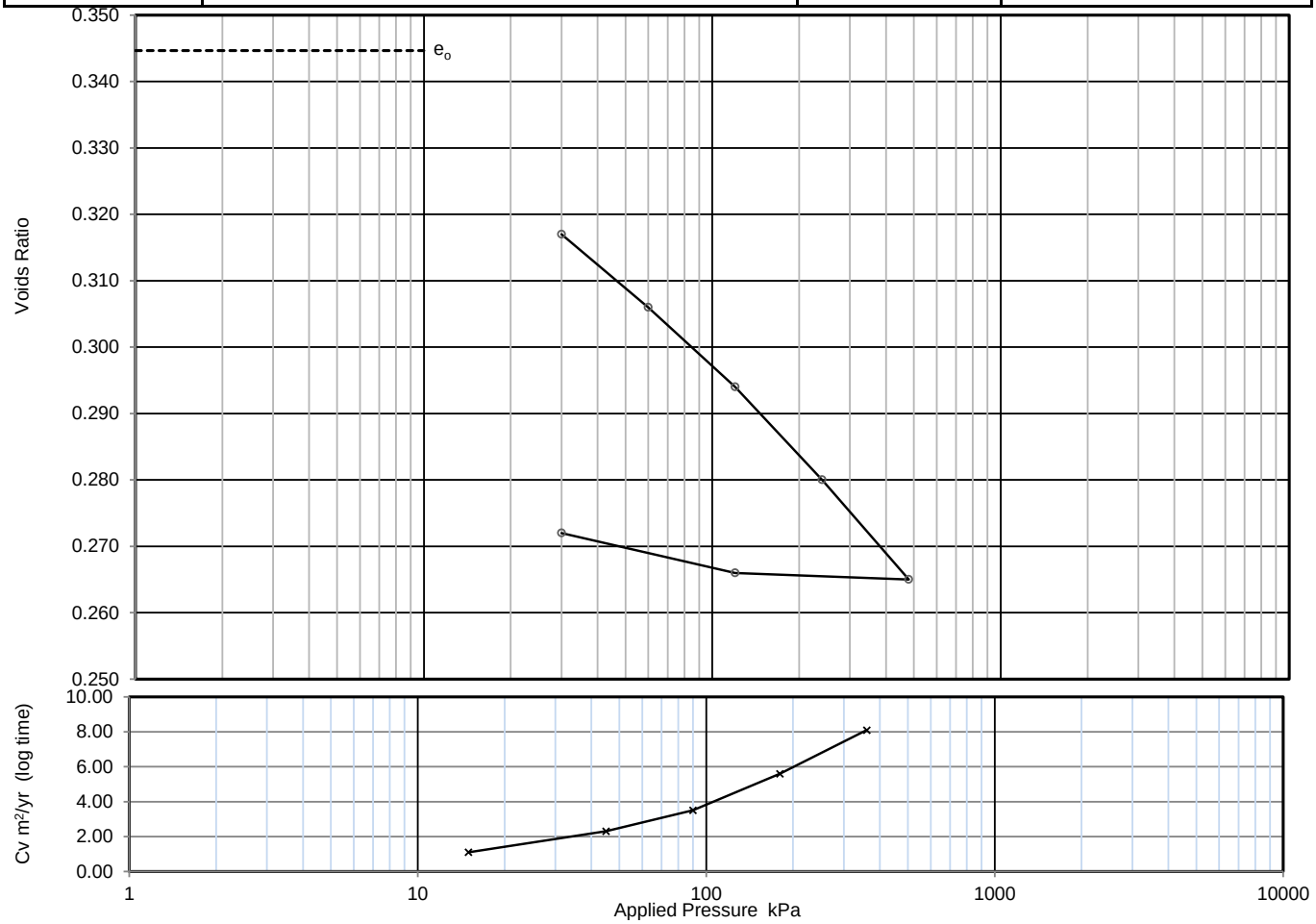
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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		15
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	3.00
						Bottom	3.45
Specimen Reference	5	Specimen Depth	3.05	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022070579
Test Method	BS1377:Part 5:1990, clause 3				Date started		20/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.345	-	-	-	-
30	0.317	0.69	1.1	0.99	0.00066
60	0.306	0.26	2.3	2.5	0.00063
120	0.294	0.16	3.5	3.9	0.00052
240	0.280	0.089	5.6	13	0.00053
480	0.265	0.05	8.1	19	0.00061
120	0.266	0.0026			
30	0.272	0.053			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	18.92	mm
Moisture Content	16.0	14.1	%
Bulk density	2.29	2.38	Mg/m3
Dry density	1.97	2.08	Mg/m3
Voids Ratio	0.345	0.272	
Saturation	123	137	%
Average temperature for test	20.0		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

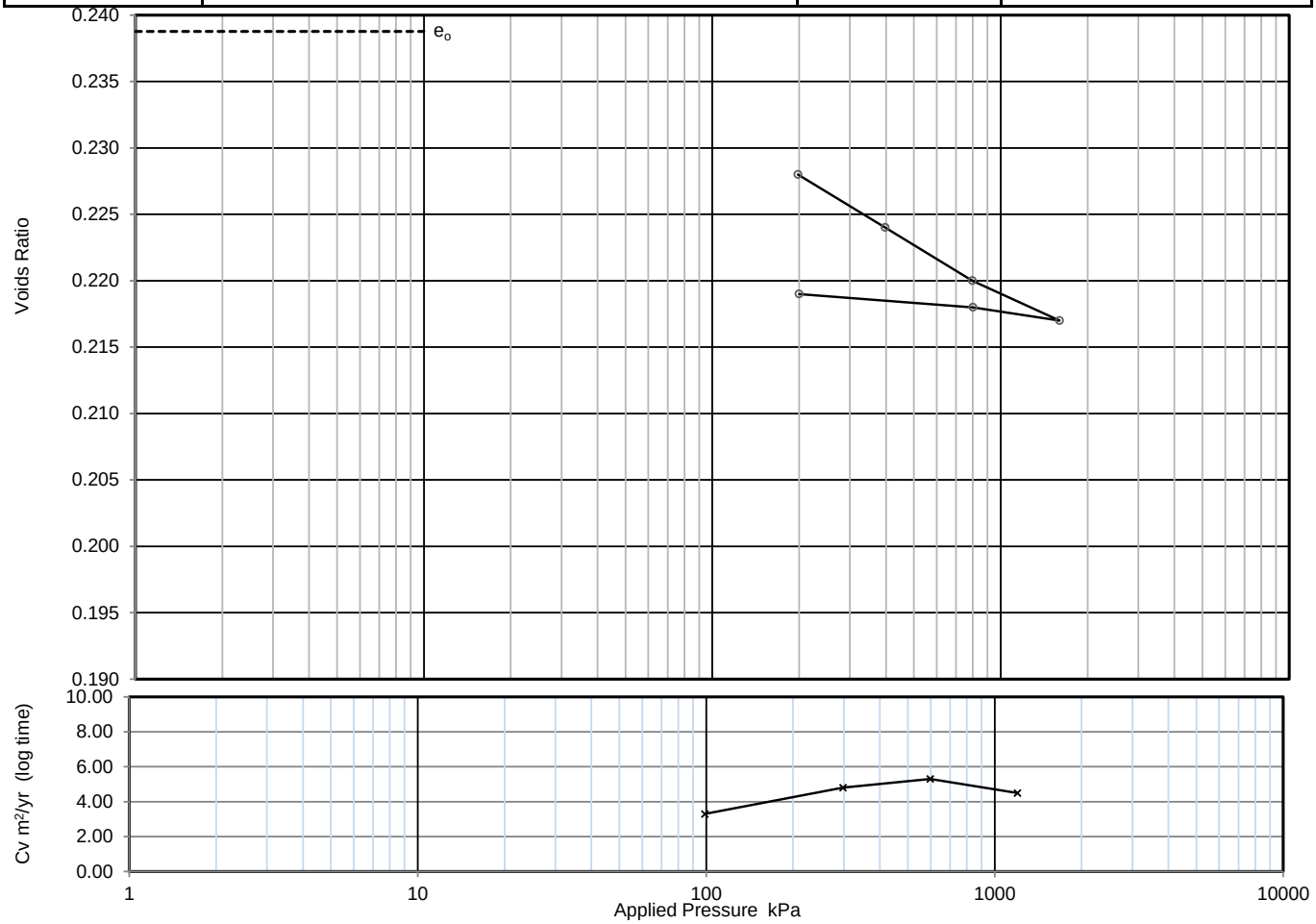
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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		23
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	9.00
						Bottom	9.4
Specimen Reference	5	Specimen Depth	9.05	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022070584
Test Method	BS1377:Part 5:1990, clause 3				Date started		16/07/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.239	-	-	-	-
198	0.228	0.044	3.3	3.6	0.00019
398	0.224	0.015	4.8	3.3	0.00047
798	0.220	0.0081	5.3	7.4	0.00037
1,599	0.217	0.0035	4.5	6.3	0.00045
802	0.218	0.00079			
200	0.219	0.0018			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.90	19.58	mm
Moisture Content	10.3	9.7	%
Bulk density	2.36	2.39	Mg/m3
Dry density	2.14	2.17	Mg/m3
Voids Ratio	0.239	0.219	
Saturation	115	118	%
Average temperature for test	20.0		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 :

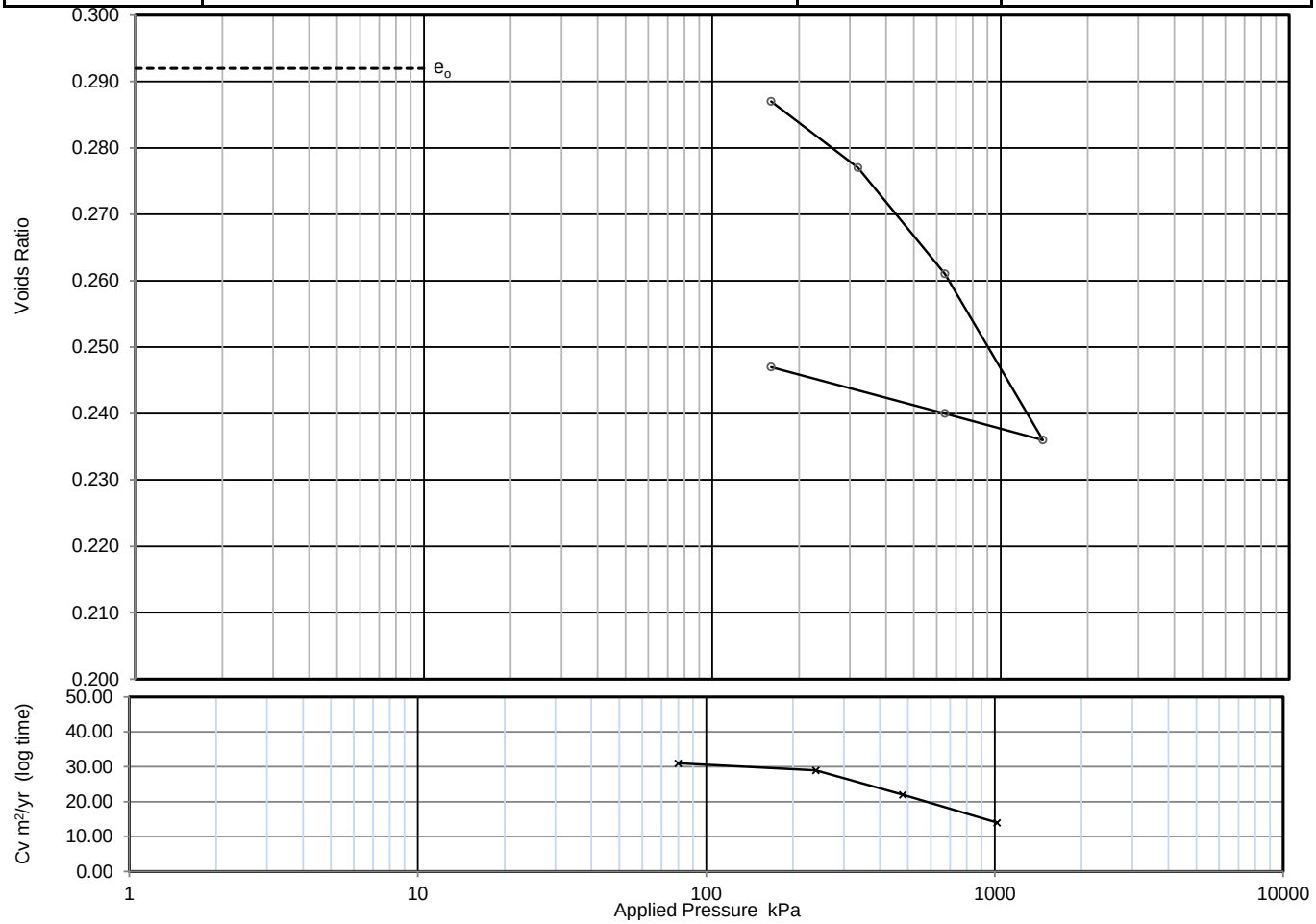
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10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.30
				Bottom	
Specimen Reference	2	Specimen Depth	16.3 m	Sample Type	C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082944
Test Method	BS1377:Part 5:1990, clause 3			Date started	09/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.292	-	-	-	-
160	0.287	0.024	31	51	0.00048
320	0.277	0.051	29	53	0.00063
640	0.261	0.038	22	55	0.00039
1,400	0.236	0.026	14	49	0.00067
640	0.240	0.0044			
160	0.247	0.012			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.30	mm
Moisture Content	10.7	11.5	%
Bulk density	2.27	2.37	Mg/m3
Dry density	2.05	2.13	Mg/m3
Voids Ratio	0.292	0.247	
Saturation	97	123	%
Average temperature for test	20.0		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

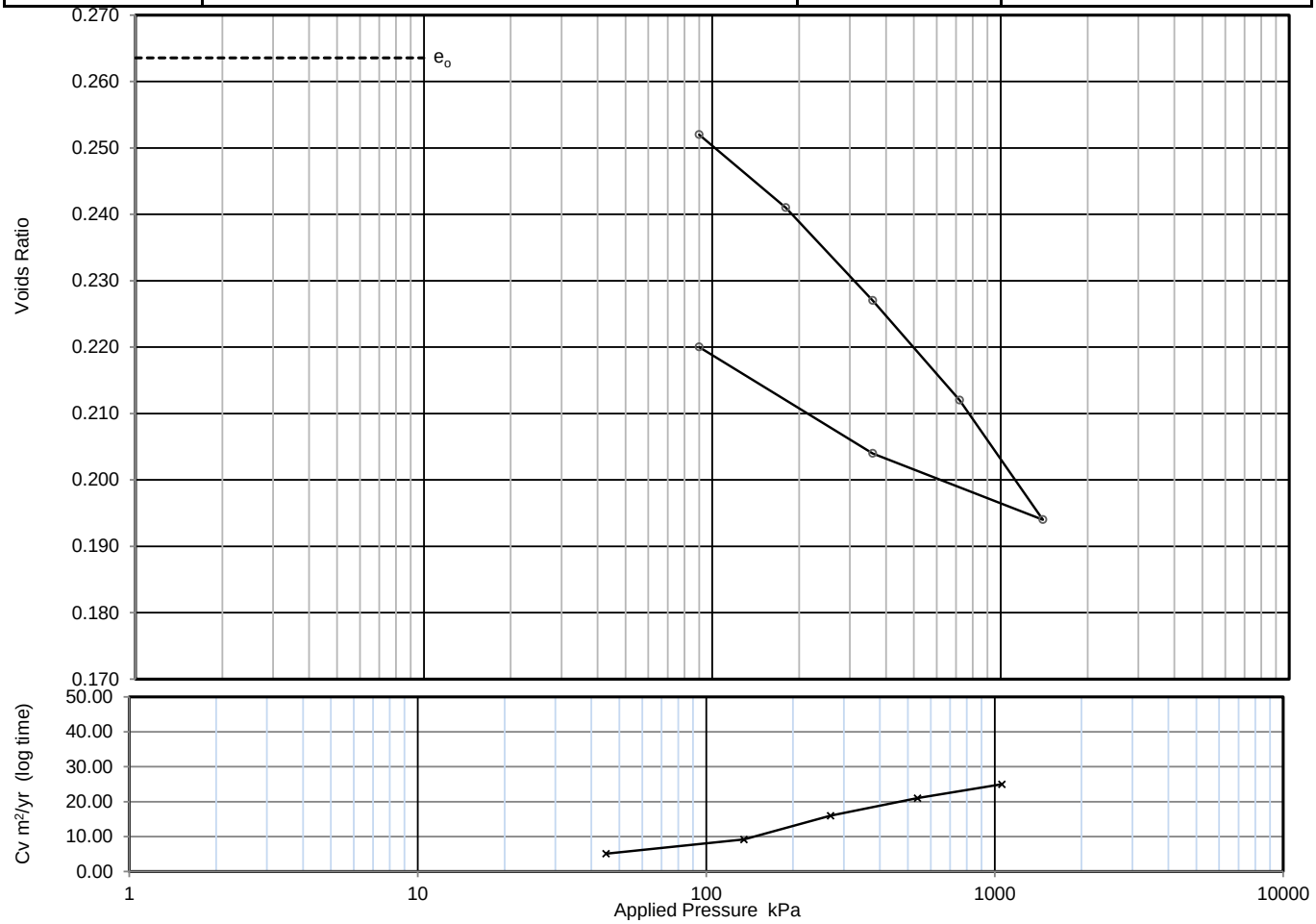
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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	9.20
						Bottom	
Specimen Reference	2	Specimen Depth	9.2	m	Sample Type		C
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus2022082932
Test Method	BS1377:Part 5:1990, clause 3				Date started		08/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.264	-	-	-	-
90	0.252	0.098	5.1	10	0.00024
180	0.241	0.099	9.2	36	0.0003
360	0.227	0.062	16	39	0.00029
720	0.212	0.035	21	45	0.00043
1,400	0.194	0.022	25	47	0.00052
360	0.204	0.0079			
90	0.220	0.049			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	19.90	19.21	mm
Moisture Content	10.9	10.5	%
Bulk density	2.33	2.40	Mg/m3
Dry density	2.10	2.17	Mg/m3
Voids Ratio	0.264	0.220	
Saturation	109	127	%
Average temperature for test	20.0		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

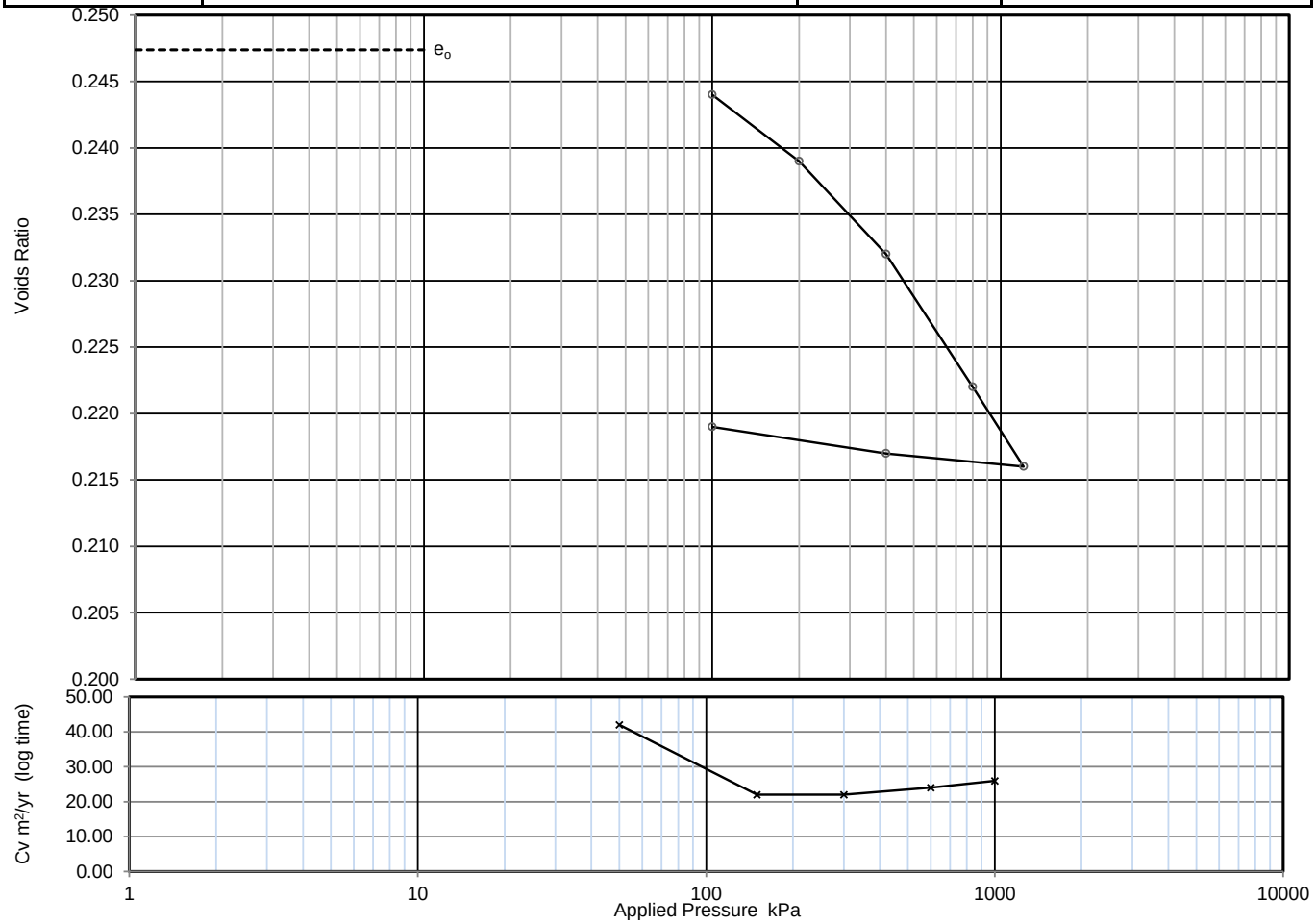
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CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH020
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		2
Soil Description	Brown sandy gravelly silty CLAY.				Sample Depth (m)	Top	11.10
						Bottom	11.45
Specimen Reference	1	Specimen Depth	11.1	m	Sample Type		C
Specimen Description	Brown sandy gravelly silty CLAY.				KeyLAB ID		Caus2022092117
Test Method	BS1377:Part 5:1990, clause 3				Date started		21/09/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.247	-	-	-	-
100	0.244	0.027	42	87	0.00035
200	0.239	0.04	22	53	0.00021
400	0.232	0.028	22	52	0.00025
800	0.222	0.02	24	51	0.00046
1,200	0.216	0.013	26	51	0.00047
400	0.217	0.0009			
100	0.219	0.0064			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	20.00	19.55	mm
Moisture Content	9.5	10.4	%
Bulk density	2.33	2.40	Mg/m3
Dry density	2.12	2.17	Mg/m3
Voids Ratio	0.247	0.219	
Saturation	102	126	%
Average temperature for test	20.0		oC
Swelling Pressure			kPa
Settlement on saturation			%
Remarks			

Final values should be used with caution

Cv plotted at mid point of load increments

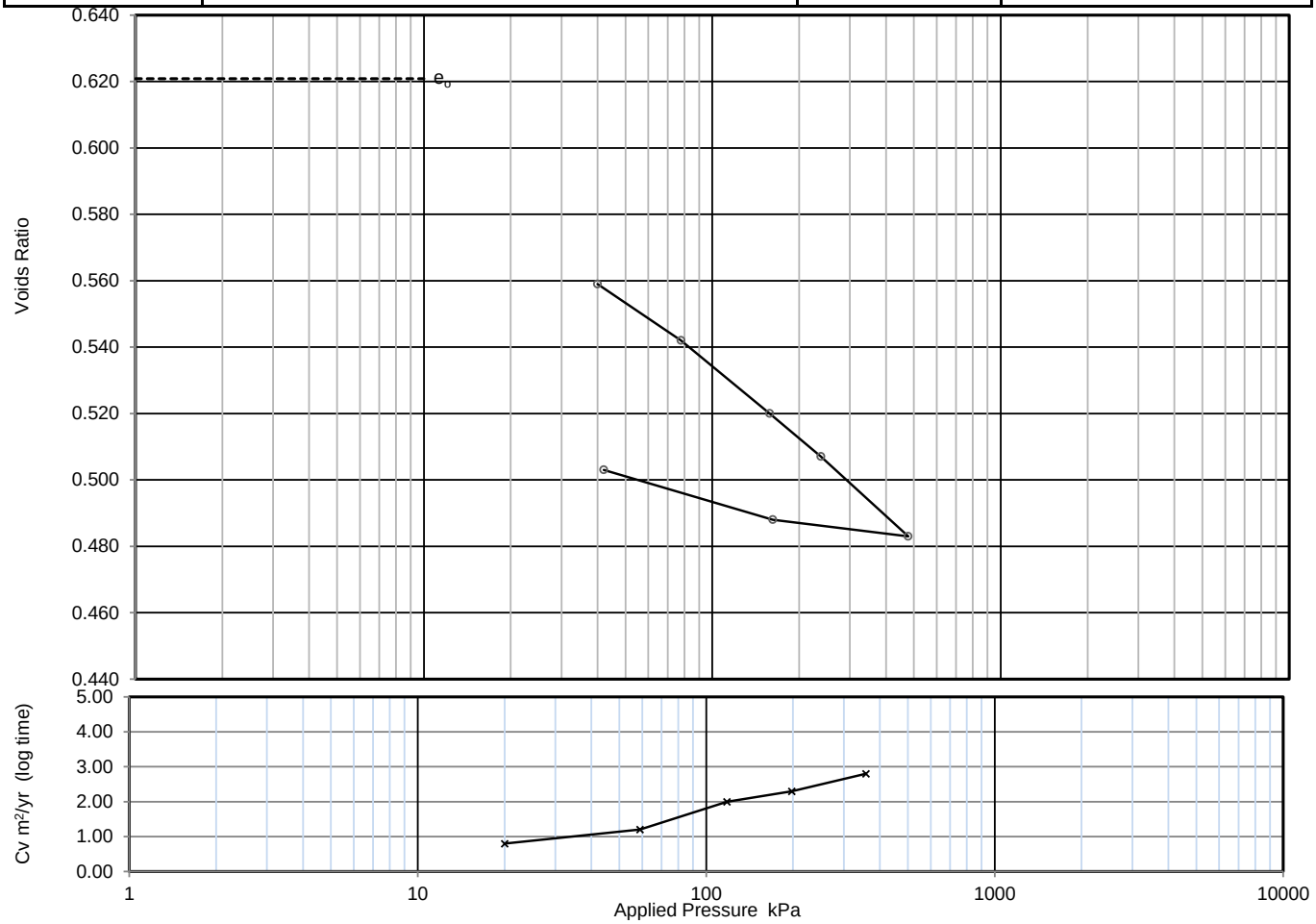
Cv corrected to 20oC

Approved: Stephen.Watson

Printed : 03/10/2022 14:30

UKAS TESTING 10122

CAUSEWAY GEOTECH	ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3				Job Ref		21-1682
					Borehole/Pit No.		RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only				Sample No.		18
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.				Sample Depth (m)	Top	4.00
						Bottom	4.45
Specimen Reference	5	Specimen Depth	4.05	m	Sample Type		U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.				KeyLAB ID		Caus20220621104
Test Method	BS1377:Part 5:1990, clause 3				Date started		29/06/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.621	-	-	-	-
40	0.559	0.95	0.8	0.72	0.0013
78	0.542	0.29	1.2	1.4	0.0013
158	0.520	0.18	2	2.3	0.00096
238	0.507	0.11	2.3	2.2	0.0017
478	0.483	0.067	2.8	2.4	0.0012
162	0.488	0.012			
42	0.503	0.083			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	19.90	18.46	mm
Moisture Content	27.9	22.5	%
Bulk density	2.09	2.16	Mg/m3
Dry density	1.63	1.76	Mg/m3
Voids Ratio	0.621	0.503	
Saturation	119	119	%
Average temperature for test	20.0		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 :

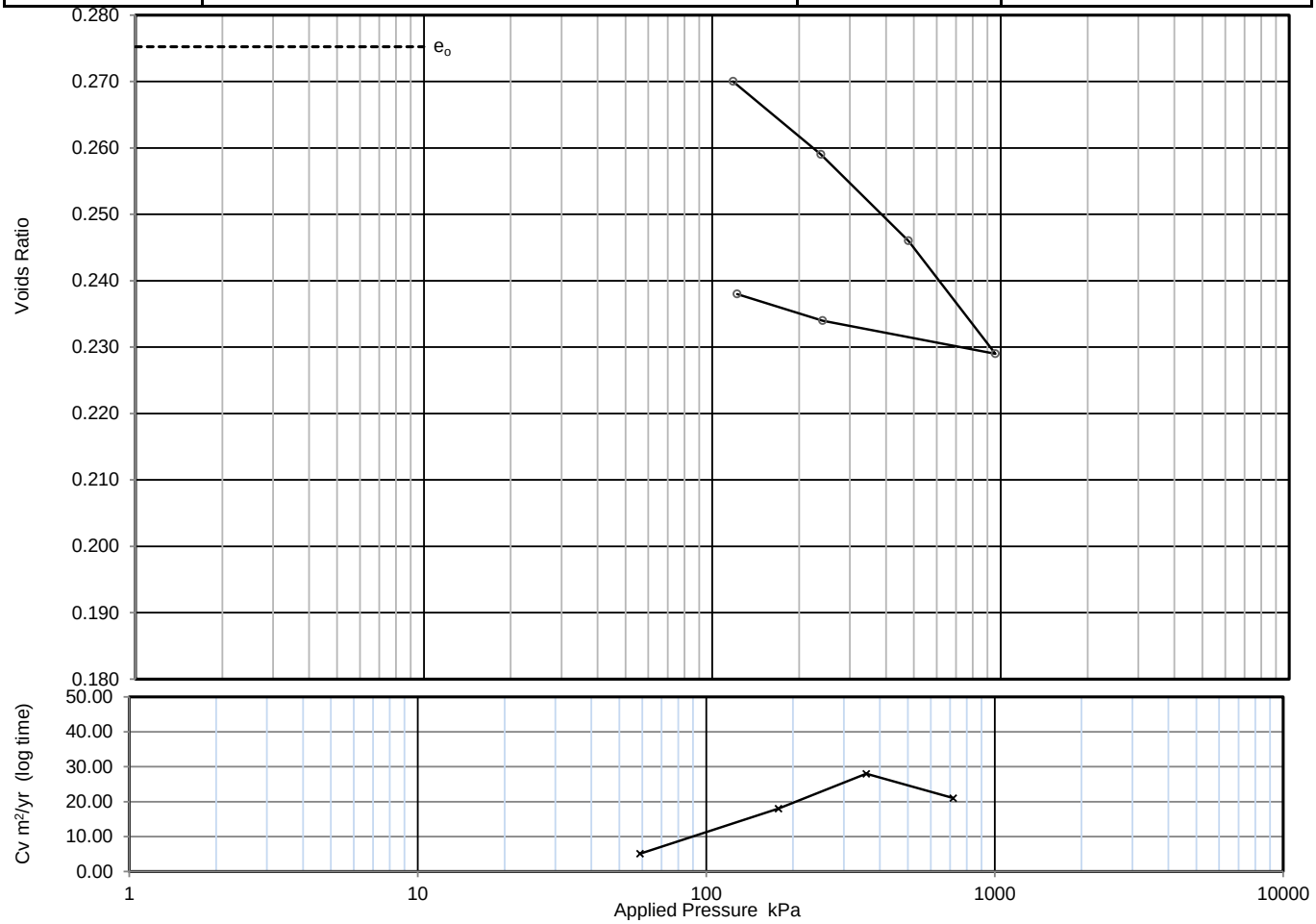
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LAB 13R - Version 6

UKAS TESTING

10122

CAUSEWAY GEOTECH	**ONE DIMENSIONAL CONSOLIDATION TEST BS1377:Part 5:1990, clause 3**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	26
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Bottom	12
Specimen Reference	5	Specimen Depth	12.05 m	Sample Type	U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220621109
Test Method	BS1377:Part 5:1990, clause 3			Date started	29/06/2022



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
0.0	0.275	-	-	-	-
118	0.270	0.036	5.1	5.5	0.00044
238	0.259	0.068	18	180	0.00029
479	0.246	0.044	28	180	0.00025
958	0.229	0.029	21	52	0.00036
241	0.234	0.0063			
122	0.238	0.026			

Preparation

Particle density assumed 2.65 Mg/m3

Specimen details	Initial	Final	
Diameter	75.10	-	mm
Height	20.00	19.42	mm
Moisture Content	10.3	10.6	%
Bulk density	2.29	2.37	Mg/m3
Dry density	2.08	2.14	Mg/m3
Voids Ratio	0.275	0.238	
Saturation	99	118	%
Average temperature for test	20.0		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 :

03/10/2022 14:30

LAB 13R - Version 6

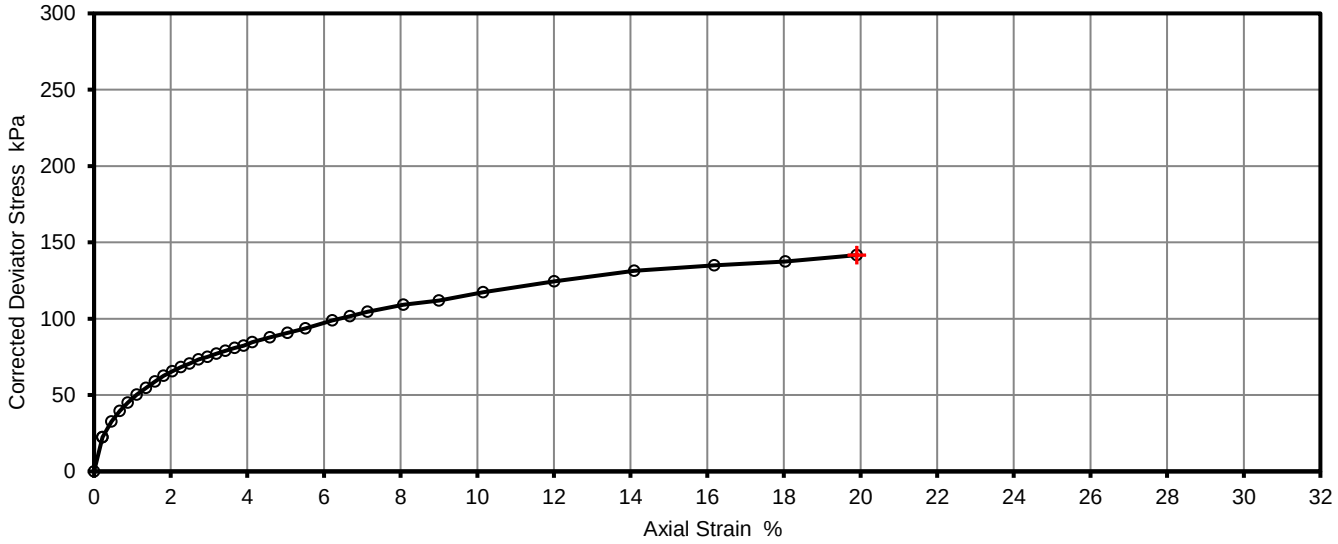
UKAS TESTING

10122

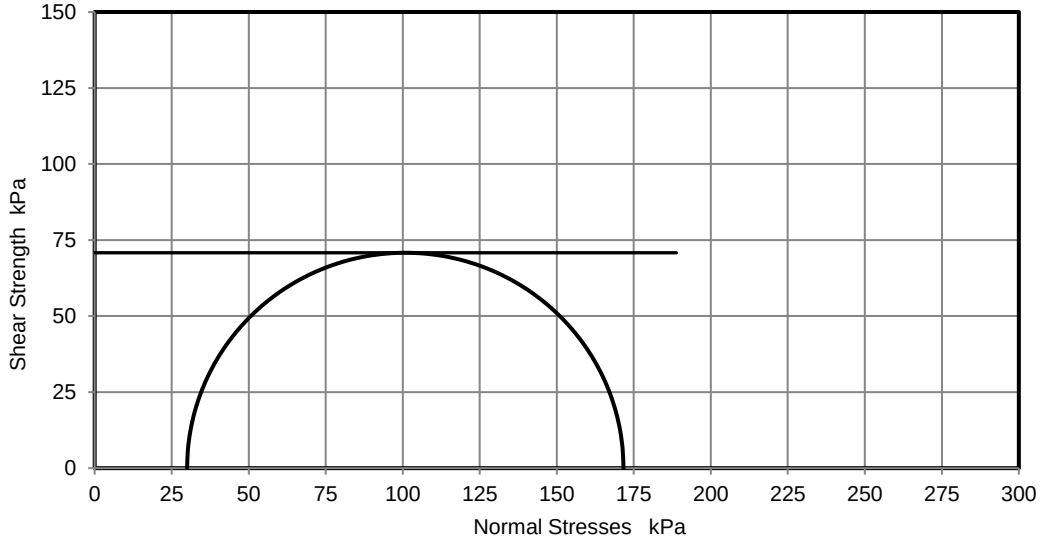
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	17
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.20
				Base	1.65
Specimen Reference	3	Specimen Depth	1.25 m	Sample Type	U
Specimen Description	Firm greyish brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022062151
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	01/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.6	mm
Bulk Density		2.09	Mg/m3
Moisture Content		13	%
Dry Density		1.85	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		30	kPa
At failure	Axial Strain	19.9	%
	Deviator Stress, (σ1 - σ3)f	142	kPa
	Undrained Shear Strength, cu	71	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

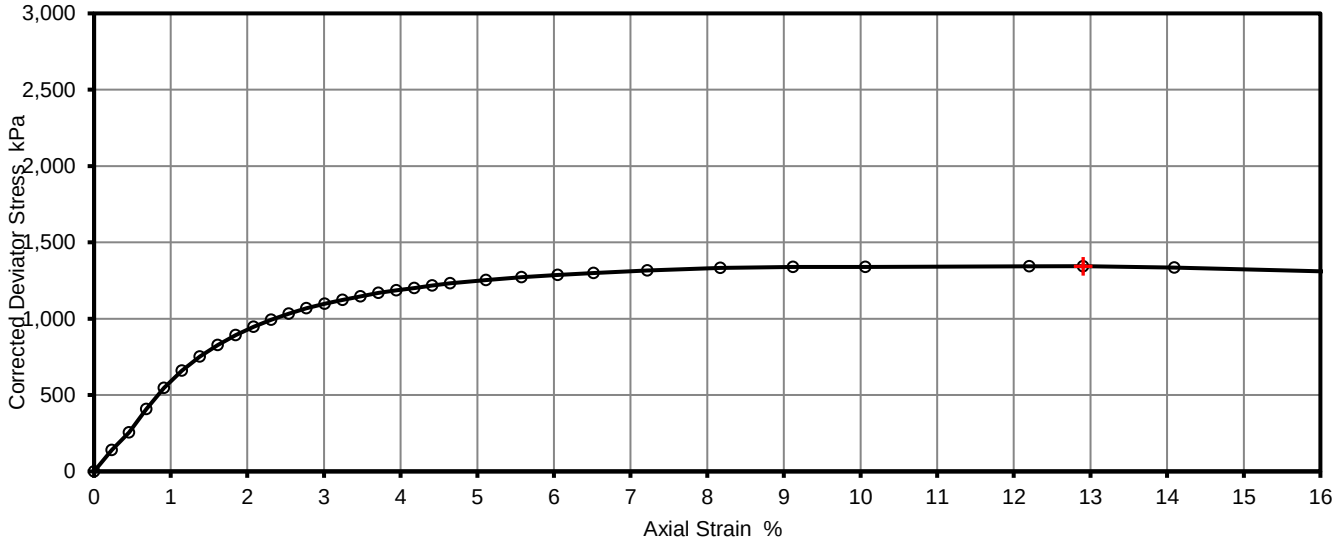
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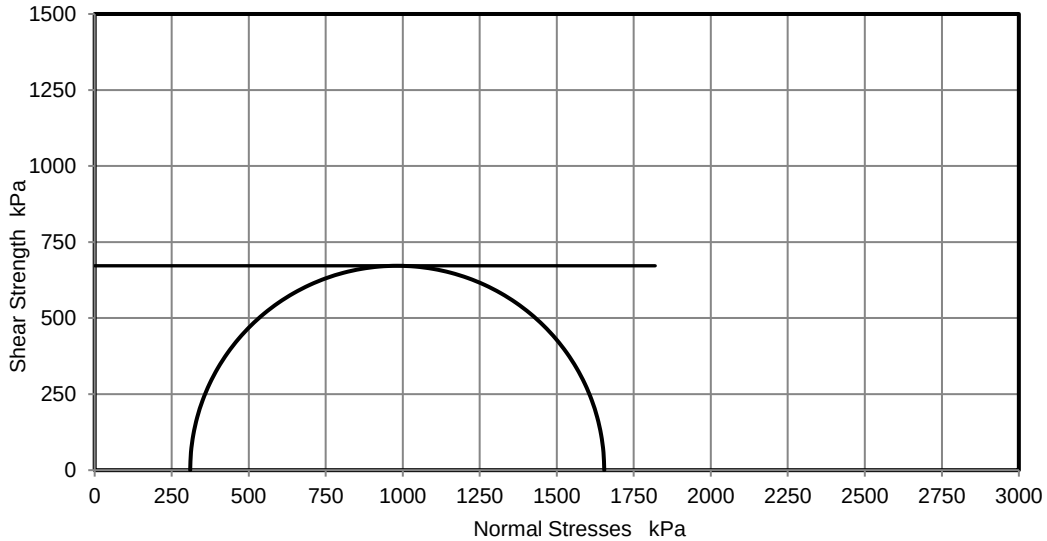
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	7
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.30
				Base	15.50
Specimen Reference	2	Specimen Depth	15.30 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082569
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	13/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.0	mm
Bulk Density		2.21	Mg/m3
Moisture Content		13	%
Dry Density		1.95	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		310	kPa
At failure	Axial Strain	12.9	%
	Deviator Stress, (σ1 - σ3)f	1344	kPa
	Undrained Shear Strength, cu	672	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

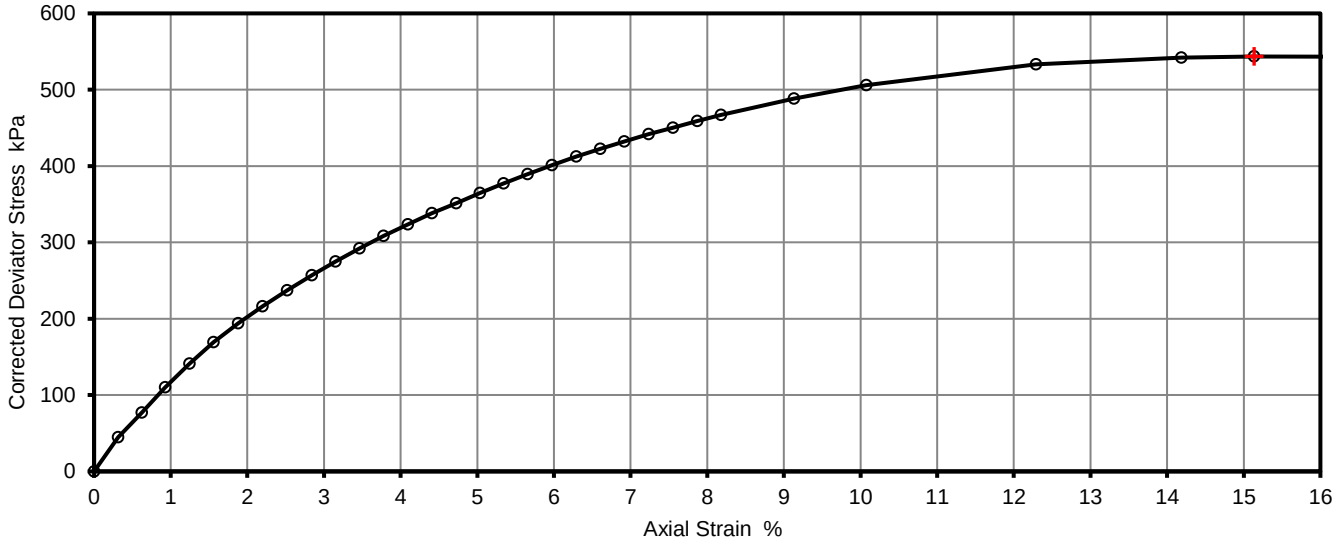
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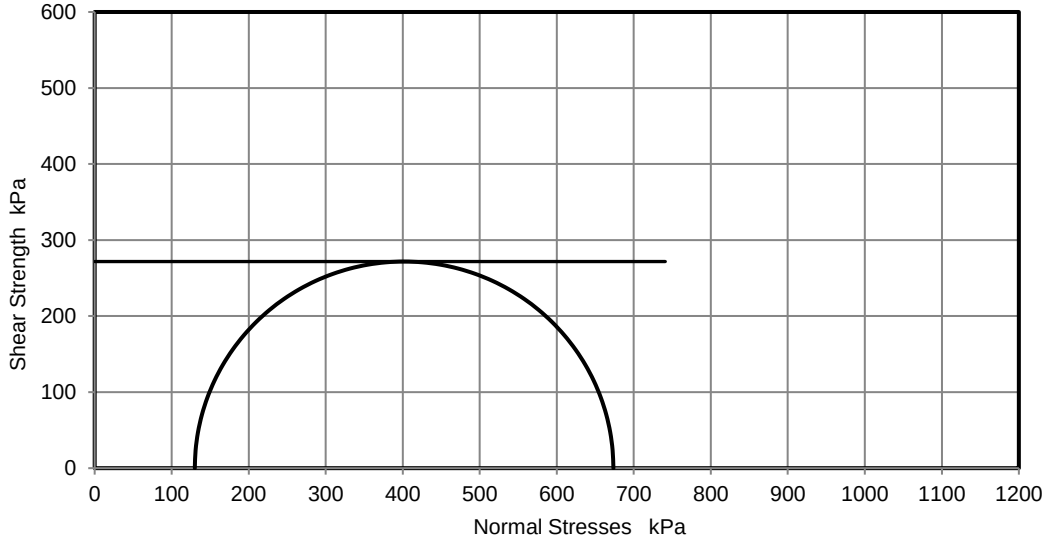
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH008
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	17
Soil Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	6.50
				Base	6.95
Specimen Reference	3	Specimen Depth	6.55 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy gravelly silty CLAY.			KeyLAB ID	Caus2022070536
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	18/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.4	mm
Bulk Density		2.32	Mg/m3
Moisture Content		10	%
Dry Density		2.10	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		130	kPa
At failure	Axial Strain	15.1	%
	Deviator Stress, (σ1 - σ3)f	544	kPa
	Undrained Shear Strength, cu	272	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

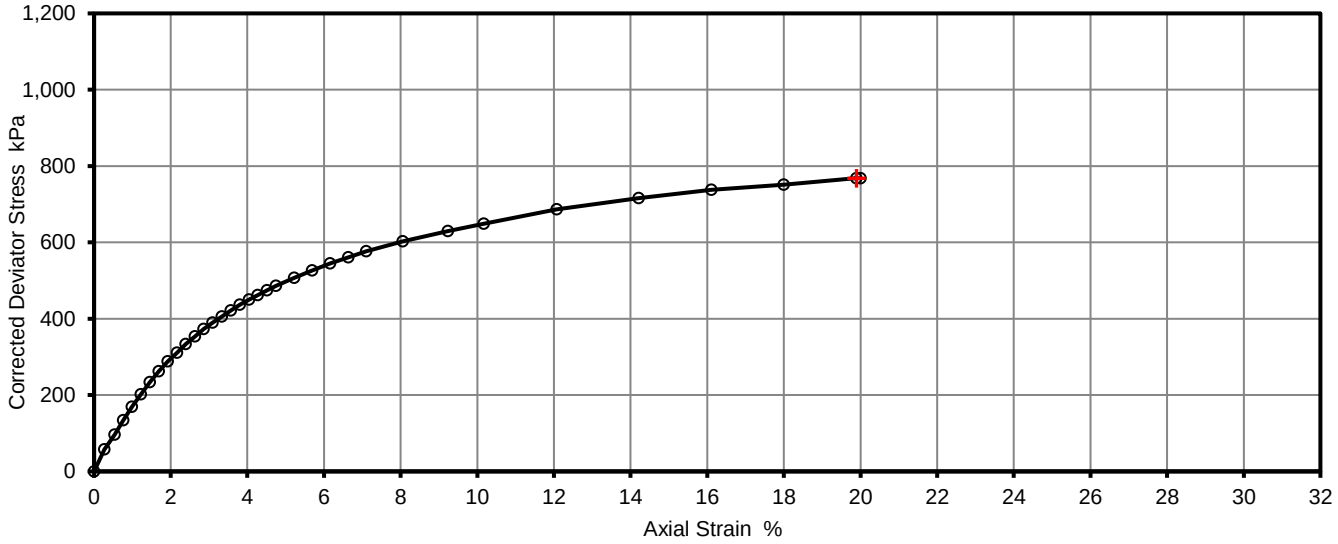
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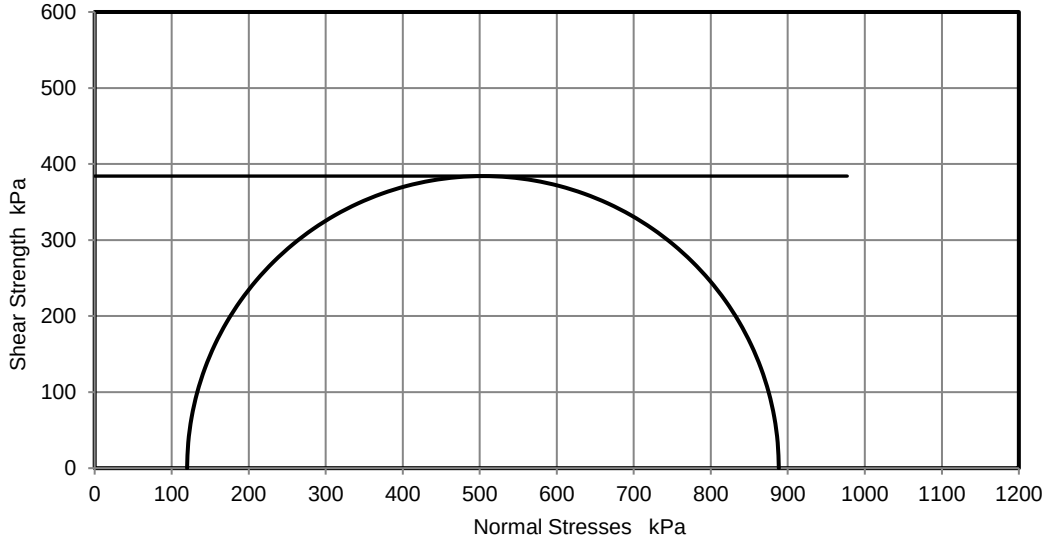
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	7
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	5.70
				Base	6.00
Specimen Reference	2	Specimen Depth	5.70 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082920
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.4	mm
Bulk Density		2.33	Mg/m3
Moisture Content		13	%
Dry Density		2.06	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		120	kPa
At failure	Axial Strain	19.9	%
	Deviator Stress, (σ1 - σ3)f	768	kPa
	Undrained Shear Strength, cu	384	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

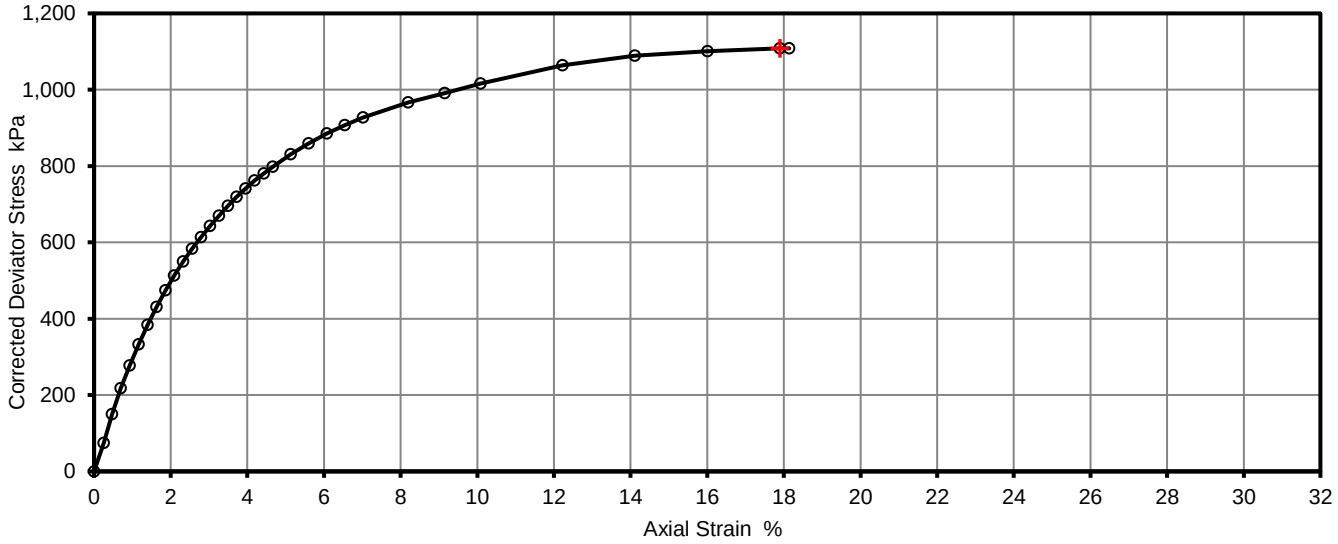
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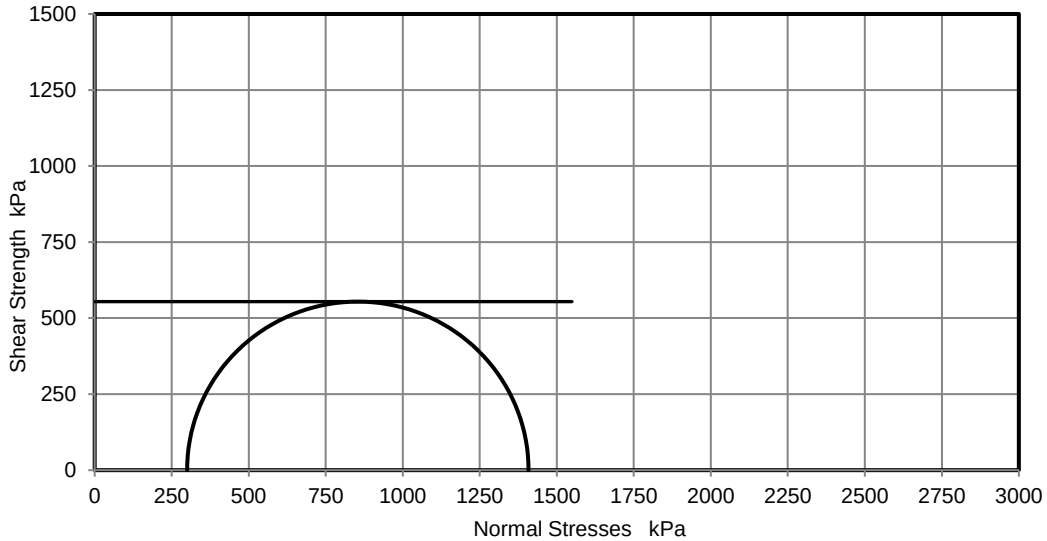
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	14.60
				Sample Depth (m) Base	14.90
Specimen Reference	2	Specimen Depth	14.60 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082922
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.4	mm
Bulk Density		2.21	Mg/m3
Moisture Content		9	%
Dry Density		2.02	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	17.9	%
	Deviator Stress, (σ1 - σ3)f	1108	kPa
	Undrained Shear Strength, cu	554	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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

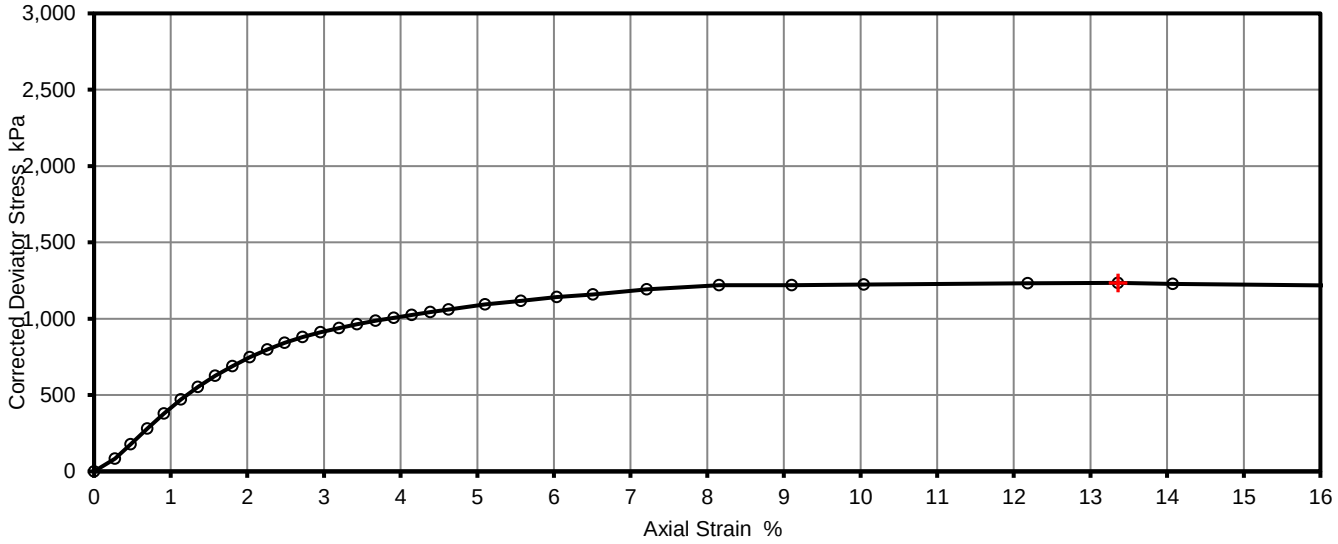
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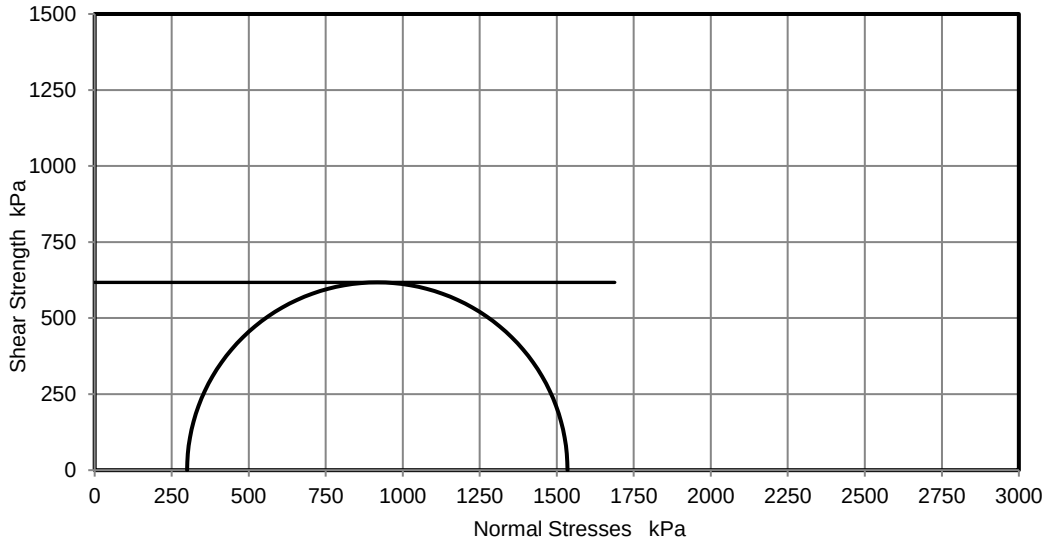
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.40
				Base	15.70
Specimen Reference	2	Specimen Depth	15.40 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082923
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		104.7	mm
Bulk Density		2.25	Mg/m3
Moisture Content		10	%
Dry Density		2.05	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	13.4	%
	Deviator Stress, (σ1 - σ3)f	1235	kPa
	Undrained Shear Strength, cu	617	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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

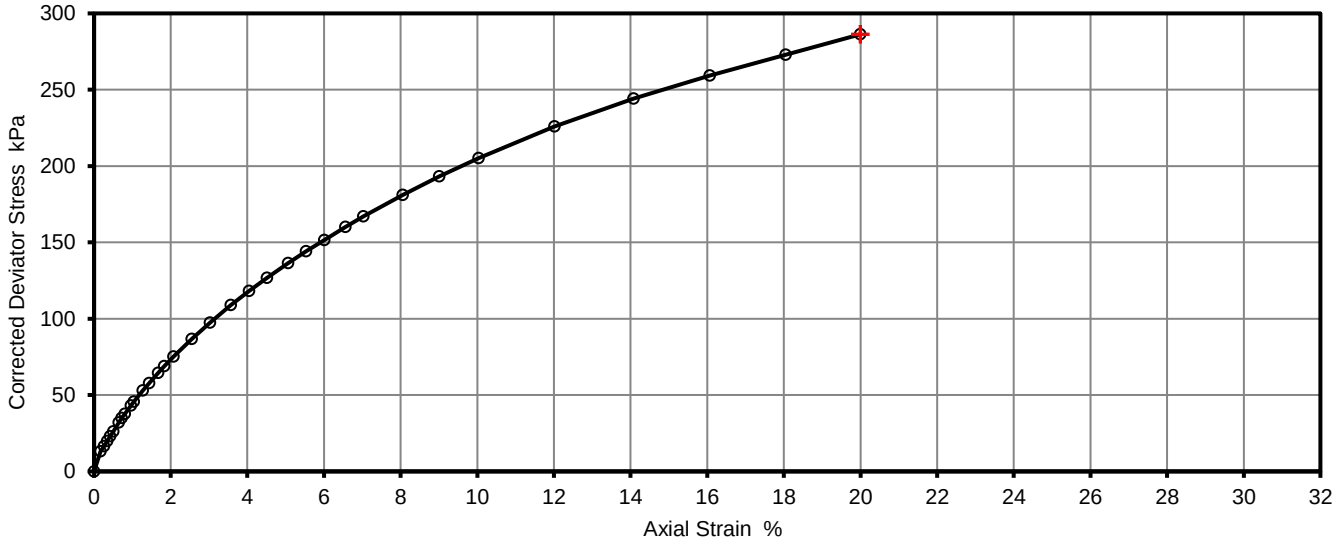
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10122

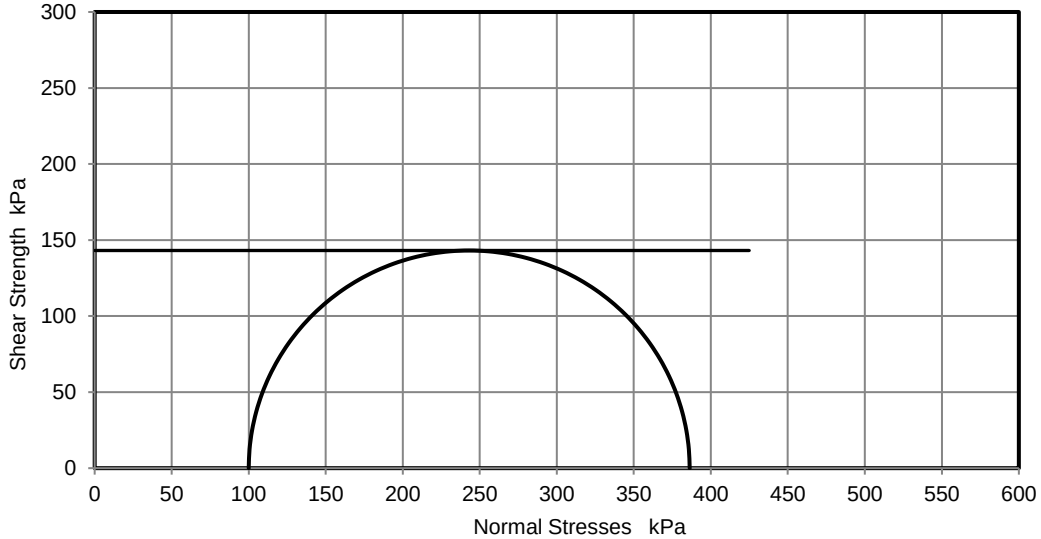
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	10
Soil Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	5.00
				Sample Depth (m) Base	5.40
Specimen Reference	5	Specimen Depth	5.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy gravelly silty CLAY.			KeyLAB ID	Caus2022070543
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	18/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.2	mm
Bulk Density		2.29	Mg/m3
Moisture Content		13	%
Dry Density		2.04	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		100	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	286	kPa
	Undrained Shear Strength, cu	143	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

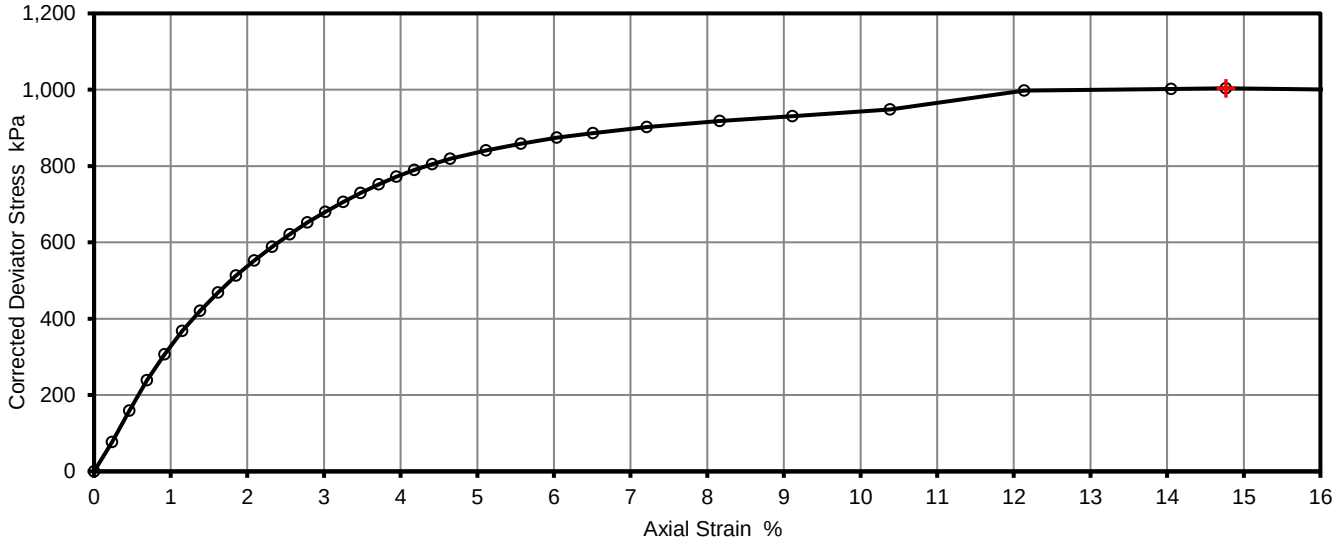
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UKAS TESTING
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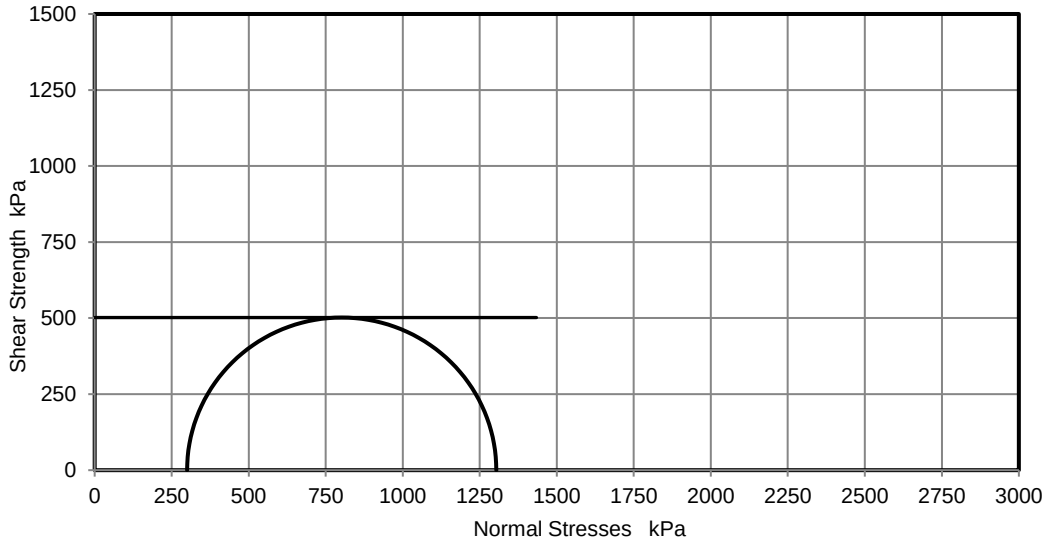
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	15.50
				Sample Depth (m) Base	15.80
Specimen Reference	2	Specimen Depth	15.50 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082576
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	13/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		104.9	mm
Bulk Density		2.26	Mg/m3
Moisture Content		9	%
Dry Density		2.08	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	14.8	%
	Deviator Stress, (σ1 - σ3)f	1004	kPa
	Undrained Shear Strength, cu	502	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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

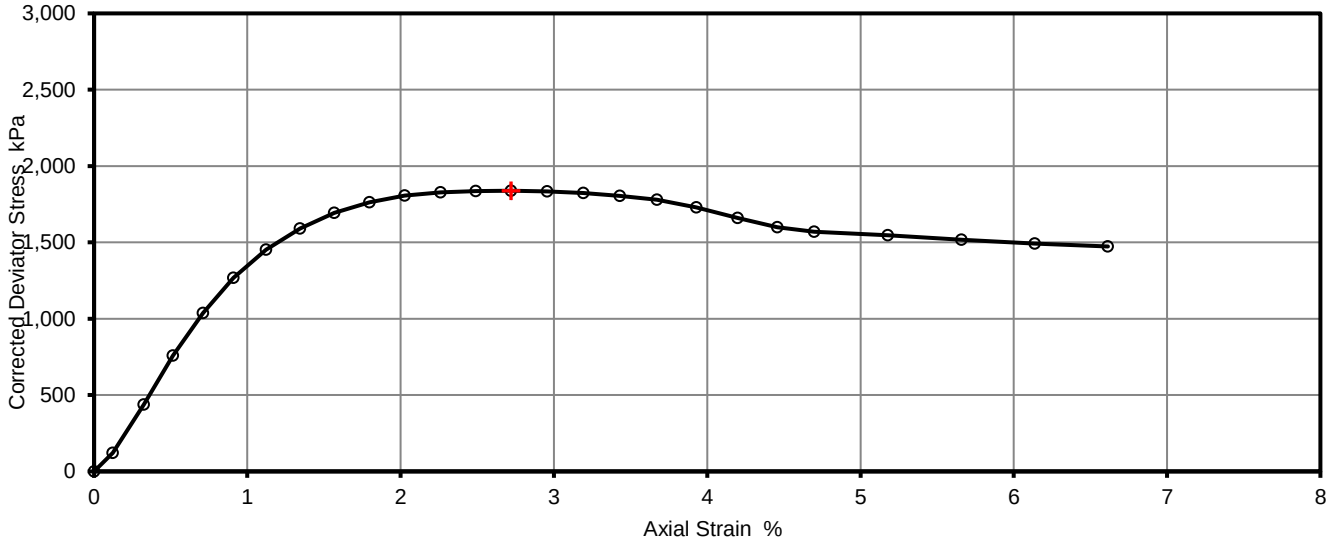
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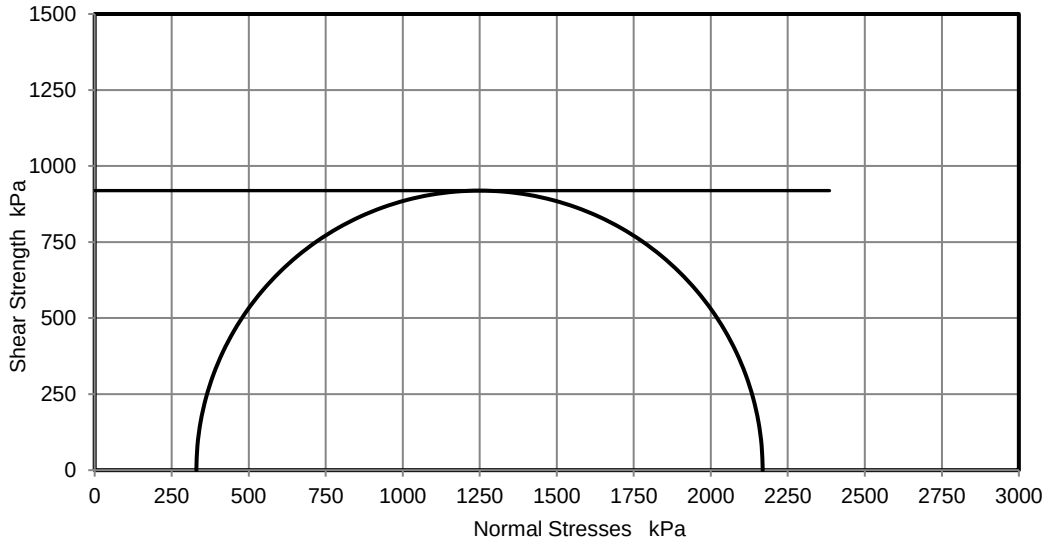
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	8
Soil Description	Brownish grey sandy gravelly silty CLAY.			Sample Depth (m) Top	16.80
				Base	17.10
Specimen Reference	2	Specimen Depth	16.80 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy gravelly silty CLAY.			KeyLAB ID	Caus2022082578
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	13/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		104.1	mm
Bulk Density		2.25	Mg/m3
Moisture Content		6	%
Dry Density		2.12	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		330	kPa
At failure	Axial Strain	2.7	%
	Deviator Stress, (σ1 - σ3)f	1839	kPa
	Undrained Shear Strength, cu	919	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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

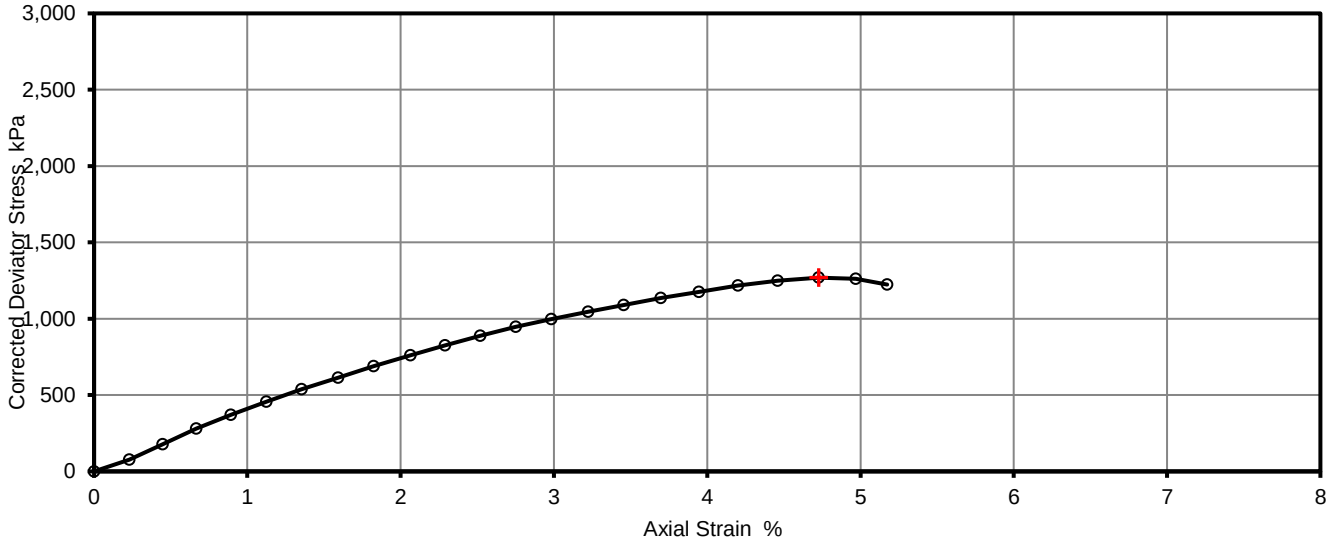
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Stephen.Watson	03/10/2022 14:34

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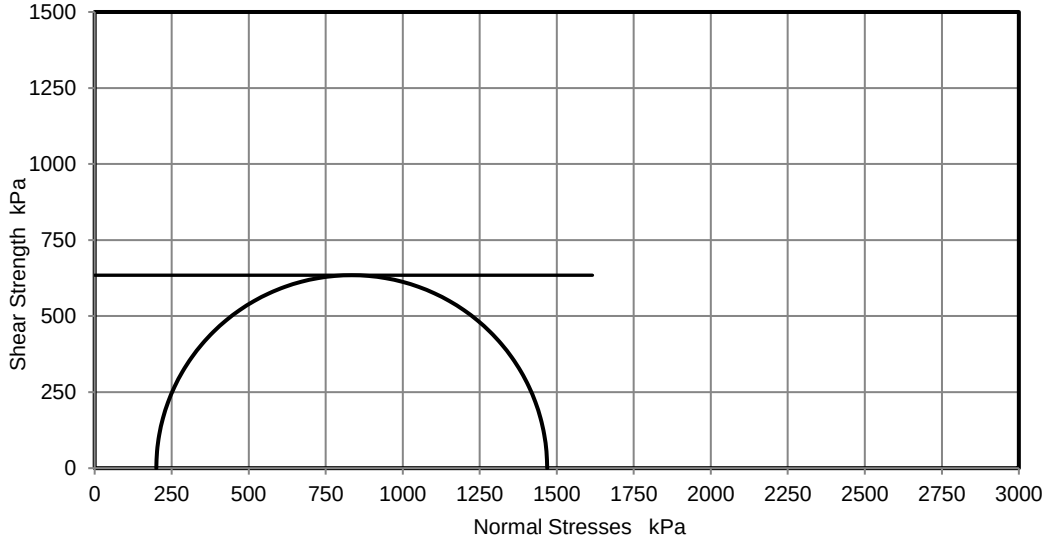
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	6
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.60
				Base	10.90
Specimen Reference	3	Specimen Depth	10.60 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082589
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	14/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		104.6	mm
Bulk Density		2.27	Mg/m3
Moisture Content		8	%
Dry Density		2.10	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		200	kPa
At failure	Axial Strain	4.7	%
	Deviator Stress, (σ1 - σ3)f	1269	kPa
	Undrained Shear Strength, cu	634	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

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Stephen.Watson	03/10/2022 14:34

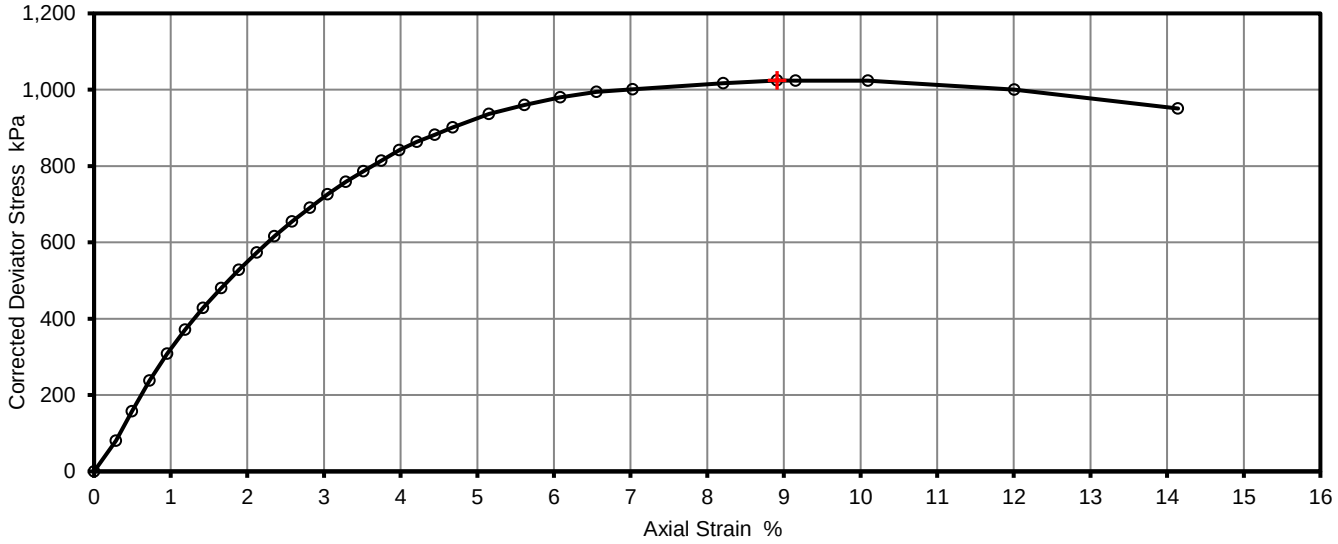
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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

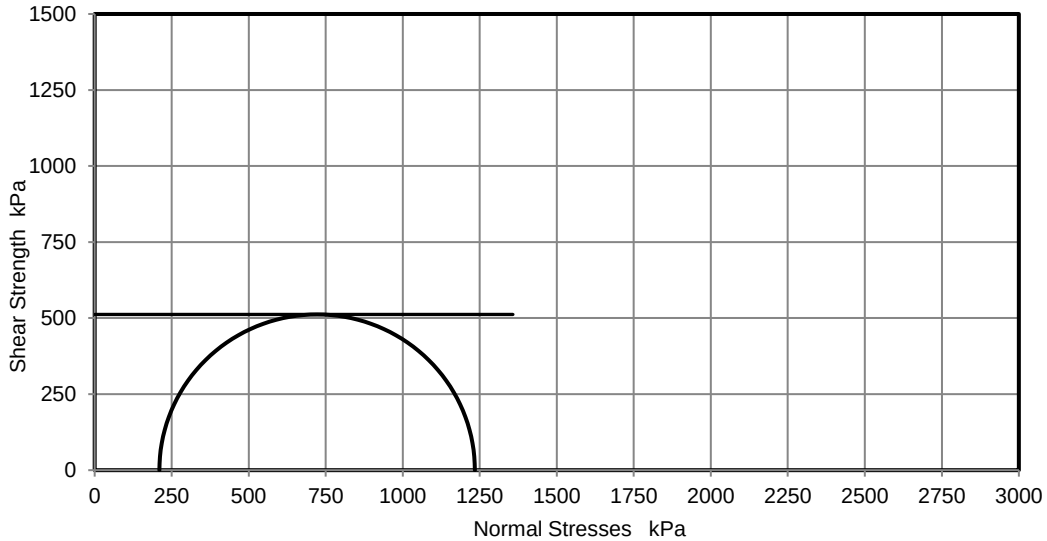
				Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.15
				Sample Depth (m) Base	11.45
Specimen Reference	2	Specimen Depth	11.15 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082928
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	20/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		104.3	mm
Bulk Density		2.29	Mg/m3
Moisture Content		8	%
Dry Density		2.12	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		210	kPa
At failure	Axial Strain	8.9	%
	Deviator Stress, (σ1 - σ3)f	1024	kPa
	Undrained Shear Strength, cu	512	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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.

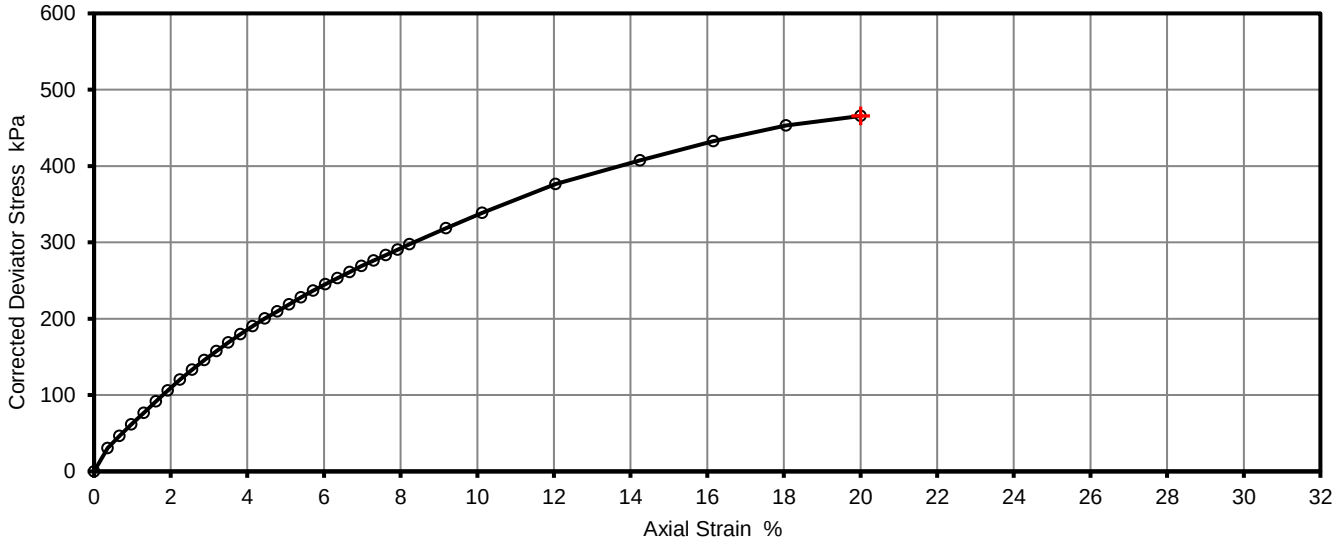
Remarks

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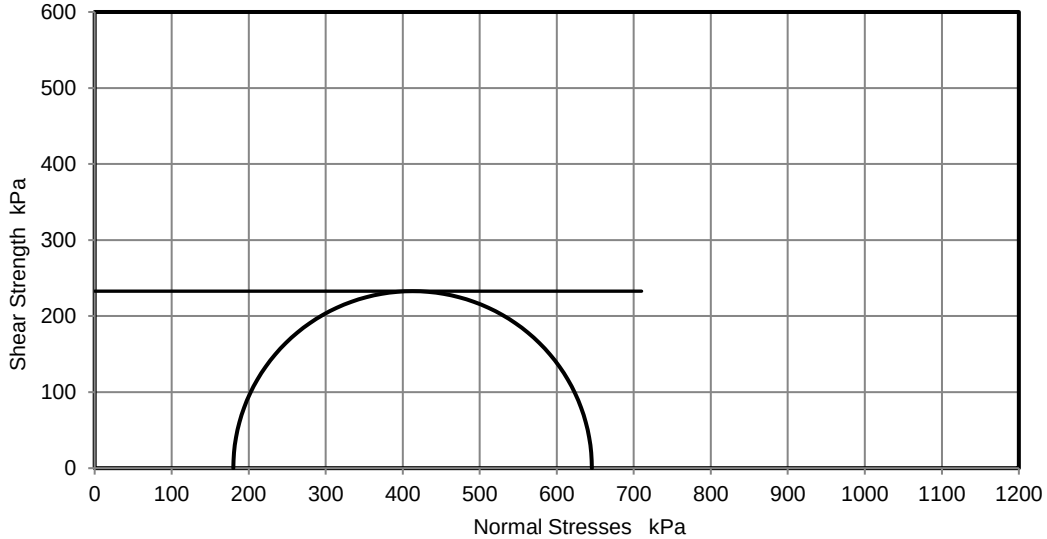
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	19
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.00
				Base	9.45
Specimen Reference	2	Specimen Depth	9.05 m	Sample Type	U
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022071468
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.3	mm
Bulk Density		2.32	Mg/m3
Moisture Content		10	%
Dry Density		2.10	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		180	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	466	kPa
	Undrained Shear Strength, cu	233	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

No failure defined. Testing terminated at 20% axial strain.

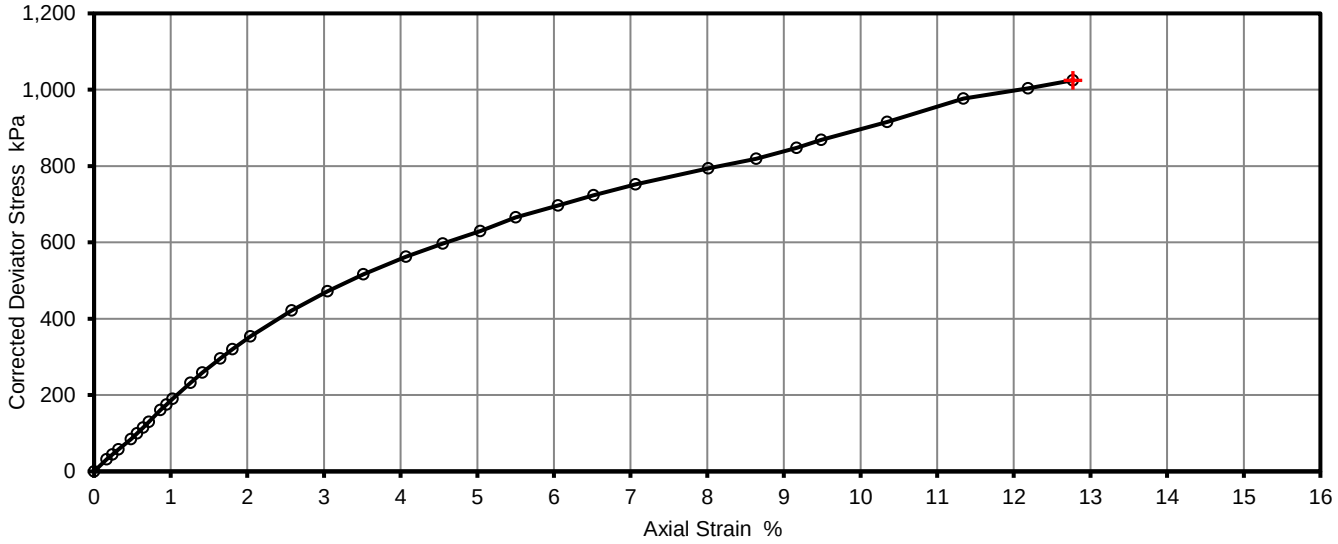
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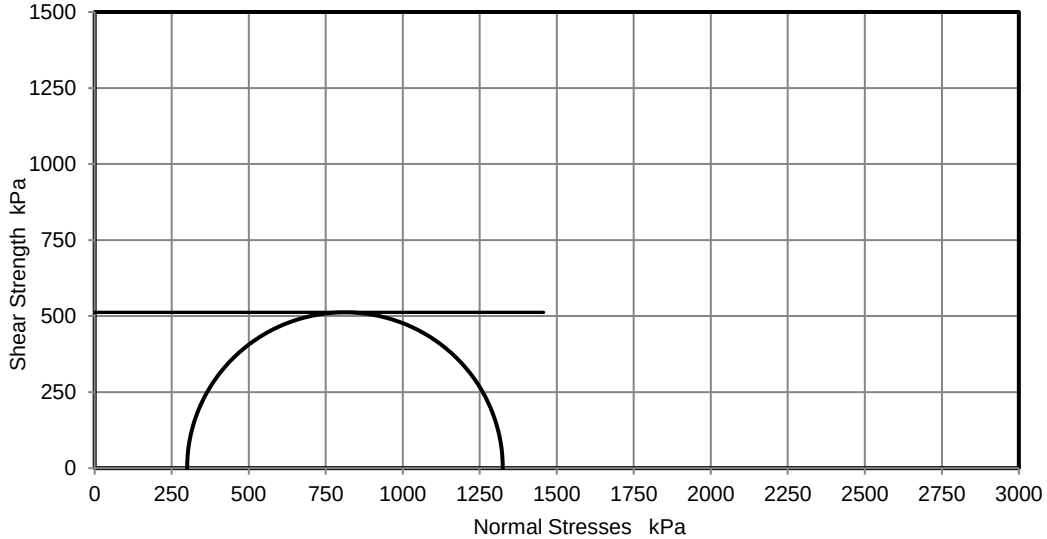
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				Borehole/Pit No.	RWRM-BH012
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	14.60
				Base	14.90
Specimen Reference	3	Specimen Depth	14.60 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082592
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	14/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.1	mm
Bulk Density		2.33	Mg/m3
Moisture Content		7	%
Dry Density		2.17	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	12.8	%
	Deviator Stress, (σ1 - σ3)f	1025	kPa
	Undrained Shear Strength, cu	512	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

Multistage test not suitable. Max capacity of load ring met.

Approved: Stephen.Watson

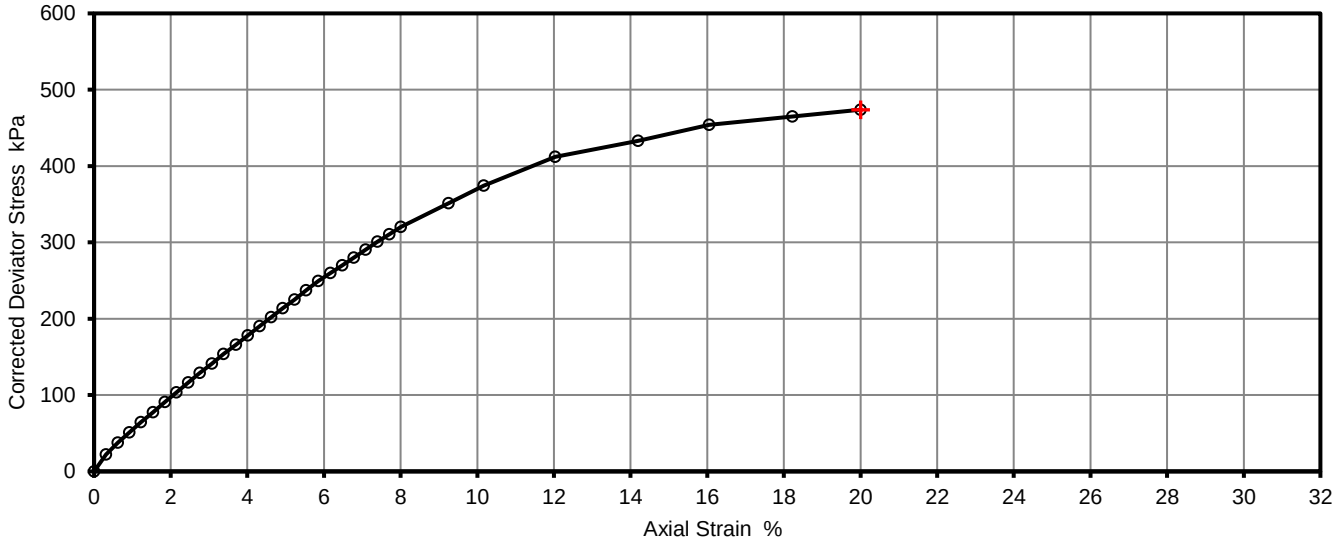
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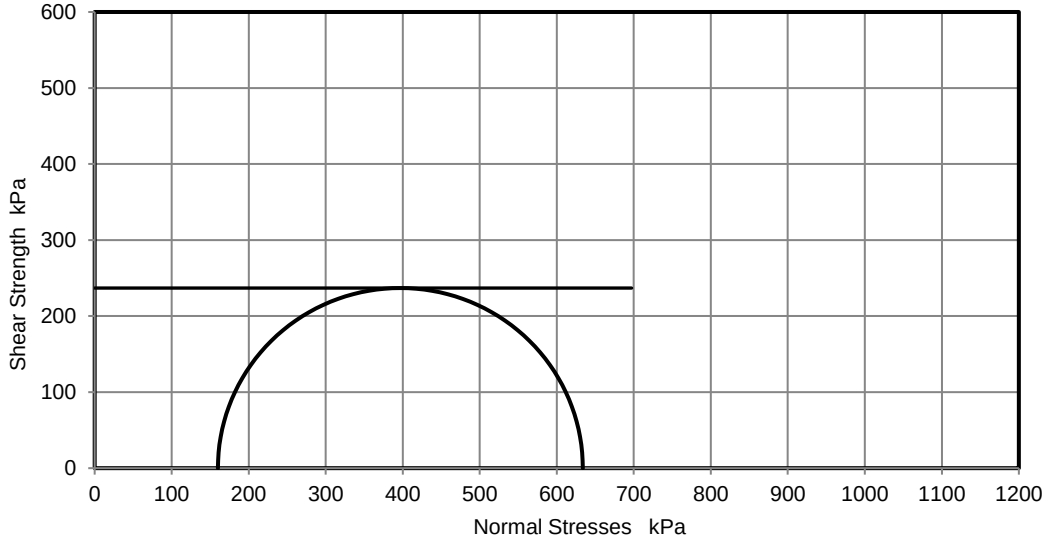
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.00
				Base	8.45
Specimen Reference	3	Specimen Depth	8.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022062187
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	08/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.3	mm
Bulk Density		2.30	Mg/m3
Moisture Content		10	%
Dry Density		2.10	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		160	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	474	kPa
	Undrained Shear Strength, cu	237	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

No failure defined. Testing terminated at 20% axial strain.

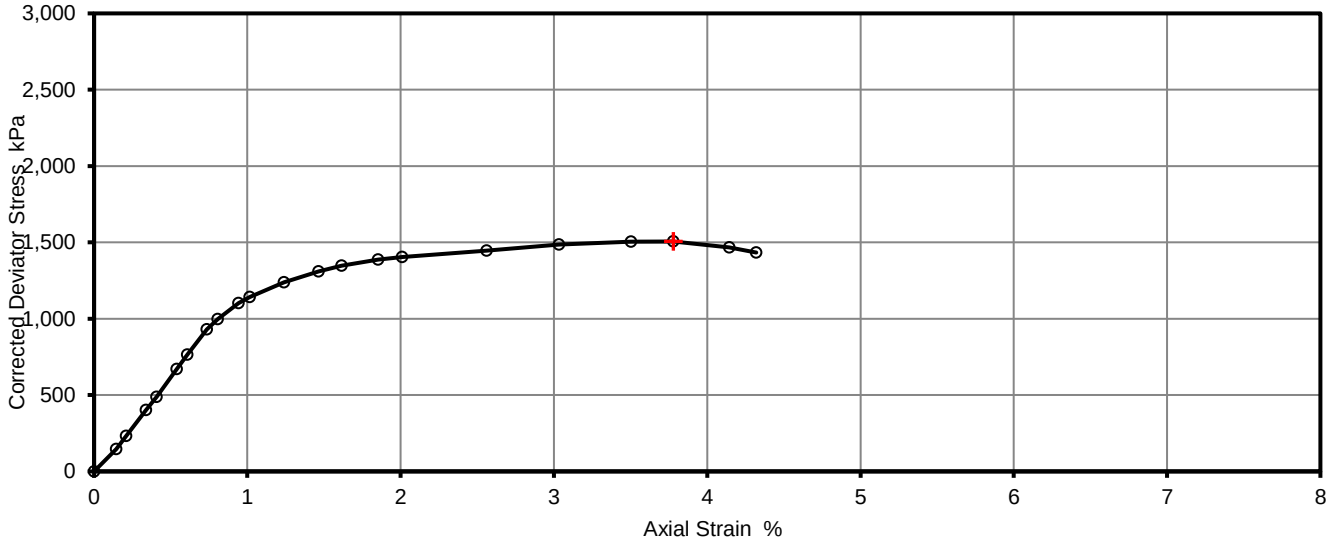
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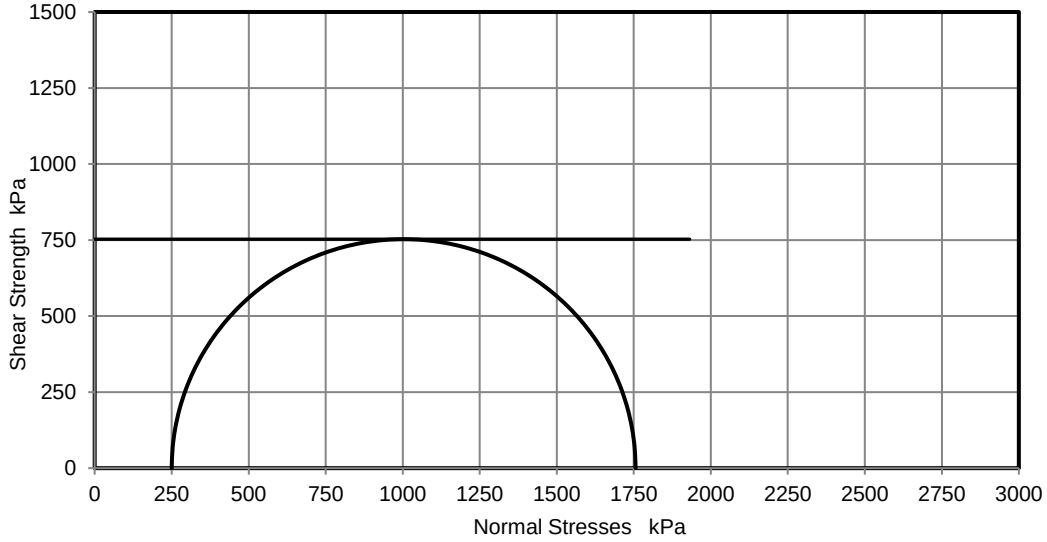
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH013
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	13.50
				Base	13.80
Specimen Reference	3	Specimen Depth	13.50 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082596
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	15/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.6	mm
Bulk Density		2.22	Mg/m3
Moisture Content		7	%
Dry Density		2.07	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		250	kPa
At failure	Axial Strain	3.8	%
	Deviator Stress, (σ1 - σ3)f	1506	kPa
	Undrained Shear Strength, cu	753	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

Multistage testing not suitable. Sample failed when attempting to boost to stage 2.

Approved: Stephen.Watson

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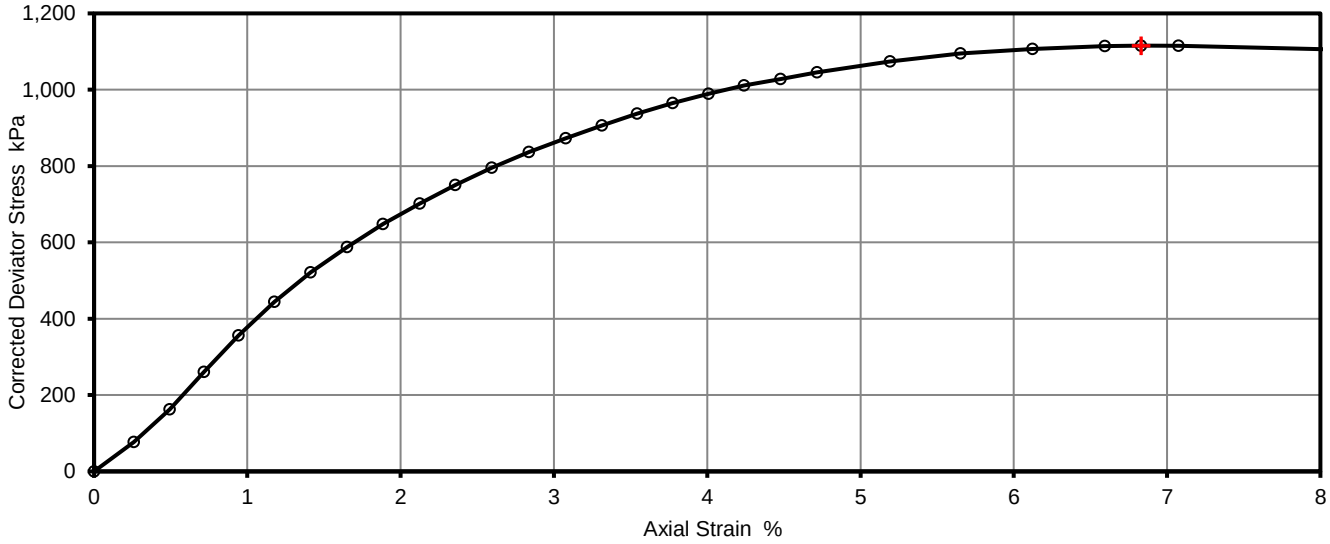
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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

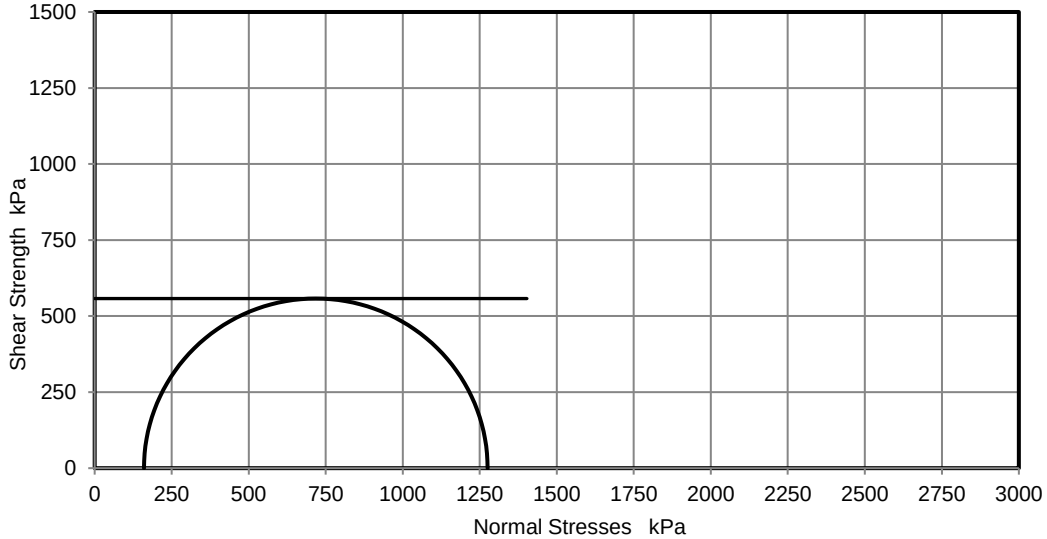
Job Ref					21-1682
Borehole/Pit No.					RWRM-BH014
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.70
				Base	9.00
Specimen Reference	3	Specimen Depth	8.70 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220825100
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	14/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.1	mm
Bulk Density		2.27	Mg/m3
Moisture Content		8	%
Dry Density		2.10	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		160	kPa
At failure	Axial Strain	6.8	%
	Deviator Stress, (σ1 - σ3)f	1116	kPa
	Undrained Shear Strength, cu	558	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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

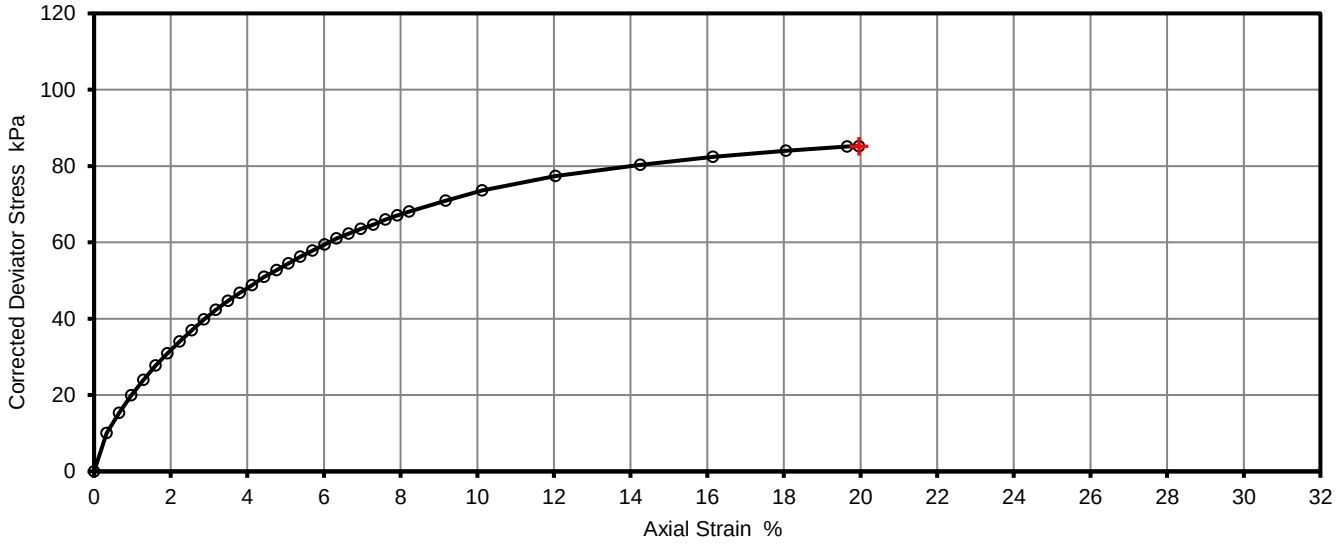
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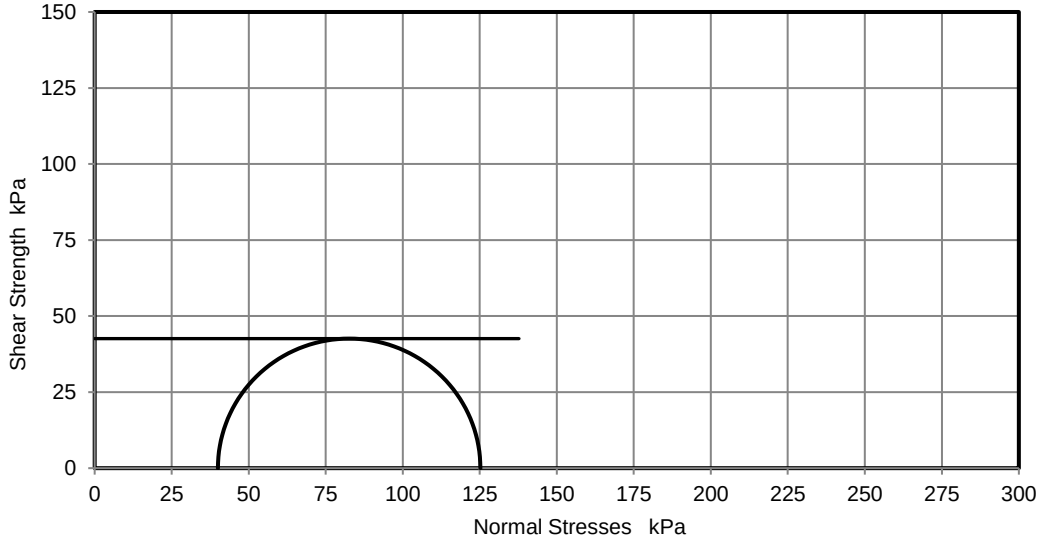
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	17
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.00
				Base	2.65
Specimen Reference	2	Specimen Depth	2.05 m	Sample Type	U
Specimen Description	Firm brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022071472
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.6	mm
Bulk Density		2.25	Mg/m3
Moisture Content		15	%
Dry Density		1.96	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		40	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	85	kPa
	Undrained Shear Strength, cu	43	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

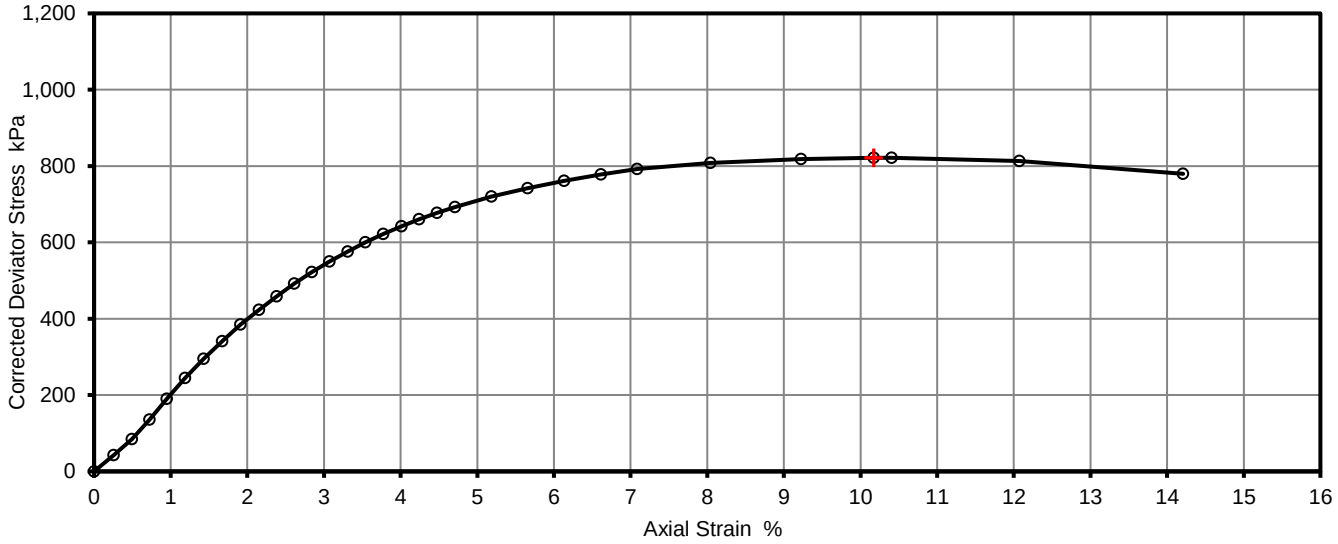
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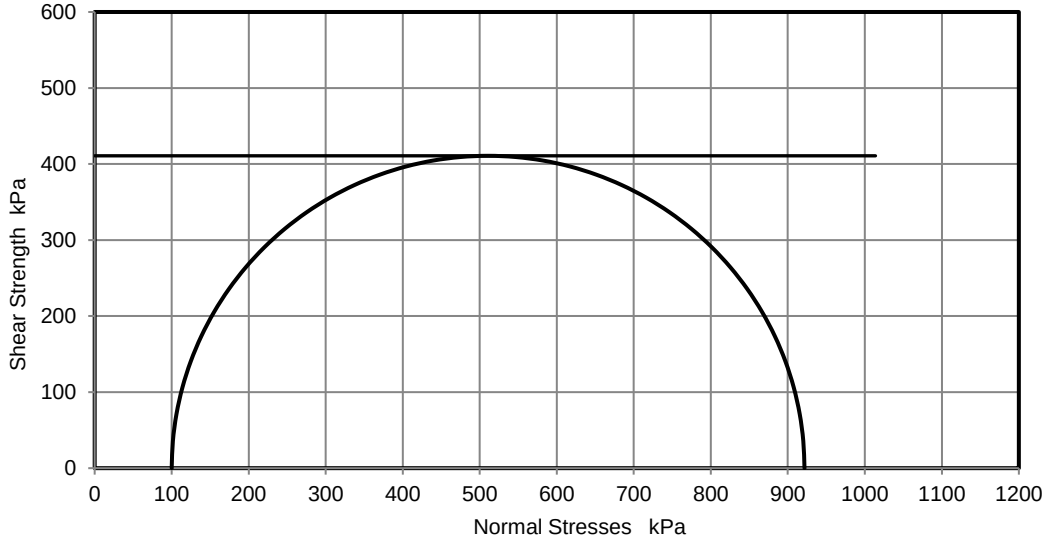
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH015
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.35
				Base	11.65
Specimen Reference	3	Specimen Depth	11.35 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220825104
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	16/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		104.8	mm
Bulk Density		2.28	Mg/m3
Moisture Content		10	%
Dry Density		2.07	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		100	kPa
At failure	Axial Strain	10.2	%
	Deviator Stress, (σ1 - σ3)f	822	kPa
	Undrained Shear Strength, cu	411	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

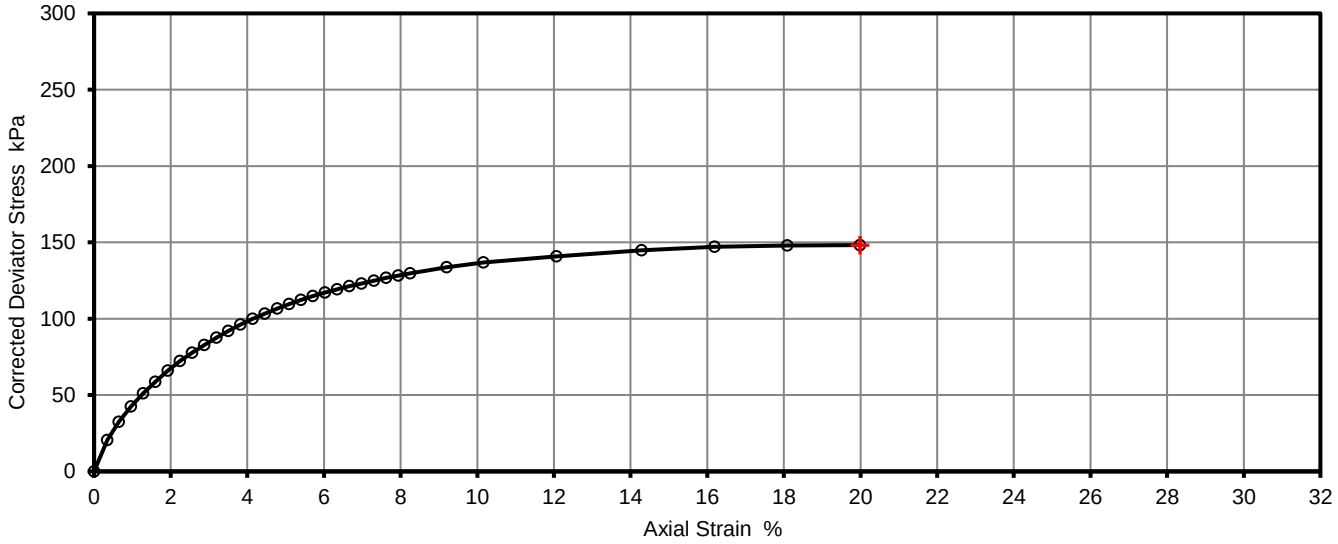
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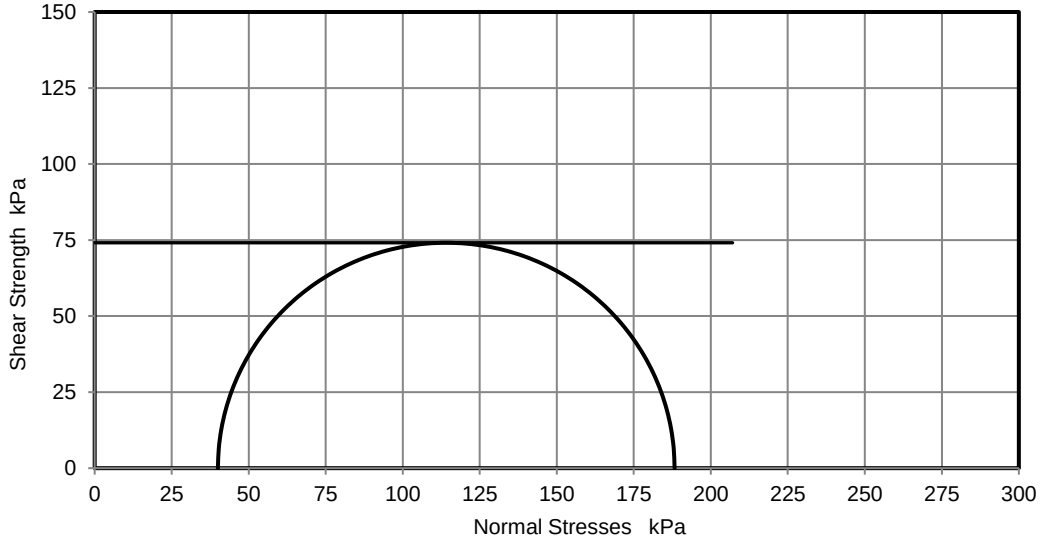
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	15
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.20
				Base	1.65
Specimen Reference	3	Specimen Depth	1.25 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070547
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	18/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.5	mm
Bulk Density		2.23	Mg/m3
Moisture Content		14	%
Dry Density		1.96	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		40	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	148	kPa
	Undrained Shear Strength, cu	74	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

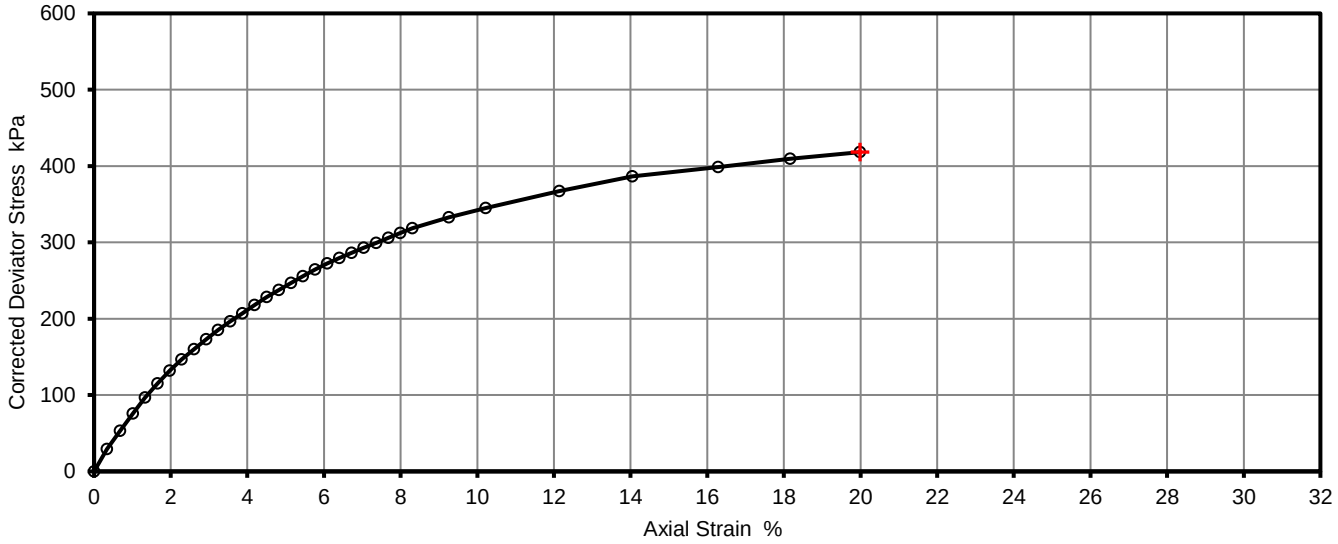
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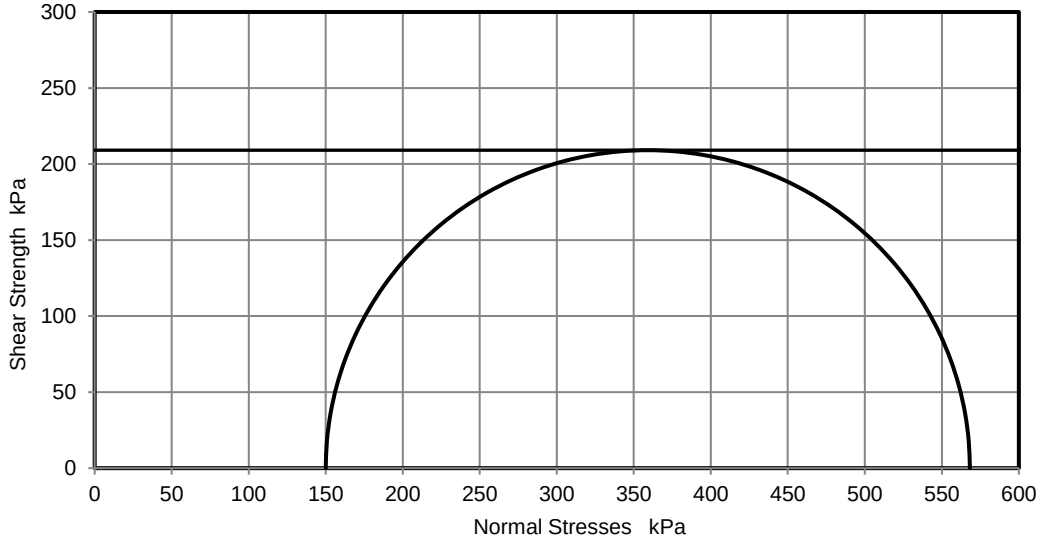
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	23
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.50
				Base	7.90
Specimen Reference	3	Specimen Depth	7.55 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070554
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	18/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.8	mm
Bulk Density		2.34	Mg/m3
Moisture Content		10	%
Dry Density		2.13	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		150	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	418	kPa
	Undrained Shear Strength, cu	209	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

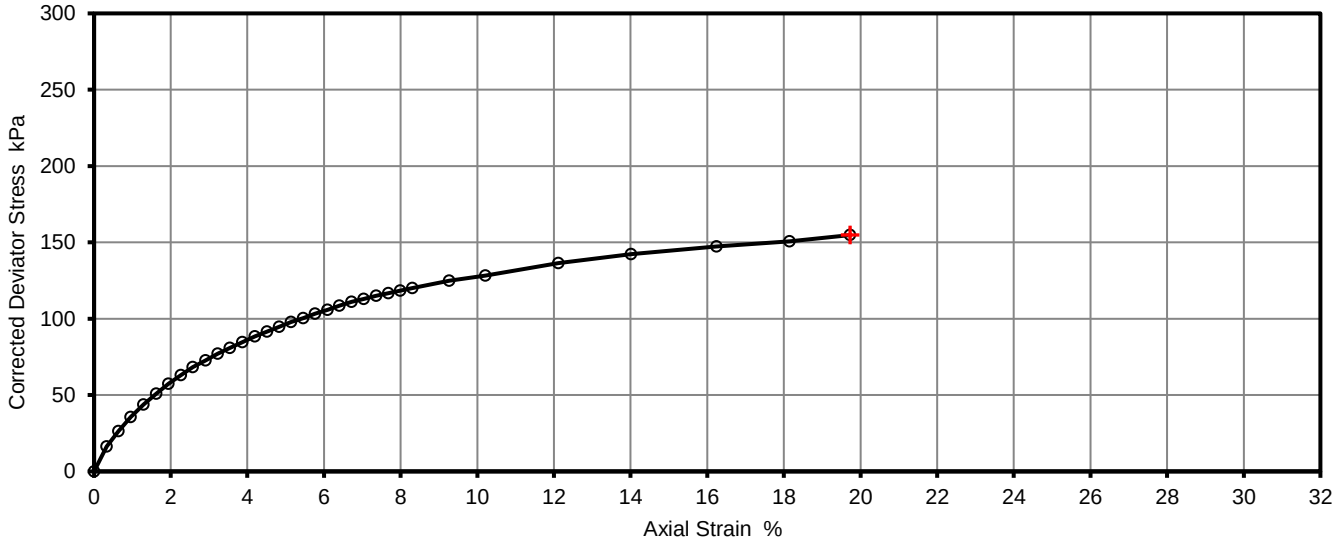
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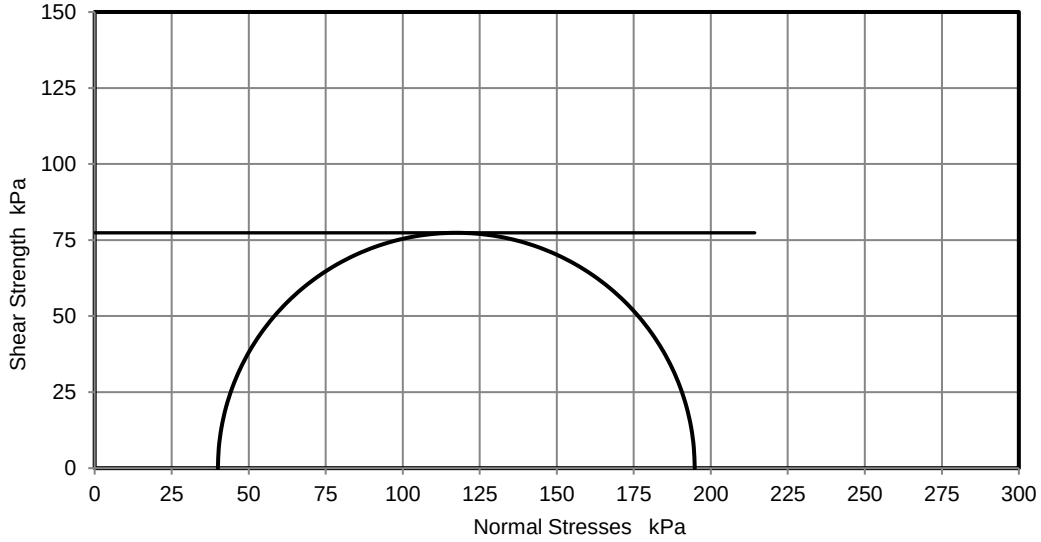
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.00
				Sample Depth (m) Base	2.45
Specimen Reference	3	Specimen Depth	2.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070559
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		209.9	mm
Diameter		106.3	mm
Bulk Density		2.27	Mg/m3
Moisture Content		11	%
Dry Density		2.05	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		40	kPa
At failure	Axial Strain	19.7	%
	Deviator Stress, (σ1 - σ3)f	155	kPa
	Undrained Shear Strength, cu	77	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

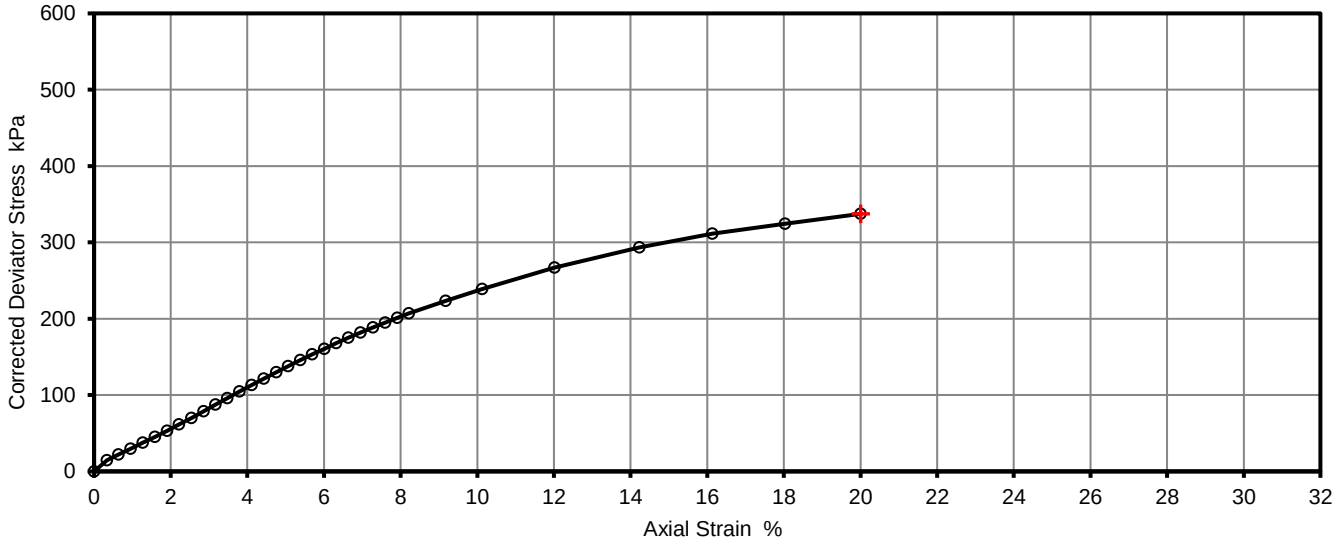
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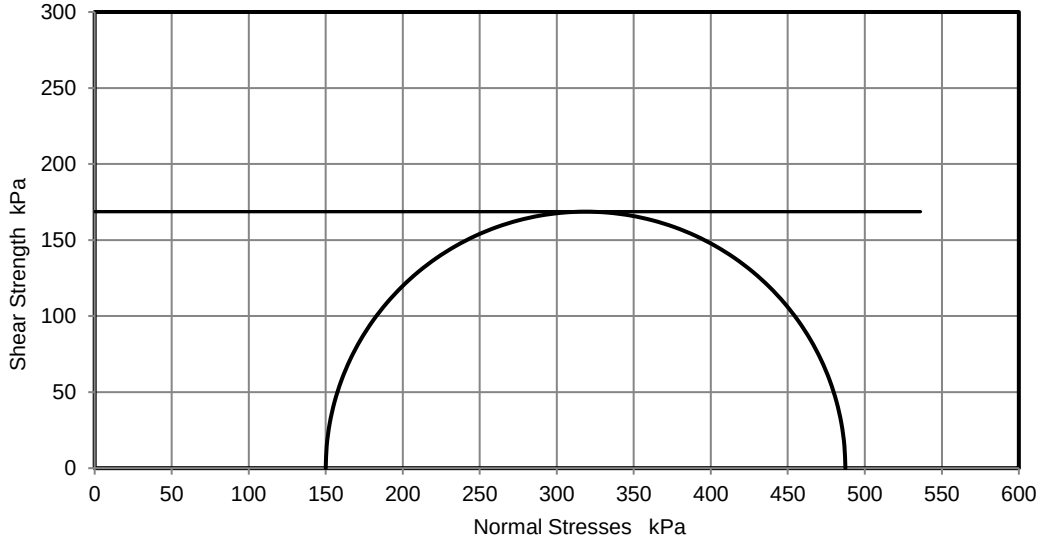
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				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	23
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.50
				Base	7.90
Specimen Reference	3	Specimen Depth	7.55 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070567
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		106.1	mm
Bulk Density		2.08	Mg/m3
Moisture Content		20	%
Dry Density		1.73	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		150	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	337	kPa
	Undrained Shear Strength, cu	169	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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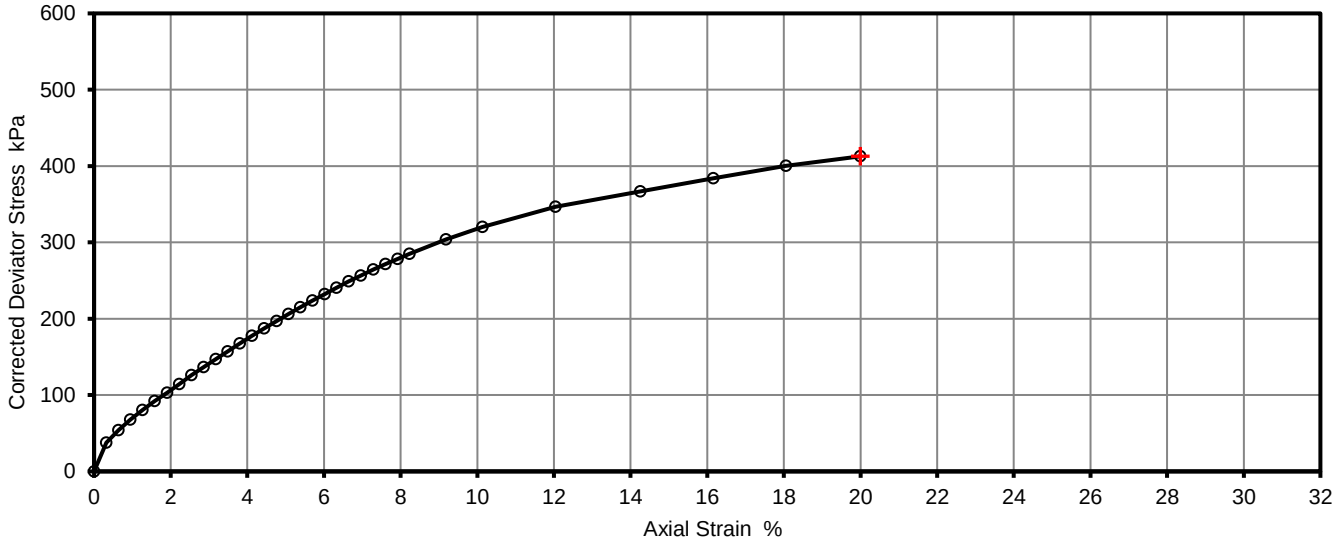
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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

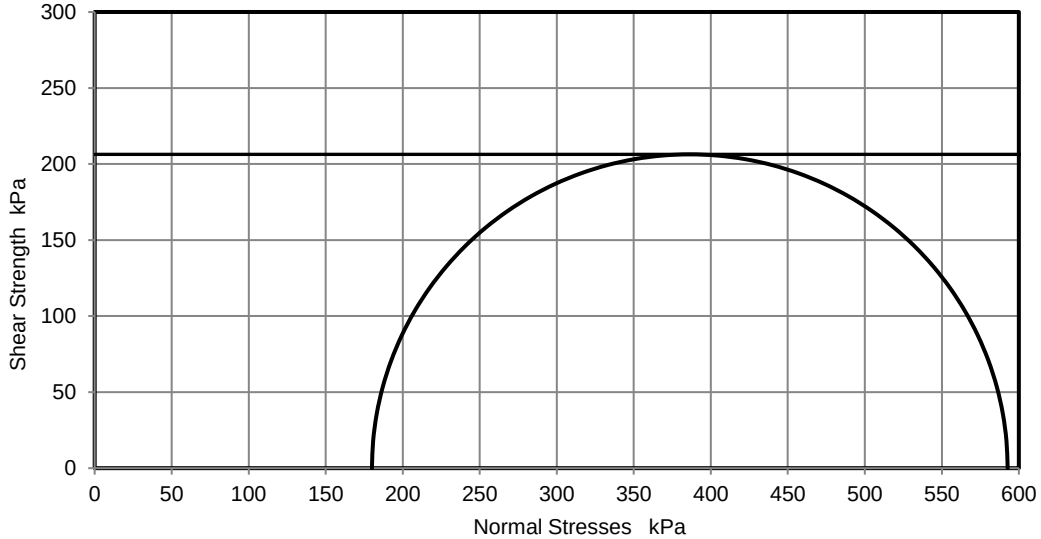
				Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH018
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	23
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.00
				Base	9.40
Specimen Reference	5	Specimen Depth	9.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070584
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	19/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.6	mm
Bulk Density		2.25	Mg/m3
Moisture Content		18	%
Dry Density		1.91	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		180	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	413	kPa
	Undrained Shear Strength, cu	206	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

No failure defined. Testing terminated at 20% axial strain.

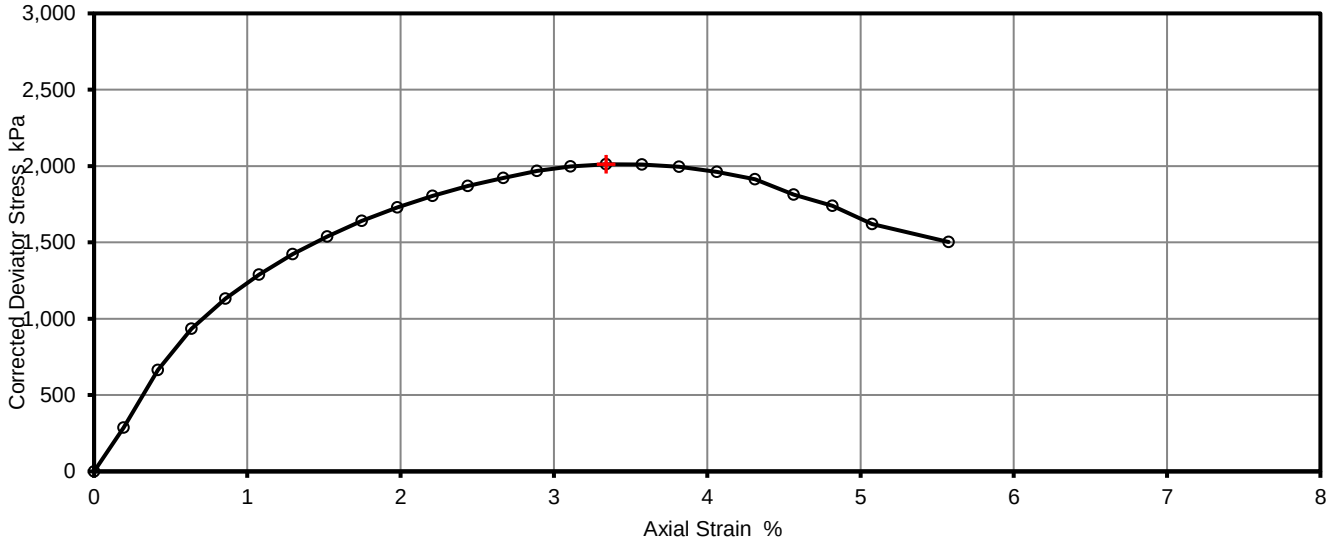
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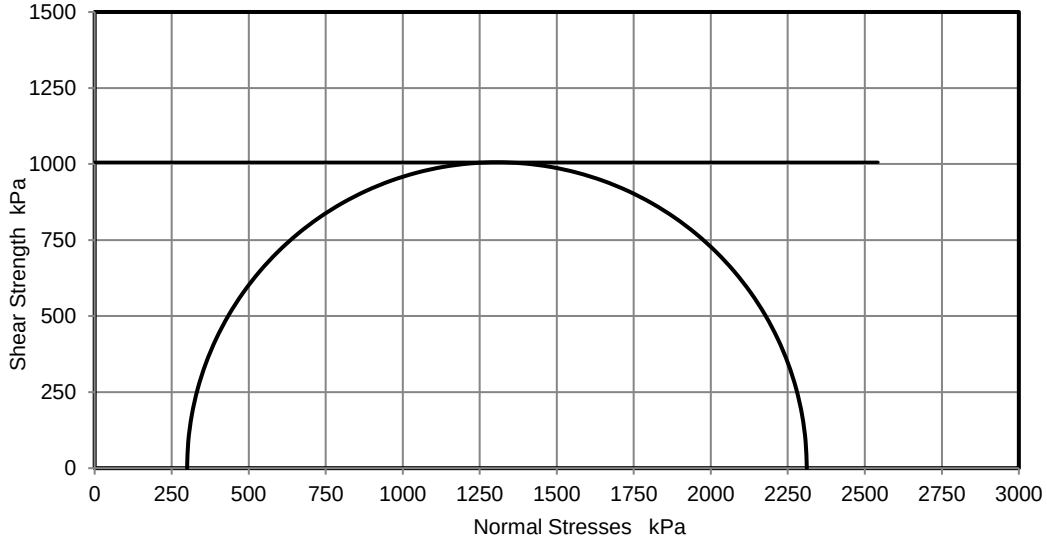
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	5
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	16.00
				Base	16.30
Specimen Reference	2	Specimen Depth	16.00 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082935
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	20/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		105.6	mm
Bulk Density		2.22	Mg/m3
Moisture Content		7	%
Dry Density		2.06	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	3.3	%
	Deviator Stress, (σ1 - σ3)f	2012	kPa
	Undrained Shear Strength, cu	1006	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

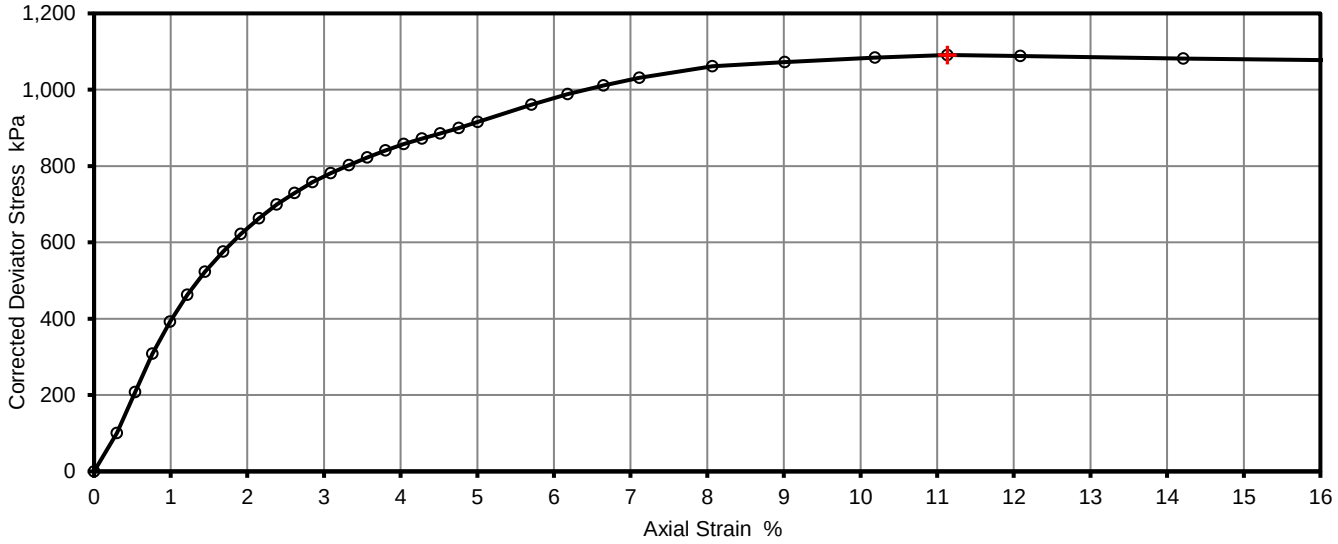
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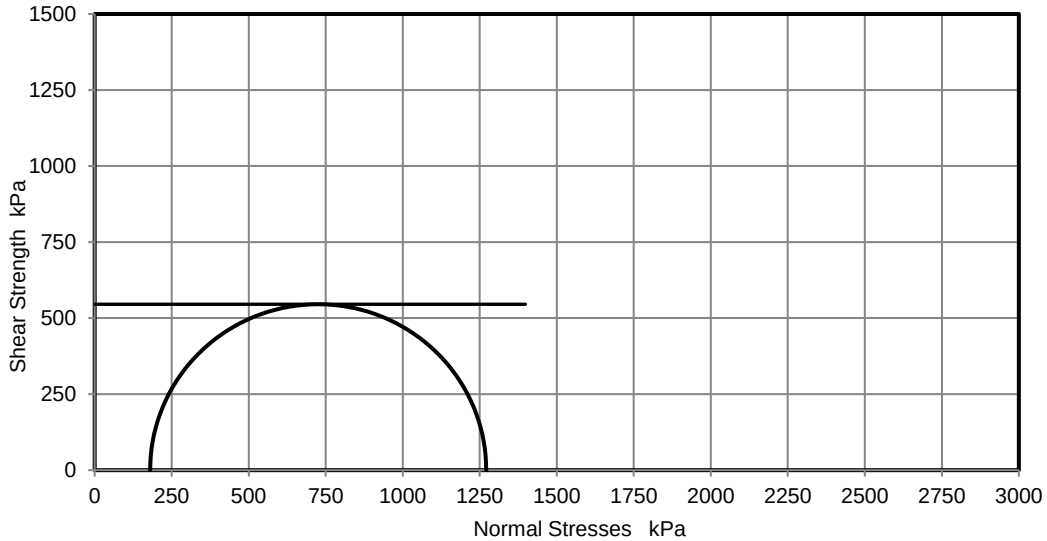
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH020
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.10
				Sample Depth (m) Base	10.40
Specimen Reference	3	Specimen Depth	10.10 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220825108
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	16/09/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.5	mm
Bulk Density		2.28	Mg/m3
Moisture Content		8	%
Dry Density		2.11	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		180	kPa
At failure	Axial Strain	11.1	%
	Deviator Stress, (σ1 - σ3)f	1091	kPa
	Undrained Shear Strength, cu	546	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

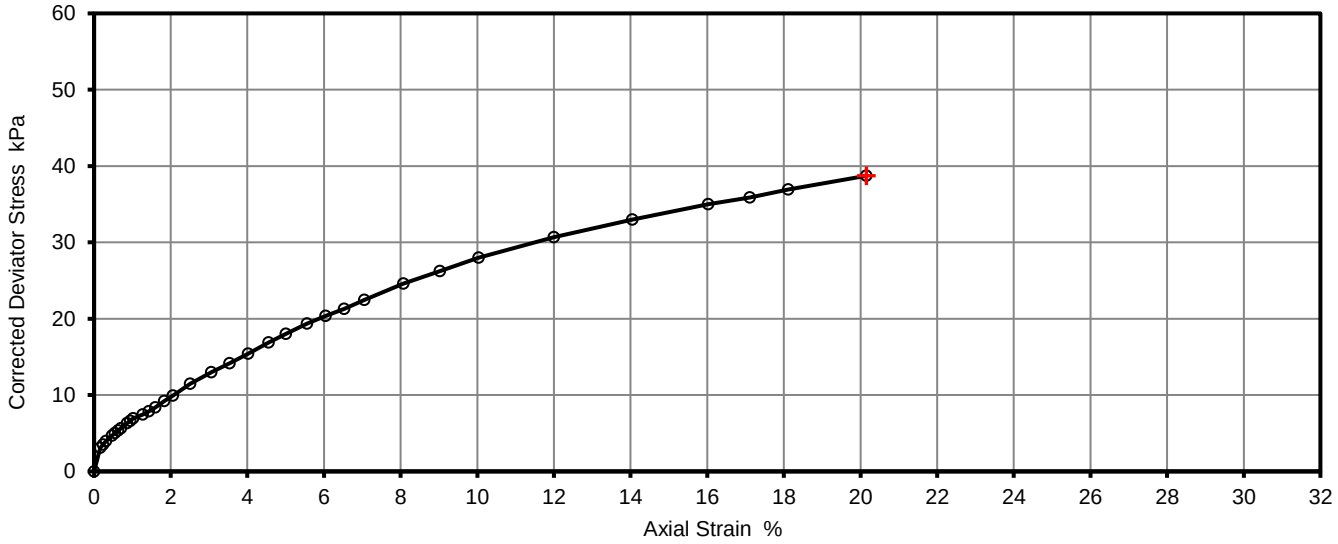
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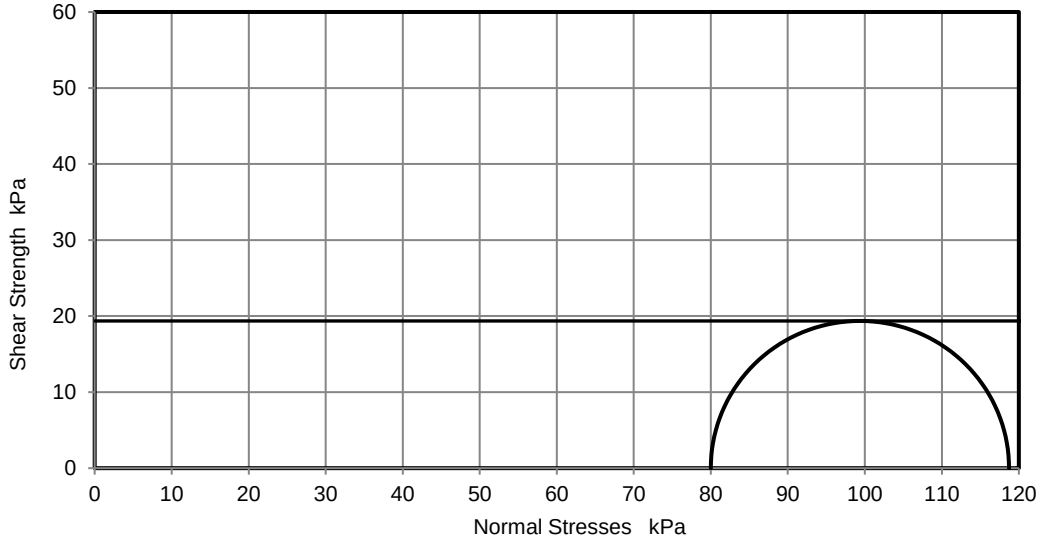
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	18
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Base	4.45
Specimen Reference	5	Specimen Depth	4.05 m	Sample Type	U
Specimen Description	Brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220621104
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	08/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		208.0	mm
Diameter		107.2	mm
Bulk Density		2.02	Mg/m3
Moisture Content		27	%
Dry Density		1.58	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		80	kPa
At failure	Axial Strain	20.2	%
	Deviator Stress, (σ1 - σ3)f	39	kPa
	Undrained Shear Strength, cu	19	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

Multistage not suitable. No failure defined.
Testing terminated at 20% axial strain.

Approved: Stephen.Watson

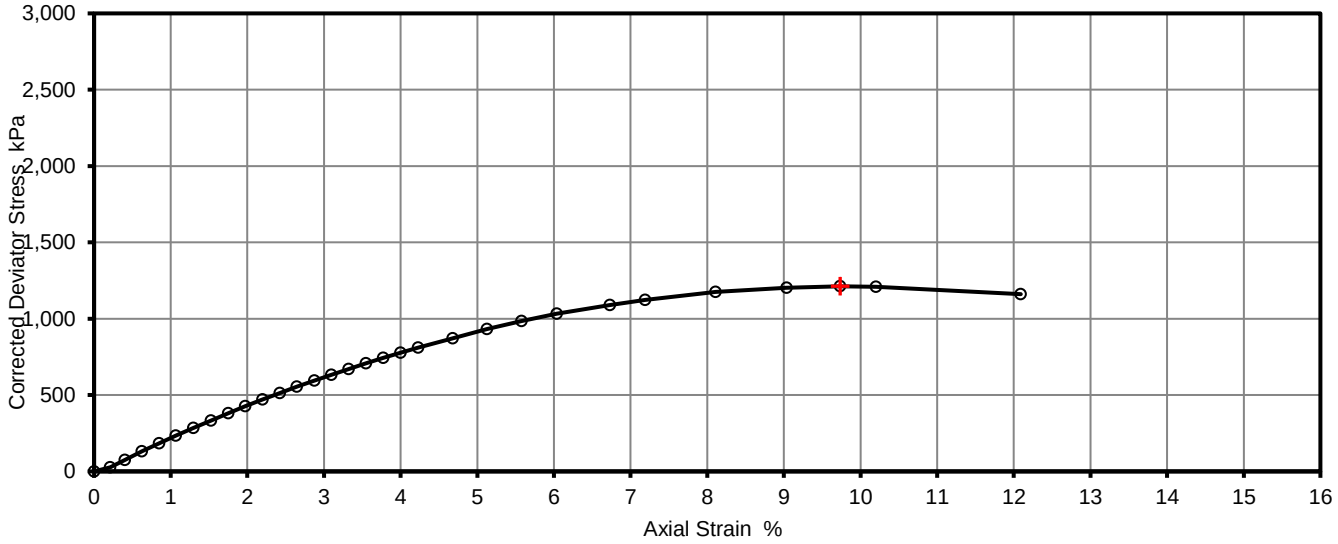
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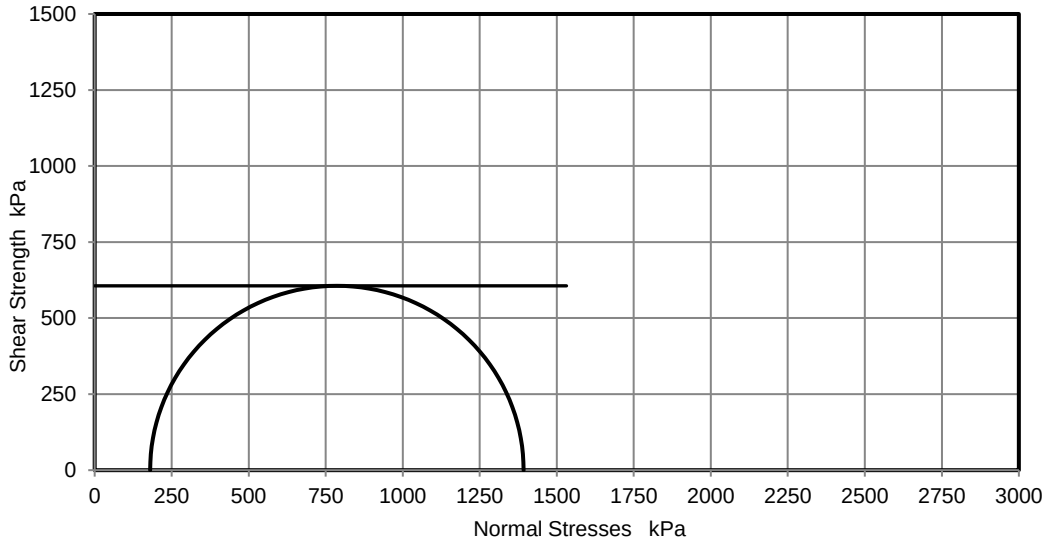
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	20
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	9.00
				Base	9.45
Specimen Reference	3	Specimen Depth	9.05 m	Sample Type	U
Specimen Description	Very stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220621107
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	08/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.0	mm
Diameter		105.4	mm
Bulk Density		2.31	Mg/m3
Moisture Content		9	%
Dry Density		2.13	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		180	kPa
At failure	Axial Strain	9.7	%
	Deviator Stress, (σ1 - σ3)f	1212	kPa
	Undrained Shear Strength, cu	606	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

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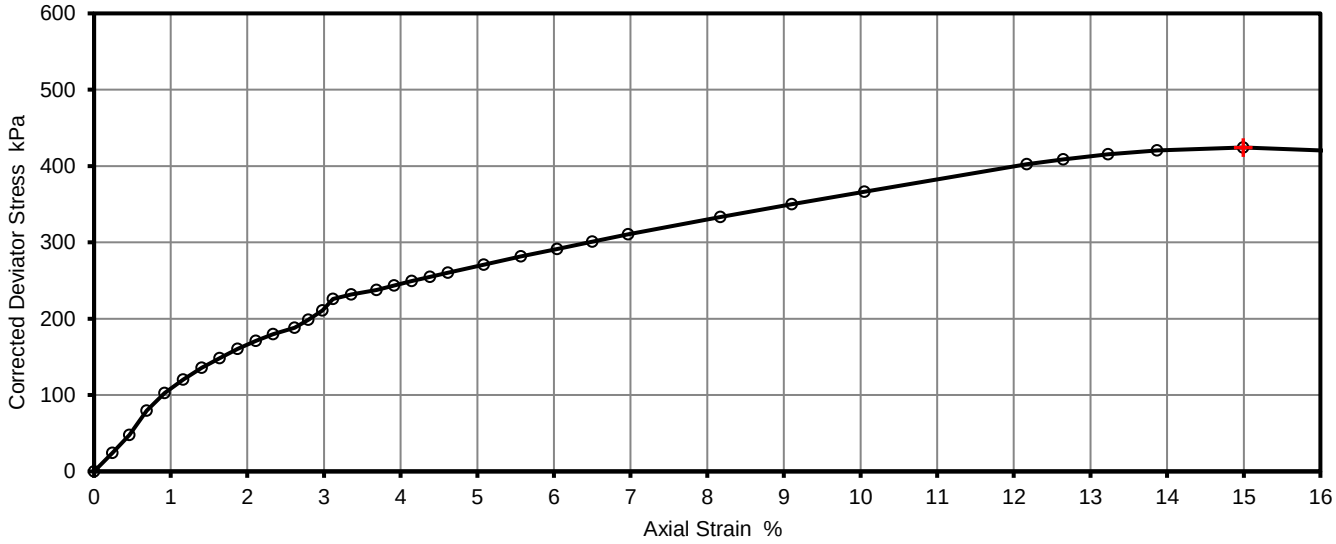
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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

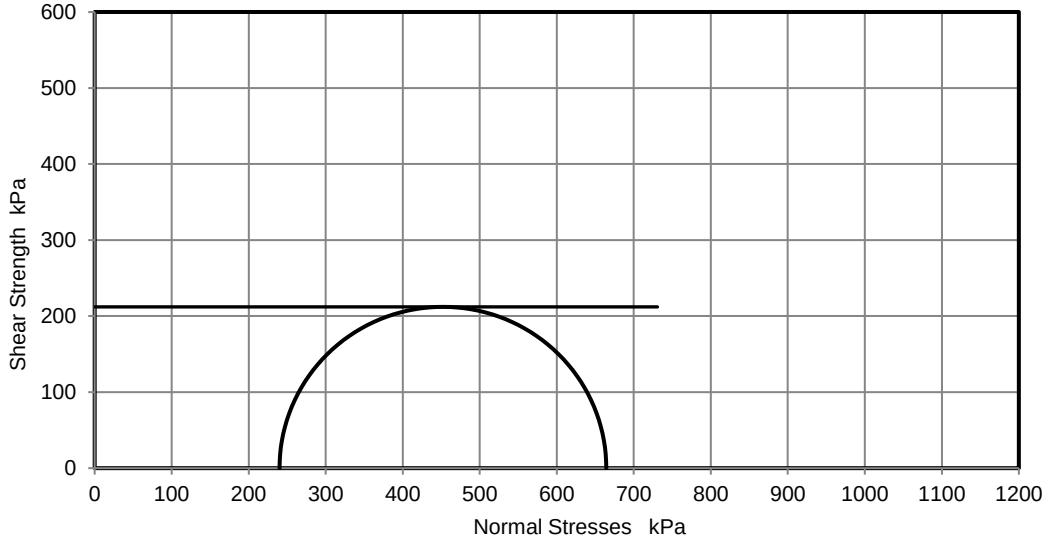
				Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH021
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	26
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.00
				Base	12.00
Specimen Reference	6	Specimen Depth	12.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus20220621109
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	08/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		206.4	mm
Diameter		103.4	mm
Bulk Density		2.11	Mg/m3
Moisture Content		10	%
Dry Density		1.93	Mg/m3
Rate of Strain		3.0	%/min
Cell Pressure		240	kPa
At failure	Axial Strain	15.0	%
	Deviator Stress, (σ1 - σ3)f	424	kPa
	Undrained Shear Strength, cu	212	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

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.

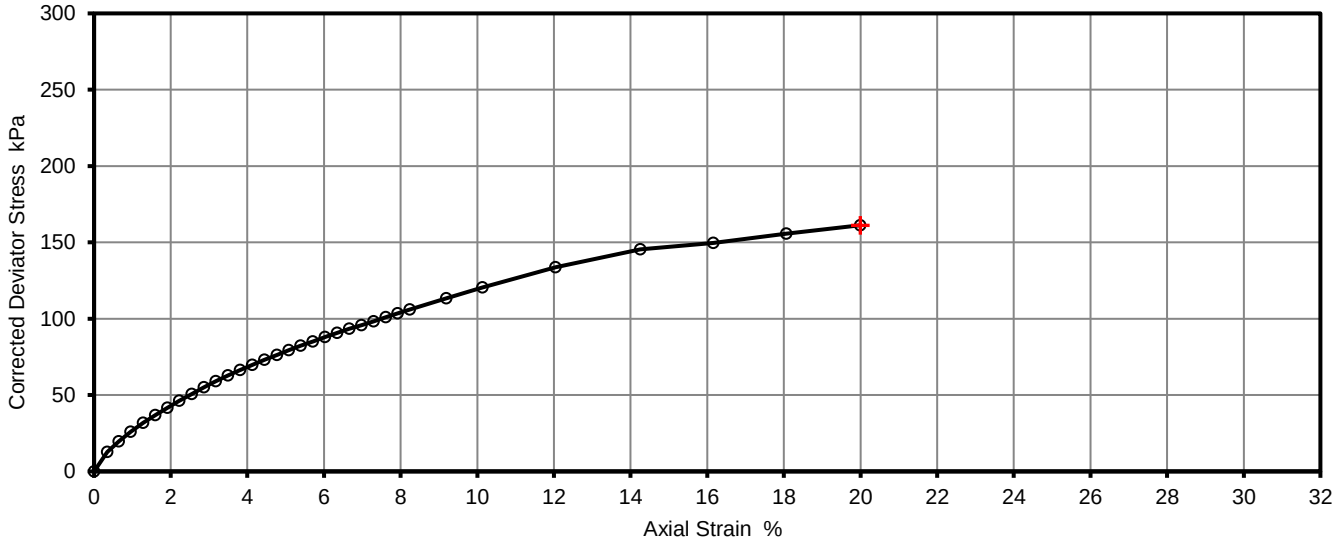
Remarks

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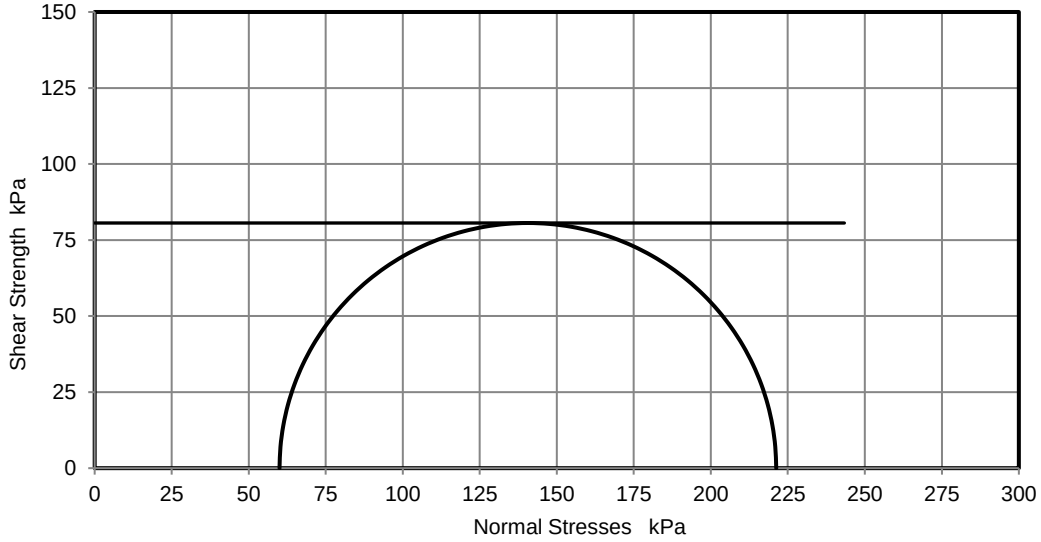
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH022
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	17
Soil Description	Greyish brown slightly sandy silty CLAY.			Sample Depth (m) Top	3.00
				Base	3.45
Specimen Reference	2	Specimen Depth	3.05 m	Sample Type	U
Specimen Description	Stiff greyish brown slightly sandy silty CLAY.			KeyLAB ID	Caus2022071484
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	21/07/2022

Sample Condition		UNDISTURBED	
Test Number		1	
Length		210.1	mm
Diameter		106.5	mm
Bulk Density		2.22	Mg/m3
Moisture Content		9	%
Dry Density		2.03	Mg/m3
Rate of Strain		4.0	%/min
Cell Pressure		60	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	161	kPa
	Undrained Shear Strength, cu	81	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

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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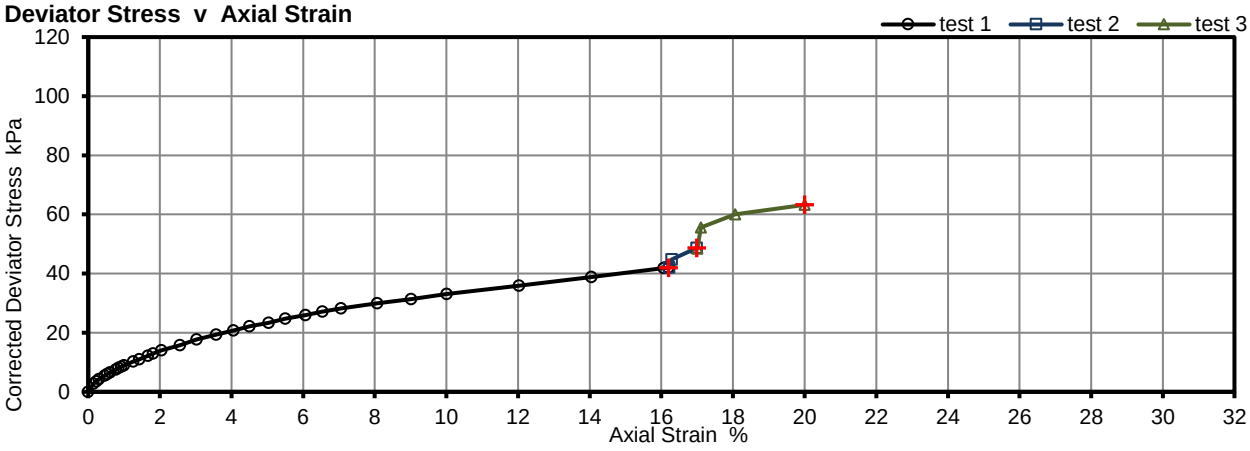
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CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH001
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	18
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Base	4.40
Specimen Reference	6	Specimen Depth	4.00 m	Sample Type	U
Specimen Description	Soft greyish brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022062157
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	30/06/2022

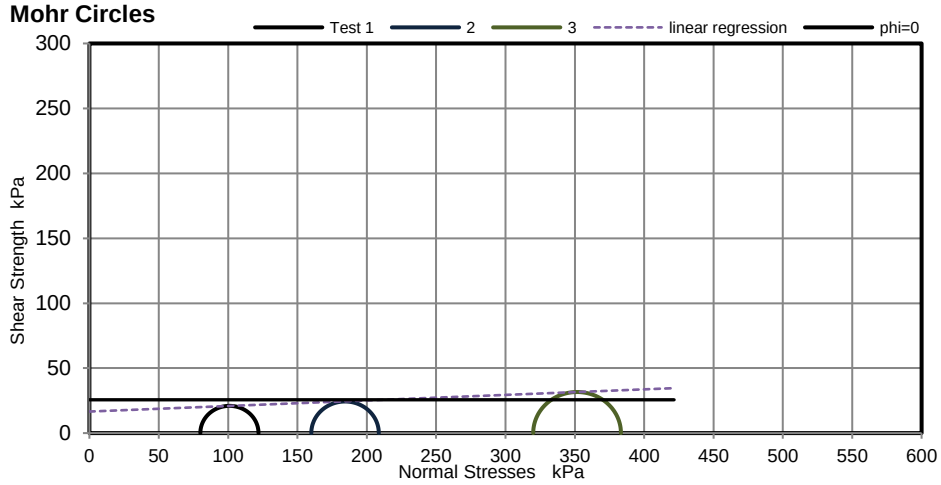
Length	mm	209.9
Diameter	mm	105.7
Bulk Density	Mg/m3	2.36
Moisture Content	%	13.3
Dry Density	Mg/m3	2.08

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	80	160	320
End of stage	Axial Strain	%	16.2	17.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	41.9	48.7	63.2
	Shear strength, cu	kPa	21.0	24.3	31.6
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 26 kPa

Linear Regression

ϕu 2.4 °

cu 17 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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LAB 16R - Version 6

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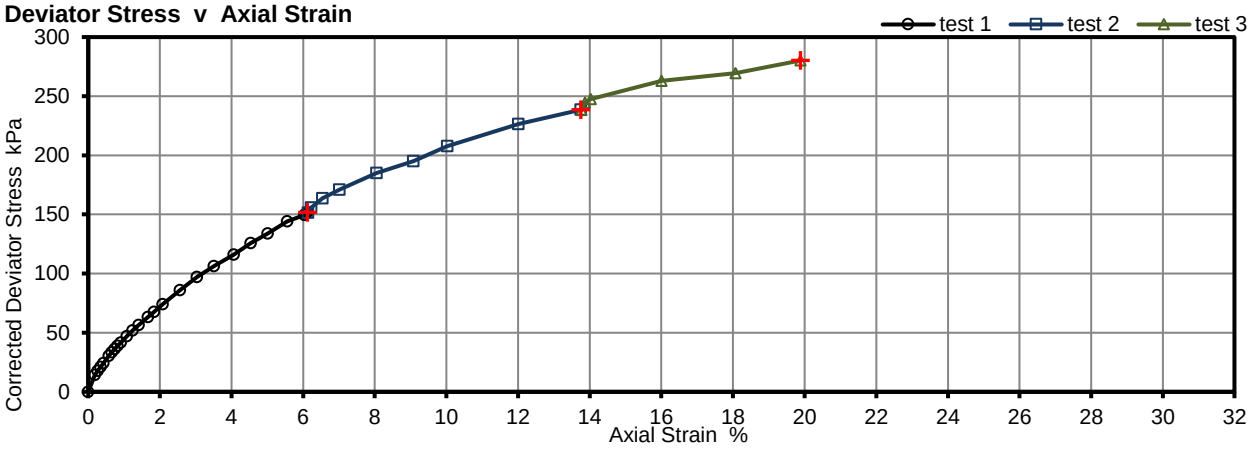
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	9
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.00
				Base	3.45
Specimen Reference	4	Specimen Depth	3.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022071450
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	21/07/2022

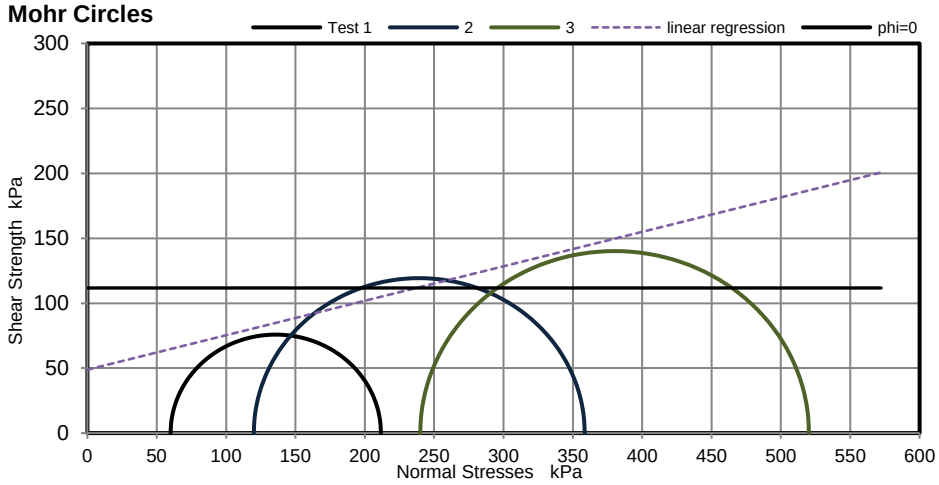
Length	mm	210.0
Diameter	mm	105.7
Bulk Density	Mg/m3	2.40
Moisture Content	%	11.8
Dry Density	Mg/m3	2.14

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	60	120	240
End of stage	Axial Strain	%	6.1	13.8	19.9
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	151.6	238.6	280.2
	Shear strength, cu	kPa	75.8	119.3	140.1
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 112 kPa

Linear Regression

ϕu 14.9 °

cu 49 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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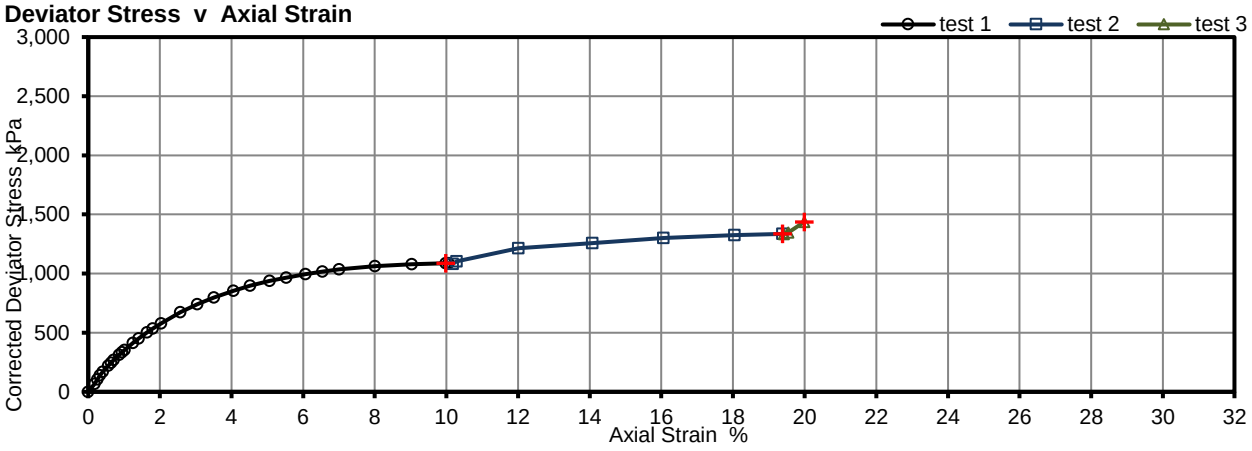
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CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH007
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.60
				Base	11.90
Specimen Reference	2	Specimen Depth	11.60 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082565
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	12/09/2022

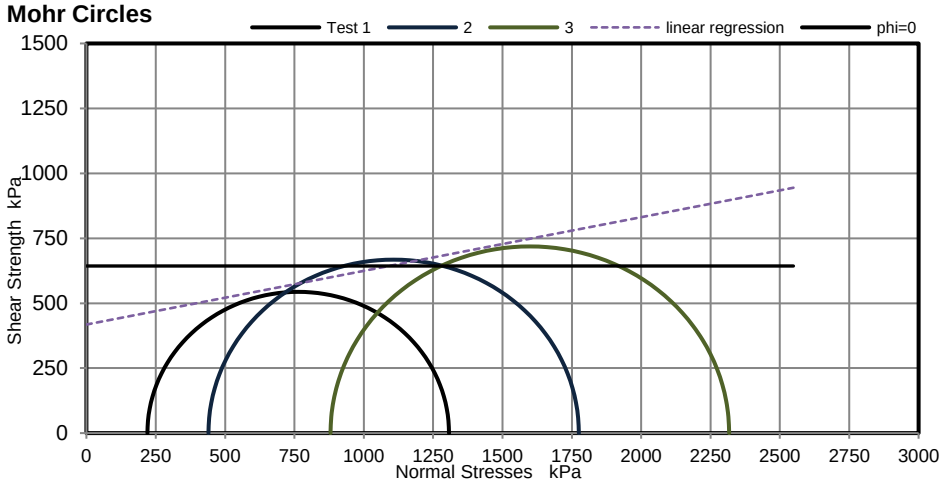
Length	mm	210.0
Diameter	mm	104.9
Bulk Density	Mg/m3	2.27
Moisture Content	%	10.8
Dry Density	Mg/m3	2.05

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	220	440	880
End of stage	Axial Strain	%	10.0	19.4	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	1087.3	1335.3	1437.2
	Shear strength, cu	kPa	543.6	667.6	718.6
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 643 kPa

Linear Regression

ϕu 11.7 °

cu 418 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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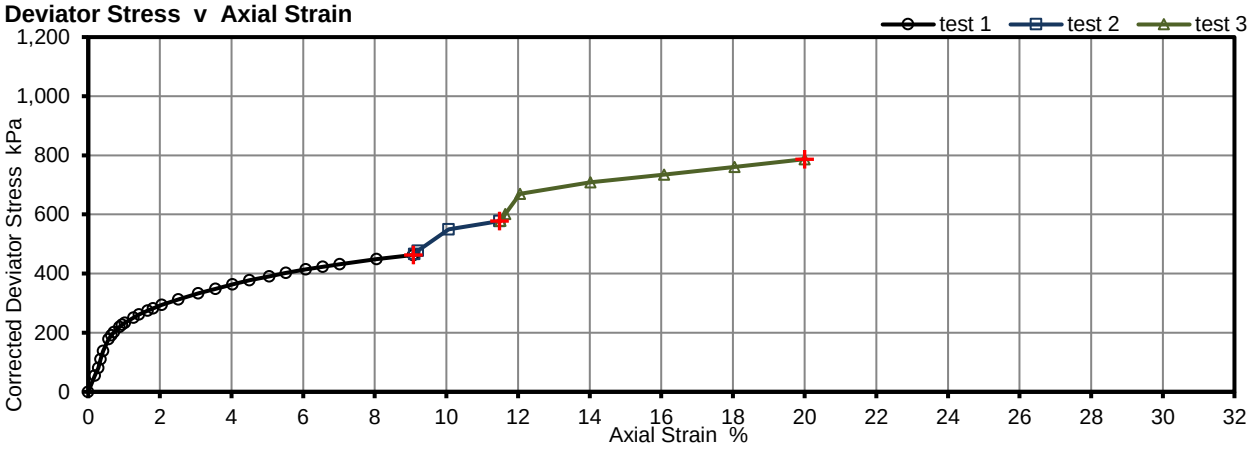
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CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH008A
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.30
				Base	3.60
Specimen Reference	2	Specimen Depth	3.30 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082917
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	19/09/2022

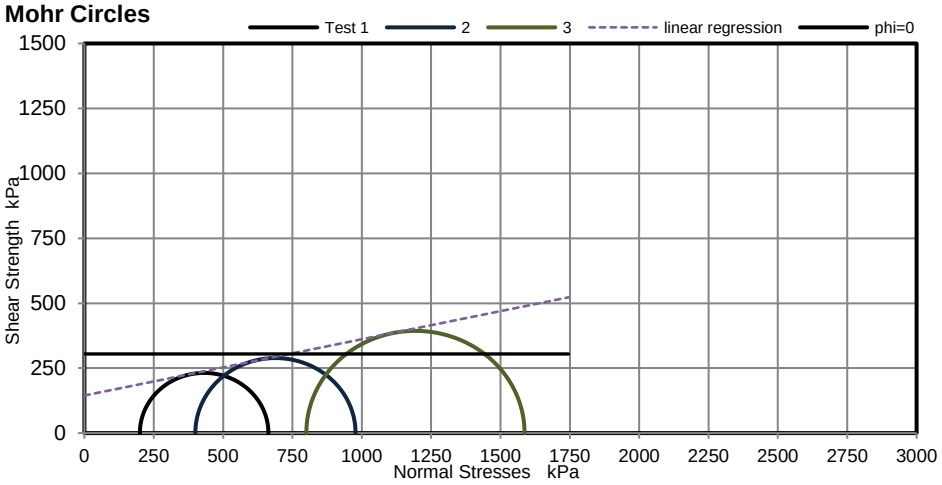
Length	mm	210.0
Diameter	mm	105.1
Bulk Density	Mg/m3	2.38
Moisture Content	%	9.5
Dry Density	Mg/m3	2.17

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	200	400	800
End of stage	Axial Strain	%	9.1	11.5	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	463.4	577.6	786.9
	Shear strength, cu	kPa	231.7	288.8	393.4
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 305 kPa

Linear Regression

ϕu 12.2 °

cu 145 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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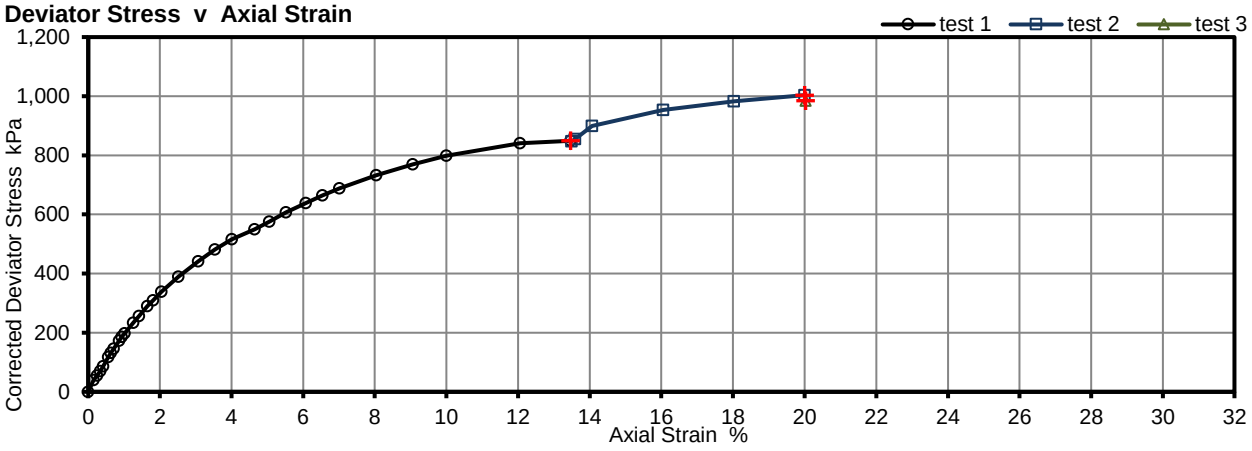
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CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH009
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	10.20
				Base	10.50
Specimen Reference	2	Specimen Depth	10.20 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082573
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	12/09/2022

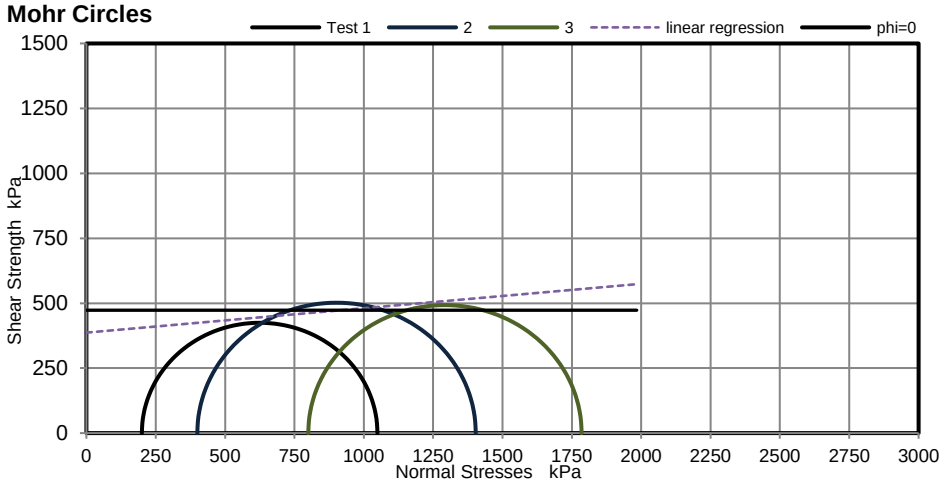
Length	mm	210.0
Diameter	mm	105.3
Bulk Density	Mg/m3	2.26
Moisture Content	%	9.2
Dry Density	Mg/m3	2.07

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	200	400	800
End of stage	Axial Strain	%	13.5	20.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	849.1	1003.6	985.2
	Shear strength, cu	kPa	424.6	501.8	492.6
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 473 kPa

Linear Regression

ϕu 5.4 °

cu 387 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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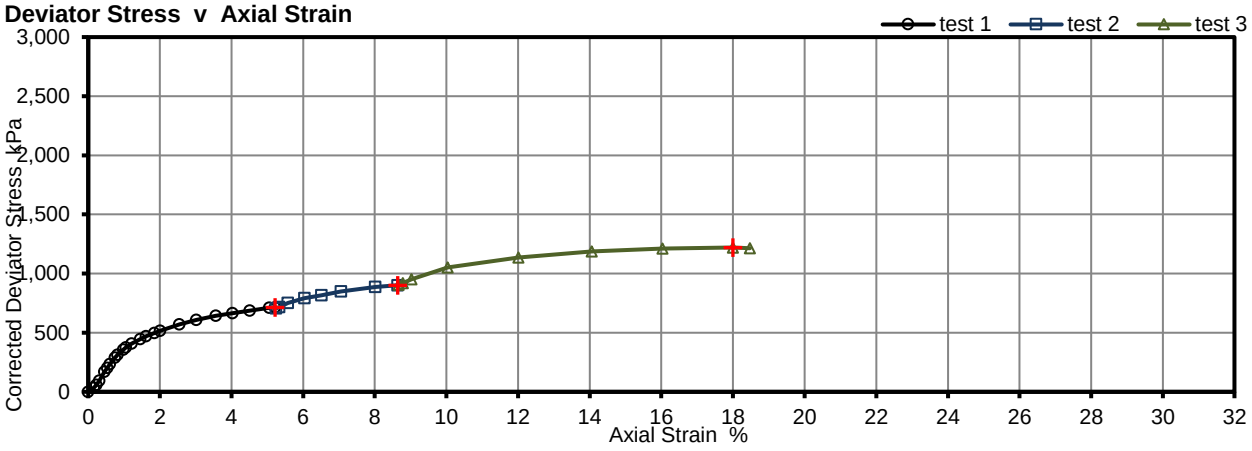
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CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH010
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	7.90
				Base	8.20
Specimen Reference	3	Specimen Depth	7.90 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082587
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	14/09/2022

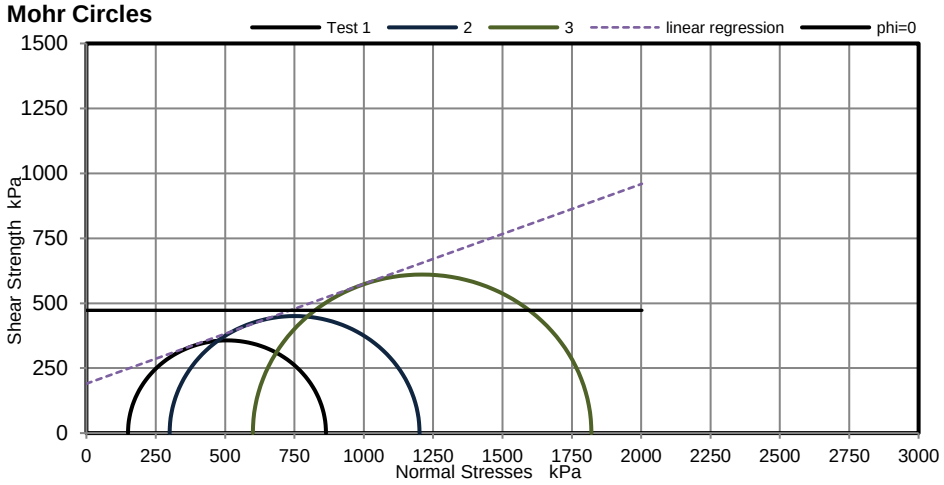
Length	mm	210.0
Diameter	mm	105.6
Bulk Density	Mg/m3	2.21
Moisture Content	%	9.0
Dry Density	Mg/m3	2.03

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	150	300	600
End of stage	Axial Strain	%	5.2	8.6	18.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	713.7	901.1	1220.6
	Shear strength, cu	kPa	356.9	450.5	610.3
	Mode of failure		Compound		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 473 kPa

Linear Regression

ϕu 21.0 °

cu 190 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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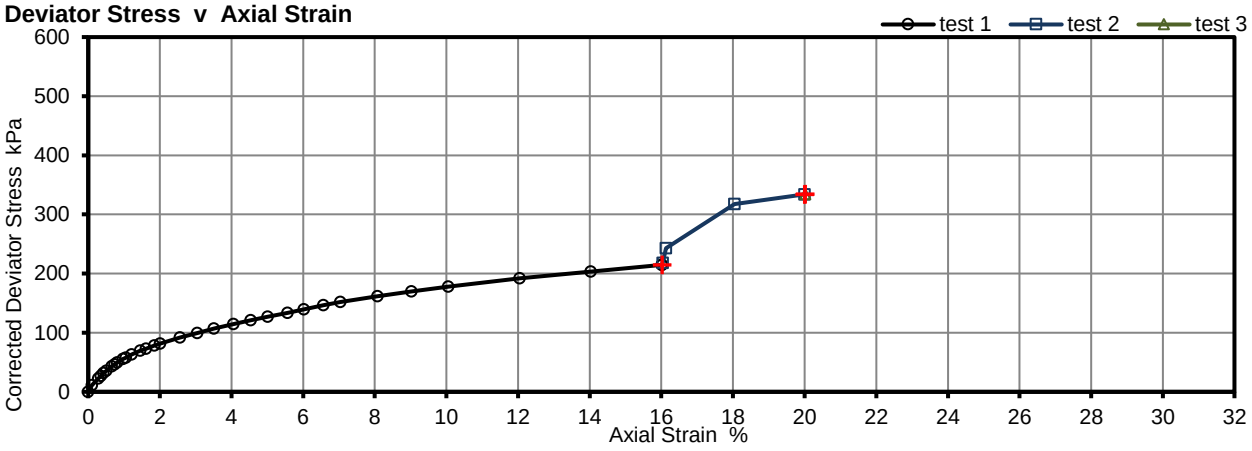
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	18
Soil Description	Brown sandy gravelly silty CLAY.			Sample Depth (m) Top	4.00
				Sample Depth (m) Base	4.45
Specimen Reference	2	Specimen Depth	4.05 m	Sample Type	U
Specimen Description	Stiff brown sandy gravelly silty CLAY.			KeyLAB ID	Caus2022071461
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	21/07/2022

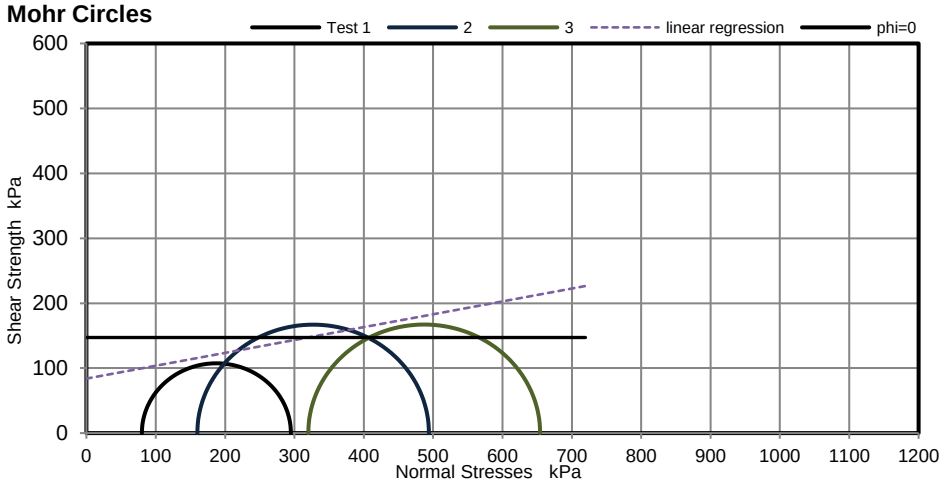
Length	mm	210.0
Diameter	mm	105.5
Bulk Density	Mg/m3	2.30
Moisture Content	%	10.0
Dry Density	Mg/m3	2.09

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	80	160	320
End of stage	Axial Strain	%	16.0	20.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	214.9	333.9	334.3
	Shear strength, cu	kPa	107.4	167.0	167.1
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 147 kPa

Linear Regression

ϕu 11.2 °

cu 84 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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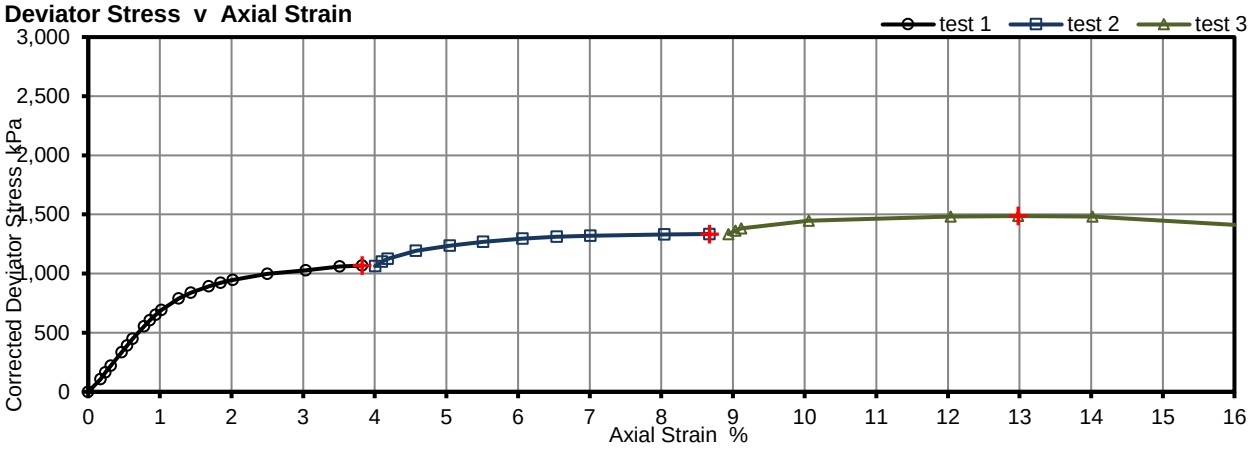
Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH011
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	8.70
				Base	9.00
Specimen Reference	2	Specimen Depth	8.70 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082926
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	19/09/2022

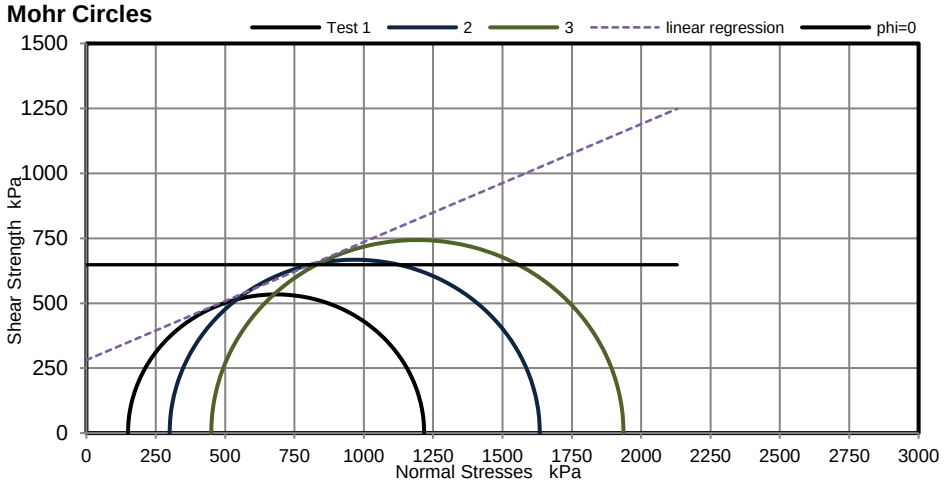
Length	mm	210.1
Diameter	mm	104.8
Bulk Density	Mg/m3	2.24
Moisture Content	%	8.2
Dry Density	Mg/m3	2.07

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	150	300	450
End of stage	Axial Strain	%	3.8	8.7	13.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	1067.7	1334.6	1486.4
	Shear strength, cu	kPa	533.8	667.3	743.2
	Mode of failure		Compound		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 648 kPa

Linear Regression

ϕu 24.4 °

cu 281 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

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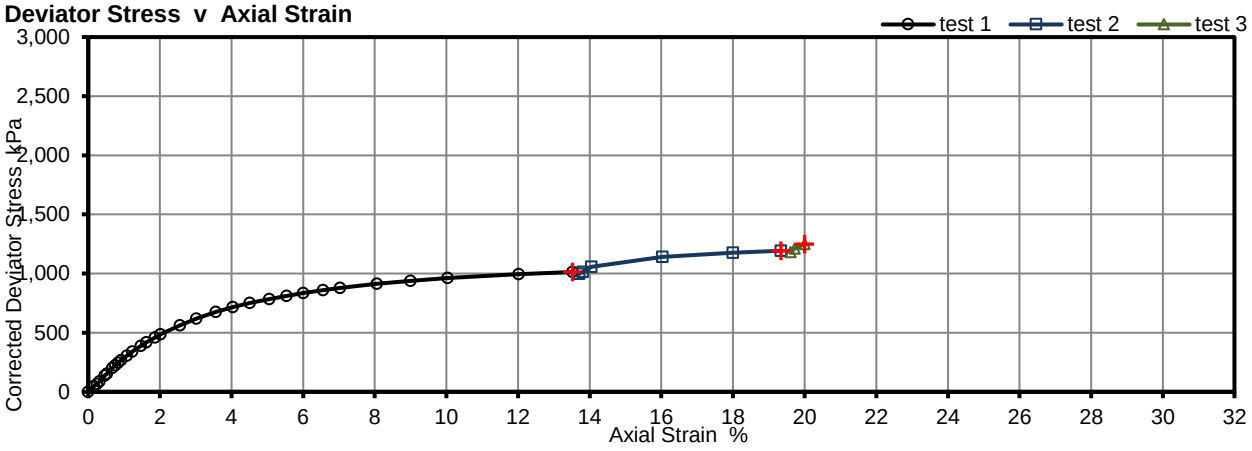
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH016
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	3
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.80
				Base	12.10
Specimen Reference	2	Specimen Depth	11.80 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082938
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	21/09/2022

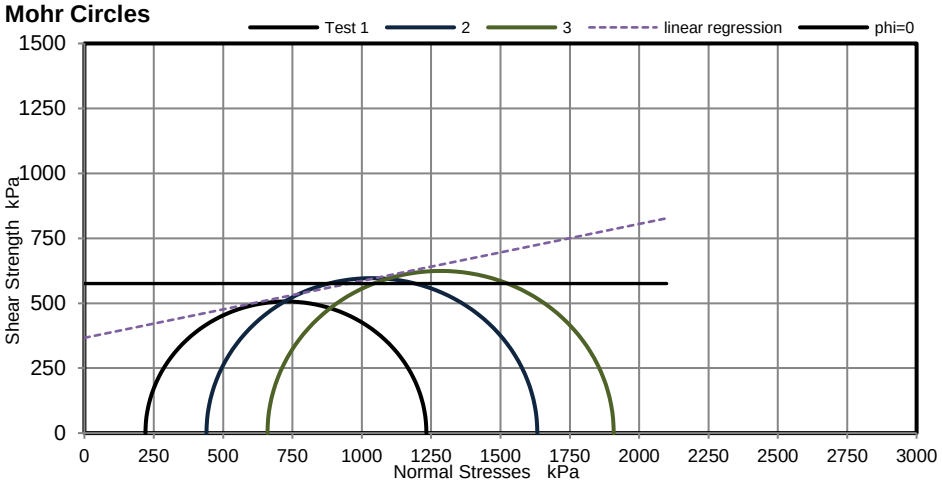
Length	mm	210.0
Diameter	mm	105.3
Bulk Density	Mg/m3	2.28
Moisture Content	%	8.2
Dry Density	Mg/m3	2.11

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	220	440	660
End of stage	Axial Strain	%	13.5	19.3	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	1013.0	1192.9	1248.3
	Shear strength, cu	kPa	506.5	596.4	624.2
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 576 kPa

Linear Regression

ϕu 12.4 °

cu 367 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% strain.

Approved: Stephen.Watson

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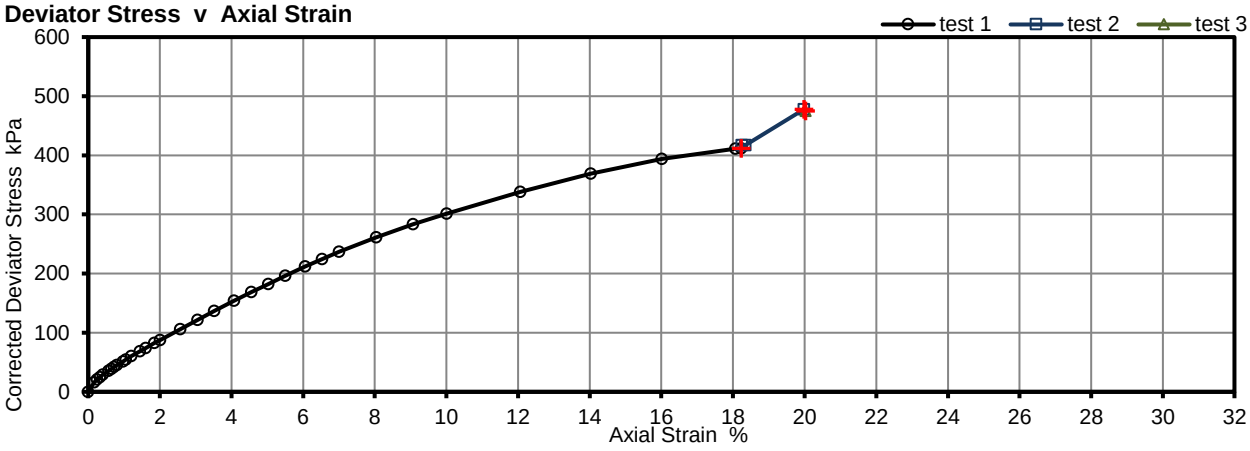
10122

CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**			Job Ref	21-1682
				Borehole/Pit No.	RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	22
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	5.00
				Sample Depth (m) Base	5.40
Specimen Reference	3	Specimen Depth	5.05 m	Sample Type	U
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022070565
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	19/07/2022

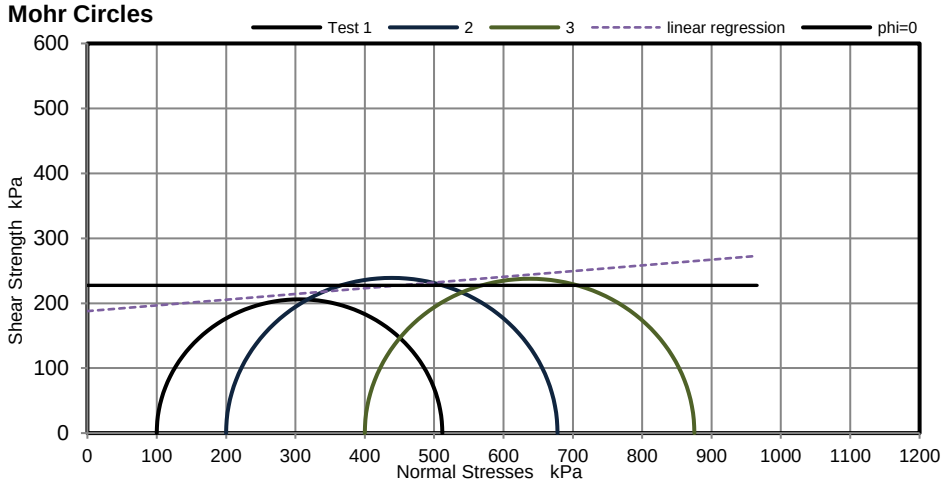
Length	mm	210.0
Diameter	mm	105.8
Bulk Density	Mg/m3	2.28
Moisture Content	%	9.6
Dry Density	Mg/m3	2.08

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	100	200	400
End of stage	Axial Strain	%	18.2	20.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	411.8	477.9	475.3
	Shear strength, cu	kPa	205.9	239.0	237.6
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 228 kPa

Linear Regression

ϕu 5.0 °

cu 188 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

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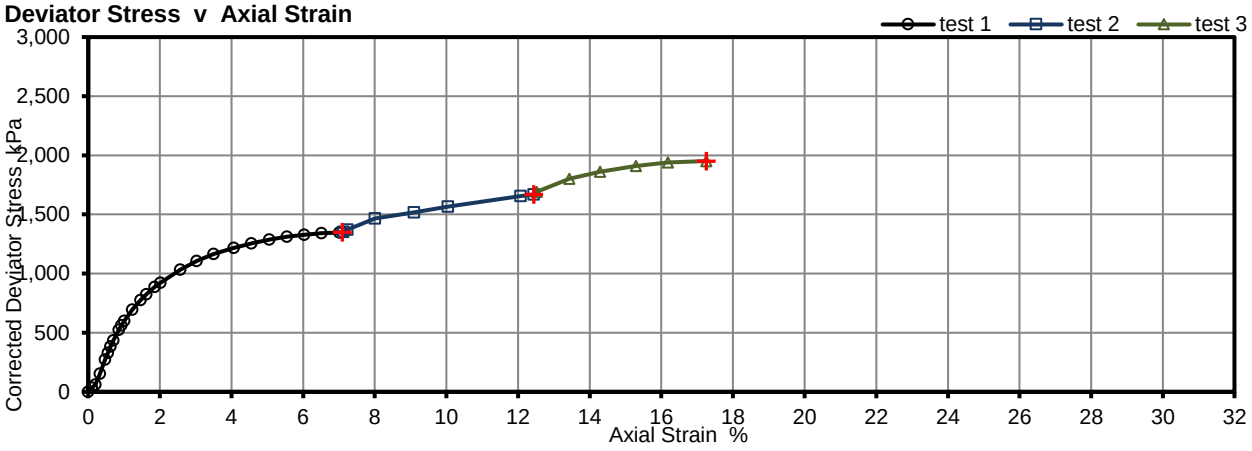
Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH017
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	2
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	11.60
				Base	11.90
Specimen Reference	2	Specimen Depth	11.60 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082941
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	21/09/2022

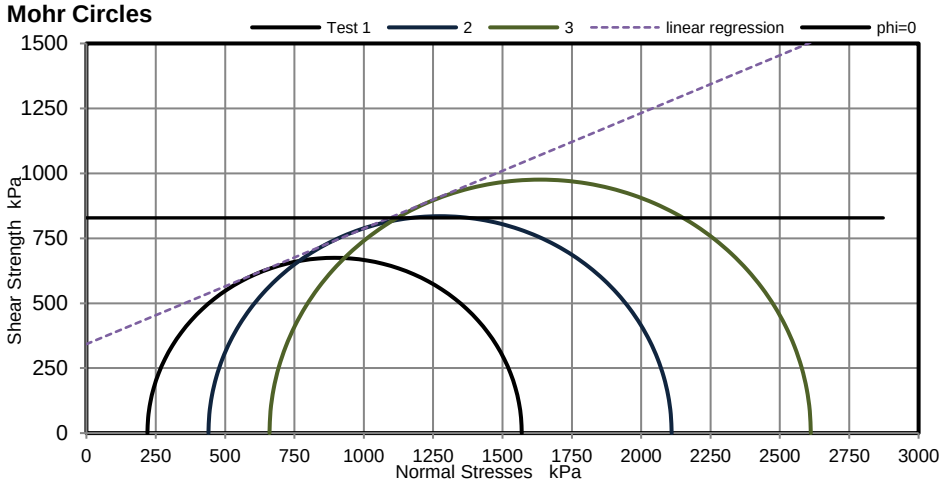
Length	mm	210.0
Diameter	mm	103.6
Bulk Density	Mg/m3	2.29
Moisture Content	%	13.3
Dry Density	Mg/m3	2.02

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	220	440	660
End of stage	Axial Strain	%	7.1	12.4	17.3
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	1349.5	1669.9	1951.6
	Shear strength, cu	kPa	674.7	834.9	975.8
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 828 kPa

Linear Regression

ϕu 24.0 °

cu 343 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

Testing terminated at 17.3% axial strain. Max capacity of load.

Approved: Stephen.Watson

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UKAS TESTING

10122

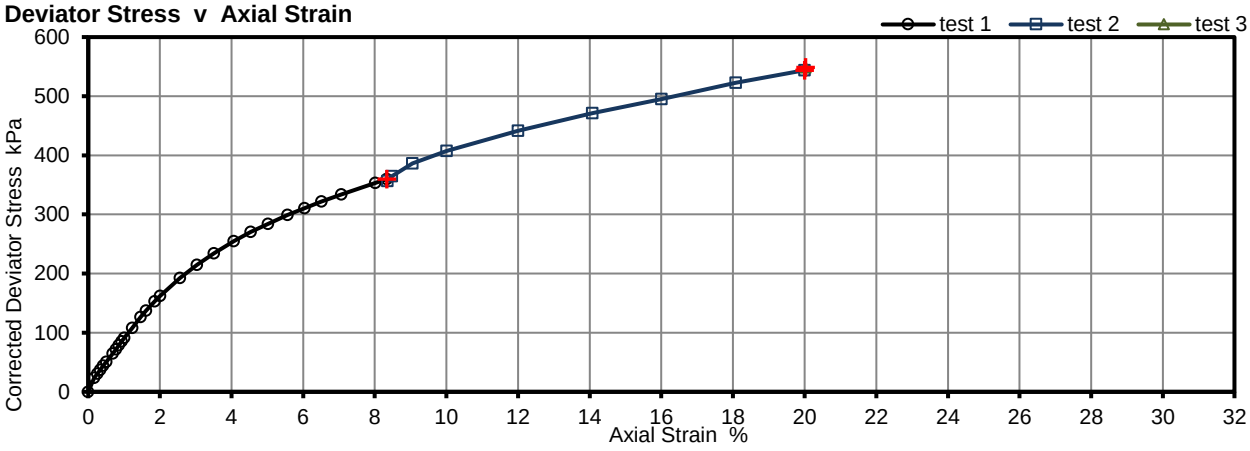
Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH019
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Brownish grey sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	12.20
				Base	12.50
Specimen Reference	2	Specimen Depth	12.20 m	Sample Type	C
Specimen Description	Stiff brownish grey sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus2022082934
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	20/09/2022

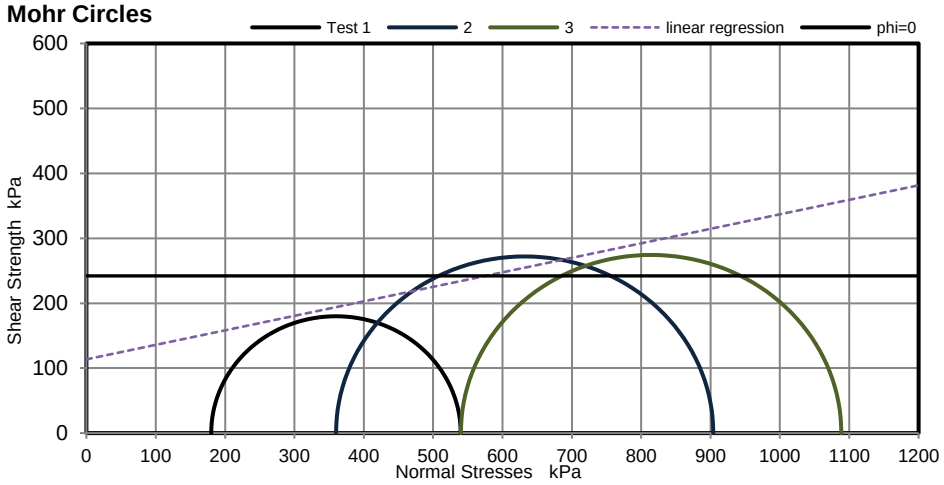
Length	mm	210.0
Diameter	mm	106.0
Bulk Density	Mg/m3	2.26
Moisture Content	%	11.8
Dry Density	Mg/m3	2.02

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	180	360	540
End of stage	Axial Strain	%	8.3	20.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	359.8	543.9	548.6
	Shear strength, cu	kPa	179.9	272.0	274.3
	Mode of failure		Compound		

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 242 kPa

Linear Regression

ϕu 12.6 °

cu 114 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen.Watson

Printed: 03/10/2022 14:39

LAB 16R - Version 6

UKAS TESTING

10122

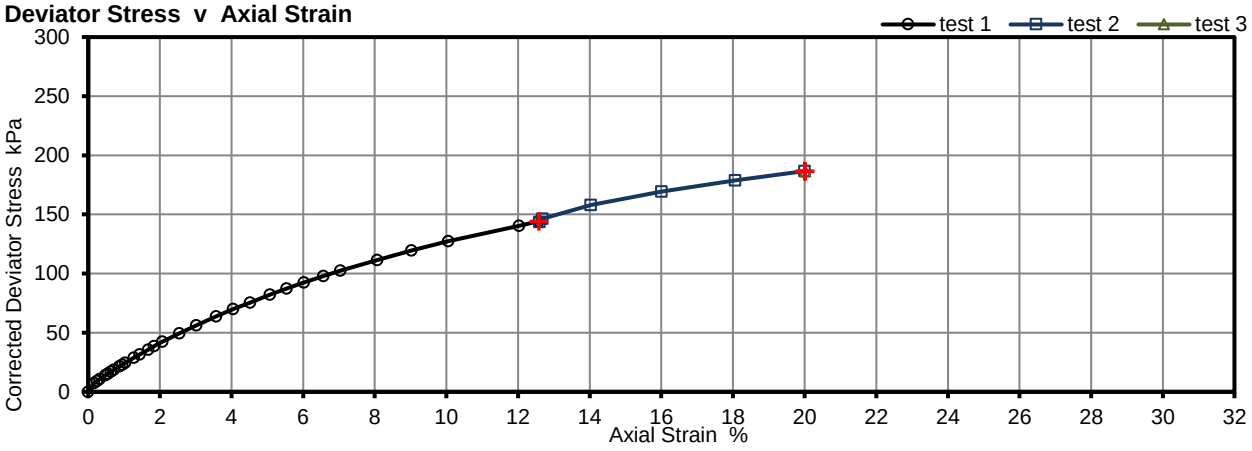
Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Job Ref					21-1682
Borehole/Pit No.					RWRM-BH027
Site Name	Eastern and Midlands Region WSP - Ground Investigation - Lot 1 Pipeline Section Only			Sample No.	4
Soil Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	5.90
				Sample Depth (m) Base	
Specimen Reference	1	Specimen Depth	5.90 m	Sample Type	C
Specimen Description	Stiff brown sandy slightly gravelly silty CLAY.			KeyLAB ID	Caus202210142
Test Method	BS1377:Part 7:1990, clause 9, multistage test on a single spe			Date of test	15/10/2022

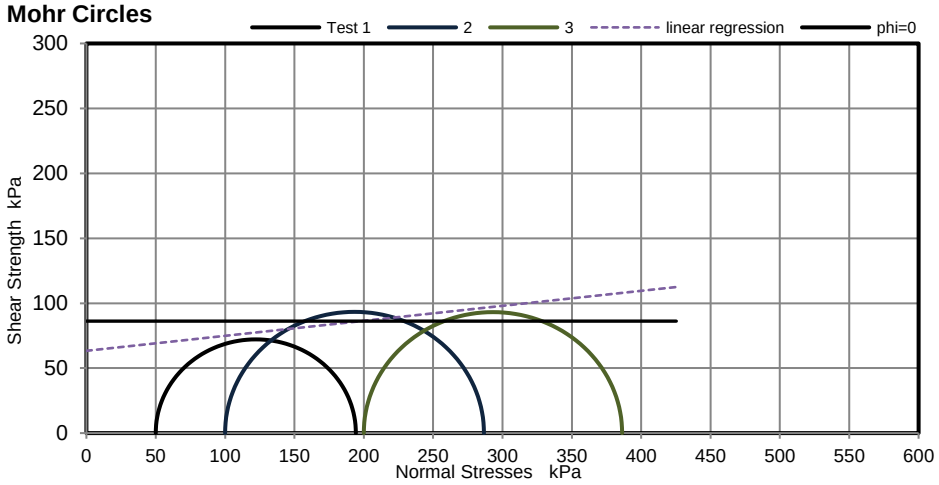
Length	mm	210.0
Diameter	mm	105.4
Bulk Density	Mg/m3	2.32
Moisture Content	%	10.8
Dry Density	Mg/m3	2.09

Rate of Strain		%/min	2.00		
Stage Number			1	2	3
Cell Pressure		kPa	50	100	200
End of stage	Axial Strain	%	12.6	20.0	20.0
	Deviator Stress, (σ1 - σ3) corrected for area and membrane	kPa	144.3	186.7	186.3
	Shear strength, cu	kPa	72.1	93.3	93.1
	Mode of failure				

Deviator Stress v Axial Strain



Mohr Circles



ϕu = 0

Average cu 86 kPa

Linear Regression

ϕu 6.6 °

cu 63 kPa

Mohr circles and their interpretation is not covered by BS1377-7: 1990. These are provided for information only.

Remarks

No failure defined. Testing terminated at 20% axial strain.

Approved: Stephen Watson

Printed: 27/10/2022 16:13

LAB 16R - Version 6

UKAS TESTING

10122

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	22-22463-4		
Initial Date of Issue:	20-Jun-2022	**Date of Re-Issue:**	04-Oct-2022
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllister		
Project	21-1682 Water Supply Project		
Quotation No.:		**Date Received:**	16-Jun-2022
Order No.:	NEIL HAGGAN	**Date Instructed:**	16-Jun-2022
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	24-Jun-2022
Date Approved:	20-Jun-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 21-1682 Water Supply Project

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	22-22463	22-24374	22-24380	22-27152	22-27152	22-27152	22-27152	22-27152	22-29048
Quotation No.:					**Chemtest Sample ID.:**	1449671	1457820	1457840	1470335	1470336	1470337	1470338	1470339	1478980
Order No.: NEIL HAGGAN					Client Sample Ref.:	5	12	18	13	9	11	7	10	14
					Sample Location:	RWRM-BH002	RWRM-BH001	RWRM-BH014	RWRM-BH008	RWRM-BH016	RWRM-BH016	RWRM-BH017	RWRM-BH018	RWRM-BH007
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	3.00	2.00	2.0	1.0	3.0	2.0	2.0	4.0
					Date Sampled:	15-Jun-2022	28-Jun-2022	28-Jun-2022	15-Jul-2022	15-Jul-2022	15-Jul-2022	15-Jul-2022	15-Jul-2022	29-Jul-2022
					Asbestos Lab:				IN-TRAN-D					
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Moisture	N	2030	%	0.020		8.2	9.7	12	6.0	10	11	59	7.7	6.6
pH	U	2010		4.0		8.4	8.7	8.6	7.5	7.3	7.7	7.9	8.4	
pH (2.5:1)	N	2010		4.0										8.6
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010		< 0.010	< 0.010	< 0.010	0.031	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010										< 0.010
Sulphate (Total)	U	2430	%	0.010		< 0.010	< 0.010	< 0.010	0.085	0.014	0.030	< 0.010	0.024	
Sulphate (Acid Soluble)	U	2430	%	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
LOI	U	2610	%	0.10										
Organic Matter	U	2625	%	0.40										

Results - Soil

Project: 21-1682 Water Supply Project

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			22-29048	22-29048	22-29048	22-29048	22-33018	22-33996	22-33996	22-34167	22-35839
Quotation No.:		**Chemtest Sample ID.:**			1478981	1478982	1478983	1478984	1496530	1501096	1501097	1501904	1509275
Order No.: NEIL HAGGAN		Client Sample Ref.:			14	12	22	11	1	1	1	3	5
		Sample Location:			RWRM-BH011	RWRM-BH012	RWRM-BH015	RWRM-BH022	RWRM-BH010	RWRM-BH006	RWRM-BH008A	RWRM-DS-006	RWRM-DS001
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			5.0	3.0	9.0	2.0	4.5	2.2	2.1	1.2	2.7
		Date Sampled:			29-Jul-2022	29-Jul-2022	29-Jul-2022	29-Jul-2022	26-Aug-2022	05-Sep-2022	05-Sep-2022	06-Sep-2022	16-Sep-2022
		Asbestos Lab:											
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	7.5	9.5	7.5	9.1	7.2	6.5	10	21	6.8
pH	U	2010		4.0									
pH (2.5:1)	N	2010		4.0	8.9	8.7	9.0	8.8	9.2	9.0	8.2		8.9
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.011	0.014	< 0.010	0.012	< 0.010	0.025	0.021		0.015
Total Sulphur	U	2175	%	0.010	0.014	0.011	< 0.010	< 0.010	< 0.010	0.027	0.023		0.021
Sulphate (Total)	U	2430	%	0.010									
Sulphate (Acid Soluble)	U	2430	%	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.019	0.010		0.017
LOI	U	2610	%	0.10								9.7	
Organic Matter	U	2625	%	0.40								13	

Results - Soil

Project: 21-1682 Water Supply Project

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		22-35839
Quotation No.:			**Chemtest Sample ID.:**		1509276
Order No.: NEIL HAGGAN			Client Sample Ref.:		6
			Sample Location:		RWRM-DS002
			Sample Type:		SOIL
			Top Depth (m):		3
			Date Sampled:		16-Sep-2022
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	12
pH	U	2010		4.0	
pH (2.5:1)	N	2010		4.0	8.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010
Total Sulphur	U	2175	%	0.010	< 0.010
Sulphate (Total)	U	2430	%	0.010	
Sulphate (Acid Soluble)	U	2430	%	0.010	0.017
LOI	U	2610	%	0.10	
Organic Matter	U	2625	%	0.40	

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

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I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
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LOD	Limit of detection

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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 30 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.com

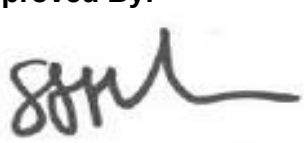
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-39844-1
Initial Date of Issue:	26-Oct-2022
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Alistair McQuat Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraha
Project	21-1682 Water Supply Project

Quotation No.:		**Date Received:**	18-Oct-2022
Order No.:		**Date Instructed:**	18-Oct-2022
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	26-Oct-2022
Date Approved:	26-Oct-2022		

Approved By:



Details: Stuart Henderson, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 21-1682 Water Supply Project

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		22-39844
Quotation No.:			**Chemtest Sample ID.:**		1527424
Order No.:			Client Sample Ref.:		1
			Sample Location:		RWRM-BH027
			Sample Type:		SOIL
			Top Depth (m):		2.20
			Date Sampled:		17-Oct-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	17
pH (2.5:1)	N	2010		4.0	8.3
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.057
Sulphate (Acid Soluble)	U	2430	%	0.010	0.012

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

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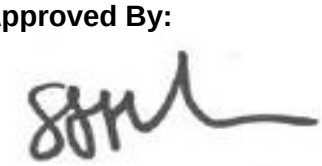
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-40233-1
Initial Date of Issue:	27-Oct-2022
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stuart Abraham Alistair McQuat Carin Cornwall Ciaran Doherty Joe Gervin Lucy Newland Martin Gardiner Megan Walsh Rac
Project	21-1682 Water Supply Project

Quotation No.:		**Date Received:**	20-Oct-2022
Order No.:		**Date Instructed:**	20-Oct-2022
No. of Samples:	8		
Turnaround (Wkdays):	7	**Results Due:**	28-Oct-2022
Date Approved:	27-Oct-2022		

Approved By:



Details: Stuart Henderson, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 21-1682 Water Supply Project

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		22-40233	
Quotation No.:			**Chemtest Sample ID.:**		1529295	
Order No.:			Client Sample Ref.:		2	
			Sample Location:		RWRM-BH028	
			Sample Type:		SOIL	
			Top Depth (m):		4.5	
			Date Sampled:		19-Oct-2022	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	8.2	
pH (2.5:1)	N	2010		4.0	8.8	
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	
Total Sulphur	U	2175	%	0.010	< 0.010	
Sulphate (Acid Soluble)	U	2430	%	0.010	< 0.010	

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
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2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
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customerservices@chemtest.com

LABORATORY RESTRICTION REPORT

Project Reference	21-1682	To	Neil Haggan
Project Name	Eastern and Midlands Region WSP GI - Lot 1 Raw Water Rising Main (RWRM)	Position	Project Manager
		From	Joseph Nicholl
TR reference	21-1682 / RWRM	Position	Laboratory Quality Manager

The following sample(s) and test(s) are restricted as detailed below. Could you please complete the "Required Action" column and return the completed form to the laboratory.

Hole Number	Sample			Test Type	Reason for Restriction	Required Action
	Number	Depth (m)	Type			
RWRM-BH001	19	7.50	U	UU Triaxial	Insufficient intact material to obtain test specimen - 40% recovery	CANCEL TEST
RWRM-BH002	18	6.30	U	UU Triaxial	Insufficient material to obtain test specimen - 35% recovery	CANCEL TEST
RWRM-BH008A		16.90	C	UU triaxial (single stage)	Material was too granular to obtain test specimen	Alternate specimen taken at 15.40-15.70m (C10)
RWRM-BH009	9	2.00	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 40% recovery	CANCEL TEST No alternate test required
RWRM-BH009	10	5.00	U	UU Triaxial (multistage)	Multistage testing not suitable	Reported as single stage test.
RWRM-BH011	17	1.20	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 60% recovery	CANCEL TEST
RWRM-BH012	18	6.00	U	UU Triaxial (multistage)	Insufficient material to obtain test specimen after Oedometer test - 50% recovery	CANCEL TEST
RWRM-BH012	2	14.60	C	UU triaxial (multistage)	Multistage testing not suitable. Max capacity of load ring met	Reported as single stage test
RWRM-BH013	1	1.20	U	UU Triaxial (Multistage)	Insufficient intact material to obtain test specimen after Oedometer test - 30% recovery	CANCEL TEST
RWRM-BH013	2	13.50	C	UU triaxial (multistage)	Multistage testing not suitable. Sample failed when attempting to boost to stage 2.	Reported as single stage test
RWRM-BH014	4	3.00	B	CBR	>25% retained on 20mm sieve Insufficient material to conduct test	CANCEL TEST
RWRM-BH014	19	1.20	U	UU Triaxial	Insufficient intact material to obtain test specimen after Oedometer test - 40% recovery	CANCEL TEST
RWRM-BH014	21	6.00	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 50% recovery	CANCEL TEST
RWRM-BH015	18	5.00	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 70% recovery	CANCEL TEST
RWRM-BH015	25	9.00	U	UU Triaxial (multistage)	Insufficient intact material to obtain test specimen (sample disturbed) - 50% recovery	CANCEL TEST
RWRM-BH016	16	4.00	U	UU Triaxial (multistage)	Insufficient intact material to obtain test specimen after Oedometer test - 50% recovery	CANCEL TEST No alternate test required

LABORATORY RESTRICTION REPORT

Project Reference	21-1682	To	Neil Haggan
Project Name	Eastern and Midlands Region WSP GI - Lot 1 Raw Water Rising Main (RWRM)	Position	Project Manager
		From	Joseph Nicholl
TR reference	21-1682 / RWRM	Position	Laboratory Quality Manager

The following sample(s) and test(s) are restricted as detailed below. Could you please complete the "Required Action" column and return the completed form to the laboratory.

Hole Number	Sample			Test Type	Reason for Restriction	Required Action
	Number	Depth (m)	Type			
RWRM-BH017	27	10.50	U	UU Triaxial	Insufficient intact material to obtain test specimen after Oedometer test - 50% recovery	CANCEL TEST
RWRM-BH018	15	3.00	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 30% recovery	CANCEL TEST No alternate test required
RWRM-BH018	16	6.00	U	UU Triaxial (multistage)	Insufficient intact material to obtain test specimen (sample disturbed) - 50% recovery	CANCEL TEST No alternate test required
RWRM-BH018		14.20	C	Oedometer	No suitable sample	Substitute sample taken at 16.30-16.50m (C2)
RWRM-BH018		14.20	C	UU triaxial (multistage)	No suitable sample	Substitute sample taken at 15.70-16.00m (C2)
RWRM-BH018	2	15.70	C	UU triaxial (multistage)	Unable to form suitable test specimen due to the high gravel content throughout sample.	CANCEL TEST
RWRM-BH019	9	1.20	U	UU Triaxial	Insufficient intact material to obtain test specimen (sample disturbed) - 50% recovery	CANCEL TEST No alternate test required
RWRM-BH019		9.00	C	UU triaxial (multistage)	Material was too granular to obtain test specimen	Alternate specimen taken at 12.20-12.50m (C4)
RWRM-BH020		9.80	C	Oedometer	Material was too granular to obtain test specimen	Alternative test, suitable sample from 11.10-11.45m (C2) Test pressures 100/200/ 400/800/1200/400/400kpa.
RWRM-BH021	18	4.00	U	UU Triaxial (Multistage)	No failure incrementals met. Multistage test not suitable.	Testing reported as single stage test

For electronic reporting a form of electronic signature or printed name is acceptable

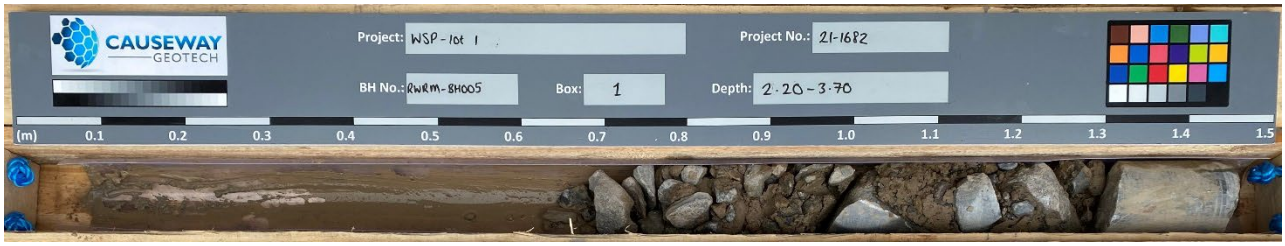
Laboratory Signature	Project Manager Signature
Joseph Nicholl	Neil Haggan
Date	Date
28 November 2022	28 November 2022

CAUSEWAY GEOTECH

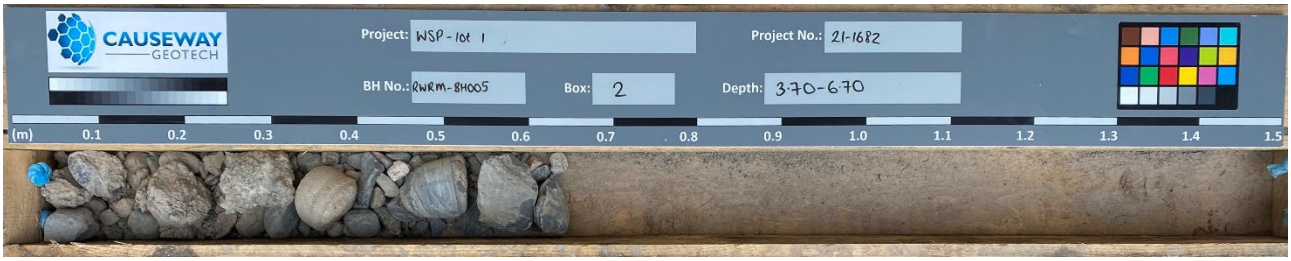
APPENDIX 2I

CORE PHOTOGRAPHS
TRIAL PIT PHOTOGRAPHS

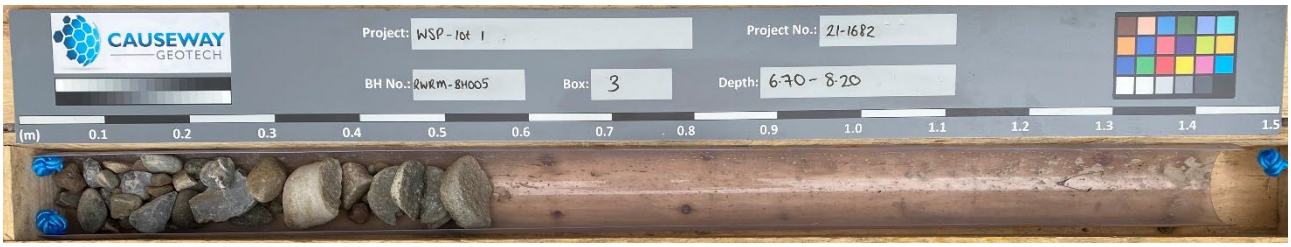




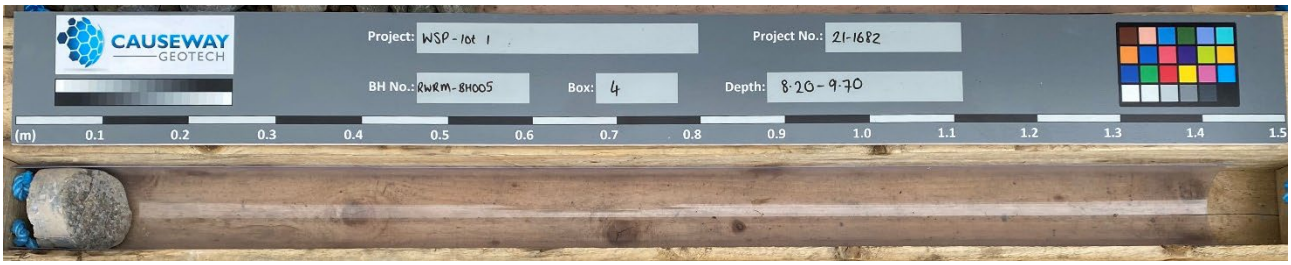
RWRM-BH005 Box 1 (2.20-3.70m)



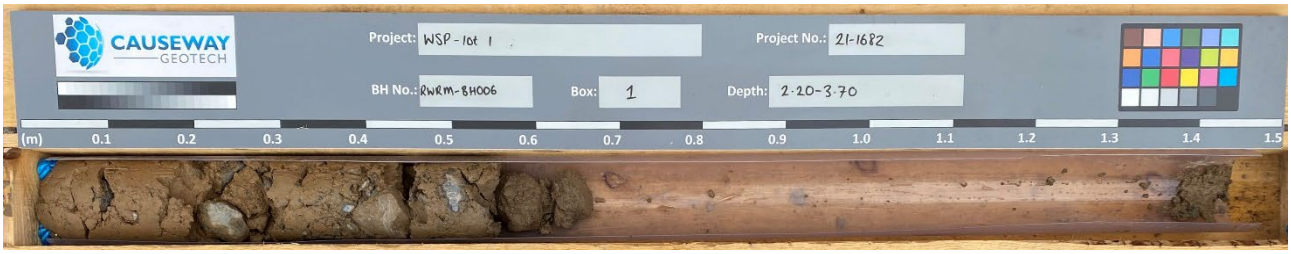
RWRM-BH005 Box 2 (3.70-6.70m)



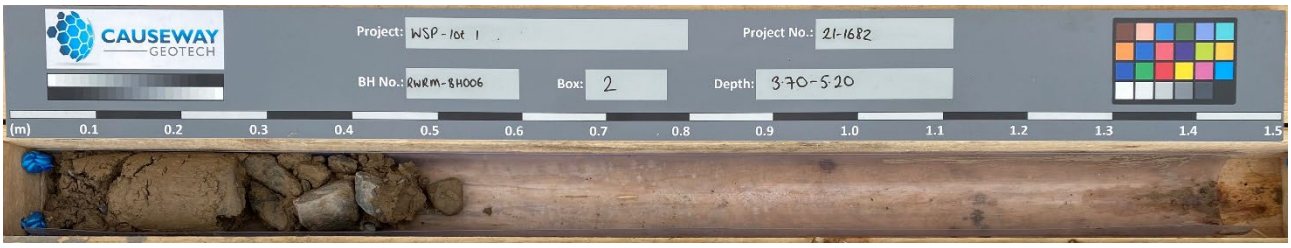
RWRM-BH005 Box 3 (6.70-8.20m)



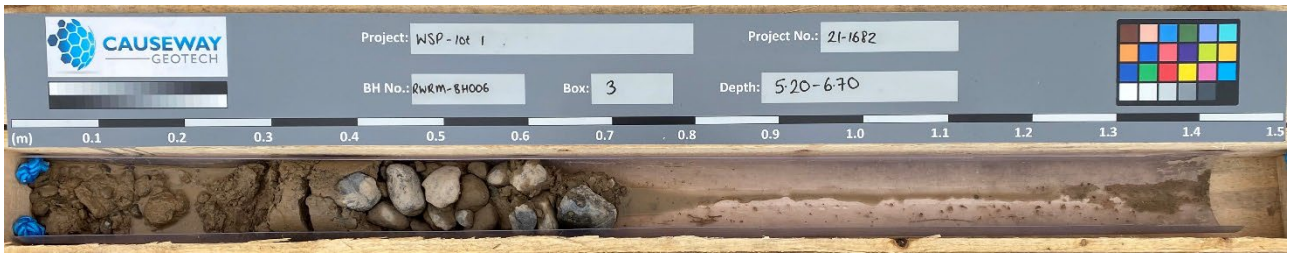
RWRM-BH005 Box 4 (8.20-9.70m)



RWRM-BH006 Box 1 (2.20-3.70m)

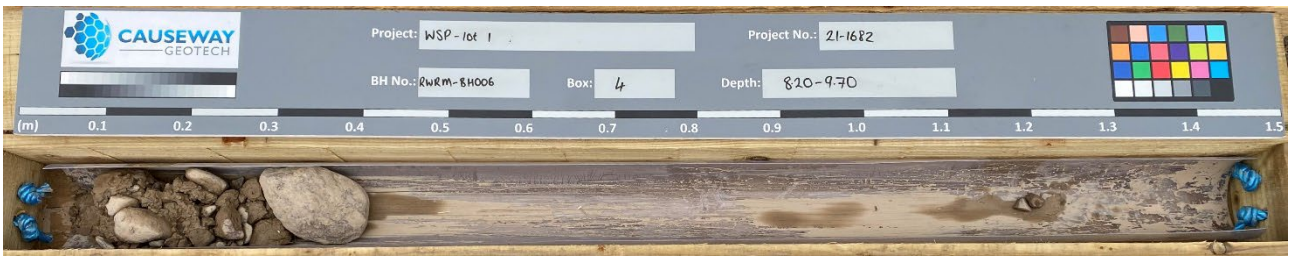


RWRM-BH006 Box 2 (3.70-5.20m)

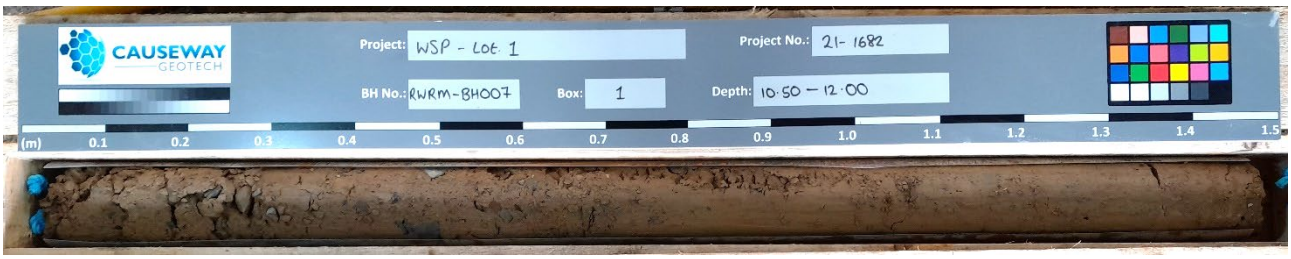


RWRM-BH006 Box 3 (5.20-6.70m)

No Core Recovery (6.70-8.20m)



RWRM-BH006 Box 4 (8.20-9.70m)



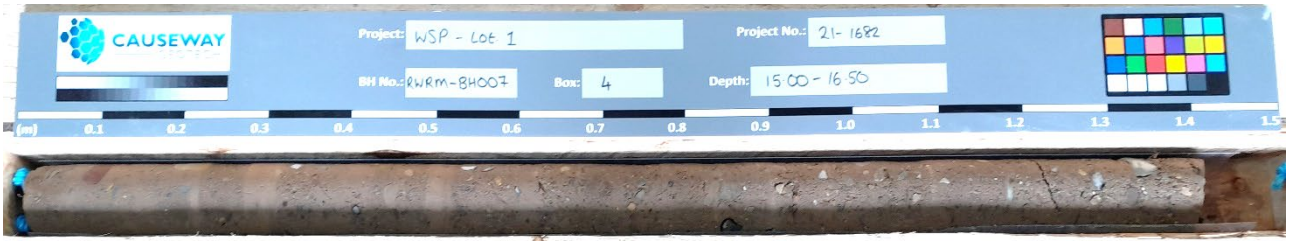
RWRM-BH007 Box 1 (10.50-12.00m)



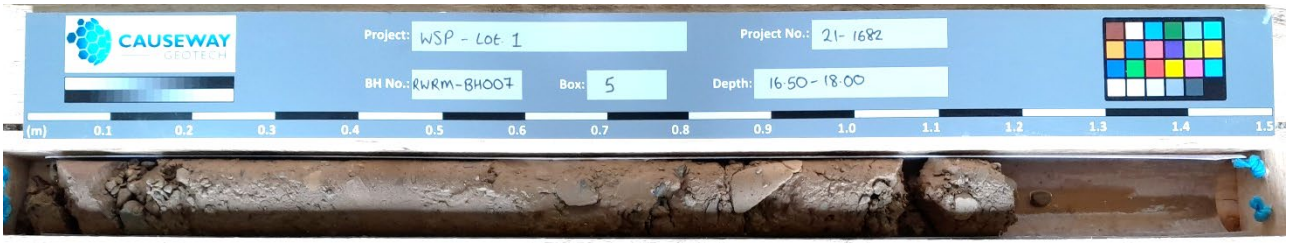
RWRM-BH007 Box 2 (12.00-13.50m)



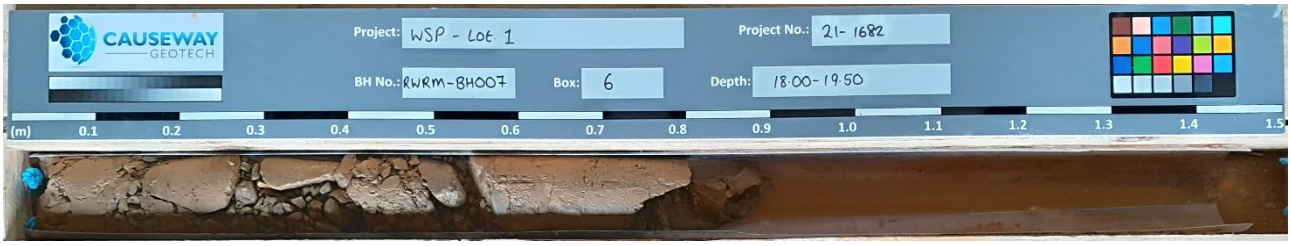
RWRM-BH007 Box 3 (13.50-15.00m)



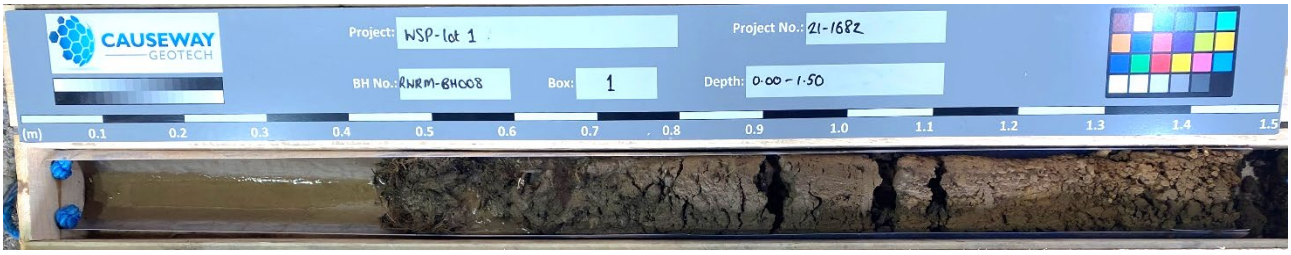
RWRM-BH007 Box 4 (15.00-16.50m)



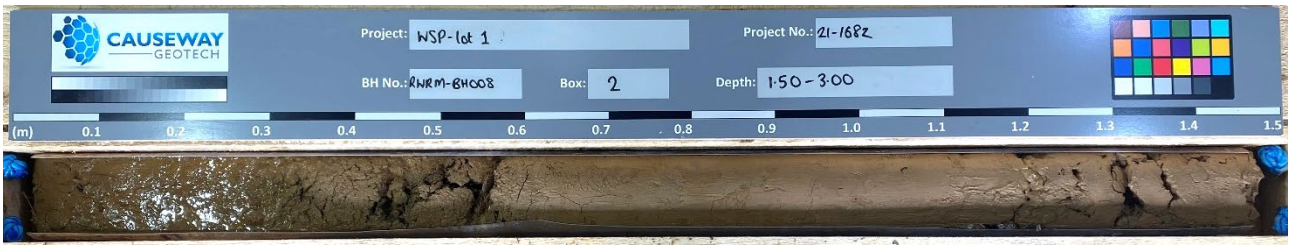
RWRM-BH007 Box 5 (16.50-18.00m)



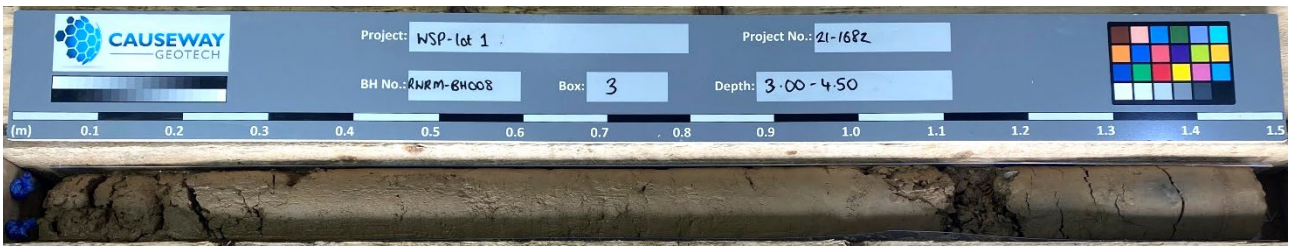
RWRM-BH007 Box 6 (18.00-19.50m)



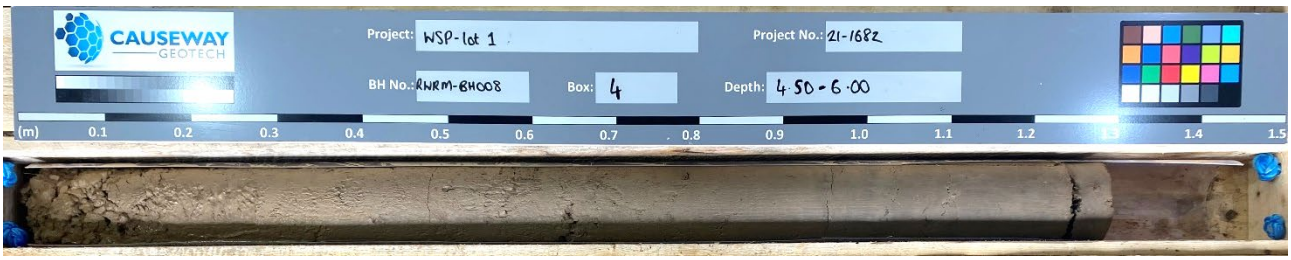
RWRM-BH008A Box 1 (0.00-1.50m)



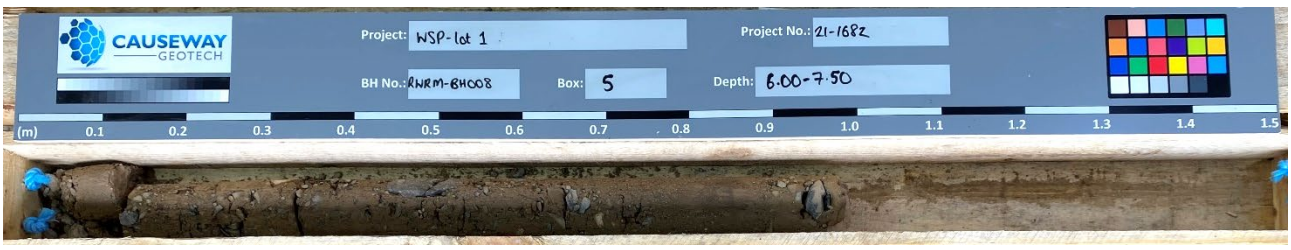
RWRM-BH008A Box 2 (1.50-3.00m)



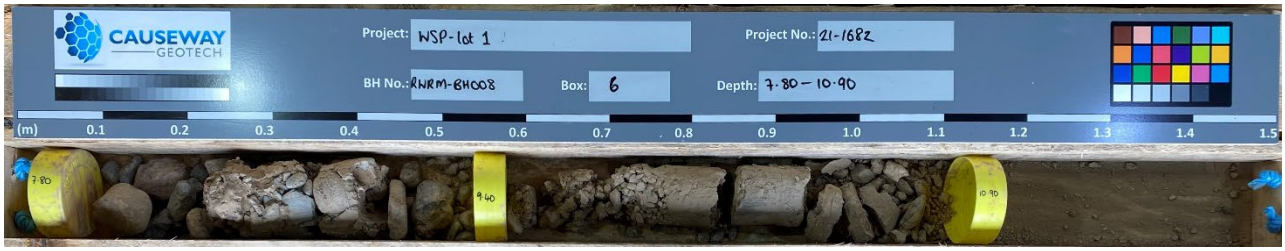
RWRM-BH008A Box 3 (3.00-4.50m)



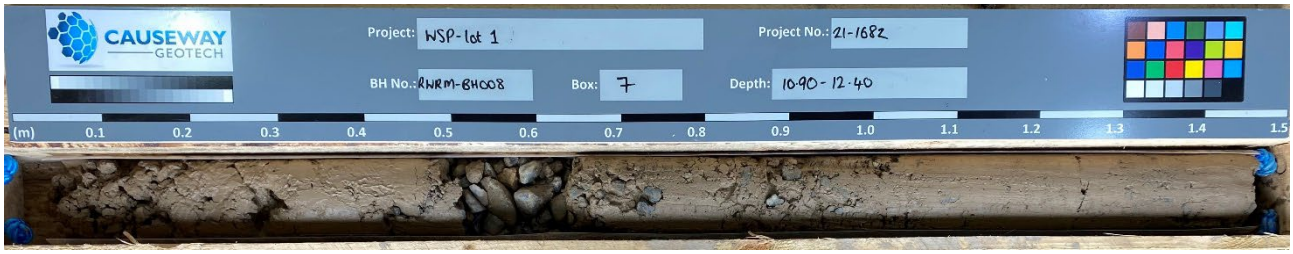
RWRM-BH008A Box 4 (4.50-6.00m)



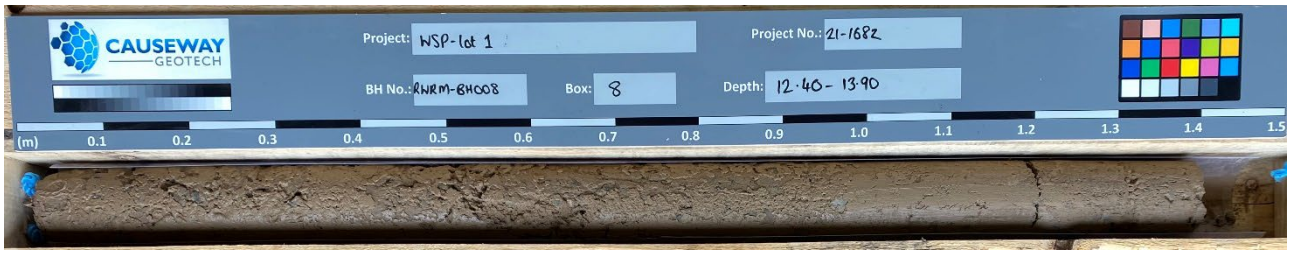
RWRM-BH008A Box 5 (6.00-7.50m)



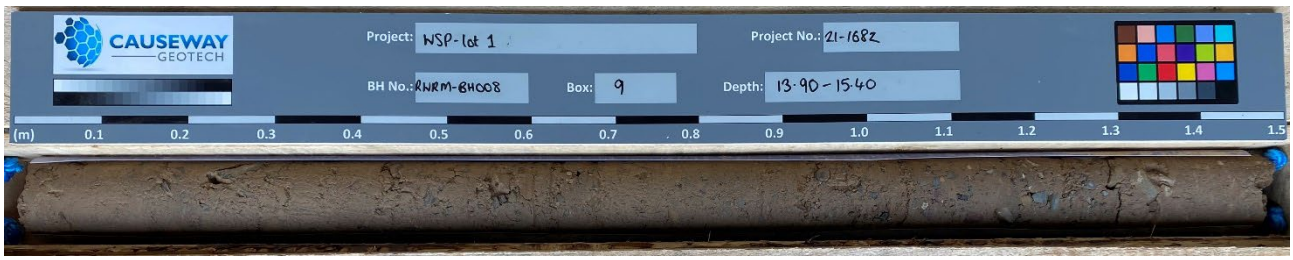
RWRM-BH008A Box 6 (7.80-10.90m)



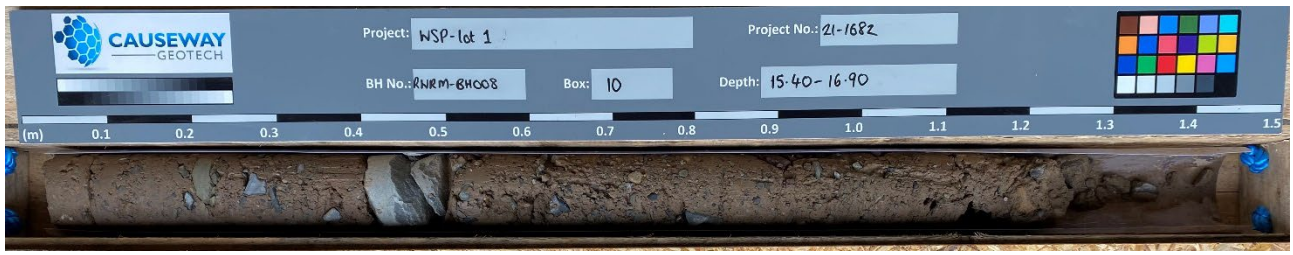
RWRM-BH008A Box 7 (10.90-12.40m)



RWRM-BH008A Box 8 (12.40-13.90m)



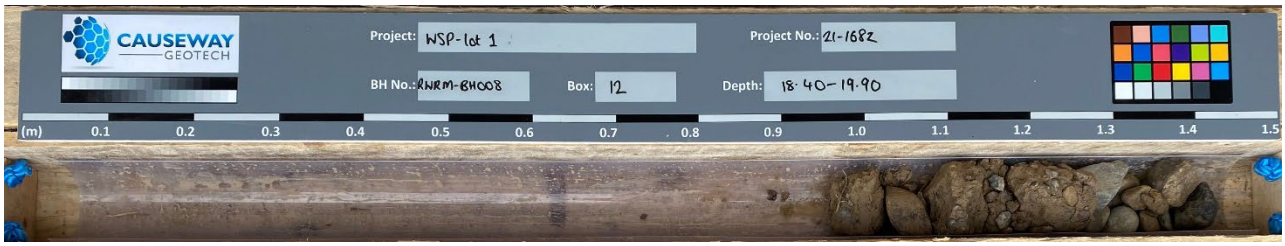
RWRM-BH008A Box 9 (13.90-15.40m)



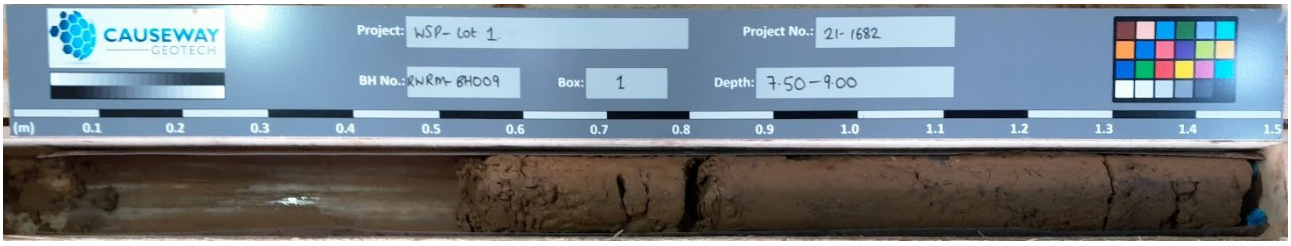
RWRM-BH008A Box 10 (15.40-16.90m)



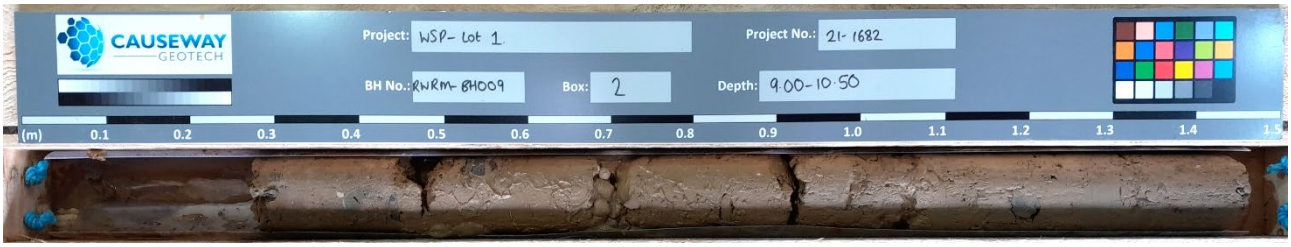
RWRM-BH008A Box 11 (16.90-18.40m)



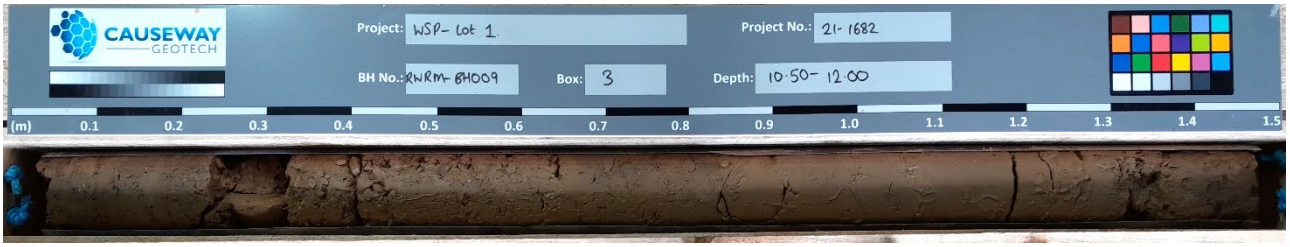
RWRM-BH008A Box 12 (18.40-19.90m)



RWRM-BH009 Box 1 (7.50-9.00m)



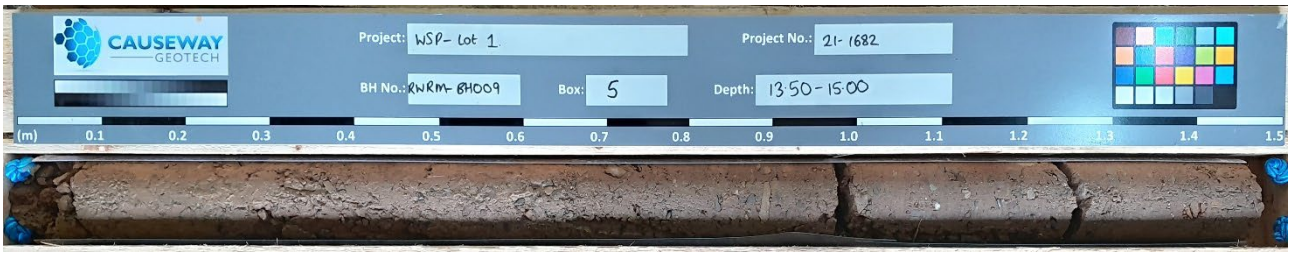
RWRM-BH009 Box 2 (9.00-10.50m)



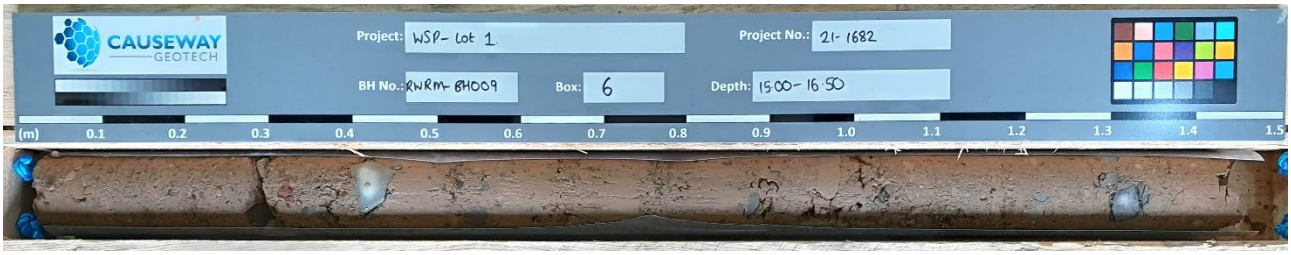
RWRM-BH009 Box 3 (10.50-12.00m)



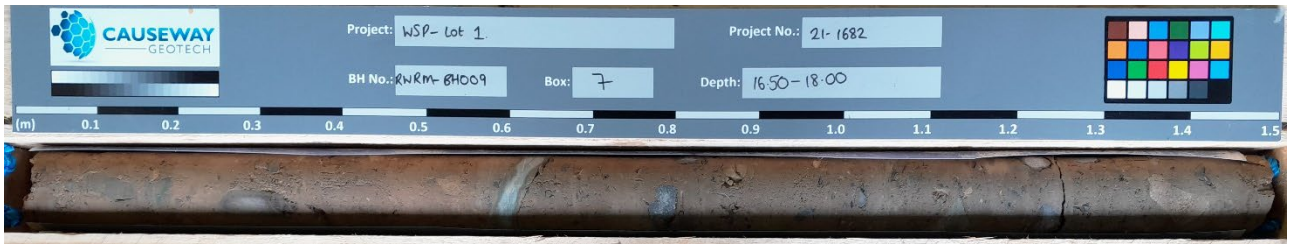
RWRM-BH009 Box 4 (12.00-13.50m)



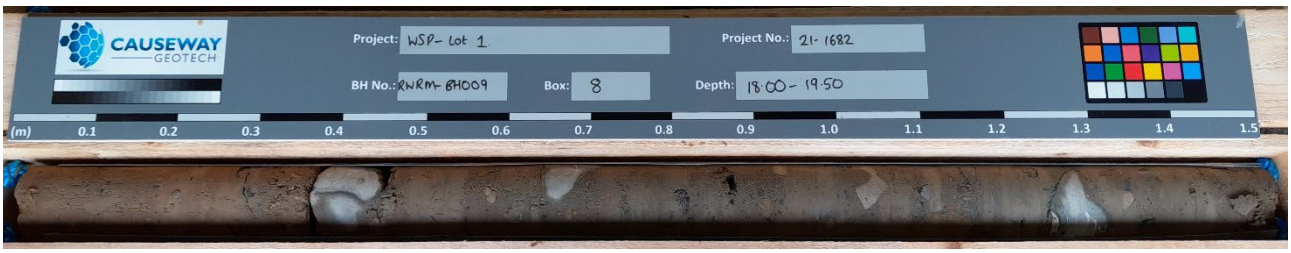
RWRM-BH009 Box 5 (13.50-15.00m)



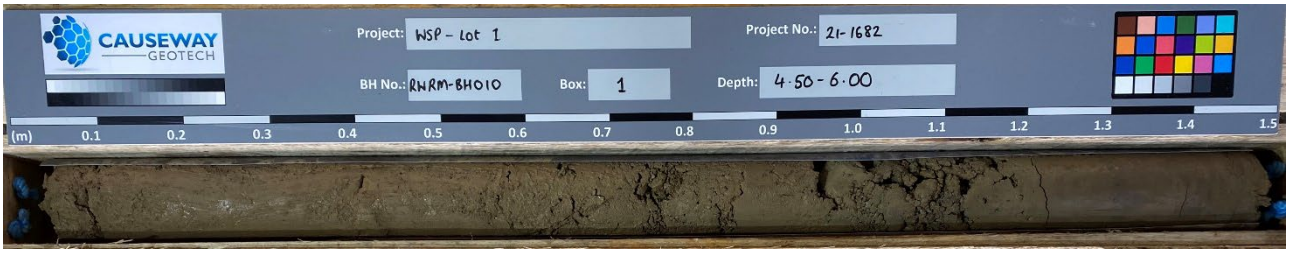
RWRM-BH009 Box 6 (15.00-16.50m)



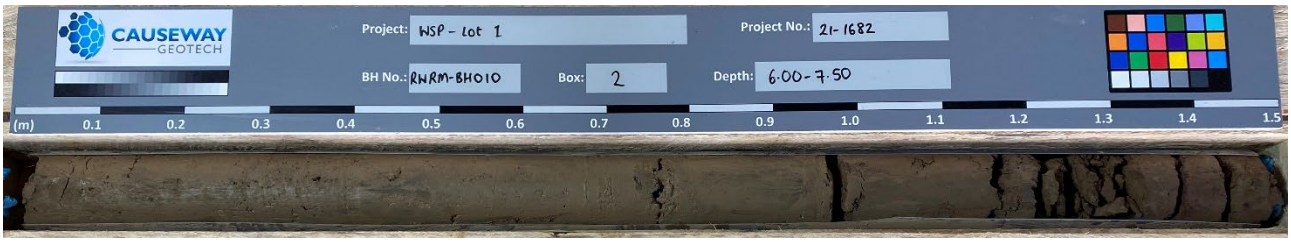
RWRM-BH009 Box 7 (16.50-18.00m)



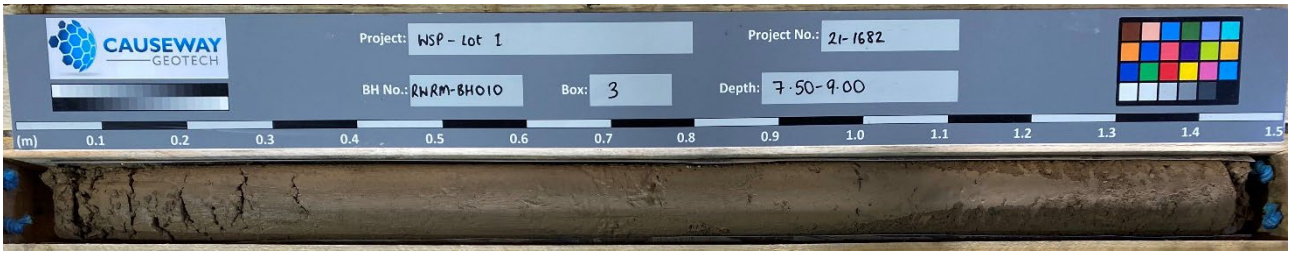
RWRM-BH009 Box 8 (18.00-19.50m)



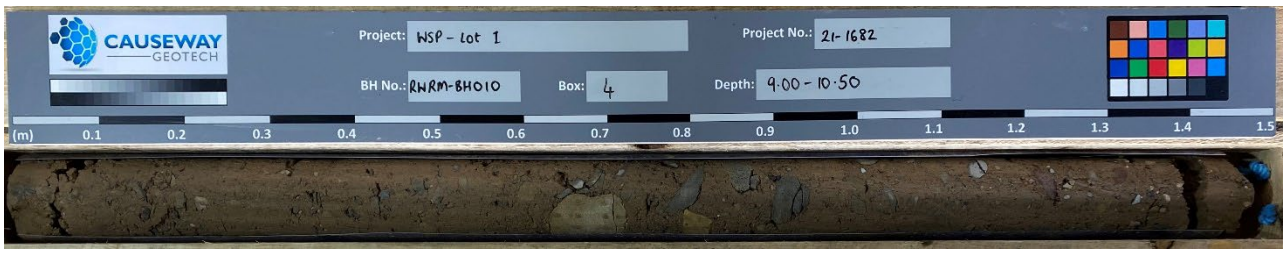
RWRM-BH010 Box 1 (4.50-6.00m)



RWRM-BH010 Box 2 (6.00-7.50m)



RWRM-BH010 Box 3 (7.50-9.00m)



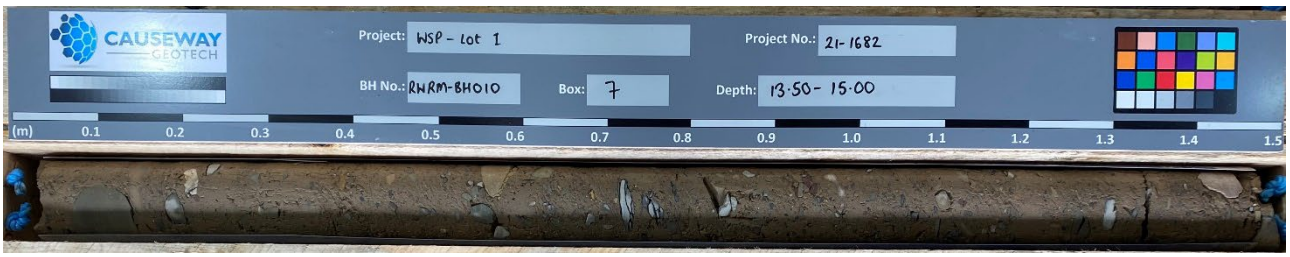
RWRM-BH010 Box 4 (9.00-10.50mm)



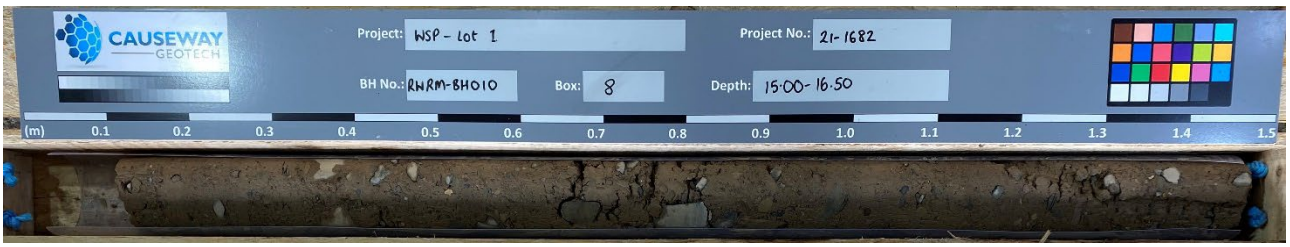
RWRM-BH010 Box 5 (10.50-12.00m)



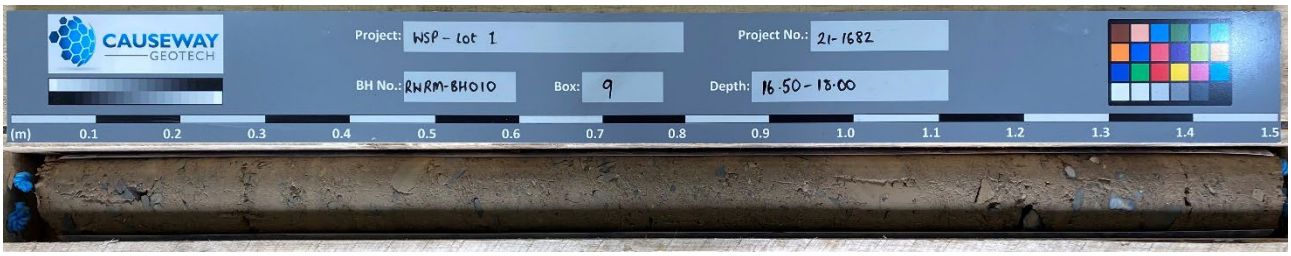
RWRM-BH010 Box 6 (12.00-13.50m)



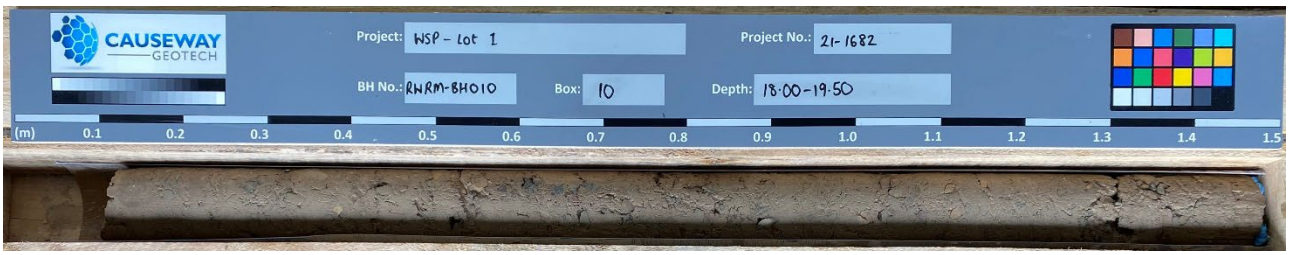
RWRM-BH010 Box 7 (13.50-15.00m)



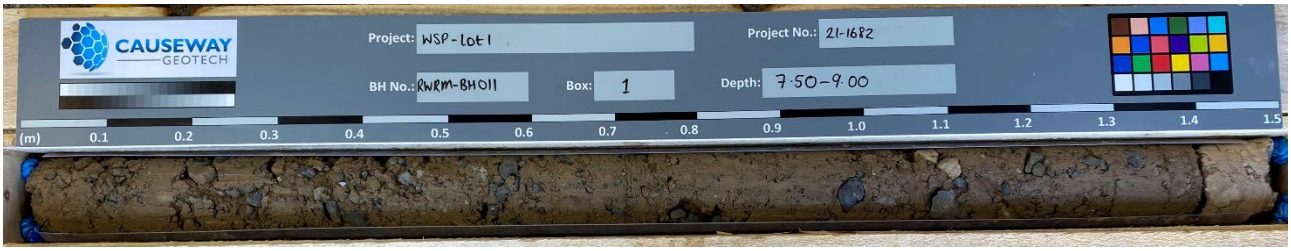
RWRM-BH010 Box 8 (15.00-16.50m)



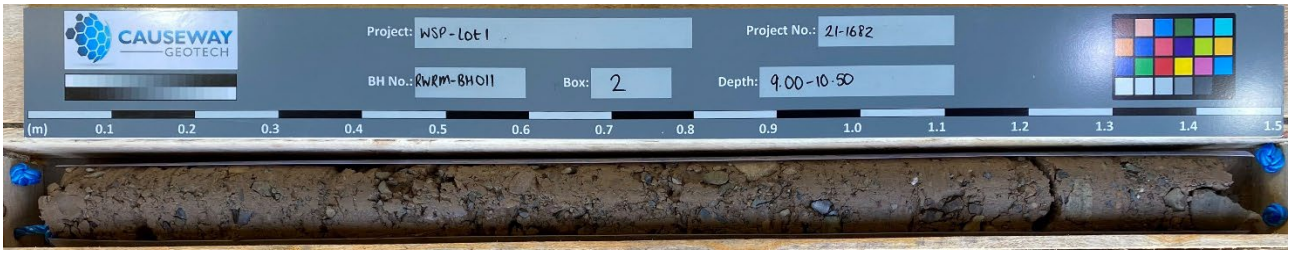
RWRM-BH010 Box 9 (16.50-18.00m)



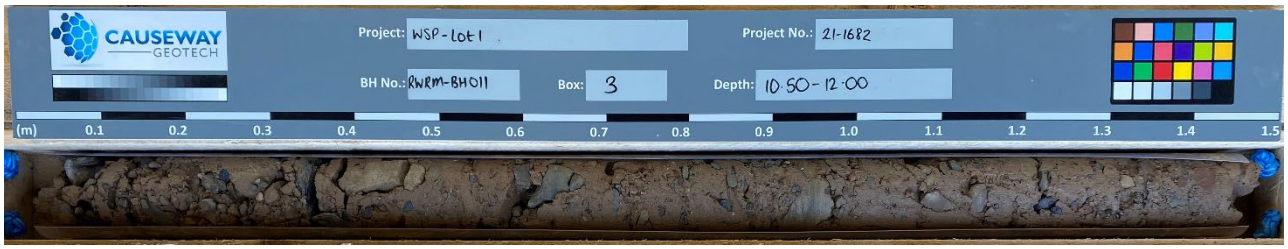
RWRM-BH010 Box 10 (18.00-19.50m)



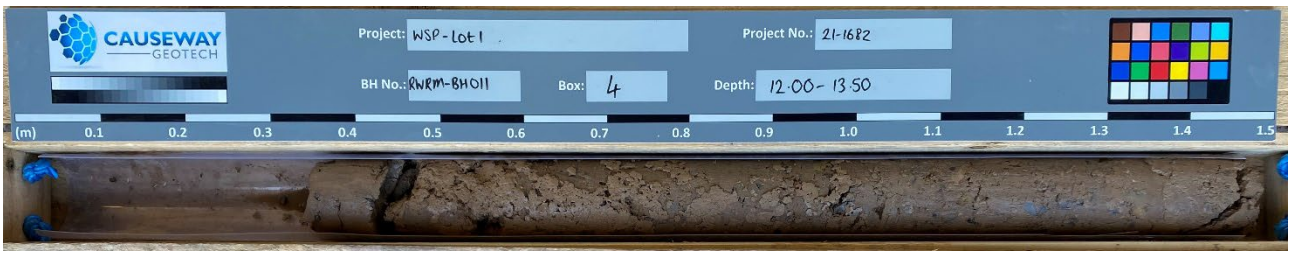
RWRM-BH011 Box 1 (7.50-9.00m)



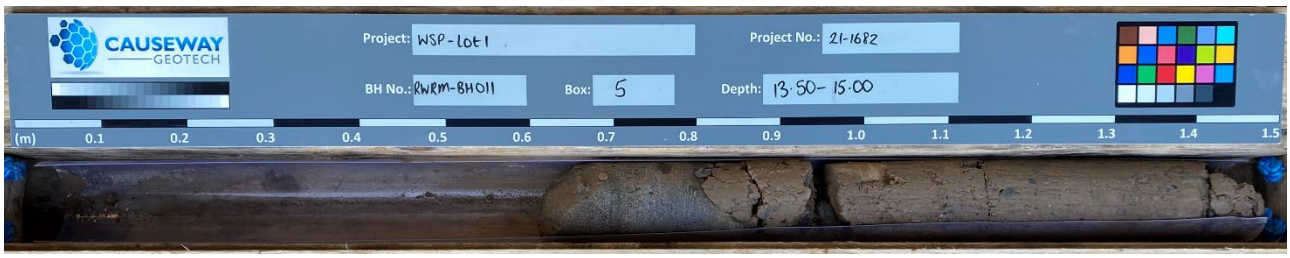
RWRM-BH011 Box 2 (9.00-10.50m)



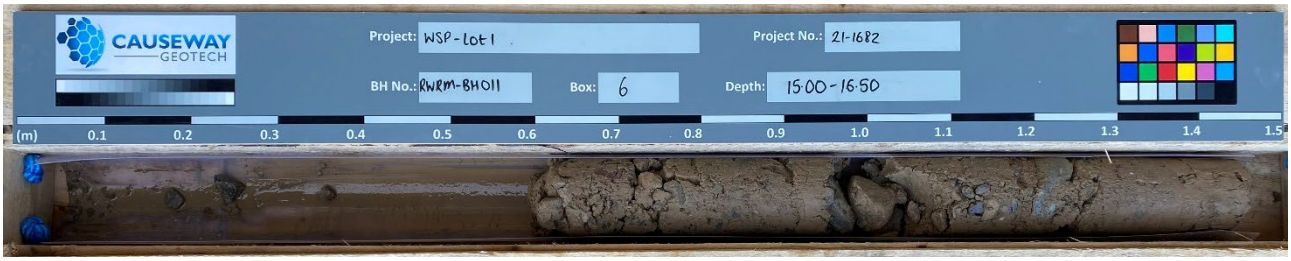
RWRM-BH011 Box 3 (10.50-12.00m)



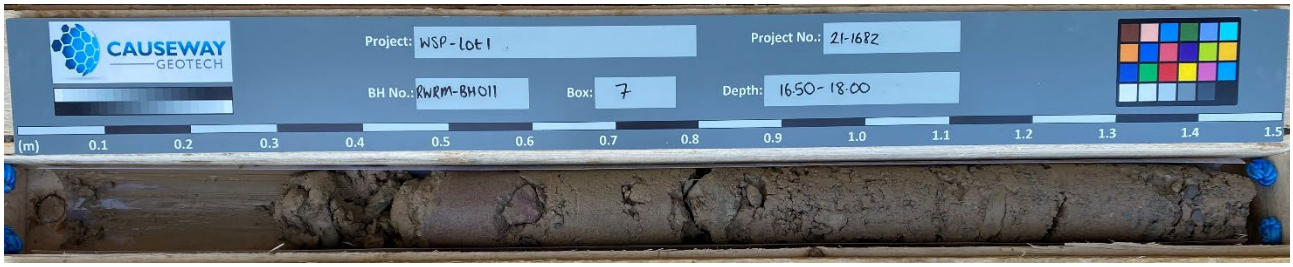
RWRM-BH011 Box 4 (12.00-13.50m)



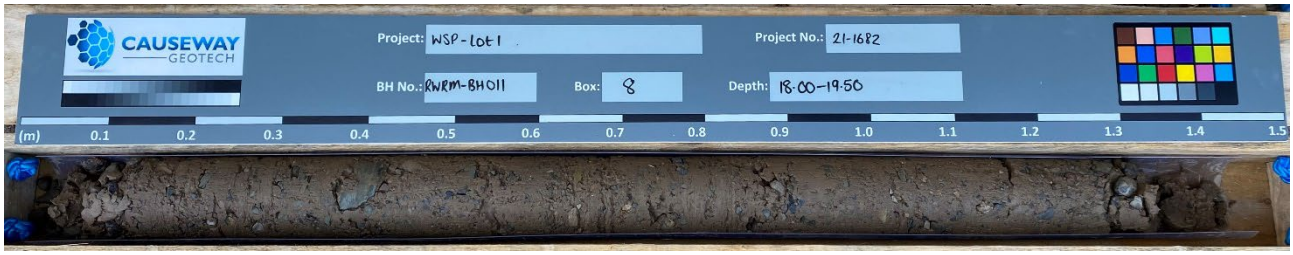
RWRM-BH011 Box 5 (13.50-15.00m)



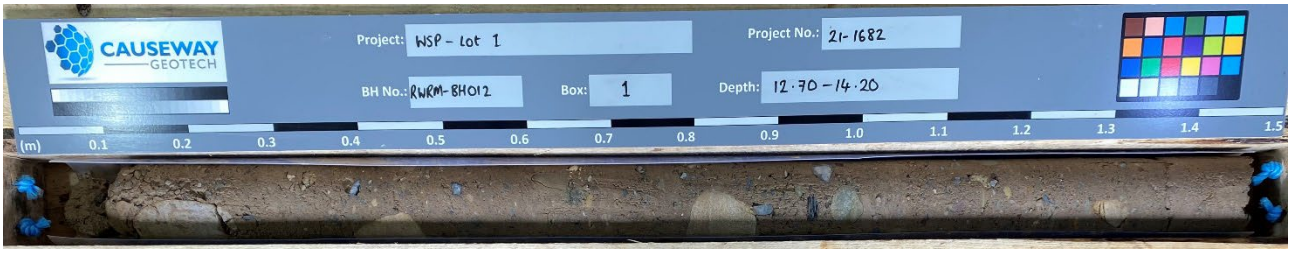
RWRM-BH011 Box 6 (15.00-16.50m)



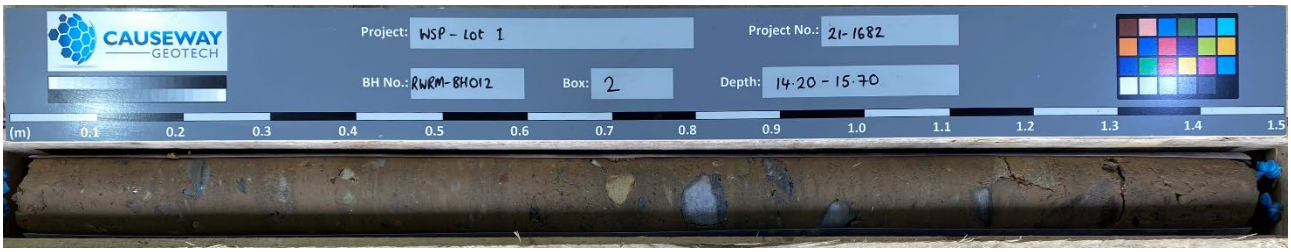
RWRM-BH011 Box 7 (16.50-18.00m)



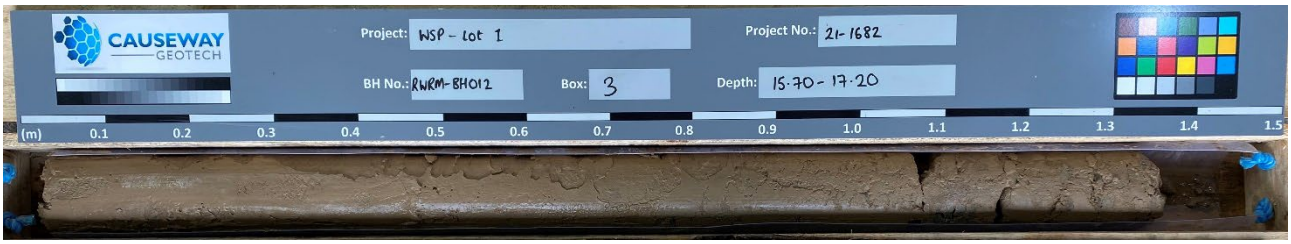
RWRM-BH011 Box 8 (18.00-19.50m)



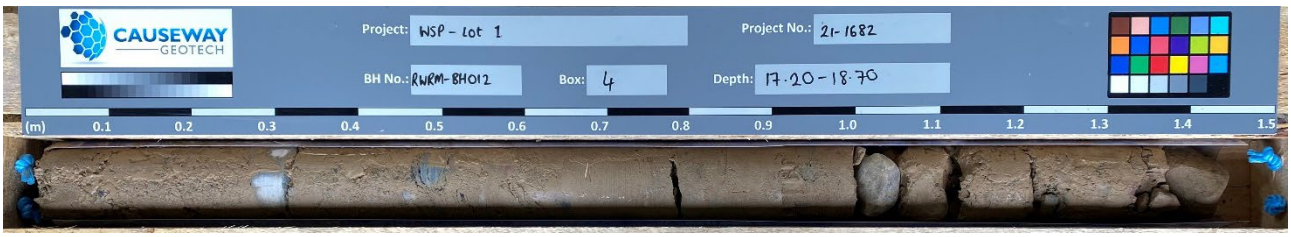
RWRM-BH012 Box 1 (12.70-14.20m)



RWRM-BH012 Box 2 (14.20-15.70m)



RWRM-BH012 Box 3 (15.70-17.20m)



RWRM-BH012 Box 4 (17.20-18.70m)



RWRM-BH012 Box 5 (18.70-20.20m)



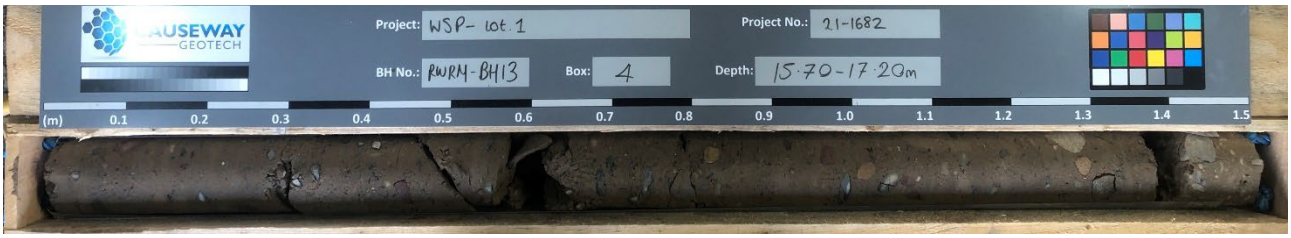
RWRM-BH013 Box 1 (11.20-12.70m)



RWRM-BH013 Box 2 (12.70-14.20m)



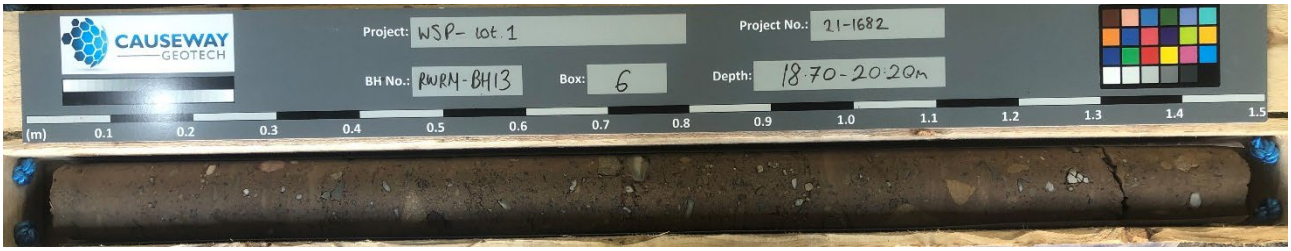
RWRM-BH013 Box 3 (14.20-15.70m)



RWRM-BH013 Box 4 (15.70-17.20m)



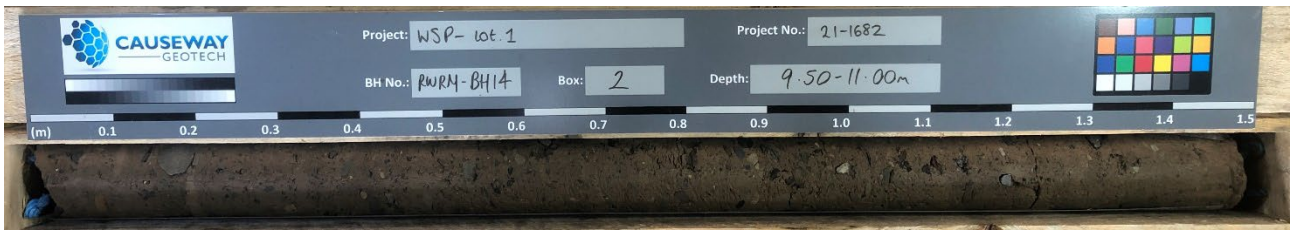
RWRM-BH013 Box 5 (17.20-18.70m)



RWRM-BH013 Box 6 (18.70-20.20m)

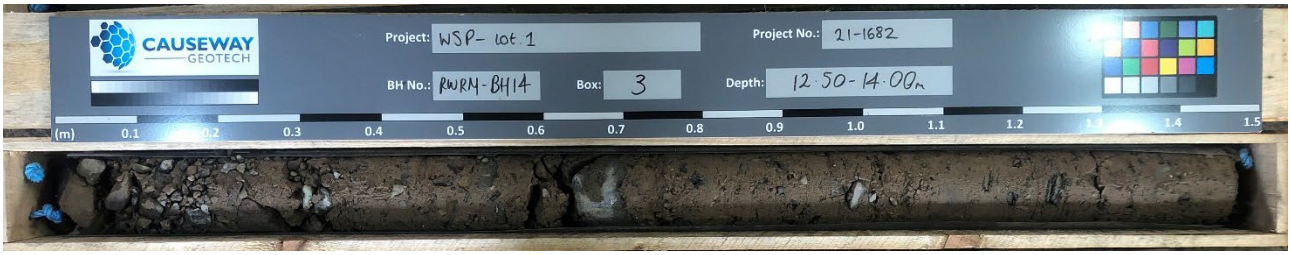


RWRM-BH014 Box 1 (8.00-9.50m)



RWRM-BH014 Box 2 (9.50-11.00m)

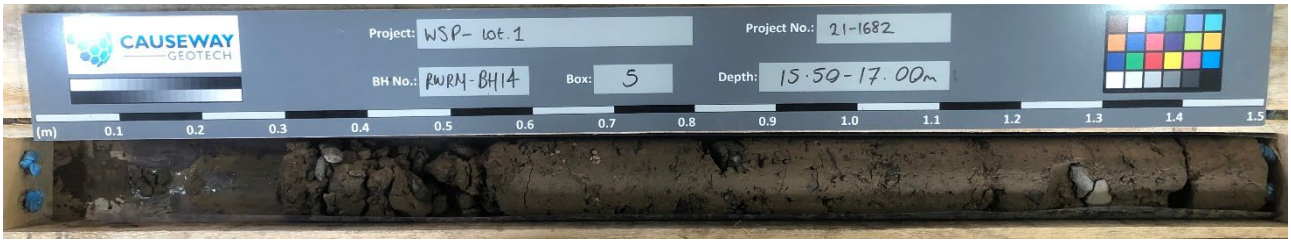
HPD Test Pocket (no core recovery) 11.00-12.50m



RWRM-BH014 Box 3 (12.50-14.00m)



RWRM-BH014 Box 4 (14.00-15.50m)



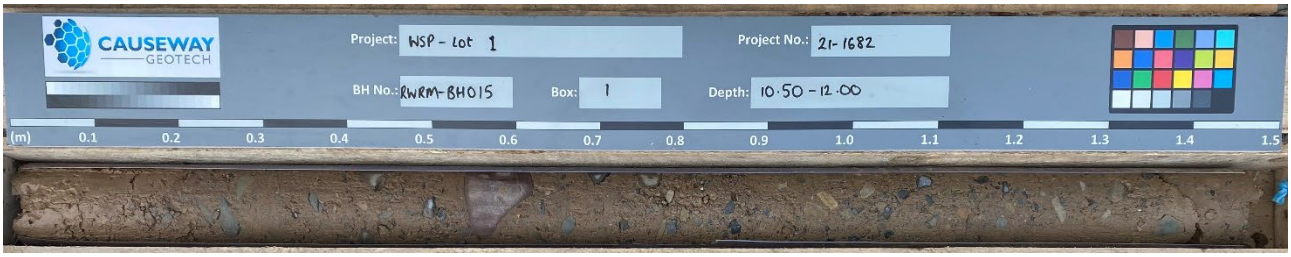
RWRM-BH014 Box 5 (15.50-17.00m)



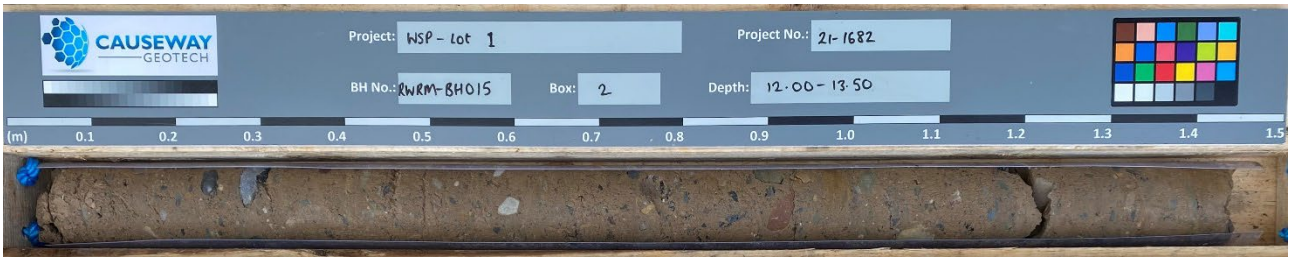
RWRM-BH014 Box 6 (17.00-18.50m)



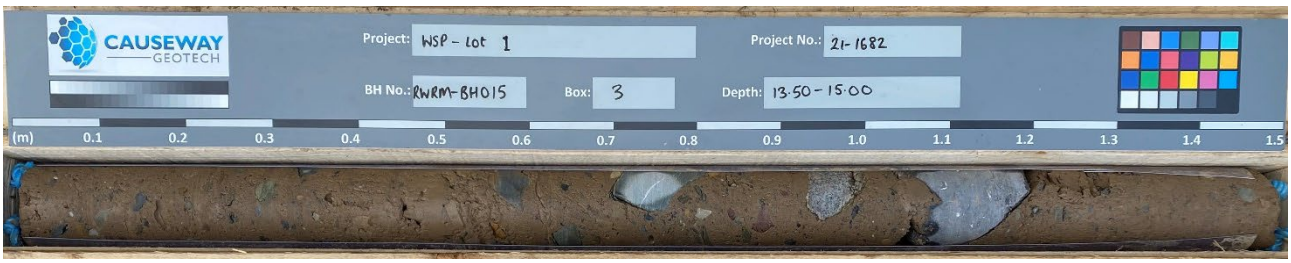
RWRM-BH014 Box 7 (18.50-20.00m)



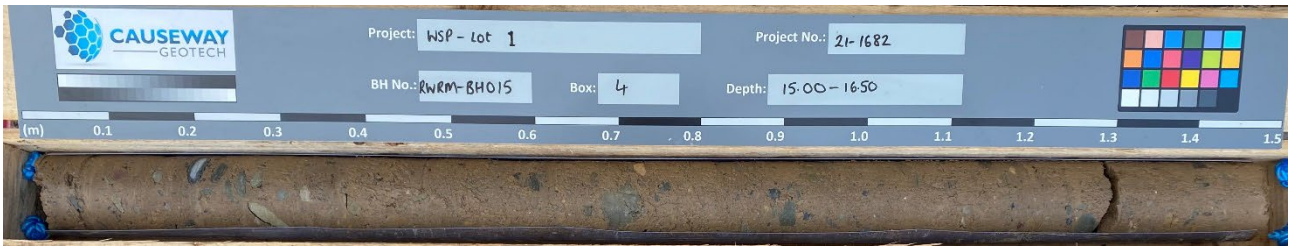
RWRM-BH015 Box 1 (10.50-12.00m)



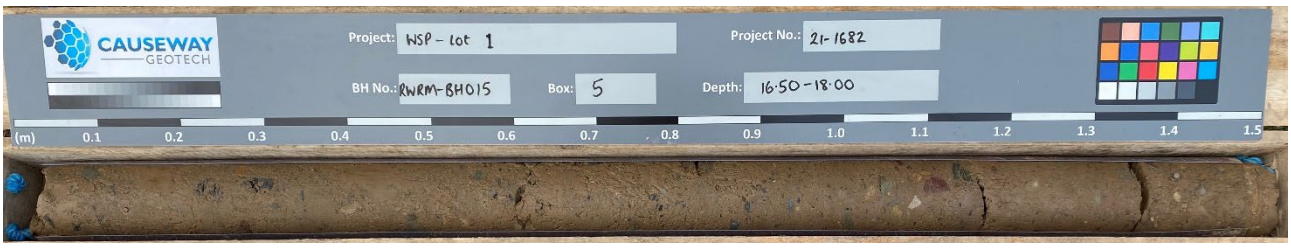
RWRM-BH015 Box 2 (12.00-13.50m)



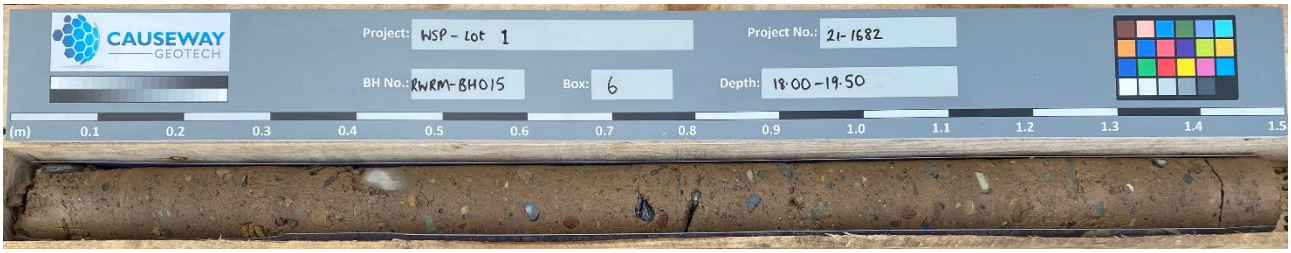
RWRM-BH015 Box 3 (13.50-15.00m)



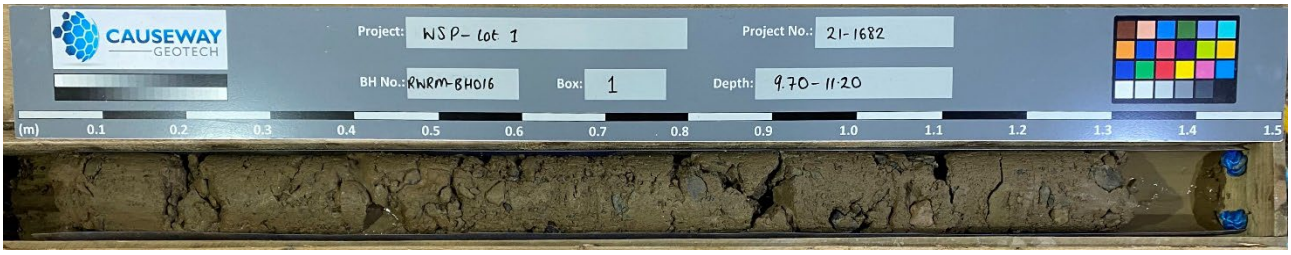
RWRM-BH015 Box 4 (15.00-16.50m)



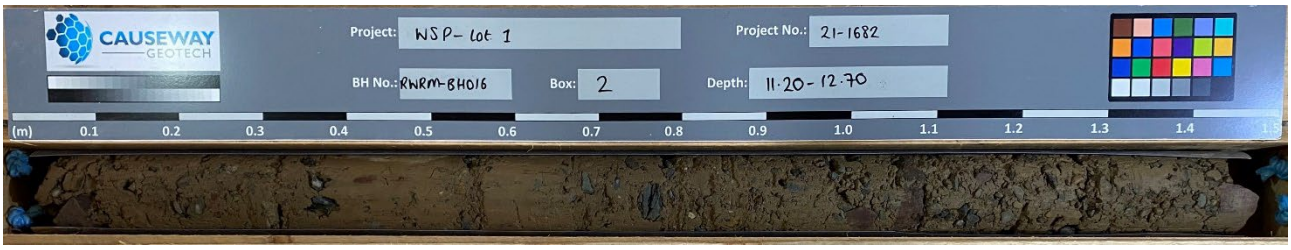
RWRM-BH015 Box 5 (16.50-18.00m)



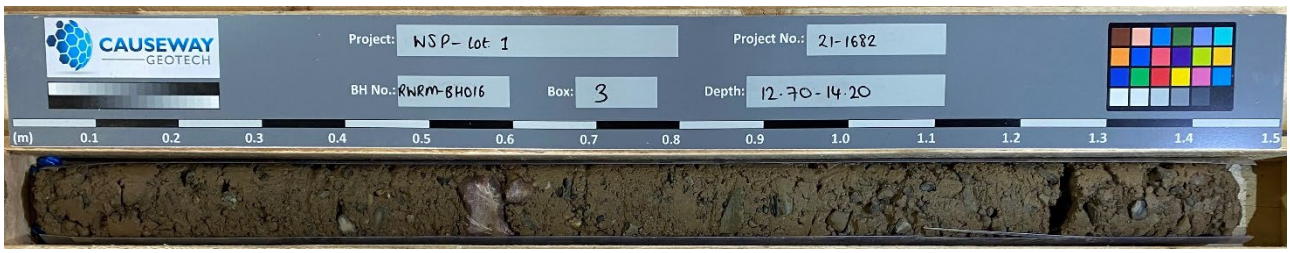
RWRM-BH015 Box 6 (18.00-19.50m)



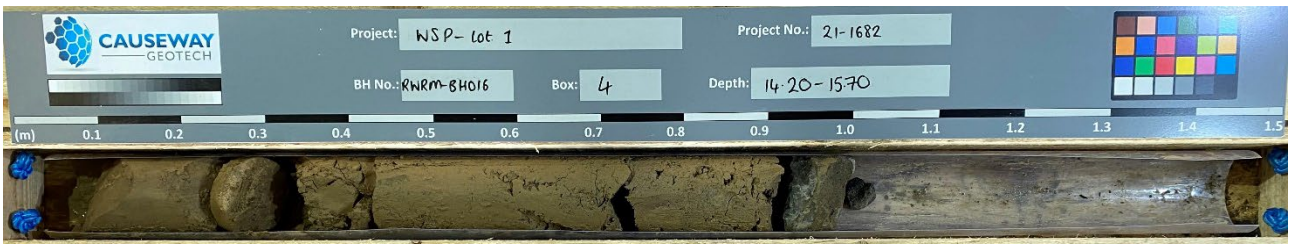
RWRM-BH016 Box 1 (9.70-11.20m)



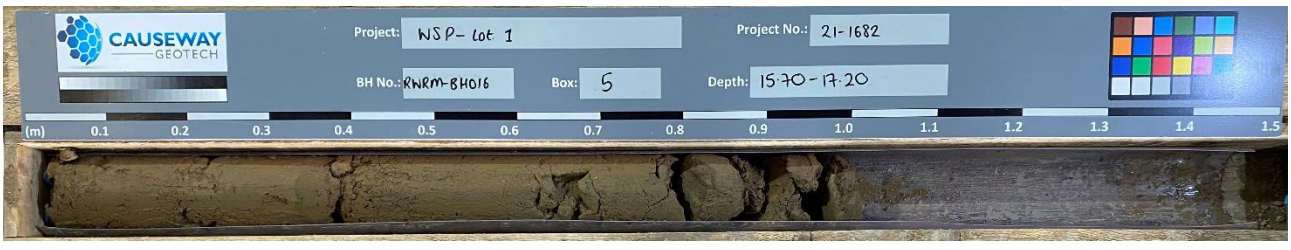
RWRM-BH016 Box 2 (11.20-12.70m)



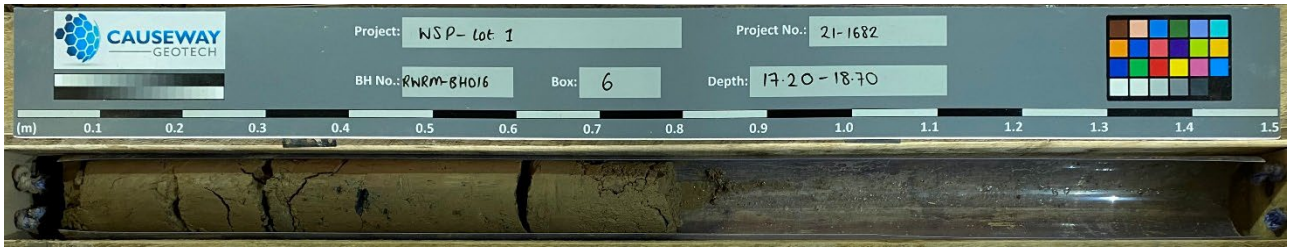
RWRM-BH016 Box 3 (12.70-14.20m)



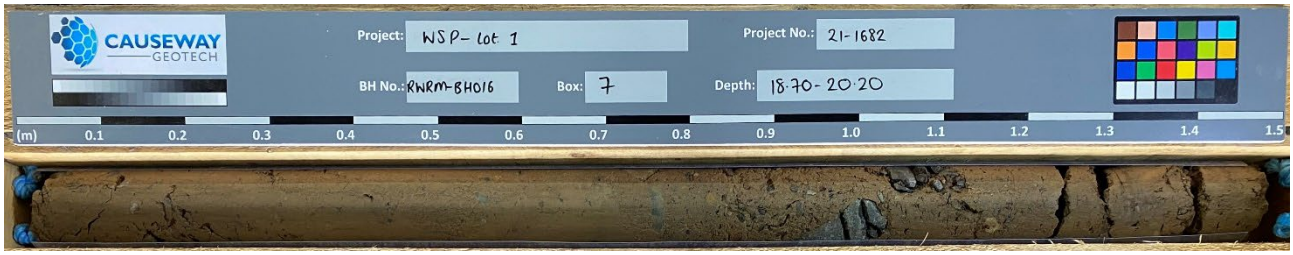
RWRM-BH016 Box 4 (14.20-15.70m)



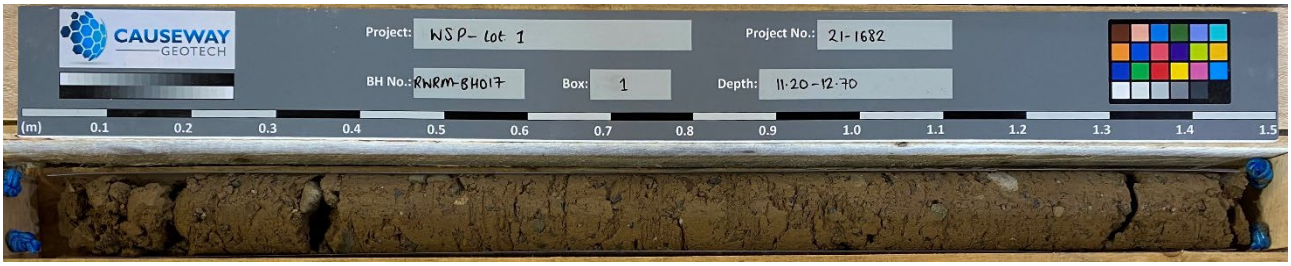
RWRM-BH016 Box 5 (15.70-17.20m)



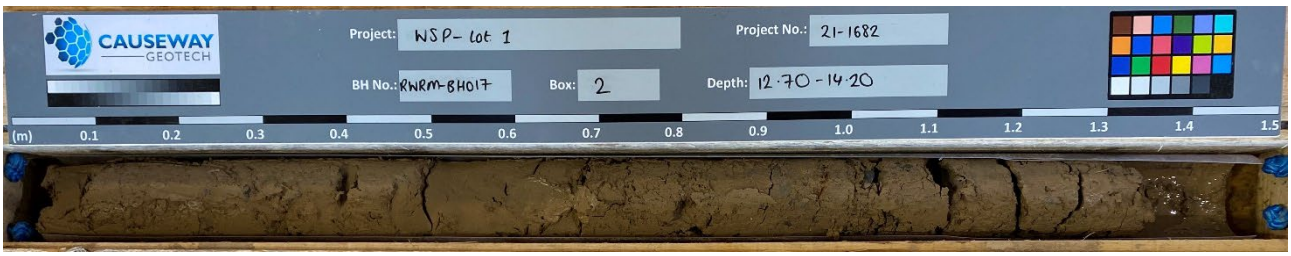
RWRM-BH016 Box 6 (17.20-18.70m)



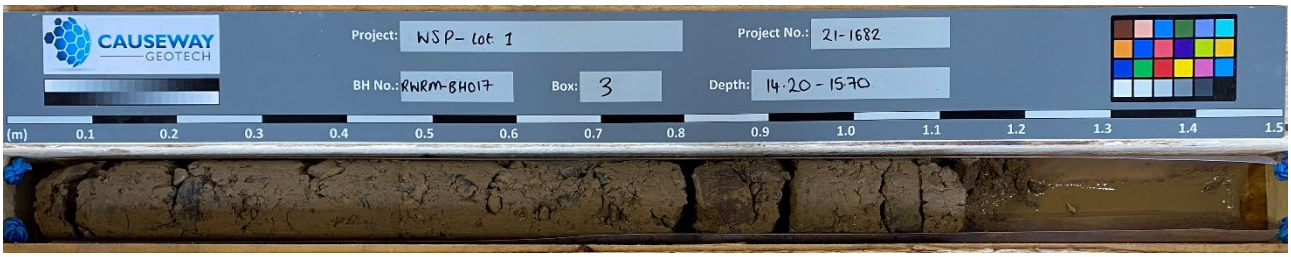
RWRM-BH016 Box 7 (18.70-20.20m)



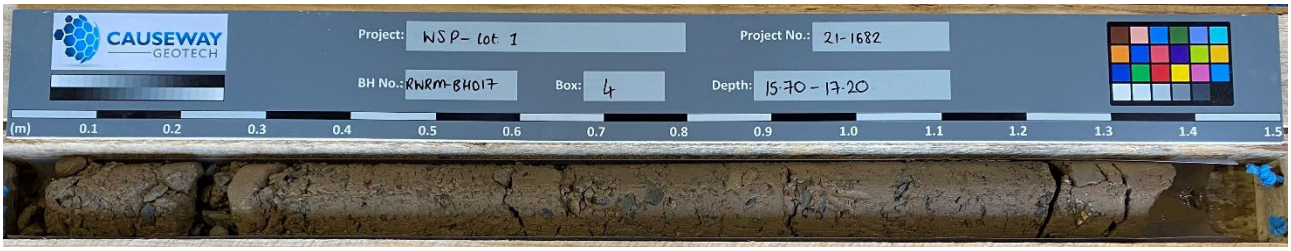
RWRM-BH017 Box 1 (11.20-12.70m)



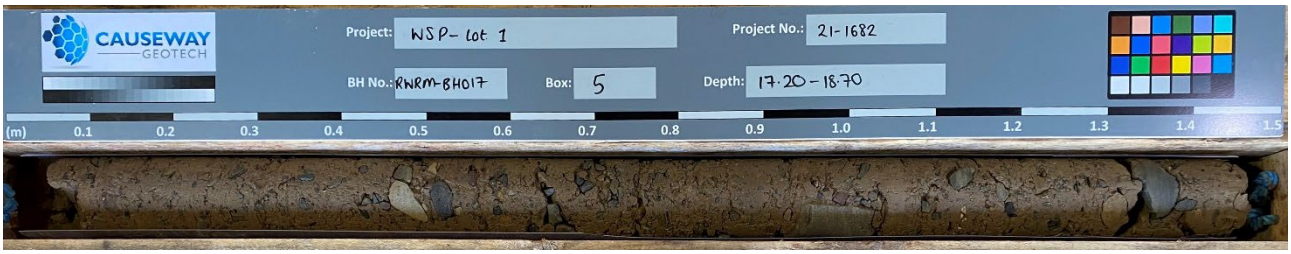
RWRM-BH017 Box 2 (12.70-14.20m)



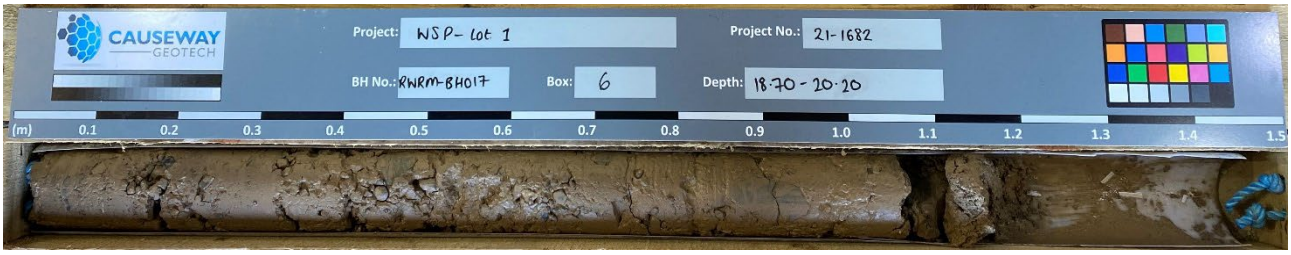
RWRM-BH017 Box 3 (14.20-15.70m)



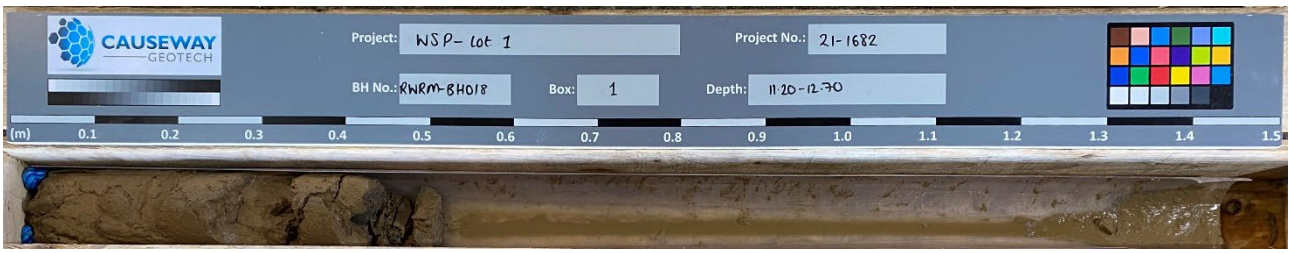
RWRM-BH017 Box 4 (15.70-17.20m)



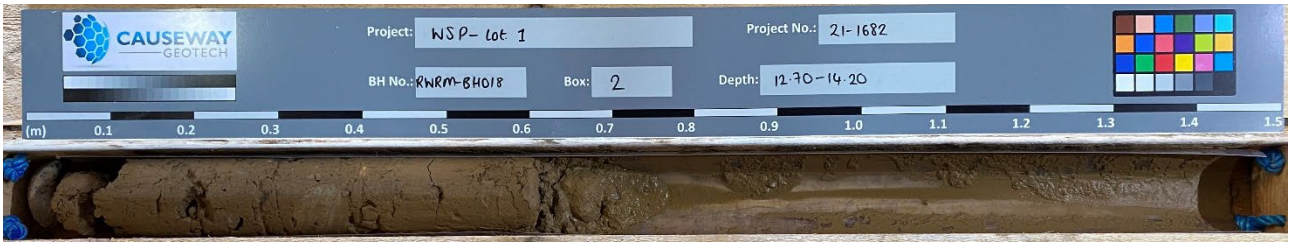
RWRM-BH017 Box 5 (17.20-18.70m)



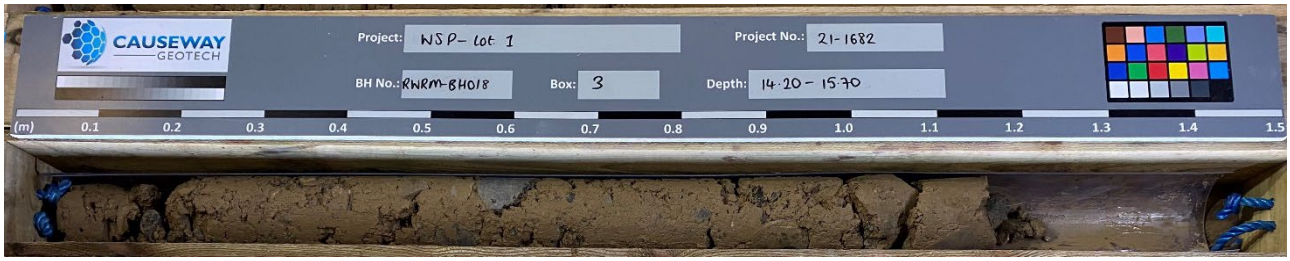
RWRM-BH017 Box 6 (18.70-20.20m)



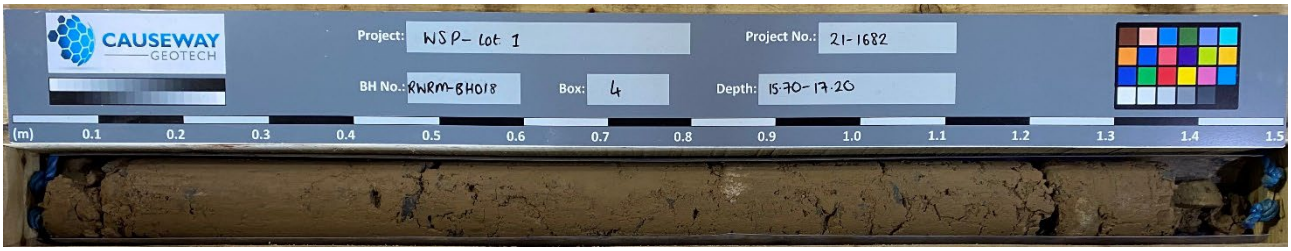
RWRM-BH018 Box 1 (11.20-12.70m)



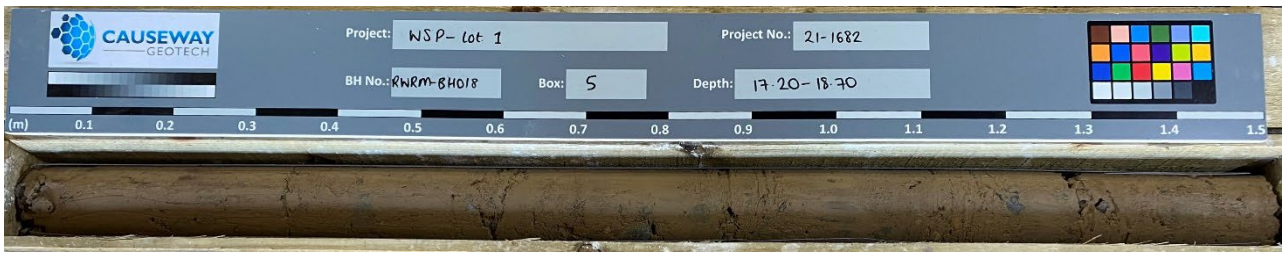
RWRM-BH018 Box 2 (12.70-14.20m)



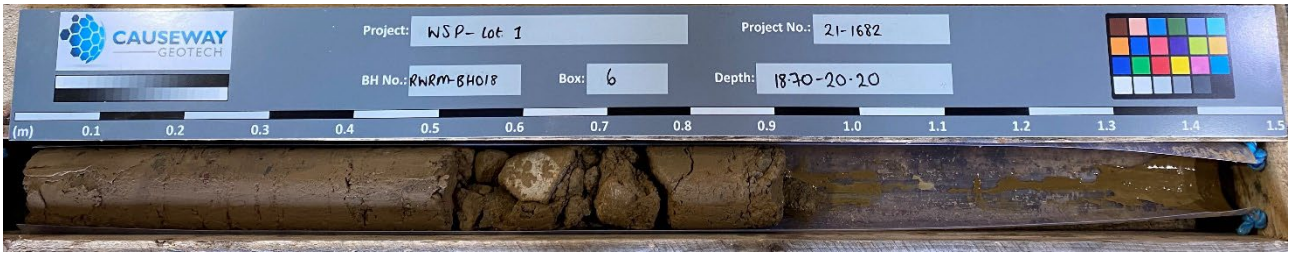
RWRM-BH018 Box 3 (14.20-15.70m)



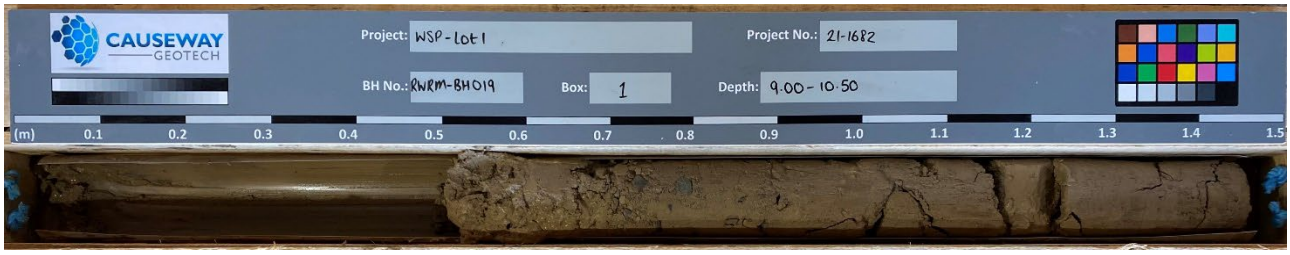
RWRM-BH018 Box 4 (15.70-17.20m)



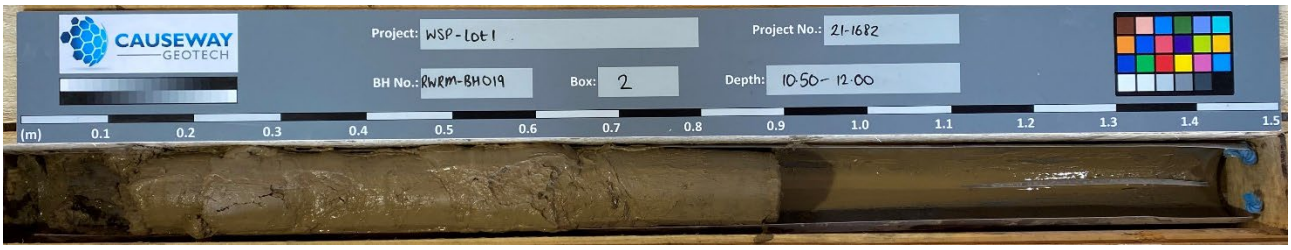
RWRM-BH018 Box 5 (17.20-18.70m)



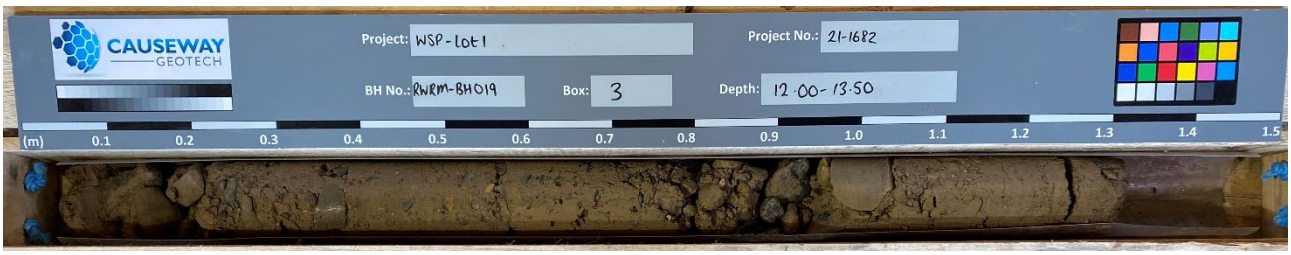
RWRM-BH018 Box 6 (18.70-20.20m)



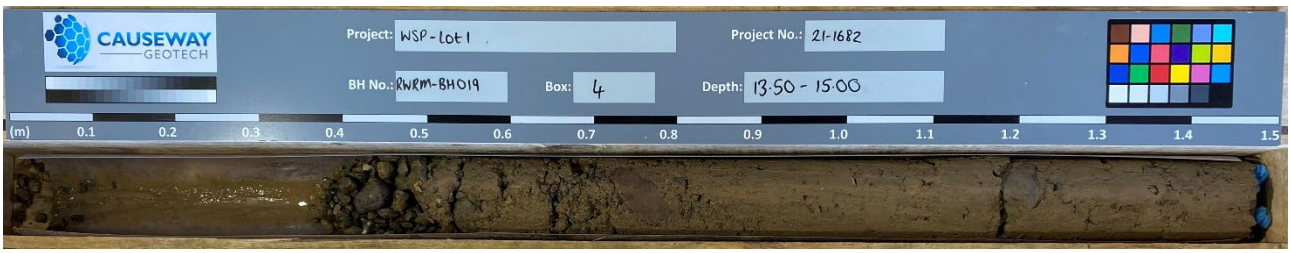
RWRM-BH019 Box 1 (9.00-10.50m)



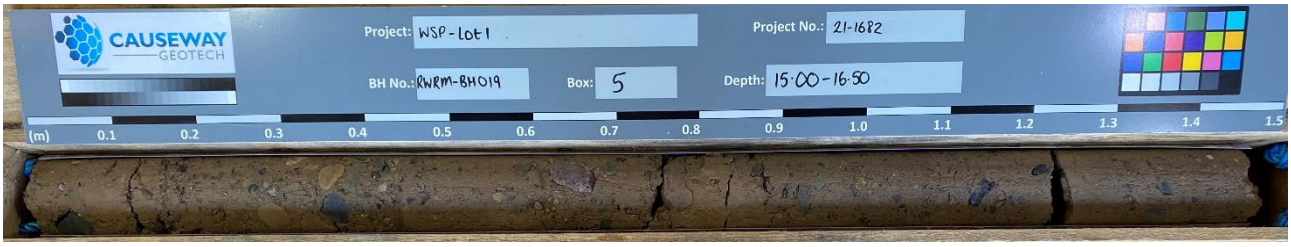
RWRM-BH019 Box 2 (10.50-12.00m)



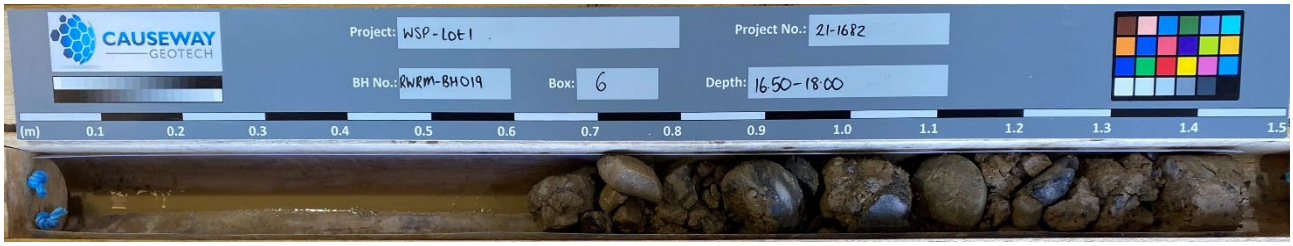
RWRM-BH019 Box 3 (12.00-13.50m)



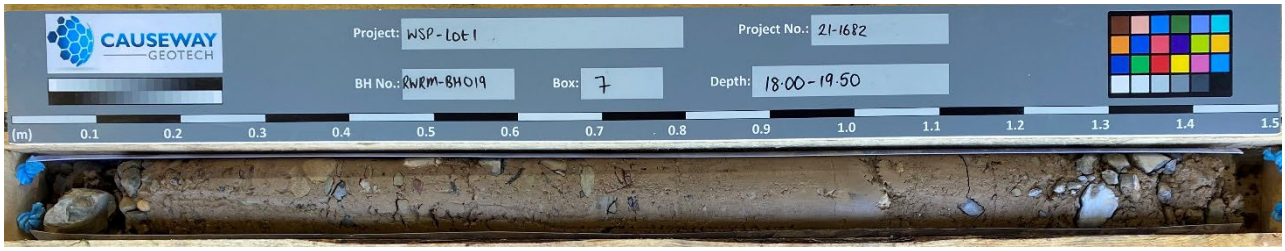
RWRM-BH019 Box 4 (13.50-15.00m)



RWRM-BH019 Box 5 (15.00-16.50m)



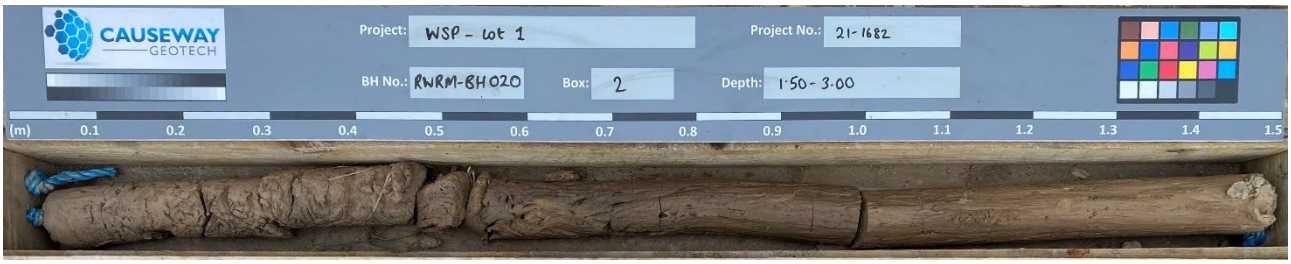
RWRM-BH019 Box 6 (16.50-18.00m)



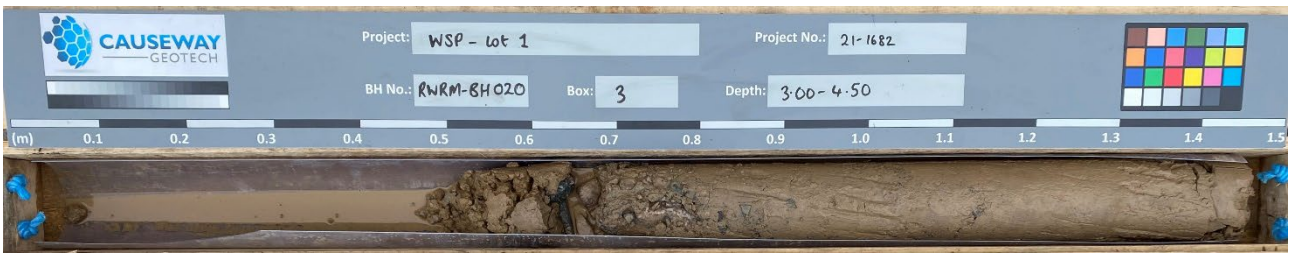
RWRM-BH019 Box 7 (18.00-19.50m)



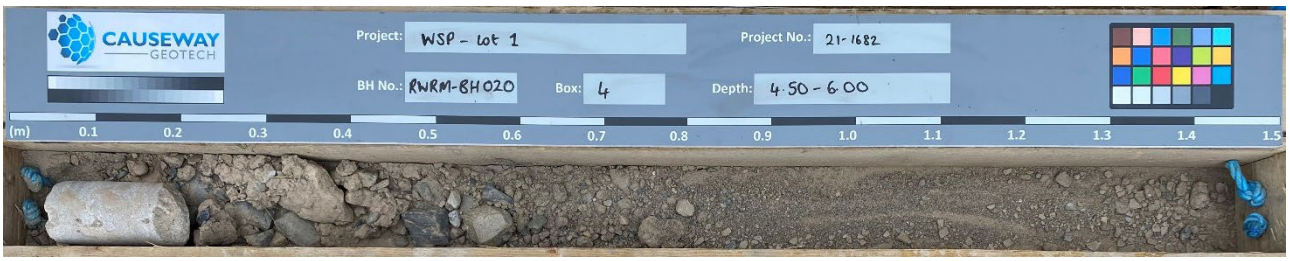
RWRM-BH020 Box 1 (0.00-1.50m)



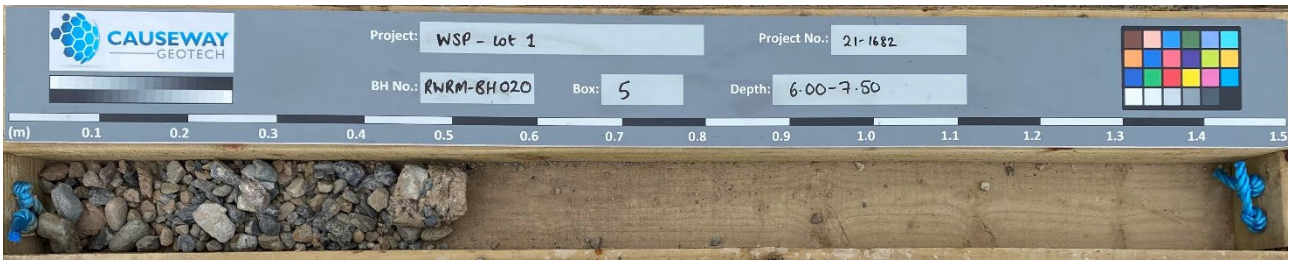
RWRM-BH020 Box 2 (1.50-3.00m)



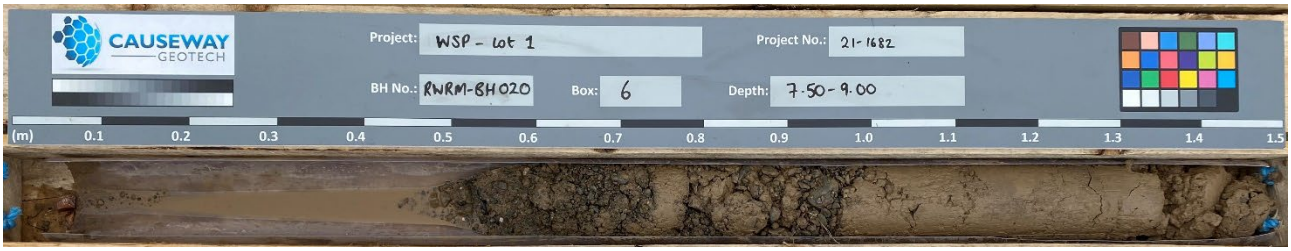
RWRM-BH020 Box 3 (3.00-4.50m)



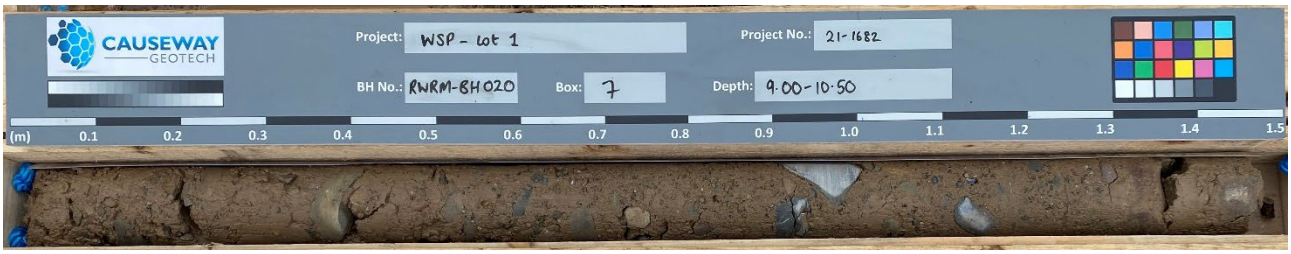
RWRM-BH020 Box 4 (4.50-6.00m)



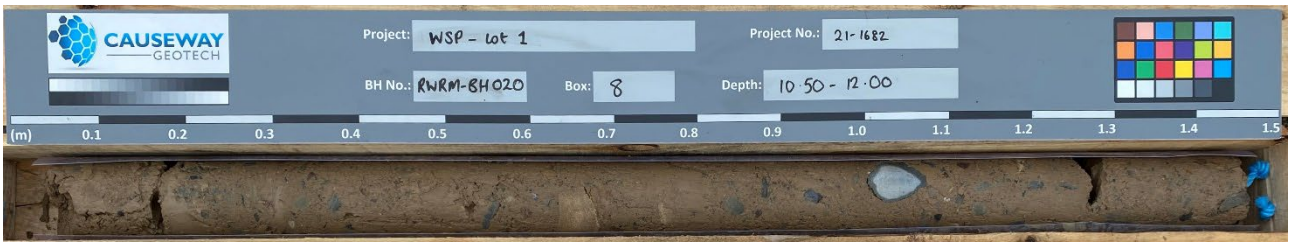
RWRM-BH020 Box 5 (6.00-7.50m)



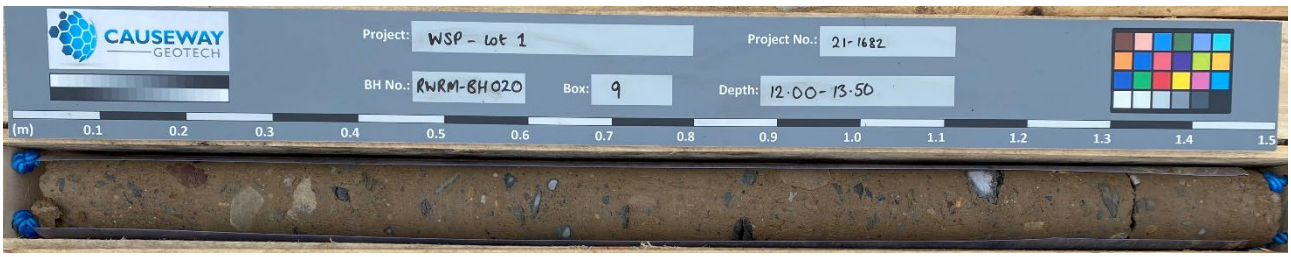
RWRM-BH020 Box 6 (7.50-9.00m)



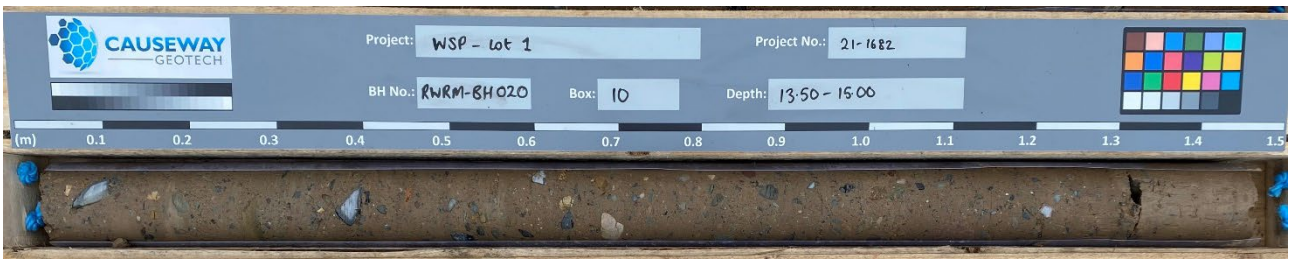
RWRM-BH020 Box 7 (9.00-10.50m)



RWRM-BH020 Box 8 (10.50-12.00m)



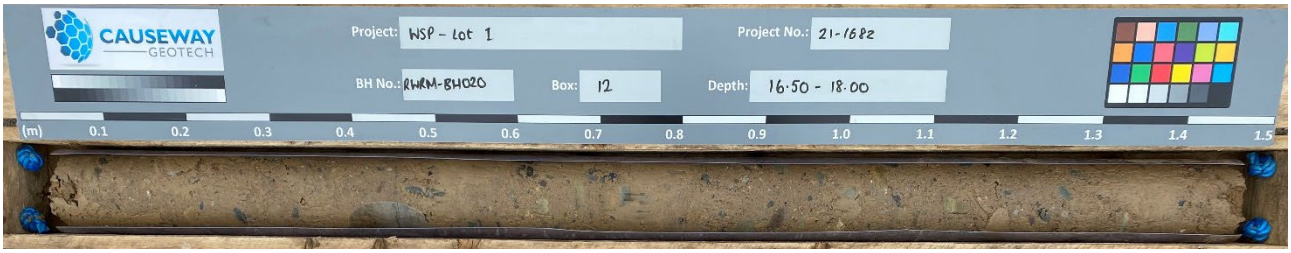
RWRM-BH020 Box 9 (12.00-13.50m)



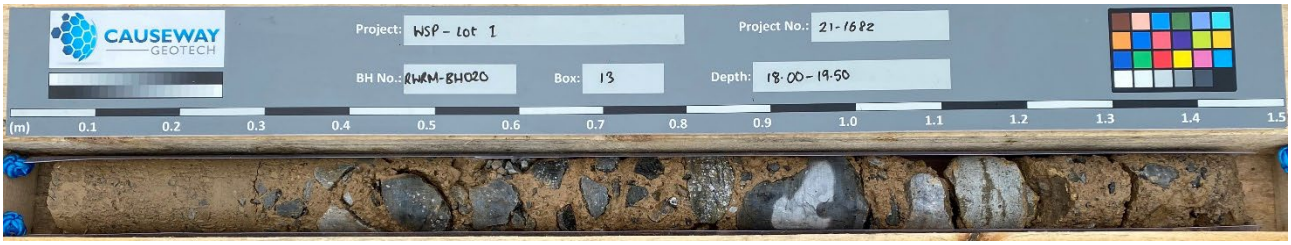
RWRM-BH020 Box 10 (13.50-15.00m)



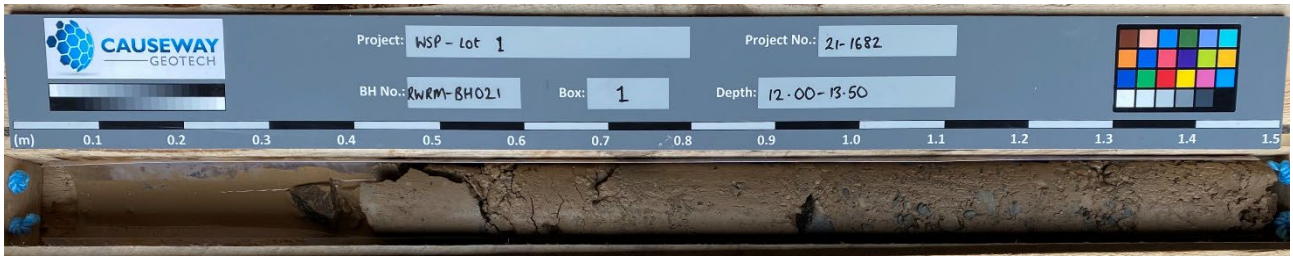
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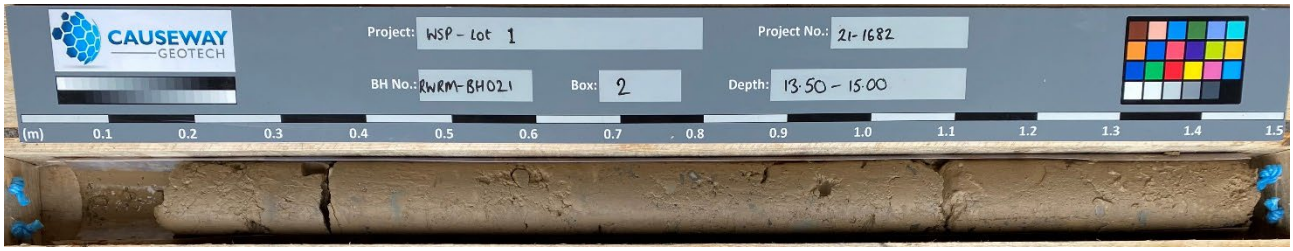
RWRM-BH020 Box 1 (16.50-18.00m)



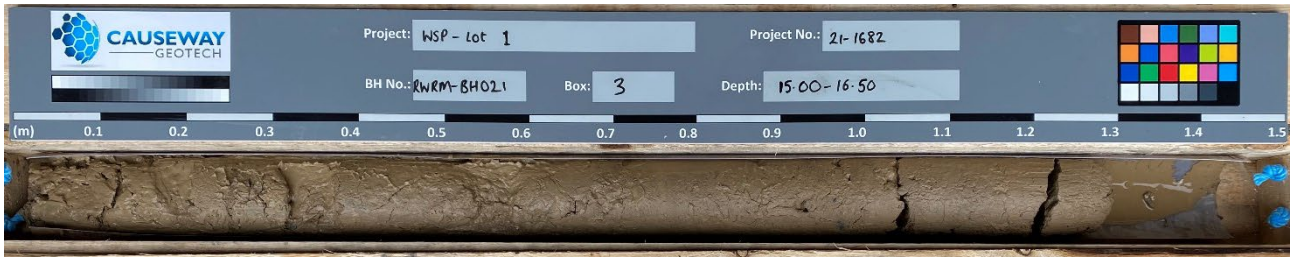
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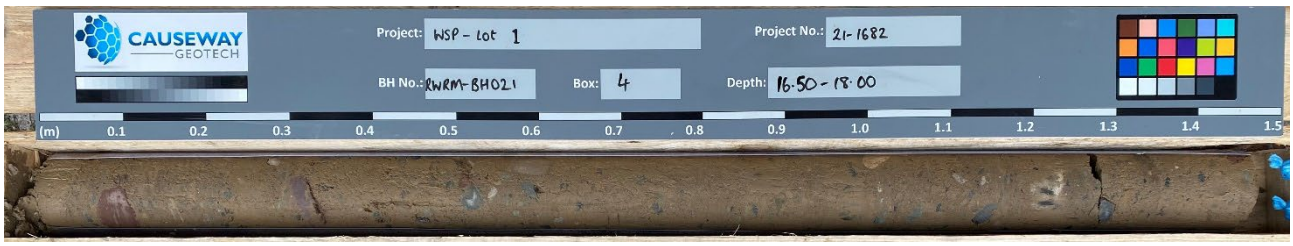
RWRM-BH021 Box 1 (12.00-13.50m)



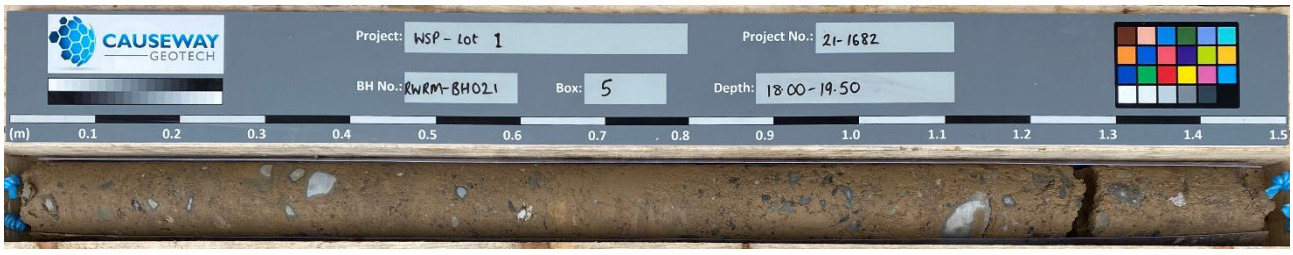
RWRM-BH021 Box 2 (13.50-15.00m)



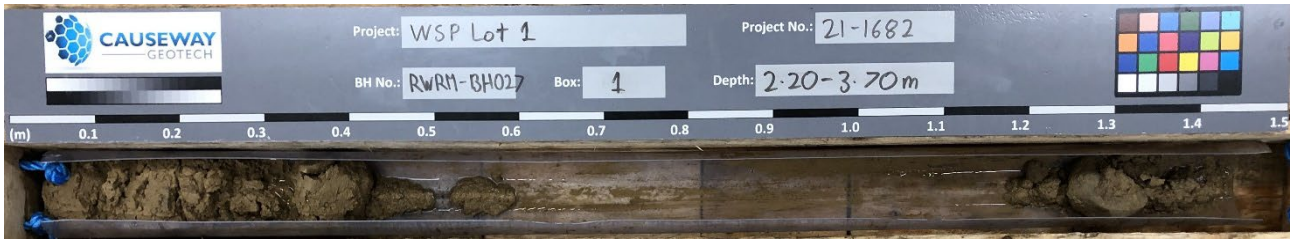
RWRM-BH021 Box 3 (15.00-16.50m)



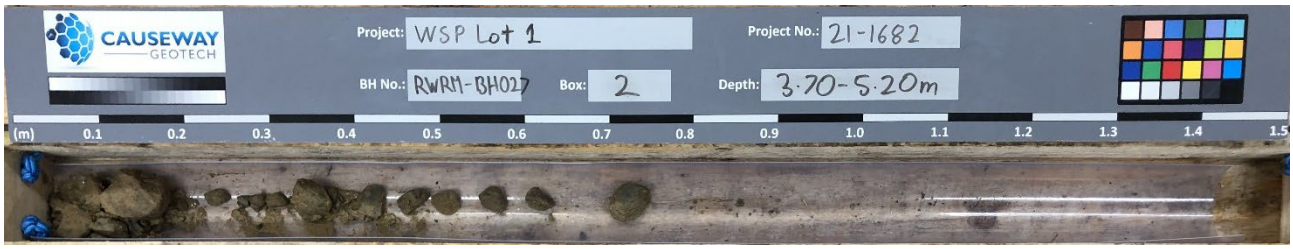
RWRM-BH021 Box 4 (16.50-18.00m)



RWRM-BH021 Box 5 (18.00-19.50m)



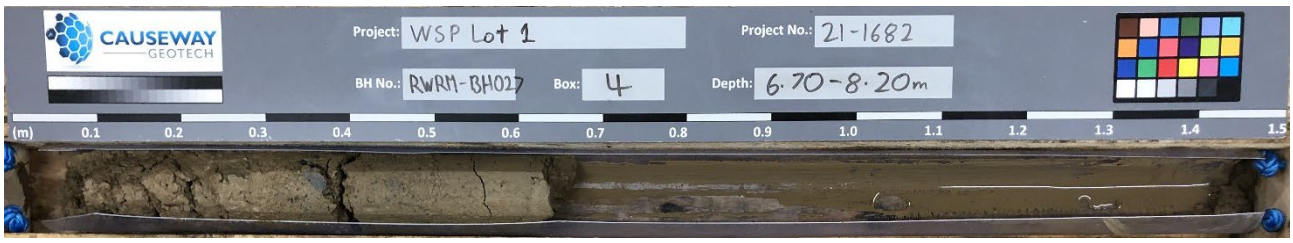
RWRM-BH027 Box 1 (2.20-3.70m)



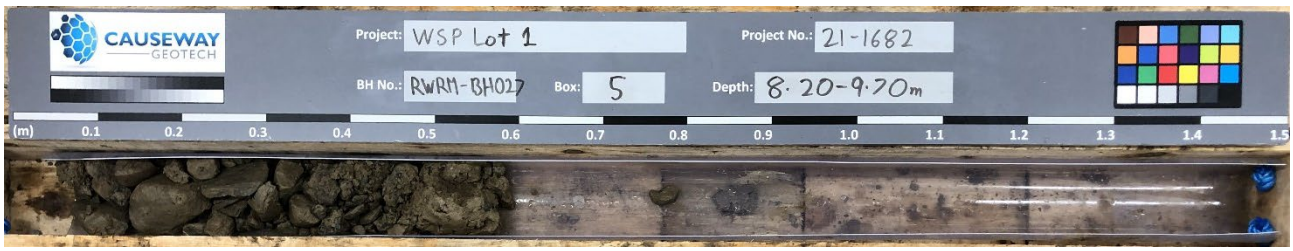
RWRM-BH027 Box 2 (3.70-5.20m)



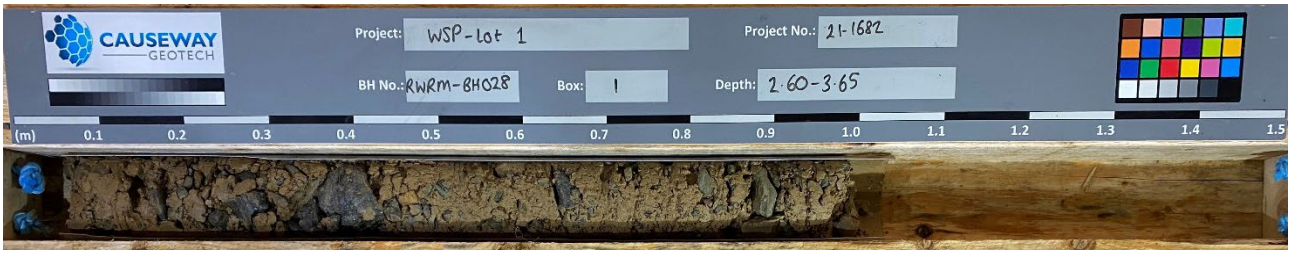
RWRM-BH027 Box 3 (5.20-6.70m)



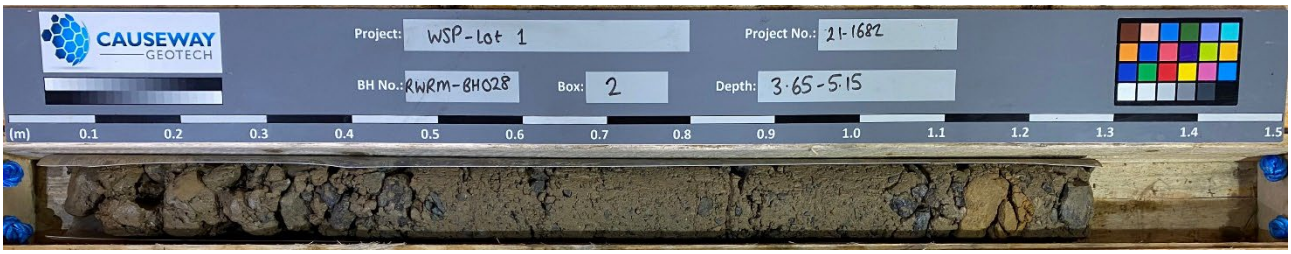
RWRM-BH027 Box 4 (6.70-8.20m)



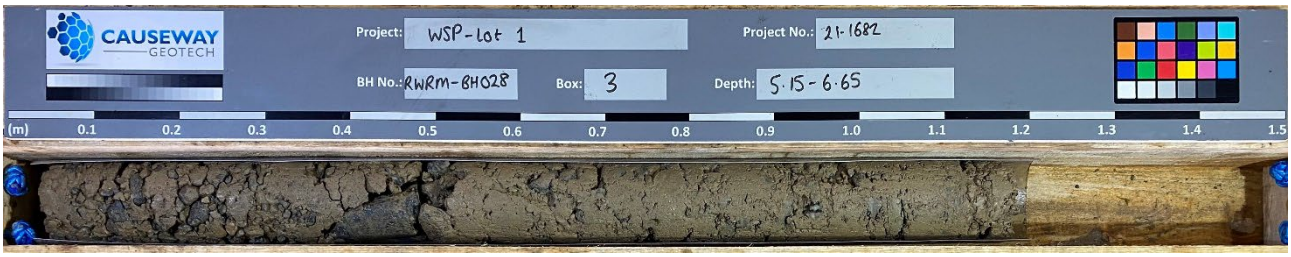
RWRM-BH027 Box 5 (8.20-9.70m)



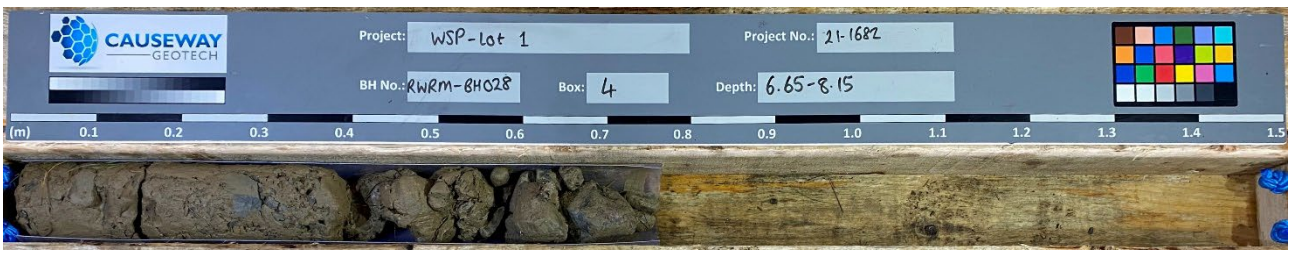
RWRM-BH028 Box 1 (2.60-3.65m)



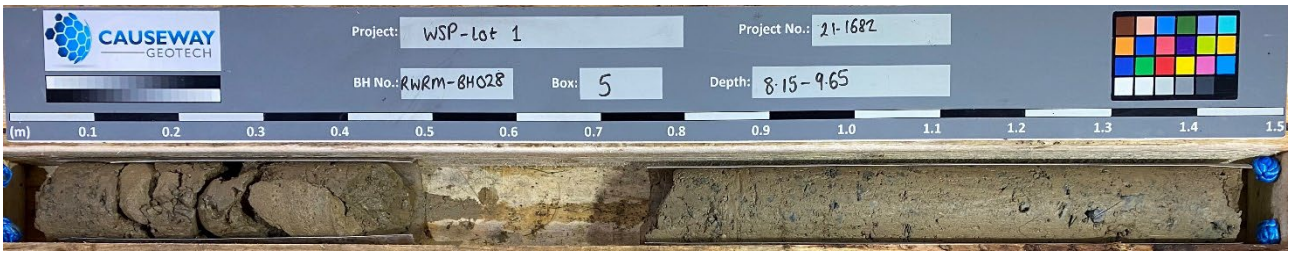
RWRM-BH028 Box 2 (3.65-5.15m)



RWRM-BH028 Box 3 (5.15-6.65m)



RWRM-BH028 Box 4 (6.65-8.15m)



RWRM-BH028 Box 5 (8.15-9.65m)



RWRM-TP002


CAUSEWAY
GEOTECH
Project: WSP
Project No.: 21-1682
Date: 16/08/22
EH No.: RWRM-TP002
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RWRM-TP002



RWRM-TP002

CAUSEWAY GEOTECH



RWRM-TP002

CAUSEWAY GEOTECH



RWRM-TP002

CAUSEWAY GEOTECH



RWRM-TP002



RWRM-TP002

CAUSEWAY GEOTECH


CAUSEWAY
GEOTECH
Project: WSP
Project No.: 21-1682
Date: 16/08/22
EH No.: RWRM-TP003
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0.5

RWRM-TP003



RWRM-TP003

CAUSEWAY GEOTECH


CAUSEWAY
GEOTECH
Project:
WSP
Project No.:
21-1682
Date:
16/08/22
EH No.:
RWRM-
TP003

RWRM-TP003


CAUSEWAY
GEOTECH
Project:
WSP
Project No.:
21-1682
Date:
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RWRM-TP003



RWRM-TP003

CAUSEWAY GEOTECH


CAUSEWAY
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Project No.: 21-1682
Date: 16/08/22
EH No.: RWRM-TP003
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RWRM-TP003



RWRM-TP003

CAUSEWAY GEOTECH



RWRM-TP007



RWRM-TP007



RWRM-TP007



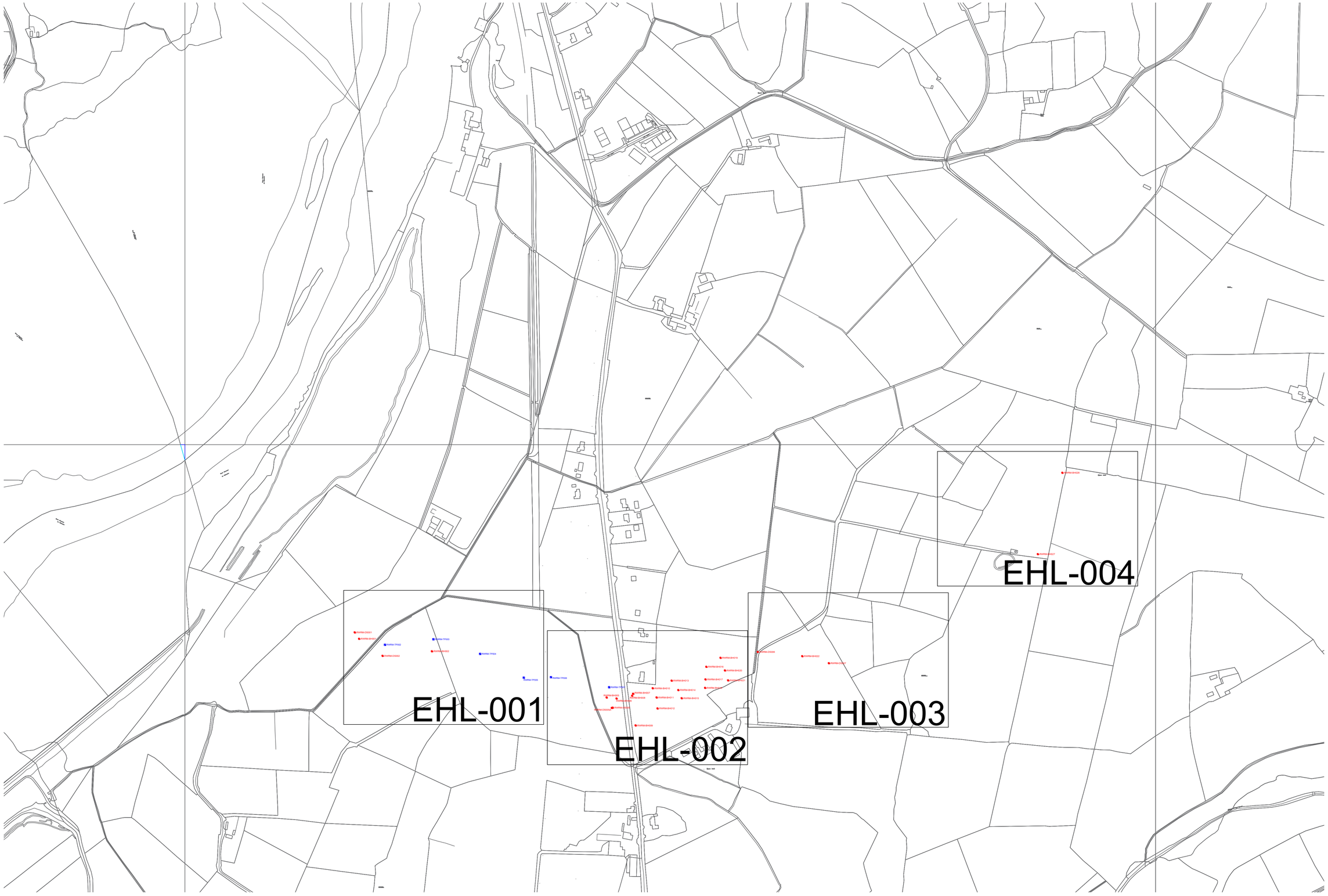
RWRM-TP007

CAUSEWAY GEOTECH

APPENDIX 2K

DRAWINGS





PROJECT: Water Supply Project	CLIENT: Ervia	CAUSEWAY GEOTECH	KEY: Borehole, Trial Pit, Russian Core, Slit Trench, Peat Probe	SCALE: 1:500 A1	DATE: 22/12/2022	NOTES:
TITLE: Exploratory hole location plan	ENGINEER: Mott MacDonald			DRWN: BS CHCK: NH	SERIES: 1 of 1	SHEET : 21-1682-EHL-OW-001



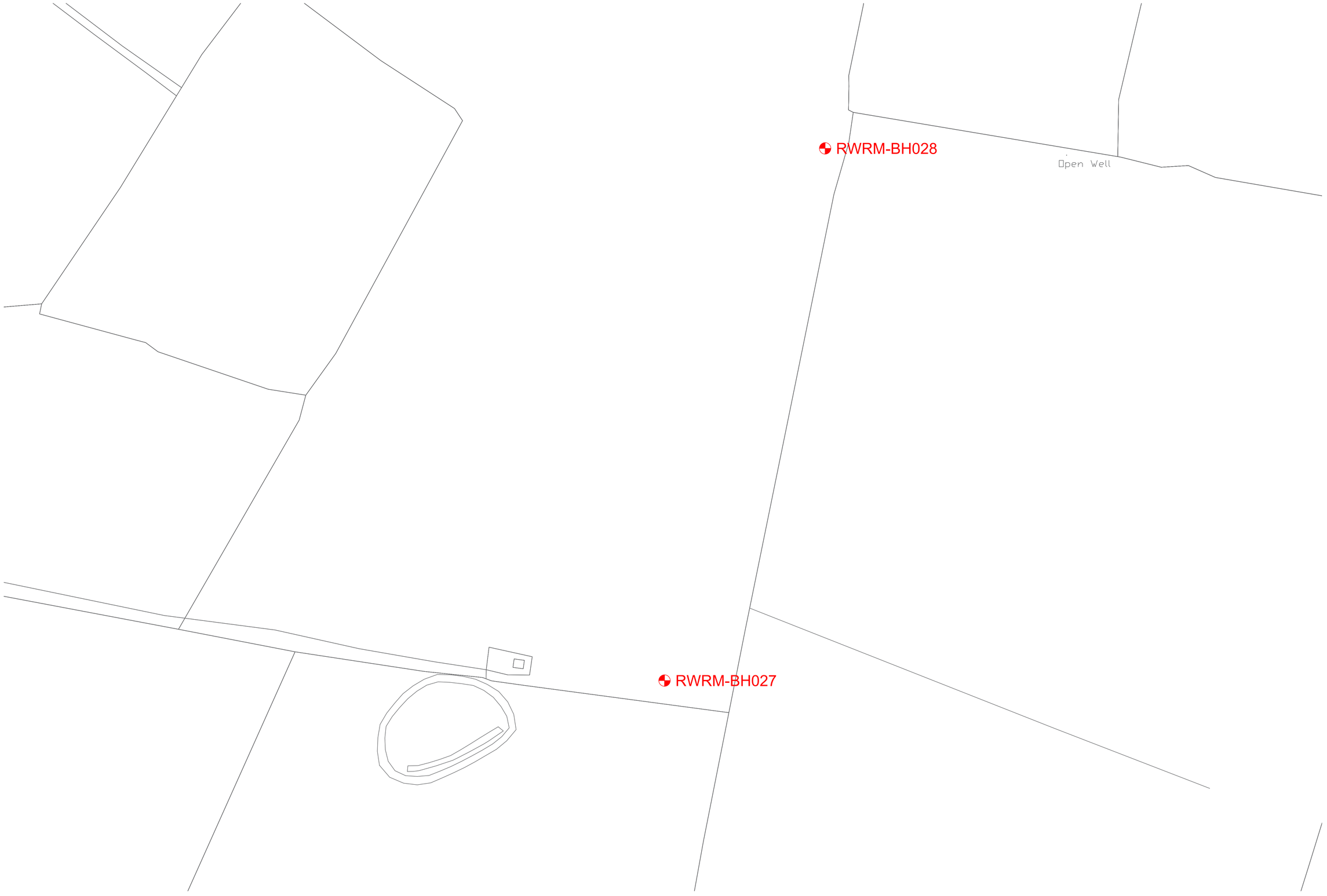
PROJECT: Water Supply Project	CLIENT: Ervia	CAUSEWAY GEOTECH	KEY: Borehole, Trial Pit, Russian Core, Slit Trench, Pilot Probe	SCALE: 1:500 A1	DATE: 22/12/2022	NOTES:
TITLE: Exploratory hole location plan	ENGINEER: Mott MacDonald			DRWN: BS CHCK: NH	SERIES: 1 of 4	SHEET : 21-1682-EHL-001



PROJECT: Water Supply Project	CLIENT: Ervia	CAUSEWAY GEOTECH	KEY: Borehole, Trial Pit, Russian Core, Slit Trench, Peat Probe	SCALE: 1:500 A1	DATE: 22/12/2022	NOTES:
TITLE: Exploratory hole location plan	ENGINEER: Mott MacDonald			DRWN: BS / CHCK: NH	SERIES: 2 of 4	SHEET : 21-1682-EHL-002



PROJECT: Water Supply Project	CLIENT: Ervia	CAUSEWAY GEOTECH	KEY: Borehole, Trial Pit, Russian Core, Slit Trench, Peat Probe	SCALE: 1:500 A1	DATE: 22/12/2022		NOTES:
TITLE: Exploratory hole location plan	ENGINEER: Mott MacDonald			DRWN: BS CHCK: NH	SERIES: 3 of 4	SHEET : 21-1682-EHL-003	



PROJECT: Water Supply Project	CLIENT: Ervia	CAUSEWAY GEOTECH	KEY: Borehole, Trial Pit, Russian Core, Slit Trench, Peat Probe	SCALE: 1:500 A1	DATE: 22/12/2022	NOTES:
TITLE: Exploratory hole location plan	ENGINEER: Mott MacDonald			DRWN: BS CHCK: NH	SERIES: 4 of 4	SHEET : 21-1682-EHL-004

CAUSEWAY GEOTECH

APPENDIX 2L

DIGITAL DATA (AGS)

