

# **Donegal Stud Residential Subdivision Stage 16 at 36 Tir Conaill Avenue, Flat Bush**

## **Geotechnical Completion Report**

Hugh Green Limited

**Reference: 773-GENZAUCK16856AE**

20 February 2023

## DONEGAL STUD RESIDENTIAL & COMMERCIAL/RETAIL SUBDIVISION STAGE 16 AT 36 TIR CONAILL AVENUE

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### Geotechnical Completion Report

**Report reference number: 773-GENZAUCK16856AE**

20 February 2023

### PREPARED FOR

**Hugh Green Limited**

C/- Harrison Grierson Consultants Limited  
PO Box 5760  
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Auckland 1051

### PREPARED BY

**Tetra Tech Coffey**

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NZBN 9429033691923

## QUALITY INFORMATION

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Revision	Description	Date	Author	Reviewer	Approver
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## 1. INTRODUCTION AND DESCRIPTION OF SUBDIVISION

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This Geotechnical Completion Report has been prepared for Hugh Green Limited as part of the documentation required to be submitted to Auckland Council following residential subdivisional development. It contains our Suitability Statement, relevant test data and the Harrison Grierson Consultants Limited as-built plan set relating to Stage 16 of the Donegal Stud Residential Subdivision as follows:

**Table 1: Harrison Grierson Consultants Limited As-Built Plans**

Title	Reference No.	Date
Finished Contours As-Built Plan	A2111813.00-16-AB200	February 2023
Cut to Fill As-Built Plan	A2111813.00-16-AB220	February 2023

This report covers the construction period between October 2020 and December 2022 and is intended to be used for certification purposes for:

- 25 residential lots numbered Lots 1 to 25;
- 1 Commercial/Retail numbered Lot 1003;
- 1 electrical substation numbered Lot 508; and
- 2 new roads identified as Lots 505 and 506.

Stage 16 is located at 36 Tir Conaill Avenue, Flat Bush, and as can be seen on the Cut to Fill As-Built Plan, most of the lots in this residential development have been partly or totally affected by bulk earthworks with associated fill depths of approximately 2.5 metres.

## 2. RELATED REPORTS

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Previous Tetra Tech Coffey geotechnical reports relevant to the subject land include:

- Geotechnical Investigation Report on Proposed Donegal Stud Stage 10 Residential Subdivision, 62 Thomas Road, Flat Bush, reference GENZAUCK16856AB, dated 11 May 2017;
- Geotechnical Completion Report on Donegal Stud Stage 10A Residential Subdivision, 84 Thomas Road, Flat Bush, reference GENZAUCK16856AB, dated 24 September 2018;
- Proposed MSE Block Retaining Wall at Road 6 Donegal Stud Stage 13 Residential Subdivision Flat Bush, reference GENZAUCK16856AE, dated 23 January 2020;
- Geotechnical Investigation Report on Proposed Donegal Stud Stage 14-16 at, 64 Thomas Road, Flat Bush, reference GENZAUCK16856AE, dated 8 April 2020;
- Geotechnical Completion Report on Donegal Stud Stages 13, Flat Bush, reference GENZAUCK16856AE, dated 19 January 2021;
- Geotechnical Completion Report on Donegal Stud Stages 14, Flat Bush, reference GENZAUCK16856AE, dated 27 September 2021; and,
- Geotechnical Completion Report on Donegal Stud Stages 15A & 15C, Flat Bush, reference GENZAUCK16856AE, dated 29 November 2021.

The conclusions and recommendations of the above documents (where relevant) have been referenced as part of the preparation of this report.

## 3. EARTHWORKS OPERATIONS

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### 3.1. PLANT

The main items of plant used by the subdivision contractor, Dempsey Wood Civil Limited, included:

- Motor Scrapers;
- Bulldozers with Scoops;
- Bulldozers;
- Dump Trucks;
- Excavators;
- Tractor with Discs;
- Tractors;
- Front End Loaders;
- Water Trucks;
- Sheep Foot Compactors;
- Pad Foot Compactor;
- Graders; and
- Vibrating Drum Rollers.

### 3.2. CONSTRUCTION PROGRAMME

Bulk earthworks operations for Stage 16 were largely undertaken in conjunction with the construction of Stage 10 and Stages 13 to 15. Initially earthworks were conducted within Stage 16 to form a working compound containing site sheds, equipment, and consumables. The compound was formed by Transpower to enable the construction of a stable corridor along Koromeke Street and Dungloe Avenue for a high voltage underground power cable to be connected to a substation located on Charlestown Drive.

The construction events and fill placed during this time was discussed in detail and certified in Geotechnical Completion Report (GCR) prepared for those stages. We do not intend to reiterate those comments in this report.

More recently (2021 to 2022) earthworks were conducted within Stage 16 to remove stockpiles and to place minor depths of fill to lift ground levels to the final subgrade levels shown on the attached Harrison Grierson Consultants Limited, Final Contours Plan and to construct the associated accessways. Most of the earthworks were completed by December 2022.

## 4. QUALITY ASSURANCE AND CONTROLS

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### 4.1. INSPECTIONS

During the earthworks operation engineering inspections were undertaken on a regular basis to assess compliance with NZS 4431:1989 and our project specific recommendations and specifications. Project specific inspections were required on Stage 16 for:

- Topsoil stripping;
- Undercuts to remove soft and/or unsuitable material and to confirm that adequate strength base materials had been exposed;
- Removal of existing stockpiles;
- Silt pond stripping and preparation for backfilling to ensure that all soft unsuitable material had been removed; and
- Observation of bulk cut to fill operations and compaction testing on Engineered fill.

## 4.2. QUALITY CONTROL CRITERIA

### 4.2.1. Compaction

Due to the varying soil types being used as filling, the compaction control criteria of minimum allowable shear strength and maximum allowable air voids were mainly used for quality assurance purposes.

Specification details were as follows:

#### Minimum Shear Strength and Maximum Air Voids Method

**Table 2: Minimum Shear Strength and Maximum Air Voids Method**

(a)	<u>Air Voids Percentage</u>	
	(As defined in NZS 4402)	
	General Fill	
	Average value less than	10%
	Maximum single value	12%
(b)	<u>Undrained Shear Strength</u>	
	(Measured by Pilcon shear vane - calibrated using NZGS 2001 method)	
	General fill	
	Average value not less than	140 kPa
	Minimum single value	120 kPa

Note: The average value shall be determined over any ten consecutive tests

## 4.3. QUALITY ASSURANCE TESTING

### 4.3.1. Compaction

Regular insitu density, strength and water content tests were carried out on all areas of the filling at or in excess of the frequency recommended by NZS 4431:1989.

Control tests carried out on the filling showed that on a few occasions the required compaction standards were not achieved. Results of these test failures were relayed to the site foreman and/or his staff, and to the best of our knowledge the affected areas of fill were re-worked as necessary.

In each case, further testing was carried out until compliance with the above standards was achieved except for test number 216 which was awarded a discretionary pass based on the its location being at depth within a proposed cul de sac head.

## 5. PROJECT EVALUATION

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### 5.1. BEARING CAPACITY AND SETTLEMENT OF BUILDING FOUNDATIONS

Following the completion of earthworks operations, we returned to the site during November 2022 and drilled a series of hand auger boreholes at appropriate locations in order to evaluate likely foundation options for future residential building development. Typical topsoil depths on each lot were also assessed during this time period as the test sites became available.

Based on the findings of the boreholes we have assessed that at current subgrade levels, all cut, filled and undisturbed natural ground has a geotechnical ultimate bearing capacity of 300 kPa (as required by NZS 3604:2011) within the zone of influence of conventional shallow residential building foundation loads.

It should be noted that NZS 3604:2011 only allows a maximum backfill depth of 600mm over the building platform of a dwelling unless an Engineering design solution is proposed, on account of the risk of induced consolidation of the subsoils caused by the weight of the backfill.

As required by Module 4 of NZGS/MBIE guidelines “Earthquake Resistant Foundation Design” Table 5.1 we recommend that for shallow footings a strength reduction factor of 0.5 for all ultimate limit state design loads.

### 5.2. EXPANSIVE SOILS

Three sets of laboratory Shrink Swell Index Tests were carried out on samples selected from within the zone of likely influence of future shallow building foundations over the wider area of Stages 14 to 16, one test per stage area.

These tests were carried out in accordance with AS1289, Methods of Testing Soils for Engineering Purposes test Section 7 and were primarily intended to assess the Expansive Site Class of the site materials as defined in AS2870, “Residential Slabs and Footings – Construction”.

All test results are IANZ (International Accreditation New Zealand) endorsed and full details are included in Appendix B.

Based on the results of the laboratory tests together with our visual-tactile assessment and local knowledge, the assessed AS2870 expansive site Class is presented below in Table 3. Specific design alternatives for this site Class are presented in the Suitability Statement. Alternatively, foundation design can be undertaken in accordance with B1VM4.

On some expansive clay sites if cast on-grade floor slab construction takes place during a long dry summer, exposed building platform soils may dry out and become highly desiccated.

Over time the presence of the floor slab will cause capillary rise of moisture to the underside of the damp proof course and potentially expansive dry ground may wet up and swell, causing floor slab uplift. The effect may be very slight in some cases and extreme in others, especially if free water can reach the central underside of the slab as could occur if any subsoil drainage is discharged beneath the slab or an under-slab water pipe leaks.

Floor slab uplift usually remains unnoticed in carpeted homes but can cause distress on tile floors and in garages where cracks are more apparent. It may also rack upper storeys if non-load bearing ground floor walls are lifted and act as struts. Further, it may cause drainage problems on flat roofed houses where gutter gradients may be reversed.

Thorough soaking (in the form of low flow sprinklers for an extended period rather than flooding of the surface with a hose only once is recommended to allow for infiltration into the soil) of the exposed building platform

area a few days before hardfill placement can help to reduce this potential problem. Careful detailing of construction joints in brittle building elements can also be of benefit. Alternatively, removal and replacement of the desiccated surface layers could be undertaken.

### 5.3. FILL INDUCED SETTLEMENT LOTS 1 TO 25

As a result of our pre-fill inspections and quality control testing, we are of the opinion that induced differential settlements beneath or within the certified filling due to its imposed weight, should be insignificant with respect to conventional NZS 3604:2011 residential building developments.

### 5.4. SETTLEMENT ANALYSIS LOT 1003

As a result of our pre-fill inspections and quality control testing, we are of the opinion that induced differential settlements beneath or within the certified filling due to its imposed weight, should be insignificant with respect to light commercial/ retail building loads on lot 1003.

A machine borehole and CPTs were also put down in Lot 1003 to assess and to collect laboratory samples of the subsoils beneath the proposed future light commercial/retail area. The assessment of the subsoils has allowed for soil parameters to be assessed and to enable settlement analysis to be undertaken. Accordingly, potential magnitudes of differential settlement have been assessed in critical areas using consolidation analysis, Plaxis 2D.

The results of our analysis demonstrated that the strength of the filled and natural ground was sufficient and that under a maximum Live floor load of 10kPa, predicted magnitudes of differential settlement were within Building Code limits and perceived remedial works were not required.

The results of our laboratory testing and settlement analysis are presented in Appendix D.

### 5.5. LIQUEFACTION POTENTIAL

According to Guidelines Geotechnical Earthquake Engineering Practice, Module 3: Identification, assessment and mitigation of liquefaction hazards by the New Zealand Geotechnical Society (November 2021) liquefaction susceptibility is generally assessed based on geological and compositional criteria.

With regard to geological criteria, NZGS guidance states that natural soils typically susceptible to liquefaction are young Holocene sediments. The geological units present on site are older (mid-Pleistocene) soils which would not be typically expected to liquefy based on both age and origin.

Based on this assessment, we consider the site to have very low liquefaction potential under either serviceability or ultimate limit state seismic events.

### 5.6. STORMWATER CONTROLS

It is important on all lots that due care is paid to the design and construction of appropriate stormwater disposal systems. These systems should serve to collect all runoff from roofs, driveways and paved areas, together with discharges from retaining wall drains and other subsoil drains and should connect directly into the public stormwater drainage network.

### 5.7. SERVICE TRENCHES

As is normal on all subdivisions, building developments involving foundations within the 45-degree zone of influence from pipe inverts will require engineering input. However, it is unlikely to be an issue for the Stage 15A and 15C lots based on the as-built plans provided.

## 5.8. ROAD SUBGRADES

Dynamic Cone Penetrometer (DCP) testing was undertaken at regular intervals on the trimmed road subgrades and the results were subsequently forwarded to HGCL for pavement design purposes.

## 5.9. VEGETATION COVER

Wherever practical on sloping land beyond building platform areas, all existing grass cover should be maintained and even supplemented with new plantings. Any vegetation cleared beyond the immediate area of building platforms for temporary construction purposes should be replanted replaced as soon as possible.

The contribution of appropriate vegetation cover to sediment and erosion control should not be underestimated.

## 5.10. TOPSOIL

Topsoil depths in likely building platform areas were checked by the drilling of a shallow borehole probe in the approximate centre of each lot. Our findings, which are indicative only and subject to variation at other locations, show that topsoil depths are likely range between 100 mm and 300 mm.

## 5.11. CONTRACTOR'S WORK

We have relied on the Contractor's work practices and assume that the works have been carried out in accordance with:

- (i) The approved Contract drawings and design details,
- (ii) The approved Contract specifications,
- (iii) Authorised Variations issued during the execution of the works,
- (iv) The conditions of Resource, Earthworks and Building Consents where applicable,
- (v) The relevant Tetra Tech Coffey Geotechnics reports, recommendations and site instructions,

and that all as-built information and other details provided to the Client and/or Tetra Tech Coffey (NZ) Limited are accurate and correct in all respects.

## 6. STATEMENT OF PROFESSIONAL OPINION AS TO THE SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

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I, Chris Armstrong, of Tetra Tech Coffey (NZ) Limited, Auckland, hereby confirm that:

1. I am a Chartered Professional Engineer experienced in the field of geotechnical engineering as defined in section 1.2.3 of NZS 4404:1989 and was retained by the Developer as the Geotechnical Engineer on Stage 16 of the Donegal Stud residential subdivision, Flat Bush.
2. The extent of preliminary investigations carried out to date are described in the Coffey Geotechnical Investigation Report, reference GENZAUCK16856AE, dated 08 April 2020. The conclusions and recommendations of that document have been re-evaluated during the preparation of this report. Details of the results of all tests carried out are appended.
3. In my professional opinion, not to be construed as a guarantee, I consider that:
  - a. The earth fills shown on the appended Harrison Grierson Consultants Limited Cut to Fill as-built plan have been placed in compliance with NZS 4431:1989 and related documents.

- b. A geotechnical ultimate bearing capacity of 300 kPa may be assumed for shallow foundation design on residential Lots 1 to 25.
- c. For Lot 1003 light commercial/retail building platform, a geotechnical ultimate bearing capacity of 300 kPa may be assumed for foundation design on for strip or pad foundation of up to 1.5 metres width.

The design floor live load should be limited to 10 kPa. In addition, any building platform earth fill and hardfill depths should be limited to 600mm (10 kPa). This is because high floor loads and large post earthworks subfloor fill depths may trigger unacceptable ground settlements beneath buildings.

Building loads, post earthworks subfloor fill depths or foundation widths beyond the limits presented above will need to be substantiated by site specific foundation investigations and analyses by a Chartered Professional Geotechnical Engineer familiar with the contents of this report.

- d. The backfilling and compaction of the stormwater and sanitary sewer trenches on this subdivision has, where possible, been carried out to appropriate standards having regard for the prevailing ground conditions and associated compaction induced pipe loadings.
- e. Nevertheless, no building development should take place within the 45-degree zone of influence of drain inverts unless endorsed by specific site investigations, foundation designs and by construction inspections undertaken by a Chartered Professional Engineer experienced in geomechanics to ensure that lateral stability and differential settlement issues are addressed and that building loads are transferred beyond the influence of the pipe and the trench backfill.
- f. The assessed AS 2870:2011 expansive site Class for all residential and light commercial/retail lots in Stage 16 is M (Moderate).
- g. Subject to the geotechnical recommendations and expansive soil assessment associated with 3(b), 3(c), 3(d), 3(e) and 3(f) above:
  - (i) The cut, filled and original ground within residential lot boundaries is generally suitable for residential buildings constructed in accordance with NZS 3604:2011 (that incorporates specific foundation and associated structural design on account of the expansive soils site Class) and related documents.
  - (ii) On all residential and light commercial/retail lots in Stage 16 foundation design may be carried out in accordance with AS 2870 (Class M) or alternatively, the foundation design may be carried out in accordance with NZS3604:2011 provided that in this case the minimum recommended foundation depth below cleared ground level following topsoil removal and benching of building platform areas is 600mm.
- 4. Subject to the geotechnical limitations, restrictions and assessments associated with 3(a) and 3(c) above, the filled and original ground within Lot 1003 is suitable for the construction of conventional light commercial or retail buildings (i.e. single storey structures with or without timber mezzanine floors, comprising reinforced concrete block or tilt panel boundary walls, lightweight roofing and cladding elements fixed to timber or steel portal or truss frames with reinforced concrete floor slabs on grade) incorporating shallow strip and/or pad foundations. The minimum recommended perimeter footing depth is 600mm.

Specific site investigations, design modifications and construction inspections should be carried out as necessary by a Chartered Professional Engineer experienced in geomechanics for all buildings exceeding these limitations, but in any event, we consider it prudent for all light commercial/retail landowners to undertake site specific investigation and foundation design with a view to optimising design bearing capacities, design loads on retaining walls and final site gradients.
- 5. Road subgrades have been formed having due regard for slope stability and settlement, although CBR values will likely vary between natural and filled ground as is to be expected.

## 7. LIMITATIONS

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The as-built plans and the professional opinion contained within this report are furnished to Auckland Council and Hugh Green Limited for their purposes alone on the express condition that they will not be relied upon by any other person. Prospective purchasers should still satisfy themselves as to any specific conditions pertaining to their particular land interest.



The appended table summarises the status of each residential lot covered by this Suitability Statement.

For and on behalf of Tetra Tech Coffey

Prepared By:



**Ray Berry**  
Associate Engineering Geologist

Reviewed and Authorised By:



**Chris Armstrong**  
Principal Geotechnical Engineer  
CMEng.NZ, CPEng



**Table 3: Suitability Statement Summary**

Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870: 2011 Class
1	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
2	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
3	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
4	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
5	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
6	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
7	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	100	300	M
8	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	100	300	M
9	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	100	300	M
10	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
11	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
12	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
13	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	250	300	M
14	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
15	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
16	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
17	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
18	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
19	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	300	300	M
20	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	100	300	M
21	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	250	300	M

22	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	250	300	M
23	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
24	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	250	300	M
25	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M
1003	AS 2870 foundation design or NZS 3604 with minimum footing depth 600mm	200	300	M

## APPENDIX A: HARRISON GRIERSON LIMITED AS-BUILT PLANS

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ASSOCIATION OF CONSULTING  
ENGINEERS NEW ZEALAND

ISO 9001  
QUALITY  
ASSURED

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NOTES:

1. ORIGIN OF LEVELS  
S 66 SO 48643  
RL 54.50m

2. ORIGIN OF COORDINATES  
S 66 SO 48643  
5905356.71mN  
1770941.22mE

3. SURVEY INFORMATION PROVIDED BY DEMPSEY  
WOOD CIVIL LTD AND TO THE BEST OF OUR  
KNOWLEDGE IS ACCURATE.

LEGEND:

EARTHWORKS BOUNDARY

STAGE 16 BOUNDARY

55.0

CONTOUR MAJOR AT 1.0m INTERVALS

55.5

CONTOUR MINOR AT 0.2m INTERVALS

ENGINEERING APPROVAL  
ENG-60397590



HUGH GREEN  
LIMITED



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PARNELL AUCKLAND 1052  
T +64 9 917 5000  
W www.harrisingrierson.com

REF	REVISIONS	BY	DATE
A	AS-BUILT	WKK	10.02.23

PROJECT:

HUGH GREEN LIMITED  
DONEGAL STAGE 16  
36 TIR CONAILL AVENUE, FLAT BUSH

TITLE:

FINISHED CONTOURS  
AS-BUILT PLAN

ORIGINATOR:	DATE:	SIGNED:	PLOT BY:
KKA	15.11.21		WKK
DRAWN:	DATE:	SIGNED:	PLOT DATE:
WKK	02.2023		15.11.21
CHECKED:	DATE:	SIGNED:	SURVEY BY:
DAS	02.2023		DEMPSEY WOOD
APPROVED:	DATE:	SIGNED:	SURVEY DATE:
DAS	02.2023		02.2023

ISSUE STATUS:

AS-BUILT

PROJECT No:	SCALES:	A3
A2111813.00	1:500-A1 1:1000-A3	
DRAWING No:		REV
A2111813.00-16-AB200		A







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ASSURED

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NOTES:

1. ORIGIN OF LEVELS  
S 66 SO 48643  
RL 54.50m

2. ORIGIN OF COORDINATES  
S 66 SO 48643  
5905356.71mN  
1770941.22mE

3. EARTHWORKS VOLUMES :  
AREA = 21,559m<sup>2</sup>  
CUT VOLUME (UNADJUSTED) = 23,056m<sup>3</sup>  
FILL VOLUME (UNADJUSTED) = 2,736m<sup>3</sup>  
NET (UNADJUSTED) = 20,320m<sup>3</sup>

4. SURVEY INFORMATION PROVIDED BY DEMPSEY WOOD CIVIL LTD AND TO THE BEST OF OUR KNOWLEDGE IS ACCURATE.

LEGEND:

 CUT CONTOURS SHOWN AT 0.5m INTERVALS

 FILL CONTOURS SHOWN AT 0.5m INTERVALS

 EARTHWORKS BOUNDARY

 STAGE 16 BOUNDARY

ENGINEERING APPROVAL  
ENG-60397590



HUGH GREEN GROUP

HUGH GREEN  
LIMITED

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A	AS-BUILT	WKK	10.02.23
REF	REVISIONS	BY	DATE
PROJECT:			
HUGH GREEN LIMITED			
DONEGAL STAGE 16			
36 TIR CONAILL AVENUE, FLAT BUSH			
TITLE:			
CUT AND FILL			
AS-BUILT PLAN			
ORIGINATOR:	DATE:	SIGNED:	PLOT BY:
KKA	15.11.21		WKK
DRAWN:	DATE:	SIGNED:	PLOT DATE:
WKK	02.2023		15.11.21
CHECKED:	DATE:	SIGNED:	SURVEY BY:
DAS	02.2023		DEMPSEY WOOD
APPROVED:	DATE:	SIGNED:	SURVEY DATE:
DAS	02.2023		02.2023
ISSUE STATUS:			
AS-BUILT			
PROJECT No:	SCALES:	A3	
A2111813.00	1:500-A1 1:1000-A3		
DRAWING No:	REV		
A2111813.00-16-AB220	A		



## APPENDIX B: CLASSIFICATION TEST DATA

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# Shrink Swell Index Report

Report No: SSI:ETAM21S-02605

Issue No: 1

Client: Coffey Services (NZ) Limited (Auckland)  
PO Box 8261, Symonds Street  
Auckland 1150

Principal: Ray Berry

Project No.: 773-ETAM01121AA

Project Name: 773-GENZAUCK16856AE - DONEGAL STUD

Lot No.: - TRN: -



Approved Signatory: James McKelvey  
(Senior Technician)

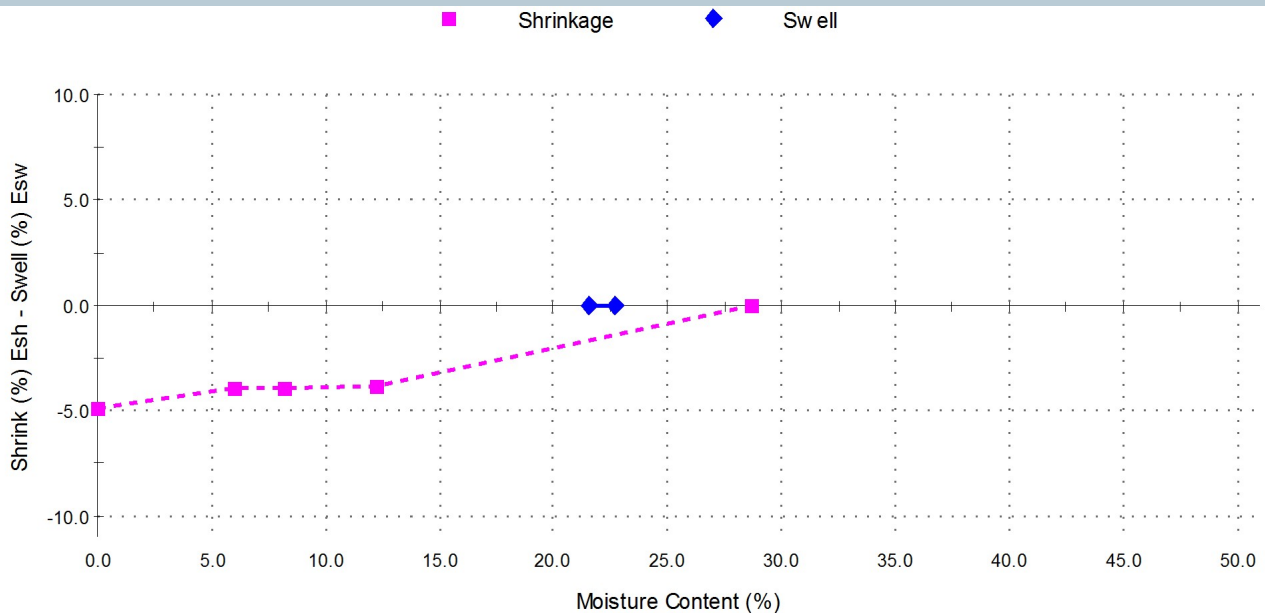
Date of Issue: 4/06/2021

## Sample Details

Sample ID:	ETAM21S-02605	Sampling Method:	NZS4407: 2015 Part 2.4.8.3
Date Sampled:	27/05/2021	Material:	Undisturbed Soil
Date Submitted:	28/05/2021	Source:	In-Situ
Date Tested:	28/05/2021		
Project Location:	Greenam Drive, Flat Bush		
Sample Location:	HA01		
Borehole Number:	HA01		
Borehole Depth (m):	0.2		

Swell Test AS 1289.7.1.1		Shrink Test AS 1289.7.1.1	
Swell on Saturation (%):	0.0	Shrink on drying (%):	4.9
Moisture Content before (%):	21.6	Shrinkage Moisture Content (%):	28.7
Moisture Content after (%):	22.7	Est. inert material (%):	2%
Est. Unc. Comp. Strength before (kPa):	450+	Crumbling during shrinkage:	0.5%
Est. Unc. Comp. Strength after (kPa):	450+	Cracking during shrinkage:	0.5%

## Shrink Swell



Shrink Swell Index - Iss (%): 2.7

## Comments

# Not accredited  
Work Order No : ETAM21W00723  
Tested By: JM

# Shrink Swell Index Report

Report No: SSI:ETAM21S-02606

Issue No: 1

Client: Coffey Services (NZ) Limited (Auckland)  
PO Box 8261, Symonds Street  
Auckland 1150

Principal: Ray Berry

Project No.: 773-ETAM01121AA

Project Name: 773-GENZAUCK16856AE - DONEGAL STUD

Lot No.: - TRN: -



Approved Signatory: James McKelvey  
(Senior Technician)

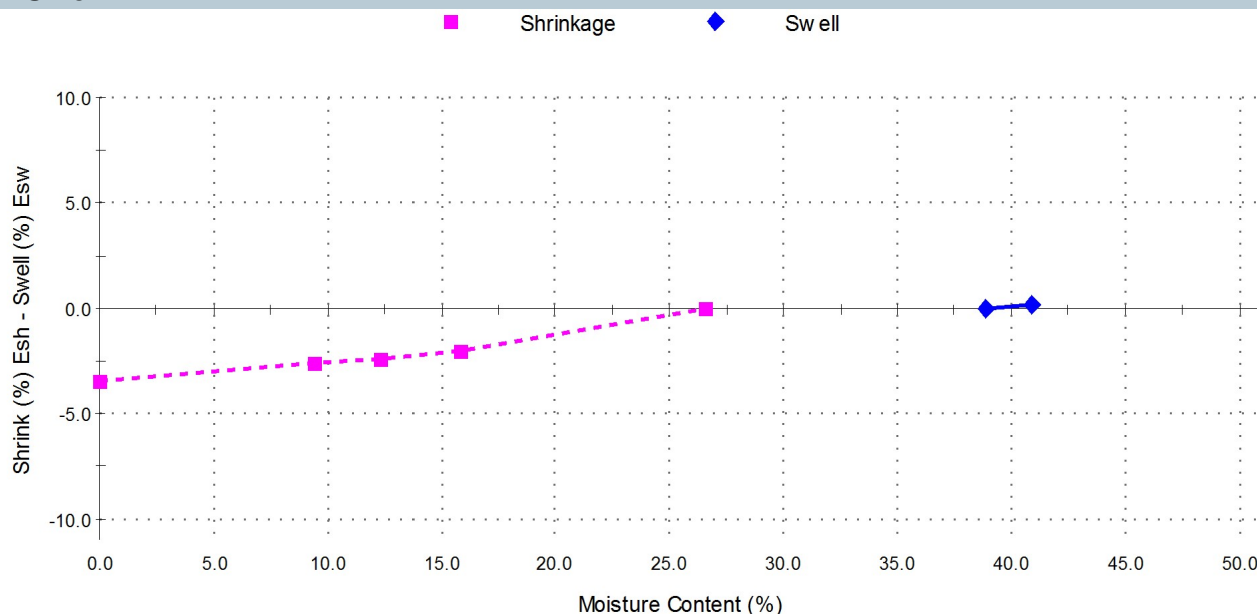
Date of Issue: 4/06/2021

## Sample Details

Sample ID:	ETAM21S-02606	Sampling Method:	NZS4407: 2015 Part 2.4.8.3
Date Sampled:	27/05/2021	Material:	Undisturbed Soil
Date Submitted:	28/05/2021	Source:	In-Situ
Date Tested:	28/05/2021		
Project Location:	Greenam Drive, Flat Bush		
Sample Location:	HA33, 0.2 - 0.5 m		
Borehole Number:	HA33		
Borehole Depth (m):	0.2 - 0.5		

Swell Test AS 1289.7.1.1		Shrink Test AS 1289.7.1.1	
Swell on Saturation (%):	0.1	Shrink on drying (%):	3.5
Moisture Content before (%):	38.9	Shrinkage Moisture Content (%):	26.6
Moisture Content after (%):	40.9	Est. inert material (%):	1%
Est. Unc. Comp. Strength before (kPa):	350	Crumbling during shrinkage:	0.5%
Est. Unc. Comp. Strength after (kPa):	275	Cracking during shrinkage:	1.5%

## Shrink Swell



Shrink Swell Index - Iss (%): 2.0

## Comments

# Not accredited  
Work Order No : ETAM21W00723  
Tested By: JM



# Shrink Swell Index Report

Report No: SSI:ETAM21S-02607

Issue No: 1

Client: Coffey Services (NZ) Limited (Auckland)  
PO Box 8261, Symonds Street  
Auckland 1150

Principal: Ray Berry

Project No.: 773-ETAM01121AA

Project Name: 773-GENZAUCK16856AE - DONEGAL STUD

Lot No.: - TRN: -



Approved Signatory: James McKelvey  
(Senior Technician)

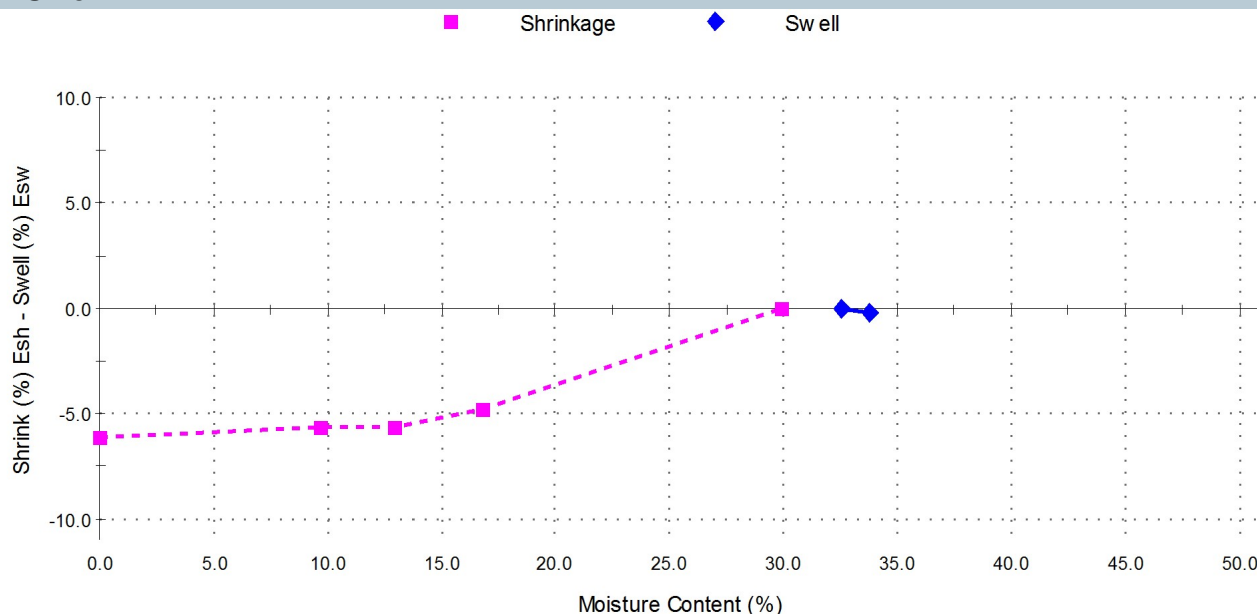
Date of Issue: 4/06/2021

## Sample Details

Sample ID:	ETAM21S-02607	Sampling Method:	NZS4407: 2015 Part 2.4.8.3
Date Sampled:	27/05/2021	Material:	Undisturbed Soil
Date Submitted:	28/05/2021	Source:	In-Situ
Date Tested:	28/05/2021		
Project Location:	Greenam Drive, Flat Bush		
Sample Location:	HA36, 0.3 - 0.5 m		
Borehole Number:	HA36		
Borehole Depth (m):	0.3 - 0.5		

Swell Test AS 1289.7.1.1		Shrink Test AS 1289.7.1.1	
Swell on Saturation (%):	-0.2	Shrink on drying (%):	6.1
Moisture Content before (%):	32.6	Shrinkage Moisture Content (%):	29.9
Moisture Content after (%):	33.8	Est. inert material (%):	15%
Est. Unc. Comp. Strength before (kPa):	275	Crumbling during shrinkage:	3%
Est. Unc. Comp. Strength after (kPa):	175	Cracking during shrinkage:	0.5%

## Shrink Swell



Shrink Swell Index - Iss (%): 3.4

## Comments

# Not accredited  
Work Order No : ETAM21W00723  
Tested By: JM

## APPENDIX C: FIELD DENSITY TEST SUMMARY SHEETS

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# Earthworks Fill Report

**Report No: EFIL:ETAM21W01023**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM21W01023*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** DONEGAL STUD Stage 14 – 16



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Cesar Pura  
Senior Technician  
IANZ Site Number: 105  
Date of Issue: 3/08/2021

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZGS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL (m)	Material Tested	Comments
30/07/2021	ETAM21W01023	AK	216	1.85	38.5	1.33	2.70	0	89	89	76	131	Pond Backfill	1770810	5905358	50.83	Silty CLAY	Aggregate present in fill

## Comments:

Moisture contents and dry densities are corrected against oven dried moisture content testing. Probe Depth: 150mm; SG= 2.70 T/m3 (Assumed)

# Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** DONEGAL STUD Stage 14 – 16

**Report No:** EFIL:ETAM21W01023

**Issue No:** 1

*This report replaces all previous issues of report no. EFIL:ETAM21W01023*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

*[Signature]*

Approved Signatory: Cesar Pura  
Senior Technician  
IANZ Site Number: 105  
Date of Issue: 3/08/2021



**SITE PLAN** (NOT TO SCALE)

# Earthworks Fill Report

**Report No: EFIL:ETAM21W01036**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM21W01036*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** DONEGAL STUD Stage 14 – 16



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Cesar Pura  
Senior Technician  
IANZ Site Number: 105  
Date of Issue: 3/08/2021

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZGS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL (m)	Material Tested	Comments
2/08/2021	ETAM21W01036	AK	217	1.84	32.7	1.39	2.70	3	63	63	90	77	Pond Backfill	1770810	5905358	50.83	Silty CLAY	Retest of Test No. 216

## Comments:

Moisture contents and dry densities are corrected against oven dried moisture content testing. Probe Depth: 150mm; SG= 2.70 T/m3 (Assumed)





# Earthworks Fill Report

**Report No: EFIL:ETAM22W00648**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00648*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 20/04/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
8/04/2022	ETAM22W00648	RP	218	1.70	42.1	1.20	2.65	4.4	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770794	5905226	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	219	1.76	29.3	1.36	2.65	9.0	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770813	5905222	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	220	1.84	26.2	1.45	2.65	7.0	141	UTP	UTP	UTP	Old Site Office Compound Area	1770832	5905217	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	221	1.83	21.9	1.50	2.65	10.3	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770832	5905234	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	222	1.85	31.0	1.41	2.65	3.0	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770815	5905238	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	223	1.82	32.6	1.37	2.65	3.6	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770802	5905241	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	224	1.83	29.5	1.41	2.65	5.2	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770806	5905260	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	225	1.79	26.4	1.41	2.65	9.5	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770826	5905251	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	226	1.79	29.7	1.38	2.65	6.9	130.9	130.9	120.9	99.9	Old Site Office Compound Area	1770839	5905254	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	227	1.84	28.3	1.43	2.65	5.5	102.8	UTP	UTP	UTP	Old Site Office Compound Area	1770839	5905271	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	228	1.76	30.9	1.35	2.65	7.6	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770823	5905274	59.83	Silty Clay	-
8/04/2022	ETAM22W00648	RP	229	1.87	27.3	1.47	2.65	4.3	UTP	UTP	UTP	UTP	Old Site Office Compound Area	1770815	5905275	59.83	Silty Clay	-

**Comments:**

## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W00648**

**Issue No:1**

*This report replaces all previous issues of report no. EFIL:ETAM22W00648*



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

{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: Eric Paton

Director-Testing

IANZ Site Number: 105

Date of Issue: 20/04/2022





# Earthworks Fill Report

**Report No: EFIL:ETAM22W00745**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00745*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 22/04/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
11/04/2022	ETAM22W00745	RP	230	1.84	26.6	1.46	2.65	6.3	UTP	UTP	UTP	UTP	Old Carpark	1770836	5905219	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	231	1.95	24.0	1.57	2.65	3.1	UTP	UTP	UTP	UTP	Old Carpark	1770814	5905223	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	232	1.90	22.5	1.55	2.65	6.5	UTP	UTP	UTP	UTP	Old Carpark	1770797	5905226	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	233	1.88	25.5	1.50	2.65	5.4	UTP	UTP	UTP	UTP	Old Carpark	1770803	5905252	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	234	1.93	33.2	1.45	2.65	0.0	UTP	UTP	UTP	UTP	Old Carpark	1770825	5905239	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	235	1.90	25.1	1.52	2.65	4.5	UTP	UTP	UTP	UTP	Old Carpark	1770840	5905236	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	236	1.79	25.7	1.42	2.65	9.7	UTP	UTP	UTP	UTP	Old Carpark	1770841	5905253	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	237	1.88	23.2	1.52	2.65	7.2	UTP	UTP	UTP	UTP	Old Carpark	1770823	5905259	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	238	1.86	27.3	1.46	2.65	4.8	UTP	UTP	UTP	UTP	Old Carpark	1770809	5905264	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	239	1.80	23.2	1.46	2.65	10.8	UTP	UTP	UTP	UTP	Old Carpark	1770820	5905279	59.83	Silty Clay	-
11/04/2022	ETAM22W00745	RP	240	1.89	27.8	1.48	2.65	2.9	UTP	UTP	UTP	UTP	Old Carpark	1770831	5905275	59.83	Silty Clay	-

**Comments:**

## Earthworks Fill Report

**Report No: EFIL:ETAM22W00745**

**Issue No:1**

*This report replaces all previous issues of report no. EFIL:ETAM22W00745*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 22/04/2022



# Earthworks Fill Report

**Report No: EFIL:ETAM22W00747**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00747*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 22/04/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
14/04/2022	ETAM22W00747	RP	241	1.80	23.8	1.45	2.65	10.7	UTP	UTP	UTP	UTP	Old Carpark	1770813	5905262	59.83	Silty Clay	-
14/04/2022	ETAM22W00747	RP	242	1.87	26.0	1.49	2.65	5.3	UTP	UTP	UTP	UTP	Old Carpark	1771821	5905242	59.83	Silty Clay	-
14/04/2022	ETAM22W00747	RP	243	1.83	33.2	1.37	2.65	2.7	155	165	160	184	Old Carpark	1770888	5905355	59.83	Silty Clay	-

**Comments:**

## Earthworks Fill Report

**Report No: EFIL:ETAM22W00747**

**Issue No:1**

*This report replaces all previous issues of report no. EFIL:ETAM22W00747*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 22/04/2022



# Earthworks Fill Report

**Report No: EFIL:ETAM22W00779**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00779*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** STAGE 1A2



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Cesar Pura  
Laboratory Supervisor  
IANZ Site Number: 105  
Date of Issue: 29/04/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001);Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2); Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL (m)	Material Tested	Comments
26/04/2022	ETAM22W00779	RP	244	1.82	26.5	1.44	2.65	8	UTP	UTP	UTP	UTP	Refer to plan	1770890	5905360	-	Silty CLAY	0.70m below finished level
26/04/2022	ETAM22W00779	RP	245	1.97	23.7	1.59	2.65	2	UTP	UTP	UTP	UTP	Refer to plan	1770866	5905363	-	Silty CLAY	0.70m below finished level
26/04/2022	ETAM22W00779	RP	246	1.87	26.8	1.47	2.65	5	UTP	UTP	UTP	UTP	Refer to plan	1770899	5905355	-	Silty CLAY	0.70m below finished level
26/04/2022	ETAM22W00779	RP	247	1.85	30.3	1.42	2.65	4	201	UTP	201	UTP	Old Carpark	1770813	5905262	59.83	Silty CLAY	Retest of Test No. 241

## Comments:

Moisture contents and dry densities are corrected against oven dried moisture content testing. Probe Depth: 150mm; SG= 2.65 T/m3 (Supplied)



## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** STAGE 1A2

**Report No:** EFIL:ETAM22W00779

**Issue No:** 1

*This report replaces all previous issues of report no. EFIL:ETAM22W00779*



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

{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: Cesar Pura  
Laboratory Supervisor  
IANZ Site Number: 105  
Date of Issue: 29/04/2022



**SITE PLAN** (NOT TO SCALE)

# Earthworks Fill Report

**Report No: EFIL:ETAM22W00795**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00795*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 4/05/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
28/04/2022	ETAM22W00795	SC	248	1.89	27.8	1.47	2.70	4.3	UTP	UTP	UTP	UTP	Stage 16	1770896	5905356	-	Silty Clay	-
28/04/2022	ETAM22W00795	SC	249	1.89	28.2	1.47	2.70	3.8	UTP	UTP	UTP	UTP	Stage 16	1770880	5905351	-	Silty Clay	-

**Comments:**

## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W00795**

**Issue No:1**

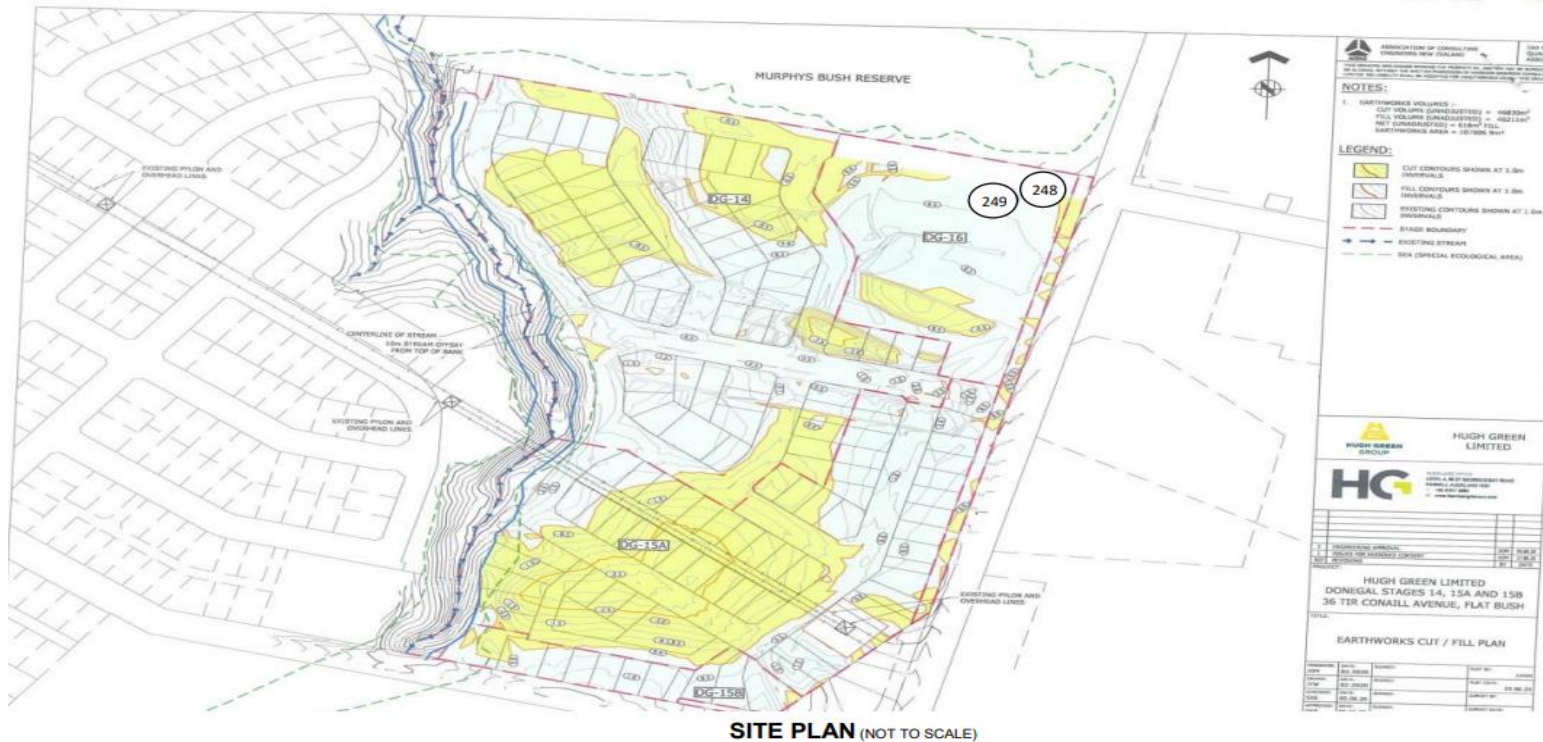
*This report replaces all previous issues of report no. EFIL:ETAM22W00795*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 4/05/2022



**SITE PLAN (NOT TO SCALE)**



# Earthworks Fill Report

**Report No: EFIL:ETAM22W00825**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00825*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 5/05/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
2/05/2022	ETAM22W00825	SC	250	1.81	28.4	1.41	2.70	7.6	UTP	UTP	UTP	UTP	Stage 16, see plan	1770883	5905361	-	Silty Clay	FL
2/05/2022	ETAM22W00825	SC	251	1.94	29.6	1.50	2.70	0.3	UTP	UTP	UTP	UTP	Stage 16, see plan	1770863	5905365	-	Silty Clay	FL

**Comments:**

# Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W00825**

**Issue No:1**

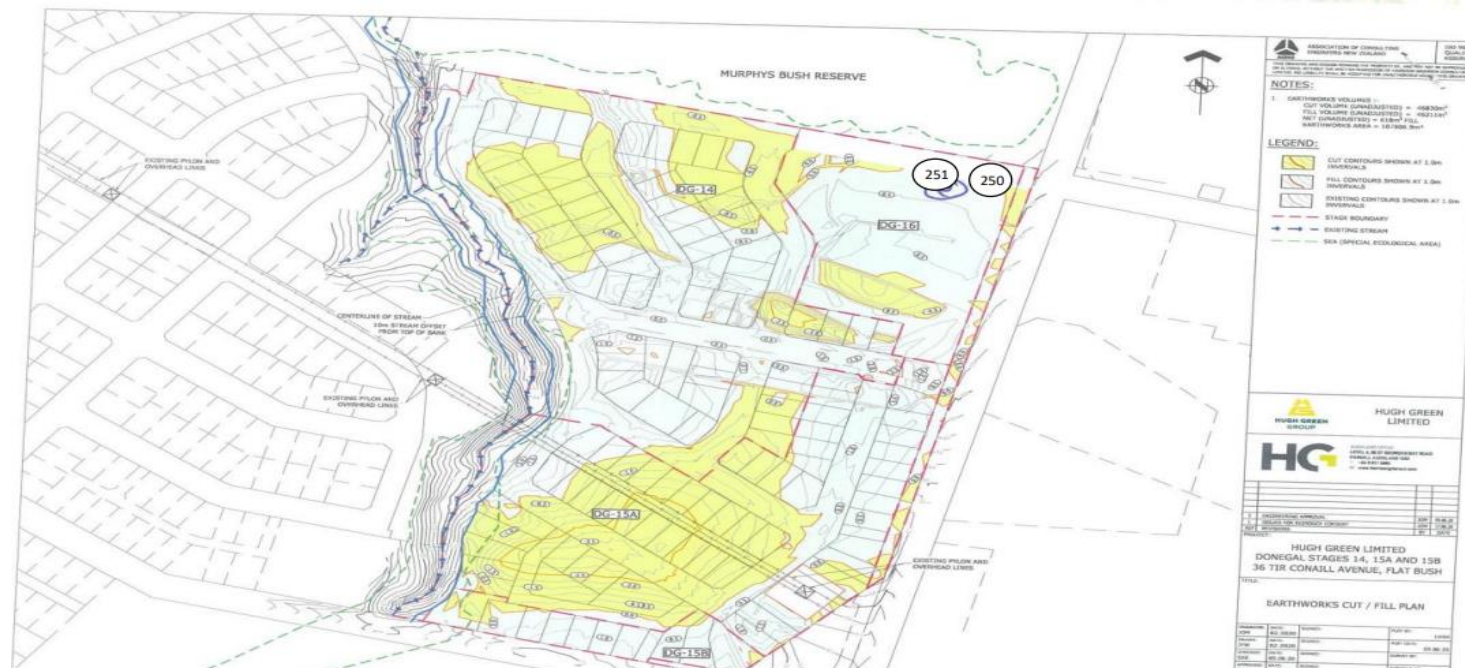
*This report replaces all previous issues of report no. EFIL:ETAM22W00825*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 5/05/2022



# Earthworks Fill Report

**Report No: EFIL:ETAM22W00853**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00853*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 5/05/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
4/05/2022	ETAM22W00853	RP	252	1.92	28.1	1.50	2.65	1.2	UTP	UTP	UTP	UTP	Balance Lot	1770881	5905332	-	Silty Clay	Subgrade
4/05/2022	ETAM22W00853	RP	253	1.91	29.0	1.48	2.65	1.0	UTP	UTP	UTP	UTP	Balance Lot	1770855	5905339	-	Silty Clay	Subgrade
4/05/2022	ETAM22W00853	RP	254	1.82	36.3	1.33	2.65	1.2	UTP	UTP	UTP	UTP	Pond	1770815	5905353	-	Silty Clay	In Fill

**Comments:**

## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W00853**

**Issue No:1**

*This report replaces all previous issues of report no. EFIL:ETAM22W00853*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 5/05/2022



# Earthworks Fill Report

**Report No: EFIL:ETAM22W00873**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W00873*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 8/05/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
5/05/2022	ETAM22W00873	SC	255	1.84	26.9	1.45	2.70	7.3	168	160	188	168	Stage 16 Silt Pond	1770830	5905348	-	Silty Clay	500mm below FL
5/05/2022	ETAM22W00873	SC	256	1.72	25.6	1.37	2.70	14.4	188	UTP	UTP	168	Stage 16 Silt Pond	1770808	5905355	-	Silty Clay	500mm below FL

**Comments:**

# Earthworks Fill Report

<b>Client:</b>	Tetra Tech Coffey (NZ) Limited- Auckland Coffey House, Level 4, Teed Street New Market Auckland 1023
<b>Principal:</b>	Ray Berry
<b>cc to:</b>	-
<b>Project No.:</b>	773-ETAM01121AA
<b>Project Name.:</b>	773-GENZAUCK16856AE - DONEGAL STUD
<b>Project Location:</b>	Greenam Drive, Flat Bush

Report No: EFIL:ETAM22W00873

**Issue No:1**

*This report replaces all previous issues of report no. EFIL:ETAM22W00873*

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

{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



E. Peter

Approved Signatory: Eric Paton

## Director-Testing

IANZ Site Number: 105

Date of Issue: 8/05/2022





# Earthworks Fill Report

**Report No: EFIL:ETAM22W01758**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W01758*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Liam Walker  
Assistant Manager  
IANZ Site Number: 105  
Date of Issue: 29/09/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
22/09/2022	ETAM22W01758	RP	257	1.95	28.2	1.52	2.65	-0.2	UTP	UTP	UTP	UTP	Under Stockpile	1770874	5905246	-	Silty Clay	RL unavailable
22/09/2022	ETAM22W01758	RP	258	1.91	23.6	1.55	2.65	5.1	UTP	UTP	UTP	UTP	Under Stockpile	1770879	5905264	-	Silty Clay	RL unavailable

**Comments:**



## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No:** EFIL:ETAM22W01758

**Issue No:** 1

*This report replaces all previous issues of report no. EFIL:ETAM22W01758*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

*Liam Walker*

Approved Signatory: Liam Walker  
Assistant Manager  
IANZ Site Number: 105  
Date of Issue: 29/09/2022



# Earthworks Fill Report

**Report No: EFIL:ETAM22W01793**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W01793*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)



Approved Signatory: Liam Walker  
Assistant Manager  
IANZ Site Number: 105  
Date of Issue: 4/10/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):

Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
29/09/2022	ETAM22W01793	RP	259	1.90	28.3	1.48	2.65	2.4	UTP	UTP	UTP	UTP	Lot 24	1770878	5905221	59.09	Silty Clay	-
29/09/2022	ETAM22W01793	RP	260	1.88	31.9	1.42	2.65	1.0	164	182	199	178	Lot 24-25	1770860	5905221	59.03	Silty Clay	-
29/09/2022	ETAM22W01793	RP	261	1.82	29.9	1.40	2.65	5.0	UTP	UTP	UTP	UTP	Centre Lot 20	1770871	5905265	57.80	Silty Clay	-

**Comments:**

## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W01793**

**Issue No:1**

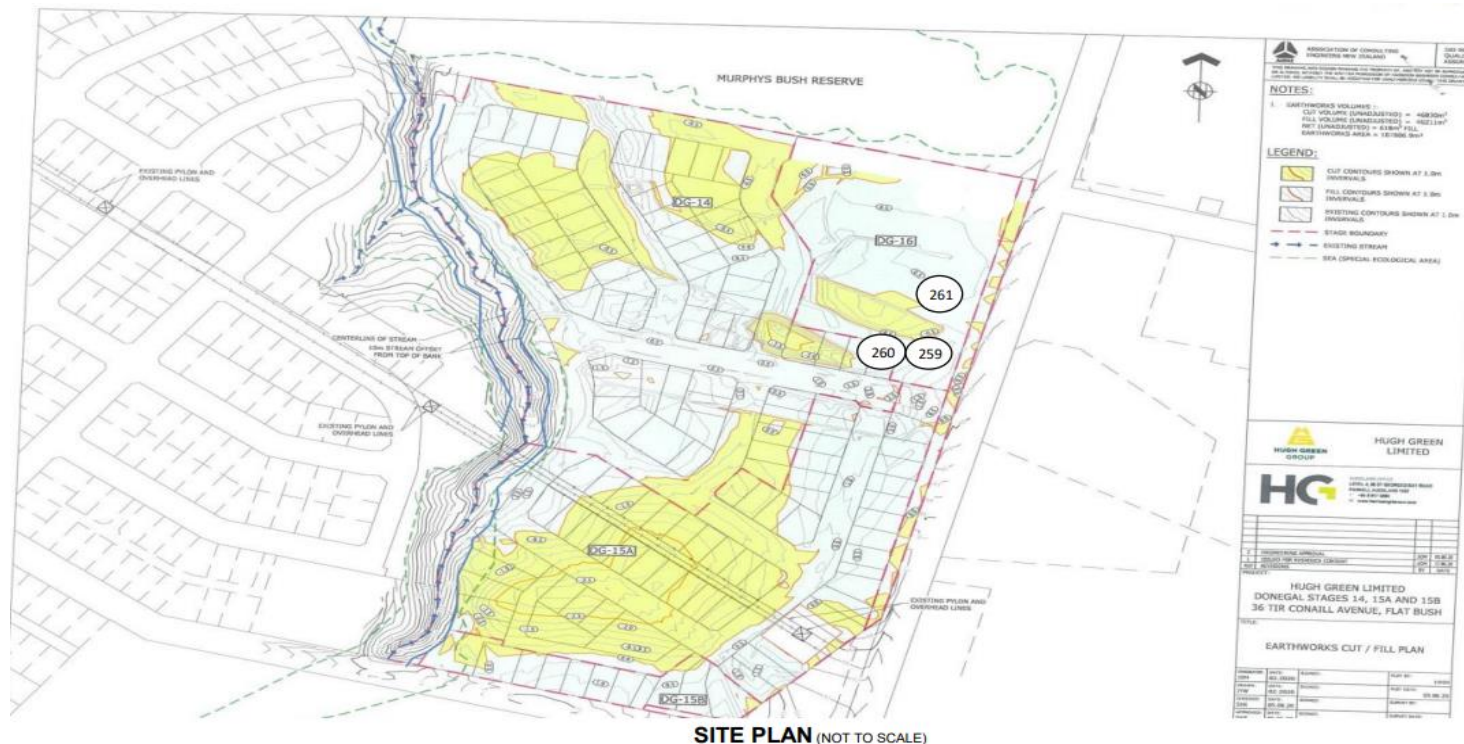
*This report replaces all previous issues of report no. EFIL:ETAM22W01793*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*L Walker*

Approved Signatory: Liam Walker  
Assistant Manager  
IANZ Site Number: 105  
Date of Issue: 4/10/2022



**SITE PLAN** (NOT TO SCALE)

# Earthworks Fill Report

**Report No: EFIL:ETAM22W01928**
**Issue No:1**
*This report replaces all previous issues of report no. EFIL:ETAM22W01928*

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}



Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 30/10/2022

## Test Results

Test Methods : Shear Strength (using field Shear vane in accordance with NZS 2001):Nuclear Densometer Testing (in accordance with NZS 4407:2015 Test 4.2): Water Content Testing (in accordance with NZS 4402:1986 Test 2.1):  
Density Calculations (in accordance with NZS 4402:1986 Tests 4.2.7)

Date Sampled	Work Order	Tested By	Test No.	Wet Density t/m <sup>3</sup>	Oven Water Content %	Dry Density t/m <sup>3</sup>	Solid Density t/m <sup>3</sup>	Air Voids %	Field Shear Strength (UTP = Unable to penetrate) kPa				Test Location	Easting	Northing	RL	Material Tested	Comments
25/10/2022	ETAM22W01928	SC	262	1.91	26.8	1.51	2.65	2.9	143	152	147	152	Silt Pond (Retest)	1770806	5905358	-	Silty Clay	0.5m below FL
25/10/2022	ETAM22W01928	SC	263	1.88	28.5	1.46	2.65	3.0	155	152	170	158	Silt Pond	1770792	5905365	-	Silty Clay	0.5m below FL

**Comments:**

## Earthworks Fill Report

**Client:** Tetra Tech Coffey (NZ) Limited- Auckland  
Coffey House, Level 4, Teed Street  
New Market Auckland 1023

**Principal:** Ray Berry

**cc to:** -

**Project No.:** 773-ETAM01121AA

**Project Name.:** 773-GENZAUCK16856AE - DONEGAL STUD

**Project Location:** Greenam Drive, Flat Bush

**Report No: EFIL:ETAM22W01928**

**Issue No:1**

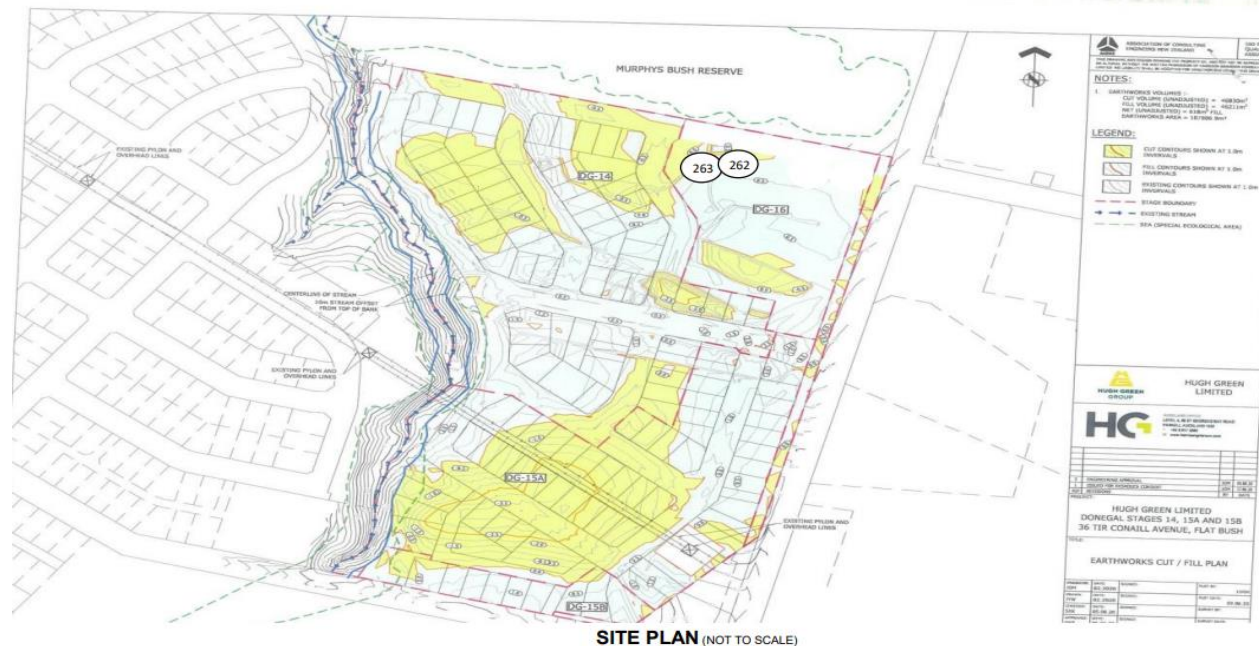
*This report replaces all previous issues of report no. EFIL:ETAM22W01928*



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.  
(This document may not be altered or reproduced except in full. This report relates only to the positions tested.)

*E. Paton*

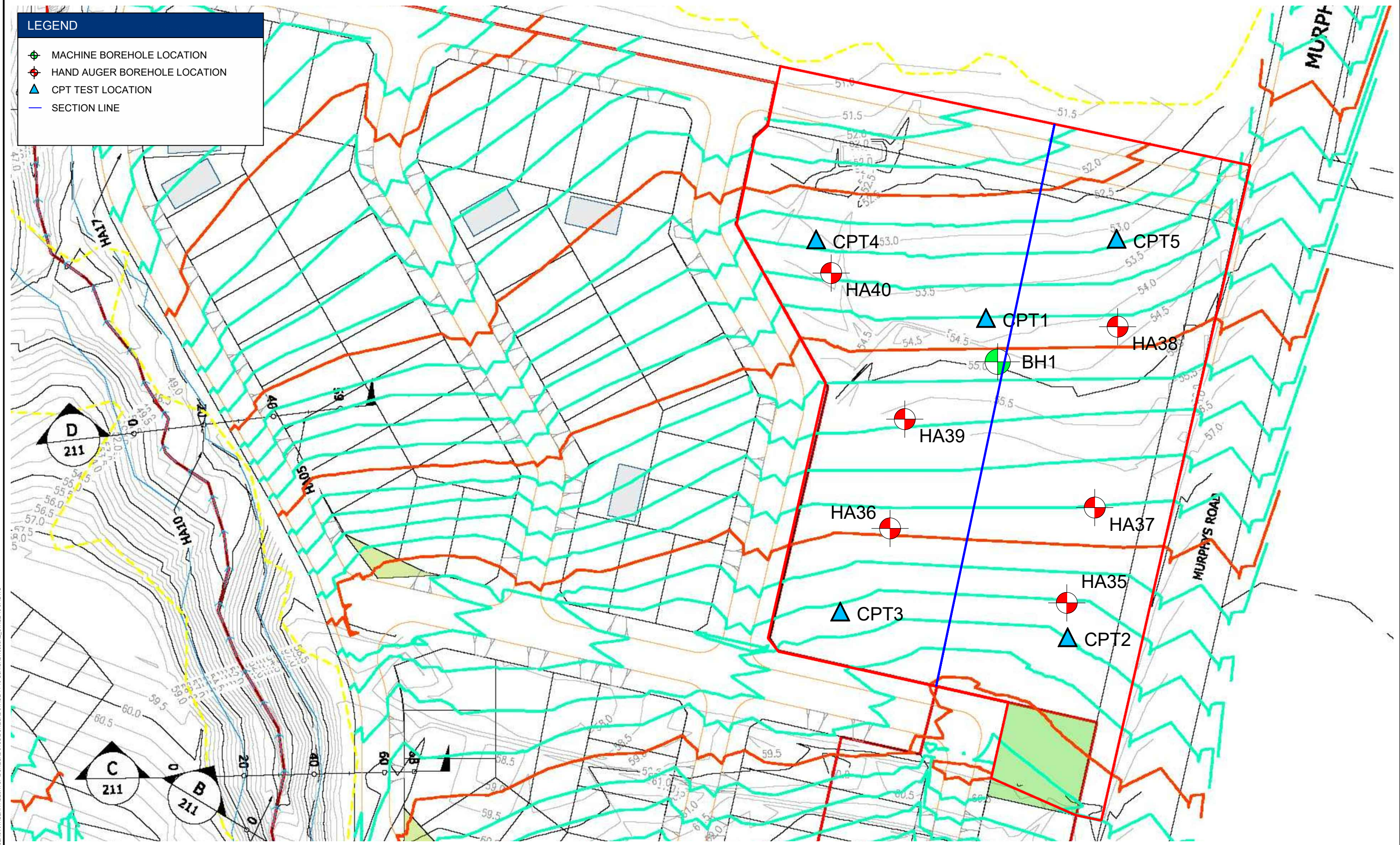
Approved Signatory: Eric Paton  
Director-Testing  
IANZ Site Number: 105  
Date of Issue: 30/10/2022



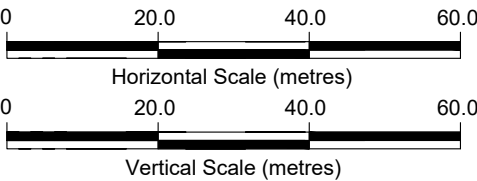
## APPENDIX D: SETTLEMENT ANALYSIS LOT 1003

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revision	no.	description		drawn	approved	date
	A	ORIGINAL ISSUE		##	##	14/06/2021



drawn	RB
approved	-
date	14/06/2021
scale	1:1000
original size	A3



**TETRA TECH**  
COFFEY

client:		HUGH GREEN LIMITED		
project:		DONEGAL STUD STAGE 16 RETAIL RESIDENTIAL ZONE FLATBUSH		
title:		SITE INVESTIGATION PLAN		
project no:	GENZAUCK16856AE	figure no:	SP-1	rev: A



PLOT DATE: 14/06/2021 11:40:10 AM DWG FILE: C:\USERS\RAY BERRY\DESKTOP\DONEGAL STUDD\DONEGAL\_STAGE 14-16 GCR\CAD\16856AE\_STAGE 16 GM.DWG

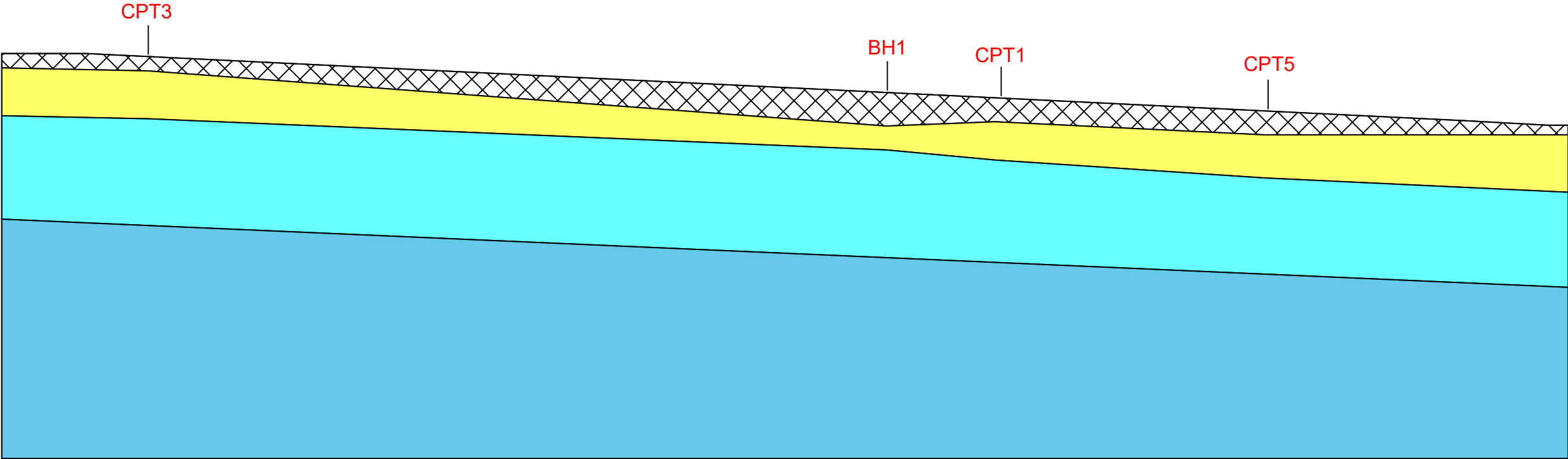
LEGEND

ENGINEERED FILL

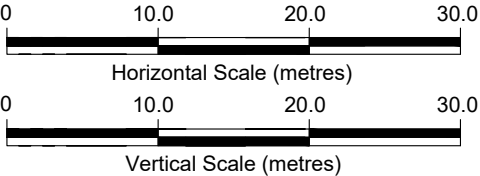
TAURANGA GROUP SOILS

TRANSITION ZONE SOILS

BEDROCK - WAITEMATA GROUP



revision	no.	description			drawn	approved	date
	A	ORIGINAL ISSUE			##	##	14/06/2021



drawn	RB
approved	-
date	14/06/2021
scale	1:500
original size	A3



client: HUGH GREEN LIMITED		
project: DONEGAL STUD STAGE 16 RETAIL RESIDENTIAL ZONE FLATBUSH		
title: GEOTECHNICAL GROUND MODEL		
project no: GENZAUCK16856AE	figure no: GM-1	rev: A



# Engineering Log - Borehole

client: **Dempsey Wood**

principal:

project: **Donegal Stud Stage 14-16**

location: **Refer to Site Plan**

Borehole ID: **MH01**

sheet: 1 of 4

project no. **GENZAUCK16856AE**

date started: **28 May 2021**

date completed: **28 May 2021**

logged by: **EP**

checked by:

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
drill model: Kubota Tractor Rig drilling fluid: Water casing diameter: HWT vane id.: 270

drilling information					material substance								
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa)	structure and additional observations	
OB CASING N OB	1							<b>Silty CLAY:</b> low plasticity, pale brown mottled orange and pale grey, w trace fine to coarse grained angular gravel.		VSt	⊕ ⊙	<b>FILL</b> Core Run (0.0-0.5 m): 50% recovery	
	2				1.0			<b>NO CORE:</b> 0.10m (0.90-1.00 m)				H	Core Run (0.5-1.0 m): 80% recovery VS 145/ 37 kPa
	3						<b>Silty CLAY:</b> low plasticity, pale brown mottled orange and pale grey, w trace fine to coarse grained angular gravel.	Core Run (1.0-1.5 m): 70% recovery VS UTP					
			SPT 2, 3, 3, 4, 5, 5 N=17		2.0			<b>NO CORE:</b> 0.15m (1.35-1.50 m)			Core Run (1.5-1.95 m): 100% recovery VS UTP		
								<b>Silty CLAY:</b> low plasticity, pale brown mottled orange and pale grey, w trace fine to coarse grained angular gravel. 2.0 m: becoming mottled brown  2.35 m: becoming brown flecked grey, orange, and red			Core Run (1.95-3.0 m): 55% recovery		
					3.0			<b>PUSH TUBE SAMPLE.</b>	VSt	⊕ ⊙	Core Run (3.0-3.5 m): 100% recovery VS 169/ 37 kPa		
			SPT 1, 1, 1, 2, 2, 2 N=7		4.0		CI	<b>Silty CLAY:</b> medium plasticity, pale grey mottled orange.  3.95 to 4.1 m: clayey SILT, low plasticity, pale grey streaked orange 4.13 m: becoming brown streaked orange			<b>PUKETOKA FORMATION</b> Core Run (3.5-4.5 m): 33% recovery		
			SPT 1, 1, 0, 1, 1, 1 N=3		5.0		CH	<b>NO CORE:</b> 0.33m (4.17-4.50 m) <b>Silty CLAY:</b> high plasticity, brown, with minor organic inclusions.  5.07 to 5.15 m: pale grey mottled orange and brown 5.3 m: becoming dark grey, with minor organic inclusions		⊕ ⊙	Core Run (4.5-4.95 m): 100% recovery VS 111/ 28 kPa Core Run (4.95-6.0 m): 53% recovery		
					6.0			<b>NO CORE:</b> 0.49m (5.51-6.00 m)					
									<b>PUSH TUBE SAMPLE.</b>	F	⊕ ⊙	Core Run (6.0-6.5 m): 100% recovery VS 46/ 22 kPa	
		SPT 2, 2, 3, 4, 3, 4 N=14		7.0			CL	<b>Silty CLAY:</b> low plasticity, green grey, with minor organic inclusions.  7.05 to 7.06 m: with some limonite			Core Run (6.5-6.95 m): 100% recovery  Core Run (6.95-8.0 m): 100% recovery		
							CL	<b>Silty CLAY:</b> low plasticity, pale blue grey to green grey. 7.5 to 7.7 m: with green inclusions			<b>TRANSITIONAL EAST COAST BAYS FORMATION</b>		

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore OB open barrel  * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	<b>support</b> M mud C casing N nil  <b>penetration</b>  no resistance ranging to refusal <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	<b>soil group symbol &amp; soil description</b> based on AS 1726:2017  <b>moisture condition</b> D dry M moist W wet Wp plastic limit WL liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Borehole

client: **Dempsey Wood**

principal:

project: **Donegal Stud Stage 14-16**

location: **Refer to Site Plan**

Borehole ID: **MH01**

sheet: 2 of 4

project no. **GENZAUCK16856AE**

date started: **28 May 2021**



date completed: **28 May 2021**

logged by: **EP**

checked by:

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
drill model: Kubota Tractor Rig drilling fluid: Water casing diameter: HWT vane id.: 270

drilling information				material substance								
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description	moisture condition	consistency / relative density	vane shear ● remoulded ● peak (kPa)	structure and additional observations
OB   												

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore OB open barrel  * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	<b>support</b> M mud C casing N nil  <b>penetration</b>  no resistance ranging to refusal  <b>water</b> 10-Oct-12 water level on date shown  water inflow water outflow	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	<b>soil group symbol &amp; soil description</b> based on AS 1726:2017  <b>moisture condition</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Borehole

 client: **Dempsey Wood**

principal:

 project: **Donegal Stud Stage 14-16**

 location: **Refer to Site Plan**

 Borehole ID. **MH01**

sheet: 3 of 4

 project no. **GENZAUCK16856AE**

 date started: **28 May 2021**


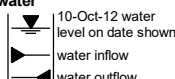
 date completed: **28 May 2021**

 logged by: **EP**

checked by:

 position: Not Specified      surface elevation: Not Specified      angle from horizontal: 90°  
 drill model: Kubota Tractor Rig      drilling fluid: Water      casing diameter: HWT      vane id.: 270

drilling information					material substance												
method & support	penetration			water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description	moisture condition	consistency / relative density	vane shear ① remoulded ② peak (kPa)			structure and additional observations	
OB  <																	

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore OB open barrel  * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	<b>support</b> M mud      N nil C casing  <b>penetration</b>  no resistance ranging to refusal  <b>water</b>  10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	<b>soil group symbol &amp; soil description</b> based on AS 1726:2017  <b>moisture condition</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Cored Borehole

 client: **Dempsey Wood**

principal:

 project: **Donegal Stud Stage 14-16**

 location: **Refer to Site Plan**

 Borehole ID. **MH01**

sheet: 4 of 4

 project no. **GENZAUCK16856AE**

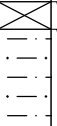


 date started: **28 May 2021**


 date completed: **28 May 2021**

 logged by: **EP**

checked by:

 position: Not Specified      surface elevation: Not Specified      angle from horizontal: 90°  
 drill model: Kubota Tractor Rig      drilling fluid: Water      casing diameter: HWT

drilling information				material substance				rock mass defects			
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characteristics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 X= axial; O= diametral a = axial; d = diametral	samples, field tests & Is(50) (MPa)	core run & RQD	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)
							VL JL ML HL VH EH			30 100 300 1000 3000	particular general
			17.0		started coring at 17.30m						
OB ↑ ↓ HQ	Not Observable		18.0		<b>SILTSTONE:</b> grey to green grey. 17.37 to 17.39 m: silty SAND, medium dense, green grey to grey 17.50 to 17.53 m: SANDSTONE, fine to medium grained, grey, slightly to moderately weathered, low strength <b>NO CORE:</b> 0.18 m <b>SILTSTONE:</b> grey to green grey.	MW					<b>EAST COAST BAYS FORMATION ROCK</b> PT, 10°, PL, SO, CN PT, 3°, PL, RO, CN PT, 4°, PL, RO, CN
			19.0		<b>NO CORE:</b> 0.80 m			SPT 9, 13, 13, 20, 17/65mm N=R			
					<b>SILTSTONE:</b> grey to green grey.			SPT 15, 35/50mm Nc=R			
			20.0		Borehole MH01 terminated at 19.95 m Target depth						
			21.0								
			22.0								
			23.0								

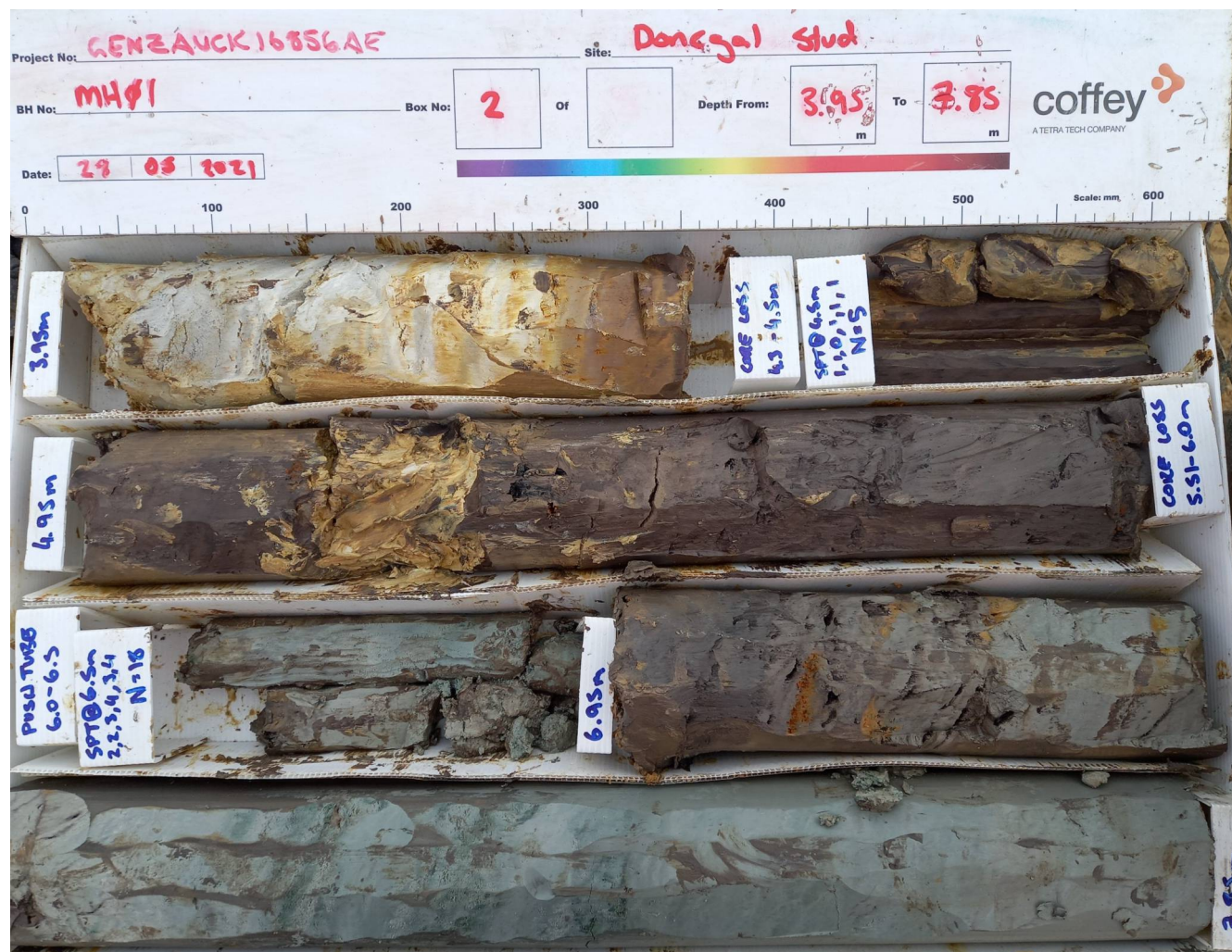
<b>method &amp; support</b> AS auger screwing AD auger drilling CB claw or blade bit W washbore RR rock roller NMLCNMLC core (51.9 mm) NQ wireline core (47.6mm) HQ wireline core (63.5mm) PQ wireline core (85.0mm) OB open barrel	<b>support</b> C casing M mud N none <b>water</b> 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss water pressure test result (lugeons) for depth interval shown	<b>graphic log / core recovery</b>  core recovered (graphic symbols indicate material) no core recovered <b>core run &amp; RQD</b> barrel withdrawn RQD = Rock Quality Designation (%)	<b>weathering &amp; alteration*</b> RS residual soil XW extremely weathered HW highly weathered MW moderately weathered SW slightly weathered FR fresh *W replaced with A for alteration <b>strength</b> VL very low L low M medium H high VH very high EH extremely high	<b>defect type</b> PT parting JT joint SS shear surface SZ shear zone CO contact CS crushed seam SM seam <b>roughness</b> VR very rough RO rough SO smooth POL polished SL slickensided	<b>planarity</b> PL planar CU curved UN undulating ST stepped IR irregular <b>coating</b> CN clean SN stained VN veneer CO coating
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MH01 0.00 - 3.95 m

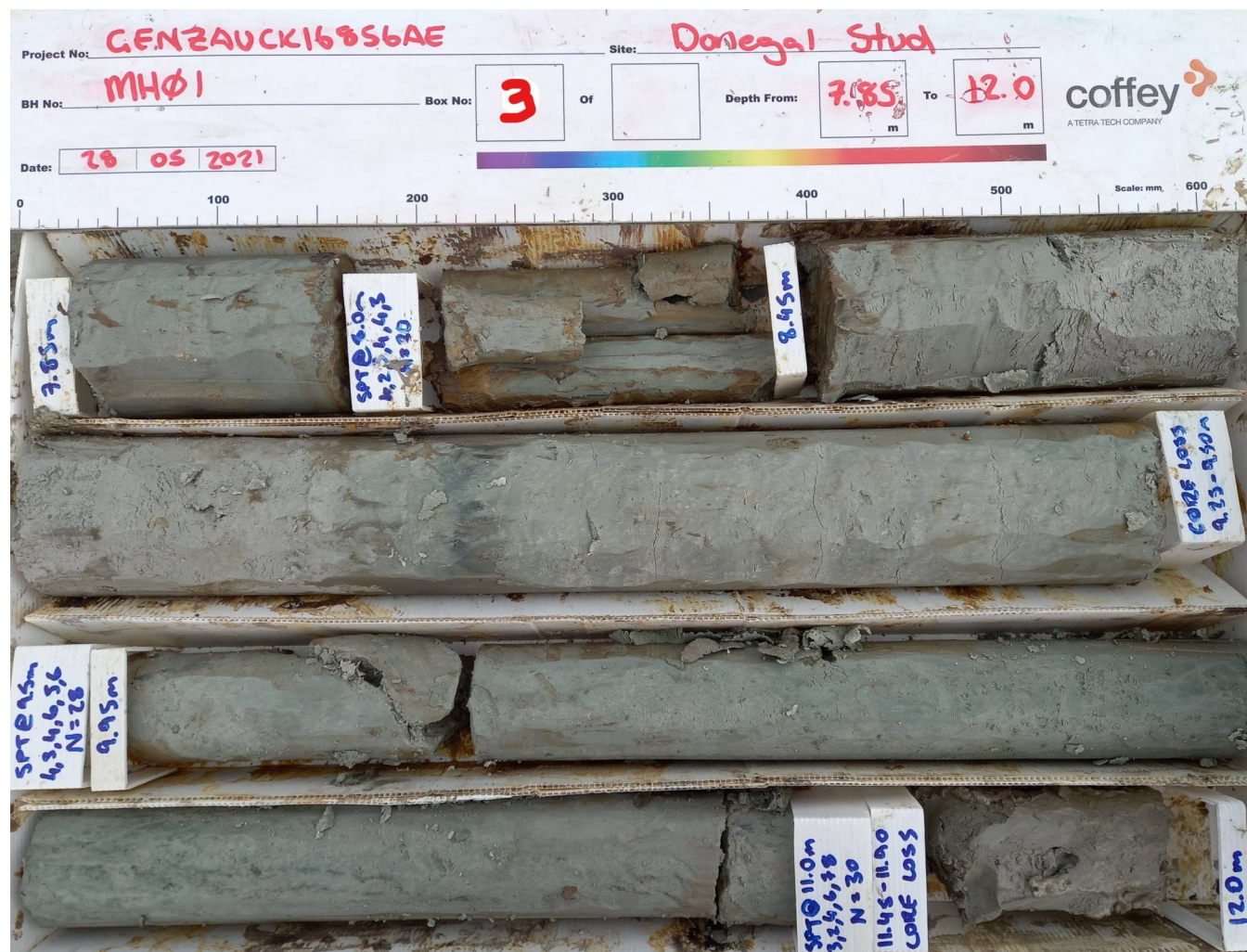
drawn	EP	<div></div> <div>TETRA TECH COFFEY</div>	client: Dempsey Wood		
approved	31/05/2021		project: Donegal Stud Stage 14-16 Refer to Site Plan		
date	31/05/2021		CORE PHOTOGRAPH MH01		
scale	N.T.S.		project no: GENZAUCK16856AE		
original size	A4		fig no: <b>FIGURE 1</b> rev:		




MH01 3.95 - 7.85 m

drawn	EP	client: Dempsey Wood		
approved	31/05/2021	project: Donegal Stud Stage 14-16 Refer to Site Plan		
date	31/05/2021	<div>  <b>TETRA TECH</b> COFFEY </div>		
scale	N.T.S.			
original size	A4			
		project no: GENZAUCK16856AE	fig no: <b>FIGURE 2</b>	rev:






MH01 7.85 - 12.00 m

drawn	EP	client: Dempsey Wood	
approved	31/05/2021	project: Donegal Stud Stage 14-16 Refer to Site Plan	
date	31/05/2021	<div>  </div>	
scale	N.T.S.		
original size	A4		
		CORE PHOTOGRAPH MH01	
		project no: GENZAUCK16856AE	fig no: <b>FIGURE 3</b>
		rev:	




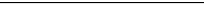


MH01 12.00 - 16.00 m

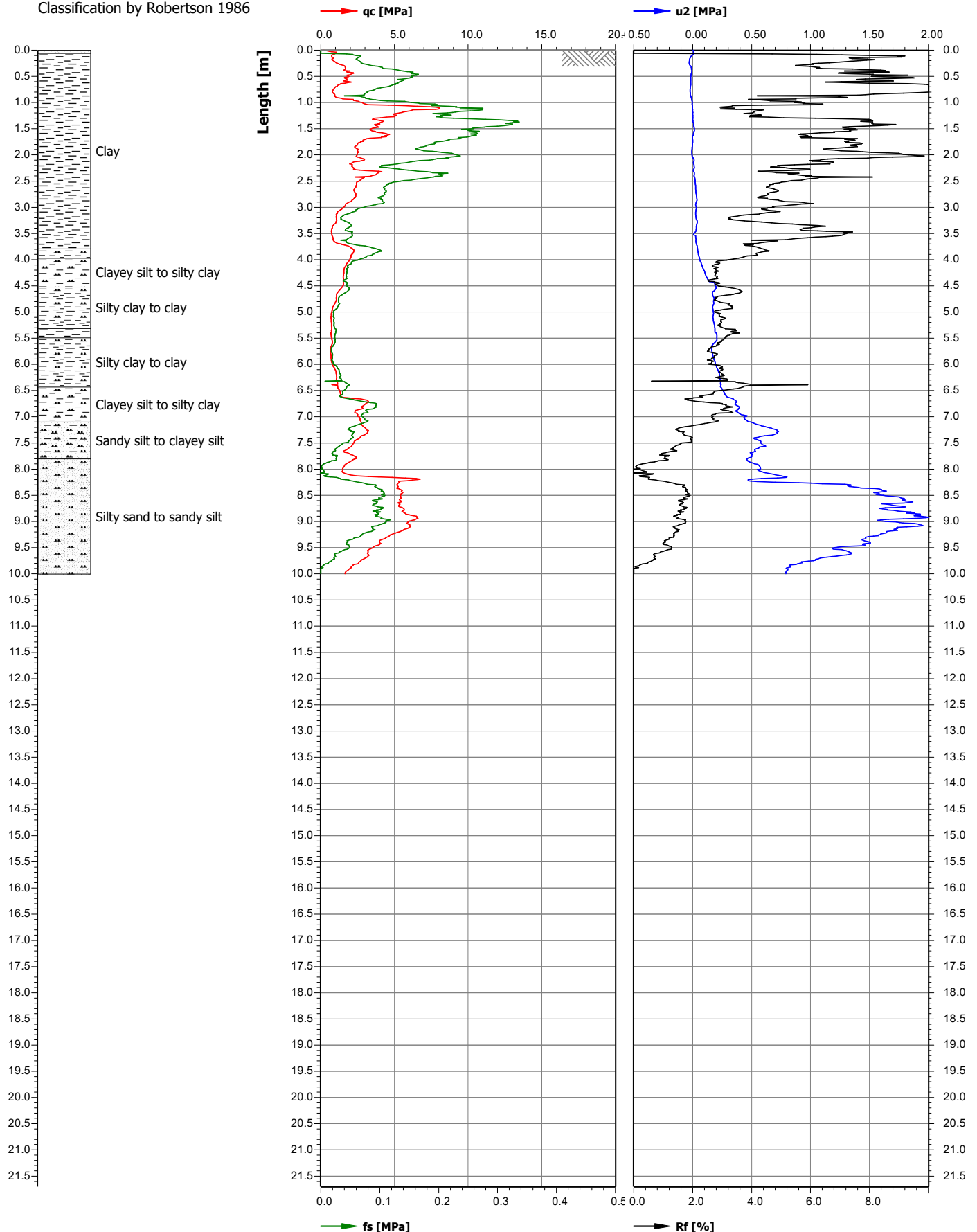
drawn	EP	<div></div> <div><b>TETRA TECH</b> COFFEY</div>	client: Dempsey Wood		
approved	31/05/2021		project: Donegal Stud Stage 14-16 Refer to Site Plan		
date	31/05/2021		<b>CORE PHOTOGRAPH MH01</b>		
scale	N.T.S.		project no: GENZAUCK16856AE		
original size	A4		fig no: <b>FIGURE 4</b>		
			rev:		



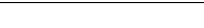
drawn	EP	 <b>TETRA TECH</b> COFFEY	client: Dempsey Wood	
approved	31/05/2021		project: Donegal Stud Stage 14-16 Refer to Site Plan	
date	31/05/2021		<b>CORE PHOTOGRAPH</b> <b>MH01</b>	
scale	N.T.S.			
original size	A4			

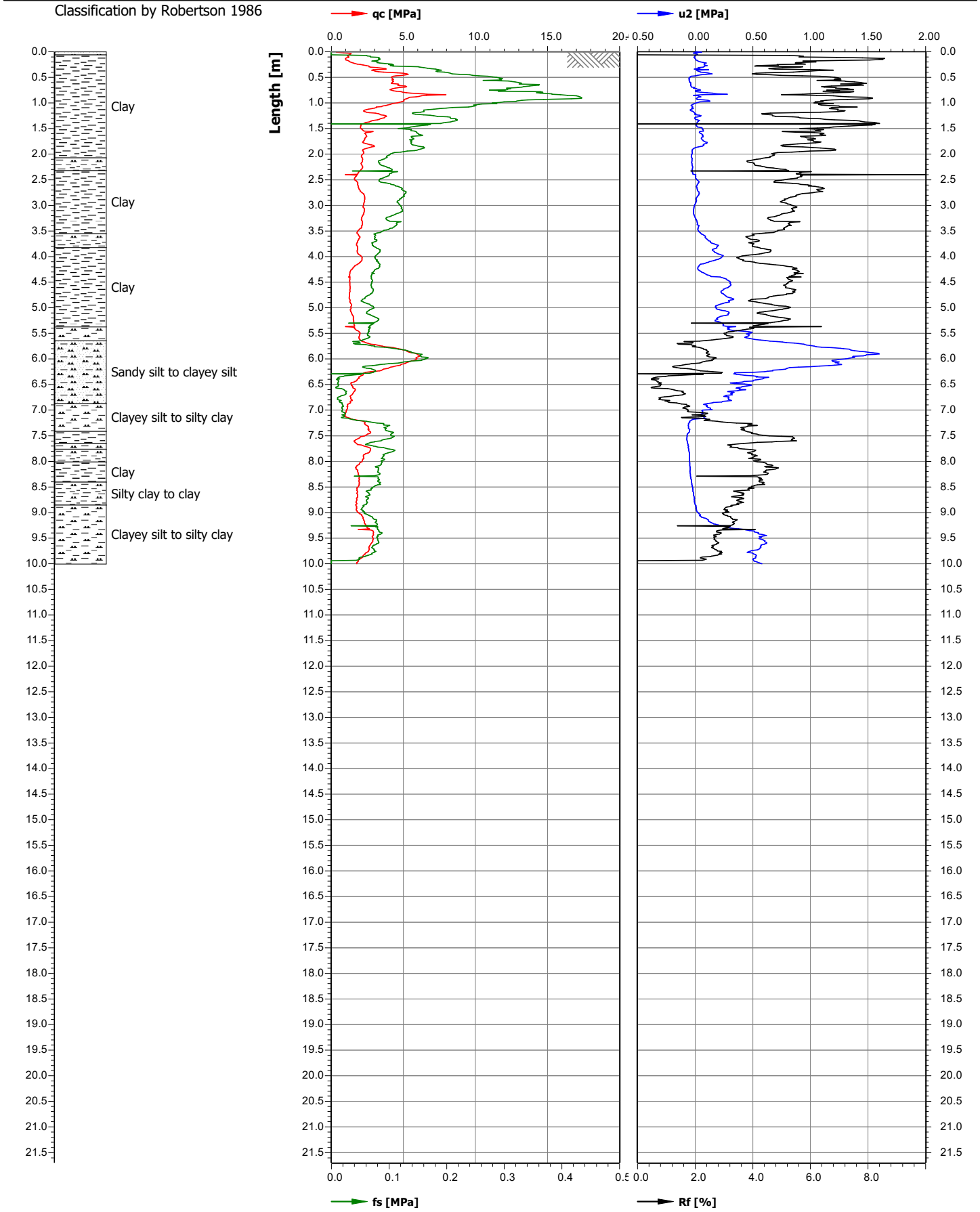
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	Test name	CPT01	Cone name		S10CFIIP.1920	
Test location name	Client	Coffey	Net surface area quotient of ...		Nominal surface area of cone...	
			0.800/0.000		10.0/150.0	
X coordinate [m]/Y coordinat... 0.00/0.00	Project contractors		Fig. no.:			
Z value [m] 0.00	Project engineer		Scale		Page	
			1:100		1/1	
Remarks1						

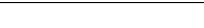
Classification by Robertson 1986

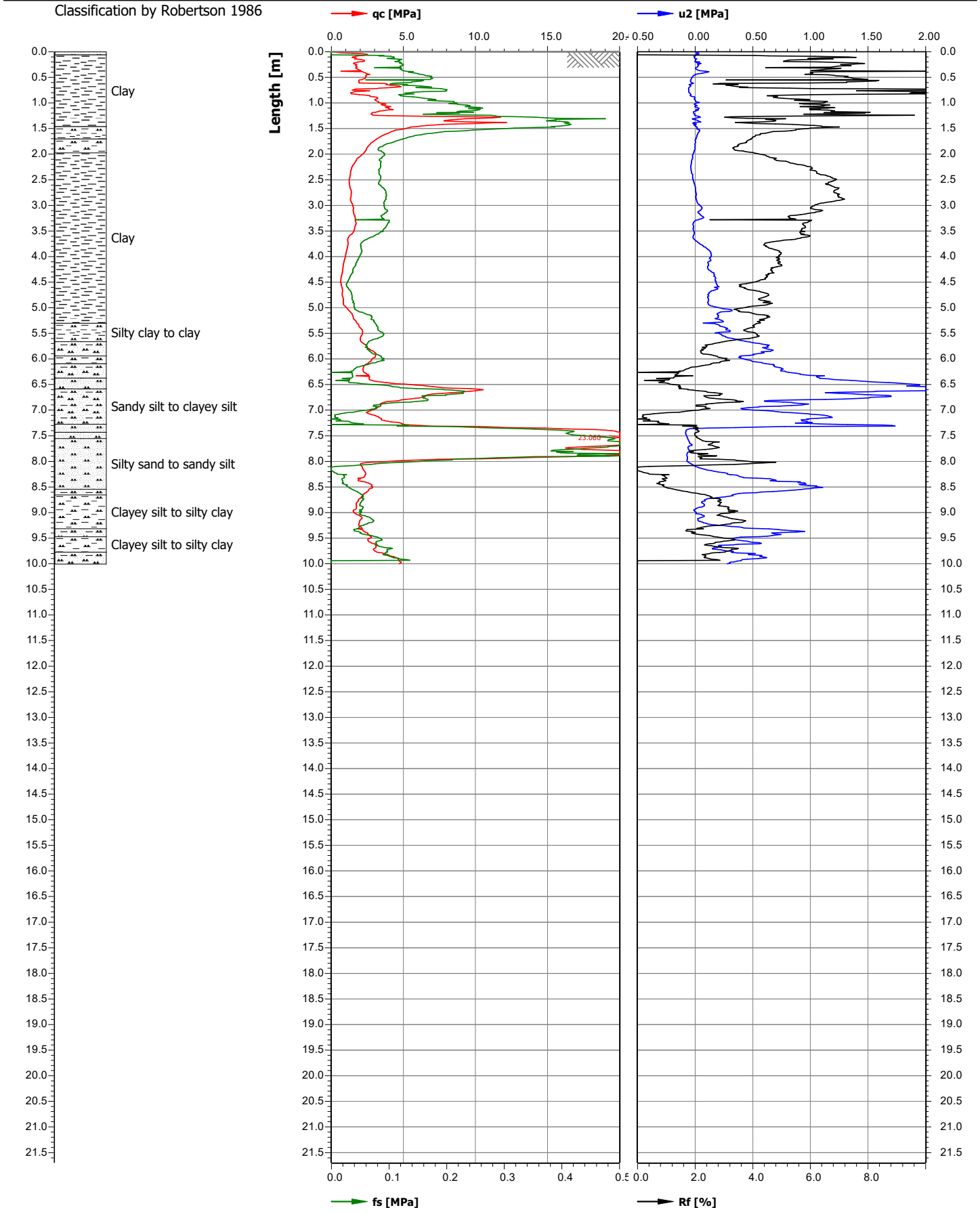


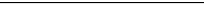


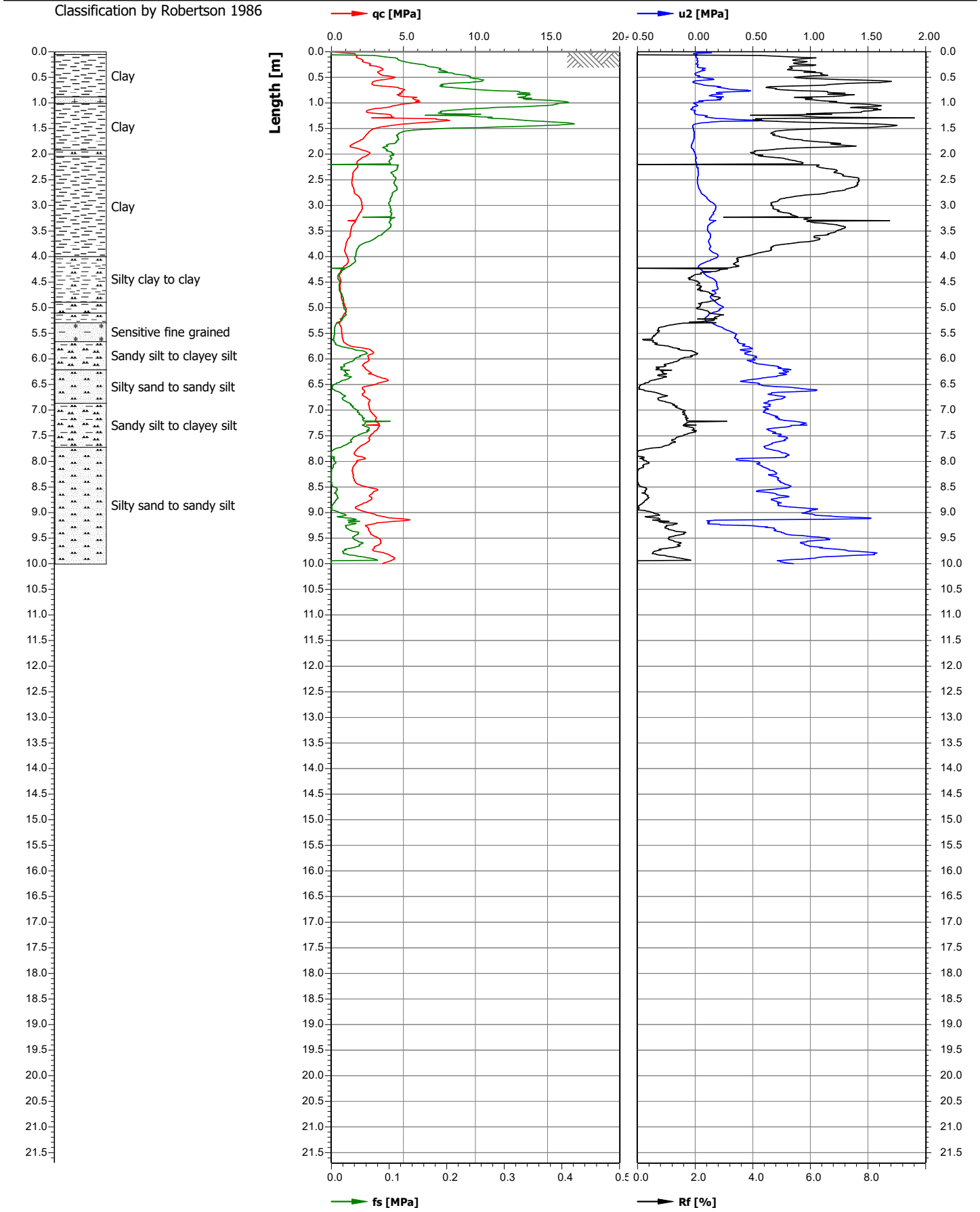
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Test location name	Client	Coffey	Net surface area quotient of ...	0.800/0.000	Nominal surface area of cone...	10.0/150.0
X coordinate [m]/Y coordinat... 0.00/0.00	Project contractors		Fig. no.:			
Z value [m] 0.00	Project engineer		Scale	1:100	Page	1/1
Remarks1						



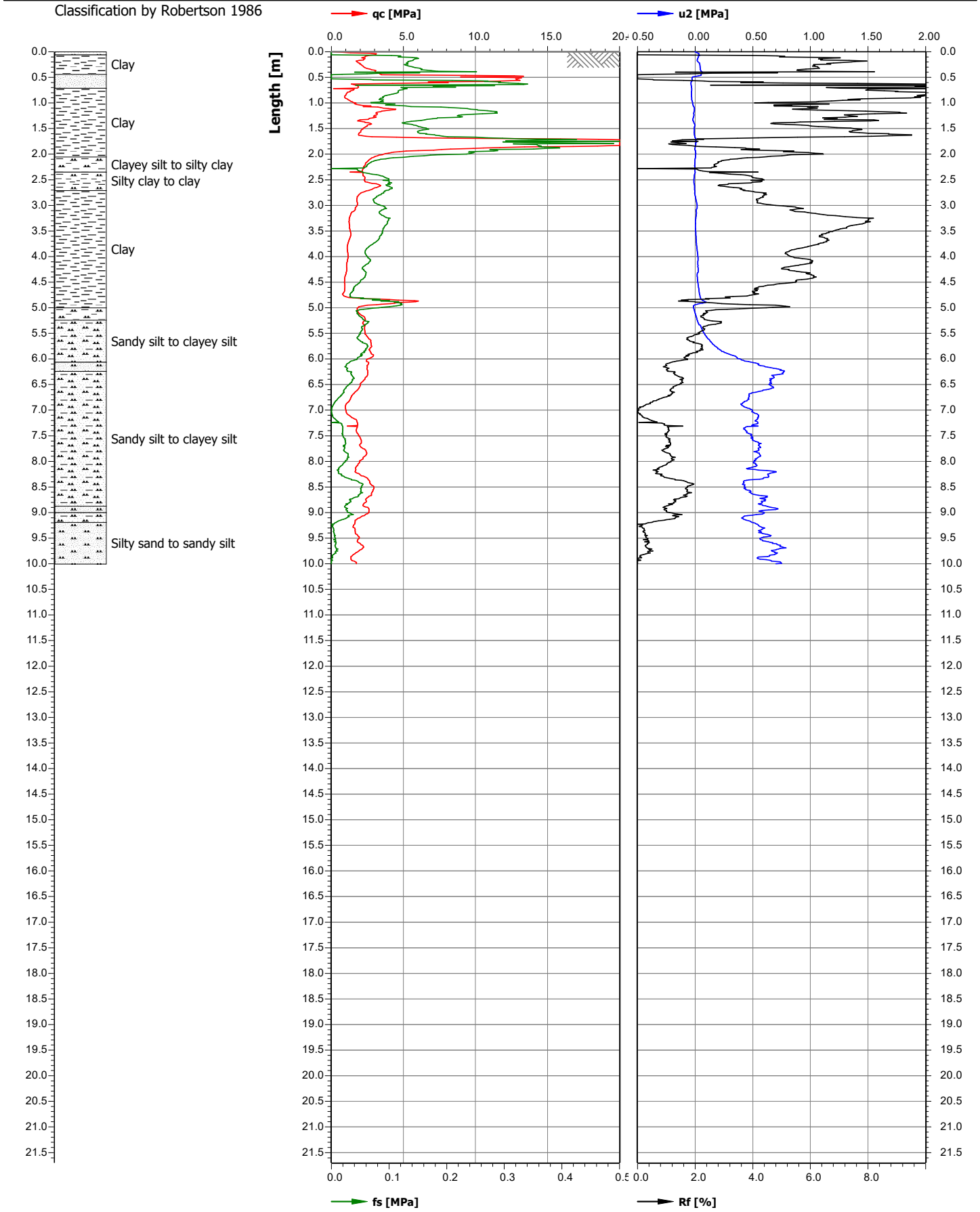
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Test location name	Client	Coffey	Net surface area quotient of ...		0.800/0.000	Nominal surface area of cone...
X coordinate [m]/Y coordinat...	Project contractors		Fig. no.:			
Z value [m]	Project engineer		Scale		1:100	Page
Remarks1					1/1	

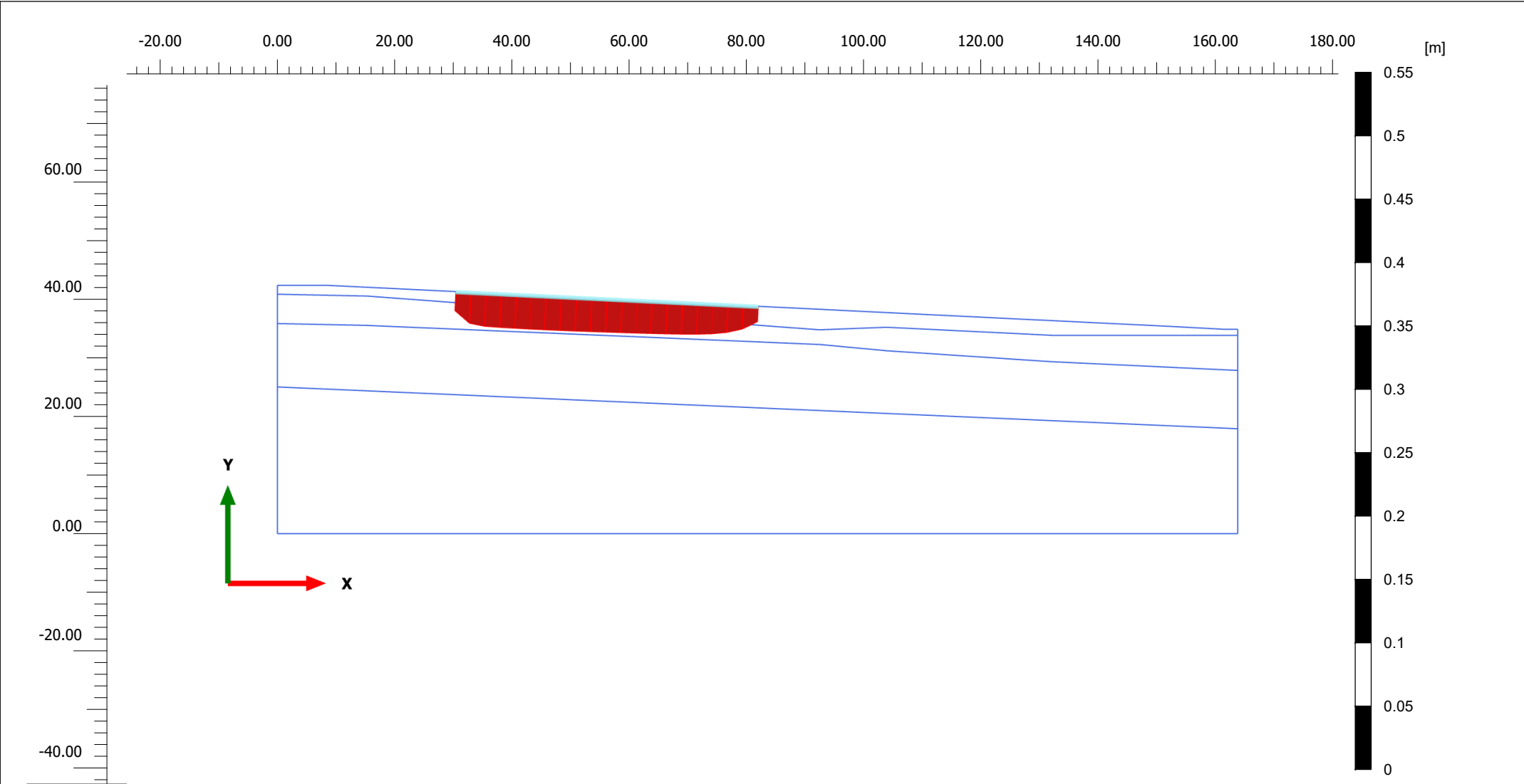


 SPECIALIST DRILLING ENGINEERS	Project name	Coffey140MurphyRd	Date investigation		28/05/2021	
	Test name	CPT04	Cone name		S10CFIIP.1920	
Test location name	Client	Coffey	Net surface area quotient of ...		0.800/0.000	Nominal surface area of cone...
X coordinate [m]/Y coordinat...	Project contractors		Fig. no.:			
Z value [m]	Project engineer		Scale		1:100	Page
					1/1	
Remarks1						



<div>PRO-DRILL</div> <div>SPECIALIST DRILLING ENGINEERS</div>	Project name	Coffey140MurphyRd	Date investigation		28/05/2021
	Test name	CPT05	Cone name		S10CFIIP.1920
Test location name	Client	Coffey	Net surface area quotient of ...	Nominal surface area of cone...	
X coordinate [m]/Y coordinat... 0.00/0.00	Project contractors		0.800/0.000	10.0/150.0	
			Fig. no.:		
Z value [m] 0.00	Project engineer		Scale	1:100	Page
					1/1
Remarks1					





**Total displacements  $u_y$  (scaled up 200 times) (Time 0.4331 day)**

Maximum value = -0.01268 m

Minimum value = -0.02842 m

<i>Project description</i>		<i>Date</i>	
Donegal Stud Stage 16_Settlement Analysis		29/06/2021	
<i>Project filename</i>	<i>Step</i>	<i>Company</i>	
Donegal Stud Stage 16_Se ...	177	Tetra Tech, Inc.	