REPORT

Tonkin+Taylor

Proposed Solar Farm, Selwyn

Prepared for
KeaX Ltd
Prepared by
Tonkin & Taylor Ltd
Date
December 2021
Job Number
1018779.v1

Exceptional thinking together
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Document Control

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1 Introduction

1.1 Engagement

KeaX Ltd has engaged Tonkin & Taylor Ltd (T+T) to undertake a geotechnical investigation and assessment for a proposed solar farm in Selwyn District. This work has been completed in accordance with our letter of engagement dated 28 September 2021.

1.2 Site and proposed development

The subject proposed site is located southeast of the intersection of Branch Drain, Buckleys, Stewarts, Irwell-Rakaia, and Dunsandel-Brookside Roads, near Leeston, and is located partly on the land parcels described as Lot 1 DP 7545, and Lot 2 DP 54392. Site topography is generally flat and the land is currently used as a dairy farm.

The proposed solar farm comprises arrays of solar panels, likely mounted on driven steel piles, together with an inverter, which could be on shallow foundations. The solar farm will be established over an area of approximately 20 Ha.

1.3 Scope of work

We have completed the following scope of work:

- Review of existing available geotechnical information including published geological maps and investigation data available on the New Zealand Geotechnical Database.
- A site investigation comprising:
  - 6 heavy dynamic cone penetration (DCP) tests advanced to 10 m below existing ground level (bgl),
  - Installation of 6 open standpipe piezometers, approximately 1.5 m deep, in the heavy DCP holes,
  - 20 DCP (Scala penetrometer) tests advanced to refusal (tests all refused at less than 1.0 m deep),
  - 10 hand auger boreholes to refusal (all refused at less than 1.0 m deep),
  - Retrieval of 10 soil samples for laboratory testing for pH, chlorides, and resistivity with respect to AS2159-2009
- Development of a geotechnical model of soil strength and stratigraphy,
- Assessment of relevant geotechnical hazards including liquefaction, lateral spreading, erosion, and subsidence,
- Assessment of soil exposure classification with respect to AS2159-2009,
- Development of foundation recommendations relevant to the proposed development,
- Preparation and issue of this report summarising the above work.

2 Geotechnical assessment

2.1 Geotechnical investigation

The geotechnical investigation was carried out on site from 28 October to 1 November 2021; a summary of this work, and the investigation logs and locations, are presented in Appendix A.

2.2 Published geology and hazard maps

Published geological maps[1] indicate that the site is underlain by brownish-grey river alluvium, described as an unweathered, brownish-grey, variable mix of gravels/sand/silt/clay in low river terraces, with a silt cap up to 2.0 m thick.

The site is within an area designated as "Damaging liquefaction unlikely" on a liquefaction hazard assessment map prepared by Environment Canterbury (ECan) in 2012[2]. Observations made following the 2010 – 2011 Canterbury earthquakes[3] indicate that surface water, possibly related to liquefaction but more likely related to flooding, was observed on the site following the 04 September 2010 earthquake. No similar observations relating to liquefaction were recorded at this site following the 22 February 2011 earthquake.

2.3 Geotechnical model

The general subsurface profile at the site is inferred to comprise:

- Layer 1: Stiff SILT, sometimes clayey or sandy, typically 0.5 m thick and up to 0.8 m thick
- Layer 2: Medium dense to dense sandy GRAVEL, with occasional medium dense sand layers, extending to deeper than 10 m bgl

A layer of topsoil, described as soft sandy SILT, typically 0.2 m thick, overlies Layer 1.

Inferred geotechnical parameters for these materials are summarised in Table 1 below.

Table 1: Inferred geotechnical parameters

Layer	Description	Unit weight (kN/m^3)	Friction angle (°)	Undrained shear strength (kPa)
1	Stiff SILT	17	30	75
2	Dense sandy GRAVEL	19	34	N/A

2.4 Groundwater level

Groundwater was not specifically encountered during the investigations. Open standpipe piezometers were installed in the heavy DCP holes following the tests, however the holes collapsed below a depth of approximately 2.0 – 2.5 m and therefore the piezometers were not able to extend below this depth. The piezometers were dipped both immediately following installation and after approximately 2 weeks and were found to be dry. The operator noted that the drill rods were wet

[1] Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. (compilers) 2008. Geology of the Christchurch area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 16. 1 sheet + 67 p. Lower Hutt, New Zealand. GNS Science.
[2] Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts. Environment Canterbury Report R12/83. December 2012. Accessed 19 Feb 2013 from http://ecan.govt.nz/advice/emergencies-and-hazard/earthquakes/Pages/liquefaction-information.aspx#review
Canterbury Geotechnical Database Map CGD5142 - 19 Feb 201
[3] Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts. Environment Canterbury Report R12/83. December 2012. Accessed 19 Feb 2013 from http://ecan.govt.nz/advice/emergencies-and-hazard/earthquakes/Pages/liquefaction-information.aspx#review
Please cite the Environment Canterbury report when referring to these map layers.
Canterbury Geotechnical Database Map CGD5143 - 19 Feb 2013

when the test extended below approximately 2 – 3 m bgl, which indicates the presence of groundwater at this depth.

Depth to groundwater contours available on the Canterbury Maps viewer indicate a groundwater level between 2.5 m and 2.0 m bgl, which is consistent with the observations made on site during the investigation. A groundwater level of 2.0 m bgl should be assumed for design.

2.5 Geotechnical hazards (RMA Section 106 assessment)

Section 106 of the RMA (1991) includes subdivision consent provisions relating to risk from natural hazards. This includes a combined assessment of likelihood, material damage and subsequent use, and the option of specifying consent conditions for the purpose of avoiding, remedying or mitigating the effects of natural hazards.

This geotechnical report is intended to help inform a Section 106 assessment by providing information about geotechnical-related natural hazards:

- The proposed development of a solar farm at the site is considered feasible from a geotechnical perspective.
- Liquefaction-related ground damage is not expected to occur at this site in future earthquakes. This assessment is based on the geotechnical characteristics of the soil layers underlying the site. Specifically:
  - Layer 1 (silt) is unlikely to be saturated and is considered too stiff to be susceptible to liquefaction,
  - Layer 2 (gravel) is considered too dense and too permeable to be susceptible to liquefaction,
  - While there is a possibility that medium dense sand layers are present within Layer 2 at depth, and may be susceptible to liquefaction, this is not expected to result in ground surface damage.
  - This assessment is consistent with the lack of observations of evidence of liquefaction following the Canterbury earthquake sequence, and with the classification of "Damaging liquefaction unlikely" made by Ecan, noted above.
- Subsidence of the ground surface is not expected to occur at this site as the underlying soils are generally stiff / dense. Structures with appropriately designed and constructed foundations in accordance with the recommendations in this report (Section 3 below) are not expected to be subject to damaging settlement.
- Geotechnical hazards related to slope instability such as slippage or falling debris are not relevant due to the flat terrain at this site.
- The proposed development of a solar farm is unlikely to accelerate, worsen or result in geotechnical-related hazards.
- The potential for any future erosion is expected to be managed by the Erosion and Sediment Control Plan for the site (to be prepared by others).
- Flooding / inundation from surface water has not been considered in this assessment, however, we note that the Canterbury Maps GIS viewer[4] does not show any watercourses, springs, or stormwater features on the site.

[4] https://mapviewer.canterburymaps.govt.nz/, accessed on 12 December 2021, Layers "Spring Locations, "Drains and watercourses…", "Storm Water"

2.6 Soil and groundwater aggressivity

Laboratory testing for pH, chloride and resistivity was carried out on soil samples obtained from Layer 1, for the purpose of assessing the soil exposure classification in accordance with AS2159-2009, Table 6.5.2I, for steel piles in soil. The laboratory test results are presented in Appendix B.

Soil samples from Layer 2 were unable to be obtained due to the investigation method which employed heavy DCP tests rather than machine drilled boreholes. Similarly, groundwater samples were not obtained as the heavy DCP holes collapsed above the groundwater level, preventing installation of deeper piezometers. However, Layer 1 and Layer 2 soils are understood to be derived from the same rock type, are of a similar age (quaternary), and deposited by similar processes (alluvial). Groundwater within Layer 1 and Layer 2 is also likely to be connected, due to infiltration. On this basis we consider it is unlikely that the soil exposure classification for Layer 2 differs from Layer 1, and we have extrapolated the Layer 1 results to Layer 2.

A soil exposure classification of “Mild” is recommended, based on the following:

- Review of these results indicates that pH is the critical criteria, as soil chlorides in soil and resistivity are well within the “Non-aggressive” category.
- Soil Condition A (high permeability sand/gravel soils in groundwater) applies for Layer 2,
- Soil pH is slightly lower than 5.0, in 7 out of the 16 tests.

3 Foundation recommendations

3.1 Driven piles

We understand that the solar equipment manufacturer will undertake design of driven steel pile foundations to support the solar panels and associated infrastructure. Driven steel pile foundations are considered feasible at this site; comments and recommendations from a geotechnical perspective are summarised in the following section.

For piles comprising steel sections driven with a drop hammer, ultimate vertical compression pile capacity can be estimated based on:

- Ultimate shaft friction capacity range of 5 – 15 kPa,
- Ultimate end bearing capacity range of 4 – 8 MPa.

The above values are ‘geotechnical ultimate’ values which are expected to apply during driving of the pile. These values can be used for estimating how deep piles will need to be driven to achieve a specified load capacity. However, the actual pile capacity should be verified during driving based on driving sets (pile penetration per hammer blow) and hammer drop properties, using the Hiley formula or similar.

It will also be necessary to check that the structural compression capacity of the steel section can withstand the pile driving force, particularly if the piles are driven deeper/harder than on other projects where similar foundations have been used. This could limit how deep piles can be driven, particularly if a relatively light steel section is used.

The ultimate working load capacity of the pile in compression (i.e. ultimate limit state pile capacity) should be taken as 50% of the geotechnical ultimate’ pile driving resistance.

Pile uplift capacity for working load should be calculated based on 35% of the ultimate shaft friction capacity.

Pile capacity is not expected to be affected by earthquake shaking.

Provided that the piles are designed and constructed in accordance with the above recommendations, pile settlement is not expected to exceed 25 mm under working load.

Pile lateral capacity is dependent on pile depth and steel section properties; we would be pleased to provide comment on this once this information is available, if required. As noted above, the structural capacity of the steel section could limit how deep piles can be driven, and therefore this should be checked with respect to any pile lateral load requirements which relate to pile depth.

From a geotechnical perspective, driven timber piles could also be considered as an alternative to driven steel piles, and other foundation options could be developed for the site if required.

3.2 Shallow foundations

Shallow foundations such as pads and strips could also be used, for example for the inverter. Shallow foundations should be at least 0.5 m deep below the ground surface, and may be designed based on a geotechnical ultimate bearing capacity of 300 kPa. This corresponds to a working bearing pressure of 100 kPa, and an ultimate limit state design bearing pressure of 150 kPa.

If shallow foundations are used, following excavation the subgrade should be observed by a geotechnical engineer/technician who is competent to confirm that the subgrade condition is in accordance with the ground conditions described on this report.

Foundations which are designed and constructed in accordance with the above recommendations are not expected to settle more than 25 mm under working load.

4 Applicability

This report has been prepared for the exclusive use of our client KeaX Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on data from discrete investigation locations. The nature and continuity of subsoil away from these locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Scott Sutherland	Anna Sleight
Geotechnical Engineer	Project Director

13-Dec-21
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Appendix A: Investigation summary

GEOTECHNICS

Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779
3 November 2021

Tonkin + Taylor
PwC Center, Level 3/60 Cashel Street
Christchurch Central City
Christchurch
8013

Attention: Scott Sutherland

Dear Scott

Solar Farm Geotechnical Investigation

Site Report

Customer's Instructions

We were instructed to complete:

- 6 DPSH tests to 10.0 m or refusal,
- 20 Scala penetrometer tests to 3.0 m or refusal, and
- 10 Hand augers to 3.0 m or refusal, logging and sampling recovered core.

Specifications

None issued.

Dates of Procedures

28th - 29th October, and 1st November 2021.

Locations

Test locations were determined by the customer.

The attached plan provides indicative locations only and is not to scale. All other information we provide regarding location should be referenced to the asset owner.

Samples

Samples of each stratigraphic unit taken and delivered to Analytica laboratories as requested by customer.

Methods

NZS 4402:1988 Test 6.5.2 - Determination of the penetration resistance of a soil (Hand method using a dynamic cone penetrometer) – Scala.

BS 1377: Part 9:1990 Test 3.2 - Determination of the Dynamic Probing Resistance using the 90˚ Cone (DPSH).

Material Description

Material descriptions are provided in the attached results.

Results

The following is attached:

- Location Plan.
- Borehole Logs.
- Scala penetrometer Results.
- DPSH Results.

Test Remarks

Material Logging

Material logging and descriptions in the field are in general accordance with the New Zealand Geotechnical Society Inc in 'Guideline for the Field Classification of Soil and Rock for Engineering Purposes' (December 2005), excluding geological information and are based on the observational behaviour of the recovered material.

The logs represent our best assessment of the sub-surface conditions, but due to the subjective nature of material logging, we take no responsibility for any inaccuracies or misinterpretations.

Scala

Scala tests –

- deeper than 1.5 m, or
- for which adapters have been used, or
- that have been carried out at increments of >50 mm,

are not covered under the IANZ endorsement of this report.

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements". The determination of equivalent CBR is not covered under the IANZ endorsement of this report.

Our standard test procedure is to over-drill Scala penetrometer tests every 1 m. As requested, we have not over-drilled these tests. This variation to the standard test method may increase friction with depth due to skin friction and the protrusion of the rod connectors. The results >1 m deep may therefore not be accurate and are provided for interpretation and inference. In addition, the results are therefore not covered under the IANZ endorsement of this report.

For ease of reference, Scala results have been included in the borehole log(s) even though they were performed adjacent to the borehole(s).

DPSH

Dynamic probe tests were completed using Super Heavy (DPSH) apparatus. DPSH testing is not covered under the IANZ endorsement of this report. Geotechnics' Dando Terrier rig has the following energy measurement parameters[1]:

- Average DPSH Hammer Energy Efficiency: 75.95 %
- Average Theoretical Energy Transfer: 0.355 kNm
- Measurements taken between DPSH Hammer and Probing Rods

General Remarks

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

The inherent uncertainties of site investigation work, mean the nature and continuity of subsoil away from the test location could vary from the data logged.

Material descriptions and logs are included for information only and are not covered under the IANZ endorsement of this report.

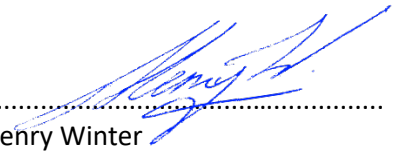
Sample(s) not destroyed during testing will be retained for one month from the date of this report before being discarded.

Please reproduce this report in full when transmitting to others or including in internal reports.

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

GEOTECHNICS LTD

Report prepared by:

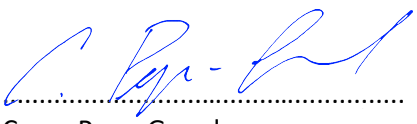


.....
Henry Winter
Senior Technician

Authorised for Geotechnics by:

.....
Paul Burton
Project Director

Report checked by:



.....
Corey Papu-Gread
Christchurch Manager
Approved Signatory

ACCREDITED TESTING LABORATORY

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

[1] As reported in "SPT Energy Measurements on Geotechnics Dando Terrier rig with DPSH 63.5kg Hammer" (by Tonkin & Taylor Ltd, January 2014).

3-Nov-21

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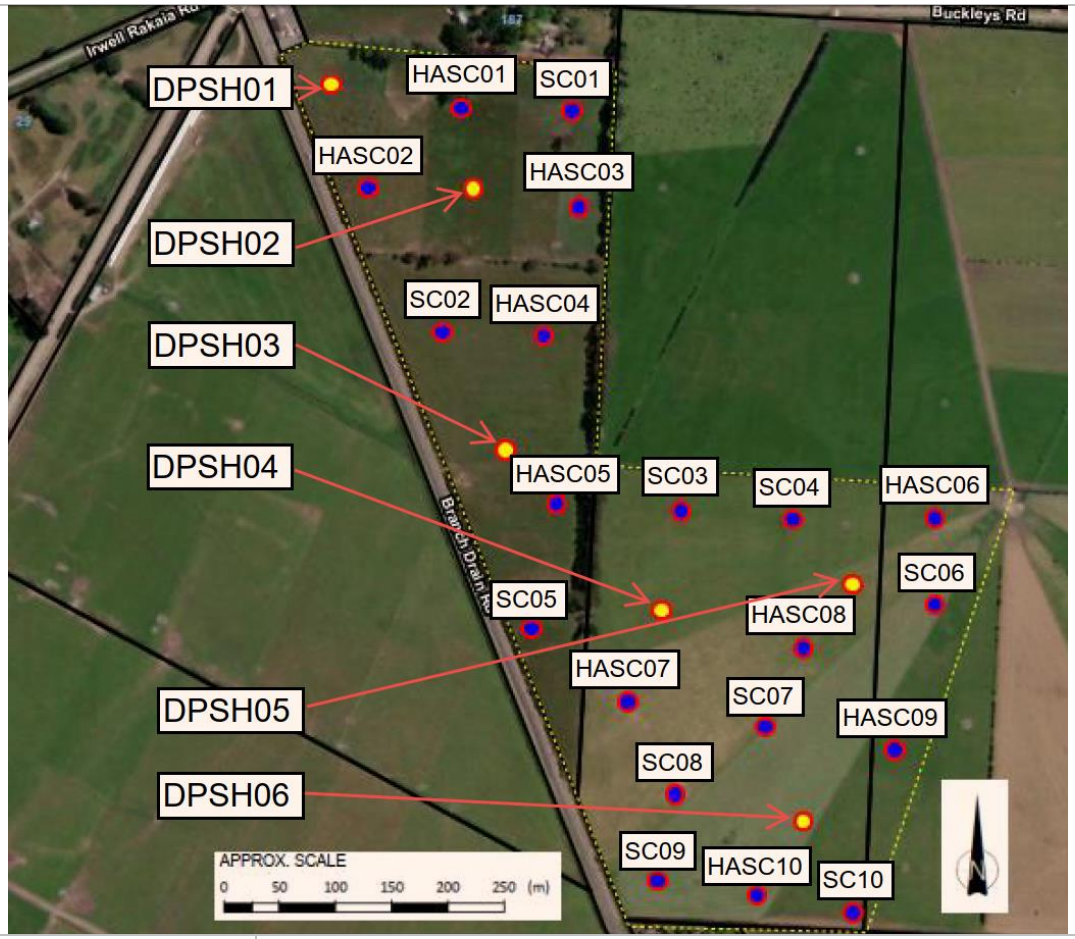


GEOTECHNICS	**LOCATION PLAN**		**Solar Farm Geotechnical Investigation**						Locations are indicative only	
45A Parkhouse Road Wigram Christchurch 8042		Site	Solar Farm	Our Ref	1100987.1.0.0/REP01	Drawn	HEWI	Date	2/11/2021	N
		Location	Buckleys Road, Leeston	Customer Ref	1018779	Checked	JEBR	Date	2/11/2021	
		Project	Solar Farm Geotechnical Investigation	Lab Ref	N/A	Scale	Not to Scale			

Drawing(s) supplied by T+T

HOLE Id: **HASC01**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160991 mN 1541933 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021 HOLE FINISHED: 28/11/2021
R.L.:	38.00m	DRILL METHOD: HA+DCP	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
				0 1 2 3 4 5 6 7 8 9						M	S	10 25 50 100 200	*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine.
					HASC01-Topsoil @ 0.10m						St		*0.20m:* Clayey SILT, trace sand; greyish brown with orange mottling. Stiff, moist, low plasticity; sand, fine.
	28/10/2021 Dry	100	HA+DCP	1 1 2 3 2 2 3 5 3 4 3 3	HASC01-Sample1 @ 0.40m			0.5					
				6 20 >>									0.6m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.6m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC02**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI	LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000) 5160931 mN 1541807 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021
	DRILL METHOD: HA+DCP	HOLE FINISHED: 28/11/2021
R.L.: 38.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
		100	HA+DCP	2	HASC02- Topsoil @ 0.10m				M	S		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine.
				2								
				1								
				2								
				3						St		*0.20m:* Clayey SILT, trace sand; greyish brown with orange mottling. Stiff, moist, low plasticity; sand, fine.
				3								
				3								
				3	HASC02- Sample 1 @ 0.40m							
				3								
				4			0.5					
	28/10/2021 Dry			5								
				20 >>								0.6m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.6m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC03**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI	LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000) 5160916 mN 1542013 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021
	DRILL METHOD: HA+DCP	HOLE FINISHED: 28/11/2021
R.L.: 38.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
				2					M	S		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine.
				2								
				2	HASC03- Topsoil @ 0.10m							
				2								
				2						St		*0.20m:* Clayey SILT, some sand; brownish grey with orange mottling. Stiff, moist, low plasticity; sand, fine.
				2								
		100	HA+DCP	2								
				3	HASC03- Sample 1 @ 0.30m							
				3								
	28/10/2021 Dry			7			0.5					
				10								0.5m: Refusal
				20 >>								

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.5m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC04**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI	LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000) 5160790 mN 1541991 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021
	DRILL METHOD: HA+DCP	HOLE FINISHED: 28/11/2021
R.L.: 38.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
		100	HA+DCP	2 2 2 2 2 2 2 2 2 2 3 3 4 3 4	HASC04- Topsoil @ 0.10m HASC04- Sample 1 @ 0.40m		0.5		M	S St		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine. *0.20m:* Clayey SILT, trace sand; brownish grey with orange mottling. Stiff, moist, low plasticity; sand, fine.
	28/10/2021 Dry			13 >> 13 >> 20 >>								0.7m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.7m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC05**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160641 mN 1541994 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021 HOLE FINISHED: 28/11/2021
R.L.:	38.00m	DRILL METHOD: HA+DCP	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	28/10/2021 Dry	100	HA+DCP	3 2 2 1 2 1 2 2 2 2	HASC05-Topsoil @ 0.10m HASC05-Sample 1 @ 0.30m		0.5		M	S St		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine. *0.20m:* Clayey SILT, trace sand; brownish grey with orange mottling. Stiff, moist, low plasticity; sand, fine.
				5 8 18 >>								0.5m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.5m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC06**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160628 mN 1542329 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021 HOLE FINISHED: 28/11/2021
R.L.:	38.00m	DRILL METHOD: HA+DCP	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
		100	HA+DCP	3 2 3 3 3 2 2 2 2 2 2 3 3 2 3 5 12 >>	HASC06-Topsoil @ 0.10m HASC06-Sample 1 @ 0.50m			0.5		M	S St		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine. *0.30m:* Clayey SILT, trace sand; greyish brown with orange mottling. Stiff, moist, low plasticity; sand, fine. *0.70m:* Sandy SILT, minor clay; greyish brown with orange mottling. Stiff, moist, non-plastic; sand, fine.
	28/10/2021 Dry			6 7 10 10 10			37	1.0					0.8m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.8m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:6

Rev.: A

HOLE Id: **HASC07**

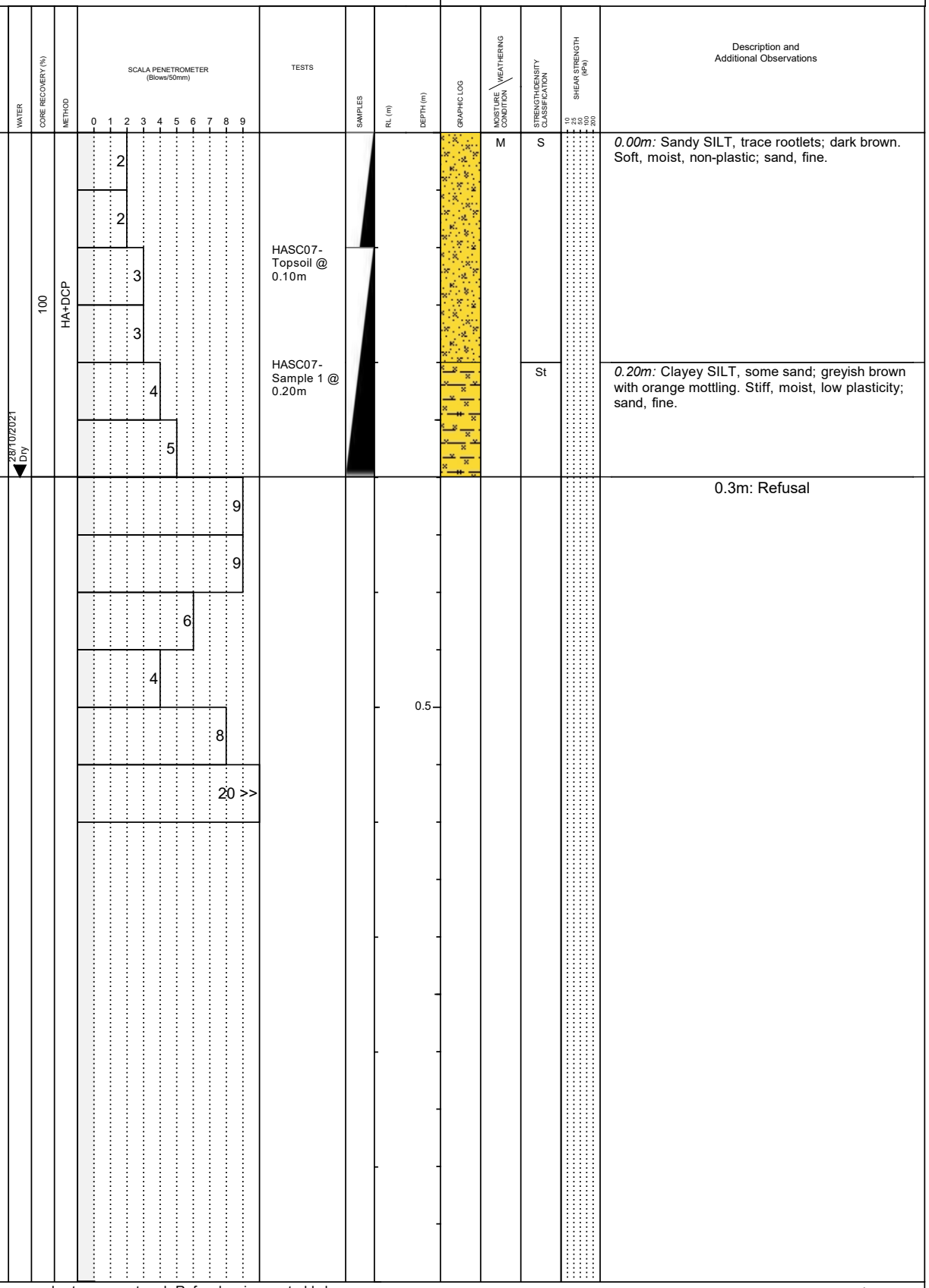
SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160470 mN 1542052 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021 HOLE FINISHED: 28/11/2021
R.L.:	38.00m	DRILL METHOD: HA+DCP	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION



COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.3m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC08**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI	LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000) 5160513 mN 1542219 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021
	DRILL METHOD: HA+DCP	HOLE FINISHED: 28/11/2021
R.L.: 38.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	28/10/2021 Dry	100	HA+DCP	2, 1, 1, 2, 2, 3	HASC08- Topsoil @ 0.10m					M	S		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine.
				7, 7, 7, 6, 7, 7, 9, 12 >>, 14 >>, 15 >>				0.5					0.3m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.3m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC09**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160415 mN 1542295 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021
		DRILL METHOD: HA+DCP	HOLE FINISHED: 28/11/2021
R.L.:	38.00m		DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
		100	HA+DCP	2, 2, 1, 2, 1, 1, 1, 2, 2, 2, 2	HASC09-Topsoil @ 0.10m HASC09-SAMPLE 1 @ 0.35m		0.5		M	S St		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine. *0.20m:* Clayey SILT, trace sand; greyish brown with orange mottling. Stiff, moist, low plasticity; sand, fine.
	28/10/2021 Dry			2, 6, 7, 10, 20 >>								0.5m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.5m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

HOLE Id: **HASC10**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: G CH TT Solar Farm SI		LOCATION: Buckleys Road, Leeston	JOB No.: 1100987.0001
CO-ORDINATES: (NZTM2000)	5160301 mN 1542174 mE	DRILL TYPE: HA/SC	HOLE STARTED: 28/11/2021 HOLE FINISHED: 28/11/2021
R.L.:	38.00m	DRILL METHOD: HA+DCP	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016		LOGGED BY: SITA CHECKED: JEBR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
		100	HA+DCP	2 1 3 2 2 2 2 2 2 2 2 3 5 8	HASC10-Topsoil @ 0.10m HASC10-Sample 1 @ 0.50m			0.5		M	S St		*0.00m:* Sandy SILT, trace rootlets; dark brown. Soft, moist, non-plastic; sand, fine. *0.20m:* Clayey SILT; greyish brown with orange mottling. Stiff, moist, low plasticity. *0.30m:* Sandy SILT, minor clay; greyish brown with orange mottling. Stiff, moist, non-plastic; sand, fine.
	28/10/2021 Dry			11 >> 9 12 >>									0.7m: Refusal

COMMENTS: No standing groundwater encountered. Refusal on impenetrable layer.

Hole Depth 0.7m

3 November 2021
Our Ref: 1100987.1.0.0/REP01
Customer Ref: 1018779

Scale 1:5

Rev.: A

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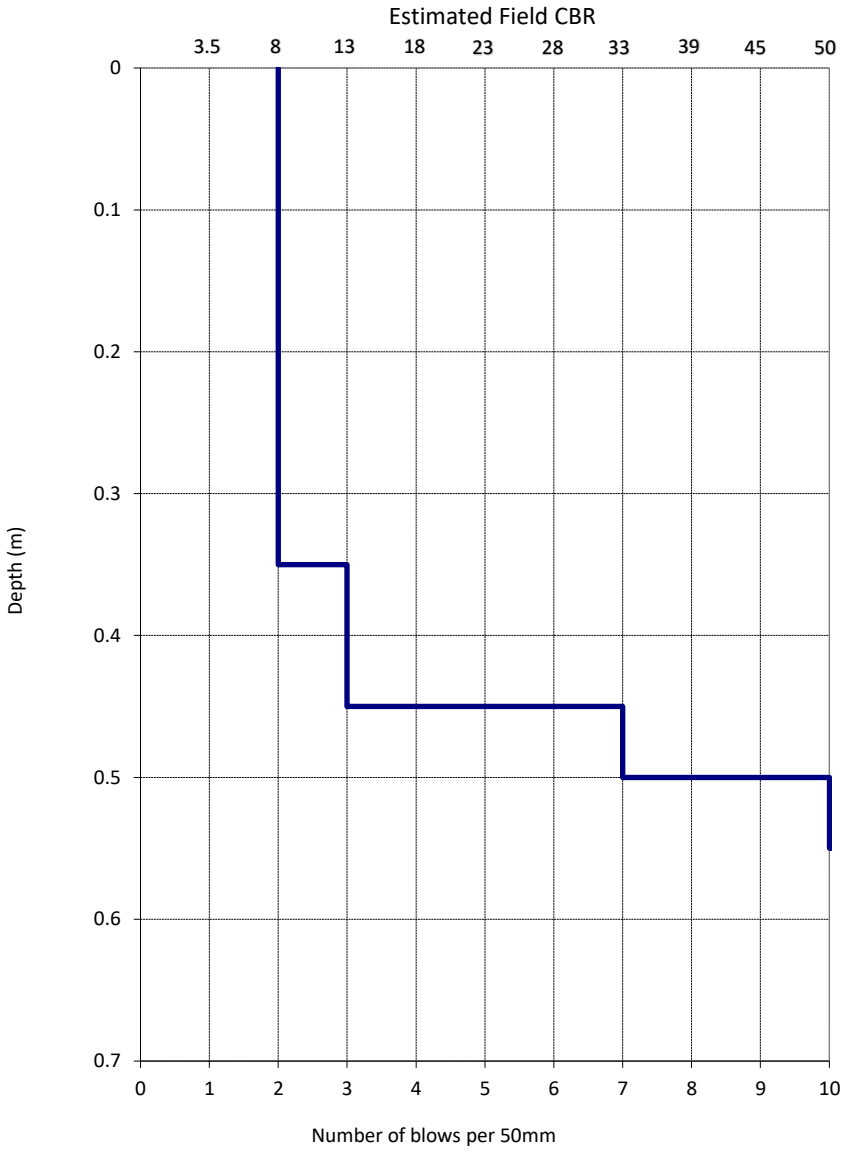
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC01

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.701855	172.280285	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	2
150	150	2
200	200	2
250	250	2
300	300	2
350	350	2
400	400	3
450	450	3
500	500	7
550	550	10
600	600	20
650	650	
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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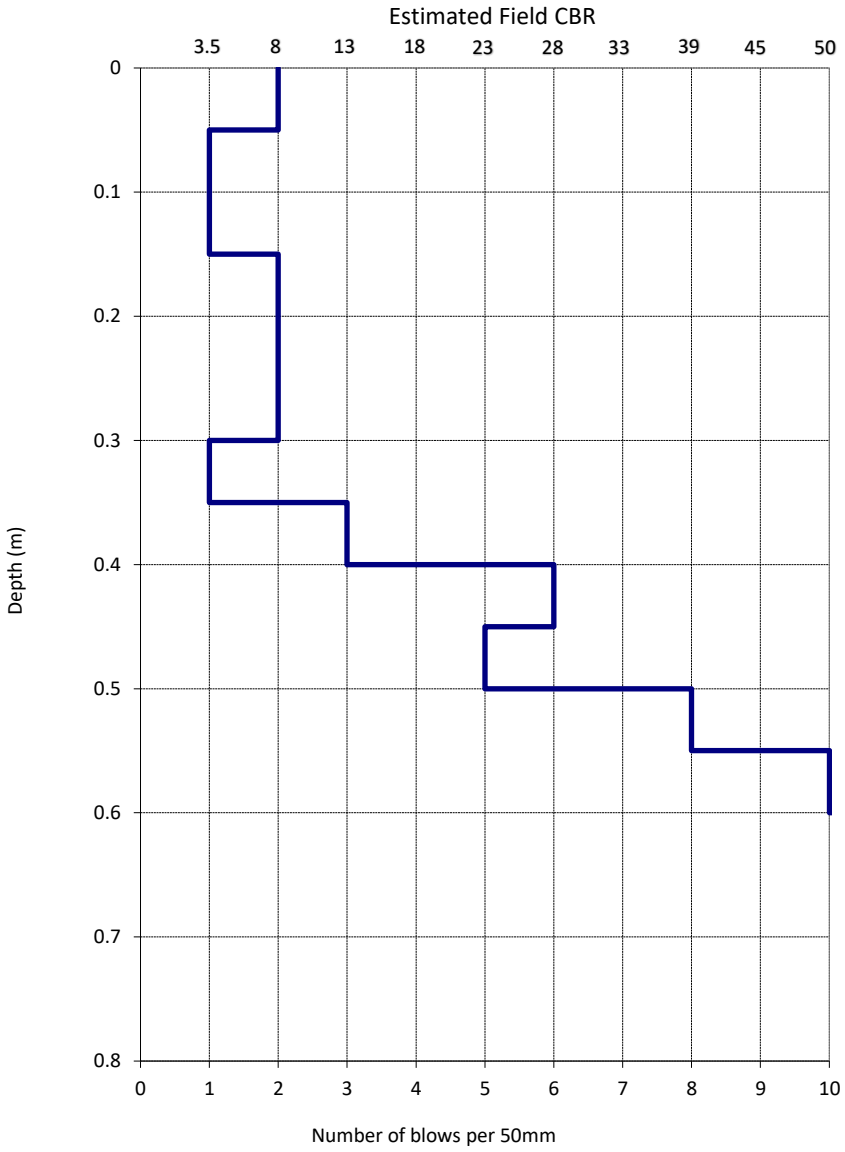
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC02

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.703589	172.278808	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	1
150	150	1
200	200	2
250	250	2
300	300	2
350	350	1
400	400	3
450	450	6
500	500	5
550	550	8
600	600	10
650	650	15
700	700	15
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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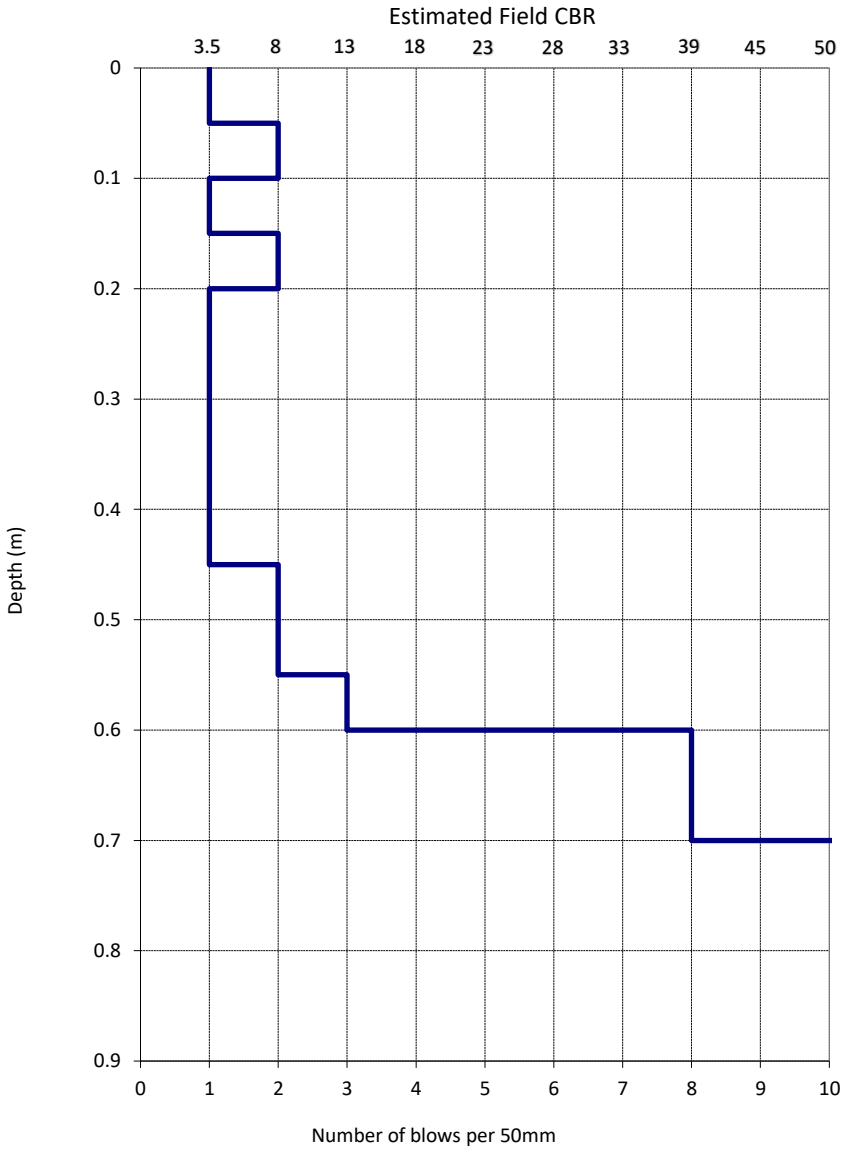
Lab Ref/URN: N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC03

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.705027	172.281914	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	1
100	100	2
150	150	1
200	200	2
250	250	1
300	300	1
350	350	1
400	400	1
450	450	1
500	500	2
550	550	2
600	600	3
650	650	8
700	700	8
750	750	13
800	800	17
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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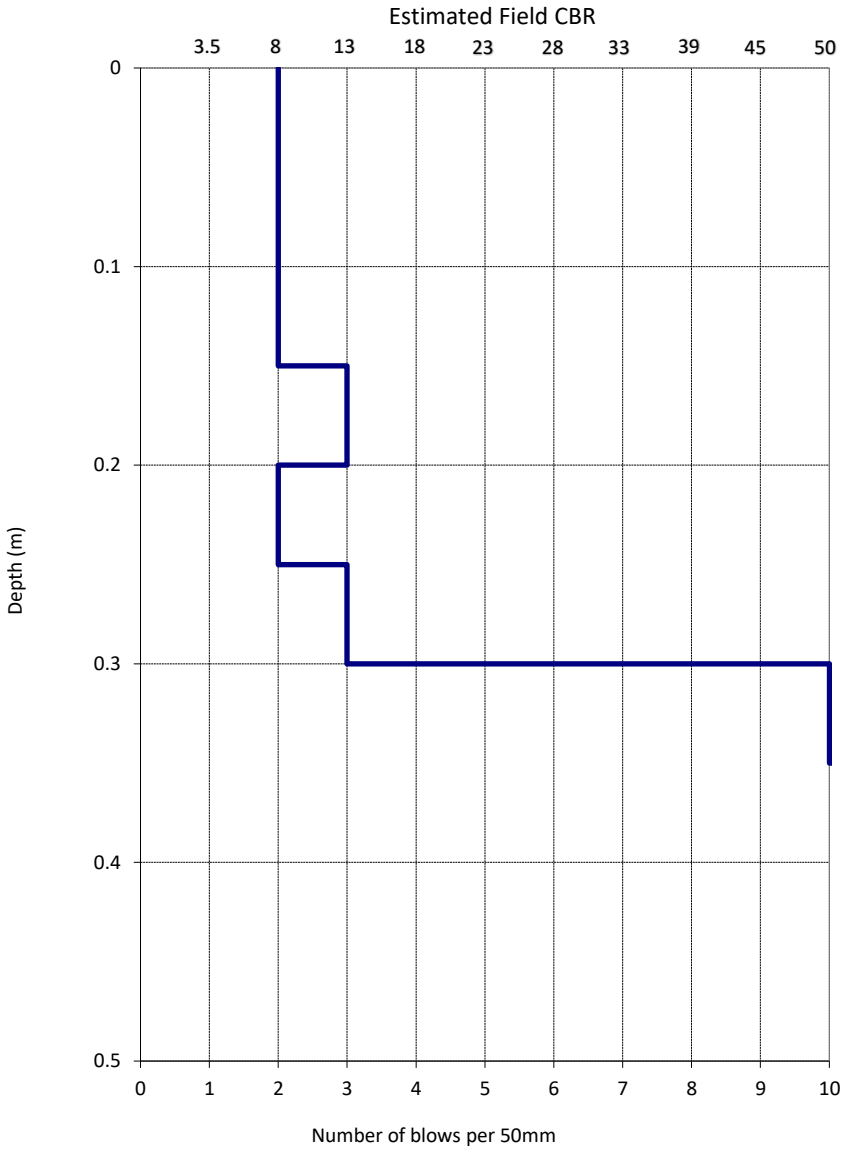
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC04

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.705074	172.283222	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	2
150	150	2
200	200	3
250	250	2
300	300	3
350	350	10
400	400	16
450	450	20
500	500	
550	550	
600	600	
650	650	
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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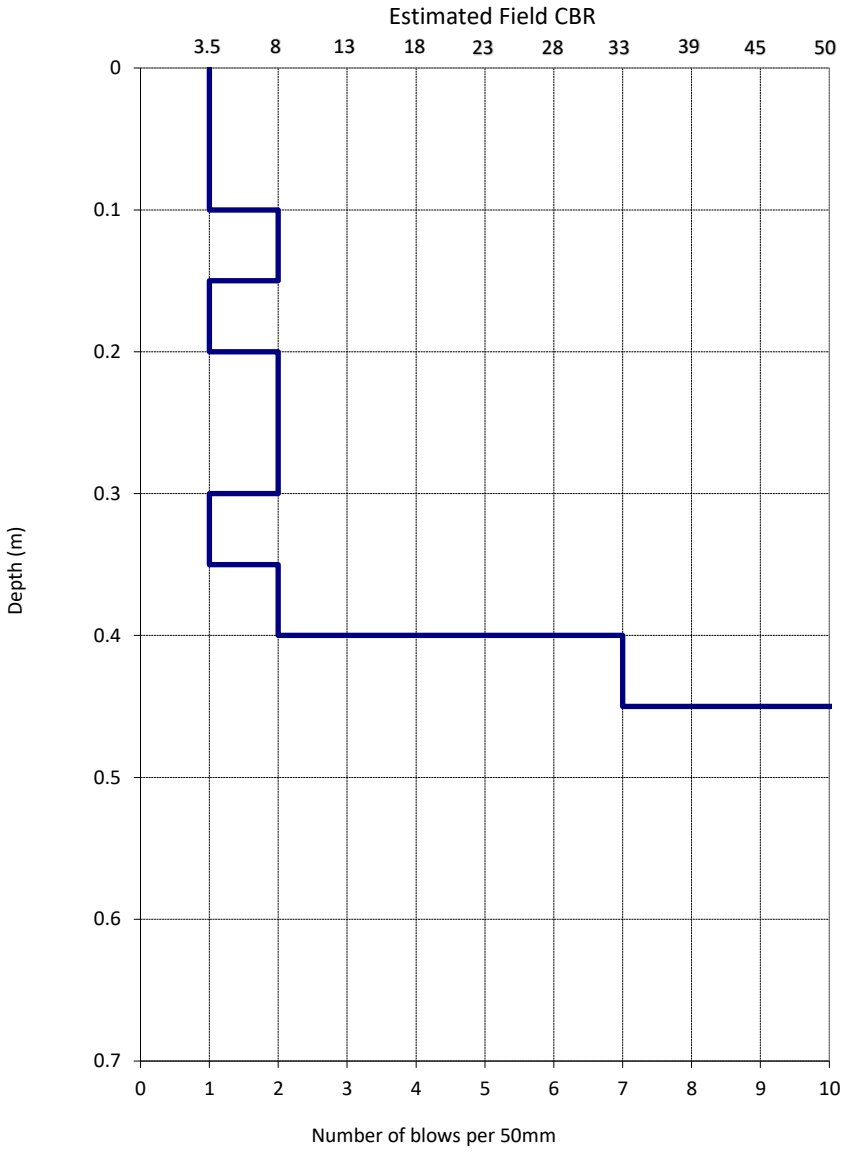
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC05

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.706113	172.279831	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	1
100	100	1
150	150	2
200	200	1
250	250	2
300	300	2
350	350	1
400	400	2
450	450	7
500	500	12
550	550	11
600	600	14
650	650	
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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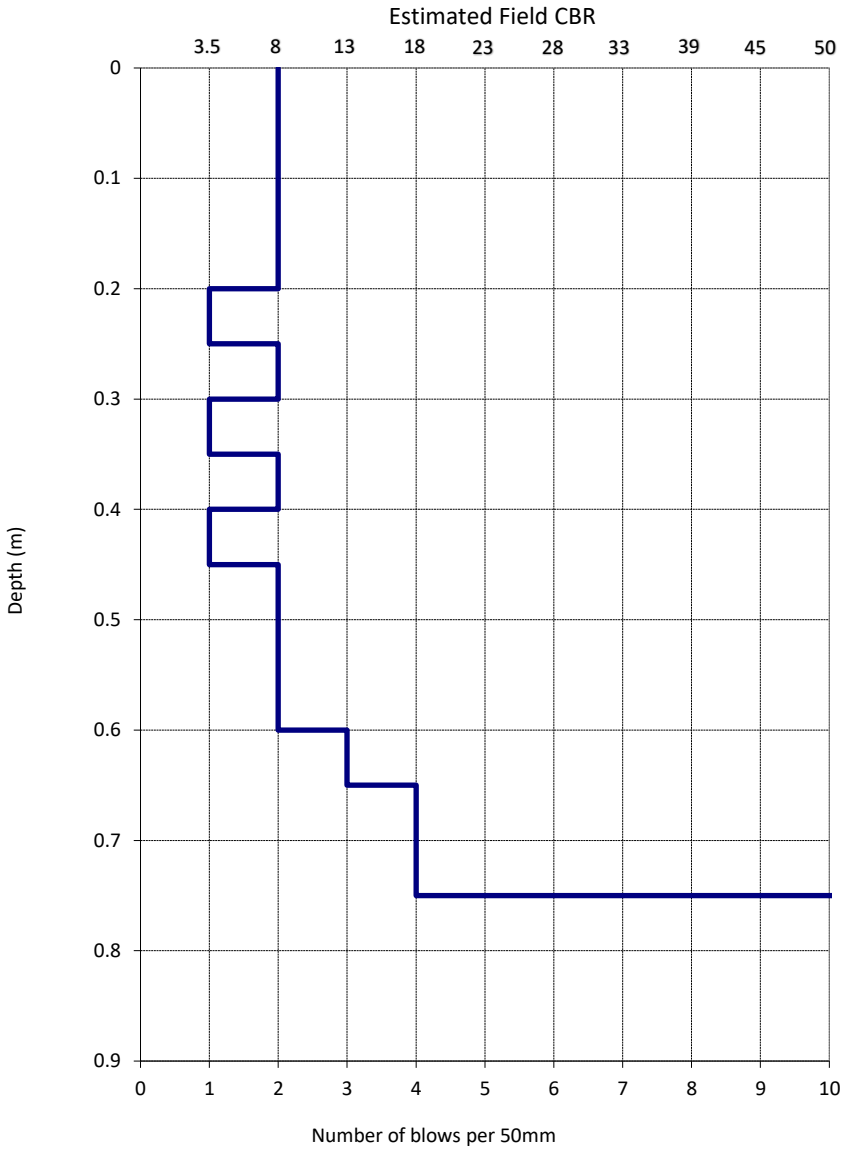
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC06

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.705719	172.284385	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	2
150	150	2
200	200	2
250	250	1
300	300	2
350	350	1
400	400	2
450	450	1
500	500	2
550	550	2
600	600	2
650	650	3
700	700	4
750	750	4
800	800	15
850	850	20
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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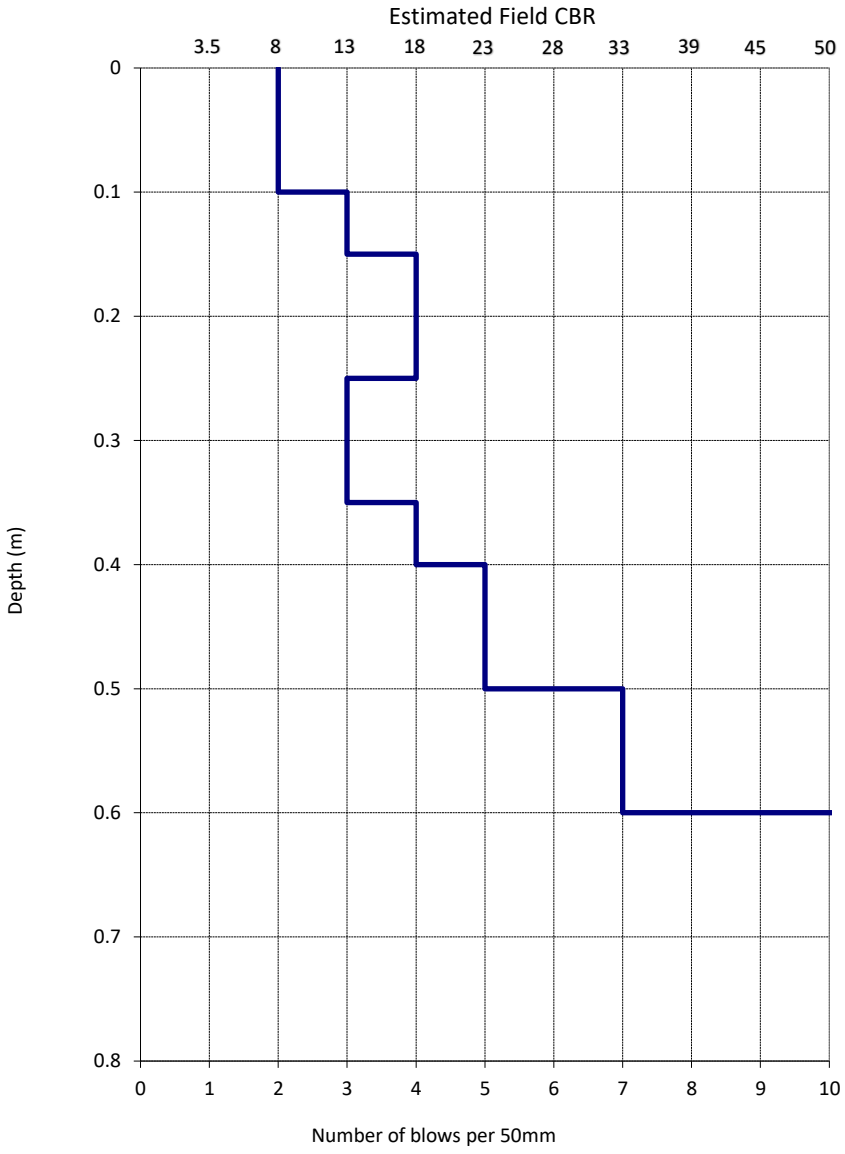
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC07

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.706447	172.283101	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	2
150	150	3
200	200	4
250	250	4
300	300	3
350	350	3
400	400	4
450	450	5
500	500	5
550	550	7
600	600	7
650	650	12
700	700	20
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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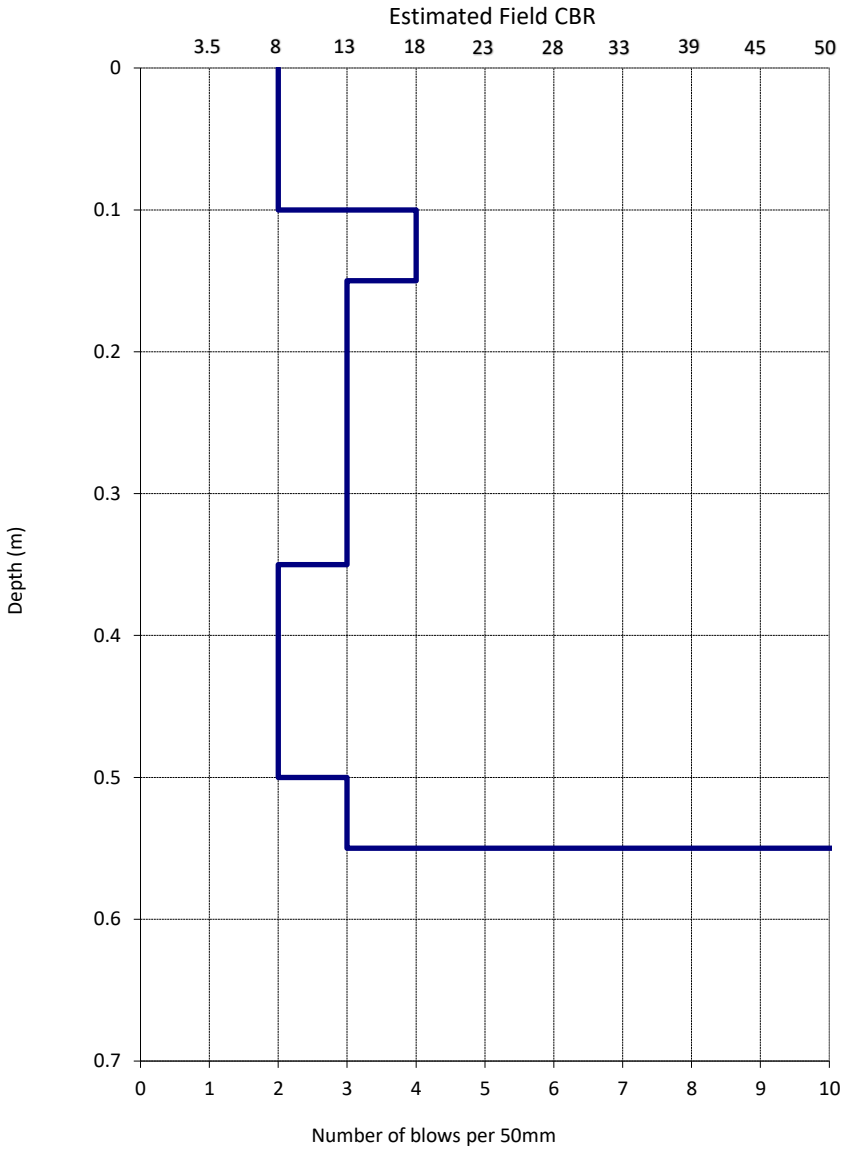
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC08

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.707257	172.281582	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	2
100	100	2
150	150	4
200	200	3
250	250	3
300	300	3
350	350	3
400	400	2
450	450	2
500	500	2
550	550	3
600	600	11
650	650	20
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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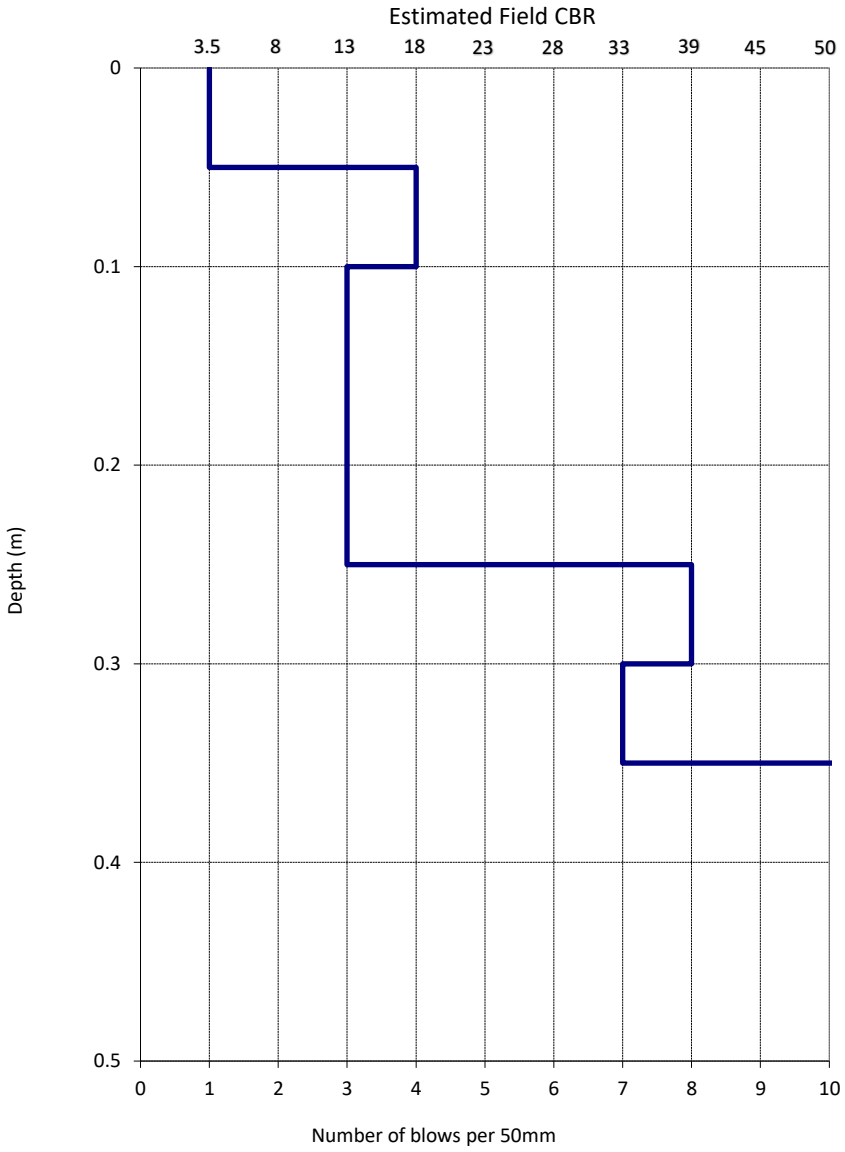
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC09

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.708101	172.281187	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	1
100	100	4
150	150	3
200	200	3
250	250	3
300	300	8
350	350	7
400	400	11
450	450	20
500	500	
550	550	
600	600	
650	650	
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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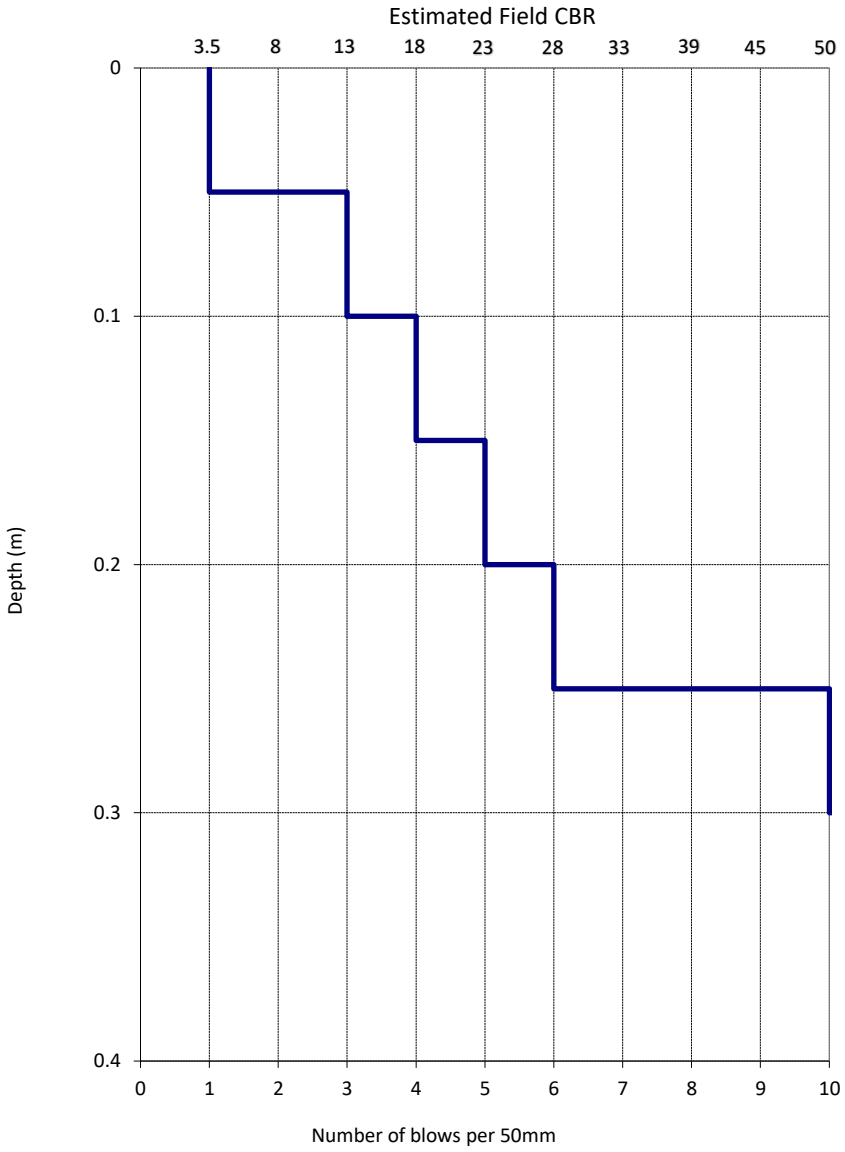
Lab Ref/URN
N/A

NZS 4402: 1988 Test 6.5.2 Dynamic Cone Penetrometer - Scala

Project Name	G CH TT Solar Farm SI	Project ID	1100987.0001
Customer Project ID	Solar Farm SI	Equipment ID	CH014
Site Location	Buckleys Road, Leeston	Material Source	Natural
Material Description	Natural	Test Series	N/A
Depth from ground surface to commencement of penetration (m)	0	Test Number	SC10

Coordinate system		Datum
NZTM2000		WGS84
Northing	Easting	R.L.
-43.708336	172.284593	38.00

Vertical distance driven (mm)	Depth (mm)	Number of blows
50	50	1
100	100	3
150	150	4
200	200	5
250	250	6
300	300	10
350	350	20
400	400	
450	450	
500	500	
550	550	
600	600	
650	650	
700	700	
750	750	
800	800	
850	850	
900	900	
950	950	
1000	1000	



Test Remarks

The estimated CBR values are based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - A Guide to the Structural Design of Road Pavements".

Please note Estimated Field CBR cannot be calculated over 10 blows.

Tested By	HEWI/SITA	Date	28/10/2021	**This test is IANZ Accredited**
Data Entry By	JEBR	Date	3/11/2021	
Checked By	HEWI	Date	3/11/2021	

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Schedule Name
N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A
Site Location	Buckleys Road, Leeston				Test No	DPSH01
Coordinates	Latitude	-43.701863°	Longitude	172.277620°	Datum	WGS84
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750
Cone Type	Sacrificial				Equipment ID	CH099

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	5	4	5	6	15	22	22	25	23	26	33.0
1	24	22	21	20	17	19	19	21	20	19	28.0
2	18	14	11	10	10	12	14	13	11	13	41.2
3	11	10	14	15	16	16	16	16	16	14	35.9
4	12	11	11	13	15	14	12	12	13	10	137.1
5	8	10	11	10	13	15	15	14	15	18	86.2
6	19	18	16	15	14	17	19	18	18	14	76.7
7	13	14	13	8	8	12	15	12	13	13	126.4
8	16	16	15	16	18	17	18	19	23	20	163.8
9	19	17	21	25	23	23	23	31	38	-	137.1
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Test Remarks

Tested By	HEWI/JEBR		Date	29/10/2021
Data Entry By	HEWI		Date	2/11/2021
Checked By	JEBR		Date	3/11/2021
Approved By	CXPG		Date	3/11/2021

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Schedule Name

N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001	
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A	
Site Location	Buckleys Road, Leeston				Test No	DPSH02	
Coordinates	Latitude	-43.702744°	Longitude	172.279175°	Datum	WGS84	
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5	
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750	
Cone Type	Sacrificial				Equipment ID	CH099	

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	3	6	6	7	6	10	12	12	10	16	22.1
1	20	31	40	30	27	26	26	24	22	23	15.4
2	14	14	15	15	16	14	13	9	9	10	19.9
3	13	15	14	14	13	11	11	10	11	11	43.8
4	11	10	11	14	17	14	14	10	16	15	76.8
5	15	18	17	15	18	14	14	14	18	17	102.8
6	14	13	14	15	17	16	17	17	15	12	149.9
7	12	11	16	16	14	16	13	15	19	18	133.1
8	17	16	15	15	16	23	10	8	9	8	143.7
9	10	8	8	8	12	13	18	21	24	-	184.0
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Test Remarks

Tested By	HEWI/JEBR		Date	29/10/2021
Data Entry By	HEWI		Date	2/11/2021
Checked By	JEBR		Date	3/11/2021
Approved By	CXPG		Date	3/11/2021

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Schedule Name

N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001	
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A	
Site Location	Buckleys Road, Leeston				Test No	DPSH03	
Coordinates	Latitude	-43.704751°	Longitude	172.279476°	Datum	WGS84	
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5	
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750	
Cone Type	Sacrificial				Equipment ID	CH099	

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	4	3	6	7	9	12	20	19	15	10	19.3
1	9	9	10	9	13	35	43	42	34	29	22.3
2	21	19	17	15	11	10	8	7	7	8	16.8
3	12	17	18	21	20	17	16	13	15	15	45.8
4	18	18	15	15	11	13	14	15	16	16	53.7
5	15	18	15	14	16	16	14	11	9	10	101.9
6	10	9	11	11	12	14	13	10	10	8	90.2
7	10	18	13	12	13	19	31	34	29	18	115.0
8	14	12	12	12	11	15	21	29	29	36	145.7
9	38	34	31	28	24	25	29	32	33	-	136.3
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Test Remarks

Tested By	HEWI/JEBR		Date	1/11/2021
Data Entry By	HEWI		Date	2/11/2021
Checked By	JEBR		Date	3/11/2021
Approved By	CXPG		Date	3/11/2021

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Schedule Name

N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001	
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A	
Site Location	Buckleys Road, Leeston				Test No	DPSH04	
Coordinates	Latitude	-43.706054°	Longitude	172.281225°	Datum	WGS84	
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5	
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750	
Cone Type	Sacrificial				Equipment ID	CH099	

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	3	5	5	7	7	8	10	13	14	13	5.3
1	15	17	20	23	19	17	17	24	29	21	42.4
2	15	11	9	8	8	7	6	3	5	5	18.1
3	7	10	10	11	10	11	11	11	11	9	29.5
4	11	12	15	21	15	13	15	14	14	15	49.9
5	13	13	15	18	18	16	16	13	13	11	53.1
6	12	12	13	14	15	14	13	13	14	17	88.1
7	21	16	13	15	19	17	14	12	16	15	102.1
8	15	17	17	11	11	12	14	16	16	23	122.4
9	23	21	27	25	17	19	28	35	35	-	137.8
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Test Remarks

Tested By	HEWI/JEBR		Date	1/11/2021
Data Entry By	HEWI		Date	2/11/2021
Checked By	JEBR		Date	3/11/2021
Approved By	CXPG		Date	3/11/2021

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Schedule Name

N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A
Site Location	Buckleys Road, Leeston				Test No	DPSH05
Coordinates	Latitude	-43.705875°	Longitude	172.283311°	Datum	WGS84
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750
Cone Type	Sacrificial				Equipment ID	CH099

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	3	5	5	4	4	5	5	8	13	15	6.3
1	16	21	33	42	46	47	47	45	34	25	29.6
2	24	23	23	25	25	24	25	24	17	18	49.0
3	19	17	14	13	12	11	10	10	10	12	31.4
4	13	13	13	18	15	13	14	12	14	10	42.4
5	10	9	8	8	9	12	13	17	16	13	59.1
6	11	10	10	11	10	11	13	16	20	21	68.7
7	17	17	17	17	25	28	28	23	19	22	90.2
8	22	18	17	19	27	36	34	37	28	21	155.5
9	21	22	31	26	28	29	22	19	23	-	169.9
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Test Remarks

Tested By	HEWI/JEBR	Date	1/11/2021
Data Entry By	HEWI	Date	2/11/2021
Checked By	JEBR	Date	3/11/2021
Approved By	CXPG	Date	3/11/2021

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Schedule Name

N/A

Dynamic Probing Resistance using the 90° Cone - BS 1377: Part 9: 1990 Test 3.2

Project Name	G CH TT SOLAR FARM SI				Project ID	1100987.0001
Client Project ID	Solar Farm SI				Lab Ref / URN	N/A
Site Location	Buckleys Road, Leeston				Test No	DPSH06
Coordinates	Latitude	-43.707790°	Longitude	172.282760°	Datum	WGS84
Type of Probing	Dynamic Probing - Super Heavy (DPSH)				Hammer Weight (kg)	63.5
Rods	35 mmø Standard Driven				Hammer Drop (mm)	750
Cone Type	Sacrificial				Equipment ID	CH099

Top Depth (m)	Individual Readings (Blows/100mm)										Torque (Nm)
0	5	7	5	3	8	12	15	15	11	10	5.7
1	9	8	9	13	12	13	12	13	12	11	12.2
2	19	17	15	15	16	17	14	15	15	16	40.6
3	13	17	14	16	12	11	10	8	7	11	41.1
4	9	9	11	13	13	13	12	11	14	14	62.7
5	12	12	14	14	14	14	13	15	15	13	82.2
6	14	17	21	18	15	11	9	12	14	16	72.3
7	24	21	25	19	16	14	12	14	15	14	133.0
8	14	12	18	15	13	13	11	11	11	12	141.6
9	20	22	24	24	25	26	31	35	32	-	194.1
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Test Remarks

Tested By	HEWI/JEBR		Date	1/11/2021
Data Entry By	HEWI		Date	2/11/2021
Checked By	JEBR		Date	3/11/2021
Approved By	CXPG		Date	3/11/2021

Appendix B: Laboratory test results

Table B1- Soil analytical results and exposure classification

Sample ID	Units	HASC01-Topsoil	HASC01 - Sample 1	HASC02 - Sample 1	HASC03 - Sample 1	HASC04-Topsoil	HASC04 - Sample 1	HASC05-Topsoil	HASC05 - Sample 1
Depth (m bgl)		0.1	0.4	0.4	0.3	0.1	0.4	0.1	0.3
Soil type		Sandy SILT	Clayey SILT	Clayey SILT	Clayey SILT	Sandy SILT	Clayey SILT	Sandy SILT	Clayey SILT
pH*	pH	5.1	4.9	4.6	4.7	4.9	4.7	4.9	4.7
Chloride*	mg/kg	<3.0	<3.1	<3.1	<3.0	<3.0	<3.1	6.3	<3.1
Resistivity*	Ω·cm	23,474	36,496	53,191	41,152	26,455	41,667	26,178	46,948
Electrical Conductivity*	µS/cm	42.6	27.4	18.8	24.3	37.8	24.0	38.2	21.3

Sample ID	Units	HASC06 - Sample 1	HASC07 - Sample 1	HASC08-Topsoil	HASC08 - Sample 1	HASC09-Topsoil	HASC09 - Sample 1	HASC10-Topsoil	HASC10 - Sample 1
Depth (m bgl)		0.5	0.2	0.1	0.2	0.1	0.35	0.1	0.5
Soil type		Clayey SILT	Clayey SILT	SILT	SILT	SILT	Clayey SILT	SILT	Sandy SILT
pH*	pH	5.7	5.6	5.3	5.2	5.9	5.1	5.7	4.7
Chloride*	mg/kg	<2.9	<3.2	15.6	<3.1	17.0	<3.0	7.3	<3.0
Resistivity*	Ω·cm	10,101	36,765	11,249	16,639	22,321	44,248	22,472	42,373
Electrical Conductivity*	µS/cm	99.0	27.2	88.9	60.1	44.8	22.6	44.5	23.6

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