hepburn wind community energy

Hybrid Planning Permit | Attachment 6

Geotechnical Investigation

21 February 2020

Our ref: 754-MELGE270329AB

Hepburn Wind
PO Bix 225
Daylesford VIC 3460

Attention: Taryn Lane

Dear Taryn,

Geotechnical Investigation – Hepburn Wind Solar Farm

1. Introduction

This letter presents the results of a geotechnical investigation carried out by Coffey Services Australia Pty Ltd. (Coffey) for the proposed solar farm located at Leonards Hill, Victoria.

The proposed Solar Farm comprises a mixture of PEG east-west technology and PEG south technology. The proposed site is located to the north of the existing Wind Farm at Leonards Hill, approximately 9km to the south of Daylesford in western Victoria on 18ha of land.

The investigation was carried out in general accordance with Coffey proposal 754-MELGE270329AA dated 16 January 2020.

2. Project aims

The aims of the investigation were to assess the subsurface conditions to confirm if the recommendations within the previous Coffey report (GEOTABTF08188AA-AC dated 27 September 2010) conducted on the southern portion of the site are suitable for the northern section of the site where the new solar farm is proposed.

3. Field investigation

The fieldwork was undertaken on 5 February 2020 and comprised the completion of 5 test pits, designated TP01 to TP05, to 2m depth and Dynamic Cone Penetrometer (DCP) test adjacent to each test pit at various locations around the area of the proposed solar farm.

Upon completion, the test pits were backfilled with the excavated soil and track rolled at the surface. The fieldwork was performed by a geotechnical engineer from Coffey who positioned and completed

the test pits and prepared engineering logs. The test pit locations were recorded using a hand held GPS unit and the coordinates are presented on the engineering logs.

Engineering logs describing the subsurface conditions encountered in the test pits, including DCP test results are attached to this letter. The logs are preceded by summary sheets of descriptive terms and symbols used in their preparation.

4. Site conditions

The proposed solar farm site is located on Leonards Hill and consists of open farm land with undulating topography. At the time of the site visit, the site was accessible to 4WD and tracked vehicles.

5. Subsurface conditions

The Geological Survey of Victoria 1:50,000 scale Daylesford map sheet indicates that the site is underlain by Quaternary age Newer Volcanics, comprising weathered basalt overlain by associated residual clayey soils of varying depth.

The subsurface conditions encountered within the test pits are considered to be generally consistent with the geological map indications. A summary of the subsurface conditions encountered in the test pits are presented in Table 1 below.

Table 1: Summary of subsurface conditions

Unit	Unit Description	Approx. Depth to Top of Unit (m)	Approx. Thickness of Unit (m)	Description of Material
1	Residual soil	0	Not Pene-trated	**CLAYEY SILT:** low to high plasticity, dark grey, brown, with some fine to coarse grained sand and gravel, dry, stiff to hard **CLAY:** high plasticity, grey, brown, trace of fine to medium grained sand, dry, stiff to hard.

6. Laboratory testing

Following the field investigation, samples recovered from the test pits were sent to a NATA accredited laboratory for 4 Atterberg Limits classification tests. The results of the laboratory testing are presented in Attachment B and summarised in Table 2 below.

Table 2: Summary of laboratory test results

Sample Location	Depth From (m)	Material	Atterberg Limits			
			Linear Shrink-age (%)	LL (%)	PL (%)	PI (%)
TP02	1.1 – 1.2	Clayey Silt (MI)	10	48	33	15
TP03	0.2 – 0.3	Clayey Silt (MH)	6	54	39	15
TP04	1.1 – 1.2	Clayey Silt (MI)	6	49	35	14
TP05	1.7 – 1.8	Clayey Silt (MH)	5.5	66	40	26
LL – Liquid Limit, PL – Plastic Limit, PI – Plasticity Index						

7. Geotechnical recommendations

Based on the results of the geotechnical investigation, the recommendations provided the previous Coffey report are suitable for the subject site where the new solar farm is proposed. Deviations and additional recommendations from those previously provided are presented in the following sections.

7.1. Geotechnical design parameters

Table 3: Geotechnical parameters

Founding Material	Geotechnical Parameters							
	Cohesion c' (kPa)	Internal angle of friction ϕ' (deg)	Young's Modulus E' (MPa)	Poisson's Ratio υ	Saturated unit weight of soil γ (t/m^3)	Coefficient of Earth Pressure at rest K_0	Coefficient of Active Earth Pressure Ka	Shear Modulus G (MPa)
CLAY (CH) /CLAYEY SILT (MI-MH): stiff to very stiff	5	26	20-25	0.3	1.8	0.56	0.39	5-10

7.2. Spread footings

Based on the subsurface conditions encountered within the test pits, it is considered that the proposed solar farm may be supported on spread footings founded in the underlying natural soils.

It is considered that a maximum allowable bearing pressure of 150kPa can be adopted for the design of pad footings and 125kpa for stirp footings.

It is recommended that excavations be assessed by a suitably experienced geotechnical engineer during construction to confirm that the founding conditions are consistent with those on which the design recommendations are based. Footing excavations should be clean and free of all loose and/or water softened material prior to pouring concrete.

7.3. Seismic site subsoil class

Based on the proposed development and the subsurface conditions encountered in the test pits as per the generalised subsurface profile presented in Table 1, it is considered that a site subsoil classification of Class “Ce – Shallow soil site” is applicable to this site in accordance with Section 4 of AS1170.4 (2007) “Earthquake Loads”.

Should you require further information regarding this letter, please contact the undersigned.

Regards,

Liam Moody
Project Geotechnical Engineer

Attachments:

Site Plan

Engineering logs and explanation sheets

Laboratory test reports

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	GY	LM	20.02.20

LEGEND

- TEST PIT
- PARCEL BOUNDARY

SITE AERIAL IMAGE SOURCE: NEARMAP (CAPTURE DATE 27 NOVEMBER 2019)

N

0 25 50 75 100

SCALE 1:2,500 (A3) METRES

Projection: GDA 1994 MGA Zone 55

drawn	GY
approved	LM
date	20.02.2020
scale	AS SHOWN
original size	A3

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client:	CLIENT		
project:	LEONARDS HILL SOLAR ARRAY		
title:	SITE PLAN		
project no: 754-MELGE270329	figure no: FIGURE 1	rev: A	

MXD Template Reference: 270329_01_GIS001_v0_1

Soil Description Explanation Sheet (1 of 2)

DEFINITION:
In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 – 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 – 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 – 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 – 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 – 35
Medium Dense	35 – 65
Dense	65 – 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man-made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES USC (Excluding particles larger than 60 mm and basing fractions on estimated mass)						USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes		GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.		GP	GRAVEL
			GRAVELS WITH FINES Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)		GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)		GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes		SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).		SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm				
		SILTS & CLAYS Liquid limit less than 50	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**		
			None to Low	Quick to slow	None	ML	SILT
			Medium to High	None	Medium	CL	CLAY
			Low to medium	Slow to very slow	Low	CL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium	MH	SILT
			High	None	High	CH	CLAY
			Medium to High	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			PT	PEAT

● Low plasticity – Liquid Limit w_L less than 35%. ● Medium plasticity – w_L between 35% and 50%. ● High plasticity – w_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter.	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

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Engineering Log - Test pit

Borehole ID.	**TP01**
sheet:	1 of 1
project no.	**754-MELGE270329**
client:	**Hepburn Wind**
date started:	**05 Feb 2020**
principal:	
date completed:	**05 Feb 2020**
project:	**Leonards Hill Solar Farm**
logged by:	**FR**
location:	**Leonards Hill**
checked by:	**LM**

position: E: 245233; N: 5854297 (MGA94) | surface elevation: Not Specified | angle from horizontal: 90° | DCP id.:

drill model: Case 580 Super LE, Backhoe mounted | drilling fluid: | hole diameter :

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
BH N		Not Observed			0.5		CH	**CLAY**: medium to high plasticity, dark brown, rootlets top 300 mm.	D	VSt			**NATURAL**
					1.0			trace highy weathered basalt cobbles and gravel		H			HP 300 - 340 kPa; VS 65 kPa shear vane unable to penetrate HP 550 - 600 kPa
					1.5								HP >600 kPa
					2.0			Test pit TP01 terminated at 2.2 m Target depth					
					2.5								
					3.0								
					3.5								

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: NON CORED + DCP 754-MELGE270329.GPJ <<DrawingFile>> 20/02/2020 10:00

method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

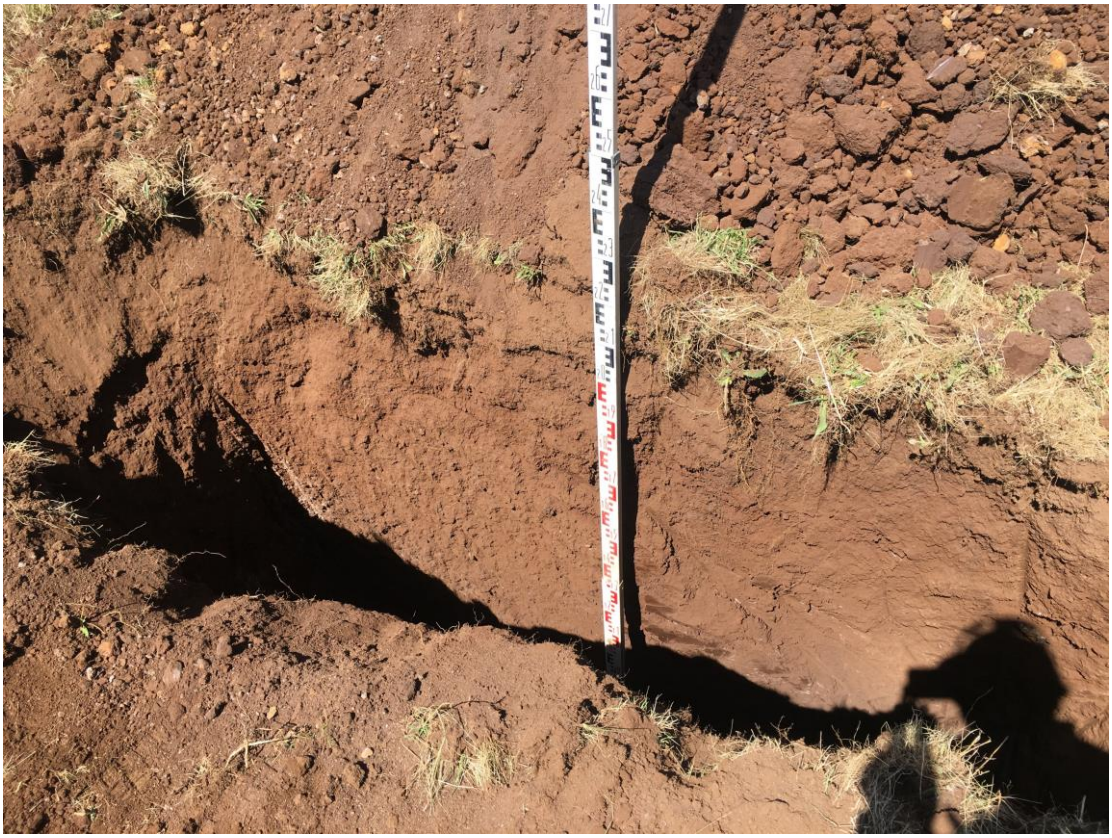
water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- 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/remouded (kPa)
- R refusal
- HB hammer bouncing

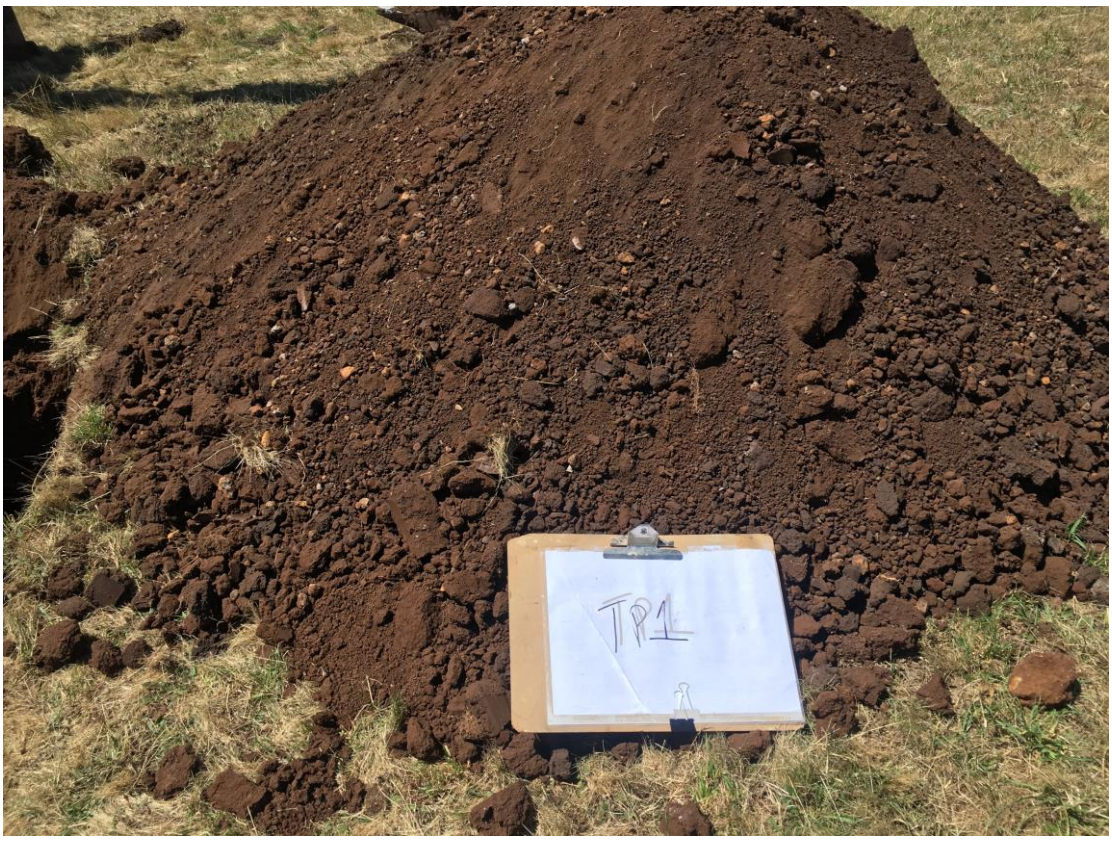
soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- 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



TP01 - Excavation



TP01 - Spoil

drawn	**LM**		client: **Hepburn Wind**	
approved	**GM**		project: **Leonards Hill Solar Array**	
date	**20 Feb 2020**			
scale	**NTS**		title: **Test Pit Photos**	
original size	**A4**		project no: **754-MELGE270329**	figure no: **TP01**

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Engineering Log - Test pit

Borehole ID.	***TP02***
sheet:	1 of 1
project no.	***754-MELGE270329***
client: ***Hepburn Wind***	date started: ***05 Feb 2020***
principal:	date completed: ***05 Feb 2020***
project: ***Leonards Hill Solar Farm***	logged by: ***FR***
location: ***Leonards Hill***	checked by: ***LM***

position: E: 245230; N: 5854160 (MGA94) | surface elevation: Not Specified | angle from horizontal: 90° | DCP id.:

drill model: CAse 580 SUper LE, Backhoe mounted | drilling fluid: | hole diameter :

drilling information | **material substance**

method & support	penetration (1 2 3)	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (**SOIL NAME**: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) (100 200 300 400)	DCP (blows/ 100 mm) (2 4 6 8 10)	structure and additional observations
BH, N		Not Observed	D		0.5		ML	**Clayey SILT**: low liquid limit, brown, trace clay.	D	St			**NATURAL** HP 140 - 170 kPa; VS 68 kPa
					1.0		ML	**Clayey SILT**: medium liquid limit, brown, with silt, trace sand.		VSt - H	>>		HP 550 kPa; VS 153 kPa
					2.0			Test pit TP02 terminated at 2.0 m Target depth					
					2.5								
					3.0								
					3.5								

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: NON CORED + DCP 754-MELGE270329.GPJ <<DrawingFile>> 20/02/2020 10:00

method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
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support
- M mud
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penetration
1 2 3 no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
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- water outflow

samples & field tests
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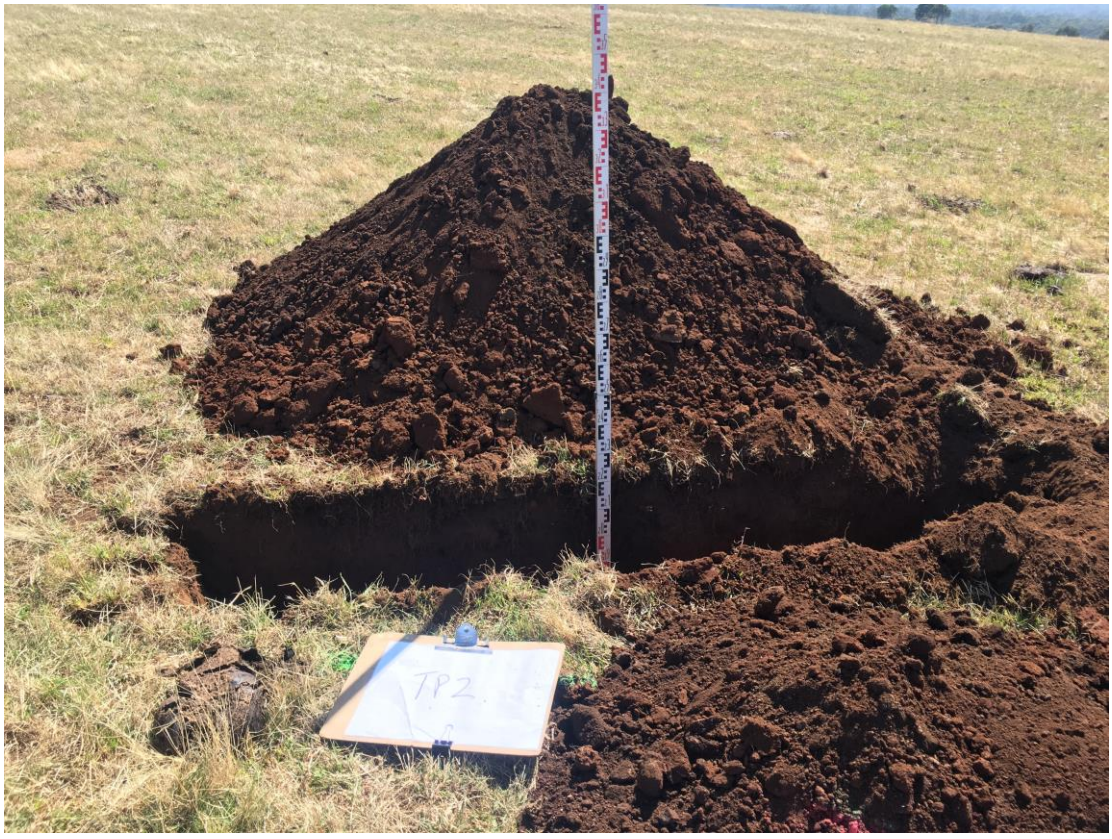
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- 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

TP02 - Excavation



TP02 - Spoil

drawn	**LM**		client: **Hepburn Wind**	
approved	**GM**		project: **Leonards Hill Solar Array**	
date	**20 Feb 2020**			
scale	**NTS**		title: **Test Pit Photos**	
original size	**A4**		project no: **754-MELGE270329**	figure no: **TP02**

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Engineering Log - Test pit

Borehole ID.	**TP03**
sheet:	1 of 1
project no.	**754-MELGE270329**
client:	**Hepburn Wind**
date started:	**05 Feb 2020**
principal:	
date completed:	**05 Feb 2020**
project:	**Leonards Hill Solar Farm**
logged by:	**FR**
location:	**Leonards Hill**
checked by:	**LM**

position: E: 245372; N: 5854142 (MGA94) | surface elevation: Not Specified | angle from horizontal: 90° | DCP id.:

drill model: CAse 580 SUper LE, Backhoe mounted | drilling fluid: | hole diameter :

drilling information | **material substance**

method & support	penetration (1 2 3)	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa)	DCP (blows/ 100 mm)	structure and additional observations
BH, N		Not Observed	D		0.5		ML	**Clayey SILT**: low to medium liquid limit, brown, trace sand.	D	St			**NATURAL**
					1.0		CH	**CLAY**: high plasticity, brown.		St - VSt			HP 150 - 180 kPa HP 200 - 220 kPa
					1.5			trace highly weathered basalt, fine to coarse grained gravel becoming red-brown					
					2.0			Test pit TP03 terminated at 2.2 m Target depth					
					2.5								
					3.0								
					3.5								

method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix, e.g. AD/T
- B blank bit
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support
- M mud
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penetration (1 2 3) — no resistance ranging to refusal

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- 10-Oct-12 water level on date shown
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samples & field tests
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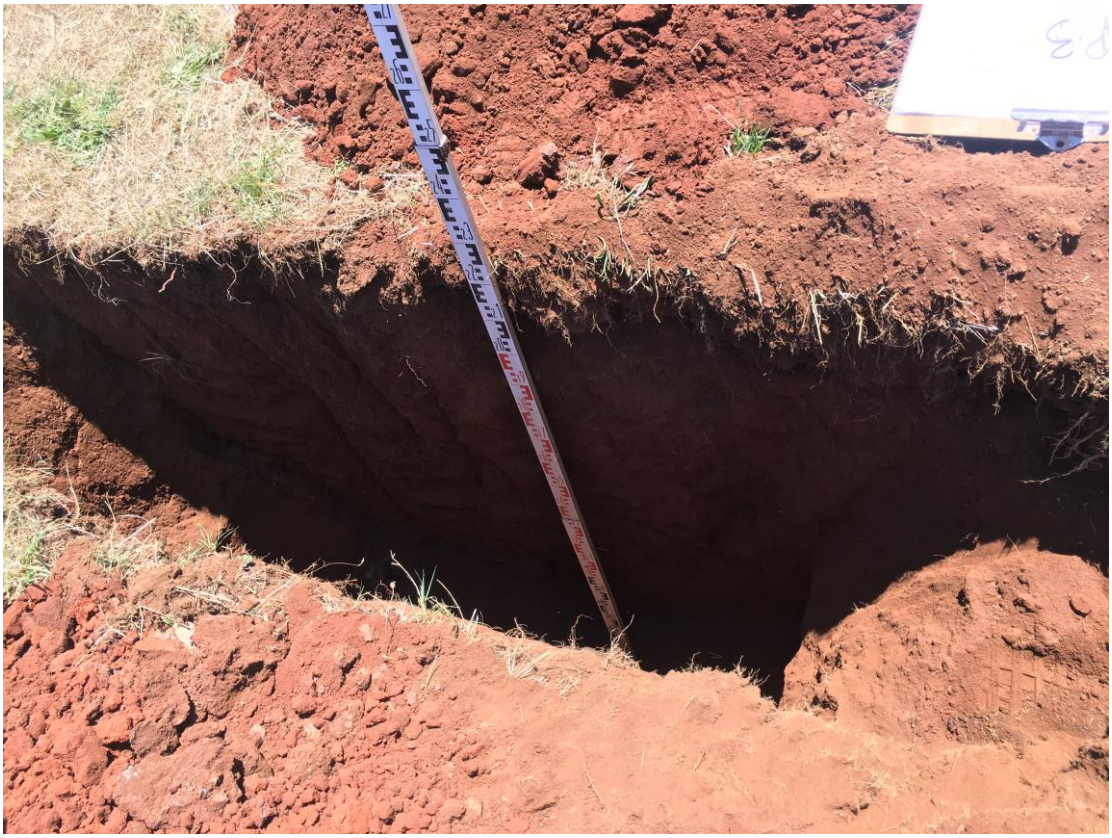
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description based on AS 1726:2017

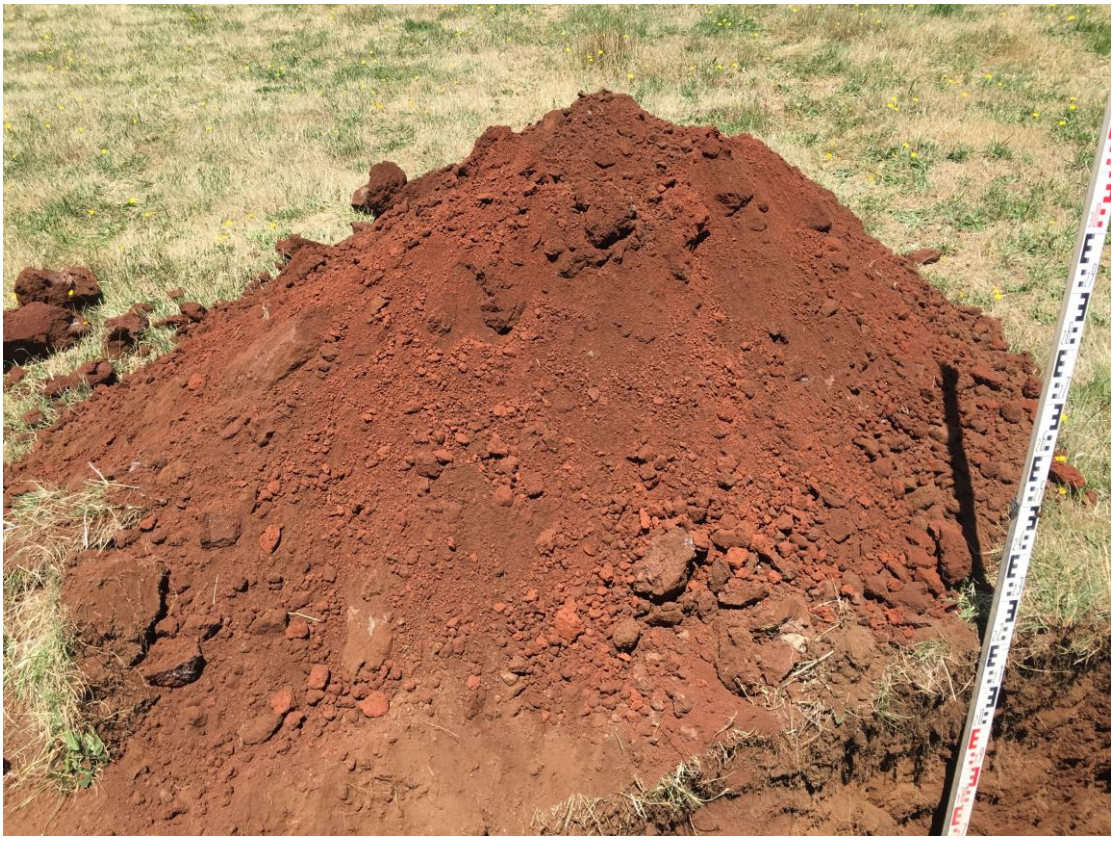
moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- 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

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: NON CORED + DCP 754-MELGE270329.GPJ <<DrawingFile>> 20/02/2020 10:00



TP03 - Excavation



TP03 - Spoil

drawn	**LM**	coffey A TETRA TECH COMPANY	client: **Hepburn Wind**	
approved	**GM**		project: **Leonards Hill Solar Array**	
date	**20 Feb 2020**		title: **Test Pit Photos**	
scale	**NTS**		project no: **754-MELGE270329**	figure no: **TP03**
original size	**A4**			

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Engineering Log - Test pit

Borehole ID.	**TP04**
sheet:	1 of 1
project no.	**754-MELGE270329**
client:	**Hepburn Wind**
date started:	**05 Feb 2020**
principal:	
date completed:	**05 Feb 2020**
project:	**Leonards Hill Solar Farm**
logged by:	**FR**
location:	**Leonards Hill**
checked by:	**LM**

position: E: 245366; N: 5854036 (MGA94) | surface elevation: Not Specified | angle from horizontal: 90° | DCP id.:

drill model: CAse 580 SUper LE, Backhoe mounted | drilling fluid: | hole diameter :

drilling information | **material substance**

method & support	penetration (1 2 3)	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) (100 200 300 400)	DCP (blows/100 mm) (2 4 6 8 10)	structure and additional observations
BH, N		Not Observed	D		0.5		ML-MH	**Clayey SILT**: medium to high liquid limit, brown.	D	VSt - H	>>		**NEWER VOLCANICS** HP 350 - 450 kPa HP 600 kPa; VS 135 kPa
					1.0			trace highly weathered basalt gravel					VS 108 kPa
					1.5			becoming brown-grey, high plasticity					HP 500 kPa
					2.0			Test pit TP04 terminated at 2.2 m Target depth					
					2.5								
					3.0								
					3.5								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- 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/remouded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

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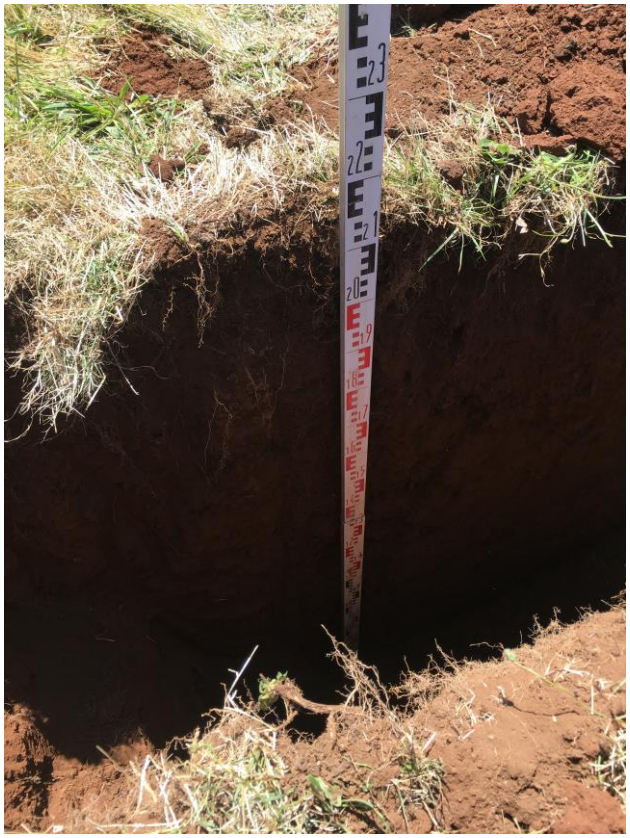
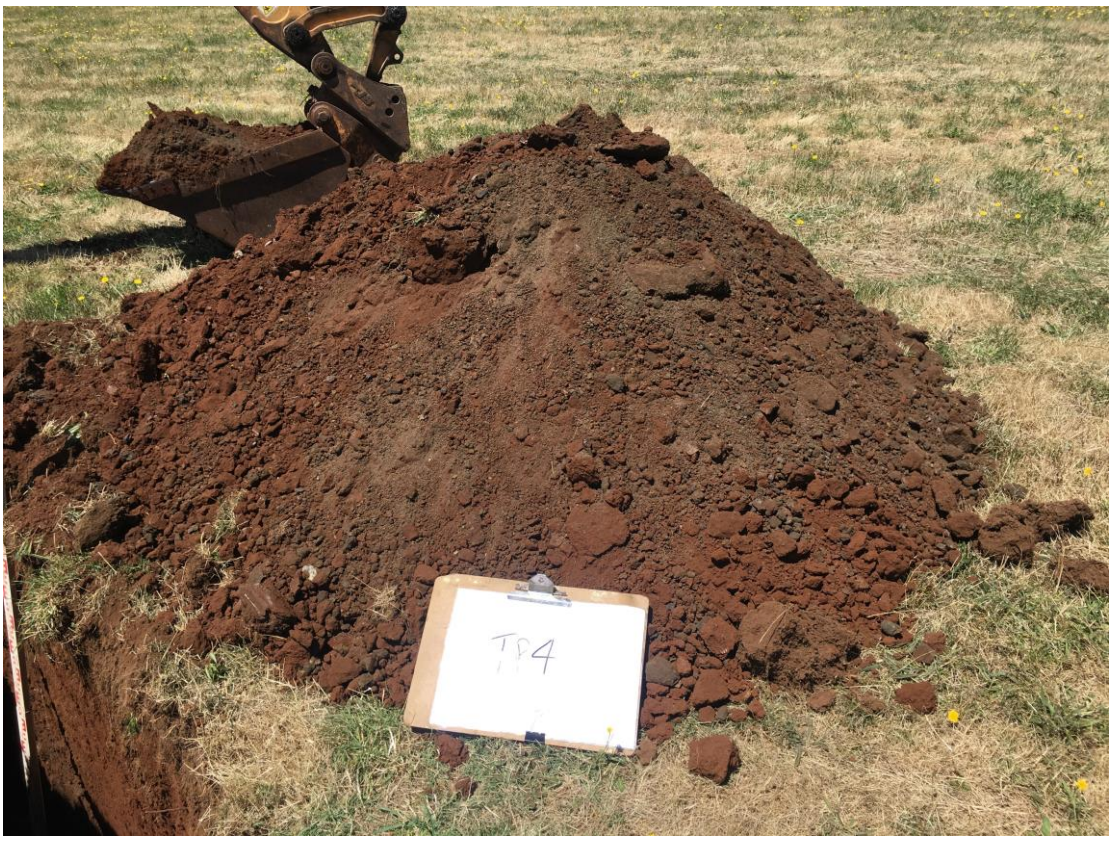


TP04 - Excavation



TP04 - Spoil

drawn	**LM**		client: **Hepburn Wind**	
approved	**GM**		project: **Leonards Hill Solar Array**	
date	**20 Feb 2020**			
scale	**NTS**		title: **Test Pit Photos**	
original size	**A4**		project no: **754-MELGE270329**	figure no: **TP04**

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Engineering Log - Test pit

Borehole ID.	**TP05**
sheet:	1 of 1
project no.	**754-MELGE270329**
client:	**Hepburn Wind**
date started:	**05 Feb 2020**
principal:	
date completed:	**05 Feb 2020**
project:	**Leonards Hill Solar Farm**
logged by:	**FR**
location:	**Leonards Hill**
checked by:	**LM**

position: E: 245254; N: 5854058 (MGA94) | surface elevation: Not Specified | angle from horizontal: 90° | DCP id.:

drill model: CAse 580 SUper LE, Backhoe mounted | drilling fluid: | hole diameter :

drilling information | **material substance**

method & support	penetration (1 2 3)	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (**SOIL NAME**: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) (100 200 300 400)	DCP (blows/100 mm) (2 4 6 8 10)	structure and additional observations
BH — N		Not Observed	D		0.5		ML	**Clayey SILT**: low liquid limit, brown, trace fine to medium grained sand, rootlets top 200 mm.	D	St			**NEWER VOLCANICS**
					1.0		MH	**Clayey SILT**: medium liquid limit, brown, with silt.		VSt			HP 100 - 120 kPa HP 250 - 300 kPa
					1.5								
					2.0			Test pit TP05 terminated at 2.1 m Target depth					
					2.5								
					3.0								
					3.5								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration (1 2 3) — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- 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
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soil group symbol & soil description
based on AS 1726:2017

moisture condition
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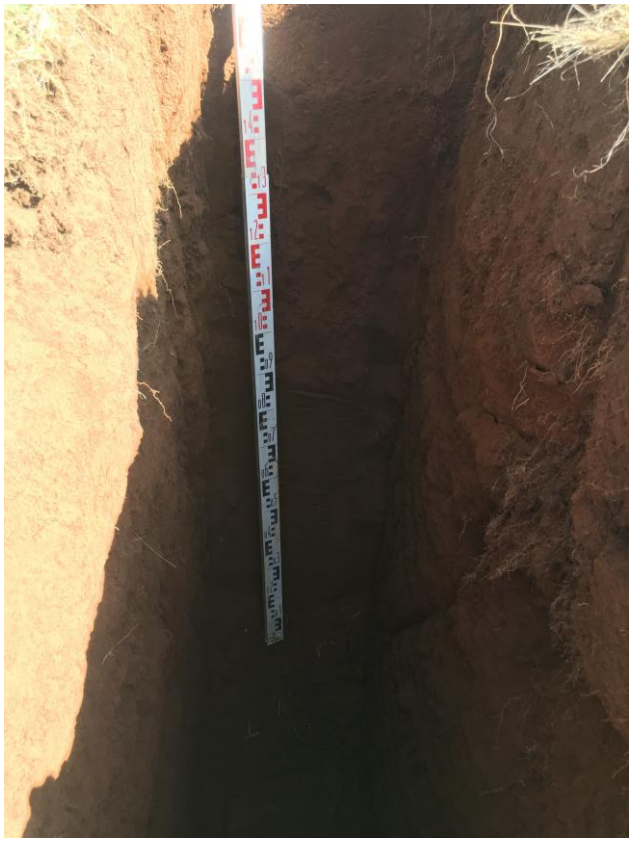
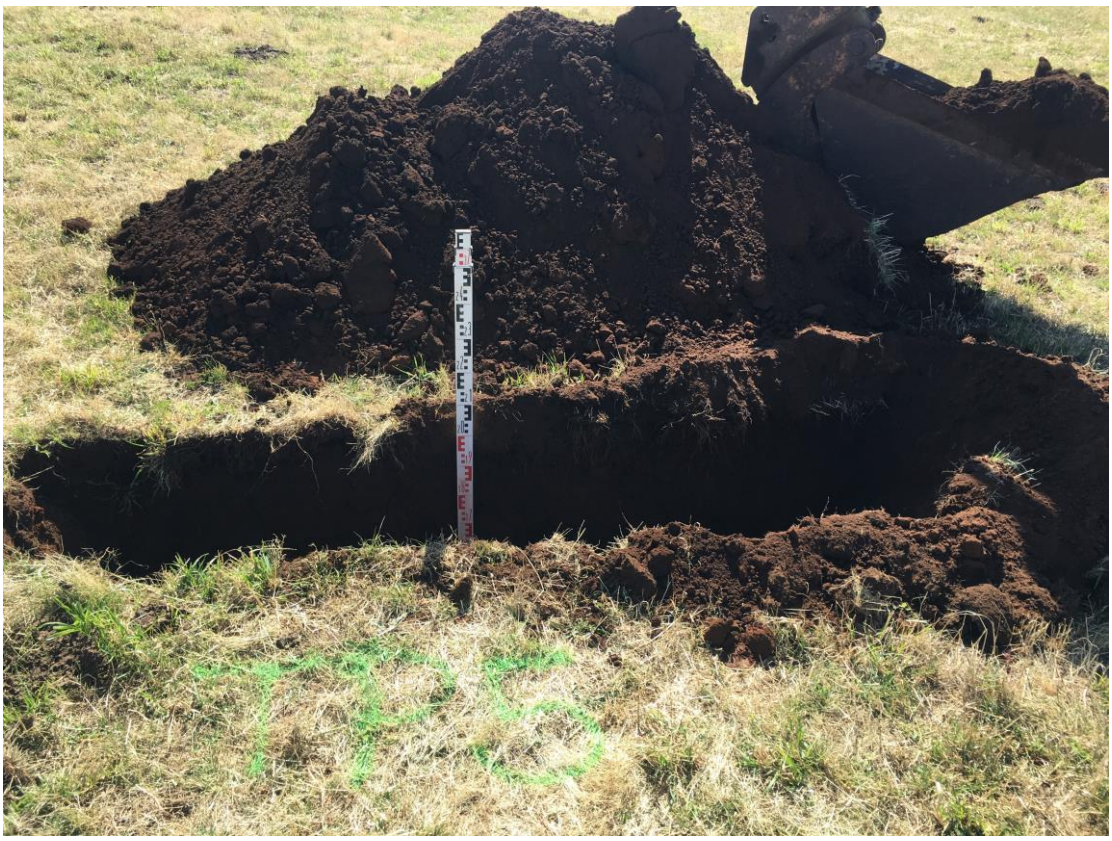
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense



TP05 - Excavation



TP05 - Spoil

drawn	**LM**		client: **Hepburn Wind**	
approved	**GM**		project: **Leonards Hill Solar Array**	
date	**20 Feb 2020**			
scale	**NTS**		title: **Test Pit Photos**	
original size	**A4**		project no: **754-MELGE270329**	figure no: **TP05**

coffey
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Dynamic Cone Penetrometer Test Results

Client: ***Hepburn Wind***
Project: ***Leonards Hill Solar Farm***
Location: ***Leonards Hill***
Standard Used (eg AS, RTA): ***AS***

Principal:
Project No: 754-MELGE270329
Date of Issue: 5/02/2020

Sample Details

Test Procedure:
Test Date:

Depth below surface (m)	Test Numbers								*Reading Recorded in Blows per 100mm*
	TP1	***TP2***	***TP3***	***TP4***	***TP5***	***6***	***7***	***8***	Test Locations/ Remarks
0.1	4	4	3	5	4				
0.2	6	3	4	6	5				
0.3	8	6	6	6	6				
0.4	11	9	6	8	8				
0.5	10	6	5	8	4				
0.6	7	7	7	8	2				
0.7	9	7	6	7	5				
0.8	5	7	7	6	3				
0.9	9	7	8	6	5				
1	7	6	6	8	6				
1.1	10	7	6	6	7				
1.2	11	6	7	7	6				
1.3	8	6	6	6	5				
1.4	6	7	6	9	6				
1.5	8	7	6	8	6				
1.6	9	7	5	8	6				
1.7	10	7	6	6	5				
1.8	7	7	13	7	5				
1.9	8	5	11	7	6				
2	8	7	11	6	5				
2.1									
2.2									
2.3									
2.4									
2.5									
2.6									

Remarks:

General Information:
AS 1289 6.3.2
■ Drop height 510mm ± 5
■ Cone tip
□ Blunt tip
AS 1289 6.3.3
□ Drop height 600mm ± 5

GroundScience

ACN 31 105 704 078
13 Brock Street, Thomastown, VIC **P** 03 9464 4617 **Email** reception@groundscience.com.au

Test Results - Atterberg Limits

Client:	**COFFEY INFORMATION (ABBOTSFORD)**	Job No.	**GS5116/1**
Project:	**LEONARDS HILL SOLAR FARM**	Report No.	**AN**
Location:	**LEONARDS HILL**	Test Date:	**17-Feb-20**

Sample identification		**TP2 @ 1.1 - 1.2m**	**TP3 @ 0.2 - 0.3m**	**TP4 @ 1.1 - 1.2m**	**TP5 @ 1.7 - 1.8m**
Sample number		**#18**	**#19**	**#20**	**#21**
Test methods		AS1289 3.1.2 3.2.1 3.3.1 3.4.1 2.1.1			
ATTERBERG LIMITS					
Liquid Limit	%	**48**	**54**	**49**	**66**
Plastic Limit	%	**33**	**39**	**35**	**40**
Plasticity Index	%	**15**	**15**	**14**	**26**
Linear Shrinkage	%	**10**	**6**	**6**	**5.5**
Curling/ Crumbling/ Cracking		**Cracking & Crumbling**	**Cracking**	**Cracking & Crumbling**	**Cracking**
Sample History		Oven dried, Dry sieved	Oven dried, Dry sieved	Oven dried, Dry sieved	Oven dried, Dry sieved
Sample Description		**CLAY, medium plasticity, brown.**	**CLAY, high plasticity, brown.**	**CLAY, medium plasticity, brown.**	**CLAY, high plasticity, brown.**

Comments:

Sampling Method Sampled by client, tested as received

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards

Approved Signatory **Chris Senserrick**

Date of issue 18/02/2020