Garrane Green Energy Project, Charleville, Co. Limerick

Preliminary Site Investigation Works for Construction of New Wind Turbines, Access Tracks and Associated Infrastructure

Report No: 2177-22B

17th October 2022

This document has been prepared by Whiteford Geoservices Ltd on behalf of

Garrane Green Energy Ltd

and

Jennings O'Donovan Ltd

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CONTENTS

1 INTRODUCTION

This report should be read in conjunction with the Garrane Green Energy Project - Desktop Study and Walkover Survey for Preliminary Determination of Ground Conditions Report 2177-22A.

In July 2022 Whiteford Geoservices Ltd was commissioned by Jennings O'Donovan Ltd to undertake investigation works at Garrane Green Energy Project near Charleville, County Cork, Ireland.

The investigation was required to obtain information for the civil design of access tracks and other infrastructure; primarily with respect to the assessment of soils and geology in relation to an application for planning permission in respect to: -

> *A total of 12nr new wind turbine generators, associated infrastructure and turbine hardstands as well as new and upgraded site access tracks.*

The results of this site investigation have been employed to screen for the significance of peat soil thickness in respect to peat landslide susceptibility. The same information has also be analysed to gain a clearer understanding of the nature of soils and rock present along the proposed route of the access track network, at the proposed wind turbine generators, hardstandings and other infrastructure to be constructed as part of the Garrane Green Energy Project development.

Prior to undertaking the site investigation works a desktop study and walkover survey had been undertaken for the site to provide a broad understanding of ground conditions present and an initial assessment of peat stability. As part of the desktop study and walkover report preliminary Peat Depth and Ground Slope plots were compiled and from this and other observations a Preliminary Plot of Peat Slide Risk Hazard had been compiled.

This analysis determined that peat is not present in sufficient depth to cause peat landslide. Peat soils were not identified within the wind farm boundary.

These site investigation works consisted of the following elements; aimed at assessing the soils and geology of the site underlying the proposed development.

The scope of these works was as follows: -

Ref	SI Component	Remarks
A	In-situ testing to determine soil strength	Shear Vane testing and Gouge cores at selected locations (Turbine locations and existing spoil disposal sites)
B	Trial pitting to determine the underlying soils	6nr Trial pit locations were picked to give an overview of the underlying soils and geology across the whole site

The investigation was performed in accordance with the relevant standards (see References) and data presented within the relevant appendix to this report.

This report presents the factual records of the investigations undertaken.

2 SITE AND GEOLOGY

2.1 The Site

Garrane Green Energy Project is situated approximately 1km north of Charleville, County Cork and straddles relatively flat lands that slope generally in a northerly direction.

Ground surface elevations vary between approximately 59m to 67m above Ordnance Datum (Malin Head).

The land usage does not appear to vary across the number of land holdings which make up the Garrane Green Energy Project development, consisting of agricultural pastureland for grazing sheep and cattle.

The closest active quarrying operations to the site are set out in Appendix 9.1, Section 2.7, the closest is approximately 7km to the south.

2.2 Published Geology

A study was made of available geological information for the area (GSI Online Database). This study indicated that the following natural geology is present across the site of Garrane Green Energy Project;

- Lacustrine deposits
- Boulder Clay
- River Deposits
- Limestone rock

2.2.1 Solid Geology

According to the GSI online database, the Garrane Green Energy Project site is underlain by a succession of Limestone formations. Those being the Visean Limestones, Ballysteen Formation and the Waulsortian Limestones

Visean Limestones; undifferentiated limestones
Ballysteen Formation; dark muddy limestone interbedded with shale
Waulsortian Limestones; undifferentiated limestones

The rock formations are also bisected by a series of faults that trend both in a south west – north east direction and in a west to east direction. These indicate previous differential movement between adjacent rock formations the date of which is unknown.

Two of which faults cut directly across the wind farm site. It is unlikely that these faults will be re-activated during the lifetime of the wind farm; Ireland being one of the less seismically active parts of the world. However, it is probable that these fault zones will be associated with highly fractured and locally weaker rock masses. Such conditions can have significance for foundation design of structures such as wind turbines and warrant further investigation at construction phase.

2.2.2 Superficial Geology

Superficial soils present within the wind farm boundary largely consists of lake (lacustrine) deposits and river deposits (alluvium). The northern and southern extents of the site are underlain by glacial till, with small pockets of gravels present elsewhere.

For further information pertaining to site geology refer to the Desk Study and Walkover Survey Report (2177-22A).

3 FIELDWORK

3.1 General

All fieldwork was carried out in general accordance with BS 5930:2015+A1:2020 and other related standards.

Please refer to Appendix A for the location of all geotechnical investigations undertaken.

3.2 Exploratory Holes

The exploratory holes are detailed within the following table.

METHOD	QUANTITY	MAXIMUM DEPTH (m)	EQUIPMENT
Trial Pit	6 Nr.	3.60	Trial pits were carried out with the use of a 13T Tracked Excavator

Refer to Appendix B for engineering logs of trial holes

3.3 In-situ Testing

The in-situ testing works carried out are detailed within the following table.

TYPE	QUANTITY	MAX. DEPTH (M)	EQUIPMENT
Peat Probing	12[1]	0.00	Rigid "depthing rods"

Refer to Appendix B for details

[1] Additional peat probes were undertaken during this phase of the works at turbines and hardstands. Previously 106 peat probes had been undertaken during the Walkover phase of the assessment.

3.4 Topographical Survey

A topographical survey of exploratory hole locations was undertaken post-completion of all associated investigation works and is detailed in the table below.

EQUIPMENT	COORDINATE SYSTEM
Leica RTK / GNSS DGPS System	Irish Transverse Mercator (ITM) / Malin Hean (Ordnance Datum)

4 LABORATORY TESTING

4.1 Geotechnical Testing

Following detailed analysis soils laboratory testing was undertaken on samples collected from the site.

This testing was scheduled and carried out in accordance with BS 1377 (1990) and other standards by Whiteford Geoservices Ltd.

A schedule of this testing is summarised in the table below and the results are presented within Appendix C.

TYPE	QUANTITY	REMARKS
Bulk and Dry Density	6	BS1377:1990 Part 2
Natural Moisture Content	6	BS1377:1990 Part 2
Partial size Distribution	6	BS1377:1990 Part 2
Sulphate Content of Water Extract	6	Bs 1377- Part 3 (1990)
Chloride Content of Water Extract	6	Bs 1377- Part 3 (1990)
Sulphide Content of Water Extract	6	Bs 1377- Part 3 (1990)
pH	6	Bs 1377- Part 3 (1990)

5 REFERENCES

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

BS 5930:2015 + A1:2020 Code of practice for ground investigations. British Standards Institution.

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

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

BS EN ISO 14689-1: 2003 : Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.

BS EN ISO 22475-1: 2006 : Geotechnical investigation and testing – Sampling methods and groundwater measurements - Part 1 Technical principles for execution. British Standards Institution.

BS EN ISO 22476-2: 2005 : Geotechnical investigation and testing - Field testing - Part 2 Dynamic probing. British Standards Institution.

BS EN ISO 22476-3: 2005 : Geotechnical investigation and testing - Field testing - Part 3 Standard penetration test. British Standards Institution.

ISRM: 2007: The Complete ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring (1974-2006). Commission on Testing Methods, International Society for Rock Mechanics (Editors Ulusay R & Hudson JA).

ASTM D5731-08: Standard test method for determination of the point load strength index of rock and application to rock strength

APPENDICES

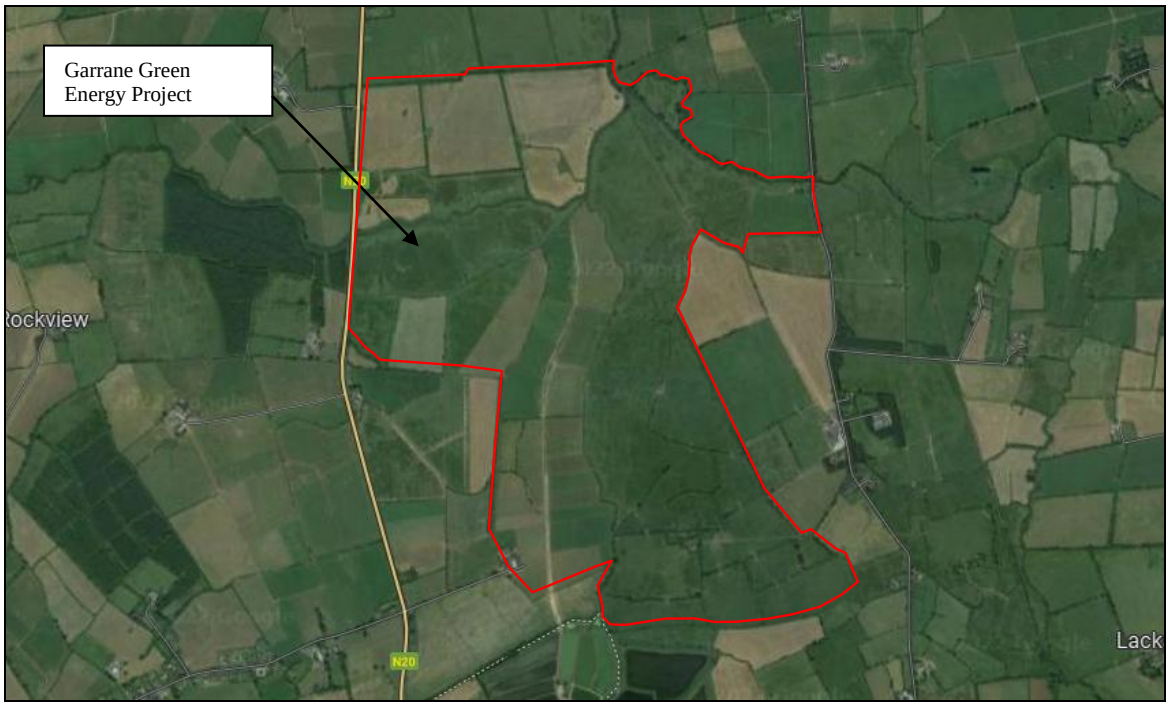
Appendix A	Drawings
Appendix B	Exploratory Holes and In-situ Test Results
Appendix C	Laboratory Testing Results Employed for Analysis Purposes
Appendix D	Photographic Record

APPENDIX A

DRAWINGS

General Site Location Plan	1 x A4
Site Layout Plan showing position of Exploratory Holes and Insitu Tests	1 x A3

P1 - General Location Plan (Aerial view)
(© google maps 2021)



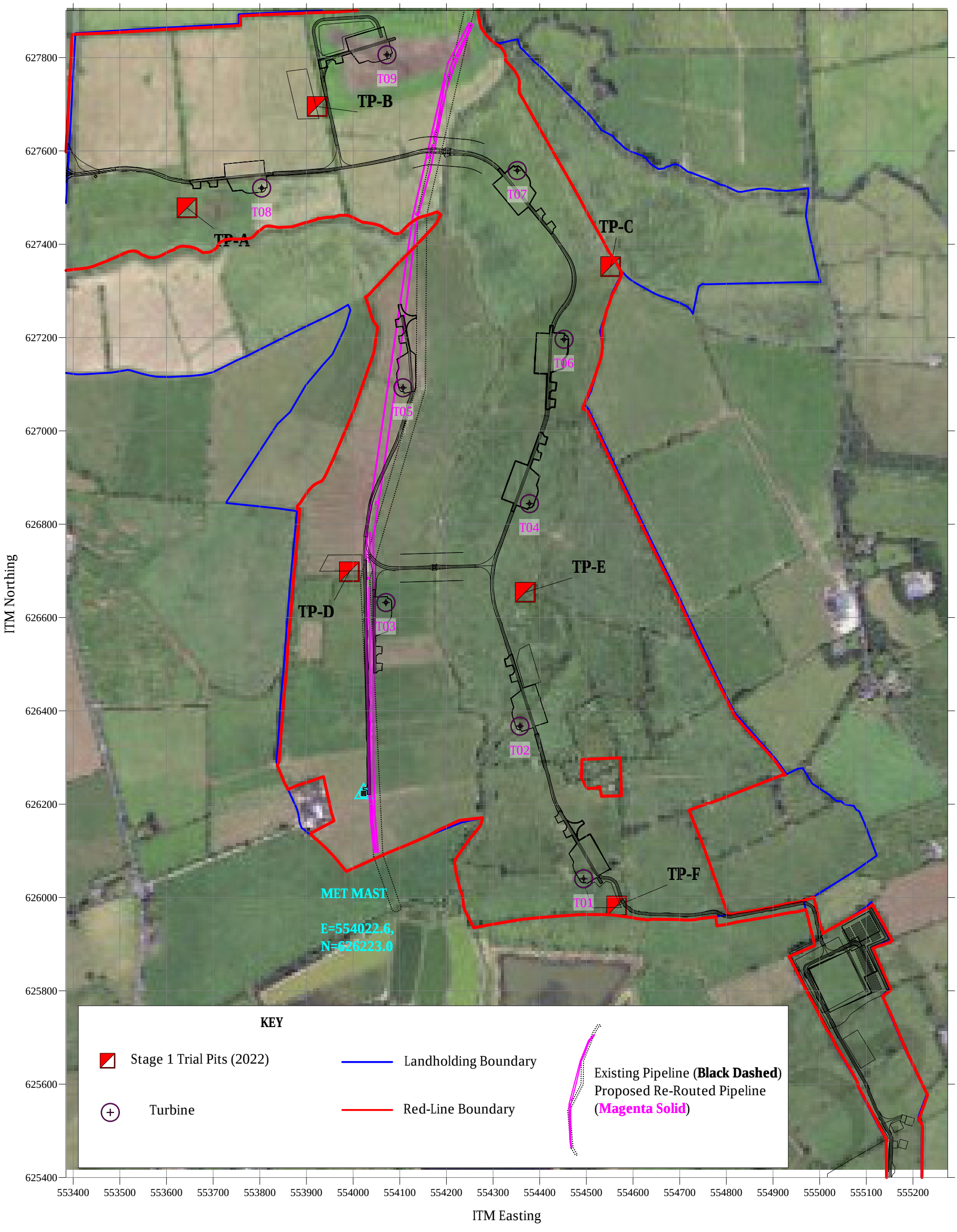
P2 - Local Location Plan (Aerial view)
(© google maps 2021)

2177-22 Garrane Green Energy Project

Site Layout Plan - Garrane Green Energy Project - SI Exploratory Works

Includes:
Trial Holes within Wind Farm Landholding

17th June 2025



Notes:

1. All depths are relative to ground level existing at the time of the survey / investigation.
2. All positions relate to the ITM coordinate system.
3. Any elevations are provided relative to Ordnance Datum Malin Head
4. Do not scale from drawing; not to be used for measurement.

Designed by	Checked by	Approved by - date	Drawing No.	Date	Scale
J.W.	J.W.	J.M - 18/06/2025	2177/22 - L1	18/06/2025	1 : 7500

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UNITED KINGDOM

Garrane Green Energy
Soils and Geology Assessment

Site Layout Plan - Phase 1 (SI Works - Sept 22)	Edition	Sheet
	2	A3

APPENDIX B

IN-SITU TEST RESULTS

Trail Pit Logs	6 x A4
Peat Probing Data	1 x A4

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E553644.00 N627478.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-A	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Dark brown, slightly organic, sandy, silty TOPSOIL
		0.50	B		0.45			Soft to firm, grey mottled orange, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
					2.00			Firm to stiff, grey, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		2.50	B					
					3.40			Stiff, brownish grey, sandy, gravelly SILT/CLAY with a medium cobble, low boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
					3.60			End of Pit at 3.600m

1 2 3 4

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides stable upon completion	None		0.00	3.60	Arisings

Remarks

No groundwater encountered.

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E553923.00 N627695.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-B	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.20			Dark brown, slightly organic, sandy, silty TOPSOIL
		0.50	B					Soft to firm, grey mottled orange, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
					0.90			Firm to stiff, grey, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		1.50	B					
					2.30			Stiff, brownish grey, sandy, gravelly SILT/CLAY with a medium cobble, low boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
		3.00	B					
					3.50			End of Pit at 3.500m

1 2 3 4

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides unstable upon completion	None		0.00	3.50	Arisings

Remarks

No groundwater encountered.

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E554552.00 N627352.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-C	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.30			Dark brown, slightly organic, sandy, silty TOPSOIL
		0.50	B					Soft to firm, grey mottled orange, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		1.50	B		1.50			Firm to stiff, brownish grey, sandy, gravelly SILT/ CLAY with a medium cobble and low boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
	▼	3.00	B		2.80			Loose to medium dense, silty, very gravelly, fine to coarse SAND with a low cobble content. Gravel is sub angular to sub rounded. Cobbles are sub rounded.
					3.20			End of Pit at 3.200m

1 2 3 4

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides unstable upon completion	None		0.00	3.20	Arisings

Remarks

Groundwater encountered 3.0m b.g.l. (weak flow)

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E553992.00 N626698.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-D	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			Dark brown, slightly organic, sandy, silty TOPSOIL
		0.50	B					Soft to firm, grey mottled orange, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
					1.20			Firm to stiff, grey, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		2.00	B					
					2.20			Stiff, brownish grey, sandy, gravelly SILT/CLAY with a medium cobble, low boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
		3.00	B					
					3.50			End of Pit at 3.500m

1
2
3
4

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides unstable upon completion	None		0.00	3.50	Arisings

Remarks

No groundwater encountered.

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E554369.00 N626654.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-E	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			Dark brown, slightly organic, sandy, silty TOPSOIL
		0.50	B					Soft to firm, grey mottled orange, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		1.50	B		1.40			Firm to stiff, grey, slightly sandy, slightly gravelly SILT with a low cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles are sub rounded.
		2.50	B		2.50			Stiff, brownish grey, sandy, gravelly SILT/CLAY with a medium cobble, low boulder and low large boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
		3.50	B		3.40 3.60			Loose to medium dense, silty, very gravelly, fine to coarse SAND with a low cobble content. Gravel is sub angular to sub rounded. Cobbles are sub rounded. End of Pit at 3.600m

1 2 3 4

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides unstable upon completion	None		0.00	3.60	Arisings

Remarks

No groundwater encountered.

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Trial Pit Log

Project Name: Garrane Green Energy Project- S.I.	Project No: 2177-22	Client: Garrane Green Energy Ltd	Date: 27/09/2022
		Contractor: Whiteford Geoservices Ltd	Co-ords: E554565.00 N625982.00
Location: Ballynagoul, Co. Limerick		Sub Contractor: tli group	Equipment: Hyundai hx140lc

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP-F	TP		J.Stothers	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25			Dark brown, slightly organic, sandy, silty TOPSOIL
		1.00	B					Firm to stiff, orangish brown mottled grey, slightly sandy, slightly gravelly SILT with a medium cobble content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
					2.00			Stiff, brownish grey, sandy, gravelly SILT/CLAY with a medium cobble, low boulder and low large boulder content. Sand is fine to coarse, Gravel is sub angular to sub rounded. Cobbles and boulders are sub rounded.
		2.50	B					
					3.50			End of Pit at 3.500m

Dimensions		Trench Comments			Backfill Details		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Top	Base	Description
4.00	2.00	Sides unstable upon completion	None		0.00	3.50	Arisings

Remarks

No groundwater encountered.

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2177-22 - Garrane Green Energy Project
Preliminary Data of Peat Depth at Turbines

Location	Easting	Northing	Depth
T1	553641	627475	0
T2	553921	627685	0
T3	554267	627779	0
T4	554338	627570	0
T5	553979	627331	0
T6	554111	627129	0
T7	554454	627324	0
T8	554406	627003	0
T9	554032	626747	0
T10	554352	626620	0
T11	554442	626284	0
T12	554587	625974	0

APPENDIX C

LABORATORY TESTING RESULTS

Bulk and Dry Density & Natural Moisture Content	1 x A4
Partial size Distribution	6 x A4
Sulphate Content of Water Extract, Chloride Content of Water Extract, Sulphide Content of Water Extract & pH	1 x A4

Laboratory Results

Location: Garrane Green Energy Project

Job No: 2177-22

Client: Garrane Green Energy Ltd

Sample no:	Depth (m)	Water Content (%)	Bulk Density kg/m3	Dry Density kg/m3
TP-A	2.50	27.7	2082	1500
TP-B	1.50	26.4	2098	1506
TP-C	3.00	11.0	2251	2041
TP-D	3.0	10.5	2492	2045
TP-E	3.5	14.4	2439	2062
TP-F	2.5	12.9	2392	1967

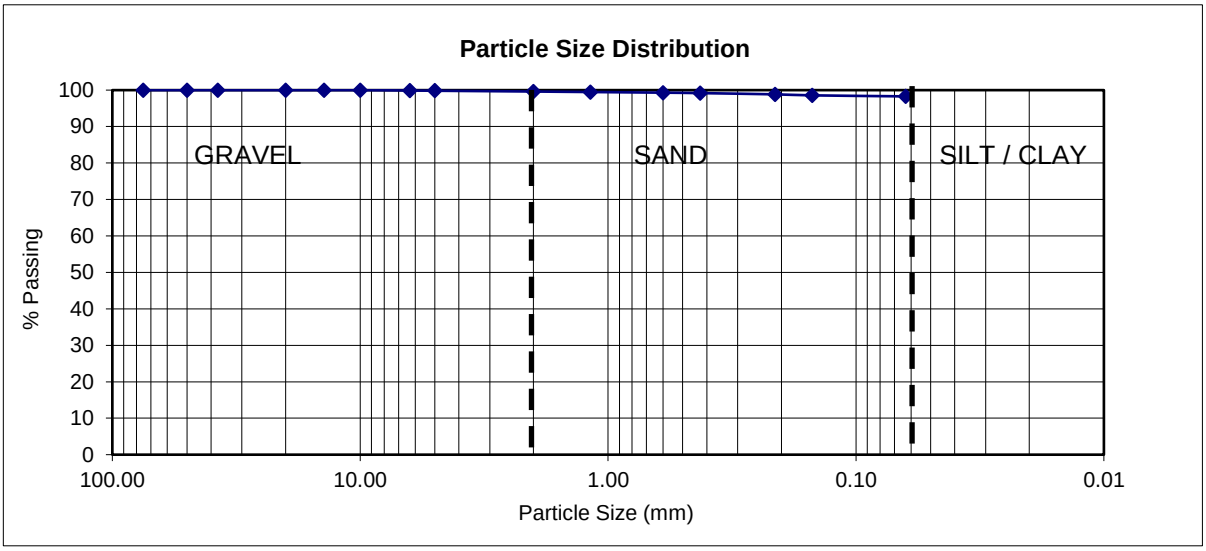
Operator	Checked	Approved
LJ	JMCN	JW

BS1377-Part2 (1990) Section 2

Particle Size Distribution

Location: Garrane Green Energy Project		**Job ref:**	2177-22
		Borehole/ Pit no.	TP-A
Soil description: SLIT / CLAY		**Sample no.**	
		Depth	2.50
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*		**Date**	28.10.22
Initial dry mass (m1)	2082.00		
Mass of receiver (g)			

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		0.00	0.00	100.00
14		0.00	0.00	100.00
10		0.00	0.00	100.00
6.3		2.40	0.12	99.88
5		1.20	0.06	99.83
2		4.50	0.22	99.61
1.18		2.90	0.14	99.47
0.6		3.60	0.17	99.30
0.425		2.50	0.12	99.18
0.212		7.10	0.34	98.84
0.15		5.80	0.28	98.56
0.063		5.70	0.27	98.29
Bottom tray		2046.30	98.29	0.00

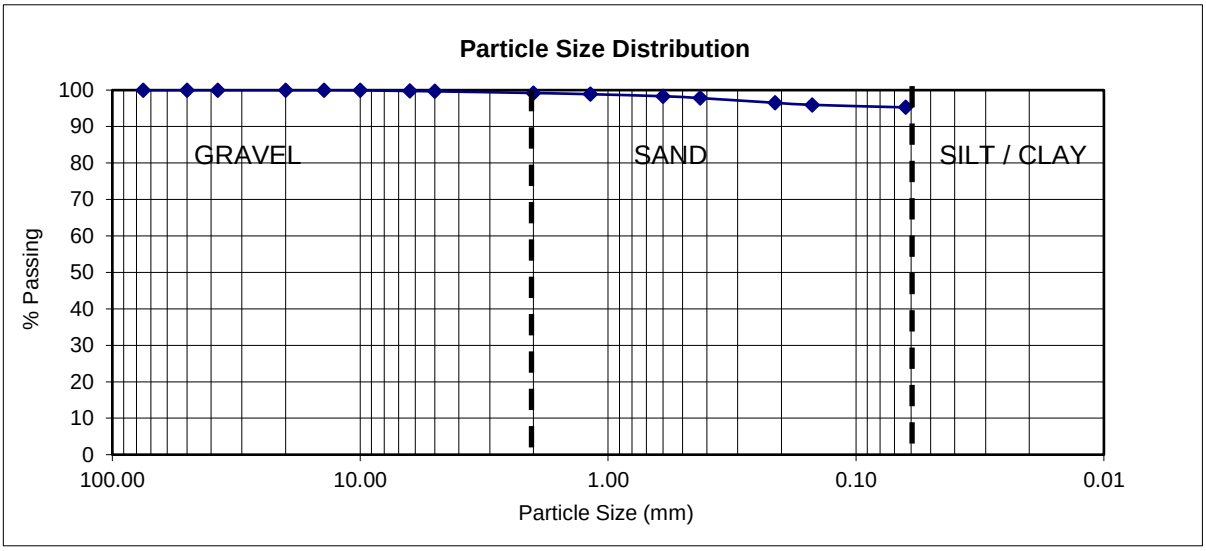


Operator	Checked	Approved
LJ	JMcN	JW

Particle Size Distribution

Location: Garrane Green Energy Project		**Job ref:**	2177-22
		Borehole/ Pit no.	TP-B
Soil description: Slightly Sandy SILT / CLAY		**Sample no.**	
		Depth	1.50
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*		**Date**	28.10.22
Initial dry mass (m1)	2043.30		
Mass of receiver (g)			

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		0.00	0.00	100.00
14		0.00	0.00	100.00
10		1.00	0.05	99.95
6.3		4.20	0.21	99.75
5		1.60	0.08	99.67
2		9.50	0.46	99.20
1.18		6.70	0.33	98.87
0.6		11.40	0.56	98.32
0.425		10.20	0.50	97.82
0.212		26.60	1.30	96.52
0.15		11.50	0.56	95.95
0.063		14.10	0.69	95.26
Bottom tray		1946.50	95.26	0.00

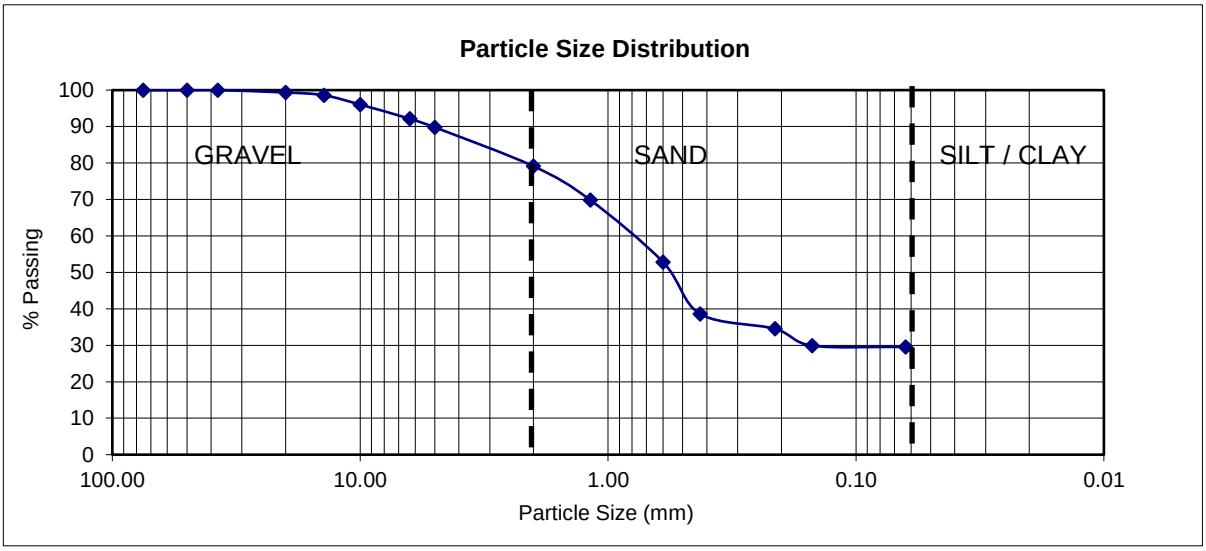


Operator	Checked	Approved
LJ	JMcN	JW

Particle Size Distribution

Location: Garrane Green Energy Project	**Job ref:**	2177-22	
	Borehole/ Pit no.	TP-C	
Soil description: Slightly Gravelly, Sandy, SILT / CLAY	**Sample no.**		
	Depth	3.00	
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*	**Date**	28.10.22	
Initial dry mass (m1)	1744.10		
Mass of receiver (g)			

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		11.30	0.65	99.35
14		13.40	0.77	98.58
10		44.60	2.56	96.03
6.3		68.00	3.90	92.13
5		40.90	2.35	89.78
2		186.00	10.66	79.12
1.18		161.70	9.27	69.85
0.6		297.10	17.03	52.81
0.425		247.80	14.21	38.60
0.212		71.40	4.09	34.51
0.15		80.60	4.62	29.89
0.063		5.70	0.33	29.56
Bottom tray		515.60	29.56	0.00



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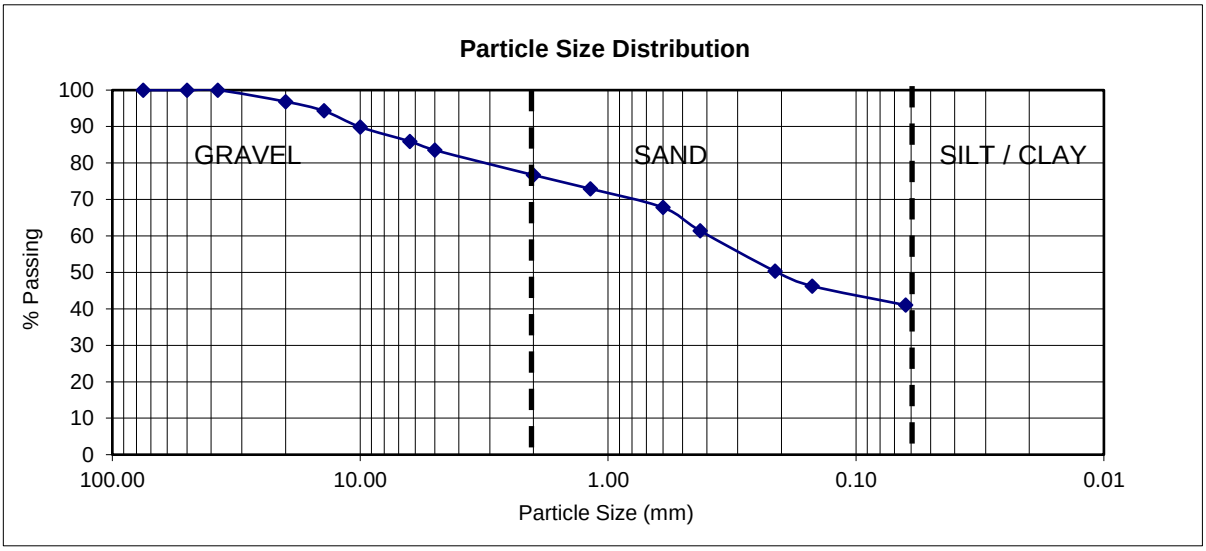
Operator	Checked	Approved
LJ	JMcN	JW

Particle Size Distribution

Location: Garrane Green Energy Project	**Job ref:**	2177-22
	Borehole/ Pit no.	TP-D
Soil description: Slightly Gravelly, Sandy, CLAY / SILT	**Sample no.**	
	Depth	3.00
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*	**Date**	28.10.22

Initial dry mass (m1)	2304.90
Mass of receiver (g)	

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		73.00	3.17	96.83
14		58.50	2.54	94.29
10		101.80	4.42	89.88
6.3		91.00	3.95	85.93
5		55.20	2.39	83.54
2		157.70	6.84	76.69
1.18		86.50	3.75	72.94
0.6		119.00	5.16	67.78
0.425		147.00	6.38	61.40
0.212		255.80	11.10	50.30
0.15		93.30	4.05	46.25
0.063		121.00	5.25	41.00
Bottom tray		945.10	41.00	0.00



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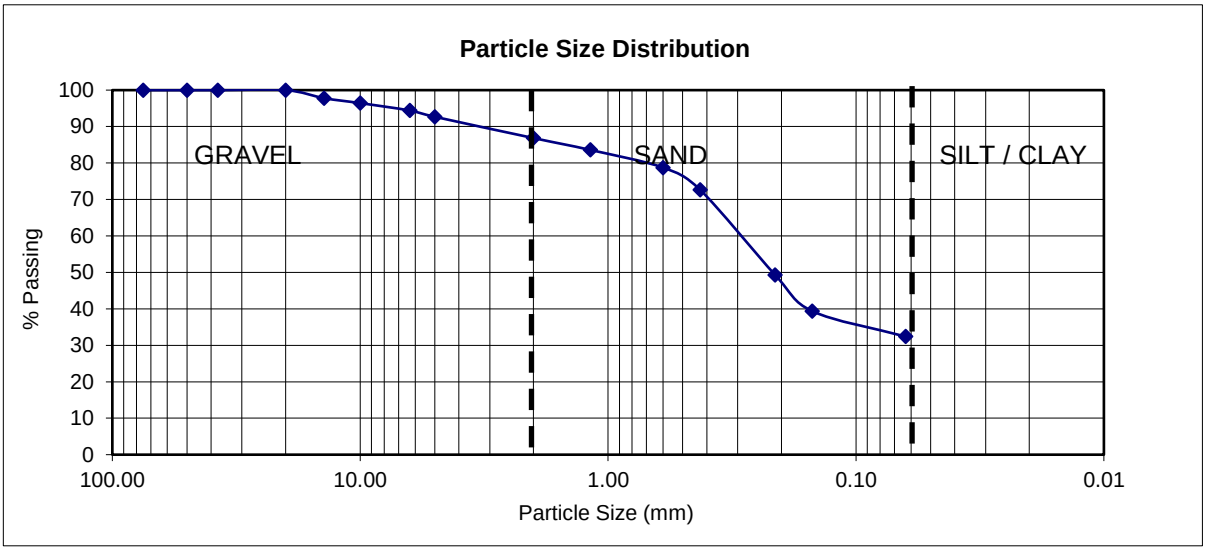
Particle Size Distribution

Location: Garrane Green Energy Project	**Job ref:**	2177-22
	Borehole/ Pit no.	TP-E
Soil description:Slightly Gravelly, Very Sandy CLAY / SILT	**Sample no.**	
	Depth	3.50
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*	**Date**	28.10.22

Initial dry mass (m1)	2270.20
Mass of receiver (g)	

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		0.00	0.00	100.00
14		50.10	2.21	97.79
10		30.90	1.36	96.43
6.3		46.20	2.04	94.40
5		39.10	1.72	92.67
2		132.30	5.83	86.85
1.18		73.90	3.26	83.59
0.6		110.20	4.85	78.74
0.425		138.90	6.12	72.62
0.212		529.10	23.31	49.31
0.15		225.90	9.95	39.36
0.063		158.30	6.97	32.39
Bottom tray		735.30	32.39	0.00



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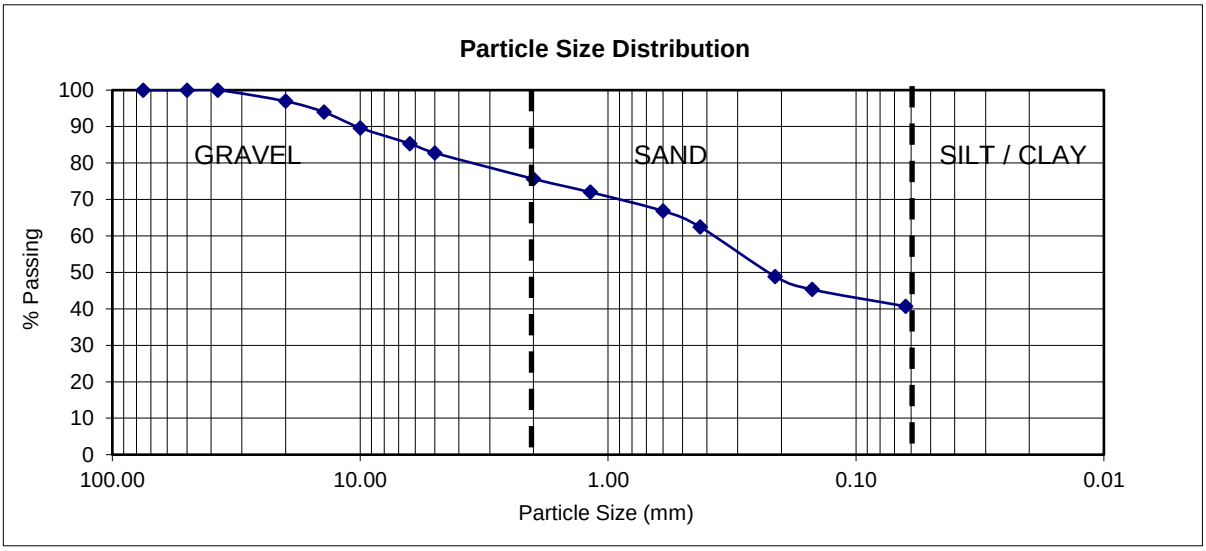
Operator	Checked	Approved
LJ	JMcN	JW

Particle Size Distribution

Location: Garrane Green Energy Project	**Job ref:**	2177-22
	Borehole/ Pit no.	TP-F
Soil description: Slightly gravelly, Sandy, SILT / CLAY	**Sample no.**	
	Depth	2.50
Test method BS 1377-2:1990:9.2/9.3/9.4/9.5*	**Date**	28.10.22

Initial dry mass (m1)	2636.40
Mass of receiver (g)	

BS test sieve (mm)	Mass of dry soil + receiver (g)	Mass of dry soil retained (m2) (g)	Percentage retained (m2/m1)100	Cumulative percentage passing
75		0.00	0.00	100.00
50		0.00	0.00	100.00
37.5		0.00	0.00	100.00
20		80.70	3.06	96.94
14		78.40	2.97	93.97
10		114.10	4.33	89.64
6.3		114.20	4.33	85.31
5		66.90	2.54	82.77
2		187.70	7.12	75.65
1.18		96.20	3.65	72.00
0.6		136.30	5.17	66.83
0.425		115.70	4.39	62.44
0.212		357.20	13.55	48.89
0.15		94.80	3.60	45.30
0.063		121.80	4.62	40.68
Bottom tray		1072.40	40.68	0.00



Operator	Checked	Approved
LJ	JMcN	JW

Chemical Content Results

Location: Garrane Green Energy Project

Job No: 2177-22

Client: Garrane Green Energy Ltd

Sample ID:	Depth (m)	Sulphate (mg/l)	Chloride (mg/l)	Sulphide (mg/l)	pH
TP-A	2.50	38	23	0.16	8.86
TP-B	1.50	0	180	0.60	8.89
TP-C	3.00	56	51	0.10	7.75
TP-D	3.00	42	60	0.13	7.68
TP-E	3.50	53	93	0.06	8.42
TP-F	2.50	39	38	0.19	8.36

Operator	Checked	Approved
LJ	JWJM	WGS

BS1377-Part2 (1990) Section 2

APPENDIX D

PHOTOGRAPHIC RECORD

Photographic Plates	1 x A4

Plate 1—TP-A

Plate 2—TP-A

Plate 3—TP-B

Plate 4—TP-B

Plate 5—TP-C

Plate 6—TP-C

Plate 7—TP-D

Plate 8—TP-D

Plate 9—TP-E

Plate 10—TP-E

Plate 11—TP-F

Plate 12—TP-F