



GROUNDTECH
CONSULTING

HOLLINGWORTH GATE, LITTLEBOROUGH

DESIGN SUBMISSION

COUNTRYSIDE PARTNERSHIPS –
WAKEFIELD OFFICE

JUNE 2023

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Plans		
Plan Reference	Revision	Title
GRO-23131-P01	-	Project Location Plan
GRO-23131-P03A-G (exc C)	1.2/1.4	Tensar Profile Plan
GRO-23131-P04	1.2	Slope Section Plan
GRO-23131-P05	1.4	Tensar Areas Plan
GRO-23131-P06	-	Manhole Detail – Section View
GRO-23131-P07	-	Manhole Detail – Plan View
GRO-23131-P08	-	North Western Approach – Tensar Elevation Plan

1.0 INTRODUCTION

1.1 Background

Groundtech Consulting Ltd have been appointed to design the TensarTech Natural GreenSlope reinforced soil slope for the residential housing project at Hollingworth Gate, Littleborough.

The Design Submission is based solely on the information provided by the client Countryside Partnerships Yorkshire.

The reinforced soil design is strictly in accordance with the information contained within the Design Brief attached. Variations to the information contained within the Design Brief or the scope of the services detailed may affect the design of the reinforcement and should be notified to Groundtech prior to commencement of construction.

1.2 Sources of Information

In preparing this Design Submission the following documents and Plans were reviewed and should be read in conjunction with this report:

- *HOLL-WBA-XX-XX-DR-A-PL_501-P15_Proposed Masterplan*
- *10861-01 Topographical Survey*
- *45466_015H - Canal Sections Plan*
- *45466_016H Canal Sections 1*
- *45466_017K Canal Sections 2*
- *45466_018G Canal Sections 3*
- *45466_004P - Levels Appraisal Sheet 1*
- *45466_005P - Levels Appraisal Sheet 2*
- *Ground Investigation Report (Factual) - Hollingworth Gate, Littleborough 21-763 by ARC Environmental, dated 20 December 2021*

2.0 DESIGN BRIEF

2.1 Summary

The purpose of this document is to set out the agreed design parameters and scope of the design services on which the design of the Tensar soil reinforcement has been based. The responsibility on providing representative strength parameters for the soil lies with the Client. Groundtech assumes no liability for interpretation or verification of subsurface conditions, for suitability of soil design parameters or for interpretation of subsurface groundwater conditions. The Client is responsible to verify that actual site conditions, parameters, loadings and structure geometries are as described herein prior to construction commencement.

2.2 Slope Stability

A slope stability assessment for the existing slope along the sites northern boundary has been undertaken by Groundtech Consulting to assess the overall stability and the findings are discussed in Section 9.0.

2.3 Reinforced Slope details

1) Type of Structure

TensarTech NaturalGreen Slope with select areas of Tensar reinforcement in a single retaining structure along the sites northern boundary adjacent to the canal. The area to be reinforced is shown on Eastwood and Partners Drawings 45466_016H to 45466_018K as sections:

- *Section A-A – Proposed 1:1 slope*
- *Section B-B – Proposed 1:1.2 slope*
- *Section C-C – Proposed 1:2 slope*
- *Section D-D – Proposed 1:1 slope*
- *Section E-E – Proposed 1:1 slope*
- *Section F-F – Proposed 1:1 slope*
- *Section G-G – Proposed 1:1.5 slope*

2) Facing

TensarTech erosion control mat on all the faces of the engineered slope.

3) Reinforcement

Tensar uniaxial geogrids with Tensar triaxial secondary geogrids.

4) Geometry

Max. Design Height: 6.0m

Slope Face Angle: 45°

(Stability of Toe slope is to be checked and confirmed by Client Geotechnical Engineer prior to commencement of Construction)

5) Method of Analysis

Internal Stability only - Limit equilibrium Bishop method of slices with minimum factor of safety of 1.3 or higher.

External stability – Slope stability was modelled by Groundtech Consulting utilising Oasys software using the Bishop (circular failures) method to determine a range of Over Design Factors (ODF).

External stability – Slope stability was modelled by Groundtech Consulting utilising Oasys software using the Janbu (non-circular failures) method to determine a range of Over Design Factors (ODF).

Bearing capacity (including stability of toe slope if required) is by others and outside the scope of Groundtech. The stability of the unreinforced slope is the responsibility of the Client.

6) Reinforced Fill

Geotechnical parameters were derived from the Ground Investigation undertaken by Arc Environmental, additional trial pits have been undertaken by Groundtech Consulting. The existing slope is predominantly constructed from Made Ground Clay and clayey sand/gravel. A bulk density of $\gamma_b = 17.5\text{kN/m}^3$ has been utilised for the Tensor design.

Earthworks testing of the site won material has been undertaken and site specific results have been used. A conservative friction angle of $\phi' = 29^\circ$ has been selected for the Tensor design.

7) Retained fill

Indicated to be soft to firm and firm Made Ground Clay or clayey gravel/sand as such the following bulk density and phi values have been utilised for the Tensor design. Design Properties: $\gamma_b = 17.5\text{kN/m}^3$ $\phi' = 29^\circ$. This should be confirmed and managed throughout the design process.

8) Foundation Soil

Foundation soil is presented by the clients Geotechnical Engineer within the Arc Environmental Reports. Inspection of the foundation soils will be required prior to construction, this forms a fundamental part of the design and suitable preparation should be implemented. The reinforced earth will not be constructed on soft clay. The inspection highlighted that the foundation soils at Section A, B and D are unsuitable and should be excavated and replaced with engineered fill.

9) Water Conditions

Based on the Ground Investigation by others, no groundwater has been modelled as groundwater was encountered at the base as a seepage locally, a slight seepage has been recorded at the base of the Made Ground locally – this should be further assessed during construction and the risk removed by the proposed drainage strategy. Canal is located

immediately to the north of the reinforced slope, it has been assumed the watercourse does not encroach on the reinforced earth slope and does not affect the stability. The wall has not been modelled in the overall stability, exact construction details of the canal are not known.

The drainage strategy implemented by Countryside Properties should be installed so the reinforced earth remains dry.

10) External Loading

10kPa temporary (live) surcharge considered to model traffic for private drives and carriageways.

75 to 100 kPa permanent surcharge for considered to model gabion wall for Section F.

No other loads (vertical/horizontal loads) are modelled for the proposed TensarTech NaturalGreen Slope System. It is assumed that plots adjacent to the crest of the slope will be piled and no loadings have been applied in the model.

An acceleration of 0.2g taken from Barkins equation and published values has been modelled to assess the potential affect of vibration from driven piling. The loadings of the piling rig has not been modelled.

2.4 Modelling

Introduction

The following selected relevant sections were modelled by Groundtech Consulting:

- Section A-A – Proposed 1:1 slope
- Section B-B – Proposed 1:1.2 slope
- Section C-C – Proposed 1:2 slope
- Section D-D – Proposed 1:1 slope
- Section E-E – Proposed 1:1 slope
- Section F-F – Proposed 1:1 slope
- Section G-G – Proposed 1:1.5 slope

Modelling Results

The sections listed above were modelled in TensarSoil to check the internal stability of the reinforced earth and the results are presented in the table below:

Section	Height (m)	Load 1 (kN/m ²)	Distance load applied from crest (m)	Load 2 (kN/m ²)	Distance load applied from crest (m)	Design Acceptable (Yes/No)	Strap Length Required (m)
A-A	4.1- 4.45	10.0 variable	1.0 – 4.0	n/a	n/a	Yes	4.3
B-B	2.1 -2.4	10.0 variable	1.0 – 4.0	n/a	n/a	Yes	4.0
C-C	3.2	10.0 variable	1.0 – 4.0	n/a	n/a	No Reinforced Earth Required	

D-D	4.2-4.9	10.0 variable	1.0 – 4.0	n/a	n/a	Yes	4.8
E-E	5.85-7.45	10.0 variable	1.0 – 4.0	10.0 variable	5.0 – 9.45	Yes	4.5 to 8.0
F-F	3.5-4.5	10.0 variable	1.0 – 4.0	100 Permanent	7.4 – 9.6	Yes	5.0
G-G	4.0	10.0 variable	1.0 – 11.0	n/a	n/a	Yes	4.6

Variable loads have generally been modelled for the driveways and carriageways adjacent to the proposed slope crest. Permanent loads have not been modelled for the proposed plots as it is assumed these will be piled to bedrock.

A permanent load has been modelled for the proposed gabion adjacent to the crest of section F-F. Based on the angle of friction (ϕ') of 29° selected, the straps do not extend beneath the gabion structure.

2.5 Project Specific Notes

- *The maximum height of the slope is 6.0m therefore the maximum exerted unfactored imposed bearing pressure at the base of the 6.0m (max. height) TensarTech NaturalGreen Slope itself is approximately 120kPa.*
- *Any proposed barriers or fences on top of TensarTech Natural Green Slope should be self-stable and should not impose any horizontal loads onto the face of TensarTech structure. Minimum distance to any barrier foundation should be 0.7m.*
- *Geogrid should be curtailed longitudinally around any tree root bulbs, drainage pipes or inverts to be installed. Ideally this should be done during construction of the slope and not retroactively to ensure the cuts are neat and accurate.*
- *No structures have been assumed to be supported by the slope and therefore no allowance has been made for loadings on the reinforced soil slope.*
- *Please also note that the reinforced soil slopes are flexible structures and may accommodate larger differential settlement compared to rigid form of structures. The building foundations must not rely on the surrounding soil as any movement within reinforced soil slope will have a direct impact on the serviceability of the house.*
- *Drainage requirements to be assessed by others. The reinforced soil has been assessed for dry conditions and should remain reasonably dry both during the construction phase and its design life. The customer's geotechnical engineer should assess the need for an appropriate drainage layer at the base and back of the reinforced soil block.*
- *The mine shaft on the site has not been included in the model, subject to suitable earthworks the slope in this area will not require reinforced earth.*
- *Piling of the plots at the crest of the slope should not be within 3m, piling should commence away from the crest and sequence progress towards the slope.*

- *The existing slope continues below the reinforced earth towards the canal and allowances should be made for working on existing slope and preparation at toe will be required. Permissions will be required from the Rivers and Canal Trust.*
- *The angle of the toe slope should not exceed 20°.*
- *When cutting back the existing slope, to aid in construction the retained material face should be left stepped, with each step spacing being the associated geogrid spacing. During the upfill and geogrid placement exercise each layer horizon would then be easily identifiable as the next step up for the contractor onsite.*
- *As base strata is assumed to be competent the lower proportion of existing slope should be assessed during the cutting back exercise to confirm this as it forms a fundamental part of the design. Trial pits undertaken within the section areas have confirmed reengineering of the foundation soils in Section A, B and D is required.*
- *From the recent trial pitting exercise, the Made Ground is variable and will require processing if to be reused in the reinforced earth and placed in accordance with an agreed specification in accordance with Series 600.*
- *Organic contamination was also encountered and will require consideration in the design and construction of the reinforced earth, specifically where remedial work is proposed.*
- *To facilitate the most viable design the material may need to be improved via treatment/drying or additional material would need to be imported to for use in the slope, particularly in the lower levels where the associated failure forces are the largest and the highest strength material would be required. Reuse of material is subject to processing and additional confirmatory testing.*
- *The material is generally less than 4% wet of optimum and within the allowable moisture content range – the moisture content requires confirming during the construction/earthworks process. Some of the material is dry and outside the allowable range.*
- *Earthworks testing has classified the Made Ground as 2A/2B, 2C and 1B. The appropriate methods of compaction, number of passes and thickness layers should be adhered to.*
- *Groundwater level to be observed during construction and remodelled if required.*
- *Proposed roads will be underlain by geogrid such as at Section G, requires consideration for roads and sewers.*
- *Utilities including chambers are present along the crest of the existing slope and a pipe is present that exits from the existing slope and crosses the adjacent canal to the north. The position of these utilities and substructure to remain will require consideration prior to the construction of the reinforced earth.*
- *The ground conditions adjacent to the canal have been further investigated and reengineering is required in Section A, B and D. If they vary further during construction to the models produced, the design should be reassessed.*

2.6 Exclusions

1. *Bearing Capacity of foundation soils to be assessed by the Client.*
2. *All other design methods, modes of failure, limit states etc. not specifically detailed above are outside the limits of the services offered and arrangements should be made for these to be covered by others.*
3. *Any proposed/existing manholes, lampposts, fence/sign posts, parapets etc should be notified to Groundtech so they can be incorporated in the reinforced earth design prior to detailed design. Foundation design of any such structures is beyond the scope of Groundtechs services and should be designed by the Client as stand-alone structures and without transferring any horizontal loading on the Tensor structure.*
4. *Appropriate surface water and erosion control systems should be designed by the Client to operate during construction and during the design life of the Tensor structure. The reinforced earth zone should remain free-drained and pore water pressures should be appropriately assessed by the Client to dissipate by capturing and disposing of groundwater that might build up behind the Tensor structure.*
5. *Utilities carrying water within the reinforced zone or on the face of the Tensor structure must be designed (by the Client) to prevent/contain leakage. The potential of differential soil movement within the reinforced zone and its effect on any utilities would also need to be considered by the Client.*
6. *Groundtech exercises the right to rely on geometries, strength parameters, groundwater and loading conditions stated by the Client for the purpose of determining the geogrid layout for the Project. In the absence of the above explicitly stated by the Client, Groundtech recommends that the Client retain the services of a Geotechnical Engineer to confirm the appropriateness of the assumptions above.*
7. *Unless specifically stated no allowance has been included for entering into any warranties or collateral warranties and the contract will be solely between Groundtech and the company placing the order.*
8. *Treatment of mine entries is not covered by the design.*
9. *Modelling of the mine shaft, substructure and unidentified structures requires consideration where appropriate.*



3.0 DESIGN CALCULATIONS

The following designs were produced using TensorSoils modelling software, with the design parameters and geometric provided by the clients plans.

Client: Vistry

Project: Hollingworth Gate, Littleborough

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**Method of
analysis**

The Tensar 2-part Wedge Slope Design Method is based on the 2-part wedge calculation procedure described in Advice Note HA68/94 "Design Methods for the Reinforcement of Highway Slopes by Reinforced Soil and Soil Nailing Techniques" (Design Manual for Roads and Bridges, Volume 4, Section 1, Part 4, now withdrawn). Partial material factors are applied to the soil strength and the resistance provided by the geogrid reinforcement.

Reference

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Date

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Design analysis
prepared by

Groundtech Consulting

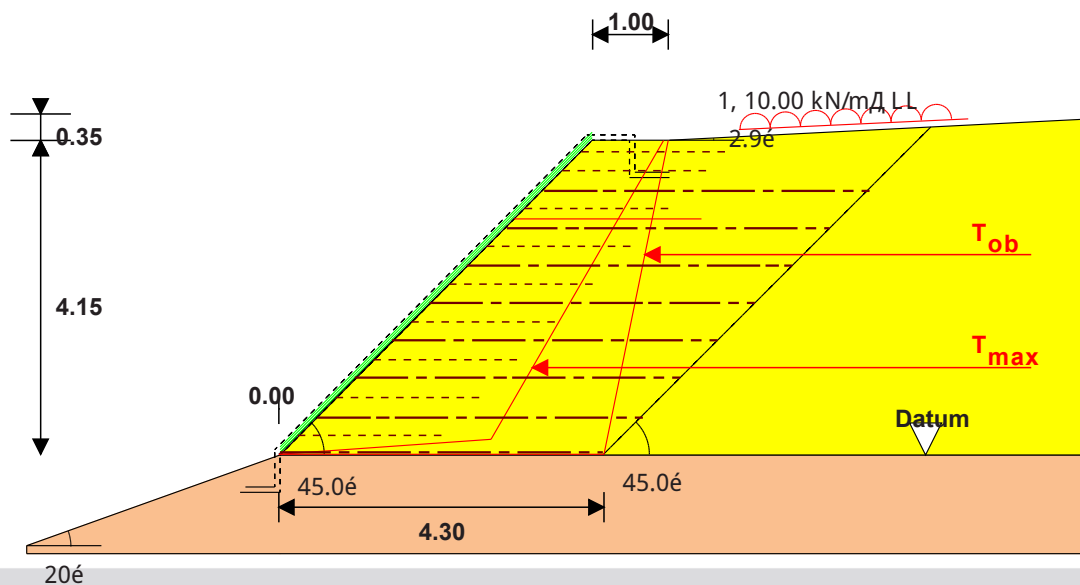
Telephone:

Fax:

E-mail:

Input data and Section

Project: Hollingworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m ²)	φ (°)	γ _{bulk} (kN/m ³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m ²)	Temporary/Permanent
1	1.95	4.95	10	Temporary

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (m)	r _u
In front of structure	No water pressures	
Within fill	No water pressures	NA

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Stability results	T _{ob} mechanism gives the minimum length of the base geogrid (m)		4.3
	T _{max} mechanism gives minimum length of theoretical top grid (m)		2.48
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	26.6%
		1.04 m	33.4%
		2.08 m	39.5%
		3.11 m	40.5%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f _b
	RE520	7	0.50	0.50	3.50	100	0.85
	RE520	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	9	2.00	0.250 m where primary spacing >0.250 m

Further information relevant to this Tensar Earth Retention System	Further information, specifications and bill of quantities descriptions for this TensarTechEarth Retaining Structure are given in the following documents which form part of this Design Analysis		System overview Installation guide Case histories Construction Animation Link
	The current versions of these documents may be found by following the website link to "Tensar Documentation" in the Help menu of the TensarSoil+ program		
	For program users who do not have a link to the internet contact your nearest Tensar representative or distributor	Tensar International Limited software@tensar.co.uk Web: www.tensar.co.uk	

Client: Vistry

Project: Hollingworth Gate, Littleborough

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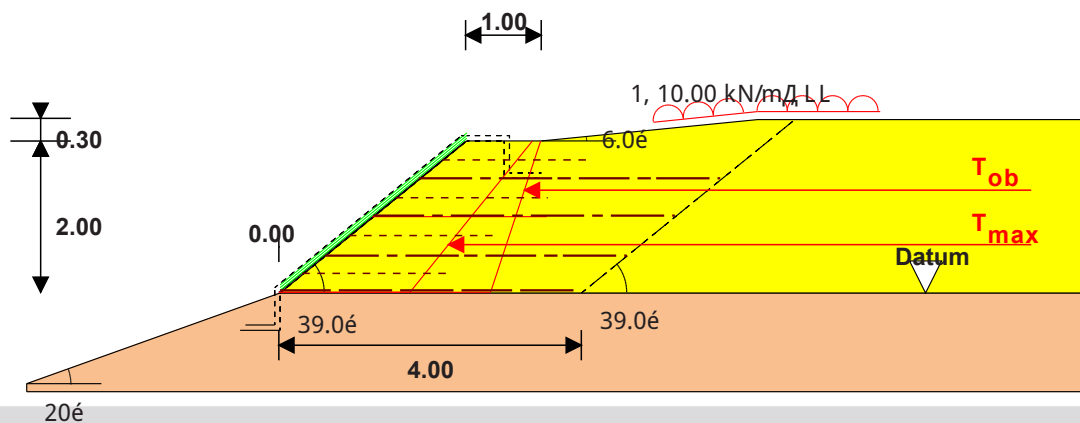
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Project: Hollingworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m ²)	φ (°)	γ _{bulk} (kN/m ³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m ²)	Temporary/Permanent
1	2.48	5.48	10	Temporary

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (m)	r _u
In front of structure	No water pressures	
Within fill	No water pressures	NA

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Stability results	T _{ob} mechanism gives the minimum length of the base geogrid (m)		2.8
	T _{max} mechanism gives minimum length of theoretical top grid (m)		2.31
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	27.0%
		0.5 m	23.9%
		1.0 m	33.4%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f _b
	RE520	3	0.50	0.50	1.50	100	0.85
	RE510	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	4	2.00	0.250 m where primary spacing >0.250 m

Further information relevant to this Tensar Earth Retention System	Further information, specifications and bill of quantities descriptions for this TensarTechEarth Retaining Structure are given in the following documents which form part of this Design Analysis		System overview Installation guide Case histories Construction Animation Link
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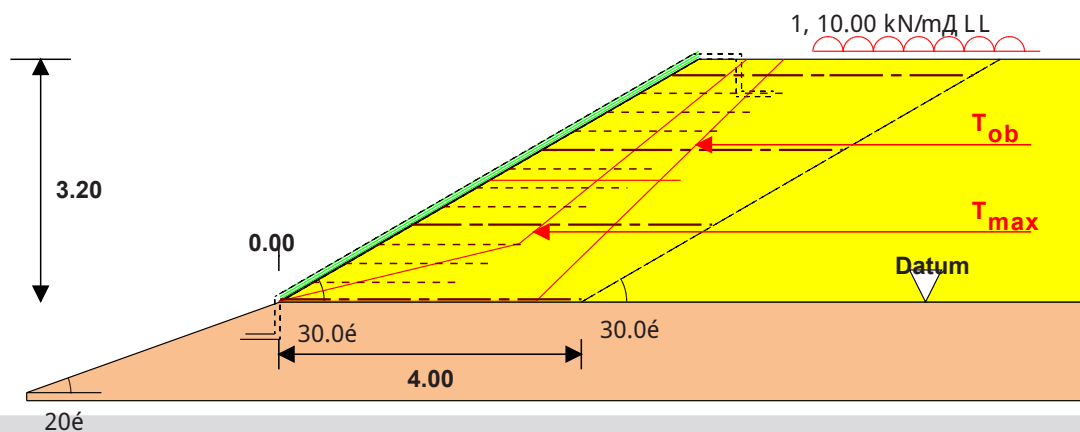
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Project: Hollingworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m ²)	φ (°)	γ _{bulk} (kN/m ³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m ²)	Temporary/Permanent
1	1.52	4.52	10	Temporary

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (m)	r _u
In front of structure	No water pressures	
Within fill	No water pressures	NA

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Stability results	T _{ob} mechanism gives the minimum length of the base geogrid (m)		3.4
	T _{max} mechanism gives minimum length of theoretical top grid (m)		2.54
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	11.7%
		0.8 m	11.2%
		1.6 m	10.0%
		2.4 m	6.5%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f _b
	RE520	3	1.00	1.00	3.00	100	0.85
	RE520	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	9	2.00	0.250 m where primary spacing >0.250 m

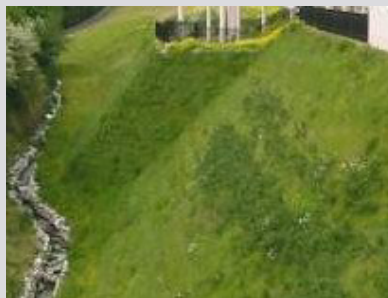
Further information relevant to this Tensar Earth Retention System	Further information, specifications and bill of quantities descriptions for this TensarTechEarth Retaining Structure are given in the following documents which form part of this Design Analysis		System overview Installation guide Case histories Construction Animation Link
	The current versions of these documents may be found by following the website link to "Tensar Documentation" in the Help menu of the TensarSoil+ program		
	For program users who do not have a link to the internet contact your nearest Tensar representative or distributor	Tensar International Limited software@tensar.co.uk Web: www.tensar.co.uk	

Client: Vistry

Project: Hollingworth Gate, Littleborough

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**Method of
analysis**

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13 Jul 2023

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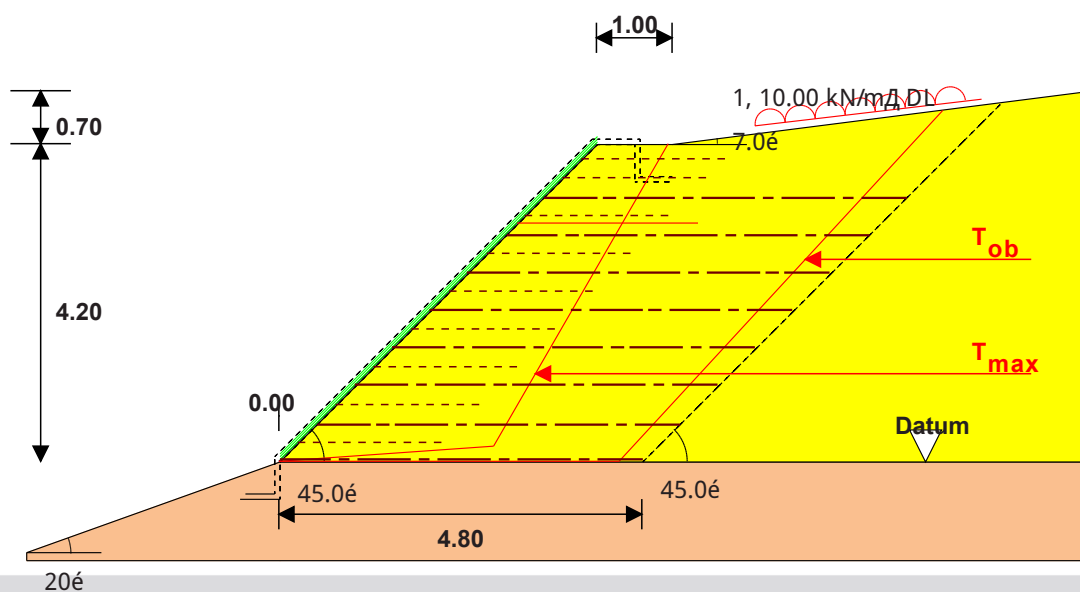
Telephone:

Fax:

E-mail:

Input data and Section

Project: Hollingworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m²)	φ (°)	γ _{bulk} (kN/m³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m²)	Temporary/Permanent
1	2.10	5.10	10	Permanent

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (m)	r _u
In front of structure	No water pressures	
Within fill	No water pressures	NA

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Stability results	T _{ob} mechanism gives the minimum length of the base geogrid (m)		4.5
	T _{max} mechanism gives minimum length of theoretical top grid (m)		2.39
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	36.3%
		1.05 m	31.0%
		2.1 m	34.0%
		3.15 m	40.0%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f _b
	RE520	7	0.50	0.50	3.50	100	0.85
	RE520	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	9	2.00	0.250 m where primary spacing >0.250 m

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	For program users who do not have a link to the internet contact your nearest Tensar representative or distributor	Tensar International Limited software@tensar.co.uk Web: www.tensar.co.uk	

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IMPORTANT NOTES

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Method of analysis

The calculation method used to create this Application Suggestion is the simplified method of slices using a circular slip surface following the method given by Bishop (Geotechnique, Vol 5, No 1, 1955) modified to take into account the stabilising effect of layers of geogrid reinforcement

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Date

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Tel:

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E-mail:



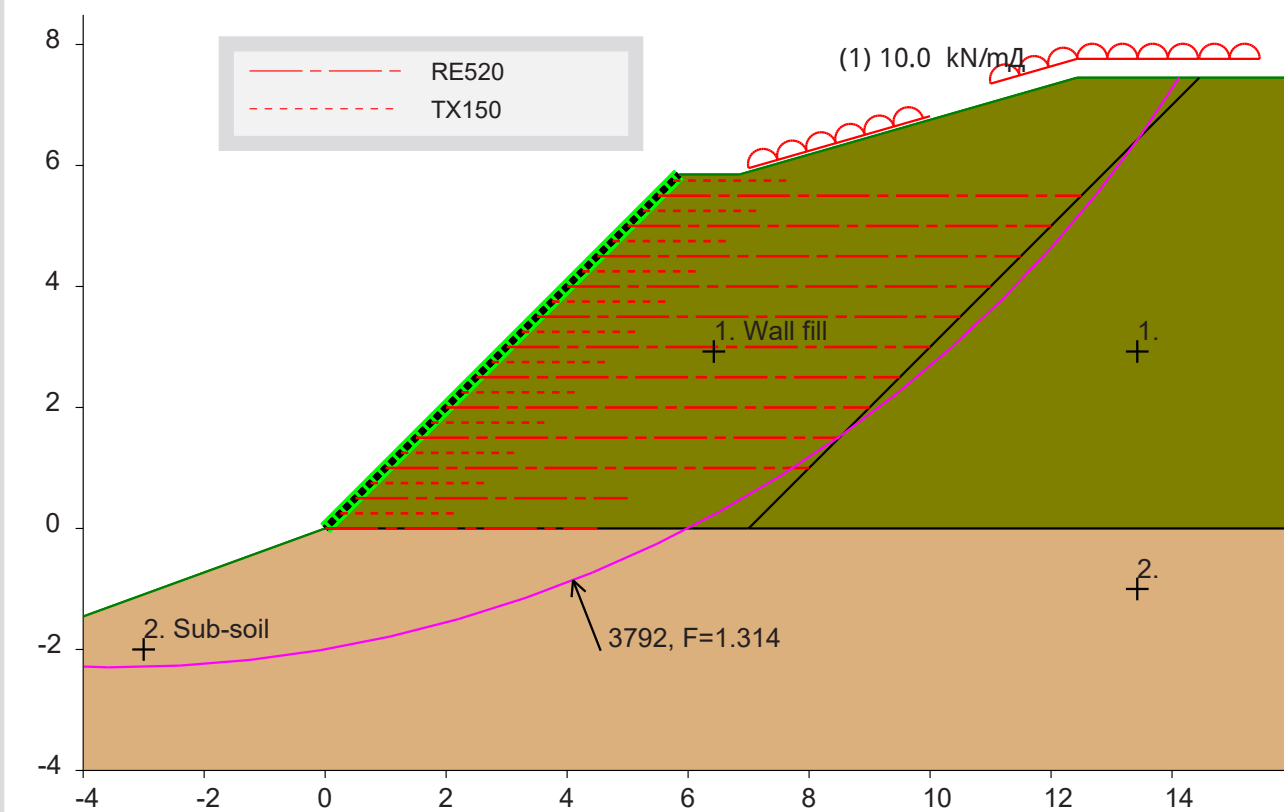
Cert - QM505288
Applicable to Tensar International
and Tensar Manufacturing Ltd



Cert - EMS86463
Applicable to Tensar Manufacturing Ltd

Input data and Section

Project: Hollingsworth Gate, Littleborough



Tensar Structural Systems Tensar *tech* NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:125

Soil properties

Soil zone	Drained/ undrained	c' (kN/m ²)	ϕ' (°)	$\gamma_{bulk,k}$ (kN/m ³)
1, Wall fill	Drained	0.0	29.0	20.0
2, Sub-soil	Drained	0.0	36.0	17.0

Soil strength values given above are characteristic values, design values are obtained by applying appropriate partial material factors. Design soil strength parameters are peak values

Surcharges

Load	Load acts from x (m)	To x (m)	Load (kN/m ²)	Live/Dead
1	7.000	10.000	10.00	Dead
2	11.000	15.450	10.00	Live

x values are measured from X=0

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Stability results	Circle number	Disturbing moment (kNm/m)	Resisting moment soil (kNm/m)	Resisting moment geogrids (kNm/m)	Factor of safety
Moments per linear metre of structure	3792	11932	15432	247	1.314

Further information relevant to this Design Analysis	Further information, specifications and bill of quantities descriptions for this Tensar Earth Retaining Structure are given in the following documents which form part of this Design Analysis	System overview Installation guide Case histories Construction Animation Link
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	For program users who do not have a link to the internet contact your nearest Tensar representative or distributor	Tensar International Limited +7 812 3275067 +7 812 3242560 info@tensar.ru

Detailed input information

The following tables provide the detailed input information used to define the reinforced fill structure including: coordinates of soil lines and water pressure lines (both internal water pressure and external standing water), geogrid design data and geogrid layout.

In all the tables which follow, X and Y are cartesian coordinates in metres, with Y measured vertically upwards, and measured from X = 0 in the horizontal direction and Y = 0 in the vertical direction.

Soil lines

The soil type found beneath each line is indicated in the table below.

Where a facing is associated with any line, this is also indicated in the table below.

Line No.	X ₁ (m)	Y ₁ (m)	X ₂ (m)	Y ₂ (m)	Soil No.	Facing type
1	-20.000	-7.279	0.000	0.000	2	NaturalGreen
2	0.000	0.000	5.850	5.850	1	
3	5.850	5.850	6.850	5.850	1	
4	6.850	5.850	12.430	7.450	1	
5	12.430	7.450	14.450	7.450	1	
6	14.450	7.450	57.280	7.450	1	
7	0.000	0.000	7.000	0.000	2	
8	7.000	0.000	62.280	0.000	2	
9	7.000	0.000	14.450	7.450	1	

Water pressures

Pore pressures only exist where a soil-specific pore pressure ratio is not zero (see 'Soil properties' above).

Reinforcement design data

Reinforcement design strength is calculated using the strengths and factors given below

In soil type 1 - Wall fill			Design life (years) 60		Design temperature (°C) 10	
Tensar Geogrid	Creep rupture strength (kN/m)	Extrapolation & manufacturing variation	Installation damage factor	Environmental effects	Characteristic design strength (kN/m)	Sliding coefficient
	P _c	f _m	f _d	f _e	P _{des}	s
RE520	27.85	1.00	1.07	1.00	26.02	0.85
TX150	1.41	1.00	1.00	1.00	1.41	0.85

Reinforcement layout

Reinforcement level is defined by its Y co-ordinate

Tensar geogrid	Level	Left end	Right end	Length	Coverage	Pullout interaction factor	Fixed at	
	Y (m)	X (m)	X (m)	(m)	(%)	≡ B	left	right
RE520	0.000	0.000	4.500	4.500	100	0.85	No	No

Reinforcement continued on next page . . .

Reinforcement layout continued

Tensar geogrid	Level	Left end	Right end	Length	Coverage	Pullout interaction factor	Fixed at	
	Y (m)	X (m)	X (m)	(m)	(%)	$\cong B$	left	right
TX150	0.250	0.250	2.250	2.000	100	0.85	No	No
RE520	0.500	0.500	5.000	4.500	100	0.85	No	No
TX150	0.750	0.750	2.750	2.000	100	0.85	No	No
RE520	1.000	1.000	8.000	7.000	100	0.85	No	No
TX150	1.250	1.250	3.250	2.000	100	0.85	No	No
RE520	1.500	1.500	8.500	7.000	100	0.85	No	No
TX150	1.750	1.750	3.750	2.000	100	0.85	No	No
RE520	2.000	2.000	9.000	7.000	100	0.85	No	No
TX150	2.250	2.250	4.250	2.000	100	0.85	No	No
RE520	2.500	2.500	9.500	7.000	100	0.85	No	No
TX150	2.750	2.750	4.750	2.000	100	0.85	No	No
RE520	3.000	3.000	10.000	7.000	100	0.85	No	No
TX150	3.250	3.250	5.250	2.000	100	0.85	No	No
RE520	3.500	3.500	10.500	7.000	100	0.85	No	No
TX150	3.750	3.750	5.750	2.000	100	0.85	No	No
RE520	4.000	4.000	11.000	7.000	100	0.85	No	No
TX150	4.250	4.250	6.250	2.000	100	0.85	No	No
RE520	4.500	4.500	11.500	7.000	100	0.85	No	No
TX150	4.750	4.750	6.750	2.000	100	0.85	No	No
RE520	5.000	5.000	12.000	7.000	100	0.85	No	No
TX150	5.250	5.250	7.250	2.000	100	0.85	No	No
RE520	5.500	5.500	12.500	7.000	100	0.85	No	No
TX150	5.750	5.750	7.750	2.000	100	0.85	No	No

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Project: Hollingsworth Gate, Littleborough

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**Method of
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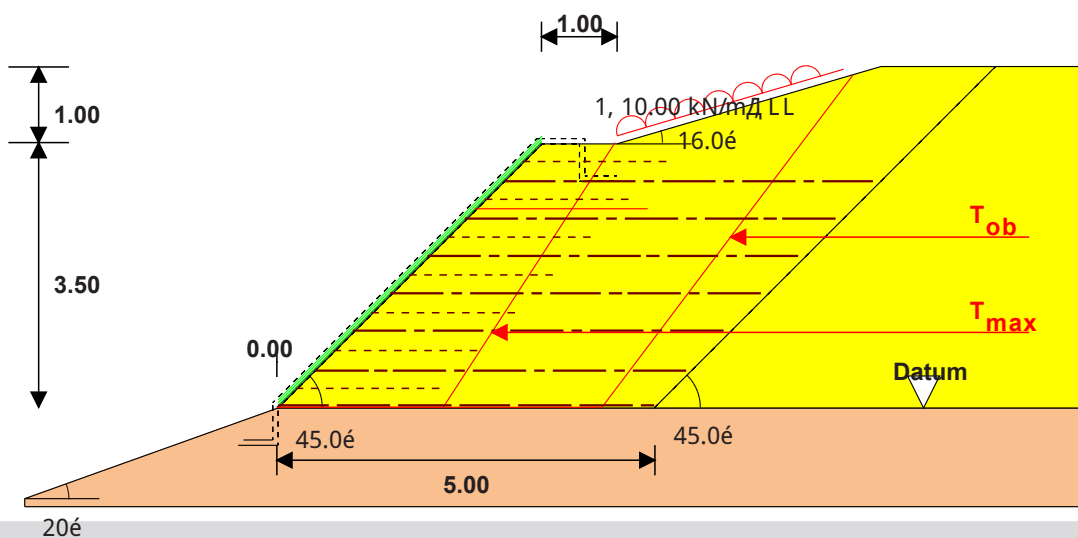
Telephone:

Fax:

E-mail:

Input data and Section

Project: Hollingsworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m²)	φ (°)	γ _{bulk} (kN/m³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m²)	Temporary/Permanent
1	1.00	4.00	10	Temporary
2	7.40	9.60	100	Permanent

x coordinates are measured from the top of the reinforced fill block.

Water pressure data	Location	Height of water level above datum (m)	r_u
	In front of structure	No water pressures	
	Within fill	No water pressures	NA

Stability results	T_{ob} mechanism gives the minimum length of the base geogrid (m)		4.3
	T_{max} mechanism gives minimum length of theoretical top grid (m)		2.28
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	32.6%
		0.88 m	29.1%
		1.75 m	32.1%
		2.63 m	36.4%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f_b
	RE520	6	0.50	0.50	3.00	100	0.85
	RE510	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	7	2.00	0.250 m where primary spacing >0.250 m

Further information relevant to this Tensar Earth Retention System	Further information, specifications and bill of quantities descriptions for this TensarTechEarth Retaining Structure are given in the following documents which form part of this Design Analysis		System overview Installation guide Case histories Construction Animation Link
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Reference

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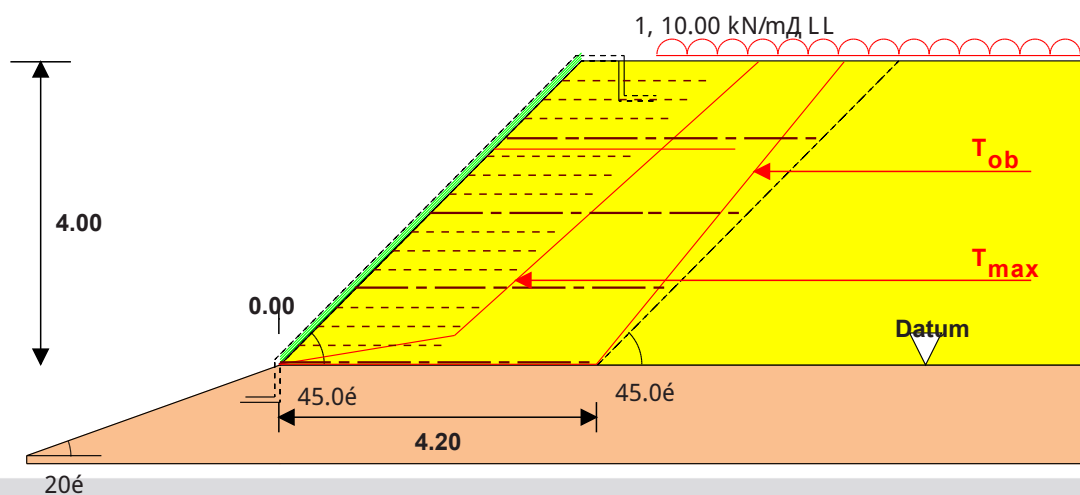
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Input data and Section

Project: Hollingworth Gate, Littleborough



Tensar Structural Systems **TensarTech** NaturalGreen System

Static loading case

All dimensions in metres

Scale 1:100

Fill/foundation properties

Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (kN/m ²)	φ (°)	γ _{bulk} (kN/m ³)
Reinforced fill	Drained	0.0	29.0	17.5
Retained fill	Drained	0.0	29.0	17.5
Foundation soil	Assumed to be competent			

Surcharges

No	Load acts from x (m)	To x (m)	Load (kN/m ²)	Temporary/Permanent
1	1.00	11.00	10	Temporary

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (m)	r _u
In front of structure	No water pressures	
Within fill	No water pressures	NA

Reference

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18 Oct 2023

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Stability results	T _{ob} mechanism gives the minimum length of the base geogrid (m)		4.2
	T _{max} mechanism gives minimum length of theoretical top grid (m)		3.19
	Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 m	54.1%
		1.0 m	52.6%
		2.0 m	47.2%

Reinforcement layout Starting and finishing levels are related to datum	Tensar Geogrid	No of layers	Starting level (m)	Vertical spacing (m)	Finishing level (m)	Coverage (%)	f _b
	RE520	3	1.00	1.00	3.00	100	0.85
	RE520	1	0.00	-	-	100	0.85

Secondary reinforcement layout	Tensar Geogrid	No of layers	Length (m)	Vertical spacing (m)
	TX150	12	2.00	0.250 m where primary spacing >0.250 m

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	For program users who do not have a link to the internet contact your nearest Tensar representative or distributor	Tensar International Limited software@tensar.co.uk Web: www.tensar.co.uk	

4.0 CONSTRUCTION SEQUENCE

The following construction sequence has been provided by Tensar for the TensarTech NaturalGreen Earth Retaining Systems.

Installation Guideline for TensarTech® NaturalGreen™ Reinforced Embankment System



Introduction

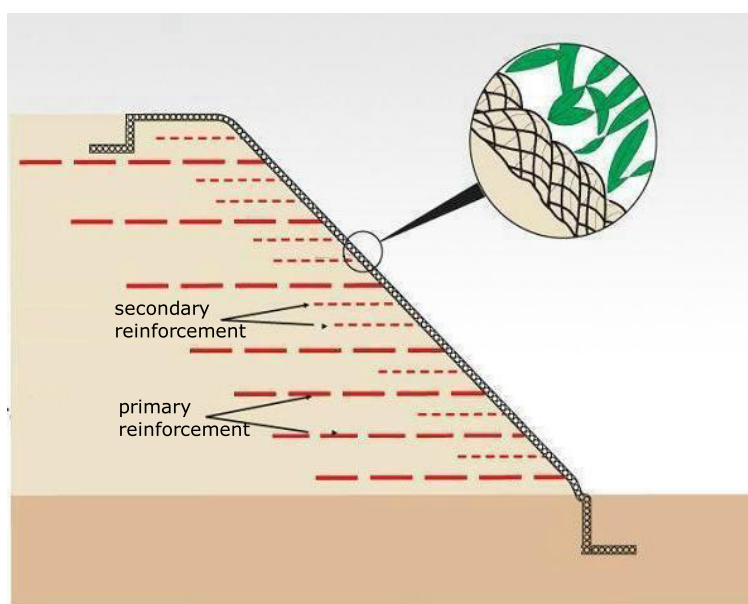
This Installation Guideline provides a step-by-step guide intended for use by contractors planning to construct a reinforced soil slope using TensarTech® NaturalGreen™ system.

TensarTech NaturalGreen System has been developed to provide engineers, architects and builders with an attractive and economical solution for the construction of embankments with a face slope angle up to 45° to the horizontal.

TensarTech NaturalGreen is one of a range of earth retaining systems available from Tensar International Limited, comprising proprietary Tensar uniaxial geogrid as primary reinforcement, TriAx® geogrid as secondary reinforcement and a rolled erosion control product secured with Tensar pegs.

Where applicable, the Contractor shall ensure that the installation fully complies with CDM Regulations 2015 and should refer to the Designer's Risk Assessment and COSHH statements.

The Tensar uniaxial geogrid for primary reinforcement are available in different strength grades identified by coloured banding. All supplied in 1.3m wide rolls either 50m or 75m long. TriAx geogrid for secondary reinforcement is supplied in 4m wide rolls 75m long. Both materials are supplied unwrapped and bound using coloured identifying tape. Both materials are UV protected and may be stored outside until use.



Typical section - TensarTech® NaturalGreen™ Slope

Rolled erosion control product can be supplied by Tensar depending on the project. A suitable erosion product is P300, supplied in rolls 35.0m long by 2.4m wide and comprising 100% UV stable polypropylene fibres incorporated between two layers of UV stable polypropylene netting. Erosion control materials are normally wrapped in polythene but should be stored in a cool dry place avoiding exposure to naked flame or spark, as they may be readily flammable, particularly bio-degradable erosion products comprising natural materials. They are vulnerable until installed and have had the opportunity to absorb moisture.

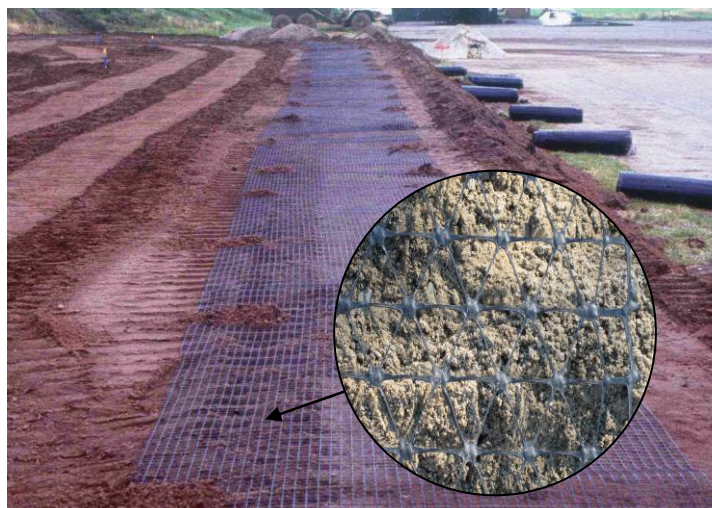
Tensar pegs to secure the rolled erosion control product are supplied in bags of 25 and may be stored outside if necessary.

Installation

1. The Contractor shall excavate to the lines and grades shown on the construction drawings and should take precautions to minimize over-excavation. Over-excavation should be filled with compacted approved infill material, or as directed by the Engineer.
2. Following the excavation, the foundation soil should be examined by the Engineer to assure actual foundation soil strength meets or exceeds the design bearing strength. Soils not meeting the required strength should be removed and replaced with infill soils, as directed.
3. Foundation soil shall be proof rolled and compacted then inspected by the Engineer prior to commencement of construction of the reinforced soil slopes.
4. Cut and position the base layer of Tensar uniaxial geogrid primary reinforcement at the formation level shown on the contract drawings. The uniaxial geogrid grades are identified by the letters RE and a number which will correspond with the geogrid layout shown on the construction drawing(s). The principle strength direction of the uniaxial geogrid is along the roll length and as such primary geogrid should be laid perpendicular to the slope face alignment.
5. Each geogrid reinforcement length shall be positioned to intercept the line of the final slope face at that elevation (after slope trim). Adjacent lengths of geogrid are butt jointed side-to-side at the slope face.
6. All geogrid should be installed to the levels, lengths and orientations as shown on the construction drawings.
7. Selected suitable fill material should be in full compliance with the needs of the design and have the approval of the engineer.
8. Place and compact the fill in layers as specified in the Contract Documents, incorporating primary reinforcement and secondary reinforcement as shown on the construction drawings.
9. The TriAx geogrid secondary reinforcement must be laid in the correct direction rolled out parallel to the slope face. The 4m wide rolls may be cut whilst still on the roll to widths corresponding with the construction drawing; normally 2m, but this must be checked.
10. Fill should be placed by plant such as an excavator with an opening bucket, which causes the fill to cascade onto the geogrid. A 150mm thick cover of fill must be maintained between the tracks of any plant and the geogrid to avoid damage to the geogrid.



11. The embankment may be overfilled, compacted and then trimmed to the final face slope profile in the conventional manner.
12. Use of a toothless excavator bucket is recommended for face trimming to prevent snagging on the edge of the buried geogrid. Although care should be taken not to over cut, the machine performing the face trim will not cause structural damage whilst performing this task.
13. On completion of the filling operation the slope surface should be covered with a minimum 100mm layer of suitable topsoil in accordance with BS3882, or as specified in the Contract Documents. Over-compaction of the topsoil should be avoided.
14. Where a grass cover is specified, scatter the chosen seed mix on to the slope at the specified rate per square metre.



TriAx geogrid secondary reinforcement cut from the roll 2m wide and rolled-out parallel to the slope face.

15. The rolled erosion control product should then be installed.

16. The rolled erosion control product is rolled down the slope face lapping adjacent rolls by a minimum of 100mm. Tensar pegs should be used to fix the rolled erosion control product at 1.0m centres along the laps by driving them into the soil using an appropriate rubber hammer. Rolled erosion control product must follow the slope profile and remain in contact with the underlying topsoil layer. Additional pinning and/or pinning of the centre of roll may be required.



17. Roll ends shall be buried at the shoulder and toe respectively in shallow trenches approximately 450mm wide by 250mm deep.

18. If specified, the slope may be planted with a suitable ground cover plant species as per the Contract Documents. The rolled erosion control product should be slit to allow the chosen plants pushed through the product into the topsoil below.

19. Care should be taken at this stage when using biodegradable rolled erosion control products to avoid exposure to naked flame or spark, as the product may be flammable until it has had the opportunity to absorb moisture.

20. The Contractor must fully assess the safety risk associated with working on the slope and at height and where appropriate install any necessary temporary edge protection and provide operatives with the appropriate safety equipment.

Notes

The contractor is responsible for checking slope geometry during construction and taking necessary action to ensure that tolerance are met in accordance with Tensar recommendations.

For cellular confinement erosion control products this construction sequence should be read in conjunction with IG_NaturalGreen_Cellular.

Please refer to Tensar International Limited if more specific advice is required.

This document was formerly published with the reference:CS/NaturalGreen

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5.0 PRODUCT SPECIFICATION

The following product specification has been provided by Tensar for the RE520 GeoGrid, RE580 Gagrid and TX150 Grid which is being utilised for the retaining slope design.

TensarTech® NaturalGreen™ Earth Retaining Structures: Model Specification

This document is intended to form a basis for Tender documents where the TensarTech® NaturalGreen™ reinforced soil system is required.

1. GENERAL

This work shall consist of constructing reinforced soil steep slopes (often referred to as strengthened embankments) typically using a proprietary system, constructed in accordance with the suppliers drawings and specifications and in conformity with the alignment, grades and dimensions shown on the contract documents or as established by the Engineer. Where necessary the Contractor shall provide complete set of drawings issued for construction, design calculations and complete specifications of the proposed system for the approval of the Engineer 90 days prior construction. Any particular requirements of approved detailed specifications for the approved proprietary system shall override any conflicting or incompatible requirement contained within this section.

The proposed solution must demonstrate previous use for reinforced soil steep slopes with a minimum height of 20.0m and a minimum in service life of 20 years.

The soil reinforcement must have a current British Board of Agrément (BBA) HAPAS certificate, demonstrating suitability for use in highways structures with a minimum 60-year design life.

2. DESIGN

The design shall address the climatic and soil conditions existing in UK and the specifically the site in question and provide a minimum design life of 60 years. The specifications as presented to the Engineer shall state any requirements for or limitations on the backfill used in the structure to ensure the design life. The tender submission shall be accompanied by:

- A. A copy of the current BBA certificate
- B. Sample design calculations for the proposed slopes in compliance with HA68/94 or BS8006 as appropriate
- C. Soils test information of the proposed reinforced soil fill
- D. Method statement for construction
- E. Confirmation of the Professional Indemnity and Product Liability insurance cover provided by the Slope System Supplier

3. STANDARDS

The following standards and codes in their latest edition shall be particularly applied to work covered by this specification where applicable; together with any further standards or codes as described within the approved Specification for the approved reinforced soil slope system.

3.01 Geogrid Reinforcement

- | | | |
|---|------------------------------|--|
| A | ISO 2602: 1980 | Statistical Interpretation of Test Results |
| B | BS EN ISO 9001: 2000 | Quality Systems – Model for Quality Assurance in Production, design and development Installation & Servicing |
| C | BS 2782: Part 4 | Methods of Testing Plastics. Part 4: Chemical Properties |
| D | GRI GG2 - 87 | Geogrid Junction Strength |
| E | BS EN ISO 10321: 1996 | Geotextiles – Tensile Test for Joints-Seams by Wide-Width Method |
| F | BS EN ISO 10319: 1996 | Wide-Width Tensile Test |
| G | BS EN ISO 13431: 1999 | Geotextiles and geotextiles related products. Determination of tensile creep and creep rupture behaviour |

3.02 Soils

- | | | |
|---|---------------------|--|
| A | BS1377: 1990 | Moisture Density Relationship for Soils, Standard Method |
| B | BS1377: 1990 | Gradation of Soils |
| C | BS1377: 1990 | Atterberg Limits of Soil |
| D | BS1377: 1990 | Shear Box Test |
| E | BS3882: 1994 | Specification for topsoil |

4. MATERIALS

The slope system will comprise primary horizontal layers of uniaxially orientated high density polyethylene (HDPE) geogrids and secondary polypropylene geogrids with a rolled erosion control product for erosion protection to the slope face helping establish and reinforce the root system of the vegetation in the long-term.

4.01 Geogrid Reinforcement

4.01.1 Primary Geogrid reinforcement

- A. The primary reinforcing element shall be a geogrid manufactured in accordance with a Quality Management System which complies with the requirements of BS EN ISO 9001:2000. If required by the Engineer, the Contractor shall provide evidence that the manufacturer's Quality Assurance System has been certified to conform with BS EN ISO 9001:2000 by an external authenticating authority approved by the Department of Trade and Industry.
- B. The reinforcing element shall be a geogrid manufactured from high density polyethylene sheet, oriented in one direction so that the resulting ribs shall have a high degree of molecular orientation, which is continued through the integral transverse bar.
- C. The long term creep rupture strength P_C (Ultimate Limit State), for a design life of 60 or 120 years, shall be in accordance with the following table at a mean temperature for design country (10°C, 20°C or 30°C). This shall be determined by application of standard extrapolation techniques to creep data obtained in accordance with BS EN ISO 13431:1999 and shall be a lower bound value. Values shall be based on a minimum 100,000 hour of continuous creep testing.

		Geogrid Type - design life of 60 years					
	Units	RE510	RE520	RE540	RE560	RE570	RE580
$P_{C 10^\circ C}$	kN/m	21.10	27.85	34.02	46.78	62.44	72.41
$P_{C 20^\circ C}$	kN/m	19.37	25.56	31.23	42.95	57.33	66.48
$P_{C 30^\circ C}$	kN/m	17.56	23.18	28.32	38.94	51.98	60.27

		Geogrid Type - design life of 120 years					
	Units	RE510	RE520	RE540	RE560	RE570	RE580
$P_{C 10^\circ C}$	kN/m	20.71	27.34	33.40	45.93	61.31	71.09
$P_{C 20^\circ C}$	kN/m	19.01	25.10	30.66	42.16	56.28	65.27
$P_{C 30^\circ C}$	kN/m	17.24	22.76	27.80	38.23	51.03	59.17

- D. The geogrid shall have an appropriate partial factor for site installation and construction damage, determined by the particle size distribution of the reinforced fill and in accordance with the values used in the design. This factor shall be based on full-scale tests carried out in accordance with BS8006 Annex D and witnessed by an independent Approval Authority. If required by the Engineer, the Contractor shall provide supporting documented evidence of testing for this and any other partial factors assumed in the design. Partial factors for site installation and construction damage based on limited laboratory based testing are not acceptable.
- E. The strength of the junctions between the longitudinal ribs and transverse bars, as determined by the Geosynthetics Research Institute, Drexel University, USA, Test Method GG2-87, shall be not less than 95% of the Quality Control Strength.
- F. Any site joints in the reinforcement roll length shall be capable of carrying 100% of the geogrid long term creep rupture strength. If required by the Engineer, the Contractor shall provide evidence of this.
- G. The geogrid shall be inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature. It shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis, shall be non-biodegradable and shall have a minimum of 2% finely divided carbon black, as determined by BS 2782 Part 4, Method 452B 1993, to inhibit attack by ultraviolet light.
- H. The primary geogrid shall have an independent test certificate proving resistance and durability in a pH range of 2.0 to 12.5. Specifically, 'The sample of the primary geogrid chosen shall have a test certificate from a recognised independent test authority, showing that when tested to ENV ISO 12960, March 1998, they can withstand immersion in a saturated solution of calcium hydroxide with a pH of 12.5, at 60 deg C for 3 days with no loss of tensile strength'.
- I. The geogrid shall be CE Marked by an independent, authorised Certification Body to demonstrate that the product has been tested in accordance with the relevant European Standard relating to its specific use in construction, in accordance with the EU Construction Products Directive.
- J. The product labelling must show the CE Mark, together with the Certification Body Number and the FPC (factory production control) number. 'Accompanying Documentation' indicating the relevant testing 'declared values', should be available on request.

4.01.2 Erosion Control Product

To establish a grass cover to the finished structure by dry seeding, the face should be covered with one of the following as determined by the engineer:

- A. rolled erosion control product comprising of biodegradable coconut fibres incorporated into a permanent three-dimensional polypropylene mesh.
- B. Non-biodegradable rolled erosion control product comprising of four layers of polyethylene mesh which are heat bonded together to form a three-dimensional mat.

- C. Where a depth of topsoil greater than 150mm is required, a cellular confinement erosion control product should be used.

4.02 Erosion control to slope face

- A. Horticultural topsoil should be applied to the face of the slope to a thickness determined for the contract, but typically not greater than 100mm. The rolled erosion control product should be fixed to the slope face, in accordance with specification clause 5.03.

4.03 Reinforced (Infill) Soil

The reinforced soil material proposed should conform to the following:

- A. Minimum angle of friction (ϕ_{cv}) of 30 degrees unless agreed with the Engineer.
- B. The Contractor should provide the Slope System supplier and the Engineer/Client with Effective Stress Parameters soil test information including soil density to allow completion and checking of the final design.

4.04 Horticultural Topsoil Layer

- A. The horticultural soil layer shall be a medium loam with a workable 'crumb-like' consistency placed and lightly compacted immediately onto the trimmed fully compacted reinforced soil for the purpose of supporting vegetation and in accordance with BS3882:2007 'Specification for Topsoil'.
- B. It shall have moisture content in the range 20 to 25% when placed.

4.05 Vegetation

4.05.01 Primary vegetation

- A. Grass cover will be established by applying the specified seed mix at the specified rate (typically 60g/m²)
- B. One suggested specification of seed mix is as follows or as proposed by the engineer.

75%	Creeping Red Fescue
25%	Smooth Stalked Meadow Grass

4.05.02 Secondary vegetation (where detailed on the construction drawings)

- A. Ground cover vegetation will be established by planting healthy plants from an approved supplier at the base and on the face of the structure.
- B. Plants on the face should be planted on a 2m square grid pattern. This may be carried out either during or post construction but with the approval and agreement of the engineer.
- C. All plants should be well established in 75mm pots prior to planting and should be seen to have a good quality rootball.
- D. All plants should be correctly irrigated when necessary during the first 3 months after completion of the structure.
- E. One suggested specification for ground cover planting is: Vinca Major Variegata or as specified elsewhere by the Engineer.

5. Construction

5.01 Excavation

- A. Contractor shall excavate to the lines and grades shown on the Contract Drawings. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted approved infill material, or as directed by the client's Engineer.
- B. Contractor shall verify the location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of any excavation. Excavation support, if required, is the responsibility of the Contractor.

5.02 Foundation Preparation

- A. Following the excavation, the foundation soil shall be examined by the Engineer to assure actual foundation soil strength meets or exceeds the design bearing strength. Soils not meeting the required strength shall be removed and replaced with infill soils, as directed by the Engineer.
- B. Foundation soil shall be proof rolled and compacted to 95% standard Proctor density and inspected by the Engineer prior to commencement of construction of the reinforced soil slopes.

5.03 Construction of Steep Slope

- A. Cut and position the base layer of primary uniaxial geogrid reinforcement at the formation level shown on the contract drawings. The principle strength direction of the uniaxial geogrids is along the roll length and as such should be laid perpendicular to the longitudinal alignment of the slope structure. Adjacent lengths of geogrid are butt jointed at the slope face.
- B. The geogrid reinforcement need not be folded up the face on NaturalGreen slopes which have a maximum face angle of 45° to the horizontal.
- C. All of the geogrids should be installed to the levels, lengths and orientations as shown on the construction drawings.

- D. Selected suitable fill material should be in full compliance with the needs of the design and have the approval of the engineer. Place and compact the fill in layers to the Contract's specification incorporating primary reinforcement and secondary reinforcement as shown on the construction drawings.
- E. The secondary reinforcement geogrid must be laid in the correct direction. As such the material must be rolled out parallel to the face. The 4m wide material may be cut whilst still on the roll, into the widths which correspond with the construction drawing; normally 2m, but this must be checked. The newly cut narrower roll may now be laid out easily and parallel with the slope face.
- F. Fill should be placed by plant such as an excavator with an opening bucket, which causes the fill to cascade onto the geogrids. A 150mm thick cover of fill must be maintained between the tracks of any plant and the geogrid to avoid damage.
- G. The embankment may be overfilled, compacted and face trimmed in a conventional manner to the design angle.
- H. Use of a toothless excavator bucket is recommended for face trimming to prevent snagging on the edge of the buried geogrids. Although care should be taken not to over cut, the machine performing the face trim will not cause structural damage whilst performing this task.
- I. On completion of the structural filling operation the slope surface should be covered with a layer of suitable topsoil in accordance with BS3882 and the landscaping requirements. The thickness of the topsoil layer is typically 100mm thick or as indicated on the construction drawing. Over compaction of the topsoil should be avoided.
- J. Where a grass cover is detailed, scatter the chosen seed mix on to the slope at the specified rate per square metre.
- K. The rolled erosion control product should then be carefully installed.
- L. The rolled erosion control product is rolled down the slope face lapping adjacent rolls by a minimum of 100mm. The barbed polymer pegs supplied should be used to fix the mat at 1.0m centres along the laps by driving them into the soil using an appropriate hammer, preferably rubber to prevent damage. Rolled erosion control product must follow exact slope profile and remain in contact with the underlying topsoil layer. Additional pinning and/or pinning of the centre of roll may be required.
- M. Roll ends shall be buried at the shoulder and toe respectively in shallow trenches approximately 450mm wide by 250mm deep.
- N. Where the rolled erosion control used is a non-biodegradable product the finished slope surface should be filled with a friable topsoil brushed into the mat and sown with selected grass seed mix.
- O. If demanded by the Client, the slope may be planted with a suitable ground cover plant species as per the Client's requirements. The rolled erosion control product should be carefully cut and the chosen plants pushed into the topsoil below.
- P. Care should be taken at this stage when using biodegradable rolled erosion control products to avoid exposing it to naked flame or spark, as it may be flammable until it has had the opportunity to absorb moisture.
- Q. The Contractor must fully assess the safety risk associated with working on the slope and at height and where appropriate install any necessary temporary edge protection and provide operatives with the appropriate safety equipment.

6. Submission of Alternatives

6.01 Any alternative to the specified system for Reinforced Steep Slopes proposed by the Tenderer shall be submitted with the tender and shall include:

- the names of the supplier and designer
- a full set of calculations
- outline drawings
- product samples and specifications
- test certificates for the reinforcing elements

The outline drawings must be sufficient to indicate the details of the construction of the Reinforced Steep Slopes including:

- typical plans
- elevations and section drawings
- foundations
- facing details (including vegetation if appropriate)
- anchoring reinforcing elements at the face
- reinforcing element joints and overlaps
- The width and length of the soil reinforcing elements should be clearly shown along with details of their orientation in the works.

This document is drafted on an entirely generic basis and its use in any tender documentation in any way must be reviewed by the user and made specific to their project

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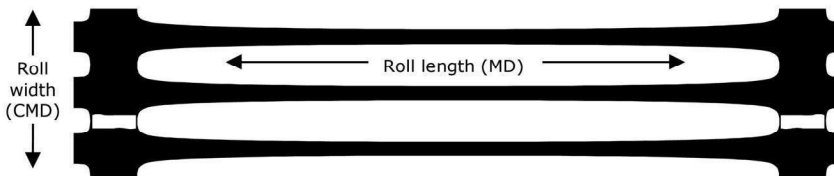
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Tensar RE500 series geogrids

Product specifications design temperature 10°C

Tensar RE500 geogrids are used for the reinforcement of soils in the construction of structures such as retaining walls, load bearing bridge abutments, steep slopes, slip repairs and TensarTech®Stratum® mattresses.



Properties	Units	Tensar RE500 geogrids (1), (2), (3)					
		RE510	RE520	RE540	RE560	RE570	RE580
Polymer		High density polyethylene					
Minimum carbon black (4)	%	2	2	2	2	2	2
Roll width	m	1.3	1.3	1.3	1.3	1.3	1.3
Roll length	m	75	75	50	50	50	50
Unit weight	kg/m ²	0.29	0.36	0.45	0.63	0.87	0.98
Roll weight	kg	30.0	37.0	31.0	45.0	59.0	67.0
Junction strength (5)	%	95	95	95	95	95	95
Long term strength at 10°C (6)							
ULS T _{CR} for 120 yrs (7)	kN/m	20.71	27.34	33.40	45.93	61.31	71.09
SLS T _{CS} for 1 month to 120 yrs (8)	kN/m	8.99	11.87	14.50	19.94	26.61	30.86
Partial factors of safety to calculate safe ultimate limit state (ULS) design strength (T_D) (9)							
Extrapolation of chemical and creep rupture data		$f_s = 1 + \sqrt{((1-R_1)^2 + (1-R_2)^2)} = 1.0$					
Installation damage D ₁₀₀ < 2mm, D ₈₅ < 0.65mm		RF _{ID} = 1.01	RF _{ID} = 1.00	RF _{ID} = 1.00	RF _{ID} = 1.00	RF _{ID} = 1.00	RF _{ID} = 1.00
Installation damage D ₁₀₀ < 37.5mm, D ₈₅ < 28mm		RF _{ID} = 1.18	RF _{ID} = 1.07	RF _{ID} = 1.07	RF _{ID} = 1.07	RF _{ID} = 1.07	RF _{ID} = 1.00
Installation damage D ₁₀₀ < 75mm, D ₈₅ < 69mm		RF _{ID} = 1.30	RF _{ID} = 1.25	RF _{ID} = 1.20	RF _{ID} = 1.15	RF _{ID} = 1.12	RF _{ID} = 1.06
Installation damage D ₁₀₀ < 125mm, D ₈₅ < 110mm		RF _{ID} = 1.60	RF _{ID} = 1.48	RF _{ID} = 1.36	RF _{ID} = 1.25	RF _{ID} = 1.19	RF _{ID} = 1.12
Weathering (including exposure to UV light)		RF _W = 1.00					
Chemical/environmental effects (10)		RF _{CH} = 1.05 for pH = 2 to 4, RF _{CH} = 1.00 for pH = 4 to 12.5					

- Tensar RE500 geogrids** are stiff monolithic geogrids with integral junctions and are manufactured in accordance with Quality and Environmental Management Systems which comply with the requirements of BS EN ISO 9001:2015 and BS EN ISO 14001:2015 respectively.
- All quoted dimensions and values are typical unless stated otherwise.
- Tensar RE500 geogrids** accreditation includes:
 - The British Board of Agrément (BBA) has awarded HAPAS Certificates: No 13/H201 and No 13/H202
 - The Geotechnical Engineering Office of the Civil Engineering & Development Department of the Government of Hong Kong SAR has awarded Certificate RF 2/2017
- Carbon black inhibits attack by UV light. Determined in accordance with ASTM D1603-14. Any section of grid fully exposed to sunlight can be expected to retain 90% of its quality control strength for periods in excess of 40 years in temperature climates and 20 years in tropical climates.
- Determined in accordance with GRI Test Method GG2-87, and expressed as a % of the quality control strength.
- In-soil temperature.
- ULS determined as a lower bound using standard extrapolation techniques to creep rupture data (real time test duration > 100,000 hours) obtained following the test procedure in BS EN ISO 13431:1999 for 120 year design life.
- SLS determined as the lower bound load which limits post-construction strain to 1% over the period from 1 month until design life, based on isochronous curves derived from creep tests carried out to BS EN ISO 13431:1999.
- Partial factors are determined following the requirements of BS EN 13251:2016 and guidelines given in PD ISO/TR 20432:2007, and are used to derive the ULS design strength which is given as: $T_D = T_{CR} / (f_s \times RF_{ID} \times RF_W \times RF_{CH})$
- Tensar RE500 geogrids** are inert to all chemicals naturally found in soils and have no solvents at ambient temperature. They are not susceptible to hydrolysis and are resistant to aqueous solutions of salts, acids and alkalis (pH 2.0 to 12.5) and are non-biodegradable.



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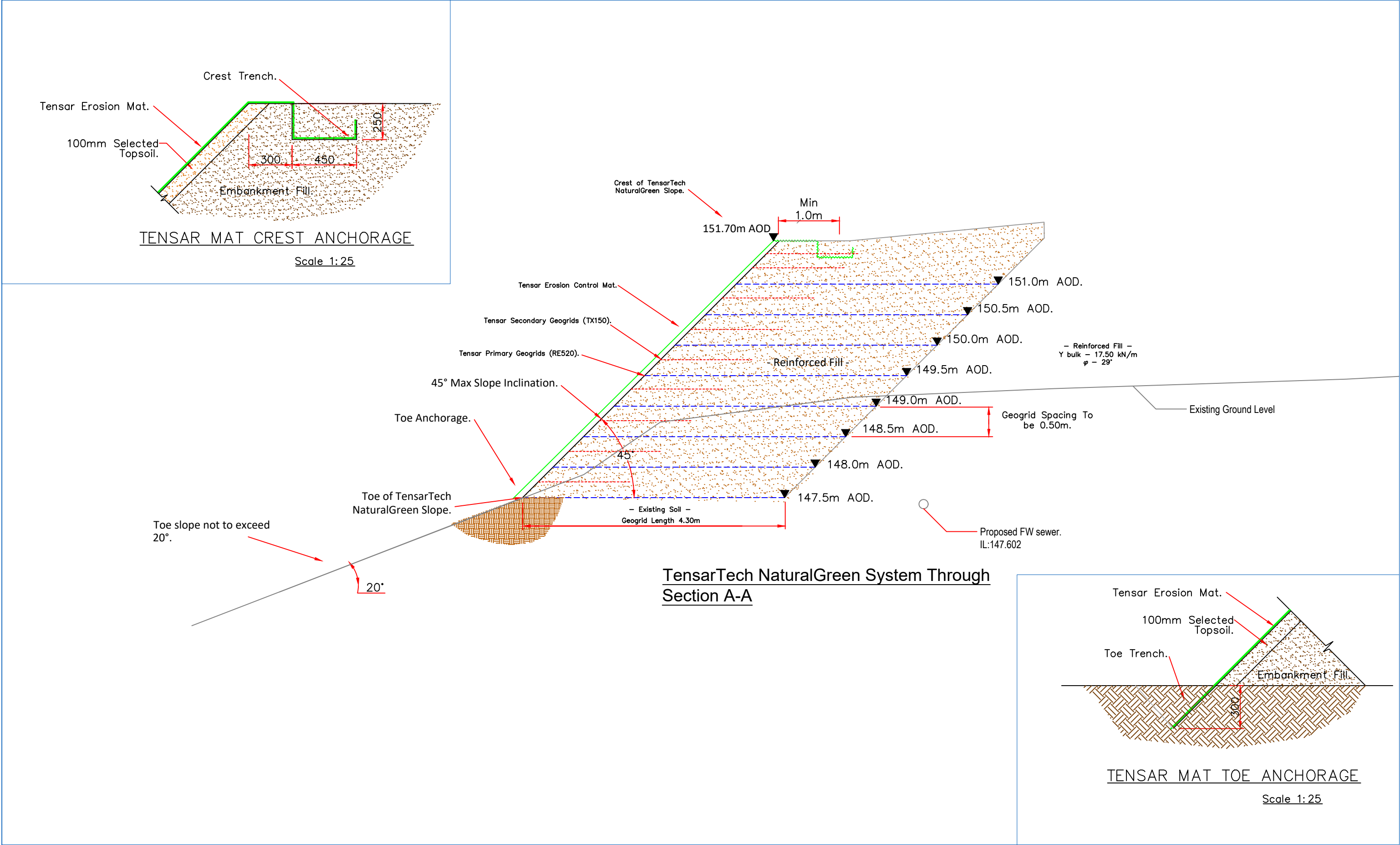
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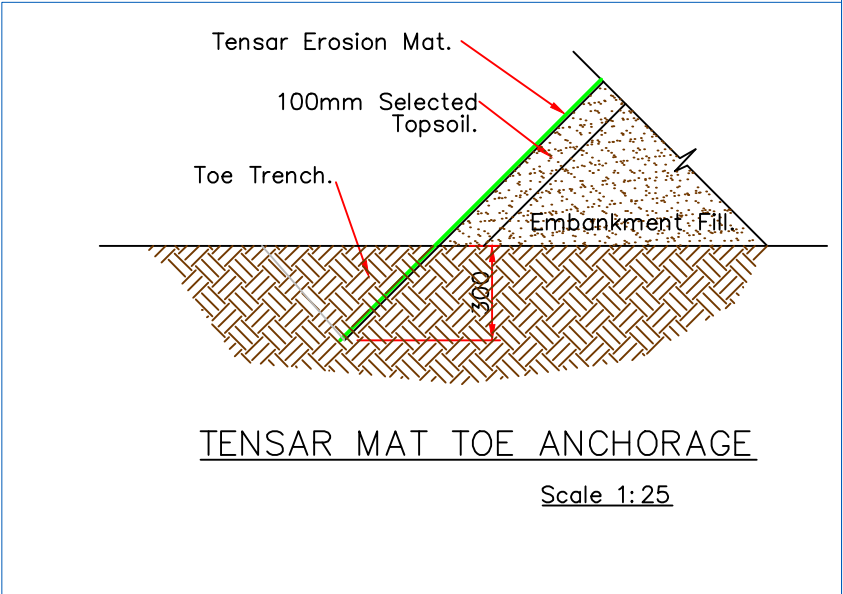
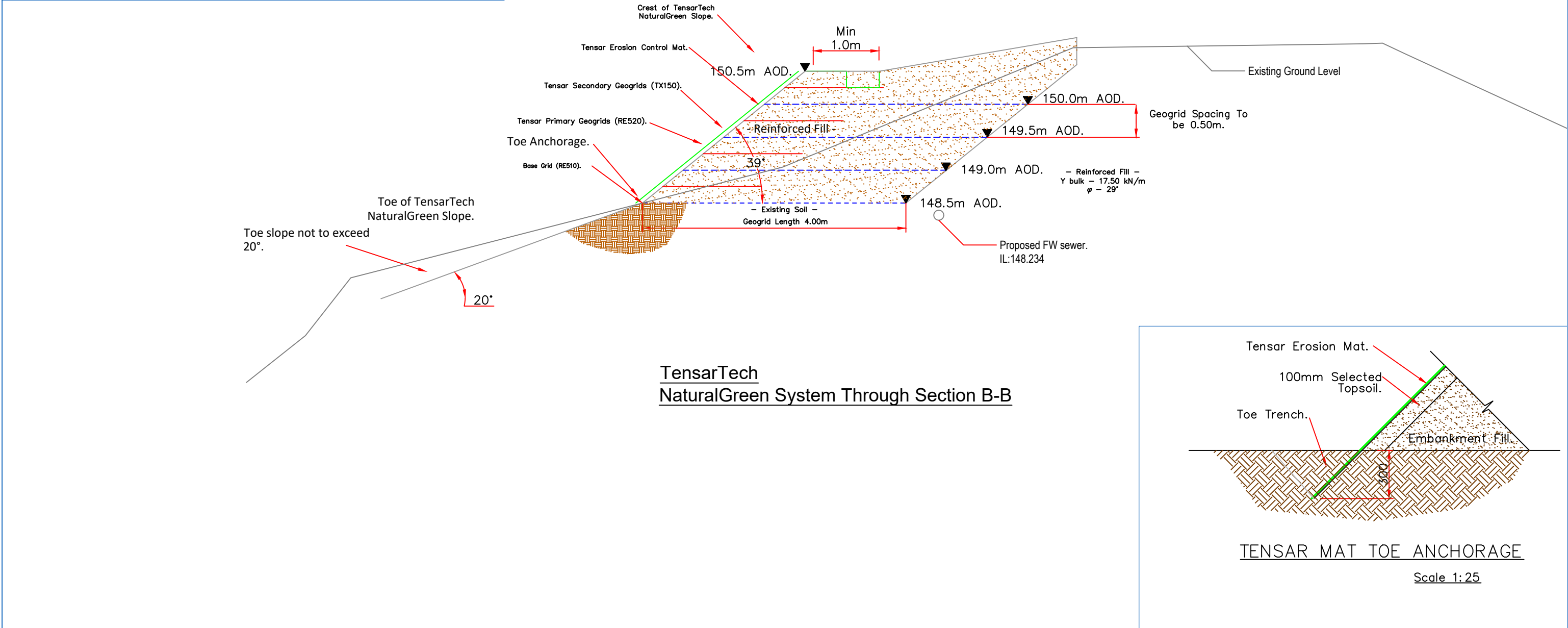
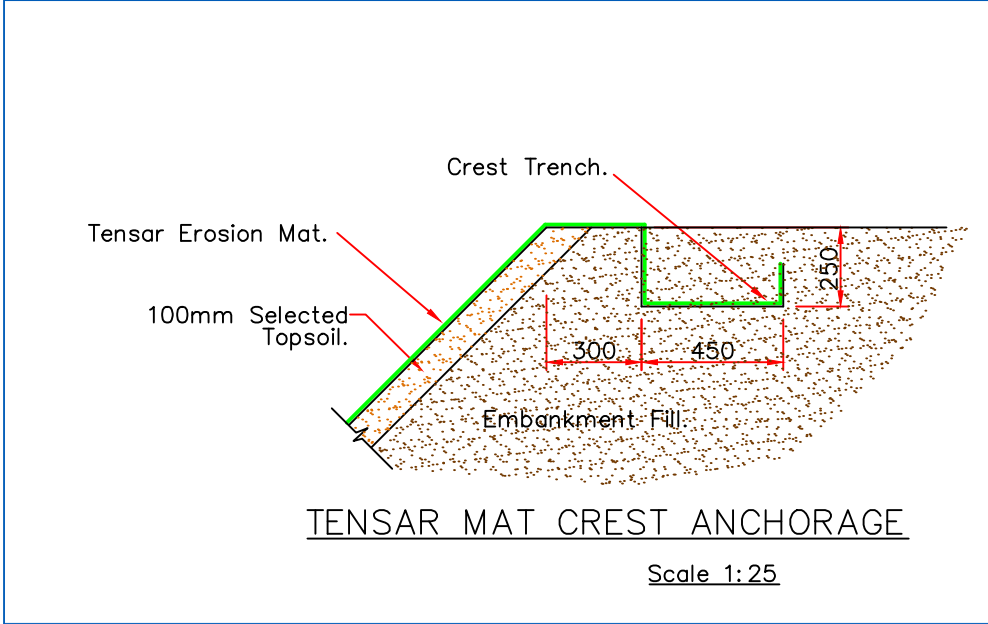


6.0 PLANS

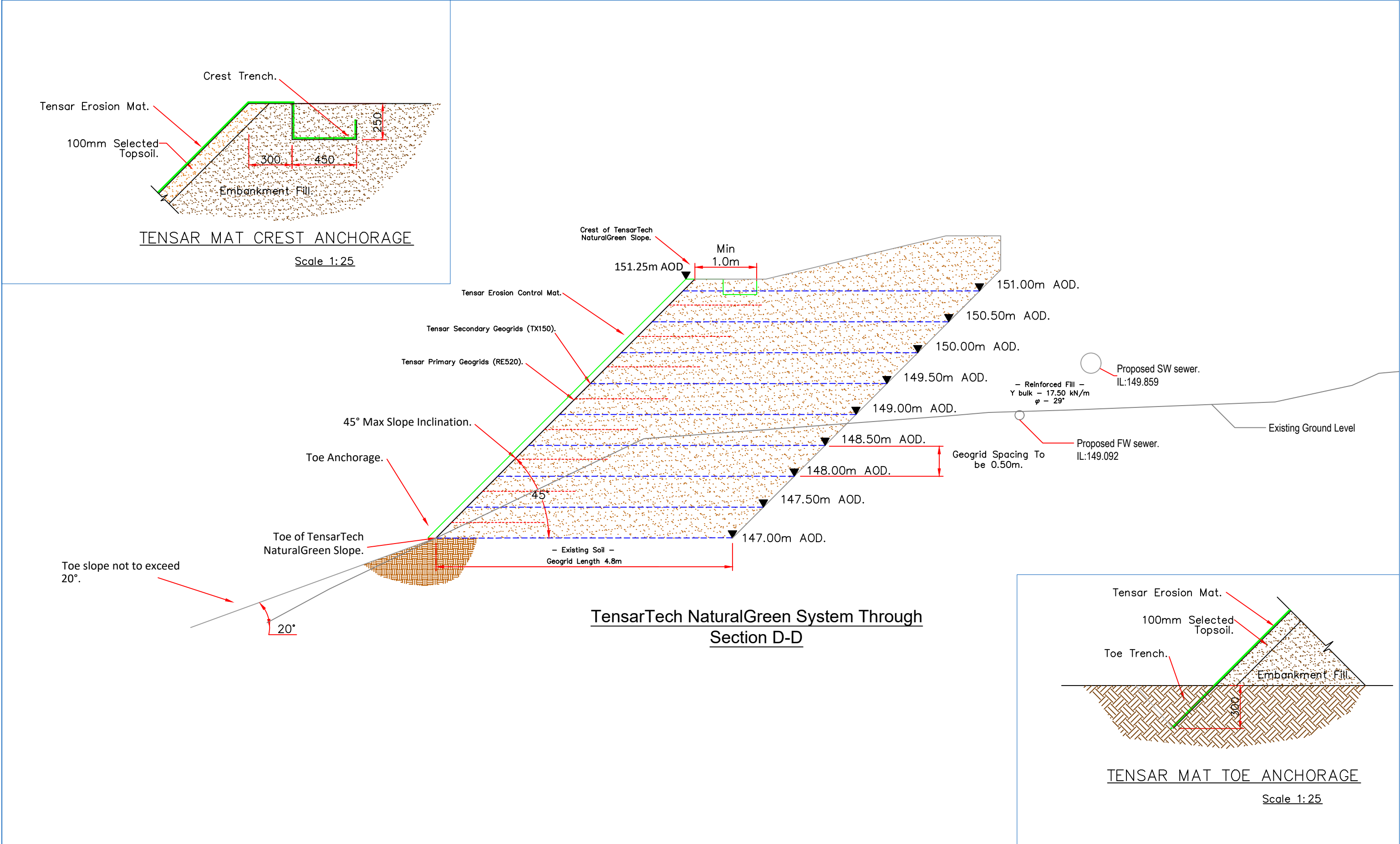
The following designs were produced using CAD software, based off the TensarSoils modelling software with the design parameters and geometric provided by the clients plans.



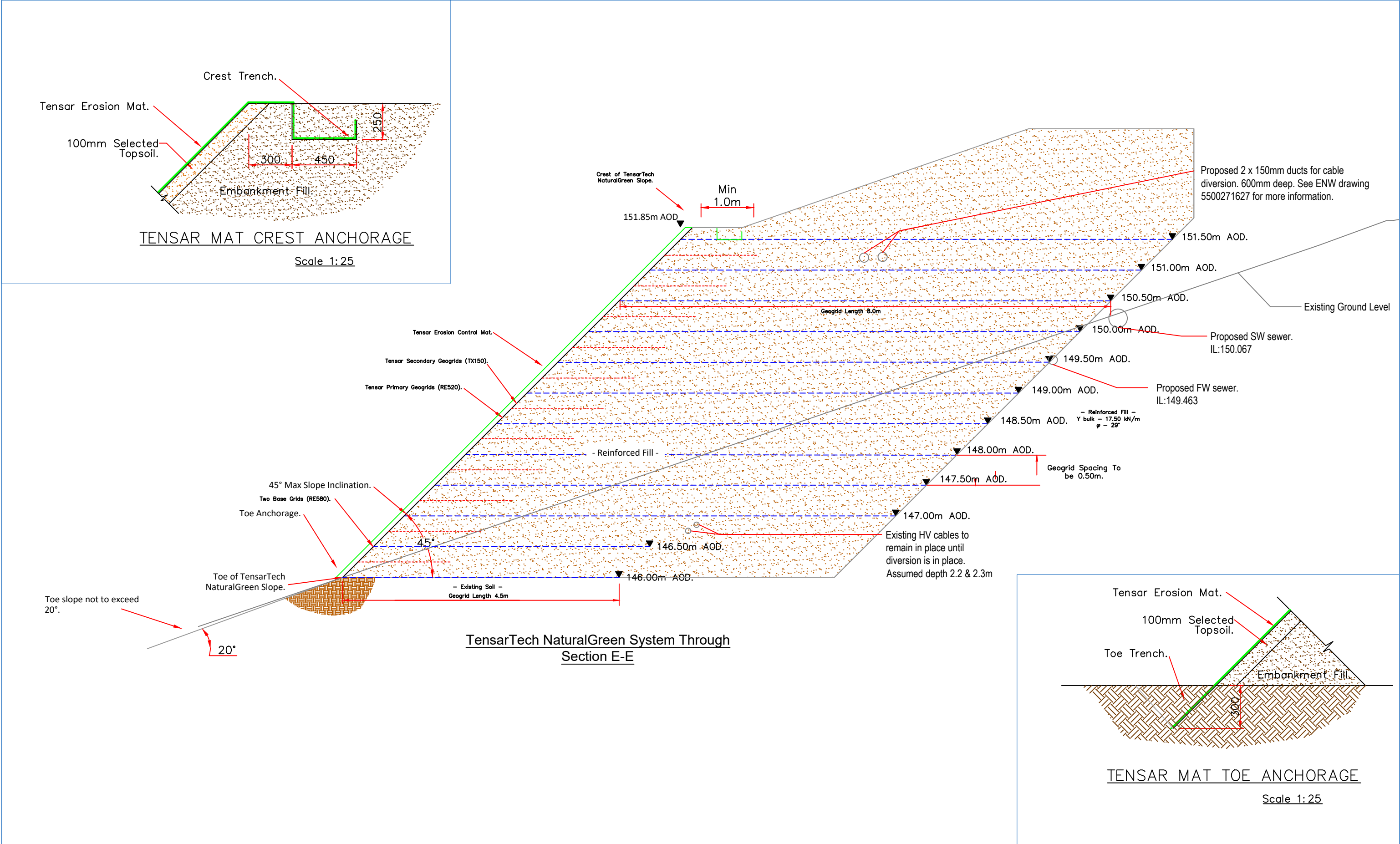
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	PROJECT TITLE HOLLINGWORTH GATE, LITTLEBOROUGH	SCALE NTS	_1.4 Amended Levels	16/10/23	Preliminary		
	PLAN TITLE TENSARTECH NATURAL GREEN PROFILE PLAN - SECTION A	PLAN NUMBER GRO-23131-P03A_1.4	_1.3 Amended Levels	09/10/23	Draft		
			_1.2 Added coordinates to toe of slope	19/07/23	Issued		
			_1.1 Adjustment of levels	13/07/23	For Comment		
			Rev. Details	Date	Approved		



GROUNDTECH CONSULTING 	CLIENT	DATE				Status		Notes Proposed services to be installed during the construction of Tensar Slopes. Proposed services to be undisturbed during the construction of Tensar Slopes. 
	COUNTRYSIDE HOMES	JULY 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	HOLLINGWORTH GATE, LITTLEBOROUGH	NTS	_1.2	Added coordinates to toe of slope	19/07/23	Issued		
	PLAN TITLE	PLAN NUMBER	_1.1	Adjustment of levels	13/07/23	For Comment		
	TENSARTECH NATURAL GREEN PROFILE PLAN - SECTION B	GRO-23131-P03B_1.2	Rev.	Details	Date	Approved		



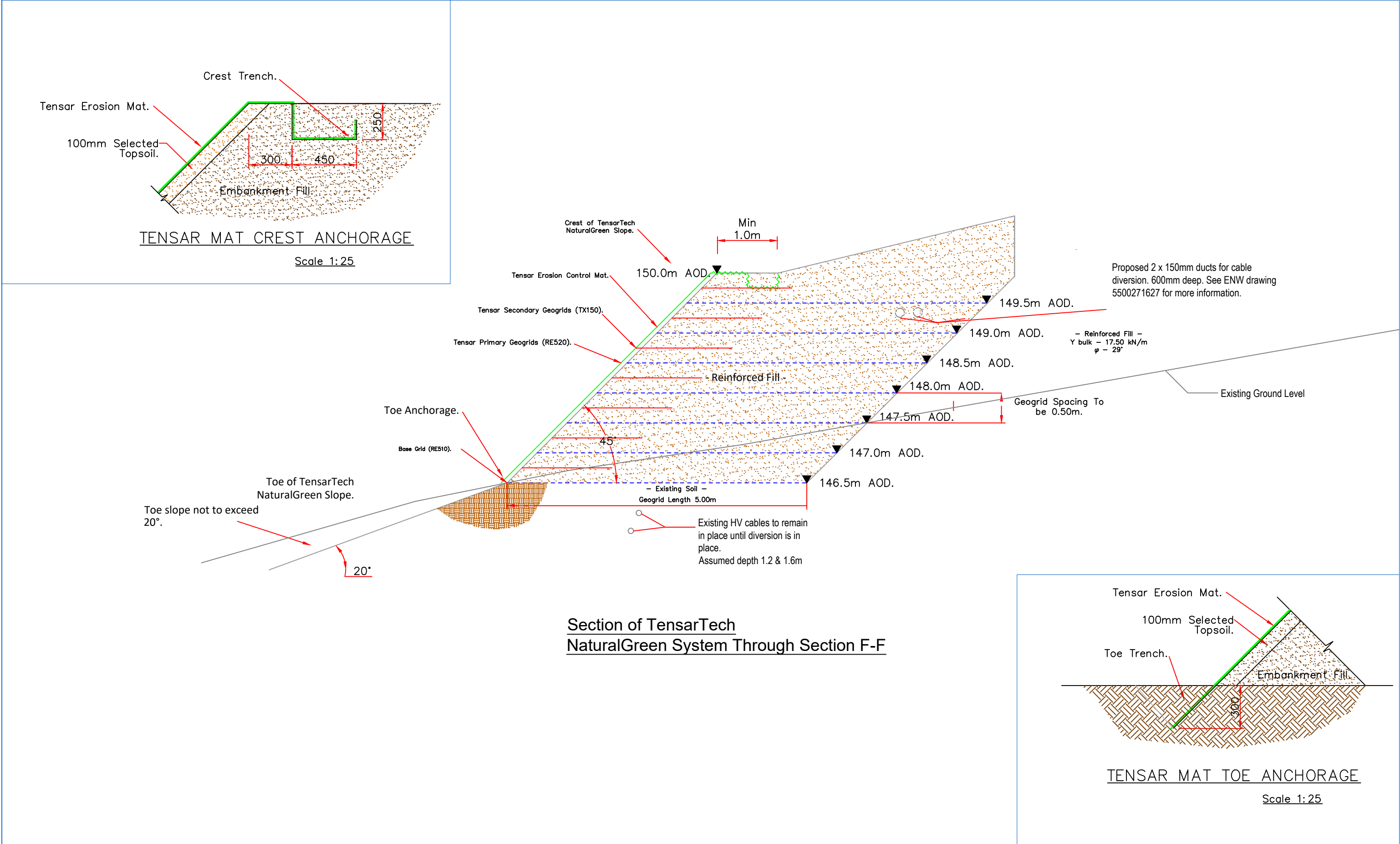
GROUNDTECH CONSULTING	CLIENT COUNTRYSIDE HOMES	DATE JULY 2023	_1.5 Amended level 15/10/23	Status		Notes Proposed services to be installed during the construction of Tensar Slopes. Proposed services to be undisturbed during the construction of Tensar Slopes.
	PROJECT TITLE HOLLINGWORTH GATE, LITTLEBOROUGH	SCALE NTS	_1.4 Amended level 09/10/23	Preliminary		
	PLAN TITLE TENSARTECH NATURAL GREEN PROFILE PLAN - SECTION D	PLAN NUMBER GRO-23131-P03D_1.5	_1.3 Amended coordinates 27/07/23	Draft		
			_1.2 Added coordinates to toe of slope 19/07/23	Issued		
			_1.1 Adjustment of levels 13/07/23	For Comment		
			Rev. Details Date	Approved		



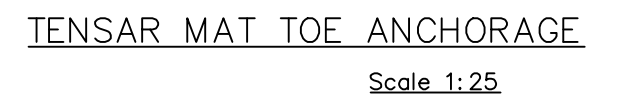
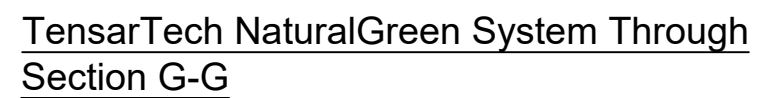
TENSAR MAT CREST ANCHORAGE
Scale 1:25

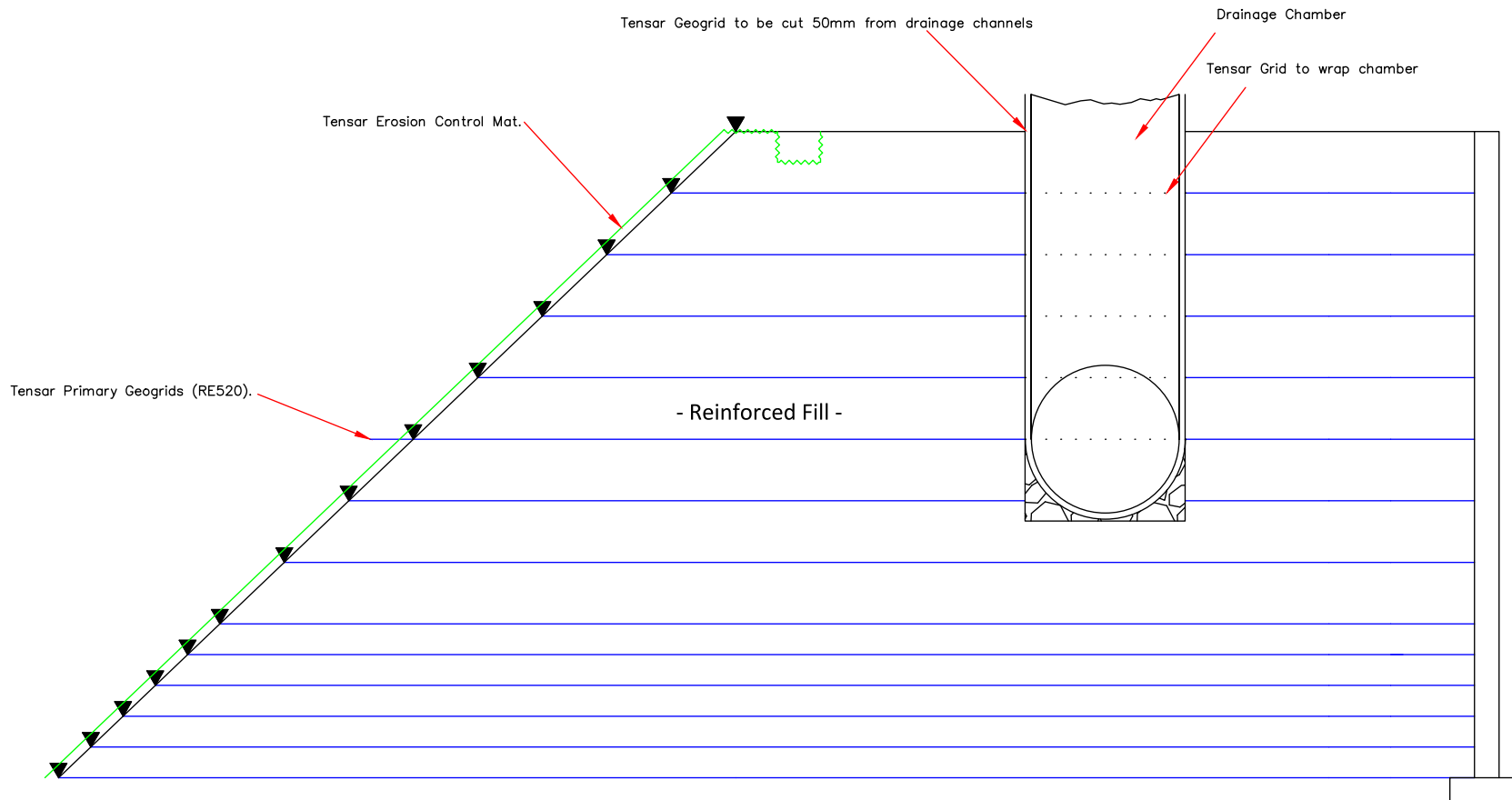
TENSAR MAT TOE ANCHORAGE
Scale 1:25

GROUNDTECH CONSULTING 	CLIENT	DATE	_1.5	Amended levels	09/10/23	Status		Notes Proposed services to be installed during the construction of Tensar Slopes. Proposed services to be undisturbed during the construction of Tensar Slopes. 
	COUNTRYSIDE HOMES	JULY 2023	_1.4	Amended coordinates	27/07/23	Preliminary		
	PROJECT TITLE	SCALE	_1.3	Added coordinates to toe of slope	19/07/23	Draft		
	HOLLINGWORTH GATE, LITTLEBOROUGH	NTS	_1.2	Adjustment of grid sizes to accommodate for existing services	18/07/23	Issued		
	PLAN TITLE	PLAN NUMBER	_1.1	Adjustment of levels	13/07/23	For Comment		
	TENSARTECH NATURAL GREEN PROFILE PLAN - SECTION E	GRO-23131-P03E_1.5	Rev.	Details	Date	Approved		



GROUNDTECH CONSULTING	CLIENT	DATE				Status		Notes Proposed services to be installed during the construction of Tensar Slopes. Proposed services to be undisturbed during the construction of Tensar Slopes.
	COUNTRYSIDE HOMES	JULY 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	HOLLINGWORTH GATE, LITTLEBOROUGH	NTS	_1.2	Added coordinates to toe of slope	19/07/23	Issued		
	PLAN TITLE	PLAN NUMBER	_1.1	Adjustment of levels	13/07/23	For Comment		
TENSARTECH NATURAL GREEN PROFILE PLAN - SECTION F	GRO-23131-P03F_1.2	Rev.	Details	Date	Approved			





GROUNDTECH CONSULTING G	CLIENT	DATE			Status	Notes Drainage installation requires to be programmed/sequenced with Tensor reinforced earth construction as levels raised. G
	COUNTRYSIDE PROPERTIES	JUNE 2023			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	HOLLINGWORTH GATE, LITTLEBOROUGH	NTS			Issued	
	PLAN TITLE	PLAN NUMBER			For Comment	
	MANHOLE DETAIL	GRO-23131-P06	Rev.	Details	Date	Approved

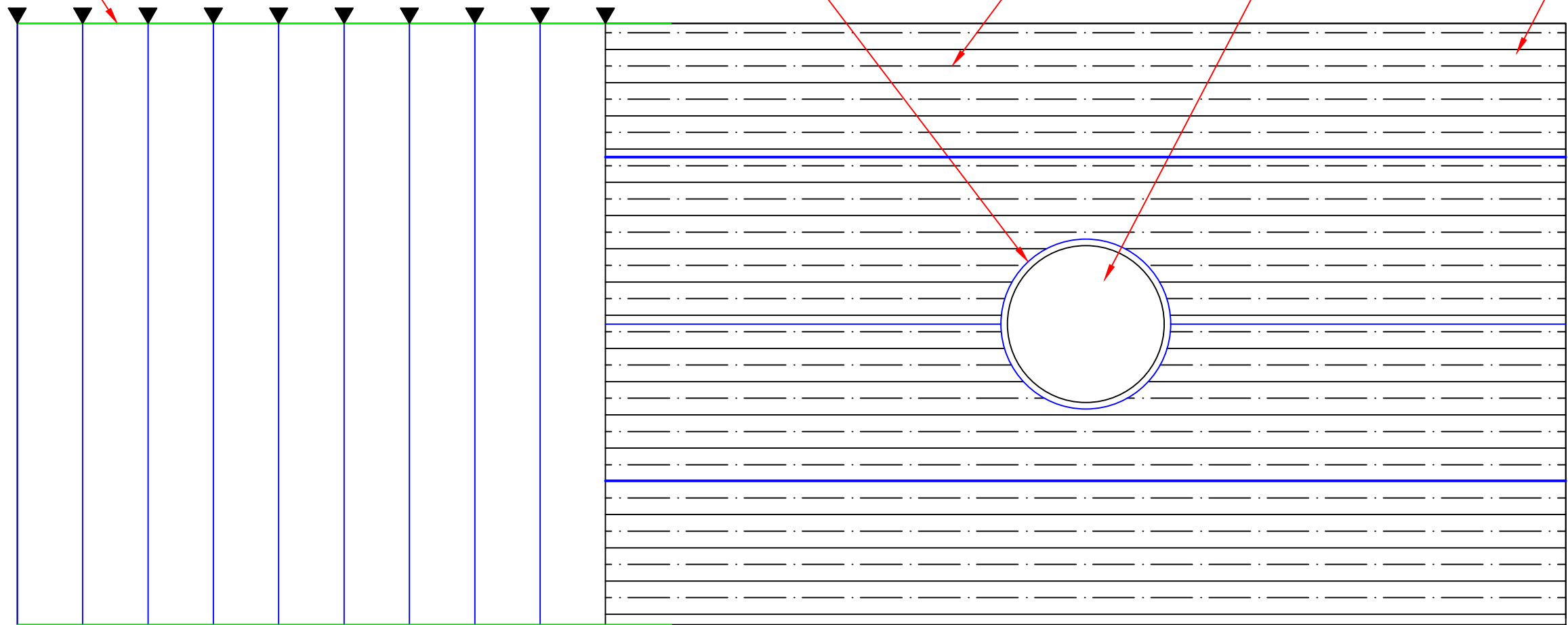
Tensor Erosion Control Mat.

Tensor Geogrid to be cut 50mm from drainage channels

Tensor Grid to wrap chamber

Drainage Chamber

Tensor Uniaxal Grid





7.0 DESIGN BRIEF CONFIRMATION FORM

Please complete, sign and return to:

*Groundtech Consulting Ltd
1st Floor Lloyd House
Orford Court
Greenfold Way
Leigh
WN7 3XJ*

We hereby confirm that the contents of the Design Brief as stated in Section 2 of this document are representative of the actual site conditions and are hereby agreed to be used for the detailed design of the reinforced soil structure for the above project.

Company:.....

Signed:

Name:

Title:.....

Date:.....

Notes

As Groundtech carries no liability for the accuracy of the assumed geotechnical components of this project, it is strongly recommended that the client assigns a suitably qualified Geotechnical engineer to carry out a review and confirmation of the Design Brief prepared by Groundtech.

8.0 SETTLEMENT ASSESSMENT

Settlement assessment has been undertaken for the proposed embankment.

The proposed embankment will have a slope angle of circa 45° . The largest change in loading will be applied where the reinforced earth is circa 6m in height.

Settlement calculations have been undertaken and where bedrock forms the foundation, settlement will be negligible. Where the stiff Clay is anticipated to be present, settlement will be less than 25mm.

The Made Ground is variable and also requires excavation and processing due to cobbles and boulders. The further assessment to date identified the Made Ground and firm Clay is not suitable bearing strata, a watching brief is required where Made Ground and Clay is encountered at formation level. The risk from total and differential settlement can be designed out by preparing the foundation soils during construction. The settlement calculations are based on the available ground conditions information.

9.0 SLOPE STABILITY ASSESSMENT

The objective of the Slope Stability Appraisal is to demonstrate that the proposed reprofiling of the embankment using reinforced earth is stable. The appraisal has been undertaken in accordance with EC7-1 and BS 8006.

9.1 History

The site comprises a former chemical works, the site is currently disused comprising different levels generally sloping down to the canal to the north/north east.

9.2 Geology

Glacial Till and Head Deposits are indicated to underlie the site, the solid geology is the Pennine Lower Coal Measures including the Milnrow Sandstone Formation and Undifferentiated Mudstone.

9.3 Hydrology

A canal abuts the site to the north. A small pond is located to the south of the site and Hollingworth Lake is located further to the south.

9.4 Ground Investigation Information

The depth of Made Ground was highly variable, generally the Made Ground was deeper along the northern boundary. Clay was encountered on the eastern and western areas of the site and was variable in consistency.

The bedrock varied between Mudstone, Sandstone and Siltstone.

9.5 Assessment

A Slope Stability Appraisal has been undertaken using Oasys modelling software, both the graphical and tabular outputs are appended.

9.6 Parameters

Parameters were obtained from a range of sources and are summarised in the table below:

Parameter	Value	Source
Angle of proposed slope	39° - 45°	Tensar Green Slope
Groundwater level	NGW GW modelled in Section A and F	- Base of reinforced earth
Canal Water Level	145.0 – 145.2m AOD	Surveyed in by surveyor
Strata	Section A	Ground model in CP05 + trial pits
	Section B	Ground Model in CP05, TP21 + trial pits
	Section D	Ground Model in MW03, MW05, TP19, TP20 + trial pits
	Section E	Ground Model in TP07 + trial pits
	Section F	Ground Model in MW01, TP01, TP02 + trial pits

Topography	-	From topographical survey and canal bank by additional surveying 1 to 1.65m beyond canal bank
------------	---	---

The stability assessment has been undertaken using the above parameters.

The geotechnical testing results are presented in *Appendix 7* and the Trial Pit Logs for the sections are presented in *Appendix 8*.

Geotechnical Parameters

The parameters for the strata on the subject site have been obtained from the Arc Environmental Ground Investigation and earthworks testing.

The following geotechnical parameters and properties were considered to be representative of the soils:

Strata	Friction angle ϕ' (°)	Unit weight γ (kNm ³)
Reinforced Earth	29	17.5
Backfill Made Ground	29	17.5
Soft Clay	24	20
Stiff Clay (conservative in the absence of testing results)	24	20
Sand	34	20
Mudstone	33	21
Siltstone/Sandstone	40 to 42	21

Drained analysis has been carried out for long term stability, the model was run using a c' of 0 kPa for cohesive strata.

9.7 Slope Model Results (Rotational Failure)

The software model was run using the Bishop (circular failures) method to determine a range of Over Design Factors (ODF) which is the reciprocal of the Degree of Utilization for rotational failure. The results for Bishop Method are presented in the table below, non-circular failures were also assessed where relevant using the Janbu Method and the results are also presented in the below.

Design Situation	Computation Method	Sensitivity Analysis	ODF
Section A	Bishop	Circular (existing foundation)	0.895
Section A	Bishop	Circular (engineered foundation/No Groundwater)	1.279
Section A	Bishop	Circular (engineered foundation/Groundwater)	1.001
Section B	Bishop	Circular	1.66
Section B	Janbu	Non-Circular	1.512
Section D	Bishop	Circular	1.392
Section E	Bishop	Circular	1.377
Section F	Bishop	Circular (Groundwater)	1.065

Section F	Janbu	Non-Circular	1.462
Section F	Bishop	Vibration	1.2

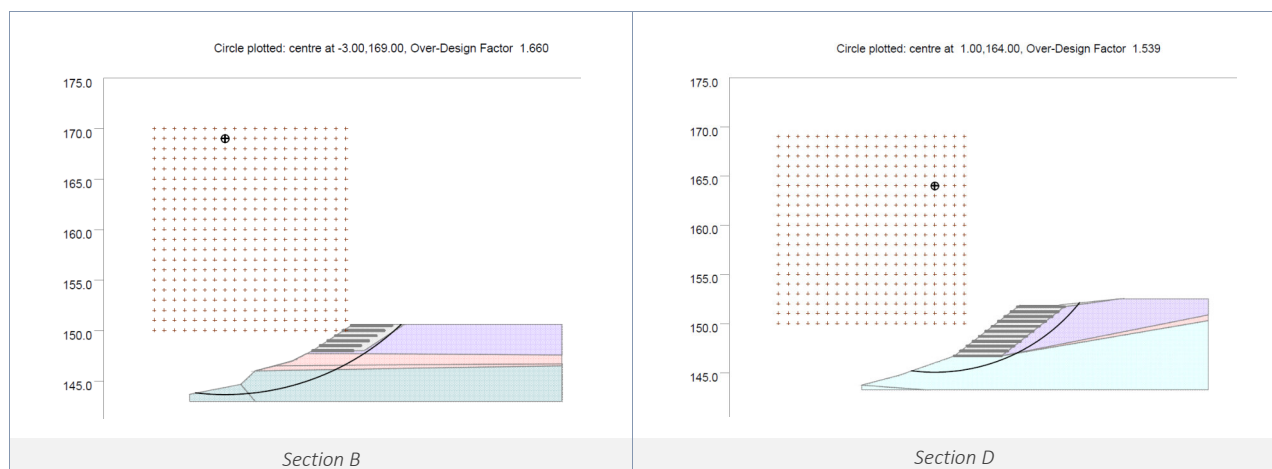
The results presented in the table above confirm the overall stability is acceptable as an ODF of greater than 1 has been generated using partial factor analysis in accordance with EC7 Design Approach 1 Combination 2 (BS EN 1997-1:2011 DA1-2). The overall stability assessment confirms the Made Ground and firm Clay requires removal at foundation level - Section A, B and D.

The horizontal acceleration function in the model has been used to assess the potential vibration risk from piling.

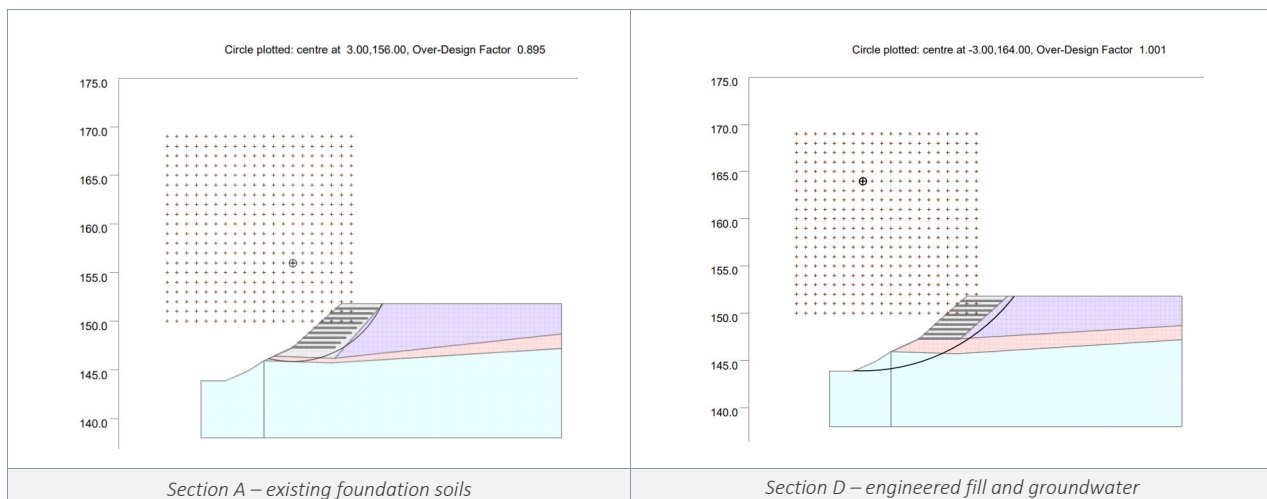
The model was initially run with the reinforcement not active using defined radii, using these results a common point was identified behind the reinforced earth wedge to assess the most sensitive failure plane for global stability.

The site reconnaissance noted the absence of a canal wall and the sections have been remodelled with the new topographical information. Trial pitting was undertaken in each section and the surveyed levels provided by Countryside to revise the slope stability sections and assessment.

Below are the graphical outputs for Section B and Section D showing the circular failure behind the reinforced block with ODFs greater than 1.



Below is the graphical output for Sections A, an ODF below 1 was generated when the Made Ground and firm Clay was modelled at foundation level. An ODF of greater than 1 was recorded when the soils were replaced with engineered fill, weathered Sandstone was encountered in the trial pits. Groundwater was modelled in this section, the ODF was greater than 1.



The length of the straps in Section F is 5m which doesn't extend beneath the proposed gabion structure. No permanent structures should be constructed over the reinforced earth and requires consideration.

The Public Open Space area in the vicinity of Section C does not require reinforced earth as shown on GRO-23131-P04_1.1. This will also be dependent on the treatment of the mine shaft in this area.

9.8 Limitations

The following assumptions and exclusions have been made in the modelling of the slope stability, if the assumptions are varied in the design or construction the modelling results are not applicable and the slope should be remodelled:

- *Ground models are generated from available Ground Investigation information by others, assessment applicable to geometrics and ground conditions in modelling sections.*
- *Inspection of formation level undertaken and recommendations undertaken to validate design.*
- *Based on levels provided on dwg plans and canal sections.*
- *Treatment of the mine entry may have an effect on the proposed design, further details should be provided when available.*
- *No groundwater modelled based on Ground Investigation information provided, if this differs in construction or drainage strategy changes groundwater regime – design should be revisited.*
- *Design does not account for contamination or remedial activities.*
- *Based on the levels provided, some excavation into bedrock may be required and the contractor should allow for this.*
- *Processing of Made Ground will be required if proposed to be used in the reinforced earth construction.*
- *An earthworks specification in accordance with Series 600 is required to inform installation of material in reinforced earth. Fill material should be placed within the allowable moisture content range and suitably compacted.*
- *Foundations are assumed to be piles and no additional loads are being applied to the reinforced earth or backfill material.*

9.9 Summary

The slope stability results demonstrate the embankment is stable, reengineering is required for Section A, B and D. Also where Made Ground and firm Clay is present at foundation level.

Peak ϕ' values have been used in the assessment as there is no evidence of ancient slippages, if observed during the earthworks, the modelling should be revised using residual values.



APPENDIX 1 - Plans



GROUNDTECH CONSULTING	CLIENT	DATE			Status		Notes Site Location
	COUNTRYSIDE PARTNERSHIPS	JUNE 2023			Preliminary		
	PROJECT TITLE	SCALE			Draft		
	HOLLINGWORTH GATE, LITTLEBOROUGH	NTS			Issued		
	PLAN TITLE	PLAN NUMBER			For Comment		
PROJECT LOCATION PLAN	GRO-23131-P01	Rev.	Details	Date	Approved		



Reedbed / swot

Flow control
manhole to
restrict flow to
29.6l/s. In-built
sump

SW Storage
Tank
Depth: 2.9m
Volume
provided: 2116m³
95% Void
IL: 148.10 Top of
tank: 151.000

break



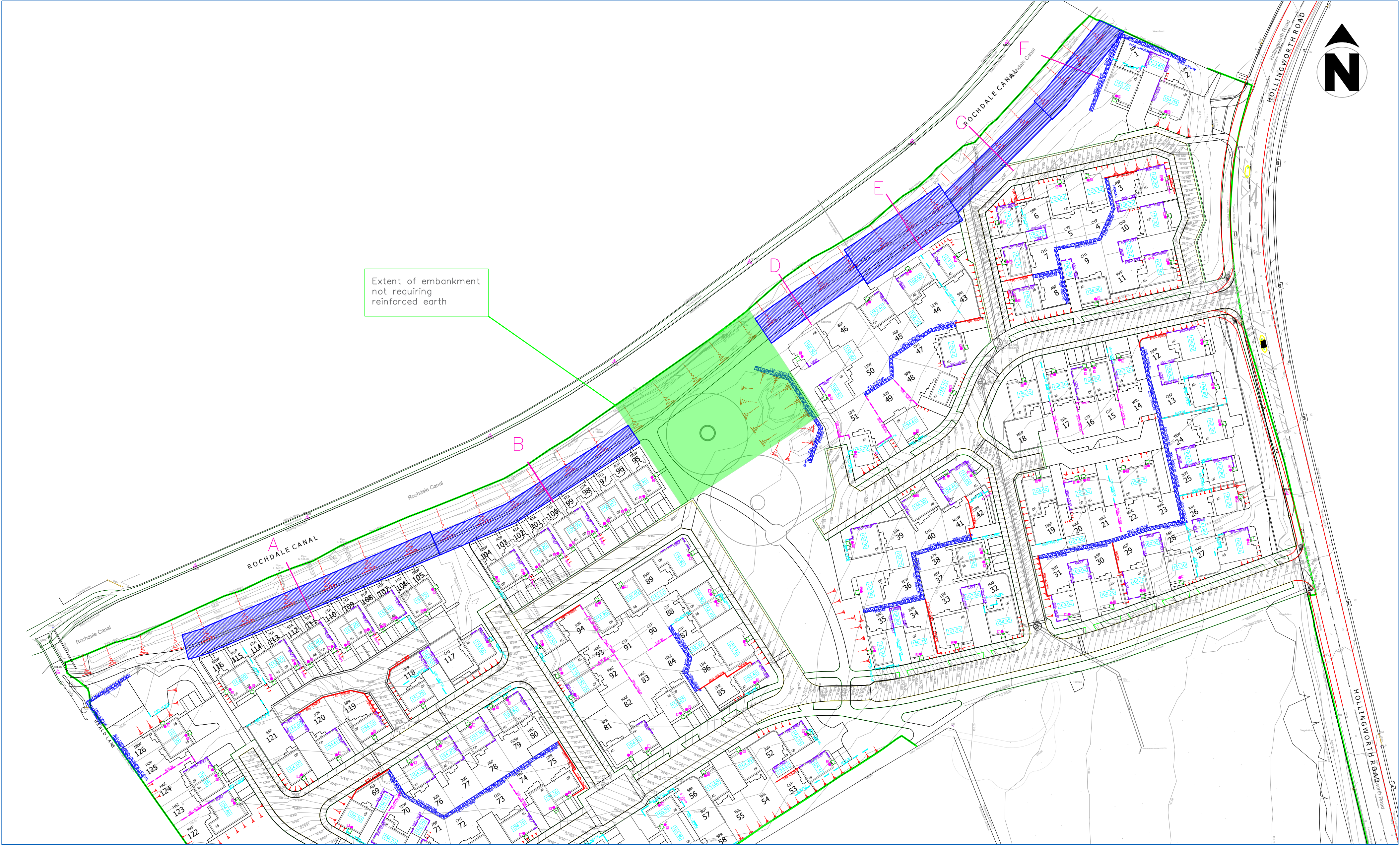
DATE	JULY 2023
SCALE	NTS
PLAN NUMBER	GRO-23131-P04_1.2

1.2	Added area G	
1.1	Text change for area of no reinforcement	10 July 2023
Rev.	Details	Date

Status
Preliminary
Draft
Issued
For Comment
Approved

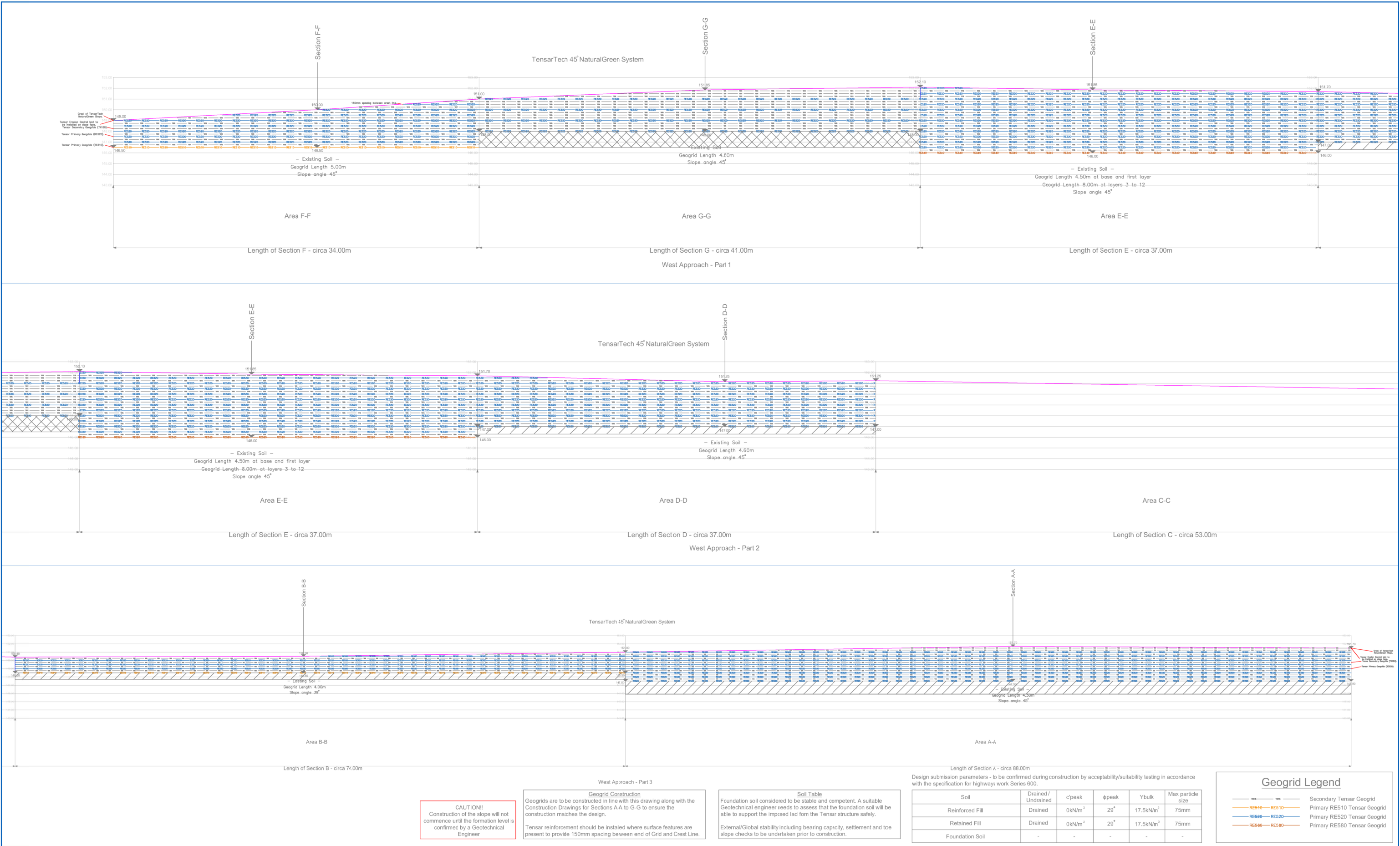
Notes





GROUNDTECH CONSULTING 	CLIENT	DATE			Status		Notes  - Extent of Tensar Geogrids for each Section
	COUNTRYSIDE PARTNERSHIPS - WAKEFIELD	JULY 2023	1.4.	Area G Amended for slope angle	18 October 2023	Preliminary	
	PROJECT TITLE	SCALE	1.3.	Area E and D moved for existing services	27 July 2023	Draft	
	HOLLINGSWORTH GATE, LITTLEBOROUGH	NTS	1.2.	Coordinates Added for Tensar Areas	19 July 2023	Issued	
	PLAN TITLE	PLAN NUMBER	1.1.	Width of reinforced earth reduced	10 July 2023	For Comment	
	TENSAR AREAS PLAN	GRO-23131-P05_1.4	Rev.	Details	Date	Approved	





GROUNDTECH
CONSULTING

CLIENT

COUNTRYSIDE PARTNERSHIPS

PROJECT TITLE

HOLLINGWORTH GATE, LITTLEBOROUGH

PLAN TITLE

NORTH WESTERN APPROACH - TENSAR ELEVATION PLAN

DATE

OCTOBER 2023

SCALE

A1 1:2

PLAN NUMBER

GRO-23131-P08

Rev.

Details

Date

Status

Preliminary

Draft

Issued

For Comment

Approved

Notes

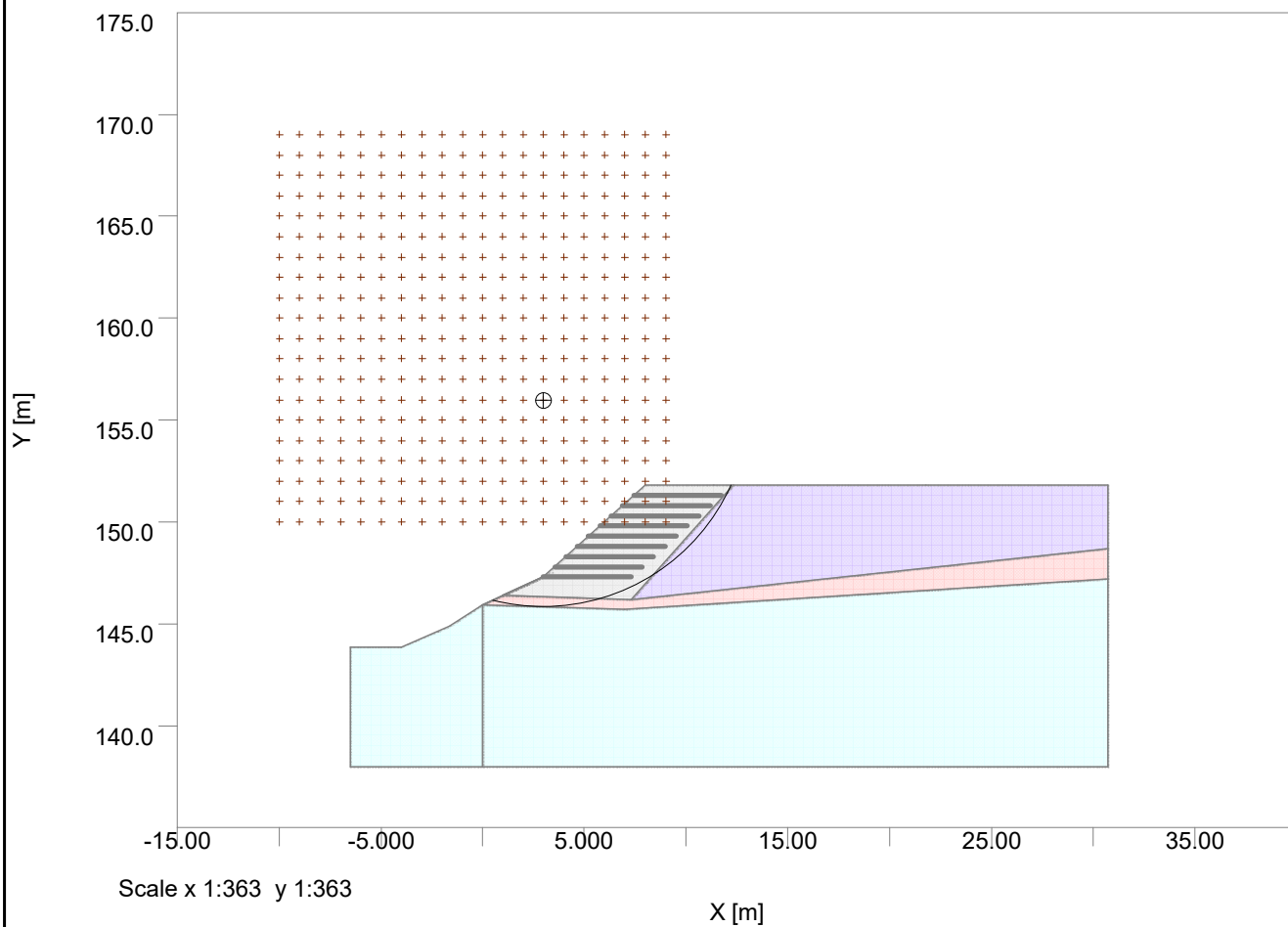
Area requiring further excavation due to unsuitable formation soils

Area requiring build up due to over excavation

APPENDIX 2 - Section A Modelling Outputs

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date 08 Jun 2023	Checked Date

Circle plotted: centre at 3.00,156.00, Over-Design Factor 0.895



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Method Partial Factors

```

BS EN 1997-1:2011 DA1-2
Factor on FAVOURABLE PERMANENT LOAD: 1.00000
Factor on UNFAVOURABLE PERMANENT LOAD: 1.00000
Factor on FAVOURABLE VARIABLE LOAD: 0.00000
Factor on UNFAVOURABLE VARIABLE LOAD: 1.30000
Factor on UNIT WEIGHT: 1.00000
Factor on DRAINED COHESION: 1.25000
Factor on UNDRAINED COHESION: 1.40000
Factor on TAN PHI': 1.25000
Factor on REINFORCEMENT PULLOUT: 1.50000
Factor on ECONOMIC FAILURE: 1.00000
Factor on SLIDING ALONG REINFORCEMENT: 1.50000

```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters	Phi or c
		Above GWL	Below GWL		
	or c0'				
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	25.000	25.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	20.000	Drained	29.000
0.0	3 Backfill made Ground	17.500	20.000	Drained	29.000
0.0	4 CLAY	20.000	22.000	Drained	24.000
0.0	5 Weathered SANDSTONE	21.000	23.000	Drained	40.000

Reinforcement

Geotextile Reinforcement 1						
Layers	Level of top layer	Vertical Spacing	Length		Offset from surface	Angle from horizon
	[m]	[m]	Top [m]	Btm [m]	[m]	[°]
9	151.30	0.50000	4.3000	4.3000	0.0	0

Bond Length	Bond Strength	Prestress	Grout Diameter
	[kN/m]	[kN]	[mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
Bottom left of grid: $x = -10.00000$ m $y = 150.00000$ m


```
Inclination of grid: 0.00000 deg
(positive anticlockwise direction about bottom left of grid)
Centres on grid: 20 in x direction at 1.00000m spacing
                20 in y direction at 1.00000m spacing
Grid extended to find minimum FoS
All circles pass through common point at x = 8.20000 m, y = 147.30000 m
```

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-10.000	150.00	18.399		Only 1 intersection with ground level			
-10.000	151.00	18.572		Only 1 intersection with ground level			
-10.000	152.00	18.797		Only 1 intersection with ground level			
-10.000	153.00	19.072		Only 1 intersection with ground level			
-10.000	154.00	19.394		Only 1 intersection with ground level			
-10.000	155.00	19.762		Only 1 intersection with ground level			
-10.000	156.00	20.173		Only 1 intersection with ground level			
-10.000	157.00	20.624		Only 1 intersection with ground level			
-10.000	158.00	21.112		Only 1 intersection with ground level			
-10.000	159.00	21.636		Only 1 intersection with ground level			
-10.000	160.00	22.193		Only 1 intersection with ground level			
-10.000	161.00	22.780		Only 1 intersection with ground level			
-10.000	162.00	23.395		Only 1 intersection with ground level			
-10.000	163.00	24.036		Only 1 intersection with ground level			
-10.000	164.00	24.701		Only 1 intersection with ground level			
-10.000	165.00	25.388		Only 1 intersection with ground level			
-10.000	166.00	26.095		Only 1 intersection with ground level			
-10.000	167.00	26.820		Only 1 intersection with ground level			
-10.000	168.00	27.563		Only 1 intersection with ground level			
-10.000	169.00	28.322		Only 1 intersection with ground level			
-9.0000	150.00	17.411		Only 1 intersection with ground level			
-9.0000	151.00	17.593		Only 1 intersection with ground level			
-9.0000	152.00	17.831		Only 1 intersection with ground level			
-9.0000	153.00	18.120		Only 1 intersection with ground level			
-9.0000	154.00	18.459		Only 1 intersection with ground level			
-9.0000	155.00	18.845		Only 1 intersection with ground level			
-9.0000	156.00	19.275		Only 1 intersection with ground level			
-9.0000	157.00	19.747		Only 1 intersection with ground level			
-9.0000	158.00	20.257		Only 1 intersection with ground level			
-9.0000	159.00	20.802		Only 1 intersection with ground level			
-9.0000	160.00	21.381		Only 1 intersection with ground level			
-9.0000	161.00	21.989		Only 1 intersection with ground level			
-9.0000	162.00	22.626		Only 1 intersection with ground level			
-9.0000	163.00	23.288		Only 1 intersection with ground level			
-9.0000	164.00	23.974		Only 1 intersection with ground level			
-9.0000	165.00	24.681		Only 1 intersection with ground level			
-9.0000	166.00	25.407		Only 1 intersection with ground level			
-9.0000	167.00	26.152		Only 1 intersection with ground level			
-9.0000	168.00	26.913		Only 1 intersection with ground level			
-9.0000	169.00	27.690		Only 1 intersection with ground level			
-8.0000	150.00	16.423		Only 1 intersection with ground level			
-8.0000	151.00	16.617		Only 1 intersection with ground level			
-8.0000	152.00	16.868		Only 1 intersection with ground level			
-8.0000	153.00	17.174		Only 1 intersection with ground level			
-8.0000	154.00	17.531		Only 1 intersection with ground level			
-8.0000	155.00	17.937		Only 1 intersection with ground level			
-8.0000	156.00	18.388		Only 1 intersection with ground level			
-8.0000	157.00	18.882		Only 1 intersection with ground level			
-8.0000	158.00	19.415		Only 1 intersection with ground level			
-8.0000	159.00	19.983		Only 1 intersection with ground level			
-8.0000	160.00	20.585		Only 1 intersection with ground level			
-8.0000	161.00	21.216		Only 1 intersection with ground level			
-8.0000	162.00	21.875		Only 1 intersection with ground level			
-8.0000	163.00	22.559		Only 1 intersection with ground level			
-8.0000	164.00	23.267		Only 1 intersection with ground level			
-8.0000	165.00	23.994		Only 1 intersection with ground level			
-8.0000	166.00	24.741		Only 1 intersection with ground level			
-8.0000	167.00	25.505		Only 1 intersection with ground level			
-8.0000	168.00	26.286		Only 1 intersection with ground level			
-8.0000	169.00	27.080		Only 1 intersection with ground level			
-7.0000	150.00	15.438		Only 1 intersection with ground level			
-7.0000	151.00	15.644		Only 1 intersection with ground level			



Hollingsworth Gate, Littleborough
Section A

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date 08 Jun 2023	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-7.0000	152.00	15.910		Only 1 intersection with ground level			
-7.0000	153.00	16.234		Only 1 intersection with ground level			
-7.0000	154.00	16.611		Only 1 intersection with ground level			
-7.0000	155.00	17.039		Only 1 intersection with ground level			
-7.0000	156.00	17.514		Only 1 intersection with ground level			
-7.0000	157.00	18.031		Only 1 intersection with ground level			
-7.0000	158.00	18.588		Only 1 intersection with ground level			
-7.0000	159.00	19.182		Only 1 intersection with ground level			
-7.0000	160.00	19.807		Only 1 intersection with ground level			
-7.0000	161.00	20.463		Only 1 intersection with ground level			
-7.0000	162.00	21.145		Only 1 intersection with ground level			
-7.0000	163.00	21.852		Only 1 intersection with ground level			
-7.0000	164.00	22.582		Only 1 intersection with ground level			
-7.0000	165.00	23.331		Only 1 intersection with ground level			
-7.0000	166.00	24.098		Only 1 intersection with ground level			
-7.0000	167.00	24.882		Only 1 intersection with ground level			
-7.0000	168.00	25.681		Only 1 intersection with ground level			
-7.0000	169.00	26.494		Only 1 intersection with ground level			
-6.0000	150.00	14.454		Only 1 intersection with ground level			
-6.0000	151.00	14.674		Only 1 intersection with ground level			
-6.0000	152.00	14.958		Only 1 intersection with ground level			
-6.0000	153.00	15.301		Only 1 intersection with ground level			
-6.0000	154.00	15.701		Only 1 intersection with ground level			
-6.0000	155.00	16.153		Only 1 intersection with ground level			
-6.0000	156.00	16.653		Only 1 intersection with ground level			
-6.0000	157.00	17.197		Only 1 intersection with ground level			
-6.0000	158.00	17.780		Only 1 intersection with ground level			
-6.0000	159.00	18.399		Only 1 intersection with ground level			
-6.0000	160.00	19.051		Only 1 intersection with ground level			
-6.0000	161.00	19.731		Only 1 intersection with ground level			
-6.0000	162.00	20.438		Only 1 intersection with ground level			
-6.0000	163.00	21.169		Only 1 intersection with ground level			
-6.0000	164.00	21.921		Only 1 intersection with ground level			
-6.0000	165.00	22.692		Only 1 intersection with ground level			
-6.0000	166.00	23.480		Only 1 intersection with ground level			
-6.0000	167.00	24.284		Only 1 intersection with ground level			
-6.0000	168.00	25.102		Only 1 intersection with ground level			
-6.0000	169.00	25.933		Only 1 intersection with ground level			
-5.0000	150.00	13.473		Only 1 intersection with ground level			
-5.0000	151.00	13.709		Only 1 intersection with ground level			
-5.0000	152.00	14.012		Only 1 intersection with ground level			
-5.0000	152.00	14.012		Only 1 intersection with ground level			
-5.0000	153.00	14.378		Only 1 intersection with ground level			
-5.0000	154.00	14.803		Only 1 intersection with ground level			
-5.0000	155.00	15.282		Only 1 intersection with ground level			
-5.0000	156.00	15.809		Only 1 intersection with ground level			
-5.0000	157.00	16.381		Only 1 intersection with ground level			
-5.0000	158.00	16.992		Only 1 intersection with ground level			
-5.0000	159.00	17.639		Only 1 intersection with ground level			
-5.0000	160.00	18.317		Only 1 intersection with ground level			
-5.0000	161.00	19.024		Only 1 intersection with ground level			
-5.0000	162.00	19.757		Only 1 intersection with ground level			
-5.0000	163.00	20.512		Only 1 intersection with ground level			
-5.0000	164.00	21.287		Only 1 intersection with ground level			
-5.0000	165.00	22.080		Only 1 intersection with ground level			
-5.0000	166.00	22.890		Only 1 intersection with ground level			
-5.0000	167.00	23.713		Only 1 intersection with ground level			
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-5.0000	169.00	25.399		Only 1 intersection with ground level			
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-4.0000	151.00	12.749		Only 1 intersection with ground level			
-4.0000	152.00	13.074		Only 1 intersection with ground level			
-4.0000	153.00	13.466		Only 1 intersection with ground level			
-4.0000	154.00	13.919		Only 1 intersection with ground level			
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-4.0000	156.00	14.984		Only 1 intersection with ground level			
-4.0000	157.00	15.586		Only 1 intersection with ground level			
-4.0000	158.00	16.227		Only 1 intersection with ground level			
-4.0000	159.00	16.904		Only 1 intersection with ground level			
-4.0000	160.00	17.611		Only 1 intersection with ground level			
-4.0000	161.00	18.345		Only 1 intersection with ground level			
-4.0000	162.00	19.103		Only 1 intersection with ground level			
-4.0000	163.00	19.883		Only 1 intersection with ground level			
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-4.0000	165.00	21.497		Only 1 intersection with ground level			
-4.0000	166.00	22.328		Only 1 intersection with ground level			
-4.0000	167.00	23.172	807.98	0.92566	7525.4	6966.0	0.0

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date 08 Jun 2023	Checked Date

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-4.0000	168.00	24.028	790.34	0.92266	7657.9	7065.6
-4.0000	169.00	24.894	776.72	0.92987	7744.8	7201.7
-3.0000	150.00	11.521		Only 1 intersection with ground level		
-3.0000	151.00	11.795		Only 1 intersection with ground level		
-3.0000	152.00	12.146		Only 1 intersection with ground level		
-3.0000	153.00	12.567		Only 1 intersection with ground level		
-3.0000	154.00	13.051		Only 1 intersection with ground level		
-3.0000	155.00	13.592		Only 1 intersection with ground level		
-3.0000	156.00	14.182		Only 1 intersection with ground level		
-3.0000	157.00	14.817		Only 1 intersection with ground level		
-3.0000	158.00	15.490		Only 1 intersection with ground level		
-3.0000	159.00	16.197		Only 1 intersection with ground level		
-3.0000	160.00	16.933		Only 1 intersection with ground level		
-3.0000	161.00	17.695		Only 1 intersection with ground level		
-3.0000	162.00	18.481		Only 1 intersection with ground level		
-3.0000	163.00	19.285	826.98	0.92590	6474.2	5994.5
-3.0000	164.00	20.108	800.55	0.91532	6591.9	6033.7
-3.0000	165.00	20.946	780.84	0.91510	6680.6	6113.4
-3.0000	166.00	21.797	764.96	0.93510	6740.8	6303.3
-3.0000	167.00	22.661	752.27	0.93212	6859.0	6393.5
-3.0000	168.00	23.536	742.46	0.94867	6948.5	6591.8
-3.0000	169.00	24.420	735.11	0.96600	7045.7	6806.2
-2.0000	150.00	10.551		Only 1 intersection with ground level		
-2.0000	151.00	10.850		Only 1 intersection with ground level		
-2.0000	152.00	11.231		Only 1 intersection with ground level		
-2.0000	153.00	11.685		Only 1 intersection with ground level		
-2.0000	154.00	12.204		Only 1 intersection with ground level		
-2.0000	155.00	12.780		Only 1 intersection with ground level		
-2.0000	156.00	13.406		Only 1 intersection with ground level		
-2.0000	157.00	14.076		Only 1 intersection with ground level		
-2.0000	158.00	14.783	919.43	0.99027	5347.9	5275.4
-2.0000	159.00	15.522	866.97	0.95605	5422.4	5172.7
-2.0000	160.00	16.289	826.50	0.93949	5492.9	5160.5
-2.0000	161.00	17.080	796.41	0.91576	5620.0	5146.6
-2.0000	162.00	17.892	772.30	0.92042	5694.3	5241.1
-2.0000	163.00	18.722	753.20	0.92230	5788.3	5338.6
-2.0000	164.00	19.569	738.20	0.93421	5876.0	5489.4
-2.0000	165.00	20.429	726.70	0.94334	5980.1	5641.2
-2.0000	166.00	21.301	718.18	0.96165	6077.3	5844.2
-2.0000	167.00	22.184	712.06	0.97421	6194.1	6034.4
-2.0000	168.00	23.077	708.11	0.98827	6318.5	6244.4
-2.0000	169.00	23.978	705.66	1.0077	6435.5	6485.1
-1.0000	150.00	9.5880		Only 1 intersection with ground level		
-1.0000	151.00	9.9161		Only 1 intersection with ground level		
-1.0000	152.00	10.331		Only 1 intersection with ground level		
-1.0000	153.00	10.823		Only 1 intersection with ground level		
-1.0000	154.00	11.381	1037.7	1.1314	4286.4	4825.6
-1.0000	155.00	11.997	952.28	1.0558	4363.0	4583.2
-1.0000	156.00	12.662	886.14	1.0108	4436.4	4456.9
-1.0000	157.00	13.369	835.91	0.96029	4556.2	4351.9
-1.0000	158.00	14.111	796.70	0.94558	4630.7	4365.4
-1.0000	159.00	14.884	765.82	0.93218	4721.3	4400.4
-1.0000	160.00	15.682	741.73	0.92717	4819.2	4468.2
-1.0000	161.00	16.502	723.22	0.93364	4913.5	4587.5
-1.0000	162.00	17.342	709.33	0.93884	5022.3	4715.2
-1.0000	163.00	18.197	699.12	0.95306	5127.1	4886.4
-1.0000	164.00	19.066	692.02	0.96326	5249.7	5056.8
-1.0000	165.00	19.948	687.34	0.97933	5368.7	5257.7
-1.0000	166.00	20.841	684.59	0.99705	5492.6	5476.4
-1.0000	167.00	21.742	683.49	1.0138	5621.6	5699.2
-1.0000	168.00	22.652	683.83	1.0323	5755.5	5941.1
-1.0000	169.00	23.570	685.27	1.0528	5893.4	6204.9
0.0	150.00	8.6331		Centre embedded/below end of slip		
0.0	151.00	8.9961		Centre embedded/below end of slip		
0.0	152.00	9.4515	1026.8	1.2193	3362.3	4084.4
0.0	153.00	9.9865	934.00	1.1418	3438.5	3908.4
0.0	154.00	10.589	862.95	1.0490	3566.0	3717.5
0.0	155.00	11.249	807.49	1.0059	3654.6	3653.0
0.0	156.00	11.955	765.13	0.98174	3743.6	3654.9
0.0	157.00	12.702	732.99	0.96245	3846.2	3686.9
0.0	158.00	13.481	708.73	0.94947	3954.7	3753.2
0.0	159.00	14.287	690.76	0.95265	4059.0	3866.8
0.0	160.00	15.117	677.95	0.95355	4181.2	3987.0
0.0	161.00	15.967	669.07	0.96235	4301.8	4139.8

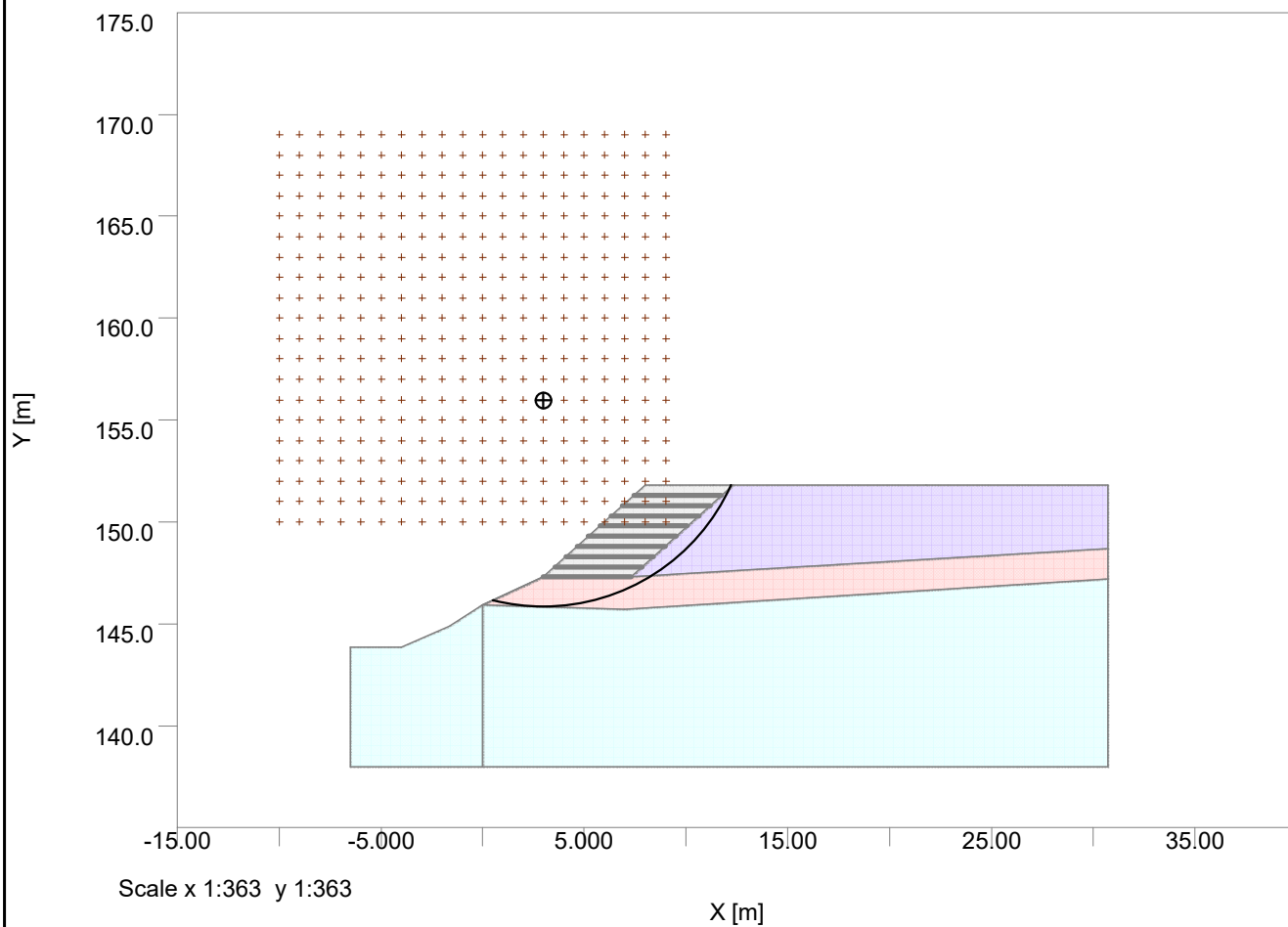
Oasys Hollingsworth Gate, Littleborough Section A						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date 08 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]			
0.0	162.00	16.832	663.15	0.97340	4427.2	4309.4	0.0		
0.0	163.00	17.712	659.93	0.98393	4558.9	4485.6	0.0		
0.0	164.00	18.605	658.65	0.99724	4695.1	4682.1	0.0		
0.0	165.00	19.507	659.09	1.0136	4835.9	4901.8	0.0		
0.0	166.00	20.419	660.91	1.0348	4979.8	5152.8	0.0		
0.0	167.00	21.338	664.10	1.0576	5127.4	5422.9	0.0		
0.0	168.00	22.265	667.89	1.0836	5277.4	5718.4	0.0		
0.0	169.00	23.198	672.37	1.1107	5429.1	6030.0	0.0		
1.0000	150.00	7.6896	Centre embedded/below end of slip						
1.0000	151.00	8.0951	Centre embedded/below end of slip						
1.0000	152.00	8.5983	843.13	1.1661	2662.2	3092.7	11.503		
1.0000	153.00	9.1831	779.38	1.0921	2772.6	3010.4	17.550		
1.0000	154.00	9.8351	731.75	1.0410	2882.9	2983.1	17.940		
1.0000	155.00	10.542	696.76	1.0147	2988.1	3015.8	16.380		
1.0000	156.00	11.293	672.14	0.99145	3112.4	3073.0	12.870		
1.0000	157.00	12.080	654.43	0.97875	3234.8	3163.3	2.7911		
1.0000	158.00	12.897	642.24	0.97360	3362.5	3273.8	0.0		
1.0000	159.00	13.738	634.68	0.97064	3497.8	3395.1	0.0		
1.0000	160.00	14.599	630.42	0.97324	3637.5	3540.2	0.0		
1.0000	161.00	15.477	628.96	0.98161	3781.5	3712.0	0.0		
1.0000	162.00	16.369	629.50	0.99478	3929.5	3909.0	0.0		
1.0000	163.00	17.272	631.71	1.0128	4080.2	4132.5	0.0		
1.0000	164.00	18.186	635.65	1.0354	4234.6	4384.5	0.0		
1.0000	165.00	19.108	640.34	1.0593	4390.9	4651.2	0.0		
1.0000	166.00	20.038	646.21	1.0937	4548.8	4975.1	0.0		
1.0000	167.00	20.975	652.91	1.1368	4709.2	5353.4	0.0		
1.0000	168.00	21.916	660.17	1.1797	4870.4	5745.4	0.0		
1.0000	169.00	22.863	668.01	1.2223	5033.0	6151.8	0.0		
2.0000	150.00	6.7624	Centre embedded/below end of slip						
2.0000	151.00	7.2201	Centre embedded/below end of slip						
2.0000	152.00	7.7801	694.94	1.1775	2026.3	2375.0	11.050		
2.0000	153.00	8.4220	656.62	1.1067	2163.7	2381.8	12.740		
2.0000	154.00	9.1285	629.60	1.0568	2298.4	2416.4	12.480		
2.0000	155.00	9.8858	611.74	1.0177	2438.3	2471.1	10.270		
2.0000	156.00	10.683	600.61	0.99087	2583.3	2555.7	4.0152		
2.0000	157.00	11.512	594.38	0.97508	2731.8	2663.8	0.0		
2.0000	158.00	12.366	592.20	0.96969	2884.8	2797.4	0.0		
2.0000	159.00	13.241	593.03	0.97269	3041.1	2958.0	0.0		
2.0000	160.00	14.133	596.28	0.97274	3199.9	3112.7	0.0		
2.0000	161.00	15.038	601.29	1.0014	3360.1	3364.9	0.0		
2.0000	162.00	15.954	607.83	1.0505	3522.6	3700.4	0.0		
2.0000	163.00	16.880	615.36	1.0998	3686.3	4054.4	0.0		
2.0000	164.00	17.814	623.73	1.1494	3851.3	4426.8	0.0		
2.0000	165.00	18.754	632.74	1.1991	4017.7	4817.5	0.0		
2.0000	166.00	19.701	642.29	1.2491	4185.3	5227.9	0.0		
2.0000	167.00	20.653	652.25	1.3002	4353.4	5660.5	0.0		
2.0000	168.00	21.609	662.45	1.3488	4522.5	6099.8	0.0		
2.0000	169.00	22.568	672.85	1.3814	4691.7	6481.2	0.0		
3.0000	150.00	5.8592	Centre embedded/below end of slip						
3.0000	151.00	6.3820	Centre embedded/below end of slip						
3.0000	152.00	7.0093	576.00	1.1702	1522.3	1770.4	11.050		
3.0000	153.00	7.7156	558.70	1.0848	1687.3	1817.5	12.740		
3.0000	154.00	8.4812	549.24	1.0200	1848.4	1876.9	8.5015		
3.0000	155.00	9.2914	546.13	0.96663	2011.2	1939.6	4.4740		
3.0000	156.00	10.136	547.60	0.89550	2174.9	1947.6	0.0		
3.0000	157.00	11.006	552.39	0.94758	2339.8	2217.1	0.0		
3.0000	158.00	11.897	559.48	1.0021	2506.9	2512.2	0.0		
3.0000	159.00	12.804	568.02	1.0597	2675.0	2834.7	0.0		
3.0000	160.00	13.723	578.00	1.1216	2844.1	3189.9	0.0		
3.0000	161.00	14.654	588.70	1.2166	3014.0	3667.0	0.0		
3.0000	162.00	15.593	600.17	1.2507	3184.6	3982.8	0.0		
3.0000	163.00	16.539	612.08	1.2855	3356.2	4314.4	0.0		
3.0000	164.00	17.491	624.06	1.3207	3527.8	4659.1	0.0		
3.0000	165.00	18.448	636.42	1.3565	3700.1	5019.2	0.0		
3.0000	166.00	19.410	648.88	1.3922	3873.2	5392.4	0.0		
3.0000	167.00	20.375	661.46	1.4281	4046.6	5778.9	0.0		
3.0000	168.00	21.343	674.00	1.4639	4219.8	6177.2	0.0		
3.0000	169.00	22.314	686.46	1.4993	4392.9	6586.6	0.0		
4.0000	150.00	4.9930	Centre embedded/below end of slip						
4.0000	151.00	5.5973	Centre embedded/below end of slip						
4.0000	152.00	6.3032	485.23	1.0373	1157.1	1192.7	7.5400		
4.0000	153.00	7.0803	487.83	0.91891	1333.2	1216.5	8.5800		
4.0000	154.00	7.9076	495.11	0.96959	1507.0	1457.7	3.5100		

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date 08 Jun 2023	Checked Date

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
4.0000	155.00	8.7710	505.33	1.0437	1679.8	1753.2
4.0000	156.00	9.6607	517.49	1.1609	1852.9	2151.0
4.0000	157.00	10.570	531.04	1.1892	2026.6	2410.0
4.0000	158.00	11.495	545.37	1.2221	2200.4	2689.2
4.0000	159.00	12.431	560.23	1.2579	2374.8	2987.1
4.0000	160.00	13.376	575.26	1.2953	2549.3	3302.0
4.0000	161.00	14.329	590.46	1.3337	2724.3	3633.5
4.0000	162.00	15.288	605.48	1.3725	2899.3	3979.1
4.0000	163.00	16.252	620.66	1.4117	3074.8	4340.8
4.0000	164.00	17.220	635.66	1.4511	3250.0	4715.9
4.0000	165.00	18.191	650.59	1.4902	3425.5	5104.9
4.0000	166.00	19.166	665.36	1.5290	3601.4	5506.6
4.0000	167.00	20.143	680.02	1.5676	3777.4	5921.3
4.0000	168.00	21.122	694.43	1.6056	3953.2	6347.2
4.0000	169.00	22.103	708.69	1.6432	4129.3	6785.1
5.0000	150.00	4.1869	Centre embedded/below end of slip			
5.0000	151.00	4.8918	Centre embedded/below end of slip			
5.0000	152.00	5.6859	428.47	1.2465	881.78	1094.4
5.0000	153.00	6.5368	448.35	1.2253	1062.7	1299.2
5.0000	154.00	7.4250	468.30	1.2333	1239.2	1528.2
5.0000	155.00	8.3385	488.59	1.2583	1415.6	1781.2
5.0000	156.00	9.2698	508.94	1.2908	1592.8	2056.0
5.0000	157.00	10.214	528.88	1.3280	1769.4	2349.7
5.0000	158.00	11.168	548.48	1.3674	1946.4	2661.5
5.0000	159.00	12.130	567.78	1.4088	2123.2	2991.1
5.0000	160.00	13.097	586.64	1.4510	2299.7	3336.8
5.0000	161.00	14.069	605.11	1.4930	2476.8	3697.8
5.0000	162.00	15.044	623.22	1.5354	2653.6	4074.2
5.0000	163.00	16.023	640.90	1.5772	2830.5	4464.4
5.0000	164.00	17.004	658.32	1.6189	3007.7	4869.2
5.0000	165.00	17.987	675.23	1.6602	3184.2	5286.2
5.0000	166.00	18.972	691.85	1.7008	3361.0	5716.5
5.0000	167.00	19.958	708.22	1.7409	3538.3	6159.6
5.0000	168.00	20.946	724.18	1.7802	3715.3	6614.1
5.0000	169.00	21.935	739.87	1.8189	3892.6	7080.3
6.0000	150.00	3.4828	Centre embedded/below end of slip			
6.0000	151.00	4.3046	Centre embedded/below end of slip			
6.0000	152.00	5.1894	405.04	1.4556	667.88	963.57
6.0000	153.00	6.1098	436.51	1.4347	845.74	1206.0
6.0000	154.00	7.0519	465.71	1.4472	1022.7	1471.3
6.0000	155.00	8.0081	493.10	1.4742	1199.3	1758.0
6.0000	156.00	8.9739	519.07	1.5086	1376.2	2064.8
6.0000	157.00	9.9464	543.78	1.5472	1553.0	2390.3
6.0000	158.00	10.924	567.37	1.5881	1729.9	2733.3
6.0000	159.00	11.905	590.07	1.6302	1907.0	3093.4
6.0000	160.00	12.889	611.88	1.6726	2084.0	3469.3
6.0000	161.00	13.876	632.90	1.7152	2261.0	3860.3
6.0000	162.00	14.864	653.25	1.7575	2438.2	4266.0
6.0000	163.00	15.853	672.97	1.7997	2615.1	4686.0
6.0000	164.00	16.844	692.09	1.8414	2792.0	5119.5
6.0000	165.00	17.836	710.67	1.8824	2969.3	5566.3
6.0000	166.00	18.829	728.78	1.9231	3146.1	6026.1
6.0000	167.00	19.822	746.45	1.9630	3323.4	6498.1
6.0000	168.00	20.817	763.62	2.0022	3500.6	6981.9
6.0000	169.00	21.811	780.44	2.0413	3677.0	7477.7
7.0000	150.00	2.9547	Centre embedded/below end of slip			
7.0000	151.00	3.8897	Centre embedded/below end of slip			
7.0000	152.00	4.8508	407.27	1.8636	506.09	931.59
7.0000	153.00	5.8249	447.81	1.8068	677.29	1209.5
7.0000	154.00	6.8066	483.74	1.7965	849.07	1508.6
7.0000	155.00	7.7929	516.62	1.8069	1022.7	1828.7
7.0000	156.00	8.7824	546.87	1.8296	1196.8	2167.7
7.0000	157.00	9.7739	575.18	1.8595	1371.3	2525.4
7.0000	158.00	10.767	601.77	1.8847	1546.2	2900.2
7.0000	159.00	11.761	626.93	1.9215	1720.9	3291.4
7.0000	160.00	12.757	650.94	1.9588	1896.6	3698.5
7.0000	161.00	13.752	673.90	1.9975	2072.0	4120.9
7.0000	162.00	14.749	695.97	2.0363	2247.8	4558.2
7.0000	163.00	15.746	717.16	2.0750	2423.8	5008.9
7.0000	164.00	16.743	737.66	2.1142	2599.3	5473.7
7.0000	165.00	17.741	757.45	2.1523	2775.6	5951.2
7.0000	166.00	18.738	776.66	2.1903	2952.0	6441.7
7.0000	167.00	19.737	795.38	2.2285	3128.1	6945.3

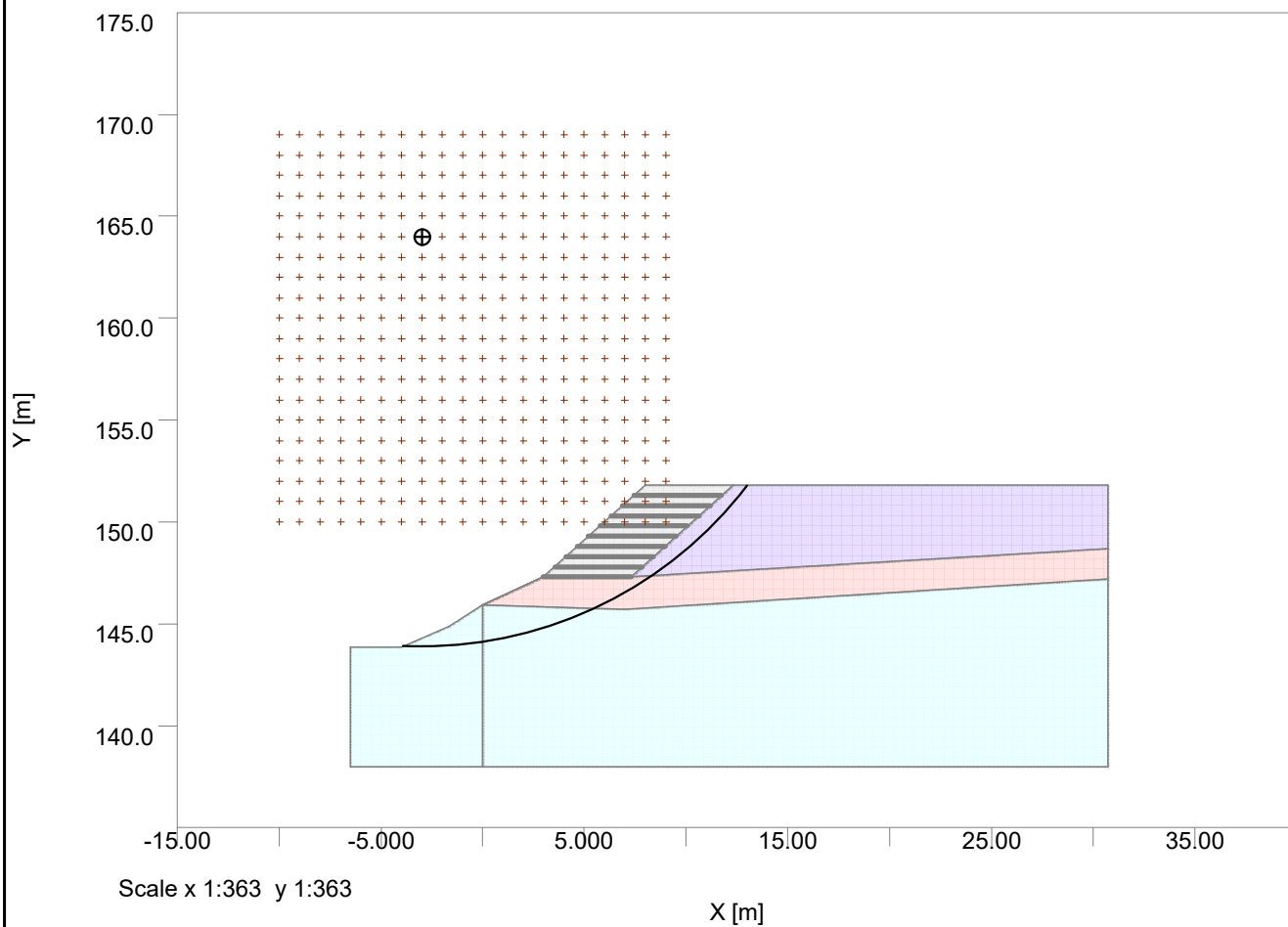
 Hollingsworth Gate, Littleborough Section A						Job No.	Sheet No.	Rev.
						GRO-23131		
						Drg. Ref.		
						Made by JD	Date 08 Jun 2023	Checked Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
7.0000	168.00	20.735	813.59	2.2656	3304.9	7460.8	26.910	
7.0000	169.00	21.733	831.24	2.3027	3480.9	7987.5	28.210	
8.0000	150.00	2.7074		Centre embedded/below end of slip				
8.0000	151.00	3.7054		Centre embedded/below end of slip				
8.0000	152.00	4.7043	436.98	2.6133	385.45	997.04	10.270	
8.0000	153.00	5.7035	483.68	2.4193	547.23	1311.1	12.870	
8.0000	154.00	6.7030	524.34	2.3307	712.52	1645.2	15.470	
8.0000	155.00	7.7026	560.58	2.2938	879.29	1998.8	18.070	
8.0000	156.00	8.7023	593.63	2.2728	1048.0	2371.3	10.660	
8.0000	157.00	9.7021	624.18	2.2774	1218.0	2761.9	11.960	
8.0000	158.00	10.702	652.68	2.2918	1388.8	3169.6	13.260	
8.0000	159.00	11.702	679.61	2.3123	1560.7	3594.3	14.560	
8.0000	160.00	12.702	705.08	2.3373	1733.0	4034.7	15.860	
8.0000	161.00	13.701	729.33	2.3651	1905.8	4490.2	17.160	
8.0000	162.00	14.701	752.51	2.3946	2079.3	4960.5	18.460	
8.0000	163.00	15.701	774.71	2.4250	2253.2	5444.2	19.760	
8.0000	164.00	16.701	796.11	2.4572	2426.8	5942.1	21.060	
8.0000	165.00	17.701	816.74	2.4892	2601.3	6452.9	22.360	
8.0000	166.00	18.701	836.67	2.5220	2775.5	6976.2	23.660	
8.0000	167.00	19.701	856.12	2.5547	2950.8	7513.3	24.960	
8.0000	168.00	20.701	874.92	2.5790	3125.8	8061.5	0.0	
8.0000	169.00	21.701	893.19	2.6119	3301.0	8621.8	0.0	
9.0000	150.00	2.8160		Centre embedded/below end of slip				
9.0000	151.00	3.7855		Centre embedded/below end of slip				
9.0000	152.00	4.7676	499.18	4.0351	296.68	1182.7	14.430	
9.0000	153.00	5.7559	548.01	3.4659	447.41	1532.4	18.330	
9.0000	154.00	6.7476	590.30	3.1876	603.36	1901.1	22.230	
9.0000	155.00	7.7414	627.83	3.0247	762.64	2288.7	18.070	
9.0000	156.00	8.7367	661.87	2.9374	924.53	2695.0	20.670	
9.0000	157.00	9.7329	693.35	2.8867	1088.9	3120.0	23.270	
9.0000	158.00	10.730	722.67	2.8605	1254.5	3562.5	25.870	
9.0000	159.00	11.727	750.20	2.8482	1421.9	4021.4	28.470	
9.0000	160.00	12.725	776.23	2.8373	1590.3	4496.2	15.860	
9.0000	161.00	13.723	801.03	2.8431	1760.0	4986.7	17.160	
9.0000	162.00	14.722	824.66	2.8547	1930.1	5491.5	18.460	
9.0000	163.00	15.720	847.29	2.8698	2101.2	6010.3	19.760	
9.0000	164.00	16.719	869.16	2.8883	2272.9	6543.5	21.060	
9.0000	165.00	17.718	890.15	2.9088	2445.0	7089.4	22.360	
9.0000	166.00	18.717	910.45	2.9312	2617.4	7648.4	23.660	
9.0000	167.00	19.716	930.10	2.9558	2789.4	8219.8	24.960	
9.0000	168.00	20.715	949.17	2.9800	2963.0	8803.3	26.260	
9.0000	169.00	21.715	967.74	3.0055	3136.5	9399.2	27.560	

Circle plotted: centre at 3.00,156.00, Over-Design Factor 1.279



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Circle plotted: centre at -3.00,164.00, Over-Design Factor 1.001



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Method Partial Factors

```

BS EN 1997-1:2011 DA1-2
Factor on FAVOURABLE PERMANENT LOAD: 1.00000
Factor on UNFAVOURABLE PERMANENT LOAD: 1.00000
Factor on FAVOURABLE VARIABLE LOAD: 0.00000
Factor on UNFAVOURABLE VARIABLE LOAD: 1.30000
Factor on UNIT WEIGHT: 1.00000
Factor on DRAINED COHESION: 1.25000
Factor on UNDRAINED COHESION: 1.40000
Factor on TAN PHI': 1.25000
Factor on REINFORCEMENT PULLOUT: 1.50000
Factor on ECONOMIC FAILURE: 1.00000
Factor on SLIDING ALONG REINFORCEMENT: 1.50000

```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters	Phi or c
		Above GWL	Below GWL		
	or c0'				
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	25.000	25.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	20.000	Drained	29.000
0.0	3 Backfill made Ground	17.500	20.000	Drained	29.000
0.0	4 Engineerd Fill	20.000	22.000	Drained	34.000
0.0	5 Weathered SANDSTONE	21.000	23.000	Drained	42.000

Reinforcement

Geotextile Reinforcement 1						
Layers	Level of top layer	Vertical Spacing	Length		Offset from surface	Angle from horizon
	[m]	[m]	Top [m]	Btm [m]	[m]	[°]
9	151.30	0.50000	4.3000	4.3000	0.0	0

Bond Length	Bond Strength [kN/m]	Prestress [kN]	Grout Diameter [mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
Bottom left of grid: $x = -10.00000$ m $y = 150.00000$ m

Inclination of grid: 0.00000 deg
(positive anticlockwise direction about bottom left of grid)
Centres on grid: 20 in x direction at 1.00000m spacing
20 in y direction at 1.00000m spacing
Grid extended to find minimum FoS
All circles pass through common point at x = 8.20000 m, y = 147.30000 m

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-10.000	150.00	18.399		Only 1 intersection with ground level			
-10.000	151.00	18.572		Only 1 intersection with ground level			
-10.000	152.00	18.797		Only 1 intersection with ground level			
-10.000	153.00	19.072		Only 1 intersection with ground level			
-10.000	154.00	19.394		Only 1 intersection with ground level			
-10.000	155.00	19.762		Only 1 intersection with ground level			
-10.000	156.00	20.173		Only 1 intersection with ground level			
-10.000	157.00	20.624		Only 1 intersection with ground level			
-10.000	158.00	21.112		Only 1 intersection with ground level			
-10.000	159.00	21.636		Only 1 intersection with ground level			
-10.000	160.00	22.193		Only 1 intersection with ground level			
-10.000	161.00	22.780		Only 1 intersection with ground level			
-10.000	162.00	23.395		Only 1 intersection with ground level			
-10.000	163.00	24.036		Only 1 intersection with ground level			
-10.000	164.00	24.701		Only 1 intersection with ground level			
-10.000	165.00	25.388		Only 1 intersection with ground level			
-10.000	166.00	26.095		Only 1 intersection with ground level			
-10.000	167.00	26.820		Only 1 intersection with ground level			
-10.000	168.00	27.563		Only 1 intersection with ground level			
-10.000	169.00	28.322		Only 1 intersection with ground level			
-9.0000	150.00	17.411		Only 1 intersection with ground level			
-9.0000	151.00	17.593		Only 1 intersection with ground level			
-9.0000	152.00	17.831		Only 1 intersection with ground level			
-9.0000	153.00	18.120		Only 1 intersection with ground level			
-9.0000	154.00	18.459		Only 1 intersection with ground level			
-9.0000	155.00	18.845		Only 1 intersection with ground level			
-9.0000	156.00	19.275		Only 1 intersection with ground level			
-9.0000	157.00	19.747		Only 1 intersection with ground level			
-9.0000	158.00	20.257		Only 1 intersection with ground level			
-9.0000	159.00	20.802		Only 1 intersection with ground level			
-9.0000	160.00	21.381		Only 1 intersection with ground level			
-9.0000	161.00	21.989		Only 1 intersection with ground level			
-9.0000	162.00	22.626		Only 1 intersection with ground level			
-9.0000	163.00	23.288		Only 1 intersection with ground level			
-9.0000	164.00	23.974		Only 1 intersection with ground level			
-9.0000	165.00	24.681		Only 1 intersection with ground level			
-9.0000	166.00	25.407		Only 1 intersection with ground level			
-9.0000	167.00	26.152		Only 1 intersection with ground level			
-9.0000	168.00	26.913		Only 1 intersection with ground level			
-9.0000	169.00	27.690		Only 1 intersection with ground level			
-8.0000	150.00	16.423		Only 1 intersection with ground level			
-8.0000	151.00	16.617		Only 1 intersection with ground level			
-8.0000	152.00	16.868		Only 1 intersection with ground level			
-8.0000	153.00	17.174		Only 1 intersection with ground level			
-8.0000	154.00	17.531		Only 1 intersection with ground level			
-8.0000	155.00	17.937		Only 1 intersection with ground level			
-8.0000	156.00	18.388		Only 1 intersection with ground level			
-8.0000	157.00	18.882		Only 1 intersection with ground level			
-8.0000	158.00	19.415		Only 1 intersection with ground level			
-8.0000	159.00	19.983		Only 1 intersection with ground level			
-8.0000	160.00	20.585		Only 1 intersection with ground level			
-8.0000	161.00	21.216		Only 1 intersection with ground level			
-8.0000	162.00	21.875		Only 1 intersection with ground level			
-8.0000	163.00	22.559		Only 1 intersection with ground level			
-8.0000	164.00	23.267		Only 1 intersection with ground level			
-8.0000	165.00	23.994		Only 1 intersection with ground level			
-8.0000	166.00	24.741		Only 1 intersection with ground level			
-8.0000	167.00	25.505		Only 1 intersection with ground level			
-8.0000	168.00	26.286		Only 1 intersection with ground level			
-8.0000	169.00	27.080		Only 1 intersection with ground level			
-7.0000	150.00	15.438		Only 1 intersection with ground level			
-7.0000	151.00	15.644		Only 1 intersection with ground level			



Hollingsworth Gate, Littleborough
Section A

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Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-7.0000	152.00	15.910		Only 1 intersection with ground level			
-7.0000	153.00	16.234		Only 1 intersection with ground level			
-7.0000	154.00	16.611		Only 1 intersection with ground level			
-7.0000	155.00	17.039		Only 1 intersection with ground level			
-7.0000	156.00	17.514		Only 1 intersection with ground level			
-7.0000	157.00	18.031		Only 1 intersection with ground level			
-7.0000	158.00	18.588		Only 1 intersection with ground level			
-7.0000	159.00	19.182		Only 1 intersection with ground level			
-7.0000	160.00	19.807		Only 1 intersection with ground level			
-7.0000	161.00	20.463		Only 1 intersection with ground level			
-7.0000	162.00	21.145		Only 1 intersection with ground level			
-7.0000	163.00	21.852		Only 1 intersection with ground level			
-7.0000	164.00	22.582		Only 1 intersection with ground level			
-7.0000	165.00	23.331		Only 1 intersection with ground level			
-7.0000	166.00	24.098		Only 1 intersection with ground level			
-7.0000	167.00	24.882		Only 1 intersection with ground level			
-7.0000	168.00	25.681		Only 1 intersection with ground level			
-7.0000	169.00	26.494		Only 1 intersection with ground level			
-6.0000	150.00	14.454		Only 1 intersection with ground level			
-6.0000	151.00	14.674		Only 1 intersection with ground level			
-6.0000	152.00	14.958		Only 1 intersection with ground level			
-6.0000	153.00	15.301		Only 1 intersection with ground level			
-6.0000	154.00	15.701		Only 1 intersection with ground level			
-6.0000	155.00	16.153		Only 1 intersection with ground level			
-6.0000	156.00	16.653		Only 1 intersection with ground level			
-6.0000	157.00	17.197		Only 1 intersection with ground level			
-6.0000	158.00	17.780		Only 1 intersection with ground level			
-6.0000	159.00	18.399		Only 1 intersection with ground level			
-6.0000	160.00	19.051		Only 1 intersection with ground level			
-6.0000	161.00	19.731		Only 1 intersection with ground level			
-6.0000	162.00	20.438		Only 1 intersection with ground level			
-6.0000	163.00	21.169		Only 1 intersection with ground level			
-6.0000	164.00	21.921		Only 1 intersection with ground level			
-6.0000	165.00	22.692		Only 1 intersection with ground level			
-6.0000	166.00	23.480		Only 1 intersection with ground level			
-6.0000	167.00	24.284		Only 1 intersection with ground level			
-6.0000	168.00	25.102		Only 1 intersection with ground level			
-6.0000	169.00	25.933		Only 1 intersection with ground level			
-5.0000	150.00	13.473		Only 1 intersection with ground level			
-5.0000	151.00	13.709		Only 1 intersection with ground level			
-5.0000	152.00	14.012		Only 1 intersection with ground level			
-5.0000	152.00	14.012		Only 1 intersection with ground level			
-5.0000	153.00	14.378		Only 1 intersection with ground level			
-5.0000	154.00	14.803		Only 1 intersection with ground level			
-5.0000	155.00	15.282		Only 1 intersection with ground level			
-5.0000	156.00	15.809		Only 1 intersection with ground level			
-5.0000	157.00	16.381		Only 1 intersection with ground level			
-5.0000	158.00	16.992		Only 1 intersection with ground level			
-5.0000	159.00	17.639		Only 1 intersection with ground level			
-5.0000	160.00	18.317		Only 1 intersection with ground level			
-5.0000	161.00	19.024		Only 1 intersection with ground level			
-5.0000	162.00	19.757		Only 1 intersection with ground level			
-5.0000	163.00	20.512		Only 1 intersection with ground level			
-5.0000	164.00	21.287		Only 1 intersection with ground level			
-5.0000	165.00	22.080		Only 1 intersection with ground level			
-5.0000	166.00	22.890		Only 1 intersection with ground level			
-5.0000	167.00	23.713		Only 1 intersection with ground level			
-5.0000	168.00	24.551		Only 1 intersection with ground level			
-5.0000	169.00	25.399		Only 1 intersection with ground level			
-4.0000	150.00	12.495		Only 1 intersection with ground level			
-4.0000	151.00	12.749		Only 1 intersection with ground level			
-4.0000	152.00	13.074		Only 1 intersection with ground level			
-4.0000	153.00	13.466		Only 1 intersection with ground level			
-4.0000	154.00	13.919		Only 1 intersection with ground level			
-4.0000	155.00	14.427		Only 1 intersection with ground level			
-4.0000	156.00	14.984		Only 1 intersection with ground level			
-4.0000	157.00	15.586		Only 1 intersection with ground level			
-4.0000	158.00	16.227		Only 1 intersection with ground level			
-4.0000	159.00	16.904		Only 1 intersection with ground level			
-4.0000	160.00	17.611		Only 1 intersection with ground level			
-4.0000	161.00	18.345		Only 1 intersection with ground level			
-4.0000	162.00	19.103		Only 1 intersection with ground level			
-4.0000	163.00	19.883		Only 1 intersection with ground level			
-4.0000	164.00	20.682		Only 1 intersection with ground level			
-4.0000	165.00	21.497		Only 1 intersection with ground level			
-4.0000	166.00	22.328		Only 1 intersection with ground level			
-4.0000	167.00	23.172	817.35	1.0123	7609.9	7703.8	0.0

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Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-4.0000	168.00	24.028	799.61	1.0109	7741.9	7826.4
-4.0000	169.00	24.894	785.93	1.0204	7828.1	7987.6
-3.0000	150.00	11.521	Only 1	intersection with ground level		
-3.0000	151.00	11.795	Only 1	intersection with ground level		
-3.0000	152.00	12.146	Only 1	intersection with ground level		
-3.0000	153.00	12.567	Only 1	intersection with ground level		
-3.0000	154.00	13.051	Only 1	intersection with ground level		
-3.0000	155.00	13.592	Only 1	intersection with ground level		
-3.0000	156.00	14.182	Only 1	intersection with ground level		
-3.0000	157.00	14.817	Only 1	intersection with ground level		
-3.0000	158.00	15.490	Only 1	intersection with ground level		
-3.0000	159.00	16.197	Only 1	intersection with ground level		
-3.0000	160.00	16.933	Only 1	intersection with ground level		
-3.0000	161.00	17.695	Only 1	intersection with ground level		
-3.0000	162.00	18.481	Only 1	intersection with ground level		
-3.0000	163.00	19.285	836.58	1.0110	6552.2	6624.3
-3.0000	164.00	20.108	810.01	1.0010	6668.6	6675.1
-3.0000	165.00	20.946	790.25	1.0029	6756.8	6776.7
-3.0000	166.00	21.797	774.25	1.0260	6815.7	6993.0
-3.0000	167.00	22.661	761.49	1.0251	6933.2	7107.1
-3.0000	168.00	23.536	751.57	1.0443	7021.5	7332.5
-3.0000	169.00	24.420	744.06	1.0640	7117.4	7572.7
-2.0000	150.00	10.551	Only 1	intersection with ground level		
-2.0000	151.00	10.850	Only 1	intersection with ground level		
-2.0000	152.00	11.231	Only 1	intersection with ground level		
-2.0000	153.00	11.685	Only 1	intersection with ground level		
-2.0000	154.00	12.204	Only 1	intersection with ground level		
-2.0000	155.00	12.780	Only 1	intersection with ground level		
-2.0000	156.00	13.406	Only 1	intersection with ground level		
-2.0000	157.00	14.076	Only 1	intersection with ground level		
-2.0000	158.00	14.783	929.78	1.0739	5422.5	5803.1
-2.0000	159.00	15.522	876.80	1.0401	5492.8	5702.5
-2.0000	160.00	16.289	836.09	1.0245	5562.3	5698.6
-2.0000	161.00	17.080	805.80	1.0014	5687.7	5695.4
-2.0000	162.00	17.892	781.59	1.0085	5760.9	5809.9
-2.0000	163.00	18.722	762.42	1.0127	5854.3	5928.7
-2.0000	164.00	19.569	747.30	1.0276	5940.9	6104.9
-2.0000	165.00	20.429	735.69	1.0394	6044.0	6282.3
-2.0000	166.00	21.301	727.05	1.0607	6140.1	6513.0
-2.0000	167.00	22.184	720.79	1.0757	6255.5	6728.8
-2.0000	168.00	23.077	716.70	1.0917	6378.8	6963.7
-2.0000	169.00	23.978	714.16	1.1129	6495.1	7228.4
-1.0000	150.00	9.5880	Only 1	intersection with ground level		
-1.0000	151.00	9.9161	Only 1	intersection with ground level		
-1.0000	152.00	10.331	Only 1	intersection with ground level		
-1.0000	153.00	10.823	Only 1	intersection with ground level		
-1.0000	154.00	11.381	1048.2	1.2184	4354.1	5280.9
-1.0000	155.00	11.997	962.98	1.1404	4431.0	5030.1
-1.0000	156.00	12.662	896.26	1.0956	4500.3	4905.2
-1.0000	157.00	13.369	845.78	1.0444	4618.4	4801.1
-1.0000	158.00	14.111	806.43	1.0321	4691.7	4829.3
-1.0000	159.00	14.884	775.45	1.0211	4781.2	4881.6
-1.0000	160.00	15.682	751.15	1.0187	4877.2	4968.5
-1.0000	161.00	16.502	732.55	1.0282	4970.6	5111.0
-1.0000	162.00	17.342	718.49	1.0363	5078.3	5262.8
-1.0000	163.00	18.197	708.15	1.0538	5181.8	5460.7
-1.0000	164.00	19.066	700.93	1.0668	5303.4	5657.7
-1.0000	165.00	19.948	696.00	1.0855	5420.9	5884.6
-1.0000	166.00	20.841	693.16	1.1054	5544.2	6128.5
-1.0000	167.00	21.742	691.92	1.1238	5672.2	6374.2
-1.0000	168.00	22.652	692.07	1.1427	5804.4	6632.7
-1.0000	169.00	23.570	693.37	1.1631	5941.1	6910.0
0.0	150.00	8.6331	Centre embedded/below end of slip			
0.0	151.00	8.9961	Centre embedded/below end of slip			
0.0	152.00	9.4515	1039.2	1.3086	3434.1	4478.5
0.0	153.00	9.9865	944.82	1.2307	3497.6	4287.1
0.0	154.00	10.589	873.22	1.1357	3620.7	4089.7
0.0	155.00	11.249	817.69	1.0935	3708.9	4032.5
0.0	156.00	11.955	775.14	1.0720	3796.4	4049.3
0.0	157.00	12.702	742.64	1.0555	3897.1	4098.9
0.0	158.00	13.481	718.16	1.0461	4003.5	4186.4
0.0	159.00	14.287	700.11	1.0530	4107.3	4324.8
0.0	160.00	15.117	687.12	1.0571	4228.3	4469.8
0.0	161.00	15.967	678.08	1.0691	4347.7	4648.2

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						Made by JD	Date 08 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]			
0.0	162.00	16.832	672.01	1.0832	4472.1	4844.2	0.0		
0.0	163.00	17.712	668.65	1.0962	4603.0	5045.7	0.0		
0.0	164.00	18.605	667.21	1.1115	4738.0	5266.1	0.0		
0.0	165.00	19.507	667.44	1.1293	4877.3	5508.1	0.0		
0.0	166.00	20.419	669.04	1.1501	5019.6	5772.8	0.0		
0.0	167.00	21.338	671.85	1.1730	5166.0	6059.6	0.0		
0.0	168.00	22.265	675.53	1.1973	5315.0	6363.5	0.0		
0.0	169.00	23.198	680.08	1.2228	5466.2	6684.2	0.0		
1.0000	150.00	7.6896	Centre embedded/below end of slip						
1.0000	151.00	8.0951	Centre embedded/below end of slip						
1.0000	152.00	8.5983	854.34	1.2583	2713.9	3403.9	11.050		
1.0000	153.00	9.1831	789.77	1.1854	2817.9	3322.6	17.550		
1.0000	154.00	9.8351	741.67	1.1368	2925.6	3307.7	17.940		
1.0000	155.00	10.542	706.77	1.1145	3031.2	3361.8	16.380		
1.0000	156.00	11.293	681.72	1.0948	3152.7	3438.7	12.870		
1.0000	157.00	12.080	663.76	1.0867	3273.6	3554.7	2.8999		
1.0000	158.00	12.897	651.47	1.0858	3400.8	3692.6	0.0		
1.0000	159.00	13.738	643.70	1.0865	3534.8	3840.4	0.0		
1.0000	160.00	14.599	639.30	1.0920	3673.8	4011.8	0.0		
1.0000	161.00	15.477	637.65	1.1027	3816.7	4208.6	0.0		
1.0000	162.00	16.369	637.97	1.1171	3963.3	4427.5	0.0		
1.0000	163.00	17.272	640.08	1.1357	4113.5	4671.8	0.0		
1.0000	164.00	18.186	643.59	1.1580	4266.4	4940.5	0.0		
1.0000	165.00	19.108	648.25	1.1813	4421.5	5223.3	0.0		
1.0000	166.00	20.038	653.89	1.2109	4578.9	5544.7	0.0		
1.0000	167.00	20.975	660.37	1.2460	4737.9	5903.7	0.0		
1.0000	168.00	21.916	667.40	1.2812	4897.7	6274.9	0.0		
1.0000	169.00	22.863	675.02	1.3161	5059.7	6659.2	0.0		
2.0000	150.00	6.7624	Centre embedded/below end of slip						
2.0000	151.00	7.2201	Centre embedded/below end of slip						
2.0000	152.00	7.7801	706.35	1.2796	2068.8	2636.3	11.050		
2.0000	153.00	8.4220	666.45	1.2145	2196.8	2655.2	12.740		
2.0000	154.00	9.1285	639.22	1.1695	2330.3	2712.7	12.480		
2.0000	155.00	9.8858	621.22	1.1357	2469.7	2794.6	10.270		
2.0000	156.00	10.683	609.85	1.1140	2613.1	2907.0	3.8522		
2.0000	157.00	11.512	603.54	1.1041	2760.3	3047.8	0.0		
2.0000	158.00	12.366	601.07	1.1030	2912.1	3212.0	0.0		
2.0000	159.00	13.241	601.65	1.1086	3067.1	3400.1	0.0		
2.0000	160.00	14.133	604.62	1.1147	3225.1	3595.0	0.0		
2.0000	161.00	15.038	609.42	1.1392	3384.0	3854.9	0.0		
2.0000	162.00	15.954	615.69	1.1759	3545.2	4168.7	0.0		
2.0000	163.00	16.880	622.98	1.2130	3708.2	4498.0	0.0		
2.0000	164.00	17.814	631.04	1.2506	3872.2	4842.5	0.0		
2.0000	165.00	18.754	639.82	1.2883	4037.7	5201.7	0.0		
2.0000	166.00	19.701	649.05	1.3259	4204.2	5574.4	0.0		
2.0000	167.00	20.653	658.67	1.3633	4371.6	5959.9	0.0		
2.0000	168.00	21.609	668.59	1.4005	4539.9	6357.9	0.0		
2.0000	169.00	22.568	678.73	1.4375	4708.2	6768.1	0.0		
3.0000	150.00	5.8592	Centre embedded/below end of slip						
3.0000	151.00	6.3820	Centre embedded/below end of slip						
3.0000	152.00	7.0093	586.81	1.2953	1550.7	1997.6	11.050		
3.0000	153.00	7.7156	568.49	1.2182	1710.1	2070.6	12.696		
3.0000	154.00	8.4812	558.68	1.1643	1870.0	2169.4	7.7865		
3.0000	155.00	9.2914	555.04	1.1255	2030.2	2280.5	4.4716		
3.0000	156.00	10.136	556.31	1.0797	2193.1	2367.8	0.0		
3.0000	157.00	11.006	560.79	1.1110	2357.0	2618.6	0.0		
3.0000	158.00	11.897	567.56	1.1459	2522.9	2891.1	0.0		
3.0000	159.00	12.804	575.92	1.1831	2690.3	3182.9	0.0		
3.0000	160.00	13.723	585.42	1.2219	2858.4	3492.6	0.0		
3.0000	161.00	14.654	595.76	1.2616	3027.3	3819.3	0.0		
3.0000	162.00	15.593	606.76	1.3019	3197.0	4162.2	0.0		
3.0000	163.00	16.539	618.24	1.3422	3367.9	4520.2	0.0		
3.0000	164.00	17.491	629.97	1.3825	3538.8	4892.5	0.0		
3.0000	165.00	18.448	641.99	1.4228	3710.5	5279.2	0.0		
3.0000	166.00	19.410	654.13	1.4624	3883.1	5678.5	0.0		
3.0000	167.00	20.375	666.44	1.5019	4056.0	6091.6	0.0		
3.0000	168.00	21.343	678.72	1.5410	4228.8	6516.6	0.0		
3.0000	169.00	22.314	690.98	1.5797	4401.5	6953.3	0.0		
4.0000	150.00	4.9930	Centre embedded/below end of slip						
4.0000	151.00	5.5973	Centre embedded/below end of slip						
4.0000	152.00	6.3032	495.10	1.2479	1172.3	1455.5	7.5400		
4.0000	153.00	7.0803	497.16	1.1461	1345.2	1533.2	8.5800		
4.0000	154.00	7.9076	503.84	1.1546	1516.7	1747.7	3.5100		

Oasys Hollingsworth Gate, Littleborough Section A						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date 08 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]			
4.0000	155.00	8.7710	513.46	1.1779	1688.2	1988.5	0.0		
4.0000	156.00	9.6607	525.11	1.2107	1860.6	2252.7	0.0		
4.0000	157.00	10.570	538.03	1.2482	2033.4	2538.2	0.0		
4.0000	158.00	11.495	551.75	1.2885	2206.6	2843.1	0.0		
4.0000	159.00	12.431	566.06	1.3300	2380.5	3166.1	0.0		
4.0000	160.00	13.376	580.64	1.3724	2554.6	3506.0	0.0		
4.0000	161.00	14.329	595.46	1.4151	2729.3	3862.2	0.0		
4.0000	162.00	15.288	610.25	1.4580	2903.8	4233.6	0.0		
4.0000	163.00	16.252	625.11	1.5004	3079.1	4619.9	0.0		
4.0000	164.00	17.220	639.85	1.5428	3254.0	5020.4	0.0		
4.0000	165.00	18.191	654.52	1.5847	3429.4	5434.8	0.0		
4.0000	166.00	19.166	669.08	1.6261	3605.1	5862.5	0.0		
4.0000	167.00	20.143	683.55	1.6672	3780.9	6303.5	0.0		
4.0000	168.00	21.122	697.80	1.7076	3956.7	6756.4	0.0		
4.0000	169.00	22.103	711.93	1.7475	4132.5	7221.8	0.0		
5.0000	150.00	4.1869	Centre embedded/below end of slip						
5.0000	151.00	4.8918	Centre embedded/below end of slip						
5.0000	152.00	5.6859	436.82	1.3210	885.88	1165.6	4.6800		
5.0000	153.00	6.5368	454.96	1.3125	1063.8	1393.2	3.0376		
5.0000	154.00	7.4250	474.09	1.3274	1240.3	1646.4	0.0		
5.0000	155.00	8.3385	493.71	1.3575	1416.8	1923.3	0.0		
5.0000	156.00	9.2698	513.46	1.3939	1593.9	2221.8	0.0		
5.0000	157.00	10.214	532.99	1.4346	1770.4	2539.8	0.0		
5.0000	158.00	11.168	552.29	1.4771	1947.2	2876.2	0.0		
5.0000	159.00	12.130	571.24	1.5208	2123.9	3230.0	0.0		
5.0000	160.00	13.097	589.81	1.5650	2300.5	3600.2	0.0		
5.0000	161.00	14.069	608.11	1.6091	2477.4	3986.6	0.0		
5.0000	162.00	15.044	626.01	1.6532	2654.2	4388.0	0.0		
5.0000	163.00	16.023	643.52	1.6968	2831.2	4803.8	0.0		
5.0000	164.00	17.004	660.77	1.7400	3008.4	5234.7	0.0		
5.0000	165.00	17.987	677.55	1.7829	3184.9	5678.3	0.0		
5.0000	166.00	18.972	694.05	1.8253	3361.7	6136.0	0.0		
5.0000	167.00	19.958	710.31	1.8670	3539.0	6607.2	0.0		
5.0000	168.00	20.946	726.21	1.9082	3715.9	7090.7	0.0		
5.0000	169.00	21.935	741.81	1.9487	3893.2	7586.5	0.0		
6.0000	150.00	3.4828	Centre embedded/below end of slip						
6.0000	151.00	4.3046	Centre embedded/below end of slip						
6.0000	152.00	5.1894	407.86	1.6132	667.35	1068.0	8.5800		
6.0000	153.00	6.1098	438.96	1.5854	845.80	1333.5	7.4100		
6.0000	154.00	7.0519	467.81	1.5943	1022.8	1622.0	8.7100		
6.0000	155.00	8.0081	494.97	1.6194	1199.5	1932.5	10.010		
6.0000	156.00	8.9739	520.72	1.6527	1376.4	2263.4	11.310		
6.0000	157.00	9.9464	545.27	1.6912	1553.0	2613.9	12.610		
6.0000	158.00	10.924	568.73	1.7317	1730.1	2982.2	13.910		
6.0000	159.00	11.905	591.31	1.7740	1907.3	3368.3	15.210		
6.0000	160.00	12.889	613.07	1.8172	2084.3	3771.1	16.510		
6.0000	161.00	13.876	634.02	1.8604	2261.5	4189.5	17.810		
6.0000	162.00	14.864	654.30	1.9037	2438.6	4623.3	19.110		
6.0000	163.00	15.853	673.90	1.9473	2615.2	5072.1	20.410		
6.0000	164.00	16.844	692.99	1.9902	2792.3	5535.6	21.710		
6.0000	165.00	17.836	711.56	2.0326	2969.7	6013.1	23.010		
6.0000	166.00	18.829	729.61	2.0747	3146.8	6504.5	24.310		
6.0000	167.00	19.822	747.27	2.1166	3324.1	7010.0	25.610		
6.0000	168.00	20.817	764.42	2.1579	3501.0	7527.7	26.910		
6.0000	169.00	21.811	781.19	2.1990	3677.6	8058.7	28.210		
7.0000	150.00	2.9547	Centre embedded/below end of slip						
7.0000	151.00	3.8897	Centre embedded/below end of slip						
7.0000	152.00	4.8508	407.79	2.0290	505.98	1015.0	11.570		
7.0000	153.00	5.8249	448.29	1.9583	677.43	1312.4	14.170		
7.0000	154.00	6.8066	484.16	1.9411	849.34	1631.9	16.770		
7.0000	155.00	7.7929	517.00	1.9478	1023.1	1973.4	19.370		
7.0000	156.00	8.7824	547.20	1.9695	1196.8	2335.2	21.970		
7.0000	157.00	9.7739	575.47	1.9989	1371.4	2716.7	24.570		
7.0000	158.00	10.767	602.08	2.0246	1546.3	3116.8	13.910		
7.0000	159.00	11.761	627.22	2.0620	1721.4	3534.4	15.210		
7.0000	160.00	12.757	651.22	2.1014	1896.9	3969.6	16.510		
7.0000	161.00	13.752	674.17	2.1420	2072.3	4421.0	17.810		
7.0000	162.00	14.749	696.27	2.1830	2248.4	4889.0	19.110		
7.0000	163.00	15.746	717.44	2.2243	2424.2	5371.8	20.410		
7.0000	164.00	16.743	737.92	2.2665	2599.5	5870.2	21.710		
7.0000	165.00	17.741	757.73	2.3077	2775.9	6383.0	23.010		
7.0000	166.00	18.738	776.92	2.3490	2952.1	6910.1	24.310		
7.0000	167.00	19.737	795.65	2.3904	3128.3	7452.2	25.610		

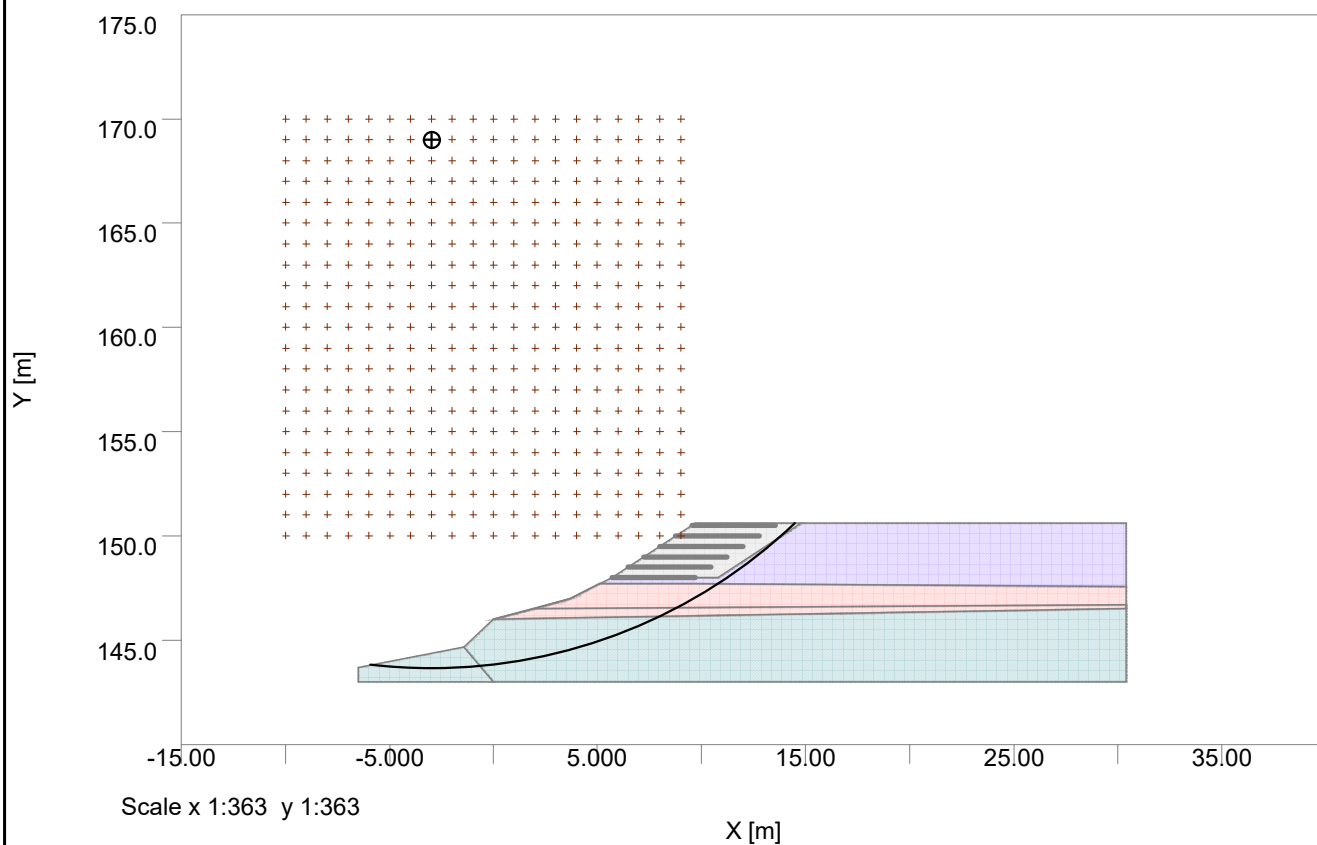
Job No.	Sheet No.	Rev.
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Drg. Ref.		
Made by JD	Date 08 Jun 2023	Checked Date

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]		[kNm/m]	[kNm/m]	[kNm/m]
7.0000	168.00	20.735	813.83	2.4309	3305.1	8007.4
7.0000	169.00	21.733	831.50	2.4714	3481.4	8575.8
8.0000	150.00	2.7074	Centre embedded/below end of slip			
8.0000	151.00	3.7054	Centre embedded/below end of slip			
8.0000	152.00	4.7043	437.14	2.7471	385.54	1048.8
8.0000	153.00	5.7035	483.81	2.5463	547.21	1380.5
8.0000	154.00	6.7030	524.49	2.4556	712.57	1734.3
8.0000	155.00	7.7026	560.76	2.4186	879.65	2109.4
8.0000	156.00	8.7023	593.83	2.3996	1048.5	2505.3
8.0000	157.00	9.7021	624.33	2.4082	1218.0	2921.1
8.0000	158.00	10.702	652.91	2.4257	1389.1	3356.2
8.0000	159.00	11.702	679.83	2.4500	1560.9	3809.7
8.0000	160.00	12.702	705.29	2.4790	1733.2	4280.7
8.0000	161.00	13.701	729.58	2.5107	1906.2	4768.8
8.0000	162.00	14.701	752.73	2.5444	2079.5	5272.6
8.0000	163.00	15.701	774.91	2.5796	2253.0	5792.2
8.0000	164.00	16.701	796.47	2.6156	2427.6	6328.6
8.0000	165.00	17.701	817.10	2.6523	2601.8	6878.4
8.0000	166.00	18.701	837.04	2.6894	2776.2	7442.7
8.0000	167.00	19.701	856.48	2.7263	2951.6	8021.9
8.0000	168.00	20.701	875.32	2.7553	3126.6	8614.8
8.0000	169.00	21.701	893.62	2.7927	3301.8	9221.0
9.0000	150.00	2.8160	Centre embedded/below end of slip			
9.0000	151.00	3.7855	Centre embedded/below end of slip			
9.0000	152.00	4.7676	499.75	4.3460	296.87	1275.7
9.0000	153.00	5.7559	548.60	3.7306	447.55	1651.3
9.0000	154.00	6.7476	590.95	3.4289	603.80	2048.1
9.0000	155.00	7.7414	628.50	3.2558	763.01	2466.2
9.0000	156.00	8.7367	662.54	3.1628	925.01	2904.9
9.0000	157.00	9.7329	694.03	3.1101	1089.3	3364.5
9.0000	158.00	10.730	723.38	3.0829	1255.1	3843.6
9.0000	159.00	11.727	750.95	3.0714	1422.6	4341.0
9.0000	160.00	12.725	777.01	3.0621	1591.1	4856.3
9.0000	161.00	13.723	801.80	3.0702	1760.8	5388.7
9.0000	162.00	14.722	825.45	3.0841	1931.2	5937.6
9.0000	163.00	15.720	848.13	3.1022	2102.4	6502.3
9.0000	164.00	16.719	870.01	3.1240	2274.0	7082.9
9.0000	165.00	17.718	891.05	3.1481	2446.1	7678.4
9.0000	166.00	18.717	911.42	3.1742	2618.7	8288.6
9.0000	167.00	19.716	931.11	3.2012	2792.0	8912.9
9.0000	168.00	20.715	950.20	3.2306	2964.5	9550.8
9.0000	169.00	21.715	968.85	3.2599	3138.3	10203.



APPENDIX 3 - Section B Modelling Outputs

Circle plotted: centre at -3.00,169.00, Over-Design Factor 1.660



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters Condition	Phi or c
		Above GWL	Below GWL		
or c0'					
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	25.000	25.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	20.000	Drained	29.000
0.0	3 Backfilled Made Ground	17.500	20.000	Drained	29.000
0.0	4 SAND	20.000	22.000	Drained	34.000
0.0	5 Firm CLAY	20.000	22.000	Drained	24.000
0.0	6 Soft CLAY	20.000	22.000	Drained	24.000
0.0	7 Weathered Sandstone	21.000	23.000	Drained	42.000

Reinforcement

Layers	Level of top layer	Vertical Spacing [m]	Length Top [m]	Length Btm [m]	Offset from surface [m]	Angle from horizon [°]
6	150.50	0.50000	4.0000	4.0000	0.0	0

Bond Length	Bond Strength	Prestress	Grout Diameter
	[kN/m]	[kN]	[mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
 Bottom left of grid: x = -10.00000 m y = 150.00000 m
 Inclination of grid: 0.00000 deg
 (positive anticlockwise direction about bottom left of grid)
 Centres on grid: 20 in x direction at 1.00000m spacing
 20 in y direction at 1.00000m spacing
 Grid extended to find minimum FoS
 All circles pass through common point at x = 10.50000 m, y = 147.50000 m

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Out of Tensile Plate Material
plane Capacity Capacity Partial
spacing Factor

[m] [kN] [kN]
using the currently selected Method Partial Factors.

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-10.000	150.00	20.652	Only 1	intersection with ground level		
-10.000	151.00	20.797	Only 1	intersection with ground level		
-10.000	152.00	20.988	Only 1	intersection with ground level		
-10.000	153.00	21.225	Only 1	intersection with ground level		
-10.000	154.00	21.506	Only 1	intersection with ground level		
-10.000	155.00	21.829	Only 1	intersection with ground level		
-10.000	156.00	22.192	Only 1	intersection with ground level		
-10.000	157.00	22.594	Only 1	intersection with ground level		
-10.000	158.00	23.033	Only 1	intersection with ground level		
-10.000	159.00	23.505	Only 1	intersection with ground level		
-10.000	160.00	24.010	Only 1	intersection with ground level		
-10.000	161.00	24.546	Only 1	intersection with ground level		
-10.000	162.00	25.110	Only 1	intersection with ground level		
-10.000	163.00	25.700	Only 1	intersection with ground level		
-10.000	164.00	26.315	Only 1	intersection with ground level		
-10.000	165.00	26.954	Only 1	intersection with ground level		
-10.000	166.00	27.613	Only 1	intersection with ground level		
-10.000	167.00	28.293	Only 1	intersection with ground level		
-10.000	168.00	28.991	Only 1	intersection with ground level		
-10.000	169.00	29.707	Only 1	intersection with ground level		
-9.00000	150.00	19.660	Only 1	intersection with ground level		
-9.00000	151.00	19.812	Only 1	intersection with ground level		
-9.00000	152.00	20.012	Only 1	intersection with ground level		
-9.00000	153.00	20.261	Only 1	intersection with ground level		
-9.00000	154.00	20.555	Only 1	intersection with ground level		
-9.00000	155.00	20.893	Only 1	intersection with ground level		
-9.00000	156.00	21.272	Only 1	intersection with ground level		
-9.00000	157.00	21.691	Only 1	intersection with ground level		
-9.00000	158.00	22.147	Only 1	intersection with ground level		
-9.00000	159.00	22.638	Only 1	intersection with ground level		
-9.00000	160.00	23.162	Only 1	intersection with ground level		
-9.00000	161.00	23.717	Only 1	intersection with ground level		
-9.00000	162.00	24.300	Only 1	intersection with ground level		
-9.00000	163.00	24.910	Only 1	intersection with ground level		
-9.00000	164.00	25.544	Only 1	intersection with ground level		
-9.00000	165.00	26.201	Only 1	intersection with ground level		
-9.00000	166.00	26.879	Only 1	intersection with ground level		
-9.00000	167.00	27.577	Only 1	intersection with ground level		
-9.00000	168.00	28.293	Only 1	intersection with ground level		
-9.00000	169.00	29.026	Only 1	intersection with ground level		
-8.00000	150.00	18.668	Only 1	intersection with ground level		
-8.00000	151.00	18.828	Only 1	intersection with ground level		
-8.00000	152.00	19.039	Only 1	intersection with ground level		
-8.00000	153.00	19.300	Only 1	intersection with ground level		
-8.00000	154.00	19.609	Only 1	intersection with ground level		
-8.00000	155.00	19.962	Only 1	intersection with ground level		
-8.00000	156.00	20.359	Only 1	intersection with ground level		
-8.00000	157.00	20.797	Only 1	intersection with ground level		
-8.00000	158.00	21.272	Only 1	intersection with ground level		
-8.00000	159.00	21.783	Only 1	intersection with ground level		
-8.00000	160.00	22.327	Only 1	intersection with ground level		
-8.00000	161.00	22.902	Only 1	intersection with ground level		
-8.00000	162.00	23.505	Only 1	intersection with ground level		
-8.00000	163.00	24.135	Only 1	intersection with ground level		
-8.00000	164.00	24.789	Only 1	intersection with ground level		
-8.00000	165.00	25.466	Only 1	intersection with ground level		
-8.00000	166.00	26.163	Only 1	intersection with ground level		
-8.00000	167.00	26.879	Only 1	intersection with ground level		
-8.00000	168.00	27.613	Only 1	intersection with ground level		
-8.00000	169.00	28.364	Only 1	intersection with ground level		
-7.00000	150.00	17.678	Only 1	intersection with ground level		
-7.00000	151.00	17.847	Only 1	intersection with ground level		
-7.00000	152.00	18.069	Only 1	intersection with ground level		
-7.00000	153.00	18.344	Only 1	intersection with ground level		
-7.00000	154.00	18.668	Only 1	intersection with ground level		
-7.00000	155.00	19.039	Only 1	intersection with ground level		
-7.00000	156.00	19.455	Only 1	intersection with ground level		
-7.00000	157.00	19.912	Only 1	intersection with ground level		
-7.00000	158.00	20.408	Only 1	intersection with ground level		
-7.00000	159.00	20.940	Only 1	intersection with ground level		
-7.00000	160.00	21.506	Only 1	intersection with ground level		
-7.00000	161.00	22.102	Only 1	intersection with ground level		

 Hollingsworth Gate, Littleborough Section B					Job No.		Sheet No.	Rev.
					GRO-23131			
					Drg. Ref.			
					Made by JD	Date	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-7.0000	162.00	22.727	Only 1	intersection with	ground level			
-7.0000	163.00	23.377	Only 1	intersection with	ground level			
-7.0000	164.00	24.052	Only 1	intersection with	ground level			
-7.0000	165.00	24.749	Only 1	intersection with	ground level			
-7.0000	166.00	25.466	Only 1	intersection with	ground level			
-7.0000	167.00	26.201	Only 1	intersection with	ground level			
-7.0000	168.00	26.954	Only 1	intersection with	ground level			
-7.0000	169.00	27.722	Only 1	intersection with	ground level			
-6.0000	150.00	16.688	Only 1	intersection with	ground level			
-6.0000	151.00	16.867	Only 1	intersection with	ground level			
-6.0000	152.00	17.103	Only 1	intersection with	ground level			
-6.0000	153.00	17.393	Only 1	intersection with	ground level			
-6.0000	154.00	17.734	Only 1	intersection with	ground level			
-6.0000	155.00	18.125	Only 1	intersection with	ground level			
-6.0000	156.00	18.561	Only 1	intersection with	ground level			
-6.0000	157.00	19.039	Only 1	intersection with	ground level			
-6.0000	158.00	19.558	Only 1	intersection with	ground level			
-6.0000	159.00	20.112	Only 1	intersection with	ground level			
-6.0000	160.00	20.700	Only 1	intersection with	ground level			
-6.0000	161.00	21.319	Only 1	intersection with	ground level			
-6.0000	162.00	21.966	Only 1	intersection with	ground level			
-6.0000	163.00	22.638	Only 1	intersection with	ground level			
-6.0000	164.00	23.335	Only 1	intersection with	ground level			
-6.0000	165.00	24.052	Only 1	intersection with	ground level			
-6.0000	166.00	24.789	Only 1	intersection with	ground level			
-6.0000	167.00	25.544	Only 1	intersection with	ground level			
-6.0000	168.00	26.315	Only 1	intersection with	ground level			
-6.0000	169.00	27.102	Only 1	intersection with	ground level			
-5.0000	150.00	15.700	Only 1	intersection with	ground level			
-5.0000	151.00	15.890	Only 1	intersection with	ground level			
-5.0000	152.00	16.140	Only 1	intersection with	ground level			
-5.0000	153.00	16.447	Only 1	intersection with	ground level			
-5.0000	154.00	16.808	Only 1	intersection with	ground level			
-5.0000	155.00	17.219	Only 1	intersection with	ground level			
-5.0000	156.00	17.678	Only 1	intersection with	ground level			
-5.0000	157.00	18.180	Only 1	intersection with	ground level			
-5.0000	158.00	18.722	Only 1	intersection with	ground level			
-5.0000	159.00	19.300	Only 1	intersection with	ground level			
-5.0000	160.00	19.912	Only 1	intersection with	ground level			
-5.0000	161.00	20.555	Only 1	intersection with	ground level			
-5.0000	162.00	21.225	Only 1	intersection with	ground level			
-5.0000	163.00	21.920	Only 1	intersection with	ground level			
-5.0000	164.00	22.638	Only 1	intersection with	ground level			
-5.0000	165.00	23.377	Only 1	intersection with	ground level			
-5.0000	166.00	24.135	Only 1	intersection with	ground level			
-5.0000	167.00	24.910	Only 1	intersection with	ground level			
-5.0000	168.00	25.700	Only 1	intersection with	ground level			
-5.0000	169.00	26.505	Only 1	intersection with	ground level			
-4.0000	150.00	14.714	Only 1	intersection with	ground level			
-4.0000	151.00	14.916	Only 1	intersection with	ground level			
-4.0000	152.00	15.182	Only 1	intersection with	ground level			
-4.0000	153.00	15.508	Only 1	intersection with	ground level			
-4.0000	154.00	15.890	Only 1	intersection with	ground level			
-4.0000	155.00	16.325	Only 1	intersection with	ground level			
-4.0000	156.00	16.808	Only 1	intersection with	ground level			
-4.0000	157.00	17.335	Only 1	intersection with	ground level			
-4.0000	158.00	17.903	Only 1	intersection with	ground level			
-4.0000	159.00	18.507	Only 1	intersection with	ground level			
-4.0000	160.00	19.144	Only 1	intersection with	ground level			
-4.0000	161.00	19.812	Only 1	intersection with	ground level			
-4.0000	162.00	20.506	Only 1	intersection with	ground level			
-4.0000	163.00	21.225	Only 1	intersection with	ground level			
-4.0000	164.00	21.966	Only 1	intersection with	ground level			
-4.0000	165.00	22.727	Only 1	intersection with	ground level			
-4.0000	166.00	23.505	Only 1	intersection with	ground level			
-4.0000	167.00	24.300	Only 1	intersection with	ground level			
-4.0000	168.00	25.110	Only 1	intersection with	ground level			
-4.0000	168.00	25.110	Only 1	intersection with	ground level			
-4.0000	169.00	25.933	Only 1	intersection with	ground level			
-3.0000	150.00	13.730	Only 1	intersection with	ground level			
-3.0000	151.00	13.946	Only 1	intersection with	ground level			
-3.0000	152.00	14.230	Only 1	intersection with	ground level			
-3.0000	153.00	14.577	Only 1	intersection with	ground level			
-3.0000	154.00	14.983	Only 1	intersection with	ground level			
-3.0000	155.00	15.443	Only 1	intersection with	ground level			
-3.0000	156.00	15.953	Only 1	intersection with	ground level			
-3.0000	157.00	16.508	Only 1	intersection with	ground level			

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Made by JD	Date	Checked Date

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-3.0000	158.00	17.103	Only 1	intersection with ground level		
-3.0000	159.00	17.734	Only 1	intersection with ground level		
-3.0000	160.00	18.398	Only 1	intersection with ground level		
-3.0000	161.00	19.092	Only 1	intersection with ground level		
-3.0000	162.00	19.812	Only 1	intersection with ground level		
-3.0000	163.00	20.555	Only 1	intersection with ground level		
-3.0000	164.00	21.319	Only 1	intersection with ground level		
-3.0000	165.00	22.102	Only 1	intersection with ground level		
-3.0000	165.00	22.102	Only 1	intersection with ground level		
-3.0000	166.00	22.902	Only 1	intersection with ground level		
-3.0000	167.00	23.717	Only 1	intersection with ground level		
-3.0000	168.00	24.546	851.53	1.6640	6663.7	11089.0
-3.0000	169.00	25.387	813.38	1.6596	6644.8	11028.0
-2.0000	150.00	12.748	Only 1	intersection with ground level		
-2.0000	151.00	12.981	Only 1	intersection with ground level		
-2.0000	152.00	13.285	Only 1	intersection with ground level		
-2.0000	153.00	13.656	Only 1	intersection with ground level		
-2.0000	154.00	14.089	Only 1	intersection with ground level		
-2.0000	155.00	14.577	Only 1	intersection with ground level		
-2.0000	156.00	15.116	Only 1	intersection with ground level		
-2.0000	157.00	15.700	Only 1	intersection with ground level		
-2.0000	158.00	16.325	Only 1	intersection with ground level		
-2.0000	159.00	16.985	Only 1	intersection with ground level		
-2.0000	160.00	17.678	Only 1	intersection with ground level		
-2.0000	161.00	18.398	Only 1	intersection with ground level		
-2.0000	161.00	18.398	Only 1	intersection with ground level		
-2.0000	162.00	19.144	Only 1	intersection with ground level		
-2.0000	162.00	19.144	Only 1	intersection with ground level		
-2.0000	163.00	19.912	Only 1	intersection with ground level		
-2.0000	164.00	20.700	900.71	1.6750	5919.9	9915.8
-2.0000	165.00	21.506	852.70	1.6648	5903.5	9828.4
-2.0000	166.00	22.327	811.06	1.6688	5878.1	9809.2
-2.0000	167.00	23.162	774.86	1.6681	5867.8	9788.1
-2.0000	168.00	24.010	743.52	1.6810	5848.8	9831.7
-2.0000	169.00	24.870	716.54	1.6911	5839.2	9874.3
-1.0000	150.00	11.769	Only 1	intersection with ground level		
-1.0000	151.00	12.021	Only 1	intersection with ground level		
-1.0000	152.00	12.349	Only 1	intersection with ground level		
-1.0000	153.00	12.748	Only 1	intersection with ground level		
-1.0000	154.00	13.210	Only 1	intersection with ground level		
-1.0000	155.00	13.730	Only 1	intersection with ground level		
-1.0000	156.00	14.300	Only 1	intersection with ground level		
-1.0000	157.00	14.916	Only 1	intersection with ground level		
-1.0000	157.00	14.916	Only 1	intersection with ground level		
-1.0000	158.00	15.572	Only 1	intersection with ground level		
-1.0000	158.00	15.572	Only 1	intersection with ground level		
-1.0000	159.00	16.263	Only 1	intersection with ground level		
-1.0000	159.00	16.263	Only 1	intersection with ground level		
-1.0000	160.00	16.985	978.72	1.7093	5181.7	8849.2
-1.0000	161.00	17.734	914.95	1.6970	5153.7	8742.9
-1.0000	162.00	18.507	860.27	1.6816	5144.0	8649.4
-1.0000	163.00	19.300	813.38	1.6829	5126.4	8627.3
-1.0000	164.00	20.112	773.25	1.6811	5121.7	8610.3
-1.0000	165.00	20.940	739.06	1.6944	5108.5	8656.0
-1.0000	166.00	21.783	710.24	1.7062	5105.0	8710.0
-1.0000	167.00	22.638	685.44	1.7185	5107.2	8776.8
-1.0000	168.00	23.505	664.67	1.7442	5103.3	8901.3
-1.0000	169.00	24.382	647.43	1.7673	5108.7	9028.7
0.0	150.00	10.794	Only 1	intersection with ground level		
0.0	151.00	11.068	Only 1	intersection with ground level		
0.0	152.00	11.424	Only 1	intersection with ground level		
0.0	153.00	11.853	Only 1	intersection with ground level		
0.0	153.00	11.853	Only 1	intersection with ground level		
0.0	154.00	12.349	Only 1	intersection with ground level		
0.0	154.00	12.349	Only 1	intersection with ground level		
0.0	155.00	12.903	Only 1	intersection with ground level		
0.0	155.00	12.903	Only 1	intersection with ground level		
0.0	156.00	13.509	Only 1	intersection with ground level		
0.0	156.00	13.509	Only 1	intersection with ground level		
0.0	157.00	14.160	Only 1	intersection with ground level		
0.0	157.00	14.160	Only 1	intersection with ground level		
0.0	158.00	14.849	943.46	1.7420	4402.8	7653.8
0.0	159.00	15.572	878.20	1.7271	4386.1	7566.5
0.0	160.00	16.325	823.35	1.7129	4385.0	7508.5
0.0	161.00	17.103	777.25	1.7156	4378.1	7510.3
0.0	162.00	17.903	738.46	1.7211	4376.5	7532.2
						16.099
						8.6980
						2.6944
						0.54200
						0.0

Oasys Hollingsworth Gate, Littleborough Section B						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date	Checked	Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
0.0	163.00	18.722	706.24		1.7320	4379.1	7584.6
0.0	164.00	19.558	679.18		1.7445	4386.7	7652.9
0.0	165.00	20.408	656.88		1.7788	4382.4	7795.6
0.0	166.00	21.272	638.34		1.7879	4414.9	7893.2
0.0	167.00	22.147	622.31		1.8116	4424.8	8016.1
0.0	168.00	23.033	608.43		1.8325	4441.2	8138.3
0.0	169.00	23.927	596.30		1.8453	4469.3	8247.5
1.0000	150.00	9.8234		Only 1	intersection with ground level		
1.0000	150.00	9.8234		Only 1	intersection with ground level		
1.0000	151.00	10.124		Only 1	intersection with ground level		
1.0000	151.00	10.124		Only 1	intersection with ground level		
1.0000	152.00	10.512		Only 1	intersection with ground level		
1.0000	152.00	10.512		Only 1	intersection with ground level		
1.0000	153.00	10.977		Only 1	intersection with ground level		
1.0000	153.00	10.977		Only 1	intersection with ground level		
1.0000	154.00	11.511		Only 1	intersection with ground level		
1.0000	154.00	11.511		Only 1	intersection with ground level		
1.0000	155.00	12.104		Only 1	intersection with ground level		
1.0000	155.00	12.104		Only 1	intersection with ground level		
1.0000	156.00	12.748	914.57		1.8037	3649.6	6565.3
1.0000	157.00	13.435	846.24		1.7764	3650.9	6471.2
1.0000	158.00	14.160	790.12		1.7713	3648.4	6453.0
1.0000	159.00	14.916	744.48		1.7736	3650.6	6472.3
1.0000	160.00	15.700	706.46		1.7813	3658.3	6516.2
1.0000	161.00	16.508	675.71		1.7924	3681.7	6599.0
1.0000	162.00	17.335	650.28		1.8172	3687.2	6700.3
1.0000	163.00	18.180	628.61		1.8395	3700.3	6806.6
1.0000	164.00	19.039	610.03		1.8584	3719.4	6912.0
1.0000	165.00	19.912	594.24		1.8683	3751.5	7009.0
1.0000	166.00	20.797	580.78		1.8759	3782.7	7095.9
1.0000	167.00	21.691	569.25		1.8701	3818.6	7141.2
1.0000	168.00	22.594	559.38		1.8656	3857.7	7196.7
1.0000	169.00	23.505	551.07		1.8618	3901.2	7263.1
2.0000	150.00	8.8600		Only 1	intersection with ground level		
2.0000	150.00	8.8600		Only 1	intersection with ground level		
2.0000	151.00	9.1924		Only 1	intersection with ground level		
2.0000	151.00	9.1924		Only 1	intersection with ground level		
2.0000	152.00	9.6177		Only 1	intersection with ground level		
2.0000	152.00	9.6177		Only 1	intersection with ground level		
2.0000	153.00	10.124		Only 1	intersection with ground level		
2.0000	153.00	10.124		Only 1	intersection with ground level		
2.0000	154.00	10.700	894.03		1.9235	2915.4	5592.1
2.0000	155.00	11.336	820.37		1.8876	2924.4	5502.0
2.0000	156.00	12.021	761.59		1.8774	2930.1	5488.2
2.0000	157.00	12.748	714.59		1.8722	2951.5	5516.2
2.0000	158.00	13.509	676.25		1.8868	2959.8	5581.9
2.0000	159.00	14.300	644.57		1.9019	2977.1	5661.6
2.0000	160.00	15.116	618.17		1.9103	3006.7	5743.6
2.0000	161.00	15.953	596.13		1.9192	3037.5	5829.6
2.0000	162.00	16.808	577.77		1.9173	3074.3	5894.1
2.0000	163.00	17.678	562.39		1.8996	3115.4	5918.1
2.0000	164.00	18.561	549.53		1.8830	3161.0	5952.3
2.0000	165.00	19.455	538.79		1.8685	3210.0	5998.0
2.0000	166.00	20.359	529.85		1.8559	3261.8	6053.6
2.0000	167.00	21.272	522.46		1.8448	3316.7	6118.6
2.0000	168.00	22.192	516.44		1.8348	3374.5	6191.3
2.0000	169.00	23.119	511.42		1.8254	3433.4	6267.4
3.0000	150.00	7.9057		Only 1	intersection with ground level		
3.0000	150.00	7.9057		Only 1	intersection with ground level		
3.0000	151.00	8.2765		Only 1	intersection with ground level		
3.0000	151.00	8.2765		Only 1	intersection with ground level		
3.0000	152.00	8.7464	886.83		2.1615	2197.6	4741.1
3.0000	153.00	9.3005	803.03		2.0910	2221.2	4632.9
3.0000	154.00	9.9247	736.88		2.0681	2234.2	4604.8
3.0000	155.00	10.607	684.15		2.0451	2260.8	4612.6
3.0000	156.00	11.336	642.11		2.0343	2292.6	4653.9
3.0000	157.00	12.104	608.11		2.0200	2330.5	4705.4
3.0000	158.00	12.903	580.71		2.0024	2374.3	4753.9
3.0000	159.00	13.730	558.52		1.9688	2422.9	4770.3
3.0000	160.00	14.577	540.42		1.9305	2475.3	4778.5
3.0000	161.00	15.443	525.76		1.8969	2531.5	4802.1
3.0000	162.00	16.325	513.85		1.8672	2590.3	4836.6
3.0000	163.00	17.219	504.22		1.8396	2651.4	4877.6
3.0000	164.00	18.125	496.83		1.8138	2714.8	4924.0

Oasys Hollingsworth Gate, Littleborough Section B						Job No.	Sheet No.	Rev.	
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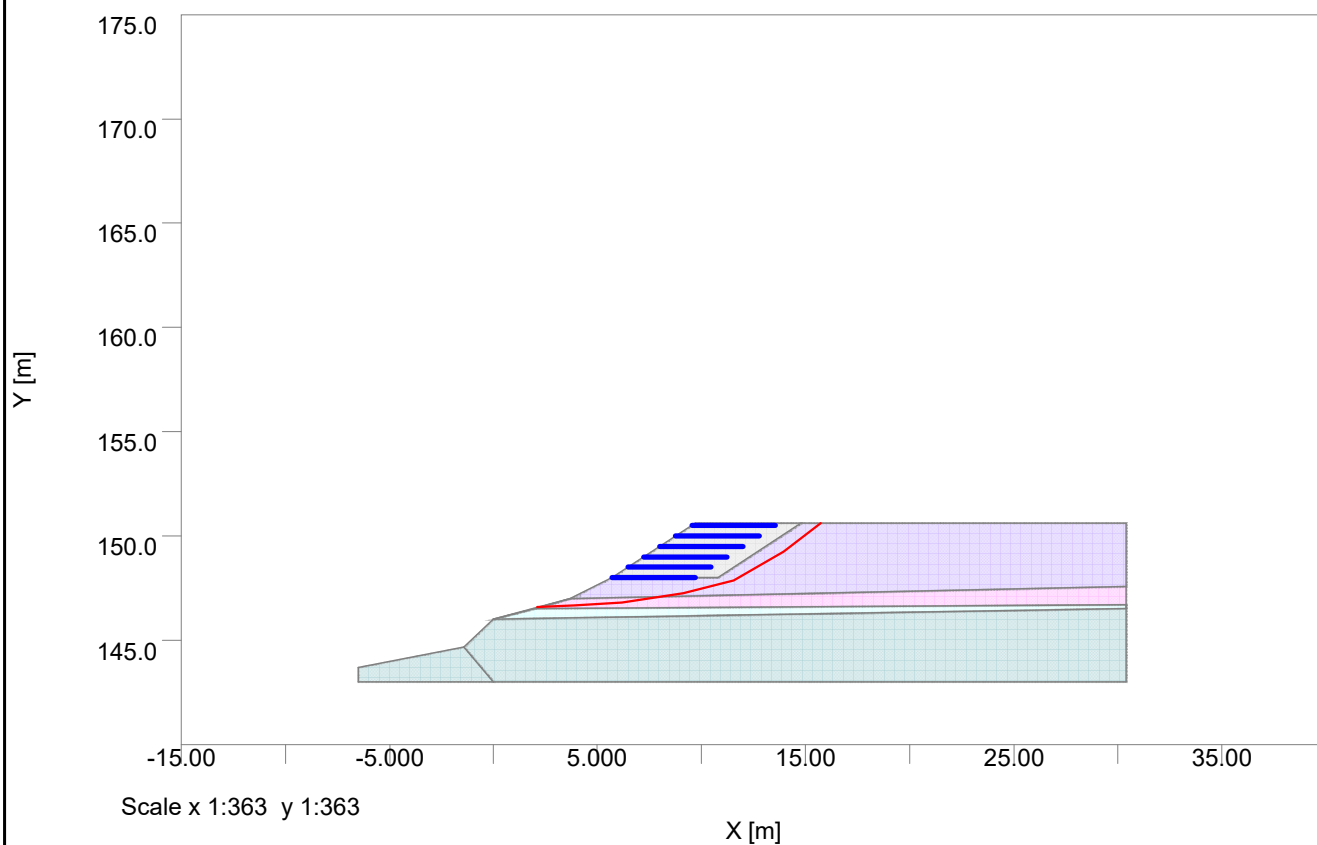
Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment	
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]	
3.0000	165.00	19.039	491.21	1.7873	2779.3	4967.7	0.0	
3.0000	166.00	19.962	487.09	1.7465	2845.1	4968.9	0.0	
3.0000	167.00	20.893	484.36	1.7342	2912.3	5050.6	0.0	
3.0000	168.00	21.829	482.75	1.7600	2981.1	5246.7	0.0	
3.0000	169.00	22.771	481.87	1.7872	3050.3	5451.4	0.0	
4.0000	150.00	6.9642	Centre embedded/below end of slip					
4.0000	151.00	7.3824	792.67	2.5039	1541.3	3852.6	6.5000	
4.0000	152.00	7.9057	711.02	2.3755	1582.8	3752.3	7.8000	
4.0000	153.00	8.5147	649.14	2.2777	1634.1	3710.4	11.700	
4.0000	154.00	9.1924	601.36	2.1994	1687.7	3702.9	9.0133	
4.0000	155.00	9.9247	564.46	2.1305	1745.9	3709.9	9.7881	
4.0000	156.00	10.700	535.84	2.0445	1807.4	3693.2	2.1202	
4.0000	157.00	11.511	513.98	1.9680	1871.1	3681.9	0.33814	
4.0000	158.00	12.349	497.27	1.9066	1936.3	3691.8	0.0	
4.0000	159.00	13.210	484.60	1.8543	2002.8	3713.7	0.0	
4.0000	160.00	14.089	475.15	1.8057	2070.4	3738.5	0.0	
4.0000	161.00	14.983	468.39	1.7499	2139.6	3744.1	0.0	
4.0000	162.00	15.890	463.83	1.6830	2209.8	3719.2	0.0	
4.0000	163.00	16.808	460.89	1.7066	2281.1	3893.0	0.0	
4.0000	164.00	17.734	459.33	1.7333	2353.5	4079.2	0.0	
4.0000	165.00	18.668	458.81	1.7623	2426.6	4276.4	0.0	
4.0000	166.00	19.609	459.18	1.7932	2500.5	4484.0	0.0	
4.0000	167.00	20.555	460.25	1.8255	2574.9	4700.5	0.0	
4.0000	168.00	21.506	462.03	1.8590	2650.5	4927.2	0.0	
4.0000	169.00	22.461	464.21	1.8933	2726.1	5161.2	0.0	
5.0000	150.00	6.0415	Centre embedded/below end of slip					
5.0000	151.00	6.5192	609.88	2.5943	1085.8	2811.2	5.7684	
5.0000	152.00	7.1063	555.02	2.3886	1158.4	2759.1	7.8000	
5.0000	153.00	7.7782	515.21	2.2279	1227.7	2725.7	9.5742	
5.0000	154.00	8.5147	486.92	2.0784	1299.0	2691.7	8.0586	
5.0000	155.00	9.3005	466.65	1.9623	1370.1	2686.7	1.9199	
5.0000	156.00	10.124	452.54	1.8677	1443.0	2694.8	0.28807	
5.0000	157.00	10.977	442.95	1.7704	1516.9	2685.4	0.0	
5.0000	158.00	11.853	436.83	1.6689	1590.9	2655.1	0.0	
5.0000	159.00	12.748	433.26	1.6878	1666.3	2812.4	0.0	
5.0000	160.00	13.656	431.64	1.7127	1742.5	2984.4	0.0	
5.0000	161.00	14.577	431.47	1.7421	1819.1	3169.1	0.0	
5.0000	162.00	15.508	432.43	1.7746	1896.3	3365.2	0.0	
5.0000	163.00	16.447	434.27	1.8095	1974.0	3571.9	0.0	
5.0000	164.00	17.393	436.91	1.8462	2052.4	3789.1	0.0	
5.0000	165.00	18.344	440.11	1.8843	2131.1	4015.6	0.0	
5.0000	166.00	19.300	443.77	1.9236	2209.9	4251.0	0.0	
5.0000	167.00	20.261	447.86	1.9631	2289.7	4495.0	0.0	
5.0000	168.00	21.225	452.24	2.0033	2369.5	4746.8	0.0	
5.0000	169.00	22.192	456.87	2.0438	2449.5	5006.2	0.0	
6.0000	150.00	5.1478	Centre embedded/below end of slip					
6.0000	151.00	5.7009	465.26	2.4925	755.28	1878.6	3.9000	
6.0000	152.00	6.3640	435.52	2.2140	833.63	1837.9	7.8000	
6.0000	153.00	7.1063	416.34	1.9980	914.04	1820.0	6.2273	
6.0000	154.00	7.9057	406.01	1.7595	991.58	1743.0	1.6738	
6.0000	155.00	8.7464	400.12	1.7120	1070.4	1832.3	0.23745	
6.0000	156.00	9.6177	397.76	1.7219	1150.2	1980.6	0.0	
6.0000	157.00	10.512	397.68	1.7438	1230.2	2145.2	0.0	
6.0000	158.00	11.424	399.36	1.7739	1310.4	2324.5	0.0	
6.0000	159.00	12.349	402.32	1.8092	1391.0	2516.6	0.0	
6.0000	160.00	13.285	406.21	1.8480	1471.9	2720.1	0.0	
6.0000	161.00	14.230	410.77	1.8893	1553.2	2934.3	0.0	
6.0000	162.00	15.182	415.92	1.9324	1634.7	3158.8	0.0	
6.0000	163.00	16.140	421.45	1.9768	1716.2	3392.7	0.0	
6.0000	164.00	17.103	427.27	2.0219	1798.1	3635.5	0.0	
6.0000	165.00	18.069	433.30	2.0669	1880.4	3886.6	0.0	
6.0000	166.00	19.039	439.48	2.1122	1962.6	4145.5	0.0	
6.0000	167.00	20.012	445.79	2.1578	2044.8	4412.3	0.0	
6.0000	168.00	20.988	452.22	2.2026	2127.8	4686.6	0.0	
6.0000	169.00	21.966	458.68	2.2475	2210.5	4967.9	0.0	
7.0000	150.00	4.3012	Centre embedded/below end of slip					
7.0000	151.00	4.9497	361.82	2.2184	495.82	1096.0	3.9000	
7.0000	152.00	5.7009	354.90	1.9192	580.89	1110.6	4.2355	
7.0000	153.00	6.5192	353.54	1.8647	664.36	1237.4	1.3732	
7.0000	154.00	7.3824	355.55	1.8535	747.66	1385.6	0.18417	
7.0000	155.00	8.2765	359.92	1.8679	831.03	1552.2	0.0	
7.0000	156.00	9.1924	365.64	1.8958	914.55	1733.8	0.0	
7.0000	157.00	10.124	372.27	1.9325	997.98	1928.6	0.0	

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Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
7.0000	158.00	11.068	379.54	1.9746	1081.5	2135.5
7.0000	159.00	12.021	387.23	2.0197	1165.3	2353.5
7.0000	160.00	12.981	395.11	2.0667	1249.0	2581.2
7.0000	161.00	13.946	403.16	2.1153	1332.7	2819.0
7.0000	162.00	14.916	411.30	2.1643	1416.5	3065.7
7.0000	163.00	15.890	419.45	2.2138	1500.2	3321.1
7.0000	164.00	16.867	427.61	2.2632	1584.1	3585.2
7.0000	165.00	17.847	435.79	2.3123	1668.2	3857.4
7.0000	166.00	18.828	443.85	2.3616	1751.8	4137.0
7.0000	167.00	19.812	451.90	2.4101	1835.8	4424.3
7.0000	168.00	20.797	459.84	2.4578	1919.9	4718.7
7.0000	169.00	21.783	467.70	2.5055	2003.6	5020.0
8.0000	150.00	3.5355	Centre embedded/below end of slip			
8.0000	151.00	4.3012	293.00	2.2841	312.10	710.91
8.0000	152.00	5.1478	303.04	2.1547	397.04	853.90
8.0000	153.00	6.0415	314.36	2.1126	481.30	1016.6
8.0000	154.00	6.9642	326.16	2.1161	565.13	1195.9
8.0000	155.00	7.9057	338.05	2.1413	648.95	1389.6
8.0000	156.00	8.8600	349.93	2.1790	732.70	1596.6
8.0000	157.00	9.8234	361.66	2.2232	816.60	1815.5
8.0000	158.00	10.794	373.19	2.2712	900.67	2045.6
8.0000	159.00	11.769	384.43	2.3215	984.62	2285.8
8.0000	160.00	12.748	395.40	2.3735	1068.3	2535.7
8.0000	161.00	13.730	406.19	2.4254	1152.4	2795.2
8.0000	162.00	14.714	416.68	2.4777	1236.4	3063.3
8.0000	163.00	15.700	426.95	2.5301	1320.1	3340.2
8.0000	164.00	16.688	437.03	2.5818	1404.3	3625.6
8.0000	165.00	17.678	446.85	2.6328	1488.4	3918.7
8.0000	166.00	18.668	456.41	2.6835	1572.2	4219.0
8.0000	167.00	19.660	465.89	2.7335	1656.4	4527.7
8.0000	168.00	20.652	475.13	2.7827	1740.6	4843.5
8.0000	169.00	21.645	484.19	2.8321	1824.2	5166.3
9.0000	150.00	2.9155	Centre embedded/below end of slip			
9.0000	151.00	3.8079	254.16	2.8790	189.49	540.44
9.0000	152.00	4.7434	277.27	2.6731	268.28	711.87
9.0000	153.00	5.7009	298.01	2.6024	348.33	899.99
9.0000	154.00	6.6708	316.85	2.5909	428.70	1102.9
9.0000	155.00	7.6485	334.36	2.6057	510.00	1319.8
9.0000	156.00	8.6313	350.65	2.6367	591.45	1549.1
9.0000	157.00	9.6177	366.04	2.6589	673.33	1790.3
9.0000	158.00	10.607	380.64	2.7040	755.43	2042.6
9.0000	159.00	11.597	394.51	2.7515	837.78	2305.2
9.0000	160.00	12.590	407.80	2.8007	920.38	2577.7
9.0000	161.00	13.583	420.57	2.8512	1003.0	2859.7
9.0000	162.00	14.577	432.86	2.9020	1085.7	3150.8
9.0000	163.00	15.572	444.70	2.9525	1168.6	3450.3
9.0000	164.00	16.568	456.18	3.0032	1251.5	3758.5
9.0000	165.00	17.564	467.30	3.0530	1334.6	4074.7
9.0000	166.00	18.561	478.14	3.1021	1418.1	4399.0
9.0000	167.00	19.558	488.62	3.1511	1501.2	4730.6
9.0000	168.00	20.555	498.88	3.1998	1584.4	5069.8
9.0000	169.00	21.552	508.85	3.2478	1667.6	5416.0
-10.0000	170.00	30.438	Only 1 intersection with ground level			
-9.0000	170.00	29.774	Only 1 intersection with ground level			
-8.0000	170.00	29.129	Only 1 intersection with ground level			
-7.0000	170.00	28.504	Only 1 intersection with ground level			
-6.0000	170.00	27.902	Only 1 intersection with ground level			
-5.0000	170.00	27.322	Only 1 intersection with ground level			
-4.0000	170.00	26.768	Only 1 intersection with ground level			
-3.0000	170.00	26.239	779.86	1.6702	6613.5	11046.
-2.0000	170.00	25.739	693.60	1.7025	5836.9	9937.6
-1.0000	170.00	25.269	633.16	1.7781	5144.1	9146.8
0.0	170.00	24.829	585.84	1.8579	4496.6	8354.4
1.0000	170.00	24.423	543.90	1.8587	3947.6	7337.4
2.0000	170.00	24.052	507.55	1.8156	3495.3	6345.9
3.0000	170.00	23.717	481.72	1.8155	3120.6	5665.6
4.0000	170.00	23.420	466.83	1.9281	2802.4	5403.3
5.0000	170.00	23.162	461.73	2.0846	2529.8	5273.4
6.0000	170.00	22.946	465.20	2.2922	2293.2	5256.3
7.0000	170.00	22.771	475.40	2.5512	2088.0	5326.9
8.0000	170.00	22.638	493.10	2.8802	1908.3	5496.1
9.0000	170.00	22.550	518.60	3.2948	1751.0	5769.3

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Moments taken about 3.80,165.87, Over-Design Factor 1.512



Oasys

Hollingsworth Gate, Littleborough

Section B

Job No.

Sheet No.

Rev.

GRO-23131

Drg. Ref.

Made by

Date

Checked

Date

JD

Specification

Slip Type: NON-CIRCULAR

Direction of slip: Downhill

Minimum slip weight [kN/m] :80.00000

Type of analysis: STATIC

Partial factor analysis

Minimum number of slices 25

Method: Janbu(Variably inclined interslice forces)

Maximum number of iterations: 300

Reinforcement: ACTIVE

Material Partial Factors

Description	Friction	Adhesion	Creep	Manufacture	Extrapolation	Damage	Environment
	Interaction	Interaction	Reduction		of Test Data		
	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Material Properties

No	Description	Unit Weight	Shear Strength Parameters	Phi or c	
		Above GWL	Below GWL	Condition	
	or c0'				Phi0
		[kN/m3]	[kN/m3]		[°]
	[kN/m²]				
1	Canal Wall	25.000	25.000	Drained	40.000
2	Reinforced Earth	17.500	20.000	Drained	29.000
3	Backfilled Made Ground	17.500	20.000	Drained	29.000
4	SAND	20.000	22.000	Drained	34.000
5	Firm CLAY	20.000	22.000	Drained	24.000
6	Soft CLAY	20.000	22.000	Drained	24.000
7	MUDSTONE	21.000	23.000	Drained	35.000

Reinforcement

Geotextile Reinforcement 1

Layers	Level	Vertical Length	Offset	Angle
	of top	Spacing	from	from
	layer		surface	horiz
	[m]	[m]	[m]	[°]
6	150.50	0.50000	4.0000	4.0000
			0.0	0

Bond

Bond Length	Bond Strength	Prestress	Grout Diameter
	[kN/m]	[kN]	[mm]
0.0%	0.0	0.0	0.0

Out of plane spacing

Tensile Capacity	Plate Capacity	Material Partial Factor
[kN]	[kN]	
0.0	1.3000	0.0

Non Circular Slips

No	Name	Coordinates
1	Slip 1	(15.7, 151) (14, 149) (11.5, 148) (9.14, 147) (6.19, 147) (3.89, 147) (2.12, 147)

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Description	Slip Centre	Slip	Comment/	Disturbing Soil
Reinforcement				

Program Oasys Slope Version 21.0.0.46

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Hollingsworth Gate, Littleborough
Section B

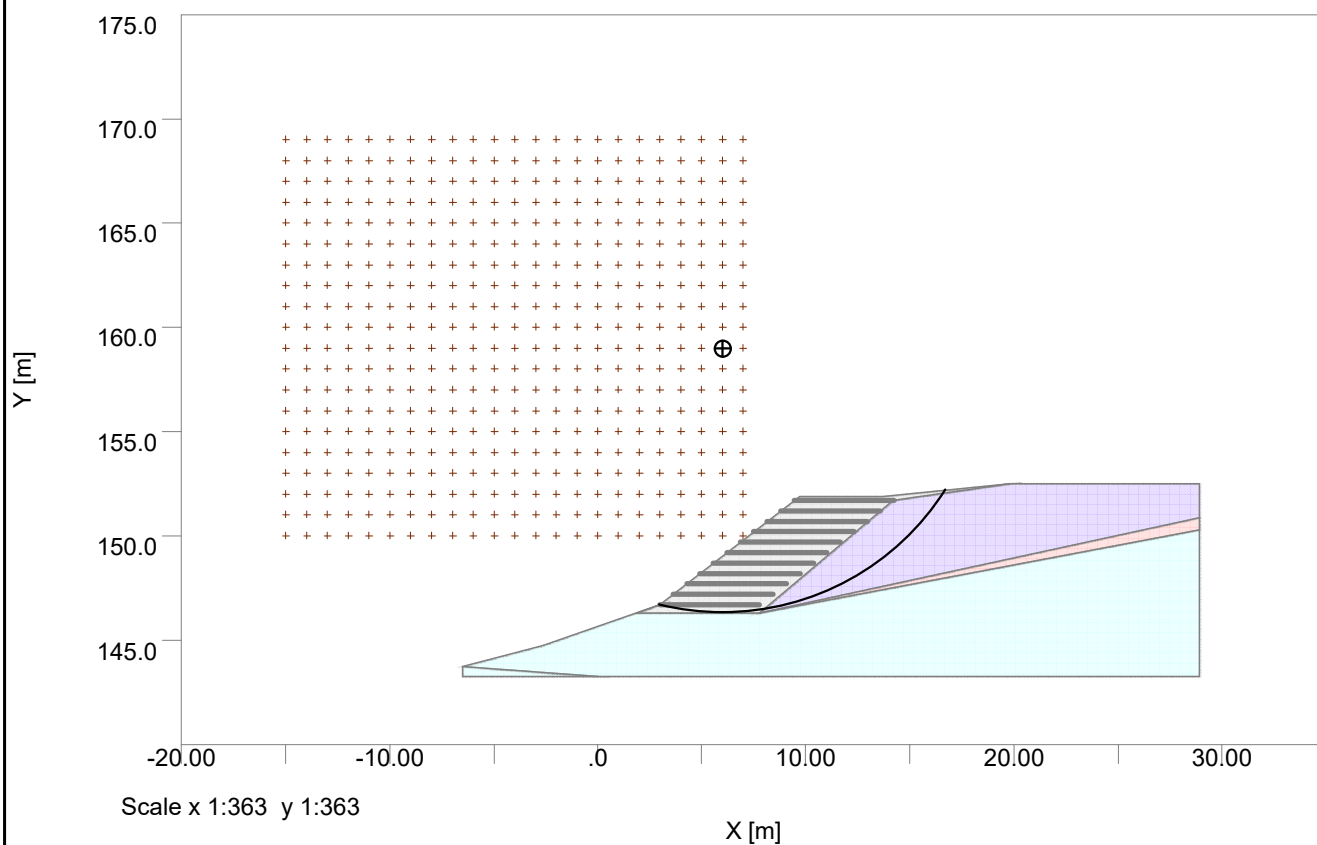
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		Weight	Over-Design	Moment	Strength	Restoring
			Factor		Restoring	Moment
					Moment	
	x [m]	y [m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
Slip 1	3.7956	165.87	397.22	1.5121	2071.5	3132.3
0.0						

APPENDIX 4 - Section D Modelling Outputs

Job No.	Sheet No.	Rev.
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Made by JD	Date 07 Jun 2023	Checked Date

Circle plotted: centre at 6.00,159.00, Over-Design Factor 1.392



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters	Phi or c
		Above GWL	Below GWL		
	or c0'			Condition	
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	35.000	35.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	20.000	Drained	29.000
0.0	3 Made Ground Backfill	17.500	20.000	Drained	29.000
0.0	4 Made Ground Gravel	17.500	20.000	Drained	29.000
0.0	5 SANDSTONE	22.000	24.000	Drained	40.000

Reinforcement

Geotextile Reinforcement 1

Layers	Level of top layer [m]	Vertical Spacing [m]	Length Top [m] Btm [m]		Offset from surface [m]	Angle from horiz [°]
11	151.70	0.50000	4.8000	4.8000	0.0	0

Bond Length	Bond Strength	Prestress	Grout Diameter
	[kN/m]	[kN]	[mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
 Bottom left of grid: x = -15.00000 m y = 150.00000 m
 Inclination of grid: 0.00000 deg
 (positive anticlockwise direction about bottom left of grid)
 Centres on grid: 20 in x direction at 1.00000m spacing
 20 in y direction at 1.00000m spacing
 Grid extended to find minimum FoS
 All circles pass through common point at x = 9.50000 m, y = 146.80000 m

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Centre	Radius Slip	Comment/ Weight Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
-------------	-------------	--	----------------------	--------------------------------------	--------------------------------------



Hollingsworth Gate, Littleborough
Section D

Job No.	Sheet No.	Rev.
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Made by JD	Date 07 Jun 2023	Checked Date

x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-15.000	150.00	24.708	Only 1	intersection with ground level		
-15.000	151.00	24.857	Only 1	intersection with ground level		
-15.000	152.00	25.046	Only 1	intersection with ground level		
-15.000	153.00	25.272	Only 1	intersection with ground level		
-15.000	154.00	25.536	Only 1	intersection with ground level		
-15.000	155.00	25.836	Only 1	intersection with ground level		
-15.000	156.00	26.170	Only 1	intersection with ground level		
-15.000	157.00	26.538	Only 1	intersection with ground level		
-15.000	158.00	26.939	Only 1	intersection with ground level		
-15.000	159.00	27.370	Only 1	intersection with ground level		
-15.000	160.00	27.830	Only 1	intersection with ground level		
-15.000	161.00	28.318	Only 1	intersection with ground level		
-15.000	162.00	28.832	Only 1	intersection with ground level		
-15.000	163.00	29.372	Only 1	intersection with ground level		
-15.000	164.00	29.935	Only 1	intersection with ground level		
-15.000	165.00	30.520	Only 1	intersection with ground level		
-15.000	166.00	31.127	Only 1	intersection with ground level		
-15.000	167.00	31.754	Only 1	intersection with ground level		
-15.000	168.00	32.399	Only 1	intersection with ground level		
-15.000	169.00	33.062	Only 1	intersection with ground level		
-14.000	150.00	23.717	Only 1	intersection with ground level		
-14.000	151.00	23.872	Only 1	intersection with ground level		
-14.000	152.00	24.068	Only 1	intersection with ground level		
-14.000	153.00	24.304	Only 1	intersection with ground level		
-14.000	154.00	24.578	Only 1	intersection with ground level		
-14.000	155.00	24.890	Only 1	intersection with ground level		
-14.000	156.00	25.237	Only 1	intersection with ground level		
-14.000	157.00	25.618	Only 1	intersection with ground level		
-14.000	158.00	26.032	Only 1	intersection with ground level		
-14.000	159.00	26.478	Only 1	intersection with ground level		
-14.000	160.00	26.953	Only 1	intersection with ground level		
-14.000	161.00	27.457	Only 1	intersection with ground level		
-14.000	162.00	27.987	Only 1	intersection with ground level		
-14.000	163.00	28.543	Only 1	intersection with ground level		
-14.000	164.00	29.122	Only 1	intersection with ground level		
-14.000	165.00	29.724	Only 1	intersection with ground level		
-14.000	166.00	30.346	Only 1	intersection with ground level		
-14.000	167.00	30.989	Only 1	intersection with ground level		
-14.000	168.00	31.649	Only 1	intersection with ground level		
-14.000	169.00	32.328	Only 1	intersection with ground level		
-13.000	150.00	22.726	Only 1	intersection with ground level		
-13.000	151.00	22.889	Only 1	intersection with ground level		
-13.000	152.00	23.093	Only 1	intersection with ground level		
-13.000	153.00	23.339	Only 1	intersection with ground level		
-13.000	154.00	23.624	Only 1	intersection with ground level		
-13.000	155.00	23.948	Only 1	intersection with ground level		
-13.000	156.00	24.308	Only 1	intersection with ground level		
-13.000	157.00	24.704	Only 1	intersection with ground level		
-13.000	158.00	25.133	Only 1	intersection with ground level		
-13.000	159.00	25.595	Only 1	intersection with ground level		
-13.000	160.00	26.086	Only 1	intersection with ground level		
-13.000	161.00	26.606	Only 1	intersection with ground level		
-13.000	162.00	27.153	Only 1	intersection with ground level		
-13.000	163.00	27.725	Only 1	intersection with ground level		
-13.000	164.00	28.321	Only 1	intersection with ground level		
-13.000	165.00	28.939	Only 1	intersection with ground level		
-13.000	166.00	29.579	Only 1	intersection with ground level		
-13.000	167.00	30.237	Only 1	intersection with ground level		
-13.000	168.00	30.914	Only 1	intersection with ground level		
-13.000	169.00	31.608	Only 1	intersection with ground level		
-12.000	150.00	21.737	Only 1	intersection with ground level		
-12.000	151.00	21.906	Only 1	intersection with ground level		
-12.000	152.00	22.120	Only 1	intersection with ground level		
-12.000	153.00	22.376	Only 1	intersection with ground level		
-12.000	154.00	22.674	Only 1	intersection with ground level		
-12.000	155.00	23.011	Only 1	intersection with ground level		
-12.000	156.00	23.386	Only 1	intersection with ground level		
-12.000	157.00	23.797	Only 1	intersection with ground level		
-12.000	158.00	24.242	Only 1	intersection with ground level		
-12.000	159.00	24.720	Only 1	intersection with ground level		
-12.000	160.00	25.229	Only 1	intersection with ground level		
-12.000	161.00	25.766	Only 1	intersection with ground level		
-12.000	162.00	26.330	Only 1	intersection with ground level		
-12.000	163.00	26.920	Only 1	intersection with ground level		
-12.000	164.00	27.533	Only 1	intersection with ground level		
-12.000	165.00	28.169	Only 1	intersection with ground level		

Oasys Hollingsworth Gate, Littleborough Section D					Job No.		Sheet No.	Rev.
					GRO-23131			
					Drg. Ref.			
					Made by JD	Date 07 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-12.000	166.00	28.825	Only 1	intersection with	ground level			
-12.000	167.00	29.501	Only 1	intersection with	ground level			
-12.000	168.00	30.194	Only 1	intersection with	ground level			
-12.000	169.00	30.905	Only 1	intersection with	ground level			
-11.000	150.00	20.748	Only 1	intersection with	ground level			
-11.000	151.00	20.926	Only 1	intersection with	ground level			
-11.000	152.00	21.149	Only 1	intersection with	ground level			
-11.000	153.00	21.417	Only 1	intersection with	ground level			
-11.000	154.00	21.728	Only 1	intersection with	ground level			
-11.000	155.00	22.079	Only 1	intersection with	ground level			
-11.000	156.00	22.470	Only 1	intersection with	ground level			
-11.000	157.00	22.897	Only 1	intersection with	ground level			
-11.000	158.00	23.360	Only 1	intersection with	ground level			
-11.000	159.00	23.856	Only 1	intersection with	ground level			
-11.000	160.00	24.382	Only 1	intersection with	ground level			
-11.000	161.00	24.938	Only 1	intersection with	ground level			
-11.000	162.00	25.520	Only 1	intersection with	ground level			
-11.000	163.00	26.128	Only 1	intersection with	ground level			
-11.000	164.00	26.760	Only 1	intersection with	ground level			
-11.000	165.00	27.413	Only 1	intersection with	ground level			
-11.000	166.00	28.087	Only 1	intersection with	ground level			
-11.000	167.00	28.780	Only 1	intersection with	ground level			
-11.000	168.00	29.491	Only 1	intersection with	ground level			
-11.000	169.00	30.217	Only 1	intersection with	ground level			
-10.000	150.00	19.761	Only 1	intersection with	ground level			
-10.000	151.00	19.947	Only 1	intersection with	ground level			
-10.000	152.00	20.181	Only 1	intersection with	ground level			
-10.000	153.00	20.462	Only 1	intersection with	ground level			
-10.000	154.00	20.787	Only 1	intersection with	ground level			
-10.000	155.00	21.154	Only 1	intersection with	ground level			
-10.000	156.00	21.561	Only 1	intersection with	ground level			
-10.000	157.00	22.007	Only 1	intersection with	ground level			
-10.000	158.00	22.488	Only 1	intersection with	ground level			
-10.000	159.00	23.002	Only 1	intersection with	ground level			
-10.000	160.00	23.548	Only 1	intersection with	ground level			
-10.000	161.00	24.122	Only 1	intersection with	ground level			
-10.000	162.00	24.724	Only 1	intersection with	ground level			
-10.000	163.00	25.351	Only 1	intersection with	ground level			
-10.000	164.00	26.002	Only 1	intersection with	ground level			
-10.000	165.00	26.674	Only 1	intersection with	ground level			
-10.000	166.00	27.366	Only 1	intersection with	ground level			
-10.000	167.00	28.077	Only 1	intersection with	ground level			
-10.000	168.00	28.804	Only 1	intersection with	ground level			
-10.000	169.00	29.548	Only 1	intersection with	ground level			
-9.0000	150.00	18.775	Only 1	intersection with	ground level			
-9.0000	151.00	18.971	Only 1	intersection with	ground level			
-9.0000	152.00	19.217	Only 1	intersection with	ground level			
-9.0000	153.00	19.511	Only 1	intersection with	ground level			
-9.0000	154.00	19.852	Only 1	intersection with	ground level			
-9.0000	155.00	20.236	Only 1	intersection with	ground level			
-9.0000	156.00	20.661	Only 1	intersection with	ground level			
-9.0000	157.00	21.126	Only 1	intersection with	ground level			
-9.0000	158.00	21.626	Only 1	intersection with	ground level			
-9.0000	159.00	22.161	Only 1	intersection with	ground level			
-9.0000	160.00	22.726	Only 1	intersection with	ground level			
-9.0000	161.00	23.321	Only 1	intersection with	ground level			
-9.0000	162.00	23.943	Only 1	intersection with	ground level			
-9.0000	163.00	24.590	Only 1	intersection with	ground level			
-9.0000	164.00	25.260	Only 1	intersection with	ground level			
-9.0000	165.00	25.952	Only 1	intersection with	ground level			
-9.0000	166.00	26.663	Only 1	intersection with	ground level			
-9.0000	167.00	27.391	Only 1	intersection with	ground level			
-9.0000	168.00	28.137	Only 1	intersection with	ground level			
-9.0000	169.00	28.898	Only 1	intersection with	ground level			
-8.0000	150.00	17.790	Only 1	intersection with	ground level			
-8.0000	151.00	17.997	Only 1	intersection with	ground level			
-8.0000	152.00	18.256	Only 1	intersection with	ground level			
-8.0000	153.00	18.566	Only 1	intersection with	ground level			
-8.0000	154.00	18.923	Only 1	intersection with	ground level			
-8.0000	155.00	19.326	Only 1	intersection with	ground level			
-8.0000	156.00	19.771	Only 1	intersection with	ground level			
-8.0000	157.00	20.256	Only 1	intersection with	ground level			
-8.0000	158.00	20.777	Only 1	intersection with	ground level			
-8.0000	159.00	21.333	Only 1	intersection with	ground level			
-8.0000	160.00	21.920	Only 1	intersection with	ground level			
-8.0000	161.00	22.536	Only 1	intersection with	ground level			
-8.0000	162.00	23.180	Only 1	intersection with	ground level			

Oasys Hollingsworth Gate, Littleborough Section D							Job No.		Sheet No.		Rev.
							GRO-23131				
							Drg. Ref.				
							Made by JD		Date 07 Jun 2023		Checked Date
Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment				
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]				
-8.0000	163.00	23.847		Only 1 intersection with ground level							
-8.0000	164.00	24.538		Only 1 intersection with ground level							
-8.0000	165.00	25.249		Only 1 intersection with ground level							
-8.0000	166.00	25.979		Only 1 intersection with ground level							
-8.0000	167.00	26.726		Only 1 intersection with ground level							
-8.0000	168.00	27.490		Only 1 intersection with ground level							
-8.0000	169.00	28.268		Only 1 intersection with ground level							
-7.0000	150.00	16.807		Only 1 intersection with ground level							
-7.0000	151.00	17.026		Only 1 intersection with ground level							
-7.0000	152.00	17.300		Only 1 intersection with ground level							
-7.0000	153.00	17.626		Only 1 intersection with ground level							
-7.0000	154.00	18.003		Only 1 intersection with ground level							
-7.0000	155.00	18.425		Only 1 intersection with ground level							
-7.0000	156.00	18.892		Only 1 intersection with ground level							
-7.0000	157.00	19.398		Only 1 intersection with ground level							
-7.0000	158.00	19.942		Only 1 intersection with ground level							
-7.0000	159.00	20.520		Only 1 intersection with ground level							
-7.0000	160.00	21.130		Only 1 intersection with ground level							
-7.0000	161.00	21.769		Only 1 intersection with ground level							
-7.0000	162.00	22.434		Only 1 intersection with ground level							
-7.0000	163.00	23.123		Only 1 intersection with ground level							
-7.0000	164.00	23.835		Only 1 intersection with ground level							
-7.0000	165.00	24.566		Only 1 intersection with ground level							
-7.0000	166.00	25.316		Only 1 intersection with ground level							
-7.0000	167.00	26.082		Only 1 intersection with ground level							
-7.0000	168.00	26.864		Only 1 intersection with ground level							
-7.0000	169.00	27.660		Only 1 intersection with ground level							
-6.0000	150.00	15.827		Only 1 intersection with ground level							
-6.0000	151.00	16.059		Only 1 intersection with ground level							
-6.0000	152.00	16.349		Only 1 intersection with ground level							
-6.0000	153.00	16.694		Only 1 intersection with ground level							
-6.0000	154.00	17.091		Only 1 intersection with ground level							
-6.0000	155.00	17.535		Only 1 intersection with ground level							
-6.0000	156.00	18.025		Only 1 intersection with ground level							
-6.0000	157.00	18.555		Only 1 intersection with ground level							
-6.0000	158.00	19.123		Only 1 intersection with ground level							
-6.0000	159.00	19.725		Only 1 intersection with ground level							
-6.0000	160.00	20.359		Only 1 intersection with ground level							
-6.0000	161.00	21.021		Only 1 intersection with ground level							
-6.0000	162.00	21.709		Only 1 intersection with ground level							
-6.0000	163.00	22.421		Only 1 intersection with ground level							
-6.0000	164.00	23.154		Only 1 intersection with ground level							
-6.0000	165.00	23.906		Only 1 intersection with ground level							
-6.0000	166.00	24.676		Only 1 intersection with ground level							
-6.0000	167.00	25.462		Only 1 intersection with ground level							
-6.0000	168.00	26.262		Only 1 intersection with ground level							
-6.0000	169.00	27.076		Only 1 intersection with ground level							
-5.0000	150.00	14.849		Only 1 intersection with ground level							
-5.0000	151.00	15.096		Only 1 intersection with ground level							
-5.0000	152.00	15.404		Only 1 intersection with ground level							
-5.0000	153.00	15.770		Only 1 intersection with ground level							
-5.0000	154.00	16.189		Only 1 intersection with ground level							
-5.0000	155.00	16.658		Only 1 intersection with ground level							
-5.0000	156.00	17.172		Only 1 intersection with ground level							
-5.0000	157.00	17.728		Only 1 intersection with ground level							
-5.0000	158.00	18.322		Only 1 intersection with ground level							
-5.0000	159.00	18.950		Only 1 intersection with ground level							
-5.0000	160.00	19.608		Only 1 intersection with ground level							
-5.0000	161.00	20.295		Only 1 intersection with ground level							
-5.0000	162.00	21.007		Only 1 intersection with ground level							
-5.0000	163.00	21.741		Only 1 intersection with ground level							
-5.0000	164.00	22.496		Only 1 intersection with ground level							
-5.0000	165.00	23.270		Only 1 intersection with ground level							
-5.0000	166.00	24.060		Only 1 intersection with ground level							
-5.0000	167.00	24.865		Only 1 intersection with ground level							
-5.0000	168.00	25.684		Only 1 intersection with ground level							
-5.0000	169.00	26.516		Only 1 intersection with ground level							
-4.0000	150.00	13.874		Only 1 intersection with ground level							
-4.0000	151.00	14.138		Only 1 intersection with ground level							
-4.0000	152.00	14.467		Only 1 intersection with ground level							
-4.0000	153.00	14.856		Only 1 intersection with ground level							
-4.0000	154.00	15.300		Only 1 intersection with ground level							
-4.0000	155.00	15.795		Only 1 intersection with ground level							
-4.0000	156.00	16.337		Only 1 intersection with ground level							
-4.0000	157.00	16.920		Only 1 intersection with ground level							
-4.0000	158.00	17.541		Only 1 intersection with ground level							
-4.0000	159.00	18.196		Only 1 intersection with ground level							

 Hollingsworth Gate, Littleborough Section D						Job No.	Sheet No.	Rev.
						GRO-23131		
						Drg. Ref.		
						Made by JD	Date 07 Jun 2023	Checked Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-4.0000	160.00	18.881	Only 1	intersection with	ground level			
-4.0000	161.00	19.593	Only 1	intersection with	ground level			
-4.0000	162.00	20.330	Only 1	intersection with	ground level			
-4.0000	163.00	21.088	Only 1	intersection with	ground level			
-4.0000	164.00	21.865	Only 1	intersection with	ground level			
-4.0000	165.00	22.660	Only 1	intersection with	ground level			
-4.0000	166.00	23.471	Only 1	intersection with	ground level			
-4.0000	167.00	24.296	Only 1	intersection with	ground level			
-4.0000	168.00	25.133	Only 1	intersection with	ground level			
-4.0000	169.00	25.982	Only 1	intersection with	ground level			
-3.0000	150.00	12.903	Only 1	intersection with	ground level			
-3.0000	151.00	13.187	Only 1	intersection with	ground level			
-3.0000	152.00	13.538	Only 1	intersection with	ground level			
-3.0000	153.00	13.953	Only 1	intersection with	ground level			
-3.0000	154.00	14.425	Only 1	intersection with	ground level			
-3.0000	155.00	14.950	Only 1	intersection with	ground level			
-3.0000	156.00	15.521	Only 1	intersection with	ground level			
-3.0000	157.00	16.134	Only 1	intersection with	ground level			
-3.0000	158.00	16.784	Only 1	intersection with	ground level			
-3.0000	159.00	17.467	Only 1	intersection with	ground level			
-3.0000	160.00	18.179	Only 1	intersection with	ground level			
-3.0000	161.00	18.918	Only 1	intersection with	ground level			
-3.0000	162.00	19.680	Only 1	intersection with	ground level			
-3.0000	163.00	20.462	Only 1	intersection with	ground level			
-3.0000	164.00	21.262	Only 1	intersection with	ground level			
-3.0000	165.00	22.079	Only 1	intersection with	ground level			
-3.0000	166.00	22.910	Only 1	intersection with	ground level			
-3.0000	166.00	22.910	Only 1	intersection with	ground level			
-3.0000	167.00	23.755	Only 1	intersection with	ground level			
-3.0000	167.00	23.755	Only 1	intersection with	ground level			
-3.0000	168.00	24.611	Only 1	intersection with	ground level			
-3.0000	169.00	25.477	1092.0	1.6208	9980.3	16176.	0.0	
-2.0000	150.00	11.937	Only 1	intersection with	ground level			
-2.0000	151.00	12.243	Only 1	intersection with	ground level			
-2.0000	152.00	12.621	Only 1	intersection with	ground level			
-2.0000	153.00	13.065	Only 1	intersection with	ground level			
-2.0000	154.00	13.568	Only 1	intersection with	ground level			
-2.0000	155.00	14.124	Only 1	intersection with	ground level			
-2.0000	156.00	14.727	Only 1	intersection with	ground level			
-2.0000	157.00	15.372	Only 1	intersection with	ground level			
-2.0000	158.00	16.053	Only 1	intersection with	ground level			
-2.0000	159.00	16.766	Only 1	intersection with	ground level			
-2.0000	160.00	17.507	Only 1	intersection with	ground level			
-2.0000	161.00	18.273	Only 1	intersection with	ground level			
-2.0000	161.00	18.273	Only 1	intersection with	ground level			
-2.0000	162.00	19.060	Only 1	intersection with	ground level			
-2.0000	162.00	19.060	Only 1	intersection with	ground level			
-2.0000	163.00	19.867	Only 1	intersection with	ground level			
-2.0000	163.00	19.867	Only 1	intersection with	ground level			
-2.0000	164.00	20.690	1110.5	1.6708	8298.0	13865.	0.0	
-2.0000	165.00	21.529	1081.5	1.6426	8441.7	13866.	0.0	
-2.0000	166.00	22.381	1057.4	1.6188	8594.5	13913.	0.0	
-2.0000	167.00	23.244	1037.3	1.5995	8753.6	14001.	0.0	
-2.0000	168.00	24.118	1020.9	1.5837	8920.4	14128.	0.0	
-2.0000	169.00	25.002	1007.7	1.5715	9094.5	14292.	0.0	
-1.0000	150.00	10.977	Only 1	intersection with	ground level			
-1.0000	151.00	11.309	Only 1	intersection with	ground level			
-1.0000	152.00	11.717	Only 1	intersection with	ground level			
-1.0000	153.00	12.194	Only 1	intersection with	ground level			
-1.0000	154.00	12.731	Only 1	intersection with	ground level			
-1.0000	155.00	13.323	Only 1	intersection with	ground level			
-1.0000	156.00	13.960	Only 1	intersection with	ground level			
-1.0000	157.00	14.639	Only 1	intersection with	ground level			
-1.0000	157.00	14.639	Only 1	intersection with	ground level			
-1.0000	158.00	15.352	Only 1	intersection with	ground level			
-1.0000	158.00	15.352	Only 1	intersection with	ground level			
-1.0000	159.00	16.096	Only 1	intersection with	ground level			
-1.0000	159.00	16.096	Only 1	intersection with	ground level			
-1.0000	160.00	16.867	Only 1	intersection with	ground level			
-1.0000	160.00	16.867	Only 1	intersection with	ground level			
-1.0000	161.00	17.660	1081.8	1.6943	6938.1	11750.	5.4188	
-1.0000	162.00	18.474	1049.4	1.6561	7089.8	11742.	0.0	
-1.0000	163.00	19.305	1022.7	1.6257	7248.2	11783.	0.0	
-1.0000	164.00	20.152	1000.9	1.6012	7413.6	11870.	0.0	
-1.0000	165.00	21.012	983.46	1.5816	7585.1	11997.	0.0	
-1.0000	166.00	21.884	969.67	1.5664	7763.8	12162.	0.0	

Oasys Hollingsworth Gate, Littleborough Section D						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date 07 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]		
-1.0000	167.00	22.766	959.26	1.5550	7950.1	12362.	0.0		
-1.0000	168.00	23.658	951.61	1.5468	8142.4	12595.	0.0		
-1.0000	169.00	24.558	946.43	1.5412	8341.5	12856.	0.0		
0.0	150.00	10.024	Only	1 intersection with ground level					
0.0	151.00	10.387	Only	1 intersection with ground level					
0.0	152.00	10.830	Only	1 intersection with ground level					
0.0	152.00	10.830	Only	1 intersection with ground level					
0.0	153.00	11.344	Only	1 intersection with ground level					
0.0	153.00	11.344	Only	1 intersection with ground level					
0.0	154.00	11.920	Only	1 intersection with ground level					
0.0	154.00	11.920	Only	1 intersection with ground level					
0.0	155.00	12.550	Only	1 intersection with ground level					
0.0	155.00	12.550	Only	1 intersection with ground level					
0.0	156.00	13.225	Only	1 intersection with ground level					
0.0	156.00	13.225	Only	1 intersection with ground level					
0.0	157.00	13.939	Only	1 intersection with ground level					
0.0	157.00	13.939	Only	1 intersection with ground level					
0.0	158.00	14.686	1057.0	1.7475	5621.7	9797.6	26.520		
0.0	159.00	15.463	1018.6	1.6928	5778.5	9762.5	19.630		
0.0	160.00	16.263	987.93	1.6480	5942.4	9787.8	5.3963		
0.0	161.00	17.085	963.42	1.6138	6112.1	9863.8	0.0		
0.0	162.00	17.925	944.30	1.5880	6288.8	9986.3	0.0		
0.0	163.00	18.780	929.72	1.5682	6472.1	10150.	0.0		
0.0	164.00	19.649	918.74	1.5533	6661.1	10347.	0.0		
0.0	165.00	20.530	911.31	1.5428	6857.7	10580.	0.0		
0.0	166.00	21.422	906.56	1.5359	7059.6	10843.	0.0		
0.0	167.00	22.322	904.38	1.5321	7268.7	11136.	0.0		
0.0	168.00	23.231	904.09	1.5304	7483.5	11453.	0.0		
0.0	169.00	24.147	905.45	1.5305	7703.9	11791.	0.0		
1.0000	150.00	9.0824	Only	1 intersection with ground level					
1.0000	150.00	9.0824	Only	1 intersection with ground level					
1.0000	151.00	9.4810	Only	1 intersection with ground level					
1.0000	151.00	9.4810	Only	1 intersection with ground level					
1.0000	152.00	9.9644	Only	1 intersection with ground level					
1.0000	152.00	9.9644	Only	1 intersection with ground level					
1.0000	153.00	10.521	Only	1 intersection with ground level					
1.0000	153.00	10.521	Only	1 intersection with ground level					
1.0000	154.00	11.140	Only	1 intersection with ground level					
1.0000	154.00	11.140	Only	1 intersection with ground level					
1.0000	155.00	11.811	Only	1 intersection with ground level					
1.0000	155.00	11.811	Only	1 intersection with ground level					
1.0000	156.00	12.526	992.69	1.7749	4504.5	7968.9	26.260		
1.0000	157.00	13.277	955.42	1.7063	4678.0	7959.6	22.620		
1.0000	158.00	14.060	926.08	1.6544	4851.6	8009.3	17.030		
1.0000	159.00	14.869	903.88	1.6135	5031.7	8113.4	5.2976		
1.0000	160.00	15.700	887.42	1.5840	5217.4	8264.1	0.0		
1.0000	161.00	16.550	875.63	1.5629	5409.8	8454.9	0.0		
1.0000	162.00	17.415	867.94	1.5479	5609.1	8682.4	0.0		
1.0000	163.00	18.295	863.30	1.5377	5813.5	8939.6	0.0		
1.0000	164.00	19.186	861.42	1.5306	6025.8	9223.3	0.0		
1.0000	165.00	20.087	861.84	1.5269	6243.2	9532.8	0.0		
1.0000	166.00	20.997	864.29	1.5255	6466.8	9864.9	0.0		
1.0000	167.00	21.916	868.19	1.5257	6694.9	10215.	0.0		
1.0000	168.00	22.841	873.62	1.5274	6929.2	10584.	0.0		
1.0000	169.00	23.772	880.18	1.5297	7168.5	10966.	0.0		
2.0000	150.00	8.1541	Only	1 intersection with ground level					
2.0000	150.00	8.1541	Only	1 intersection with ground level					
2.0000	151.00	8.5959	Only	1 intersection with ground level					
2.0000	151.00	8.5959	Only	1 intersection with ground level					
2.0000	152.00	9.1263	Only	1 intersection with ground level					
2.0000	152.00	9.1263	Only	1 intersection with ground level					
2.0000	153.00	9.7309	976.40	1.9720	3254.1	6397.0	19.890		
2.0000	154.00	10.397	927.00	1.8435	3440.1	6320.1	21.450		
2.0000	155.00	11.113	890.03	1.7498	3627.0	6325.6	21.060		
2.0000	156.00	11.870	862.51	1.6805	3816.4	6394.7	18.720		
2.0000	157.00	12.661	842.54	1.6302	4007.2	6518.0	14.430		
2.0000	158.00	13.479	828.44	1.5926	4201.3	6685.8	5.1114		
2.0000	159.00	14.321	819.63	1.5663	4402.2	6895.0	0.0		
2.0000	160.00	15.182	814.80	1.5487	4608.8	7137.8	0.0		
2.0000	161.00	16.059	813.39	1.5370	4822.6	7412.2	0.0		
2.0000	162.00	16.950	814.62	1.5294	5042.0	7711.0	0.0		
2.0000	163.00	17.852	817.98	1.5252	5266.4	8032.2	0.0		
2.0000	164.00	18.764	823.27	1.5235	5496.3	8373.8	0.0		
2.0000	165.00	19.685	830.09	1.5235	5731.6	8732.4	0.0		

Oasys Hollingsworth Gate, Littleborough Section D						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date 07 Jun 2023	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]		[kNm/m]	[kNm/m]	[kNm/m]			
2.0000	166.00	20.613	838.33	1.5246	5972.5	9105.7 0.0			
2.0000	167.00	21.547	847.51	1.5258	6217.7	9486.9 0.0			
2.0000	168.00	22.488	857.84	1.5263	6469.1	9873.8 0.0			
2.0000	169.00	23.433	868.89	1.5243	6724.1	10249. 0.0			
3.0000	150.00	7.2450	Only 1 intersection with ground level						
3.0000	150.00	7.2450	Only 1 intersection with ground level						
3.0000	151.00	7.7389	Centre embedded/below end of slip						
3.0000	152.00	8.3241	858.95	2.0050	2427.0	4854.1 12.090			
3.0000	153.00	8.9828	820.65	1.8522	2629.5	4855.5 14.950			
3.0000	154.00	9.7000	794.15	1.7454	2833.3	4929.2 15.860			
3.0000	155.00	10.464	766.54	1.6712	3038.2	5060.9 16.504			
3.0000	156.00	11.265	765.57	1.6191	3243.9	5239.1 12.995			
3.0000	157.00	12.095	759.87	1.5823	3451.9	5456.9 4.8295			
3.0000	158.00	12.950	758.42	1.5578	3665.2	5709.6 0.0			
3.0000	159.00	13.824	760.22	1.5427	3883.6	5991.1 0.0			
3.0000	160.00	14.714	765.04	1.5331	4108.7	6299.2 0.0			
3.0000	161.00	15.617	771.91	1.5277	4338.9	6628.6 0.0			
3.0000	162.00	16.531	780.67	1.5250	4574.9	6976.5 0.0			
3.0000	163.00	17.455	790.77	1.5238	4815.1	7337.4 0.0			
3.0000	164.00	18.387	802.13	1.5227	5060.7	7705.9 0.0			
3.0000	165.00	19.326	814.47	1.5197	5311.3	8071.4 0.0			
3.0000	166.00	20.270	827.50	1.5154	5565.4	8434.1 0.0			
3.0000	167.00	21.220	841.34	1.5243	5825.0	8879.1 0.0			
3.0000	168.00	22.174	855.84	1.5342	6089.9	9343.0 0.0			
3.0000	169.00	23.132	870.68	1.5448	6358.0	9822.2 0.0			
4.0000	150.00	6.3632	Centre embedded/below end of slip						
4.0000	151.00	6.9203	Centre embedded/below end of slip						
4.0000	152.00	7.5690	717.09	1.8961	1904.9	3603.3 8.6396			
4.0000	153.00	8.2879	702.19	1.7642	2124.8	3733.7 14.950			
4.0000	154.00	9.0604	695.09	1.6778	2342.8	3914.9 15.860			
4.0000	155.00	9.8737	693.82	1.6208	2560.8	4137.4 13.018			
4.0000	156.00	10.719	696.66	1.5831	2778.7	4394.0 4.9392			
4.0000	157.00	11.588	702.84	1.5595	3000.8	4679.7 0.0			
4.0000	158.00	12.478	711.96	1.5458	3229.4	4991.8 0.0			
4.0000	159.00	13.382	722.97	1.5376	3461.9	5323.3 0.0			
4.0000	160.00	14.300	735.76	1.5318	3701.0	5669.2 0.0			
4.0000	161.00	15.228	749.72	1.5263	3944.6	6020.5 0.0			
4.0000	162.00	16.164	764.77	1.5160	4193.3	6357.1 0.0			
4.0000	163.00	17.108	780.48	1.5125	4445.6	6724.1 0.0			
4.0000	164.00	18.058	797.00	1.5200	4704.1	7150.0 0.0			
4.0000	165.00	19.013	813.94	1.5286	4966.2	7591.5 0.0			
4.0000	166.00	19.972	831.30	1.5383	5232.7	8049.5 0.0			
4.0000	167.00	20.935	849.03	1.5485	5504.3	8523.6 0.0			
4.0000	168.00	21.902	867.07	1.5593	5780.3	9013.2 0.0			
4.0000	169.00	22.871	885.19	1.5705	6059.0	9515.6 0.0			
5.0000	150.00	5.5218	Centre embedded/below end of slip						
5.0000	151.00	6.1555	Centre embedded/below end of slip						
5.0000	152.00	6.8768	611.87	1.8207	1495.9	2715.2 8.4500			
5.0000	153.00	7.6609	617.33	1.7100	1724.7	2938.5 10.660			
5.0000	154.00	8.4906	626.88	1.6442	1950.8	3196.6 10.920			
5.0000	155.00	9.3536	639.02	1.6030	2175.2	3481.6 5.3163			
5.0000	156.00	10.242	653.48	1.5770	2403.2	3789.9 0.0			
5.0000	157.00	11.149	670.02	1.5604	2637.7	4115.9 0.0			
5.0000	158.00	12.070	687.81	1.5442	2876.8	4442.5 0.0			
5.0000	159.00	13.003	706.52	1.5127	3120.8	4720.8 0.0			
5.0000	160.00	13.946	725.98	1.5129	3369.7	5098.1 0.0			
5.0000	161.00	14.896	745.99	1.5149	3624.1	5490.0 0.0			
5.0000	162.00	15.852	766.35	1.5184	3882.7	5895.4 0.0			
5.0000	163.00	16.813	787.01	1.5224	4145.6	6311.3 0.0			
5.0000	164.00	17.779	807.93	1.5257	4413.4	6733.4 0.0			
5.0000	165.00	18.748	828.98	1.5266	4685.6	7152.8 0.0			
5.0000	166.00	19.720	850.16	1.5208	4962.0	7546.1 0.0			
5.0000	167.00	20.695	871.41	1.4871	5241.7	7795.1 0.0			
5.0000	168.00	21.672	892.74	1.5145	5525.2	8367.9 0.0			
5.0000	169.00	22.651	913.78	1.5422	5808.6	8957.7 0.0			
6.0000	150.00	4.7424	Centre embedded/below end of slip						
6.0000	151.00	5.4672	Centre embedded/below end of slip						
6.0000	152.00	6.2682	543.25	1.7962	1172.7	2100.9 5.4600			
6.0000	153.00	7.1197	565.78	1.6979	1403.3	2375.7 7.0200			
6.0000	154.00	8.0056	588.87	1.6373	1630.9	2665.1 5.0954			
6.0000	155.00	8.9157	612.76	1.5851	1861.9	2951.3 0.0			
6.0000	156.00	9.8433	637.33	1.5186	2097.7	3185.5 0.0			
6.0000	157.00	10.784	662.25	1.4938	2339.4	3494.6 0.0			

Oasys Hollingsworth Gate, Littleborough Section D						Job No.		Sheet No.		Rev.			
						GRO-23131							
						Drg. Ref.							
						Made by JD		Date 07 Jun 2023		Checked Date			
Slip Centre		Radius		Slip		Comment/ Over-Design		Disturbing		Soil Strength		Reinforcement	
				Weight		Factor		Moment		Restoring		Restoring	
										Moment		Moment	
x [m]		y [m]		[m]		[kN/m]		[kNm/m]		[kNm/m]		[kNm/m]	
6.0000		158.00		11.734		687.48		1.4634		2586.1		3784.6	
6.0000		159.00		12.692		712.92		1.3915		2838.1		3949.3	
6.0000		160.00		13.656		738.34		1.4204		3095.2		4396.4	
6.0000		161.00		14.625		763.51		1.4494		3356.9		4865.5	
6.0000		162.00		15.598		788.54		1.4784		3623.6		5357.2	
6.0000		163.00		16.574		813.36		1.5126		3895.0		5870.4	
6.0000		164.00		17.552		837.89		1.5408		4170.9		6403.9	
6.0000		165.00		18.533		862.32		1.5686		4451.9		6959.3	
6.0000		166.00		19.516		886.40		1.5961		4735.9		7533.7	
6.0000		167.00		20.501		910.03		1.6240		5020.2		8126.5	
6.0000		168.00		21.487		933.11		1.6520		5304.5		8735.2	
6.0000		169.00		22.474		955.78		1.6802		5588.7		9361.2	
7.0000		150.00		4.0608									
7.0000		151.00		4.8877									
7.0000		152.00		5.7697		509.86		1.7753		909.23		1597.9	
7.0000		153.00		6.6851		546.99		1.4828		1139.5		1670.0	
7.0000		154.00		7.6217		581.90		1.4708		1369.4		2004.7	
7.0000		155.00		8.5726		615.43		1.4821		1604.3		2366.9	
7.0000		156.00		9.5336		647.89		1.4999		1845.7		2756.2	
7.0000		157.00		10.502		679.35		1.5214		2093.0		3170.8	
7.0000		158.00		11.476		710.18		1.5455		2346.0		3611.0	
7.0000		159.00		12.454		740.27		1.5707		2604.8		4075.4	
7.0000		160.00		13.435		769.70		1.5966		2868.9		4563.3	
7.0000		161.00		14.418		798.41		1.6229		3137.3		5072.9	
7.0000		162.00		15.404		826.65		1.6490		3411.4		5605.5	
7.0000		163.00		16.392		854.50		1.6749		3690.8		6160.6	
7.0000		164.00		17.381		881.75		1.7005		3974.3		6735.9	
7.0000		165.00		18.371		908.28		1.7270		4258.1		7329.9	
7.0000		166.00		19.362		934.14		1.7540		4542.3		7942.2	
7.0000		167.00		20.354		959.34		1.7817		4825.9		8572.0	
7.0000		168.00		21.347		983.88		1.8097		5109.2		9218.4	
7.0000		169.00		22.340		1007.9		1.8378		5392.8		9881.8	

Program Oasys Slope Version 21.0.0.46

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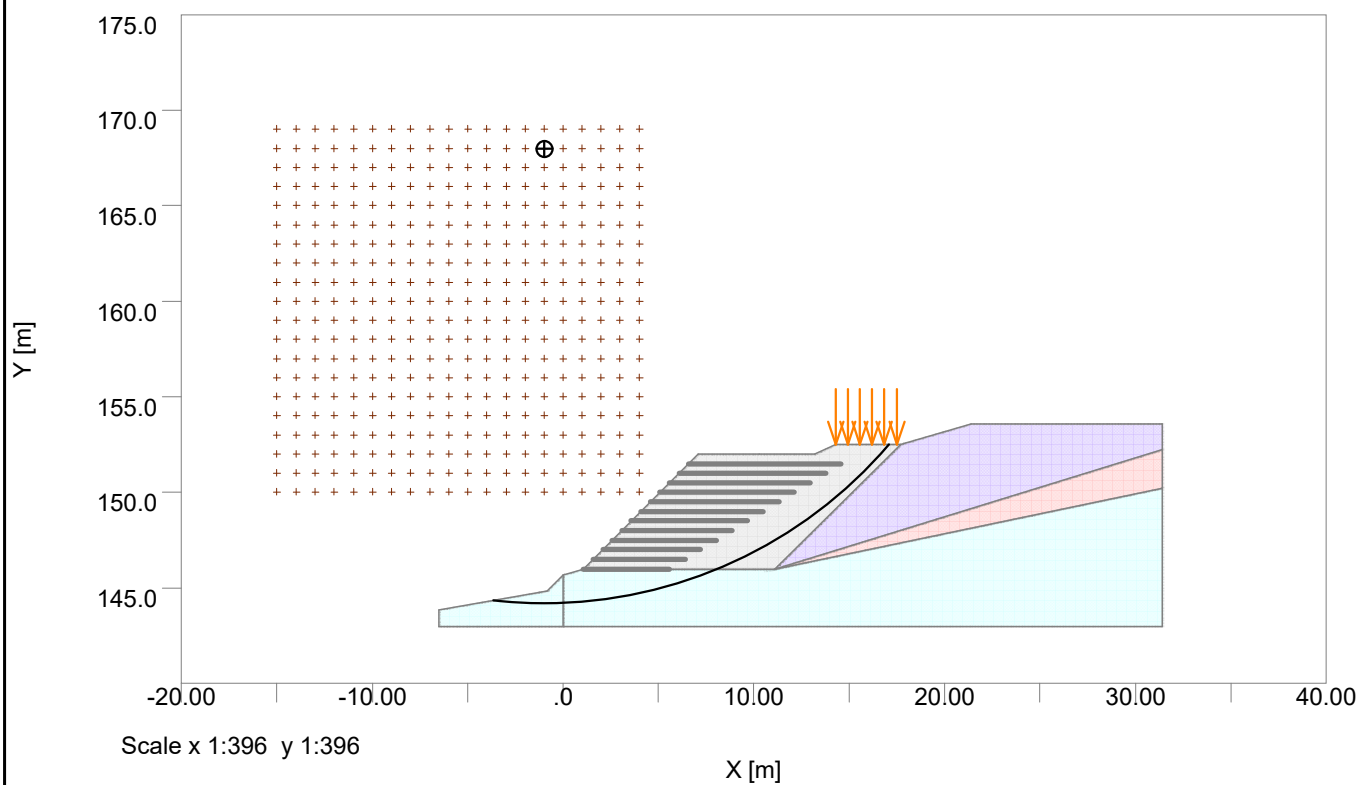
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APPENDIX 5 - Section E Modelling Outputs

Circle plotted: centre at -1.00,168.00, Over-Design Factor 1.377



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :100.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Method Partial Factors

```

BS EN 1997-1:2011 DA1-2
Factor on FAVOURABLE PERMANENT LOAD: 1.00000
Factor on UNFAVOURABLE PERMANENT LOAD: 1.00000
Factor on FAVOURABLE VARIABLE LOAD: 0.00000
Factor on UNFAVOURABLE VARIABLE LOAD: 1.30000
Factor on UNIT WEIGHT: 1.00000
Factor on DRAINED COHESION: 1.25000
Factor on UNDRAINED COHESION: 1.40000
Factor on TAN PHI': 1.25000
Factor on REINFORCEMENT PULLOUT: 1.50000
Factor on ECONOMIC FAILURE: 1.00000
Factor on SLIDING ALONG REINFORCEMENT: 1.50000

```

Material Partial Factors

[illegible]

Material Properties

Material Properties		Unit Weight		Shear Strength Parameters		Phi or c
No	Description	Above GWL	Below GWL	Condition		
	or c0'					
		[kN/m3]	[kN/m3]			Phi0 [°]
	[kN/m²]					
0.0	1 Canal Wall	25.000	25.000	Drained		40.000
0.0	2 Reinforced Earth	17.500	20.000	Drained		24.000
0.0	3 Clay Made Ground	17.500	20.000	Drained		24.000
0.0	4 Stiff CLAY	21.000	23.000	Drained		24.000
0.0	5 Weathered SANDSTONE	21.000	23.000	Drained		40.000

Surface loads

No.	Limits of loaded area		Distributed load		Permanent / Variable load	Favourable / Unfavourable load	Use in pull-out calc
	X1 [m]	X2 [m]	Vert [kN/m ²]	Horiz [kN/m ²]			
1	14.300	17.500	10.000	0.0	Variable	Unfavourable	No

Reinforcement

Layers	Level of top layer [m]	Vertical Spacing [m]	Length Top [m]	Length Btm [m]	Offset from surface [m]	Angle from horizon [°]
12	151.50	0.50000	8.0000	4.5000	0.0	0

Bond Length	Bond Strength	Prestress	Grout Diameter
	[kN/m]	[kN]	[mm]
0.0%	0.0	0.0	0.0

Out of Tensile Plate Material

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Drg. Ref.		
Made by JD	Date	Checked Date

plane spacing	Capacity [kN]	Capacity [kN]	Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:

Bottom left of grid: x = -15.00000 m y = 150.00000 m

Inclination of grid: 0.00000 deg

(positive anticlockwise direction about bottom left of grid)

Centres on grid: 20 in x direction at 1.00000m spacing

20 in y direction at 1.00000m spacing

Grid extended to find minimum FoS

All circles pass through common point at x = 8.10000 m, y = 146.00000 m

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values
using the currently selected Method Partial Factors.

Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-15.000	150.00	23.444	Only 1	intersection with ground level		
-15.000	151.00	23.635	Only 1	intersection with ground level		
-15.000	152.00	23.867	Only 1	intersection with ground level		
-15.000	153.00	24.137	Only 1	intersection with ground level		
-15.000	154.00	24.446	Only 1	intersection with ground level		
-15.000	155.00	24.791	Only 1	intersection with ground level		
-15.000	156.00	25.172	Only 1	intersection with ground level		
-15.000	157.00	25.585	Only 1	intersection with ground level		
-15.000	158.00	26.031	Only 1	intersection with ground level		
-15.000	159.00	26.507	Only 1	intersection with ground level		
-15.000	160.00	27.011	Only 1	intersection with ground level		
-15.000	161.00	27.543	Only 1	intersection with ground level		
-15.000	162.00	28.100	Only 1	intersection with ground level		
-15.000	163.00	28.681	Only 1	intersection with ground level		
-15.000	164.00	29.285	Only 1	intersection with ground level		
-15.000	165.00	29.910	Only 1	intersection with ground level		
-15.000	166.00	30.555	Only 1	intersection with ground level		
-15.000	167.00	31.219	Only 1	intersection with ground level		
-15.000	168.00	31.900	Only 1	intersection with ground level		
-15.000	169.00	32.598	Only 1	intersection with ground level		
-14.000	150.00	22.459	Only 1	intersection with ground level		
-14.000	151.00	22.659	Only 1	intersection with ground level		
-14.000	152.00	22.900	Only 1	intersection with ground level		
-14.000	153.00	23.182	Only 1	intersection with ground level		
-14.000	154.00	23.503	Only 1	intersection with ground level		
-14.000	155.00	23.862	Only 1	intersection with ground level		
-14.000	156.00	24.257	Only 1	intersection with ground level		
-14.000	157.00	24.686	Only 1	intersection with ground level		
-14.000	158.00	25.148	Only 1	intersection with ground level		
-14.000	159.00	25.640	Only 1	intersection with ground level		
-14.000	160.00	26.161	Only 1	intersection with ground level		
-14.000	161.00	26.710	Only 1	intersection with ground level		
-14.000	162.00	27.284	Only 1	intersection with ground level		
-14.000	163.00	27.882	Only 1	intersection with ground level		
-14.000	164.00	28.503	Only 1	intersection with ground level		
-14.000	165.00	29.145	Only 1	intersection with ground level		
-14.000	166.00	29.806	Only 1	intersection with ground level		
-14.000	167.00	30.486	Only 1	intersection with ground level		
-14.000	168.00	31.183	Only 1	intersection with ground level		
-14.000	169.00	31.897	Only 1	intersection with ground level		
-13.000	150.00	21.476	Only 1	intersection with ground level		
-13.000	151.00	21.684	Only 1	intersection with ground level		
-13.000	152.00	21.936	Only 1	intersection with ground level		
-13.000	153.00	22.231	Only 1	intersection with ground level		
-13.000	154.00	22.566	Only 1	intersection with ground level		
-13.000	155.00	22.939	Only 1	intersection with ground level		
-13.000	156.00	23.350	Only 1	intersection with ground level		
-13.000	157.00	23.795	Only 1	intersection with ground level		
-13.000	158.00	24.274	Only 1	intersection with ground level		
-13.000	159.00	24.783	Only 1	intersection with ground level		
-13.000	160.00	25.322	Only 1	intersection with ground level		
-13.000	161.00	25.888	Only 1	intersection with ground level		
-13.000	162.00	26.480	Only 1	intersection with ground level		



Hollingsworth Gate, Littleborough
Section E

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-13.000	163.00	27.096		Only 1	intersection with ground level		
-13.000	164.00	27.735		Only 1	intersection with ground level		
-13.000	165.00	28.394		Only 1	intersection with ground level		
-13.000	166.00	29.072		Only 1	intersection with ground level		
-13.000	167.00	29.769		Only 1	intersection with ground level		
-13.000	168.00	30.483		Only 1	intersection with ground level		
-13.000	169.00	31.212		Only 1	intersection with ground level		
-12.000	150.00	20.494		Only 1	intersection with ground level		
-12.000	151.00	20.713		Only 1	intersection with ground level		
-12.000	152.00	20.976		Only 1	intersection with ground level		
-12.000	153.00	21.284		Only 1	intersection with ground level		
-12.000	154.00	21.634		Only 1	intersection with ground level		
-12.000	155.00	22.023		Only 1	intersection with ground level		
-12.000	156.00	22.450		Only 1	intersection with ground level		
-12.000	157.00	22.913		Only 1	intersection with ground level		
-12.000	158.00	23.410		Only 1	intersection with ground level		
-12.000	159.00	23.938		Only 1	intersection with ground level		
-12.000	160.00	24.495		Only 1	intersection with ground level		
-12.000	161.00	25.080		Only 1	intersection with ground level		
-12.000	162.00	25.691		Only 1	intersection with ground level		
-12.000	163.00	26.325		Only 1	intersection with ground level		
-12.000	164.00	26.982		Only 1	intersection with ground level		
-12.000	165.00	27.659		Only 1	intersection with ground level		
-12.000	166.00	28.355		Only 1	intersection with ground level		
-12.000	167.00	29.069		Only 1	intersection with ground level		
-12.000	168.00	29.799		Only 1	intersection with ground level		
-12.000	169.00	30.545		Only 1	intersection with ground level		
-11.000	150.00	19.514		Only 1	intersection with ground level		
-11.000	151.00	19.744		Only 1	intersection with ground level		
-11.000	152.00	20.020		Only 1	intersection with ground level		
-11.000	153.00	20.342		Only 1	intersection with ground level		
-11.000	154.00	20.708		Only 1	intersection with ground level		
-11.000	155.00	21.114		Only 1	intersection with ground level		
-11.000	156.00	21.559		Only 1	intersection with ground level		
-11.000	157.00	22.041		Only 1	intersection with ground level		
-11.000	158.00	22.557		Only 1	intersection with ground level		
-11.000	159.00	23.104		Only 1	intersection with ground level		
-11.000	160.00	23.681		Only 1	intersection with ground level		
-11.000	161.00	24.286		Only 1	intersection with ground level		
-11.000	162.00	24.916		Only 1	intersection with ground level		
-11.000	163.00	25.570		Only 1	intersection with ground level		
-11.000	164.00	26.245		Only 1	intersection with ground level		
-11.000	165.00	26.941		Only 1	intersection with ground level		
-11.000	166.00	27.655		Only 1	intersection with ground level		
-11.000	167.00	28.387		Only 1	intersection with ground level		
-11.000	168.00	29.134		Only 1	intersection with ground level		
-11.000	169.00	29.897		Only 1	intersection with ground level		
-10.000	150.00	18.537		Only 1	intersection with ground level		
-10.000	151.00	18.778		Only 1	intersection with ground level		
-10.000	152.00	19.069		Only 1	intersection with ground level		
-10.000	153.00	19.406		Only 1	intersection with ground level		
-10.000	154.00	19.789		Only 1	intersection with ground level		
-10.000	155.00	20.214		Only 1	intersection with ground level		
-10.000	156.00	20.679		Only 1	intersection with ground level		
-10.000	157.00	21.180		Only 1	intersection with ground level		
-10.000	158.00	21.717		Only 1	intersection with ground level		
-10.000	159.00	22.285		Only 1	intersection with ground level		
-10.000	160.00	22.883		Only 1	intersection with ground level		
-10.000	161.00	23.508		Only 1	intersection with ground level		
-10.000	162.00	24.158		Only 1	intersection with ground level		
-10.000	163.00	24.832		Only 1	intersection with ground level		
-10.000	164.00	25.527		Only 1	intersection with ground level		
-10.000	165.00	26.241		Only 1	intersection with ground level		
-10.000	166.00	26.974		Only 1	intersection with ground level		
-10.000	167.00	27.724		Only 1	intersection with ground level		
-10.000	168.00	28.489		Only 1	intersection with ground level		
-10.000	169.00	29.268		Only 1	intersection with ground level		
-9.0000	150.00	17.562		Only 1	intersection with ground level		
-9.0000	151.00	17.816		Only 1	intersection with ground level		
-9.0000	152.00	18.122		Only 1	intersection with ground level		
-9.0000	153.00	18.477		Only 1	intersection with ground level		
-9.0000	154.00	18.879		Only 1	intersection with ground level		
-9.0000	155.00	19.324		Only 1	intersection with ground level		
-9.0000	156.00	19.809		Only 1	intersection with ground level		
-9.0000	157.00	20.332		Only 1	intersection with ground level		
-9.0000	158.00	20.890		Only 1	intersection with ground level		
-9.0000	159.00	21.480		Only 1	intersection with ground level		

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-9.0000	160.00	22.100		Only 1 intersection with ground level			
-9.0000	161.00	22.747		Only 1 intersection with ground level			
-9.0000	162.00	23.418		Only 1 intersection with ground level			
-9.0000	163.00	24.112		Only 1 intersection with ground level			
-9.0000	164.00	24.828		Only 1 intersection with ground level			
-9.0000	165.00	25.562		Only 1 intersection with ground level			
-9.0000	166.00	26.314		Only 1 intersection with ground level			
-9.0000	167.00	27.082		Only 1 intersection with ground level			
-9.0000	168.00	27.864		Only 1 intersection with ground level			
-9.0000	169.00	28.660		Only 1 intersection with ground level			
-8.0000	150.00	16.589		Only 1 intersection with ground level			
-8.0000	151.00	16.859		Only 1 intersection with ground level			
-8.0000	152.00	17.182		Only 1 intersection with ground level			
-8.0000	153.00	17.556		Only 1 intersection with ground level			
-8.0000	154.00	17.978		Only 1 intersection with ground level			
-8.0000	155.00	18.445		Only 1 intersection with ground level			
-8.0000	156.00	18.953		Only 1 intersection with ground level			
-8.0000	157.00	19.499		Only 1 intersection with ground level			
-8.0000	158.00	20.080		Only 1 intersection with ground level			
-8.0000	159.00	20.693		Only 1 intersection with ground level			
-8.0000	160.00	21.336		Only 1 intersection with ground level			
-8.0000	161.00	22.005		Only 1 intersection with ground level			
-8.0000	162.00	22.698		Only 1 intersection with ground level			
-8.0000	163.00	23.414		Only 1 intersection with ground level			
-8.0000	164.00	24.150		Only 1 intersection with ground level			
-8.0000	165.00	24.904		Only 1 intersection with ground level			
-8.0000	166.00	25.675		Only 1 intersection with ground level			
-8.0000	167.00	26.461		Only 1 intersection with ground level			
-8.0000	168.00	27.262		Only 1 intersection with ground level			
-8.0000	169.00	28.075		Only 1 intersection with ground level			
-7.0000	150.00	15.621		Only 1 intersection with ground level			
-7.0000	151.00	15.906		Only 1 intersection with ground level			
-7.0000	152.00	16.248		Only 1 intersection with ground level			
-7.0000	153.00	16.644		Only 1 intersection with ground level			
-7.0000	154.00	17.088		Only 1 intersection with ground level			
-7.0000	155.00	17.579		Only 1 intersection with ground level			
-7.0000	156.00	18.111		Only 1 intersection with ground level			
-7.0000	157.00	18.682		Only 1 intersection with ground level			
-7.0000	158.00	19.288		Only 1 intersection with ground level			
-7.0000	159.00	19.925		Only 1 intersection with ground level			
-7.0000	160.00	20.592		Only 1 intersection with ground level			
-7.0000	161.00	21.284		Only 1 intersection with ground level			
-7.0000	162.00	22.000		Only 1 intersection with ground level			
-7.0000	163.00	22.738		Only 1 intersection with ground level			
-7.0000	164.00	23.495		Only 1 intersection with ground level			
-7.0000	165.00	24.270		Only 1 intersection with ground level			
-7.0000	166.00	25.060		Only 1 intersection with ground level			
-7.0000	167.00	25.865		Only 1 intersection with ground level			
-7.0000	168.00	26.684		Only 1 intersection with ground level			
-7.0000	169.00	27.514		Only 1 intersection with ground level			
-6.0000	150.00	14.656		Only 1 intersection with ground level			
-6.0000	151.00	14.960		Only 1 intersection with ground level			
-6.0000	152.00	15.324		Only 1 intersection with ground level			
-6.0000	153.00	15.742		Only 1 intersection with ground level			
-6.0000	154.00	16.211		Only 1 intersection with ground level			
-6.0000	155.00	16.728		Only 1 intersection with ground level			
-6.0000	156.00	17.286		Only 1 intersection with ground level			
-6.0000	157.00	17.883		Only 1 intersection with ground level			
-6.0000	158.00	18.515		Only 1 intersection with ground level			
-6.0000	159.00	19.178		Only 1 intersection with ground level			
-6.0000	160.00	19.870		Only 1 intersection with ground level			
-6.0000	161.00	20.587		Only 1 intersection with ground level			
-6.0000	162.00	21.326		Only 1 intersection with ground level			
-6.0000	163.00	22.086		Only 1 intersection with ground level			
-6.0000	164.00	22.865		Only 1 intersection with ground level			
-6.0000	165.00	23.660		Only 1 intersection with ground level			
-6.0000	166.00	24.471		Only 1 intersection with ground level			
-6.0000	167.00	25.294		Only 1 intersection with ground level			
-6.0000	168.00	26.131		Only 1 intersection with ground level			
-6.0000	169.00	26.978		Only 1 intersection with ground level			
-5.0000	150.00	13.697		Only 1 intersection with ground level			
-5.0000	151.00	14.022		Only 1 intersection with ground level			
-5.0000	152.00	14.409		Only 1 intersection with ground level			
-5.0000	153.00	14.853		Only 1 intersection with ground level			
-5.0000	154.00	15.350		Only 1 intersection with ground level			
-5.0000	155.00	15.894		Only 1 intersection with ground level			
-5.0000	156.00	16.481		Only 1 intersection with ground level			

Oasys Hollingsworth Gate, Littleborough Section E							Job No.		Sheet No.		Rev.
							GRO-23131				
							Drg. Ref.				
							Made by JD		Date		Checked
Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment				
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]				
-5.0000	157.00	17.106		Only 1 intersection with ground level							
-5.0000	158.00	17.765		Only 1 intersection with ground level							
-5.0000	159.00	18.456		Only 1 intersection with ground level							
-5.0000	160.00	19.173		Only 1 intersection with ground level							
-5.0000	161.00	19.915		Only 1 intersection with ground level							
-5.0000	162.00	20.679		Only 1 intersection with ground level							
-5.0000	163.00	21.462		Only 1 intersection with ground level							
-5.0000	164.00	22.262		Only 1 intersection with ground level							
-5.0000	165.00	23.078		Only 1 intersection with ground level							
-5.0000	166.00	23.908		Only 1 intersection with ground level							
-5.0000	167.00	24.751		Only 1 intersection with ground level							
-5.0000	168.00	25.605		Only 1 intersection with ground level							
-5.0000	169.00	26.469		Only 1 intersection with ground level							
-4.0000	150.00	12.744		Only 1 intersection with ground level							
-4.0000	151.00	13.092		Only 1 intersection with ground level							
-4.0000	152.00	13.506		Only 1 intersection with ground level							
-4.0000	153.00	13.979		Only 1 intersection with ground level							
-4.0000	154.00	14.506		Only 1 intersection with ground level							
-4.0000	155.00	15.080		Only 1 intersection with ground level							
-4.0000	156.00	15.697		Only 1 intersection with ground level							
-4.0000	157.00	16.353		Only 1 intersection with ground level							
-4.0000	158.00	17.041		Only 1 intersection with ground level							
-4.0000	159.00	17.760		Only 1 intersection with ground level							
-4.0000	160.00	18.504		Only 1 intersection with ground level							
-4.0000	161.00	19.272		Only 1 intersection with ground level							
-4.0000	162.00	20.060		Only 1 intersection with ground level							
-4.0000	163.00	20.866		Only 1 intersection with ground level							
-4.0000	164.00	21.689		Only 1 intersection with ground level							
-4.0000	165.00	22.526		Only 1 intersection with ground level							
-4.0000	166.00	23.375		Only 1 intersection with ground level							
-4.0000	167.00	24.237		Only 1 intersection with ground level							
-4.0000	168.00	25.108		Only 1 intersection with ground level							
-4.0000	168.00	25.108		Only 1 intersection with ground level							
-4.0000	169.00	25.989		Only 1 intersection with ground level							
-3.0000	150.00	11.799		Only 1 intersection with ground level							
-3.0000	151.00	12.174		Only 1 intersection with ground level							
-3.0000	152.00	12.618		Only 1 intersection with ground level							
-3.0000	153.00	13.123		Only 1 intersection with ground level							
-3.0000	154.00	13.682		Only 1 intersection with ground level							
-3.0000	155.00	14.290		Only 1 intersection with ground level							
-3.0000	156.00	14.940		Only 1 intersection with ground level							
-3.0000	157.00	15.627		Only 1 intersection with ground level							
-3.0000	158.00	16.347		Only 1 intersection with ground level							
-3.0000	159.00	17.094		Only 1 intersection with ground level							
-3.0000	160.00	17.866		Only 1 intersection with ground level							
-3.0000	161.00	18.660		Only 1 intersection with ground level							
-3.0000	162.00	19.473		Only 1 intersection with ground level							
-3.0000	163.00	20.303		Only 1 intersection with ground level							
-3.0000	163.00	20.303		Only 1 intersection with ground level							
-3.0000	164.00	21.147		Only 1 intersection with ground level							
-3.0000	164.00	21.147		Only 1 intersection with ground level							
-3.0000	165.00	22.005		Only 1 intersection with ground level							
-3.0000	166.00	22.874		Only 1 intersection with ground level							
-3.0000	167.00	23.753		Only 1 intersection with ground level							
-3.0000	168.00	24.642		Only 1 intersection with ground level							
-3.0000	169.00	25.538		Only 1 intersection with ground level							
-2.0000	150.00	10.863		Only 1 intersection with ground level							
-2.0000	151.00	11.270		Only 1 intersection with ground level							
-2.0000	152.00	11.748		Only 1 intersection with ground level							
-2.0000	153.00	12.289		Only 1 intersection with ground level							
-2.0000	154.00	12.884		Only 1 intersection with ground level							
-2.0000	155.00	13.528		Only 1 intersection with ground level							
-2.0000	156.00	14.213		Only 1 intersection with ground level							
-2.0000	157.00	14.934		Only 1 intersection with ground level							
-2.0000	158.00	15.685		Only 1 intersection with ground level							
-2.0000	158.00	15.685		Only 1 intersection with ground level							
-2.0000	159.00	16.462		Only 1 intersection with ground level							
-2.0000	159.00	16.462		Only 1 intersection with ground level							
-2.0000	160.00	17.263		Only 1 intersection with ground level							
-2.0000	160.00	17.263		Only 1 intersection with ground level							
-2.0000	161.00	18.083		Only 1 intersection with ground level							
-2.0000	161.00	18.083		Only 1 intersection with ground level							
-2.0000	162.00	18.921		Only 1 intersection with ground level							
-2.0000	163.00	19.774		Only 1 intersection with ground level							
-2.0000	164.00	20.640	1240.7	1.4585	9915.5	14446.	16.250				
-2.0000	165.00	21.518	1235.2	1.4344	10325.	14810.	0.0				
-2.0000	166.00	22.406	1232.2	1.4169	10735.	15210.	0.0				

Job No.	Sheet No.	Rev.
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Drg. Ref.		
Made by JD	Date	Checked Date

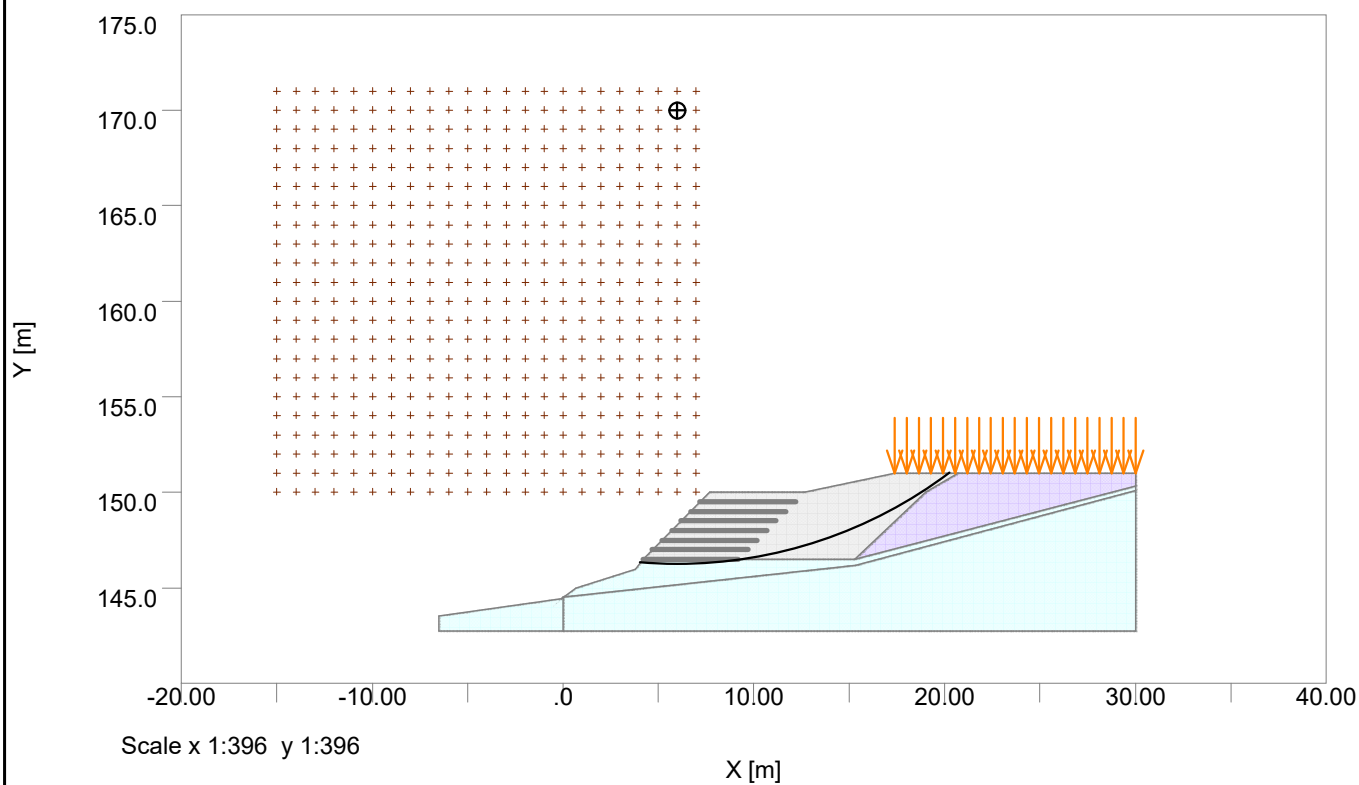
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
-2.0000	167.00	23.303	1232.0	1.4036	11148.	15647.
-2.0000	168.00	24.208	1233.5	1.3938	11561.	16114.
-2.0000	169.00	25.120	1236.8	1.3872	11976.	16612.
-1.0000	150.00	9.9403		Only 1	intersection with ground level	
-1.0000	151.00	10.383		Only 1	intersection with ground level	
-1.0000	152.00	10.900		Only 1	intersection with ground level	
-1.0000	153.00	11.481		Only 1	intersection with ground level	
-1.0000	154.00	12.117		Only 1	intersection with ground level	
-1.0000	154.00	12.117		Only 1	intersection with ground level	
-1.0000	155.00	12.799		Only 1	intersection with ground level	
-1.0000	155.00	12.799		Only 1	intersection with ground level	
-1.0000	156.00	13.521		Only 1	intersection with ground level	
-1.0000	156.00	13.521		Only 1	intersection with ground level	
-1.0000	157.00	14.276		Only 1	intersection with ground level	
-1.0000	157.00	14.276		Only 1	intersection with ground level	
-1.0000	158.00	15.060		Only 1	intersection with ground level	
-1.0000	158.00	15.060		Only 1	intersection with ground level	
-1.0000	159.00	15.869	1198.8	1.5371	7356.2	11264.
-1.0000	160.00	16.698	1183.6	1.5062	7647.6	11484.
-1.0000	161.00	17.545	1174.8	1.4781	7977.2	11766.
-1.0000	162.00	18.407	1170.7	1.4470	8394.9	12131.
-1.0000	163.00	19.282	1169.5	1.4236	8813.0	12534.
-1.0000	164.00	20.170	1171.1	1.4051	9232.5	12973.
-1.0000	165.00	21.067	1175.0	1.3927	9653.9	13445.
-1.0000	166.00	21.973	1180.6	1.3843	10075.	13948.
-1.0000	167.00	22.887	1188.0	1.3793	10499.	14482.
-1.0000	168.00	23.808	1196.8	1.3771	10926.	15045.
-1.0000	169.00	24.735	1206.7	1.3774	11352.	15636.
0.0	150.00	9.0338		Only 1	intersection with ground level	
0.0	150.00	9.0338		Only 1	intersection with ground level	
0.0	151.00	9.5189		Only 1	intersection with ground level	
0.0	151.00	9.5189		Only 1	intersection with ground level	
0.0	152.00	10.080		Only 1	intersection with ground level	
0.0	152.00	10.080		Only 1	intersection with ground level	
0.0	153.00	10.706		Only 1	intersection with ground level	
0.0	153.00	10.706		Only 1	intersection with ground level	
0.0	154.00	11.385		Only 1	intersection with ground level	
0.0	154.00	11.385		Only 1	intersection with ground level	
0.0	155.00	12.108		Only 1	intersection with ground level	
0.0	155.00	12.108		Only 1	intersection with ground level	
0.0	156.00	12.869	1137.4	1.5708	5717.5	8945.0
0.0	157.00	13.661	1119.7	1.5270	6003.3	9134.6
0.0	158.00	14.478	1107.8	1.4974	6288.4	9378.4
0.0	159.00	15.317	1101.5	1.4739	6585.8	9675.8
0.0	160.00	16.174	1101.1	1.4531	6918.6	10031.
0.0	161.00	17.047	1104.8	1.4264	7345.9	10466.
0.0	162.00	17.933	1111.3	1.4076	7774.3	10937.
0.0	163.00	18.831	1119.6	1.3948	8201.4	11439.
0.0	164.00	19.739	1129.9	1.3871	8631.7	11973.
0.0	165.00	20.655	1141.5	1.3832	9063.0	12536.
0.0	166.00	21.578	1154.4	1.3825	9495.6	13128.
0.0	167.00	22.508	1168.2	1.3843	9928.7	13745.
0.0	168.00	23.444	1182.9	1.3902	10343.	14379.
0.0	169.00	24.385	1198.5	1.4028	10699.	15008.
1.0000	150.00	8.1492		Only 1	intersection with ground level	
1.0000	150.00	8.1492		Only 1	intersection with ground level	
1.0000	151.00	8.6839		Only 1	intersection with ground level	
1.0000	151.00	8.6839		Only 1	intersection with ground level	
1.0000	152.00	9.2957		Only 1	intersection with ground level	
1.0000	152.00	9.2957		Only 1	intersection with ground level	
1.0000	153.00	9.9705	1075.1	1.6771	4112.6	6875.8
1.0000	154.00	10.696	1051.9	1.6013	4397.2	7011.9
1.0000	155.00	11.463	1038.6	1.5454	4693.2	7223.8
1.0000	156.00	12.264	1031.7	1.5078	4987.4	7492.7
1.0000	157.00	13.092	1029.7	1.4851	5281.3	7810.6
1.0000	158.00	13.943	1032.4	1.4690	5584.1	8175.9
1.0000	159.00	14.812	1040.5	1.4553	5918.8	8593.7
1.0000	160.00	15.697	1052.3	1.4324	6353.7	9089.9
1.0000	161.00	16.595	1065.9	1.4167	6789.1	9617.8
1.0000	162.00	17.505	1081.2	1.4085	7226.1	10178.
1.0000	163.00	18.423	1097.4	1.4046	7662.5	10763.
1.0000	164.00	19.350	1114.7	1.4042	8101.2	11375.
1.0000	165.00	20.283	1132.7	1.4067	8540.5	12014.
1.0000	166.00	21.223	1151.2	1.4118	8980.4	12678.

Oasys Hollingsworth Gate, Littleborough Section E						Job No.	Sheet No.	Rev.	
						GRO-23131			
						Drg. Ref.			
						Made by JD	Date	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment			
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]			
1.0000	167.00	22.168	1170.1	1.4246	9364.1	13340.	0.0		
1.0000	168.00	23.117	1189.8	1.4398	9733.0	14013.	0.0		
1.0000	169.00	24.071	1210.8	1.4538	10121.	14714.	0.0		
2.0000	150.00	7.2945	Only 1 intersection with ground level						
2.0000	150.00	7.2945	Only 1 intersection with ground level						
2.0000	151.00	7.8873	Centre embedded/below end of slip						
2.0000	152.00	8.5563	Centre embedded/below end of slip						
2.0000	153.00	9.2849	953.64	1.6195	3422.5	5521.1	21.450		
2.0000	154.00	10.060	952.52	1.5653	3724.3	5806.9	22.750		
2.0000	155.00	10.872	956.61	1.5318	4025.1	6143.4	22.100		
2.0000	156.00	11.714	964.85	1.5146	4325.7	6524.2	27.300		
2.0000	157.00	12.578	976.59	1.5046	4632.7	6946.8	23.400		
2.0000	158.00	13.461	993.06	1.4957	4969.8	7415.9	17.550		
2.0000	159.00	14.360	1012.6	1.4739	5409.8	7963.8	9.7500		
2.0000	160.00	15.271	1032.9	1.4590	5852.4	8538.9	0.0		
2.0000	161.00	16.193	1053.8	1.4515	6296.6	9139.6	0.0		
2.0000	162.00	17.123	1075.1	1.4483	6740.2	9762.1	0.0		
2.0000	163.00	18.061	1096.8	1.4484	7186.6	10409.	0.0		
2.0000	164.00	19.006	1118.6	1.4512	7633.1	11077.	0.0		
2.0000	165.00	19.955	1140.7	1.4575	8069.9	11761.	0.0		
2.0000	166.00	20.910	1162.6	1.4735	8436.7	12431.	0.0		
2.0000	167.00	21.868	1185.9	1.4882	8821.8	13129.	0.0		
2.0000	168.00	22.830	1210.2	1.5015	9226.2	13853.	0.0		
2.0000	169.00	23.795	1235.6	1.5134	9652.1	14607.	0.0		
3.0000	150.00	6.4815	Centre embedded/below end of slip						
3.0000	151.00	7.1421	Centre embedded/below end of slip						
3.0000	152.00	7.8746	Centre embedded/below end of slip						
3.0000	153.00	8.6608	877.00	1.6633	2803.9	4647.6	16.250		
3.0000	154.00	9.4874	891.87	1.6208	3114.5	5031.2	16.900		
3.0000	155.00	10.345	909.26	1.5981	3425.3	5451.7	22.100		
3.0000	156.00	11.225	928.76	1.5840	3741.1	5906.4	19.500		
3.0000	157.00	12.125	951.74	1.5713	4084.1	6402.4	14.950		
3.0000	158.00	13.039	977.39	1.5412	4528.5	6971.0	8.4500		
3.0000	159.00	13.965	1003.4	1.5201	4979.6	7569.3	0.0		
3.0000	160.00	14.900	1029.4	1.5084	5430.4	8191.5	0.0		
3.0000	161.00	15.843	1055.5	1.5025	5882.1	8838.0	0.0		
3.0000	162.00	16.793	1081.2	1.5010	6332.9	9505.5	0.0		
3.0000	163.00	17.749	1107.0	1.5028	6784.5	10196.	0.0		
3.0000	164.00	18.709	1132.5	1.5140	7188.8	10884.	0.0		
3.0000	165.00	19.673	1158.5	1.5300	7568.6	11580.	0.0		
3.0000	166.00	20.640	1185.6	1.5440	7968.3	12303.	0.0		
3.0000	167.00	21.610	1213.7	1.5562	8389.3	13055.	0.0		
3.0000	168.00	22.583	1242.5	1.5668	8829.4	13834.	0.0		
3.0000	169.00	23.559	1272.3	1.5760	9291.7	14643.	0.0		
4.0000	150.00	5.7280	Centre embedded/below end of slip						
4.0000	151.00	6.4661	Centre embedded/below end of slip						
4.0000	152.00	7.2670	Centre embedded/below end of slip						
4.0000	153.00	8.1123	823.02	1.7464	2298.8	4001.0	13.530		
4.0000	154.00	8.9894	850.85	1.7069	2616.1	4448.5	16.900		
4.0000	155.00	9.8899	879.36	1.6835	2936.2	4927.5	15.600		
4.0000	156.00	10.808	910.27	1.6636	3280.7	5445.6	12.350		
4.0000	157.00	11.739	943.31	1.6224	3724.6	6035.5	7.1500		
4.0000	158.00	12.681	975.75	1.5928	4178.7	6655.8	0.0		
4.0000	159.00	13.631	1007.7	1.5759	4633.1	7301.3	0.0		
4.0000	160.00	14.588	1039.0	1.5667	5086.8	7969.7	0.0		
4.0000	161.00	15.550	1069.7	1.5629	5541.3	8660.5	0.0		
4.0000	162.00	16.517	1099.7	1.5637	5992.9	9371.2	0.0		
4.0000	163.00	17.487	1129.5	1.5811	6366.8	10066.	0.0		
4.0000	164.00	18.461	1160.0	1.5962	6759.5	10790.	0.0		
4.0000	165.00	19.437	1191.2	1.6091	7171.8	11540.	0.0		
4.0000	166.00	20.416	1223.3	1.6197	7606.0	12320.	0.0		
4.0000	167.00	21.396	1256.0	1.6284	8062.0	13128.	0.0		
4.0000	168.00	22.379	1289.7	1.6353	8542.1	13969.	0.0		
4.0000	169.00	23.363	1323.9	1.6408	9042.9	14837.	0.0		

APPENDIX 6 - Section F Modelling Outputs

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Circle plotted: centre at 6.00,170.00, Over-Design Factor 1.065



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: STATIC
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters	Phi or c
		Above GWL	Below GWL		
	or c0'				
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	25.000	25.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	2.0000	Drained	29.000
0.0	3 Backfill Made Ground	17.500	20.000	Drained	29.000
0.0	4 Stiff CLAY	20.000	22.000	Drained	29.000
0.0	5 SILTSTONE	21.000	23.000	Drained	40.000

Surface loads

No.	Limits of loaded area		Distributed load		Permanent / Variable load	Favourable / Unfavourable load	Use in pull-out calc
	X1 [m]	X2 [m]	Vert [kN/m ²]	Horiz [kN/m ²]			
1	17.400	30.000	100.00	0.0	Permanent	Unfavourable	No

Reinforcement

Geotextile Reinforcement	Level	Vertical Spacing	Length of top layer	Length of Btm layer	Offset from surface	Angle from horizon
	[m]	[m]	Top [m]	Btm [m]	[m]	[°]
7	149.50	0.50000	5.0000	5.0000	0.0	0

Bond Length	Bond Strength [kN/m]	Prestress [kN]	Grout Diameter [mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
Bottom left of grid: x = -15.00000 m y = 150.00000 m
Inclination of grid: 0.00000 deg
(positive anticlockwise direction about bottom left of grid)
Centres on grid: 20 in x direction at 1.00000m spacing
 20 in y direction at 1.00000m spacing
Grid extended to find minimum FoS
All circles pass through common point at x = 9.50000 m, y = 146.50000 m

Out of plane spacing [m]	Tensile Capacity [kN]	Plate Capacity [kN]	Material Partial Factor
-----------------------------------	-----------------------------	---------------------------	-------------------------------

Non Circular Slips

No	Name	Coordinates
1	Slip 1	
2	Slip 2	(18.3, 151) (15.9, 149) (13.6, 148) (10.4, 146) (7.09, 146) (3.9, 146) (2.16, 145)

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-15.000	150.00	24.749		Only 1	intersection with ground level		
-15.000	151.00	24.910		Only 1	intersection with ground level		
-15.000	152.00	25.110		Only 1	intersection with ground level		
-15.000	153.00	25.348		Only 1	intersection with ground level		
-15.000	154.00	25.622		Only 1	intersection with ground level		
-15.000	155.00	25.933		Only 1	intersection with ground level		
-15.000	156.00	26.277		Only 1	intersection with ground level		
-15.000	157.00	26.655		Only 1	intersection with ground level		
-15.000	158.00	27.065		Only 1	intersection with ground level		
-15.000	159.00	27.505		Only 1	intersection with ground level		
-15.000	160.00	27.973		Only 1	intersection with ground level		
-15.000	161.00	28.469		Only 1	intersection with ground level		
-15.000	162.00	28.991		Only 1	intersection with ground level		
-15.000	163.00	29.538		Only 1	intersection with ground level		
-15.000	164.00	30.108		Only 1	intersection with ground level		
-15.000	165.00	30.700		Only 1	intersection with ground level		
-15.000	166.00	31.313		Only 1	intersection with ground level		
-15.000	167.00	31.945		Only 1	intersection with ground level		
-15.000	168.00	32.596		Only 1	intersection with ground level		
-15.000	169.00	33.264		Only 1	intersection with ground level		
-14.000	150.00	23.759		Only 1	intersection with ground level		
-14.000	151.00	23.927		Only 1	intersection with ground level		
-14.000	152.00	24.135		Only 1	intersection with ground level		
-14.000	153.00	24.382		Only 1	intersection with ground level		
-14.000	154.00	24.668		Only 1	intersection with ground level		
-14.000	155.00	24.990		Only 1	intersection with ground level		
-14.000	156.00	25.348		Only 1	intersection with ground level		
-14.000	157.00	25.739		Only 1	intersection with ground level		
-14.000	158.00	26.163		Only 1	intersection with ground level		
-14.000	159.00	26.618		Only 1	intersection with ground level		
-14.000	160.00	27.102		Only 1	intersection with ground level		
-14.000	161.00	27.613		Only 1	intersection with ground level		
-14.000	162.00	28.151		Only 1	intersection with ground level		
-14.000	163.00	28.714		Only 1	intersection with ground level		
-14.000	164.00	29.300		Only 1	intersection with ground level		
-14.000	165.00	29.908		Only 1	intersection with ground level		
-14.000	166.00	30.537		Only 1	intersection with ground level		
-14.000	167.00	31.185		Only 1	intersection with ground level		
-14.000	168.00	31.851		Only 1	intersection with ground level		
-14.000	169.00	32.535		Only 1	intersection with ground level		
-13.000	150.00	22.771		Only 1	intersection with ground level		
-13.000	151.00	22.946		Only 1	intersection with ground level		
-13.000	152.00	23.162		Only 1	intersection with ground level		
-13.000	153.00	23.420		Only 1	intersection with ground level		
-13.000	154.00	23.717		Only 1	intersection with ground level		
-13.000	155.00	24.052		Only 1	intersection with ground level		
-13.000	156.00	24.423		Only 1	intersection with ground level		
-13.000	157.00	24.829		Only 1	intersection with ground level		
-13.000	158.00	25.269		Only 1	intersection with ground level		
-13.000	159.00	25.739		Only 1	intersection with ground level		
-13.000	160.00	26.239		Only 1	intersection with ground level		
-13.000	161.00	26.768		Only 1	intersection with ground level		
-13.000	162.00	27.322		Only 1	intersection with ground level		
-13.000	163.00	27.902		Only 1	intersection with ground level		
-13.000	164.00	28.504		Only 1	intersection with ground level		
-13.000	165.00	29.129		Only 1	intersection with ground level		
-13.000	166.00	29.774		Only 1	intersection with ground level		
-13.000	167.00	30.438		Only 1	intersection with ground level		
-13.000	168.00	31.121		Only 1	intersection with ground level		
-13.000	169.00	31.820		Only 1	intersection with ground level		



Hollingsworth Gate, Littleborough
Section F

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-12.000	150.00	21.783		Only 1 intersection with ground level			
-12.000	151.00	21.966		Only 1 intersection with ground level			
-12.000	152.00	22.192		Only 1 intersection with ground level			
-12.000	153.00	22.461		Only 1 intersection with ground level			
-12.000	154.00	22.771		Only 1 intersection with ground level			
-12.000	155.00	23.119		Only 1 intersection with ground level			
-12.000	156.00	23.505		Only 1 intersection with ground level			
-12.000	157.00	23.927		Only 1 intersection with ground level			
-12.000	158.00	24.382		Only 1 intersection with ground level			
-12.000	159.00	24.870		Only 1 intersection with ground level			
-12.000	160.00	25.387		Only 1 intersection with ground level			
-12.000	161.00	25.933		Only 1 intersection with ground level			
-12.000	162.00	26.505		Only 1 intersection with ground level			
-12.000	163.00	27.102		Only 1 intersection with ground level			
-12.000	164.00	27.722		Only 1 intersection with ground level			
-12.000	165.00	28.364		Only 1 intersection with ground level			
-12.000	166.00	29.026		Only 1 intersection with ground level			
-12.000	167.00	29.707		Only 1 intersection with ground level			
-12.000	168.00	30.406		Only 1 intersection with ground level			
-12.000	169.00	31.121		Only 1 intersection with ground level			
-11.000	150.00	20.797		Only 1 intersection with ground level			
-11.000	151.00	20.988		Only 1 intersection with ground level			
-11.000	152.00	21.225		Only 1 intersection with ground level			
-11.000	153.00	21.506		Only 1 intersection with ground level			
-11.000	154.00	21.829		Only 1 intersection with ground level			
-11.000	155.00	22.192		Only 1 intersection with ground level			
-11.000	156.00	22.594		Only 1 intersection with ground level			
-11.000	157.00	23.033		Only 1 intersection with ground level			
-11.000	158.00	23.505		Only 1 intersection with ground level			
-11.000	159.00	24.010		Only 1 intersection with ground level			
-11.000	160.00	24.546		Only 1 intersection with ground level			
-11.000	161.00	25.110		Only 1 intersection with ground level			
-11.000	162.00	25.700		Only 1 intersection with ground level			
-11.000	163.00	26.315		Only 1 intersection with ground level			
-11.000	164.00	26.954		Only 1 intersection with ground level			
-11.000	165.00	27.613		Only 1 intersection with ground level			
-11.000	166.00	28.293		Only 1 intersection with ground level			
-11.000	167.00	28.991		Only 1 intersection with ground level			
-11.000	168.00	29.707		Only 1 intersection with ground level			
-11.000	169.00	30.438		Only 1 intersection with ground level			
-10.000	150.00	19.812		Only 1 intersection with ground level			
-10.000	151.00	20.012		Only 1 intersection with ground level			
-10.000	152.00	20.261		Only 1 intersection with ground level			
-10.000	153.00	20.555		Only 1 intersection with ground level			
-10.000	154.00	20.893		Only 1 intersection with ground level			
-10.000	155.00	21.272		Only 1 intersection with ground level			
-10.000	156.00	21.691		Only 1 intersection with ground level			
-10.000	157.00	22.147		Only 1 intersection with ground level			
-10.000	158.00	22.638		Only 1 intersection with ground level			
-10.000	159.00	23.162		Only 1 intersection with ground level			
-10.000	160.00	23.717		Only 1 intersection with ground level			
-10.000	161.00	24.300		Only 1 intersection with ground level			
-10.000	162.00	24.910		Only 1 intersection with ground level			
-10.000	163.00	25.544		Only 1 intersection with ground level			
-10.000	164.00	26.201		Only 1 intersection with ground level			
-10.000	165.00	26.879		Only 1 intersection with ground level			
-10.000	166.00	27.577		Only 1 intersection with ground level			
-10.000	167.00	28.293		Only 1 intersection with ground level			
-10.000	168.00	29.026		Only 1 intersection with ground level			
-10.000	169.00	29.774		Only 1 intersection with ground level			
-9.0000	150.00	18.828		Only 1 intersection with ground level			
-9.0000	151.00	19.039		Only 1 intersection with ground level			
-9.0000	152.00	19.300		Only 1 intersection with ground level			
-9.0000	153.00	19.609		Only 1 intersection with ground level			
-9.0000	154.00	19.962		Only 1 intersection with ground level			
-9.0000	155.00	20.359		Only 1 intersection with ground level			
-9.0000	156.00	20.797		Only 1 intersection with ground level			
-9.0000	157.00	21.272		Only 1 intersection with ground level			
-9.0000	158.00	21.783		Only 1 intersection with ground level			
-9.0000	159.00	22.327		Only 1 intersection with ground level			
-9.0000	160.00	22.902		Only 1 intersection with ground level			
-9.0000	161.00	23.505		Only 1 intersection with ground level			
-9.0000	162.00	24.135		Only 1 intersection with ground level			
-9.0000	163.00	24.789		Only 1 intersection with ground level			
-9.0000	164.00	25.466		Only 1 intersection with ground level			
-9.0000	165.00	26.163		Only 1 intersection with ground level			
-9.0000	166.00	26.879		Only 1 intersection with ground level			

Oasys Hollingsworth Gate, Littleborough Section F					Job No.		Sheet No.	Rev.
					GRO-23131			
					Drg. Ref.			
					Made by JD	Date	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-9.0000	167.00	27.613	Only 1	intersection with	ground level			
-9.0000	168.00	28.364	Only 1	intersection with	ground level			
-9.0000	169.00	29.129	Only 1	intersection with	ground level			
-8.0000	150.00	17.847	Only 1	intersection with	ground level			
-8.0000	151.00	18.069	Only 1	intersection with	ground level			
-8.0000	152.00	18.344	Only 1	intersection with	ground level			
-8.0000	153.00	18.668	Only 1	intersection with	ground level			
-8.0000	154.00	19.039	Only 1	intersection with	ground level			
-8.0000	155.00	19.455	Only 1	intersection with	ground level			
-8.0000	156.00	19.912	Only 1	intersection with	ground level			
-8.0000	157.00	20.408	Only 1	intersection with	ground level			
-8.0000	158.00	20.940	Only 1	intersection with	ground level			
-8.0000	159.00	21.506	Only 1	intersection with	ground level			
-8.0000	160.00	22.102	Only 1	intersection with	ground level			
-8.0000	161.00	22.727	Only 1	intersection with	ground level			
-8.0000	162.00	23.377	Only 1	intersection with	ground level			
-8.0000	163.00	24.052	Only 1	intersection with	ground level			
-8.0000	164.00	24.749	Only 1	intersection with	ground level			
-8.0000	165.00	25.466	Only 1	intersection with	ground level			
-8.0000	166.00	26.201	Only 1	intersection with	ground level			
-8.0000	167.00	26.954	Only 1	intersection with	ground level			
-8.0000	168.00	27.722	Only 1	intersection with	ground level			
-8.0000	169.00	28.504	Only 1	intersection with	ground level			
-7.0000	150.00	16.867	Only 1	intersection with	ground level			
-7.0000	151.00	17.103	Only 1	intersection with	ground level			
-7.0000	152.00	17.393	Only 1	intersection with	ground level			
-7.0000	153.00	17.734	Only 1	intersection with	ground level			
-7.0000	154.00	18.125	Only 1	intersection with	ground level			
-7.0000	155.00	18.561	Only 1	intersection with	ground level			
-7.0000	156.00	19.039	Only 1	intersection with	ground level			
-7.0000	157.00	19.558	Only 1	intersection with	ground level			
-7.0000	158.00	20.112	Only 1	intersection with	ground level			
-7.0000	159.00	20.700	Only 1	intersection with	ground level			
-7.0000	160.00	21.319	Only 1	intersection with	ground level			
-7.0000	161.00	21.966	Only 1	intersection with	ground level			
-7.0000	162.00	22.638	Only 1	intersection with	ground level			
-7.0000	163.00	23.335	Only 1	intersection with	ground level			
-7.0000	164.00	24.052	Only 1	intersection with	ground level			
-7.0000	165.00	24.789	Only 1	intersection with	ground level			
-7.0000	166.00	25.544	Only 1	intersection with	ground level			
-7.0000	167.00	26.315	Only 1	intersection with	ground level			
-7.0000	168.00	27.102	Only 1	intersection with	ground level			
-7.0000	169.00	27.902	Only 1	intersection with	ground level			
-6.0000	150.00	15.890	Only 1	intersection with	ground level			
-6.0000	151.00	16.140	Only 1	intersection with	ground level			
-6.0000	152.00	16.447	Only 1	intersection with	ground level			
-6.0000	153.00	16.808	Only 1	intersection with	ground level			
-6.0000	154.00	17.219	Only 1	intersection with	ground level			
-6.0000	155.00	17.678	Only 1	intersection with	ground level			
-6.0000	156.00	18.180	Only 1	intersection with	ground level			
-6.0000	157.00	18.722	Only 1	intersection with	ground level			
-6.0000	158.00	19.300	Only 1	intersection with	ground level			
-6.0000	159.00	19.912	Only 1	intersection with	ground level			
-6.0000	160.00	20.555	Only 1	intersection with	ground level			
-6.0000	161.00	21.225	Only 1	intersection with	ground level			
-6.0000	162.00	21.920	Only 1	intersection with	ground level			
-6.0000	163.00	22.638	Only 1	intersection with	ground level			
-6.0000	164.00	23.377	Only 1	intersection with	ground level			
-6.0000	165.00	24.135	Only 1	intersection with	ground level			
-6.0000	166.00	24.910	Only 1	intersection with	ground level			
-6.0000	167.00	25.700	Only 1	intersection with	ground level			
-6.0000	168.00	26.505	Only 1	intersection with	ground level			
-6.0000	169.00	27.322	Only 1	intersection with	ground level			
-5.0000	150.00	14.916	Only 1	intersection with	ground level			
-5.0000	151.00	15.182	Only 1	intersection with	ground level			
-5.0000	152.00	15.508	Only 1	intersection with	ground level			
-5.0000	153.00	15.890	Only 1	intersection with	ground level			
-5.0000	154.00	16.325	Only 1	intersection with	ground level			
-5.0000	155.00	16.808	Only 1	intersection with	ground level			
-5.0000	156.00	17.335	Only 1	intersection with	ground level			
-5.0000	157.00	17.903	Only 1	intersection with	ground level			
-5.0000	158.00	18.507	Only 1	intersection with	ground level			
-5.0000	159.00	19.144	Only 1	intersection with	ground level			
-5.0000	160.00	19.812	Only 1	intersection with	ground level			
-5.0000	161.00	20.506	Only 1	intersection with	ground level			
-5.0000	162.00	21.225	Only 1	intersection with	ground level			
-5.0000	163.00	21.966	Only 1	intersection with	ground level			

Oasys Hollingsworth Gate, Littleborough Section F					Job No.		Sheet No.	Rev.
					GRO-23131			
					Drg. Ref.			
					Made by JD	Date	Checked	Date
Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment	
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]	
-5.0000	164.00	22.727		Only 1 intersection with ground level				
-5.0000	165.00	23.505		Only 1 intersection with ground level				
-5.0000	166.00	24.300		Only 1 intersection with ground level				
-5.0000	167.00	25.110		Only 1 intersection with ground level				
-5.0000	168.00	25.933		Only 1 intersection with ground level				
-5.0000	169.00	26.768		Only 1 intersection with ground level				
-4.0000	150.00	13.946		Only 1 intersection with ground level				
-4.0000	151.00	14.230		Only 1 intersection with ground level				
-4.0000	152.00	14.577		Only 1 intersection with ground level				
-4.0000	153.00	14.983		Only 1 intersection with ground level				
-4.0000	154.00	15.443		Only 1 intersection with ground level				
-4.0000	155.00	15.953		Only 1 intersection with ground level				
-4.0000	156.00	16.508		Only 1 intersection with ground level				
-4.0000	157.00	17.103		Only 1 intersection with ground level				
-4.0000	158.00	17.734		Only 1 intersection with ground level				
-4.0000	159.00	18.398		Only 1 intersection with ground level				
-4.0000	160.00	19.092		Only 1 intersection with ground level				
-4.0000	161.00	19.812		Only 1 intersection with ground level				
-4.0000	162.00	20.555		Only 1 intersection with ground level				
-4.0000	163.00	21.319		Only 1 intersection with ground level				
-4.0000	164.00	22.102		Only 1 intersection with ground level				
-4.0000	165.00	22.902		Only 1 intersection with ground level				
-4.0000	166.00	23.717		Only 1 intersection with ground level				
-4.0000	167.00	24.546		Only 1 intersection with ground level				
-4.0000	168.00	25.387		Only 1 intersection with ground level				
-4.0000	168.00	25.387		Only 1 intersection with ground level				
-4.0000	169.00	26.239		Only 1 intersection with ground level				
-3.0000	150.00	12.981		Only 1 intersection with ground level				
-3.0000	151.00	13.285		Only 1 intersection with ground level				
-3.0000	152.00	13.656		Only 1 intersection with ground level				
-3.0000	153.00	14.089		Only 1 intersection with ground level				
-3.0000	154.00	14.577		Only 1 intersection with ground level				
-3.0000	155.00	15.116		Only 1 intersection with ground level				
-3.0000	156.00	15.700		Only 1 intersection with ground level				
-3.0000	157.00	16.325		Only 1 intersection with ground level				
-3.0000	158.00	16.985		Only 1 intersection with ground level				
-3.0000	159.00	17.678		Only 1 intersection with ground level				
-3.0000	160.00	18.398		Only 1 intersection with ground level				
-3.0000	161.00	19.144		Only 1 intersection with ground level				
-3.0000	162.00	19.912		Only 1 intersection with ground level				
-3.0000	163.00	20.700		Only 1 intersection with ground level				
-3.0000	164.00	21.506		Only 1 intersection with ground level				
-3.0000	164.00	21.506		Only 1 intersection with ground level				
-3.0000	165.00	22.327		Only 1 intersection with ground level				
-3.0000	165.00	22.327		Only 1 intersection with ground level				
-3.0000	166.00	23.162		Only 1 intersection with ground level				
-3.0000	167.00	24.010		Only 1 intersection with ground level				
-3.0000	168.00	24.870		Only 1 intersection with ground level				
-3.0000	169.00	25.739		Only 1 intersection with ground level				
-2.0000	150.00	12.021		Only 1 intersection with ground level				
-2.0000	151.00	12.349		Only 1 intersection with ground level				
-2.0000	152.00	12.748		Only 1 intersection with ground level				
-2.0000	153.00	13.210		Only 1 intersection with ground level				
-2.0000	154.00	13.730		Only 1 intersection with ground level				
-2.0000	155.00	14.300		Only 1 intersection with ground level				
-2.0000	156.00	14.916		Only 1 intersection with ground level				
-2.0000	157.00	15.572		Only 1 intersection with ground level				
-2.0000	158.00	16.263		Only 1 intersection with ground level				
-2.0000	159.00	16.985		Only 1 intersection with ground level				
-2.0000	160.00	17.734		Only 1 intersection with ground level				
-2.0000	160.00	17.734		Only 1 intersection with ground level				
-2.0000	161.00	18.507		Only 1 intersection with ground level				
-2.0000	161.00	18.507		Only 1 intersection with ground level				
-2.0000	162.00	19.300		Only 1 intersection with ground level				
-2.0000	162.00	19.300		Only 1 intersection with ground level				
-2.0000	163.00	20.112		Only 1 intersection with ground level				
-2.0000	164.00	20.940	768.30	1.4730	4878.9	7186.8	0.0	
-2.0000	165.00	21.783	725.25	1.4640	4817.1	7052.3	0.0	
-2.0000	166.00	22.638	687.19	1.4462	4770.4	6898.8	0.0	
-2.0000	167.00	23.505	653.42	1.4422	4714.2	6798.8	0.0	
-2.0000	168.00	24.382	623.58	1.4275	4672.6	6670.2	0.0	
-2.0000	169.00	25.269	597.30	1.4270	4622.3	6595.8	0.0	
-1.0000	150.00	11.068		Only 1 intersection with ground level				
-1.0000	151.00	11.424		Only 1 intersection with ground level				
-1.0000	152.00	11.853		Only 1 intersection with ground level				
-1.0000	153.00	12.349		Only 1 intersection with ground level				
-1.0000	154.00	12.903		Only 1 intersection with ground level				

Oasys Hollingsworth Gate, Littleborough Section F						Job No.	Sheet No.	Rev.
						GRO-23131		
						Drg. Ref.		
						Made by JD	Date	Checked Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-1.0000	155.00	14.160	Only 1	intersection with ground level				
-1.0000	156.00	14.160	Only 1	intersection with ground level				
-1.0000	156.00	14.160	Only 1	intersection with ground level				
-1.0000	157.00	14.849	Only 1	intersection with ground level				
-1.0000	157.00	14.849	Only 1	intersection with ground level				
-1.0000	158.00	15.572	Only 1	intersection with ground level				
-1.0000	158.00	15.572	Only 1	intersection with ground level				
-1.0000	159.00	16.325	Only 1	intersection with ground level				
-1.0000	159.00	16.325	Only 1	intersection with ground level				
-1.0000	160.00	17.103	821.74	1.4758	4376.4	6458.6	0.0	
-1.0000	161.00	17.903	767.86	1.4616	4318.9	6312.6	0.0	
-1.0000	162.00	18.722	720.87	1.4436	4272.7	6168.0	0.0	
-1.0000	163.00	19.558	679.96	1.4289	4229.4	6043.4	0.0	
-1.0000	164.00	20.408	644.25	1.4280	4178.7	5967.1	0.0	
-1.0000	165.00	21.272	613.10	1.4176	4140.2	5869.3	0.0	
-1.0000	166.00	22.147	586.01	1.4209	4095.3	5819.1	0.0	
-1.0000	167.00	23.033	562.42	1.4136	4061.6	5741.5	0.0	
-1.0000	168.00	23.927	541.92	1.4194	4021.0	5707.6	0.0	
-1.0000	169.00	24.829	524.23	1.4139	3991.1	5643.1	0.0	
0.0	150.00	10.124	Only 1	intersection with ground level				
0.0	151.00	10.512	Only 1	intersection with ground level				
0.0	151.00	10.512	Only 1	intersection with ground level				
0.0	152.00	10.977	Only 1	intersection with ground level				
0.0	152.00	10.977	Only 1	intersection with ground level				
0.0	153.00	11.511	Only 1	intersection with ground level				
0.0	153.00	11.511	Only 1	intersection with ground level				
0.0	154.00	12.104	Only 1	intersection with ground level				
0.0	154.00	12.104	Only 1	intersection with ground level				
0.0	155.00	12.748	Only 1	intersection with ground level				
0.0	155.00	12.748	Only 1	intersection with ground level				
0.0	156.00	13.435	Only 1	intersection with ground level				
0.0	156.00	13.435	Only 1	intersection with ground level				
0.0	157.00	14.160	836.40	1.4827	3783.3	5600.2	9.4757	
0.0	158.00	14.916	777.06	1.4486	3775.7	5469.5	0.0	
0.0	159.00	15.700	724.35	1.4283	3741.2	5343.3	0.0	
0.0	160.00	16.508	678.73	1.4240	3692.8	5258.5	0.0	
0.0	161.00	17.335	639.79	1.4168	3655.0	5178.2	0.0	
0.0	162.00	18.180	606.42	1.4214	3612.5	5134.7	0.0	
0.0	163.00	19.039	577.84	1.4198	3579.1	5081.8	0.0	
0.0	164.00	19.912	553.37	1.4192	3547.9	5035.0	0.0	
0.0	165.00	20.797	532.65	1.4295	3513.4	5022.3	0.0	
0.0	166.00	21.691	515.01	1.4304	3486.2	4986.8	0.0	
0.0	167.00	22.594	500.25	1.4331	3460.0	4958.4	0.0	
0.0	168.00	23.505	487.84	1.4335	3437.7	4927.9	0.0	
0.0	169.00	24.423	476.90	1.4034	3438.4	4825.4	0.0	
1.0000	150.00	9.1924	Only 1	intersection with ground level				
1.0000	150.00	9.1924	Only 1	intersection with ground level				
1.0000	151.00	9.6177	Only 1	intersection with ground level				
1.0000	151.00	9.6177	Only 1	intersection with ground level				
1.0000	152.00	10.124	Only 1	intersection with ground level				
1.0000	152.00	10.124	Only 1	intersection with ground level				
1.0000	153.00	10.700	Only 1	intersection with ground level				
1.0000	153.00	10.700	Only 1	intersection with ground level				
1.0000	154.00	11.336	Only 1	intersection with ground level				
1.0000	154.00	11.336	Only 1	intersection with ground level				
1.0000	155.00	12.021	793.15	1.4796	3138.1	4619.7	23.400	
1.0000	156.00	12.748	735.51	1.4462	3161.3	4560.0	11.866	
1.0000	157.00	13.509	685.86	1.4213	3166.0	4499.8	0.0	
1.0000	158.00	14.300	641.92	1.4135	3139.9	4438.4	0.0	
1.0000	159.00	15.116	604.68	1.4230	3101.3	4413.1	0.0	
1.0000	160.00	15.953	573.43	1.4286	3070.3	4386.2	0.0	
1.0000	161.00	16.808	547.45	1.4366	3042.2	4370.6	0.0	
1.0000	162.00	17.678	525.78	1.4465	3015.7	4362.3	0.0	
1.0000	163.00	18.561	507.83	1.4703	2985.3	4389.2	0.0	
1.0000	164.00	19.455	492.49	1.4610	2980.0	4353.7	0.0	
1.0000	165.00	20.359	479.02	1.4566	2957.6	4308.0	0.0	
1.0000	166.00	21.272	467.16	1.3976	2936.9	4104.5	0.0	
1.0000	167.00	22.192	456.69	1.3677	2919.8	3993.4	0.0	
1.0000	168.00	23.119	447.46	1.3867	2906.7	4030.9	0.0	
1.0000	169.00	24.052	439.29	1.4030	2896.8	4064.4	0.0	
2.0000	150.00	8.2765	Only 1	intersection with ground level				
2.0000	150.00	8.2765	Only 1	intersection with ground level				
2.0000	151.00	8.7464	Only 1	intersection with ground level				
2.0000	151.00	8.7464	Only 1	intersection with ground level				
2.0000	152.00	9.3005	Only 1	intersection with ground level				

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Made by JD	Date	Checked Date

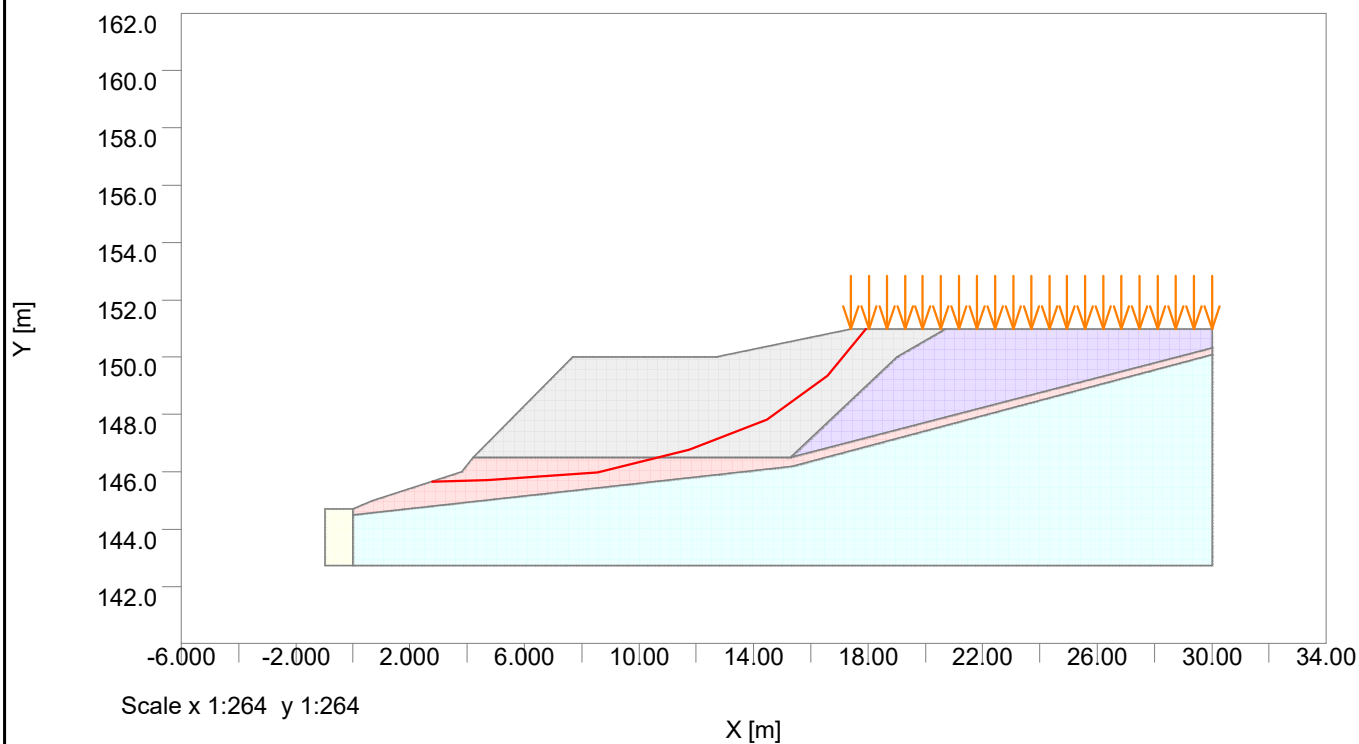
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
2.0000	152.00	9.3005	Only 1 intersection with ground level			
2.0000	153.00	9.9247	755.46	1.5195	2486.5	3756.0
2.0000	154.00	10.607	697.00	1.4682	2540.1	3709.9
2.0000	155.00	11.336	649.52	1.4400	2579.6	3702.2
2.0000	156.00	12.104	609.70	1.4268	2595.7	3703.6
2.0000	157.00	12.903	574.76	1.4478	2571.4	3722.9
2.0000	158.00	13.730	545.49	1.4737	2539.9	3743.2
2.0000	159.00	14.577	521.48	1.4846	2526.0	3750.1
2.0000	160.00	15.443	501.11	1.5007	2506.7	3761.7
2.0000	161.00	16.325	483.73	1.5084	2484.7	3747.8
2.0000	162.00	17.219	468.71	1.4764	2466.5	3641.6
2.0000	163.00	18.125	455.81	1.3828	2452.7	3391.6
2.0000	164.00	19.039	444.52	1.4077	2441.5	3436.9
2.0000	165.00	19.962	434.74	1.4296	2433.7	3479.3
2.0000	166.00	20.893	426.43	1.4499	2429.3	3522.2
2.0000	167.00	21.829	419.33	1.4679	2427.4	3563.1
2.0000	168.00	22.771	413.11	1.4837	2427.0	3601.0
2.0000	169.00	23.717	408.00	1.4736	2499.0	3682.6
3.0000	150.00	7.3824	Only 1 intersection with ground level			
3.0000	150.00	7.3824	Only 1 intersection with ground level			
3.0000	151.00	7.9057	726.43	1.6290	1847.0	2992.5
3.0000	152.00	8.5147	663.00	1.5526	1914.0	2954.8
3.0000	153.00	9.1924	615.25	1.5181	1972.7	2979.1
3.0000	154.00	9.9247	578.47	1.5087	2022.0	3038.2
3.0000	155.00	10.700	547.10	1.5052	2052.0	3087.7
3.0000	156.00	11.511	518.54	1.5306	2040.5	3123.2
3.0000	157.00	12.349	493.97	1.5490	2021.7	3131.6
3.0000	158.00	13.210	473.58	1.5440	2007.1	3099.0
3.0000	159.00	14.089	456.63	1.4482	1996.6	2891.5
3.0000	160.00	14.983	442.54	1.4195	1988.6	2822.8
3.0000	161.00	15.890	430.78	1.4514	1983.9	2879.4
3.0000	162.00	16.808	420.92	1.4816	1981.3	2935.5
3.0000	163.00	17.734	412.66	1.5093	1981.4	2990.6
3.0000	164.00	18.668	405.71	1.5342	1983.7	3043.4
3.0000	165.00	19.609	399.80	1.5564	1987.6	3093.4
3.0000	166.00	20.555	394.79	1.5751	1993.3	3139.7
3.0000	167.00	21.506	390.62	1.5903	2001.2	3182.5
3.0000	168.00	22.461	388.66	1.4402	2440.9	3515.3
3.0000	169.00	23.420	388.30	1.3253	2939.2	3895.3
4.0000	150.00	6.5192	Centre embedded/below end of slip			
4.0000	151.00	7.1063	580.34	1.7004	1368.9	2313.6
4.0000	152.00	7.7782	540.47	1.6497	1441.6	2363.6
4.0000	153.00	8.5147	510.66	1.6175	1506.9	2427.6
4.0000	154.00	9.3005	486.04	1.5974	1548.7	2472.2
4.0000	155.00	10.124	463.27	1.5775	1555.5	2453.8
4.0000	156.00	10.977	443.89	1.4169	1550.5	2196.8
4.0000	157.00	11.853	428.41	1.4615	1547.9	2262.3
4.0000	158.00	12.748	415.97	1.5060	1547.9	2331.2
4.0000	159.00	13.656	405.82	1.5490	1549.8	2400.7
4.0000	160.00	14.577	397.51	1.5888	1553.4	2468.1
4.0000	161.00	15.508	390.76	1.6246	1559.5	2533.5
4.0000	162.00	16.447	385.24	1.6565	1567.2	2596.0
4.0000	163.00	17.393	380.65	1.6835	1576.7	2654.3
4.0000	164.00	18.344	376.98	1.7058	1587.7	2708.4
4.0000	165.00	19.300	373.93	1.7236	1599.9	2757.6
4.0000	166.00	20.261	372.63	1.5657	1926.0	3015.5
4.0000	167.00	21.225	373.52	1.3990	2428.4	3397.3
4.0000	168.00	22.192	375.64	1.2893	2944.1	3796.0
4.0000	169.00	23.162	378.85	1.2134	3472.5	4213.4
5.0000	150.00	5.7009	Centre embedded/below end of slip			
5.0000	151.00	6.3640	465.31	1.8014	975.54	1745.6
5.0000	152.00	7.1063	445.33	1.7071	1055.4	1793.2
5.0000	153.00	7.9057	429.41	1.5264	1112.5	1695.8
5.0000	154.00	8.7464	413.59	1.5171	1132.0	1717.4
5.0000	155.00	9.6177	399.75	1.5787	1136.0	1793.4
5.0000	156.00	10.512	389.07	1.6411	1141.7	1873.7
5.0000	157.00	11.424	380.74	1.7004	1149.3	1954.4
5.0000	158.00	12.349	374.23	1.7551	1158.2	2032.7
5.0000	159.00	13.285	369.13	1.8037	1168.6	2107.8
5.0000	160.00	14.230	365.14	1.8457	1180.5	2178.8
5.0000	161.00	15.182	362.04	1.8806	1193.8	2245.1
5.0000	162.00	16.140	359.64	1.9087	1207.9	2305.5
5.0000	163.00	17.103	357.84	1.9289	1223.7	2360.5

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Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]
5.0000	164.00	18.069	357.25	1.7715	1436.5	2544.9
5.0000	165.00	19.039	359.10	1.5096	1938.8	2926.7
5.0000	166.00	20.012	362.41	1.3535	2457.1	3325.7
5.0000	167.00	20.988	367.35	1.2517	2992.9	3746.1
5.0000	168.00	21.966	372.76	1.1830	3535.4	4182.4
5.0000	169.00	22.946	378.93	1.1353	4086.9	4640.0
-15.000	170.00	33.948	Only 1	intersection with ground level		
-14.000	170.00	33.234	Only 1	intersection with ground level		
-13.000	170.00	32.535	Only 1	intersection with ground level		
-12.000	170.00	31.851	Only 1	intersection with ground level		
-11.000	170.00	31.185	Only 1	intersection with ground level		
-10.000	170.00	30.537	Only 1	intersection with ground level		
-9.0000	170.00	29.908	Only 1	intersection with ground level		
-8.0000	170.00	29.300	Only 1	intersection with ground level		
-7.0000	170.00	28.714	Only 1	intersection with ground level		
-6.0000	170.00	28.151	Only 1	intersection with ground level		
-5.0000	170.00	27.613	Only 1	intersection with ground level		
-4.0000	170.00	27.102	Only 1	intersection with ground level		
-3.0000	170.00	26.618	666.13	1.4435	5279.4	7620.8
-2.0000	170.00	26.163	573.88	1.4146	4584.2	6484.8
-1.0000	170.00	25.739	509.09	1.4095	3962.6	5585.3
0.0	170.00	25.348	467.17	1.3480	3416.2	4605.0
1.0000	170.00	24.990	432.02	1.4165	2890.1	4093.9
2.0000	170.00	24.668	405.13	1.3573	2979.2	4043.8
3.0000	170.00	24.382	389.22	1.2444	3451.2	4294.8
4.0000	170.00	24.135	382.95	1.1603	4009.4	4652.0
5.0000	170.00	23.927	385.72	1.1018	4646.3	5119.1
6.0000	150.00	4.9497	Centre embedded/below end of slip			
6.0000	151.00	5.7009	384.95	1.7297	662.94	1138.9
6.0000	152.00	6.5192	378.63	1.7286	730.97	1261.0
6.0000	153.00	7.3824	370.11	1.7881	761.27	1361.2
6.0000	154.00	8.2765	361.56	1.8798	770.91	1449.2
6.0000	155.00	9.1924	355.31	1.9680	782.17	1539.3
6.0000	156.00	10.124	350.73	2.0470	794.73	1626.9
6.0000	157.00	11.068	347.34	2.1163	808.29	1710.5
6.0000	158.00	12.021	344.83	2.1739	823.07	1789.2
6.0000	159.00	12.981	343.12	2.2192	839.13	1862.2
6.0000	160.00	13.946	341.97	2.2526	856.12	1928.5
6.0000	161.00	14.916	341.26	2.2748	873.92	1988.0
6.0000	162.00	15.890	341.28	2.1551	973.58	2098.1
6.0000	163.00	16.867	344.17	1.6850	1476.7	2488.2
6.0000	164.00	17.847	348.75	1.4467	1998.2	2890.7
6.0000	165.00	18.828	354.61	1.3056	2534.0	3308.3
6.0000	166.00	19.812	362.04	1.2146	3086.8	3749.2
6.0000	167.00	20.797	369.67	1.1538	3643.9	4204.4
6.0000	168.00	21.783	377.92	1.1126	4208.5	4682.2
6.0000	169.00	22.771	386.63	1.0844	4778.0	5181.1
6.0000	170.00	23.759	395.70	1.0649	5355.3	5702.7
-15.000	171.00	34.648	Only 1	intersection with ground level		
-14.000	171.00	33.948	Only 1	intersection with ground level		
-13.000	171.00	33.264	Only 1	intersection with ground level		
-12.000	171.00	32.596	Only 1	intersection with ground level		
-11.000	171.00	31.945	Only 1	intersection with ground level		
-10.000	171.00	31.313	Only 1	intersection with ground level		
-9.0000	171.00	30.700	Only 1	intersection with ground level		
-8.0000	171.00	30.108	Only 1	intersection with ground level		
-7.0000	171.00	29.538	Only 1	intersection with ground level		
-6.0000	171.00	28.991	Only 1	intersection with ground level		
-5.0000	171.00	28.469	Only 1	intersection with ground level		
-4.0000	171.00	27.973	Only 1	intersection with ground level		
-3.0000	171.00	27.505	637.06	1.4394	5219.1	7512.4
-2.0000	171.00	27.065	553.44	1.3994	4552.1	6370.2
-1.0000	171.00	26.655	496.22	1.4000	3938.5	5514.0
0.0	171.00	26.277	458.43	1.3466	3397.5	4574.9
1.0000	171.00	25.933	426.09	1.3830	3070.1	4245.9
2.0000	171.00	25.622	403.69	1.2729	3475.0	4423.5
3.0000	171.00	25.348	391.14	1.1860	3973.5	4712.7
4.0000	171.00	25.110	387.81	1.1220	4555.6	5111.2
5.0000	171.00	24.910	392.95	1.0786	5211.1	5620.8
6.0000	171.00	24.749	405.07	1.0702	5936.0	6352.8
7.0000	150.00	4.3012	Centre embedded/below end of slip			
7.0000	151.00	5.1478	328.26	2.2743	411.91	929.02
7.0000	152.00	6.0415	327.48	2.3309	449.62	1040.9
7.0000	153.00	6.9642	323.83	2.4710	462.18	1133.6

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
7.0000	154.00	7.9057	321.77	2.5965	476.17	1226.7	9.7500
7.0000	155.00	8.8600	320.65	2.7039	490.65	1315.6	11.050
7.0000	156.00	9.8234	320.25	2.7894	506.08	1399.3	12.350
7.0000	157.00	10.794	320.34	2.8489	523.14	1476.7	13.650
7.0000	158.00	11.769	320.85	2.8899	540.56	1547.2	14.950
7.0000	159.00	12.748	321.64	2.9090	559.16	1610.3	16.250
7.0000	160.00	13.730	322.66	2.9095	578.63	1666.0	17.550
7.0000	161.00	14.714	326.76	1.9690	1046.6	2042.0	18.850
7.0000	162.00	15.700	333.03	1.5735	1569.6	2449.5	20.150
7.0000	163.00	16.688	340.76	1.3715	2108.0	2869.6	21.450
7.0000	164.00	17.678	350.11	1.2504	2666.9	3311.8	22.750
7.0000	165.00	18.668	359.69	1.1745	3229.0	3768.4	24.050
7.0000	166.00	19.660	369.82	1.1242	3799.6	4246.2	25.350
7.0000	167.00	20.652	380.31	1.0908	4375.4	4746.0	26.650
7.0000	168.00	21.645	391.16	1.0724	4957.8	5288.8	27.950
7.0000	169.00	22.638	402.22	1.0887	5543.0	6005.2	29.250
7.0000	170.00	23.633	414.85	1.0973	6147.0	6714.7	30.550
7.0000	171.00	24.627	426.23	1.1089	6743.1	7445.3	31.850

Moments taken about 4.98,163.57, Over-Design Factor 1.462





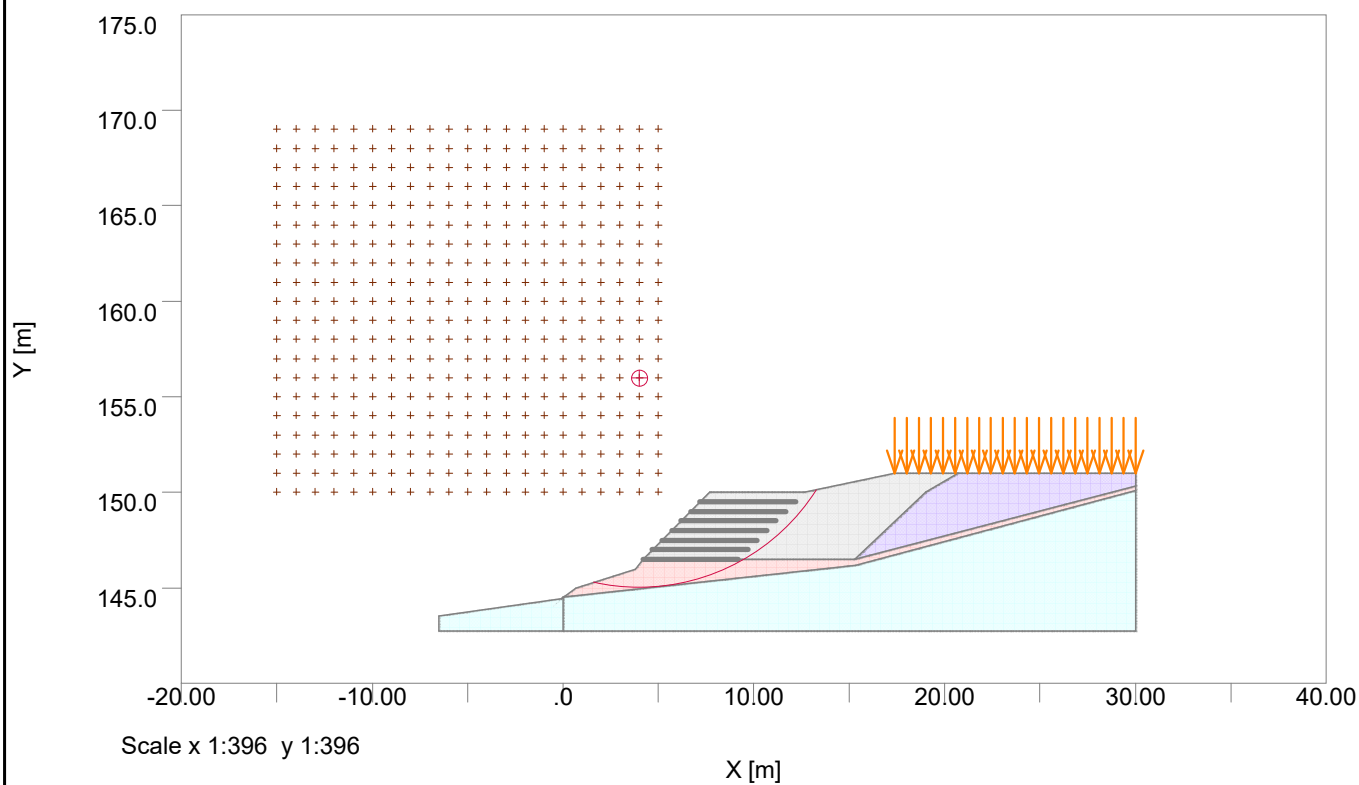
Hollingsworth Gate, Littleborough
Section F

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		Weight	Over-Design	Moment	Strength	Restoring
			Factor		Restoring	Moment
					Moment	
x [m]	y [m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
Slip 1						
0.0	4.9827	163.57	655.16	1.4624	3791.4	5544.6

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Circle plotted: centre at 4.00,156.00, Over-Design Factor 1.200



Specification

```
Slip Type: CIRCULAR
Direction of slip: Downhill
Minimum slip weight [kN/m] :80.00000
Type of analysis: Downhill
Partial factor analysis
Minimum number of slices 25
Method: Bishop (Variably inclined interslice forces)
Maximum number of iterations: 300
Reinforcement: ACTIVE
```

Material Partial Factors

[illegible]

Material Properties

No	Description	Unit Weight		Shear Strength Parameters	Phi or c
		Above GWL	Below GWL		
or c0'					
		[kN/m3]	[kN/m3]		Phi0 [°]
0.0	1 Canal Wall	25.000	25.000	Drained	40.000
0.0	2 Reinforced Earth	17.500	2.0000	Drained	29.000
0.0	3 Backfill Made Ground	17.500	20.000	Drained	29.000
0.0	4 Stiff CLAY	20.000	22.000	Drained	29.000
0.0	5 SILTSTONE	21.000	23.000	Drained	40.000

Surface loads

No.	Limits of loaded area		Distributed load		Permanent / Variable load	Favourable / Unfavourable load	Use in pull-out calc
	X1 [m]	X2 [m]	Vert [kN/m ²]	Horiz [kN/m ²]			
1	17.400	30.000	100.00	0.0	Permanent	Unfavourable	No

Reinforcement

Geotextile Reinforcement 1

Layers	Level of top layer	Vertical Spacing	Length		Offset from surface	Angle from horizon
	[m]	[m]	Top [m]	Btm [m]	[m]	[°]
7	149.50	0.50000	5.0000	5.0000	0.0	0

Bond Length	Bond Strength [kN/m]	Prestress [kN]	Grout Diameter [mm]
0.0%	0.0	0.0	0.0

Out of plane spacing	Tensile Capacity	Plate Capacity	Material Partial Factor
[m]	[kN]	[kN]	
0.0	1.3000	0.0	

Slip Surface Specification

Circle centre specification:
Bottom left of grid: x = -15.00000 m y = 150.00000 m
Inclination of grid: 0.00000 deg
(positive anticlockwise direction about bottom left of grid)
Centres on grid: 20 in x direction at 1.00000m spacing
 20 in y direction at 1.00000m spacing
Grid extended to find minimum FoS
All circles pass through common point at x = 9.50000 m, y = 146.50000 m

Out of plane spacing [m]	Tensile Capacity [kN]	Plate Capacity [kN]	Material Partial Factor
-----------------------------------	-----------------------------	---------------------------	-------------------------------

Non Circular Slips

No

Name

Coordinates

1

Slip 1

2

Slip 2

(18.3, 151) (15.9, 149) (13.6, 148) (10.4, 146)
(7.09, 146) (3.9, 146) (2.16, 145)

RESULTS OF ANALYSIS

In the following tables, values in italics are factored values using the currently selected Method Partial Factors.

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]

[m]	[m]	[m]			[mm/m]	[mm/m]
-15.000	150.00	24.749	Only	1 intersection with ground level		
-15.000	151.00	24.910	Only	1 intersection with ground level		
-15.000	152.00	25.110	Only	1 intersection with ground level		
-15.000	153.00	25.348	Only	1 intersection with ground level		
-15.000	154.00	25.622	Only	1 intersection with ground level		
-15.000	155.00	25.933	Only	1 intersection with ground level		
-15.000	156.00	26.277	Only	1 intersection with ground level		
-15.000	157.00	26.655	Only	1 intersection with ground level		
-15.000	158.00	27.065	Only	1 intersection with ground level		
-15.000	159.00	27.505	Only	1 intersection with ground level		
-15.000	160.00	27.973	Only	1 intersection with ground leve		
-15.000	161.00	28.469	Only	1 intersection with ground level		
-15.000	162.00	28.991	Only	1 intersection with ground level		
-15.000	163.00	29.538	Only	1 intersection with ground level		
-15.000	164.00	30.108	Only	1 intersection with ground level		
-15.000	165.00	30.700	Only	1 intersection with ground level		
-15.000	166.00	31.313	Only	1 intersection with ground level		
-15.000	167.00	31.945	Only	1 intersection with ground level		
-15.000	168.00	32.596	Only	1 intersection with ground level		
-15.000	169.00	33.264	Only	1 intersection with ground level		
-14.000	150.00	23.759	Only	1 intersection with ground level		
-14.000	151.00	23.927	Only	1 intersection with ground level		
-14.000	152.00	24.135	Only	1 intersection with ground level		
-14.000	153.00	24.382	Only	1 intersection with ground level		
-14.000	154.00	24.668	Only	1 intersection with ground level		
-14.000	155.00	24.990	Only	1 intersection with ground level		
-14.000	156.00	25.348	Only	1 intersection with ground level		
-14.000	157.00	25.739	Only	1 intersection with ground level		
-14.000	158.00	26.163	Only	1 intersection with ground level		
-14.000	159.00	26.618	Only	1 intersection with ground level		
-14.000	160.00	27.102	Only	1 intersection with ground level		
-14.000	161.00	27.613	Only	1 intersection with ground level		
-14.000	162.00	28.151	Only	1 intersection with ground level		
-14.000	163.00	28.714	Only	1 intersection with ground level		
-14.000	164.00	29.300	Only	1 intersection with ground level		
-14.000	165.00	29.908	Only	1 intersection with ground level		
-14.000	166.00	30.537	Only	1 intersection with ground level		
-14.000	167.00	31.185	Only	1 intersection with ground level		
-14.000	168.00	31.851	Only	1 intersection with ground level		
-14.000	169.00	32.535	Only	1 intersection with ground level		
-13.000	150.00	22.771	Only	1 intersection with ground leve		
-13.000	151.00	22.946	Only	1 intersection with ground level		
-13.000	152.00	23.162	Only	1 intersection with ground level		
-13.000	153.00	23.420	Only	1 intersection with ground level		
-13.000	154.00	23.717	Only	1 intersection with ground level		
-13.000	155.00	24.052	Only	1 intersection with ground level		
-13.000	156.00	24.423	Only	1 intersection with ground level		
-13.000	157.00	24.829	Only	1 intersection with ground level		
-13.000	158.00	25.269	Only	1 intersection with ground level		
-13.000	159.00	25.739	Only	1 intersection with ground level		
-13.000	160.00	26.239	Only	1 intersection with ground level		
-13.000	161.00	26.768	Only	1 intersection with ground level		
-13.000	162.00	27.322	Only	1 intersection with ground level		
-13.000	163.00	27.902	Only	1 intersection with ground level		
-13.000	164.00	28.504	Only	1 intersection with ground level		
-13.000	165.00	29.129	Only	1 intersection with ground level		
-13.000	166.00	29.774	Only	1 intersection with ground level		
-13.000	167.00	30.438	Only	1 intersection with ground level		
-13.000	168.00	31.121	Only	1 intersection with ground level		
-13.000	169.00	31.820	Only	1 intersection with ground level		



Hollingsworth Gate, Littleborough
Section F

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Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-12.000	150.00	21.783		Only 1 intersection with ground level			
-12.000	151.00	21.966		Only 1 intersection with ground level			
-12.000	152.00	22.192		Only 1 intersection with ground level			
-12.000	153.00	22.461		Only 1 intersection with ground level			
-12.000	154.00	22.771		Only 1 intersection with ground level			
-12.000	155.00	23.119		Only 1 intersection with ground level			
-12.000	156.00	23.505		Only 1 intersection with ground level			
-12.000	157.00	23.927		Only 1 intersection with ground level			
-12.000	158.00	24.382		Only 1 intersection with ground level			
-12.000	159.00	24.870		Only 1 intersection with ground level			
-12.000	160.00	25.387		Only 1 intersection with ground level			
-12.000	161.00	25.933		Only 1 intersection with ground level			
-12.000	162.00	26.505		Only 1 intersection with ground level			
-12.000	163.00	27.102		Only 1 intersection with ground level			
-12.000	164.00	27.722		Only 1 intersection with ground level			
-12.000	165.00	28.364		Only 1 intersection with ground level			
-12.000	166.00	29.026		Only 1 intersection with ground level			
-12.000	167.00	29.707		Only 1 intersection with ground level			
-12.000	168.00	30.406		Only 1 intersection with ground level			
-12.000	169.00	31.121		Only 1 intersection with ground level			
-11.000	150.00	20.797		Only 1 intersection with ground level			
-11.000	151.00	20.988		Only 1 intersection with ground level			
-11.000	152.00	21.225		Only 1 intersection with ground level			
-11.000	153.00	21.506		Only 1 intersection with ground level			
-11.000	154.00	21.829		Only 1 intersection with ground level			
-11.000	155.00	22.192		Only 1 intersection with ground level			
-11.000	156.00	22.594		Only 1 intersection with ground level			
-11.000	157.00	23.033		Only 1 intersection with ground level			
-11.000	158.00	23.505		Only 1 intersection with ground level			
-11.000	159.00	24.010		Only 1 intersection with ground level			
-11.000	160.00	24.546		Only 1 intersection with ground level			
-11.000	161.00	25.110		Only 1 intersection with ground level			
-11.000	162.00	25.700		Only 1 intersection with ground level			
-11.000	163.00	26.315		Only 1 intersection with ground level			
-11.000	164.00	26.954		Only 1 intersection with ground level			
-11.000	165.00	27.613		Only 1 intersection with ground level			
-11.000	166.00	28.293		Only 1 intersection with ground level			
-11.000	167.00	28.991		Only 1 intersection with ground level			
-11.000	168.00	29.707		Only 1 intersection with ground level			
-11.000	169.00	30.438		Only 1 intersection with ground level			
-10.000	150.00	19.812		Only 1 intersection with ground level			
-10.000	151.00	20.012		Only 1 intersection with ground level			
-10.000	152.00	20.261		Only 1 intersection with ground level			
-10.000	153.00	20.555		Only 1 intersection with ground level			
-10.000	154.00	20.893		Only 1 intersection with ground level			
-10.000	155.00	21.272		Only 1 intersection with ground level			
-10.000	156.00	21.691		Only 1 intersection with ground level			
-10.000	157.00	22.147		Only 1 intersection with ground level			
-10.000	158.00	22.638		Only 1 intersection with ground level			
-10.000	159.00	23.162		Only 1 intersection with ground level			
-10.000	160.00	23.717		Only 1 intersection with ground level			
-10.000	161.00	24.300		Only 1 intersection with ground level			
-10.000	162.00	24.910		Only 1 intersection with ground level			
-10.000	163.00	25.544		Only 1 intersection with ground level			
-10.000	164.00	26.201		Only 1 intersection with ground level			
-10.000	165.00	26.879		Only 1 intersection with ground level			
-10.000	166.00	27.577		Only 1 intersection with ground level			
-10.000	167.00	28.293		Only 1 intersection with ground level			
-10.000	168.00	29.026		Only 1 intersection with ground level			
-10.000	169.00	29.774		Only 1 intersection with ground level			
-9.0000	150.00	18.828		Only 1 intersection with ground level			
-9.0000	151.00	19.039		Only 1 intersection with ground level			
-9.0000	152.00	19.300		Only 1 intersection with ground level			
-9.0000	153.00	19.609		Only 1 intersection with ground level			
-9.0000	154.00	19.962		Only 1 intersection with ground level			
-9.0000	155.00	20.359		Only 1 intersection with ground level			
-9.0000	156.00	20.797		Only 1 intersection with ground level			
-9.0000	157.00	21.272		Only 1 intersection with ground level			
-9.0000	158.00	21.783		Only 1 intersection with ground level			
-9.0000	159.00	22.327		Only 1 intersection with ground level			
-9.0000	160.00	22.902		Only 1 intersection with ground level			
-9.0000	161.00	23.505		Only 1 intersection with ground level			
-9.0000	162.00	24.135		Only 1 intersection with ground level			
-9.0000	163.00	24.789		Only 1 intersection with ground level			
-9.0000	164.00	25.466		Only 1 intersection with ground level			
-9.0000	165.00	26.163		Only 1 intersection with ground level			
-9.0000	166.00	26.879		Only 1 intersection with ground level			

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Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-9.0000	167.00	27.613	Only 1	intersection with	ground level			
-9.0000	168.00	28.364	Only 1	intersection with	ground level			
-9.0000	169.00	29.129	Only 1	intersection with	ground level			
-8.0000	150.00	17.847	Only 1	intersection with	ground level			
-8.0000	151.00	18.069	Only 1	intersection with	ground level			
-8.0000	152.00	18.344	Only 1	intersection with	ground level			
-8.0000	153.00	18.668	Only 1	intersection with	ground level			
-8.0000	154.00	19.039	Only 1	intersection with	ground level			
-8.0000	155.00	19.455	Only 1	intersection with	ground level			
-8.0000	156.00	19.912	Only 1	intersection with	ground level			
-8.0000	157.00	20.408	Only 1	intersection with	ground level			
-8.0000	158.00	20.940	Only 1	intersection with	ground level			
-8.0000	159.00	21.506	Only 1	intersection with	ground level			
-8.0000	160.00	22.102	Only 1	intersection with	ground level			
-8.0000	161.00	22.727	Only 1	intersection with	ground level			
-8.0000	162.00	23.377	Only 1	intersection with	ground level			
-8.0000	163.00	24.052	Only 1	intersection with	ground level			
-8.0000	164.00	24.749	Only 1	intersection with	ground level			
-8.0000	165.00	25.466	Only 1	intersection with	ground level			
-8.0000	166.00	26.201	Only 1	intersection with	ground level			
-8.0000	167.00	26.954	Only 1	intersection with	ground level			
-8.0000	168.00	27.722	Only 1	intersection with	ground level			
-8.0000	169.00	28.504	Only 1	intersection with	ground level			
-7.0000	150.00	16.867	Only 1	intersection with	ground level			
-7.0000	151.00	17.103	Only 1	intersection with	ground level			
-7.0000	152.00	17.393	Only 1	intersection with	ground level			
-7.0000	153.00	17.734	Only 1	intersection with	ground level			
-7.0000	154.00	18.125	Only 1	intersection with	ground level			
-7.0000	155.00	18.561	Only 1	intersection with	ground level			
-7.0000	156.00	19.039	Only 1	intersection with	ground level			
-7.0000	157.00	19.558	Only 1	intersection with	ground level			
-7.0000	158.00	20.112	Only 1	intersection with	ground level			
-7.0000	159.00	20.700	Only 1	intersection with	ground level			
-7.0000	160.00	21.319	Only 1	intersection with	ground level			
-7.0000	161.00	21.966	Only 1	intersection with	ground level			
-7.0000	162.00	22.638	Only 1	intersection with	ground level			
-7.0000	163.00	23.335	Only 1	intersection with	ground level			
-7.0000	164.00	24.052	Only 1	intersection with	ground level			
-7.0000	165.00	24.789	Only 1	intersection with	ground level			
-7.0000	166.00	25.544	Only 1	intersection with	ground level			
-7.0000	167.00	26.315	Only 1	intersection with	ground level			
-7.0000	168.00	27.102	Only 1	intersection with	ground level			
-7.0000	169.00	27.902	Only 1	intersection with	ground level			
-6.0000	150.00	15.890	Only 1	intersection with	ground level			
-6.0000	151.00	16.140	Only 1	intersection with	ground level			
-6.0000	152.00	16.447	Only 1	intersection with	ground level			
-6.0000	153.00	16.808	Only 1	intersection with	ground level			
-6.0000	154.00	17.219	Only 1	intersection with	ground level			
-6.0000	155.00	17.678	Only 1	intersection with	ground level			
-6.0000	156.00	18.180	Only 1	intersection with	ground level			
-6.0000	157.00	18.722	Only 1	intersection with	ground level			
-6.0000	158.00	19.300	Only 1	intersection with	ground level			
-6.0000	159.00	19.912	Only 1	intersection with	ground level			
-6.0000	160.00	20.555	Only 1	intersection with	ground level			
-6.0000	161.00	21.225	Only 1	intersection with	ground level			
-6.0000	162.00	21.920	Only 1	intersection with	ground level			
-6.0000	163.00	22.638	Only 1	intersection with	ground level			
-6.0000	164.00	23.377	Only 1	intersection with	ground level			
-6.0000	165.00	24.135	Only 1	intersection with	ground level			
-6.0000	166.00	24.910	Only 1	intersection with	ground level			
-6.0000	167.00	25.700	Only 1	intersection with	ground level			
-6.0000	168.00	26.505	Only 1	intersection with	ground level			
-6.0000	169.00	27.322	Only 1	intersection with	ground level			
-5.0000	150.00	14.916	Only 1	intersection with	ground level			
-5.0000	151.00	15.182	Only 1	intersection with	ground level			
-5.0000	152.00	15.508	Only 1	intersection with	ground level			
-5.0000	153.00	15.890	Only 1	intersection with	ground level			
-5.0000	154.00	16.325	Only 1	intersection with	ground level			
-5.0000	155.00	16.808	Only 1	intersection with	ground level			
-5.0000	156.00	17.335	Only 1	intersection with	ground level			
-5.0000	157.00	17.903	Only 1	intersection with	ground level			
-5.0000	158.00	18.507	Only 1	intersection with	ground level			
-5.0000	159.00	19.144	Only 1	intersection with	ground level			
-5.0000	160.00	19.812	Only 1	intersection with	ground level			
-5.0000	161.00	20.506	Only 1	intersection with	ground level			
-5.0000	162.00	21.225	Only 1	intersection with	ground level			
-5.0000	163.00	21.966	Only 1	intersection with	ground level			



Hollingsworth Gate, Littleborough
Section F

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
-5.0000	164.00	22.727		Only 1 intersection with ground level			
-5.0000	165.00	23.505		Only 1 intersection with ground level			
-5.0000	166.00	24.300		Only 1 intersection with ground level			
-5.0000	167.00	25.110		Only 1 intersection with ground level			
-5.0000	168.00	25.933		Only 1 intersection with ground level			
-5.0000	169.00	26.768		Only 1 intersection with ground level			
-4.0000	150.00	13.946		Only 1 intersection with ground level			
-4.0000	151.00	14.230		Only 1 intersection with ground level			
-4.0000	152.00	14.577		Only 1 intersection with ground level			
-4.0000	153.00	14.983		Only 1 intersection with ground level			
-4.0000	154.00	15.443		Only 1 intersection with ground level			
-4.0000	155.00	15.953		Only 1 intersection with ground level			
-4.0000	156.00	16.508		Only 1 intersection with ground level			
-4.0000	157.00	17.103		Only 1 intersection with ground level			
-4.0000	158.00	17.734		Only 1 intersection with ground level			
-4.0000	159.00	18.398		Only 1 intersection with ground level			
-4.0000	160.00	19.092		Only 1 intersection with ground level			
-4.0000	161.00	19.812		Only 1 intersection with ground level			
-4.0000	162.00	20.555		Only 1 intersection with ground level			
-4.0000	163.00	21.319		Only 1 intersection with ground level			
-4.0000	164.00	22.102		Only 1 intersection with ground level			
-4.0000	165.00	22.902		Only 1 intersection with ground level			
-4.0000	166.00	23.717		Only 1 intersection with ground level			
-4.0000	167.00	24.546		Only 1 intersection with ground level			
-4.0000	168.00	25.387		Only 1 intersection with ground level			
-4.0000	168.00	25.387		Only 1 intersection with ground level			
-4.0000	169.00	26.239		Only 1 intersection with ground level			
-3.0000	150.00	12.981		Only 1 intersection with ground level			
-3.0000	151.00	13.285		Only 1 intersection with ground level			
-3.0000	152.00	13.656		Only 1 intersection with ground level			
-3.0000	153.00	14.089		Only 1 intersection with ground level			
-3.0000	154.00	14.577		Only 1 intersection with ground level			
-3.0000	155.00	15.116		Only 1 intersection with ground level			
-3.0000	156.00	15.700		Only 1 intersection with ground level			
-3.0000	157.00	16.325		Only 1 intersection with ground level			
-3.0000	158.00	16.985		Only 1 intersection with ground level			
-3.0000	159.00	17.678		Only 1 intersection with ground level			
-3.0000	160.00	18.398		Only 1 intersection with ground level			
-3.0000	161.00	19.144		Only 1 intersection with ground level			
-3.0000	162.00	19.912		Only 1 intersection with ground level			
-3.0000	163.00	20.700		Only 1 intersection with ground level			
-3.0000	164.00	21.506		Only 1 intersection with ground level			
-3.0000	164.00	21.506		Only 1 intersection with ground level			
-3.0000	165.00	22.327		Only 1 intersection with ground level			
-3.0000	165.00	22.327		Only 1 intersection with ground level			
-3.0000	166.00	23.162		Only 1 intersection with ground level			
-3.0000	167.00	24.010		Only 1 intersection with ground level			
-3.0000	168.00	24.870		Only 1 intersection with ground level			
-3.0000	169.00	25.739		Only 1 intersection with ground level			
-2.0000	150.00	12.021		Only 1 intersection with ground level			
-2.0000	151.00	12.349		Only 1 intersection with ground level			
-2.0000	152.00	12.748		Only 1 intersection with ground level			
-2.0000	153.00	13.210		Only 1 intersection with ground level			
-2.0000	154.00	13.730		Only 1 intersection with ground level			
-2.0000	155.00	14.300		Only 1 intersection with ground level			
-2.0000	156.00	14.916		Only 1 intersection with ground level			
-2.0000	157.00	15.572		Only 1 intersection with ground level			
-2.0000	158.00	16.263		Only 1 intersection with ground level			
-2.0000	159.00	16.985		Only 1 intersection with ground level			
-2.0000	160.00	17.734		Only 1 intersection with ground level			
-2.0000	160.00	17.734		Only 1 intersection with ground level			
-2.0000	161.00	18.507		Only 1 intersection with ground level			
-2.0000	161.00	18.507		Only 1 intersection with ground level			
-2.0000	162.00	19.300		Only 1 intersection with ground level			
-2.0000	162.00	19.300		Only 1 intersection with ground level			
-2.0000	163.00	20.112		Only 1 intersection with ground level			
-2.0000	164.00	20.940	798.22	1.3558	5471.3	7418.1	0.0
-2.0000	165.00	21.783	764.37	1.3389	5527.1	7400.4	0.0
-2.0000	166.00	22.638	735.67	1.3164	5601.4	7373.9	0.0
-2.0000	167.00	23.505	711.10	1.3068	5669.2	7408.7	0.0
-2.0000	168.00	24.382	690.52	1.2905	5754.2	7425.8	0.0
-2.0000	169.00	25.269	673.67	1.2871	5835.5	7510.9	0.0
-1.0000	150.00	11.068		Only 1 intersection with ground level			
-1.0000	151.00	11.424		Only 1 intersection with ground level			
-1.0000	152.00	11.853		Only 1 intersection with ground level			
-1.0000	153.00	12.349		Only 1 intersection with ground level			
-1.0000	154.00	12.903		Only 1 intersection with ground level			

 Hollingsworth Gate, Littleborough Section F						Job No.	Sheet No.	Rev.
						GRO-23131		
						Drg. Ref.		
						Made by JD	Date	Checked Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment		
x [m]	y [m]	[m]	[kN/m]	[kNm/m]	[kNm/m]	[kNm/m]		
-1.0000	155.00	13.509	Only 1	intersection with ground level				
-1.0000	156.00	14.160	Only 1	intersection with ground level				
-1.0000	156.00	14.160	Only 1	intersection with ground level				
-1.0000	157.00	14.849	Only 1	intersection with ground level				
-1.0000	157.00	14.849	Only 1	intersection with ground level				
-1.0000	158.00	15.572	Only 1	intersection with ground level				
-1.0000	158.00	15.572	Only 1	intersection with ground level				
-1.0000	159.00	16.325	Only 1	intersection with ground level				
-1.0000	159.00	16.325	Only 1	intersection with ground level				
-1.0000	160.00	17.103	826.17	1.3813	4629.9	6395.5	0.0	
-1.0000	161.00	17.903	782.39	1.3558	4682.1	6348.2	0.0	
-1.0000	162.00	18.722	745.31	1.3282	4747.6	6305.8	0.0	
-1.0000	163.00	19.558	714.21	1.3052	4818.3	6288.8	0.0	
-1.0000	164.00	20.408	688.26	1.2955	4884.6	6327.8	0.0	
-1.0000	165.00	21.272	666.98	1.2797	4967.5	6356.9	0.0	
-1.0000	166.00	22.147	649.72	1.2767	5046.5	6443.1	0.0	
-1.0000	167.00	23.033	636.03	1.2673	5140.4	6514.2	0.0	
-1.0000	168.00	23.927	625.50	1.2697	5231.9	6643.0	0.0	
-1.0000	169.00	24.829	617.85	1.2654	5337.5	6754.2	0.0	
0.0	150.00	10.124	Only 1	intersection with ground level				
0.0	151.00	10.512	Only 1	intersection with ground level				
0.0	151.00	10.512	Only 1	intersection with ground level				
0.0	152.00	10.977	Only 1	intersection with ground level				
0.0	152.00	10.977	Only 1	intersection with ground level				
0.0	153.00	11.511	Only 1	intersection with ground level				
0.0	153.00	11.511	Only 1	intersection with ground level				
0.0	154.00	12.104	Only 1	intersection with ground level				
0.0	154.00	12.104	Only 1	intersection with ground level				
0.0	155.00	12.748	Only 1	intersection with ground level				
0.0	155.00	12.748	Only 1	intersection with ground level				
0.0	156.00	13.435	Only 1	intersection with ground level				
0.0	156.00	13.435	Only 1	intersection with ground level				
0.0	157.00	14.160	825.45	1.4016	3872.2	5417.6	9.5033	
0.0	158.00	14.916	774.38	1.3585	3933.5	5343.8	0.0	
0.0	159.00	15.700	731.78	1.3268	3995.2	5300.8	0.0	
0.0	160.00	16.508	696.79	1.3097	4054.3	5309.8	0.0	
0.0	161.00	17.335	668.41	1.2912	4126.7	5328.5	0.0	
0.0	162.00	18.180	645.48	1.2842	4197.8	5390.9	0.0	
0.0	163.00	19.039	627.40	1.2735	4282.0	5453.3	0.0	
0.0	164.00	19.912	613.38	1.2654	4371.1	5531.4	0.0	
0.0	165.00	20.797	603.20	1.2682	4461.2	5657.6	0.0	
0.0	166.00	21.691	596.11	1.2654	4562.7	5773.6	0.0	
0.0	167.00	22.594	592.05	1.2667	4670.0	5915.4	0.0	
0.0	168.00	23.505	590.40	1.2701	4785.0	6077.5	0.0	
0.0	169.00	24.423	590.39	1.2418	4951.1	6148.3	0.0	
1.0000	150.00	9.1924	Only 1	intersection with ground level				
1.0000	150.00	9.1924	Only 1	intersection with ground level				
1.0000	151.00	9.6177	Only 1	intersection with ground level				
1.0000	151.00	9.6177	Only 1	intersection with ground level				
1.0000	152.00	10.124	Only 1	intersection with ground level				
1.0000	152.00	10.124	Only 1	intersection with ground level				
1.0000	153.00	10.700	Only 1	intersection with ground level				
1.0000	153.00	10.700	Only 1	intersection with ground level				
1.0000	154.00	11.336	Only 1	intersection with ground level				
1.0000	154.00	11.336	Only 1	intersection with ground level				
1.0000	155.00	12.021	778.42	1.3979	3196.8	4445.3	23.400	
1.0000	156.00	12.748	727.27	1.3579	3257.6	4411.6	11.988	
1.0000	157.00	13.509	685.83	1.3232	3323.9	4398.1	0.0	
1.0000	158.00	14.300	652.70	1.3019	3391.4	4415.4	0.0	
1.0000	159.00	15.116	626.81	1.2952	3458.3	4479.0	0.0	
1.0000	160.00	15.953	606.88	1.2856	3536.7	4546.9	0.0	
1.0000	161.00	16.808	592.20	1.2798	3621.7	4634.9	0.0	
1.0000	162.00	17.678	581.74	1.2770	3711.5	4739.5	0.0	
1.0000	163.00	18.561	575.04	1.2879	3800.9	4895.2	0.0	
1.0000	164.00	19.455	570.96	1.2642	3935.7	4975.5	0.0	
1.0000	165.00	20.359	568.92	1.2483	4050.7	5056.4	0.0	
1.0000	166.00	21.272	568.67	1.2153	4165.0	5061.7	0.0	
1.0000	167.00	22.192	570.12	1.2144	4288.8	5208.5	0.0	
1.0000	168.00	23.119	572.78	1.2436	4421.5	5498.6	0.0	
1.0000	169.00	24.052	576.66	1.2714	4562.3	5800.4	0.0	
2.0000	150.00	8.2765	Only 1	intersection with ground level				
2.0000	150.00	8.2765	Only 1	intersection with ground level				
2.0000	151.00	8.7464	Only 1	intersection with ground level				
2.0000	151.00	8.7464	Only 1	intersection with ground level				
2.0000	152.00	9.3005	Only 1	intersection with ground level				

Oasys Hollingsworth Gate, Littleborough Section F							Job No.	Sheet No.	Rev.	
							GRO-23131			
							Drg. Ref.			
							Made by JD	Date	Checked	Date
Slip Centre	Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment				
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]			
2.0000	152.00	9.3005	Only 1	intersection with ground level						
2.0000	153.00	9.9247	738.35	1.4309	2537.1	3608.4	22.100			
2.0000	154.00	10.607	685.16	1.3769	2607.9	3571.3	19.500			
2.0000	155.00	11.336	644.35	1.3417	2679.8	3583.0	12.541			
2.0000	156.00	12.104	613.11	1.3170	2752.0	3624.4	0.0			
2.0000	157.00	12.903	589.58	1.3186	2817.3	3714.8	0.0			
2.0000	158.00	13.730	572.59	1.3213	2890.6	3819.4	0.0			
2.0000	159.00	14.577	560.74	1.3059	2990.1	3904.6	0.0			
2.0000	160.00	15.443	552.61	1.2876	3094.1	3984.0	0.0			
2.0000	161.00	16.325	547.31	1.2743	3190.0	4064.9	0.0			
2.0000	162.00	17.219	544.65	1.2427	3293.7	4093.0	0.0			
2.0000	163.00	18.125	544.31	1.1950	3407.6	4071.9	0.0			
2.0000	164.00	19.039	545.60	1.2248	3531.2	4325.0	0.0			
2.0000	165.00	19.962	548.48	1.2555	3661.2	4596.8	0.0			
2.0000	166.00	20.893	552.77	1.2833	3800.4	4877.0	0.0			
2.0000	167.00	21.829	558.33	1.3102	3946.1	5170.4	0.0			
2.0000	168.00	22.771	564.85	1.3339	4099.0	5467.7	0.0			
2.0000	169.00	23.717	572.41	1.3450	4326.7	5819.3	0.0			
3.0000	150.00	7.3824	Only 1	intersection with ground level						
3.0000	150.00	7.3824	Only 1	intersection with ground level						
3.0000	151.00	7.9057	706.82	1.5221	1897.2	2871.6	16.250			
3.0000	152.00	8.5147	649.32	1.4489	1973.8	2843.0	16.900			
3.0000	153.00	9.1924	607.26	1.4121	2046.3	2874.0	15.600			
3.0000	154.00	9.9247	576.80	1.3912	2122.3	2940.0	12.350			
3.0000	155.00	10.700	554.49	1.3541	2213.8	2996.8	0.90708			
3.0000	156.00	11.511	538.41	1.3443	2291.6	3080.7	0.0			
3.0000	157.00	12.349	527.24	1.3294	2375.9	3158.5	0.0			
3.0000	158.00	13.210	520.19	1.3010	2468.4	3211.5	0.0			
3.0000	159.00	14.089	516.71	1.2151	2573.6	3127.0	0.0			
3.0000	160.00	14.983	516.18	1.2066	2684.9	3239.7	0.0			
3.0000	161.00	15.890	517.88	1.2405	2803.0	3477.2	0.0			
3.0000	162.00	16.808	521.37	1.2712	2928.3	3722.5	0.0			
3.0000	163.00	17.734	526.48	1.2969	3062.0	3970.9	0.0			
3.0000	164.00	18.668	532.95	1.3224	3203.6	4236.4	0.0			
3.0000	165.00	19.609	540.44	1.3480	3351.6	4518.1	0.0			
3.0000	166.00	20.555	548.95	1.3732	3507.5	4816.6	0.0			
3.0000	167.00	21.506	558.36	1.3974	3672.4	5131.9	0.0			
3.0000	168.00	22.461	568.35	1.3456	4248.5	5717.0	0.0			
3.0000	169.00	23.420	578.54	1.3055	4868.2	6355.4	0.0			
4.0000	150.00	6.5192	Centre embedded/below end of slip							
4.0000	151.00	7.1063	571.54	1.5399	1441.7	2206.2	13.928			
4.0000	152.00	7.7782	537.62	1.4892	1525.1	2256.4	14.790			
4.0000	153.00	8.5147	514.53	1.4443	1613.4	2320.5	9.7500			
4.0000	154.00	9.3005	499.25	1.4030	1701.9	2386.0	1.7235			
4.0000	155.00	10.124	489.90	1.3542	1792.2	2427.1	0.0			
4.0000	156.00	10.977	485.32	1.2000	1881.0	2257.2	0.0			
4.0000	157.00	11.853	484.53	1.2289	1994.0	2450.4	0.0			
4.0000	158.00	12.748	486.57	1.2579	2106.6	2649.8	0.0			
4.0000	159.00	13.656	490.75	1.2860	2226.5	2863.3	0.0			
4.0000	160.00	14.577	496.70	1.3148	2354.1	3095.3	0.0			
4.0000	161.00	15.508	504.25	1.3438	2489.7	3345.7	0.0			
4.0000	162.00	16.447	513.03	1.3727	2632.5	3613.8	0.0			
4.0000	163.00	17.393	522.79	1.4006	2783.3	3898.4	0.0			
4.0000	164.00	18.344	533.57	1.4279	2942.0	4200.8	0.0			
4.0000	165.00	19.300	545.03	1.4543	3107.6	4519.5	0.0			
4.0000	166.00	20.261	557.19	1.4081	3577.9	5037.9	0.0			
4.0000	167.00	21.225	569.36	1.3510	4200.4	5674.7	0.0			
4.0000	168.00	22.192	581.60	1.3144	4824.2	6341.1	0.0			
4.0000	169.00	23.162	593.90	1.2915	5449.4	7037.7	0.0			
5.0000	150.00	5.7009	Centre embedded/below end of slip							
5.0000	151.00	6.3640	469.25	1.6146	1049.8	1683.3	11.700			
5.0000	152.00	7.1063	455.76	1.5127	1146.9	1726.6	8.3750			
5.0000	153.00	7.9057	449.41	1.3043	1245.3	1622.0	2.2427			
5.0000	154.00	8.7464	447.99	1.2657	1344.5	1701.7	0.0			
5.0000	155.00	9.6177	450.17	1.2927	1449.7	1874.1	0.0			
5.0000	156.00	10.512	455.18	1.3236	1562.0	2067.4	0.0			
5.0000	157.00	11.424	462.43	1.3555	1682.4	2280.6	0.0			
5.0000	158.00	12.349	471.41	1.3882	1810.0	2512.6	0.0			
5.0000	159.00	13.285	481.76	1.4200	1945.7	2762.9	0.0			
5.0000	160.00	14.230	493.25	1.4507	2089.4	3031.2	0.0			
5.0000	161.00	15.182	505.60	1.4806	2240.3	3316.9	0.0			
5.0000	162.00	16.140	518.82	1.5091	2399.2	3620.6	0.0			
5.0000	163.00	17.103	532.71	1.5358	2566.6	3941.6	0.0			



Hollingsworth Gate, Littleborough
Section F

Job No.	Sheet No.	Rev.
GRO-23131		
Drg. Ref.		
Made by JD	Date	Checked Date

Slip Centre		Radius	Slip Weight	Comment/ Over-Design Factor	Disturbing Moment	Soil Strength Restoring Moment	Reinforcement Restoring Moment
x [m]	y [m]	[m]	[kN/m]		[kNm/m]	[kNm/m]	[kNm/m]
5.0000	164.00	18.069	547.10	1.5005	2927.6	4392.8	0.0
5.0000	165.00	19.039	561.58	1.4146	3553.9	5027.4	0.0
5.0000	166.00	20.012	575.91	1.3616	4180.5	5692.3	0.0
5.0000	167.00	20.988	590.07	1.3287	4806.4	6386.4	0.0
5.0000	168.00	21.966	604.05	1.3089	5433.2	7111.5	0.0
5.0000	169.00	22.946	617.93	1.2983	6060.6	7868.5	0.0

APPENDIX 7 - Geotechnical Testing Results



LABORATORY REPORT



Contract Number: PSL23/4181

Report Date: 27 June 2023
Client's Reference: GRO-23131
Client Name: Groundtech Consulting
First Floor
Lloyd House
Orford Court
Greenfold Way
WN7 3XJ

For the attention of: Callum Holden

Contract Title: Hollingworth Gate - Littleborough

Date Received: 1/6/2023
Date Commenced: 1/6/2023
Date Completed: 27/6/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

L Knight
(Assistant Laboratory Manager)

R Berriman
(Associate Director)

S Royle
(Laboratory Manager)

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(Managing Director)


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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Hollingworth Gate - Littleborough

Contract No:

PSL23/4181

Client Ref:

GRO-23131

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



Hollingworth Gate - Littleborough

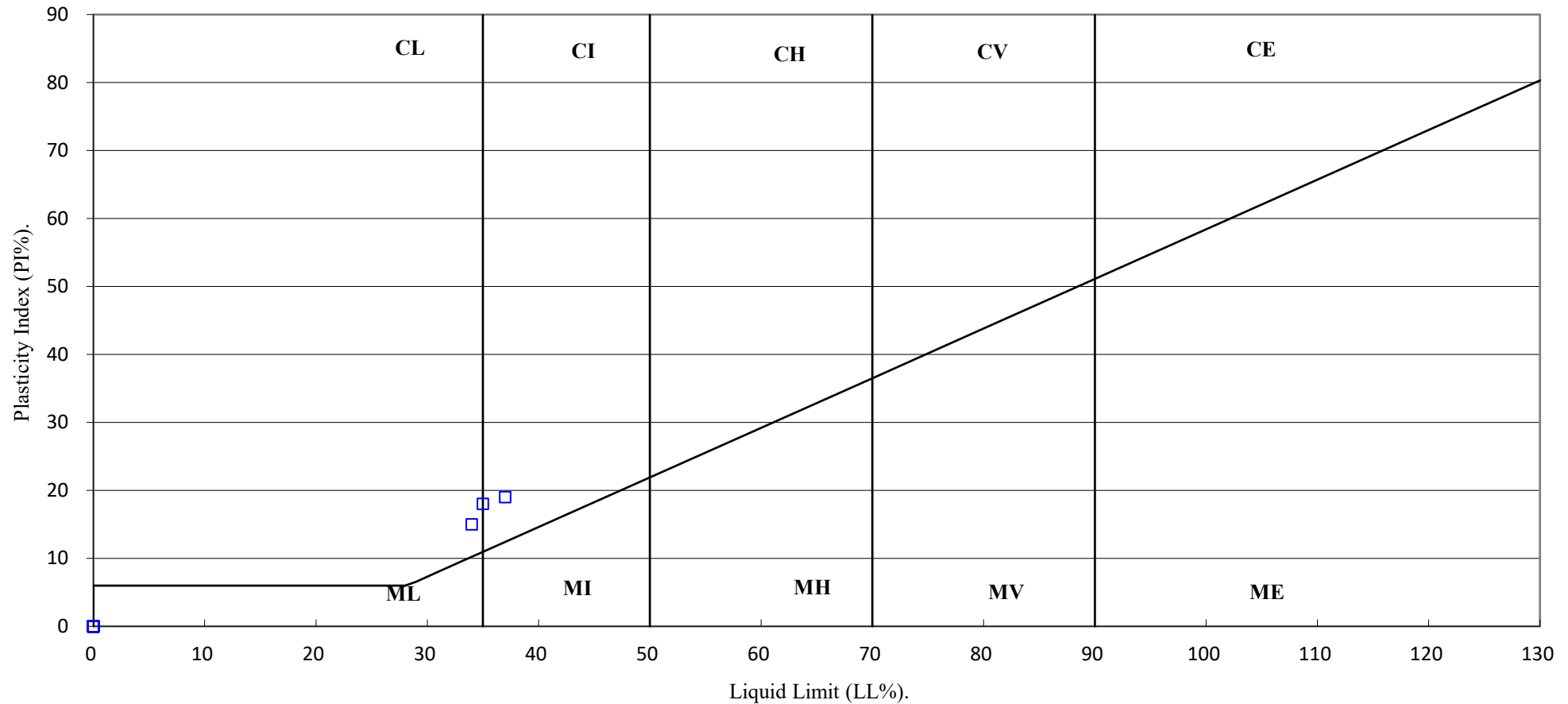
Contract No:

PSL23/4181

Client Ref:

GRO-23131

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Hollingworth Gate - Littleborough

Contract No:

PSL23/4181

Client Ref:

GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

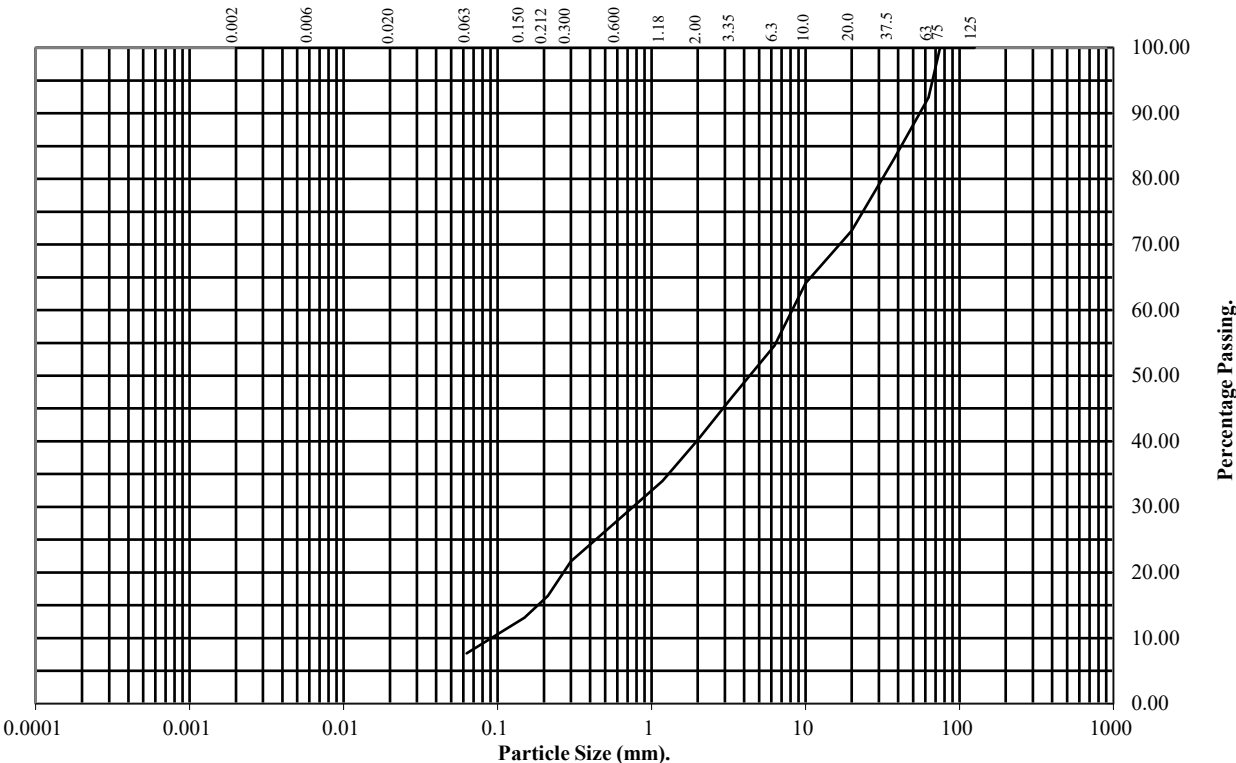
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 Top Depth (m): 0.20

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	92
37.5	83
20	72
10	64
6.3	55
3.35	47
2	40
1.18	34
0.6	28
0.3	22
0.212	16
0.15	13
0.063	8

Soil Fraction	Total Percentage
Cobbles	8
Gravel	52
Sand	32
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

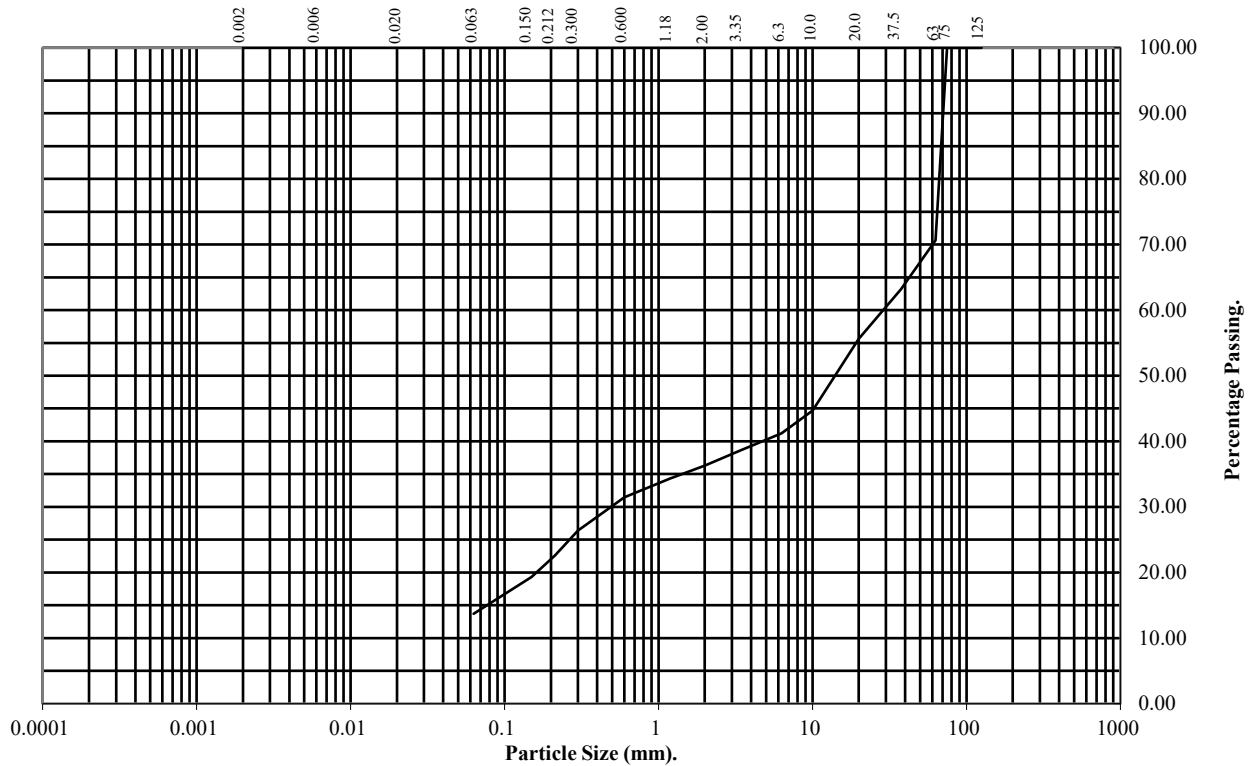
Hole Number: TP01

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	71
37.5	63
20	56
10	45
6.3	41
3.35	39
2	36
1.18	34
0.6	31
0.3	26
0.212	23
0.15	19
0.063	14

Soil Fraction	Total Percentage
Cobbles	29
Gravel	35
Sand	22
Silt/Clay	14

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:

TP02

Top Depth (m):

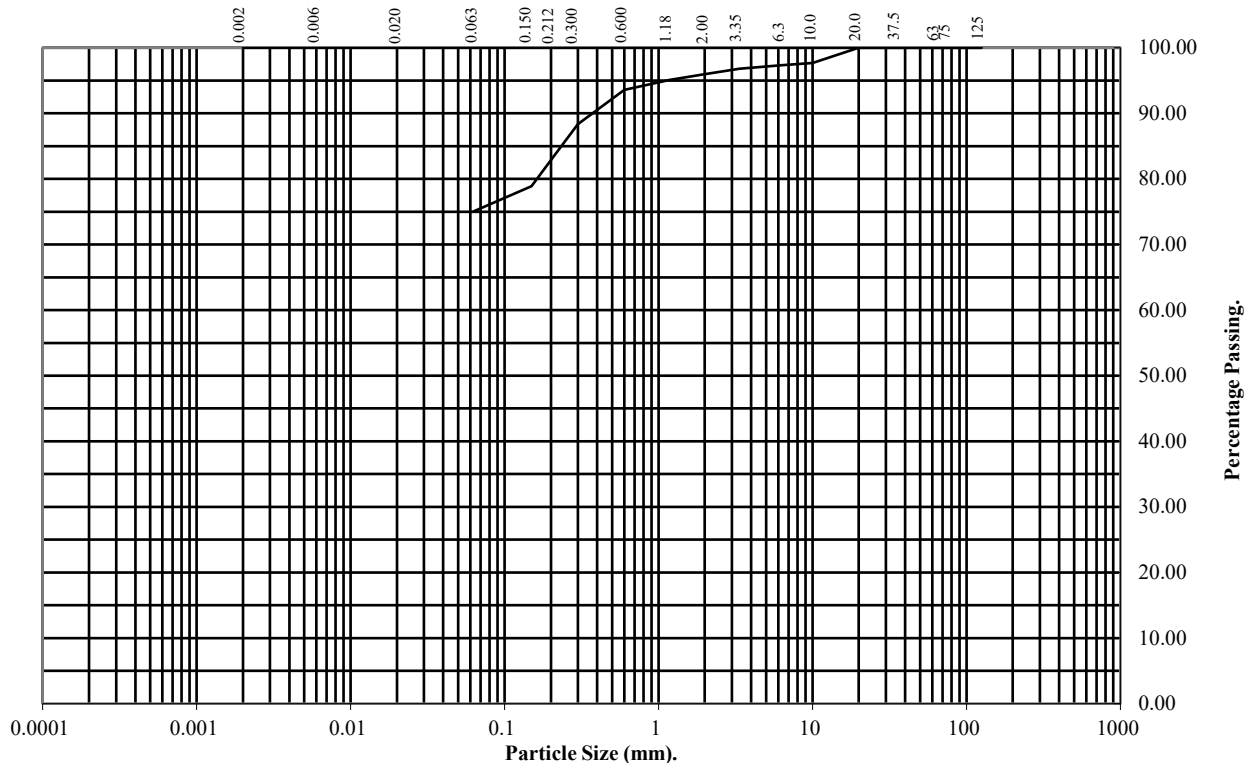
0.90

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	97
3.35	97
2	96
1.18	95
0.6	94
0.3	88
0.212	84
0.15	79
0.063	75

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	21
Silt/Clay	75

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:

PSL23/4181

Client Ref:

GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:

TP03

Top Depth (m):

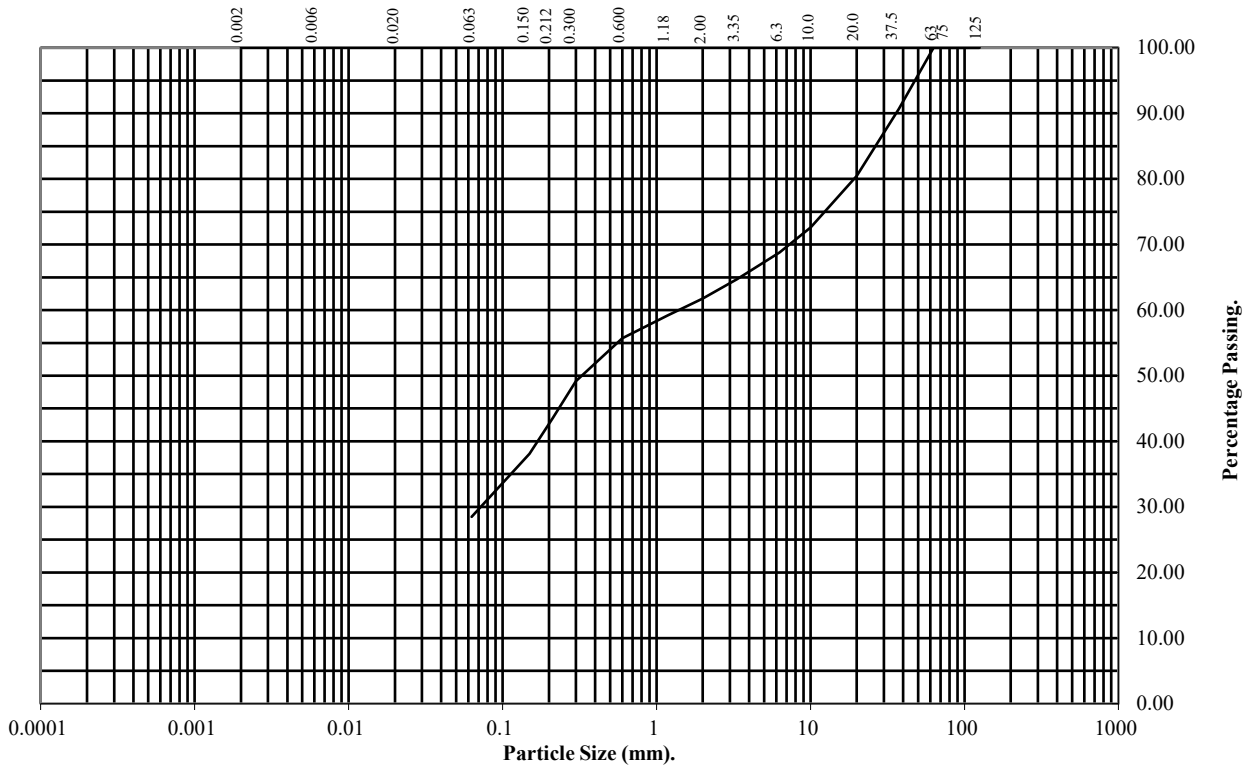
1.50

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	80
10	73
6.3	69
3.35	65
2	62
1.18	59
0.6	56
0.3	49
0.212	44
0.15	38
0.063	28

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	34
Silt/Clay	28

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:

PSL23/4181

Client Ref:

GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

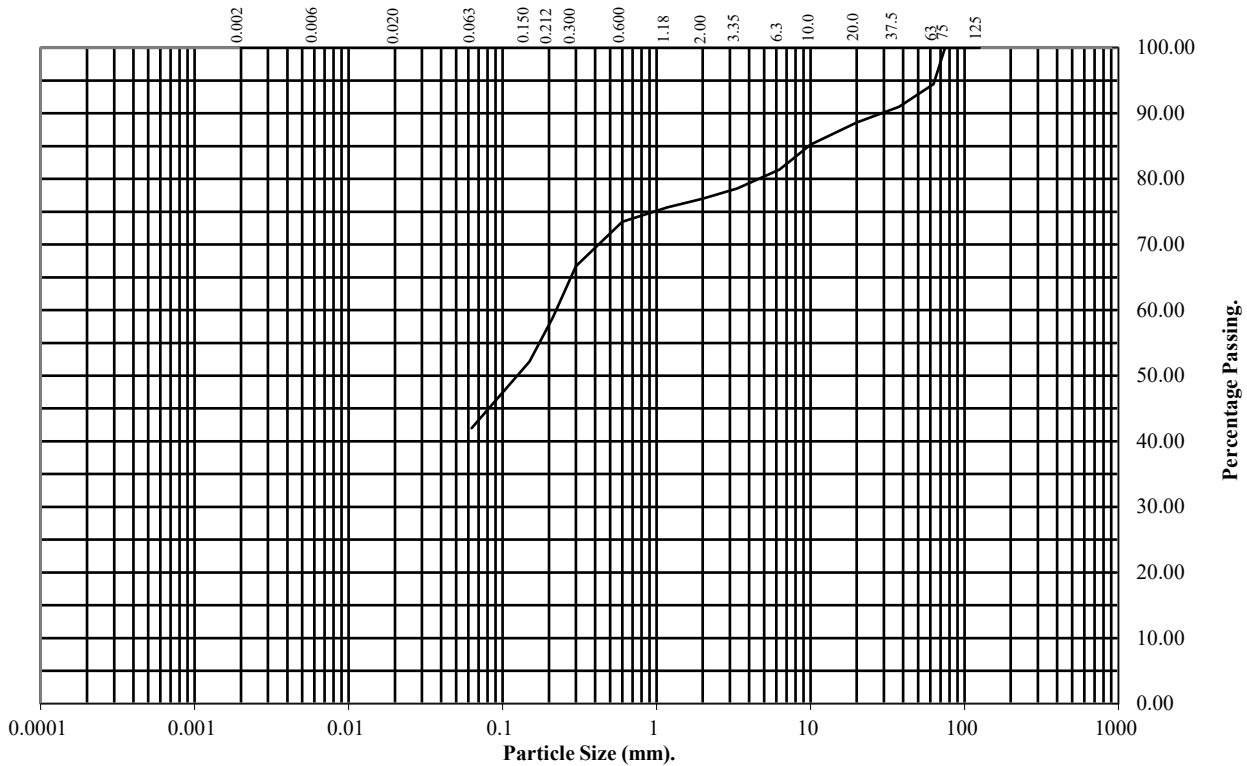
Hole Number: TP03

Top Depth (m): 2.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	94
37.5	91
20	89
10	85
6.3	81
3.35	79
2	77
1.18	76
0.6	73
0.3	67
0.212	59
0.15	52
0.063	42

Soil Fraction	Total Percentage
Cobbles	6
Gravel	17
Sand	35
Silt/Clay	42

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

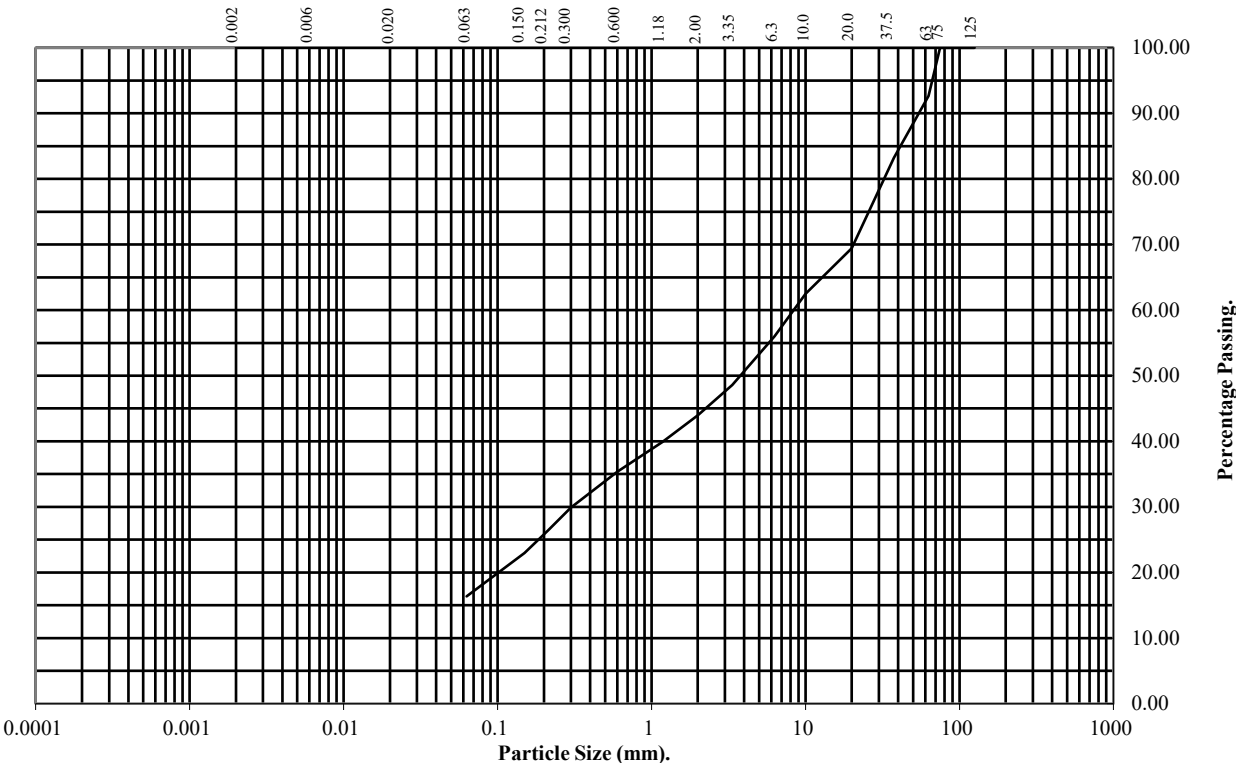
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP04 Top Depth (m): 0.50

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	93
37.5	83
20	69
10	62
6.3	56
3.35	49
2	44
1.18	40
0.6	35
0.3	30
0.212	26
0.15	23
0.063	16

Soil Fraction	Total Percentage
Cobbles	7
Gravel	49
Sand	28
Silt/Clay	16

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

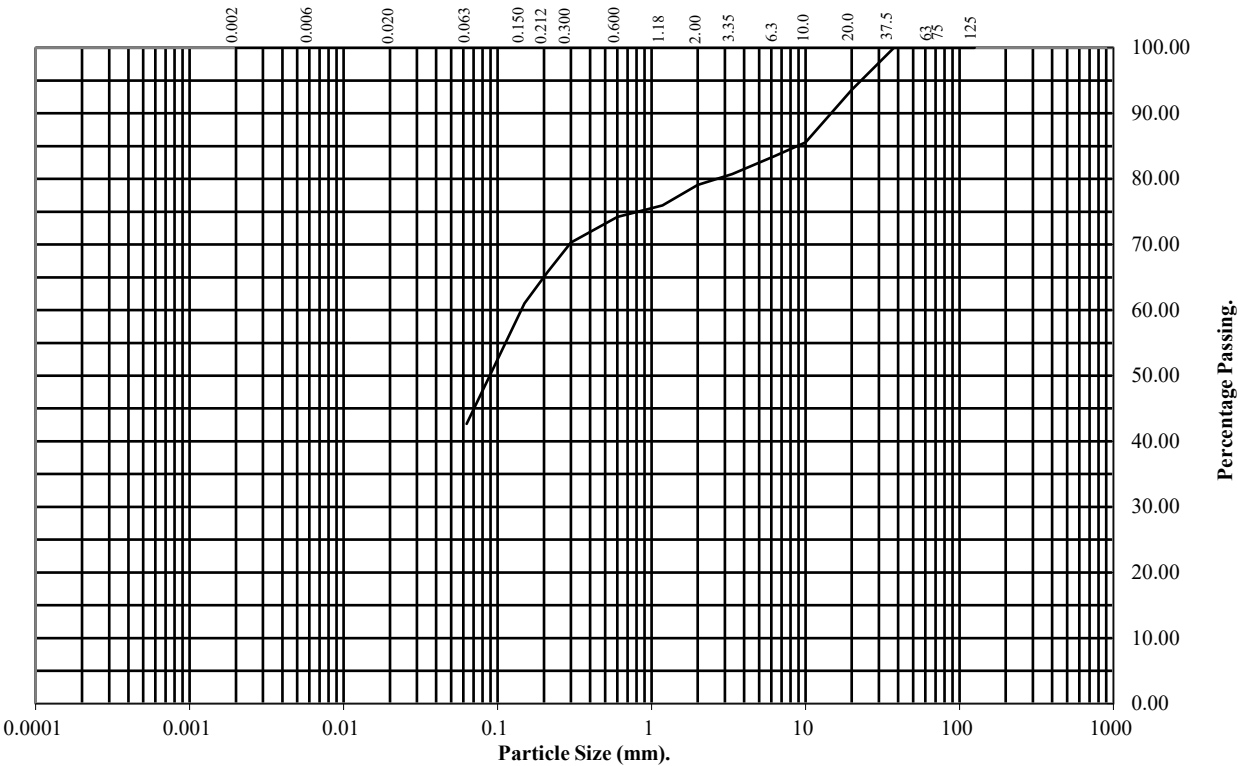
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP06 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	86
6.3	83
3.35	81
2	79
1.18	76
0.6	74
0.3	70
0.212	66
0.15	61
0.063	43

Soil Fraction	Total Percentage
Cobbles	0
Gravel	21
Sand	36
Silt/Clay	43

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:

TP07

Top Depth (m):

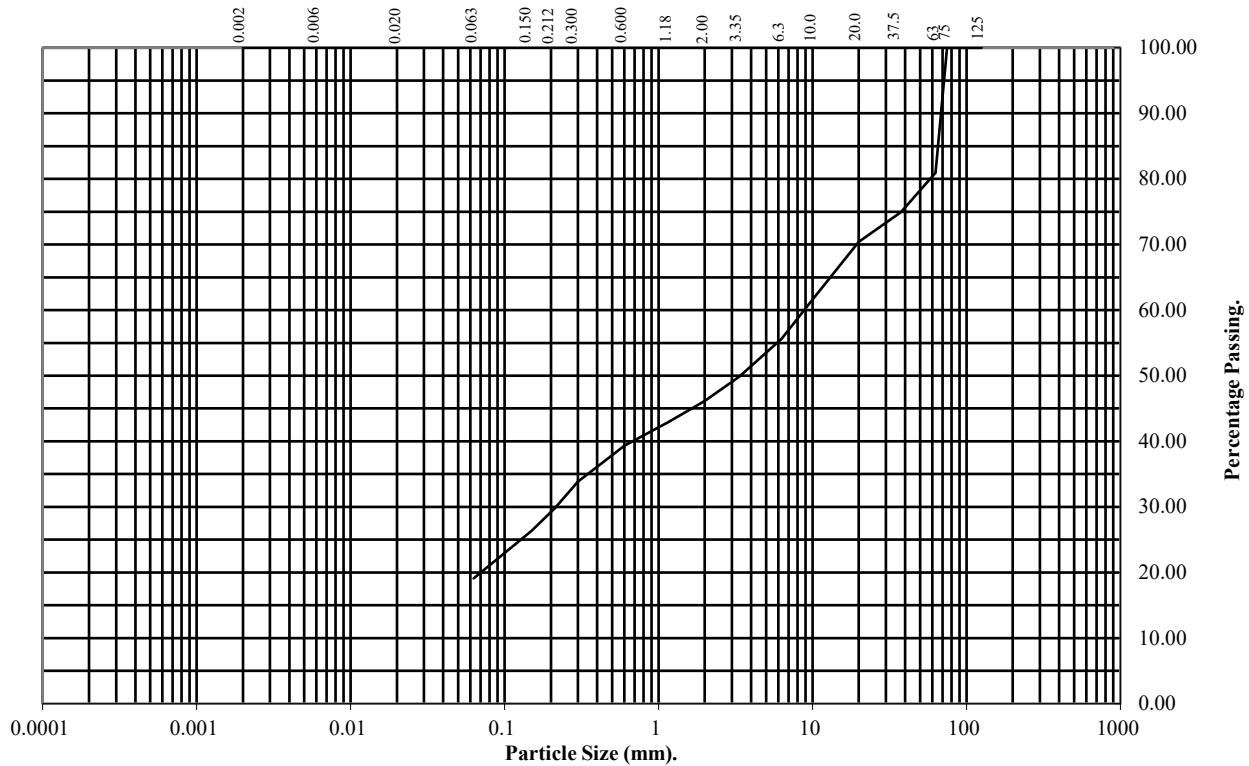
0.50

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	81
37.5	75
20	70
10	62
6.3	56
3.35	50
2	46
1.18	43
0.6	39
0.3	34
0.212	30
0.15	26
0.063	19

Soil Fraction	Total Percentage
Cobbles	19
Gravel	35
Sand	27
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

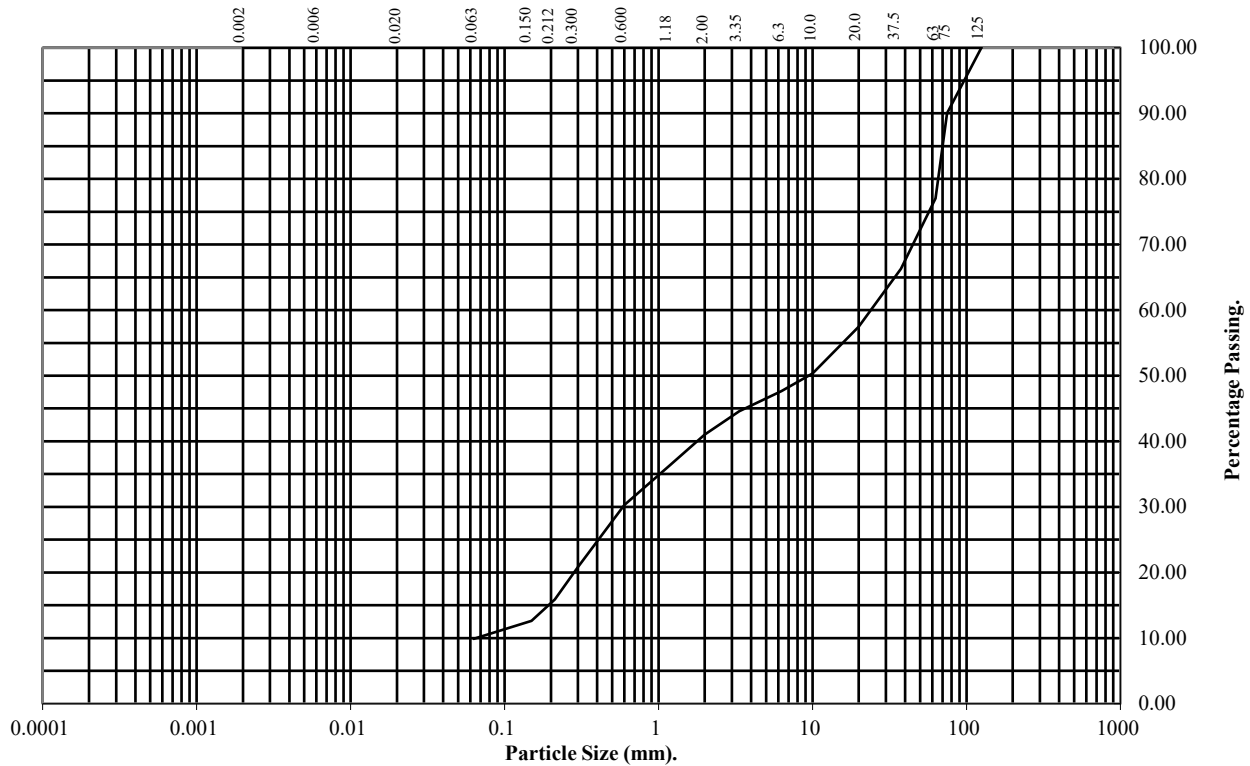
Hole Number: TP07

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	90
63	77
37.5	66
20	57
10	50
6.3	48
3.35	45
2	41
1.18	36
0.6	30
0.3	21
0.212	16
0.15	13
0.063	10

Soil Fraction	Total Percentage
Cobbles	23
Gravel	36
Sand	31
Silt/Clay	10

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

PARTICLE SIZE DISTRIBUTION TEST

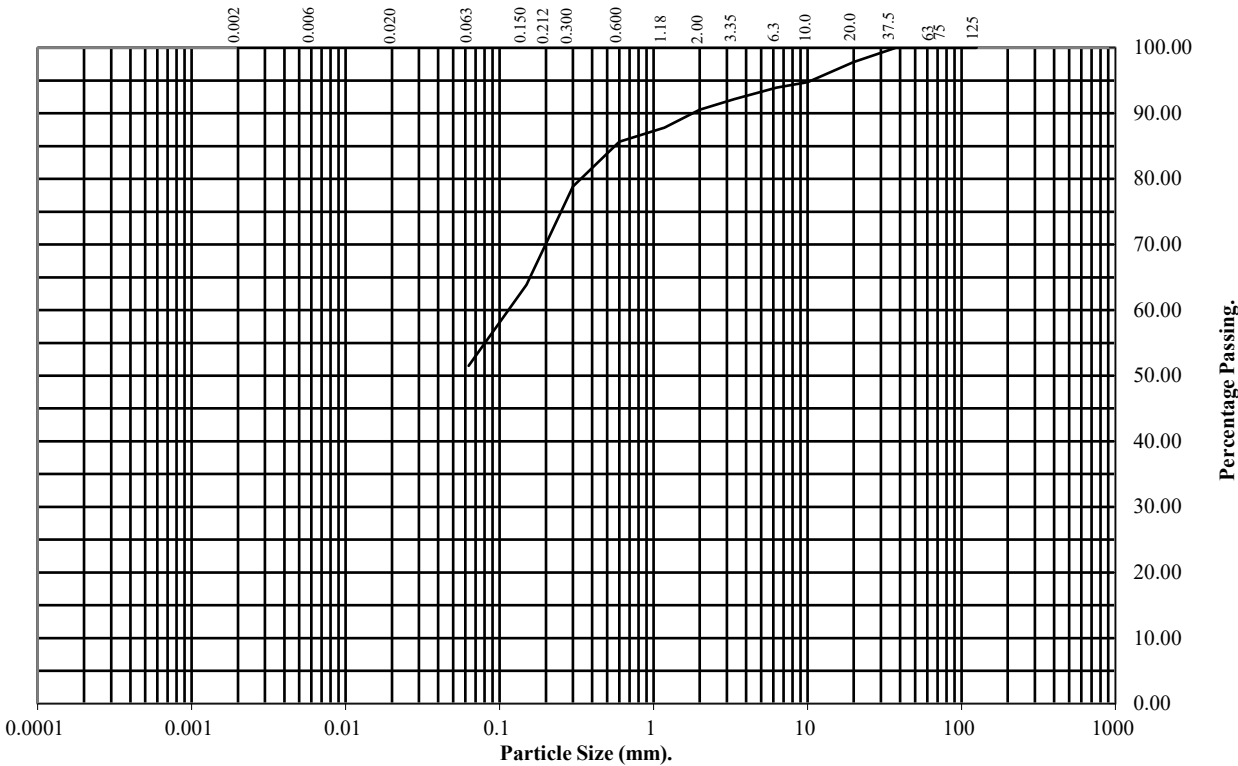
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP08 Top Depth (m): 0.50

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	95
6.3	94
3.35	92
2	91
1.18	88
0.6	86
0.3	79
0.212	71
0.15	64
0.063	52

Soil Fraction	Total Percentage
Cobbles	0
Gravel	9
Sand	39
Silt/Clay	52

Remarks:

See Summary of Soil Descriptions



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

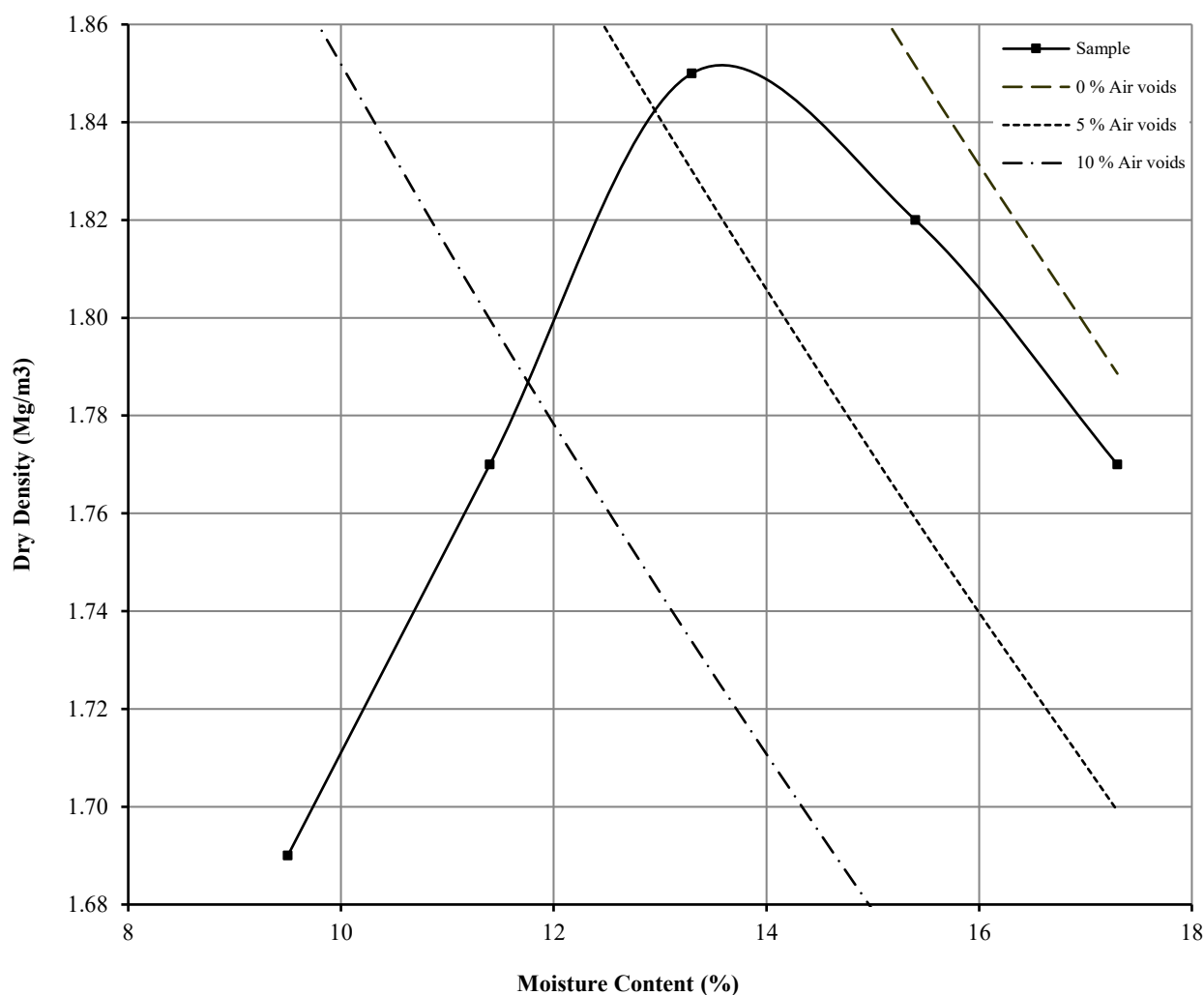
Hole Number: TP01

Top Depth (m) : 0.20

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	11	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.59	Assumed	Material Retained on 37.5 mm Test Sieve (%):	17
Maximum Dry Density (Mg/m3):	1.85		Material Retained on 20.0 mm Test Sieve (%):	11
Optimum Moisture Content (%):	13			
Remarks See summary of soil descriptions				



Hollingworth Gate - Littleborough

Contract
PSL23/4181
Client Ref
GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

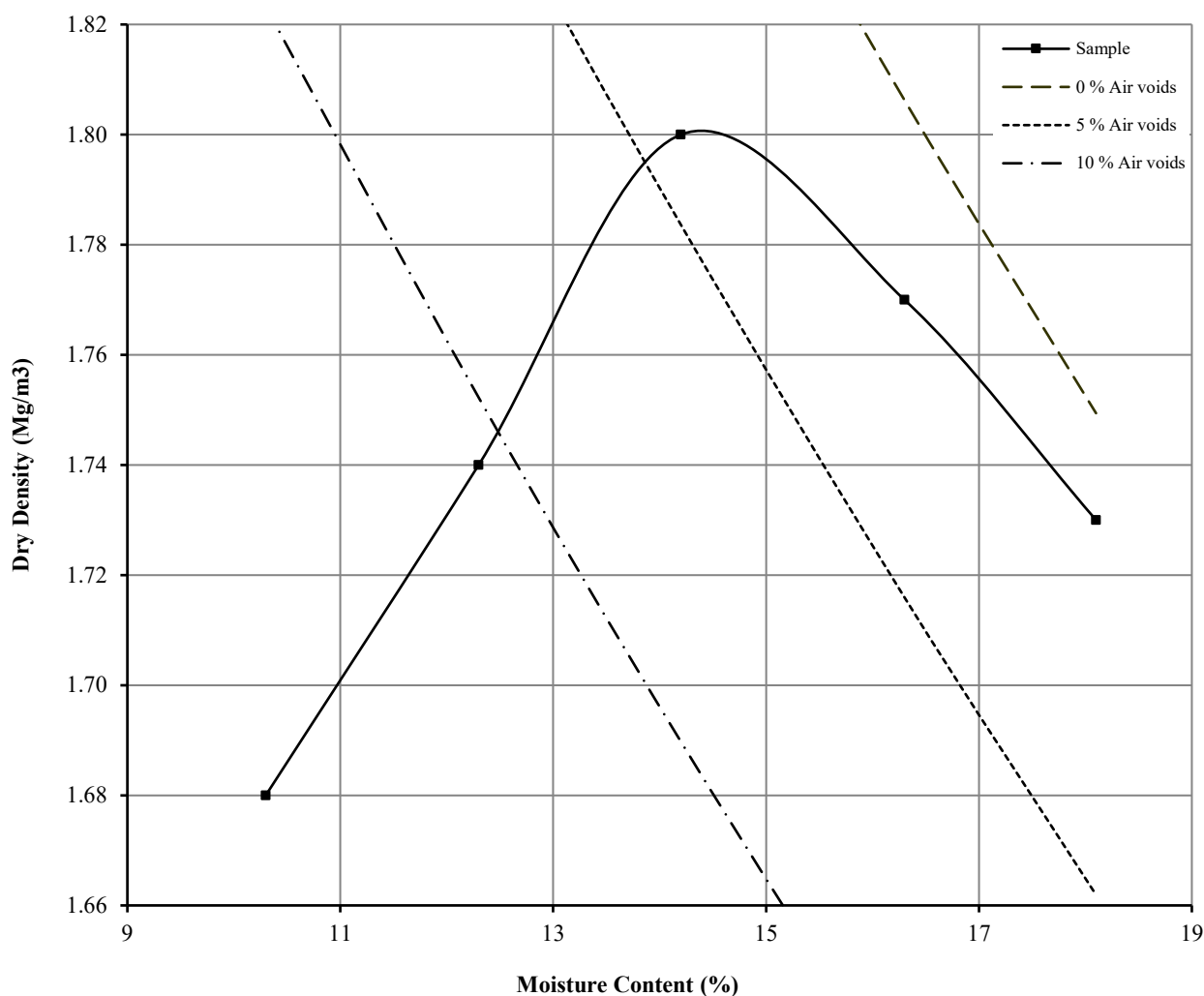
Hole Number: TP01

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	18	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.56	Assumed	Material Retained on 37.5 mm Test Sieve (%):	37
Maximum Dry Density (Mg/m ³):	1.80		Material Retained on 20.0 mm Test Sieve (%):	7
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				

		Hollingworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

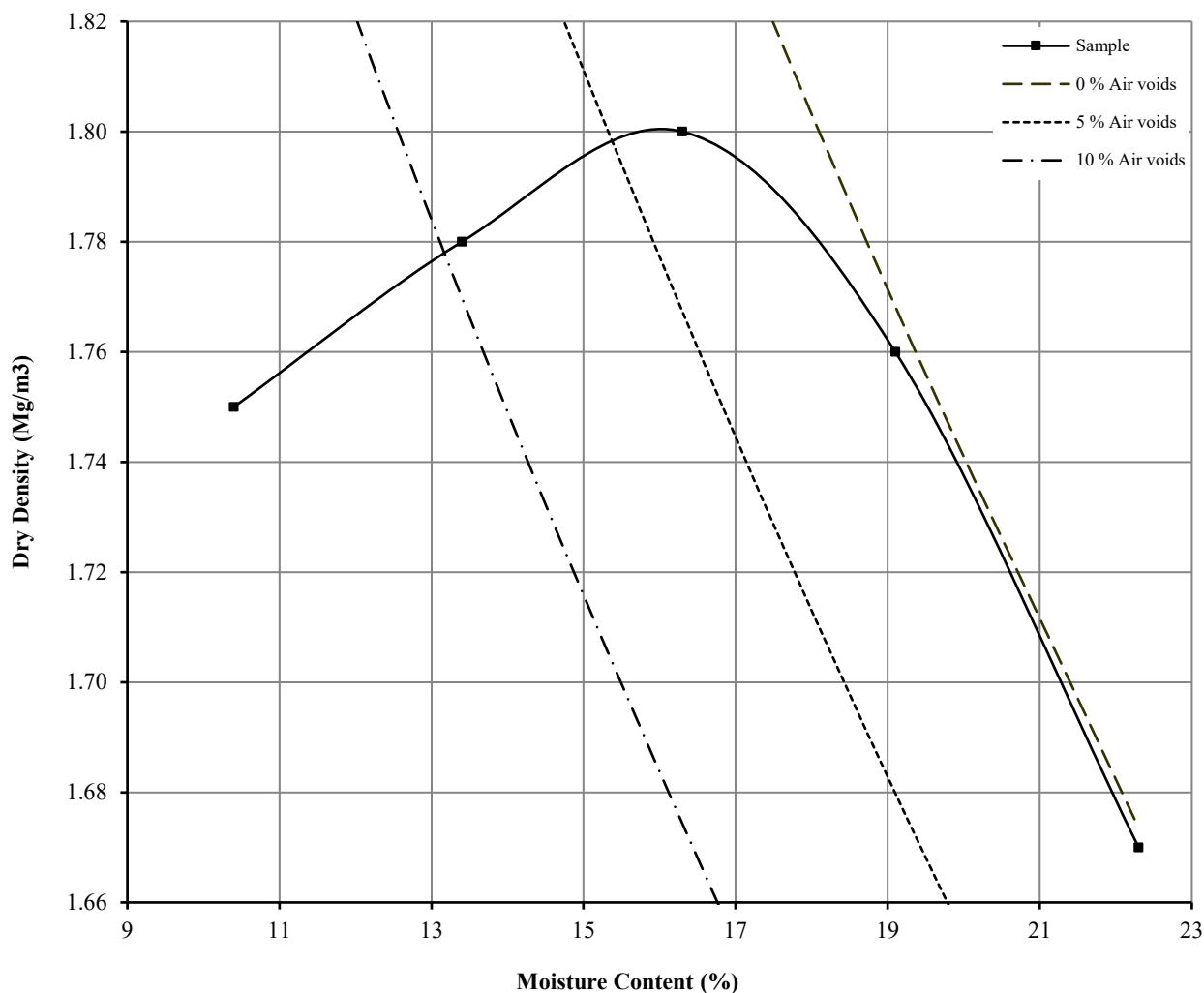
Hole Number: TP02

Top Depth (m) : 0.90

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	19	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.80		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	16			
Remarks See summary of soil descriptions				



Hollingworth Gate - Littleborough

Contract
PSL23/4181
Client Ref
GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

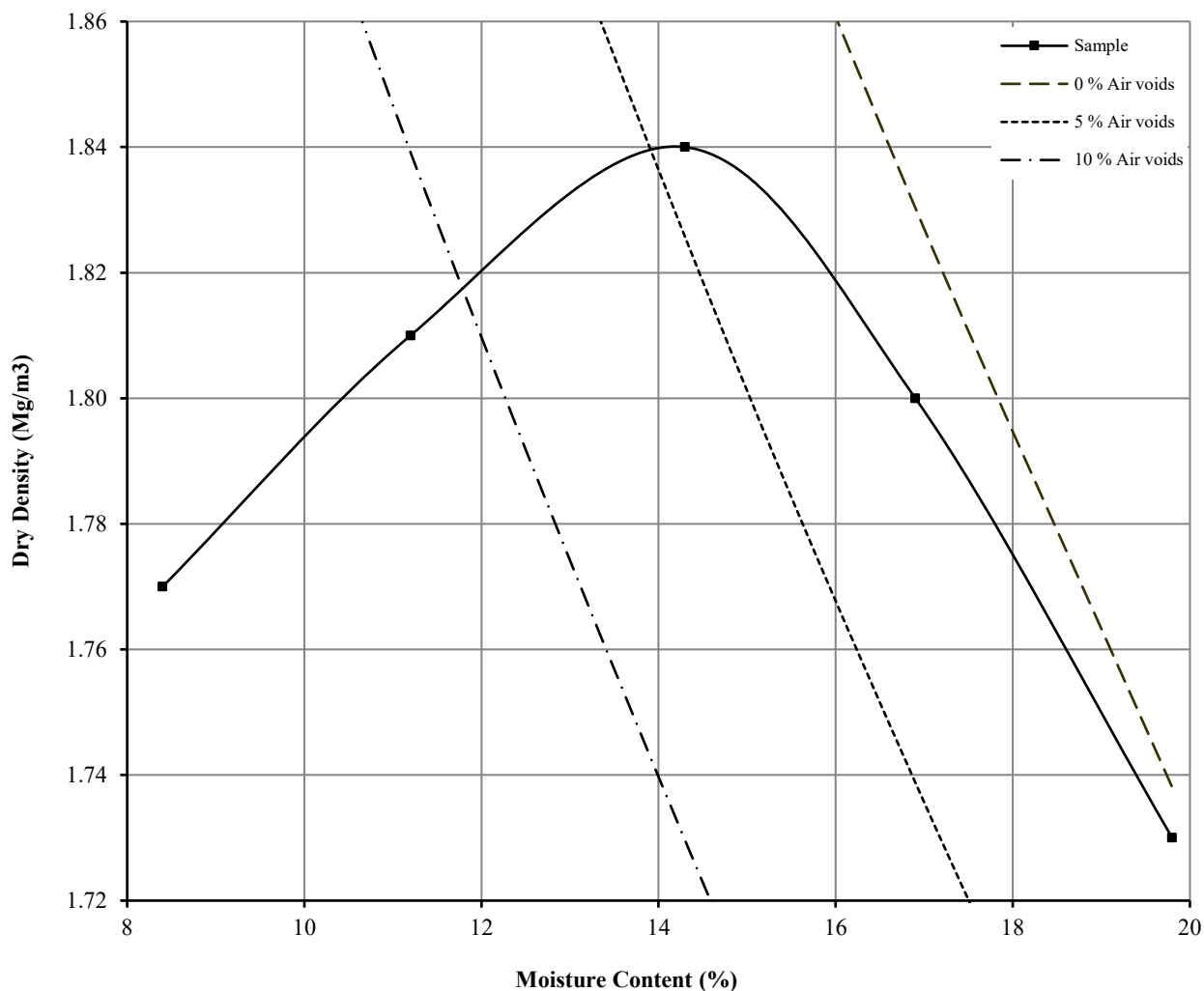
Hole Number: TP03

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	17	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	9
Maximum Dry Density (Mg/m ³):	1.84		Material Retained on 20.0 mm Test Sieve (%):	11
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				

 4043	 A PHENNA GROUP COMPANY	Hollingworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

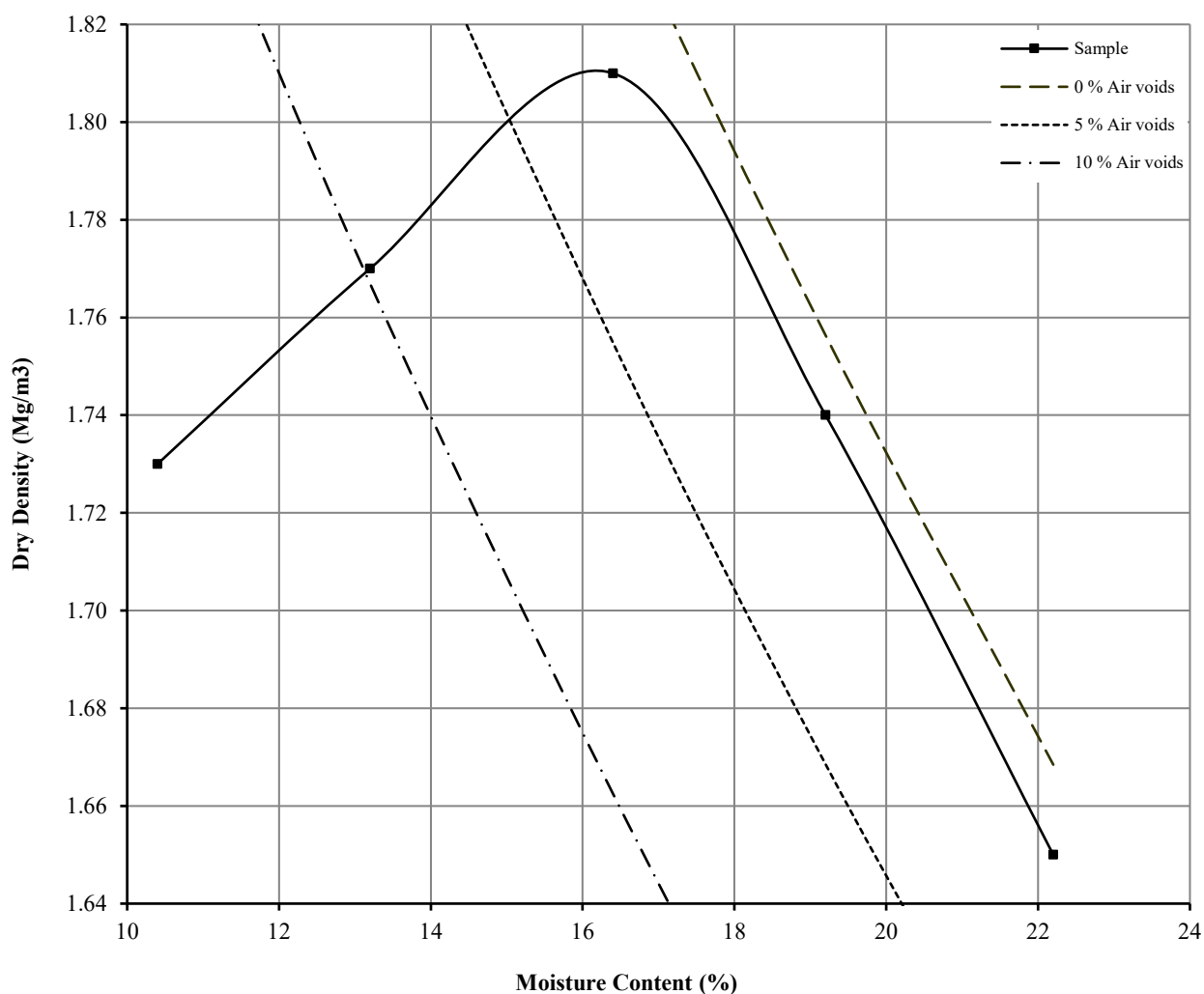
Hole Number: TP03

Top Depth (m) : 2.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	13	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	9
Maximum Dry Density (Mg/m ³):	1.81		Material Retained on 20.0 mm Test Sieve (%):	2
Optimum Moisture Content (%):	16			
Remarks See summary of soil descriptions				

		Hollingworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

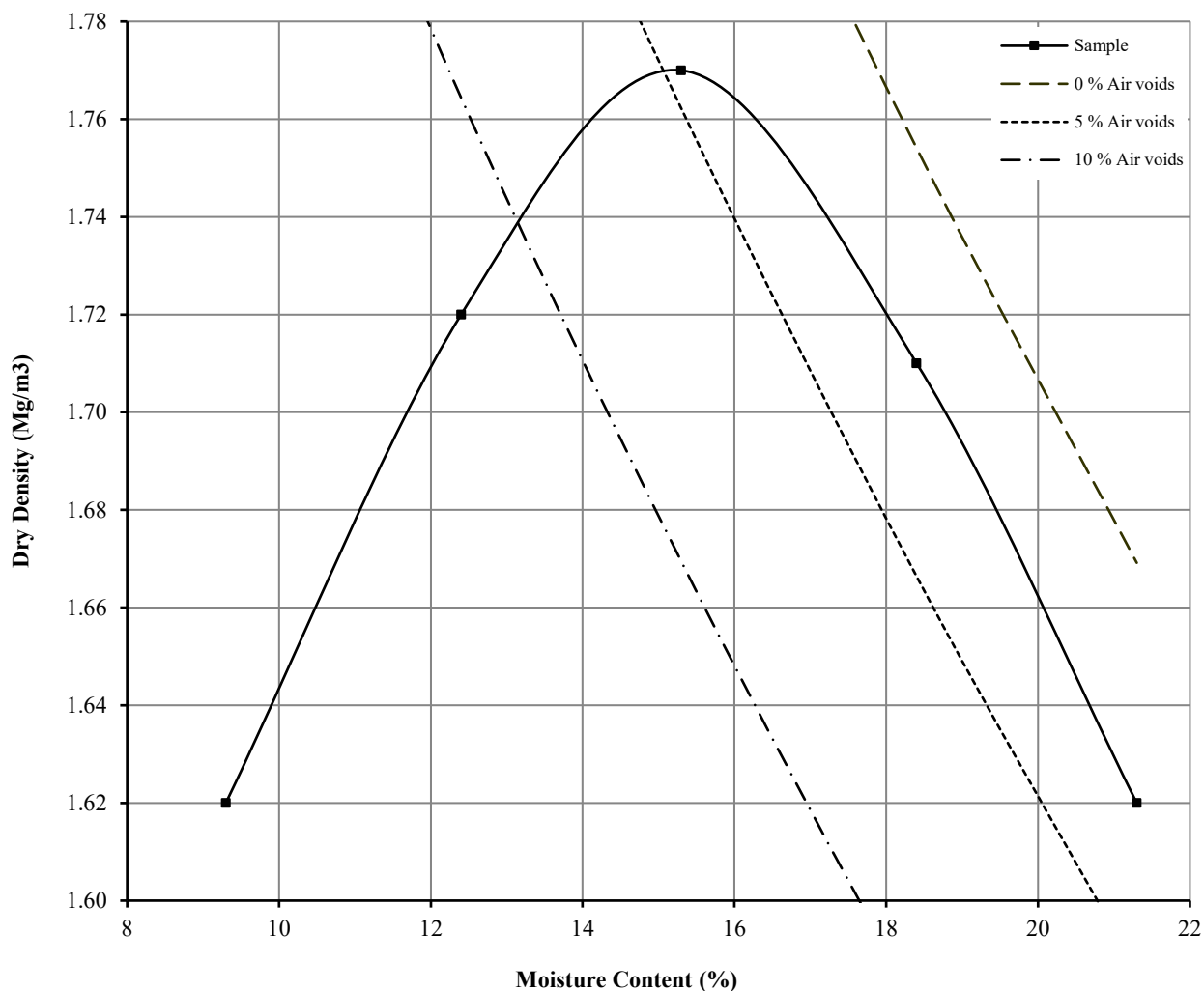
Hole Number: TP04

Top Depth (m) : 0.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	18	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.59	Assumed	Material Retained on 37.5 mm Test Sieve (%):	17
Maximum Dry Density (Mg/m3):	1.77		Material Retained on 20.0 mm Test Sieve (%):	14
Optimum Moisture Content (%):	15			
Remarks See summary of soil descriptions				

		Hollingsworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

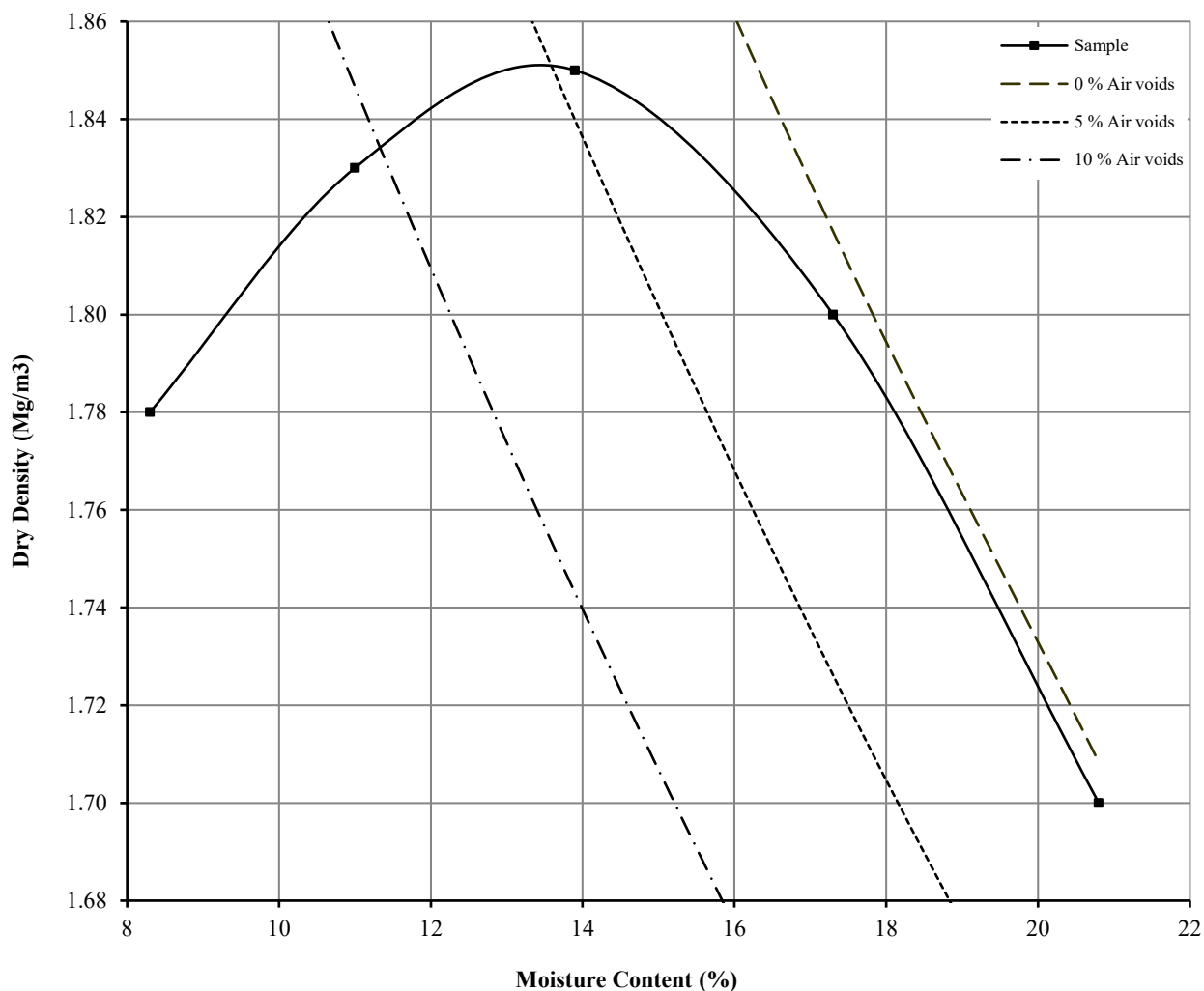
Hole Number: TP06

Top Depth (m) : 1.00

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	14	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.85		Material Retained on 20.0 mm Test Sieve (%):	6
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				

 4043	 A PHENIA GROUP COMPANY	Hollingworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

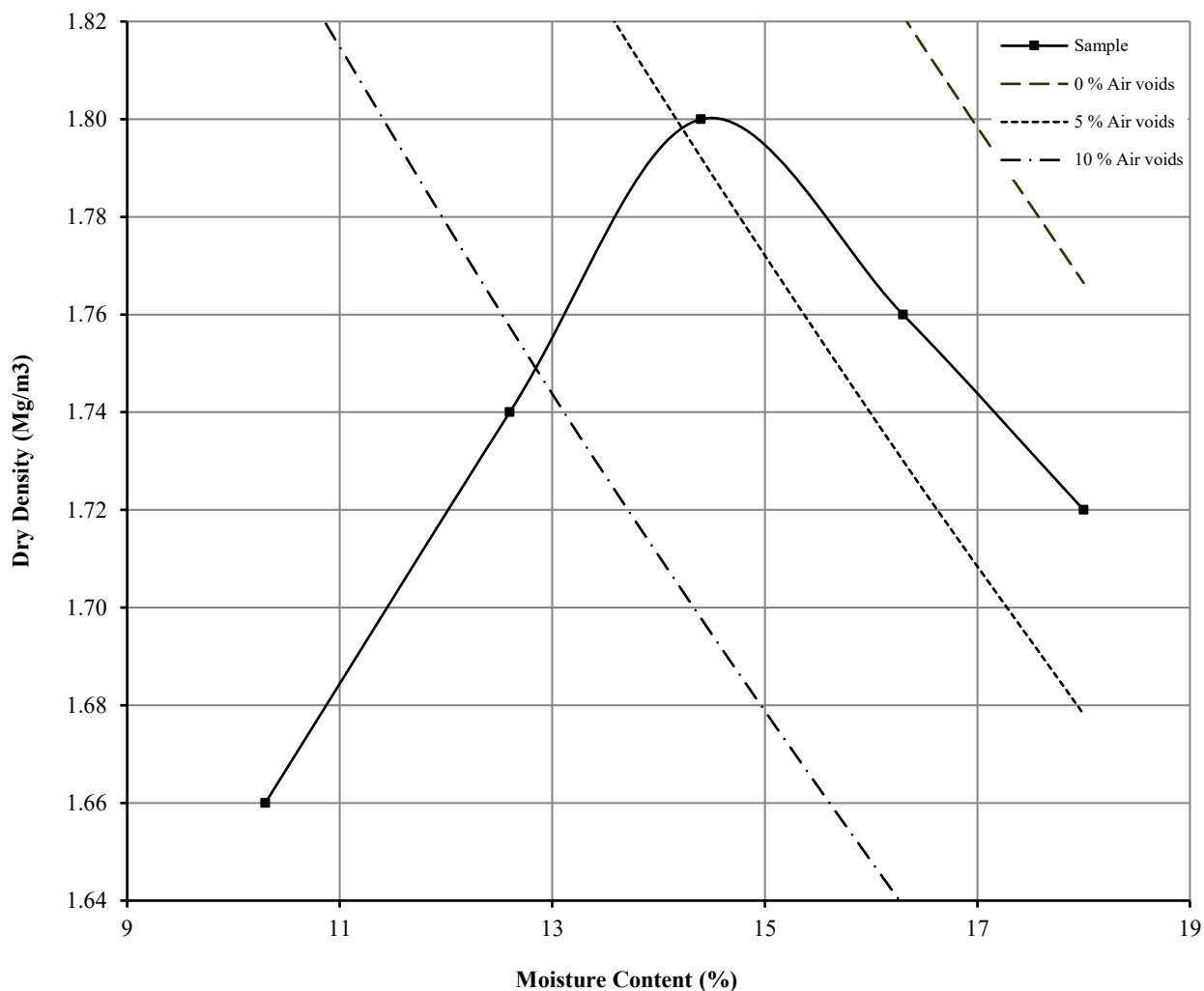
Hole Number: TP07

Top Depth (m) : 0.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	18	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.59	Assumed	Material Retained on 37.5 mm Test Sieve (%):	25
Maximum Dry Density (Mg/m3):	1.80		Material Retained on 20.0 mm Test Sieve (%):	5
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				

		Hollingsworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

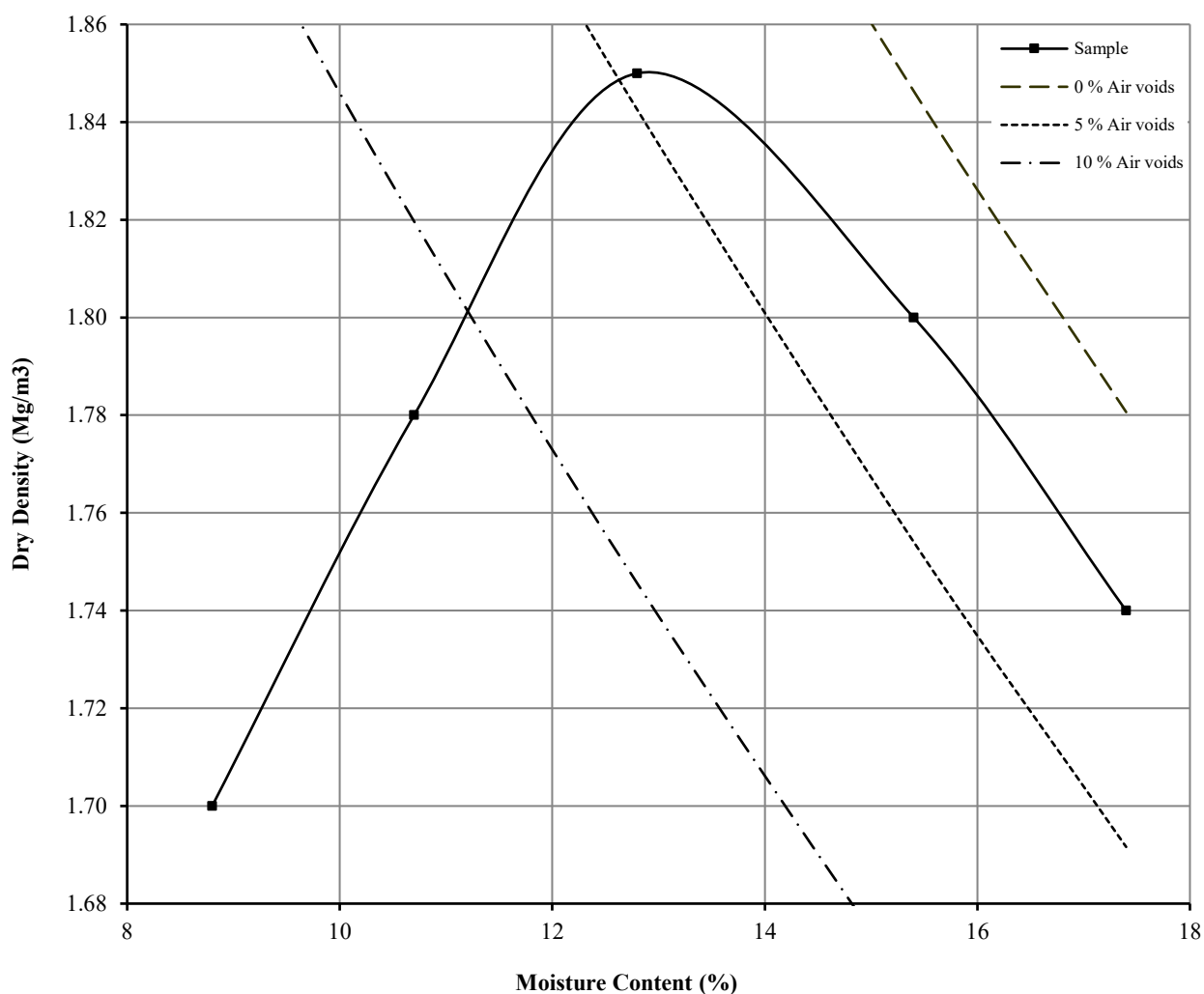
Hole Number: TP07

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	13	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.58	Assumed	Material Retained on 37.5 mm Test Sieve (%):	34
Maximum Dry Density (Mg/m3):	1.85		Material Retained on 20.0 mm Test Sieve (%):	9
Optimum Moisture Content (%):	13			
Remarks See summary of soil descriptions				

		Hollingworth Gate - Littleborough	Contract
			PSL23/4181
			Client Ref
			GRO-23131

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

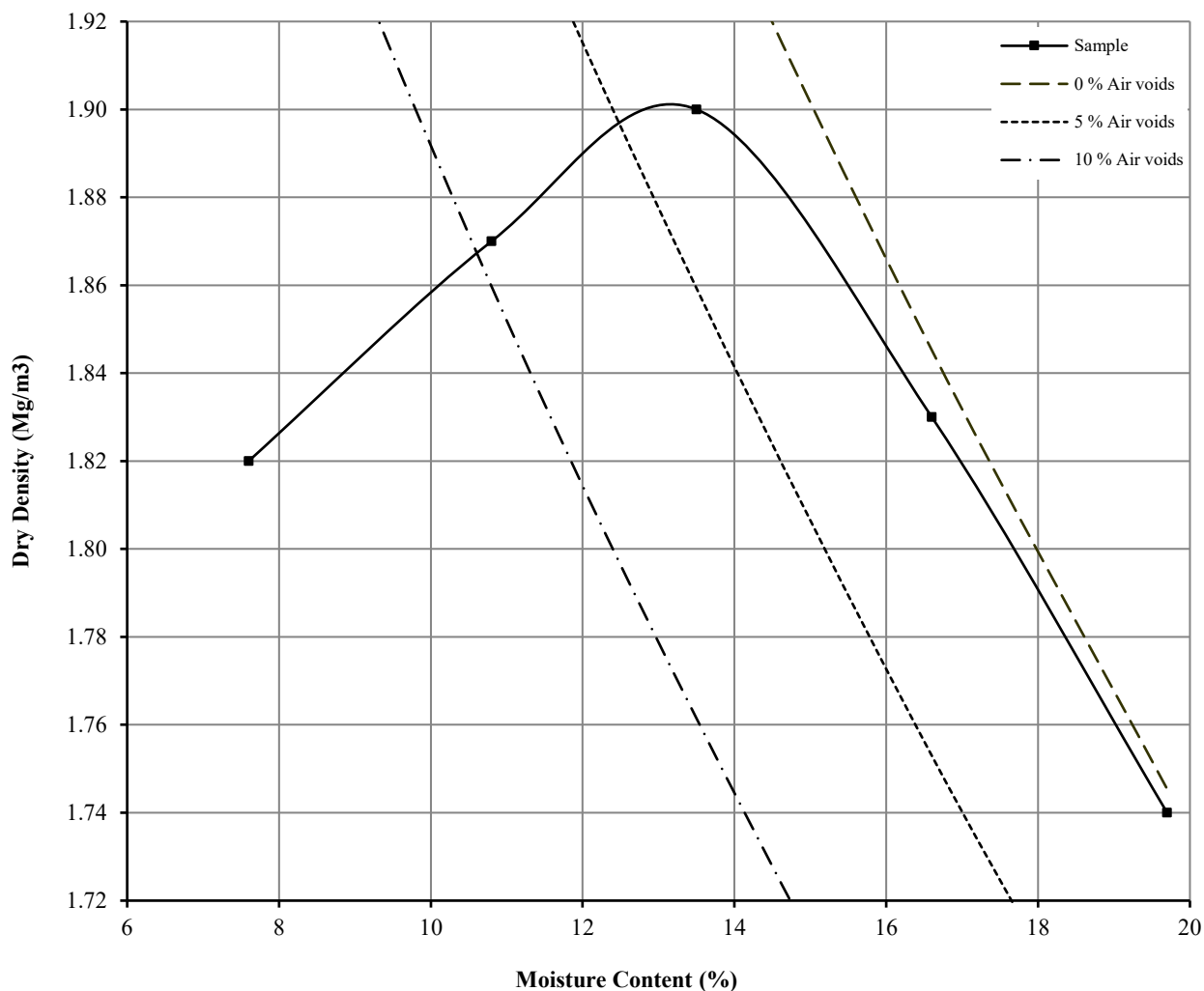
Hole Number: TP08

Top Depth (m) : 0.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	11	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.66	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m3):	1.90		Material Retained on 20.0 mm Test Sieve (%):	2
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				



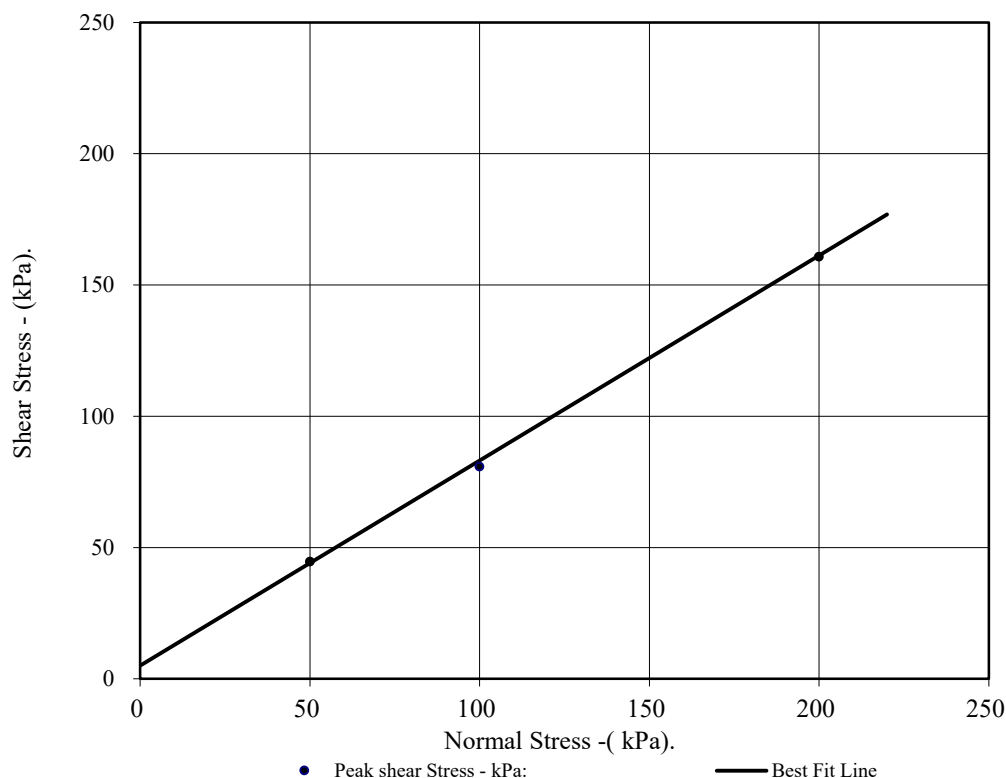
Hollingworth Gate - Littleborough

Contract
PSL23/4181
Client Ref
GRO-23131

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP01		Top Depth:	0.20	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			13	13	13
Bulk Density - Mg/m3:			2.00	2.00	2.00
Dry Density - Mg/m3:			1.76	1.76	1.76
Voids Ratio:			0.504	0.504	0.504
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			18.81	18.46	18.19
Shearing Stage					
Rate of Strain - mm/min			0.056	0.056	0.056
Displacement at peak shear stress - mm			6.30	6.30	8.40
Peak shear Stress - kPa:			45	81	161
Final Consolidated Conditions					
Moisture Content - %:			20	19	18
Bulk Density - Mg/m3:			2.13	2.17	2.20
Dry Density - Mg/m3:			1.77	1.83	1.87
Peak					
Angle of Shearing Resistance:(θ)			38		
Effective Cohesion - kPa:			5		



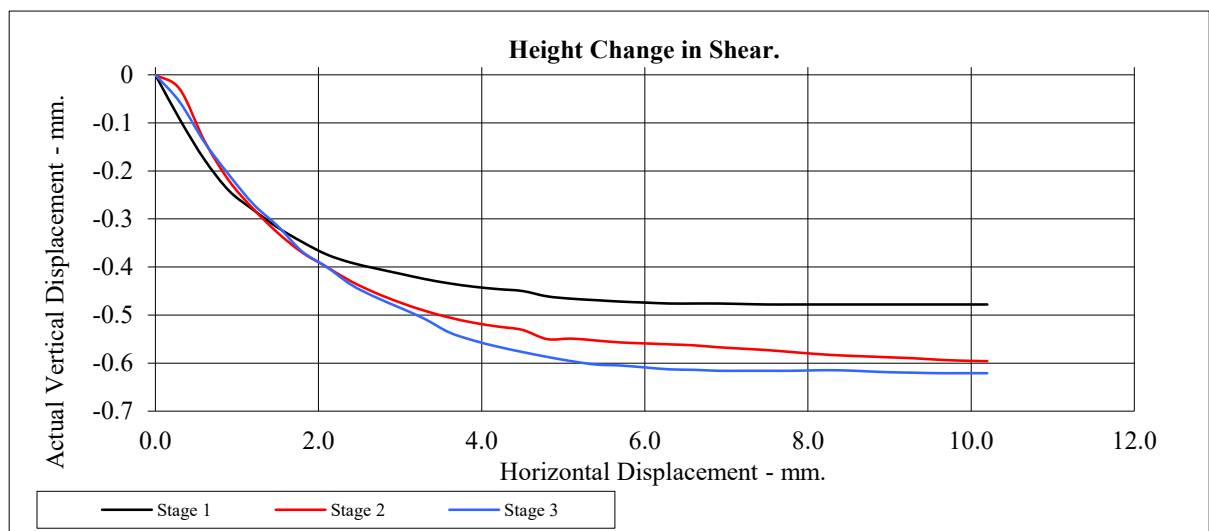
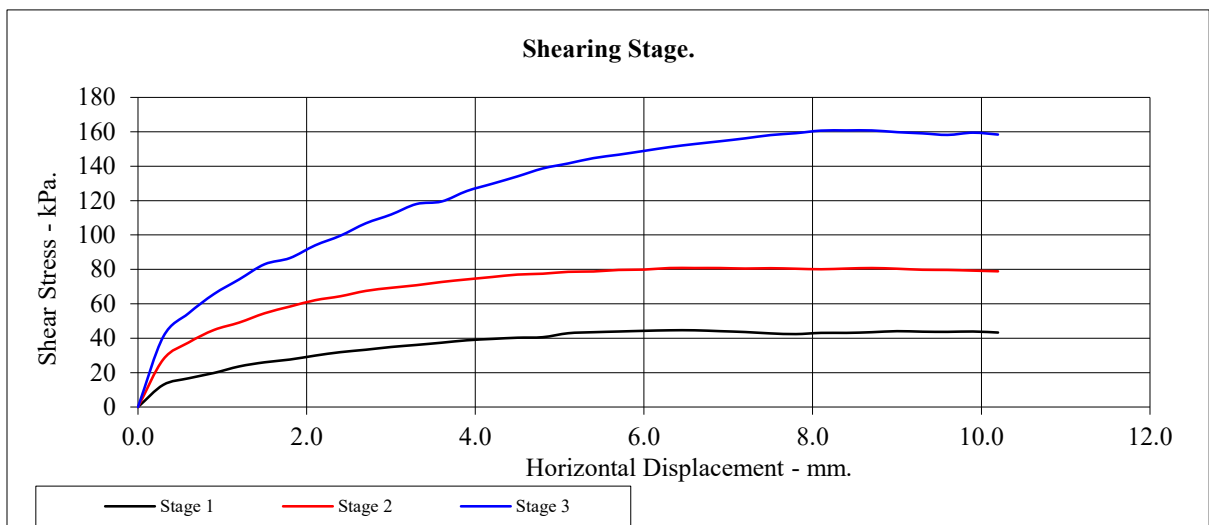
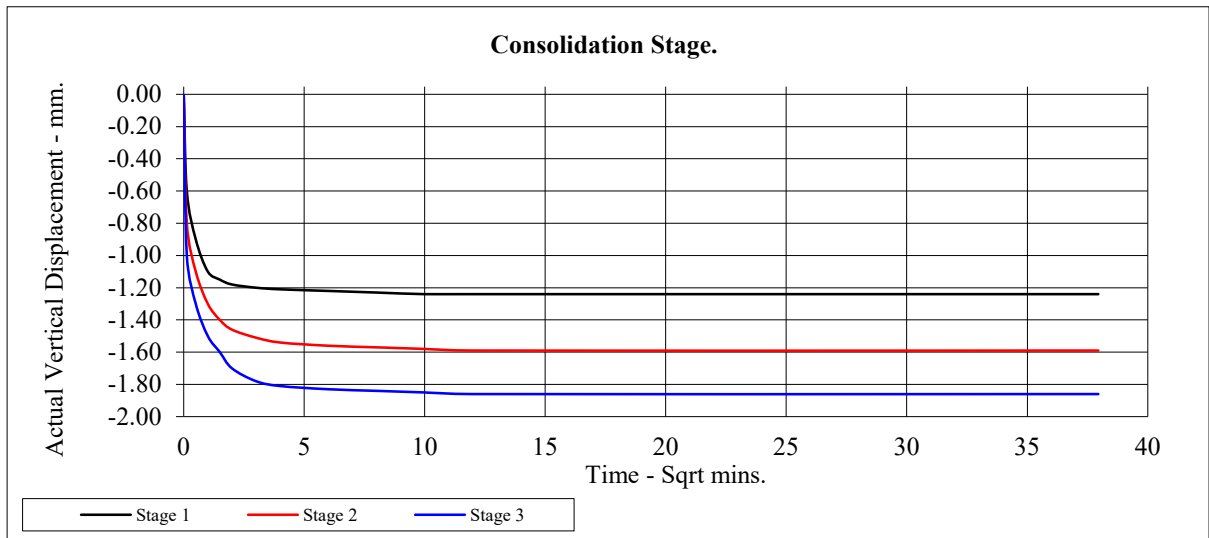
Hollingworth Gate - Littleborough

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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP01	Top Depth:	0.20
Sample Number:		Base Depth:	



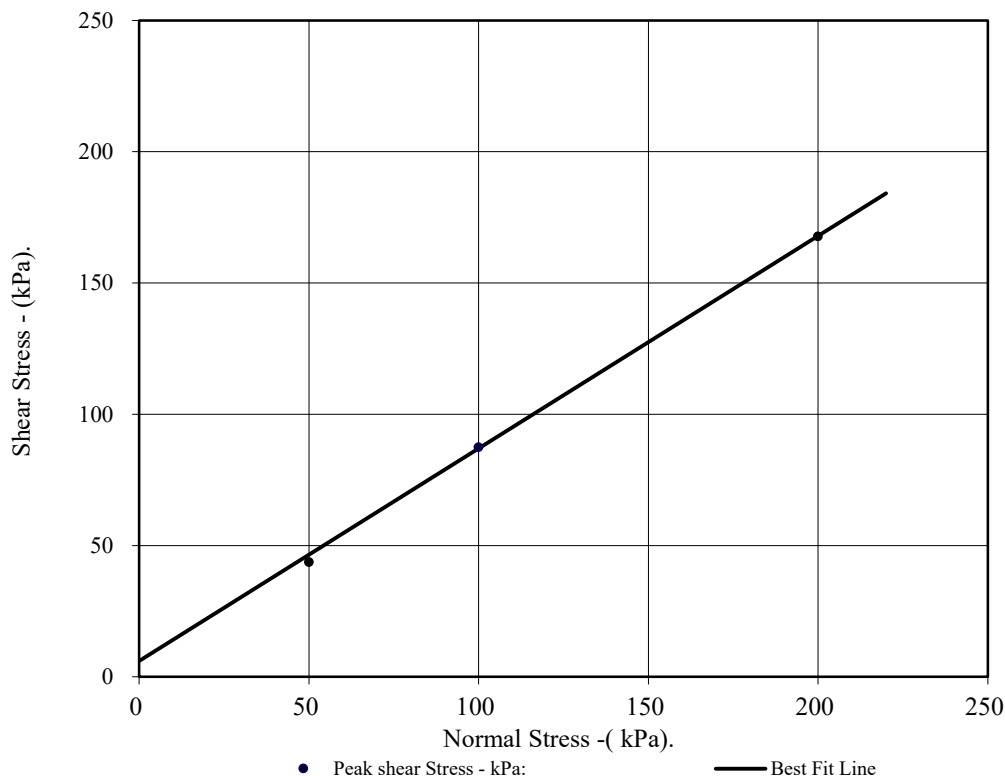
Hollingworth Gate - Littleborough

Contract No:
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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP01		Top Depth:	1.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			1.95	1.95	1.95
Dry Density - Mg/m3:			1.71	1.71	1.71
Voids Ratio:			0.548	0.548	0.548
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.27	19.10	18.26
Shearing Stage					
Rate of Strain - mm/min			0.059	0.059	0.059
Displacement at peak shear stress - mm			6.90	3.30	7.20
Peak shear Stress - kPa:			44	87	168
Final Consolidated Conditions					
Moisture Content - %:			21	19	19
Bulk Density - Mg/m3:			2.03	2.05	2.15
Dry Density - Mg/m3:			1.68	1.73	1.81
Peak					
Angle of Shearing Resistance:(θ)			39		
Effective Cohesion - kPa:			6		



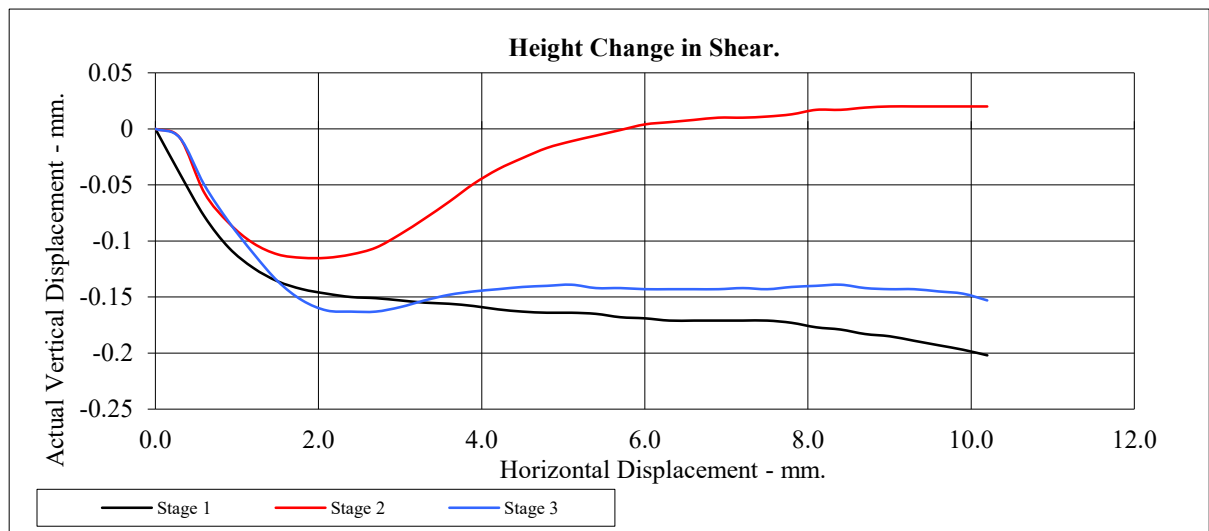
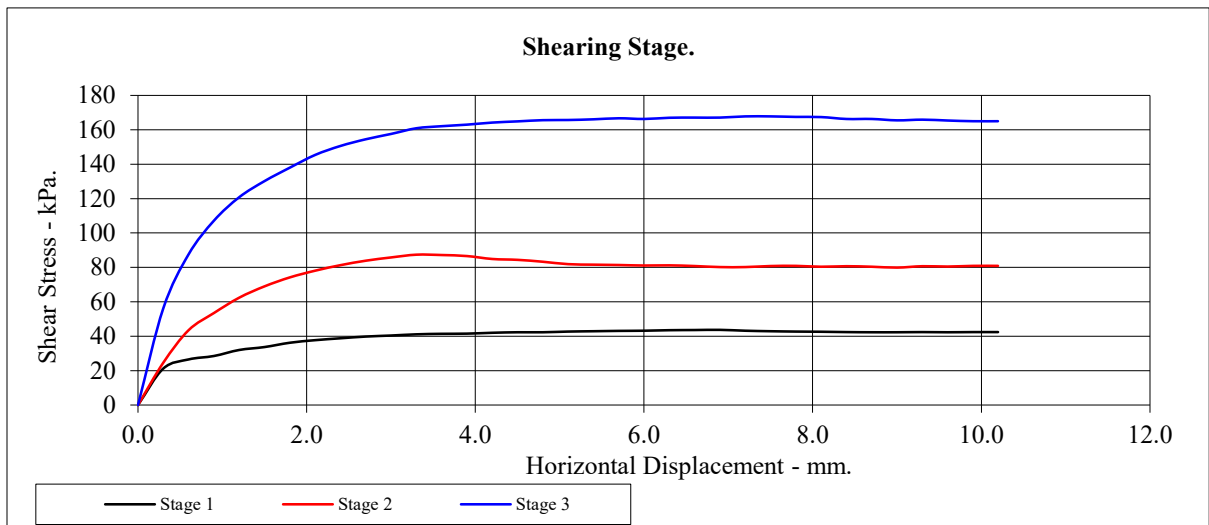
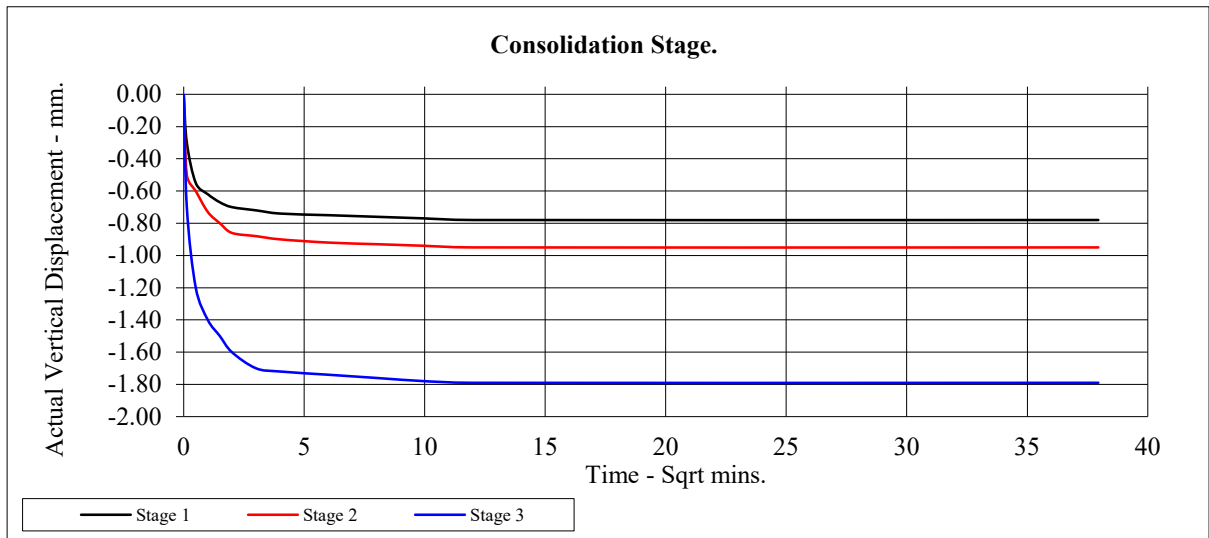
Hollingworth Gate - Littleborough

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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP01	Top Depth:	1.50
Sample Number:		Base Depth:	



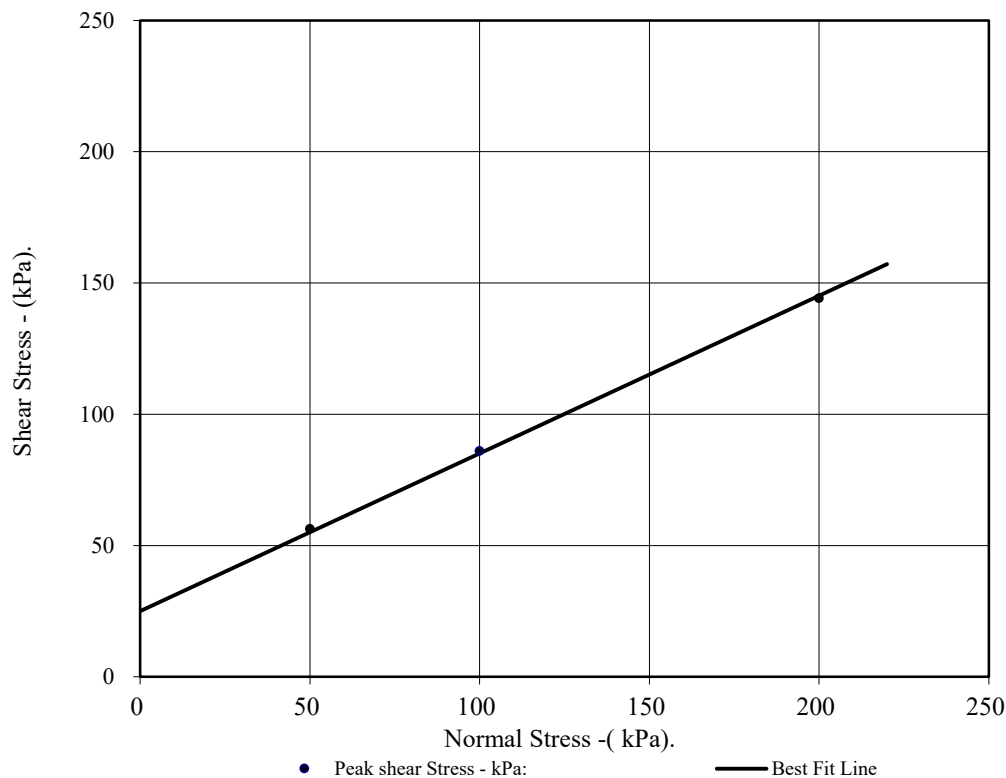
Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP02		Top Depth:	0.90	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			16	16	16
Bulk Density - Mg/m3:			1.98	1.98	1.98
Dry Density - Mg/m3:			1.71	1.71	1.71
Voids Ratio:			0.550	0.550	0.550
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.46	19.21	19.06
Shearing Stage					
Rate of Strain - mm/min			0.049	0.049	0.049
Displacement at peak shear stress - mm			3.01	3.91	5.41
Peak shear Stress - kPa:			56	86	144
Final Consolidated Conditions					
Moisture Content - %:			19	18	18
Bulk Density - Mg/m3:			2.04	2.07	2.08
Dry Density - Mg/m3:			1.72	1.75	1.77
Peak					
Angle of Shearing Resistance:(θ)			31		
Effective Cohesion - kPa:			25		



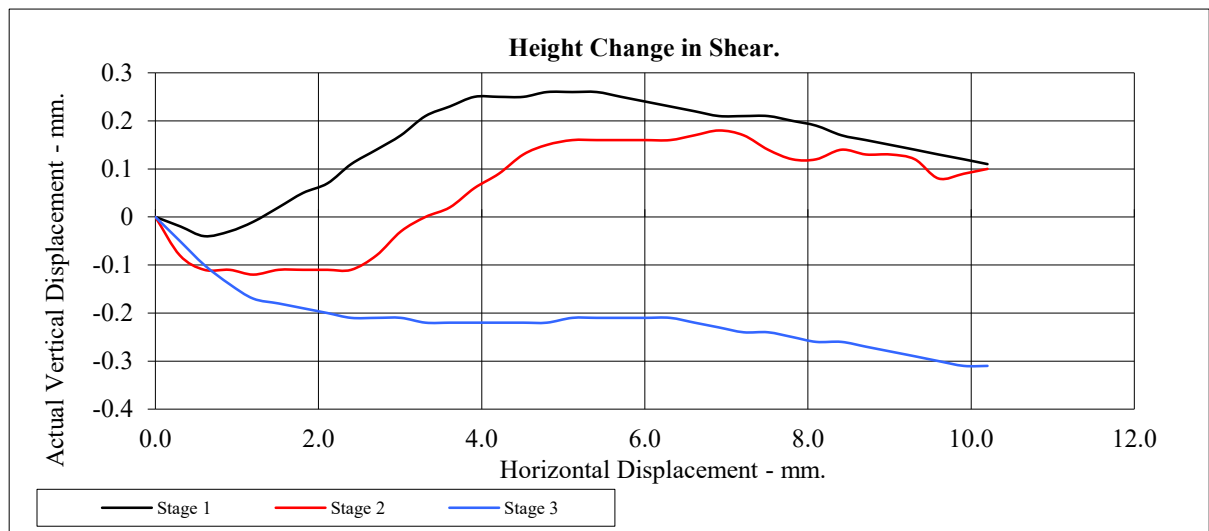
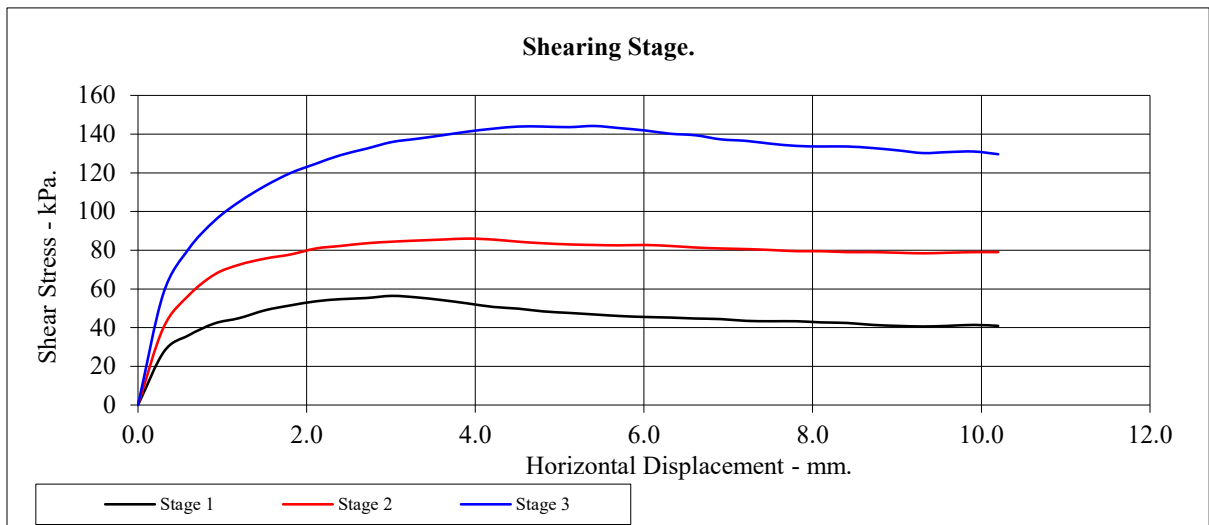
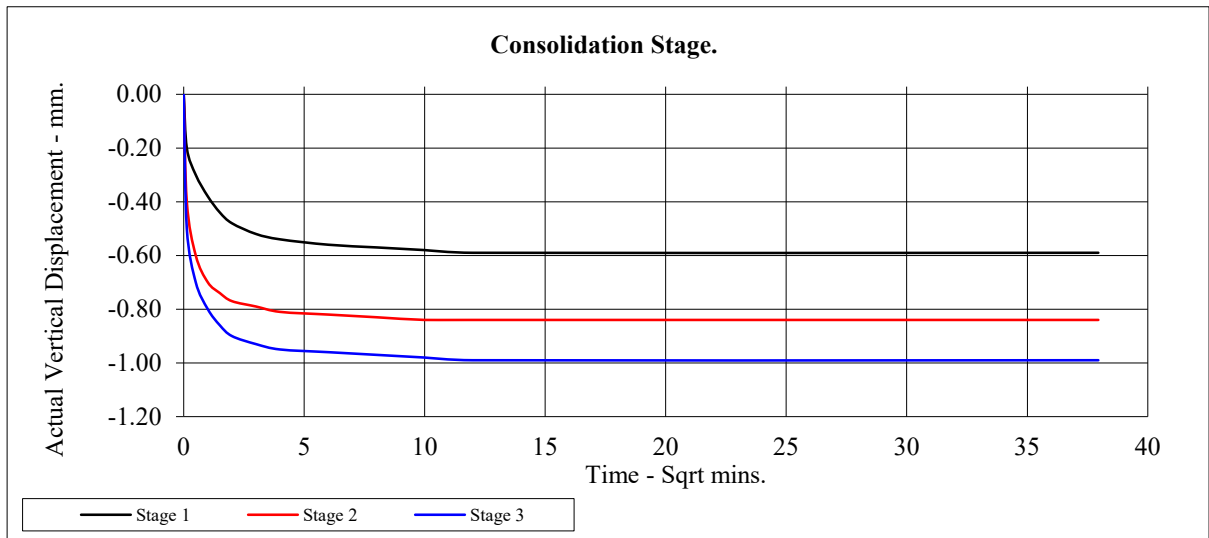
Hollingworth Gate - Littleborough

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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP02	Top Depth:	0.90
Sample Number:		Base Depth:	



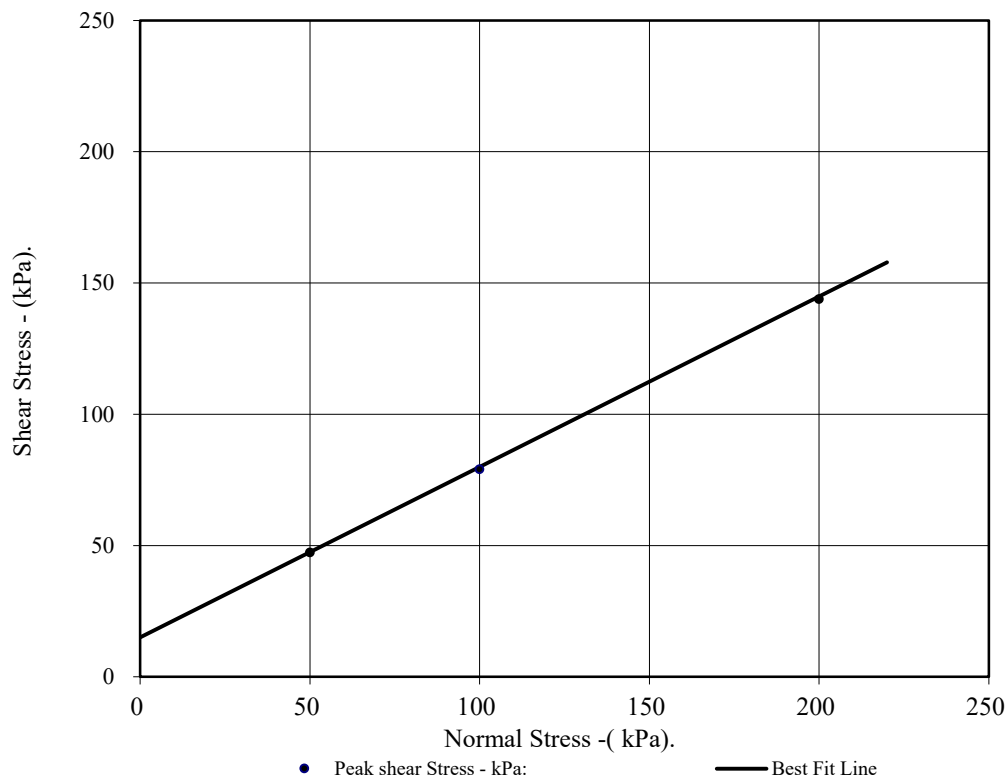
Hollingworth Gate - Littleborough

Contract No:
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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP03		Top Depth:	1.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			2.00	2.00	2.00
Dry Density - Mg/m3:			1.75	1.75	1.75
Voids Ratio:			0.515	0.515	0.515
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.36	18.86	18.39
Shearing Stage					
Rate of Strain - mm/min			0.052	0.052	0.052
Displacement at peak shear stress - mm			2.70	10.20	6.00
Peak shear Stress - kPa:			47	79	144
Final Consolidated Conditions					
Moisture Content - %:			20	19	18
Bulk Density - Mg/m3:			2.07	2.12	2.18
Dry Density - Mg/m3:			1.73	1.78	1.84
Peak					
Angle of Shearing Resistance:(θ)			33		
Effective Cohesion - kPa:			15		



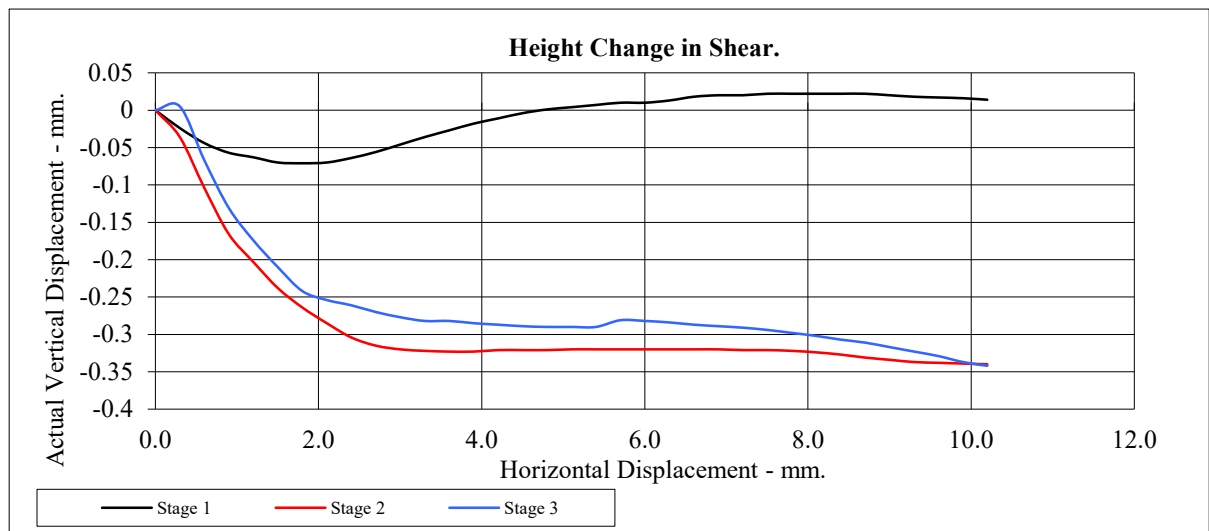
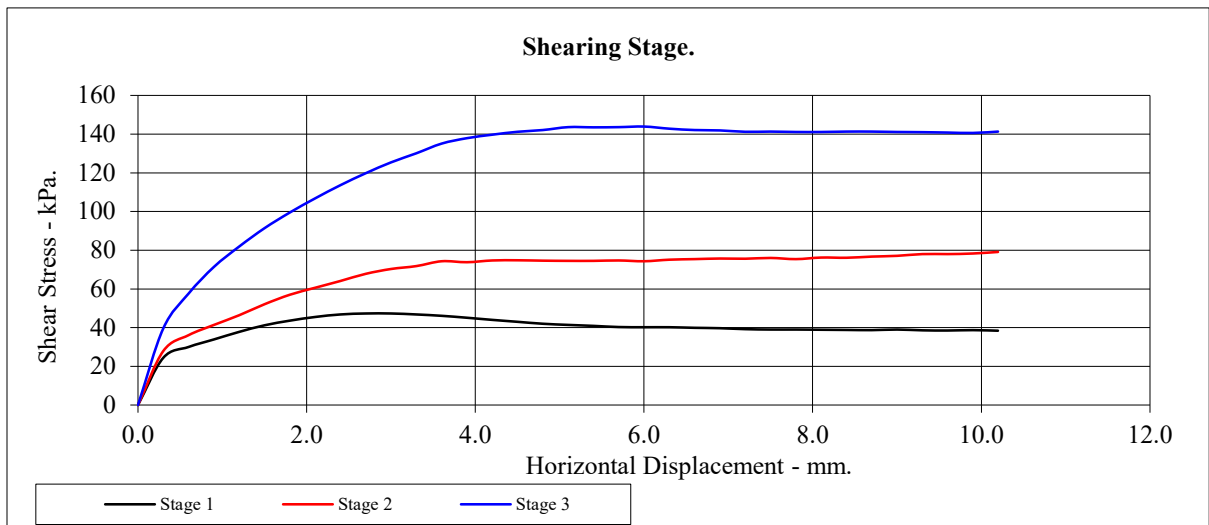
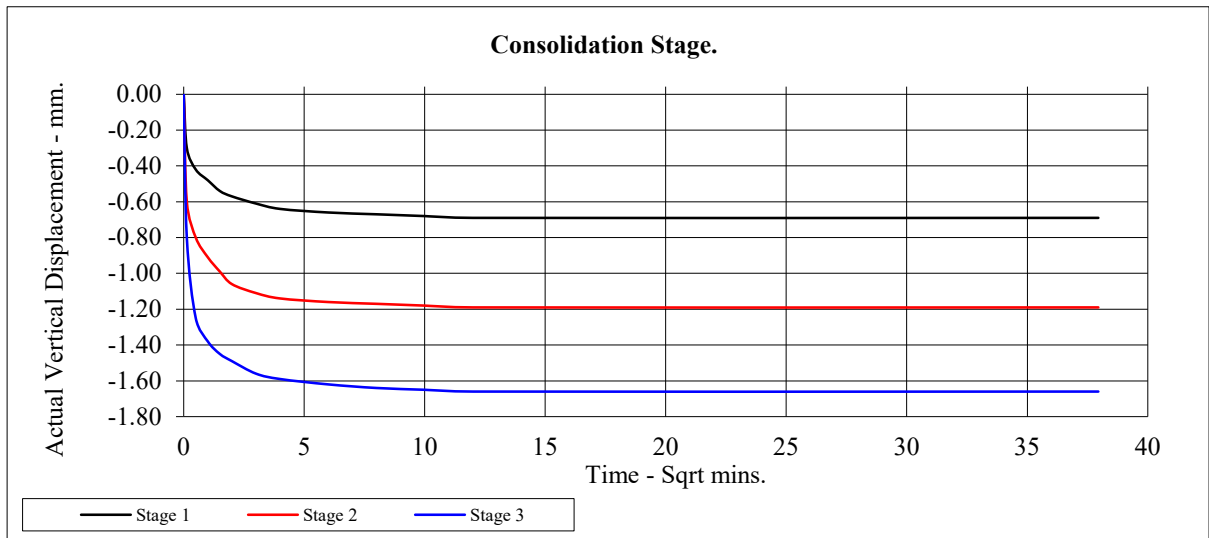
Hollingworth Gate - Littleborough

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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP03	Top Depth:	1.50
Sample Number:		Base Depth:	



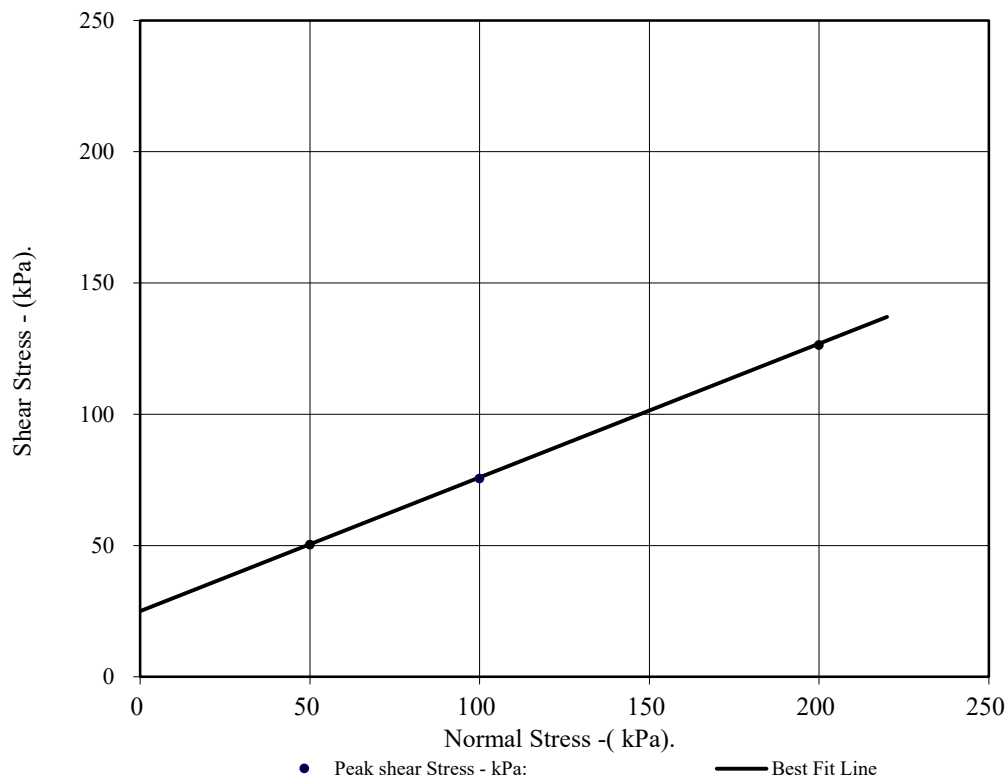
Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP03		Top Depth:	2.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			16	16	16
Bulk Density - Mg/m3:			2.00	2.00	2.00
Dry Density - Mg/m3:			1.72	1.72	1.72
Voids Ratio:			0.539	0.539	0.539
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.28	19.13	18.85
Shearing Stage					
Rate of Strain - mm/min			0.047	0.047	0.047
Displacement at peak shear stress - mm			4.21	10.20	9.91
Peak shear Stress - kPa:			50	76	126
Final Consolidated Conditions					
Moisture Content - %:			18	17	17
Bulk Density - Mg/m3:			2.08	2.09	2.12
Dry Density - Mg/m3:			1.76	1.78	1.81
Peak					
Angle of Shearing Resistance:(θ)			27		
Effective Cohesion - kPa:			25		



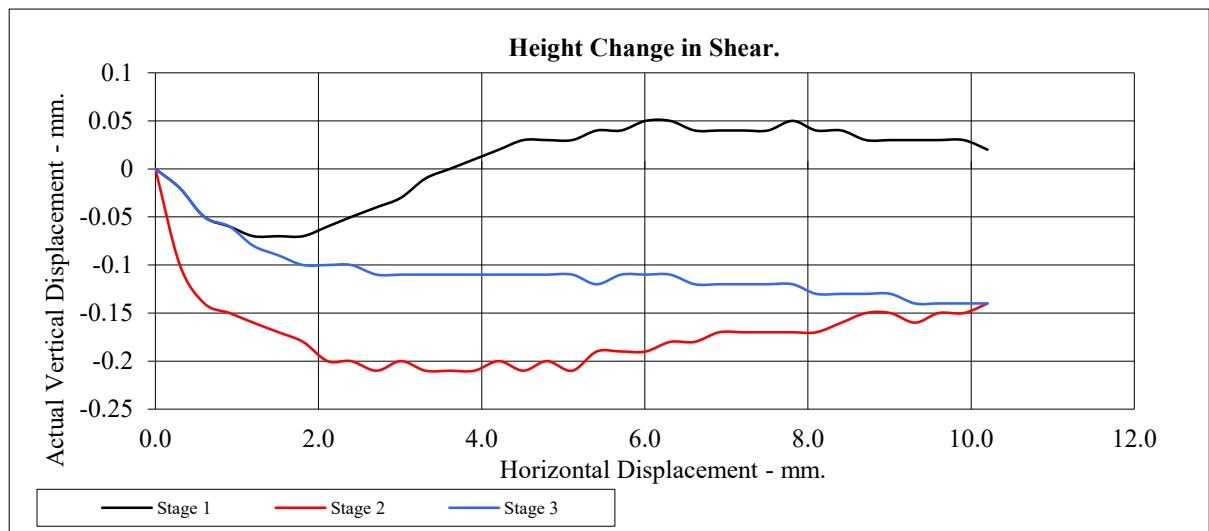
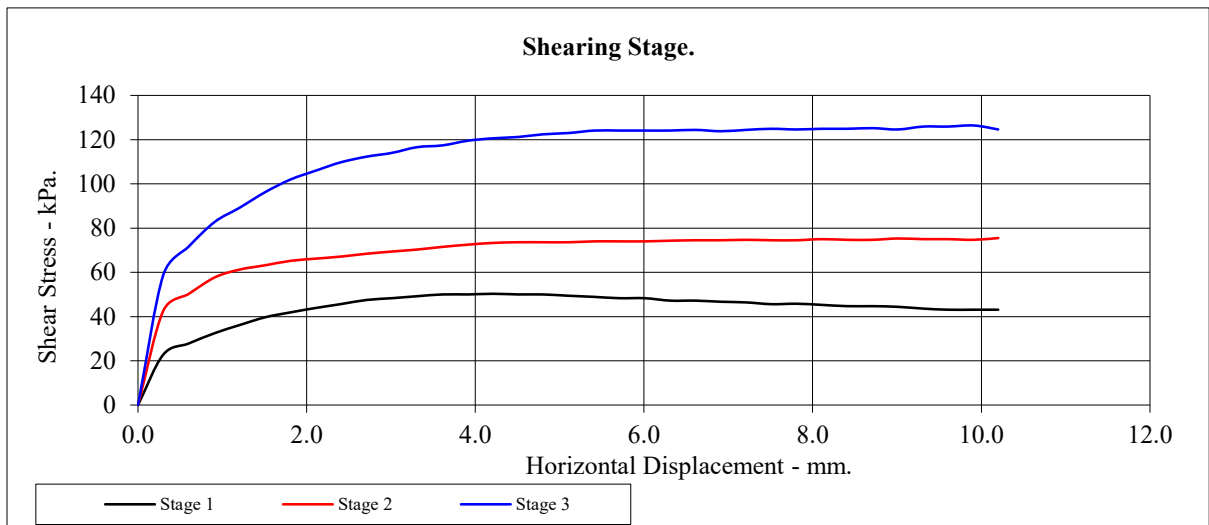
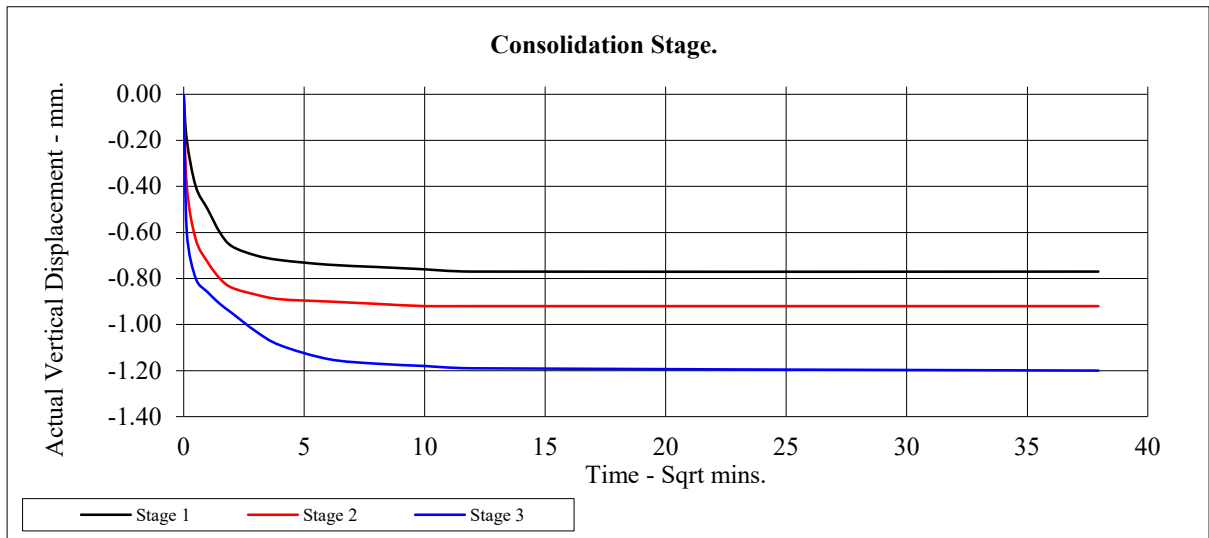
Hollingworth Gate - Littleborough

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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP03	Top Depth:	2.50
Sample Number:		Base Depth:	



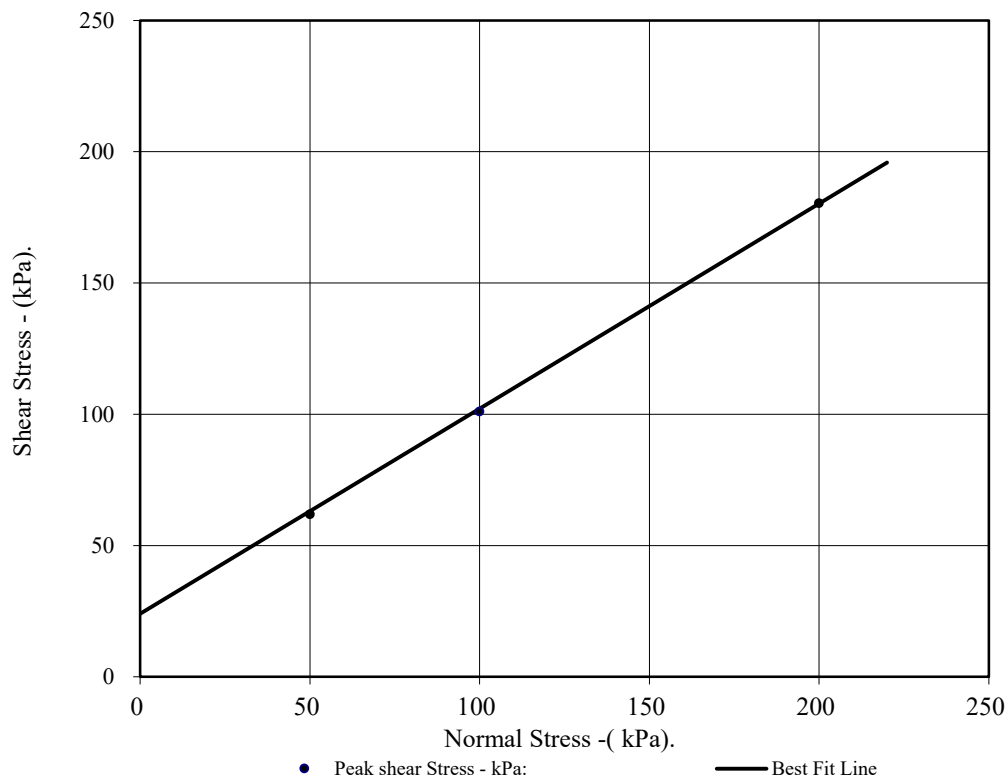
Hollingworth Gate - Littleborough

Contract No:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP04		Top Depth:	0.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			15	15	15
Bulk Density - Mg/m3:			1.94	1.94	1.94
Dry Density - Mg/m3:			1.68	1.68	1.68
Voids Ratio:			0.574	0.574	0.574
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.04	18.71	18.03
Shearing Stage					
Rate of Strain - mm/min			0.054	0.054	0.054
Displacement at peak shear stress - mm			3.01	3.91	3.61
Peak shear Stress - kPa:			62	101	180
Final Consolidated Conditions					
Moisture Content - %:			21	20	20
Bulk Density - Mg/m3:			2.04	2.08	2.16
Dry Density - Mg/m3:			1.68	1.73	1.80
Peak					
Angle of Shearing Resistance:(θ)			38		
Effective Cohesion - kPa:			24		



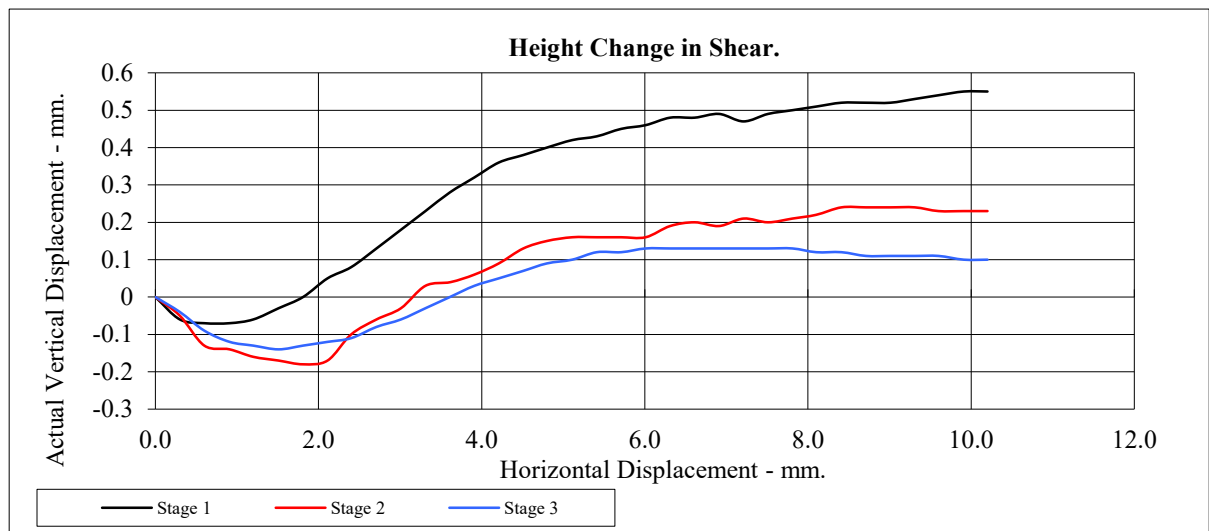
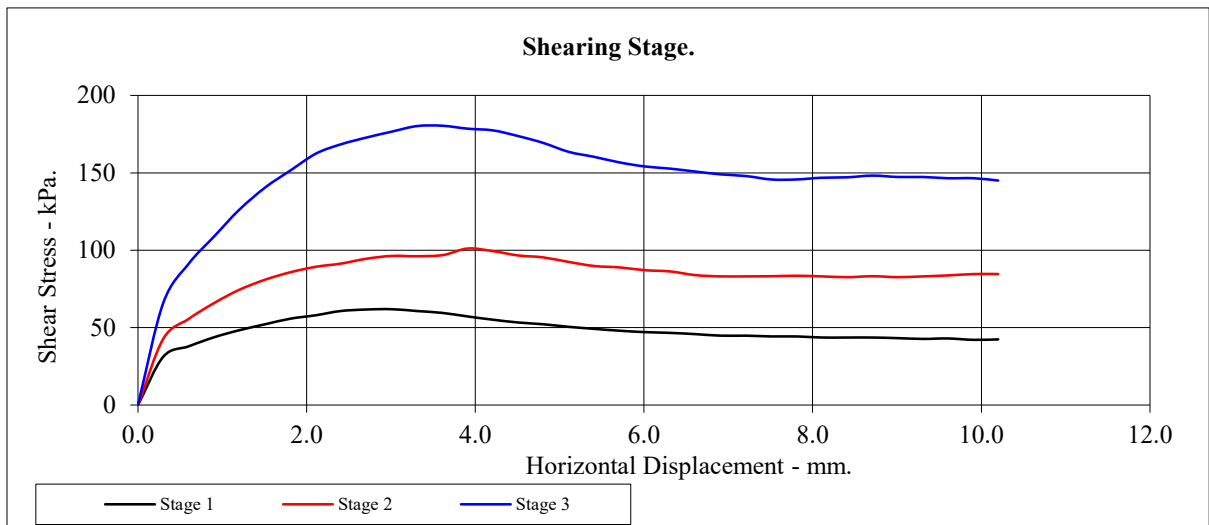
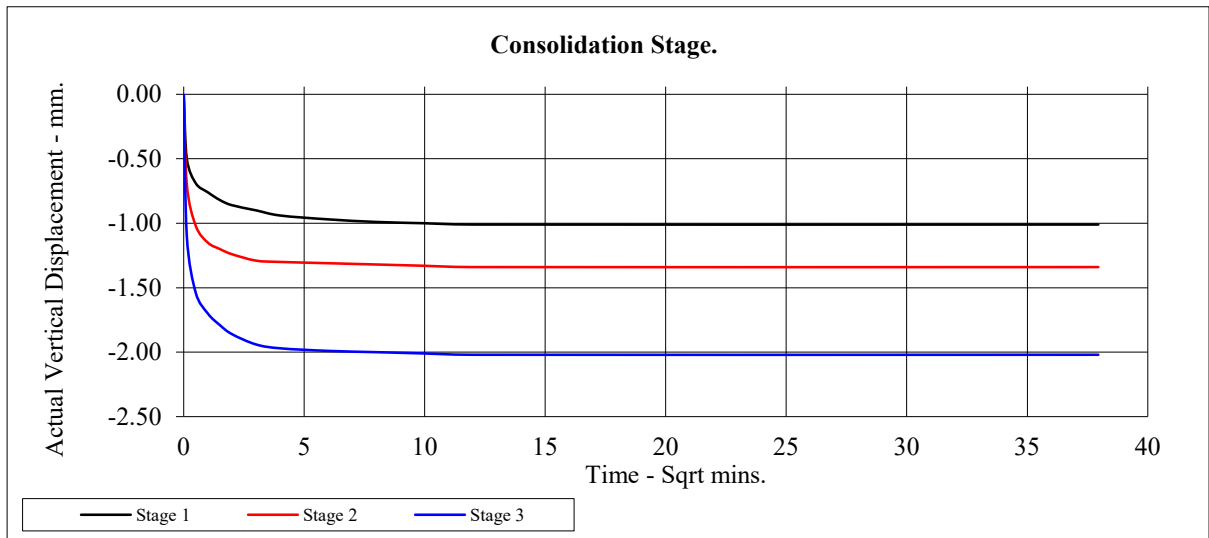
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP04	Top Depth:	0.50
Sample Number:		Base Depth:	



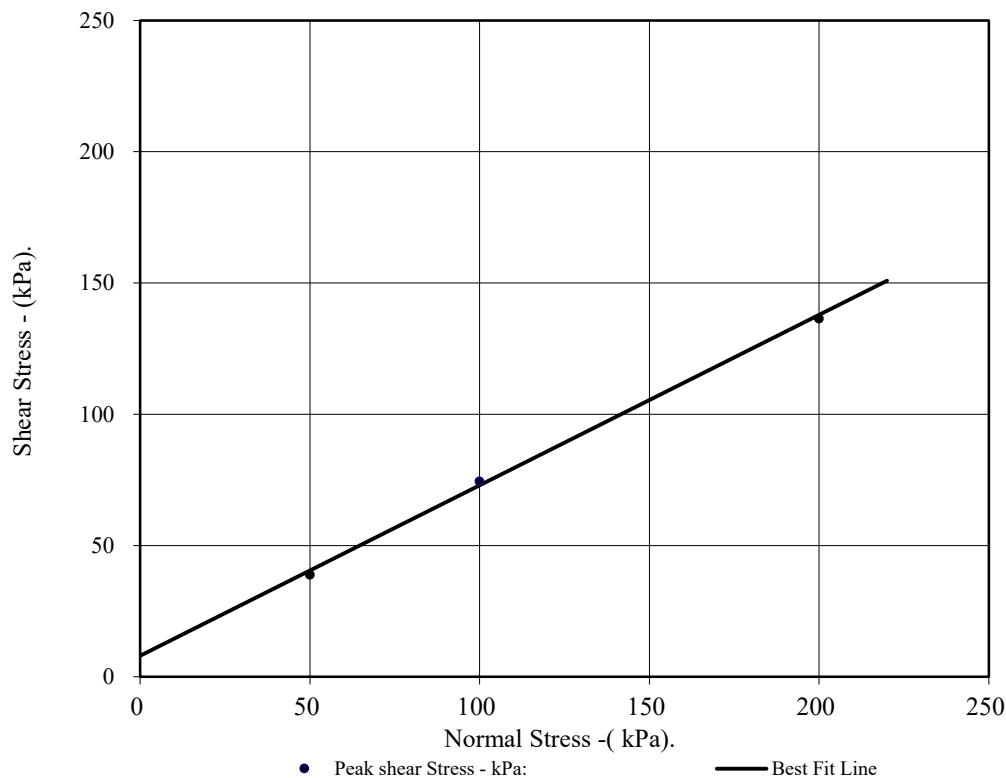
Hollingworth Gate - Littleborough

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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP06		Top Depth:	1.00	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			2.01	2.01	2.01
Dry Density - Mg/m3:			1.76	1.76	1.76
Voids Ratio:			0.505	0.505	0.505
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.51	19.33	18.30
Shearing Stage					
Rate of Strain - mm/min			0.051	0.051	0.051
Displacement at peak shear stress - mm			4.80	9.01	9.01
Peak shear Stress - kPa:			39	74	136
Final Consolidated Conditions					
Moisture Content - %:			18	17	17
Bulk Density - Mg/m3:			2.06	2.08	2.20
Dry Density - Mg/m3:			1.76	1.78	1.88
Peak					
Angle of Shearing Resistance:(θ)			33		
Effective Cohesion - kPa:			8		



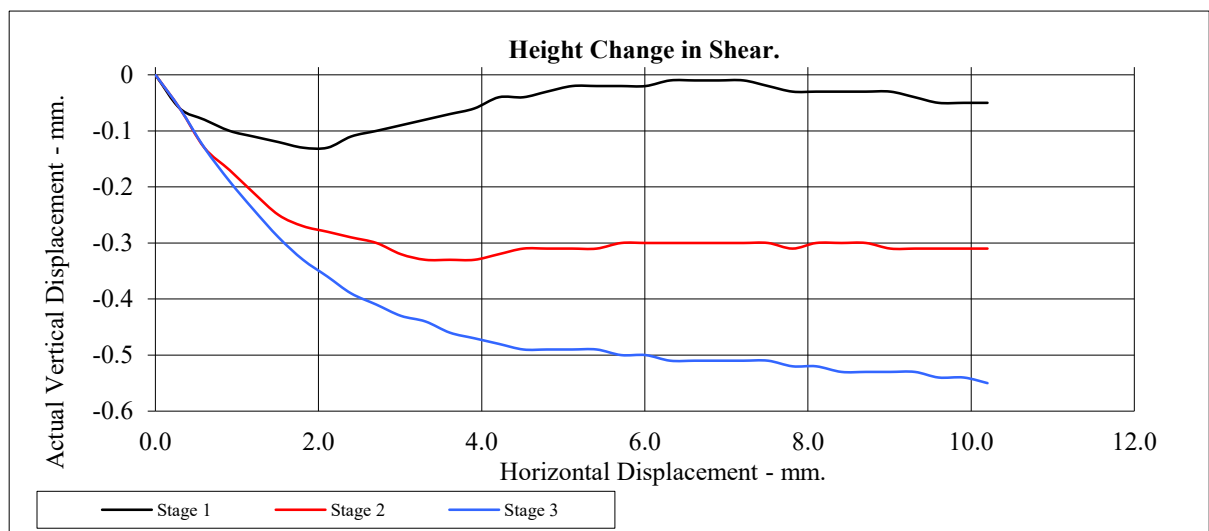
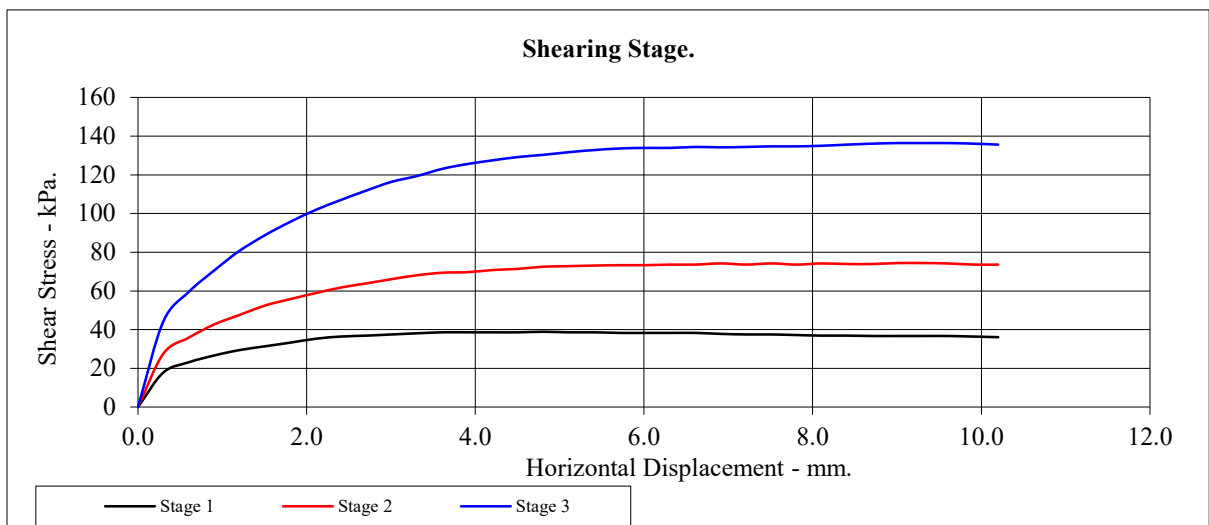
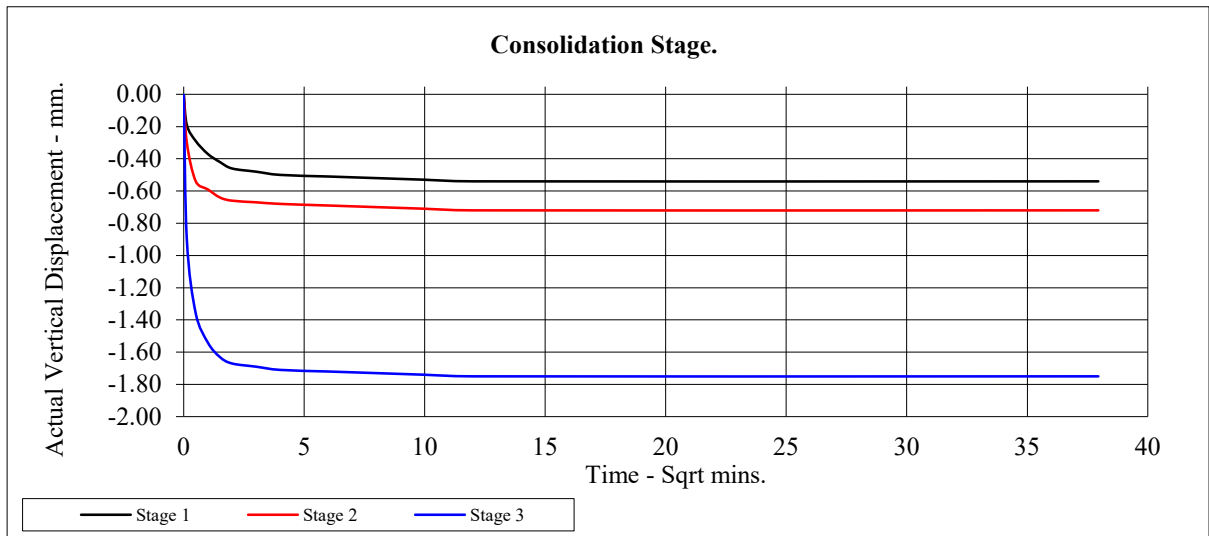
Hollingworth Gate - Littleborough

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Client Ref:
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP06	Top Depth:	1.00
Sample Number:		Base Depth:	



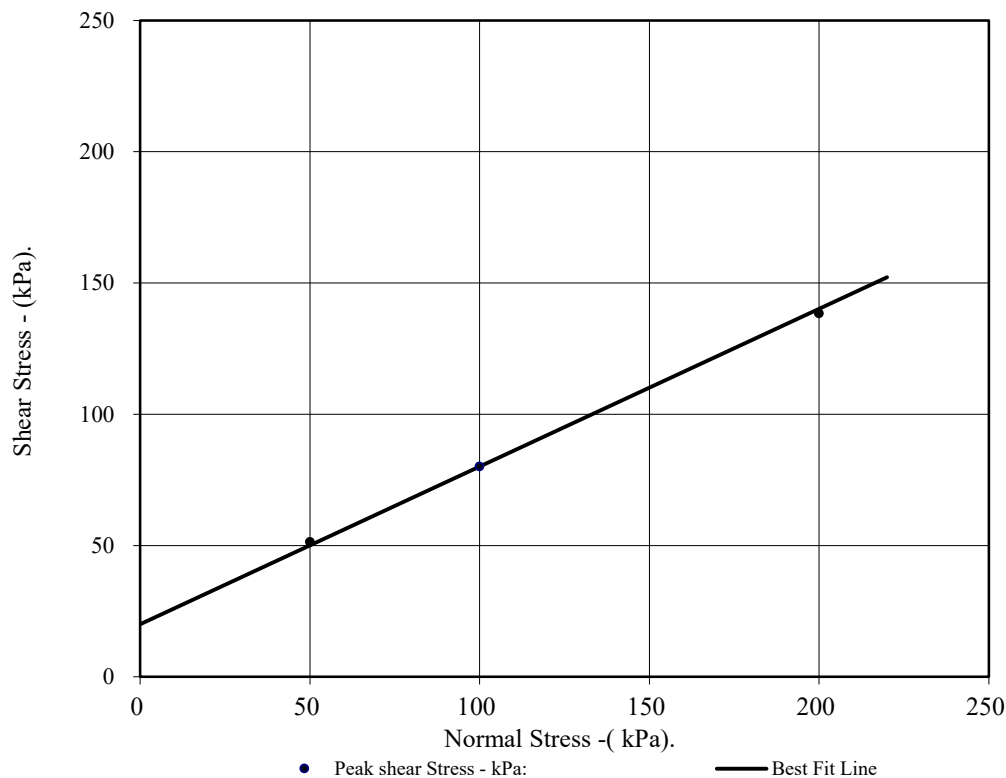
Hollingworth Gate - Littleborough

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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP07		Top Depth:	0.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			1.95	1.95	1.95
Dry Density - Mg/m3:			1.71	1.71	1.71
Voids Ratio:			0.550	0.550	0.550
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.16	18.98	17.77
Shearing Stage					
Rate of Strain - mm/min			0.053	0.053	0.053
Displacement at peak shear stress - mm			3.60	4.50	8.70
Peak shear Stress - kPa:			51	80	138
Final Consolidated Conditions					
Moisture Content - %:			20	19	18
Bulk Density - Mg/m3:			2.04	2.06	2.20
Dry Density - Mg/m3:			1.71	1.73	1.87
Peak					
Angle of Shearing Resistance:(θ)			31		
Effective Cohesion - kPa:			20		



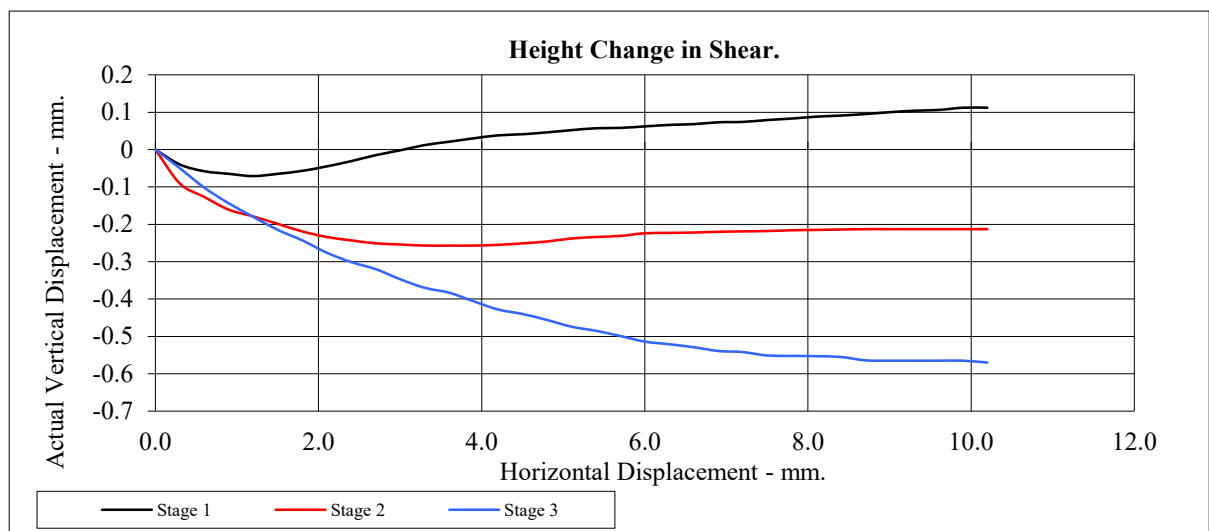
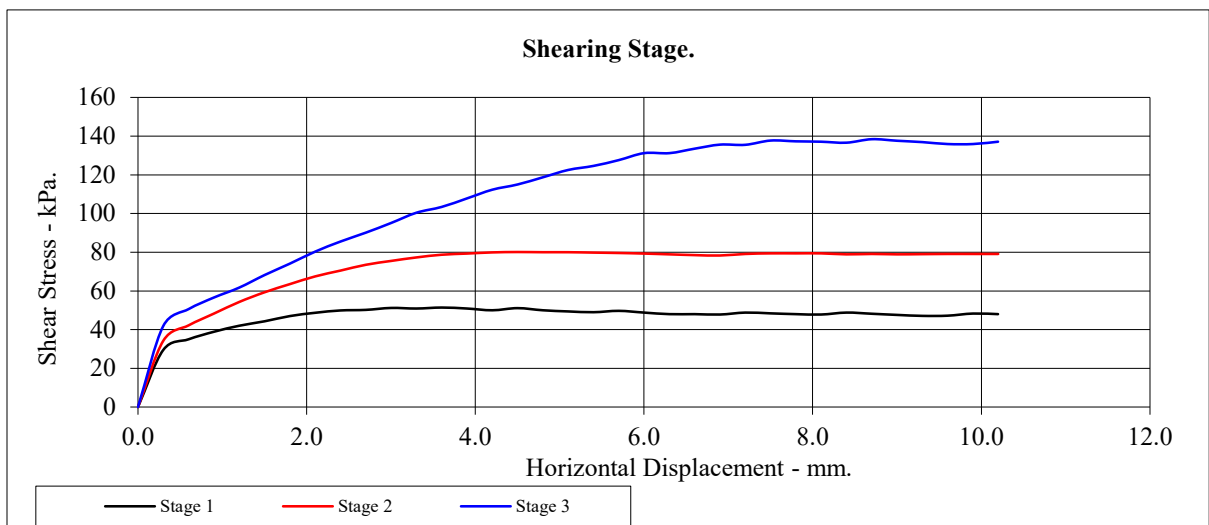
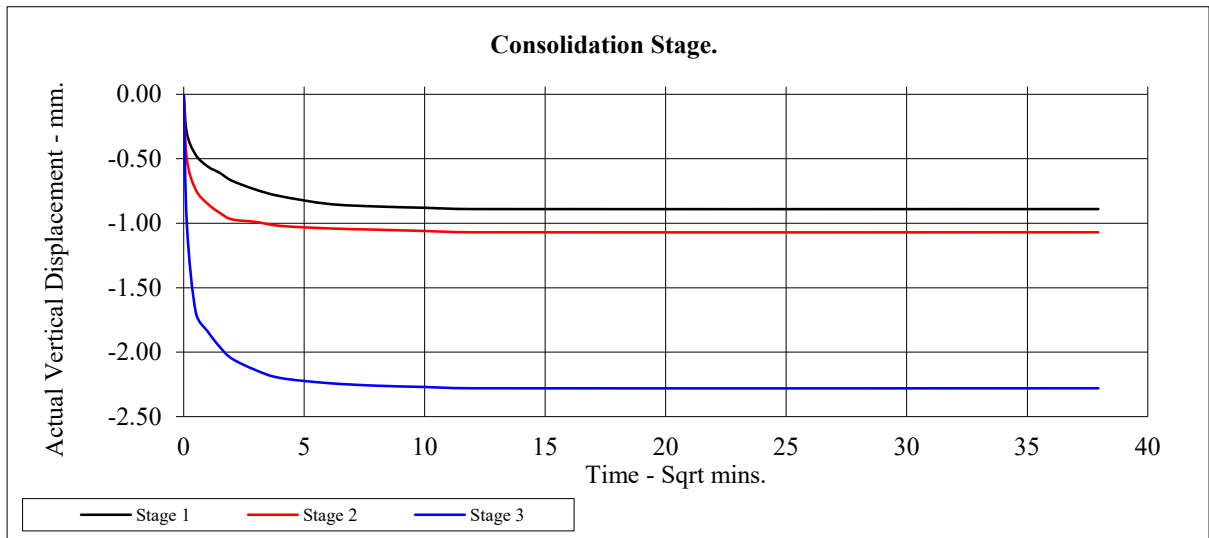
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP07	Top Depth:	0.50
Sample Number:		Base Depth:	



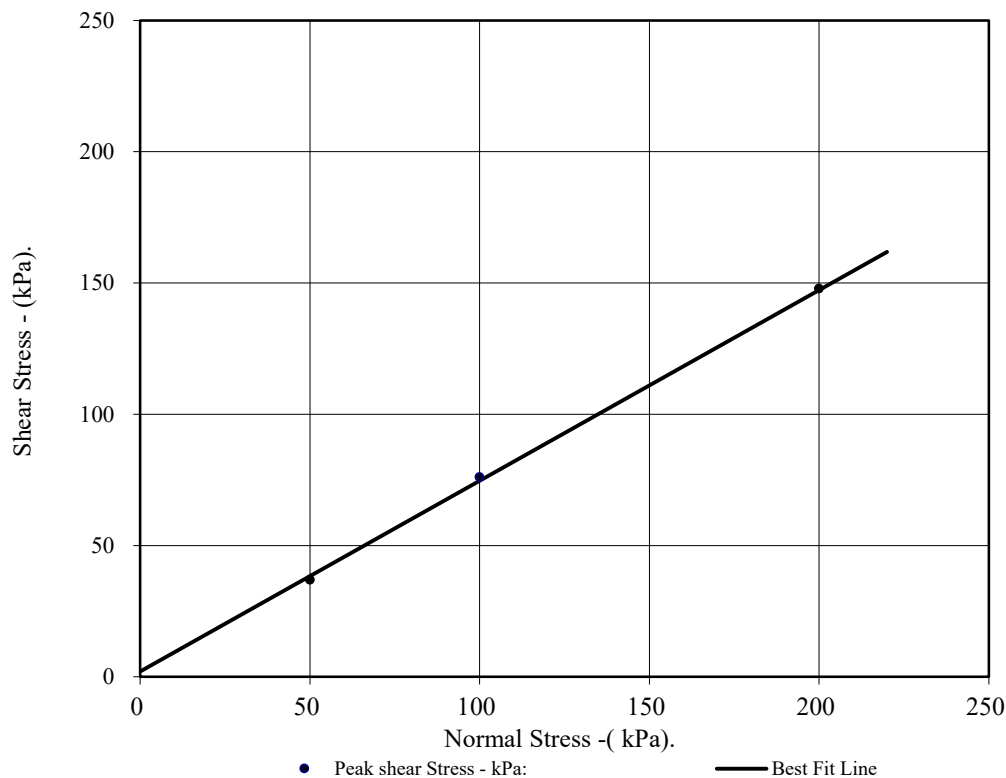
Hollingworth Gate - Littleborough

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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP07		Top Depth:	1.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			13	13	13
Bulk Density - Mg/m3:			1.99	1.99	1.99
Dry Density - Mg/m3:			1.76	1.76	1.76
Voids Ratio:			0.506	0.506	0.506
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			19.54	19.06	18.50
Shearing Stage					
Rate of Strain - mm/min			0.055	0.055	0.055
Displacement at peak shear stress - mm			4.51	9.60	8.71
Peak shear Stress - kPa:			37	76	148
Final Consolidated Conditions					
Moisture Content - %:			20	20	19
Bulk Density - Mg/m3:			2.04	2.09	2.16
Dry Density - Mg/m3:			1.70	1.75	1.81
Peak					
Angle of Shearing Resistance:(θ)			36		
Effective Cohesion - kPa:			2		



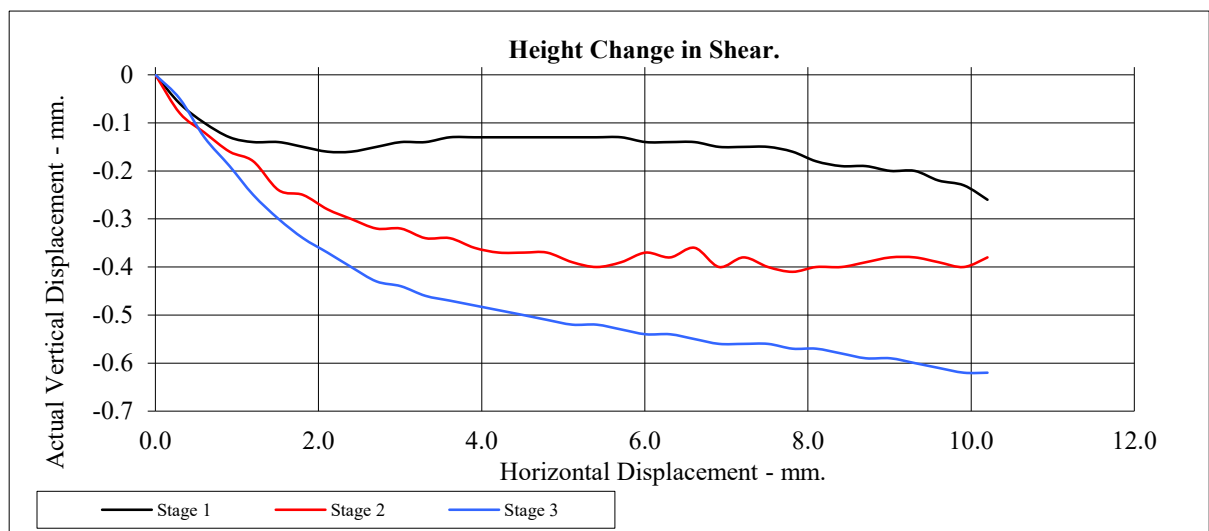
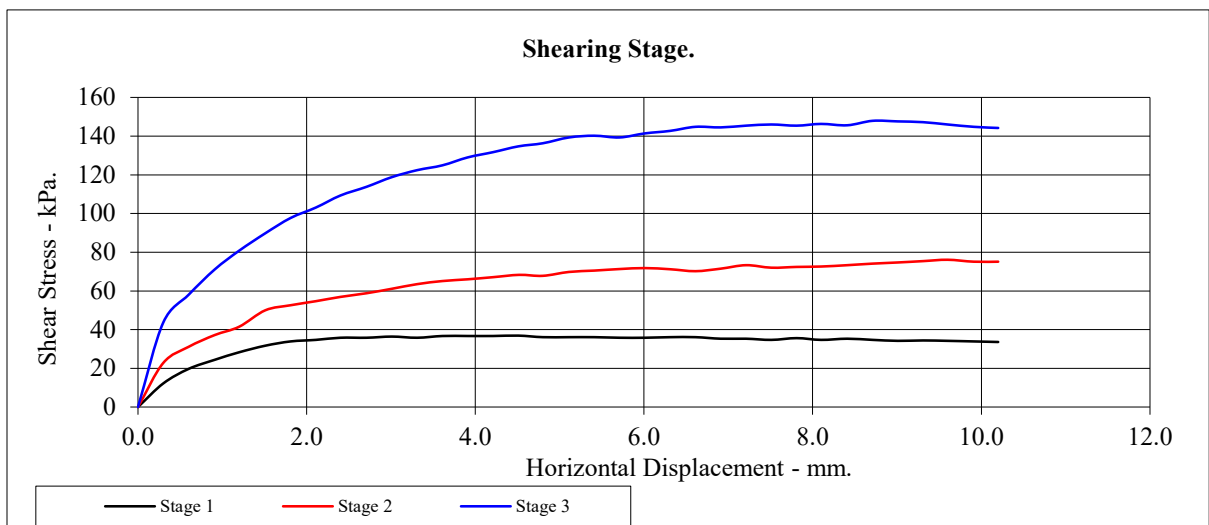
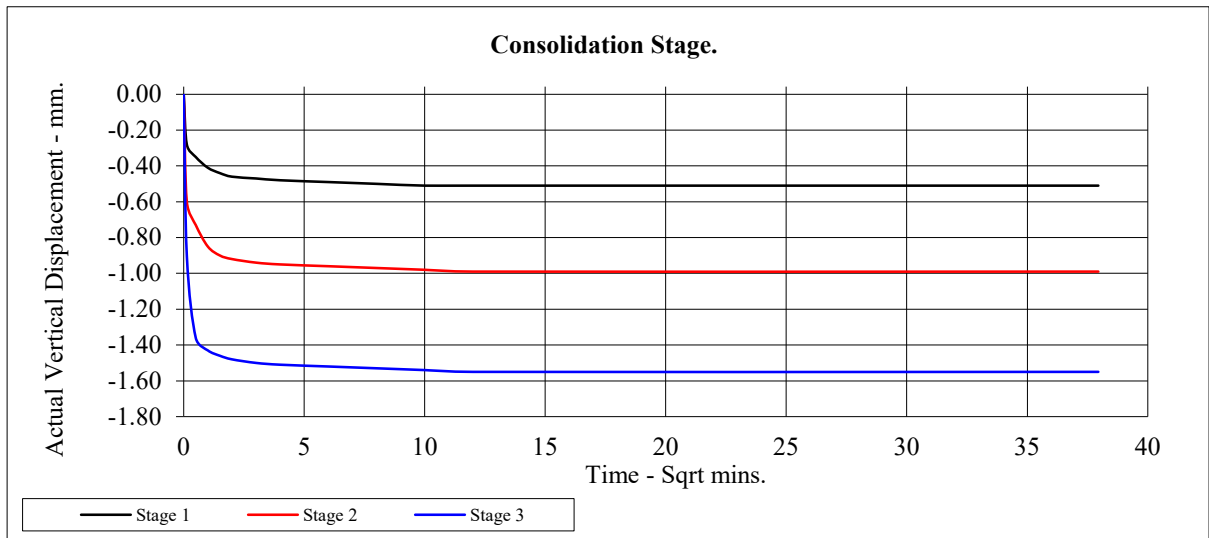
Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP07	Top Depth:	1.50
Sample Number:		Base Depth:	



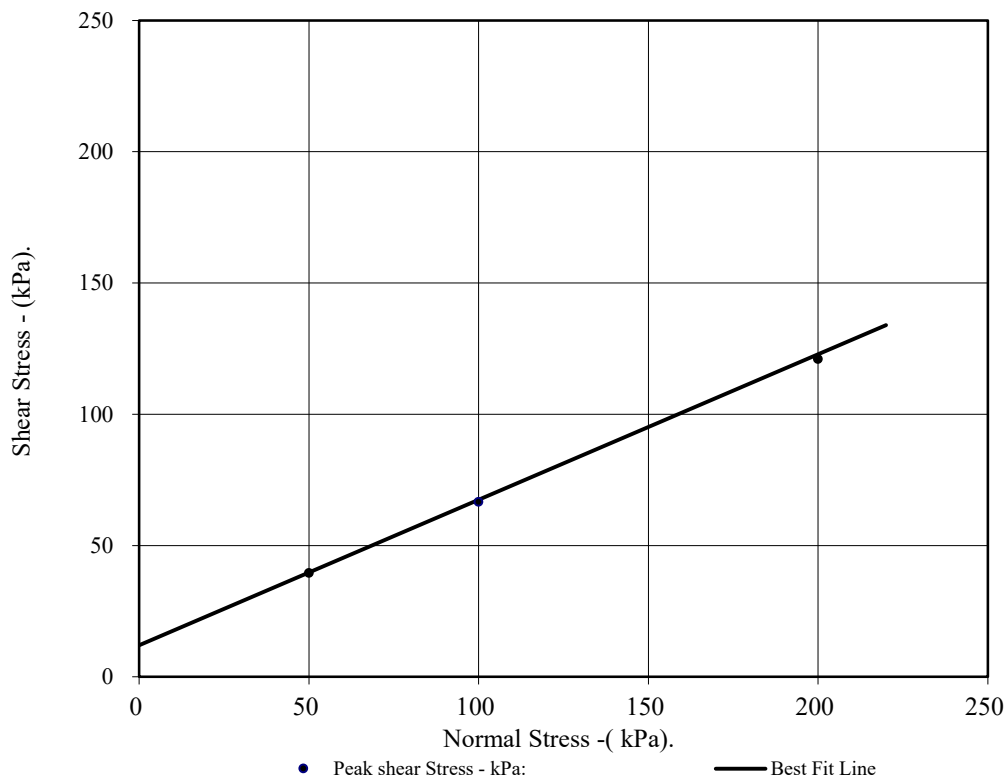
Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP08		Top Depth:	0.50	
Sample Number:			Base Depth:		
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded to 95% of MDD				
Sample Description:	See summary of soil descriptions.				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			2.06	2.06	2.06
Dry Density - Mg/m3:			1.81	1.81	1.81
Voids Ratio:			0.464	0.464	0.464
Normal Pressure- kPa			50	100	200
Consolidation Stage					
Consolidated Height - mm:			18.88	18.18	17.93
Shearing Stage					
Rate of Strain - mm/min			0.045	0.045	0.045
Displacement at peak shear stress - mm			4.50	6.30	7.20
Peak shear Stress - kPa:			40	67	121
Final Consolidated Conditions					
Moisture Content - %:			17	16	16
Bulk Density - Mg/m3:			2.19	2.27	2.30
Dry Density - Mg/m3:			1.86	1.96	1.99
Peak					
Angle of Shearing Resistance:(θ)			29		
Effective Cohesion - kPa:			12		



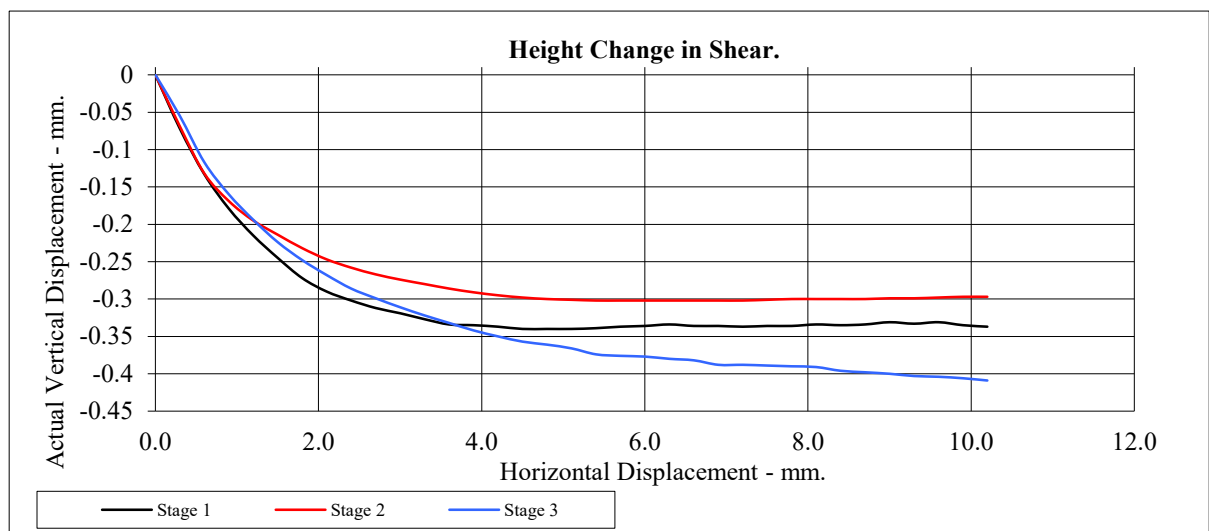
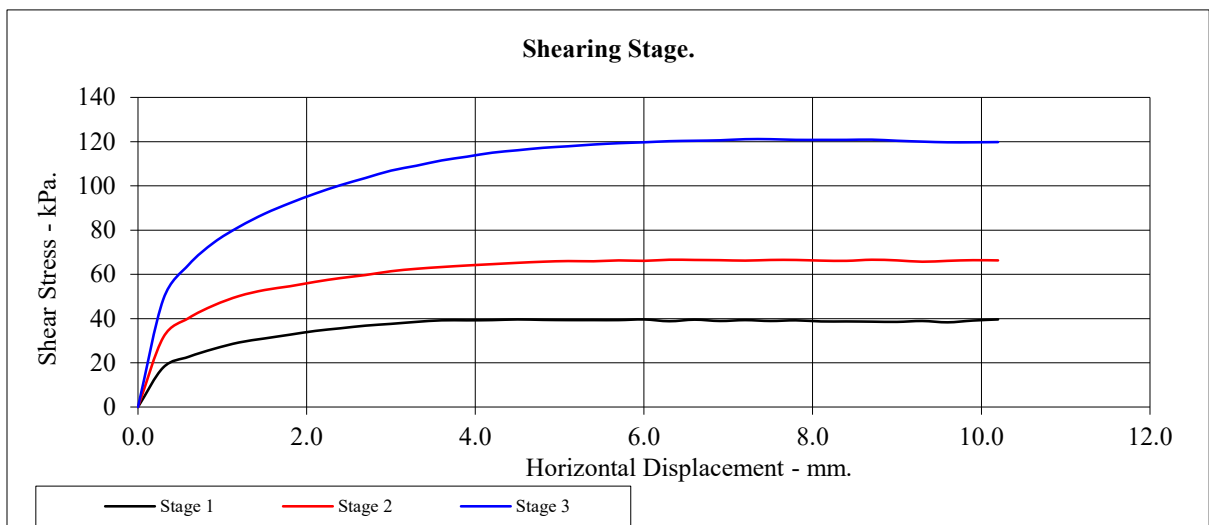
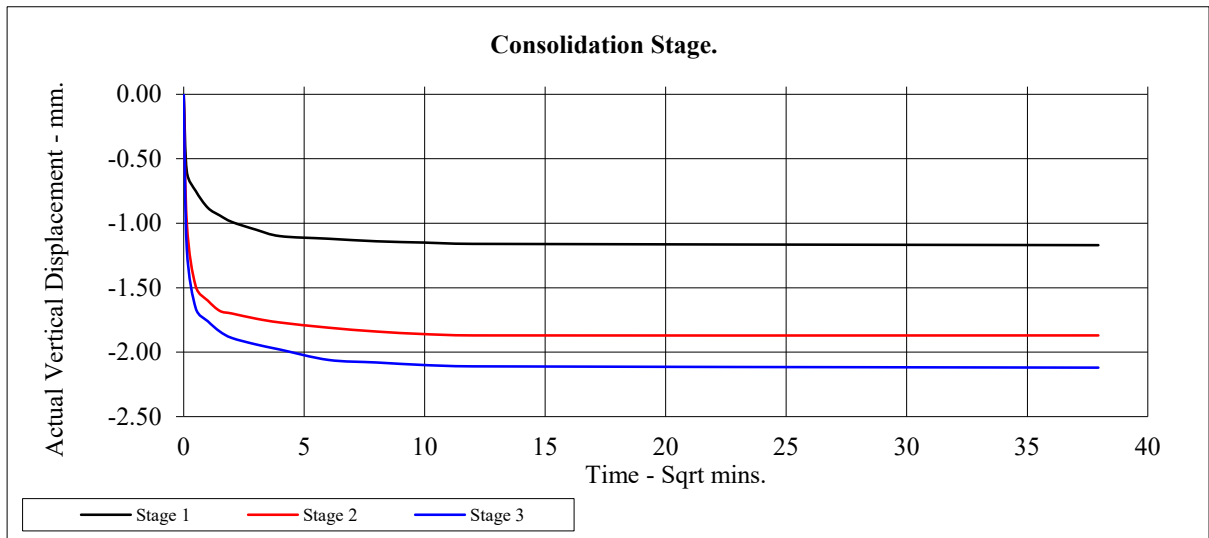
Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP08	Top Depth:	0.50
Sample Number:		Base Depth:	



Hollingworth Gate - Littleborough

Contract No:
PSL23/4181
Client Ref:
GRO-23131

APPENDIX 8 - Trial Pit Logs (for Sections)

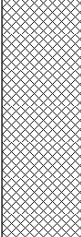
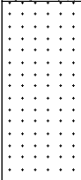
 GROUNDTECH CONSULTING				Trial Pit Log				Trialpit No A Sheet 1 of 1	
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 147.80		Date 20/10/2023	
Location: LITTLEBOROUGH				Dimensions (m): Depth 3.50 0.6 1.8		Scale 1:25		Logged CJH	
Client: COUNTRYSIDE PARTNERSHIP									

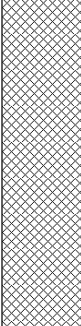
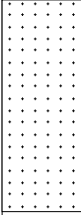
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
							MADE GROUND: Black brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick with moderate cobble content of brick.	1
				1.60	146.20		Firm dark grey mottled grey very sandy clay. Sand is fine to coarse.	2
				2.10	145.70		Extremely weak to weak grey fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.	3
				3.50	144.30		End of pit at 3.50 m	4
								5

Remarks:

Stability: Stable

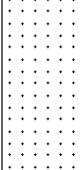


				Trial Pit Log			Trialpit No B Sheet 1 of 1			
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 148.50		Date 20/10/2023		
Location: LITTLEBOROUGH				Dimensions (m): Depth 2.60		1.7 0.6		Scale 1:25 Logged CJH		
Client: COUNTRYSIDE PARTNERSHIP										
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.80	147.70		MADE GROUND: Grey brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and concrete with moderate cobble content of brick.			1
							Orange brown clayey very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including sandstone.			
							Extremely weak to weak brown fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.			
							End of pit at 2.60 m			
				2.00	146.50					2
				2.60	145.90					3
										4
										5
Remarks:										
Stability: Stable										

				Trial Pit Log			Trialpit No D Sheet 1 of 1						
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 147.70		Date 20/10/2023					
Location: LITTLEBOROUGH				Dimensions (m): Depth 2.10		1.9 0.7		Scale 1:25 Logged CJH					
Client: COUNTRYSIDE PARTNERSHIP													
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description						
	Depth	Type	Results										
				1.10	146.60		MADE GROUND: Grey brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and concrete with moderate cobble content of brick.			1			
				1.40	146.30		MADE GROUND: Red angular to subangular fine to coarse gravel of brick.						
										Extremely weak to weak brown fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.			2
										End of pit at 2.10 m			
				2.10	145.60					3			
										4			
										5			
Remarks:													
Stability: Stable													

 GROUNDTECH CONSULTING				Trial Pit Log				Trialpit No E Sheet 1 of 1	
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 146.00		Date 20/10/2023	
Location: LITTLEBOROUGH						Dimensions (m): 0.6 2		Scale 1:25	
Client: COUNTRYSIDE PARTNERSHIP						Depth 0.70		Logged CJH	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.10	145.90	                                      	MADE GROUND: Grey brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and concrete. Extremely weak to weak brown fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.		
				0.70	145.30		End of pit at 0.70 m		
1 2 3 4 5									
Remarks:									
Stability: Stable									

				Trial Pit Log			Trialpit No F Sheet 1 of 1		
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 146.50		Date 20/10/2023	
Location: LITTLEBOROUGH				Dimensions (m): Depth 0.80		1.6 0.7		Scale 1:25 Logged CJH	
Client: COUNTRYSIDE PARTNERSHIP									
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30	146.20		MADE GROUND: Grey brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and concrete.		
				0.50	146.00		Orange brown clayey very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including sandstone.		
				0.80	145.70		Extremely weak to weak brown fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.		
							End of pit at 0.80 m		
Remarks:									
Stability: Stable									

				Trial Pit Log			Trialpit No G Sheet 1 of 1		
Project Name: HOLLINGWORTH GATE				Project No. GRO-23131		Co-ords: - Level: 147.00		Date 20/10/2023	
Location: LITTLEBOROUGH				Dimensions (m): Depth 0.80		1.8 0.6		Scale 1:25 Logged CJH	
Client: COUNTRYSIDE PARTNERSHIP									
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.10	146.90		MADE GROUND: Grey brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and concrete. Extremely weak to weak brown fine to coarse grained SANDSTONE residually weathered recovered as very sandy angular to subangular fine to coarse of sandstone. Sand is fine to coarse.		
				0.80	146.20				
							End of pit at 0.80 m		
							1		
							2		
							3		
							4		
							5		
Remarks:									
Stability: Stable									

Trial Pit Log

Trialpit No
TP01
Sheet 1 of 1

Project Name:	Hollingworth Gate, Littleborough	Project No.	GRO-23131	Co-ords:	-	Date	25/05/2023
Location:	Littleborough	Dimensions (m):	Depth 3.80			Scale	1:25
Client:	Coutryside					Logged	AJ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	B		0.40			MADE GROUND: Greyish brown very gravelly fine to coarse sand. Gravel is fine to coarse subangular to subrounded of mixed lithologies including bricks, concrete and metal.	
	0.60	B		0.90			MADE GROUND: Firm dark grey slightly sandy gravelly clay. Gravel is fine to medium angular of mixed lithologies including brick, clinker and sandstone. Sand is fine to coarse.	
	1.50	B					MADE GROUND: Dark grey slightly clayey sandy fine to coarse angular to subangular gravel of mixed lithologies including bricks, slate, metal, concrete with high cobble content and frequent boulders. Sand is fine to coarse.	1
								2
								3
				3.40				
	3.60	B		3.80			MADE GROUND: Soft greyish brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subangular of mixed lithologies including bricks, glass, sandstone. Sand is fine to coarse. Pockets of reddish brown fine to coarse sand.	
							End of pit at 3.80 m	4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. Groundwater seepage at 3.5m bgl. 3. Trial pit terminated due to maximum reach of excavator. 4. Trial pit backfilled with arisings.

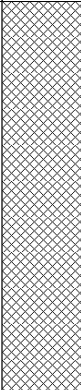
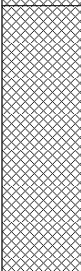
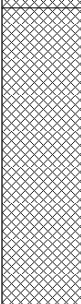
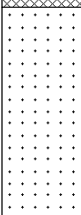
Stability: Stable



Trial Pit Log

Trialpit No
TP02
Sheet 1 of 1

Project Name:	Hollingworth Gate, Littleborough	Project No.	GRO-23131	Co-ords:	-	Date	25/05/2023
Location:	Littleborough	Dimensions (m):	Depth 3.90			Scale	1:25
Client:	Coutryside					Logged	AJ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.90	B		1.30			MADE GROUND: Firm orangish brown slightly sandy gravelly clay. Gravel is fine to coarse angular of mixed lithologies including clinker, bricks and sandstone. Sand is fine to coarse.	1
	1.50	B		2.20			MADE GROUND: Dark grey gravelly fine to coarse sand. Gravel is fine to coarse angular to subangular of mixed lithologies including clinker, bricks and sandstone.	2
	3.00	B		3.20			MADE GROUND: Dark brown clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subangular of mixed lithologies including bricks, slate, clinker and sandstone.	3
	3.60	B		3.90			Yellow fine to medium SANDSTONE residually weathered recovered as coarse angular gravel and cobbles.	
							End of pit at 3.90 m	4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated due to maximum reach of excavator. 4. Trial pit backfilled with arisings.

Stability: Stable



Trial Pit Log

Trialpit No
TP03
Sheet 1 of 1

Project Name: Hollingworth Gate, Littleborough

Project No.
GRO-23131

Co-ords: -
Level:

Date
25/05/2023

Location: Littleborough

Dimensions
(m):

Depth
3.10

Scale
1:25

Logged
AJ

Client: Coutryside

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50			0.50			MADE GROUND: Grey sandy coarse subangular to subrounded gravel of mixed lithologies including bricks, sandstone and concrete. Sand is fine to coarse.	
	1.00	B					MADE GROUND: Firm bluish dark grey slightly sandy gravelly clay. Gravel is fine to coarse angular to subangular of mixed lithologies including bricks, sandstone, clinker and ash. Sand is fine to coarse. Hydrocarbon odour present.	1
	1.50	B		1.30			MADE GROUND: Yellowish brown slightly clayey sandy fine to coarse angular gravel of mixed lithologies including brick, concrete and cement. Sand is fine to coarse.	2
	2.50	B		2.30			Yellow fine to medium SANDSTONE residually weathered recovered as coarse angular gravel and cobbles.	3
				3.10			End of pit at 3.10 m	4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated due to slow progress in bedrock. 4. Trial pit backfilled with arisings.

Stability: Stable



Trial Pit Log

Trialpit No
TP04
Sheet 1 of 1

Project Name:	Hollingworth Gate, Littleborough	Project No.	GRO-23131	Co-ords:	-	Date	25/05/2023
Location:	Littleborough	Dimensions (m):	Depth 4.40			Scale	1:25
Client:	Coutryside					Logged	AJ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	B		1.20			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subangular of mixed lithologies including bricks, sandstone, slate and metal.	1
	1.80	B		2.40			MADE GROUND: Soft dark brown slightly sandy gravelly clay. Gravel is fine to coarse angular of mixed lithologies including brick, clinker, slate and plastics. Sand is fine to coarse.	2
	2.70	B		3.00			MADE GROUND: Soft orange mottled grey sandy gravelly clay. Gravel is fine to medium subangular of mixed lithologies including brick, ceramics and clinker.	3
	3.50	B		4.40			MADE GROUND: Firm brown sandy gravelly clay. Gravel is fine to medium angular to subangular of mixed lithologies including clinker and ash. Sand is fine to coarse. Hydrocarbon sheen present.	4
							End of pit at 4.40 m	5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated due to maximum reach of excavator. 4. Trial pit backfilled with arisings.

Stability: Stable



Trial Pit Log

Trialpit No
TP05
Sheet 1 of 1

Project Name: Hollingworth Gate, Littleborough

Project No.
GRO-23131

Co-ords: -
Level:

Date
25/05/2023

Location: Littleborough

Dimensions
(m):

Depth
4.10

Scale
1:25

Logged
AJ

Client: Coutryside

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.70	B					MADE GROUND: Firm dark brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of mixed lithologies including bricks, concrete, cement. Frequent cobbles of cement and brick. Sand is fine to coarse. Hydrocarbon odour present.	1
	1.80	B		1.40			MADE GROUND: Firm brown mottled grey slightly sandy gravelly clay. Gravel is fine to coarse angular to subangular of mixed lithologies including bricks, concrete, slate and ceramics. Sand is fine to coarse. Hydrocarbon odour present.	2
	2.50	B		3.00			MADE GROUND: Firm reddish brown slightly gravelly sandy clay. Gravel is fine angular of sandstone. Sand is fine to coarse.	3
	3.50	B		4.10			End of pit at 4.10 m	4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered 3. Trial pit terminated due to maximum reach of excavator. 4. Trial pit backfilled with arisings.

Stability: Stable



Trial Pit Log

Trialpit No

TP06

Sheet 1 of 1

Project Name: Hollingworth Gate, Littleborough

Project No.
GRO-23131

Co-ords: -
Level:

Date
25/05/2023

Location: Littleborough

Dimensions
(m):

Depth
4.00

Scale
1:25

Logged
AJ

Client: Coutryside

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			MADE GROUND: Grey medium rounded gravel of mixed lithologies including sandstone.	
	1.00	B		1.20			MADE GROUND: Firm dark grey slightly sandy gravelly clay. Gravel is angular to subangular fine to coarse of mixed lithologies including bricks, ceramics, sandstone and plastics. Sand is fine to coarse.	1
	1.50	B		2.00			MADE GROUND: Firm to stiff dark grey slightly sandy gravelly clay. Gravel is angular to subangular fine to coarse of mixed lithologies including bricks, ceramics, sandstone and plastics. Sand is fine to coarse.	2
	2.50	B		2.80			MADE GROUND: Orange slightly gravelly clayey fine to coarse sand. Gravel is fine to medium angular to subrounded of mixed lithologies including brick, clinker, ash and sandstone.	
	3.60	B		4.00			MADE GROUND: Firm orange slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of mixed lithologies including brick, clinker, sandstone and ash. Sand is fine to coarse. Pockets of firm reddish brown sandy clay.	3
							End of pit at 4.00 m	4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated due to maximum reach of excavator. 4. Trial pit backfilled with arisings.

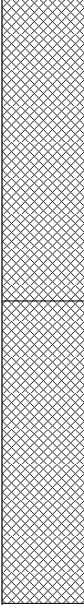
Stability: Stable



Trial Pit Log

Trialpit No
TP07
Sheet 1 of 1

Project Name:	Hollingworth Gate, Littleborough	Project No.	GRO-23131	Co-ords: -	Level:	Date	25/05/2023
Location:	Littleborough			Dimensions (m):		Scale	1:25
Client:	Coutryside			Depth		2.00	Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	B		1.00			MADE GROUND: Dark grey slightly gravelly clayey fine to coarse sand. Gravel is fine to coarse angular to subrounded of mixed lithologies including bricks, wood, slate and sandstone.	1
	1.50	B					MADE GROUND: Soft to firm grey sandy gravelly clay. Gravel is fine to coarse angular to subangular of mixed lithologies including brick, clinker and sandstone.	
	2.00	B		2.00			End of pit at 2.00 m	2
								3
								4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated at 2.0m bgl. 4. Trial pit backfilled with arisings.

Stability: Stable



Trial Pit Log

Trialpit No
TP08
Sheet 1 of 1

Project Name:	Hollingworth Gate, Littleborough	Project No.	GRO-23131	Co-ords:	-	Date	25/05/2023
Location:	Littleborough			Dimensions (m):		Scale	1:25
Client:	Coutryside			Depth		2.00	Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	B					MADE GROUND: Brown slightly sandy clayey fine to coarse subangular to subrounded gravel of mixed lithologies including brick, sandstone, plastics and concrete with frequent cobbles.	1
	1.50	B						
				2.00			End of pit at 2.00 m	2
								3
								4
								5

Remarks: 1. Area cleared of utilities using hand-held CAT scanner. 2. No groundwater encountered. 3. Trial pit terminated at 2m bgl. 4. Trial pit backfilled with arisings.

Stability: Stable





APPENDIX 9 - Limitations

Limitations

This report (Report) forms part of the Services and if applicable Additional Services undertaken by Groundtech Consulting Ltd pursuant to a written contract (Agreement) which contains detailed provisions including express limitations of the liability of Groundtech Consulting Ltd.

This Report was prepared using reasonable skill and care as stated in the Agreement for the purpose including intended end use stated by the Client (Purpose) and the liability of Groundtech Consulting Ltd in respect of the form and content of this Report is no greater than its liability under the Agreement. All records, measurements notes, or any other data (Data) obtained by or for the benefit of the Consultant were obtained at a specific point in time and it may not be assumed by the Client or any person relying on this Report that the Data will remain unaffected by the passage of time, the seasons, weather conditions, changes in the water table or the carrying out and completion of works at the Site.

Unless otherwise agreed this Report has been prepared exclusively for the use and reliance of the Client and may not be relied upon, by any other party except as provided for in the Agreement. A third party who relies on this Report, does so at their own and sole risk and Groundtech Consulting Ltd has no liability to such parties.

Groundtech Consulting Ltd that this Report is to be used for the Purpose. The Purpose was instrumental in determining the scope and of the Services provided. If the Purpose should change, the Client may not be able to rely on the Report without the separate agreement of Groundtech Consulting Ltd.

Since the Report was written, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change (see below) and should be investigated if there is any significant delay in acting on the findings of this Report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the Report inaccurate or unreliable. The information and conclusions in this Report should not be relied upon in the future without written confirmation from Groundtech Consulting Ltd that it is safe to do so.

The observations and conclusions outlined in this Report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting Ltd.

Groundtech Consulting Ltd is not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The Report is based upon Groundtech Consulting Ltd's observations of existing physical conditions at the Site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the Client on the history and usage of the Site. The findings and recommendations contained in this Report are based in part upon information provided by third parties, and Groundtech Consulting Ltd have relied upon such information assuming it to be correct.

Groundtech Consulting Ltd accepts no responsibility for errors or inaccuracies in third party information presented in this Report. Groundtech Consulting Ltd was not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services or Additional Services. Groundtech Consulting Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting Ltd and forms the contract with the client.



Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions may also vary due to the ground's heterogeneous properties and because investigation exploratory locations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this Report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. If so stipulated in the Agreement, geo-environmental testing was carried out for a limited number of parameters based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

Any groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and groundwater levels may occur at other times of the year which are higher than were recorded during this investigation.

Any site drawings provided in this Report are preliminary and used to present the general relative locations of features on, and surrounding, the Site.

