SANDOWN QUARRY LANDFILL, WEST MIDLANDS

NEW ACCESS ROAD & SIDEWALL LINER

ASSESSMENT OF STABILITY

Report No 5430/R/008/02 Rev02 18th October 2022

Prepared For:	**Prepared By:**
Booth Ventures Limited	***Plough Geotechnical Ltd*** Elysium Chambers 7 Telford Court Chestergates Chester CH1 6LT

DOCUMENT INFORMATION AND CONTROL SHEET

Document Status and Approval Schedule

Report No.	Title
5430/R/008/02	**Sandown Quarry Landfill, West Midlands** **New Access Road & Sidewall Liner** **Assessment Of Stability**

Issue History

Rev	Status		Signature	Date
00	**draft**	**Prepared By** A. Binns BSc CEng FICE		01.09.2022
01	**Final**	**A. Binns BSc CEng FICE**		29.09.2022
02	**Final**	**A. Binns BSc CEng FICE** 		18.10.2022

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SANDOWN QUARRY LANDFILL, WEST MIDLANDS NEW ACCESS ROAD & SIDEWALL LINER ASSESSMENT OF STABILITY

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NEW ACCESS ROAD & SIDEWALL LINER
ASSESSMENT OF STABILITY

1. INTRODUCTION

1.1. Report Context

1.1.1. Booth Ventures Limited, the proposed site Operator, intend to infill and restore the quarry void at Sandown Quarry and are making a permit application for the site.

1.1.2. The site is currently an active quarry for the extraction of marl/mudstone (from the Etruria Formation) to produce bricks. The landowner, Wienerberger UK, is to complete the mineral reserve extraction by the end of 2024 (using Booth Ventures Limited to carry out the extraction works). On completion of the mineral reserve removal, Booth Ventures Limited will operate the site under a lease agreement with the landowner.

1.1.3. The proposals are as follows:

- Construction of a new site access road for use by Booth Ventures Limited
- Excavation of Etruria Marl in the base from the current level of 90 m OD to a potential maximum level of approximately 75 m OD.
- Installation of a suitable engineered barrier (where applicable) to the sidewalls
- Landfilling using non-hazardous and similar wastes

1.1.4. Plough Geotechnical Ltd (PGL) was commissioned by ByrneLooby (BL - Booth Ventures' agent) to carry out a Stability Risk Assessment (SRA) on behalf of Booth Ventures to support the proposals.

1.1.5. This report discusses the stability of the proposed access road and side slope liners during the works, up to commencement of the filling. The report only considers the future extraction of the Etruria Marl where it may possibly affect the stability of the proposed access road and basal heave. It does not cover any aspects of the extraction on any other cross sections through the waste (existing or proposed waste placement) and should in no way be considered part of the design requirements for the

management of a stable quarry in accordance with the Quarries Regulations (1999). The report also does not consider the stability of landfilling using non-hazardous and similar wastes, being concerned solely with the stability of the proposed access road and sidewall liner and the global stability of the existing waste/inert soil where it affects the proposed access road and sidewall liner.

1.1.6. The report describes the work undertaken and summarises the results of the analysis and has been undertaken in accordance with the appropriate Environment Agency (EA) guidance and British Standards.

1.2. Site Location and Surroundings

1.2.1. Sandown Quarry is located approximately 4km to the northeast of Walsall, 1.7km northwest of the town of Aldridge at National Grid Reference (NGR) SK 04386 01960.

1.2.2. A plan showing the location is presented as Figure 1with an aerial view of the site in Figure 2.

Figure 1: Site Location

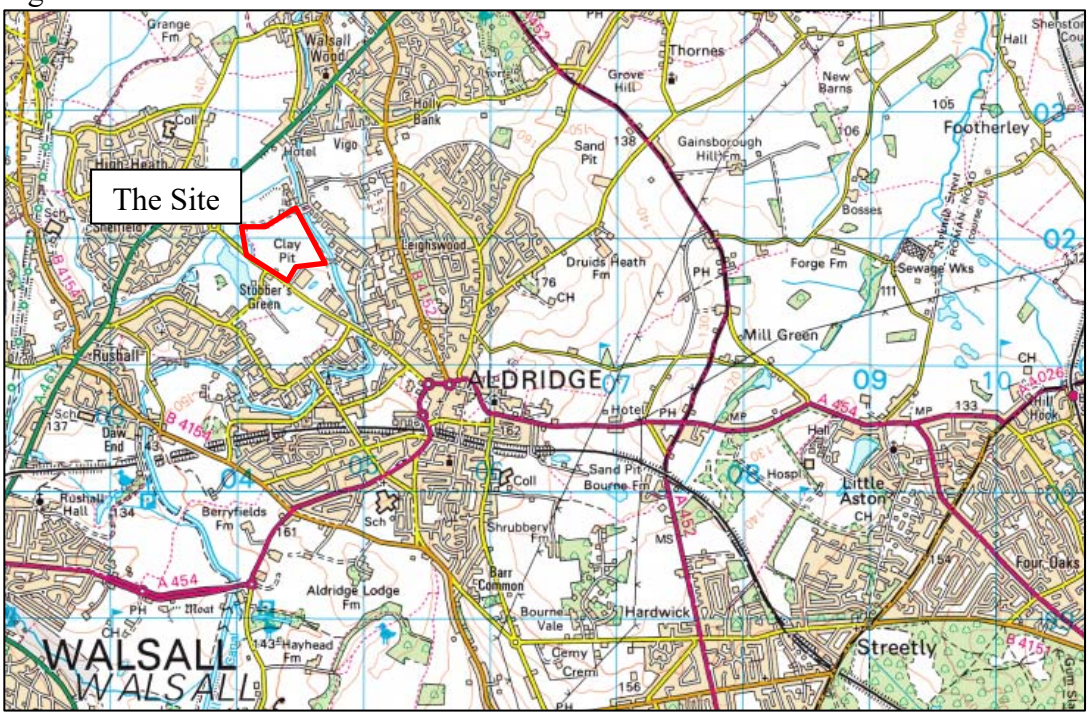
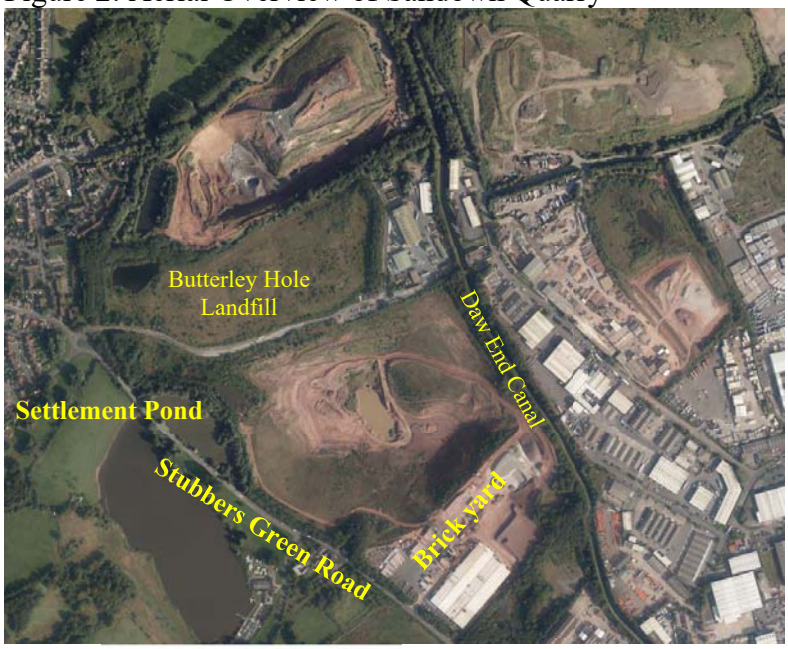


Figure 2: Aerial Overview of Sandown Quarry



1.2.3. The current operations at the Sandown Quarry occupy the central and northern end of the site, the mineral processing operations, kilns, workshop, and offices occupy the south and south-eastern end of the facility ("Brickyard" in Figure 2). Current excavation depths within the quarry are ~90m OD, accumulation of rainwater in the base of the void collects during wet periods of the year, this water is removed to the on-site surface water settlement pond in the north-western corner.

- Stubbers Green Road runs NW-SE adjacent to the south east boundary
- the brick yard (mineral processing operations, kilns, workshop, and offices) occupy the south and south-eastern end of the site.
- adjacent to the north eastern boundary is the Daw End Canal.
- Butterley Hole Landfill is adjacent to the north west boundary

2. CONCEPTUAL STABILITY SITE MODEL

2.1. Site Geology

2.1.1. The published geology for the site, based on records provided by the British Geological Society (BGS), indicates the west of the site to be underlain by Glacial Till. No superficial deposits are noted to the east of the site. The whole site is underlain by bedrock strata of the Etruria Formation - Mudstone, Sandstone and Conglomerate.

2.1.2. The published geology is generally confirmed by the investigation by Byrne Looby (Reference 14) with the borehole logs being presented in Appendix B.

2.1.3. Existing waste (Overburden/ backfill/ inert soil) at the site boundaries is up to 25 m thick where present.

1.2 Groundwater

2.2.1. Groundwater level monitoring was carried out by BL and is presented in Table 1 for the boreholes of interest in this SRA.

Table 1 - Water levels from BL monitoring

	April 22	May 22	June 22
BH22-02S	134.53	133.06	133.00
BH22-2D	134.53	122.6	123.14
BH22-04S	125.49	125.33	125.13
BH22-04D	126.56	126.58	126.1
BH22-03S	140.58	139.8	139.87
BH22-03D	138.37	139.24	139.4

2.2.2. The borehole location plan is presented in Appendix A as Drawing No. 1.

2.3. Geotechnical Parameters

2.3.1. The geotechnical parameters have been based upon the experience of PGL with similar materials, coupled with published values.

2.3.2. The resulting characteristic soil strengths are considered to be conservative.

2.4. Plant Loading on the Slope

2.4.1. Loading from construction plant is based upon a Caterpillar D6 or similar near the crest. For further details see Section 4.

3. ANALYSIS APPROACH AND SOFTWARE

3.1. Analysis Approach for Stability

3.1.1. The stability risk assessment (SRA) of the subgrade and slope has been carried out in general accordance with the principles of Eurocode 7, which uses a partial factor method (on actions and strength), to determine the Over Design Factor (ODF).

3.1.2. Eurocode 7 is based on the principles of limit state design, whereby a design must ensure that no limit state is exceeded. With respect to the analyses presented in this report, the limit state of relevance is limit state GEO defined as "*failure or excessive*

deformation of the ground, in which the strength of soil or rock is significant in providing resistance", e.g. stability of a slope, bearing capacity of foundation soils.

3.1.3. Each limit state requires different partial factors to be used in the analysis. These are presented in the National Appendix to EC7. It should be noted that the approach adopted in the UK for limit state GEO (Design Approach 1) requires two combinations of partial factors to be analysed as follows:

Combination 1 A1 + M1 + R1

Combination 2 A2 + M2 + R1

Where

A = Partial factors on actions (applied forces and moments).

M= Partial factors on soil parameters; and

R = Partial factors on resistances.

3.1.4. The values of various sets of partial factors that are applied to characteristic actions (A1 and A2), characteristic material strengths (M1 and M2) and resistances (R1) vary depending upon whether they are favourable or unfavourable to the stability of the structure. Note: Only Combination 2 is considered in this assessment because any imposed loadings are negligible compared to the soil masses.

3.1.5. When considering a limit state of rupture or excessive deformation EuroCode 7 requires that $E_d \leq R_d$ where:

E_d = design value of effect of actions (forces) and

R_d = design value of the resistance to actions

3.1.6. The ratio R_d / E_d is defined as the Over Design Factor and stability is demonstrated when the ODF $\geq$ 1.00. Hence, for each limit state considered, ODF's $\geq$ 1.00 are required for the design to be considered stable (i.e. safe).

3.1.7. Stability analyses were undertaken by considering the worst credible conditions likely to be encountered for each of the sections selected at the site.

3.2. Software

3.2.1. The analysis of slope stability was undertaken using the computer programme *FLACSlope* (version 8.1), which utilises the finite difference method of analysis. *FLACSlope* offers many advantages over traditional limit equilibrium based programmes.

3.2.2. Limit equilibrium codes use an approximate scheme (typically based on the method of slices) in which several assumptions are made (eg the location and angle of the interslice forces). Several assumed failure surfaces are tested (often many hundreds), and the one giving the lowest factor of safety is chosen. Equilibrium is only satisfied on an idealised set of surfaces.

3.2.3. In contrast, *FLACSlope* provides a full solution of the coupled stress/displacement, equilibrium, and constitutive equations. Given a set of properties, the system is determined to be stable or unstable. By automatically performing a series of simulations while changing the strength properties (strength reduction technique), the factor of safety (= ODF in these analyses) can be found to correspond to the point of stability and the critical failure (slip) surface can be located. Hence:

- Any failure mode develops naturally; there is no need to specify a range of trial surfaces in advance.
- No artificial parameters (eg functions for interslice force angles) need to be given as input.
- Multiple failure surfaces (or complex internal yielding) evolve naturally if the conditions give rise to them.
- The solution consists of mechanisms that are kinematically feasible whereas the limit equilibrium method considers only forces and not kinematics.

3.2.4 The analysis of the stability of the sidewall liners was carried out using PGL spreadsheets based on published equations.

4. STABILITY OF THE PROPOSED ACCESS ROAD

4.1. Design Approach

4.1.1. Four cross sections across the proposed access road were analysed based on as shown on Drawing No. 2 in Appendix A.

4.2. Shear strength parameters

4.2.1. The shear strength parameters used in the analysis are those summarised in Table 2.

4.2.2. Very limited geotechnical tests have been conducted and it is emphasised that the shear strength parameters used have been based upon the experience of PGL with similar materials, coupled with published values. PGL considers the characteristic soil strengths used to be conservative but recommend that care and vigilance is practiced

at all times during operations and that any minor slippages that may occur are remediated as a priority before they become worse.

Table 2 - Summary of Shear Strength Parameters

Material	Effective Stress Strength Parameters				Unit weight above GWL kN/m^3	Unit weight below GWL kN/m^3
	c'_k kPa	ϕ'_k deg	EC7 DC2 c'_{design} kPa	EC7 DC2 ϕ'_{design} deg		
Existing Waste / Inert soil	3.75	24.0	3.0	19.6	17	17
Waste – Inert Soil (Road construction subgrade)	6.25	33.0	5.0	24.8	17	17
Cohesive Glacial Till	5.00	28.4	4.0	23.4	18	18
Stiff Clay / Etruria Marl	10.00	35.0	8.0	29.3	18	18

4.2.3. It has been assumed that the Waste/Inert Soil (used for the road construction subgrade) is compacted properly on a prepared waste slope benched at about 1 in 3, in agreement with an appropriate specification.

4.3. Water Levels

4.3.1. The water levels applied in the analysis were based on the levels recorded in the BL monitoring (Table 1- page 4) raised to be conservatively close to the ground surface.

4.4. Design Loads

4.4.1. Plant loading has been applied on the road in the analyses equivalent to a loaded lorry (EC7 DC2 factored pressure of 39 kPa).

4.5. Vegetation on the Slope

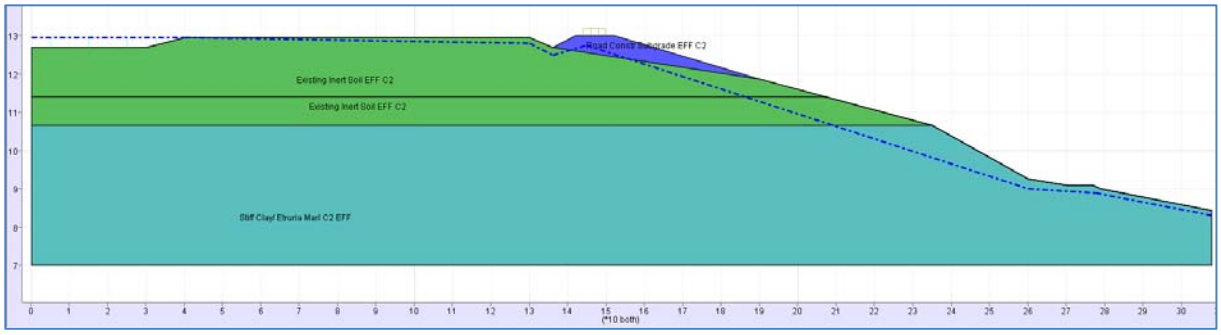
4.5.1. There is no allowance for the reinforcing effect of vegetation growing on the slope.

4.6. Design Cases

4.6.1. The stability of the slope has been considered using only effective stress parameters.

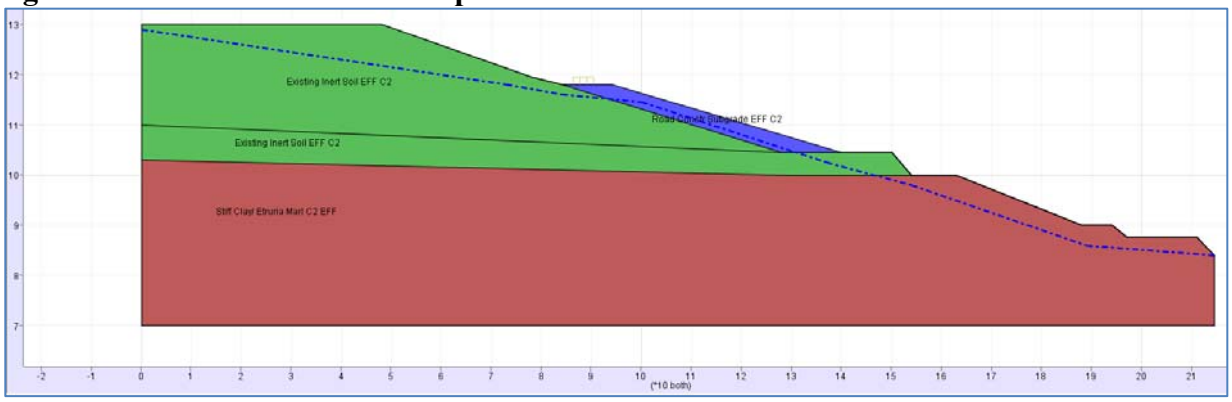
4.6.2. The FlacSlope models used the following models : the Run 01 model is shown in Figure 3.

Figure 3: General Section FlacSlope Model for Run 01



4.6.3. The FlacSlope model for Run 02 is shown in Figure 4.

Figure 4: General Section FlacSlope Model for Run 02

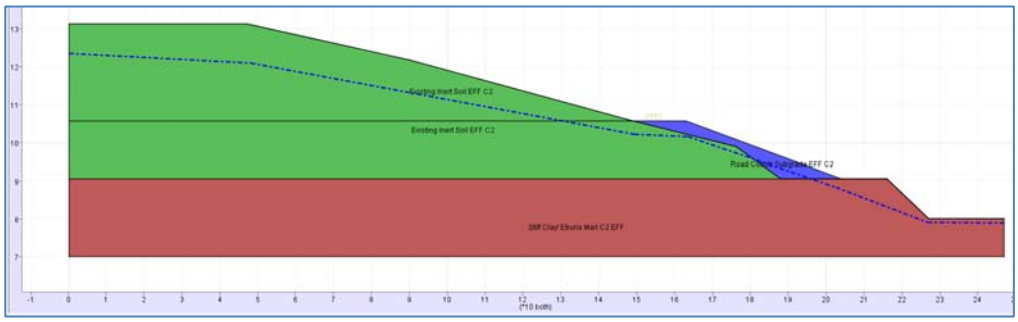


4.6.4. The FlacSlope model for Run 03 is shown in Figure 5.

Figure 5: General Section FlacSlope Model for Run 03

4.6.5. The FlacSlope model for Run 04 is shown in Figure 6.

Figure 6: General Section FlacSlope Model for Run 04



4.7. FlacSlope Stability Analyses of the Proposed Road on Existing Waste

4.7.1. The outputs/results of the analyses are presented in Appendix C with the results being summarised in Table 3.

4.7.2. An example of the FlacSlope output is shown below.

4.7.2.1. The bright yellow, green, and blue colours in Figure 7 indicate where the shear strains are highest and hence where the critical slip surface(s) would be.

Figure 7: Run03-Sect3 – Strains

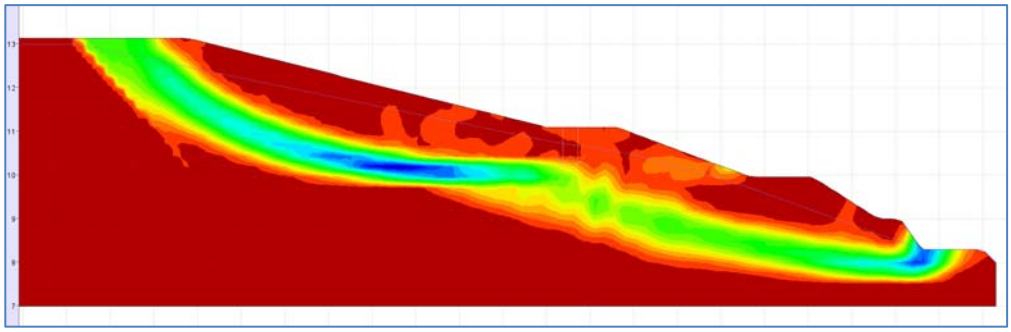


Table 3 - Summary of ODFs for the Stability of the Proposed Road on Existing Waste

Run	Model	Analysis	ODF	Comment on result
01	Plant on Proposed Road High water level	Effective	1.12	**Safe** Critical surface from road through waste
02	Plant on Proposed Road High water level	Effective	0.99	**Marginally Safe** Critical surface from crest of waste to pass under the road
03	Plant on Proposed Road High water level	Effective	1.14	**Safe** Critical surface from crest passes under road to daylight in base of the proposed excavation
04	Plant on Proposed Road High water level	Effective	1.10	**Safe** Critical surface through waste along the base of the waste

4.8. Assessment – Stability of the Proposed Road on Existing Waste

4.8.1. The analyses have shown that, with ODFs generally ≥ 1.00, the proposed road is stable with critical surfaces involving the waste slopes above and below the road.

4.8.2. However, see further comments in Section 6 relating to the stability of the adjacent properties.

4.8.3. As discussed in paragraph 4.2.2, PGL considers the characteristic soil strengths used to be conservative but recommend that care and vigilance is practiced at all times during operations and that any minor slippages that may occur are remediated as a priority before they become worse.

4.8.4. Once waste filling has started at the base of the access road then the waste requires to be placed with compaction of the layers using a standard heavy weight waste compactor following recognised industry guidelines.

5. VENEER STABILITY OF SIDEWALL LINERS

5.1. Design Scenarios

5.1.1. A re-engineered Etruria Formation 'artificial' geological barrier (AGB) will be placed across the sidewalls adjacent to the presence of any exposed *in-situ* strata to mitigate against any "permeable" lenses or layers exposed within the sidewall.

5.1.2. A 500mm minimum thickness AGB, at a permeability no greater than $1x10^{-8}$m/s is proposed to provide a combined geological barrier for lateral containment.

5.1.3. For steeper sections of the side slope any re-worked marl will be placed in lifts commensurate to the rising waste fill deposits to ensure stability. Where there are already placed, extensive thicknesses of cast back materials (interburden / overburden) overlying the natural strata, there will be no requirement for further addition of an engineered AGB.

5.1.4. The design scenarios for the sidewall barrier were:

- Scenario 1 – side slope 1(v) in 2.0(h) or flatter
- Scenario 2 – side slope steeper than 1(v) in 2.0(h)

5.2. Veneer Analysis

5.2.1 The veneer analyses for both scenarios was carried out in accordance with EC7 DC2 as with the slope analysis.

5.2.2 The veneer analysis was carried out:

- for Scenario 1 using the equation derived for an infinite slope by Barnes GE in Soil Mechanics, Principles and Practice; 2nd Ed: Pub by Palgrave, 2000.
- for Scenario 2 using the closed form of the equations detailed in Qian et al, 2001 and Thiel, 1998.

5.2.3 The calculations for both scenarios are presented in the spreadsheets in Appendix D.

5.2.4 The analysis for Scenario 1 considers:

- an infinite slope
- the slope of the surface was taken as 1 in 2.0
- sliding on a failure surface parallel to the soil surface at the base of the AGB
- water pressure from water in the AGB with a Parallel Submergence Ratio (PSR) of 0.2

5.2.5 The analysis for Scenario 2 considers:

- a limited lift (unsupported above the waste level) of 3 m.
- the slope of the surface was taken as 1 in 2.0
- sliding on a failure surface parallel to the soil surface at the base of the AGB
- water pressure from water in the AGB with a Parallel Submergence Ratio (PSR) of 0.2

5.2.6 The EC7 DC2 design interface shear strength parameters assumed between the underlying Etruria Marl and the AGB (reworked marl) is c'_{des} = 1.6kPa and δ'_{des} = 28.4º (compare with the values for the Marl itself of c'_{des} = 8kPa and ϕ'_{des} = 29.3º)

5.3 Analysis Results - Veneer Stability of Sidewall Liners

5.3.1. The spreadsheets of the analyses are presented in Appendix D and summarised in Table 4.

Table 4 - ODFs for Stability of the Sidewall Liners

Section Run	Over Design Factor (ODF)		Comment on analysis result
	Without Plant	With Plant	Slope 1 in 2.0
Scenario 1	1.04	1.04	**SAFE**
Scenario 2	1.44	-	**SAFE**

5.4 Assessment – Veneer Stability of Sidewall Liners

5.4.1. Sections of the side slope steeper than 1 in 2 should have the re-worked marl placed in lifts of no more than 3 m above the rising waste fill deposits to ensure stability of the AGB.

5.5 Waste Emplacement Methodology Against the Sidewall liner

5.5.1 The first metre of waste placed against a sidewall liner shall be free from large objects and items that, due to their physical nature, might cause penetrative damage to the geological barrier.

5.5.2 Waste shall be placed and compacted by heavy plant in lifts no greater than 3m in height.

5.5.3 A 10 m wide by 3m deep buttress of waste shall be placed against the sidewall liner as quickly as is practical to provide support to the 3m high exposed clay sidewall liner.

5.5.4 The surface of the waste shall be graded to encourage surface water run-off and no waste slope shall exceed 1:2.5**.**

6 STABILITY AGAINST BASE HEAVE

6.1 Design Approach

6.1.1 The analysis has assumed that a small area (1 m square in plan) of the base of the Etruria Marl will be forced up by the water pressure in the underlying sandstone layer.

6.1.2 The base excavation will be taken down to about 80 m OD. The sandstone layer was encountered between 71.26 mOD and 69 mOD in BH 22-02D (Reference 14).

6.2 Shear Strength Parameters

6.2.1. The shear strength parameters used in the analysis are those summarised in Table 2. This is in accordance with EC7 DC2 with the partial factors on soil parameters listed in Table A.16 of the National Annex A1: 2013 – “Partial factors for soil parameters for uplift limit state verifications”.

6.3 Water Levels

6.3.1. The water levels applied in the analysis were based on the levels recorded in the BL monitoring (Table 1- page 3).

6.3.2. In the analysis it has been assumed that the water level in the sandstone layer (base of the marl layer) is at 140 mOD assuming it to be in hydraulic continuity with the layers above. This gives a water head on the base of the marl layer of 140 - 70 = 70 m.

6.4 Design Cases

6.4.1. The stability of the base has been considered using only effective stress parameters.

6.4.2. Only EC7 DC2 has been considered because plant loading is variable and transient so may not be present to be favourable to the stability of the base against uplift.

6.4.3. The partial factor on actions has been obtained from Table A.15 of the National Annex A1: 2013. The upward force exerted by water pressure in the sandstone layer has therefore been factored up by EC7 partial factor $\gamma_{Q;dst}$ (=1.5).

6.5 Analysis and Assessment

6.5.1. The downward force exerted by the self-weight of the marl prism being forced upwards has been ignored; this is considered conservative.

6.5.2. The EC7 DC2 c'_{design} value for the Etruria Marl has been ignored (= 0) with only the friction angle ϕ'_{design} being considered in the analysis. This is conservative.

6.5.3. The coefficient of lateral earth pressure at rest has been taken as $(1 - \sin\phi'_k) = 1 - \sin 35^0$ hence $K_o = 0.43$.

6.5.4. The total design upward disturbing force exerted by the water is calculated at 1050kN. The total soil effective design resistance force is calculated at 6273kN.

This gives an EC7 DC2 Overdesign Factor = 6273/1050 = 6 > 1.0 ∴ Safe.

6.5.5. The analysis is conservative because:

- it ignores the self-weight of the marl prism
- it ignores the effective cohesion of the marl
- it assumes that the sandstone layer is in hydraulic continuity with the layers above
- it assumes that if the base started to heave, the permeability of the sandstone layer would be high enough to allow the water to inflow at a sufficient rate to keep the base moving upwards.

7 STABILITY OF ADJACENT INFRASTRUCTURE

7.1 Stubbers Green Road

7.1.1 Stubbers Green Road runs NW-SE adjacent to the south east boundary.

7.1.2 It is situated at the early chainages of SRA Sections 2 and 3. Section 2, although safe, has a relatively low ODF of 1.03 and is therefore considered to be only marginally safe.

7.1.3 Its stability is very much dependent on the compactive state of the existing waste and the water levels in that waste. It is important to continue regular inspections (as discussed in the Quarry Regulations Report – Refence 12) and to maintain or instal effective surface water drainage management i.e. away from signs of imminent slippage.

7.1.4 As the filling progresses then the stability of the existing waste should improve.

7.1.5 The next Quarry Regulation report is due in September 2022.

7.2 The brick yard

7.2.1 The brick yard (mineral processing operations, kilns, workshop, and offices) occupies the south and south-eastern end of the site.

7.2.2 Two deep mine shafts are located within the brickyard (Reference 13). Both shafts were grouted down to 134 metres and capped under the supervision of Wardell Armstrong Consultants for Leigh Interests in 1981/82. As such they are not considered to represent a significant risk to the Sandown Quarry.

7.3 The Daw End Canal

7.3.1 The Daw End Canal is adjacent to the north eastern boundary.

7.3.2 The present failures apparent in the waste slopes below and above the present access road on the north east of the site are (it is understood from Reference 12) adversely affected by groundwater seepage within the existing waste and water from the canal above. This is apparently an ongoing problem and monitoring is recommended in the Quarry Regulation report.

7.3.3 It is understood that there is no apparent movement registered along the site boundary to date, but this has not been confirmed.

7.3.4 This report has considered the stability of the proposed access road which is at the opposite side of the quarry to the canal. No remarks in this report should be construed as indicating that the stability of the north eastern boundary (and hence the canal) has been investigated in the context of this report.

7.3.5 As the filling progresses then the stability of the existing waste (and the north eastern boundary) should improve.

7.4 Butterley Hole Landfill

7.4.1 Butterley Hole Landfill is adjacent to the north west boundary

7.4.2 It is understood from Reference 12 that the existing failure on at the upper part of the waste in the area adjacent to this boundary (Area B in the report) has not change at the time of the inspection 2020 and was likely to stabilise in time.

7.4.3 The report recommended to continue buttressing the area from below and to maintain the water management which was considered vital.

7.4.4 As the filling progresses then the stability of the existing waste should improve.

7. REFERENCES

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12 The Quarries Regulations 1999 Excavations and Tips –Assessment Report: EOB CONSULT Geological Geotechnical Consultants Report: November 2020

13 Sandown Quarry, Coal Mining Report, the Coal Authority, 2022

14 Factual Ground Investigation Report, Sandown Quarry, Aldridge, Walsall, Exploration & Testing Associates Limited, June 2022

Appendix A

Drawings

No. 1 - Exploratory Hole Location Plan - Exploration Associates Drawing No. C10259.EHLP_1

No. 2 - Proposed Access Road Sections - Drawing No. 5430.5.001

Legend Key

Locations By Type - RC

Locations By Type - RO

Client:	Byrne Looby	Title:	Exploratory Hole Location Plan	EXPLORATION & TESTING ASSOCIATES
Contract:	Sandown Quarry	Drawing:	C10259.EHLP_1	
Contract No.:	C10259	Date:	28/06/2022	

A2

GENERAL NOTES

Rev	Date	Description	By	Chk	App

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CLIENT

PROJECT
SANDOWN QUARRY
LANDFILL

DRAWING TITLE

SRA SECTIONS
SHEET 1 OF 3

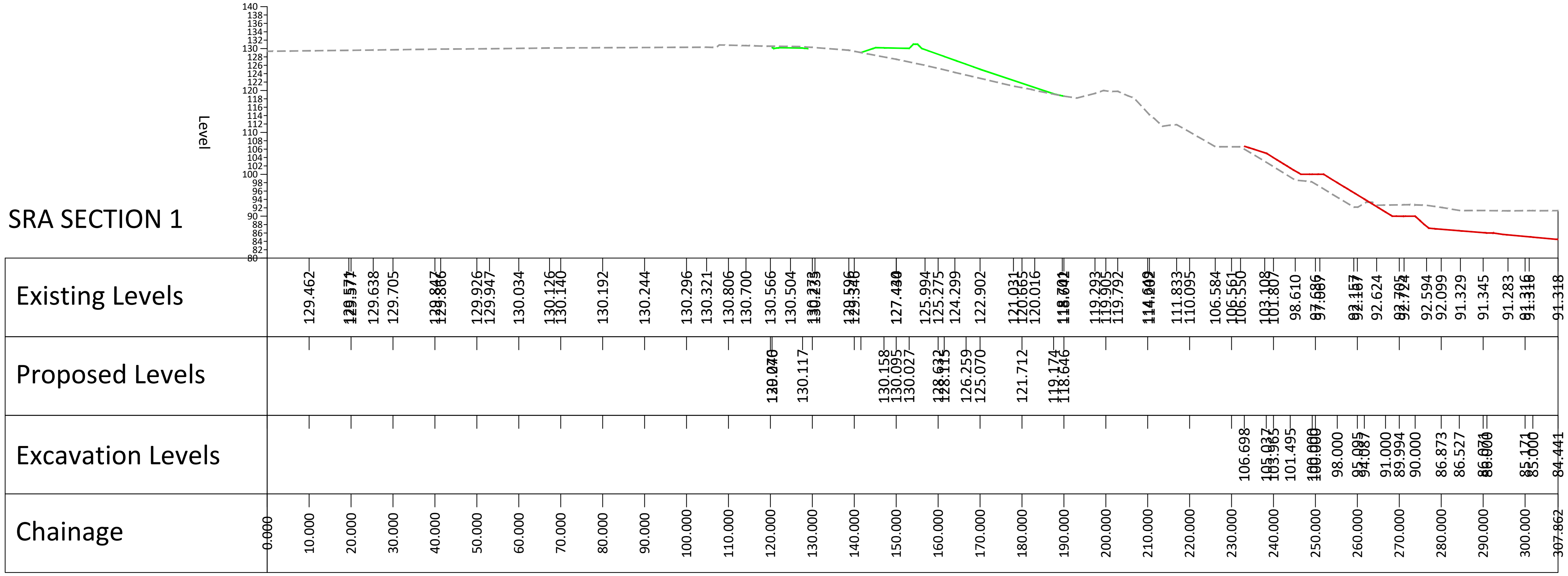
STATUS
FOR REVIEW

Date: 19/08/22	Scale: 1:1,250	Drawn: GH	Chk: PS	App: JB

Project No:	Drg. No:	Rev:
5430	5430.5.001	00

A3

SRA SECTION 1



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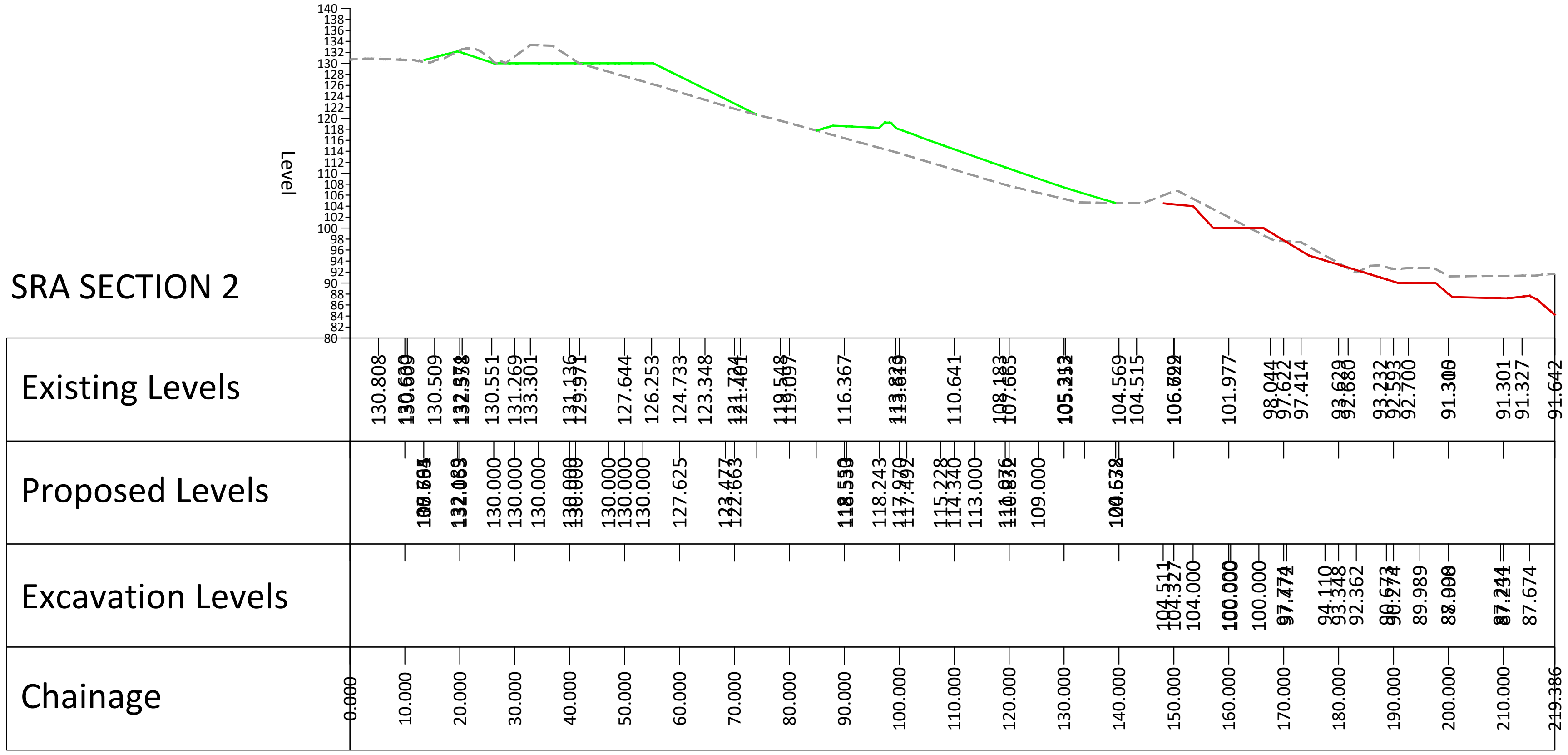
SRA SECTION 2



Scale: H 1:1250,V 1:1250.

GENERAL NOTES

Rev	Date	Description	By	Chk	App
00	00	REVISION LINE FOR A3 TITLE SHEETS	MON	MR	JB

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PROJECT
SANDOWN QUARRY LANDFILL

DRAWING TITLE
SRA SECTIONS SHEET 2 OF 3

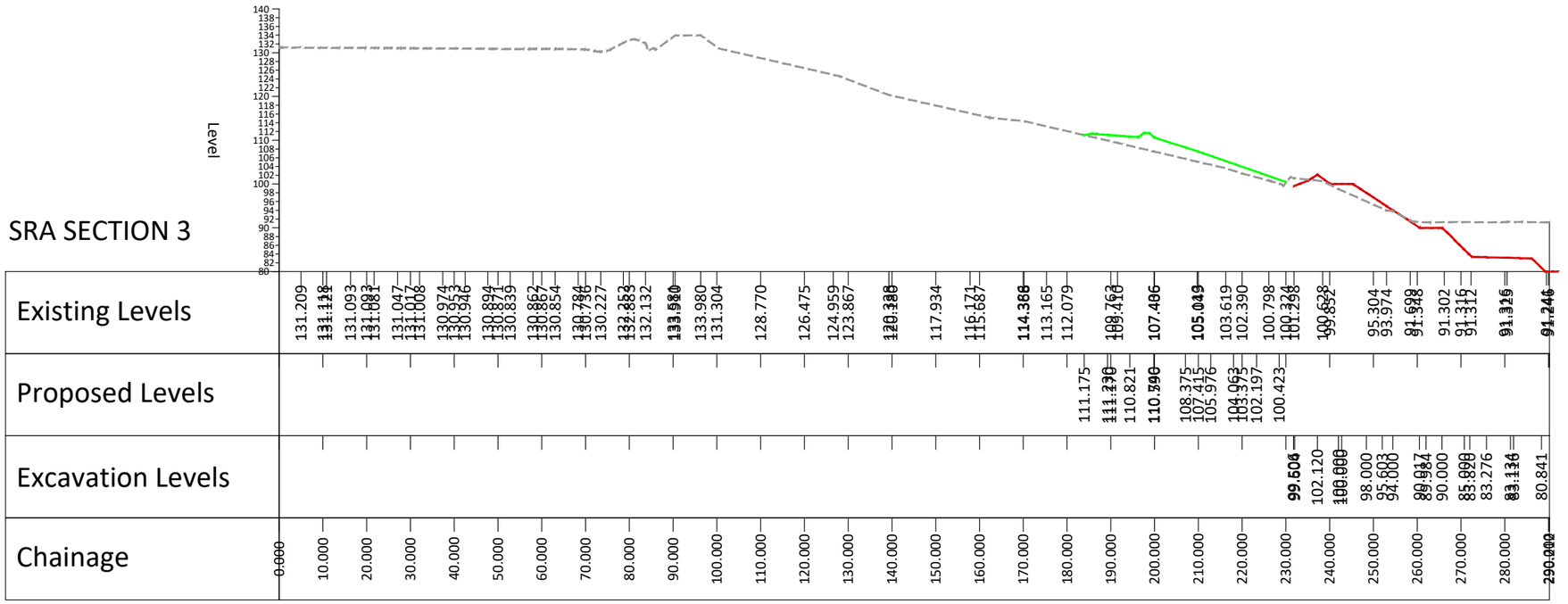
STATUS
FOR REVIEW

Date: 19/08/22	Scale: 1:1,250	Drawn: GH	Chk: PS	App: JB

Project No:	Drg. No:	Rev:
5430	5430/5/001	00

A3

SRA SECTION 3



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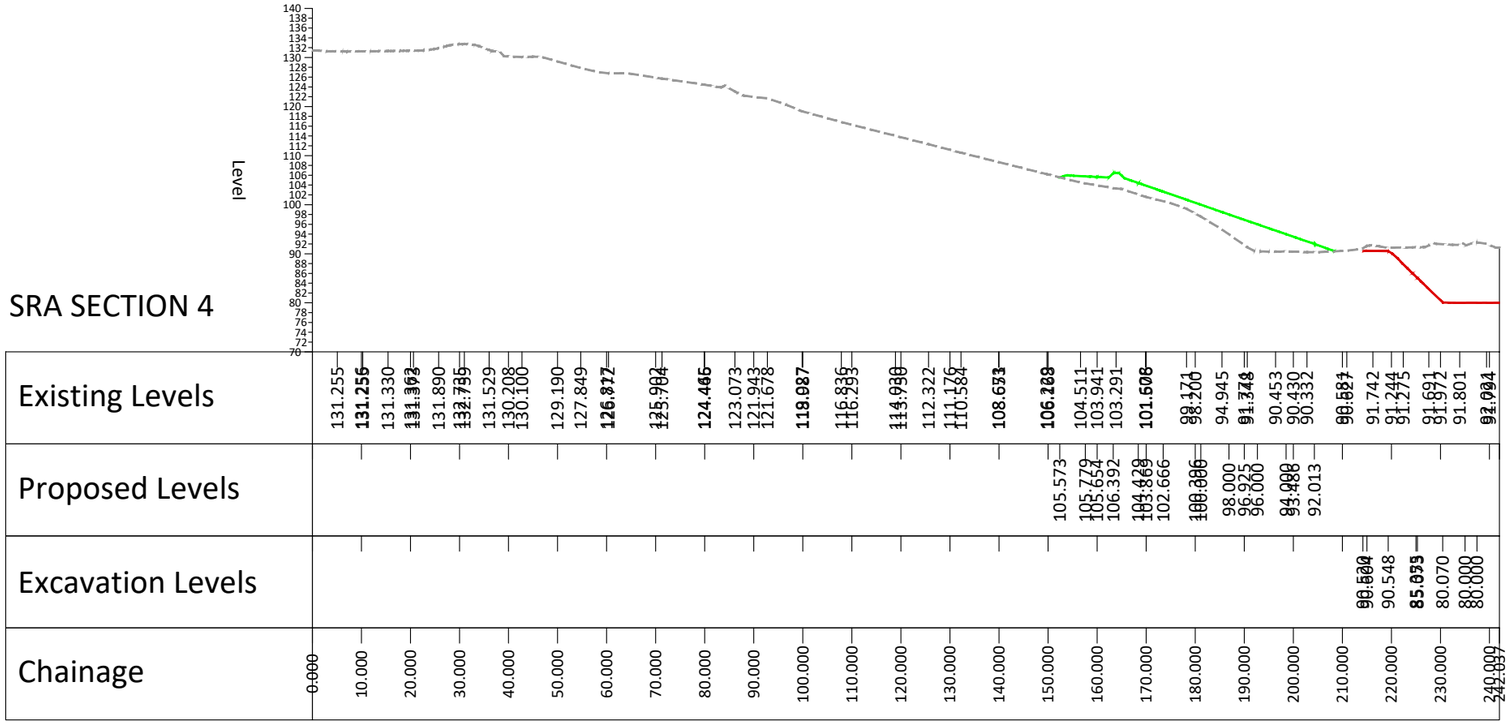
SRA SECTION 4



Scale: H 1:1250,V 1:1250.

GENERAL NOTES

Rev	Date	Description	By	Chk	App
00	00	REVISION LINE FOR A3 TITLE SHEETS	MON	MR	JB

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PROJECT
SANDOWN QUARRY
LANDFILL

DRAWING TITLE
SRA SECTIONS
SHEET 3 OF 3

STATUS
FOR REVIEW

Date: 19/08/22	Scale: 1:1,250	Drawn: GH	Chk: PS	App: JB

Project No:	Drg. No:	Rev:
5430	5430/5/001	00

Appendix B

Borehole Logs

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND: Overburden/backfill (Drillers Description)

1 2 3 4 5 6 7 8

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND: Overburden/backfill (Drillers Description)

9 10 11 12 13 14 15 16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND: Overburden/backfill (Drillers Description)
									24.00	116.85		

17 18 19 20 21 22 23 24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Mudstone (Drillers Description)

25
26
27
28
29
30
31
32

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Mudstone (Drillers Description)

33
34
35
36
37
38
39
40

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Mudstone (Drillers Description)

41
42
43
44
45
46
47
48

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 29/03/2022 - 30/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404638.99 N301972.32
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-01	RO	140.85m AoD	JS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Mudstone (Drillers Description)
									52.30	88.55		End of Borehole at 52.30m

49 50 51 52 53 54 55 56

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
52.30	140	1.50	140									0.00	52.30	Mist	Red		100

Remarks

1. 15:00-15:30-Awaiting install instructions.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)

1 2 3 4 5 6 7 8

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)
									15.00	119.53		Marl (Drillers Description)

9 10 11 12 13 14 15 16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)

17 18 19 20 21 22 23 24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)

25
26
27
28
29
30
31
32

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)

33
34
35
36
37
38
39
40

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

Rotary Core Log

EXPLORATION & TESTING ASSOCIATES

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)
		45.00 - 48.00		6					45.00	89.53		Extremely weak reddish brown MUDSTONE with rare greenish grey pockets up to 20mm in size. Discontinuities are horizontal closely spaced undulating rough with no infill. *Below 45.51m bgl: Occasional light grey and greenish grey pockets up to 70mm in size.* *Between 45.61m and 47.09m bgl: Very closely spaced interbedding bands of firm reddish brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse mudstone.* *Below 45.90m bgl: Occasional light grey and yellowish brown pockets up to 70mm in size.* *Below 46.00m bgl: Discontinuities are medium spaced.* *Between 46.11m and 46.29m bgl: Very weak.*
				4	97	69	32					
		47.74 - 48.00	C1						47.09	87.44		Very weak reddish brown MUDSTONE with rare yellowish brown pockets up to 40mm in size. Discontinuities are horizontal closely spaced to medium spaced, undulating rough and planar rough with occasional clay infill up to 25mm. *Between 47.56m and 47.74m bgl: Firm reddish brown slightly sandy*
		48.00 - 50.80							48.00	86.53		

41 42 43 44 45 46 47 48

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
									48.26	86.27		Very weak reddish brown MUDSTONE with rare yellowish brown pockets up to 40mm in size. Discontinuities are horizontal closely spaced to medium spaced, undulating rough and planar rough with occasional clay infill up to 25mm.
												Between 47.56m and 47.74m bgl: Firm reddish brown slightly sandy slightly gravelly CLAY.
				9	98	67	35					Stiff reddish brown gravelly CLAY with rare yellowish brown and light grey pockets up to 30mm in size. Gravel is angular fine to coarse mudstone. (Drilling induced).
				2					50.31	84.22		Extremely weak reddish brown MUDSTONE with rare light grey and yellowish brown pockets up to 50mm in size. Discontinuity set 1 are horizontal to subhorizontal closely to medium spaced planar rough and undulating rough with clay smear.
												Below 48.70m bgl: Discontinuity set 2 are vertical, closely to medium spaced, undulating rough and planar rough.
		50.80 - 53.80										*Below 49.17m bgl: Discontinuities are horizontal and sub-vertical, very closely spaced, planar undulating and planar smooth with clay smear.*
				AZCL								Very weak reddish brown MUDSTONE with rare light grey streaks. Discontinuities are subhorizontal, stepped, closely spaced, planar smooth with no infill. Assumed zone of core loss.
					51	49	31		52.27	82.26		
				5					52.27	82.26		Extremely weak reddish brown MUDSTONE with abundant light grey and yellowish brown streaking. Discontinuities are horizontal and sub-horizontal, closely spaced, planar smooth with clay infill up to 25mm.
												Between 52.96m and 53.07m bgl: Vertical fracture, planar smooth with no infill.
												Below 53.07 bgl: Very weak and discontinuities have no infill.
		53.80 - 55.30										
				4	96	87	80		54.09	80.44		Extremely weak reddish brown MUDSTONE. Discontinuities are horizontal and sub-vertical, closely spaced, undulating rough with clay infill up to 25mm.
												Below 54.39m bgl: With occasional light grey streaking. Discontinuities are stepped rough.
		55.30 - 58.30										*Between 55.30m and 55.85m bgl: Assumed zone of core loss.*
				AZCL								
		55.85 - 55.99	C2						55.85	78.68		Extremely weak to very weak reddish

49 50 51 52 53 54 55 56

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

Rotary Core Log

EXPLORATION & TESTING ASSOCIATES

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
				10								Extremely weak to very weak reddish brown mottled light grey MUDSTONE. Discontinuity set 1 are horizontal to sub-vertical, closely spaced, planar smooth and planar rough with clay infill up to 15mm. Discontinuity set 2 are 60-80 degrees rough, medium spaced and clean.
												Below 56.63m bgl: Extremely weak.
				4	82	66	48		57.11	77.42		Extremely weak reddish brown MUDSTONE. Discontinuities are horizontal, very closely to closely spaced, planar rough with clay infill up to 40mm.
												Below 57.51m bgl: Discontinuities are no infill.
									58.10	76.43		*Below 57.96m bgl: Very weak reddish brown with light grey streaks. Discontinuities are horizontal and sub-vertical.*
		58.30 - 61.30		2								Very weak reddish brown MUDSTONE with rare pockets of light grey up to 50mm in size. Discontinuity set 1 are horizontal and sub-horizontal, closely spaced, planar smooth with clay infill up to 10mm.
				7	93	85	52					*Below 59.41m bgl: Extremely weak. Discontinuities are very closely spaced with clay infill up to 30mm.*
												Between 59.49m and 59.59m bgl: Recovered as gravelly clay.
												Between 59.65m and 59.81m bgl: Recovered as clayey gravel.
												Below 59.65m bgl: Reddish brown and light grey.
												Below 59.98m bgl: Very weak reddish brown with light grey pockets on fractures.
												Below 60.24m bgl: Extremely weak with no light grey. Discontinuity set 2, 45 degrees, medium spaced, undulating rough, clean with grey staining
		61.30 - 64.30		6	100	99	83		61.30	73.23		Very weak to weak reddish brown MUDSTONE. Discontinuities are horizontal and sub-vertical closely spaced to medium spaced, planar smooth with occasional clay infill up to 20mm.
												Between 62.00m and 62.05m bgl: Recovered as gravelly clay.
												Between 62.05m and 63.11m bgl: Extremely weak, reddish brown and light grey.
				5					63.27	71.26		Strong dark purplish grey fine to coarse SANDSTONE. Discontinuities are horizontal, closely to medium spaced, planar smooth with no infill.

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 19/04/2022 - 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404267.52 N302142.63
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02D	RC	134.53m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		64.30 - 64.64 64.30 - 65.30	C3	6					64.64 65.30	69.89 69.23		Strong dark purplish grey fine to coarse SANDSTONE. Discontinuities are horizontal, closely to medium spaced, planar smooth with no infill. *Between 64.15m and 64.51m bgl: Occasional <10mm band of pebbles which include sandstone and quartzite.* *Between 64.30m and 64.64m bgl: Vertical 1mm quartzite vein.* Very weak to weak dark purplish reddish brown MUDSTONE with rare light grey and dark grey streaks. Discontinuities are horizontal, very closely spaced, planar smooth and planar rough with clay infill up to 10mm. *Between 65.02m and 65.14m bgl: Sub-vertical, planar smooth fracture with clay infill up to 20mm.* End of Borehole at 65.30m

65 66 67 68 69 70 71 72

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
65.30	140	50.10	140									0.00	4.50	Mist	Red		100
												4.50	48.00	Mist	Red		80
												48.00	65.30	Mist	Red		100

Remarks

1. Low loader unavailable on 14./04/22 - 5 hours standing. 2. Low loader arrives at 12pm on 17/04/22 - 4 hours standing 3. Fill water bowser 4 x 0.5 hours. 4. Collect extra casing 7 hours

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404257.44 N302144.26
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT54-6

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02S	RO	134.41m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		0.00 - 17.00										MADE GROUND (Drillers Description).

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
17.00	140	1.50	140									0.00	17.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404257.44 N302144.26
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT54-6

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02S	RO	134.41m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).
									15.00	119.41		Marl (Drillers Description).

9 10 11 12 13 14 15 16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
17.00	140	1.50	140									0.00	17.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 27/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404257.44 N302144.26
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT54-6

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-02S	RO	134.41m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description).
									17.00	117.41		End of Borehole at 17.00m

17
18
19
20
21
22
23
24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
17.00	140	1.50	140									0.00	17.00	Mist	Red		100

Remarks

Rotary Core Log

EXPLORATION & TESTING ASSOCIATES

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404113.58 N301953.40
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Bertta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-03	RO	130.49m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).
		1.20 - 2.20	U1						1.20	129.29		From 1.20-2.00m bgl: Drive sample: MADE GROUND: Firm to stiff reddish brown and light grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse quartzite and sandstone.
		1.70	D1									
		SPT(S): N=27 (4,4/6,7,6,8)						(27)	2.20	128.29		MADE GROUND (Drillers Description).
		5.50 - 6.50	B1						5.50	124.99		From 5.50-6.50m bgl: Drive sample: MADE GROUND: Orangish brown slightly clayey slightly gravelly fine to coarse SAND with <50mm pockets of clay. Gravel is subangular to subrounded fine to coarse sandstone and mudstone.
												Below 6.30m bgl: Gravel includes quartzite
									6.50	123.99		MADE GROUND (Drillers Description).

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
15.00	140	4.50	140									0.00	15.00	Mist	Red		90

Remarks

0.5 hours dayworks for induction

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404113.58 N301953.40
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Bertta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-03	RO	130.49m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		SPT(S): 50 (25 for 75mm/50 for 10mm)							10.60	119.89		MADE GROUND (Drillers Description).
									15.00	115.49		Marl (Driller Description). *At 10.60m bgl: Drive sample, refused and continued with open hole*
												End of Borehole at 15.00m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
15.00	140	4.50	140									0.00	15.00	Mist	Red		90

Remarks

0.5 hours dayworks for induction

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)

9
10
11
12
13
14
15
16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)

17 18 19 20 21 22 23 24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description)
									25.50	101.97		Marl (Drillers Description)

25
26
27
28
29
30
31
32

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)

33
34
35
36
37
38
39
40

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 11/04/2022 - 12/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404288.79 N301772.65
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04D	RO	127.47m AoD	PS/TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												Marl (Drillers Description)
									42.00	85.47		End of Borehole at 42.00m

41 42 43 44 45 46 47 48

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
42.00	140	2.00	140									0.00	42.00	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 13/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404282.56 N301772.85
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04S	RO	131.38m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).

1 2 3 4 5 6 7 8

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
27.50	140	2.00	140									0.00	27.50	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 13/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404282.56 N301772.85
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04S	RO	131.38m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).

9
10
11
12
13
14
15
16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
27.50	140	2.00	140									0.00	27.50	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 13/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404282.56 N301772.85
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04S	RO	131.38m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).

17 18 19 20 21 22 23 24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
27.50	140	2.00	140									0.00	27.50	Mist	Red		100

Remarks

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 13/04/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404282.56 N301772.85
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta GT-54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-04S	RO	131.38m AoD	PS	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).
									25.50	105.88		Marl (Drillers Description).
									27.50	103.88		End of Borehole at 27.50m

25 26 27 28 29 30 31 32

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
27.50	140	2.00	140									0.00	27.50	Mist	Red		100

Remarks

Rotary Core Log

EXPLORATION & TESTING ASSOCIATES

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 24/03/2022 - 28/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404416.26 N301939.01
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-05	RC	94.40m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
												MADE GROUND (Drillers Description).
		0.90 - 1.90			0	0	0					
		1.90 - 2.50			0	0	0					
		2.50 - 4.00			0	0	0					
		4.00 - 5.50			0	0	0					
		5.50 - 7.00		AZCL	8	7	0					
				0					6.88	87.52		
		7.00 - 8.50		AZCL								Extremely weak to very weak dark reddish brown clayey MUDSTONE with light grey pockets up to 15mm in size.
				10	79	39	8		7.31	87.10		Very weak to weak brown, reddish brown fine grained SANDSTONE with rare angular fine and medium quartzite inclusions and rare bands of mudstone <30mm. Discontinuities are horizontal very

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
25.00	140	7.00	140									0.90	8.50	Mist	Red		80
												8.50	25.00	Mist	Red		75

Remarks

1. 3hr dayworks moving equipment to location. Rig standing for 1hr due to soft ground conditions 2. 2hr dayworks to input rods, blow out water and undertake rising head and pull rods and casing.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 24/03/2022 - 28/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404416.26 N301939.01
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-05	RC	94.40m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
				7								Very weak to weak brown, reddish brown fine grained SANDSTONE with rare angular fine and medium quartzite inclusions and rare bands of mudstone <30mm. Discontinuities are horizontal very closely spaced undulating rough with no infill.
		8.50 - 10.00		AZCL	25	25	11		8.56	85.84		*Between 7.54m and 7.69m bgl: Clayey gravel.* *At 8.18m bgl: Discontinuity is vertical rough and clean.* Assumed zone of core loss
				6					9.62	84.78		Very weak dark reddish brown streaked light grey MUDSTONE with rare yellowish brown pockets up to 30mm in size. Discontinuities are horizontal very closely to closely spaced planar smooth with no infill.
		10.00 - 11.50		3	100	97	61		10.43	83.98		*Below 10.05m bgl: Discontinuities have occasional clay infill up to 5mm.* Very weak to weak reddish brown fine to coarse SANDSTONE with rare bluish grey bands <15mm, rare bands of mudstone <30mm, and rare angular fine quartzite gravels. Discontinuities are sub-horizontal closely spaced planar smooth with no infill.
		11.50 - 13.00		7	93	71	49		12.30	82.10		*Below 10.90m bgl: Sandstone is fine and medium and dark grey.* *Below 11.12m bgl: Closely spaced, interbedding bands <100mm of conglomerate* *Below 11.32m bgl: Fine grained sandstone. No coarse sandstone bands.* *Below 11.45m bgl: Discontinuities have clay smears.*
				12								Weak locally very weak dark grey SILTSTONE with occasional relic rootlet systems. Discontinuities are horizontal closely spaced planar rough with no infill.
		13.00 - 14.50		6	92	62	23		13.12	81.28		*At 12.63m bgl: Vertical discontinuity, rough with slight clay infill.* Extremely weak reddish brown MUDSTONE. Discontinuities are horizontal, very closely and closely spaced, planar rough and undulating rough with clay infill up to 15mm.
		14.50 - 16.00		AZCL	41	36	36		14.50	79.90		*Between 13.35 and 13.83m bgl: Soft reddish brown gravelly CLAY. Gravel is angular fine to coarse extremely weak mudstone.* *Below 13.83m bgl: Extremely weak to very weak, discontinuities are horizontal to subhorizontal.* Assumed zone of core loss.
				4					15.39	79.02		Extremely weak and very weak reddish brown MUDSTONE. Discontinuity set 1, horizontal closely spaced, planar rough with clay infill up to 20mm.
		16.00 - 17.00		NI								

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
25.00	140	7.00	140									0.90	8.50	Mist	Red		80
												8.50	25.00	Mist	Red		75

Remarks

1. 3hr dayworks moving equipment to location. Rig standing for 1hr due to soft ground conditions 2. 2hr dayworks to input rods, blow out water and undertake rising head and pull rods and casing.

Rotary Core Log

EXPLORATION & TESTING ASSOCIATES

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 24/03/2022 - 28/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404416.26 N301939.01
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-05	RC	94.40m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
					100	97	87					Extremely weak and very weak reddish brown MUDSTONE. Discontinuity set 1, horizontal closely spaced, planar rough with clay infill up to 20mm. *Below 16.00m bgl: Weak locally very weak. Discontinuity set 1 are medium spaced. Discontinuity set 2 are 45 degrees, medium spaced, planar rough and planar stepped with no infill.*	
		17.00 - 18.00		3	100	84	76					*Below 17.11m bgl: Very weak to weak. Discontinuity set 1 are sub horizontal, closely to medium spaced, smooth with no infill.*	17
		18.00 - 19.00		0 NI 2	100	71	66		18.07	76.33		Very weak to weak brown and light grey MUDSTONE. Discontinuities are sub-horizontal, closely spaced, planar rough and undulating rough with no infill. *Between 18.21m and 18.42m bgl: Extremely weak recovered as non-intact*	18
		19.00 - 22.00		AZCL	31	18	10		19.00	75.40		Assumed zone of core loss.	19
													20
									21.06	73.34		Very weak reddish brown mottled yellowish brown with occasional light grey streaks MUDSTONE. Discontinuities are sub horizontal, closely spaced, planar smooth and undulating rough with clay smear. *Below 21.29m bgl: Occasional bands <15mm of gravelly clay*	21
		22.00 - 23.00		9	84	56	23					*Below 22.49m bgl: Extremely weak, reddish brown and light grey with occasional yellowish brown pockets up to 20mm.*	22
		23.00 - 24.00			99	99	99		23.00	71.40		Weak, locally very weak, reddish brown MUDSTONE. Discontinuities are subhorizontal, closely spaces, planar smooth and clean *Below 23.00m bgl: Very weak to weak reddish brown rarely mottled light grey. Discontinuities are horizontal, closely spaced, planar smooth with clay infill up to 10mm. Between 23.20m and 23.45m bgl: Very weak with abundant light grey mottling*	23
		24.00 - 25.00											24

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
25.00	140	7.00	140									0.90	8.50	Mist	Red		80
												8.50	25.00	Mist	Red		75

Remarks

1. 3hr dayworks moving equipment to location. Rig standing for 1hr due to soft ground conditions 2. 2hr dayworks to input rods, blow out water and undertake rising head and pull rods and casing.

EXPLORATION & TESTING ASSOCIATES

Rotary Core Log

Project Name: Sandown Quarry	Client: Byrne Looby	Date: 24/03/2022 - 28/03/2022
Location: Walsall	Contractor: Exploration & Testing	Co-ords: E404416.26 N301939.01
Project No. : C10259	Crew Name: ACE Drilling	Drilling Equipment: Beretta T54

Borehole Number	Hole Type	Level	Logged By	Scale	Status
BH22-05	RC	94.40m AoD	TY	1:40	FINAL

Well	Water	Depth (m)	Type	FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		24.28 - 24.58	C1	3	97	90	88		25.00	69.40		Weak, locally very weak, reddish brown MUDSTONE. Discontinuities are subhorizontal, closely spaces, planar smooth and clean *Below 24.00m bgl: Discontinuities with clay infill up to 15mm.* End of Borehole at 25.00m

25 26 27 28 29 30 31 32

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
25.00	140	7.00	140									0.90	8.50	Mist	Red		80
												8.50	25.00	Mist	Red		75

Remarks

1. 3hr dayworks moving equipment to location. Rig standing for 1hr due to soft ground conditions 2. 2hr dayworks to input rods, blow out water and undertake rising head and pull rods and casing.

Appendix C

FLACSlope outputs for Stability of the Proposed Road on Existing Waste

Project file: Run01-Sect1-RoadandExcLevels.psl
Project title: BL08 Sandown Run01

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste Road Constr Subgrade EFF C2	1700.0	5000.0	0.0	24.8	0.0
Waste Existing Inert Soil EFF C2	1700.0	3000.0	0.0	19.6	0.0
Soil-Clay Cohesive Glacial Till C2 EFF	1800.0	4000.0	0.0	23.4	0.0
Soil-Clay Stiff Clay/ Etruria Marl C2 EFF	1800.0	8000.0	0.0	29.26	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
Run01Sect1RoadandExcLevels	Model_1	Mohr-Coulomb	General slope	Z120	fc	1.12

Program: FLAC/Slope v8.1.469 & GIIC/Slope v2.20.527
Created: Mon Sep 26 15:14:29 BST 2022

JOB TITLE : BL08 Sandown Run01

FLAC/SLOPE (Version 8.10)

LEGEND

26-Sep-22 15:14

Factor of Safety 1.12

Max. shear strain-rate

1.00E-05
4.00E-05
7.00E-05
1.00E-04
1.30E-04
1.60E-04
1.90E-04

Contour interval= 1.0000E-05
Extrap. by averaging
(zero contour omitted)
Boundary plot

0 1E 2

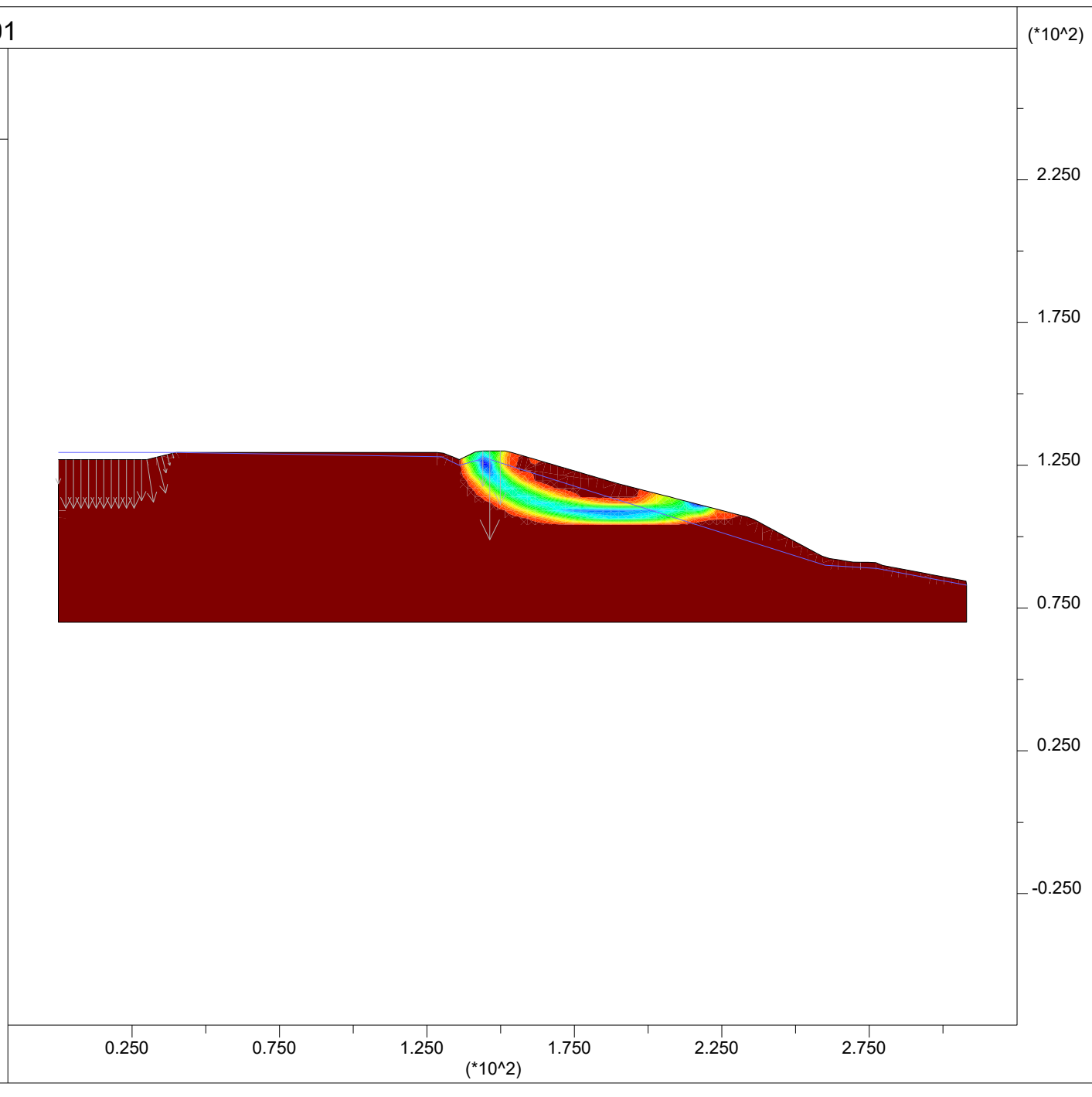
Water Table

Net Applied Forces

max vector = 1.149E+05

0 2E 5

Plough Geotechnical Limited
Strains



JOB TITLE : BL08 Sandown Run02

FLAC/SLOPE (Version 8.10)

LEGEND

26-Sep-22 15:20

Factor of Safety 0.99

Max. shear strain-rate

5.00E-06
1.50E-05
2.50E-05
3.50E-05
4.50E-05
5.50E-05
6.50E-05
7.50E-05

Contour interval= 5.0000E-06
Extrap. by averaging
(zero contour omitted)
Boundary plot

0 5E 1

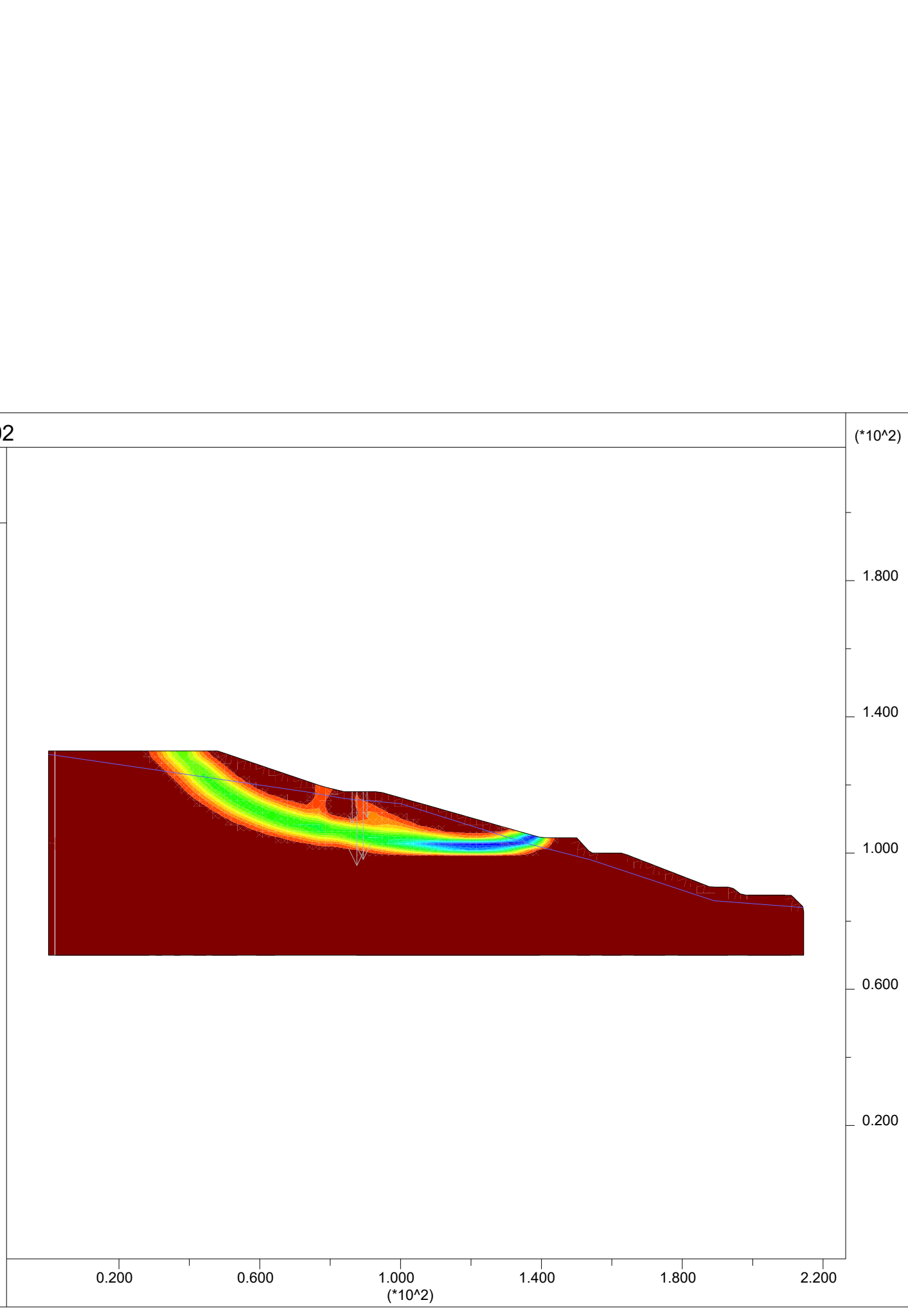
Water Table

Net Applied Forces

max vector = 6.094E+04

Plough Geotechnical Limited

Strains



JOB TITLE : BL08 Sandown Run03

FLAC/SLOPE (Version 8.10)

LEGEND

26-Sep-22 15:23

Factor of Safety 1.14

Max. shear strain-rate

2.00E-06
6.00E-06
1.00E-05
1.40E-05
1.80E-05
2.20E-05

Contour interval= 2.0000E-06
Extrap. by averaging
(zero contour omitted)
Boundary plot

0 5E 1

Water Table

Net Applied Forces

max vector = 6.697E+04

0 2E 5

Plough Geotechnical Limited
Strains

(*10^2)
2.250
1.750
1.250
0.750
0.250
-0.250
0.250 0.750 1.250 1.750 2.250 2.750
(*10^2)

JOB TITLE : BL08 Sandown Run04

FLAC/SLOPE (Version 8.10)

LEGEND

26-Sep-22 15:28

Factor of Safety 1.10

Max. shear strain-rate

1.00E-05
3.00E-05
5.00E-05
7.00E-05
9.00E-05
1.10E-04

Contour interval= 1.0000E-05
Extrap. by averaging
(zero contour omitted)
Boundary plot

0 5E 1

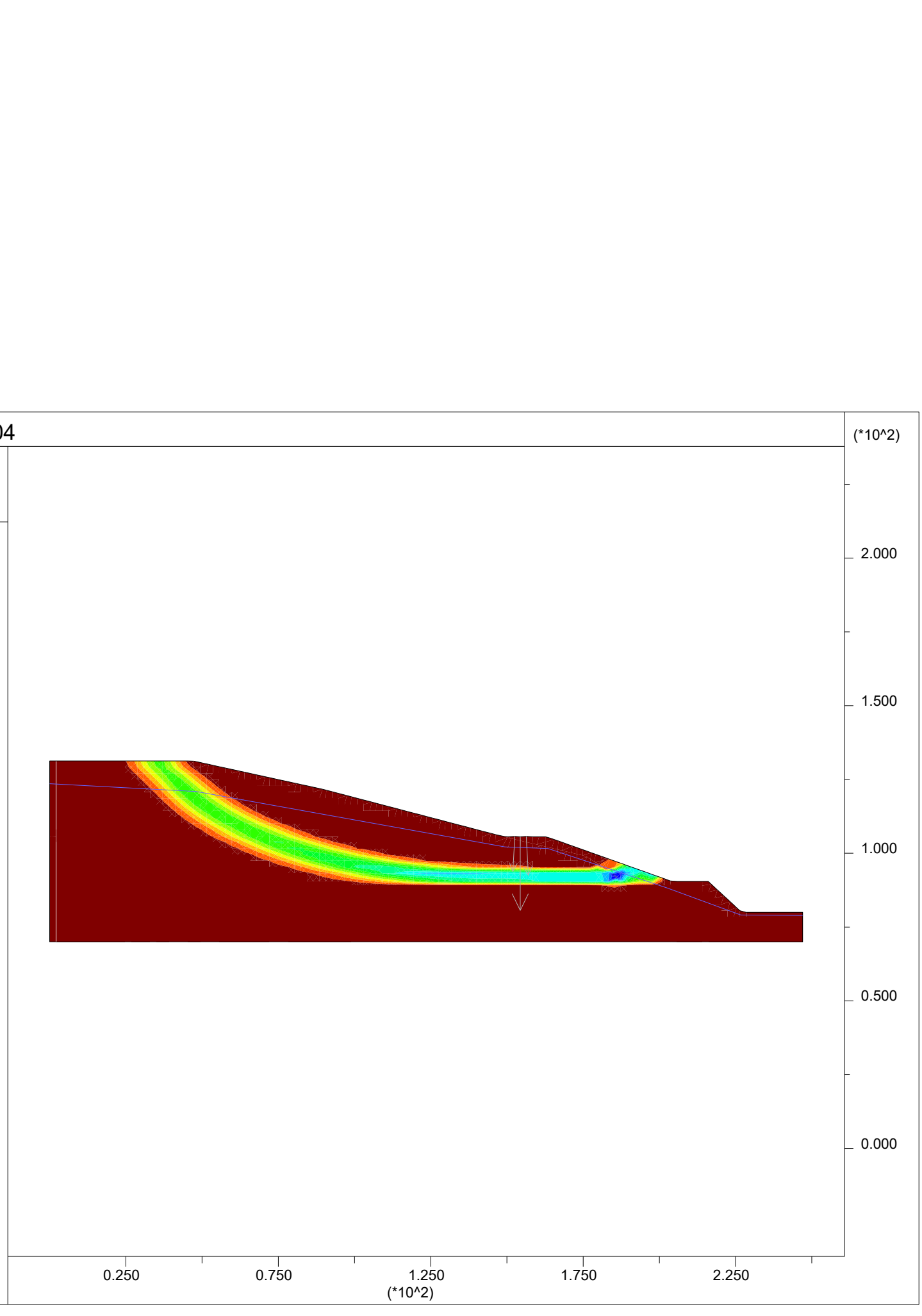
Water Table

Net Applied Forces

max vector = 7.349E+04

0 2E 5

Plough Geotechnical Limited
Strains



Appendix D

Veneer Stability Spreadsheets

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Stability of Veneer System
Upslope Placement with Plant on short lift of waste

SCENARIO 2

Calculations By: Alan Binns BSc CEng FICE **Checked By:** S Ferley BSc PhD CEng MICE

References: **Based on lab tests of failed material carried out in April 2017**

QIAN X., KOERNER R. M. and GRAY D. H. Geotechnical Aspects of Landfill Design and Construction. Prentice Hall, New Jersey, 2001
KOERNER, R. M. Designing with Geosynthetics (5th Edition). Prentice Hall, New Jersey, 2005
JONES, D. R. V. and DIXON, N. Stability of Landfill Lining Systems: Report No. 1 Literature Review. R&D Technical Report P1-385/TR1. Environment Agency, 2002
Industry Code of Practice: Landfill Engineering: Geosynthetic Interface Shear Resistance Testing.
Text agreed by Environment Agency technical staff and Landfill Regulation Group (Engineering sub group) members. January 2016

Date of assessment:

Slope design of **Sidewall Lining System**

Eng Clay liner
Marl permeable layer

	Long Term Design Tensile strength kN/m	Reduction Factor for creep RF_{CR}	Reduction Factor for installation damage RF_{ID}	Reduction Factor for degradation RF_{CBD}	Characteristic Tensile Strength kN/m
over	41.48	2.04	1.30	1.00	110.00
over	2.37	1.30	1.30	1.00	4.00
over	10.92	1.35	1.30	1.20	23.00
over	5.95	1.40	1.20	1.20	12.00
over	10.00	2.00	1.30	1.00	26.00
over	0.00				

Refer to QKG, Section 14.7 for guideline values of RF_{CR}, RF_{ID} & RF_{CBD}

For Combination 2 the partial factors are A2 + M2 + R1

The partial factors are obtained from EC7 and the National Annex

Parameter		Symbol	STR/GEO - Partial factor sets A2	STR/GEO - Partial factor sets M2	R1	EC7 Ref
Permanent action (G)	Unfavourable	$\gamma_{G;dst}$	1.00		1.00	Table A.3
	Favourable	$\gamma_{G;stb}$	1.00		1.00	Table A.3
Variable action (Q)	Unfavourable	$\gamma_{Q;dst}$	1.30		1.00	Table A.3
	Favourable	-	0.00		1.00	Table A.3
Accidental action (A)	Unfavourable	$\gamma_{A;dst}$	1.00		1.00	Clause 2.4.5.1.3
	Favourable	-	0.00		1.00	Clause 2.4.5.1.3
Angle of shearing resistance (tan ϕ')		$\gamma_{\phi'}$		1.25		Table A.NA.4
Effective cohesion (c')		$\gamma_{c'}$		1.25		Table A.NA.4
Angle of shearing resistance (tan ϕ_u)		$\gamma_{\phi u}$		1.40		Table A.NA.4
Undrained shear strength (c_u)		γ_{cu}		1.40		Table A.NA.4
Weight density (γ) or unit weight		γ_{γ}		1.00		Table A.4

Combination 2 = A2 + M2 + R1

Permanent actions,G, (loads) from buildings etc at top of slope (unfavourable) are multiplied by 1.00 (no structures allowed on veneer)
Permanent actions,G, from buildings etc at bottom of slope (favourable) are multiplied by 1.00 (no structures allowed on veneer)
Variable actions, Q, from plant etc at top of slope (unfavourable) are multiplied by 1.30
Variable actions, Q, from plant etc at bottom of slope (favourable) are multiplied by 0.00
Accidental actions, A, from impact, explosion etc at top of slope (unfavourable) are multiplied by 1.00
Accidental actions, A, from impact, explosion etc at bottom of slope (favourable) are multiplied by 0.00
Effective shear strength parameters (c' and tan ϕ') are divided by 1.25
Undrained shear strength (c_u) is divided by 1.40
Densities are unfactored for the design

The Over Design Factor Γ = resisting forces/disturbing forces
The GEO limit state for each combination is satisfied when Γ ≥ 1 for that combination

Combination 2 = A2 + M2 + R1

Parameter		Example	Factors A2	
Permanent action (G)	Unfavourable	Permanent load at top of slope	$\gamma_{G;dst}$	1.00
	Favourable	Permanent load at base of slope	$\gamma_{G;stb}$	1.00
Variable action (Q)	Unfavourable	Surcharge at top of slope	$\gamma_{Q;dst}$	1.30
	Favourable	Surcharge at base of slope	-	0.00
Accidental action (Q)	Unfavourable	Blast at top of slope	$\gamma_{A;dst}$	1.00
	Favourable	Blast at base of slope	-	0.00

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Stability of Veneer System
Upslope Placement with Plant on short lift of waste

SCENARIO 2

Calculations By: Alan Binns BSc CEng FICE **Checked By:** S Ferley BSc PhD CEng MICE

Cover Material *(for soils where undrained state is not applicable [i.e. purely frictional soils] enter same values as drained case)*

Eng Clay liner			Factors M2		Design		Comments
Angle of shearing resistance (ϕ'_c)	36.00	degrees	$\gamma_{\phi'}$	1.25	ϕ'_d	30.17	Peak Parameter
Effective cohesion (c'_c)	2.00	kPa	$\gamma_{c'}$	1.25	c'_d	1.60	Peak Parameter
Angle of shearing resistance (ϕ_{uc})	30.00	degrees	$\gamma_{\phi u}$	1.40	ϕ_{ud}	22.41	Peak Parameter
Undrained shear strength (c_{uc})	0.00	kPa	γ_{cu}	1.40	c_{ud}	0.00	Peak Parameter
Weight density ($\gamma_{moist\ c}$) above water table	17.00	kN/m^3	γ_γ	1.00	$\gamma_{moist\ d}$	17.00	
Weight density ($\gamma_{sat\ c}$) below water table	17.50	kN/m^3	γ_γ	1.00	$\gamma_{sat\ d}$	17.50	

Interface 1 *(where undrained state is not applicable enter same values as for drained case)*

Eng Clay liner/Marl permeable layer			Factors M2		Design		Comments
Angle of shearing resistance (δ')	34.00	degrees	$\gamma_{\phi'}$	1.25	δ'_d	28.35	Peak Parameter
Effective cohesion (α')	2.00	kPa	$\gamma_{c'}$	1.25	α'_d	1.60	Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained shear strength (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 2 *(where undrained state is not applicable enter same values as for drained case)*

			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 3 *(where undrained state is not applicable enter same values as for drained case)*

			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 4 *(where undrained state is not applicable enter same values as for drained case)*

			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 5 *(where undrained state is not applicable enter same values as for drained case)*

			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 6 *(where undrained state is not applicable enter same values as for drained case)*

			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Stability of Veneer System
Upslope Placement with Plant on short lift of waste

SCENARIO 2

Calculations By: Alan Binns BSc CEng FICE **Checked By:** S Ferley BSc PhD CEng MICE

Slope Information

Cover soils thickness	h	0.50	m
Height of slope	H	3.00	m
Slope angle (1 in X)	X	1.50	
Slope angle	β	33.69	°
b/h ratio*	-	0.00	
Parallel Submergence Ratio (PSR) in cover soils	-	0.20	

* Ratio of track width to cover soil thickness

Construction Plant (Unfactored Loads)

Plant Type				
Model				
Width of Track Shoe		mm		
Length of Track on Ground		m		
Ground Contact Area		m^2		
Ground Pressure		kPa		
Maximum Speed Forward		kph		
Max Gross Weight		kg		
Plant Speed		kph	0.00 mph	0.00 m/s
Braking Time		s		
Boussinesq Influence Factor	1.00	QKG Fig 13.7 p493		

Slope Reinforcement

Notes on design process:
1. Initial design should be carried out with no reinforcement included in cover soil/drainage layer. If tension subsequently occurs in one or more of the capping elements then a re-assessment should be carried out with reinforcement added. The tensile forces generated in each veneer element are summarised on the final sheet.
2. The value of required tensile force can be reduced as required, provided the relevant design criteria are all met.

Is tensile reinforcement included in cover soil or drainage layer? (Y/N)	**NO**	
No reinforcement in design - ENTER ZERO VALUE	0.00	kN/m
Has the veneer stability analysis indicated ODF ≥ 1.00 for each element?	NO	
Has the integrity analysis indicated zero tension in each veneer element?	#REF!	
	#REF!	

Specification for Reinforcement

Required safety factor for reinforcement design	1.20	
Reduction Factor for creep RF_{CR}	2.00	Refer to QKG, Section 14.7 and Koerner Table 3.3 for guideline values of RF_{CR}, RF_{ID} & RF_{CBD}
Reduction Factor for installation damage RF_{ID}	1.10	
Reduction Factor for degradation RF_{CBD}	1.10	
Allowable tensile strength of reinforcement	0.00	kN/m
Characteristic tensile strength of reinforcement	0.00	kN/m

Client: Byrne Looby
Project No: BL08
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Eurocode 7 Combination 2
Stability of Veneer System
Upslope Placement with Plant on short lift of waste
SCENARIO 2

Veneer Stability Analysis Summary (EC7 Design Approach 1 Combination 2)

Based on lab tests of failed material carried out in April 2017

Drained Geosynthetic Interface Shear Strength:		**Peak Parameter**			**Over Design Factor**	
		EC7 Combination 2 Parameters			**With Plant**	**No Plant**
Interface 1 -	Eng Clay liner/Marl permeable layer	**δ'1**	28.4		#DIV/0!	1.44
Interface 1 -	Eng Clay liner/Marl permeable layer	**α'1**	1.6			
Interface 2 -	Not Used	**δ'2**		degrees		
Interface 2 -	Not Used	**α'2**		kPa		
	Eng Clay liner					
	Interface 3 -					
Interface 4 -	Not Used	**δ'4**		degrees		
Interface 4 -	Not Used	**α'4**		kPa		
Interface 5 -	Not Used	**δ'5**		degrees		
Interface 5 -	Not Used	**α'5**		kPa		
Interface 6 -	Not Used	**δ'6**		degrees		
Interface 6 -	Not Used	**α'6**		kPa		

Undrained Geosynthetic Interface Shear Strength:		**Peak Parameter**			**Over Design Factor**	
		EC7 Combination 2 Parameters			**With Plant**	**No Plant**
Interface 1 -	Eng Clay liner/Marl permeable layer	**δ_u1**		degrees		
Interface 1 -	Eng Clay liner/Marl permeable layer	**α_u1**		kPa		
Interface 2 -	Not Used	**δ_u2**		degrees		
Interface 2 -	Not Used	**α_u2**		kPa		
Interface 3 -	0	**δ_u3**		degrees		
Interface 3 -	0	**α_u3**		kPa		
Interface 4 -	Not Used	**δ_u4**		degrees		
Interface 4 -	Not Used	**α_u4**		kPa		
Interface 5 -	Not Used	**δ_u5**		degrees		
Interface 5 -	Not Used	**α_u5**		kPa		
Interface 6 -	Not Used	**δ_u6**		degrees		
Interface 6 -	Not Used	**α_u6**		kPa		

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Stability of Veneer System
Upslope Placement with Plant on short lift of waste

SCENARIO 2

The interfaces considered in this analysis are:

Upper Surface of Liner Element (Marl permeable layer)

Interface 1 -	Eng Clay liner/Marl permeable layer	**δ'1**	28.4	degrees
Interface 1 -	Eng Clay liner/Marl permeable layer	**α'1**	1.6	kPa

Lower Surface of Liner Element (Marl permeable layer)

Interface 2 -	Not Used	**δ'2**		degrees
Interface 2 -	Not Used	**α'2**		kPa
Allowable Tensile Strength of Liner Element - Marl permeable layer			41.5	kN/m

Eng Clay liner

1. Sliding of Eng Clay liner over Marl permeable layer

Parallel Submergence Ratio (PSR) in cover soils	**0.20**		
GCL			
Pore pressure on top of Marl permeable layer (calculated from PSR)		0.82	kPa
Pore pressure at base of Marl permeable layer (calculated from PSR)		0.82	kPa
Pore pressure at base of Marl permeable layer (user defined)		0.84	kPa

Calculated Parameters:

Vertical height of active wedge (m)	H'	2.50	
Length of lower surface of active wedge (m)	L	4.51	
Thickness of water layer in cover soils (m)	h_w	0.10	
Adhesive force-upper surface of Marl permeable layer (kN/m)	C_a	7.21	QKG eq 13.6
Cohesive force along failure plane of passive wedge (kN/m)	C = c*h/sinβ	1.44	QKG eq 13.8
Weight of active wedge (kN/m)	W_A	33.92	QKG eq 13.40
Weight of passive wedge (kN/m)	W_P	4.61	QKG eq 13.41
Construction plant gravitational loading (kPa)	q	#DIV/0!	
Equivalent equipment loading (kN/m)	W_e	#DIV/0!	QKG eq 13.10
Dynamic equipment force downslope at geomembrane interface (kN/m)	F_e	#DIV/0!	QKG eq 13.11
Equipment force normal to active wedge (kN/m)	N_e	#DIV/0!	QKG eq 13.12
Pore pressure resultant under active wedge perp to slope (kN/m)	U_{an}	3.62	QKG eq 13.37
Pore pressure resultant on interwedge surfaces (kN/m)	U_H	0.05	QKG eq 13.38
Soil Force normal to active wedge on upper surface of Marl permeable layer (kN/m)	N_a	24.64	QKG eq 13.21
Resultant of pp on bottom of passive wedge (= Uv in Jones et al) (kN/m)	U_{pn}	0.07	QKG eq 13.39
Soil Force normal to active wedge on lower surface of Marl permeable layer (kN/m)	N_{aL}	24.53	
Tension force provided by reinforcement (kN/m)	T	0.00	

Parameters for ODF solution (calculated using design values of actions)	Term	With plant	No plant	
	a =	#DIV/0!	15.67	QKG eq 13.36 modified
	b =	#DIV/0!	-27.19	QKG eq 13.36 modified
	c =	#DIV/0!	6.61	QKG eq 13.36 modified
ODF for sliding of Eng Clay liner over Marl permeable layer with plant			**#DIV/0!**	QKG eq 13.36 modified
ODF for sliding of Eng Clay liner over Marl permeable layer no plant			**1.44**	QKG eq 13.36 modified
	PSR=	**0.20**	**and using**	**Peak Parameter EC7 Combination 2 Parameters**

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Liner Stability of Infinite Slope

SCENARIO 1

Calculations By: Alan Binns BSc CEng FICE **Checked By:**

References:

QIAN X., KOERNER R. M. and GRAY D. H. Geotechnical Aspects of Landfill Design and Construction. Prentice Hall, New Jersey, 2001

KOERNER, R. M. Designing with Geosynthetics (5th Edition). Prentice Hall, New Jersey, 2005

JONES, D. R. V. and DIXON, N. Stability of Landfill Lining Systems: Report No. 1 Literature Review. R&D Technical Report P1-385/TR1. Environment Agency, 2002

Industry Code of Practice: EA Landfill Engineering: Geosynthetic Interface Shear Resistance Testing.

GE Barnes: Soil Mechanics Principles and Practice, 2nd edition, Palgrave, 2000

Date of assessment:

Slope design of	Sidewall Lining System	Long Term Design Tensile strength kN/m	Reduction Factor for creep RF_{CR}	Reduction Factor for installation damage RF_{ID}	Reduction Factor for degradation RF_{CBD}	Characteristic Tensile Strength kN/m
	Eng Clay liner					
over	Marl permeable layer	11.83	1.30	1.30	1.00	20.00
over		9.47	1.30	1.30	1.00	16.00
over		0.00	1.30	1.30	1.00	
over		0.00	1.30	1.30	1.00	

Refer to QKG, Section 14.7 for guideline values of RF_{CR}, RF_{ID} & RF_{CBD}

		Factors M2		**Factors M1**		
Angle of shearing resistance (tan ϕ')	$\gamma_{\phi'}$	1.25	Table A.NA.4	Permanent action (G) Unfavourable		1.00
Effective cohesion (c')	$\gamma_{c'}$	1.25	Table A.NA.4	Variable action (Q) Unfavourable		1.30
Angle of shearing resistance (tan ϕ_u)	$\gamma_{\phi u}$	1.40	Table A.NA.4			
Undrained shear strength (c_u)	γ_{cu}	1.40	Table A.NA.4			
Weight density (γ) or unit weight	γ_{γ}	1.00	Table A.4			

Cover Material *(for soils where undrained state is not applicable [i.e. purely frictional soils] enter same values as drained case)*

Eng Clay liner			Factors M2		Design		Comments
Angle of shearing resistance (ϕ'_c)	36.00	degrees	$\gamma_{\phi'}$	1.25	ϕ'_d	30.17	Peak Parameter
Effective cohesion (c'_c)	2.00	kPa	$\gamma_{c'}$	1.25	c'_d	1.60	Peak Parameter
Angle of shearing resistance (ϕ_{uc})	0.00	degrees	$\gamma_{\phi u}$	1.40	ϕ_{ud}	0.00	Peak Parameter
Undrained shear strength (c_{uc})	0.00	kPa	γ_{cu}	1.40	c_{ud}	0.00	Peak Parameter
Weight density ($\gamma_{moist\ c}$) above water table	18.00	kN/m^3	γ_{γ}	1.00	$\gamma_{moist\ d}$	18.00	
Weight density ($\gamma_{sat\ c}$) below water table	21.00	kN/m^3	γ_{γ}	1.00	$\gamma_{sat\ d}$	21.00	

			Factors M2		Design		Comments
Angle of shearing resistance (ϕ'_c)		degrees	$\gamma_{\phi'}$	1.25	ϕ'_d		Peak Parameter
Effective cohesion (c'_c)		kPa	$\gamma_{c'}$	1.25	c'_d		Peak Parameter
Angle of shearing resistance (ϕ_{uc})		degrees	$\gamma_{\phi u}$	1.40	ϕ_{ud}		Peak Parameter
Undrained shear strength (c_{uc})		kPa	γ_{cu}	1.40	c_{ud}		Peak Parameter
Weight density ($\gamma_{moist\ c}$) above water table		kN/m^3	γ_{γ}	1.00	$\gamma_{moist\ d}$		
Weight density ($\gamma_{sat\ c}$) below water table		kN/m^3	γ_{γ}	1.00	$\gamma_{sat\ d}$		

			Factors M2		Design		Comments
Angle of shearing resistance (ϕ'_c)		degrees	$\gamma_{\phi'}$	1.25	ϕ'_d		Peak Parameter
Effective cohesion (c'_c)		kPa	$\gamma_{c'}$	1.25	c'_d		Peak Parameter
Angle of shearing resistance (ϕ_{uc})		degrees	$\gamma_{\phi u}$	1.40	ϕ_{ud}		Peak Parameter
Undrained shear strength (c_{uc})		kPa	γ_{cu}	1.40	c_{ud}		Peak Parameter
Weight density ($\gamma_{moist\ c}$) above water table		kN/m^3	γ_{γ}	1.00	$\gamma_{moist\ d}$		
Weight density ($\gamma_{sat\ c}$) below water table		kN/m^3	γ_{γ}	1.00	$\gamma_{sat\ d}$		

Interface 1 *(where undrained state is not applicable enter same values as for drained case)*

Eng Clay liner/ Marl permeable layer			Factors M2		Design		Comments
Angle of shearing resistance (δ')	31.60	degrees	$\gamma_{\phi'}$	1.25	δ'_d	26.20	Peak Parameter
Effective cohesion (α')	4.70	kPa	$\gamma_{c'}$	1.25	α'_d	3.76	Peak Parameter
Angle of shearing resistance (δ_u)	31.60	degrees	$\gamma_{\phi u}$	1.25	δ_{ud}	26.20	Peak Parameter
Undrained shear strength (α_u)	4.70	kPa	γ_{cu}	1.40	α_{ud}	3.36	Peak Parameter

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Liner Stability of Infinite Slope

SCENARIO 1

Calculations By: Alan Binns BSc CEng FICE **Checked By:**

Interface 2 *(where undrained state is not applicable enter same values as for drained case)*

Protection Geotextile/1 mm HDPE FML			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.25	α_{ud}		Peak Parameter

Interface 3 *(where undrained state is not applicable enter same values as for drained case)*

1 mm HDPE FML/Weathered shale			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.25	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 4 *(where undrained state is not applicable enter same values as for drained case)*

Weathered shale/GCL			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.40	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 5 *(where undrained state is not applicable enter same values as for drained case)*

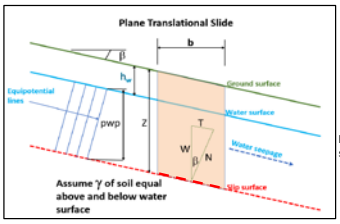
GCL/Soil blinding layer			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.25	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Interface 6 *(where undrained state is not applicable enter same values as for drained case)*

1 mm HDPE FML/Soil blinding layer			Factors M2		Design		Comments
Angle of shearing resistance (δ')		degrees	$\gamma_{\phi'}$	1.25	δ'_d		Peak Parameter
Effective adhesion (α')		kPa	$\gamma_{c'}$	1.25	α'_d		Peak Parameter
Angle of shearing resistance (δ_u)		degrees	$\gamma_{\phi u}$	1.25	δ_{ud}		Peak Parameter
Undrained adhesion (α_u)		kPa	γ_{cu}	1.40	α_{ud}		Peak Parameter

Client: Byrne Looby
Project No: BL08
Project Name: Sandown LFS

Eurocode 7 Combination 2
Liner Stability of Infinite Slope
SCENARIO 1



L = Length of machine track on ground = b/cosβ
shown heavy broken line in diagram

ODF without machine forces & without reinforcement

$$ODF = \frac{c' + \tan\phi' \cos^2\beta\,(\gamma z - \gamma_w z + \gamma_w h_w)}{\gamma z \sin\beta\cos\beta}$$

ODF with machine forces & with reinforcement

$$ODF = \frac{c' + \tan\phi' (\cos^2\beta\,(\gamma z - \gamma_w z + \gamma_w h_w) + N_e/L] + T/L}{\gamma z \sin\beta\cos\beta + (F_e/L)\cos\beta}$$

0.5 m Clay liner on marl

ODF	EC7 Overdesign factor without machine loading & NO reinforcement	**1.04**	**SAFE**	**Slope 1 in**	**2.00**	**Slip between Eng Clay liner & Marl permeable layer - Effective**	EC7 Overdesign factor without machine loading & with reinforcement	**1.52**	**SAFE**
	EC7 Overdesign factor with machine loading & NO reinforcement	**1.04**	**SAFE**				EC7 Overdesign factor with machine loading & with reinforcement	**1.10**	**SAFE**
c'	Cohesion on slip surface	1.6	kPa				**REINFORCEMENT PROVIDED**		
ϕ'	Angle of friction on slip surface	28.4	degrees	0.494802	radians				
γ	Unit vweight of cover soils	17.5	kN/m³						
γ_w	Unit vweight of water	10	kN/m³						
β	angle of slope	26.57	degrees	0.463648693	radians	**Soil slope**	**2.00**		
z	depth to slip surface	0.5	m						
h_w	depth to water surface	0.1	m			**PSR**	**0.8**	**water at top of cover soil - completely saturated pore pressure on slip surface, u = 10kPa**	
L	Length of machine track on ground	2.36	m	**D6D Excavator**					
		Char loads							
q	Machine gravitational loading	59.00	kPa	**Design loadings**	**EC7-DC2 PF**				
W_e	Equivalent machine loading	93.52	kN/m	**121.58**	1.3				
F_e	Machine static & Dynamic force downslope at interface	48.45	kN/m	**62.98**	1.3	**Machine static force downslope W_eSinβ**	**54.37**		
N_e	Force normal to interface	83.65	kN/m	**108.75**	1.3				

ODF	EC7 Overdesign factor without machine loading & NO reinforcement	**#DIV/0!**	**#DIV/0!**	**Slope 1 in**	**2.00**	**Slip between - Effective**	EC7 Overdesign factor without machine loading & with reinforcement	**#DIV/0!**	**#DIV/0!**
	EC7 Overdesign factor with machine loading & NO reinforcement	**#DIV/0!**	**#DIV/0!**				EC7 Overdesign factor with machine loading & with reinforcement	**#DIV/0!**	**#DIV/0!**
c'	Cohesion on slip surface		kPa				**REINFORCEMENT PROVIDED**		
ϕ'	Angle of friction on slip surface		degrees	0	radians				
γ	Unit vweight of cover soils		kN/m³						
γ_w	Unit vweight of water		kN/m³						
β	angle of slope	26.57	degrees	0.463648693	radians	**Soil slope**	**2.00**		
z	depth to slip surface		m						
h_w	depth to water surface		m			**PSR**	**#DIV/0!**	**water at top of cover soil - completely saturated pore pressure on slip surface, u = 10kPa**	
L	Length of machine track on ground	2.36	m	**D6D Excavator**					
		Char loads							
q	Machine gravitational loading	59.00	kPa	**Design loadings**	**EC7-DC2 PF**				
W_e	Equivalent machine loading	93.52	kN/m	**0.00**					
F_e	Machine static & Dynamic force downslope at interface	48.45	kN/m	**0.00**		**Machine static force downslope W_eSinβ**	**0.00**		
N_e	Force normal to interface	83.65	kN/m	**0.00**					

ODF	EC7 Overdesign factor without machine loading & NO reinforcement	**#DIV/0!**	**#DIV/0!**	**Slope 1 in**	**2.00**	**Slip between - Effective**	EC7 Overdesign factor without machine loading & with reinforcement	**#DIV/0!**	**#DIV/0!**
	EC7 Overdesign factor with machine loading & NO reinforcement	**#DIV/0!**	**#DIV/0!**				EC7 Overdesign factor with machine loading & with reinforcement	**#DIV/0!**	**#DIV/0!**
c'	Cohesion on slip surface		kPa				**REINFORCEMENT PROVIDED**		
ϕ'	Angle of friction on slip surface		degrees	0	radians				
γ	Unit vweight of cover soils		kN/m³						
γ_w	Unit vweight of water		kN/m³						
β	angle of slope	26.57	degrees	0.463648693	radians	**Soil slope**	**2.00**		
z	depth to slip surface		m						
h_w	depth to water surface		m			**PSR**	**#DIV/0!**	**allowing for perched water in waste pore pressure on slip surface, u = 8kPa**	
L	Length of machine track on ground	2.36	m	**D6D Excavator**					
		Char loads							
q	Machine gravitational loading	59.00	kPa	**Design loadings**	**EC7-DC2 PF**				
W_e	Equivalent machine loading	93.52	kN/m	**0.00**					
F_e	Machine static & Dynamic force downslope at interface	48.45	kN/m	**0.00**		**Machine static force downslope W_eSinβ**	**0.00**		
N_e	Force normal to interface	83.65	kN/m	**0.00**					

Slope Information

Cover soils thickness	h	1.00	m
Height of slope	H	29.00	m
Slope angle (1 in X)	X	2.00	
Slope angle	β	26.57	°
b/h ratio*	-	0.51	
Parallel Submergence Ratio (PSR) in cover soils	-	1.00	

* Ratio of track width to cover soil thickness

Construction Plant (Unfactored Loads)

Plant Type	Excavator	
Model	D6D	
Width of Track Shoe	508	mm
Length of Track on Ground	2.36	m
Ground Contact Area	2.40	m²
Ground Pressure	59.00	kPa
Maximum Speed Forward	10.80	kph
Max Gross Weight	14434	kg
Plant Speed	7.50	kph
Braking Time	3.00	s
Boussinesq Influence Factor	0.67	QKG Fig 13.7 p493

4.66 mph

2.08 m/s

Specification for Reinforcement

Required EC7 Partial safety factor for reinforcement design		1.00					
Reduction Factor for creep RF_{CR}		2.00					
Reduction Factor for installation damage RF_{ID}		1.10		Refer to QKG, Section 14.7 and Koerner Table 3.3 for guideline values of RF_{CR}, RF_{ID} & RF_{CBD}			
Reduction Factor for degradation $RF_{Y,min}$		1.10					
		Required		**Actual value**		**Actual value**	
Required design tensile strength of reinforcement	T_{design}	3.96	kN/m	**4.96**	T_{design}/b =	**2.10**	**kN/m²** **OK-tensile str ok**
Characteristic tensile strength of reinforcement		9.59	kN/m	**12**	**Secugrid 30/30 at 2% strain**		

Appendix E

Coal Mining Report

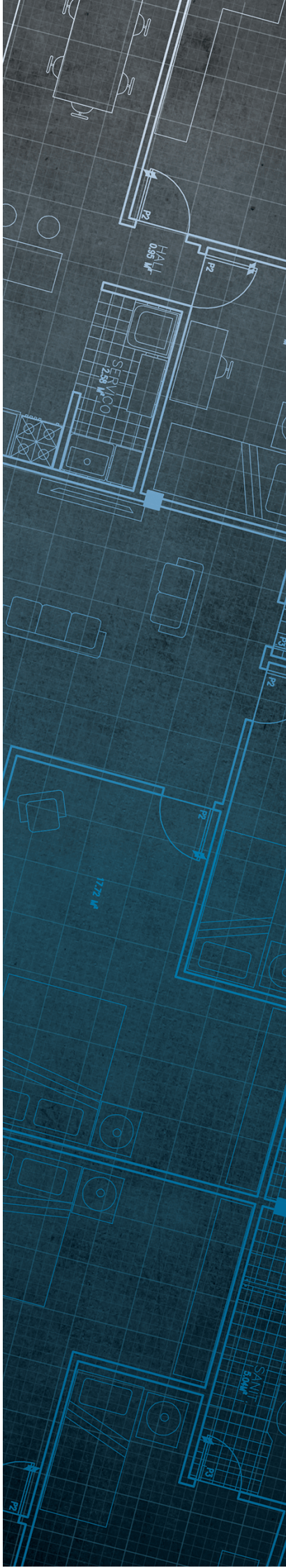
The Coal Authority

Consultants

Coal Mining Report

404353 301972
West Midlands

Date of enquiry:	**30 August 2022**
Date enquiry received:	**30 August 2022**
Issue date:	**30 August 2022**
Our reference:	**51003308105001**
Your reference:	**GS-9015316**



Consultants
Coal Mining Report

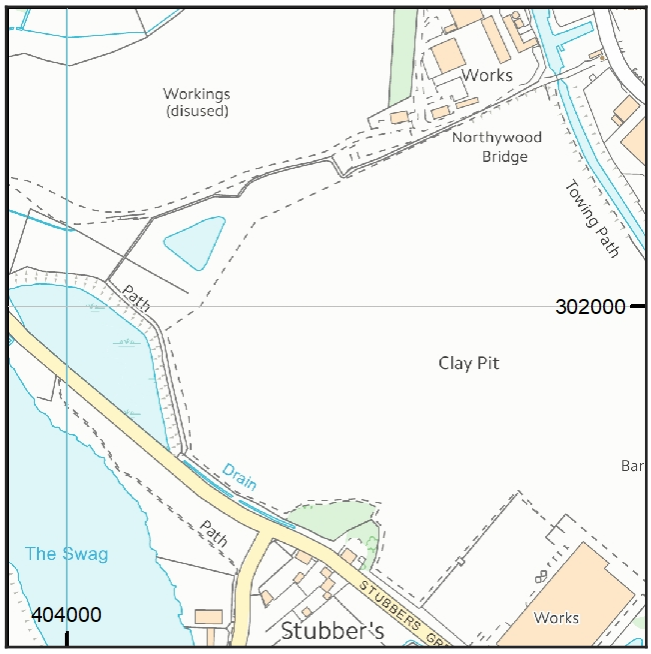
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

GROUNDSURE LIMITED

Enquiry address

404353 301972
West Midlands



Approximate position of property

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

@coalauthority
/company/the-coal-authority
/thecoalauthority
/thecoalauthority

Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	BOTTOM ROBINS	Coal	232J	201	Beneath Property	6.0	North	176	1909
unnamed	BOTTOM ROBINS	Coal	232G	203	Beneath Property	3.0	North	176	1927
unnamed	BOTTOM ROBINS	Coal	232I	205	Beneath Property	5.4	North-East	176	1909
unnamed	GUBBIN IRONSTONE MEASURES	Ironstone	22TY	206	Beneath Property	2.5	North	100	1870
unnamed	WYRLEY YARD	Coal	231J	208	Beneath Property	4.1	North	71	1875
unnamed	BOTTOM ROBINS	Coal	231O	209	Beneath Property	2.9	North-West	176	1935
unnamed	WYRLEY YARD	Coal	231F	209	Beneath Property	4.0	North-West	71	1903
unnamed	WYRLEY YARD	Coal	231I	210	Beneath Property	3.5	North	71	1915
unnamed	WYRLEY YARD	Coal	231G	210	South-West	6.3	North	71	1917
unnamed	WYRLEY YARD	Coal	231A	212	Beneath Property	3.3	North-West	71	1928
unnamed	WYRLEY YARD	Coal	231H	215	Beneath Property	0.0	East	71	1902
unnamed	BOTTOM ROBINS	Coal	231N	216	North-East	0.0	East	176	1929
unnamed	CHARLES	Coal	22SJ	219	Beneath Property	3.7	North	155	1908
unnamed	CHARLES	Coal	22SK	220	Beneath Property	3.7	North	155	1909
unnamed	BOTTOM ROBINS	Coal	231M	225	North-East	2.7	North-West	176	1915
unnamed	BROOCH	Coal	230X	227	Beneath Property	4.1	North-West	106	1933
unnamed	CHARLES	Coal	22SM	231	Beneath Property	0.0	East	155	1907
unnamed	BROOCH	Coal	230T	231	Beneath Property	2.2	North	106	1905
unnamed	CHARLES	Coal	22SL	231	North-East	0.0	East	155	1936
unnamed	BROOCH	Coal	230U	237	South-West	6.9	North	106	1906
unnamed	BOTTOM ROBINS	Coal	232H	250	South-West	9.3	North	176	1907
unnamed	BROOCH	Coal	230W	255	North-East	3.8	West	106	1884

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	YARD	Coal	22W1	339	Beneath Property	3.8	North-West	145	1905
unnamed	YARD	Coal	22YO	341	Beneath Property	4.4	North	145	1892
unnamed	YARD	Coal	22W2	344	North-East	2.9	North-West	145	1885
unnamed	YARD	Coal	22W4	369	North	4.5	North-West	145	1935
unnamed	SHALLOW	Coal	22NR	373	Beneath Property	2.8	North	213	1920
unnamed	DEEP	Coal	238U	374	East	3.4	West	167	1844
unnamed	DEEP	Coal	22LG	375	Beneath Property	4.7	North-West	167	1936
unnamed	SHALLOW	Coal	22OS	377	Beneath Property	4.5	North-West	213	1933
unnamed	DEEP	Coal	22LH	377	North-East	2.0	North	167	1892
unnamed	DEEP	Coal	22JZ	381	Beneath Property	4.6	North	167	1892
unnamed	SHALLOW	Coal	22OT	382	North-East	2.6	North	213	1911
unnamed	SHALLOW	Coal	22NQ	408	East	6.1	West	213	1888

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	404301-001	404509 301798	was grouted down to 134 metres and capped under the supervision of Wardell Armstrong Consultants for Leigh Interests in 1981/82	Coal	
Shaft	404301-002	404554 301761	was grouted down to 134 metres and capped under the supervision of Wardell Armstrong Consultants for Leigh Interests in 1981/82	Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

WM30	5435	12248
3992		

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining
None recorded.

Coal mining licensing
None recorded within 200 metres of the enquiry boundary.

Court orders
None recorded.

Section 46 notices
No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices
The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land
The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk.**

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines
Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips
Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations
Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites
Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence
Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas
Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes
Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining
Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing
Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders
Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices
Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices
Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The Coal Authority

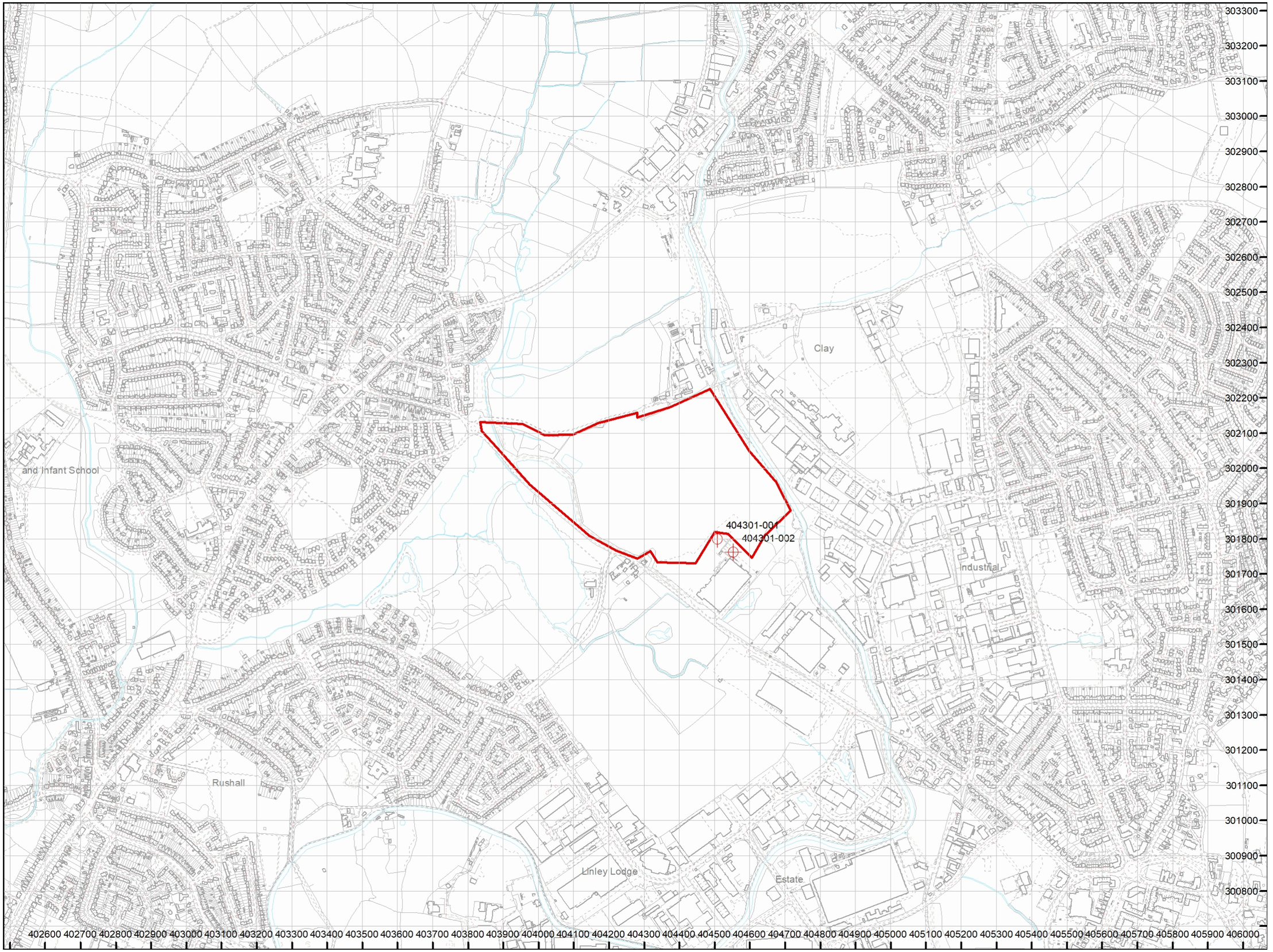
Summary of findings

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

Approximate position of the enquiry boundary shown

Disused mine shaft



How to contact us
0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com