



# Saxon Pit Southern Buttress

## Waste Recovery Plan

### East Midlands Waste Management Ltd

Saxon Works, Peterborough Road, Whittlesey, PE7 1PJ

Prepared by:

#### SLR Consulting Limited

3rd Floor, Brew House, Jacob Street, Tower Hill,  
Bristol, BS2 0EQ

SLR Project No.: 416.065341.00001

16 December 2024

Revision: 2

## Basis of Report

This document has been prepared by SLR Consulting Limited (SLR) with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with East Midlands Waste Management Limited (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.



## Table of Contents

<b>Basis of Report .....</b>	<b>i</b>
<b>Drawings.....</b>	<b>ii</b>
<b>Appendices.....</b>	<b>ii</b>
<b>1.0 Introduction .....</b>	<b>1</b>
1.1 Site Location and Setting .....	1
1.2 Planning Status .....	2
1.3 Demonstrating Waste Recovery .....	2
<b>2.0 Purpose of the Development .....</b>	<b>2</b>
2.1 How the scheme will be carried out and completed.....	2
2.2 Why the scheme is needed.....	3
2.3 How the scheme will meet the need .....	3
2.4 Quantity of Waste Used .....	4
2.4.1 Direct Replacement of Non-Waste Material.....	4
2.4.2 Minimum Amount of Waste Needed to Achieve the Function.....	4
2.4.3 Consideration of Alternative Proposals .....	4
2.5 Meeting Quality Standards.....	5
<b>3.0 Waste Recovery Criteria.....</b>	<b>6</b>
3.1 Obligations to do the Work.....	6
3.1.1 The Quarries Regulations .....	6
3.1.2 Regulation 33 Geotechnical Assessment .....	7
3.1.3 Obligation to Carry Out the Works .....	7
<b>4.0 Waste Suitability .....</b>	<b>7</b>
4.1 Waste Sources.....	7
4.2 Waste Types .....	8
4.3 Suitability of the Waste for the Scheme .....	8
<b>5.0 Conclusion.....</b>	<b>9</b>

## Drawings

- 001 Site Location Plan
- 002 Construction & Cross-Sections

## Appendices

- A Factual Ground Investigation Report – Saxon Pit, Whittlesey
- B Regulation 33 Geotechnical Assessment, Saxon Pit, Whittlesey
- C Stability Assessment of Proposed Stabilisation Buttress, Saxon Pit



## 1.0 Introduction

SLR Consulting Ltd (SLR) has been instructed by East Midlands Waste Management Limited (EMWM) to prepare a Waste Recovery Plan (WRP) in support of an application for a waste recovery Environmental Permit for the construction of a buttress for essential works to stabilise the southern face of the quarry associated with the former Saxon brickworks site, located at Peterborough Road, Whittlesey, PE7 1PD (the Site).

A Geotechnical Assessment has been carried out under Regulation 33 of the Quarry Regulations 1999 which finds that failures occurring at the southern slope of Saxon Pit represent a significant hazard. Consequently, EMWM propose to construct a buttress using approximately 216,700m<sup>3</sup> of suitable imported materials to stabilise the slope, to be authorised under an Environmental Permit as a waste recovery operation.

This WRP describes the proposed scheme and how it will meet the criteria to demonstrate that the permanent deposit of waste is a recovery operation.

### 1.1 Site Location and Setting

Saxon Pit is an inactive quarry site located immediately to the west of the town of Whittlesey in Cambridgeshire at National Grid Reference 525754E, 297057N. Saxon Pit comprises an excavation in the Oxford Clay which is between 18 and 27 metres deep and lies between the A605 Peterborough Road to the north and the Peterborough to March railway line to the south.

The eastern boundary of Saxon Pit is adjacent to a housing estate and the nearest residential properties to the proposed developments are located 250 to the east along Priors Road.

The Site is bounded to the southeast by the Peterborough to March railway line, beyond which lies the canalised Kings Dyke watercourse.

The original Saxon Brickworks and associated infrastructure which were located in the pit have now been decommissioned and buildings have been demolished or repurposed. The general site is now operated as a waste management and plant hire facility by EMWM. Access to the site is via the A605 to the north of the Site.

The Site Location is shown in Drawing 001.

The exhausted clay pit has historically suffered from several minor failures of the quarry face along its eastern and southern boundaries.

Following site investigations in 1997 and 1998 it was recommended that Hanson (the site owner at the time) undertake a slope face stabilisation scheme based on buttressing of these slopes using imported inert waste material. This was initially undertaken under a waste exemption, until a change in the Regulations required the activity to secure an Environmental Permit, which was granted originally to Glazewing Ltd in 2012. EMWM has operated the site under the current waste recovery permit (Ref EPR/BB3038Y) since October 2017.

Under the existing recovery permit, the eastern slope has been stabilised by regrading works which involved cutting back the slope crest combined with limited buttressing installed to the lower parts, using imported waste materials.

Multiple shallow failures have been observed in the south/south-western slope along the quarry face adjacent to the Peterborough to March railway line. As a consequence, it is now proposed to carry out a buttressing exercise on the southern quarry face.

In addition to the permanent deposit of material to construct the buttress, the Site will also incorporate appropriate materials reception, screening and storage areas.



## 1.2 Planning Status

The Site has a long planning history and following the cessation of mineral extraction and associated brickworks, several planning permissions have been granted over the years for relating to restoration of the site and its use for waste management activities.

Notably planning permission F/02026/02/CW was granted on 18 November 2003 for the following works:

- *“The importation of controlled inert construction and demolition wastes for the buttressing, stabilisation and restoration of a former mineral excavation face together with associated waste materials reception area”*

These existing stabilisation works for the eastern face are largely complete. A new planning application PP-13218261v1 has been submitted on 30 July 2024 to Cambridgeshire County Council for the works to stabilise the southern face of the quarry. EMWM intend the planning and environmental permitting applications to be submitted and determined concurrently.

## 1.3 Demonstrating Waste Recovery

The Environment Agency’s (EA) guidance<sup>1</sup> states that ‘Waste recovery on land, or deposit for recovery, is when you use waste material in place of non-waste material you would have used to perform a function’.

This WRP demonstrates how the proposed construction of the buttress at Saxon Pit with inert waste constitutes recovery in line with the requirements of the EA Waste Recovery Guidance. The WRP specifically addresses the issues set out in that Guidance, in order to demonstrate that if waste material couldn’t be used the work would be done to achieve the same outcome using non-waste.

## 2.0 Purpose of the Development

### 2.1 How the scheme will be carried out and completed

Essential works are required to stabilise the unrestored southern face of the quarry associated with the former Saxon brickworks site. The stabilisation will involve the placement of suitable imported material to construct an engineered buttress against the southern face of the quarry.

The buttress has been designed with a 1V:3H gradient for the main and south-western section to achieve an acceptable factor of safety for the slope gradient.

The design also takes into account the constraints posed by presence of existing site buildings at the toe of the buttress, which are under third party ownership. To address this it is proposed to install a retaining structure, such as a gabion wall at the toe of the slope.

Based on an isopachyte of the existing topography and the proposed buttress design, approximately 216,700m<sup>3</sup> of material will be required for the construction (between 325,500 and 390,600 tonnes assuming a density between 1.5 and 1.8 tonnes/m<sup>3</sup>).

All material will need to be imported for the construction of the buttress as a cut-and-fill approach is not an option for the stabilisation works. This is due to the proximity of the crest of the former quarry slope to the adjacent railway and surface water feature behind the crest of the slope meaning that it is not possible to cut the existing slope back to a suitably stable profile. In addition, all excess material which remained following closure of the quarry has

---

<sup>1</sup> <https://www.gov.uk/government/publications/deposit-for-recovery-operators-environmental-permits/waste-recovery-plans-and-deposit-for-recovery-permits>



been incorporated into the previous stabilisation phase on the eastern quarry face. The material will be imported inert clays and soils, likely to be sourced from local construction, demolition and excavation (CD&E) projects and will conform to inert Waste Acceptance Criteria (iWAC) as set out in the 2003/33/EC: Council Decision of 19 December 2002<sup>2</sup>.

The buttress-forming material will be placed to an earthworks specification<sup>3</sup> and will follow placement methods similar to those in the existing recovery permit to achieve the proposed profile and cross-sections presented in Drawing 002. In general terms this comprises:

- The former quarry floor and faces will be cleared and trimmed to remove any loose debris
- The imported material will be placed in layers and be notionally compacted by the bull dozer.
- The profile of the buttress will be controlled through topographic surveying and the use of survey boards where required.

Following completion of the engineered buttress, the slope will be finished with a comprehensive landscaping and ecological enhancement scheme designed to integrate with the existing restoration/planting scheme to the east of the site.

Surface water run-off will be managed via a swale at the base of the buttress which will direct flow to the existing on-site drainage scheme and attenuation lagoon.

It is estimated that buttress engineering work and restoration would take seven years to complete.

## 2.2 Why the scheme is needed

SLR understands that there have been historical and ongoing stability issues with other parts of the quarry faces for many years since quarrying operations ceased. The northern and eastern slopes have already been subjected to stabilisation by construction of buttresses. The southern slope, which is adjacent to the railway, now needs to be stabilised due to multiple shallow failures being recorded.

Initial visual inspections indicate that the shallow failures are contained within the uppermost soils of the slope, typically within the weathered zone of the Oxford Clay and sections containing peat. However, subsequent monitoring carried out as part of a ground investigation<sup>4</sup> in 2017 has established that displacement of the slope is occurring and that the crest of the slope is migrating back toward the railway line. A copy of the ground investigation report is provided in Appendix A of this WRP.

A subsequent Geotechnical Assessment carried out under Regulation 33 of the Quarry Regulations in 2024 identifies that the southern excavation face of the quarry presents a significant hazard which has potential to affect the nearby railway line and any site operations within the immediate vicinity of the slope. A copy of the assessment is provided in Appendix B.

## 2.3 How the scheme will meet the need

It is proposed to construct a buttress to increase the overall stability of the slope and address the hazard identified by the Geotechnical Assessment. Due to the presence of third-party

---

<sup>2</sup> 2003/33/EC: Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC

<sup>3</sup> Manual of Contract Documents for Highway Work Volume 1 Specification for highway works, national highways.

<sup>4</sup> SLR Consulting Ltd. 'Factual Ground Investigation Report – Saxon Pit, Whittlesey.' December 2017. Ref: 403.07764.00001.



land to the south and rail infrastructure to the north, the crest of the existing slope cannot be cut back to reduce the gradient and therefore a buttress is considered to be the only effective solution.

A geotechnical stability assessment of the proposed stabilisation buttress has been carried out and a copy provided in Appendix C. The assessment incorporates the results of testing carried out on samples of the in-situ material and groundwater level monitoring data. The slope forming the majority of the buttress along the south-western edge of the site has been modelled, as well as the slope adjacent to the existing site buildings. This latter additional assessment has been carried out as this section has been proposed to be steeper than the rest of the buttress, to reduce the lateral extent of the buttress at the toe of the slope to allow the existing buildings to remain in-situ. It may be necessary to install a retaining structure, such as a gabion wall, at the toe to achieve acceptable factor of safety (FOS) for the slope whilst retaining the existing buildings.

Initial stability analyses have been assessed which produce an acceptable FOS, however it should be noted that any retaining buttress would need to be considered further at detailed design stage, including stability of the buttress itself.

To ensure ongoing stability of the buttress, a specific earthworks specification will be adopted as well as regular topographic surveys and reporting of progress.

## **2.4 Quantity of Waste Used**

### **2.4.1 Direct Replacement of Non-Waste Material**

The Quarry Regulations require that the significant hazard presented by the instability of the slope is addressed. The layout of the site (location of existing third party buildings) means that the only practicable solution is to construct a buttress. The use of suitable inert wastes to achieve this outcome will directly replace non-waste virgin materials which would otherwise have had to be used to achieve this function.

### **2.4.2 Minimum Amount of Waste Needed to Achieve the Function**

It is anticipated that approximately 216,700m<sup>3</sup> (between 325,500 and 390,600 tonnes assuming a density between 1.5 and 1.8 tonnes/m<sup>3</sup>) of suitable imported material will be required for the construction of the buttress. The design of the buttress, and therefore the quantity of material required, is constrained by the presence of third-party buildings at the toe of the slope, the need to achieve an acceptable factor of safety (FOS) for the final contours and the need for it to tie in with the existing buttress on the eastern face to optimise landscape and ecological benefits.

Use of less material would result in a steeper, less stable slope which would not meet the required stabilisation and FOS.

Alternative designs incorporating a more extensive or higher retention wall would impact on the seamless integration of the 2 profiles with a resultant negative impact on ecology and landscape.

More material cannot be used due to the presence of existing buildings.

### **2.4.3 Consideration of Alternative Proposals**

The construction will involve the use of carefully selected reclamation materials of suitable chemical and physical properties to achieve a stable slope.

Other stabilisation methodologies have been considered including the use of soil nails, netting and retaining structures such as gabion walls.



Due to the geotechnical properties of the overlying overburden (alluvium and peat) soil nails and netting are not appropriate techniques for stabilising this type of material. Similarly with the underlying Oxford Clay, the discontinuities and general geological structure of the strata is not suited to soil nailing. Mesh or netting is typically used to stabilise hard rock slopes rather than the weathered mudstone which forms the Oxford Clay at the Site, this is therefore not considered an appropriate solution in this scenario.

To use other stabilisation methods such as gabions, due to the height of the slope there would be a requirement to cut the crest of the slope back initially. However, this is not desirable due to the proximity of the railway line and surface water ditch. It was considered that the use of gabion baskets for the full height of the slope would not be a suitable long term solution for the stabilisation of this phase of works at the site.

## 2.5 Meeting Quality Standards

The construction of the buttress would be carried out and implemented in strict accordance with the planning application and consent, which has been applied for from Cambridgeshire County Council. The planning and environmental permit applications are to be submitted in parallel to minimise the end-to-end consenting timeframe. This WRP assumes that approval for the proposed scheme will be granted by the Minerals and Waste Planning Authority, but does not rely on the consent to justify that the scheme is recovery.

Operations at the site would be undertaken in accordance with EMWM's Environmental Management System (EMS), which would also ensure procedures are implemented to achieve appropriate standards for managing environmental impacts.

In addition, the operations would be supervised by technically competent persons who hold the necessary Certificate of Technical Competence (CoTC) under the Waste Management Industry Training and Advisory Board (WAMITAB).

Furthermore, the proposed development would be carried out in accordance with the conditions of an Environmental Permit issued and regulated by the EA under the provisions of the Environmental Permitting (England & Wales) Regulations 2016.

Strict waste acceptance procedures would ensure that only suitable materials are accepted at the site.

Construction operations will be conducted in accordance with an approved method statement and risk assessment, to ensure that the work is carried out to an appropriate recognised standard such as Series 600 Specification for Highways.

An earthworks methodology will be set out in detail in an engineering specification that will be completed prior to undertaking any works. This will set out requirements for:

- Material acceptance testing and classification;
- Requirements for placement trials;
- Material placement and compaction requirements (method or end product placement);
- Requirements for in-situ testing during and following placement of materials;
- Procedures to be followed where materials or compaction are deemed not to have met the specification; and
- Requirements for any monitoring of the compaction / engineering works.

The finished re-profiling layer will be engineered to ensure that it integrates with the existing stabilisation buttressing and approved restoration scheme for the eastern slope and suitable



for the landscaping and ecological enhancement scheme required under (assumed) planning consent.

The finished scheme will be designed and operated to ensure that it does not result in any environmental problems such as soil erosion, pollution or increase the risk of flooding in the surrounding area.

It is considered that the foregoing factors will ensure that the proposal will be completed to an appropriate standard.

## 3.0 Waste Recovery Criteria

The EA guidance describes 3 main ways of providing evidence that waste is being used in place of non-waste, namely:

- obligations to do work;
- financial gain; or
- availability of funding to use non-waste.

Only one of these is required to demonstrate that the activity is recovery. In the case of the construction of the buttrass, there is a requirement under the Quarry Regulations to ensure that risks to health and safety resulting from instability is avoided and the stabilisation works are essential to achieve this. The following sections describe how these essential works demonstrate that there is an enforceable obligation to carry out the work.

### 3.1 Obligations to do the Work

#### 3.1.1 The Quarries Regulations

Part VI of The Quarries Regulations (1999) Health and Safety states:

*“The operator shall ensure that excavations and tips are designed, operated and maintained so as to ensure that –*

*(a) instability; or*

*(b) movement,*

*which is likely to give rise to a risk to the health and safety of any person is avoided”.*

These Regulations further require that:

*“The operator shall ensure that a suitable and sufficient appraisal of all proposed or existing excavations or tips at the quarry is undertaken by a competent person in order determine whether any such excavation or tip is a significant hazard” and that “Where the conclusion reached by the competent person following an appraisal made pursuant to paragraph (1) is that the excavation or tip represents a significant hazard, the operator shall ensure that a geotechnical assessment is carried out in accordance with the requirements of regulation 33 as soon as is reasonably practicable”.*

Regulation 33 states that; *“The operator shall ensure that any remedial works identified during the geotechnical assessment in accordance with paragraph (1)(c) are undertaken by the date specified”.*



### 3.1.2 Regulation 33 Geotechnical Assessment

A Regulation 33 Geotechnical Assessment<sup>5</sup> has been carried out of the quarry as required under Part IV of the Quarry Regulations 1999. This assessment considered excavation faces, tips, surface water features and stockpiles present at the site. A copy of the report is provided in Appendix B.

The report identifies that the southern excavation face of the quarry presents a significant hazard, defined as a face which exceeds 15m in depth and/or the overall slope angle exceeds 1V:1H. Further, that the slope's irregular crestline is characterized by a series of localized failures that dominate the entire upper section of the slope. The downslope movement of material has created backscarps of varying sizes along the slope length with a maximum anticipated depth of about 10m.

The progressive deterioration and/or recession of the existing slope crest represents a significant hazard which has potential to affect the nearby railway line and any site operations within the immediate vicinity of the slope, to the extent that it is recommended that further operations within the facility are conducted at a safe distance from the cut slope. It is further recommended that the slope ridge is not subject to any heavy vehicular traffic.

### 3.1.3 Obligation to Carry Out the Works

The Geotechnical Assessment carried out under Regulation 33 of the Quarries Regulations concludes that the exposed southern quarry face represents a significant hazard and that remedial works are required to stabilise/buttress the face to avoid risk to health and safety. The report recommends that steps to improve the situation following necessary regulatory processes must begin within 2 years and be monitored regularly in the interim and when works start.

The Health & Safety Executive (HSE) has been informed of this significant hazard by submission of the Geotechnical Assessment and in accordance with Regulation 33, there is an obligation to carry out remedial works by a specified date. Failure to carry out the works would constitute non-compliance with the Quarry Regulations and potential enforcement action by the HSE.

Therefore, it is considered that this satisfies the required criterion of an enforceable obligation to demonstrate that the construction of the buttress restoration is a recovery activity.

## 4.0 Waste Suitability

It is confirmed that only waste material that is suitable for the intended purpose and won't cause pollution will be used in the construction of the buttress at Saxon Pit.

### 4.1 Waste Sources

Approximately 217,000m<sup>3</sup> (between 325,500 and 390,600 tonnes assuming a density between 1.5 and 1.8 tonnes/m<sup>3</sup>) of suitable imported material will be required for the construction of the buttress.

The material used for the buttress will be imported inert clays and soils, likely to be sourced from local construction, demolition and excavation (CD&E) projects. Typical sources will be wastes extracted for construction of foundations, bored pilings etc and which will consist mainly of naturally occurring soils, stones, clay or sandy clay or soils. The proportion of

---

<sup>5</sup> SLR Consulting Ltd. 'Regulation 33 Geotechnical Assessment – Saxon Pit, Whittlesey' June 2024, Ref 403.07764.00001



recycled material within these waste streams is low and, as such, it is anticipated that the material will consist predominantly of uncontaminated, naturally occurring soils and stones.

## 4.2 Waste Types

The waste types which will be used for the development are detailed in Table 4-1 below with their associated European Waste Catalogue (EWC) code. These waste types have historically been accepted by the EA as being potentially suitable for recovery.

Table 4-1 List of Wastes to be Accepted

EWC Code	Description
01	WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS
01 01	wastes from mineral excavation
01 01 02	Waste from non metalliferous excavation excluding silt and tailings
01 04	wastes from physical and chemical processing of non-metalliferous minerals
01 04 08	Waste gravel and crushed rocks other than those containing dangerous substances
01 04 09	Waste sand and clays
17	CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	concrete, bricks, tiles and ceramics
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles & ceramics
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 05	Soils Stones and Dredging Soil
17 05 04	Soil and Stones
19	WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE
19 12	wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified
19 12 09	Minerals (for example sand, stones)
20	MUNICIPAL WASTE (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS
20 02	Garden and Park Wastes
20 02 02	Soil and Stones

## 4.3 Suitability of the Waste for the Scheme

Strict acceptance procedures will be implemented at the site to ensure only uncontaminated inert materials that are suitable for the required engineering specification are used in the



recovery operation. Procedures will be in place to visually inspect imported materials at the weighbridge as they enter the site to confirm that they conform with the description of the source and waste transfer note. A second visual inspection will be carried out when the materials are tipped in the construction area by a trained operative.

Any materials which are found to be unsuitable will be placed in a designated quarantine area. Depending on the reason for being unsuitable, they will either be removed from site for treatment or disposal at an appropriately permitted facility or placed in a stockpile for crushing to an appropriate size for restoration. Any such incidents will be recorded and reported to the Environment Agency.

All waste accepted at the Site will be inert, and no contaminated materials will be accepted. Documentation will accompany all waste material accepted, which will be reviewed in accordance with the Site's waste pre-acceptance and acceptance procedures to ensure any materials used are suitable for use in the restoration operations.

An earthworks methodology will be set out in detail in an engineering specification that will be completed prior to undertaking any works. This will set out requirements for:

- Material acceptance testing and classification;
- Requirements for placement trials;
- Material placement and compaction requirements (method or end product placement);
- Requirements for in-situ testing during and following placement of materials;
- Procedures to be followed where materials or compaction are deemed not to have met the specification; and
- Requirements for any monitoring of the compaction / engineering works.

A description of the material acceptance procedures for the restoration of the Site, including basic characterisation and on-site verification will be included in the environmental permit application. These procedures will ensure that only materials that are both chemically and physically suitable for use in the recovery activity will be accepted at the Site.

## 5.0 Conclusion

In view of the foregoing details it is concluded that the proposed use of waste for the construction of the buttrass at Saxon Pit using inert waste satisfies all the requirements of a recovery operation as the main aim is to replace a non-waste material that would have been used in the operation, with a waste material that performs the same function. In summary:

- there is a statutory obligation to do the work under the Quarry Regulations;
- the waste is suitable for the intended purpose;
- there are clear benefits and genuine need to do the work;
- alternative proposals that could use a smaller amount of waste have been considered but will not achieve the function required; and
- the proposal will be completed to an appropriate standard.

EMWM has identified a legitimate opportunity to use waste materials in a sustainable fashion to achieve significant improvements to the stabilisation of Saxon Pit and has demonstrated that the proposed scheme satisfies all 'recovery' criteria.

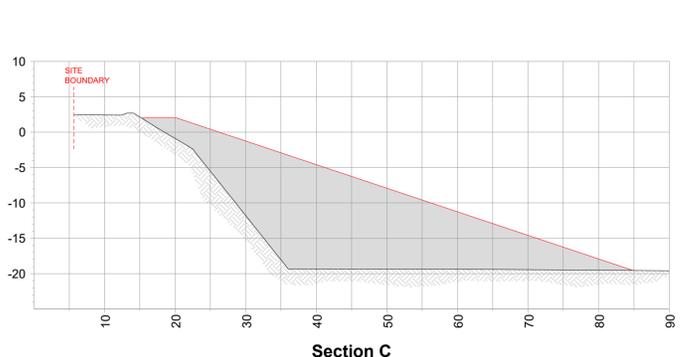
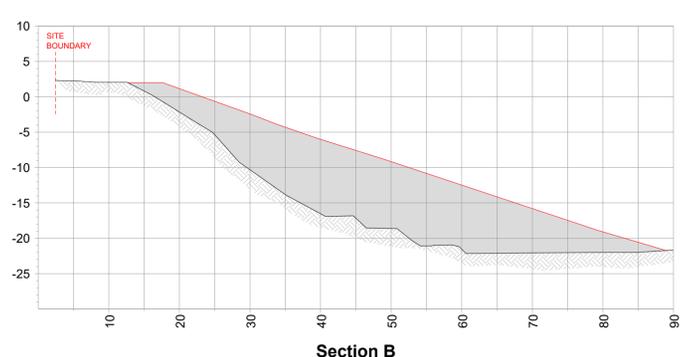
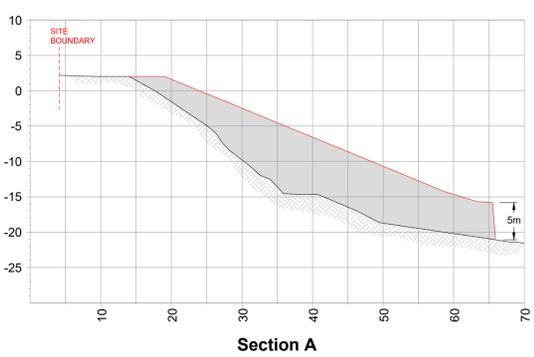
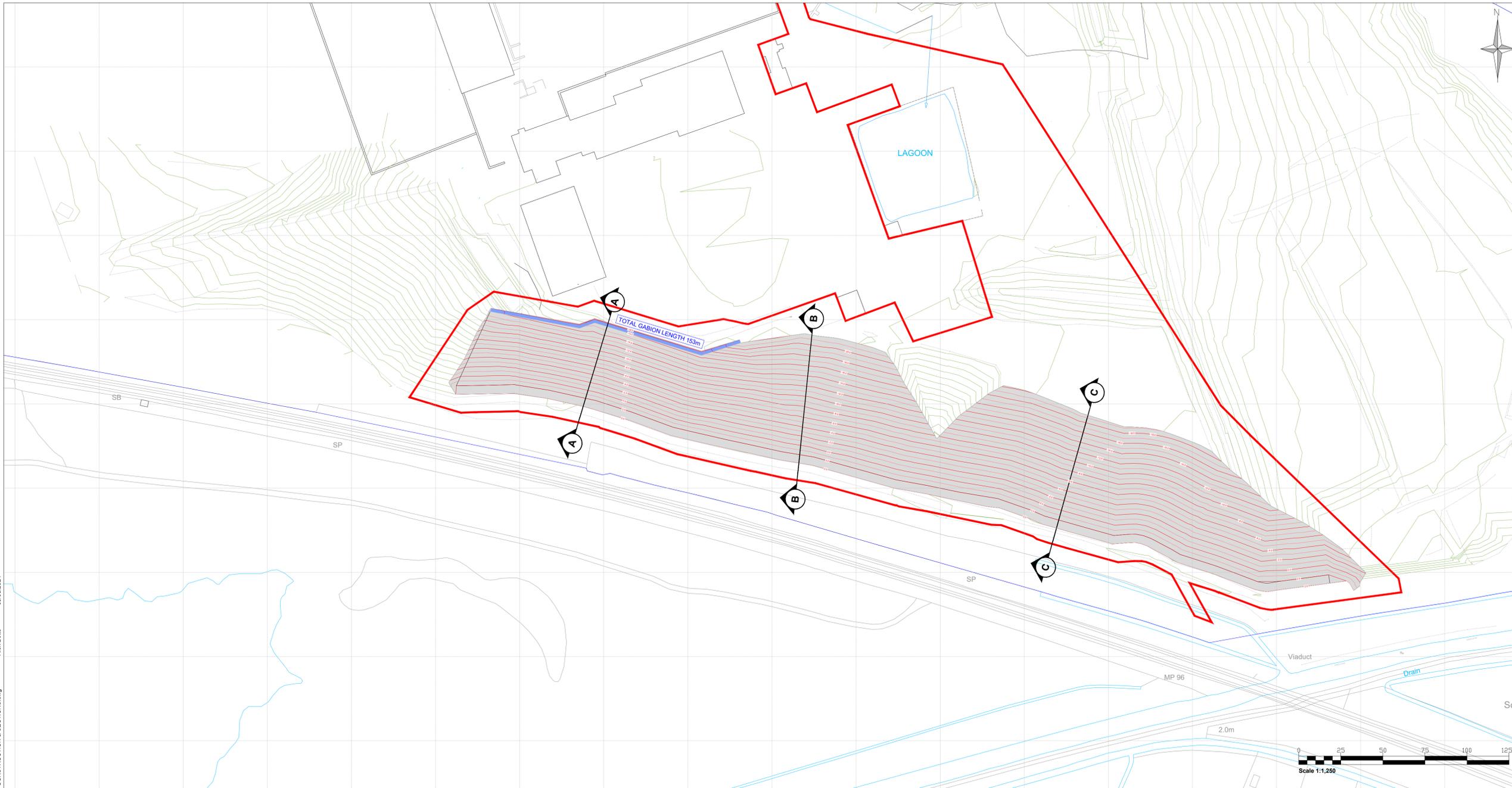


# Drawings



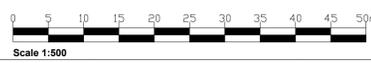


- Notes:**
- 
- Legend:**
- SURVEY 12-02-19
  - BUTTRESS AND GABIONS
  - SECTION - TOPO PROFILE
  - SECTION - PROPOSED BUTTRESS DESIGN PROFILE



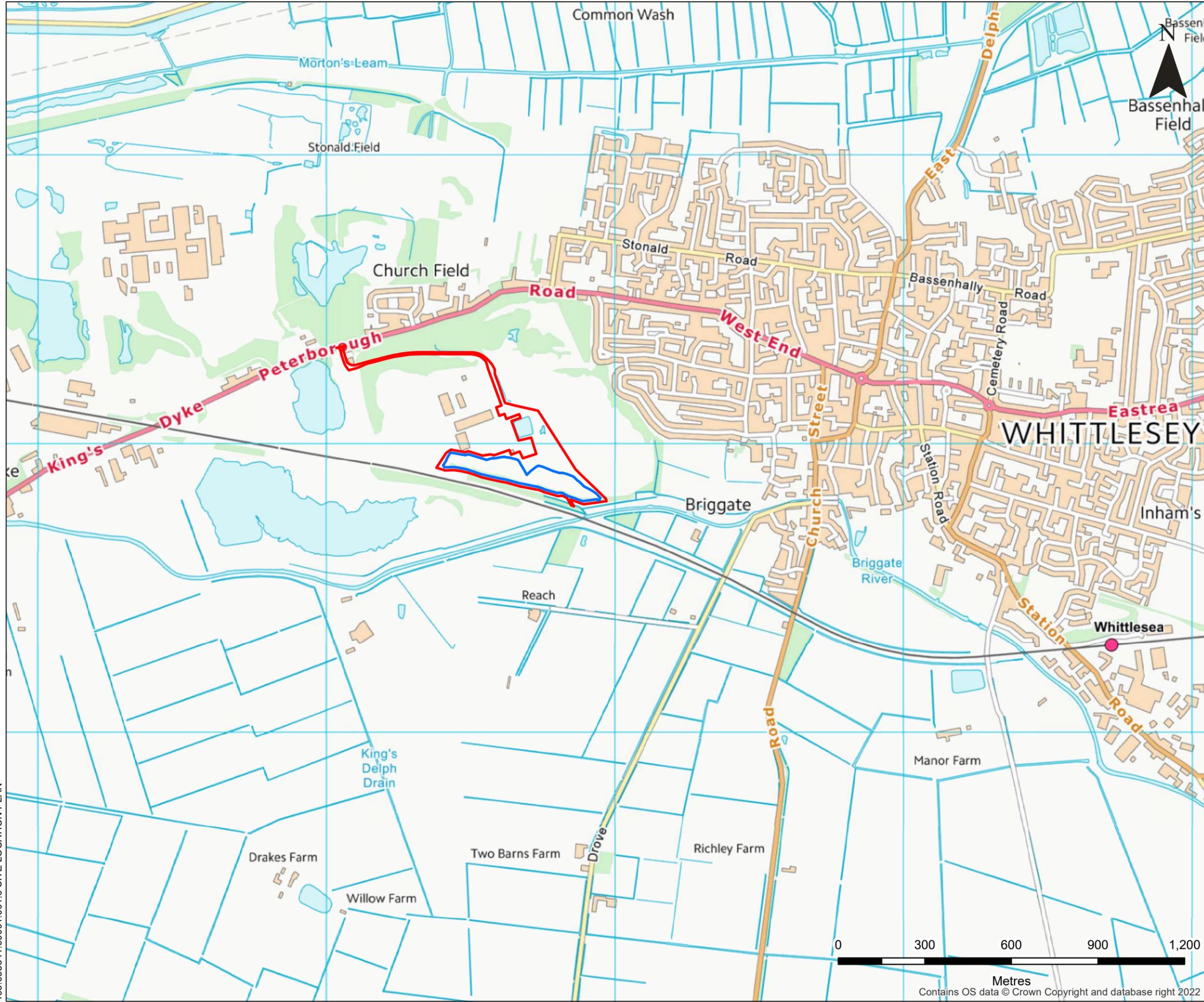
**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2D Area	Cut	Fill	Net
VOLUME CUT AND FILL	1.000	1.000	31980.84sq.m	50.51 Cu. M.	196091.00 Cu. M.	196040.49 Cu. M.<Fill>
Totals			31980.84sq.m	50.51 Cu. M.	196091.00 Cu. M.	196040.49 Cu. M.<Fill>



Rev	Amendments	Date	By	Chk	Auth
 www.slrconsulting.com					
Drawing Status & Suitability Code					
Client EAST MIDLANDS WASTE MANAGEMENT					
Project SAXON PIT SOUTHERN BUTTRESS WASTE RECOVERY PLAN					
Drawing Title CONSTRUCTION AND CROSS-SECTIONS					
Scale AS SHOWN @ A1	SLR Project No. 416.065341.00001				
Designed AB	Drawn AB	Checked SL	Authorised TD		
Date 09.23	Date 09.23	Date 09.23	Date 09.23		
Drawing Number 002					Rev 0

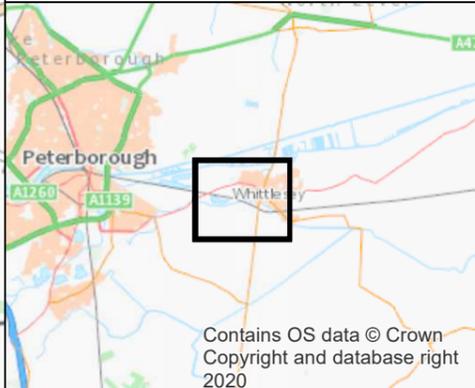
05/09/2024 Alex Betts B:\077640 - East Midlands Waste Management Ltd\416.065341.00001 - Saxon Pit Waste Recovery Application\Tech\EMPC\Drawings\403.065341.00001.002.0 CONSTRUCTION & SECTIONS.dwg



NOTES  
1.

LEGEND

- PHASE 2
- PROPOSED BUTTRESS



**EAST MIDLANDS  
WASTE MANAGEMENT**

**SLR**

GROUND FLOOR  
HELMONT HOUSE  
CHURCHILL WAY  
CARDIFF, CF10 2HE  
T: 0292 049 1010  
www.slrconsulting.com

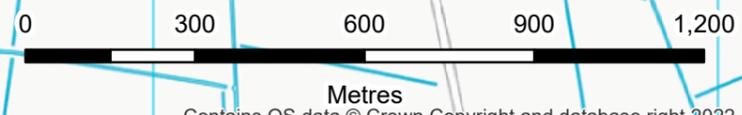
WASTE RECOVERY  
PERMIT APPLICATION

---

**SITE LOCATION PLAN**

---

**DRAWING 001**



Scale: 1:12,500 @ A3      Date: JULY 2024

403.065341.00001.001.0 SITE LOCATION PLAN

# Appendix A Factual Ground Investigation Report



# FACTUAL GROUND INVESTIGATION REPORT

**Saxon Pit, Whittlesey**

Prepared for: East Midlands Waste Management Ltd

Client Ref:

SLR Ref: 403.07764.00001  
Version No: DRAFT  
December 2017



## BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with East Midlands Waste Management Ltd (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

## CONTENTS

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2.0</b>	<b>FIELD WORK .....</b>	<b>2</b>
2.1	Cable Percussion Boreholes .....	2
2.1.1	Standard Penetration Testing (SPT).....	2
2.1.2	Installation Details .....	4
<b>3.0</b>	<b>GROUND CONDITIONS.....</b>	<b>5</b>
3.1	Regional Geology .....	5
3.1.1	Superficial Geology .....	5
3.1.2	Solid Geology .....	5
3.2	Recorded Ground Conditions.....	5
3.2.1	Made Ground.....	5
3.2.2	Superficial Deposits .....	5
3.2.3	Solid Geology .....	5
3.2.4	Groundwater.....	5
<b>4.0</b>	<b>LABORATORY RESULTS .....</b>	<b>6</b>
4.1	Geotechnical Testing.....	6
4.1.1	Moisture Content .....	6
4.1.2	Atterberg Limits.....	6
4.1.3	Particle Size Distribution .....	6
4.1.4	Quick Undrained Triaxial .....	6

---

## DOCUMENT REFERENCES

### TABLES

Table 2-1 SPT Summary.....	3
Table 2-2 Well Details.....	4
Table 4-1 Summary of Geotechnical Testing.....	13

### FIGURES

Figure 1 Moisture Content Profile.....	8
Figure 2 Atterberg Limit Results.....	9
Figure 3 PSD Profile .....	10
Figure 4 Undrained Shear Strength Profile .....	11
Figure 5 Density Profile .....	12

### DRAWINGS

Drawing 001: Site Location Plan  
Drawing 002: Borehole Location Plan

### APPENDICES

Appendix 01: Borehole Logs  
Appendix 02: Site Photographs  
Appendix 03: Geotechnical Laboratory Certificates

## 1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by East Midlands Waste Management Ltd (EMWM) to provide geotechnical consultancy services in connection with the proposed stabilisation works at Saxon Pit, Peterborough Road, Whittlesey, Cambridgeshire; hereafter referred to as the “Site”.

The location of the site is presented within Drawing 001 and is centred on the approximate National Grid Reference 525754, 297057.

SLR has been involved in historic stabilisation works at the site since 2008 in which the existing buttress was designed and monitored in order to stabilise the northern and north-eastern slopes on site.

It is now understood that it is required for the south/south-western slope to be stabilised due to multiple shallow failures being recorded along the slope adjacent to the railway. The failures appear to be shallow and contained within the uppermost soils of the slope, typically within the soft peaty clay and the possible weathered zone of the Oxford Clay. A ground investigation was carried out to determine the geological and hydrogeological conditions of the slope. This report details the results of the ground investigation undertaken to determine ground conditions at the Site.

Full-time supervision was provided by an SLR geotechnical engineer for the duration of the intrusive works which comprised:

- clearance of borehole locations using a CAT scanner;
- the excavation of hand-dug pits to 1.20m below ground level (bgl) to prove absence of underground services at borehole locations;
- construction of 4No. cable percussion boreholes including insitu Standard Penetration Testing (SPT);
- installation of 50mm diameter combined gas/groundwater monitoring wells into 2No. boreholes for subsequent monitoring;
- installation of tube-way inclinometer casing into 2No. boreholes for subsequent monitoring;
- collection of undisturbed and bulk disturbed samples for laboratory analysis; and
- preparation of a factual report based on the information obtained.

Appendix 01 presents the borehole logs, photographs can be found within Appendix 02 and the geotechnical laboratory analysis certificates are presented within Appendix 03.

## 2.0 Field Work

The intrusive works were undertaken between the 19<sup>th</sup> and 27<sup>th</sup> October 2017.

An SLR geotechnical engineer provided full time supervision of the investigation works and logged the returns from all exploratory boreholes in accordance with EN ISO 14688<sup>1</sup>.

The various aspects of the works are described in more detail below.

### 2.1 Cable Percussion Boreholes

4No. boreholes were constructed using a cable percussion rig to a maximum depth of 21.00m bgl. The boreholes were located linearly along the crest of the south/south-western slope to provide information on ground conditions along the length of the excavated face.

Borehole logs are enclosed within Appendix 01. A detailed summary of the geology encountered can be found within Section 3.0 of this report. Borehole locations can be found presented within Drawing 002.

#### 2.1.1 Standard Penetration Testing (SPT)

*In situ* SPTs were carried out throughout the progression of all cable percussive boreholes to establish the relative density of the geological strata encountered.

The 'N' values within the made ground generally ranged from 1 to 12, classifying the fine grained soils as very soft to firm. Peat was encountered within boreholes 03 and 04, returning 'N' values between 2 and 3.

Within the underlying weathered Oxford Clay, 'N' values ranged from 2 to 16, defining the clay as very soft to firm.

The Oxford Clay returned 'N' values that ranged from 23 to refusal ( $\geq 50$  blows), defining the clay as firm to very stiff.

A full set of SPT results can be found within Table 2-1 and on the borehole logs presented in Appendix 01.

---

<sup>1</sup> EN ISO 12688: Geotechnical Investigation and Testing – Identification and Classification of Soil, Parts 1 & 2.

**Table 2-1**  
**SPT Summary**

Borehole	From (m bgl)	To (m bgl)	N-Value
BH01	1.20	1.65	8
	2.00	2.45	1
	3.00	3.45	1
	4.00	4.45	14
	6.00	6.45	16
	9.00	9.45	50
	13.50	13.90	50
	20.00	20.45	50
BH02	1.20	1.65	11
	2.00	2.45	2
	3.00	3.45	13
	5.00	5.45	14
	7.50	7.95	50
	10.50	10.95	50
	16.50	16.95	50
	20.00	20.45	50
BH03	1.20	1.65	8
	2.00	2.45	3
	3.00	3.45	2
	5.00	5.45	11
	7.50	7.95	38
	10.50	10.95	50
	16.50	16.95	50
	19.00	19.50	50
BH04	1.20	1.65	12
	2.00	2.45	2

Borehole	From (m bgl)	To (m bgl)	N-Value
	3.00	3.45	2
	5.00	5.45	12
	7.50	7.95	23
	10.50	10.95	50
	13.50	13.95	50
	16.50	16.95	50
	20.00	20.45	50

### 2.1.2 Installation Details

Combined gas and groundwater monitoring wells were installed into 2No. boreholes upon completion. This comprised 50mm plain well screen pipes screwed into 50mm slotted well screen pipes in accordance with the manufacturer’s recommendations. The boreholes were backfilled with gravel surrounding the slotted section and sealed with hydrated bentonite pellets. All wells were completed with sealing bungs, gas taps and finished with flush, lockable metal covers set in concrete.

Two boreholes (BH02 and BH04) were installed with tube-way inclinometer casing to full depth and grouted using a cement/bentonite grout mix. The boreholes were finished with flush, lockable metal covers set in concrete.

Table 2-1, below, summarises the installation details for all boreholes.

**Table 2-2  
Well Details**

Borehole No.	Installation Type	Slotted Section Depth (m bgl)
BH01	Gas/Groundwater 50mm	18.00 – 21.00
BH02	Tube-Way Inclinometer	N/A
BH03	Gas/Groundwater 50mm	3.00 – 6.00
BH04	Tube-Way Inclinometer	N/A

## 3.0 Ground Conditions

### 3.1 Regional Geology

A review of the publically available<sup>2</sup> geological data has been carried out to determine the superficial and solid geology underlying the site and is summarised below.

#### 3.1.1 Superficial Geology

The site is not shown to be underlain by superficial deposits, however the southern edge of the site where the boreholes are positioned is shown to be underlain by deposits of the March Gravels Member. Typically, this formation comprises sand and gravel.

#### 3.1.2 Solid Geology

The solid geology on site is shown to be the Oxford Clay Formation which predominantly consists of mudstone, some silt and beds of argillaceous limestone nodules.

### 3.2 Recorded Ground Conditions

The investigation has confirmed that the underlying geology is broadly as expected. A summary of the encountered material is provided below.

#### 3.2.1 Made Ground

Made ground was encountered in all exploratory boreholes and typically comprised soft to firm bluish grey clay with frequent gravel of brick and some pseudo-fibrous dark brown peat.

In BH03 and BH04, pseudo-fibrous blackish brown peat was encountered between 0.45 – 2.40m bgl and 1.20 – 3.00m bgl, respectively.

#### 3.2.2 Superficial Deposits

No superficial deposits were recorded during the ground investigation.

#### 3.2.3 Solid Geology

Solid geology of the Oxford Clay Formation was proven in all exploratory locations at depths ranging from 6.70 to 6.80m bgl. The deposits comprised firm to stiff thinly laminated clay with frequent selenite crystals and shell and shell fragments, becoming very stiff with depth.

#### 3.2.4 Groundwater

No groundwater strikes were recorded during the progression of all boreholes; a slight seepage was noted within BH03.

---

<sup>2</sup> <http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html> accessed October 2017.

## 4.0 Laboratory Results

Undisturbed (UT100), disturbed and bulk disturbed samples were collected from all boreholes for subsequent laboratory testing.

Selected samples were sent to a UKAS accredited laboratory for the following analyses:

- Moisture Content;
- Atterberg Limits;
- Particle Size Distribution; and
- Quick Undrained Triaxial.

Results of the testing are discussed below and summarised within Table 4-1. Original testing certificates can be found in Appendix 03.

### 4.1 Geotechnical Testing

#### 4.1.1 Moisture Content

Twelve samples were scheduled for moisture content analysis. Results range from 18.3% in BH02 at 16.50m bgl to 112% in BH01 at 3.00m bgl. The average returned moisture content was 34.7%. Figure 1 presents the results of the testing.

As part of the Quick Undrained Triaxial tests, the moisture content of the selected samples was determined. These values range from 25.6% to 35.0%.

#### 4.1.2 Atterberg Limits

4-point Atterberg Limit testing was carried out on seven samples collected during the ground investigation. Results indicate a minimum liquid limit of 54% in BH02 (2.00m bgl) a maximum of 67% in BH04 (4.45m bgl). Similarly, plastic limits ranged from 19% in BH02 (2.00m bgl) to 31% in BH01 (7.95m bgl). The plasticity index for the samples tested ranged from 32% (BH01 at 7.95m bgl) to 40% in both BH01 (5.45m bgl) and BH04 (4.45m bgl).

Figure 2 plots the returned Atterberg Limits against depth, alongside the moisture content results.

#### 4.1.3 Particle Size Distribution

Particle size distribution testing, using the wet sieve and pipette methods, was carried out on two samples. Figure 3 presents the findings.

The sample from BH02 at 4.50m bgl was determined to comprise 49% clay, 45% silt, 5% sand and 1% gravel; described as silt and clay.

The sample from BH04 at 14.00m bgl was determined to comprise 39% clay, 60% silt and 1% sand; described as clayey silt with rare shell fragments.

#### 4.1.4 Quick Undrained Triaxial

Quick undrained triaxial testing was carried out on five undisturbed sample to determine the undrained shear strength. The tests returned shear strength values ranging from 59kPa in BH04 at 4.00m bgl to 140kPa in BH01 at 7.50m bgl. The average shear strength returned at 86kPa. Figure 4 plots the results against depth.

As part of the Triaxial testing, the density of five samples was also determined. Dry densities ranged from 1.36Mg/m<sup>3</sup> (BH04 at 4.00m bgl) to 1.52Mg/m<sup>3</sup> (BH02 at 4.00m bgl). Bulk densities ranged from 1.83Mg/m<sup>3</sup>

(BH01 at 7.50m bgl; BH04 at 4.00m bgl) to 1.96Mg/m<sup>3</sup> (BH02 at 4.00m bgl). Figure 5 presents the density range with depth.

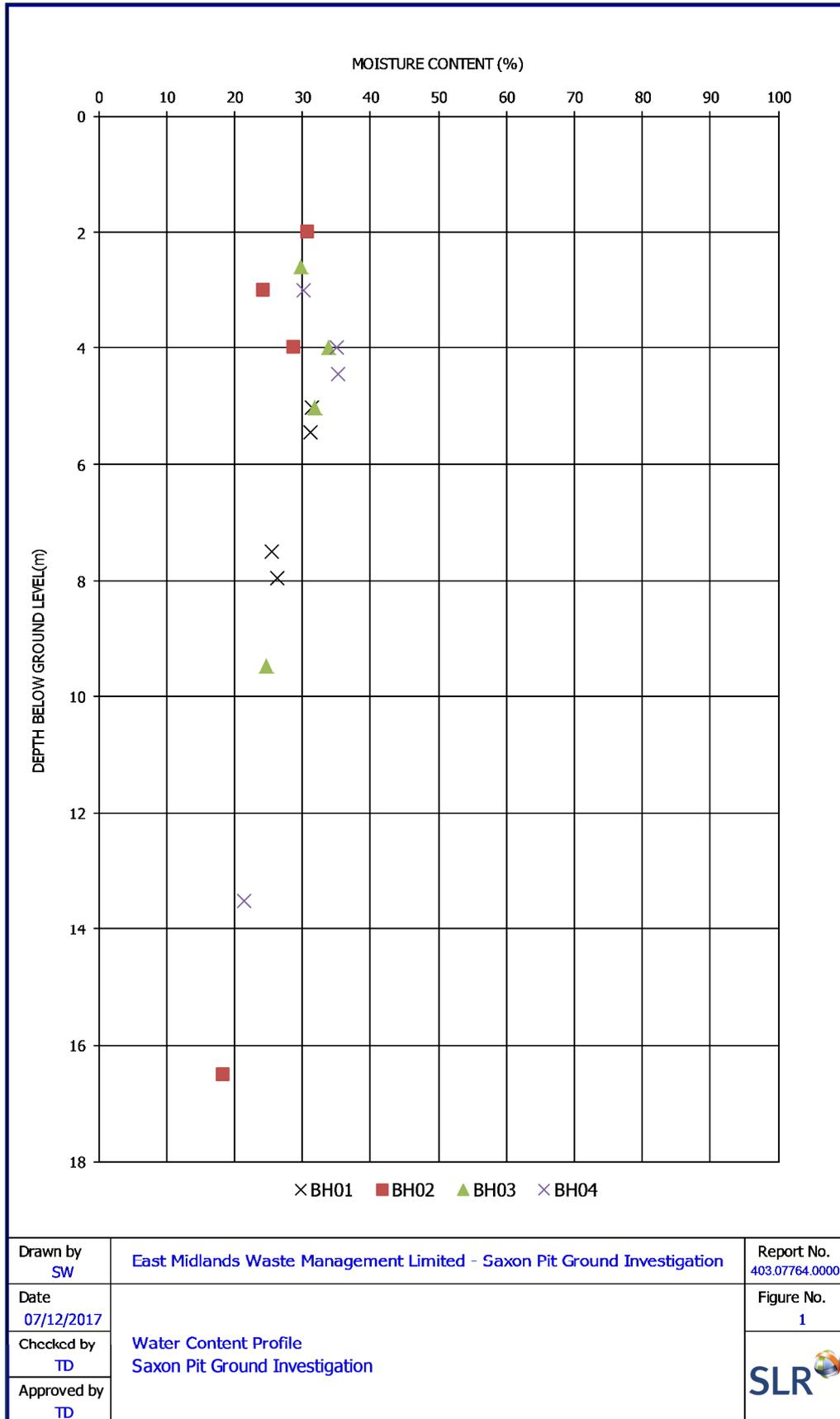
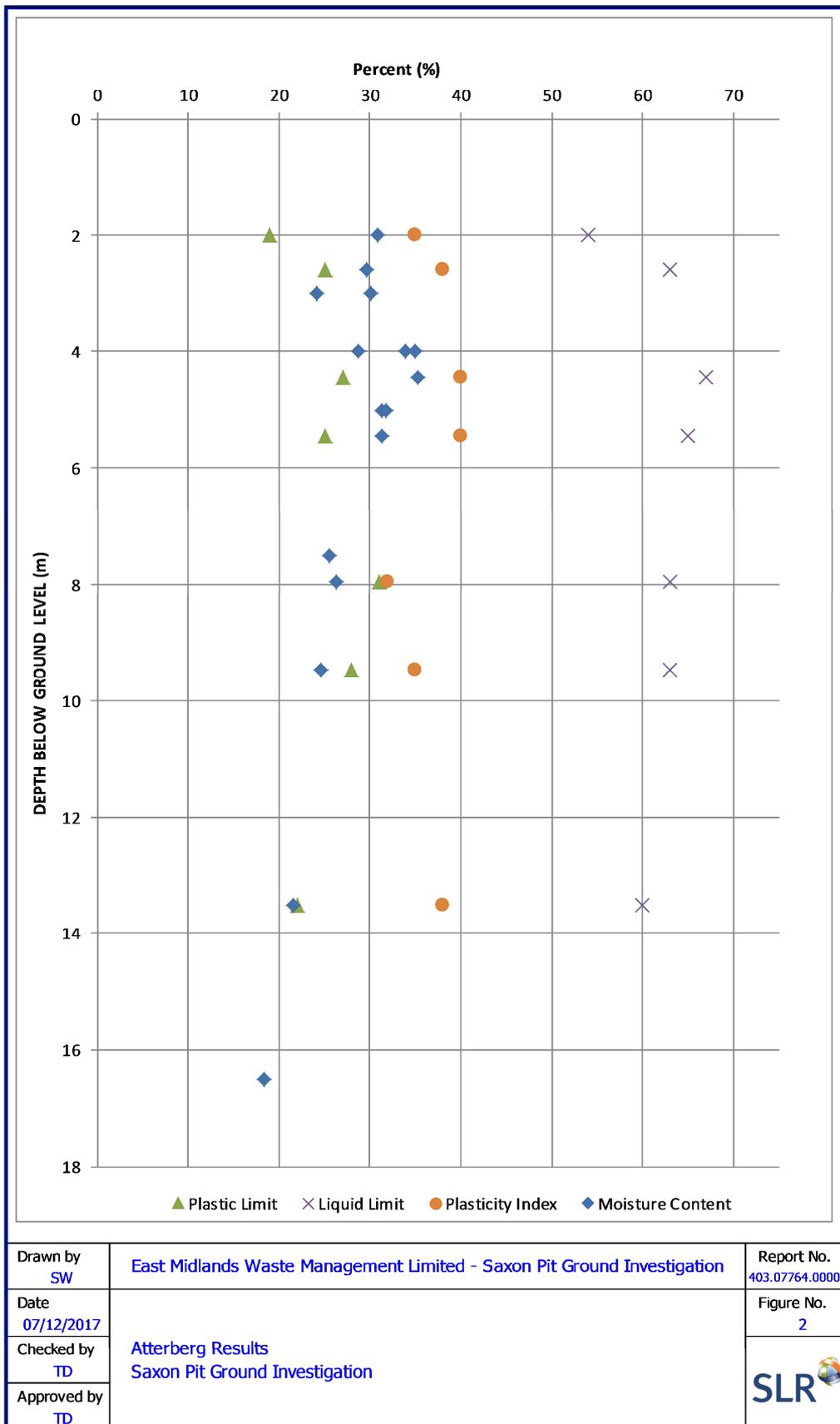


Figure 1  
 Moisture Content Profile



**Figure 2**  
**Atterberg Limit Results**

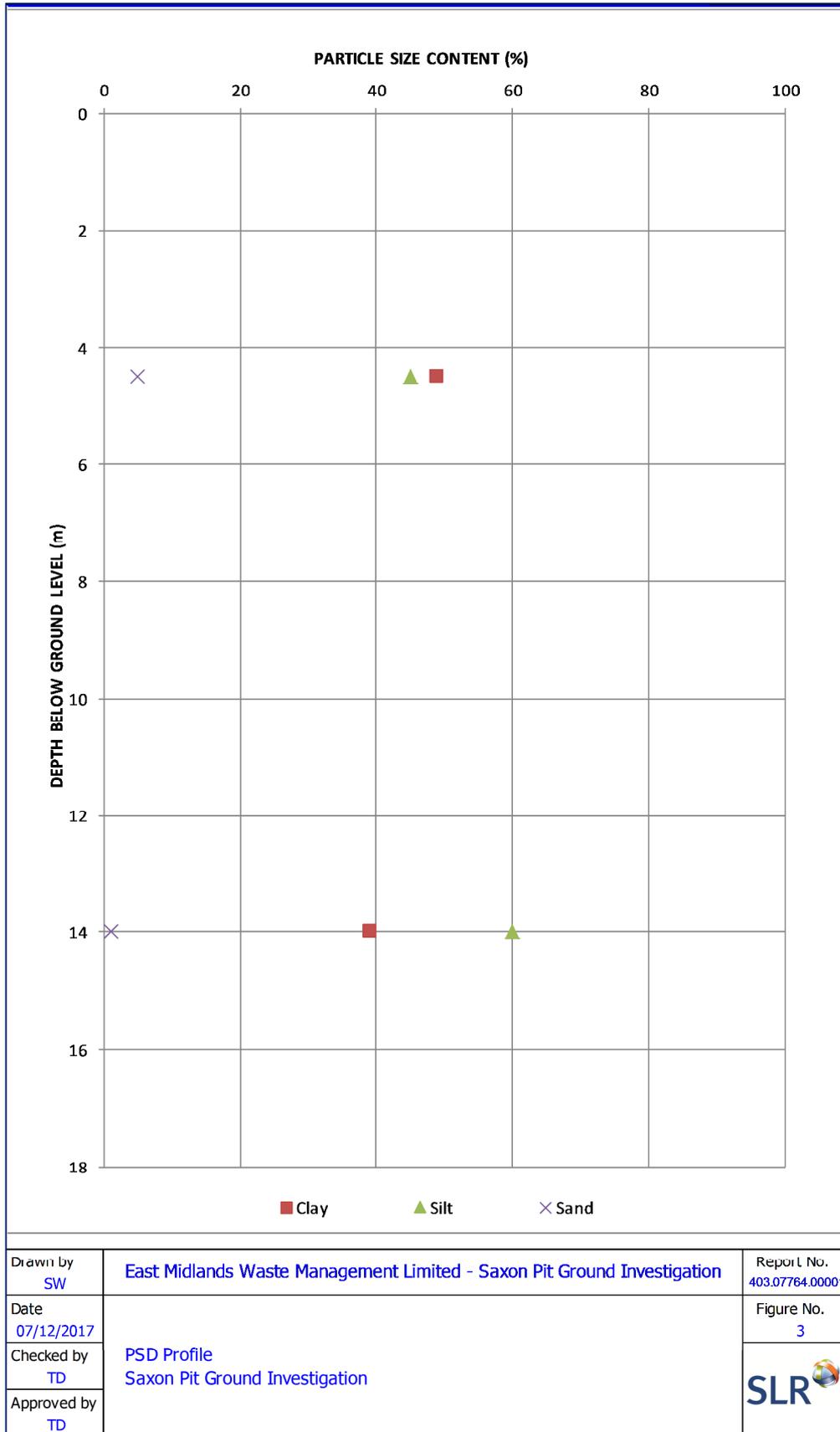
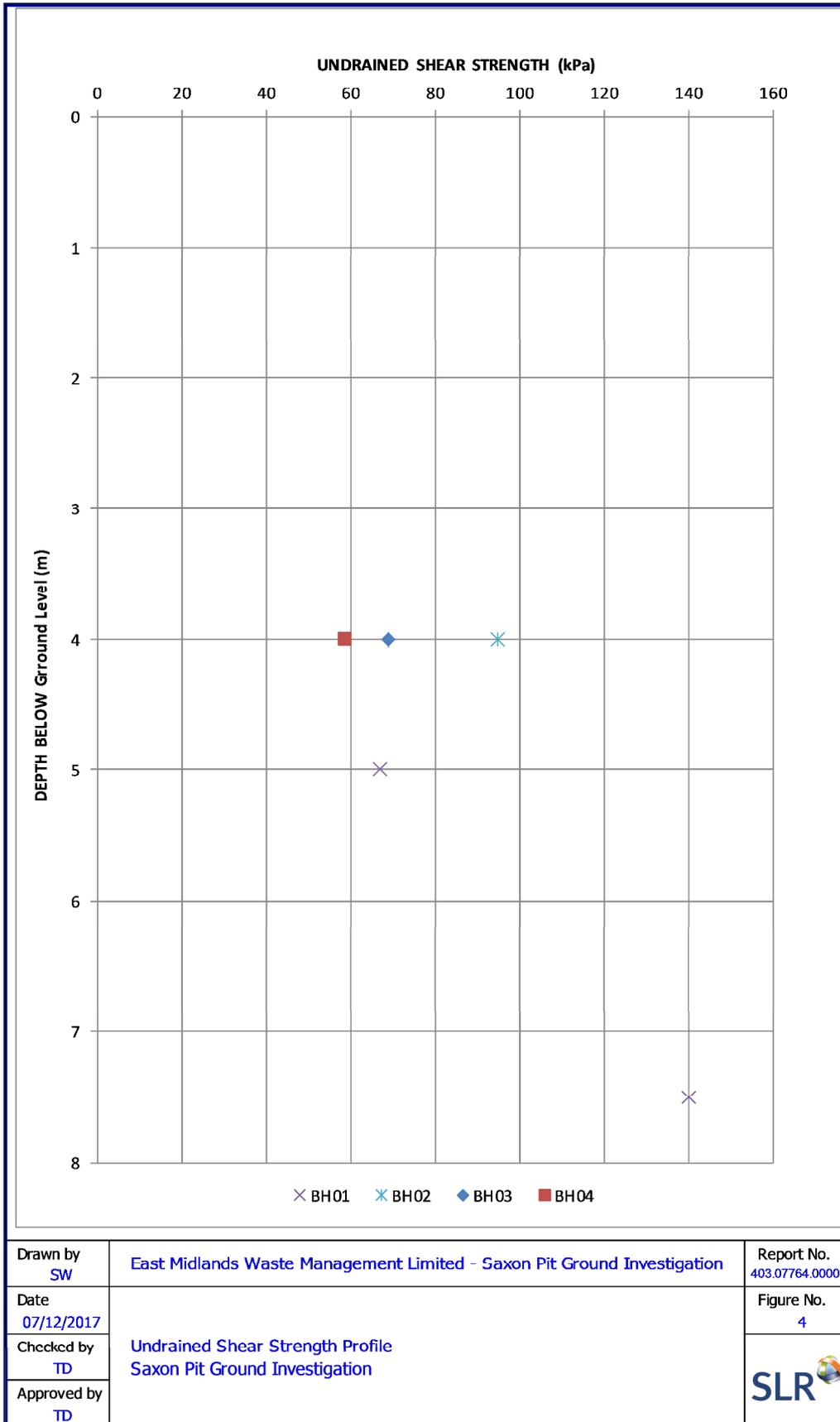
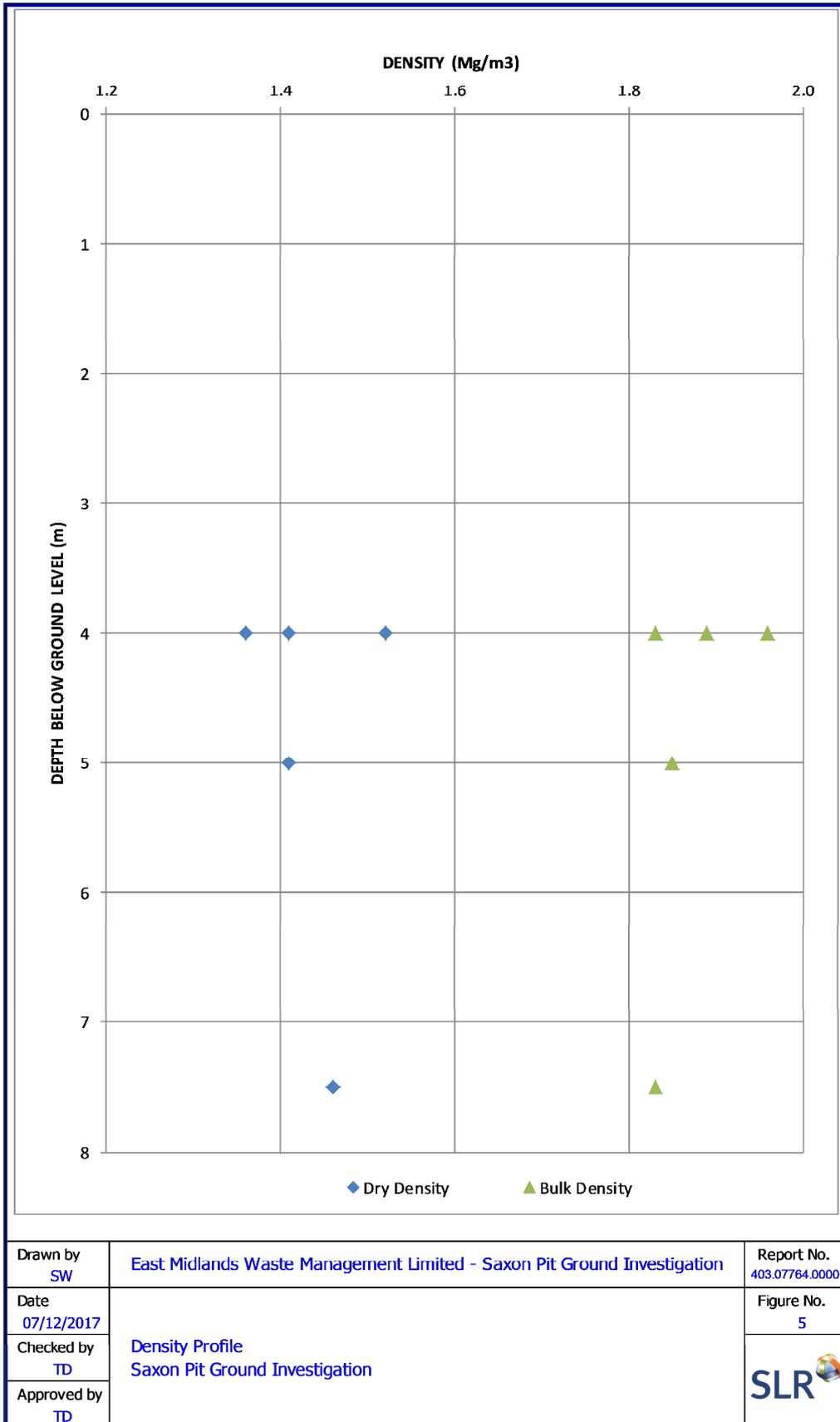


Figure 3  
PSD Profile



**Figure 4**  
**Undrained Shear Strength Profile**



**Figure 5**  
**Density Profile**

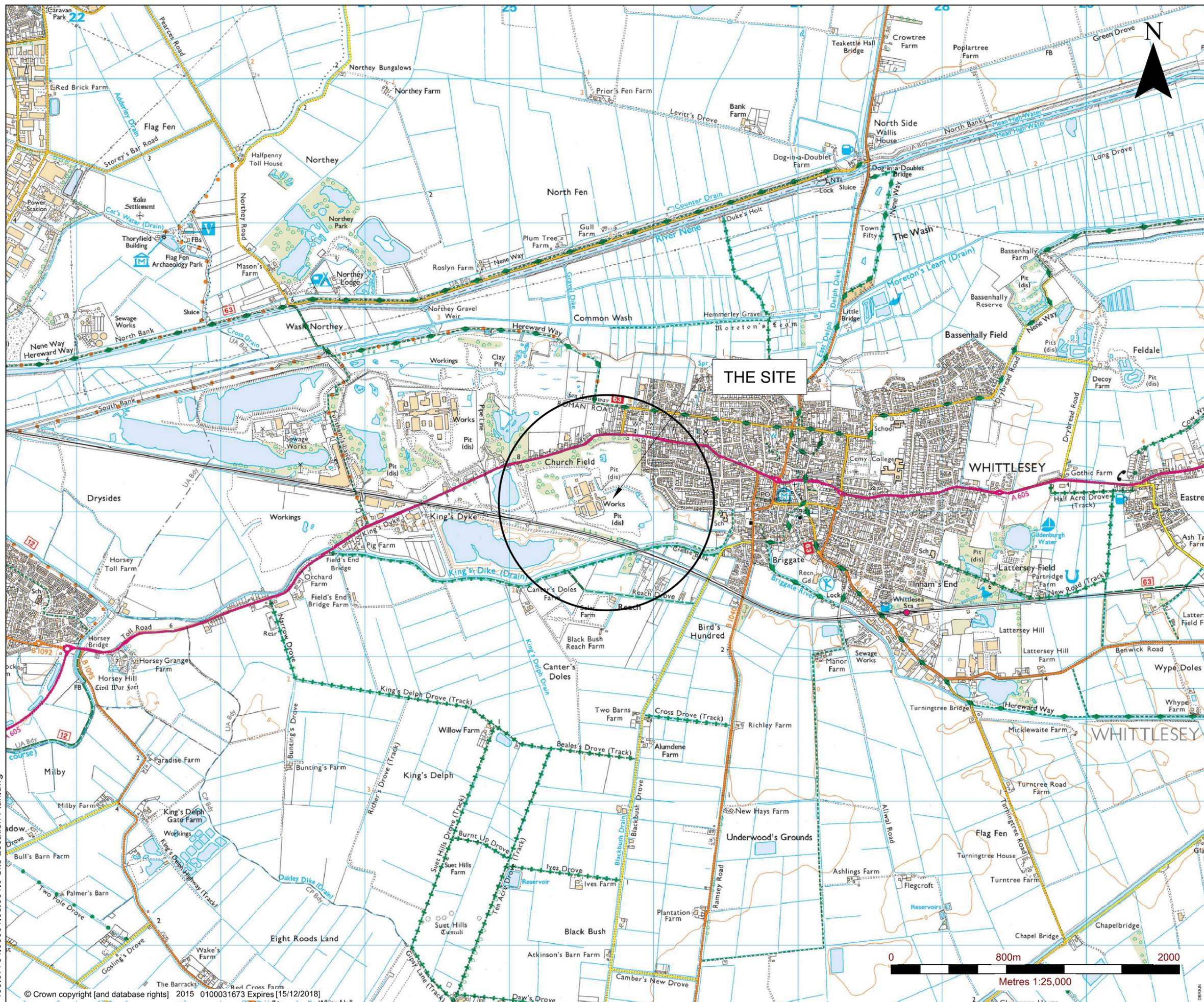
**Table 4-1**  
**Summary of Geotechnical Testing**

Borehole No.	Depth (m)	Type	Water Content (%)	Particle Size Distribution				Atterberg Limits				Density		Undrained Shear Strength (kPa)
				Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% Passing <425µm	Bulk Density (Mg/m <sup>3</sup> )	Dry Density (Mg/m <sup>3</sup> )	
BH01	3.00	D	112											
	5.00	UT	31.4									1.85	1.41	67
	5.45	D	31.3					65	25	40	100			
	7.50	UT	25.6									1.83	1.46	140
	7.95	D	26.3					63	31	32	99			
BH02	2.00	B	30.8					54	19	35	97			
	3.00	D	24.2											
	4.00	UT	28.7									1.96	1.52	95
	4.50	B	-	49	45	5	1							
	16.50	D	18.3											
BH03	2.60	B	29.7					63	25	38	99			
	4.00	UT	33.9									1.89	1.41	69
	5.00	D	31.8											
	9.45	D	24.6					63	28	35	100			
BH04	3.00	D	30.1											
	4.00	UT	35.0									1.83	1.36	59
	4.45	D	35.3					67	27	40	100			
	13.50	D	21.5					60	22	38	100			
	14.00	B	-	39	60	1	0							

---

# DRAWING 001

Site Location Plan



NOTES



THE SITE

WHITTLESEY

WHITTLESEY

**EAST MIDLANDS WASTE MANAGEMENT LIMITED**



ASPECT HOUSE  
ASPECT BUSINESS PARK  
BENNERLEY ROAD  
NOTTINGHAM, NG6 8WR  
T: 01159 647280  
F: 01159 751576  
www.slrconsulting.com

SAXON PIT

SITE LOCATION PLAN

**DRAWING 1**



Scale 1:25 000 (A3)	Date DECEMBER 2017
------------------------	-----------------------

403.07764.00001.08.001.0 Site Location Plan.dwg

© Crown copyright [and database rights] 2015 0100031673 Expires [15/12/2018]

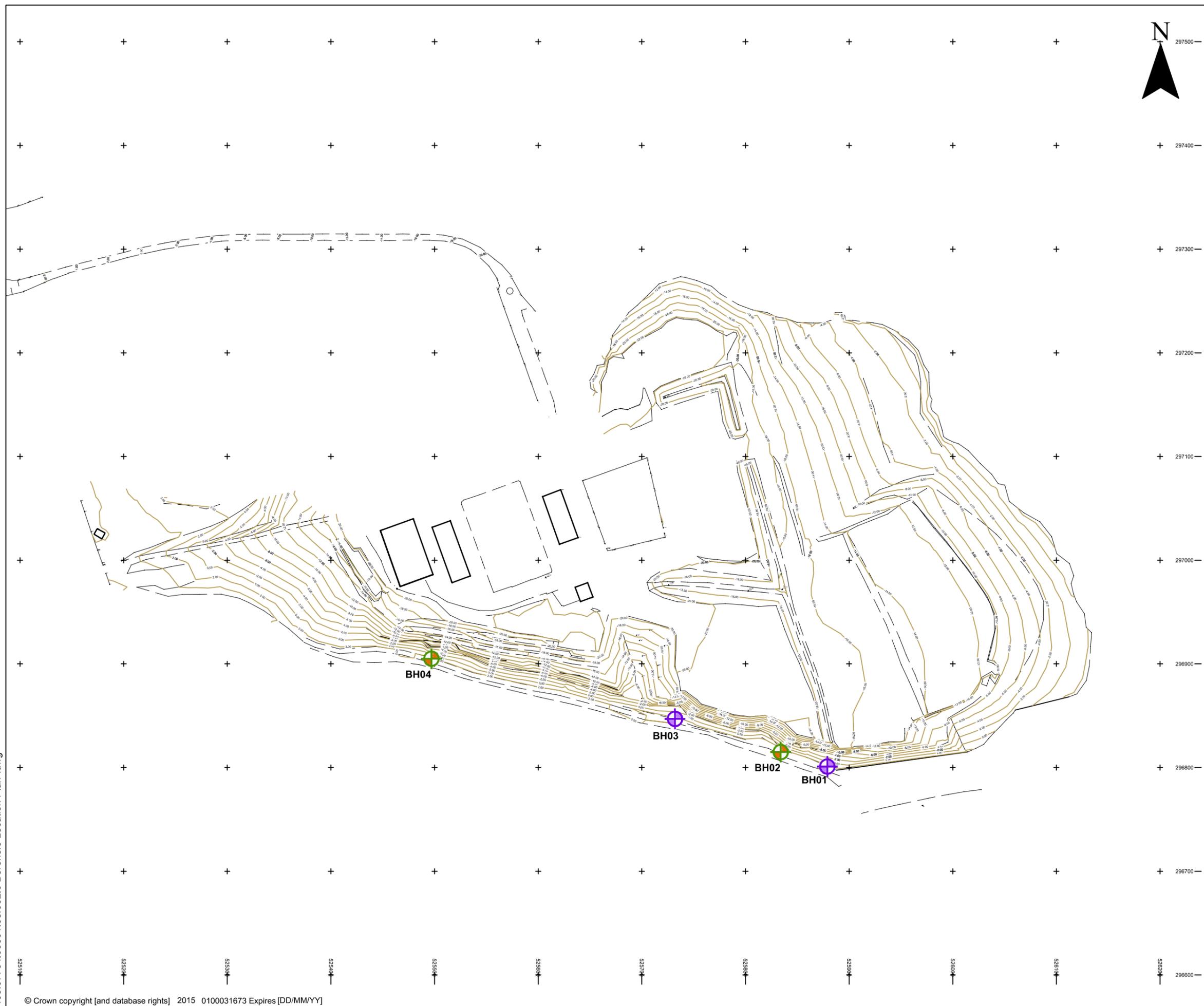
This drawing and its content are the copyright of SLR Consulting Ltd and may not be reproduced or amended except by prior written permission. SLR Consulting Ltd accepts no liability for any amendments made by other persons.

---

## **DRAWING 002**

### Borehole Location Plan

403.07764.00001.08.002.0 Borehole Location Plan-.dwg



**NOTES**

1. SURVEY SHOWN UNDERTAKEN BY H.D. SURVEYING. DATE OF SURVEY 29 to 31/08/17. FILE REF: 0903\_001\_T\_0 - Saxon Pit.DWG.
2. LEVELS SHOWN ARE NOT BASED ON METRES ABOVE ORDNANCE DATUM BUT ARE SHOWN ON A LOCAL SYSTEM.

**LEGEND**

	SURVEY CONTOURS
	GAS / GROUNDWATER BOREHOLES
	INCLINOMETER

**EAST MIDLANDS WASTE MANAGEMENT LIMITED**

**SLR**   
 global environmental solutions

ASPECT HOUSE  
 ASPECT BUSINESS PARK  
 BENNERLEY ROAD  
 NOTTINGHAM, NG6 8WR  
 T: 01159 647280  
 F: 01159 751576  
 www.slrc consulting.com

SAXON PIT

---

**BOREHOLE LOCATION PLAN**

---

**DRAWING 2**

Scale 1:3500 (A3)	Date DECEMBER 2017
----------------------	-----------------------

---

## **APPENDIX 01**

### Borehole Logs



# Borehole Log

Borehole No.

**BH01**

Sheet 1 of 3

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525879.00 - 296801.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 18/10/2017 - 19/10/2017

Logged By  
SW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 1.20	B		0.20		MADE GROUND: Brownish red slightly clayey sandy subangular fine to coarse GRAVEL of brick. Sand is fine to coarse. MADE GROUND: Soft to firm bluish grey CLAY.	
		1.20 1.20 - 1.65	SPT	N=8 (4,3/2,2,2,2)	1.20		MADE GROUND: Very soft to firm bluish grey CLAY with frequent fine angular gravel of brick with some pseudo-fibrous dark brown peat.	
		2.00 2.00 - 2.45	B	N=1 (1,0/0,1,0,0)				
		3.00 3.00 - 3.45	SPT	N=1 (1,0/0,0,1,0)				
		3.40 - 4.00	B		3.40		Soft mottled bluish grey CLAY with some organic content. Frequent lenses of selenite (<3mm).	
		4.00 4.00 - 4.45	SPT	N=14 (1,3/3,4,3,4)	3.95 4.00		Grey silty SAND. Firm to stiff mottled bluish grey CLAY with some organic content. Frequent lenses of selenite (<3mm).	
		5.00 - 5.45	UT	Ublow=16			: Becomes stiff.	
		5.45 - 5.50	D					
		6.00 6.00 - 6.45	SPT	N=16 (3,3/3,4,4,5)				
		6.50 - 7.50	B		6.80			
		7.50 - 7.95	UT	Ublow=50			: Becomes hard with frequent shell and shell fragments.	
		7.95 - 8.00	D					
		9.00 9.00 - 9.45	SPT	50 (8,9/50 for 245mm)				

Continued on next sheet

Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Groundwater monitoring screen installed between 18.0m and 21.0m.





# Borehole Log

Borehole No.

**BH01**

Sheet 2 of 3

Project Name: Saxon Pit Ground Investigation	Project No. 403.07764.00001	Co-ords: 525879.00 - 296801.00	Hole Type CP
Location: Saxon Pit, Whittlesey, Peterborough		Level:	Scale 1:50
Client: East Midlands Waste Management Limited		Dates: 18/10/2017 - 19/10/2017	Logged By SW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.50 - 10.95	UT					
		10.95 - 11.00	D					
		13.50		50 (10,12/50 for 235mm)				
		13.50 - 13.95	SPT					
		16.95 - 17.00	B					
							: Pocket of pseudo-fibrous peat (<30mm).	

Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Groundwater monitoring screen installed between 18.0m and 21.0m.



Continued on next sheet



# Borehole Log

Borehole No.

**BH01**

Sheet 3 of 3

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525879.00 - 296801.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

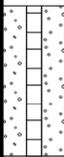
Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 18/10/2017 - 19/10/2017

Logged By  
SW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		20.00		50 (25 for 75mm/50 for 20mm)	21.00			
		20.00 - 20.45	SPT					
								21
								22
								23
								24
								25
								26
								27
								28
								29
								30

End of borehole at 21.00 m

Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Groundwater monitoring screen installed between 18.0m and 21.0m.





# Borehole Log

Borehole No.

**BH02**

Sheet 1 of 3

Project Name: Saxon Pit Ground Investigation	Project No. 403.07764.00001	Co-ords: 525834.00 - 296815.00	Hole Type CP
Location: Saxon Pit, Whittlesey, Peterborough	Level:		Scale 1:50
Client: East Midlands Waste Management Limited	Dates: 19/10/2017 - 24/10/2017		Logged By SW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15 - 1.20	B		0.15		MADE GROUND: Brownish red sandy subangular fine to coarse GRAVEL of brick. Sand is fine to coarse.		
		1.10 - 1.20	B	N=11 (1,1/2,3,3,3)	1.10		MADE GROUND: Soft to firm brownish grey slightly gravelly CLAY. Gravel is fine subangular of brick and mudstone.	1	
		1.20 - 1.65	SPT		1.20		MADE GROUND: Soft black mottled grey CLAY with occasional rootlets and fine angular gravel of brick.		
		2.00	SPT	N=2 (1,0/1,0,0,1)	2.00		: Organic odour noted.		
		2.00 - 2.45	SPT		2.00		Firm to stiff mottled bluish grey CLAY with rare relict rootlets.	2	
		2.00 - 2.60	B		2.60		Very soft to firm brown slightly sandy CLAY.		
		3.00	SPT	N=13 (1,3/3,3,4,3)	3.00		Firm to stiff mottled bluish grey CLAY with some organic content. Frequent lenses of selenite (1-2mm).	3	
		3.00 - 3.45	SPT		3.00				
		4.00 - 4.45	UT	Ublow=17	4.00			4	
		4.50 - 5.00	B		4.50				
		5.00	SPT	N=14 (2,3/3,3,4,4)	5.00			5	
		5.00 - 5.45	SPT		5.00				
		6.00 - 6.45	UT	Ublow=22	6.00			6	
		6.45 - 6.50	D		6.60				
		7.50	SPT	50 (7,8/50 for 275mm)	7.50		Very stiff to hard fissured bluish grey silty CLAY with occasional shells and shell fragments (<15mm).	7	
		7.50 - 7.95	SPT		7.50				
		9.00 - 9.45	UT	Ublow=44	9.00			9	
		9.45 - 9.50	D		9.50				

Continued on next sheet

Remarks  
 1. Hand dug inspection pit complete to 1.2m.  
 2. No groundwater encountered.  
 3. Inclinator casing installed from base of borehole.





# Borehole Log

Borehole No.

**BH02**

Sheet 2 of 3

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525834.00 - 296815.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 19/10/2017 - 24/10/2017

Logged By  
SW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50 - 10.95	SPT	50 (9,11/50 for 226mm)					11
		13.50 - 13.95	B						12
		13.95 - 14.00	D						13
		16.50 16.50 - 16.95	SPT	50 (25 for 75mm/50 for 40mm)					14
		20.00 - 20.45	D		20.00				15
									16
									17
									18
									19
									20

Continued on next sheet

## Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Inclinator casing installed from base of borehole.







# Borehole Log

Borehole No.

**BH03**

Sheet 1 of 2

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525732.00 - 296847.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 24/10/2017 - 25/10/2017

Logged By  
FC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.15 - 0.45	B		0.15		MADE GROUND: Brownish red slightly clayey sandy subangular fine to coarse GRAVEL of brick. Sand is fine to coarse.	
		0.45 - 0.70	B		0.45		MADE GROUND: Firm orangish brown slightly sandy slightly gravelly CLAY with frequent lenses of clayey sandy gravel. Gravel is subrounded fine to medium of brick. Sand is fine to coarse.	
		1.20					MADE GROUND: Pseudo-fibrous blackish brown mottled orange and grey PEAT with frequent lenses of slightly sandy silty clay and relict wood and roots.	
		1.20 - 1.65	SPT	N=8 (2,2/1,2,3,2)			: Layer of firm bluish grey slightly gravelly silty CLAY present. Gravel is subrounded fine to medium of brick.	
		2.00						
		2.00 - 2.45	SPT	N=3 (1,1/1,1,0,1)	2.40			
		2.60 - 3.00	B				Very soft to stiff bluish grey CLAY.	
		3.00						
		3.00 - 3.45	SPT	N=2 (1,1/0,1,1,0)			: Frequent lenses of selenite crystals (1-2mm) present.	
		4.00 - 4.45	UT	Ublow=13				
		4.45 - 4.50	D				: Becomes firm.	
		5.00						
		5.00 - 5.45	SPT	N=11 (1,2/3,2,3,3)				
		6.00 - 6.45	UT	Ublow=19				
		6.45 - 6.50	D					
	6.60 - 7.50	B		6.60	Very stiff to hard fissured dark bluish grey silty CLAY.			
	7.50				: Becomes hard with frequent shells and shell fragments (5-10mm) present.			
	7.50 - 7.95	SPT	N=38 (4,7/7,8,11,12)					
	9.00 - 9.45	UT	Ublow=50					
	9.45 - 9.50	D						

Continued on next sheet

**Remarks**

- Hand dug inspection pit complete to 1.2m.
- No groundwater encountered.
- Groundwater monitoring screen installed between 3.0m and 6.0m.





# Borehole Log

Borehole No.

**BH03**

Sheet 2 of 2

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525732.00 - 296847.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 24/10/2017 - 25/10/2017

Logged By  
FC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50 - 10.95	SPT	50 (12,13/50 for 105mm)					11
		13.50 - 13.95	UT	Ublow=50					12
		13.95 - 14.00	D						13
		16.50 16.50 - 16.95	SPT	50 (12,13/50 for 105mm)					14
		19.00 - 19.50	B						15
		19.50 19.50 - 19.95	SPT	50 (8,13/50 for 125mm)					16
					20.00				17
									18
									19
									20

End of borehole at 20.00 m

**Remarks**

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Groundwater monitoring screen installed between 3.0m and 6.0m.





# Borehole Log

Borehole No.

**BH04**

Sheet 1 of 3

Project Name: Saxon Pit Ground Investigation	Project No. 403.07764.00001	Co-ords: 525497.00 - 296905.00	Hole Type CP
Location: Saxon Pit, Whittlesey, Peterborough	Level:		Scale 1:50
Client: East Midlands Waste Management Limited	Dates: 25/10/2017 - 27/10/2017		Logged By FC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20 - 0.60	B		0.20		<p>MADE GROUND: Brownish red slightly sandy angular to subangular fine to coarse GRAVEL of brick with high cobble content. Cobbles are angular to subangular of brick. Sand is fine to coarse.</p> <p>MADE GROUND: Soft orangish brown mottled grey slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to medium of brick. Sand is fine to coarse.</p> <p>MADE GROUND: Firm locally soft greyish brown mottled orange slightly gravelly silty CLAY. Gravel is subangular to rounded fine to medium of mudstone, chert and brick.</p> <p>MADE GROUND: Pseudo-fibrous blackish brown mottled blue and grey PEAT with frequent lenses of silty clay and relict wood and roots.</p> <p>Pseudo-fibrous blackish brown PEAT with frequent relict wood and roots.</p>		
		0.60 - 1.20	B		0.60			1	
		1.20		N=12 (3,2/2,3,3,4)	1.20				
		1.20 - 1.65	SPT						
		1.70 - 2.00	D		1.70				
		2.00		N=2 (1,1/0,1,1,0)				2	
		2.00 - 2.45	SPT						
		2.50 - 3.00	B						
		3.00		N=2 (1,0/1,0,1,0)	3.00			3	
		3.00 - 3.45	SPT						
		4.00 - 4.45	UT	Ublow=18			4		
		4.45 - 4.50	D						
		5.00		N=12 (2,3/3,3,3,3)			5		
		5.00 - 5.45	SPT						
		6.00 - 6.45	UT	Ublow=19			6		
		6.45 - 6.50	D						
		7.50		N=23 (3,2/4,5,7,7)	6.70		7		
		7.50 - 7.95	SPT						
		9.00 - 9.45	UT	Ublow=50			8		
		9.45 - 9.50	D						
							9		
							10		

Continued on next sheet

Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Inclinator casing installed from base of borehole.





# Borehole Log

Borehole No.

**BH04**

Sheet 2 of 3

Project Name: Saxon Pit Ground Investigation

Project No.  
403.07764.00001

Co-ords: 525497.00 - 296905.00

Hole Type  
CP

Location: Saxon Pit, Whittlesey, Peterborough

Level:

Scale  
1:50

Client: East Midlands Waste Management Limited

Dates: 25/10/2017 - 27/10/2017

Logged By  
FC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
1		10.50 10.50 - 10.95	SPT	50 (8,10/50 for 255mm)				
		13.50 13.50 - 13.95 14.00 - 15.00	SPT B	50 (6,9/50 for 225mm)				
		16.50 16.50 - 16.95	SPT	50 (8,10/50 for 152mm)				
					19.95			

Continued on next sheet

## Remarks

1. Hand dug inspection pit complete to 1.2m.
2. No groundwater encountered.
3. Inclinator casing installed from base of borehole.





# Borehole Log

Borehole No.

**BH04**

Sheet 3 of 3

Project Name: Saxon Pit Ground Investigation	Project No. 403.07764.00001	Co-ords: 525497.00 - 296905.00	Hole Type CP
Location: Saxon Pit, Whittlesey, Peterborough	Level:		Scale 1:50
Client: East Midlands Waste Management Limited	Dates: 25/10/2017 - 27/10/2017		Logged By FC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		20.00		50 (8,11/50 for 115mm)				End of borehole at 20.00 m
		20.00 - 20.45	SPT					

21  
22  
23  
24  
25  
26  
27  
28  
29  
30

Remarks  
 1. Hand dug inspection pit complete to 1.2m.  
 2. No groundwater encountered.  
 3. Inclinator casing installed from base of borehole.



---

## **APPENDIX 02**

### Site Photographs



**Notes:**

- Top Left: Typical Oxford Clay*
- Top Middle: Typical Set-Up with Safety Barriers*
- Far Right: Installation of Standpipe Piezometer*
- Bottom Left: Weathered Oxford Clay and Fill Material*
- Bottom Middle: Oxford Clay with Organic Matter*
- Bottom Right: Flush Headworks*



Rev. 0171218\_403.07764.00001\_Saxon Pit Site Photographs\_Sw

Site:	SAXON PIT, WHITTLESEY	
Project:	GROUND INVESTIGATION	
Date:	DECEMBER 2017	
Drawing:	<b>OBSERVATION PHOTOGRAPHS</b>	<b>Appendix 02</b>

---

## **APPENDIX 03**

### Laboratory Certificates

## SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	WC (%)	LL (%)	PL (%)	PI (%)	<425 µm (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH01		3.00	D	Dark brown organic CLAY with rare fine to medium gravel including brick	112													
BH01		5.00	U	Firm fissured light brown mottled light grey silty CLAY with rare gypsum	31.4					1.85	1.41	100	134	67				
BH01		5.45	D	Yellow brown mottled grey CLAY with rare gypsum	31.3	65	25	40	100									
BH01		7.50	U	Very stiff fissured dark grey silty CLAY	25.6					1.83	1.46	150	279	140				
BH01		7.95	D	Dark brown CLAY with rare fine gravel	26.3	63	31	32	99									
BH02		2.00	B	Mottled yellow brown, brown and grey CLAY with rare gravel	30.8	54	19	35	97									
BH02		3.00	D	Yellow brown and grey CLAY with rare sand and fine to medium gravel	24.2													
BH02		4.00	U	Firm fissured mottled light grey, brown and dark brown silty CLAY	28.7					1.96	1.52	80	190	95				
BH02		4.50	B	Greyish brown SILT and CLAY														Particle Size Distribution
BH02		16.50	D	Dark grey brown CLAY with rare shell fragments	18.3													

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by  S Burke - Senior Technician 07/12/2017	Project Number: <p style="text-align: center;"><b>GEO / 26700</b></p> Project Name: <p style="text-align: center;"><b>SAXON PIT</b> <b>403.07764.00001</b></p>	
--	--	---

## SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	WC (%)	LL (%)	PL (%)	PI (%)	<425 µm (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH03		2.60	B	Yellow brown and blue grey CLAY with rare fine to medium gravel	29.7	63	25	38	99									
BH03		4.00	U	Firm mottled brown, grey and dark grey silty CLAY with rare gypsum	33.9					1.89	1.41	80	139	69				
BH03		5.00	D	Grey brown and yellow brown CLAY with rare gypsum	31.8													
BH03		9.45	D	Dark grey CLAY with rare shell fragments	24.6	63	28	35	100									
BH04		3.00	D	Mottled grey brown , brown and grey CLAY with rare gravel	30.1													
BH04		4.00	U	Firm mottled brown and light grey CLAY	35.0					1.83	1.36	80	118	59				
BH04		4.45	D	Grey brown and grey CLAY	35.3	67	27	40	100									
BH04		13.50	D	Dark grey CLAY	21.5	60	22	38	100									
BH04		14.00	B	Grey clayey SILT with rare shell fragments													Particle Size Distribution	

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by  S Burke - Senior Technician 07/12/2017	Project Number: <p style="text-align: center;"><b>GEO / 26700</b></p> Project Name: <p style="text-align: center;"><b>SAXON PIT</b> <b>403.07764.00001</b></p>	
--	--	---

# PARTICLE SIZE DISTRIBUTION

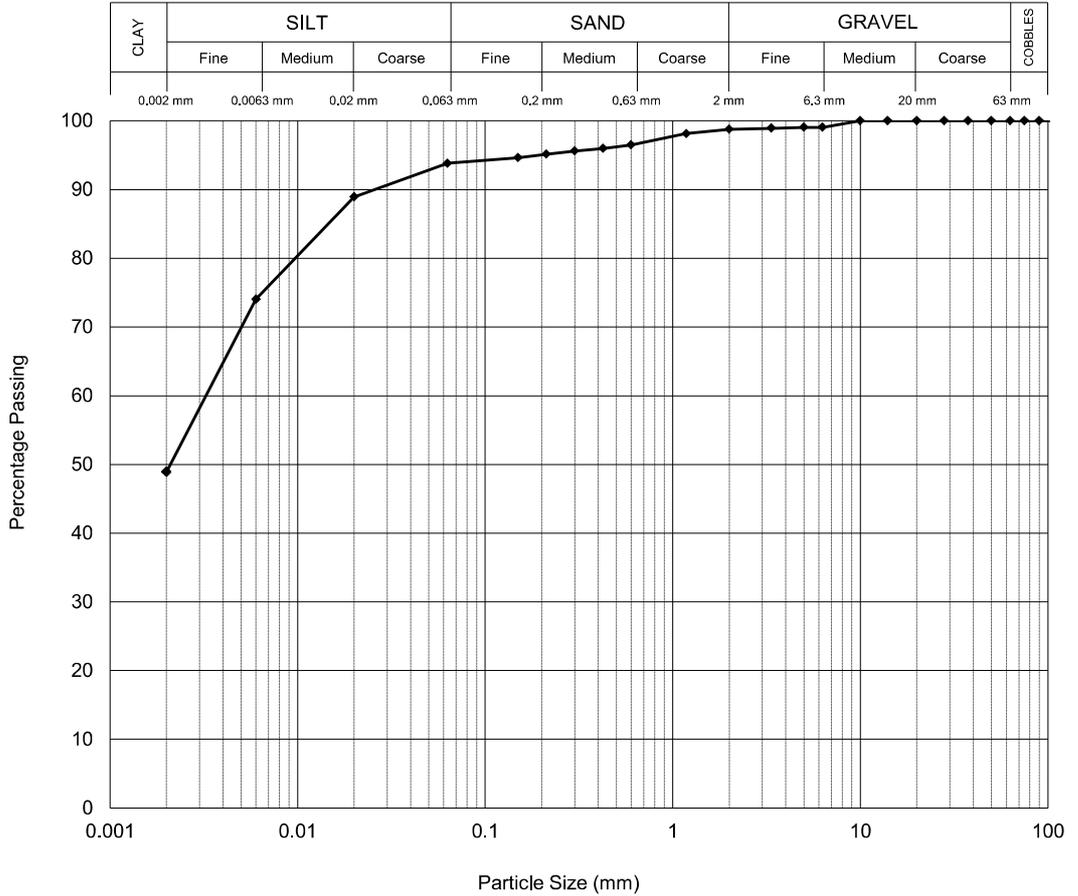
1262 - PSD BH02 04.50 B - 26700-183016.XLSM

BH / TP No.	BH02
Depth (m)	4.50
Sample Type	B

Description  
Greyish brown SILT and CLAY

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve  
BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	99
5.00 mm	99
3.35 mm	99
2.00 mm	99
1.18 mm	98
600 µm	96
425 µm	96
300 µm	96
212 µm	95
150 µm	95
63 µm	94



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
20 µm	89
6 µm	74
2 µm	49

Particle Density 2.70(A) Mg/m<sup>3</sup>

Particle Proportions	
Cobbles	0
Gravel	1
Sand	5
Silt	45
Clay	49

GL-Version 1.79 - 19/09/2017

Checked and Approved by  
*S Burke*  
S Burke - Senior Technician  
07/12/2017

Project Number: **GEO / 26700**  
Project Name: **SAXON PIT**  
**403.07764.00001**



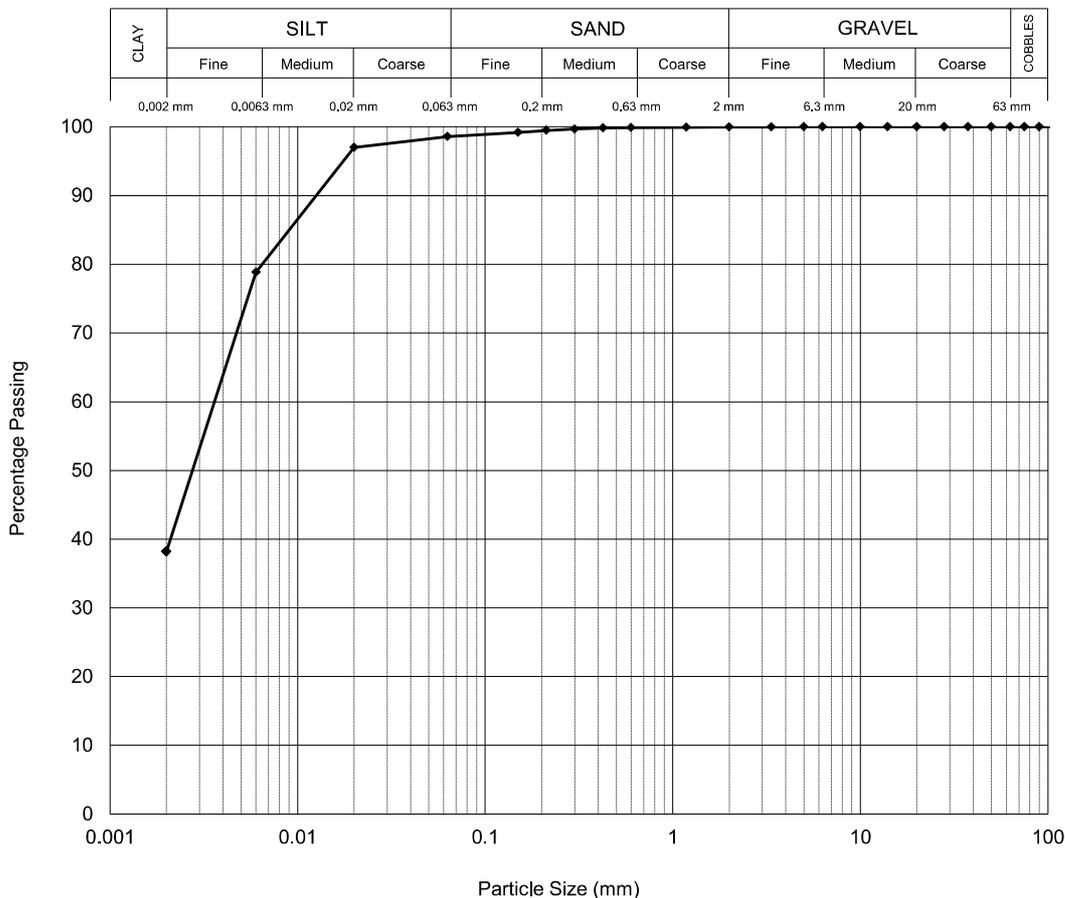
# PARTICLE SIZE DISTRIBUTION

BH / TP No. BH04  
 Depth (m) 14.00  
 Sample Type B

Description  
 Grey clayey SILT with rare shell fragments

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve  
 BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	100
600 µm	100
425 µm	100
300 µm	100
212 µm	99
150 µm	99
63 µm	99



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
20 µm	97
6 µm	79
2 µm	38

Particle Density 2.70(A) Mg/m<sup>3</sup>

Particle Proportions	
Cobbles	0
Gravel	0
Sand	1
Silt	60
Clay	39

Checked and Approved by

*S Burke*

S Burke - Senior Technician  
 07/12/2017

Project Number:

**GEO / 26700**

Project Name:

**SAXON PIT  
 403.07764.00001**



1731 - UUTXL BH01 05.00 U - 26700-182929.XLSM

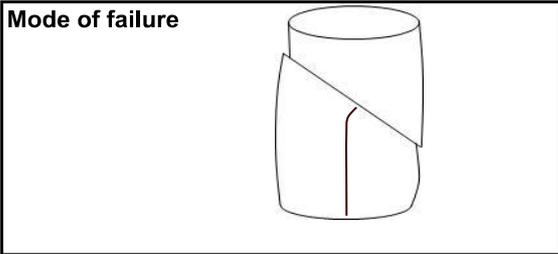
## QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	BH01
Depth (m)	5.00
Sample Type	U

**Description:**  
 Firm fissured light brown mottled light grey silty CLAY with rare gypsum

**Specimen Details**

Specimen conditions		Undisturbed
Length	(mm)	202.1
Diameter	(mm)	100.9
Moisture Content	(%)	31.4
Bulk Density	(Mg/m <sup>3</sup> )	1.85
Dry Density	(Mg/m <sup>3</sup> )	1.41
<b>Test Details</b>		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	100
Strain at failure	(%)	10.9
Maximum Deviator Stress	(kPa)	134
Shear Stress Cu	(kPa)	67



Orientation of the sample	Vertical
Distance from top of tube mm	160

GL:Version 1.68 - 21/06/2017

Checked and Approved by:  
  
 S Burke - Senior Technician  
 07/12/2017

Project Number: **GEO / 26700**

Project Name: **SAXON PIT**  
**403.07764.00001**



1731 - UUTXL BH01 07.50 U - 26700-183006.XLSM

## QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

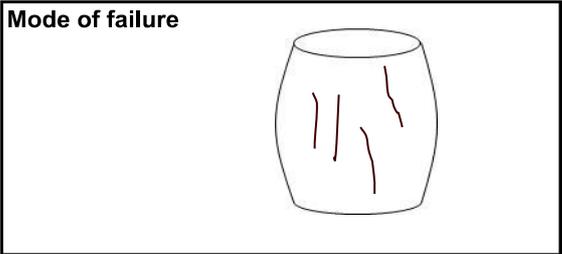
BH/TP No	BH01
Depth (m)	7.50
Sample Type	U

**Description:**  
Very stiff fissured dark grey silty CLAY

**Specimen Details**

Specimen conditions		Undisturbed
Length	(mm)	165.9
Diameter	(mm)	102.4
Moisture Content	(%)	25.6
Bulk Density	(Mg/m <sup>3</sup> )	1.83
Dry Density	(Mg/m <sup>3</sup> )	1.46
<b>Test Details</b>		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.1
Axial displacement rate	(%/min)	2.4
Cell pressure	(kPa)	150
Strain at failure	(%)	19.9
Maximum Deviator Stress	(kPa)	279
Shear Stress Cu	(kPa)	140

**Mode of failure**



Orientation of the sample	Vertical
Distance from top of tube mm	240

GL:Version 1.68 - 21/06/2017

Checked and Approved by:  
*S Burke*  
S Burke - Senior Technician  
07/12/2017

Project Number: **GEO / 26700**  
Project Name: **SAXON PIT**  
**403.07764.00001**



1731 - UUTXL BH02 04.00 U - 26700-182926.XLSM

# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

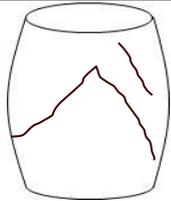
BH/TP No	BH02
Depth (m)	4.00
Sample Type	U

Description:  
Firm fissured mottled light grey, brown and dark brown silty CLAY

**Specimen Details**

Specimen conditions		Undisturbed
Length	(mm)	202.5
Diameter	(mm)	103.8
Moisture Content	(%)	28.7
Bulk Density	(Mg/m <sup>3</sup> )	1.96
Dry Density	(Mg/m <sup>3</sup> )	1.52
<b>Test Details</b>		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.8
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	80
Strain at failure	(%)	13.8
Maximum Deviator Stress	(kPa)	190
Shear Stress Cu	(kPa)	95

**Mode of failure**



Orientation of the sample	Vertical
Distance from top of tube mm	30

GL:Version 1.68 - 21/06/2017

Checked and Approved by:  
*S Burke*  
S Burke - Senior Technician  
07/12/2017

Project Number: **GEO / 26700**  
Project Name: **SAXON PIT**  
**403.07764.00001**



1731 - UUTXL BH03 04.00 U - 26700-182925.XLSM

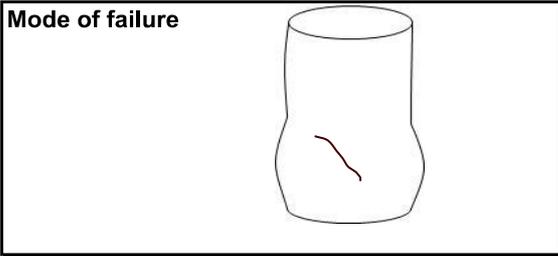
# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	BH03
Depth (m)	4.00
Sample Type	U

Description:  
Firm mottled brown, grey and dark grey silty CLAY with rare gypsum

### Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	192.1
Diameter	(mm)	102.3
Moisture Content	(%)	33.9
Bulk Density	(Mg/m <sup>3</sup> )	1.89
Dry Density	(Mg/m <sup>3</sup> )	1.41
<b>Test Details</b>		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.5
Axial displacement rate	(%/min)	2.1
Cell pressure	(kPa)	80
Strain at failure	(%)	7.3
Maximum Deviator Stress	(kPa)	139
Shear Stress Cu	(kPa)	69



Orientation of the sample	Vertical
Distance from top of tube mm	220

GL:Version 1.68 - 21/06/2017

Checked and Approved by:  
*S Burke*  
S Burke - Senior Technician  
07/12/2017

Project Number: **GEO / 26700**  
Project Name: **SAXON PIT**  
**403.07764.00001**



1731 - UUTXL BH04 04.00 U - 26700-182927.XLSM

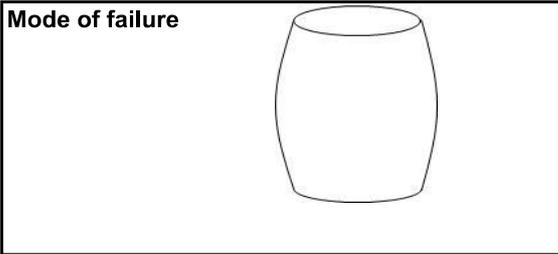
# QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	BH04
Depth (m)	4.00
Sample Type	U

Description:  
Firm mottled brown and light grey CLAY

**Specimen Details**

Specimen conditions		Undisturbed
Length	(mm)	202.3
Diameter	(mm)	104.0
Moisture Content	(%)	35.0
Bulk Density	(Mg/m <sup>3</sup> )	1.83
Dry Density	(Mg/m <sup>3</sup> )	1.36
<b>Test Details</b>		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.8
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	80
Strain at failure	(%)	13.8
Maximum Deviator Stress	(kPa)	118
Shear Stress Cu	(kPa)	59



Orientation of the sample	Vertical
Distance from top of tube mm	30

GL:Version 1.68 - 21/06/2017

Checked and Approved by:  
*S Burke*  
S Burke - Senior Technician  
07/12/2017

Project Number: **GEO / 26700**  
Project Name: **SAXON PIT**  
**403.07764.00001**



# **Appendix B    Regulation 33 Geotechnical Assessment**





# Regulation Assessment

33

# Geotechnical

**Saxon Pit, Whittlesea**

**East Midlands Waste Management Limited**

Client Address

Prepared by:

**SLR Consulting Limited**

15 Middle Pavement, Nottingham, NG1 7DX

SLR Project No.: 403.07764.00001

21 June 2024

Revision: 00

## Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
00	21 June 2024	SNL	TD	
	Click to enter a date.			
	Click to enter a date.			
	Click to enter a date.			
	Click to enter a date.			

## Basis of Report

This document has been prepared by SLR Consulting Limited (SLR) with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with East Midlands Waste Management Limited (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.



## Executive Summary

An inspection to facilitate completion of the Regulation 33 Geotechnical Assessment was carried out on 17<sup>th</sup> April 2024.

The assessment determined that the failures occurring at southern slope face of Saxon Pit represent a significant hazard. Consequently, recommendations for improvement have been made and these are contained within the report.

Regards,

**SLR Consulting Limited**

**Tom Davies**

Principal Geotechnical Engineer

**Siobhan Hall**

Principal Geologist (CGeol)



## Table of Contents

<b>Basis of Report</b> .....	<b>i</b>
<b>Executive Summary</b> .....	<b>ii</b>
<b>1.0 Introduction</b> .....	<b>1</b>
1.1 Purpose of Report .....	1
1.2 Key Features Present.....	1
1.3 General Site Details .....	2
1.4 Summary Background.....	2
1.5 Geological Setting .....	3
1.5.1 Superficial Geology .....	3
1.5.2 Solid Geology .....	3
1.6 Recorded Ground Conditions .....	4
1.7 Hydrogeological Setting.....	4
<b>2.0 Existing Information</b> .....	<b>5</b>
2.1 Site Investigation Data.....	5
2.2 Topographic Surveys .....	5
<b>3.0 Appraisal</b> .....	<b>5</b>
3.1 Excavations.....	5
3.1.1 Southern Excavation Face .....	5
3.2 Solid Tip .....	6
3.2.1 Tips .....	6
3.3 Liquid Tip.....	6
3.3.1 Surface Water Lagoon.....	6
3.4 Stockpiles.....	7
3.5 Haul Roads .....	7
<b>4.0 Assessment</b> .....	<b>8</b>
4.1 Future Inspections.....	10

## Tables in Text

Table 1-1 Key Features at Saxon Pit Quarry .....	2
Table 4-1: Category of Actions .....	8
Table 4-2: Recommendations .....	9
Table 4-3: Inspection Intervals .....	10



## Images in Text

Image 1-1 Key Site Features..... 1

## Drawings

Drawing 01: Key Instability Locations

## Appendices

Appendix A      Photographic Record



## 1.0 Introduction

This document presents a Regulation 33 Geotechnical Assessment Report for Saxon Pit, Whittlesea undertaken by SLR Consulting Limited (SLR) on behalf of East Midlands Waste Management Limited in accordance with the Quarries Regulations 1999 (the Regulations).

Following appraisal of the tips and excavations within the site boundary by site management, SLR were instructed as geotechnical specialists to undertake a Geotechnical Assessment at the site to satisfy the requirements of Part IV of the Quarry Regulations 1999. The findings of the assessment, along with associated recommendations, are contained within this report.

As part of the assessment, a site walkover was undertaken by geotechnical engineers Tom Davies and Sydney Laryea of SLR on the 17<sup>th</sup> April 2024. The weather was dry, sunny and breezy.

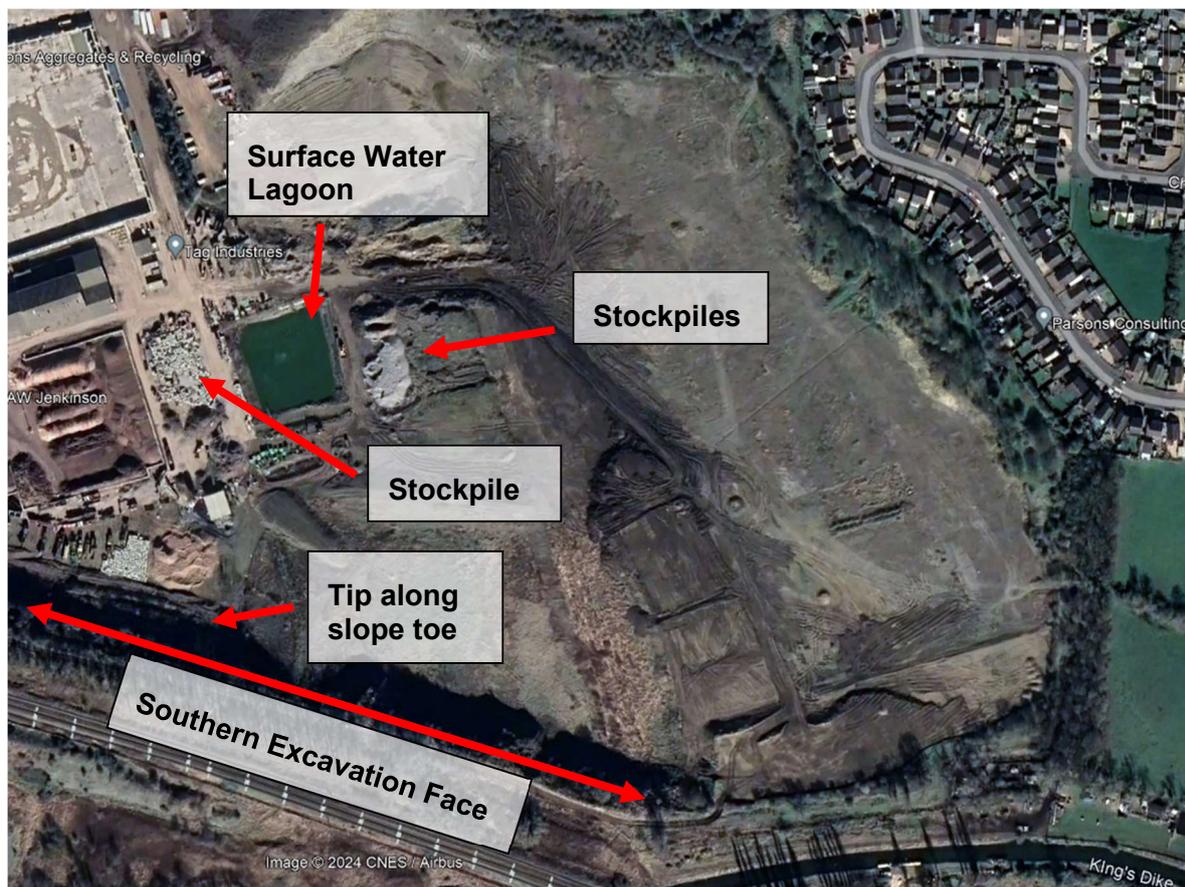
### 1.1 Purpose of Report

This report presents the findings of the Geotechnical Assessment relating to the excavations and tips at Saxon Pit. This report concludes with recommendations, as required, in respect of remedial action required to maintain safer operations and the stability of the excavations and tips.

### 1.2 Key Features Present

The key features observed during the inspection of EMW site at the Saxon Pit quarry are shown in Image 1-1 and summarised in Table 1-1

Image 1-1 Key Site Features



**Table 1-1 Key Features at Saxon Pit Quarry**

Feature	Hazard Status	Reason / detail
Southern Excavation Face	Significant Hazard	Vertical height of exceeds 15m in depth and/or the overall slope angle exceeds 1V:1H
Tips	Not a Significant Hazard	<10,000m <sup>2</sup> in plan area, <15m in height.
Surface Water Lagoon	Not a Significant Hazard	<10,000m <sup>2</sup> in volume.
Stockpiles	Not a Significant Hazard	<10,000m <sup>2</sup> in plan area, <15m in height.

### 1.3 General Site Details

Saxon Pit is an inactive quarry site located immediately to the west of the town of Whittlesey in Cambridgeshire at National Grid Reference 525754E, 297057N. Saxon Pit comprises an excavation in the Oxford Clay which is between 18 and 27 metres deep and lies between the A605 Peterborough Road to the north and the Peterborough to March railway line to the south. The eastern boundary of Saxon Pit is adjacent to a housing estate. To the southeast the canalised Kings Dyke flows beneath the Peterborough to March railway line. The original Saxon Brickworks and associated infrastructure which were located in the pit have now been demolished and/or repurposed/de-commissioned and is now operated as a waste management facility by East Midlands Waste Management Limited and Johnsons Aggregate Recycling Limited.

### 1.4 Summary Background

The exhausted clay pit has historically suffered from several minor failures of the quarry face along its eastern and southern boundaries.

Following site investigations in 1997 and 1998 it was recommended that Hanson (the site owner at the time) undertake a slope face stabilisation scheme based on buttressing of these slopes using imported inert waste material. This was initially undertaken under a waste exemption, until a change in the Regulations required the activity to secure an Environmental Permit, which was granted originally to Glazewing Ltd in 2012. East Midlands Waste Management Ltd (EMW) have operated the site under the current waste recovery permit (Ref EPR/BB3038Y) since October 2017.

Following a review of development proposals to stabilise the failing slope sections, it was preferred at the eastern slope to undertake a regrading exercise involving cutting back the slope crest with limited buttressing installed to the lower parts. In contrast, the southern slope was proposed to be safeguarded by installing an impermeable drainage barrier to disrupt the pathway that allows water to influence the weaker upper slope materials.

SLR have been involved in the historic stabilisation works at the site since 2008 in relation to the design and monitoring of the existing buttress at the north and north-eastern slopes.

Multiple shallow failures were subsequently observed in the south/south-western slope along the slope adjacent to the Peterborough to March railway line for which SLR undertook a ground investigation comprising hand dug pits and cable percussion boreholes were completed in October 2017 with monitoring instrumentation also installed.



## 1.5 Geological Setting

### 1.5.1 Superficial Geology

No superficial deposits are recorded in the BGS mapping<sup>1</sup> of the site. However, the map shows the immediate site perimeter as largely defined by a transition zone between the solid geology mapping the site and the superficial March Gravels Member and/or Peat which characterise the land immediately surrounding the site. The March Gravels Member is described as typically comprising clayey sand and gravel with thickness of 2.1m – 5.0m. The base of the deposit is reported at about 2.8m AOD (Horton and Downing, 1989)<sup>2</sup>, which is consistent with ground levels on the track behind the southern slope crest line as shown within the Master Topographical Site Plan, produced by SBRice dated February 2021 and updated by Maroon-Precise Survey Ltd in June 2022. This suggests that any evidence the March Gravels Member deposits are likely to be limited in this area. This was confirmed during the site walkover during which limited evidence of the March Gravel Member with anthropogenic content was observed locally where the slope instability has exposed the upper lithology of the southern slope face, also revealing an underlying Peat layer..

### 1.5.2 Solid Geology

BGS mapping indicates that the site is located on Oxford Clay bedrock which is described as “*silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules*”. The Oxford Clay overlies Kellaways Formation comprising of Sands overlying Clays.

The exposed faces of clay within the pit have been weathered since the last extraction took place and none of the faces could be considered 'fresh'. Surface weathering has resulted in many of the faces being altered to such an extent that the original structure of the material cannot be determined. Such alteration includes the formation of a thin 'skin' of reworked material which is often desiccated and completely masks any subsurface features. In other areas, bedding 'separations' are clearly evident and would be assessed as being extremely closely spaced (<20mm). However, this is considered to represent the spacing of non-structural bedding features overall and the spacing of structural bedding *planes* within the fresh mass of material would probably be greater.

Two sets of very highly persistent, approximately orthogonal, sub-vertical joints were identified. These joints sets were estimated to be trending north-west south-east and north-east south-west. Spacing of the joints were estimated to be as low as 0.3m but no greater than 2m, with the average being around 0.7m.

The underlying Kellaways Formation comprises ‘*Mudstone, grey, commonly silici-silty or silici-sandy, with (predominantly in the upper part) beds of generally calcareous siltstone and sandstone*’ and is typically subdivided between the Kellaways Sand (‘*Silicate sandstone and silicate siltstone, pale grey, calcareous cemented, with interbeds of sandy and silty mudstone*’) overlying Kellaways clays (‘*Silicate mudstone, grey, commonly smooth in basal part (see Previous Names), but more generally silici-silty or silici-sandy, locally with thin beds of siltstone and sandstone, and nodules of argillaceous limestone*’).

Sands are thin; typically 2m – 3m in thickness and outcrop as a thin band c.9km to the west of the site. These deposits subsequently dip in an easterly direction beneath the Oxford Clay. British Geological Survey (BGS) borehole logs to the west and south-east of the site indicate

---

<sup>1</sup> <http://mapapps2.bgs.ac.uk/geoindex/home.html>

<sup>2</sup> Horton, A., & Downing, R. A. (1989). Geology of the Peterborough District: Memoir for 1: 50 000 Geological Sheet 158 (England and Wales). HM Stationery Office.



that the base of the Oxford Clay dips from c.15m below ground level to the west and 30m below ground level to the east.

It is understood that Saxon Pit was dug to depths of between 18m and 27m; suggesting that the site will have largely excavated towards the base of the clays, although has not extended beneath the base of the Oxford Clay / top of the Kellaways Sand. It is estimated that there are several metres of clay present beneath the base of the site.

## 1.6 Recorded Ground Conditions

A site investigation undertaken in October 2017 which included the drilling of four boreholes linearly along the crest of the south/south-western slope (within the anticipated transition zone from Oxford Clay to March Gravels Member/Peat) to provide information on ground conditions along the length of the excavated face.

All four boreholes were drilled to a depth of at least 20m bgl, roughly corresponding to the average base of the quarry. The boreholes logs confirm the solid geology of *“very stiff to hard slightly fissured bluish grey silty CLAY with occasional partings of silt and rare shells and shell fragments”*. Clay is recorded to the base of all four boreholes.

While no distinct superficial deposits were encountered at any of the intrusive locations, material described as Made Ground comprising a Clayey Sand and Gravel and/or Peat with anthropogenic content was apparent, broadly confirming the BGS account of local ground conditions.

Due to the location of the deposits relative to the quarry wall, SLR previously reported that the *“deposits are not located immediately adjacent to the quarry walls and are therefore unaffected by the development”*. (SLR GIR) However during the recent site walkover, it was observed that the superficial materials are proximal to the slope face and contributing to the observed instabilities.

## 1.7 Hydrogeological Setting

Kings Dyke is just outside the southern site boundary and spans from south to southeast of the site, at which location it is closest to the site, and it is in hydraulic continuity with a reed bed (drainage discharge point) and a minor ditch that is parallel to the eastern aspect of the southern excavation face. The potential for significant quantities of water to flow onto the site via the minor ditch exists and is likely contributing to the instabilities that have been observed.

Other surface water features (presumed reservoirs) are located west and southwest of the site and are separated by the Peterborough to March railway line. The largest of the features, southwest of the site appears coincident with the former ‘Star Pit’, that has been inundated since becoming disused.

The Oxford Clay bedrock is classified by the Environment Agency as “Unproductive Strata”, described as: *‘rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow’*.

The underlying Kellaways Sands are classified as a ‘Secondary A aquifer’ which are described as: *‘Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers’*

The superficial March gravels are also classified as a ‘Secondary A aquifer’, however that these deposits have not been recorded within the site.

The site investigation confirmed minor groundwater seepages from the Oxford Clay in one of the four boreholes however no permanent waterbody was encountered as would be anticipated by the geology. Oxford Clay is characterised as having a very low permeability;



regularly recorded at less than  $1 \times 10^{-9}$  m/s.

Although classified as a Secondary A aquifer and exhibiting relatively high porosity, available laboratory testing of the Kellaways Sand indicates relatively low permeabilities, with an interquartile range of between  $3.1 \times 10^{-6}$  to  $6.8 \times 10^{-3}$  m/day ( $3.6 \times 10^{-11}$  to  $7.9 \times 10^{-8}$  m/s). Consequently, the formation yields small supplies of groundwater<sup>3</sup>.

The site is not located within a groundwater source protection zone.

## 2.0 Existing Information

### 2.1 Site Investigation Data

No intrusive site investigation has been undertaken specifically for the purposes of this Geotechnical Assessment report.

### 2.2 Topographic Surveys

Topographical survey data of the site was produced by SBRice in February 2021 and updated in June 2022 by Maroon-Precise Surveys Ltd. This showed the floor of Saxon Pit to be entirely below ordnance datum and heights of the area just beyond the southern slope crest line vary between 2m and 4m above ordnance datum. SLR is not aware of a more recent topographical survey of the site.

## 3.0 Appraisal

This section provides a summary of the observations made during the site inspection and Appraisals at Saxon Pit. A photographic record of the inspection and appraisal is presented as Appendix A.

### 3.1 Excavations

#### 3.1.1 Southern Excavation Face

The exhausted southern excavation face is undulating (as shown in Photo 1), spans ca. 500m long, is ca. 20m high and is characterised by a subvertical to IV:1H slope over much of its length.

The cut slope has been variably buttressed west to east (as shown in Photo 2) with site-won Oxford Clay, which builds up to a more substantial buttress approximately central to the slope face, as shown in Photo 3. Besides stabilising the slope, the central buttress acts as an access ramp to the crest of the slope.

As shown by Photos 4-6, the slope's crestline is irregular throughout and characterized by a series of localized failures that dominate the entire upper section of the slope albeit the evidence is more marked in some areas than others. The downslope movement of material has created backscarps of varying sizes along the slope length with a maximum anticipated depth of about 10m.

The recent observation of failure consistent with a progression of failures that were previously observed and described by SLR as "..... shallow and contained within the uppermost soils of

---

<sup>3</sup> BGS / EA (2000) The physical properties of minor aquifers in England and Wales



*the slope, typically within the soft peaty clay and the possible weathered zone of the Oxford Clay” (Saxon Pit Factual Ground Investigation Report, dated December 2017)<sup>4</sup> .*

Recently exposed geological horizons were observed in failed subvertical upper sections of the slope face in at least two locations (central and west) as shown by Photos 7 and 8. The exposed geological profiles showed at least three distinct and well- defined soil layers, the thickness of which appeared consistent across the slope face. It also suggests the crest and slope face is receding towards the railway line to the south of Saxon Pit.

The observed instabilities are considered to be related to the properties, and condition, of the superficial materials that lie above the Oxford Clay. These materials are 2-3m thick and comprise soft clays and peat, both of which typically have low shear strengths. Their stability is also further affected by recharge of groundwater from the adjacent minor ditch (on southern boundary) and the King’s Dyke (approximately 20m beyond the southern boundary).

The deterioration of the upper section materials appears to be having an impact on the basal Oxford Clay which is considered to be subject to ongoing weathering originating from the ingress of water through discontinuities that have become readily accessible due to failure of the upper soils.

The accumulation of material at the toe of the slope (vegetated or otherwise) in areas is consistent with historic and recent weathering/sloughing of the upper and lower slope material leading to debris flow to the base of the cut.

The progressive deterioration and/or recession of the existing slope crest represents a significant hazard which has potential to affect the nearby railway line and any site operations within the immediate vicinity of the slope.

It is recommended that further operations within the facility are conducted at a safe distance from the cut slope. It is further recommended that the slope ridge is not subject to any heavy vehicular traffic.

## **3.2 Solid Tip**

### **3.2.1 Tips**

The western end of the southern slope face has been irregularly buttressed at the slope toe with presumed tip material effectively slightly extending the slope toe towards the active site area. Tipped material was less than 15m high and collectively occupied an estimated plan area of less than 10,000m<sup>2</sup>. During the inspection, there was no evidence of appropriate edge protection in place. Both the eastern and northern slopes have also been buttressed historically; however, they are currently outside the demarcated quarry boundary.

## **3.3 Liquid Tip**

### **3.3.1 Surface Water Lagoon**

A surface water lagoon was located centrally within the quarry compound, southeast of the facility offices (as shown by Photo 9) . The lagoon appears to be used as a hold for surface runoff and other diverted drainage. Water from the attenuation pond is pumped as and when required to the King’s Dyke, to the South of the site via a consented discharge point. The lagoon was observed to have adequate freeboard, edge protection, warning signs and life rings. No signs of instability were observed in this area.

---

<sup>4</sup> SLR Consulting Ltd (Dec 2017) Saxon Pit: Factual Ground Investigation Report, Ref: 403-07764-00001



### **3.4 Stockpiles**

At the time of the inspection, at least 6No. stockpiles were present centrally within the site compound near the surface water lagoon as shown by Photo 10.

The stockpiles were observed to be less than 15m in height and less than 10,000m<sup>2</sup> in plan area. During the inspection, there was no evidence of appropriate edge protection in place.

### **3.5 Haul Roads**

The main and longest haul road at Saxon Pit goes skirts the full site boundary. Other haul roads were also identified, originating from the main haul road, and providing access to the various aspects or functions within the site. The most pertinent of the 'minor' haul roads for this assessment is along the toe of the southern slope and accessed via other haul roads from the north and west and leading onto the general site compound. The haul route at the toe of the slope (shown in Photo 11) is considered to have a high exposure to instability from the slope failing and it therefore recommended that access in this area is restricted.



## 4.0 Assessment

The Health and Safety Executive have indicated that they prefer a ‘Traffic Light’ system to draw attention to the more critical or significant aspects of the Geotechnical Assessment (Table 4-1).

The principal recommendations have been incorporated into a ranking system to highlight the relative importance to the safe operation of the facility (Table 4-2). However, it is necessary that the planning and permitting process is commenced as soon as possible to which would allow mitigative or restorative action to stabilise the slope to be taken in the medium to long term.

**Table 4-1: Category of Actions**

Category of Actions		
Priority	Action	To be entered into KMI?
C1	Cease all non-remedial activity in the area immediately and resolve the identified risk. Undertake a geotechnical Assessment on completion.	Yes
C2	Schedule maintenance within 3 months and monitor on a weekly basis by competent person. Undertake a Geotechnical Assessment on completion.	Yes
C3	Schedule maintenance prior to next scheduled Geotechnical Assessment and monitor on a monthly basis.	No
C4	Monitor by a competent Person.	No



**Table 4-2: Recommendations**

Item	Observations	Recommendations	Priority	FAO
Southern Excavation Face	Evidence of sloughing/soil erosion within upper section of slope face	Monitor the slope face for evidence of further erosion or weathering. Limit laden traffic to the slope ridge. Limit access to haul road on western end of the slope. Remediate as soon as possible.	C4	Quarry Manager (QM)
	Evidence of several internal slope failures within upper section of cut	Monitor progress, limit laden traffic to the slope ridge and restrict access to the immediate vicinity of slope toe	C4	QM
	Slope instability leading to exposure of upper strata	Monitor progress. Limit access to slope crest and toe	C4	QM
	Areas of soft ground and/or standing water on track near the slope crest	Monitor for further evidence of instability within upper section of cut	C4	QM



## 4.1 Future Inspections

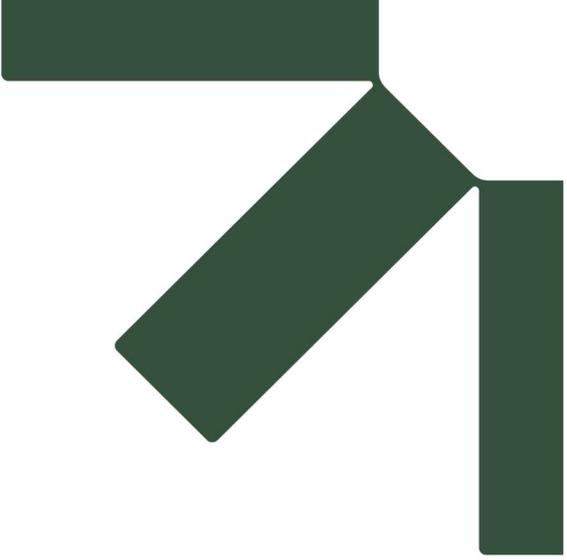
Table 4-3, below presents recommended frequency for the inspection and appraisal of features across the site:

**Table 4-3: Inspection Intervals**

Feature	Inspections		Appraisals	
	Active	Dormant / Restored	Active	Dormant / Restored
Excavation	-	Weekly	-	Annually
Tips	-	Weekly	-	Annually
Stockpiles	Weekly	-	-	Annually
Lagoons	Weekly	-	-	Annually

Given Significant Hazards remain present at the site, the next Geotechnical Assessment is recommended to be undertaken no later than April 2026.





# Drawings

## Regulation 33 Geotechnical Assessment

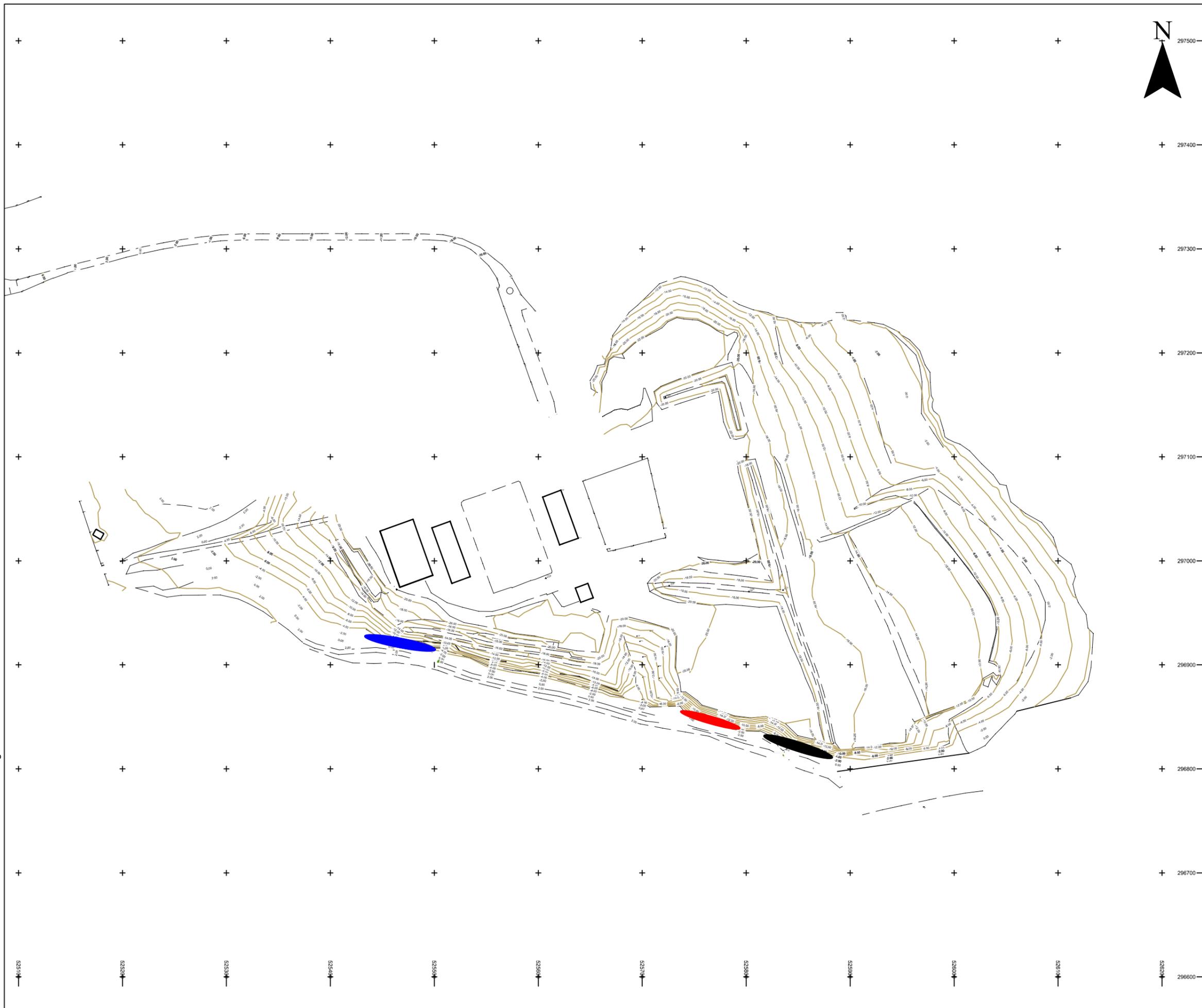
**Saxon Pit, Whittlesea**

**East Midlands Waste Management Limited**

SLR Project No.: 403.07764.00001

21 June 2024

403.07764.00001.08.002.0 Borehole Location Plan-.dwg



**NOTES**

1. SURVEY SHOWN UNDERTAKEN BY H.D. SURVEYING. DATE OF SURVEY 29 to 31/08/17. FILE REF: 0903\_001\_T\_0 - Saxon Pit.DWG.
2. LEVELS SHOWN ARE NOT BASED ON METRES ABOVE ORDNANCE DATUM BUT ARE SHOWN ON A LOCAL SYSTEM.
3. AREAS OF INSTABILITY ARE NOT TO SCALE

**LEGEND**

 SURVEY CONTOURS

**Selected Areas of Instability**

 Photo 5

 Photo 7

 Photo 8

**EAST MIDLANDS WASTE MANAGEMENT LIMITED**

 Treenwood House,  
Rowden Ln,  
Bradford-on-Avon  
BA15 2AU  
Tel: 0330 088 6631  
Web: www.slrconsulting.com

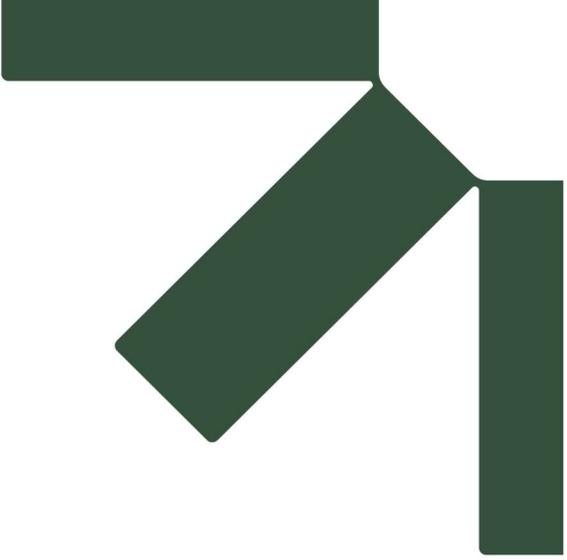
SAXON PIT GEOTECHNICAL ASSESSMENT

SOUTHERN SLOPE

KEY INSTABILITY LOCATIONS

**DRAWING 1**

Scale 1:3500 (A3) Date June 2024



# Appendix A Photographic Record

## Regulation 33 Geotechnical Assessment

Saxon Pit, Whittlesea

East Midlands Waste Management Limited

SLR Project No.: 403.07764.00001

21 June 2024

## Appendix A – Photographic Record

**Photo 1: Undulating slope face - facing west**



**Photo 2: Buttress to slope face on west of ramp - facing southwest**



**Photo 3: Central buttress and access ramp - facing southwest**



**Photo 4: Series of failures in upper section - facing south**



**Photo 5: Significant backscarp and exposed lithology - facing south**



**Photo 6: Failed section with debris flow on slope face & exposed lithology - facing south**



**Photo 7: Exposed upper lithology immediately east of ramp – facing southeast**



**Photo 8: Exposed upper lithology facing southwest**



**Photo 9: Fenced off lagoon facing northeast**



**Photo 10: Stockpiles around lagoon area – facing northeast**



**Photo 11: Haul Road/track at slope toe – facing west**



# **Appendix C    Stability Assessment of Proposed Stabilisation Buttress**





# Stability Assessment of Proposed Stabilisation Buttress

**Saxon Pit**

**East Midlands Waste Management**

Prepared by:

**SLR Consulting Limited**

15 Middle Pavement, Nottingham, NG1 7DX

SLR Project No.: 403.07764.00001

Client Reference No:

22 July 2024

Revision: 4

## Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
0	25 August 2023	SL	TD	TD
1	20 September 2023	SL	TD	TD
2	3 May 2024	TD	MR	TD
4	22 July 2024			

## Basis of Report

This document has been prepared by SLR Consulting Limited (SLR) with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with East Midlands Waste Management (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.



## Table of Contents

<b>Basis of Report</b> .....	<b>i</b>
<b>1.0 Introduction</b> .....	<b>1</b>
1.1 Proposed Development.....	1
1.1.1 Slope Monitoring .....	1
<b>2.0 Ground Model</b> .....	<b>2</b>
2.1 Geotechnical Laboratory Testing.....	2
2.1.1 2017 Results .....	2
2.2 Groundwater .....	2
<b>3.0 Stability Assessment</b> .....	<b>2</b>
3.1 Justification for Modelling Approach and Software .....	2
3.2 Justification of Geotechnical Parameters Selected for Analysis.....	2
3.3 Selection of Appropriate Factors of Safety.....	3
3.4 Topographic Survey .....	3
3.5 Limit Equilibrium Analyses.....	4
3.5.1 1V:3H Proposed Buttress Slopes .....	4
3.5.2 Localised Proposed Buttress Slopes .....	4
<b>4.0 Recommendations and Conclusions</b> .....	<b>6</b>

## Tables in Text

Table 3-1: Geotechnical Design Parameters .....	3
Table 3-2: Proposed Buttress Profile Results for Slope 1V:3H.....	4
Table 3-3: Summary of FOS for Slope Gradients.....	4

## Drawings and Appendices

<b>Drawing 001</b>	<b>Historical Slope Sections</b>
<b>Drawing 002</b>	<b>Proposed Buttress and Gabion Wall</b>
<b>Appendix A</b>	<b>1V:3H Slope Stability Assessment Outputs</b>
<b>Appendix B</b>	<b>Localised Slope Stability Assessment Outputs</b>



## 1.0 Introduction

East Midlands Waste Management Limited (EMWM) has retained SLR Consulting Limited (SLR) to prepare a geotechnical stability assessment of the proposed stabilisation buttress of the southern slope at Saxon Pit, Whittlesey. This report describes the manner in which the assessment has been carried out and presents the overall findings of the work.

### 1.1 Proposed Development

SLR understands that there have been ongoing stability issues with the Site, resulting in an over-steepened slope along the southern boundary. Historically, SLR designed and monitored the existing buttress that is being constructed to stabilise the northern and north-eastern slopes on Site. It is now required for the southern slope to be stabilised due to multiple shallow failures being recorded along the slope adjacent to the railway.

It is proposed to construct a buttress to increase the overall stability of the slope. Due to the presence of third-party land to the south, the crest of the existing slope cannot be cut back to reduce the gradient. A buttress is therefore considered to be the only effective solution.

It is understood that no cut/fill exercise will be carried out on site and therefore all material will need to be imported for the construction of the buttress.

#### 1.1.1 Slope Monitoring

Visual inspections indicate that the failures have been shallow and contained within the uppermost soils of the slope, typically within the weathered zone of the Oxford Clay and sections containing peat. However, to determine whether the ground deformation is also occurring at greater depth, two (2No.) tube-way inclinometers were installed to a maximum depth of 20.0m bgl during the 2017 ground investigation<sup>1</sup>. This allowed for subsequent monitoring to be carried out to establish rates of ground movement and position of ground deformation.

Since 2017, inclinometer monitoring has been carried out at a minimum frequency of once a month at the two locations at the crest of the southern slope. The monitoring results show maximum displacements of up to 59mm in the upper 2.0m of soils.

Drawing 001 contains historical slope sections showing a comparison between a survey carried out c. 2004 and the 2019 topographic survey. This further confirms that the crest of the southern slope is migrating.

---

<sup>1</sup> SLR Consulting Ltd. 'Factual Ground Investigation Report – Saxon Pit, Whittlesey.' December 2017. Ref: 403.07764.00001.



## 2.0 Ground Model

### 2.1 Geotechnical Laboratory Testing

It is understood that the buttress will be constructed using imported inert fill. Geotechnical laboratory testing has been conducted on typical material anticipated to be used within the filling operations. A summary of the results is presented below.

#### 2.1.1 2017 Results

Undisturbed, disturbed and bulk disturbed samples collected during the 2017 ground investigation<sup>1</sup> were sent to a UKAS accredited laboratory for the following analyses:

- Moisture content;
- Atterberg limits;
- Particle size distribution; and,
- Quick undrained triaxial.

The results indicated undrained shear strengths ranging from 59kPa to 140kPa for the weathered and in-situ Oxford Clay.

### 2.2 Groundwater

2No. groundwater monitoring wells were installed during the 2017 ground investigation. BH03 is in close proximity to the slope and has been previously monitored on an approximate monthly basis. Monitoring indicated water levels of between 3.22 and 3.53m bgl (metres below ground level), contained within the weathered Oxford Clay. It is understood that BH03 has been lost and has not been monitored since May 2021 (approximate). The groundwater levels used for this assessment have been estimated using previous data so may not be representative of the current conditions.

## 3.0 Stability Assessment

SLR understands that that the buttress-forming material will be placed to an earthworks specification and will following existing placement methods.

### 3.1 Justification for Modelling Approach and Software

The analytical method used in this assessment involves the use of limit equilibrium stability analyses for the derivation of factors of safety for the stabilisation buttress. The limit equilibrium analyses have been undertaken using the package SLOPE/W Version 11.2 (Geo-Slope International). The Bishop<sup>2</sup> slip-circle and Morgenstern-Price<sup>3</sup> non-circular methods of analysis have been used.

### 3.2 Justification of Geotechnical Parameters Selected for Analysis

A summary of the geotechnical parameters used in the design and analysis of the development are presented in tabular form for each component in Table 3-1. The geotechnical parameters for limit equilibrium analysis include the shear strength and unit

---

<sup>2</sup> Bishop, A.W., (1965), 'The use of the slip-circle in the stability analysis of slopes' Geotechnique.

<sup>3</sup> Morgenstern, N.R and Price, V.E. (1965), 'The analysis of stability of general slip surfaces' Geotechnique.



weight of each material within the model. The parameters detailed below are taken from the existing laboratory testing results and previous SLR experience, where laboratory data is not available. The analysis has assumed that the pore water pressures within the fill will be represented by a porewater pressure ratio ( $r_u$ ) of 0.2 to allow for pore fluid pressures to build up within the buttress.

**Table 3-1: Geotechnical Design Parameters**

Material	Bulk Unit Weight, $\gamma$ (kN/m <sup>3</sup> )	Undrained Shear Strength (kPa)	Drained Parameters	
			Effective cohesion, $c'$ (kPa)	Angle of shearing resistance, $\phi'$ (°)
Made Ground	18.00	-	0	28
Peat	18.00	-	6	25
Weathered Oxford Clay	17.95	45	-	-
Oxford Clay	17.95	140	-	-
Inert Fill	18.00	-	2 (peak) 0 (residual)	29 (peak) 23 (residual)

### 3.3 Selection of Appropriate Factors of Safety

The factor of safety is the numerical expression of the degree of confidence that exists, for a given set of conditions, against a particular failure mechanism occurring. It is commonly expressed as the ratio of the load or action, which would cause failure against the actual load or actions likely to be applied during service. This is readily determined for some types of analysis (e.g. limit equilibrium slope stability analyses).

Prior to determining appropriate factors of safety for the model, it is necessary to identify key 'receptors' and evaluate the consequences in the event of a failure (relating to both stability and integrity). Consideration of the following receptors is required:

- groundwater;
- property - relating to site infrastructure, third party property; and
- human beings (i.e. direct risk).

A factor of safety (FOS) of 1.3 is considered appropriate for this scenario for the peak levels and a FOS of 1.0 is considered appropriate for the residual levels, however the slope analysed is in proximity to Network Rail assets and therefore a higher FOS may be required.

### 3.4 Topographic Survey

A topographic survey<sup>4</sup> was provided by EMWM for the purpose of this assessment, Drawing 001 contains the drawing and the cross-sections produced to derive the slope profile. The slope forming the majority of the buttress along the south-western edge of the site has been modelled, as well as the slope adjacent to the existing site buildings. The geometries shall be used throughout the analyses and are solely based on the information provided.

<sup>4</sup> HD Surveying. September 2019. 'Topographic Survey – Saxon Pit.' Drawing Ref: 0903\_001\_T-0.



It should be noted that the proposed design<sup>5</sup> at the position of Section C indicates the geometry of the western edge of the buttress to be 1V:3H (full slope height), whilst the geometry of the buttress directly adjacent to the existing site buildings is to be modelled at 1V:1.6H and 1V:1.7H. The width of the crest of the buttress is proposed at 5.0m.

### 3.5 Limit Equilibrium Analyses

Limit Equilibrium analyses have been carried out on the bund in the submerged peak (short-term) and residual (long term) condition. The parameters used within the submerged condition have been taken from the laboratory testing, as well as site observations and experience on site.

#### 3.5.1 1V:3H Proposed Buttress Slopes

Analyses were carried out on the current proposed design for the majority of the buttress, with a slope gradient of 1V:3H, using anticipated parameters for the inert fill at peak and residual values.

Table 3-2 presents the results which indicate an acceptable FOS, outputs are included within Appendix A.

**Table 3-2: Proposed Buttress Profile Results for Slope 1V:3H**

Material	Gradient	Factor of Safety	Comments
Imported fill	1V:3H	1.61 (Peak)	Acceptable
		1.10 (Residual)	

#### 3.5.2 Localised Proposed Buttress Slopes

Subsequent analyses were carried out on the slope adjacent to the existing site buildings. This section of the buttress has been proposed to be steeper than the rest of the buttress, to reduce the lateral extent of the buttress at the toe of the slope to allow the existing buildings to remain in-situ. Table 3-3 presents a summary of the FOS generated for a range of slope geometries, with highlighted cells indicating an acceptable FOS. It can be seen from the results that a geometry of 1V:2.5H is the steepest slope (and therefore minimum material) that produces an acceptable FOS. In this scenario, the buttress extends approximately 59.0m out from the crest (69.0m from the natural slope crest) which will encroach on the footprint of the buildings. Outputs for the 1V:2.5H slope only are presented in Appendix B.

**Table 3-3: Summary of FOS for Slope Gradients**

Gradient	Inert Fill Peak	Inert Fill Residual
1V:1.6H	0.71	0.48
1V:1.65H	0.75	0.50
1V:1.7H	0.80	0.55
1V:1.75H	0.81	0.58
1V:1.8H	0.91	0.60
1V:1.85H	0.93	0.62

<sup>5</sup> SBRice. January 2018. 'Saxon Pit – Existing and Proposed Sections.' Drawing Ref: EMWM.SP-1-4-001.



Gradient	Inert Fill Peak	Inert Fill Residual
1V:1.9H	0.95	0.64
1V:2H	1.26	0.85
1V:2.5H	1.30	1.06
1V:3H	1.61	1.10

### 3.5.2.1 Recommendation Option

The analyses have shown that in order to achieve an acceptable FOS, the gradient of the slope needs to be at least 1V:2.5H. For the existing site buildings to remain in-situ, it may be possible to install a retaining wall, such as a gabion wall, at the toe. Based on preliminary calculations, any retaining wall would need to be approximately 47.0m from the crest of the buttress, retaining an approximate height of 5.0m along a length of 120m (Drawing 002). Initial stability analyses have been assessed which produce an acceptable FOS, however it should be noted that any retaining wall would need to be considered further at detailed design stage, including stability of the wall itself.



## 4.0 Recommendations and Conclusions

Based on the results of the stability analyses, an acceptable FOS for the 1V:3H gradient proposed for the majority of the buttress has been determined through the stability assessment.

The assessment demonstrates that an acceptable gradient for the slope adjacent to the existing site buildings is 1V:2.5H. It is anticipated that the toe of the buttress, when formed at this inclination, would need to be retained at an approximate lateral distance of 47.0m from the crest to enable the site buildings to remain in-situ. The retained height at this distance is estimated at 5.0m, extending an approximately 140m laterally. Further consideration of any potential retaining solution is required and would need to go through detailed design, including stability checks of the solution itself.

To ensure ongoing stability of the buttress, a specific earthworks specification will need to be adopted as well as regular topographic surveys and reporting of progress.

An indicative volumetric calculation has been undertaken using the geometries determined from the limit equilibrium stability modelling has estimated approximately 217,000m<sup>3</sup> of imported material will be required to buttress and stabilise the slope in the long term.





# Drawing 001 Historical Slope Sections

## Stability Assessment of Proposed Stabilisation Buttress

Saxon Pit

East Midlands Waste Management

SLR Project No.: 403.07764.00001

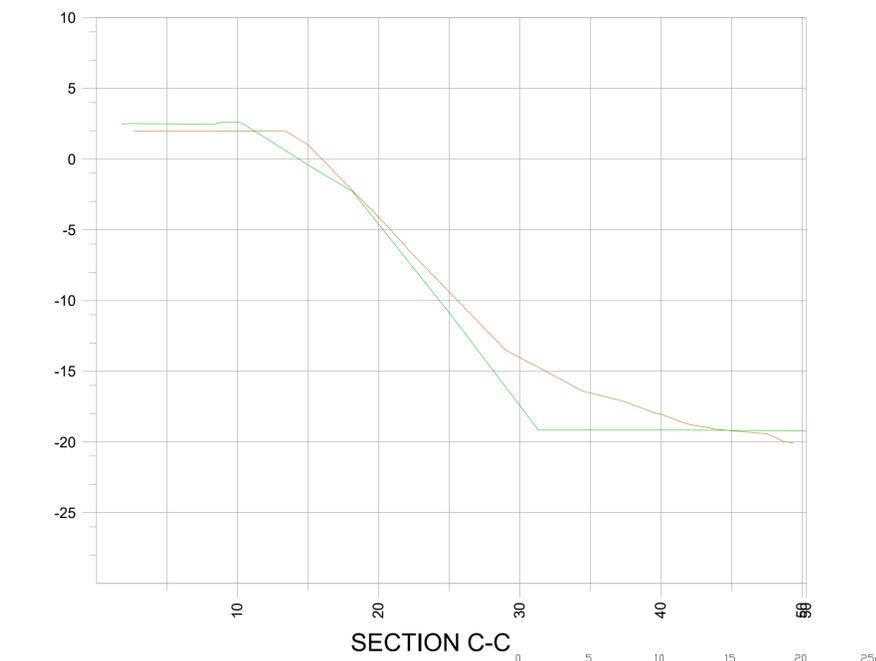
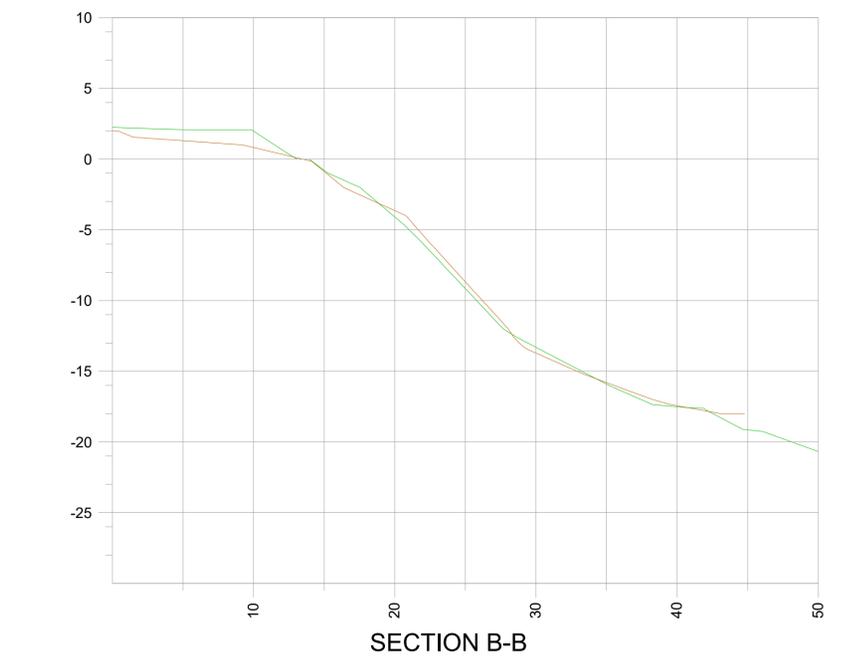
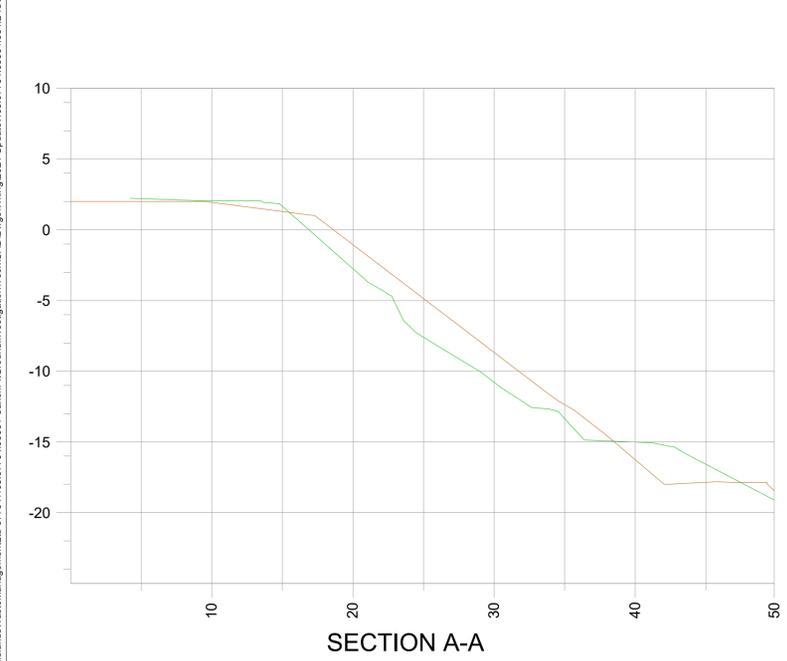
22 July 2024



Notes:  
1.

Legend:  
-12.00 EXISTING CONTOURS SURFACE (2019)

Legend Sections:  
ORIGINAL SURFACE (2005)  
EXISTING SURFACE (12-02-2019)



2	updated title	09.07.24	AB	T	TD
1	Isopachyte rendering replaced with contours	05.07.24	AB	T	TD
Rev	Amendments	Date	By	Chk	Auth



Drawing Status & Suitability Code

Client: EAST MIDLANDS WASTE MANAGEMENT

Project: STABILITY ASSESSMENT OF PROPOSED STABILISATION BUTTRESS

Drawing Title: HISTORICAL SLOPE SECTIONS / PROFILES

Scale: AS SHOWN @ A1	SLR Project No: 403.07764.00001		
Designed: AB	Drawn: AB	Checked: SL	Authorised: TD
Date: 09.23	Date: 09.23	Date: 09.23	Date: 09.23
Drawing Number: 001	Rev: 2		



# Drawing 002 Proposed Buttress and Gabion Wall

## Stability Assessment of Proposed Stabilisation Buttress

Saxon Pit

East Midlands Waste Management

SLR Project No.: 403.07764.00001

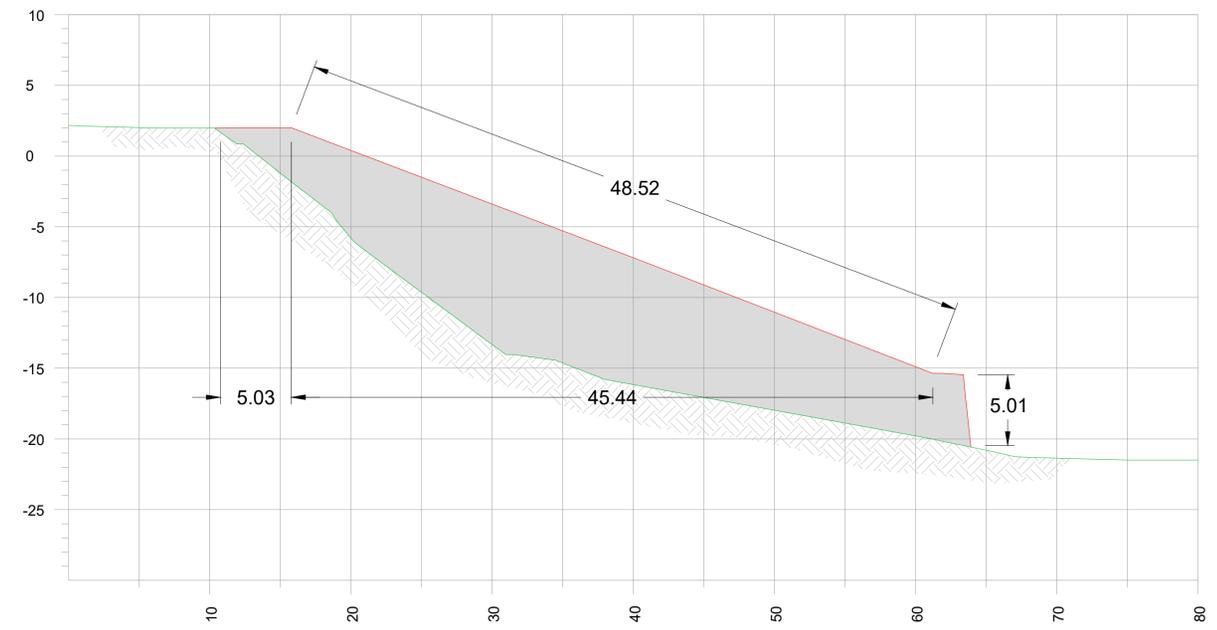
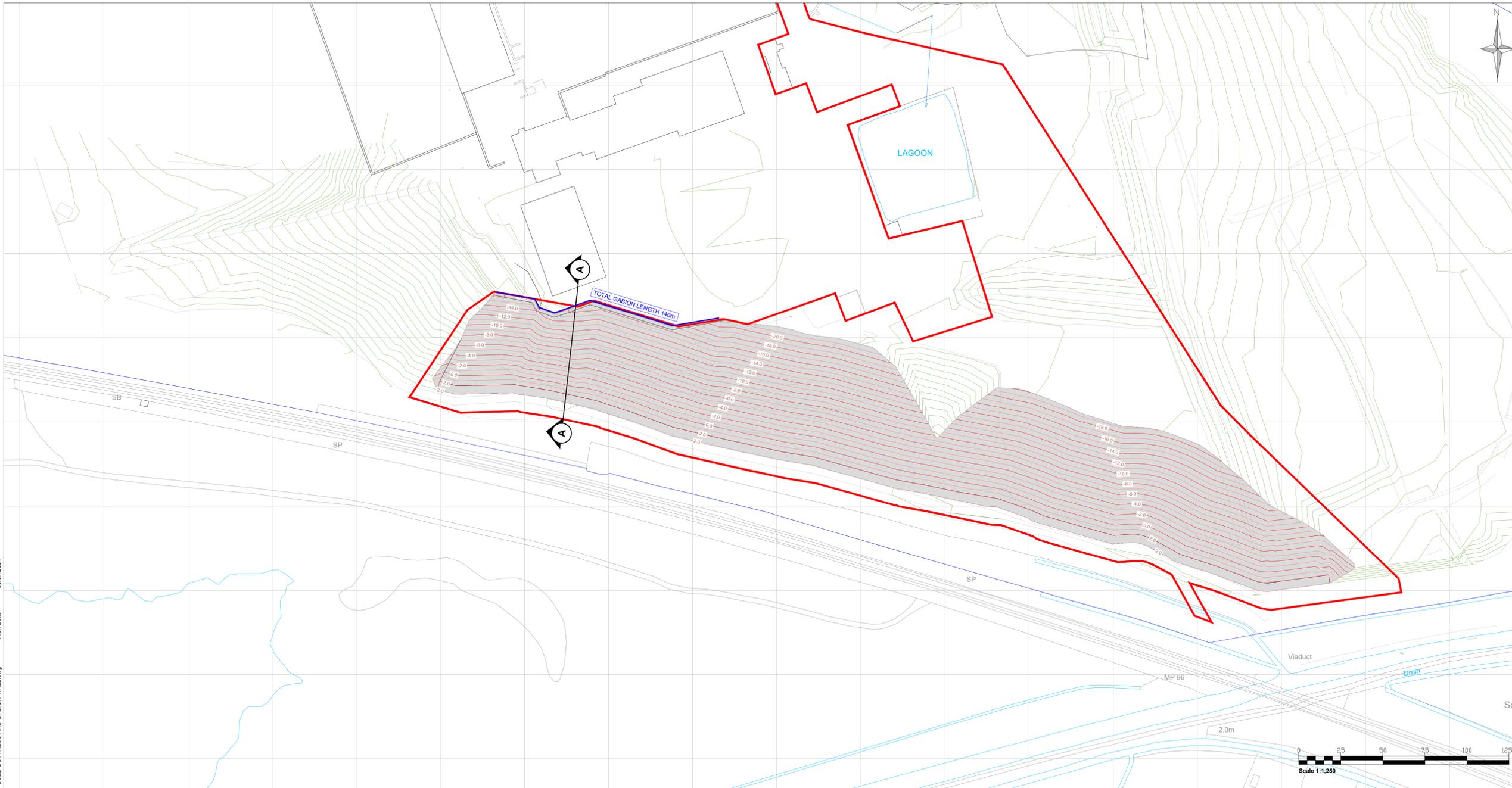
22 July 2024



Notes:  
1.

Legend:

	SURVEY 12-02-19
	BUTTRESS AND GABIONS
	PROPOSED PHASE 2 BUTTRESS MAY 2024



Rev	Amendments	Date	By	Chk	Auth
4	red line, legend, section updated	05/07/24	AB	TD	TD
3	Base map, legend amended	18/06/24	AB	TD	TD
2	design amended	05/06/24	AB	TD	TD
1		29/05/24	AB	TD	TD



Drawing Status & Suitability Code

Client:  
**EAST MIDLANDS WASTE MANAGEMENT**

Project:  
**STABILITY ASSESSMENT OF PROPOSED STABILISATION BUTTRESS**

Drawing Title:  
**PROPOSED BUTTRESS AND GABION WALL**

Scale: <b>AS SHOWN @ A1</b>	SLR Project No: <b>403.07764.00001</b>		
Designed: <b>AB</b>	Drawn: <b>AB</b>	Checked: <b>SL</b>	Authorised: <b>TD</b>
Date: <b>09.23</b>	Date: <b>09.23</b>	Date: <b>09.23</b>	Date: <b>09.23</b>
Drawing Number: <b>002</b>	Rev: <b>4</b>		

08/07/2024 Alex Betts N:\EastMidlandsWasteManagement\403.07764.00001-SubsidenceInvestigation\Tech\CAD\Drawings\Working\2024\Update\403.07764.00001.002.4 PROPOSED BUTTRESS AND GABION WALL.dwg



# **Appendix A    1V:3H Slope Stability Assessment Outputs**

## **Stability Assessment of Proposed Stabilisation Buttress**

**Saxon Pit**

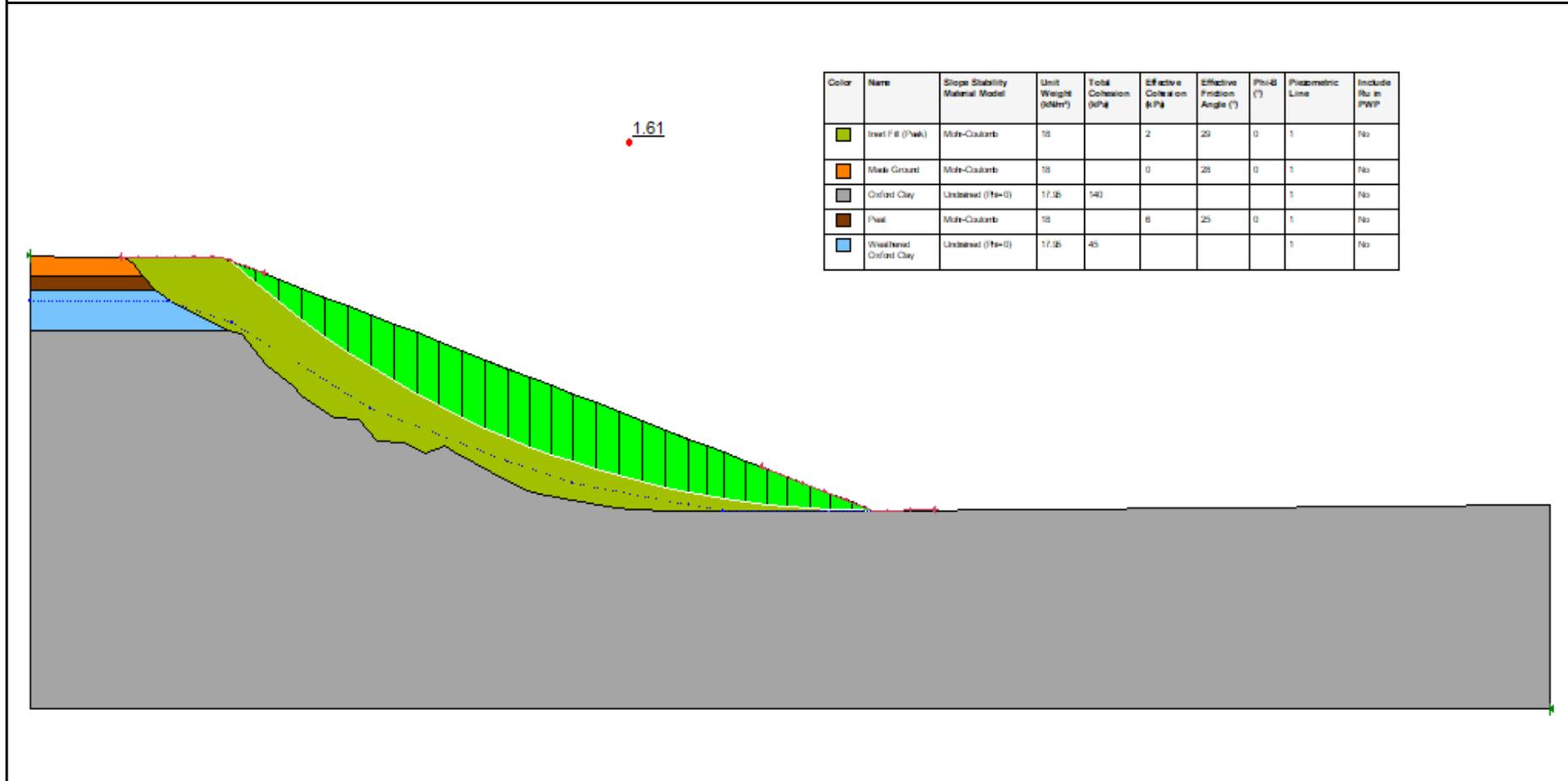
**East Midlands Waste Management**

SLR Project No.: 403.07764.00001

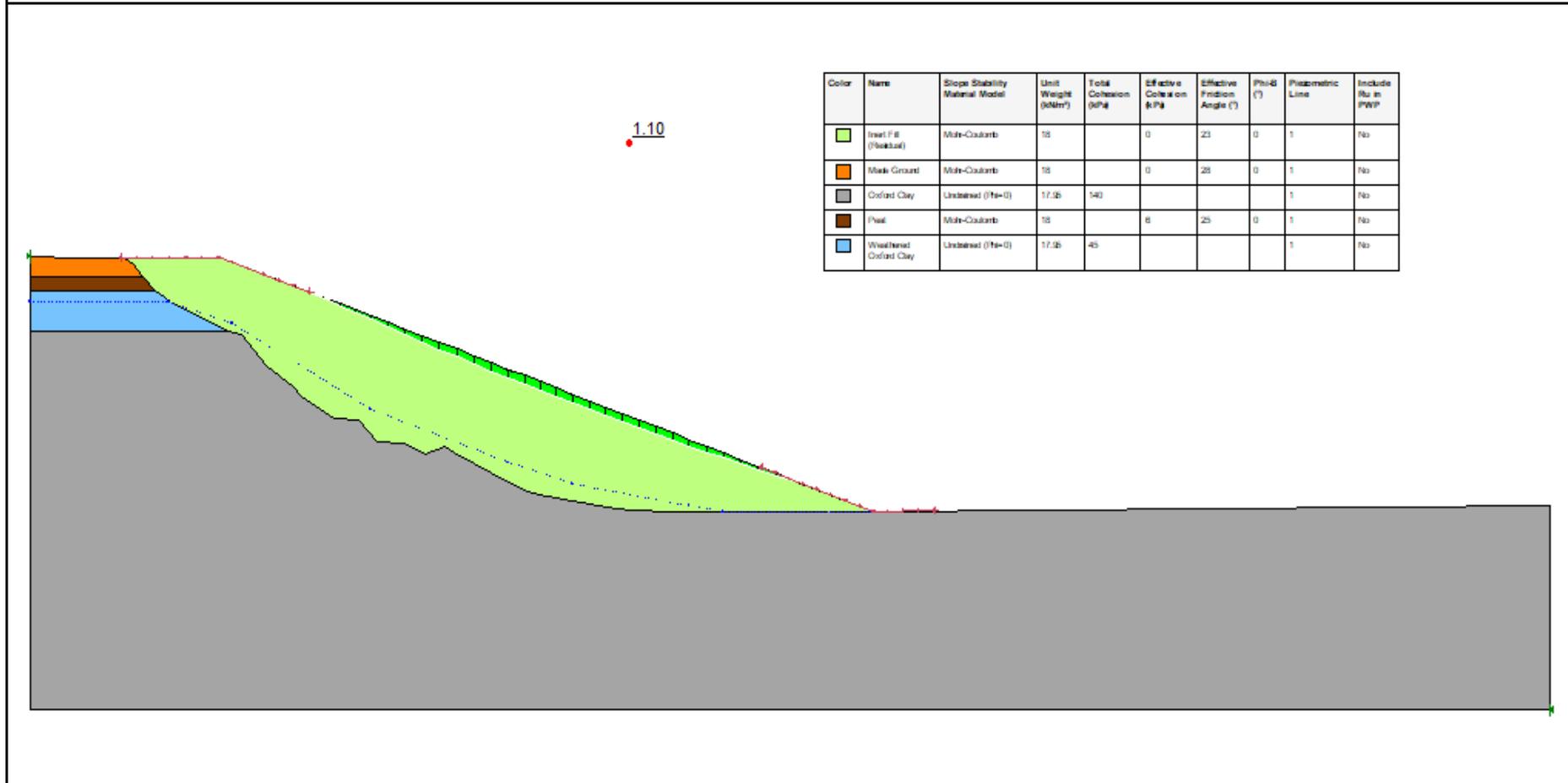
22 July 2024

## Appendix A

Figure A-1: Fill, Peak Parameters



**Figure A-2: Fill, Residual Parameters**





# **Appendix B   Localised Slope Stability Assessment Outputs**

## **Stability Assessment of Proposed Stabilisation Buttress**

**Saxon Pit**

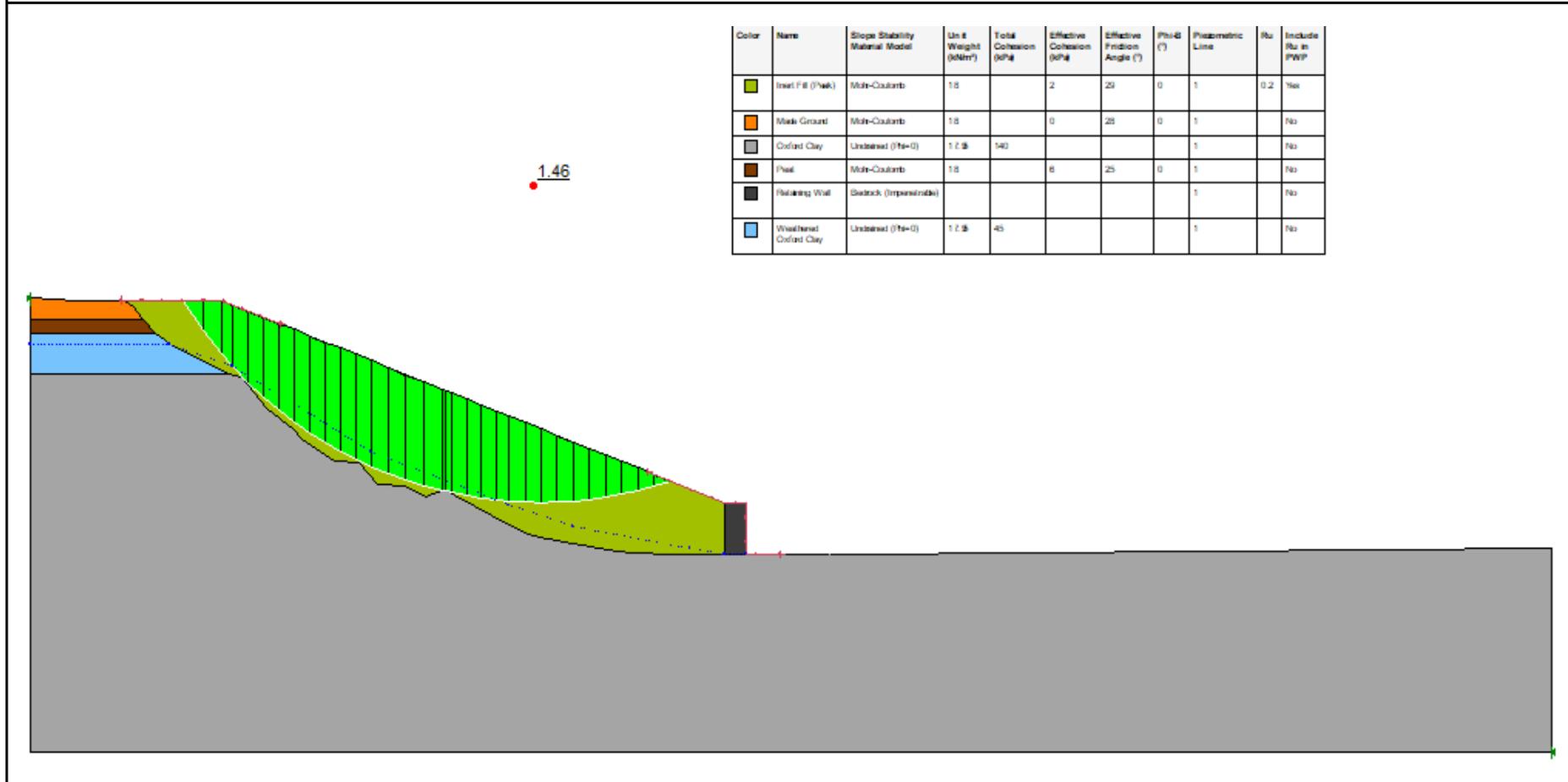
**East Midlands Waste Management**

SLR Project No.: 403.07764.00001

22 July 2024

## Appendix B

**Figure B-1: Fill, Peak Parameters, Retained Toe**



**Figure B-2: Fill, Residual Parameters, Retained Toe**

