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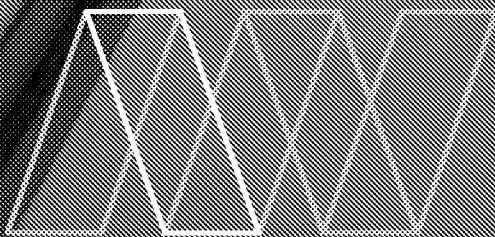
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PHASE II GEO-ENVIRONMENTAL INVESTIGATION REPORT

HMP FORD

for

Caledonian Modular Ltd

Project Reference: JMS/ST/45713-Rp001 Rev A

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Date: 27th August 2021

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For the avoidance of doubt, the parties confirm that these conditions of engagement shall not and the parties do not intend that these conditions of engagement shall confer on any party any rights to enforce any term of this Agreement pursuant of the Contracts (Rights of third Parties) Act 1999.

The Appointment of Alan Wood & Partners shall be governed by and construed in all respects in accordance with the laws of England & Wales and each party submits to the exclusive jurisdiction of the Courts of England & Wales

Report Prepared for Caledonian Modular Ltd

Page 1 of 49

CONTENTS

EXECUTIVE SUMMARY

1	INTRODUCTION.....	7
1.1	Appointment	7
1.2	Development Proposals	7
1.3	Report Status	7
1.4	Objectives of the Investigation.....	8
1.5	Site Works	8
1.6	Limitations of Study	8
2	SITE DETAILS AND DESCRIPTION.....	11
2.1	Introduction.....	11
2.2	Site Location & Description	11
3	PHASE I GEO-ENVIRONMENTAL ASSESSMENT.....	13
3.1	Anticipated Geology, Hydrogeology & Mining	13
3.2	Historical Land Use	14
3.3	Anticipated Ground Conditions.....	15
3.4	Preliminary Conceptual Site Model	16
4	GROUND INVESTIGATION FIELDWORK.....	24
4.1	Introduction.....	24
4.2	Site Works	24
4.3	Geotechnical Investigation	25
4.4	Environmental Investigation	26
5	RESULTS OF INVESTIGATION.....	28
5.1	Ground Conditions Encountered	28
5.2	Visual & Olfactory Evidence of Contamination	29
5.3	In-Situ Infiltration tests.....	29
5.4	Geotechnical Testing & Material Properties	29
5.5	Undrained Shear Strength in Triaxial Compression.....	30
5.6	One Dimensional Consolidation Test	31
5.7	Contamination and Performance of Building Materials (Cementitious Products).....	31
5.8	Chemical Testing.....	32
6	GEOTECHNICAL ASSESSMENT.....	35
6.1	Mining Risk.....	35
6.2	Foundations.....	35
6.3	Floor Slabs	35
6.4	Precautions Near Trees.....	35
6.5	Drainage and Soakaways.....	35
6.6	Roads and Car Parks	36
6.7	Ground Stability	37
6.8	Excavations	37
6.9	Sulphate Attack and Aggressive Ground Conditions.....	37

7	ENVIRONMENTAL ASSESSMENT	39
7.1	Guidance for Analytical Results - Assessment Criteria.....	39
7.2	Human Health Receptors	40
7.3	Controlled Waters Receptors	41
7.4	Ecological Receptors.....	41
7.5	Utilities.....	41
7.6	Potable Water Supplies	41
7.7	Refined Conceptual Site Model	41
7.8	Summary of Identified Contaminant Linkages	44
8	CONCLUSIONS AND RECOMMENDATIONS.....	46
8.1	General.....	46
8.2	Soil Contamination - Risk Evaluation.....	46
8.3	Hazardous Ground Gases.....	46
8.4	Outline Remediation Requirements.....	46
8.5	Disposal of Soils	47
8.6	Further Work	47
9	REGULATORY APPROVAL	48
10	INFORMATION SOURCES	49

TABLES

Table 3-1 - Geological Information	13
Table 3-2 – Historical Mapping Record (On-Site).....	14
Table 3-3 – Historical Mapping Record (Off-Site).....	14
Table 3-4 - Summary of Potential Contaminant Sources.....	17
Table 3-5 - Summary of Potential Receptors.....	18
Table 3-6 - Summary of Plausible Pathways	18
Table 3-7 - Risk Categories	20
Table 3-8 - Summary of Phase I Conceptual Site Model & Risk Assessment	22
Table 5-1 - Summary of Ground Conditions	28
Table 5.2 - Plasticity Index Test Results.....	30
Table 5.4 – Summary of Undrained Triaxial Test Results	30
Table 5.5 – Summary of Undrained Triaxial Test Results	31
Table 5-5 - Summary of Total Soil Concentrations – Made Ground	32
Table 5-6 - Summary of Total Soil Concentrations – Natural Deposits.....	33
Table 5-7 - Summary of Chemical Test Results (PAH) – Made Ground.....	33
Table 5-8 - Summary of Chemical Test Results (PAH) - Natural Deposits.....	34
Table 6-1 Summary of In-situ Soakaway Testing – Trial Pits	36
Table 6-2 Summary of In-situ CBR Tests	36
Table 7-1 - Summary of Revised Conceptual Site Model & Risk Assessment	45

FIGURES

45713/001	SITE LOCATION PLAN
45713/002	GROUND INVESTIGATION LOCATION PLAN

APPENDICES

APPENDIX A: GROUND INVESTIGATION LOGS

APPENDIX B: LABORATORY TEST RESULTS: GEOTECHNICAL

APPENDIX C: LABORATORY TEST RESULTS: CHEMICAL

APPENDIX D: CBR TEST RESULTS

APPENDIX E: AWP GENERIC ASSESSMENT CRITERIA

EXECUTIVE SUMMARY

Site Location & Description	HMP Ford is a Category D men's prison is located on Ford Road, Arundel BN18 0BX, and is centred at National Grid Reference (NGR) 500289mE, 102796mN. The perimeter of the site is marked by secure fencing, with the site accessed through the main gate and a secondary access gate off Ford Road.
Proposed Development	The construction of two houseblocks (two storeys) for 120 prisoners, extensions to existing car park (80 spaces) proposed storage facilities, and ancillary office space with secure perimeter fence at HMP Ford Category D Prison.
Historical Land Use	The earliest available historical mapping records dated 1876 show the area to have originally comprised an area of undeveloped agricultural land. The site remained undeveloped up until the 1960s when the prison was then constructed on the eastern side of Ford Road. The western side of the site was then developed in the 1970s after formerly being used as Ford Airfield. No significant changes have been noted between mapping dated from the 1970s and the most recent aerial photography of the prison.
Geology	Superficial Deposits: Raised Beach Deposits comprising sand and gravel across the majority of the site, with River Terrace Deposits, of sand, silt and clay, recorded towards the western boundary of the site. Solid Geology: Chalk of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation. All formations are undifferentiated.
Hydrogeology	Aquifer within Superficial Deposits: Secondary A - 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. Aquifer within Bedrock: Principal - These are layers of rock that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
UXO Risk	Plausible UXO risk identified. Specialist support required for intrusive works.
Ground Conditions	Made ground to a maximum depth of 0.90m present across the site, comprising sand with concrete, brick and flint inclusions. Superficial deposits comprise raised Beach Deposits were encountered to a depth of 5.70m (maximum) consisting of loose pale brown sand with chalk and flint gravel. Bedrock comprising chalk, encountered as very soft cream gravelly clay grading to chalk and flint gravel, was encountered from depths of between 1.70m and 5.70m bgl.
Mining Assessment	The site does not lie within a coal mining reporting area and as such does not lie within a development high risk area. The risk of encountering shall mine workings is therefore considered to be negligible.
Geotechnical Assessment	Six samples of cohesive soil were submitted to the laboratory for plasticity testing. The calculated modified plasticity index was found to be between 5% and 20%, which is equivalent to a low to medium volume change potential. Additional samples were submitted for triaxial testing and one-dimensional consolidation testing, with the results presented in Section 5.
Foundations	Piled foundations will be required
Ground Slabs	Suspended slabs will be required

Precautions near Trees	Protection from heave will be required where foundations and floor slabs are located within the influence of trees.
Drainage	Soakaways are likely to be suitable for disposal of surface water assuming potential risks from contamination to the underlying aquifer can be adequately managed. Consultation with the EA would be advisable to confirm.
Obstruction & Excavations	No significant obstructions to excavation anticipated. Excavations should be readily achieved using conventional plant. Excavations in natural deposits and made ground are likely to be unstable even in the short term.
Sulphate	Ground conditions not considered aggressive to concrete ACEC-1 DS-1
Roads	CBR values of between <2% and 97.5% have been recorded. The majority of results recorded <2%, which should be assumed for road and pavement design
Environmental Assessment	Localised PAH species have been identified at elevated concentrations in TP2 and TP4 at shallow depth No asbestos has been identified
Potable Water Supplies	Unlikely to require protective measures. Waters supply company should be consulted to confirm their specific requirements
Remediation requirements	Localised hotspot removal may be required.
Gas Protection Measures	Gas protection measures may be required. To be confirmed following completion of the monitoring period.
Further Works	Completion of gas monitoring Gas risk assessment Delineation of identified contaminants
NB. The Executive Summary presented above is an overview of the key findings and conclusions of the report. There may be other information contained within the body of the report which puts into context the findings of the Executive Summary. No reliance should therefore be placed on the Executive Summary until the report as a whole has been read in full.	

1 INTRODUCTION

1.1 Appointment

- 1.1.1 Alan Wood & Partners were appointed by Caledonian Modular Ltd (the 'Client') to undertake a Phase II Geo-Environmental Assessment.
- 1.1.2 This report provides geotechnical and environmental information in relation to the proposed redevelopment. The site will have a continued end use as a prison and this assessment assumes that ground levels will remain similar to present.
- 1.1.3 As the proposed end-use is not a standard end-use for which generic assessment criteria have been published, we have adopted GACs for the end-use considered to most closely reflect the prison environment in terms of use, exposure, environment etc. For the purposes of environmental assessment, GACs for a 'public open space near residential land' have been selected. Where suitable GAC values are not available for this land usage, a 'commercial' site end use has been adopted.
- 1.1.4 Interpretation and recommendations should not be assumed valid for adjacent areas of land, or for alternative land uses. Should the proposed site usage change, the recommendations and conclusions presented in this report may need to be re-assessed.

1.2 Development Proposals

- 1.2.1 The construction of two houseblocks (two storeys) for 120 prisoners, extensions to existing car park (80 spaces) proposed storage facilities, and ancillary office space with secure perimeter fence at HMP Ford Category D Prison.

1.3 Report Status

- 1.3.1 The geoenvironmental investigation of the site has been carried out in two phases. These works have comprised the completion of a Phase I preliminary assessment (desk based study) using third-party, readily available information, and a subsequent Phase II (intrusive) investigation, the results of which are presented in this report. The Phase I findings are presented herein and provide the basis for the scope of the Phase II works completed.

1.3.2 The Phase I assessment consisted of a study of information surrounding the site's geoenvironmental setting, provided by the Environment Agency, the British Geological Survey and the Coal Authority, so that an initial Conceptual Site Model (CSM) and Risk Assessment (RA) could be completed. The Phase I elements are presented in section 3 of this report.

1.4 Objectives of the Investigation

1.4.1 The scope of works undertaken as part of this appraisal was to:

- Investigate the ground conditions present on-site and identify their geotechnical properties in relation to the site's proposed end use;
- Investigate the hydrogeological regime beneath the site wherever possible;
- Identify the nature and extent of any contamination within the on-site soils and undertake a tiered risk assessment to establish likely risks to sensitive receptors. Defining a Conceptual Site Model of potential contaminant linkages relevant to the proposed redevelopment of the site;
- Provide preliminary advice in relation to any environmental or geotechnical issues associated with the site including foundation recommendations and other recommendations needed to facilitate the proposed redevelopment, including, where necessary, identifying any additional phases of work or remediation that need to be carried out.

1.5 Site Works

1.5.1 The findings and recommendations given in this report are based on fieldwork, which was completed across two phases of works. The first phase of works was undertaken between 21st and 22nd July and comprised the completion of seven windowless sample boreholes. The second phase of works was completed between 5th August and 12th August 2021, comprising the completion of four cable percussive boreholes, eight california bearing ratio (CBR) tests and four mechanically excavated trial pits, two of which were used to complete permeability testing.

1.6 Limitations of Study

1.6.1 This report presents factual and interpretative geotechnical and environmental information, along with provisional construction proposals and recommendations

relevant to the objectives of the investigation for the site end-use given above. The report has been prepared for the titled project and Alan Wood and Partners can accept no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned.

- 1.6.2 For the purposes of this report and thus defining risk to the proposed development from an environmental point of view, a 'public open space near residential land' has been adopted. Where suitable GAC values are not available for this land usage, a 'commercial' site end use has been adopted. Interpretation and recommendations should not be assumed valid for alternate land uses. Where the proposed site usage changes, the findings of this report should be re-assessed to accommodate the change in proposed end-use.
- 1.6.3 The conclusions and recommendations presented in this report are based on site-specific information obtained during the desk study, ground conditions encountered and laboratory analysis and are considered reasonable on the basis of available information at the time the assessment was carried out. They should not necessarily be relied upon to represent site conditions at a substantially later date.
- 1.6.4 The findings and opinions provided in this report are given in good faith and are subject to the limitations and constraints imposed by the methods and information sources described. Factual information has been obtained from a variety of sources. Alan Wood and Partners assumes that third party data is reliable but has not independently confirmed this. The validity and accuracy of this information is therefore outside the control of Alan Wood and Partners. Professional judgement and experience is however used to ensure that uncertainties are reduced to a level appropriate to the site conditions, the purpose of the investigation and the resources devoted to it by the Client.
- 1.6.5 Whilst every effort has been made to carry out an assessment that enables a realistic characterisation of the geotechnical and environmental parameters at the site, the possibility of significant spatial variation in actual ground, groundwater and environmental (gas and contamination) conditions existing between or beyond exploratory hole locations cannot be discounted. Where information or opinion is given this is for guidance only. Further information, ground investigation, construction activities, change of site use or the passage of time may reveal conditions that were not indicated in the data and therefore could not have been considered in the

preparation of this report. Where such information might impact upon stated opinions, Alan Wood and Partners cannot accept responsibility for conditions not encountered and reserves the right to modify or retract the opinions expressed in this report. Where opinions expressed are based on current available guidelines and legislation, no liability can be accepted by AWP for the effects of any future changes to such guidelines and legislation. New information of improved practices and changes in legislation may require reinterpretation of the report as a whole, or in part.

- 1.6.6 This report does not constitute an archaeological or ecological assessment, nor does it constitute an asbestos inspection. A suitably qualified consultant should be consulted where these aspects of work are required.
- 1.6.7 A flood risk assessment in accordance with Planning Policy Statement 25, *Development and Flood Risk* (2010) has not been undertaken as part of this commission.
- 1.6.8 All ground investigation works and soil descriptions were undertaken in general accordance with BS EN ISO 14688-1 'Geotechnical Investigation and Testing – Identification and Classification of Soil' (2002), BS10175 (2011), BS 5930 (2010) and/or BS EN 1997-1:2004 (Part 1, General Rules) and BS EN 1997-2:2007 (Part 2, Ground Investigation and Testing).

2 SITE DETAILS AND DESCRIPTION

2.1 Introduction

2.1.1 Published environmental, geological and historical data relating to the site area has been reviewed, in conjunction with a walkover survey undertaken on 21st July 2021, the findings of which are presented below. The principal considerations of immediate relevance are presented in the following sections.

2.2 Site Location & Description

2.2.1 HMP Ford is a Category D men's prison is located on Ford Road, Arundel BN18 0BX, and is centred at National Grid Reference (NGR) 500289mE, 102796mN.

2.2.2 The perimeter of the site was marked by secure fencing. The site was accessible through the main gate and a secondary access gate off Ford Road.

2.2.3 The site works were undertaken across four separate study areas within the prison grounds which are proposed for development; the wider HMP Ford site was not investigated as the information obtained would not have been relevant for this assessment. The individual study area are identified on attached figure 45713-001. Each area is described within the following sections.

2.2.4 Caledonian site compound and nearby area of soft landscaping - The site compound had been constructed across an area of gravel capped land to the west of the main prison compound. The investigation also covered a nearby area of soft landscaping.

2.2.5 Landscaped area next to the main gate - A 625m² lawned area adjacent to the main gate was investigated.

2.2.6 Area of landscaping adjacent to chapel - An area of landscaping approximately 1,650m², which is located adjacent to the chapel building and a row of empty single storey cell blocks, also formed part of the investigation.

2.2.7 Area of landscaping to the east of the kitchen building - A strip of landscaping to the east of the existing kitchen building, covering an area of approximately 160m², was also investigated.

2.2.8 Above or below ground fuel storage tanks were not observed during the works.

2.2.9 The site was relatively flat and was consistent with the surrounding land.

2.2.10 Invasive plant species, including Japanese Knotweed and Giant Hogweed were not observed during the site walkover.

3 PHASE I GEO-ENVIRONMENTAL ASSESSMENT

3.1 Anticipated Geology, Hydrogeology & Mining

3.1.1 Readily available third-party information has been reviewed to provide an understanding of the geological and geo-environmental setting of the site. The following sources have been used for the production of this section of the report:

- British Geological Survey, Geology of Britain Viewer - <https://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- DEFRA, MAGIC Map Application - <https://magic.defra.gov.uk/>
- The Coal Authority - <http://mapapps2.bgs.ac.uk/coalauthority/home.html>
- UKradon - <https://www.ukradon.org/>

Table 3-1 - Geological Information

Made Ground	As the site has previously been developed, it is anticipated that some made ground soils will be present on the site.
Geology	Superficial Deposits: Raised Beach Deposits comprising sand and gravel across the majority of the site, with River Terrace Deposits, of sand, silt and clay, recorded towards the western boundary of the site. Solid Geology: Chalk of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation. All formations are undifferentiated.
Hydrogeology	Aquifer within Superficial Deposits: Secondary A - 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. Aquifer within Bedrock: Principal - These are layers of rock that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Hydrology	The nearest surface water feature is the River Arun located approximately 200m east from the eastern edge of the site.
Mining & Ground Stability	Coal Mining The site does not lie within a coal mining reporting area and as such does not lie within a development high risk area. The risk of encountering shall mine workings is therefore considered to be negligible.
Radon	The site is located in an area where the maximum radon potential is between 1 and 3%, therefore radon protective measures are not required in new construction.

3.2 Historical Land Use

3.2.1 A study of available maps from Old Maps (old-maps.co.uk) and historical aerial photography from Google Earth is presented in the following tables. It should be noted that the maps available are limited and it may be that other development has taken place not shown on the available maps.

Table 3-2 – Historical Mapping Record (On-Site)

Date	Map Scale	Feature
1876	1:2,500	The site area comprises open fields with a roadway through the centre.
1879-1880	1:10,560	No significant changes.
1898	1:2,500	
1899	1:10,560	
1911-1912	1:2,500	
1913	1:10,560	
1932-1937	1:2,500	
1938-1951	1:10,560	
1962	1:10,560	Eastern half of the site has been developed with a number of structures assumed to be HMP Ford. The western half of the site now lies in an area labelled as Ford Airfield.
1967-1973	1:10,560	No significant changes.
1973-1975	1:2,500	Eastern half of the site is labelled as H M Prison. The prison comprises a number of buildings and structures along with roadways. The western half of the site is labelled as HM Open Prison Ford, again with a number of buildings and roadways. Two tanks are shown on the northern edge of the site, with a further tank located towards the centre of the site. An electrical substation is recorded towards the southern boundary and to the west of Ford Road.
1977-1980	1:10,000	No significant changes.
1992-1993	1:10,000	Tanks and substations no longer labelled.
2001	Aerial Photography	No significant changes.

Table 3-3 – Historical Mapping Record (Off-Site)

Date	Map Scale	Feature
1876	1:2,500	Graveyard – 50m to the south River Arun – 200m to the east
1879-1880	1:10,560	No significant changes.
1898	1:2,500	Old Gravel Pit – 25m to the north
1899	1:10,560	No significant changes.
1911-1912	1:2,500	

Date	Map Scale	Feature
1913	1:10,560	
1932-1937	1:2,500	Old Gravel Pit no longer present.
1938-1951	1:10,560	Residential development – 40m to the north
1962	1:10,560	No significant changes.
1967-1973	1:2,500	
1973-1975	1:10,560	Works – 50m south of the site Ford Aerodrome – 75m to the south of the site
1977-1980	1:10,000	No significant changes.
1992-1993	1:10,000	Works to the south now labelled as Rudford Industrial estate.
2001	Aerial Photography	Possible sewage works located approximately 150m to the south-west of the site.

3.2.2 The earliest available historical mapping records dated 1876 show the area to have originally comprised an area of undeveloped agricultural land. The site remained undeveloped up until the 1960s when the prison was then constructed on the eastern side of Ford Road. The western side of the site was then developed in the 1970s after formerly being used as Ford Airfield. No significant changes have been noted between mapping dated from the 1970s and the most recent aerial photography of the prison.

3.3 Anticipated Ground Conditions

3.3.1 Made Ground

3.3.1.1 It is anticipated that limited deposits of made ground are present, which are associated with the historical uses of the site; initially as an airfield and more recently as its current use as a prison.

3.3.2 Natural Strata

3.3.2.1 Superficial deposits are recorded comprising Raised Beach Deposits (sand and gravel) across the majority of the site, with River Terrace Deposits (sand, silt and clay) recorded towards the western boundary of the site.

3.3.2.2 Bedrock is recorded as comprising chalk of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation.

3.3.3 Groundwater

3.3.3.1 It is anticipated that some shallow perched groundwater will be present within the superficial deposits, with true groundwater present within the chalk bedrock at depth.

3.4 Preliminary Conceptual Site Model

3.4.1 Introduction

3.4.1.1 The following section summaries the Preliminary Phase I Conceptual Site Model (CSM), which has been produced following the review of available pertinent desk study and third-party information. The CSM summarises the understanding of surface and sub-surface features, the potential sources of contamination, pathways and receptors in order to support the identification and assessment of plausible contaminated linkages.

3.4.2 Initial Conceptual Site Model & Risk Assessment

3.4.2.1 The risk assessment has been carried out to assess the likelihood of risk to human health and the wider environment, on the basis of information reviewed. The risk assessment is a qualitative source-pathway-receptor assessment and its function is to assess the likelihood that each possible linkage exists and to decide whether they pose potentially unacceptable risks to identified receptors (i.e. people, structures, water bodies or ecosystems) that may be harmed.

3.4.2.2 Risk can be defined as the combination of the consequence of a harmful effect and the probability of its occurrence. The existence of a contaminant linkage is dependent on site use, as well as environmental conditions: **if no contaminant linkage(s) can be proven, then the risk(s) may be discounted.**

3.4.3 Site Summary & Environmental Sensitivity

3.4.3.1 A review of available desk study information indicates that the proposed development area and the adjacent land have previously formed agricultural fields and part of an airfield prior to being developed as a prison complex.

3.4.3.2 Significant deposits of made ground soils are not expected on site, although its presence will need to be discounted through ground investigation.

3.4.3.3 The potential leaching of mobile contaminants of concern to the underlying aquifer is

considered to be moderate given the potential for contaminant sources within made ground, the historical land use, and the anticipated granular nature of the superficial deposits.

3.4.3.4 In summary, given the site history, the anticipated contaminant load within the on-site soils, its underlying geology, gassing potential and the nature of controlled waters receptors, sensitivity of the site is considered, at this stage, to be **low to moderate**. The nature and concentration of any contamination will need to be confirmed through testing.

3.4.4 Potential Sources

3.4.4.1 A potential source is defined as 'a contaminant which is in, or under the land and has the potential to cause harm to human health or to cause pollution of controlled waters'.

3.4.4.2 The following potential contaminants that may be associated with the site are summarised in Table 3.4.

Table 3-4 - Summary of Potential Contaminant Sources

Potential Sources	Associated Potential Contaminants (<i>not limited to</i>)	
	<i>Metals, inorganics and other contaminants</i>	<i>Organics</i>
Potentially contaminated made ground soils, underlying natural strata / perched groundwater	Heavy metals/metalloids, sulphate, asbestos	PAH, TPH, BTEX
	Hazardous ground gas - CH ₄ and CO ₂	

* Invasive plant species to be assessed separately if encountered.

3.4.5 Potential Receptors

3.4.5.1 A receptor is the potential target of the source contaminant, to which either significant harm or deterioration in quality may be caused.

3.4.5.2 The potential sensitive receptors with respect to the potential contamination hazards identified above are considered in Table 3.5.

Table 3-5 - Summary of Potential Receptors

Potential Receptor	Comment
Human Health	Site end-users Site operatives (during construction phase only)
Construction	Potable water supply pipes Foundations
Underlying natural strata	Near surface soils and/or any perched groundwater Principal Aquifer

3.4.6 Plausible Pathways

3.4.6.1 Migration pathways are routes by which contaminant sources may come into contact with receptors. Potential pathways for different types of contaminants vary depending on the properties of the contaminant, the mechanism of its release and the nature of the receptor. The principal potential pollution pathways by which receptors might become exposed to potential contamination at the site are summarised as follows in Table 3.6.

Table 3-6 - Summary of Plausible Pathways

Potential Source	Pathway
Potentially contaminated made ground soils, underlying natural strata / perched groundwater	Direct ingestion, dermal contact, dust and/or vapour inhalation
	Direct ingestion and/or dermal contact with liquid contaminants
	Leaching and direct contact with foundations and potable water supply pipes. Lateral migration of contaminants through preferential pathways.
	Inhalation of asbestos fibres
Ground gases	Migration of gases and/or accumulation in void spaces via transport through service conduit, any permeable made ground and/or underlying permeable natural strata

3.4.7 Risk Assessment

3.4.7.1 The potential contaminant linkages listed above are based on available data and the features noted during the 'walkover'. Therefore, the linkages identified are tentative in nature and are subject to the following uncertainties (to be followed up through ground investigation):

- Presence of made ground at the site;

-
- Nature of the underlying natural strata at the site;
 - The actual distribution of contaminants within the near surface soils and underlying natural soils;
 - The hydrogeological regime beneath the site.

3.4.7.2 The assessment presented herein has been carried out for an area of 'public open space near residential land', as this assessment setting is considered to be the most suitable for the proposed development within the prison environment. Where suitable GAC values are not available for this land usage, a 'commercial' site end use has been adopted. Should the proposed end-use of the site change, the assessment contained herein would need to be revised to accommodate this.

3.4.7.3 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The risk classification has been estimated in accordance with those methods prescribed in CIRIA publication C552 'Contaminated Land Risk Assessment: A Guide to Good Practice', 2001.

3.4.7.4 Risk is regarded as a combination of the likelihood of an 'event' occurring and its severity: both elements must be taken into account when assessing risk. The method for risk assessment, or evaluation, is purely qualitative. As defined in CIRIA C552:2001, the magnitude of the potential 'severity' of risk occurring may be assessed against:

- **Severe:** short term risk to human health likely to result in significant harm as defined under EPA 1990, Part 2A. Short term risk of pollution to sensitive water receptor;
- **Medium:** significant harm to human health, pollution of sensitive water resource or significant change to an ecosystem or specific organism;
- **Mild:** pollution of non-sensitive water resource but significant damage to crops, buildings, structures and services or the environment;
- **Minor:** harm, which may result in financial loss, or expenditure to resolve. Non-permanent effects to human health. Easily repairable effects of damage to buildings, structures and services.

3.4.7.5 Similarly, the classification of the magnitude of the 'probability' of the risk occurring may be assessed against:

- **High Likelihood:** a contaminant linkage exists and an event appears very likely in the short term, or almost inevitable in the long term, or pollution is causing harm at the receptor;
- **Likely:** a contaminant linkage exists and it is probable that an event will occur. An event may not occur, but it is possible in the short term and likely over the long term;
- **Low Likelihood:** a contaminant linkage exists and it is possible that an event will occur. It is not certain that an event will occur over time but it is less likely in the short term;
- **Unlikely:** a contaminant linkage exists but it is not possible to say if an event will occur even over a very long time.

3.4.7.6 Following completion of the severity and probability assessment, classifications can be compared to indicate the actual risk each contaminant linkage presents: this can only be undertaken where there is a possibility of there being an active contaminant linkage.

3.4.7.7 The risk categories which can be assigned are presented in Table 3.7 and range between 'very high risk' to 'very low risk'. NB - it is not possible to classify an identified risk as 'no-risk'.

Table 3-7 - Risk Categories

		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly Likely	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

Reproduced from Table 6.5, CIRIA C552/2001.

- **Very High** – severe harm could arise to a designated receptor or that severe harm is occurring. Urgent investigation and remediation are likely to be required;

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- **High** – harm could occur to a designated receptor and that urgent investigation and remediation may be needed in the short term, but are likely over the longer term;
 - **Moderate** – harm could occur. It is unlikely to be severe, most probably relatively mild. Investigation is normally required to clarify the risk with some remedial works being required in the longer term;
 - **Low** – possible that harm could occur, but if it did, at worst it would be mild;
 - **Very Low** – low possibility of harm arising, and that if it does it is not likely to be severe.

3.4.7.8 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The resulting contaminant linkages are presented in Table 3.8.

Table 3-8 - Summary of Phase I Conceptual Site Model & Risk Assessment

Potential Source	Potential Receptor	Plausible Pathway	Probability	Severity	Initial Risk Rating	Solution
Potentially contaminated made ground soils, underlying natural strata / perched groundwater	<u>Human Health</u> Site end-users, inc. maintenance and site workers (short term risk during construction)	Direct ingestion or dermal contact with soil, dust and/or vapour inhalation	Low likelihood	Medium	Moderate/Low	Soil capping or removal of contaminated soils where necessary
		Direct ingestion and/or dermal contact with liquid contaminants	Unlikely	Mild	Very Low	
		Inhalation of asbestos fibres	Low likelihood	Severe	Moderate	Soil capping or removal of contaminated soils where necessary
	<u>Construction</u> (Potable Water Supply Pipes)	Direct contact/leaching (tainting)	Low likelihood	Mild	Low	Upgraded water pipes/clean backfill material where necessary
	<u>Construction</u> (Foundations)	Direct contact/leaching	Low likelihood	Mild	Low	Appropriate concrete specification
Hazardous Ground Gas (CH ₄ and CO ₂)	<u>Human Health</u>	Inhalation (via ingress and accumulation)	Low likelihood	Medium	Moderate/Low	TBC subject to monitoring results

3.4.7.9 The preliminary conceptual site model (CSM) presented above has indicated that a small number of contaminant linkages may exist on-site.

4 GROUND INVESTIGATION FIELDWORK

4.1 Introduction

- 4.1.1 The investigation requirements at the site were twofold: to undertake a geotechnical investigation and an environmental investigation. A ground investigation was carried out to identify geotechnical and environmental liabilities in relation to the proposed development work at the site.
- 4.1.2 The positions of the exploratory locations are limited to areas of the site, within the site boundary, that were accessible during the works.
- 4.1.3 Alan Wood and Partners scoped the intrusive investigation on the basis of information from the desk study report and in general accordance with guidance given in BS5930:2015+A1:2020, BS10175:2011+A2:2017 and BS EN 1997:2004 and 2013.

4.2 Site Works

- 4.2.1 The findings and recommendations given in this report are based on fieldwork, which was completed across two phases of works. The first phase of works was undertaken between 21st and 22nd July and comprised the completion of seven windowless sample boreholes. The second phase of works was completed between 5th August and 12th August 2021, comprising the completion of four cable percussive boreholes, eight California Bearing Ratio (CBR) tests and four mechanically excavated trial pits, two of which were used to complete permeability testing.
- 4.2.2 The positions of the exploratory holes are shown on the appended ground investigation plan, Figure 45713/002. Exploratory holes were positioned on the basis of the findings of the site conceptual model and distributed in general accordance with the requirements of BS10175:2011+A1:2013 and the working site conditions at the time each phase of investigation was completed.
- 4.2.3 No specific areas of interest were targeted from either a geotechnical or environmental point of view.
- 4.2.4 Representative samples of subsoil and made ground were collected in sterile containers appropriate to the nature of potential contaminants present for subsequent laboratory chemical and geotechnical testing.

4.2.5 Sampling was undertaken in accordance with those guidelines prescribed in BS 10175:2011. All environmental samples were collected in 500ml plastic tubs with sealable lids, 250ml glass amber jars or vials (subject to analytical requirements). Care was taken to minimise cross contamination (i.e. wiping of equipment) between sampling. Environmental samples were packed into cool boxes with ice packs and transported by courier to Chemtech Environmental, an MCERTS and UKAS accredited laboratory for analysis and subsequent storage.

4.2.6 Unexploded ordnance (UXO) support was utilised during the intrusive site investigation works. An EOD carried out regular down hole magnetometer scans.

4.2.7 No groundwater samples were taken from the exploratory hole locations.

4.3 Geotechnical Investigation

4.3.1 A geotechnical investigation was carried out to identify constraints in relation to the proposed construction works at the site and aid the design of appropriate foundation solutions. The following objectives of the ground investigation were therefore to:

- Confirm the lateral and vertical extent of any made ground soils, the nature of the underlying natural ground and the depth to bedrock at selected positions across the area under investigation;
- Determine the depth to groundwater and the stability of excavation;
- Recover undisturbed and bulk samples for geotechnical testing where necessary;
- Undertake *in situ* hand shear vane testing (in cohesive soils in trial holes) where encountered and this test could be undertaken (i.e. within soils that were not friable or gravelly);
- Complete ground gas monitoring within selected borehole locations across the site.

4.3.2 Standard strata descriptions of the soils encountered are in general compliance with BS EN 1997:2004, BS EN 1997:2007, BS EN ISO 14688-1:2018, BS EN ISO 14688-2:2018 and BS EN ISO 14689:2018. The individual strata depths recorded on each trial pit or borehole log are measured from existing ground levels.

4.3.3 Geotechnical laboratory testing was undertaken on a selection of soil samples in accordance with those techniques outlined in BS 1377:1990 'Methods of Test for Soils

for Civil Engineering Purposes' at the laboratory of Professional Soils Laboratory in Doncaster. This laboratory is a fully UKAS compliant laboratory.

4.4 Environmental Investigation

4.4.1 The environmental investigation was designed so that site-specific data could be obtained with respect to any potential soil and groundwater contamination associated with the site so that risks could be quantified in relation to the *source-pathway-receptor* scenarios and plausible contaminant linkages postulated in the initial Conceptual Site Model summarised above.

4.4.2 Given the potentially contaminative historic use of the site, it was considered possible that, when considered within the context of proposed end-use, the on-site soils may present a potential risk to human health and/or the wider environment.

4.4.3 The scope of works undertaken, were therefore to:

- Inspect and identify the general soil conditions that prevail across the site;
- Assess the potential for soil contamination within any made ground, the underlying natural strata or groundwater;
- Recover soil samples to test for heavy metals, metalloids, non-metal inorganics, organics and asbestos fibres.

4.4.4 The analytical strategy adopted for the environmental investigation was designed to provide an overall assessment of potential contaminants thought to likely be present within the on-site soils based on known historical uses. Whilst no specific contaminants of concern were anticipated in significant concentrations, the soil testing undertaken was for a suite of contaminants in general accordance with NHBC Standards Chapter 4.1 'Land Quality – Managing Ground Conditions' and CLR 8 'Potential Contaminants for the Assessment of Land' (withdrawn but used for reference purposes where applicable). The testing of the following analytes was scheduled on selected samples:

- Heavy metals suite (including As, Cd, Cr, Cu, Hg, Pb, Ni, Zn);
- Speciated Polycyclic Aromatic Hydrocarbons;
- Total Petroleum Hydrocarbons (TPH) and BTEX Compounds
- Cyanide (free and total) and Thiocyanate;
- Phenol (total);

-
- Sulphates (Total and Water Soluble);
 - Asbestos fibres;
 - Sulphide; and
 - pH.

5 RESULTS OF INVESTIGATION

5.1 Ground Conditions Encountered

5.1.1 The ground conditions encountered are summarised in Table 5.1, while discussion about each one is given in the following paragraphs.

5.1.2 A copy of the ground investigation logs is presented in Appendix A.

Table 5-1 - Summary of Ground Conditions

Lithology	Exploration Location	Approximate proven depth (m) to base from existing ground level	Approximate Thickness (m)	Allowable Bearing Capacity (kN/m ²)
Topsoil	WLS1 to WLS7, TP1, TP2, CP1	0.10 – 0.15		Nil
Made Ground	WLS7, TP1, TP2, TP3, TP4	0.30 – 0.90	0.20 – 0.90	Nil
Raised Beach Deposits	WLS1 to WLS7, TP1 to TP4, CP1 to CP4	1.70 – 5.70	1.60 – 5.60	1m – 40 2m - 75
Weathered Chalk Bedrock	WLS1 to WLS7, TP1 to TP3, CP1 to CP4	15.30	Based not encountered	3m - 115 4m - 115 5m - 60 6m - 100 7m - 50 7.5m - 120 8.5m - 120 9m - 80 10.5m - 130 11 to 15m - >250
Groundwater	CP1 - 5.5m rising to 4.4m after 30 minutes CP2 - 5.9m rising to 4.8m after 30 minutes CP3 - 5.9m rising to 4.7m after 30 minutes CP4 - 6.9m rising to 5.2m after 30 minutes WLS6 - 3.4m WLS7 - 4.0m			

5.1.3 The site surface comprised areas of soft landscaping which generally were capped by a surface covering of topsoil.

5.1.4 The internal roadways were found to comprise a surface tarmac layer over a concrete sub-layer.

-
- 5.1.5 **Made Ground:** Deposits of made ground were encountered across the surface of the Caledonian Modular site compound, with the deposits comprising a granular sand deposit with concrete, brick and flint gravel.
- 5.1.6 A relict reinforced concrete sub-structure was encountered at TP3 at between 0.30m and 0.60m bgl. This is likely to be a historical structure which has not been removed.
- 5.1.7 **Natural Strata:** The underlying undisturbed superficial deposits of the Raised Beach Deposits were generally found to comprise loose, pale brown sand with chalk and flint gravel.
- 5.1.8 Weathered chalk bedrock was encountered at all borehole locations between 1.70m and 5.70m bgl. This deposit was found to be highly weathered at a shallow depth and was recovered as chalk putty comprising very soft, cream, gravelly clay. Chalk and flint gravel was found throughout the deposit.
- 5.1.9 **Groundwater:** Groundwater was encountered at within all the cable percussive boreholes at between 5.5 and 6.9m bgl. Groundwater was also encountered in WLS6 and WLS7 at 3.4m and 4.0m respectively.

5.2 Visual & Olfactory Evidence of Contamination

- 5.2.1 With the exception of an organic odour recorded in the made ground in TP2, no other visual or olfactory evidence of gross contamination, such as hydrocarbons, was recorded during the ground investigation.

5.3 In-Situ Infiltration tests

- 5.3.1 *In situ* permeability testing was carried out in trial pits TP1 and TP2.

5.4 Geotechnical Testing & Material Properties

Atterbergs, Moisture Content & Volume Change Potential

- 5.4.1 The geotechnical laboratory testing was carried out on six samples of cohesive soil by Professional Soils LTD. A copy of the test results are presented in Appendix but are summarised in Table 5.2.

Table 5.2 - Plasticity Index Test Results

Borehole Number	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Volume Change Potential*
WS1	1.00m to 1.50m	33	20	13	97	Low
WS4	2.00m to 2.20m	35	18	17	99	Low
TP2	1.20m	43	21	22	90	Medium
TP3	1.20m	24	15	9	100	Low
CP2	3.20m	27	22	5	100	Low
CP3	3.50m	28	22	6	100	Low

* VCP: 10-19% = Low, 20-39% = Medium, 40% and greater = High (after NHBC:2021).

5.4.2 The Plasticity Index (Ip) of a soil is a measure of its Volume Change Potential (VCP) and is determined by Atterberg Limits tests, the results of which are given in the above table. All tests to determine the liquid limit (w_L) and plastic limit (w_p) were also performed by PSL LTD. A Modified Plasticity Index (I'_p) has been calculated for the samples tested, which is defined as the Plasticity Index multiplied by the percentage of particles less than 425µm. The conversion factor applied is presented in NHBC Standards (2021), Chapter 4.2.

5.4.3 The calculated modified plasticity index was found to be between 5% and 20%, which is equivalent to a **low** to **medium** volume change potential.

5.5 Undrained Shear Strength in Triaxial Compression

5.5.1 Three consolidated undrained triaxial tests were undertaken on undisturbed samples of the near surface superficial deposits, the results are summarised in Table 5.4.

Table 5.3 – Summary of Undrained Triaxial Test Results

Sample Location	Sample Depth	Cell Pressure (kN/m ²)	Shear Strength (kN/m ²)
CP1	10.00m	1000	303
CP2	9.00m	830	131
CP3	6.00m	820	192

5.5.2 The undrained shear strength results obtained through the completion of quick undrained triaxial testing in the laboratory have generally been found to be comparable

with the results of in situ standard penetration test results with an increase in ground strength with depth.

5.6 One Dimensional Consolidation Test

5.6.1 Three, one-dimensional consolidation tests were undertaken on undisturbed samples of the superficial deposits, the results are summarised in Table 5.5.

Table 5.4 – Summary of Undrained Triaxial Test Results

Sample Location	Sample Depth	Pressure Range (kN/m ²)		Mv (m ² /MN)	Cv (m ² /yr)
CP1	10.00m	0	100	0.281	19.549
		100	200	0.198	9.932
		200	400	0.096	5.357
		400	800	0.049	3.913
		800	100	0.008	19.630
CP2	9.00m	0	90	0.116	25.053
		90	180	0.053	5.705
		180	360	0.035	3.293
		360	720	0.021	2.123
		720	90	0.004	26.670
CP3	6.00m	0	60	0.544	15.542
		60	120	0.102	6.049
		120	240	0.051	3.164
		240	480	0.024	2.051
		480	60	0.001	39.794

5.7 Contamination and Performance of Building Materials (Cementitious Products)

5.7.1 Sixteen soil samples were analysed for a suite of contaminants consistent with BRE Special Digest 1 'Concrete in Aggressive Ground' (2005). A copy of the individual test results is given in the appended laboratory certificates in Appendix C.

5.7.2 The pH values recorded for the soil samples ranged between 6.8 and 8.3 (pH units) with an average of 7.8, indicating near neutral conditions prevail within the on-site soils.

5.7.3 Water soluble sulphate analysis of the soils yielded concentrations between <0.01g/l (<10mg/l) and 0.414g/l (414mg/l) in the samples (0.086g/l on average).

5.8 Chemical Testing

5.8.1 Sixteen representative samples of soil from within the near surface and at depth were analysed for the suite of contaminants outlined in Section 4.4.4. This was in order to assess the general degree and nature of contamination within the on-site soils in relation to the site's proposed redevelopment.

5.8.2 A summary of the test results is given in the following tables, whilst a copy of the individual test results is presented in full in Appendix C.

5.8.3 The results in the table below have been compared to generic assessment criteria (GACs) for a 'public open space near residential land' end-use scenario.

Table 5-5 - Summary of Total Soil Concentrations – Made Ground

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Metals						
Arsenic (inorganic)	79	8.7	18	7	0	PASS
Cadmium	220	0.2	0.8	7	0	PASS
Chromium	1,500**	67	179	7	0	PASS
Copper	12,000**	12	84	7	0	PASS
Mercury (inorganic)	120**	<0.5		7	0	PASS
Nickel	230**	15	31	7	0	PASS
Lead	630**	27	142	7	0	PASS
Selenium	1,100**	0.7	3.5	7	0	PASS
Zinc	81,000**	48	196	7	0	PASS

* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

** LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

Table 5-6 - Summary of Total Soil Concentrations – Natural Deposits

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Metals						
Arsenic (inorganic)	79	8.9	14	9	0	PASS
Cadmium	220	<0.2	0.8	9	0	PASS
Chromium	1,500**	62	113	9	0	PASS
Copper	12,000**	9.1	23	9	0	PASS
Mercury (inorganic)	120**	<0.5		9	0	PASS
Nickel	230**	14	20	9	0	PASS
Lead	630**	13	68	9	0	PASS
Selenium	1,100**	0.8	1.3	9	0	PASS
Zinc	81,000**	39	234	9	0	PASS

* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

** LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

Table 5-7 - Summary of Chemical Test Results (PAH) – Made Ground

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	4,900	<0.02	0.79	7	0	PASS
Acenaphthylene	15,000	<0.02	1.17	7	0	PASS
Acenaphthene	15,000	0.02	2.23	7	0	PASS
Fluorene	9,900	<0.02	1.43	7	0	PASS
Phenanthrene	3,100	0.08	104.76	7	0	PASS
Anthracene	74,000	0.02	28.15	7	0	PASS
Fluoranthene	3,100	0.14	228.42	7	0	PASS
Pyrene	7,400	0.12	206.73	7	0	PASS
Benzo(a)anthracene	29	0.07	78	7	3	FAIL
Chrysene	57	0.06	76.04	7	2	FAIL
Benzo(b)fluoranthene	7.2	0.06	87.82	7	3	FAIL
Benzo(k)fluoranthene	190	<0.03	31.96	7	0	PASS
Benzo(a)pyrene	5.7	0.05	91.26	7	3	FAIL
Dibenzo(a,h)anthracene	0.57	<0.02	15.29	7	3	FAIL
Indeno(1,2,3-cd)pyrene	82	0.04	66.13	7	0	PASS
Benzo(g,h,i)perylene	640	0.03	62.18	7	0	PASS

* [CLEA/LQM/CIEH, 2015] Calculated for a 'public open space near residential land' end-use scenario, in CLEA v1.071. GAC range for 6.0% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

Table 5-8 - Summary of Chemical Test Results (PAH) - Natural Deposits

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	4,900	<0.02	0.14	9	0	PASS
Acenaphthylene	15,000	<0.02	0.18	9	0	PASS
Acenaphthene	15,000	<0.02	0.23	9	0	PASS
Fluorene	9,900	<0.02	0.21	9	0	PASS
Phenanthrene	3,100	<0.02	3.60	9	0	PASS
Anthracene	74,000	<0.02	0.61	9	0	PASS
Fluoranthene	3,100	0.04	11.10	9	0	PASS
Pyrene	7,400	0.04	9.74	9	0	PASS
Benzo(a)anthracene	29	0.03	4.22	9	0	PASS
Chrysene	57	<0.03	5.27	9	0	PASS
Benzo(b)fluoranthene	7.2	0.03	6.91	9	0	PASS
Benzo(k)fluoranthene	190	<0.03	2.51	9	0	PASS
Benzo(a)pyrene	5.7	0.02	5.22	9	0	PASS
Dibenzo(a,h)anthracene	0.58	<0.02	0.75	9	1	FAIL
Indeno(1,2,3-cd)pyrene	82	0.03	5.21	9	0	PASS
Benzo(g,h,i)perylene	640	0.03	4.49	9	0	PASS

* [CLEA/LQM/CIEH, 2015] Calculated for a 'public open space near residential land' end-use scenario in CLEA v1.071. GAC range for 2.5% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

5.8.4 Samples of made ground from TP2 (0-0.4m bgl and 0.4-0.6m bgl) and TP4 (0.1-0.3m bgl) were found to have a number of elevated PAH contaminants in exceedance of for a 'public open space near residential land' end-use scenario. When compared to GACs for a commercial end-use, samples tested for Benzo(a)anthracene and Chrysene are found to have acceptable concentrations that do not pose a risk to human health. Concentrations of Benzo(b)fluoranthene, Benzo(a)pyrene, and Dibenzo(a,h)anthracene when compared to commercial GACs are still found to be in exceedance of acceptable values.

5.8.5 When looking at historical maps of the site and aerial photo, an electrical sub-station and a number of small structures were previously located within the vicinity of TP2, TP3 and TP4.

5.8.6 A sample of natural ground taken from WS4 (0.4-0.9m bgl) was found to have elevated Dibenzo(a,h)anthracene. When compared to GACs for a commercial end-use, the value recorded is acceptable and does not pose a risk to human health.

6 GEOTECHNICAL ASSESSMENT

6.1 Mining Risk

- 6.1.1 On the basis of available information, the potential for there to be shallow mine workings beneath the site is considered to be negligible.

6.2 Foundations

- 6.2.1 It is anticipated that the new structures will be constructed on piled foundations.

6.3 Floor Slabs

- 6.3.1 Given that the proposed foundation solution is piles, it is recommended that a suspended floor slab is used.
- 6.3.2 A ground bearing slab may be suitable in areas where made ground is less than 600mm thick, the proposed structural loads are sufficiently light enough for the ground below the site to support the slab, or slab be constructed on the pile mat or improved ground.

6.4 Precautions Near Trees

- 6.4.1 There are a number of trees around the most western proposed construction area. Given the predominantly granular nature of the of the near surface deposits, with the exception of TP3 and TP4, precautions are not likely to be required.
- 6.4.2 On the western most proposed construction area, given the shallow cohesive deposits that are present, a tree survey and foundation schedule is required. In addition, in this area, precautions would be required where trees are to be removed or where new planting is proposed.
- 6.4.3 All foundations should be constructed in accordance with relevant standards.

6.5 Drainage and Soakaways

- 6.5.1 *In situ* permeability testing was carried out in TP1 and TP2. A summary of the results is presented in Table 6-1.

Table 6-1 Summary of In-situ Soakaway Testing – Trial Pits

Location	Soakage Area Dimensions (average m)	Test Depth (m bcgl)	Test Number	Infiltration Rate (m/sec)
TP1	2.50 x 0.60	2.45	1	2.09×10^{-4} m/s
			2	2.65×10^{-4} m/s
			3	2.86×10^{-4} m/s
TP2	2.70 x 0.60	2.65	1	2.63×10^{-4} m/s
			2	2.50×10^{-4} m/s

6.5.2 Additional permeability testing was undertaken in WS1 and WS5 in the form of a falling head test. Results of these tests give indicative values of 7.2×10^{-3} m/s in WS1 and 3.4×10^{-3} m/s in WS5.

6.6 Roads and Car Parks

6.6.1 Eight in-situ CBR tests have been completed across the site through use of a Light Weight Deflectometer. The test results are presented in Table 6.2.

Table 6-2 Summary of In-situ CBR Tests

Test Location	Estimated CBR (%)
CBR1	97.5
CBR2	3.7
CBR3	4.9
CBR4	<2
CBR5	<2
CBR6	<2
CBR7	<2
CBR8	<2

6.6.2 The CBR values recorded varied between <2% and 97.5%. The majority of the results were <2%. Highways Agency document CD 225 (2020) states that where a subgrade has a CBR lower than 2.5%, it is considered unsuitable support for a pavement

foundation since it would tend to deform under construction traffic and must be improved. All road design should be discussed with the local authority if highways are to be subject to a Section 38 agreement.

6.7 Ground Stability

- 6.7.1 Excavations are likely to be unstable below groundwater level where granular deposits are encountered. Instability should be anticipated where weak strata is encountered and where excavations are left open over prolonged periods of time and where excavations are left open during prolonged periods of wet weather (e.g. in service trenches).
- 6.7.2 An adequate drainage system for surface water may need to be installed by a competent contractor in order to prevent surface water ponding or collection during construction, as this may lead to deterioration and weakening of the founding stratum.
- 6.7.3 Where excavations are proposed close to site boundaries and there is the possibility of weak/unstable ground passing across that boundary and beneath adjacent structures, a risk assessment of the integrity/stability should be undertaken prior to such works being carried out. Designed and engineered temporary/permanent measures should be adopted to ensure their continued stability where necessary.

6.8 Excavations

- 6.8.1 Shallow hard rock is not anticipated given the geology encountered on site.
- 6.8.2 Localised obstructions to excavations may be present given the previous development on the site.
- 6.8.3 No man entry into unsupported excavations should be allowed without an appropriate risk assessment. Reference to CIRIA Report 97 (1983) should be made to establish suitable means of support or battering of excavation sides.

6.9 Sulphate Attack and Aggressive Ground Conditions

- 6.9.1 An assessment of the data was carried out in accordance with Section C4 'Site Investigation for Aggressive Ground Conditions' and the procedure prescribed in Section C5 'Classification of Site Locations for Chemicals Aggressive to Concrete' of

BRE SD1 (2005) to assess whether ground conditions at the site are potentially aggressive to buried concrete products.

6.9.2 The results of the assessment indicate that a Design Sulphate classification of DS-1 may be adopted along with an ACEC class of AC-1.

6.9.3 Static groundwater conditions have been assumed in this assessment.

7 ENVIRONMENTAL ASSESSMENT

7.1 Guidance for Analytical Results - Assessment Criteria

Soil

- 7.1.1 With reference to the proposed end use of the site, the results of the chemical testing were assessed as part of an environmental risk assessment against a number of potential receptors, considering risks to human health, environmental quality and the built environment. Such risk assessment comprises the initial comparison of the measured soil concentrations with Generic Assessment Criteria (GAC), which in this instance are considered protective of an area of 'public open space near residential land' end use.
- 7.1.2 In line with current best practice in the UK, initial screening of contaminant concentrations is carried out against appropriate published generic assessment criteria. Currently the authoritative generic assessment criteria are considered to be DEFRA's SGVs, DEFRA's Category 4 Screening Levels (2014) and the LQM/CIEH Suitable 4 Use Levels (2015). The assessment criteria have been derived on the basis of currently widely accepted assumptions relating to the modelling of human exposure to soil contaminants for the standard land uses: residential (with and without home-grown produce), allotments, commercial and public open spaces (close to residential properties and parks).
- 7.1.3 The general consensus between contaminated land practitioners is that the C4SL values, which are based on the low level of toxicological concern (LLTC), are less cautious than the GAC values published by LQM/CIEH and may not, therefore, be wholly applicable for use outside the context of Part 2A Statutory Guidance. Although both publications in no way undermine the validity of existing Environment Agency guidance presented in, for example, SR2, SR3 and the existing CLEA software, we are of the mind that the LQM/CIEH S4UL values, which are based on Health Criteria that represents minimal or tolerable levels of risks to health (as described in the Environment Agency's SR2 guidance) but incorporates the current exposure assumptions presented in DEFRA's C4SL guidance, provide a better starting point from which to generate determine assessment criteria that can be applied to brownfield development sites and are 'suitable for use' under the planning system.

7.1.4 It should be noted that all approaches are based on sandy loam soil with 6% soil organic matter (SOM). Whilst this does not affect metal contaminants, as they are not dependent on soil type or SOM, the algorithms used to model plant uptake and volatilisation for organic contaminants do take account of SOM content in the soil. The GAC values for metals in the standard land uses may therefore be directly applied, whether these are SGVs, C4SL or S4UL derived, whilst independent GAC values for organics (e.g. PAH, TPH) have been generated using CLEA Version 1.071 and the toxicological updates presented in the aforementioned documents. These have also been adjusted for soil type and are calculated for SOM contents at 1%, 2.5% and 6% for a sandy soil.

7.1.5 A summary of the generic assessment criteria values is presented in Appendix E.

7.2 Human Health Receptors

7.2.1 In order to assess the significance of the recorded concentrations of potential contaminants of concern in relation to human health laboratory analysis was compared with the adopted generic assessment criteria.

Metals, Metalloids and Other Inorganic Analytes

7.2.2 A total of sixteen soil samples were analysed. Assessment of the soils data indicates that there are no elevated concentrations of potential contaminants of concern that exceed relevant GAC criteria.

7.2.3 There is considered to be no significant risk to human health in relation to metals, metalloids and non-metal inorganics.

Organics (PAH)

7.2.4 A total of sixteen soil samples were analysed for PAH contaminants.

7.2.5 Shallow samples taken from TP2 and TP4 recorded PAH concentrations above relevant GAC's.

7.2.6 There is considered to be a risk to human health in relation to organic contaminants.

Asbestos

7.2.7 A total of sixteen soil samples were analysed. No asbestos fibres were detected in the samples tested.

7.2.8 There is considered to be no significant risk associated with asbestos containing materials within soils at the site.

7.3 Controlled Waters Receptors

7.3.1 No sources of potentially significant contamination have been identified which could present a risk to controlled water receptors.

7.4 Ecological Receptors

7.4.1 There are no known ecological receptors at the site.

7.5 Utilities

7.5.1 It is recommended that the results of the chemical testing and details of the proposed redevelopment of the site are provided to the appropriate utility companies to determine the necessity for service protection.

7.6 Potable Water Supplies

7.6.1 Risk to potable water supply pipes is considered to be low. On the basis of available test results, it is unlikely that protective measures will be required. Consultation should however be undertaken with the local water authority with respect to any precautions they may require, prior to construction.

7.7 Refined Conceptual Site Model

7.7.1 Introduction

7.7.1.1 The preliminary CSM given above presented our initial understanding of the site, being based on available geological information, site location, likely contamination status and the overall risk it presented to the identified receptors through various pollution pathways.

7.7.1.2 This section revises the initial CSM in light of the ground investigation findings and chemical analysis results presented above.

7.7.1.3 The revised conceptual site model has been developed for the proposed future site end-use, as a prison site. This summarises our understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors assuming that no remediation has been undertaken at the site.

7.7.2 Ground Conditions - Summary

7.7.2.1 *Made Ground:* Deposits of made ground were encountered across the surface of the Caledonian Modular site compound, with the deposits comprising a granular sand deposit with concrete, brick and flint gravel.

7.7.2.2 *Natural Strata:* The underlying undisturbed superficial deposits of the Raised Beach Deposits were generally found to comprise loose, pale brown sand with chalk and flint gravel.

7.7.2.3 Weathered chalk bedrock was encountered at all borehole locations between 1.70m and 5.70m bgl. This deposit was found to be highly weathered at a shallow depth and was recovered as chalk putty comprising very soft, cream, gravelly clay. Chalk and flint gravel was found throughout the deposit.

7.7.2.4 *Groundwater:* Groundwater was encountered at within all the cable percussive boreholes at between 5.5m and 6.9m bgl. Groundwater was also encountered in WLS6 and WLS7 at 3.4m and 4.0m respectively.

7.7.2.5 A total of sixteen soil samples were analysed for inorganic and organic contaminants. Assessment of the soils data indicates that there are localised elevated concentrations of potential contaminants of concern that exceed adopted GAC.

7.7.3 Qualitative Contaminated Land Risk Assessment

7.7.3.1 Current UK legislation on contaminated land is principally contained in Sections 78(A) to (YC) in Part 2A of the Environmental Protection Act 1990, which was retrospectively inserted by Section 57 of the Environment Act 1995. The Contaminated Land Regulations 2000 were amended in 2005. The Environmental Protection Act 1990: Part 2A Contaminated Land, Statutory Guidance, Edition 2, 2006, promulgates the

revised statutory guidance with respect to the operation of the Contaminated Land Regime following the implementation of the Contaminated Land Regulations, 2005.

7.7.3.2 The definition of contaminated land is central to the operation of Part 2A. Legislation adopts the principle of a 'suitable for use' approach for the assessment of contaminated land, the rationale reflected in the site-specific risk assessment and determination of remedial strategy. Action is only required if unacceptable risks are posed to human health or to the environment, taking into account the current land use and geo-environmental setting.

7.7.3.3 The legislation places a responsibility on the Local Authority to determine whether the land under its jurisdiction is contaminated by consideration of whether:

- Significant harm is being caused;
- There is a significant possibility of significant harm being caused;
- Significant pollution of controlled waters is being caused or is likely to be caused.

7.7.4 Assessment Framework

7.7.4.1 The statutory guidance describes a risk assessment methodology in terms of 'significant contaminants' and 'contaminant linkages', using 'source-pathway-receptor' scenarios for the site. Contaminant linkages are formed when there is a linkage between a contaminant source and a receptor by means of a pathway. Each element has to be present, or no linkage can be formed.

7.7.4.2 Risk assessment and the procedure of identifying sources, pathways and receptors is recognised as an approach to determine the extent and significance of contamination either within the context of Part 2A (when assessing current site status or when considering the acquisition of an existing development) or the planning process (for the redevelopment of an existing site, or when considering the acquisition of a site for redevelopment purposes). Either way, the 'suitable for use' approach is adopted when assessing risk and the source-pathway-receptor assessment defines the conceptual model for the site.

7.7.4.3 Within the context of this report therefore, the revised risk assessment has been undertaken on the basis that the 'suitable for use' approach remains aligned with the site being redeveloped for the end use given above.

7.8 Summary of Identified Contaminant Linkages

7.8.1.1 On the basis of the ground investigation and laboratory test results, on-site soils have been found to contain locally elevated concentrations of inorganic and organic contaminants in excess of the adopted GACs.

7.8.1.2 There is considered to be a risk to human health, the development or the wider environment, with respect to the identified levels of contaminants within the on-site soils.

7.8.1.3 A summary of the revised risk assessment is given in Table 7.1.

Table 7-1 - Summary of Revised Conceptual Site Model & Risk Assessment

Potential Source	Potential Receptor	Plausible Pathway	Initial Risk Rating	Probability	Severity	Revised Risk Rating	Solution
Localised potentially contaminated made ground, near surface natural strata / perched groundwater	<u>Human Health</u> Site end-users, inc. maintenance and site workers (short term risk during construction)	Direct ingestion or dermal contact with soil, dust and/or vapour inhalation	Moderate/Low	Likely	Mild	Moderate/Low	Soil capping or removal of contaminated soils where necessary
		Direct ingestion and/or dermal contact with liquid contaminants	Very Low	Unlikely	Mild	Very Low	No risk anticipated
		Inhalation of Asbestos fibres	Moderate	Unlikely	Severe	Moderate / Low	Risk rating cannot be downgraded due to severity No risk anticipated
	<u>Construction</u> (Potable Water Supply Pipes)	Direct contact/leaching (tainting)	Low	Unlikely	Mild	Very Low	No risk anticipated
	<u>Construction</u> (Foundations)	Direct contact/leaching	Low	Unlikely	Mild	Very Low	No risk anticipated. Appropriate concrete specification
Hazardous Ground Gas (CH ₄ and CO ₂)	<u>Human Health</u>	Inhalation (via ingress and accumulation)	Moderate/Low	Low likelihood	Medium	Moderate/Low	TBC subject to monitoring results

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 This geo-environmental appraisal has been carried out in relation to the redevelopment of three parcels of land within HMP Ford, Ford Road, Arundel.

8.1.2 It has been assumed in the production of this report that the site is to be redeveloped with new prison cell buildings.

8.2 Soil Contamination - Risk Evaluation

8.2.1 The revised Conceptual Site Model confirms that potential contaminant linkages exist at the site in relation to existing on-site soils. These are localised to the most western proposed construction area

8.2.2 There is considered to be a potential risk to sensitive receptors from soil contamination at the site.

8.2.3 Potential risk to construction worker is considered to be moderate.

8.2.4 Contaminant levels are not considered likely to be potentially mobile and no significant sources of liquid contaminants have been identified. Controlled water receptors are not considered to be at risk from soil contamination at the site.

8.3 Hazardous Ground Gases

8.3.1 Hazardous ground gas associated with a nearby historical infilled stonepit are being assessed through a programme of ground gas and groundwater monitoring, the results of which will be reported under a separate cover. Monitoring is due to complete in October 2021. Initial results have identified carbon dioxide at a maximum concentration of 4.2%.

8.3.2 No radon protection measures will be required.

8.4 Outline Remediation Requirements

8.4.1 On the basis of available information, it is considered that some remediation may be required at the site. The localised metals and PAH contamination will need to be

removed from areas where exposure to end users is possible. Delineation of the affected soils will be required to determine their extent.

- 8.4.2 Confirmation of the chemical condition of any materials brought to site should be confirmed prior to importation.

8.5 Disposal of Soils

- 8.5.1 Should brightly coloured or odorous soil be encountered during the proposed construction works, Alan Wood and Partners should be notified immediately. An experienced geo-environmental engineer will visit site for further sampling, analysis and risk assessment, where required.

- 8.5.2 Any materials removed from site should be undertaken in accordance with the Duty of Care Regulations 1991 and the Hazardous Waste Regulations 2005. There will also be a requirement to classify the waste in accordance with the European Waste Catalogue. The waste should also be subject to Waste Acceptance Criteria (WAC) testing.

8.6 Further Work

- 8.6.1 Completion of the ground gas monitoring and a subsequent ground gas risk assessment.
- 8.6.2 Assessment of the influence of trees in relation to floor slabs where clays are present at founding depth.
- 8.6.3 Delineation of localised contamination.

9 REGULATORY APPROVAL

- 9.1.1 The conclusions and recommendations presented in this report are considered reasonable on the basis of available information and the assessment of the site as carried out by Alan Wood and Partners.
- 9.1.2 It should be noted however that the works undertaken cannot be guaranteed to gain approval by the Regulatory Authorities and your Warranty Provider, so copies of this report should be made available to the relevant organisations (as appropriate) for their comment and approval, prior to undertaking any irrecoverable works associated with the site.

10 INFORMATION SOURCES

In addition to the specific references cited in the text, the following references have been referred to in the production of this report, where relevant to the defined project objectives.

- 1 BRE BR211 (2015) *Radon: guidance on protective measures for new dwellings*;
- 2 BRE GBG 75 (2009), '*Radon Protection For New Large Buildings*';
- 3 BS5930 (2015), *Code of practice for site investigations*;
- 4 BS:8576 (2013), *Guidance on Investigations for Ground Gas - Permanent Gases and Volatile Organic Compounds (VOCs)*;
- 5 BSEN 1997-1 (2004), *Geotechnical Design Part 1 – General Rules*;
- 6 BSEN 1997-2 (2007), *Geotechnical Design Part 2 – Ground investigation and testing*;
- 7 Chartered Institute of Environmental Health (CIEH): *Professional Practice Note: Reviewing human health risk assessment reports invoking contaminant oral bioavailability measurements or estimates* (2009);
- 8 CIRIA C552 (2001), *Contaminated Land Risk Assessment, A Guide to Good Practice*;
- 9 CIRIA C665 (2007), *Assessing risks posed by hazardous ground gases to buildings*;
- 10 CL:AIRE / EIC / AGS: *Soil Generic Assessment Criteria for Human Health Risk Assessment* (updated January 2010 version);
- 11 Coal Authority, www.coal.decc.gov.uk;
- 12 DEFRA SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Companion Document*, December 2014;
- 13 DETR Circular 02/2000 (2000). *Environmental Protection Act 1990 Part 2A. Contaminated Land*. Department of the Environment, Transport and the Regions, Circular 02/2000, Dated 20th March 2000;
- 14 Environment Agency (EA) & DEFRA: *Model Procedures for the Management of Land Contamination – Contaminated Land Report 11 (CLR11)* (2004);
- 15 Environment Agency, www.environment-agency.org.uk;
- 16 Environment Agency (2009). *Human Health Toxicological Assessment of Contaminants in Soil*, Science Report SC050021/SR2;
- 17 Environment Agency (2009). *Updated Technical Background to the CLEA Model*, Science Report SC050021/SR3;
- 18 Land Quality Management / CIEH: *The LQM/CIEH S4UL's for Human Health Risk Assessment*, Land Quality Press, Nottingham, 2015. Publication Number S4UL3286;
- 19 NHBC Chapter 4.2 (2021), *Building near trees*, NHBC Publication, 2021.

FIGURES



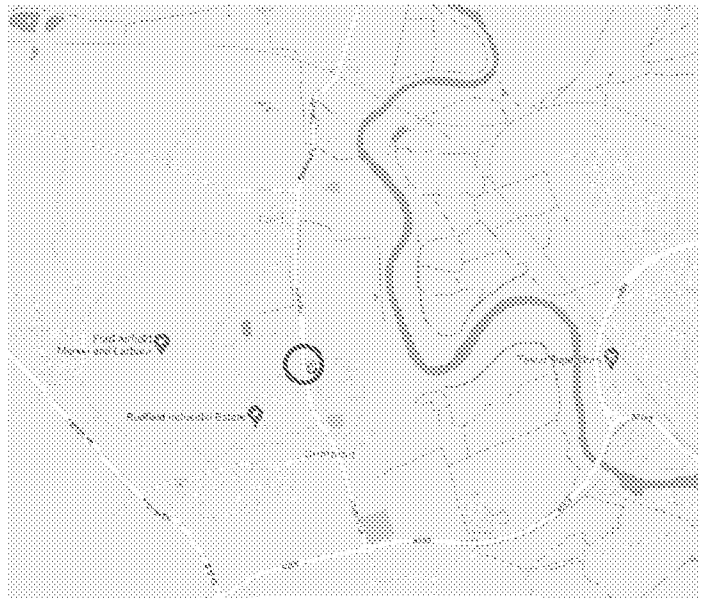
DO NOT SCALE



Approximate Site Location



Approximate Red Line Boundary

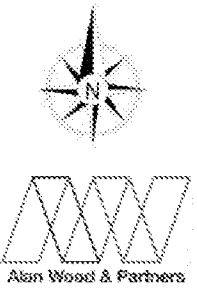


Client. Caledonian Modular Ltd		
Project. HMP Ford, Ford Road, Arundel, West Sussex		
Drawing. Site Location Plan		
Date. 23.07.21	Scale. NTS	
Drawn by. BL	Check by. ST	Approved by. JS
Status: FOR INFORMATION		
Job no. 45713	Fig. no. 001	Rev.



DO NOT SCALE

-  Windowless Sample Boreholes
-  Cable Percussion Boreholes
-  Mechanically Excavated Trial Pits
-  CBR Tests



Client. Caledonian Modular Ltd		
Project. HMP Ford, Ford Road, Arundel, West Sussex		
Drawing. Exploratory hole Location Plan		
Date. 17.08.21	Scale. NTS	
Drawn by. BL	Check by. ST	Approved by. JS
Status: FOR INFORMATION		
Job no. 45713	Fig. no. 002	Rev.

APPENDIX A

AWP GROUND INVESTIGATION LOGS



Borehole Log

Borehole No.

CP1

Sheet 1 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 05/08/2021 - 05/08/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.40	ES		0.15			TOPSOIL: Brown, slightly clayey, slightly gravelly SAND. Gravel is fine to coarse, angular flint.	
		1.20		N=7 (1,2/1,2,2,2)	1.30			Loose, brown, slightly clayey, slightly gravelly SAND. Gravel is fine to coarse, angular to subrounded chalk and flint. [RAISED BEACH DEPOSITS]	1
		2.20		N=11 (1,2/2,3,3,3)	2.50			Medium dense, brown, very clayey, gravelly SAND. Gravel is fine to coarse, angular to subrounded flint and chalk [RAISED BEACH DEPOSITS].	2
		3.20		N=10 (1,2/2,2,3,3)	3.20			Firm, pale brown cream, sandy, gravelly CLAY. [Weathered LEWES NODULAR CHALK FORMATION]	3
		4.20		N=17 (6,7/6,3,4,4)				Stiff becoming soft, cream, very sandy CLAY. [Weathered LEWES NODULAR CHALK FORMATION]	4
		5.50		N=6 (1,2/2,1,1,2)				Becoming soft and gravelly. Gravel of fine to coarse, angular to subrounded chalk.	5
		7.00		N=5 (1,2/2,1,1,1)					6
		8.50		N=29 (5,6/6,7,8,8)					7
									8
									9
									10

Continued on next sheet

Remarks

Groundwater encountered at 5.5m, rising to 4.4m after 30 minutes





Borehole Log

Borehole No.

CP1

Sheet 2 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 05/08/2021 - 05/08/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.50		50 (18,30/50 for 265mm)				Becoming cobbly. Cobbles of subrounded chalk.	11
		13.00		N=50 (25 for 100mm/50 for 230mm)					12
		14.00		N=50 (8,10/50 for 245mm)					13
		15.00		50 (9,14/50 for 150mm)	15.30				14
								End of borehole at 15.30 m	15
									16
									17
									18
									19
									20

Remarks

Groundwater encountered at 5.5m, rising to 4.4m after 30 minutes





Borehole Log

Borehole No.

CP2

Sheet 1 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 09/08/2021 - 09/08/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.40	ES		0.10			TOPSOIL: Brown, clayey SAND.	
					0.40			MADE GROUND: Brown, slightly clayey, slightly gravelly SAND. Gravel is medium and coarse, angular and subangular of flint and brick.	
		1.20		N=9 (1,1/2,2,2,3)				Loose, becoming very loose, brown, gravelly SAND. Gravel is medium and coarse, angular of flint. [RAISED BEACH DEPOSITS]	1
		2.20		N=4 (1,2/2,1,1,0)					2
					2.60				
		3.20		N=5 (1,2/2,1,1,1)				Firm becoming stiff cream white, slightly gravelly CLAY. Gravel is fine to coarse, angular and subangular of chalk. [Weathered LEWES NODULAR CHALK FORMATION]	3
		4.50		N=7 (3,3/2,2,1,2)					4
		6.00		N=9 (3,3/2,2,2,3)					5
		7.50		N=21 (3,3/4,5,6,6)				Becomes very gravelly	6
					9.00			Weathered CHALK, recovered as cream white, clayey, sub-angular chalk and flint, gravel and cobbles. [Weathered LEWES NODULAR CHALK FORMATION]	7
								Becomes cobbly. Cobbles of subangular of flint.	8
									9
									10

Continued on next sheet

Remarks

Groundwater encountered at 5.9m rising to 4.8m after 30 minutes





Borehole Log

Borehole No.

CP2

Sheet 2 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 09/08/2021 - 09/08/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50		50 (8,12/50 for 240mm)	10.50			CHALK recovered as wet clay with gravel of fine to coarse angular to subrounded chalk and flint. [LEWES NODULAR CHALK FORMATION]	11
		12.00		N=50 (9,10/50 for 265mm)					12
		13.50		50 (25 for 50mm/50 for 50mm)					13
					15.00			End of borehole at 13.50 m	14
									15
									16
									17
									18
									19
									20

Remarks

Groundwater encountered at 5.9m rising to 4.8m after 30 minutes





Borehole Log

Borehole No.

CP3

Sheet 1 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 10/08/2021 - 11/08/2021

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10			TOPSOIL; Brown sand.	
		1.20		N=9 (2,3/2,3,2,2)				Loose, brown, slightly clayey, slightly gravelly SAND. Gravel is fine to coarse, angular to sub-rounded flint. [RAISED BEACH DEPOSITS]	1
		2.30		N=7 (1,0/1,2,2,2)					2
		3.50		N=17 (4,5/4,5,4,4)	2.90			Very soft, pale brown cream, sandy, gravelly CLAY. Gravel is fine to coarse, angular an sub-angular chalk and flint [Weathered LEWES NODULAR CHALK FORMATION].	3
		4.50		N=8 (2,3/2,2,2,2)					4
		7.50		N=16 (4,4/4,4,4,4)					5
		9.00		N=8 (1,2/2,2,2,2)					6
									7
									8
									9
									10

Continued on next sheet

Remarks

Groundwater encountered at 5.9m rising to 4.7m after 30 minute





Borehole Log

Borehole No.

CP3

Sheet 2 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

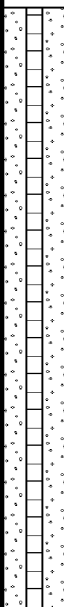
Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 10/08/2021 - 11/08/2021

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		10.50		N=36 (6,7/7,8,9,12)	10.50			Weathered CHALK. Recovered as clayey, sub-angular chalk and flint gravel and cobbles [Weathered LEWES NODULAR CHALK FORMATION].	11	
		12.00		N=50 (8,9/50 for 225mm)					12	
		13.00		50 (11,14/50 for 220mm)					13	
		13.60		50 (25 for 75mm/50 for 105mm)						
		14.00		50 (25 for 75mm/50 for 90mm)	14.16				14	
		End of borehole at 14.16 m								
									15	
									16	
									17	
									18	
									19	
							20			

Remarks

Groundwater encountered at 5.9m rising to 4.7m after 30 minute





Borehole Log

Borehole No.

CP4

Sheet 1 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 11/08/2021 - 12/08/2021

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20 - 0.40	ES		0.20			MADE GROUND: Brown SAND.	
		0.40 - 0.60	ES		0.40			MADE GROUND: Brown sandy gravelly subangular and subrounded concrete and brick COBBLES. Gravel is fine to coarse, angular subrounded brick, flint, chalk, concrete, tile and mudstone.	
		1.20		N=8 (1,1/2,2,2,2)				Loose, brown slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chalk and flint [RAISED BEACH DEPOSITS].	1
		2.50		N=20 (3,4/4,5,5,6)	2.70			Very soft, cream, gravelly CLAY. Gravel is fine to coarse, angular to subrounded chalk and flints [Weathered LEWES NODULAR CHALK FORMATION].	2
		3.50		N=13 (4,3/2,3,4,4)					3
		4.50		N=12 (1,2/2,3,4,3)					4
		6.00		N=11 (2,3/3,4,2,2)					5
		8.50		N=17 (3,4/4,4,4,5)					6
		9.50		N=31 (8,12/8,7,7,9)					7
									8
									9
									10

Continued on next sheet

Remarks

Groundwater encountered at 6.9m rising to 5.2m after 30 minutes





Borehole Log

Borehole No.

CP4

Sheet 2 of 2

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
CP

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 11/08/2021 - 12/08/2021

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00		N=43 (10,9/8,12,10,13)				Becomes cobbly. Cobbles of angular and subangular chalk.	11
		12.50		50 (5,9/50 for 210mm)				Becomes very stiff	12
		13.50		50 (25 for 60mm/50 for 75mm)					13
		14.10		50 (25,41/50 for 10mm)					14
		14.70		50 (25 for 75mm/50 for 60mm)	14.70			End of borehole at 14.83 m	15
									16
									17
									18
									19
									20

Remarks

Groundwater encountered at 6.9m rising to 5.2m after 30 minutes





Trial Pit Log

Trialpit No

TP1

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -
Level:

Date
11/08/2021

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Dimensions
(m):

Depth
2.45

Scale
1:25

Logged
ST

Client: Caledonian Modular Ltd

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10			TOPSOIL
				0.30			MADE GROUND: Pale brown, slightly gravelly SAND. Gravel is fine to coarse, subangular of chalk and flint with rare concrete cobbles.
							Loose, pale brown, slightly gravelly, slightly silty SAND. Gravel is fine to coarse, angular to subrounded of flint and chalk [RAISED BEACH DEPOSITS].
				2.40 2.45			Weathered CHALK, recovered as soft, cream, gravelly CLAY. Gravel is fine to coarse, angular and subangular of chalk and flint [Weathered LEWES NODULAR CHALK FORMATION].
							End of pit at 2.45 m

1

2

3

4

5

Remarks: No groundwater encountered. Soakaway completed at 2.45mbgl.

Stability:





Trial Pit Log

Trialpit No

TP2

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -
Level:

Date
11/08/2021

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Dimensions
(m):

Depth
2.65

Scale
1:25

Logged
ST

Client: Caledonian Modular Ltd

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.00 - 0.40	ES					MADE GROUND: Pale brown, very gravelly SAND. Gravel is fine to coarse, angular to subrounded of concrete, brick and flint. <i>Plastic membrane.</i>	
	0.40 - 0.60	ES		0.40 0.60			MADE GROUND: Dark grey, very ashy, gravelly SAND. Gravel is fine to coarse, angular of concrete and brick with an organic smell. Loose, pale brown, slightly clayey SAND [RAISED BEACH DEPOSITS].	1
				2.60 2.65			Weathered CHALK, recovered as very soft, cream, gravelly CLAY. Gravel is fine to coarse, angular to subrounded of chalk [Weathered LEWES NODULAR CHALK FORMATION]. <i>End of pit at 2.65 m</i>	3
								4
								5

Remarks: No groundwater encountered. Soakaway completed at 2.65mbgl.

Stability:





Trial Pit Log

Trialpit No

TP3

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -
Level:

Date
11/08/2021

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Dimensions
(m):

Depth
3.00

Scale
1:25

Logged
ST

Client: Caledonian Modular Ltd

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.00 - 0.20	ES					MADE GROUND: Pale brown, very gravelly SAND. Gravel os fine to coarse, angular to subrounded brick, concrete and flint.	
				0.30			MADE GROUND: Reinforced CONCRETE.	
				0.60			MADE GROUND: Brown, sandy, gravelly CLAY. Gravel is fine to coarse, angular flint and concrete.	
				0.90			Very soft, pale brown, very sandy CLAY. [RAISED BEACH DEPOSITS]	1
				3.00				2
				3.00			WEATHERED CHALK, recovered as very soft, cream, gravelly CLAY. Gravel is fine to coarse and angular of chalk and flint. [Weathered LEWES NODULAR CHALK FORMATION]	3
							End of pit at 3.00 m	4
								5

Remarks: No groundwater encountered.

Stability: Stable





Borehole Log

Borehole No.

WS1

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 20/07/2021 - 20/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.40	ES		0.10			TOPSOIL: Pale brown SAND.	
		0.40 - 1.00	ES					Loose, brown, slightly silty SAND. [RAISED BEACH DEPOSITS]	
		1.00 - 1.50	D		0.80			Loose, brown, silty SAND. [RAISED BEACH DEPOSITS]	1
		1.20		N=7 (1,1/2,1,2,2)					
		2.00		N=6 (1,2/2,1,2,1)					2
					2.50			Loose, brown SAND. [RAISED BEACH DEPOSITS]	
		3.00		N=5 (1,1/1,1,1,2)	2.90			Loose, brown, clayey SAND. [RAISED BEACH DEPOSITS]	3
					3.70			Very soft, brown cream, very gravelly CLAY. Gravel is medium and coarse, angular flint. [Weathered LEWES NODULAR CHALK FORMATION]	4
		4.00		N=11 (2,2/2,2,4,3)	4.00			Firm, pale cream, slightly gravelly CLAY. Gravel is medium and coarse, angular flint. [Weathered LEWES NODULAR CHALK FORMATION]	
		5.00		N=11 (3,3/3,2,2,4)	5.00				5
								End of borehole at 5.00 m	6
									7
									8
									9
									10

Remarks

No groundwater encountered.





Borehole Log

Borehole No.

WS2

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 20/07/2021 - 20/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.40	ES		0.10			TOPSOIL: Pale brown SAND. Loose, brown, SAND. [RAISED BEACH DEPOSITS]	1
		0.40	ES						
		1.20	D	N=8 (1,2/1,2,2,3)	1.20			Brown, clayey SAND. [RAISED BEACH DEPOSITS]	
		1.20 - 1.40							
		2.00		N=19 (3,3/4,6,4,5)				Becomes gravelly. Gravel of fine to coarse angular flint.	2
								Becomes gravelly. Gravel of fine to coarse angular flint.	
		3.00		N=13 (4,4/3,3,3,4)	3.10 3.30			Soft, pale brown, gravelly CLAY. Gravel is medium, angular flint. [Weathered LEWES NODULAR CHALK FORMATION]	3
		4.00		N=12 (3,3/3,3,3,3)				Very soft, pale cream, gravelly CLAY. Gravel is fine to coarse, angular flint and chalk. [Weathered LEWES NODULAR CHALK FORMATION]	4
		5.00		N=7 (1,2/1,2,2,2)	5.00			End of borehole at 5.00 m	5
									6
									7
									8
									9
									10

Remarks

No groundwater encountered.





Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 20/07/2021 - 20/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.50	ES		0.10			TOPSOIL: Brown SAND.	
		0.50 - 1.00	ES					Loose, brown gravelly SAND. Gravel is fine to coarse angular flint [RAISED BEACH DEPOSITS].	
		1.20		N=5 (1,1/1,1,1,2)				Becomes gravelly.	1
		2.00		N=5 (2,3/2,1,1,1)				Very gravelly.	2
		3.00		N=15 (4,3/4,3,4,4)	2.70			Stiff becoming firm, pale cream, gravelly CLAY. Gravel is fine to coarse, angular flint and chalk [Weathered LEWES NODULAR CHALK FORMATION].	3
		4.00		N=10 (6,3/2,2,3,3)					4
		5.00		N=8 (2,2/2,2,2,2)	5.00			End of borehole at 5.00 m	5
									6
									7
									8
									9
									10

Remarks

No groundwater encountered.





Borehole Log

Borehole No.

WS4

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 20/07/2021 - 20/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.50	ES		0.10			TOPSOIL: Brown SAND. Very loose, brown, slightly silty SAND. [RAISED BEACH DEPOSITS]	
		0.50 - 1.00	ES						
		1.20		N=4 (1,1/1,1,1,1)					1
		2.00		N=4 (1,1/1,1,1,1)	2.00				2
		3.00		N=8 (2,2/2,2,2,2)					3
		4.00		N=4 (1,1/1,1,1,1)					4
		5.00		N=0 (0,0/0,0,0,0)					5
		5.70		N=9 (2,2/2,3,2,2)	5.70 5.75			Soft, becoming very soft pale brown, sandy CLAY. [RAISED BEACH DEPOSITS]	
								Firm pale cream, gravelly CLAY. Gravel is fine to coarse, angular flint and chalk [Weathered LEWES NODULAR CHALK FORMATION]. <i>Chalk encountered.</i> End of borehole at 5.75 m	6
									7
									8
									9
									10

Remarks

No groundwater encountered.





Borehole Log

Borehole No.

WS5

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 20/07/2021 - 20/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.50	ES		0.10			TOPSOIL: Brown SAND.	
		0.50 - 1.00	ES					Loose, brown, slightly gravelly SAND [RAISED BEACH DEPOSITS]	
		1.20		N=5 (1,1/1,1,2,1)					1
		2.00		N=9 (4,2/2,3,2,2)	1.70 2.20			Firm, pale brown cream, very sandy, gravelly CLAY. [Weathered LEWES NODULAR CHALK FORMATION]	2
		3.00		N=11 (2,2/2,3,4,2)				Firm, pale cream, very sandy, slightly gravelly CLAY. [Weathered LEWES NODULAR CHALK FORMATION]	3
		4.00		N=6 (1,1/1,1,2,2)					4
		5.00		N=11 (1,1/3,1,4,3)	5.00			End of borehole at 5.00 m	5
									6
									7
									8
									9
									10

Remarks

No groundwater encountered.





Borehole Log

Borehole No.

WS6

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 21/07/2021 - 21/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.50	ES		0.10			TOPSOIL: Brown SAND.	
		0.50 - 1.00	ES					Loose, brown, silty, slightly gravelly SAND. [RAISED BEACH DEPOSITS]	
		1.20		N=6 (2,1/1,2,1,2)					1
		2.00		N=15 (8,4/4,3,4,4)	2.00			Firm, brown cream, silty, slightly gravelly CLAY. Gravel is fine to coarse, angular flint. [RAISED BEACH DEPOSITS]	2
		2.30			2.30			Firm to stiff, cream, slightly gravelly CLAY. Gravel is fine to coarse, angular flint and chalk. [Weathered LEWES NODULAR CHALK FORMATION]	
		3.00		N=8 (1,1/3,2,1,2)					3
		4.00		N=9 (3,2/2,2,3,2)					4
		5.00		N=10 (2,2/2,2,3,3)	5.00				5
								End of borehole at 5.00 m	
									6
									7
									8
									9
									10

Remarks

Groundwater encountered at 3.4m bgl.





Borehole Log

Borehole No.

WS7

Sheet 1 of 1

Project Name: HMP Ford

Project No.
45713

Co-ords: -

Hole Type
WLS

Location: Ford Road, Arundel, West Sussex, BN18 0BX

Level:

Scale
1:50

Client: Caledonian Modular Ltd

Dates: 21/07/2021 - 21/07/2021

Logged By
ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.50	ES		0.10			TOPSOIL: Brown SAND.	1
		0.50 - 0.70	ES		0.50			MADE GROUND: Dark brown, gravelly SAND. Gravel is fine to coarse, angular to sub-rounded chalk, brick and flint.	
					0.70			MADE GROUND: Brown, silty, slightly gravelly SAND. Gravel is fine and medium flint with rare brick.	
		1.20		N=6 (1,1/1,1,2,2)				Loose, brown, slightly silty SAND. [RAISED BEACH DEPOSITS]	2
		2.00		N=14 (3,2/4,5,3,2)	1.90			Firm to stiff pale cream, slightly gravelly CLAY. Gravel is fine to coarse, angular to sub-rounded chalk and flint. [Weathered LEWES NODULAR CHALK FORMATION]	3
		3.00		N=9 (2,1/1,3,3,2)					4
		4.00		N=10 (1,1/1,4,3,2)				5	
		5.00		N=13 (3,3/2,3,4,4)	5.00		End of borehole at 5.00 m	6	
								7	
								8	
								9	
								10	

Remarks

Groundwater encountered at 4.0m bgl.



APPENDIX B

LABORATORY TESTING RESULTS: GEOTECHNICAL



LABORATORY REPORT



4043

Contract Number: PSL21/6583

Report Date: 26 August 2021

Client's Reference: 45713

Client Name: Alan Wood & Partners
Hallamshire House
Meadow Court
Hayland Street
Sheffield
S9 1BY

For the attention of: Sam Thomas

Contract Title: HMP Ford

Date Received: 13/8/2021

Date Commenced: 13/8/2021

Date Completed: 26/8/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

T Watkins
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL

Professional Soils Laboratory

HMP Ford**Contract No:**

PSL21/6583

Client Ref:

45713/S4042

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

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



4043

PSL
Professional Soils Laboratory

HMP Ford

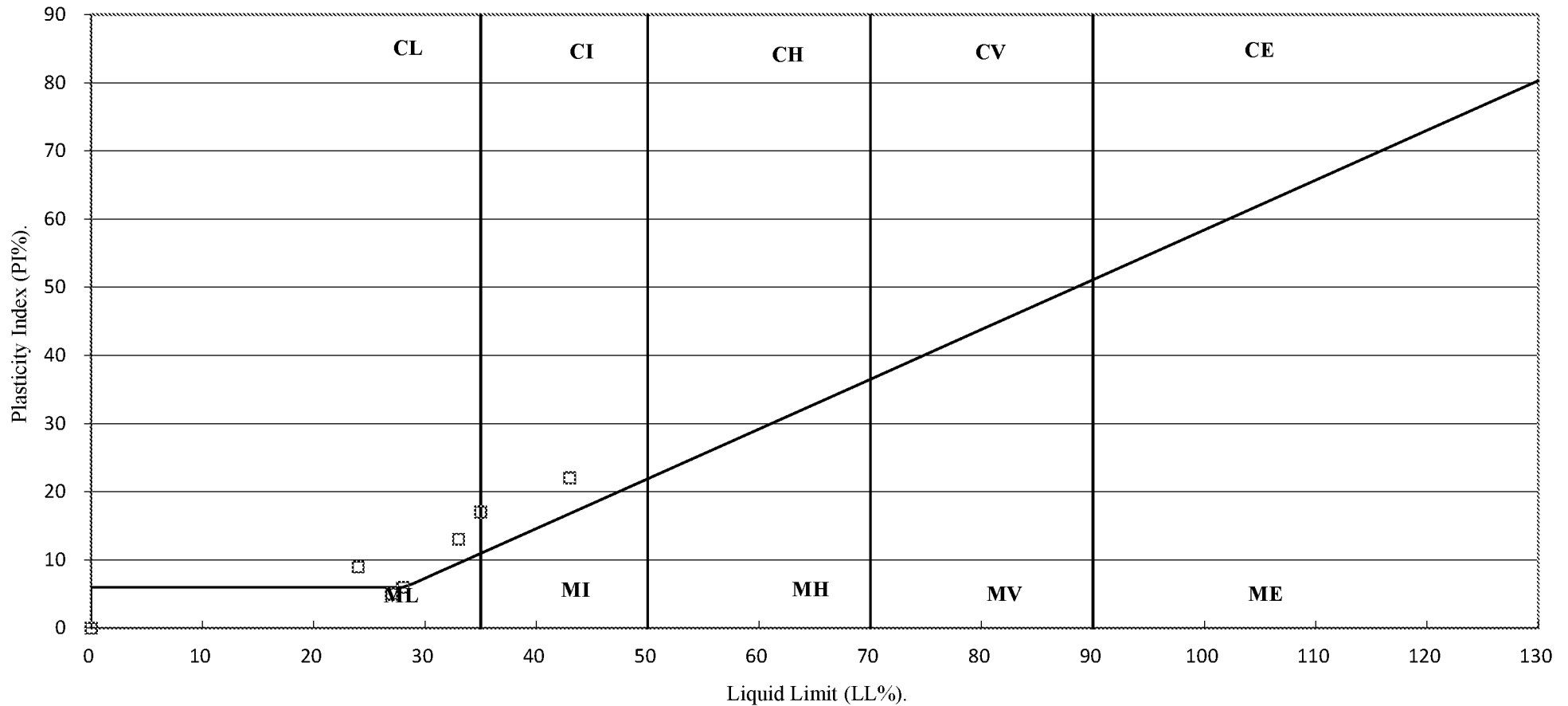
Contract No:

PSL21/6583

Client Ref:

45713/S4042

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

HMP Ford

Contract No:

PSL21/6583

Client Ref:

45713/S4042

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP1

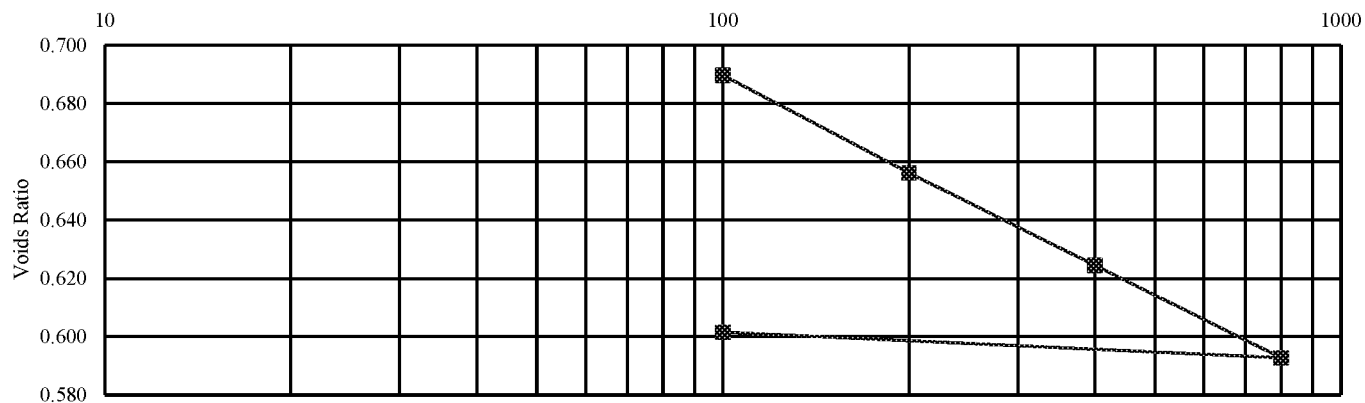
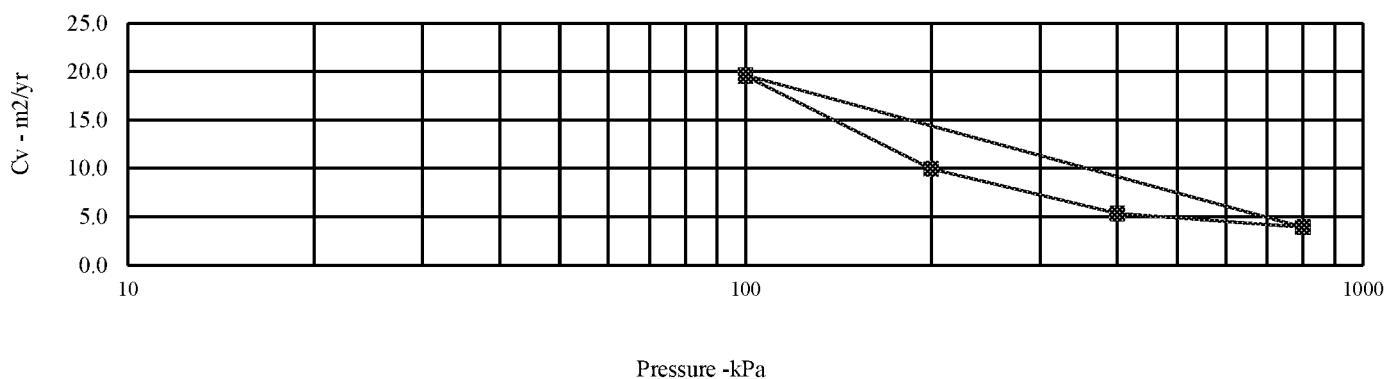
Top Depth (m): 10.00

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	23	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	1.87	0	100	0.281	19.549	Method used to	
Dry Density (Mg/m3):	1.52	100	200	0.198	9.932	determine CV:	T90
Voids Ratio:	0.738	200	400	0.096	5.357	Nominal temperature	
Degree of saturation:	82.3	400	800	0.049	3.913	during test ' C:	20
Height (mm):	20.068	800	100	0.008	19.630	Remarks:	
Diameter (mm)	75.058					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



HMP Ford

Contract No:
PSL21/6583
Client Ref:
45713/S4042

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP2

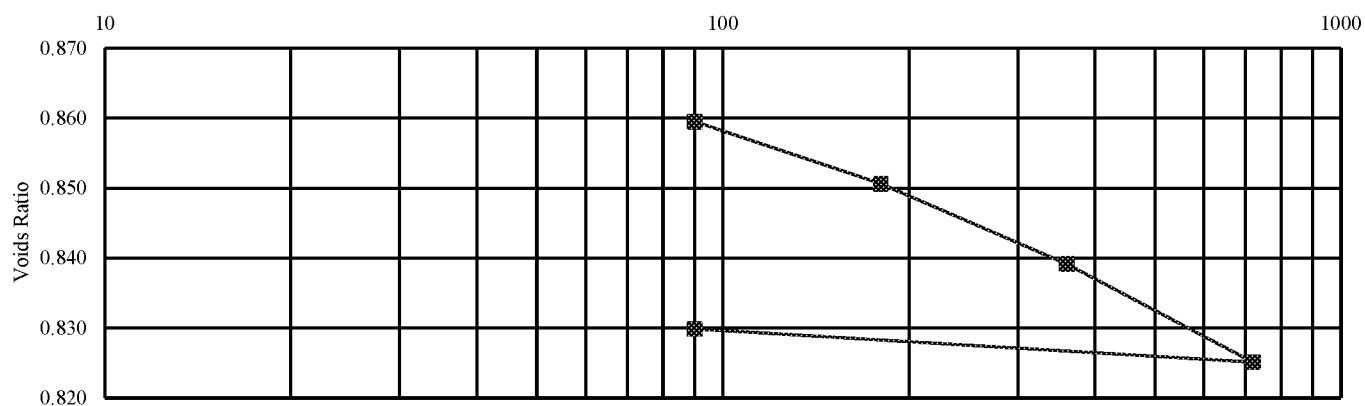
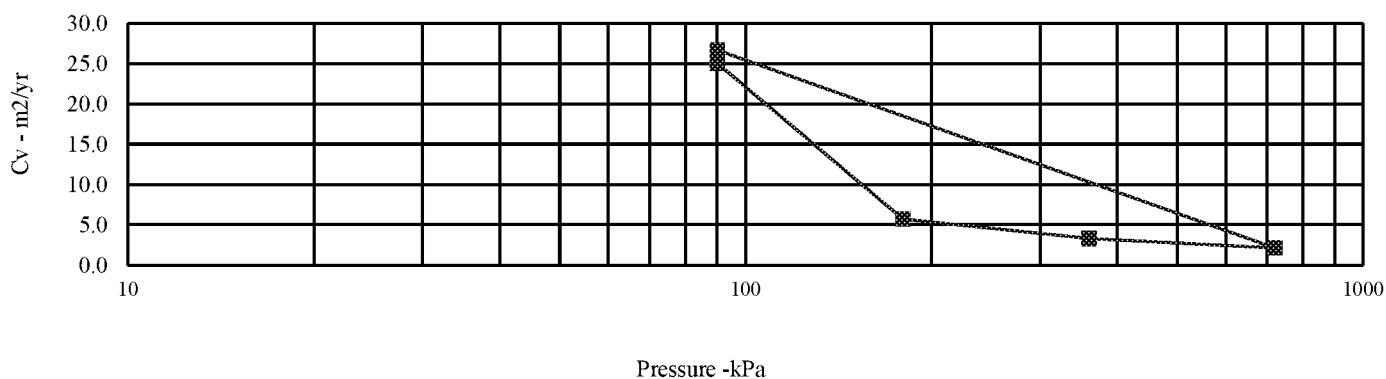
Top Depth (m): 9.00

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	23	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	1.73	0	90	0.116	25.053	Method used to	
Dry Density (Mg/m3):	1.41	90	180	0.053	5.705	determine CV:	T90
Voids Ratio:	0.879	180	360	0.035	3.293	Nominal temperature	
Degree of saturation:	69.3	360	720	0.021	2.123	during test ' C:	20
Height (mm):	20.098	720	90	0.004	26.670	Remarks:	
Diameter (mm)	50.068					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



HMP Ford

Contract No:
PSL21/6583
Client Ref:
45713/S4042

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP3

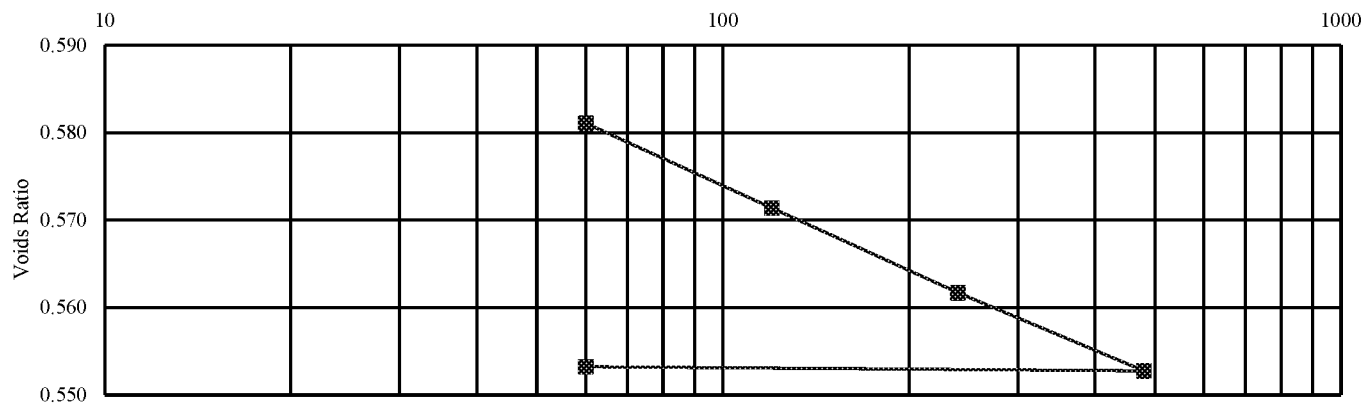
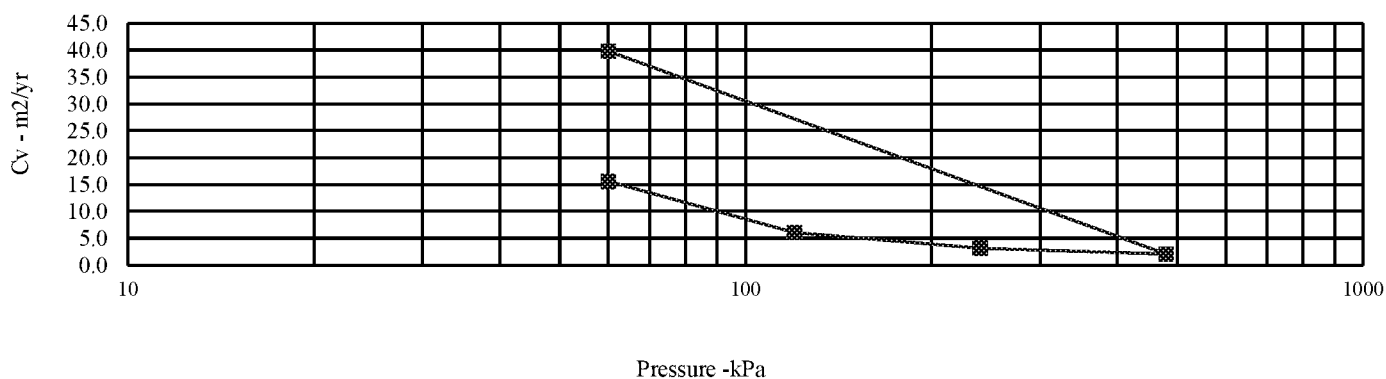
Top Depth (m): 6.00

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	23	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.00	0	60	0.544	15.542	Method used to	
Dry Density (Mg/m3):	1.62	60	120	0.102	6.049	determine CV:	T90
Voids Ratio:	0.634	120	240	0.051	3.164	Nominal temperature	
Degree of saturation:	97.0	240	480	0.024	2.051	during test ' C:	20
Height (mm):	20.086	480	60	0.001	39.794	Remarks:	
Diameter (mm)	75.078					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



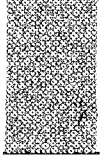
HMP Ford

Contract No:
PSL21/6583
Client Ref:
45713/S4042

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	10.00m		
	Description Type	See summary of soil descriptions. Undisturbed, vertical orientation.		
	Initial Sample Length	L ₀	(mm)	140.0
	Initial Sample Diameter	D ₀	(mm)	70.1
	Initial Sample Weight	W ₀	(gr)	1026.0
	Initial Bulk Density	ρ ₀	(Mg/m ³)	1.90
	Particle Density	ρ _s	(Mg/m ³)	2.66

Initial Conditions		Stage 1	2
Initial Cell Pressure	σ _{3i}	(kPa)	1000
Initial Back Pressure	U _{bi}	(kPa)	800
Membrane Thickness	m _b	(mm)	0.600
Displacement Input	L _{IP}	(mm)	CH 2
Load Input	N _{IP}	(N)	CH 1
Pore Water Pressure Input	U _{pwp}	(kPa)	CH 3
Sample Volume	V	(cc)	CH 2
Initial Moisture	w _i	(%)	23
Initial Dry Density	ρ _{di}	(Mg/m ³)	1.54
Initial Voids Ratio	e _i	.	0.730
Initial Degree of Saturation	S _i	(%)	86
B Value	B	.	0.95

Final Conditions		Stage 1	2
Final Moisture	w _f	(%)	24
Final Dry Density	ρ _{df}	(Mg/m ³)	1.58
Final Voids Ratio	e _f	.	0.680
Final Degree of Saturation	S _f	(%)	95.6
Failure Criteria	.	Max. Dev. Stress	.
Strain At Failure	ε _f	(%)	0.63
Stress At Failure	(σ ₁ - σ ₃)	(kPa)	303.4
Minor Stress At Failure	σ ₃ '	(kPa)	43.0
Major Stress At Failure	σ ₁ '	(kPa)	346.4
Principal Stress Ratio At Failure	σ ₁ ' / σ ₃ '		8.055

Notes		 <i>Brittle</i>

	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP1 10.00m
	Site Reference		Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP1
	Client	Alan Wood and Partners	Sample	10.00m
			Depth	10.00m

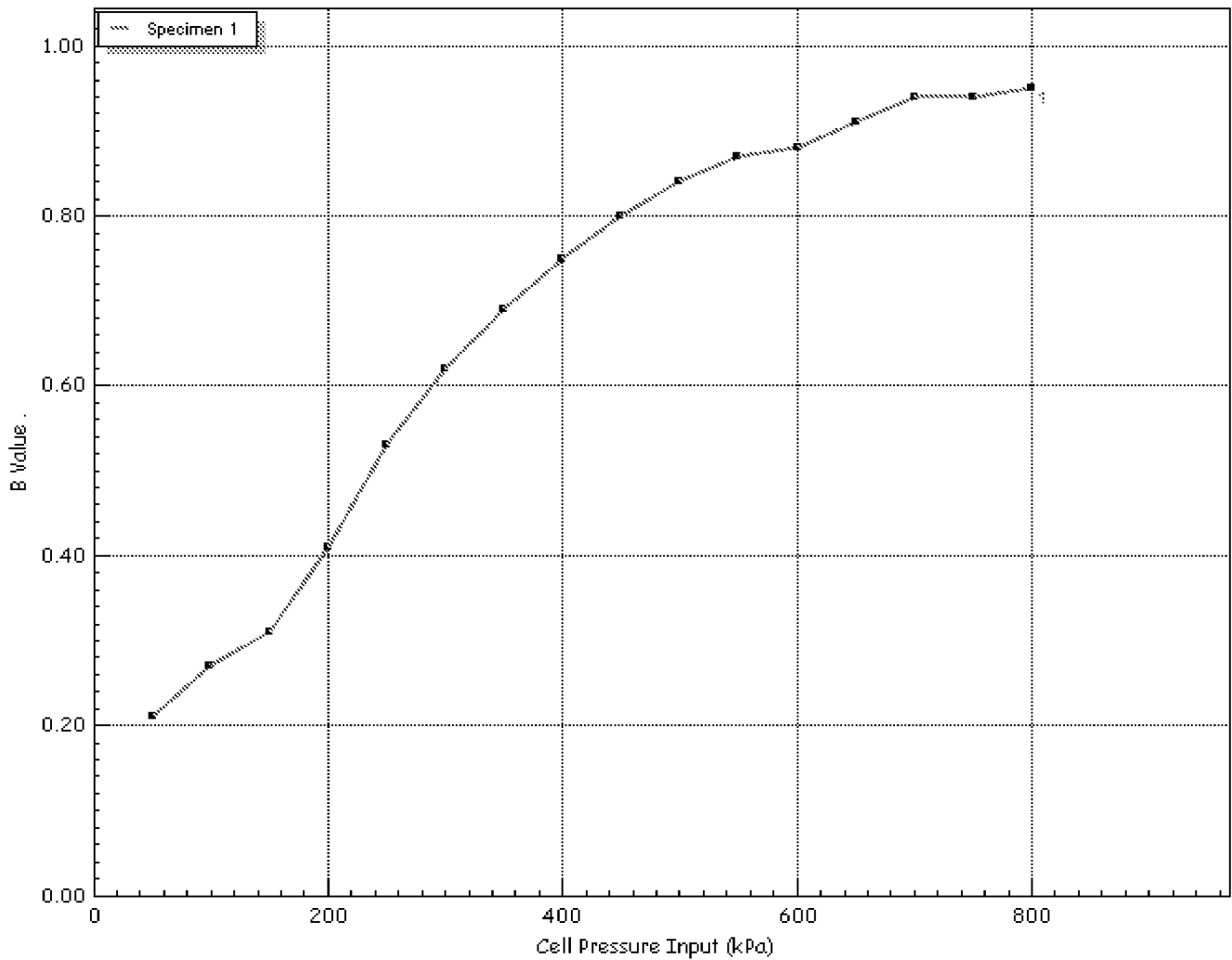


Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	σ (kPa)	800
Pore Water Pressure Input	u_{pwp} (kPa)	787
B Value	B	0.95



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP1 10.00m
			Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP1
	Client	Alan Wood and Partners	Sample	10.00m
			Depth	10.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

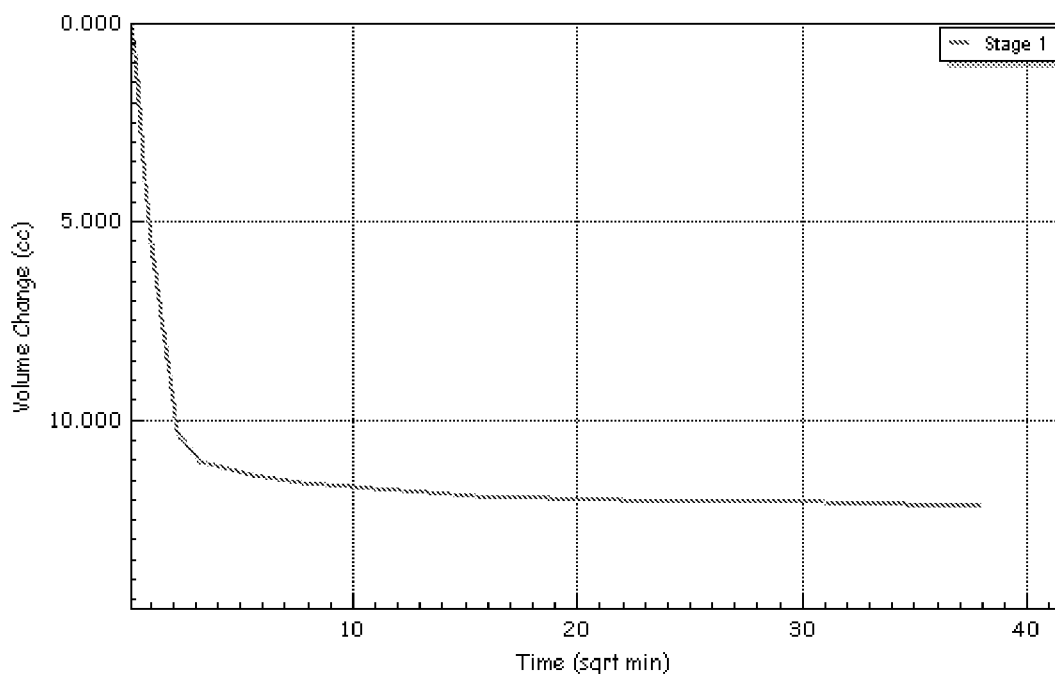
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	1000
Initial Back Pressure	u_{bi}	(kPa)	800
Pore Water Pressure Input	u_{pwp}	(kPa)	981
Drainage Method	Radial+One End		

Final Conditions

PWP Dissipation %	U%	(%)	100.00
Volumetric Strain	ϵ_v	(%)	2.25
Corrected Length	L_c	(mm)	138.9
Corrected Area	A_c	(cm ²)	38.02
Corrected Volume	V_c	(cc)	528.163
T100 Time to Failure	t_{100}	(min)	3.74
Consolidation	c_v	(m ² /year)	27.194
Compressibility	m_v	(m ² /MN)	0.124
Test Time	t_F	(h:m:s)	02:00:00
Estimated Strain to Failure	ϵ	(%)	5.0
Shear Machine Speed	d_r	(mm/min)	0.05790

Notes



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP1 10.00m

Test Date 19/08/2021

Jobfile

HMP Ford

Borehole CP1

Client

Alan Wood and Partners

Sample 10.00m

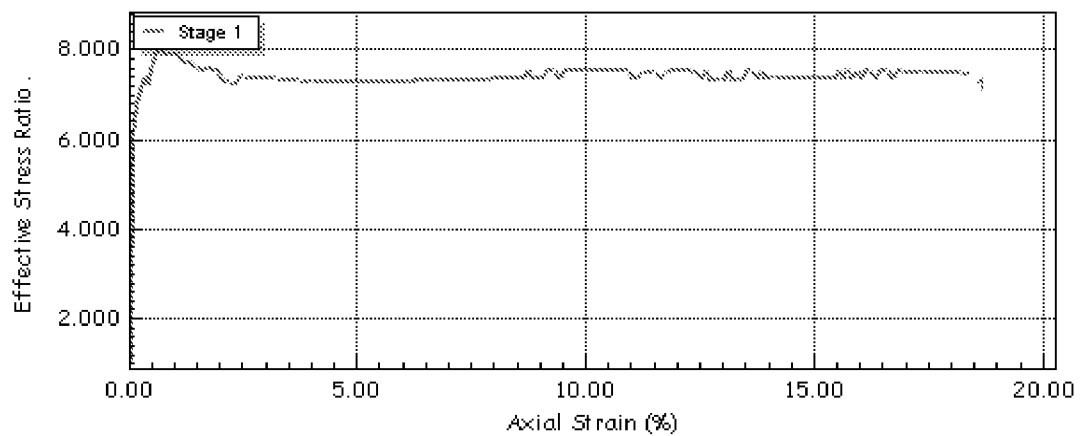
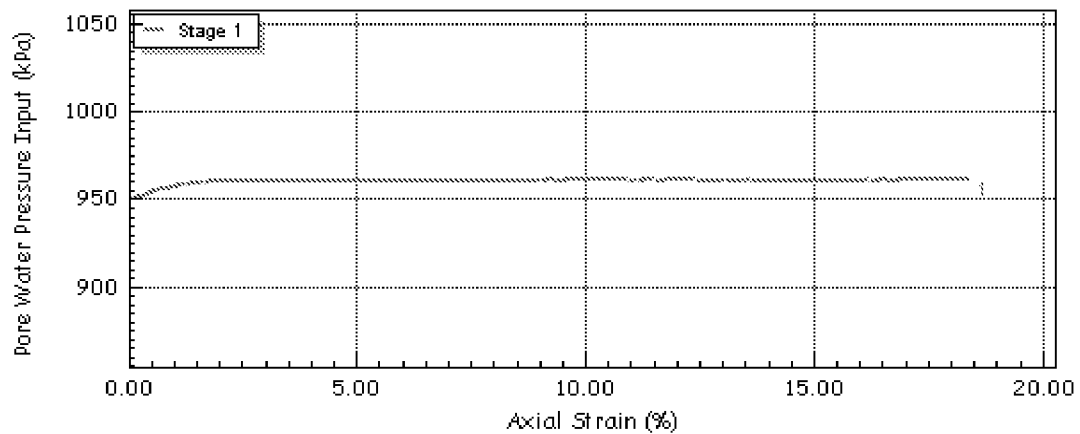
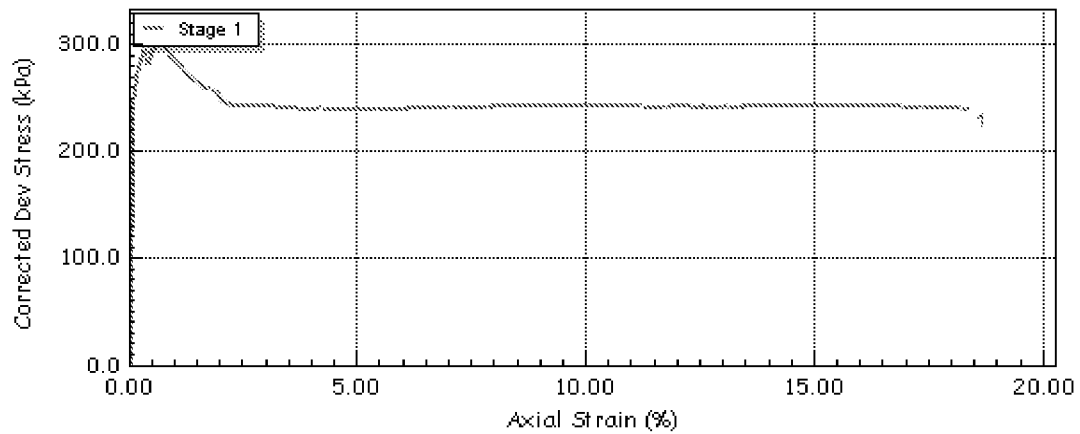
Depth 10.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP1 10.00m

Test Date 19/08/2021

Jobfile HMP Ford

Borehole CP1

Client Alan Wood and Partners

Sample 10.00m

Depth 10.00m

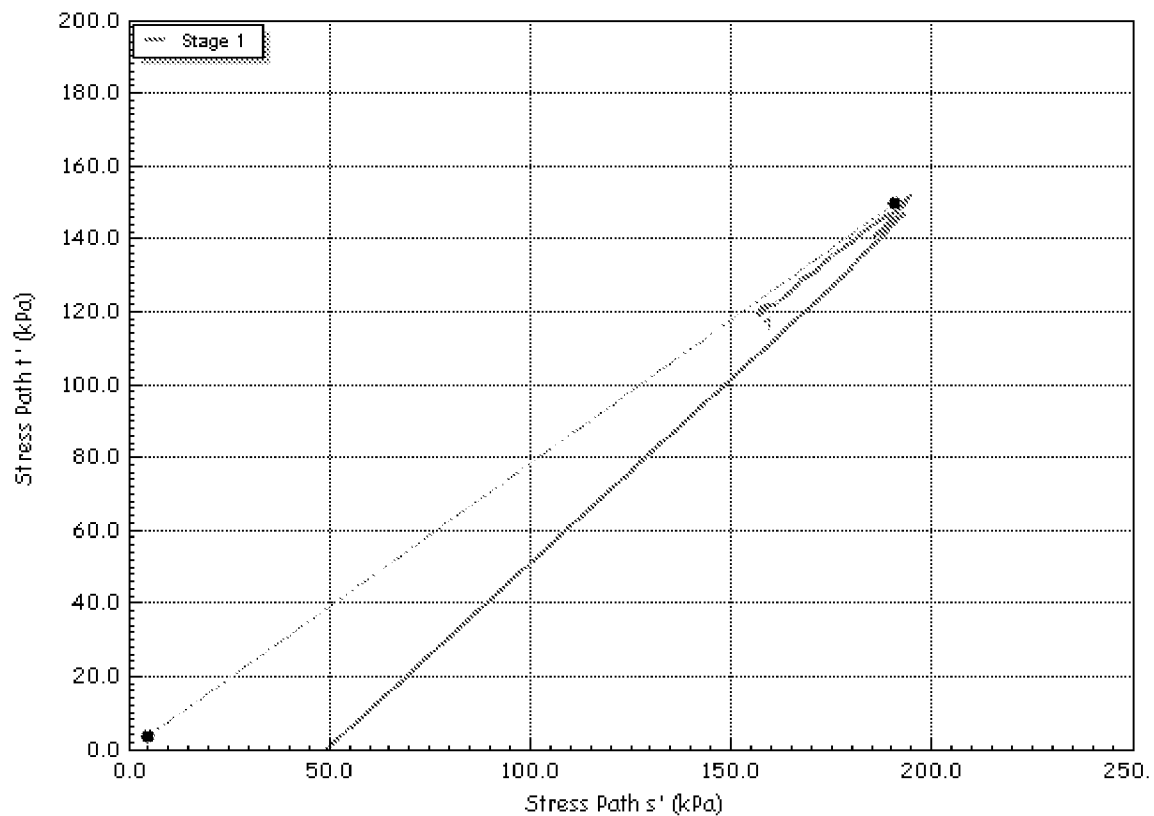
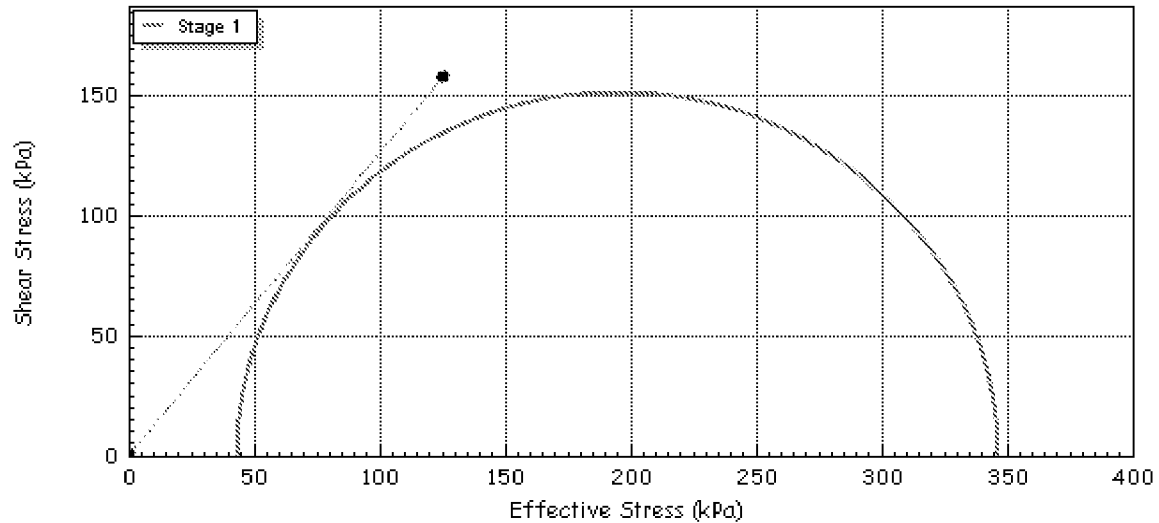


Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	0.00	Effective Cohesion	c'	(kPa)	0.00
Effective Friction	ϕ'	(deg)	51.8	Effective Friction	ϕ'	(deg)	51.8



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP1 10.00m

Test Date 19/08/2021

Jobfile HMP Ford

Borehole CP1

Client Alan Wood and Partners

Sample 10.00m

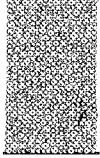
Depth 10.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	9.00m		
	Description Type	See summary of soil descriptions. Undisturbed, vertical orientation.		
Initial Sample Length		L ₀	(mm)	200.0
Initial Sample Diameter		D ₀	(mm)	100.0
Initial Sample Weight		W ₀	(gr)	2719.0
Initial Bulk Density		ρ ₀	(Mg/m ³)	1.73
Particle Density		ρ _s	(Mg/m ³)	2.66

Initial Conditions		Stage 1		2
Initial Cell Pressure	σ _{3i}	(kPa)	830	
Initial Back Pressure	U _{bi}	(kPa)	650	
Membrane Thickness	m _b	(mm)	0.600	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 4	
Pore Water Pressure Input	U _{pwp}	(kPa)	CH 3	
Sample Volume	V	(cc)	CH 6	
Initial Moisture	w _i	(%)	23	
Initial Dry Density	ρ _{di}	(Mg/m ³)	1.41	
Initial Voids Ratio	e _i	.	0.886	
Initial Degree of Saturation	S _i	(%)	68	
B Value	B	.	0.95	

Final Conditions		Stage 1		2
Final Moisture	w _f	(%)	24	
Final Dry Density	ρ _{df}	(Mg/m ³)	1.48	
Final Voids Ratio	e _f	.	0.797	
Final Degree of Saturation	S _f	(%)	81.1	
Failure Criteria		Max. Dev. Stress		.
Strain At Failure	ε _f	(%)	0.45	
Stress At Failure	(σ ₁ - σ ₃)	(kPa)	131.6	
Minor Stress At Failure	σ ₃ '	(kPa)	77.1	
Major Stress At Failure	σ ₁ '	(kPa)	208.8	
Principal Stress Ratio At Failure	σ ₁ ' / σ ₃ '		2.706	

Notes			
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	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP2 9.00m
			Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP2
	Client	Alan Wood And Partners	Sample	9.00m
			Depth	9.00m

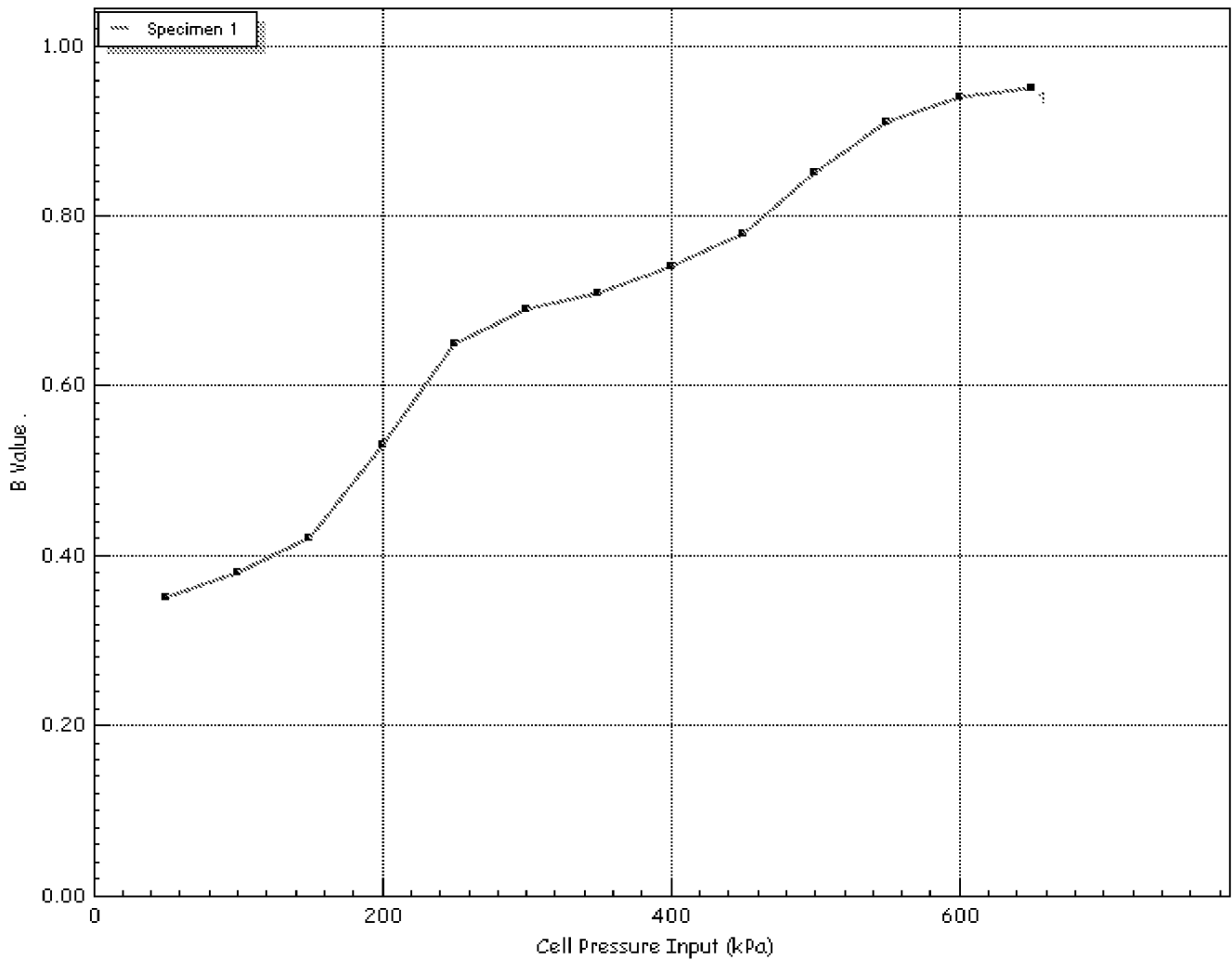


Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	σ (kPa)	650
Pore Water Pressure Input	u_{pwp} (kPa)	642
B Value	B	0.95



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP2 9.00m
			Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP2
	Client	Alan Wood And Partners	Sample	9.00m
			Depth	9.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

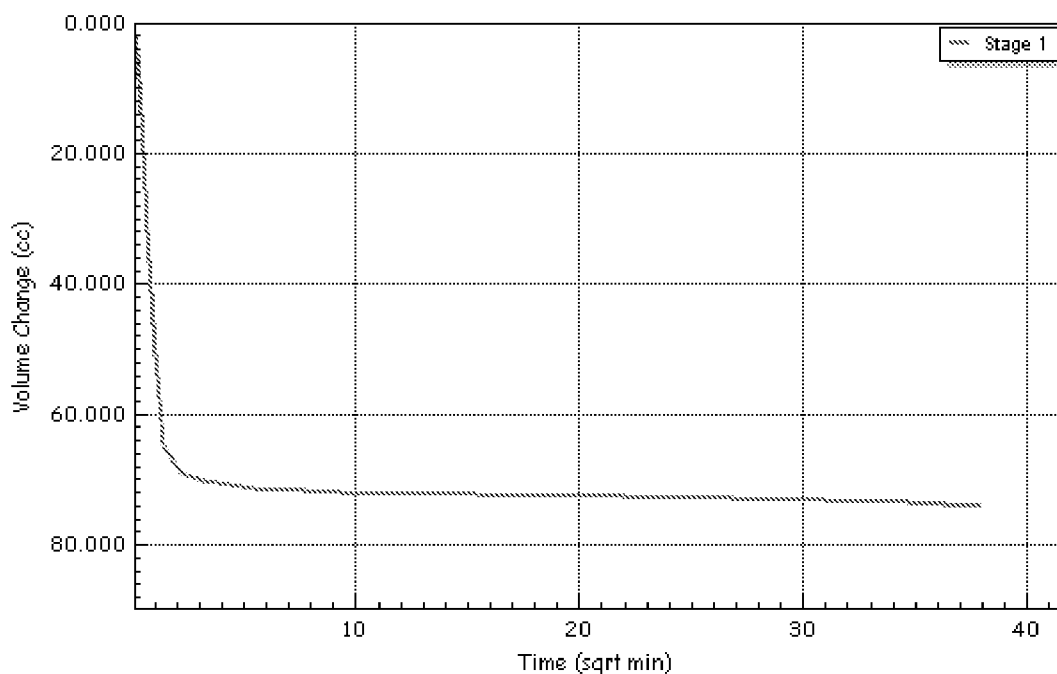
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	830
Initial Back Pressure	u_{bi}	(kPa)	650
Pore Water Pressure Input	u_{pwp}	(kPa)	809
Drainage Method	Radial+One End		

Final Conditions

PWP Dissipation %	U%	(%)	100.00
Volumetric Strain	ϵ_v	(%)	4.71
Corrected Length	L_c	(mm)	196.9
Corrected Area	A_c	(cm ²)	76.07
Corrected Volume	V_c	(cc)	1496.753
t100	t ₁₀₀	(min)	1.95
Consolidation	c _v	(m ² /year)	105.897
Compressibility	m _v	(m ² /MN)	0.297
Test Time	t _F	(h:m:s)	02:00:00
Estimated Strain to Failure	ϵ	(%)	5.0
Shear Machine Speed	d _r	(mm/min)	0.08202

Notes



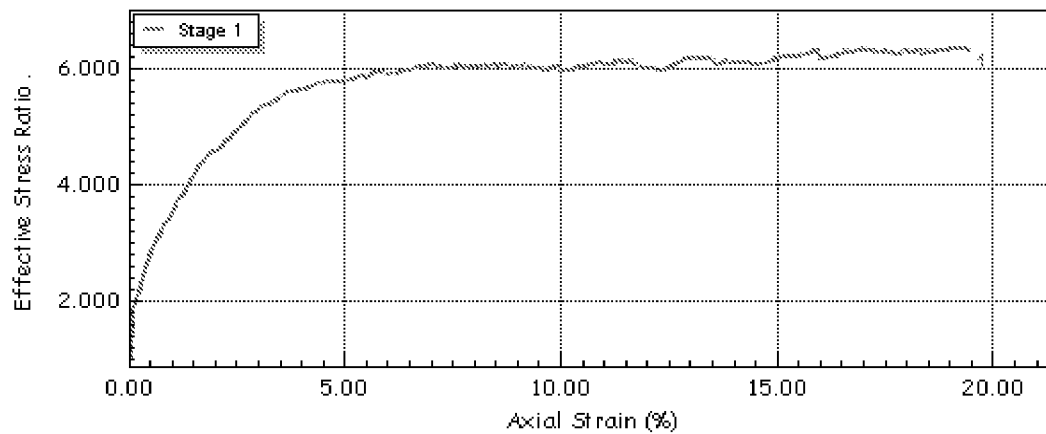
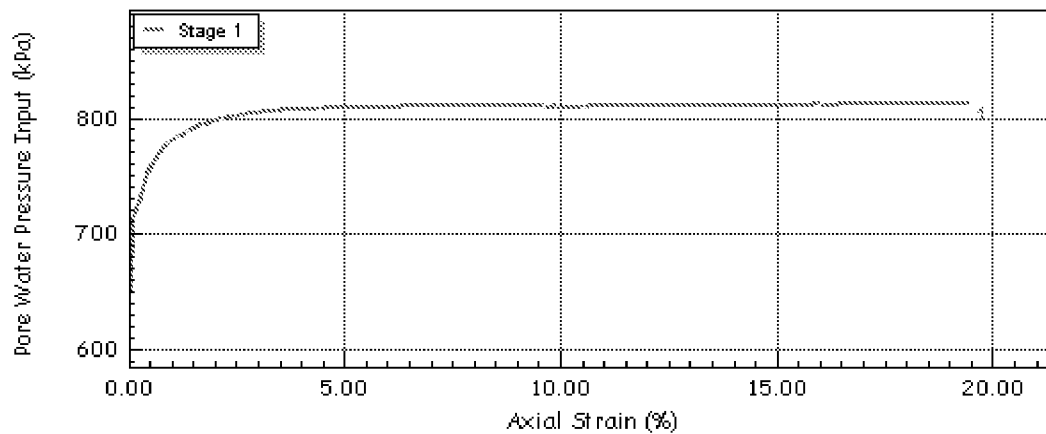
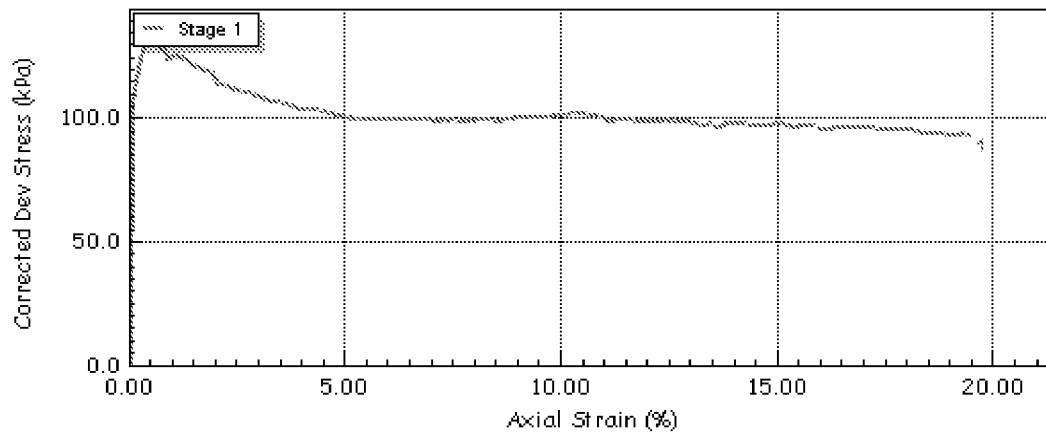
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP2 9.00m
			Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP2
	Client	Alan Wood And Partners	Sample Depth	9.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP2 9.00m

Test Date 19/08/2021

Jobfile HMP Ford

Borehole CP2

Client Alan Wood And Partners

Sample 9.00m

Depth 9.00m

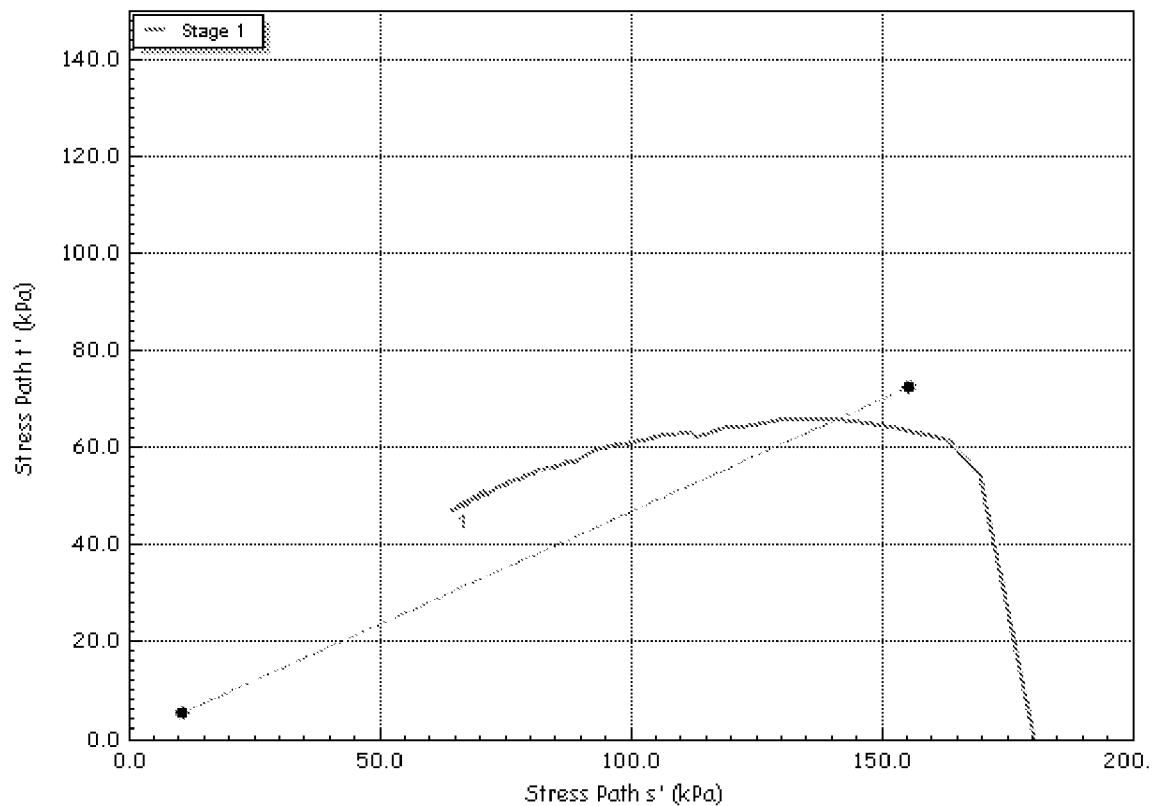
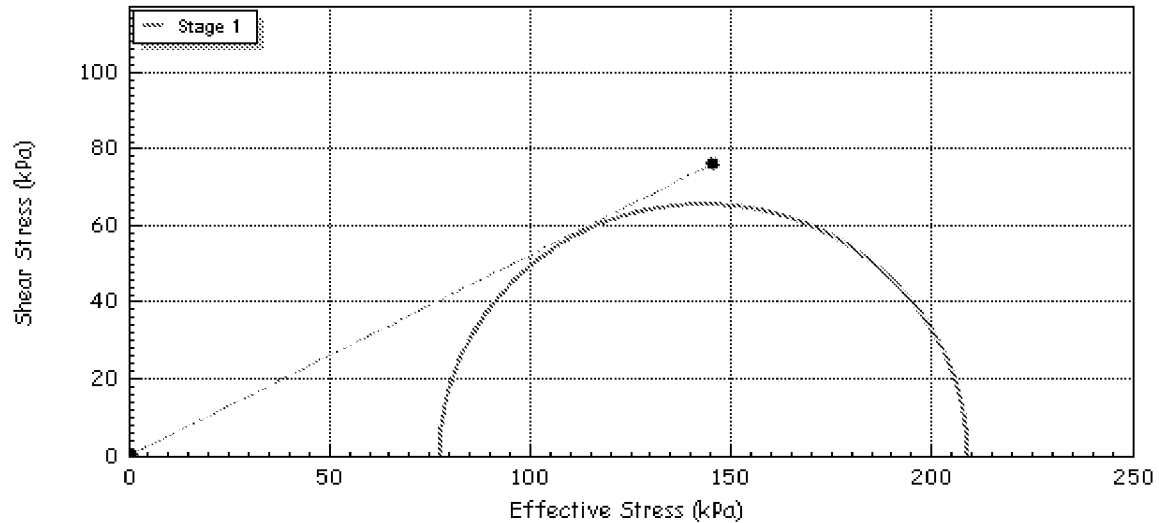


Effective Stress Triaxial Compression

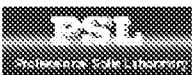
Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	0.00	Effective Cohesion	c'	(kPa)	0.00
Effective Friction	ϕ'	(deg)	27.7	Effective Friction	ϕ'	(deg)	27.7



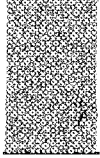
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP2 9.00m
	Jobfile	HMP Ford	Test Date	19/08/2021
Client	Alan Wood And Partners		Borehole	CP2
			Sample	9.00m
			Depth	9.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

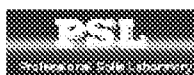
Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	6.00m		
	Description Type	See summary of soil descriptions. Undisturbed, vertical orientation.		
	Initial Sample Length	L ₀	(mm)	211.0
	Initial Sample Diameter	D ₀	(mm)	105.9
	Initial Sample Weight	W ₀	(gr)	3676.0
	Initial Bulk Density	ρ ₀	(Mg/m ³)	1.98
	Particle Density	ρ _s	(Mg/m ³)	2.66

Initial Conditions		Stage 1	2
Initial Cell Pressure	σ _{3i}	(kPa)	820
Initial Back Pressure	U _{bi}	(kPa)	700
Membrane Thickness	m _b	(mm)	0.600
Displacement Input	L _{IP}	(mm)	CH 2
Load Input	N _{IP}	(N)	CH 1
Pore Water Pressure Input	U _{pwp}	(kPa)	CH 3
Sample Volume	V	(cc)	CH 2
Initial Moisture	w _i	(%)	23
Initial Dry Density	ρ _{di}	(Mg/m ³)	1.61
Initial Voids Ratio	e _i	.	0.648
Initial Degree of Saturation	S _i	(%)	93
B Value	B	.	0.95

Final Conditions		Stage 1	2
Final Moisture	w _f	(%)	20
Final Dry Density	ρ _{df}	(Mg/m ³)	1.62
Final Voids Ratio	e _f	.	0.642
Final Degree of Saturation	S _f	(%)	84.6
Failure Criteria	.	Max. Dev. Stress	.
Strain At Failure	ε _f	(%)	14.58
Stress At Failure	(σ ₁ - σ ₃)	(kPa)	192.6
Minor Stress At Failure	σ ₃ '	(kPa)	59.0
Major Stress At Failure	σ ₁ '	(kPa)	251.5
Principal Stress Ratio At Failure	σ ₁ ' / σ ₃ '		4.267

Notes	 <i>Plastic</i>

	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP3 6.00m
			Test Date	19/08/2021
Jobfile	HMP Ford		Borehole	CP3
Client	Alan Wood and Partners		Sample	6.00m
			Depth	6.00m

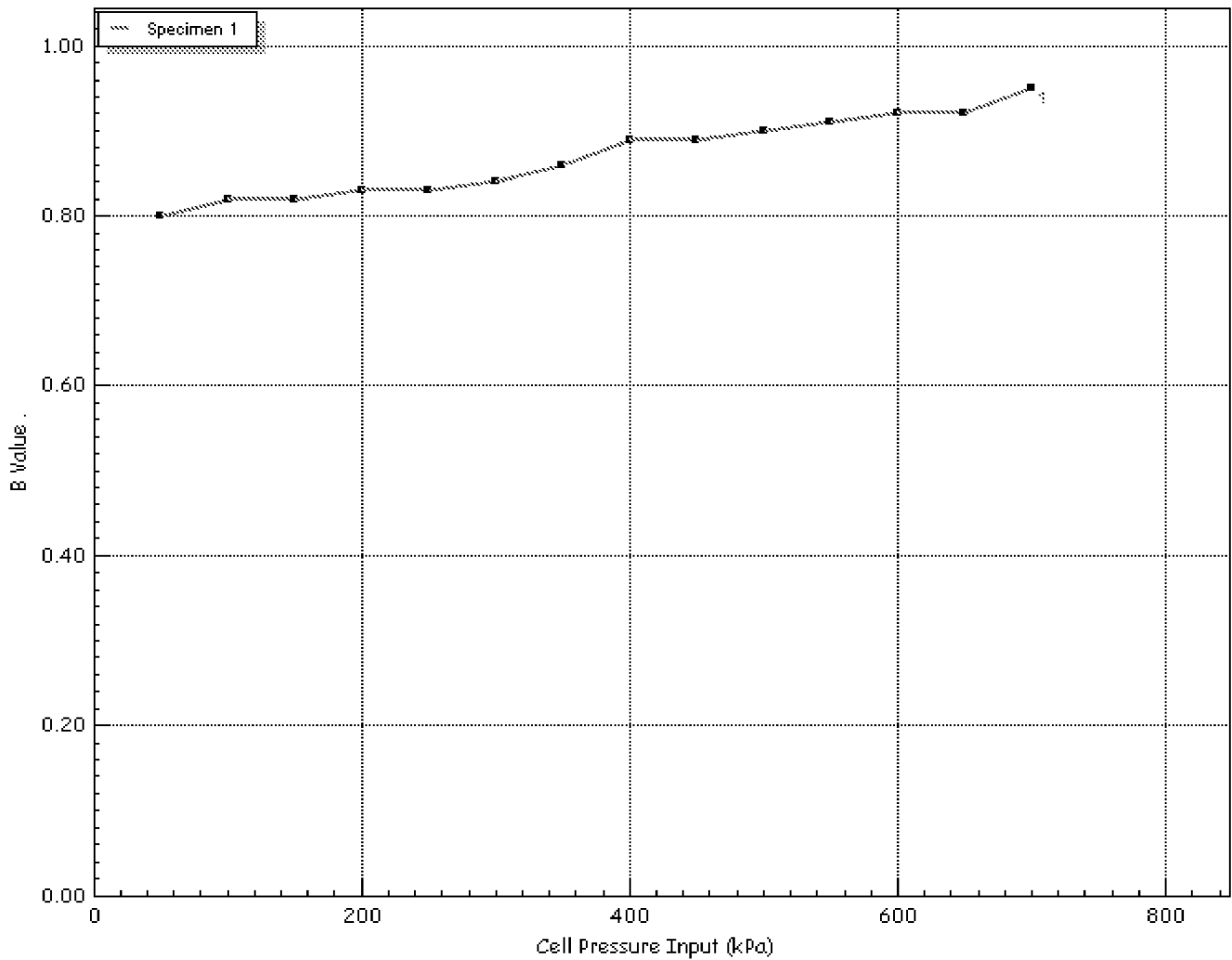


Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	σ (kPa)	700
Pore Water Pressure Input	u_{pwp} (kPa)	685
B Value	B	0.95



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP3 6.00m

Test Date 19/08/2021

Jobfile HMP Ford

Borehole CP3

Client Alan Wood and Partners

Sample 6.00m

Depth 6.00m



Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

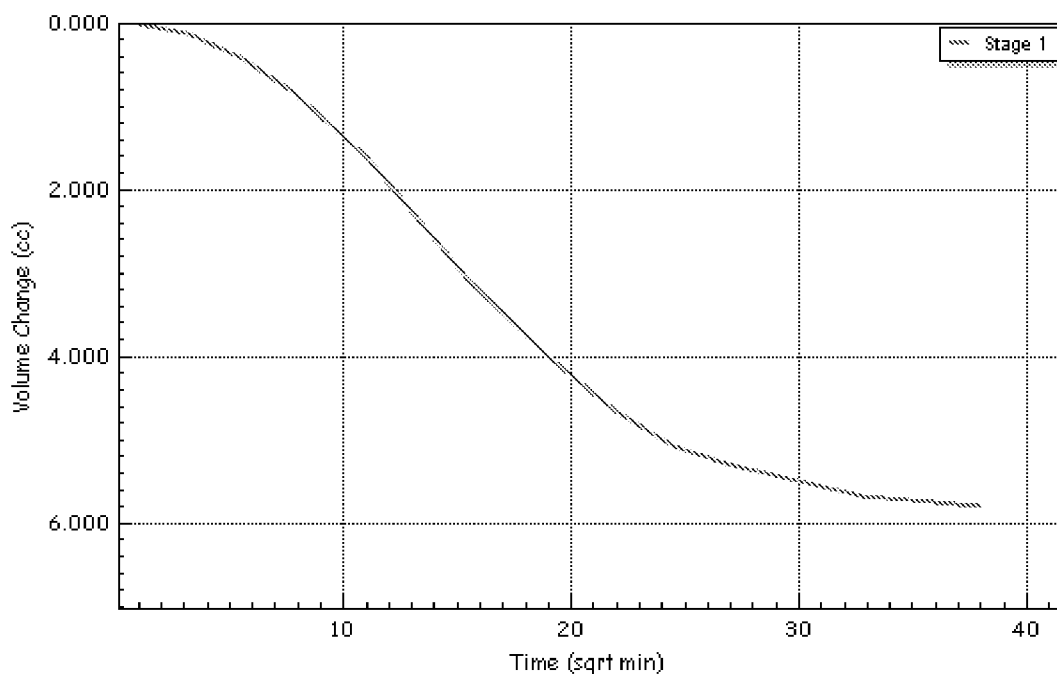
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	820
Initial Back Pressure	u_{bi}	(kPa)	700
Pore Water Pressure Input	u_{pwp}	(kPa)	800
Drainage Method	Radial+One End		

Final Conditions

PWP Dissipation %	U%	(%)	100.00
Volumetric Strain	ϵ_v	(%)	0.31
Corrected Length	L_c	(mm)	210.8
Corrected Area	A_c	(cm ²)	87.90
Corrected Volume	V_c	(cc)	1852.709
T100 Time to Failure	t_{100}	(min)	552.93
Consolidation	c_v	(m ² /year)	0.421
Compressibility	m_v	(m ² /MN)	0.031
Test Time	t_F	(h:m:s)	16:35:16
Estimated Strain to Failure	ϵ	(%)	5.0
Shear Machine Speed	d_r	(mm/min)	0.01059

Notes



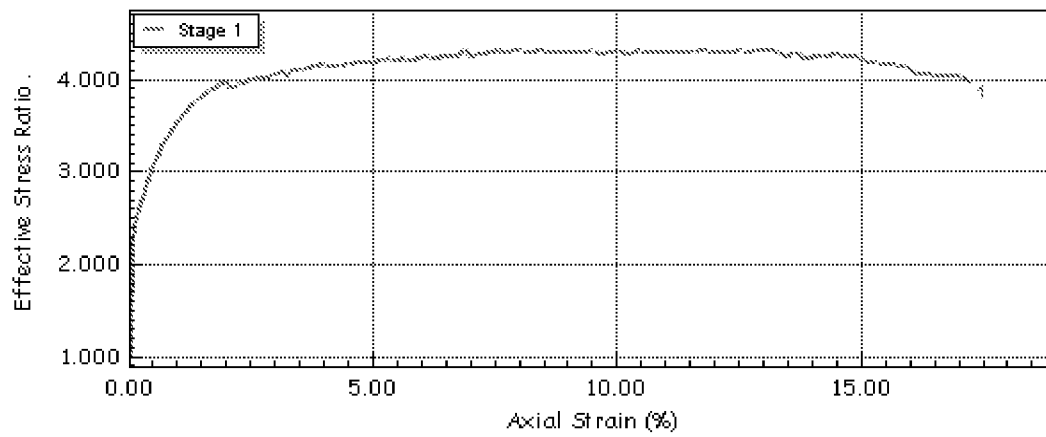
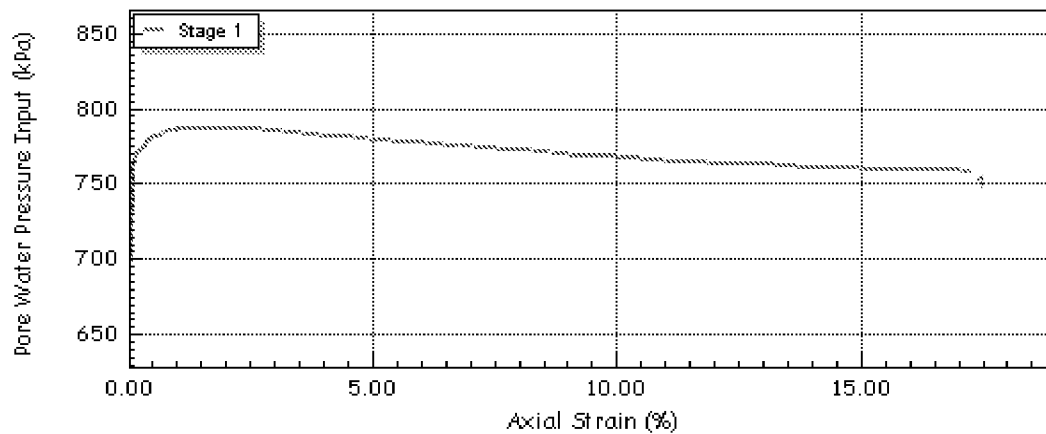
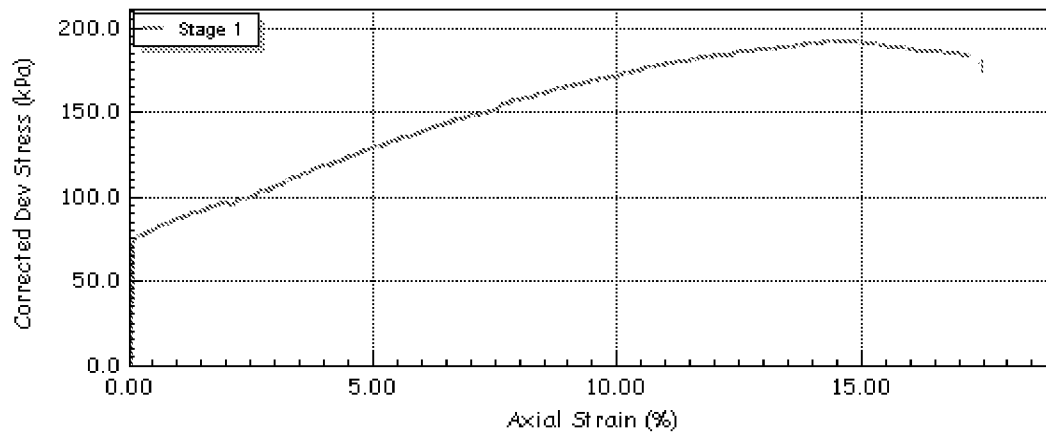
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP3 6.00m
			Test Date	19/08/2021
Jobfile	HMP Ford	Borehole	CP3	
Client	Alan Wood and Partners	Sample	6.00m	
		Depth	6.00m	



Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots



Test Method BS1377-8 : 1990 : Clause 7

Test Name CP3 6.00m

Test Date 19/08/2021

Jobfile HMP Ford

Borehole CP3

Client Alan Wood and Partners

Sample 6.00m

Depth 6.00m

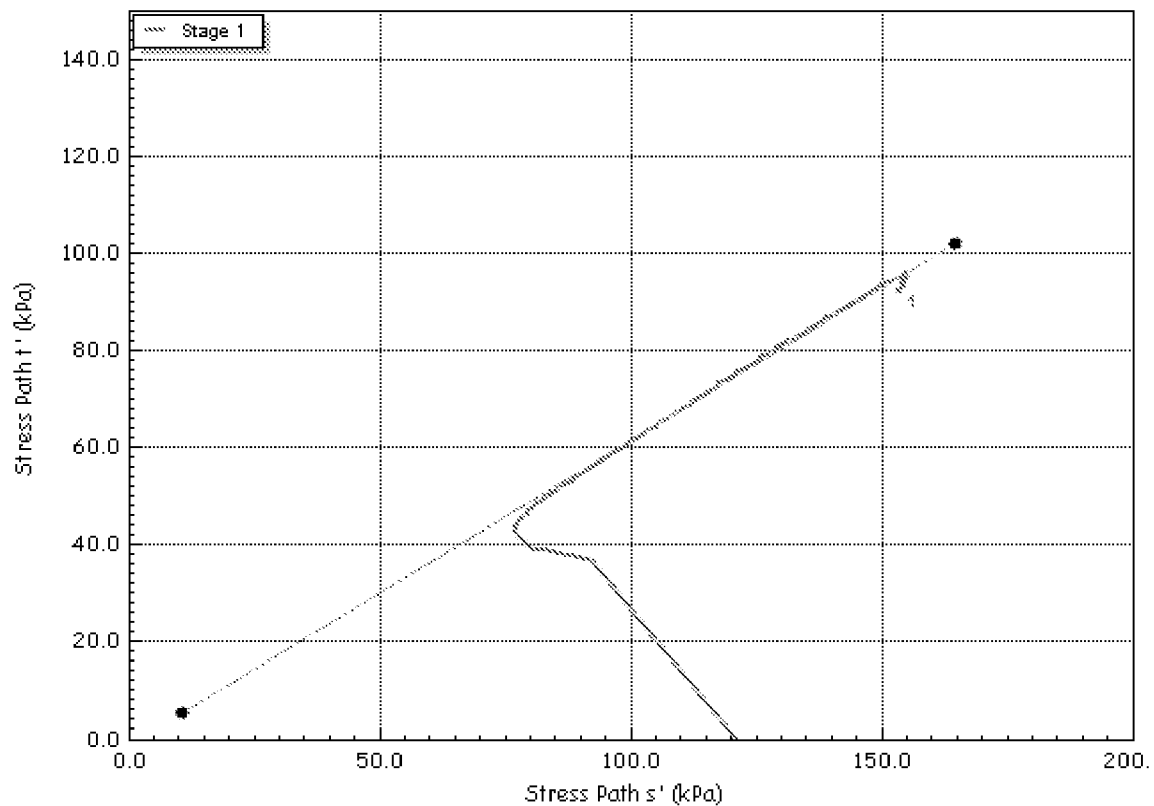
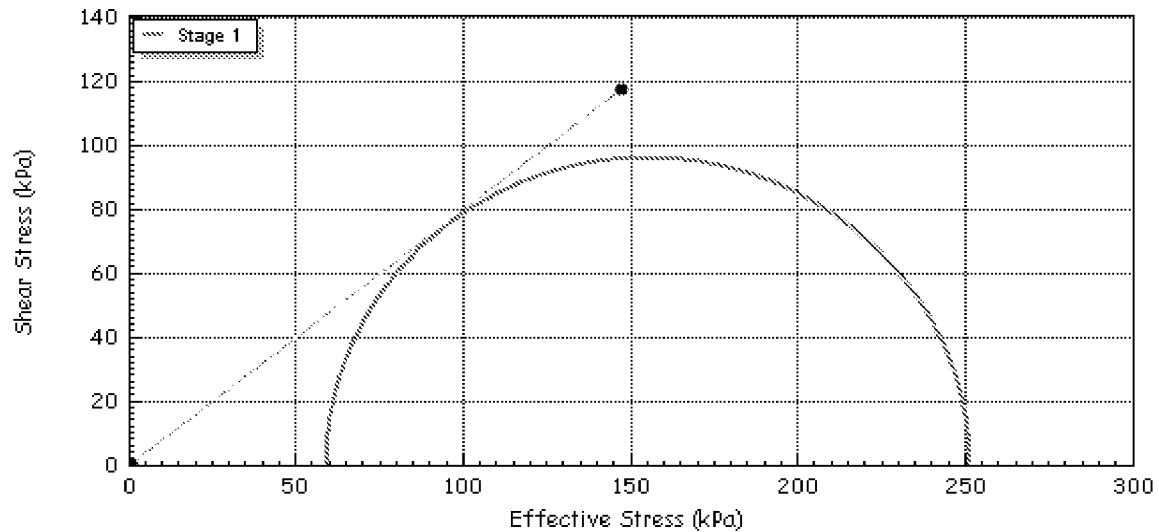


Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	0.00	Effective Cohesion	c'	(kPa)	0.00
Effective Friction	ϕ'	(deg)	38.7	Effective Friction	ϕ'	(deg)	38.7



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	CP3 6.00m
			Test Date	19/08/2021
	Jobfile	HMP Ford	Borehole	CP3
	Client	Alan Wood and Partners	Sample	6.00m
			Depth	6.00m

APPENDIX C

LABORATORY TESTING RESULTS: CHEMICAL



ANALYTICAL TEST REPORT

Contract no: 99271
Contract name: HMP Ford
Client reference: -
Clients name: Alan Wood & Partners
Clients address: Hallamshire House
Hayland Street
Sheffield
S9 1BY

Samples received: 10 August 2021

Analysis started: 10 August 2021

Analysis completed: 17 August 2021

Report issued: 17 August 2021

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.
BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:



Rachael Burton
Customer Support Squad Leader

Unit 6 Parkhead, Greengroft Industrial Park, Stanley, County Durham, DH9 7YB

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
99271-1	CBR6	0.10-0.20	Sandy Clayey Loam with Gravel & Roots	-	-	11.7
99271-2	CBR7	0.10-0.20	Sandy Clayey Loam with Roots	-	-	12.8
99271-3	CBR8	0.10-0.20	Sandy Clayey Loam with Roots	-	-	14.3
99271-4	CP1	0.10-0.40	Sandy Clayey Loam	-	-	11.0
99271-5	CP2	0.10-0.40	Sandy Clayey Loam with Roots	-	-	11.7

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			99271-1 CBR6 0.10-0.20 06/08/2021	99271-2 CBR7 0.10-0.20 06/08/2021	99271-3 CBR8 0.10-0.20 06/08/2021	99271-4 CP1 0.10-0.40 05/08/2021	99271-5 CP2 0.10-0.40 06/08/2021
Test	Method	Units					
Arsenic (total)	CE127 ^M	mg/kg As	13	12	13	8.9	12
Boron (water soluble)	CE063 ^M	mg/kg B	<0.5	<0.5	0.7	<0.5	<0.5
Cadmium (total)	CE127 ^M	mg/kg Cd	0.2	0.2	0.4	<0.2	0.3
Chromium (total)	CE127 ^M	mg/kg Cr	119	76	88	62	67
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	22	14	22	9.1	13
Lead (total)	CE127 ^M	mg/kg Pb	58	28	47	13	27
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	15	15	20	14	15
Selenium (total)	CE127 ^M	mg/kg Se	1.3	0.9	1.0	0.8	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	48	57	137	39	78
pH	CE004 ^M	units	8.3	7.3	7.6	8.1	7.0
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	12	68	<10	<10	<10
Sulphate (total)	CE062 ^M	mg/kg SO ₄	237	300	374	186	274
Sulphide	CE079	mg/kg S ²⁻	<10	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1
Thiocyanate	CE145 ^M	mg/kg SCN	7.5	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	0.9	2.3	2.3	0.4	1.2
Estimate of OMC (calculated from TOC)	CE197	% w/w	1.6	4.0	3.9	0.7	2.0
PAH							
Naphthalene	CE087 ^M	mg/kg	<0.02	0.05	0.02	0.06	<0.02
Acenaphthylene	CE087 ^M	mg/kg	0.05	0.15	0.07	0.18	<0.02
Acenaphthene	CE087 ^M	mg/kg	<0.02	0.03	<0.02	0.05	<0.02
Fluorene	CE087 ^U	mg/kg	0.03	0.07	0.05	0.21	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.46	1.16	0.74	1.95	0.08
Anthracene	CE087 ^U	mg/kg	0.19	0.30	0.19	0.23	0.02
Fluoranthene	CE087 ^M	mg/kg	1.43	2.30	1.11	1.72	0.14
Pyrene	CE087 ^M	mg/kg	1.30	2.16	0.92	1.34	0.12
Benzo(a)anthracene	CE087 ^U	mg/kg	0.84	1.44	0.50	0.64	0.07
Chrysene	CE087 ^M	mg/kg	0.86	1.63	0.54	0.83	0.06
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.94	1.87	0.55	0.79	0.06
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.41	0.80	0.23	0.35	<0.03
Benzo(a)pyrene	CE087 ^U	mg/kg	0.89	1.70	0.51	0.69	0.05
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.62	1.31	0.36	0.48	0.04
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.14	0.30	0.08	0.11	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.53	1.09	0.32	0.37	0.03
PAH (total of USEPA 16)	CE087	mg/kg	8.68	16.4	6.18	9.98	0.68

Chemtech Environmental Limited

SOILS

Lab number			99271-1	99271-2	99271-3	99271-4	99271-5
Sample id			CBR6	CBR7	CBR8	CP1	CP2
Depth (m)			0.10-0.20	0.10-0.20	0.10-0.20	0.10-0.40	0.10-0.40
Date sampled			06/08/2021	06/08/2021	06/08/2021	05/08/2021	06/08/2021
Test	Method	Units					
BTEX & TPH							
Benzene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
VPH (>C5-C7)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
VPH (>C7-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
VPH (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EPH (>C10-C12)	CE033 ^U	mg/kg	<6	<6	<6	<6	<6
EPH (>C12-C16)	CE033 ^M	mg/kg	<6	<6	7	<6	7
EPH (>C16-C21)	CE033 ^M	mg/kg	<6	8	18	<6	14
EPH (>C21-C35)	CE033 ^M	mg/kg	51	56	201	<15	63
EPH (>C35-C44)	CE033 ^M	mg/kg	18	20	137	<10	23
Subcontracted analysis							
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO ₄
CE079	Sulphide	Extraction, Continuous Flow Colorimetry	As received		10	mg/kg S ²⁻
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg
CE067	VPH (>C5-C7)	Headspace GC-FID	As received		0.1	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH (>C7-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE033	EPH (>C10-C12)	Solvent extraction, GC-FID	As received	U	6	mg/kg
CE033	EPH (>C12-C16)	Solvent extraction, GC-FID	As received	M	6	mg/kg
CE033	EPH (>C16-C21)	Solvent extraction, GC-FID	As received	M	6	mg/kg
CE033	EPH (>C21-C35)	Solvent extraction, GC-FID	As received	M	15	mg/kg
CE033	EPH (>C35-C44)	Solvent extraction, GC-FID	As received	U	10	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
99271-1	CBR6	0.10-0.20	N	
99271-2	CBR7	0.10-0.20	N	
99271-3	CBR8	0.10-0.20	N	
99271-4	CP1	0.10-0.40	N	
99271-5	CP2	0.10-0.40	N	



ANALYTICAL TEST REPORT

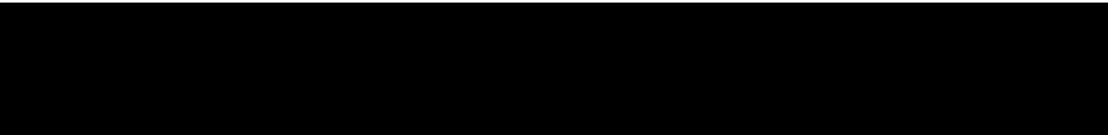
Contract no: 98778
Contract name: HMP Ford
Client reference: 45713
Clients name: Alan Wood & Partners
Clients address: Hallamshire House
Hayland Street
Sheffield
S9 1BY

Samples received: 26 July 2021
Analysis started: 26 July 2021
Analysis completed: 02 August 2021
Report issued: 02 August 2021

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by: 
Rachael Burton
Customer Support Squad Leader

Unit 

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
98778-1	WLS1	0.40-1.00	Clayey Sand	-	-	9.2
98778-2	WLS2	0.40-0.90	Clayey Sand with Roots	-	-	10.3
98778-3	WLS3	0.50-1.00	Clayey Sand with Roots	-	-	10.3
98778-4	WLS4	0.50-1.00	Clayey Sand with Roots	-	-	9.4
98778-5	WLS5	0.50-1.00	Clayey Sand with Roots	-	-	9.2
98778-6	WLS6	0.50-1.00	Clayey Sand with Roots	-	-	13.1
98778-7	WLS7	0.50-0.70	Loamy Clayey Sand with Gravel & Roots	-	-	9.4

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			98778-1 WLS1 0.40-1.00 20/07/2021	98778-2 WLS2 0.40-0.90 20/07/2021	98778-3 WLS3 0.50-1.00 20/07/2021	98778-4 WLS4 0.50-1.00 20/07/2021	98778-5 WLS5 0.50-1.00 20/07/2021	98778-6 WLS6 0.50-1.00 21/07/2021
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	11	9.4	10	12	13	14
Boron (water soluble)	CE063 ^M	mg/kg B	<0.5	0.5	<0.5	<0.5	0.6	0.5
Cadmium (total)	CE127 ^M	mg/kg Cd	0.7	0.2	0.2	0.2	0.2	0.8
Chromium (total)	CE127 ^M	mg/kg Cr	87	78	85	92	113	102
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	23	21	13	13	13	16
Lead (total)	CE127 ^M	mg/kg Pb	53	68	21	20	20	50
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	17	15	15	15	19	20
Selenium (total)	CE127 ^M	mg/kg Se	1.2	1.2	1.2	1.2	1.2	1.3
Zinc (total)	CE127 ^M	mg/kg Zn	123	45	52	44	54	234
pH	CE004 ^M	units	7.9	6.8	8.0	8.0	7.4	8.0
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	24	10	<10	<10	96	<10
Sulphate (total)	CE062 ^M	mg/kg SO ₄	285	218	184	192	277	277
Sulphide	CE079	mg/kg S ²⁻	<10	<10	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 ^M	mg/kg SCN	<1	<1	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	1.4	1.0	0.7	0.7	0.9	1.5
Estimate of OMC (calculated from TOC)	CE197	% w/w	2.4	1.7	1.1	1.2	1.5	2.7
PAH								
Naphthalene	CE087 ^M	mg/kg	0.14	0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 ^M	mg/kg	0.12	0.03	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^M	mg/kg	0.23	0.06	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 ^U	mg/kg	0.16	0.05	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	3.60	0.92	<0.02	0.05	0.10	0.24
Anthracene	CE087 ^U	mg/kg	0.61	0.23	<0.02	<0.02	0.02	0.05
Fluoranthene	CE087 ^M	mg/kg	11.10	2.22	0.04	0.16	0.28	0.64
Pyrene	CE087 ^M	mg/kg	9.74	1.97	0.04	0.15	0.26	0.58
Benzo(a)anthracene	CE087 ^U	mg/kg	4.22	1.02	0.03	0.09	0.14	0.29
Chrysene	CE087 ^M	mg/kg	5.27	1.12	<0.03	0.10	0.13	0.30
Benzo(b)fluoranthene	CE087 ^M	mg/kg	6.91	1.33	0.03	0.12	0.21	0.41
Benzo(k)fluoranthene	CE087 ^M	mg/kg	2.51	0.49	<0.03	0.04	0.08	0.15
Benzo(a)pyrene	CE087 ^U	mg/kg	5.22	0.99	0.02	0.10	0.16	0.32
Indeno(123cd)pyrene	CE087 ^M	mg/kg	5.21	0.94	0.03	0.09	0.15	0.29
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.75	0.16	<0.02	<0.02	0.02	0.05
Benzo(ghi)perylene	CE087 ^M	mg/kg	4.49	0.77	0.02	0.07	0.13	0.25
PAH (total of USEPA 16)	CE087	mg/kg	60.3	12.3	<0.34	0.96	1.69	3.55
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD

98778
HMP Ford
45713

Page 3 of 6 Pages

Chemtech Environmental Limited

SOILS

Lab number			98778-7
Sample id			WLS7
Depth (m)			0.50-0.70
Date sampled			21/07/2021
Test	Method	Units	
Arsenic (total)	CE127 ^M	mg/kg As	14
Boron (water soluble)	CE063 ^M	mg/kg B	0.6
Cadmium (total)	CE127 ^M	mg/kg Cd	0.3
Chromium (total)	CE127 ^M	mg/kg Cr	98
Chromium (VI)	CE146	mg/kg CrVI	<1
Copper (total)	CE127 ^M	mg/kg Cu	18
Lead (total)	CE127 ^M	mg/kg Pb	34
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	17
Selenium (total)	CE127 ^M	mg/kg Se	1.5
Zinc (total)	CE127 ^M	mg/kg Zn	87
pH	CE004 ^M	units	8.2
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	24
Sulphate (total)	CE062 ^M	mg/kg SO ₄	446
Sulphide	CE079	mg/kg S ²⁻	<10
Cyanide (free)	CE077	mg/kg CN	<1
Cyanide (total)	CE077	mg/kg CN	<1
Thiocyanate	CE145 ^M	mg/kg SCN	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	1.3
Estimate of OMC (calculated from TOC)	CE197	% w/w	2.2
PAH			
Naphthalene	CE087 ^M	mg/kg	0.02
Acenaphthylene	CE087 ^M	mg/kg	<0.02
Acenaphthene	CE087 ^M	mg/kg	0.02
Fluorene	CE087 ^U	mg/kg	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.31
Anthracene	CE087 ^U	mg/kg	0.05
Fluoranthene	CE087 ^M	mg/kg	0.91
Pyrene	CE087 ^M	mg/kg	0.86
Benzo(a)anthracene	CE087 ^U	mg/kg	0.45
Chrysene	CE087 ^M	mg/kg	0.54
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.68
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.25
Benzo(a)pyrene	CE087 ^U	mg/kg	0.53
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.49
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.08
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.44
PAH (total of USEPA 16)	CE087	mg/kg	5.63
Subcontracted analysis			
Asbestos (qualitative)	\$	-	NAD

98778
HMP Ford
45713

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO ₄
CE079	Sulphide	Extraction, Continuous Flow Colorimetry	As received		10	mg/kg S ²⁻
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
98778-1	WLS1	0.40-1.00	N	
98778-2	WLS2	0.40-0.90	N	
98778-3	WLS3	0.50-1.00	N	
98778-4	WLS4	0.50-1.00	N	
98778-5	WLS5	0.50-1.00	N	
98778-6	WLS6	0.50-1.00	N	
98778-7	WLS7	0.50-0.70	N	



ANALYTICAL TEST REPORT

Contract no: 99471
Contract name: HMP Ford
Client reference: -
Clients name: Alan Wood & Partners
Clients address: Hallamshire House
Hayland Street
Sheffield
S9 1BY

Samples received: 16 August 2021

Analysis started: 16 August 2021

Analysis completed: 23 August 2021

Report issued: 23 August 2021

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.
BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

Rachael Burton
Customer Support Squad Leader

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
99471-1	TP2	0.00-0.40	Loamy Clay with Gravel	-	-	12.8
99471-2	TP2	0.40-0.60	Clayey Sand with Gravel	-	-	14.5
99471-3	TP3	0.00-0.20	Sandy Clay with Gravel	-	-	9.7
99471-4	TP4	0.10-0.30	Clayey Sand with Gravel	-	-	10.4

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SOILS

Lab number Sample id Depth (m) Date sampled			99471-1 TP2 0.00-0.40 11/08/2021	99471-2 TP2 0.40-0.60 11/08/2021	99471-3 TP3 0.00-0.20 11/08/2021	99471-4 TP4 0.10-0.30 11/08/2021
Test	Method	Units				
Arsenic (total)	CE127 ^M	mg/kg As	18	13	8.7	9.0
Boron (water soluble)	CE063 ^M	mg/kg B	0.9	1.2	0.7	1.4
Cadmium (total)	CE127 ^M	mg/kg Cd	0.8	0.5	0.3	0.3
Chromium (total)	CE127 ^M	mg/kg Cr	179	133	147	99
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	25	84	35	12
Lead (total)	CE127 ^M	mg/kg Pb	120	142	35	46
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	20	31	17	16
Selenium (total)	CE127 ^M	mg/kg Se	1.4	1.1	0.7	3.5
Zinc (total)	CE127 ^M	mg/kg Zn	196	161	61	83
pH	CE004 ^M	units	8.3	8.3	8.3	7.9
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	61	102	52	414
Sulphate (total)	CE062 ^M	mg/kg SO ₄	710	757	321	18611
Sulphide	CE079	mg/kg S ²⁻	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1
Thiocyanate	CE145 ^M	mg/kg SCN	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	2.5	2.0	1.5	1.1
Total Organic Carbon (TOC)	CE197	% w/w C	4.5	6.5	0.9	2.7
Estimate of OMC (calculated from TOC)	CE197	% w/w	7.7	11.2	1.6	4.7
PAH						
Naphthalene	CE087 ^M	mg/kg	0.79	0.49	0.05	0.33
Acenaphthylene	CE087 ^M	mg/kg	1.17	1.01	0.03	0.72
Acenaphthene	CE087 ^M	mg/kg	2.23	1.98	0.15	0.72
Fluorene	CE087 ^U	mg/kg	1.38	1.43	0.13	0.37
Phenanthrene	CE087 ^M	mg/kg	104.76	83.72	1.96	9.28
Anthracene	CE087 ^U	mg/kg	28.15	24.07	0.62	4.07
Fluoranthene	CE087 ^M	mg/kg	228.42	181.37	5.40	55.10
Pyrene	CE087 ^M	mg/kg	206.73	171.10	4.97	56.29
Benzo(a)anthracene	CE087 ^U	mg/kg	66.13	78.00	2.66	29.52
Chrysene	CE087 ^M	mg/kg	63.47	76.04	2.68	30.62
Benzo(b)fluoranthene	CE087 ^M	mg/kg	71.16	87.82	3.55	43.31
Benzo(k)fluoranthene	CE087 ^M	mg/kg	29.93	31.96	1.41	17.48
Benzo(a)pyrene	CE087 ^U	mg/kg	71.47	91.26	3.03	41.58
Indeno(123cd)pyrene	CE087 ^M	mg/kg	52.78	66.13	2.63	33.42
Dibenz(ah)anthracene	CE087 ^M	mg/kg	15.29	11.63	0.50	6.26
Benzo(ghi)perylene	CE087 ^M	mg/kg	50.04	62.18	2.37	31.91
PAH (total of USEPA 16)	CE087	mg/kg	994	970	32.2	361

Chemtech Environmental Limited

SOILS

Lab number			99471-1	99471-2	99471-3	99471-4
Sample id			TP2	TP2	TP3	TP4
Depth (m)			0.00-0.40	0.40-0.60	0.00-0.20	0.10-0.30
Date sampled			11/08/2021	11/08/2021	11/08/2021	11/08/2021
Test	Method	Units				
BTEX & TPH						
Benzene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	-
Toluene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	-
Ethylbenzene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	-
m & p-Xylene	CE192 ^U	mg/kg	<0.02	<0.02	<0.02	-
o-Xylene	CE192 ^U	mg/kg	<0.01	<0.01	<0.01	-
VPH (>C5-C7)	CE067	mg/kg	<0.1	<0.1	<0.1	-
VPH (>C7-C8)	CE067	mg/kg	<0.1	0.1	<0.1	-
VPH (>C8-C10)	CE067	mg/kg	<0.1	0.1	<0.1	-
EPH (>C10-C12)	CE033 ^U	mg/kg	<6	<6	<6	-
EPH (>C12-C16)	CE033 ^M	mg/kg	63	29	<6	-
EPH (>C16-C21)	CE033 ^M	mg/kg	556	116	17	-
EPH (>C21-C35)	CE033 ^M	mg/kg	2125	439	100	-
EPH (>C35-C44)	CE033 ^M	mg/kg	722	193	71	-
Subcontracted analysis						
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO ₄
CE079	Sulphide	Extraction, Continuous Flow Colorimetry	As received		10	mg/kg S ²⁻
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg
CE067	VPH (>C5-C7)	Headspace GC-FID	As received		0.1	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH (>C7-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE033	EPH (>C10-C12)	Solvent extraction, GC-FID	As received	U	6	mg/kg
CE033	EPH (>C12-C16)	Solvent extraction, GC-FID	As received	M	6	mg/kg
CE033	EPH (>C16-C21)	Solvent extraction, GC-FID	As received	M	6	mg/kg
CE033	EPH (>C21-C35)	Solvent extraction, GC-FID	As received	M	15	mg/kg
CE033	EPH (>C35-C44)	Solvent extraction, GC-FID	As received	M	10	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
99471-1	TP2	0.00-0.40	N	
99471-2	TP2	0.40-0.60	N	
99471-3	TP3	0.00-0.20	N	
99471-4	TP4	0.10-0.30	N	

APPENDIX D

IN-SITU CBR TESTING RESULTS

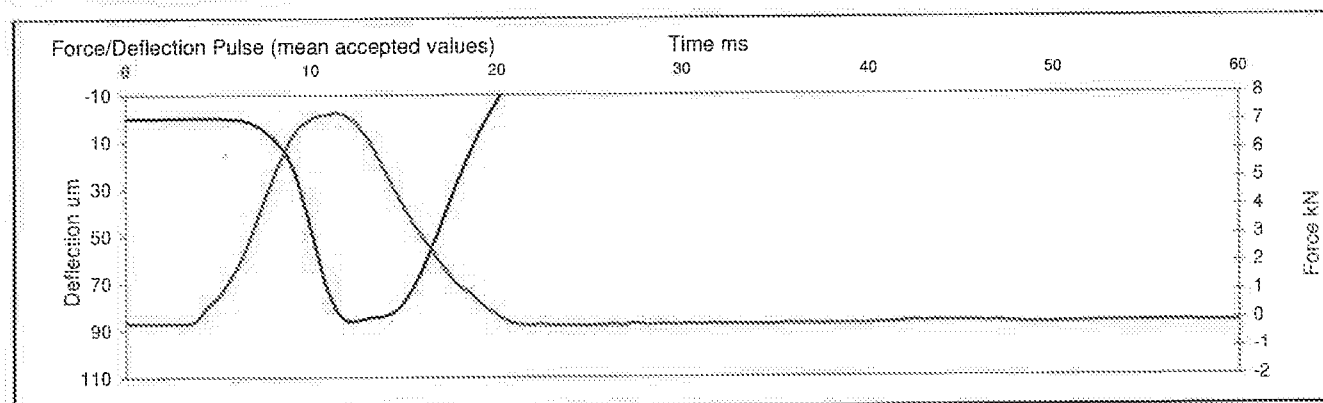
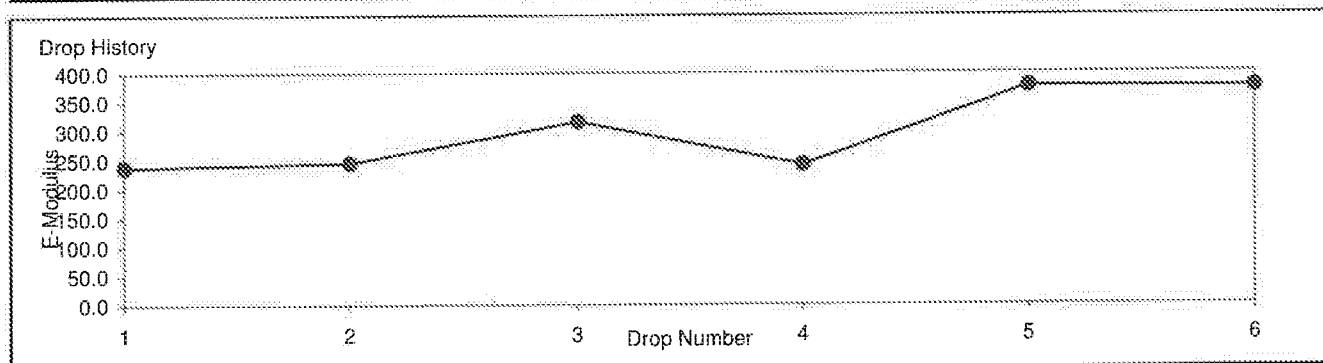


Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0100
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0523206
Test No. M1/1
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	119.1	7.6	107.3	14.0	237.3	Seating drop	
2	113.6	7.5	105.5	15.0	244.7	Seating drop	
3	88.4	7.5	105.9	15.0	315.4	Seating drop	
4	114.5	7.4	104.8	15.5	241.0	Accepted	
5	72.0	7.3	102.9	15.5	376.2	Accepted	
6	70.1	7.0	99.6	14.5	374.0	Accepted	



Mean Surface Modulus (E)

330.4 MPa

Estimated CBR 97.5 %
Moisture Content %

Page 1 of 8
Date 16/08/2021

Signed:

Certified that the testing was carried out in accordance with DIHM 312.

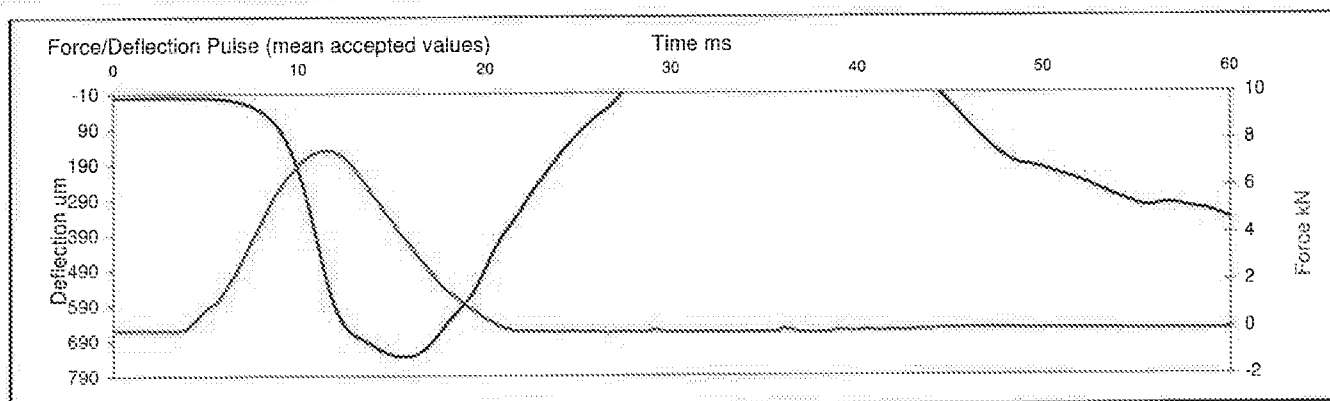
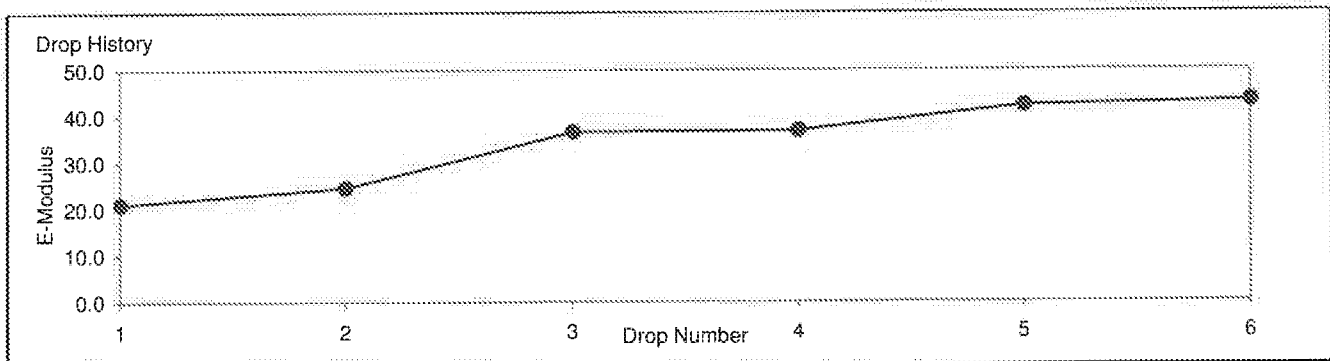
☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager



Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS Report No. UXB0523206
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX Test No. M1/2
Date of Test: 05 August 2021 Contract No. 51064284
Description material: Sandy Clay Tested By: SOCOTEC Maidstone
Plate diameter (mm): 300
Chainage (m): 0+0200
Co-Ordinates: Longitude 0-0°0.00"E Latitude 0-0°0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1382.4	7.8	110.4	14.5	21.0	Seating drop	
2	1141.7	7.5	106.7	15.0	24.6	Seating drop	
3	783.3	7.7	109.0	14.5	36.6	Seating drop	
4	772.5	7.7	108.4	15.0	36.9	Accepted	
5	664.0	7.5	106.3	15.0	42.2	Accepted	
6	656.1	7.6	107.4	15.5	43.1	Accepted	



Mean Surface Modulus (E)

40.7 MPa

Estimated CBR 3.7 %
Moisture Content %

Page 2 of 8
Date 16/08/2021

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☐ C. Moore - Client Liaison Manager
☒ M. Jaffer - Technical Manager

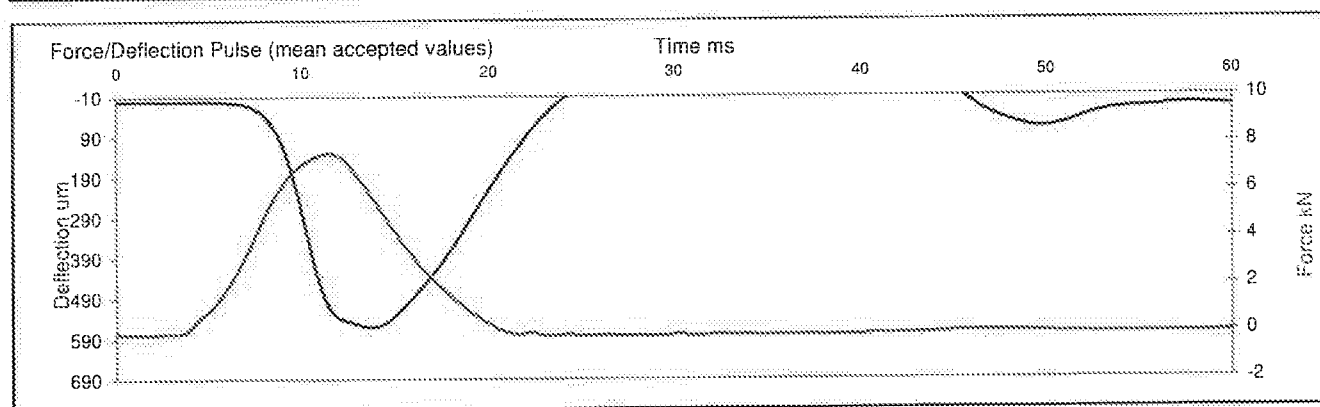
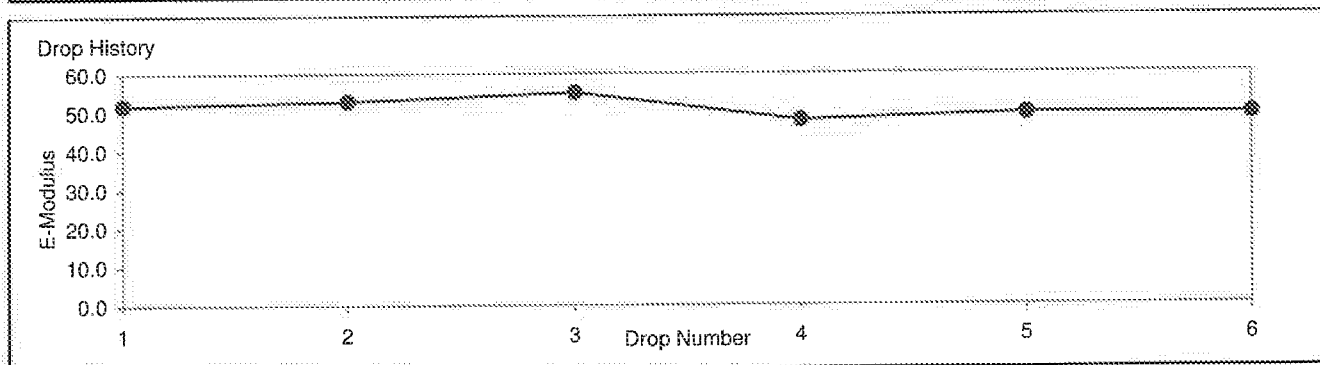


Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0300
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0523206
Test No. M1/3
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	554.6	7.7	109.0	15.0	51.7	Seating drop	
2	549.4	7.8	110.1	15.0	52.8	Seating drop	
3	512.9	7.6	107.2	15.5	55.0	Seating drop	
4	590.4	7.6	107.1	15.5	47.8	Accepted	
5	584.3	7.7	109.6	15.0	49.4	Accepted	
6	585.7	7.7	109.4	15.0	49.2	Accepted	



Mean Surface Modulus (E)

48.8 MPa

Estimated CBR 4.9 %
Moisture Content %

Page 3 of 6
Date 16/08/2021

Signed:

Certified that the testing was carried out in accordance with DIHM 312.

☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager

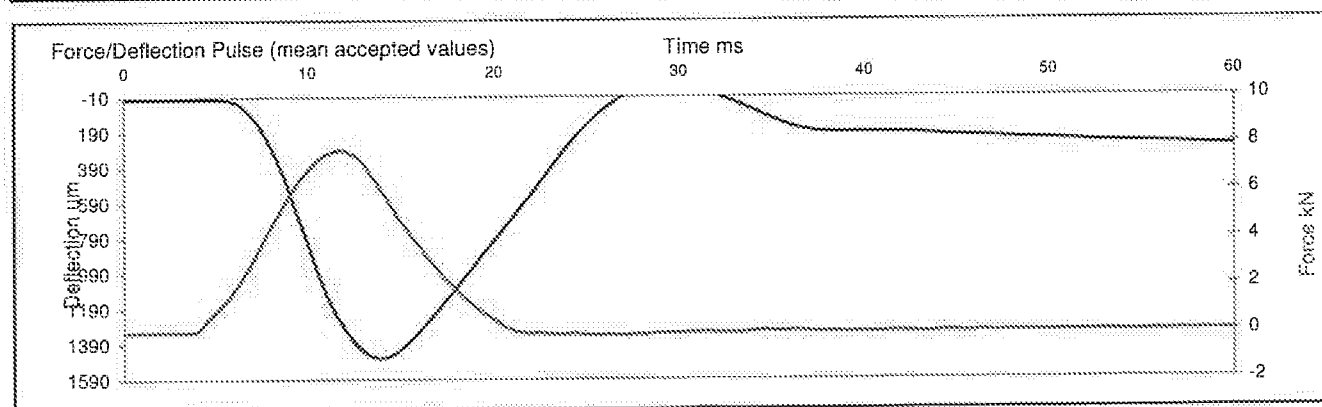
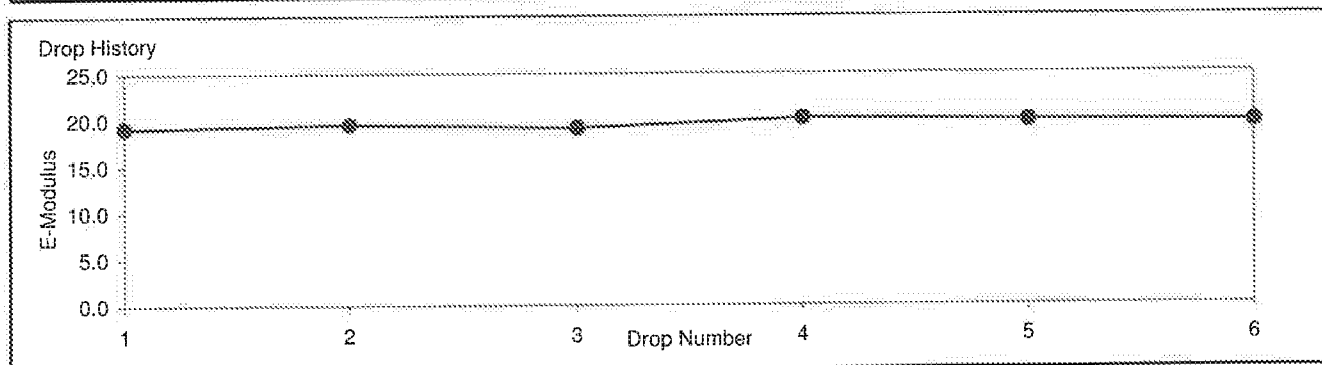


Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0200
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0523206
Test No. M1/4
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1496.4	7.7	108.8	16.0	19.1	Seating drop	
2	1453.9	7.6	107.5	15.5	19.5	Seating drop	
3	1480.4	7.6	107.1	16.0	19.1	Seating drop	
4	1459.7	7.9	111.3	15.5	20.1	Accepted	
5	1471.6	7.8	110.9	15.5	19.8	Accepted	
6	1478.9	7.8	110.1	15.0	19.6	Accepted	



Mean Surface Modulus (E)

19.8 MPa

Estimated CBR <2 %
Moisture Content %

Page 4 of 6
Date 16/08/2021

Signed:

Certified that the testing was carried out in accordance with DIHM 312.

☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager



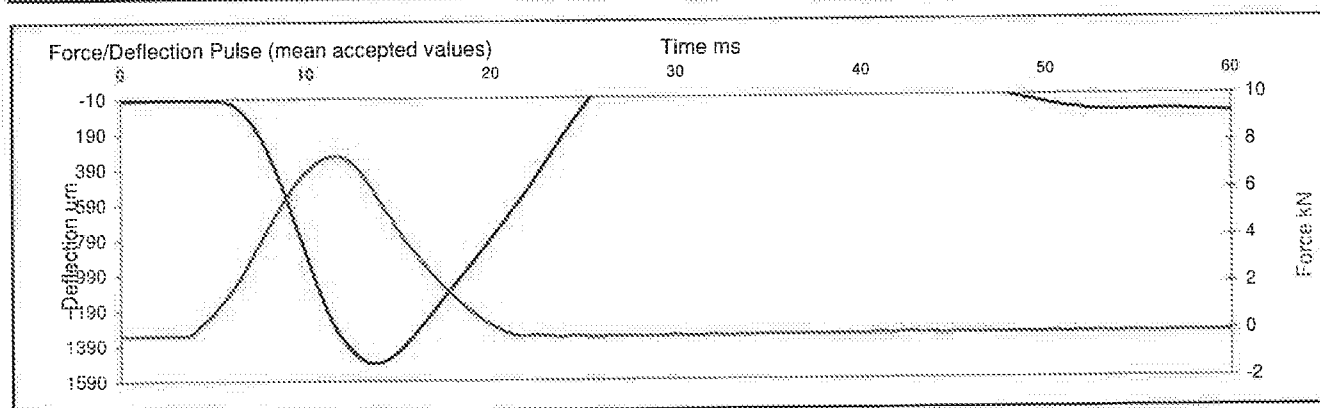
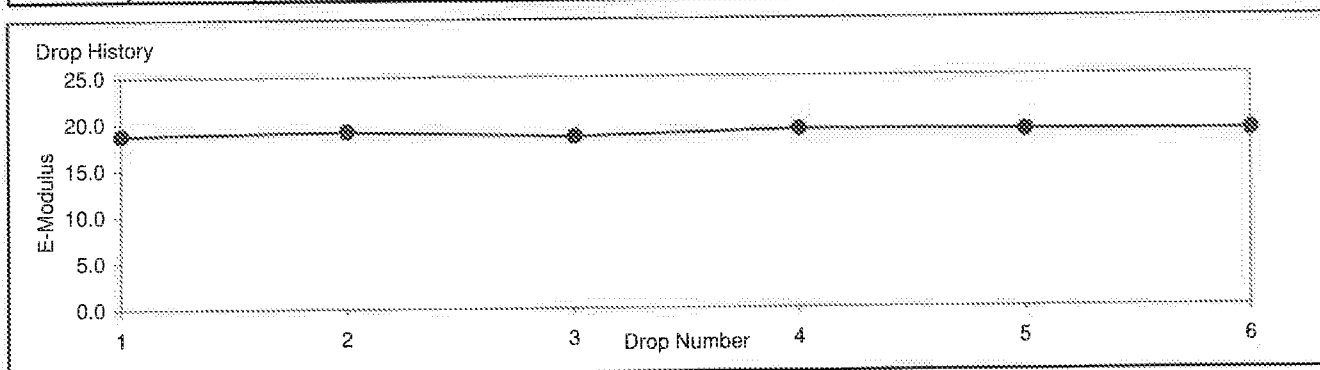
Determination of Surface Stiffness Modulus

Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0300
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0523206
Test No. M1/5
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1522.5	7.6	108.2	15.0	18.7	Seating drop	
2	1516.0	7.8	109.8	15.0	19.1	Seating drop	
3	1482.4	7.4	104.2	15.5	18.5	Seating drop	
4	1487.0	7.7	108.6	15.0	19.2	Accepted	
5	1503.9	7.7	108.4	15.0	19.0	Accepted	
6	1492.9	7.6	107.4	15.5	18.9	Accepted	



Mean Surface Modulus (E)

19.0 MPa

Estimated CBR <2 %
Moisture Content %

Page 5 of 6

Date 16/08/2021

Signed:

Certified that the testing was carried out in accordance with DIHM 312.

☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager

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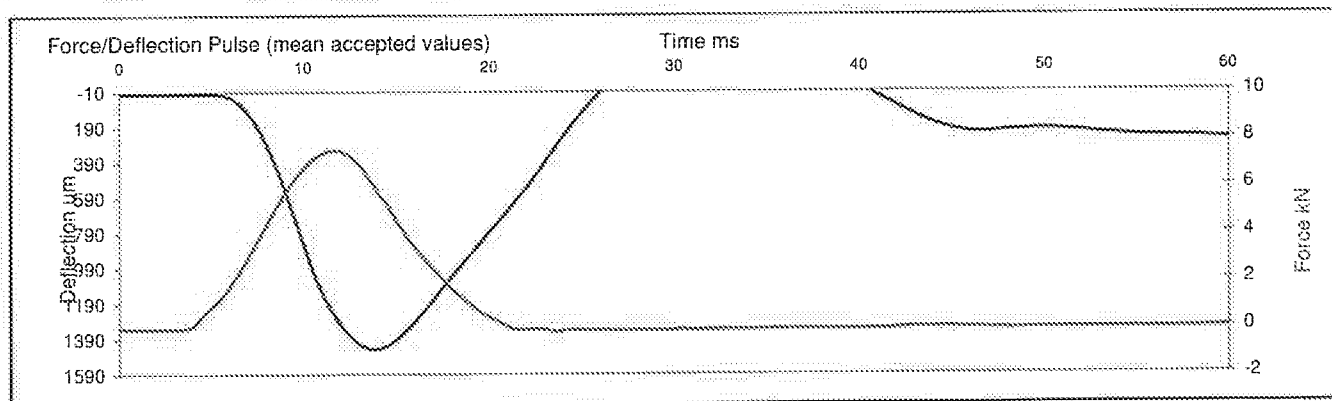
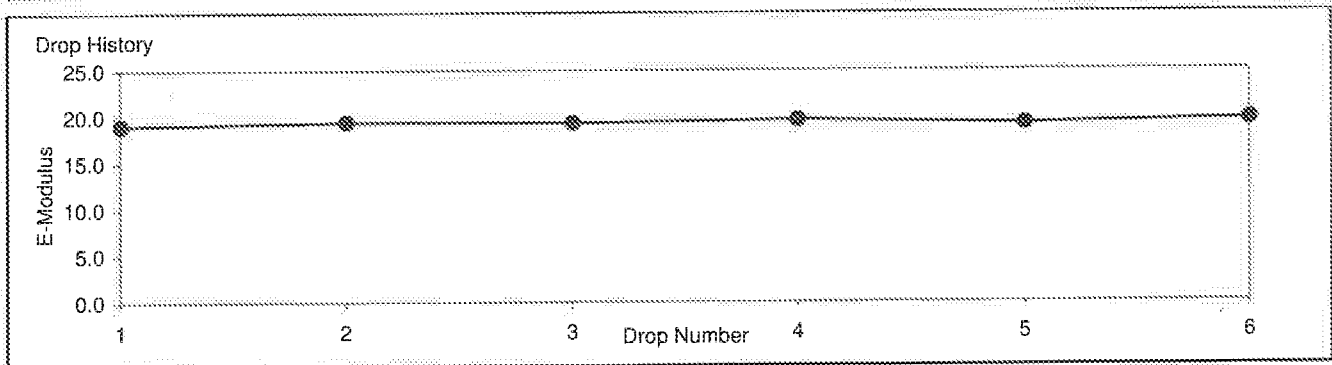


Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0400
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0529206
Test No. M1/6
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1503.0	7.7	108.5	15.0	19.0	Seating drop	
2	1445.8	7.5	106.3	15.5	19.4	Seating drop	
3	1450.1	7.5	106.5	15.5	19.3	Seating drop	
4	1461.8	7.7	108.7	15.0	19.6	Accepted	
5	1434.6	7.4	104.6	15.5	19.2	Accepted	
6	1425.3	7.5	106.2	15.0	19.6	Accepted	



Mean Surface Modulus (E)

19.5 MPa

Estimated CBR <2 %
Moisture Content %

Page 6 of 6
Date 16/08/2021

Signed:

Certified that the testing was carried out in accordance with DIHM 312.

☐ C. Moore - Client Liaison Manager
☒ M. Jaffer - Technical Manager

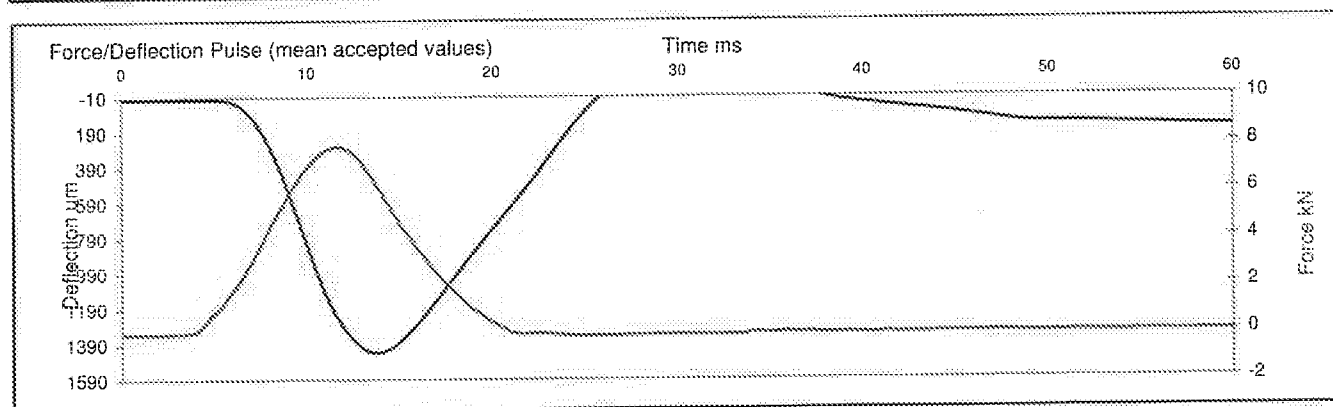
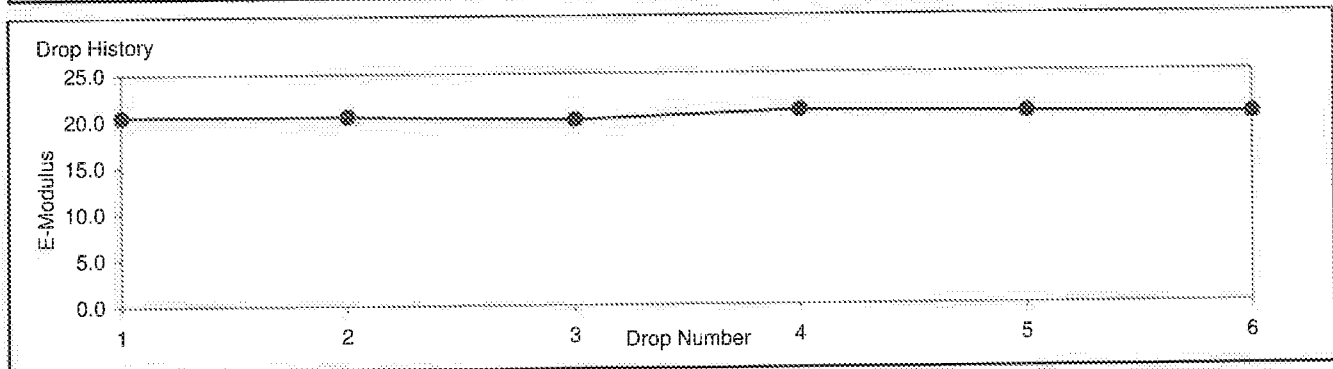


Determination of Surface Stiffness Modulus Dynamic Plate Test - Prima 100 LWD

Client: ALAN WOOD AND PARTNERS
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX
Date of Test: 05 August 2021
Description material: Sandy Clay
Plate diameter (mm): 300
Chainage (m): 0+0500
Co-Ordinates: Longitude 0-0°0.00"E Latitude 0-0°0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Report No. UXB0523206
Test No. M1/7
Contract No. 51064284
Tested By: SOCOTEC Maidstone

Drop No	Deflection μm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1451.2	8.0	112.5	15.0	20.4	Sealing drop	
2	1470.3	8.1	114.0	15.0	20.4	Sealing drop	
3	1458.5	7.8	111.0	15.0	20.0	Sealing drop	
4	1410.8	7.9	112.2	15.0	20.9	Accepted	
5	1449.8	8.0	113.3	15.0	20.6	Accepted	
6	1443.3	7.9	111.1	15.5	20.3	Accepted	



Mean Surface Modulus (E)

20.6 MPa

Estimated CBR <2 %
Moisture Content %

Page 7 of 8
Date 16/08/2021

Signed:

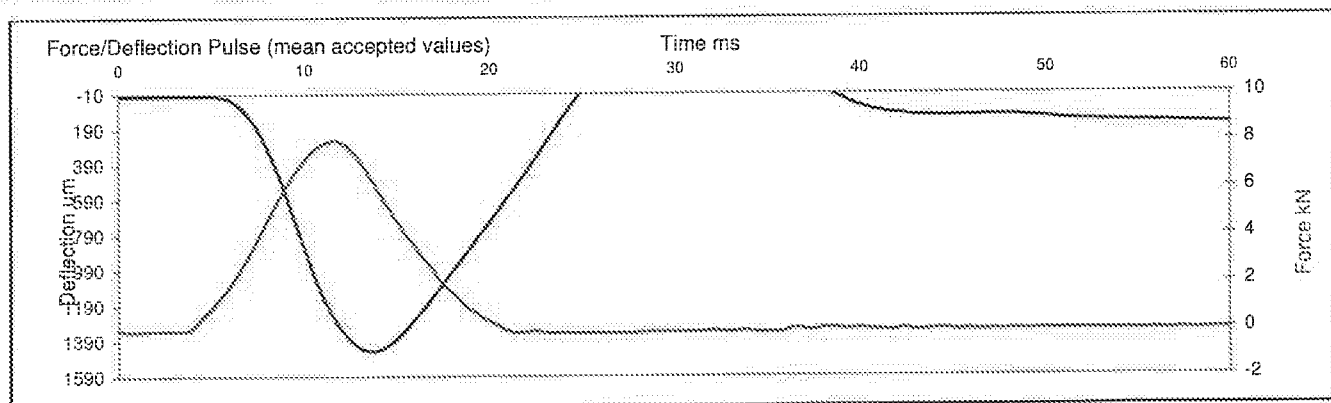
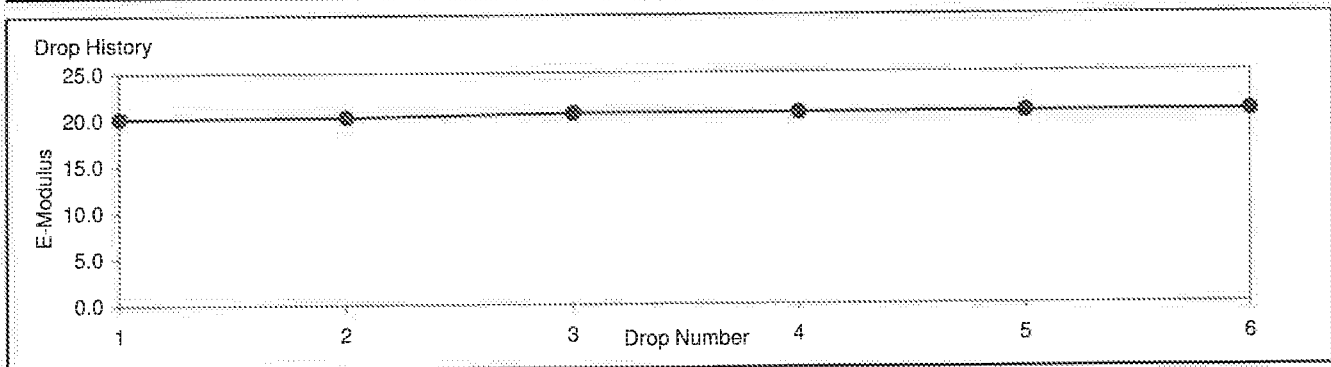
Certified that the testing was carried out in accordance with DIHM 312.

☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager

Determination of Surface Stiffness Modulus **Dynamic Plate Test - Prima 100 LWD**

Client: ALAN WOOD AND PARTNERS Report No. UXB0523206
Site: HMP Ford, Fod Road, Ford, Arundel, BN18 0BX Test No. M1/8
Date of Test: 05 August 2021 Contract No. 51064284
Description material: Sandy Clay Tested By: SOCOTEC Maidstone
Plate diameter (mm) 300
Chainage (m) 0+0600
Co-Ordinates: Longitude 0-0'0.00"E Latitude 0-0'0.00"N
Test Method: Design Guidance for Road Pavement Foundations IAN73/06 (Draft HD25/06). Poisson ratio 0.35
Remarks:

Drop No	Deflection µm	Peak Load kN	Peak Stress kPa	Pulse duration ms	E-modulus MPa	Status	Remarks
1	1421.8	7.7	108.5	15.5	20.1	Seating drop	
2	1419.9	7.7	108.7	15.0	20.2	Seating drop	
3	1445.8	8.0	113.1	15.5	20.6	Seating drop	
4	1453.7	8.0	113.8	16.0	20.6	Accepted	
5	1445.4	8.0	113.9	15.0	20.7	Accepted	
6	1441.4	8.0	113.5	15.5	20.7	Accepted	



Mean Surface Modulus (E)

20.7 MPa

Estimated CBR <2 %
Moisture Content %

Page 8 of 8
Date 16/08/2021

Signed:



☐ C. Moore - Client Liason Manager
☒ M. Jaffer - Technical Manager

Certified that the testing was carried out in accordance with DIHM 312.

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APPENDIX E

AWP GENERIC ASSESSMENT CRITERIA

Alan Wood & Partners
Generic Assessment Criteria for Soils



Revision Version: V.8 - September 2018

Parameter	Residential						Commercial			Allotment			Public Open Space near Residential land (POS _{res})			Public Park Land (POS _{park})			Source		
	With Plant Uptake			Without Plant Uptake																	
	1-6% SOM			1-6% SOM			1-6% SOM			1-6% SOM			1-6% SOM			1-6% SOM					
Metals/Metalloids ^(a)																					
Arsenic (inorganic)	37			40			640			49			79			170			DEFRA C4SL ^(b)		
Beryllium	1.7			1.7			12			35			22			63			LQM/CIEH ^(c)		
Boron	290			11,000			240,000			45			21,000			46,000			LQM/CIEH ^(c)		
Cadmium ^(d)	22			150			410			3.9			220			880			DEFRA C4SL ^(b)		
Chromium (III)	910			910			8,600			18,000			1,500			33,000			LQM/CIEH ^(c)		
Chromium (VI) ^(e)	21			21			49			170			21			250			DEFRA C4SL ^(b)		
Copper	2,400			7,100			68,000			520			12,000			44,000			LQM/CIEH ^(c)		
Lead ^(f)	200			310			2,300			80			630			1,300			DEFRA C4SL ^(b)		
Mercury (inorganic)	40			56			1,100			19			120			240			LQM/CIEH ^(c)		
Nickel	130			180			980			53			230			800			LQM/CIEH ^(c)		
Selenium	250			430			12,000			88			1,100			1,800			LQM/CIEH ^(c)		
Vanadium	410			1,200			9,000			91			2,000			5,000			LQM/CIEH ^(c)		
Zinc	3,700			40,000			730,000			620			81,000			170,000			LQM/CIEH ^(c)		
Other Inorganics																					
pH	<5			<5			<5			<5			<5			<5			-		
Total Sulphate	2400			2400			2400			2400			2400			2400			BRE (2005) ^(g)		
Water-Soluble Sulphate	0.5g/l			0.5g/l			0.5g/l			0.5g/l			0.5g/l			0.5g/l			BRE (2005)		
Parameter	Residential						Commercial ^(h)			Allotment			Public Open Space near Residential land (POS _{res})			Public Park Land (POS _{park})					
	With Plant Uptake			Without Plant Uptake																	
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM			
Organics ^(h)																					
Acenaphthene	200	490	1,080	2,000	3,600	5,200	75,000	92,000	100,000	34	85	202	15,000	15,000	15,000	29,000	30,000	30,000	CLEA/LQM/CIEH		
Acenaphthylene	170	400	900	2,000	3,600	5,200	76,000	92,000	100,000	28	68	163	15,000	15,000	15,000	29,000	30,000	30,000	CLEA/LQM/CIEH		
Anthracene	2,300	5,400	10,700	30,000	34,000	36,000	520,000	530,000	540,000	380	947	2,230	74,000	74,000	74,000	150,000	150,000	150,000	CLEA/LQM/CIEH		
Benzo(a)anthracene	7.5	11	13	12	14	15	170	170	180	2.9	6.5	13	29	29	29	49	56	62	CLEA/LQM/CIEH		
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	35	35	36	3.6	3.7	3.7	5.7	5.7	5.7	11	12	13	CLEA/LQM/CIEH		
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	44	45	45	1	2.2	3.9	7.1	7.2	7.2	13	15	16	CLEA/LQM/CIEH		
Benzo(g,h,i)perylene	315	340	350	360	360	360	3,900	4,000	4,000	290	480	646	640	640	640	1,400	1,500	1,600	CLEA/LQM/CIEH		
Benzo(k)fluoranthene	77	93	100	110	110	110	1,200	1,200	1,200	37	76	129	190	190	190	370	410	440	CLEA/LQM/CIEH		
Chrysene	15	22	27	30	31	32	350	350	350	4.1	9.5	19	57	57	57	93	110	120	CLEA/LQM/CIEH		
Dibenz(a,h)anthracene	0.24	0.28	0.30	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.44	0.57	0.57	0.58	1.1	1.3	1.4	CLEA/LQM/CIEH		
Fluoranthene	280	560	890	1,500	1,600	1,600	23,000	23,000	23,000	52	127	288	3,100	3,100	3,100	6,300	6,300	6,400	CLEA/LQM/CIEH		
Fluorene	165	390	850	2,200	3,400	4,200	60,000	67,000	70,000	27	67	158	9,900	9,900	9,900	20,000	20,000	20,000	CLEA/LQM/CIEH		
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	500	510	510	9.5	21	40	82	82	82	150	170	180	CLEA/LQM/CIEH		
Naphthalene	1	2.3	5.5	1	2.4	6	100	260	600	4	9.8	23	4900	4900	4900	1200	1900	3000	CLEA/LQM/CIEH		
Phenanthrene	95.0	220	440	1,300	1,400	1,500	22,000	22,000	23,000	15	38	90	3,100	3,100	3,100	6,200	6,200	6,300	CLEA/LQM/CIEH		
Pyrene	620	1,200	2,000	3,700	3,800	3,800	54,000	54,000	55,000	111	271	620	7,400	7,400	7,400	15,000	15,000	15,000	CLEA/LQM/CIEH		
Aliphatic EC 5-6 (benzene)	24	40	80	24	40	80	2,400	4,000	8,000	752	1,730	3,900	570,000	590,000	600,000	95,000	130,000	180,000	CLEA/LQM/CIEH		
Aliphatic EC >6-8 (toluene)	52	110	250	52	110	250	5,200	11,000	25,000	2,304	5,580	13,000	600,000	610,000	620,000	150,000	220,000	320,000	CLEA/LQM/CIEH		
Aliphatic EC >8-10	13	30	70	13	30	70	1,300	3,000	7,000	321	770	1,700	13,000	13,000	13,000	14,000	18,000	21,000	CLEA/LQM/CIEH		
Aliphatic EC >10-12	60	150	360	60	150	360	6,000	15,000	32,000	2,153	4,300	7,150	13,000	13,000	13,000	21,000	23,000	24,000	CLEA/LQM/CIEH		
Aliphatic EC >12-16	500	1,200	2,600	500	1,200	2,600	42,000	72,000	90,000	10,800	12,400	13,200	13,000	13,000	13,000	25,000	25,000	26,000	CLEA/LQM/CIEH		
Aliphatic EC >16-35	41,000	69,000	94,000	41,000	69,000	94,000	140,000	160,000	180,000	240,000	260,000	260,000	250,000	250,000	250,000	450,000	480,000	490,000	CLEA/LQM/CIEH		
Aliphatic EC >35-44	41,000	69,000	94,000	41,000	69,000	94,000	140,000	160,000	180,000	240,000	260,000	260,000	250,000	250,000	250,000	450,000	480,000	490,000	CLEA/LQM/CIEH		

Alan Wood & Partners
Generic Assessment Criteria for Soils



Revision Version: V.8 - Septmeber 2018

Parameter	Residential						Commercial ⁽ⁱ⁾			Allotment			Public Open Space near Residential land (POS _{res})			Public Park Land (POS _{park})			
	With Plant Uptake			Without Plant Uptake															
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	
Organics contd./ ^(h)																			
Aromatic EC >5-7	50	110	240	155	300	630	15,000	28,000	55,000	12	25	57	56,000	56,000	56,000	76,000	84,000	92,000	CLEA/LQM/CIEH
Aromatic EC >7-8	100	240	550	370	800	1,800	33,000	68,000	130,000	21	50	117	56,000	56,000	56,000	87,000	95,000	100,000	CLEA/LQM/CIEH
Aromatic EC >8-10	20	50	110	20	53	125	2,000	5,000	120,000	8.6	21	50	5,000.0	5,000	5,000	7,200.0	8,500	9,300	CLEA/LQM/CIEH
Aromatic EC >10-12	63	150	340	120	280	650	11,000	22,000	31,000	12.5	31	74	5,000.0	5,000	5,000	9,200.0	9,700	10,000	CLEA/LQM/CIEH
Aromatic EC >12-16	140	320	660	1,100	1,900	2,300	35,000	37,000	38,000	23	57	134	5,100	5,100	5,000	10,000	10,000	10,000	CLEA/LQM/CIEH
Aromatic EC >16-21	260	540	930	1,800	1,900	1,900	28,000	28,000	28,000	47	112	260	3,800	3,800	3,800	7,600	7,700	7,800	CLEA/LQM/CIEH
Aromatic EC >21-35	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	CLEA/LQM/CIEH
Aromatic EC >35-44	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	CLEA/LQM/CIEH
Benzene	0.06	0.13	0.30	0.16	0.30	0.64	15	28	57	0.016	0.033	0.073	72	72	73	90	100	110	CLEA/LQM/CIEH
Toluene	104	240	550	370	830	1800	33,000	68,000	130,000	22	50	117	56,000	56,000	56,000	87,000	95,000	100,000	CLEA/LQM/CIEH
Ethylbenzene	30	62	150	34	81	190	3,200	7,000	16,000	16	38	91	24,000	24,000	25,000	1,700	22,000	27,000	CLEA/LQM/CIEH
o-xylene	30	70	170	40	90	200	3,700	8,000	19,000	28	67	160	41,000	42,000	43,000	17,000	24,000	33,000	CLEA/LQM/CIEH
m-xylene	30	70	160	34	80	190	3,400	8,000	18,000	30	74	170	41,000	42,000	43,000	17,000	24,000	32,000	CLEA/LQM/CIEH
p-xylene	30	70	160	33	80	180	3,200	8,000	17,000	28	69	160	41,000	42,000	43,000	17,000	23,000	31,000	CLEA/LQM/CIEH

NOTES

- All values are rounded to 1 or 2 significant figures. All values mg/kg unless otherwise stated.

(a) Generic Assessment Criteria presented by DEFRA (2014) and LQM/CIEH (2015) for metals are not sensitive to Soil Organic Matter content and may be applied directly across the SOM range 1-6% for the land uses given.

(b) Final Category 4 Screening Levels given in DEFRA SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Companion Document, December 2014. Calculated for sandy loam soils with 6% SOM.

(c) Nathaniel, C.P., McCaffrey, C., Gillett, A.C., Ogden, R.C. And Nathaniel, J.F. (2015). The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Publication Number **S4UL3286**.

(d) GAC for cadmium are calculated for soils with pH values between 6 and 8. Care should be applied when using the GAC values outside this range and particularly below 5.

(e) Additional site specific risk assessment may be required where elevated concentrations of Chromium (VI) are measured on site.

(f) DEFRA (2014) indicate that the BGS have derived 'normal' background lead concentrations for England & Wales. In England normal background concentrations are 180mg/kg for the principal domain, 2400mg/kg for the mineralisation domain and 820mg/kg for the urban domain (DEFRA, 2012). Calculated C4SL values to be adopted for residential, allotment and POS_{res} are lower therefore than the 'normal' background concentration of lead in urban areas.

(g) BRE (2005) Special Digest 1, 3rd Edition 'Concrete in Aggressive Ground'. GAC is the upper limit for DS-1 sulphate class concrete.

(h) Organic contaminant GAC values calculated using CLEA v1.06 for sandy soil with SOM of 1%, 2.5% and 6%. Sandy soil type is considered to be conservative for the majority of soils, including brownfield soils on (potentially contaminated) sites. Changes made to default CLEA exposure parameters as per updated information given in DEFRA (2014) (C4SL Tables 3.2 and 3.5) and LQM/CIEH (2015).

(i) GAC derived for pre-1970 office buildings using default commercial CLEA model with adjustment to CLEA exposure parameters as per DEFRA (2014) (C4SL Tables 3.2 and 3.5).

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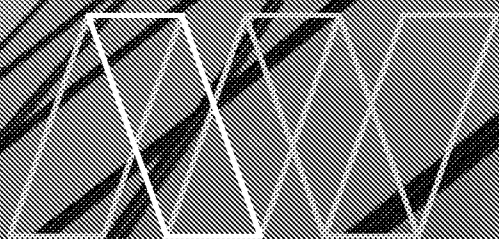
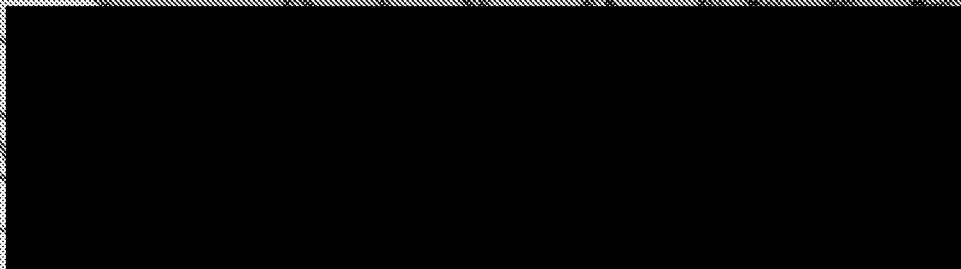
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